SGN

Your gas. Our network.

A plan for our shared future

RIIO-GD2 Business Plan

9 December 2019

Positive impact

Safe and efficient

Shared net-zero future

Checklist against Ofgem's business plan guidance is available as a supporting document: SGN Business Plan Guidance Checklist.

Executive summary

Highlights of our plan

We are proud to deliver an essential public service and we recognise this comes with important responsibilities - to our customers, our communities and the environment as we drive for net-zero by 2045. Our plan is rigorous, ambitious and deeply aligned to customer and stakeholder needs. We understand their priorities and preferences and we are confident we will be delivering extra value for our customers by:

- Reducing our share of customer bills by 10% in Scotland and 6% in Southern
- Proposing to build the UK's first 100% hydrogen network to heat customers' homes
- Reaching net-zero faster by matching Scotland's 2045 ambition across both our networks
- Investing to maintain our high standards of safety and resilience, cyber and physical security
- Helping 250,000 customers in vulnerable circumstances and delivering financial benefits of £40 million
- Providing a better than 9 out of 10 service to customers, maintaining our award-winning standards
- Delivering excellence through innovation and efficiency, reducing like-for-like costs by 4.5%.

Customers have recognised the benefits of the activities in our plan, with 92% of customers in Scotland finding our plan acceptable in testing and 86% of customers in Southern.[1]

Listening and responding to customers with our three customer commitments

We have listened extensively to our customers and stakeholders to create our plan; with 23,000 high quality, individual engagements and more than one million people reached online. Customers told us they have seven priorities, which we found also resonated with stakeholders.[2]

Our RIIO-GD2 (GD2) plan is built on these priorities, brought to life in three strong customer commitments that run throughout our plan and underpin all our proposals.

1. We will make a positive impact on society, by supporting vulnerable communities and providing excellent service.

Our plan is about doing the right thing for customers with a strong focus on social responsibility. The voluntary contribution of **£145 million we made to customers in GD1** demonstrates our commitment and the commitment of our shareholders to the people we serve.

- We will help 250,000 vulnerable customers to use energy safely, efficiently and affordably. Our extra help will deliver direct financial benefits to vulnerable households of £40 million (m) over GD2, and an additional social well-being value of £17m each year. We know that the personal support and concern provided by our staff is also welcomed and valued by our customers.
- We will continue to provide an excellent service for all our customers, keeping up our efforts to deliver an industry leading customer experience and achieve customer satisfaction scores higher than 9 out of 10.

2. We will deliver a safe and efficient service by acting safely, keeping the gas flowing and keeping costs down.

Ongoing investment in our ageing network is essential. However, given the uncertainty around the future pathway to decarbonisation, where we can reduce or delay expenditure safely we will.

- We will keep our network as safe and resilient as it is today and invest to keep our customers safe from cyber and physical attacks.
- We know our assets well and will make the right interventions, always with consideration given to safety, cost and longer-term options for decarbonisation.
- We have created a strong link between our performance and the amount we are paid, reducing risk for customers in uncertain times.
- We are reducing bills for customers and like-for-like costs are 4.5% lower in GD2.

3. We will build a shared net-zero future by accelerating decarbonised energy solutions and minimising our environmental impact.

The energy industry is changing fast and critical decisions on future heat policy will be made within the next five-year planning period. Our cutting-edge research, development and demonstrations of greener gas will provide evidence needed to support these complex decisions and resolve uncertainty about the future of the gas networks.

- We will build a 100% hydrogen demonstration network and customers will experience homes warmed by hydrogen.
- We will facilitate a greater volume of biomethane in our network.
- Working towards Scotland's 2045 net-zero target across both our networks, we will minimise our own carbon footprint to help the UK decarbonise further and faster.

[1] Percentage of informed domestic customers who found the plan acceptable, Business Plan Acceptability Testing Phase 2 (ref 079) based on SGN's cost of capital assumptions

[2] Stage 1: Explorative Qualitative Workshops and Interviews (Exploratory Phase) (ref 002) and SGN webinar 'What customers want from a gas network'

Our three commitments, and the seven customer priorities underpinning them, align to Ofgem's output categories of meeting the needs of consumer and network users, maintaining a safe and resilient network and delivering an environmentally sustainable network.

These commitments create a consistent thread throughout our plan, maintaining our focus on the outputs and outcomes prioritised and valued by our customers.

Our customers rightly expect us to deliver efficiently now, while looking after their interests for the future. We believe we have risen to the challenge and produced a plan that delivers extra value for both our customers and future customers.

Our track record in GD1

Our two distinct network regions include the most densely populated areas of South London and the remotest parts of Scotland and the Hebrides, each with its different needs and challenges.

Our costs account for around 25% of the average household gas bill, estimated at £145 a year in 2018/19. For this, our customers receive:

Lower bills

We are forecasting a reduction in our share of customer bills of 7% in real terms over the course of RIIO-GD1 (GD1). And we are doing more; we expect to replace 8,300km of our metallic mains, renew over half a million steel service pipes, reduce leakage by over 20% and exceed our target to connect 27,500 fuel poor customers by the end of the current price control.

Award winning customer service

We are recognised as the best network for customer service and we are still improving. In Scotland customer satisfaction scores have increased from 8.53 at the start of GD1 to 9.24. Our Southern scores have increased from 8.28 to 8.98. Customer complaints are down by 76% so far during GD1, and we have increased our support services to our vulnerable customers. Our Scottish network is ranked first in the UK for customer satisfaction and we were recognised as the leading gas network for stakeholder engagement for the last two years.

A highly reliable gas supply

On average our customers only experience an interruption once every 50 years. Our full emergency service responds to gas escapes 24/7, attending to uncontrolled gas escapes within an hour over 98% of the time. In 2018/19 our average response time to uncontrolled gas escapes was 43 minutes.

Deploying innovation

We lead the way on innovation and have helped other networks adopt new technologies to improve efficiencies and reduce disruption. We have reduced our environmental and community impact with new technologies for high rise buildings, excavation and robotic repair technology. We are leading the way in biogas and hydrogen exploration and have live projects underway in both networks which will help determine the future pathway for a decarbonised energy system.

Social legitimacy

As a regulated utility we recognise the importance of the social contract we have with our customers. Since the start of GD1 we have and continue to deliver all our outputs; we have improved safety, customer service, and we were the only Gas Distribution Network (GDN) to provide a voluntary contribution back to customers.

This is the foundation we will build on as we approach GD2.

An ambitious plan

Our three customer commitments are brought to life through a mosaic of interconnected ambitions and activities which will deliver real value to our customers. With significant change expected in the mid to longer-term, we focused on our future customers as well as those who rely on us today. We created ten-year ambitions which provide a pathway and momentum beyond GD2 and over the subsequent price control. We then focused on what we believe we can achieve in the five years of GD2 and defined our ambitions for the first draft of our plan in July 2019.

Delivering for our customers

We subsequently discussed and refined our ambitions with our stakeholders and customers, working collaboratively between July and December to create actionable plans and deliverables. We describe below the way that customers and stakeholders have shaped our ambitions.

1. We will make a positive impact by helping 250,000 vulnerable customers to use energy safely, efficiently and affordably

Ambition refined. On the advice of stakeholders and with additional customer feedback we have refined this ambition to provide deeper and more targeted support for vulnerable customers. Our initial July ambition was to help 500,000 vulnerable customers; however, we will now focus on delivering higher levels of support and deeper impact for 250,000 customers in vulnerable circumstances.[3]

Our people have a strong everyday commitment of care and concern for all our customers, especially those in vulnerable circumstances, and we strongly welcome Ofgem's additional focus in this area. We have developed our plan working with stakeholders to co-create ideas for valuable initiatives, targets and output measures.[3]

Plan for delivery

- We will provide targeted help for 50,000 people each year using our framework co-created with stakeholders to make best use of the new vulnerability use-it-or-lose-it price control deliverable (PCD). This will generate direct financial savings for vulnerable households of more than £3m each year.
- We will help an additional 18,000 households out of fuel poverty with a free gas connection through the Fuel Poverty Network Extension Scheme (a PCD).
- We will provide extra value to customers in vulnerable circumstances as part of our business as usual activities, for example installing a locking cooker safety valve for customers living with dementia.

See chapter 6 for more details.

2. We will make a positive impact by providing a great service to our customers, keeping up our efforts to deliver industry leading customer experience and achieving customer satisfaction scores higher than 9 out of 10

Ambition confirmed. Many customers and stakeholders were broadly supportive.[4]

We have not proposed additional outputs or incentives for customer service. We believe existing outputs and incentives are working well which is borne out by what our customers tell us. Customer expectations continue to increase each year and we have set ourselves the target of exceeding 9 out of 10 satisfaction levels each year across both our networks.

Plan for delivery

We capture and value customer feedback and use this insight to continuously improve our processes and engagement. We will prioritise the most important improvement opportunities highlighted by customers, particularly around communication, timescales and quality of work. Customers supported this approach, recognising increasing expectations require continued investment to provide the great service customers expect.[5]

We will maintain our strong focus on getting things right first time for customers, working proactively to reduce the need for customers to complain. With real-time feedback and focused management attention, we can quickly resolve any issues for customers. We will continue to work in an agile way, adapting to change efficiently and keeping our service costs low. We will invest in interactive technology, improve employee training and optimise our work sites and our daily interactions with customers. However, our customers have also expressed concern about the wider impacts of what we do; noise, dust, access disruption and inconvenience.[5] Customers asked us to improve our collaboration with other utilities to reduce these negative impacts. In response we have proposed a bespoke social value collaboration incentive.

See section 6.10 for more details.

3. We will deliver a safe and efficient service by keeping our network as safe and resilient as it is today

Ambition confirmed. Customers and stakeholders in all our research place a very high priority on us keeping the gas flowing safely. We do what is needed to ensure our network is safe and resilient from asset deterioration, physical and cyber threats. We fulfil our legislative duties and our essential social purpose to keep our customers safe and warm.

Plan for delivery

With an ageing asset base, investment is essential to retain asset integrity and maintain standards of safety and reliability. However, we are also conscious of the uncertainty around the future of heat and the risk of asset stranding. Our 4Rs strategy is to repair or refurbish before escalating to more costly replacement of components or, as a last resort, a full site rebuild. This strategy is explained further at section 7.2.

We have developed our plans with extensive internal expertise, supported by engagement with informed stakeholders who have engineering or specialist cyber security knowledge.

[3] Moving forward together stakeholder workshops (ref 013, 014, 016, 017)
[4] Positive Impact round table event - (London combined with Scotland) (ref 088) - Shaping the Business Plan Qualitative Workshops - Customer Service & Supporting Vulnerable (085)
[5] Shaping the Business Plan Qualitative Workshops - Customer Service & Supporting Vulnerable (ref 085)

- To keep our customers safe and manage risk from our pipes we focus on the mandatory replacement of iron pipes. In addition, we will accelerate steel mains replacement, decommission iron stubs, remove vulnerable redundant assets and extend riser inspection surveys to medium rise blocks of flats with three or four storeys.
- We know our assets well and have a good understanding of where the greatest risk resides. We have specifically named the projects and programmes which must be carried out to maintain the resilience of our transmission and distribution assets. We have provided a cost benefit analysis (CBA) and engineering justification paper (EJP) in each case.
- Cyber threats will be dynamically assessed during GD2 in-line with the Cyber Assessment Framework. Initiatives will be implemented to mitigate the threats to the network with advice and interaction from industry and advisory bodies, including the Energy Emergencies Executive Cyber Security Group (E3CC) and cyber security specialists.

See chapter 8 for more details.

4. We will deliver a safe and efficient service by reducing like-for-like customer bills

Ambition confirmed. Customers tell us one of their highest priorities is to keep overall bills down.

Plan for delivery
Our plan includes a reduction to our share of customer bills of 10% and 6% in Scotland and Southern respectively to give an average reduction of 7% for all our customers across SGN. To achieve this reduction we will deliver average efficiency benefits of £15.2m each year of GD2. This is generated from an overall average productivity improvement of 1% a year.

The value provided to customers from each investment project or programme costing more than £500k has been defined in one of 135 CBAs and 146 accompanying EJPs which have been submitted with this plan.

See chapter 17 for more details.

5. We will deliver a safe and efficient service by facilitating fewer interruptions to customers' supplies as a result of third-party damage, working collaboratively towards a 15% reduction

Ambition amended. At recent workshops a common theme from both customers and stakeholders was to improve collaboration to reduce disruption for customers.[6]

Plan for delivery
Acting on this feedback, we have changed the focus of our ambition and will work in collaboration to facilitate a reduction in emergency repair interruptions caused by third parties damaging our pipes. Although not directly under our control, we believe proactive engagement and collaborating to avoid third party damage will provide extra value customers want through fewer interruptions and a resulting reduction in carbon emissions.

See section 4.14.3 for more details.

6. We will build a shared net-zero future by helping the UK Government create a future for heat that is sustainable, affordable and reliable, building impartial evidence from 100% hydrogen demonstrations

Ambition confirmed. Our engagement with informed, specialist stakeholders has confirmed the importance of our 100% hydrogen demonstrations to a net-zero pathway.[7]

To achieve the Scottish and UK Government's ambitions for decarbonisation and meet our customers' expectations, the energy industry must continue to accelerate the pace of collaboration, evidence gathering and transition towards 2045 net-zero.

Plan for delivery
We created a 'whole systems charter' with electricity networks operating in Scotland and the South, setting out a series of commitments defining how we will work together during GD2.

We believe our clear role is to help provide the best available evidence to policy makers on the cost and feasibility of decarbonising the gas networks.

We have identified the following four themes for research, development and demonstration in GD2.

1. Whole systems – research and demonstrations are carried out considering the whole system to evidence cross-sector benefits
2. Emerging technologies – research and demonstration of new technologies with potential to facilitate greater levels of decarbonisation and/or enhanced security of supply
3. Demand forecasting – research into dynamic changes in demand forecasting due to a rapidly evolving energy system
4. Pathways project – research, development and demonstration projects that evidence the pathway to decarbonisation of the gas network.

See chapter 11 for more details on our proposal for whole systems.

7. We will build a shared net-zero future by increasing the amount of greener gas in our network, to supply the equivalent of 450,000 households

Ambition increased. Our July and October draft plans included an ambition of 400,000 equivalent homes to be supplied with biomethane. Biomethane producers supported maintaining or increasing this ambition,[8] and we have subsequently responded to a challenge from our Customer Engagement Group (CEG) to increase our ambition resulting in our revised target of 450,000.

Plan for delivery
We have consulted stakeholders about the primary barriers for future and current injection of biomethane on our network. Our plan has been developed to help overcome these barriers and includes:

- reducing connection costs by working on standardisation of equipment;
- longer term work to reduce propanation costs by promoting changes to regulations and codes; and
- improving network capacity for biomethane producers through smarter network control, upstream

[6] Positive Impact round table event - (London combined with Scotland) (ref 088), Shaping the Business Plan Qualitative workshops - Customer Service & Supporting Vulnerable (ref 085)
[7] Future of heat specialist panels, Edinburgh 1 & 2 (ref 023, 024), Shared Net Zero Future round table event (ref 090)
[8] Biomethane and Gas Entry connections round table event (ref 095)

compression and technical support and solutions to facilitate further capacity.

We are also proposing three feasibility studies to assess the viability of biomethane feeding the networks in our Scottish Independent Undertakings (SIU) at Oban, Wick and Thurso.

See section 11.7.2 for further details.

8. We will build a shared net-zero future by reducing our total carbon footprint by more than 25% from 2018/19 levels

Ambition increased. Customers and stakeholders wanted us to aim higher.[9] We have therefore increased our target slightly from 25% in the July plan to bring us in line with Scotland's net zero-target.[10] By the end of the plan we aim to reduce our total carbon footprint (which includes leakage) by 180ktCO_2e.

Plan for delivery
Customers want us to prioritise environmental initiatives and invest in future energy solutions. Our approach to sustainability will therefore be more ambitious for GD2 than it was in GD1, linking our strategy to the United Nations Sustainable Development Goals (UN-SDG) and driving beyond science-based targets to support the UK's carbon reduction commitments.

- We will save an average of 1.1ktCO_2e a year by reducing our replacement cycle for all vehicles to six years and replacing a proportion of existing vehicles with low emission alternatives each year. We are proposing a use-it-or-lose-it allowance for low emission vehicles, since the pace of development of large vans suitable for our work is not certain.
- We will save an average 2.2ktCO_2e a year by accelerating the mandatory pipe replacement scheme and carrying out a proactive steel programme, given that gas leakage is the major contributor to our overall carbon footprint. We will focus this acceleration on areas more likely to be converted early to hydrogen, potentially enabling more substantive reductions in future emissions.
- We will focus on resource use and waste and work with our supply chain to understand our embedded carbon.

See chapter 9 for further details of our environmental action plan.

9. Reducing the peak demand for heat by 10%, lowering the overall capacity and investment needed in the network

Ambition amended. We discussed this ambition with stakeholders[11] and customers[12] to try to create an actionable plan. We still believe that for the UK to achieve faster decarbonisation, reducing peak gas demand lowers the barriers for alternative means of heating. However, customers and stakeholders have struggled to see a relevant role for us to reduce peak heat demand, and the response was lukewarm. Acting on this feedback we will withdraw the ambition and associated suggestion for an output delivery incentive. However, we will work to improve demand forecasting during GD2, something that will be key for either electrification or hydrogen pathways to net-zero.

See section 15.5.

Delivering value for our customers

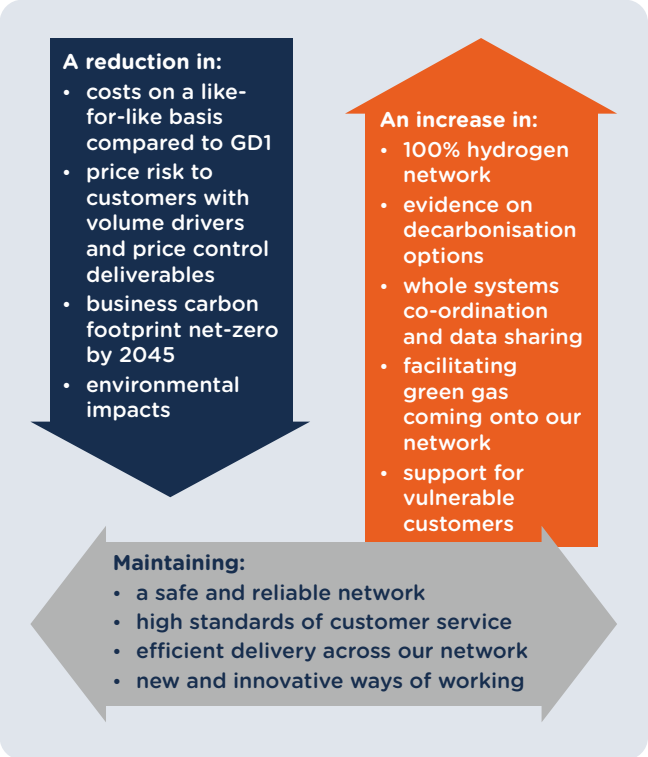
We will maintain our high performance standards and deliver extra value for our customers.

Our customer value proposition

We have clearly aligned our plan with the priorities of our customers, to provide a service that keeps pace with their increasing expectations and generates significant extra value. Many of the positive elements of our activities are not easy to quantify. For example, customers tell us about the positive interactions they have with our people and the many ways in which we go the extra mile.

At its core our plan is a fully justified, high-confidence investment proposal where the allowances requested are tightly aligned to the expenditure required to deliver outcomes valued by current and future customers.

We have summarised below the key elements of our customer value proposition:



As a result of the decisions made in the plan and the actions we take to implement those decisions, significant additional value will accrue for current and future vulnerable customers.

We have estimated our plan will deliver additional value of just over £700m as a result of investments and actions taken over the five years of GD2, in those areas of customer benefit we can value.

See chapter 5 for more details of our customer value proposition.

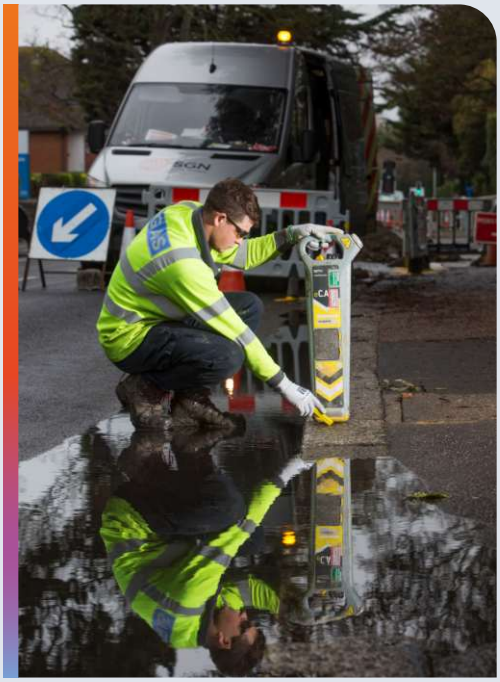
[9] Future of heat specialist panels, Edinburgh 1 & 2 (ref 023, 024) - Shared Net Zero Future round table event (ref 090)
[10] Our July plan was targeting an 80% emissions reduction pathway in line with earlier legislation
[11] Safe & Efficient round table event - London (ref 089)
[12] Business Plan Acceptability Testing Phase 1 (ref 078)

Balancing competing priorities

In creating our plan, we have tried to balance competing priorities, using insight from customers and stakeholders to make decisions about three fundamental trade-offs:

1. **Reducing cost while enhancing service**
2. **Reducing cost while managing uncertainty and risk**
3. **Balancing the interests of current and future customers.**

The chart highlights the relative importance customers placed on each of their seven priorities and the areas in which they would like us to invest to enhance our services.[13]



1. Reducing cost while enhancing service

Our customers' overarching priority is to keep overall costs and bills down. However, they have also told us they would value enhancements to our services, in particular to minimise our environmental impact, investigate future energy solutions and support vulnerable customers.

In line with the expectations of our customers that we keep our costs down, we have reduced our like-for-like totex to £563m a year for GD2, which is 4.5% lower than the last three years of GD1.

In our July draft plan, to provide customers with additional value aligned to their priorities we developed potential additional enhancements costing up to £152m, on top of our like-for-like services. Since July we have continued to engage with our customers and stakeholders[14] building our understanding of the specific service enhancements they believe should be included in our plan at a price customers are prepared to pay.

In summary, the value of enhanced services included in this final plan and supported by customers[15] is £54m and set out in table 1, with more details in chapter 16a.

Table 1 Additional investment in GD2	Positive impact	Safe and efficient	Shared net-zero future	Total enhanced services
Potential enhanced services in July plan	£10m	£113m	£30m	£152m
Final enhanced services	£12m	£9m	£34m	£54m

[13] Stage 1: Explorative Qualitative Workshops and Interviews (Exploratory Phase) (ref 002)
[14] Customer qualitative workshops (ref 083, 084, 085), Specialist stakeholder round table events (ref 088, 089, 090) and Stage 3: Conjoint & WTP Summary report (ref 005)
[15] Stage 3: Conjoint & WtP summary report (ref 005, 094), Business Plan Acceptability Testing Phase 1 and 2 (ref 078, 079)

The services have been narrowed down through engagement with customers and stakeholders, cost benefit analysis, willingness to pay research, acceptability testing and technical assessment. The highest proportion of enhanced services is aligned to our commitment to create a shared net-zero future by minimising our environmental impact or focusing on future energy solutions. These are our customers' highest priorities.[16]

Further details of our engagement with customers and the enhanced services they support are given throughout the three output sections of our plan, indicated by blue, purple or green pages – making a positive impact, delivering a safe and efficient service, and building a shared net-zero future.

2. Reducing cost while managing uncertainty and risk

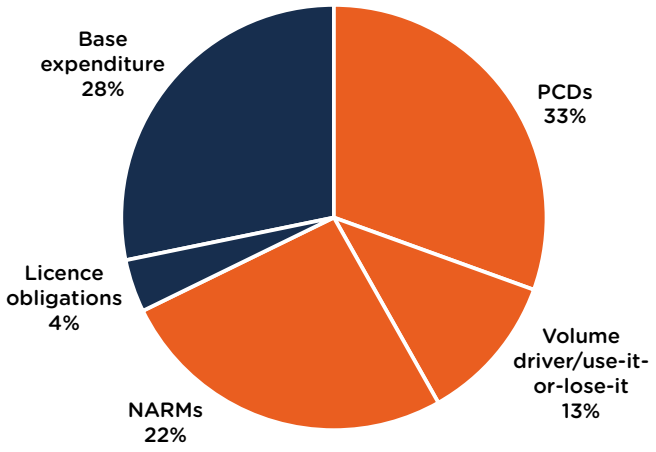
We have discussed with our customers the balance of risk they consider appropriate for a company like SGN. While customers told us they value stability, they also recognised volume-based mechanisms were appropriate for the type of work we carry out. Our customers' view was particularly for 'business as usual' expenditure, administrative and maintenance costs, fixed budgets were appropriate, but volume drivers were appropriate for up to a half of the expenditure. Customers were less supportive of larger changes and reopeners.[17]

We have reflected on this feedback as we have defined the outputs proposed in our plan. We have endeavoured to apply the right balance between protecting customers against poor forecasts while recognising their concerns that volume drivers and use-it-or-lose-it mechanisms may lead to inefficient expenditure.[17]

Figure 1 shows how two thirds of our investment in GD2 is attributed to a clearly defined output. This is an increase from just over a half of our investment in GD1. This improved level of definition gives greater confidence to our customers that the money we invest will give them an outcome they have asked for.

Full details of our proposals for uncertainty mechanisms can be found in chapter 12.

Figure 1



3. Balancing the interests of current and future customers

The interests of current customers may differ from those in the future given the uncertainty about the role of gas networks in a net-zero pathway. However, through our extensive engagement and research with current and future customers we have not seen a marked difference in views between the two groups. We do however remain concerned about inter-generational fairness and have discussed a number of challenges and mitigations with customers and stakeholders.

A responsible asset strategy. We know our assets well and apply our 4Rs strategy to make the right interventions. We ensure safety today while keeping costs down until decisions on decarbonisation are made. Expert stakeholders welcomed this strategy.[18]

Early innovation. This was defined as innovation which is not immediately ready for implementation and which may not provide a return to current customers, but which may deliver significant benefits for customers in the future.

Both current and future customers said they wanted us to continue to invest in early innovation.[17] Most participants would be prepared to pay towards early innovation, although they also expected us to make a company contribution which we have committed to.

Low regrets investment. There is a trade-off between the need to invest in replacing ageing network assets today, and the risk of asset stranding if the gas network is not an integral part of a decarbonised net-zero future. We have recognised and mitigated this risk to future customers by ensuring our investment is low regrets - 95% of investment in our plan is related to the integrity of our assets or the direct operation of our network. A very small amount of investment responds to customer needs for additional connections and network growth.

Cost of capital. By setting an inappropriate cost of capital, it will either promote or discourage investment resulting in a lower or higher cost to current and future customers. The current cost of capital proposed by Ofgem will discourage investment in areas that are considered particularly important for future customers, such as climate change and investing in the least cost decarbonisation pathway, in favour of bill reductions for current customers.

In acceptability testing of this final plan using our alternative cost of capital assumptions, we found no statistically significant difference in the levels of acceptability expressed by current and future customers.[19] With high levels of acceptability from both groups, we believe that our plan and cost of capital proposals provide a good balance between the interests of current and future customers.

16 Stage 3: Conjoint & WtP summary report (ref 005)
17 Qualitative workshops - Sharing Financial Risk. Innovation Investment (ref 083)
18 Safe & Efficient round table event – London (ref 089)
19 Business Plan Acceptability Testing Phase 1 and 2 (ref 078, 079)

Driving decarbonisation

Our plan demonstrates our ambition to support and accelerate the transition of the UK's energy system, with a long-term vision and shorter term actions.

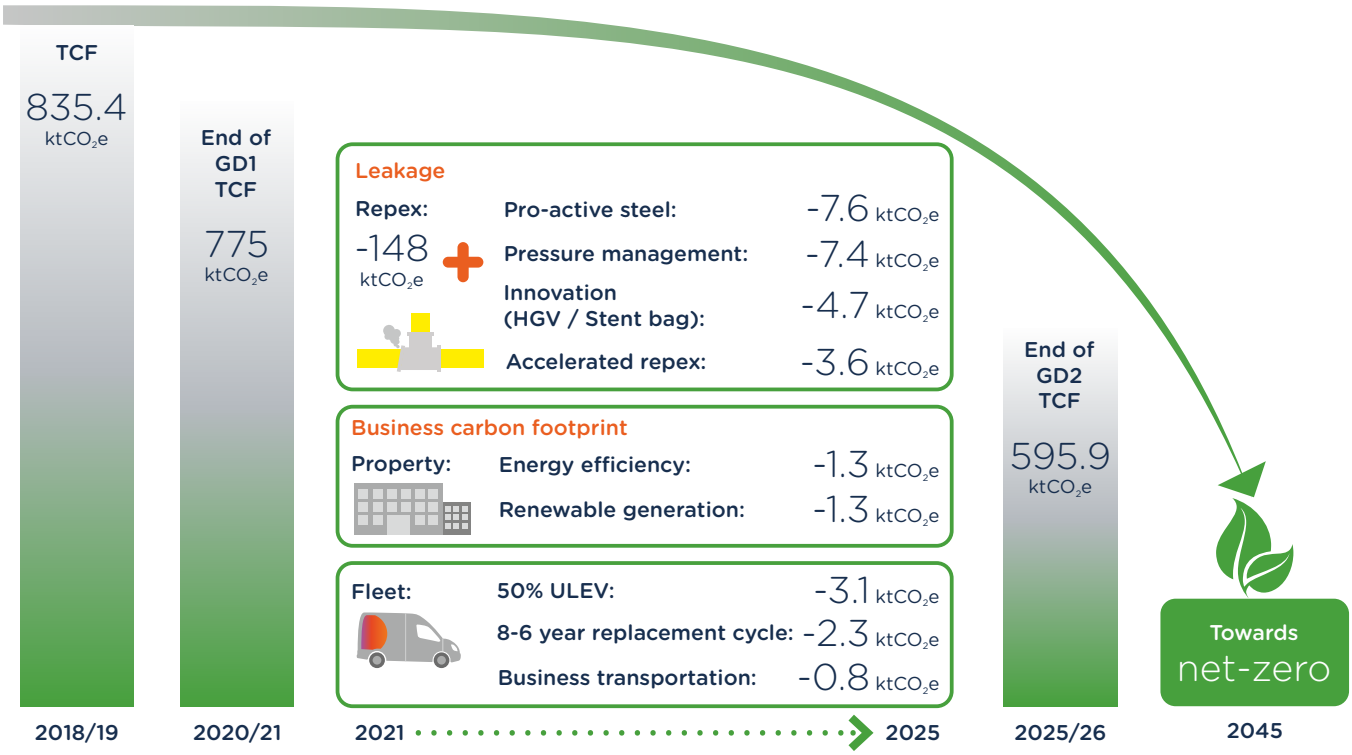
Accelerating towards 2045 net-zero

In the interests of our current and future customers we have a clear, collaborative approach to support faster decarbonisation and accelerate the UK towards a shared net-zero future in 2045.

We have a two-pronged approach within our plan: reducing our own carbon footprint and decarbonising the gas transported in our network.

1. We demonstrate how our proposals will minimise our current environmental impact by reducing leakage and other carbon emissions to achieve a total reduction of over 25% from our 2018/19 base, putting us on track for a 2045 net-zero (chapter 9 part A).

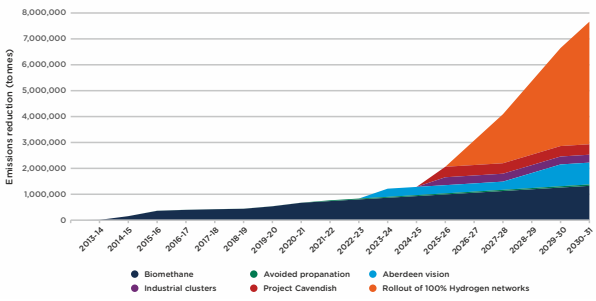
Action to support reduction in our total carbon footprint (TCF) over GD2, in $ktCO_2e$



2. We explain our ambitious approach to decarbonising the gas within our network, an approach built on collaboration and innovation. We will support the Government in making decisions about how to decarbonise heat and energy systems by providing fair and impartial evidence of a potential pathway to deliver confidence in the role of hydrogen.

If our innovation programme is successful, and subject to relevant policy decisions, GD3 could see the delivery of a significant rollout of 100% hydrogen networks across a number of cities and towns in our footprint.

Decarbonised gas on our network



By the end of GD3, we forecast a 25% reduction (eight million tonnes) in the carbon contained in the gas we transport, compared to the GD1 baseline. We aim to provide the evidence base for hydrogen so that in GD3, the network is in a state where the conversion of further customers to 100% hydrogen will be largely business as usual, paving the way to achieve decarbonisation targets in line with government policy.

The three elements of our plan that will deliver this ambition are:

- Enabling increased biomethane volumes (chapter 9 part C)
- Pursuing opportunities for optimum decarbonisation routes through whole systems thinking (chapter 11)
- Evidencing the hydrogen pathway and preparing for future roll out (chapter 13).

Delivering efficiently

Our plan builds on our strong track record of efficiency and maintains our position among the most efficient networks in the sector.

We have delivered a consistent level of efficiency in both of our networks. With eight separate reporting regions making up the UK's gas distribution networks, it is possible to compare total expenditure across each regional network, taking into account each region's size, the volume of work and some of the regional cost characteristics.

This produces a point of comparison against which the different networks can be compared. We have then compared this against the 'upper quartile', the benchmark used by Ofgem in GD1 to determine the allowances each company was awarded. In Scotland and Southern, we have consistently been performing better than average and above or close to the upper quartile.

We believe that our proposals for investment build on this efficient position. Our plan will provide additional value to our customers and, when combined with our productivity challenge, we expect to be within the upper quartile, while maintaining the high-quality service delivery our customers expect. More details can be found in section 12c.

Table 2 GD1 efficiency performance

	Standardised efficiency score SGN proposed methodology				
	2013/14	2014/15	2015/16	2016/17	2017/18
EoE	1.07	1.06	1.07	1.13	1.08
Lon	1.09	1.04	1.10	1.05	1.06
NW	1.03	1.10	1.08	1.03	1.01
WM	0.98	1.03	1.02	0.99	0.99
NGN	0.88	0.90	0.93	0.92	0.95
SC	0.95	0.92	0.89	0.93	0.98
SO	0.95	0.93	0.93	0.98	0.97
WWU	1.05	1.03	0.99	0.97	0.97
UQ	**0.95**	**0.92**	**0.93**	**0.96**	**0.97**

Cadent operates four regions under one licence, WWU and NGN have one region covered by one licence each and SGN has two regions, each with its own operating licence. A score of below one means the network is better than the average sector performance, while a score greater than one is less efficient than average. The regressions reflect our proposed updates to Ofgem's methodology as set out in Chapter 12.

Through GD1 we have prided ourselves on being at the forefront of developing and deploying innovation projects. We have specifically targeted innovations to deliver process improvements for customers and our business, targeting pain points and finding solutions to overcome them. We believe this has helped us innovate successfully, offsetting cost pressures we would otherwise have seen coming through in GD1.

We will not be able to fully repeat the step-change in efficiency that we delivered in the early years of GD1, but customers will benefit from these savings from GD2 onwards through the cost assessment process. We have already realised the one-off opportunities available, for example by increasing live insertion rates to close to the maximum achievable and efficiency gains will now be more incremental. However, we do still forecast challenging efficiency savings in GD2 which include innovation benefits with an annual average of £2.2m carried forward from the last years of GD1. We have set out our approach to innovation in chapter 13.

Investment to deliver

We believe that our plan delivers the short and long term outcomes that customers expect at a price they are prepared to pay. The investment proposals to support these outcomes are described below.

Investment for GD2

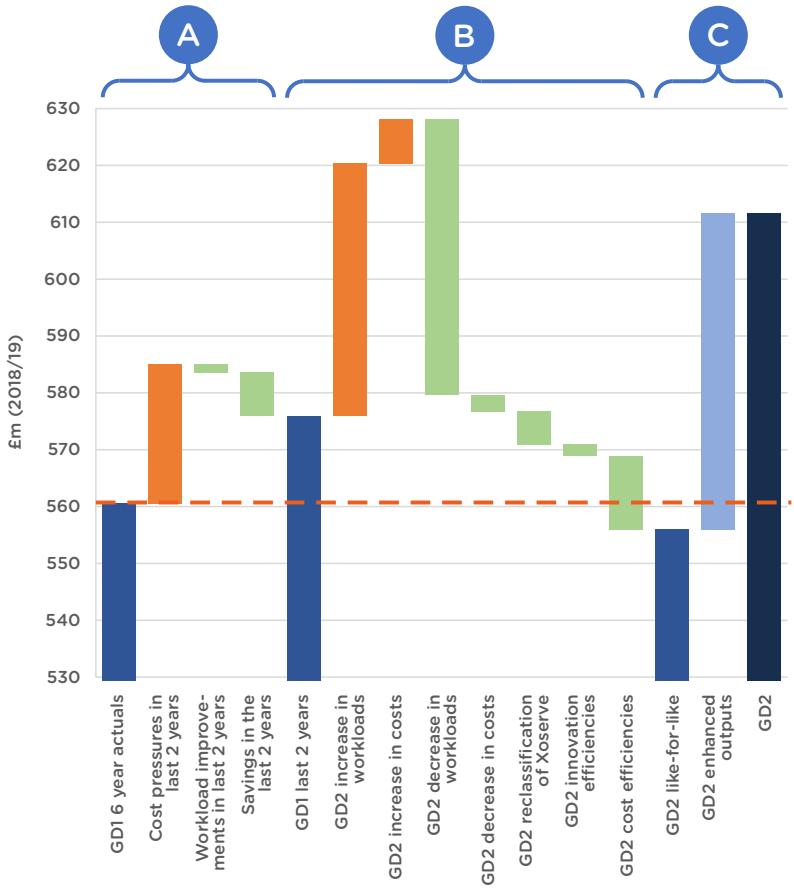
The table below summarises our investment proposal for GD2 against comparable bases in GD1. The first half of GD1 was characterised by a relatively benign low-cost environment whereas the second half of GD1 has seen increasing cost pressures, particularly in the labour market. Therefore, we believe the last three years of GD1 provide a suitable base to compare GD2. We have also included the first six years actual for GD1 as requested by the RIIO2 Customer Challenge Group.

Starting at an SGN totex level, average like-for-like totex in GD2 of £563m before new outputs is 4.5% below the last three years in GD1 and is broadly in line with the first six years actual. This has been achieved through reductions in workload and an ambitious 1% a year productivity target, despite continuing cost pressures.

Breaking this down further, we can see that the major changes in operating expenditure result from £13m a year of new outputs to improve our asset records for lower storey risers, to increase our focus on cyber resilience and to cover increasing smart meter interventions. Capex has increased as a result of local transmission system (LTS) workload and new GD2 outputs such as increased IT investment and additional environmental measures relating to buildings and fleet. Replacement expenditure (repex) overall has reduced as the workload moves across to lower cost interventions compared to the end of GD1, partially offset with new GD2 outputs focussing on accelerated and proactive workloads.

	SGN (£m 2018/19 prices)				
	GD1 6 year actuals	GD1 last 3 years	GD2: like-for-like	GD2: enhanced outputs	GD2: total
Opex	189	196	193	13	206
Capex	115	118	120	22	143
Repex	244	270	244	19	263
Totex (Excl Xoserve)	**548**	**584**	**557**	**54**	**612**
Xoserve	13	6	6	0	6
Totex	**561**	**590**	**563**	**54**	**618**
Scotland					
Opex	66	66	67	5	73
Capex	49	46	52	9	61
Repex	62	68	60	6	66
Totex	**177**	**180**	**179**	**20**	**200**
Xoserve	4	2	2	0	2
Totex	**180**	**182**	**181**	**20**	**201**
Southern					
Opex	122	130	126	7	133
Capex	66	72	68	13	81
Repex	183	202	184	13	198
Totex	**371**	**404**	**378**	**34**	**412**
Xoserve	9	4	4	0	4
Totex	**380**	**408**	**382**	**34**	**416**

The trace chart below shows the movements from the first six-year starting point of £561m, to our final GD2 position of £612m.



The trace identifies -

A The cost pressures towards the end of GD1

B The drivers of cost movements in GD2 split between cost, workload and productivity.

C Like-for-like service enhancements in line with our customers' priorities.

We have selected the additional outputs included in this final plan according to customer and stakeholder feedback, and rigorous assessment of technical and economic deliverability. At the time of the July submission these additional service enhancements came to £152m. We continued to test these extensively with stakeholders and have completed a series of technical and commercial evaluations. As a result, we have reduced the longer list of service enhancements from £152m to our final investment proposal of £54m. Chapter 16 provides a further analysis.

Ensuring financial sustainability

It is important that Ofgem, regulated companies and interested stakeholders work towards a price control that is financially sustainable in the short and long term. We must all protect the interests of current and future customers, taking into account the need to invest in future decarbonisation as customers have asked us to do.

In assessing financeability and our appropriate credit rating thresholds, we considered the following points.

- The value to customers of a strong credit rating, a benefit which has been recognised by a range of different stakeholders.
- Intergenerational fairness – avoiding burdening consumers in the longer term given that decarbonisation investment for GD3 and beyond will be significant, increasing the critical importance of attracting appropriate investment at good value for customers.
- Long term financial sustainability of our company, including the ability to attract equity in future price controls.
- Stability and predictability of customer bills in the future to avoid the need for steep increases.
- Linked to all of the above, investor appetite and confidence (both debt and equity) ensuring that our critical infrastructure investments are supported by strong credit metrics is a crucial plank of building confidence and reducing financing costs for customers today and into the future.

The board have examined carefully whether the company is financeable in GD2 using Ofgem's working assumptions. We conclude that, based on the totex, outputs and incentives put forward in this plan, the notional company is financeable under Ofgem's working assumptions for GD2. However, we suggest this is a reflection of inappropriate working assumptions rather than, necessarily, the financial strength of the notional company. For example, we note that with zero outperformance, the notional company no longer achieves credit metrics in the minimum target range for BBB+/Baa1 credit rating. Alternatively, if the outperformance wedge was removed (as we believe should be the case) and both the allowed and expected returns were 4.8% under Ofgem's working assumptions, the credit metrics would return back to BBB+/Baa1.

Ofgem's working assumptions have put increasing financial pressure on the actual company and equity investors compared to GD1, including a notional £300m equity injection. This is significantly weakening the credit quality of the energy sector, at a time when we are facing unprecedented challenges and political risks. They also materially worsen the position of the company compared to GD1 and risk undermining our ability to invest in the future in decarbonisation. These increased financial pressures are being introduced without adequate justification from Ofgem.

Over the course of GD1, SGN has maintained a responsible corporate structure with appropriate gearing and the efficient issuance of debt with costs broadly in line with historical costs experienced elsewhere. As existing loans mature and to fund additional investment, we will need to raise a further £2.6bn of new debt. Assessing the financeability of the actual company, using Ofgem's working assumptions, it now falls short of the credit metrics we require to achieve our minimum credit rating. However, the company has a range of financing mitigating options available and these can be used to achieve the minimum credit rating. None of these mitigating options have a GD2 impact on customer bills, but they are costly for the company to implement and alter the risk profile of the company. For example, as they are largely accelerating cashflows and pushing risk into GD3 and beyond, we ultimately believe this will impact on bills.

Our charges in the last three years of GD1 have averaged approximately £147 per domestic customer per year. Under Ofgem's working assumptions this would fall to around £127 – a reduction of £20 (14%). We have separately assessed financeability against an independent and stand-alone analysis on the cost of capital. Our assessment of the notional and actual company demonstrates that a solid financeable position can be reached whilst still delivering on average an £11 bill reduction in GD2. We believe SGN's assumptions will provide longer term stability and overall intergenerational fairness. On this basis, 92% of our customers in Scotland and 86% of our customers in the South found our plan acceptable.

We believe SGN's working assumptions provide the best value for money for customers as they allow for bill reductions and the maintenance of a strong credit rating. This ensures the continuation of an environment to secure and maintain equity investors now and in the future. In comparison, Ofgem's working assumptions drive the need for mitigating actions; impact intergenerational fairness to the detriment of future customers, and damage investor confidence at a challenging time for the sector. Engagement with stakeholders and customers has demonstrated support for our approach. Chapter 18 provides more details.

Assurance

Our plan has been developed through extensive consultation with customers and stakeholders to create ambitious and sustainable outcomes that we, the SGN board, and the senior management team will be proud to deliver.

Our GD2 plan has been reviewed during its development by independent engineering and subject-matter experts. We have also responded to ongoing challenge from both our CEG, led by Maxine Frerk, and the RIIO Challenge Group, particularly through their feedback on our first and second drafts.

Our final plan reflects this constructive feedback and our ongoing dialogue with both the CEG, our customers and stakeholders. We have also focused on ensuring alignment between the plan and the business plan guidance released by Ofgem on 3 June 2019, updated on 9 September and 31 October 2019.

Our submission is supported by the assurance of our Board that the plan is in the interests of existing and future customers, that it is accurate, financeable, robust and represents good value for money for customers.

This assurance is supported by an extensive independent process that covered all the major components of the plan and reported directly to the Board. This process and our subsequent response to their independent challenges has provided assurance that our plan is aligned with what customers want, is fully justified for cost and engineering excellence, and retains the right balance of ambition and pragmatism to deliver the best outcomes for the future.

We have set out details of our Board assurance process in chapter 3.

How we have structured our plan

Executive summary

Business plan structure

A strong, capable and listening network

1 Introduction
- Network diagram

2 GD1 experience
- Performance against outputs and incentives
- Value creation

Linked appendices
001 GD1 Experience

3 Business plan commitment

4A Enhanced engagement

4B Ongoing engagement strategy

Linked appendices
022 Enhanced engagement
024 Stakeholder engagement
023 Customer and vulnerability plan

5 Customer value proposition

Meeting the needs of our customers

6 Delivering a positive impact
- Drivers and strategy
- Outputs and deliverables

Linked appendices
023 Customer and vulnerability plan
020 Connections
024 Stakeholder engagement
013 Emergency service

7 Maintaining a safe and resilient network
- Drivers and strategy
- Outputs and deliverables

Linked appendices
019 Replacement expenditure
021 Transmission integrity
012 Distribution integrity
013 Emergency

8 Resilience
- Business IT security and cyber resilience
- Workforce planning
- Physical security

Linked appendices
016 Asset maintenance
015 Workforce management
011 IT and Cyber resilience
002 Property

9 Environmental action plan

Linked appendices
003 Environmental action plan

10 Delivering an environmentally sustainable network
- Drivers and strategy
- Outputs and deliverables

Linked appendices
006 Energy futures - transition
007 Future of energy - whole systems and scenarios

11 Enabling whole systems solutions
- Modernising energy data

Linked appendices
006 Energy futures - transition
007 Future of energy - whole systems and scenarios

Uncertainty and efficiency

12 Managing uncertainty
- Efficiency
- Mechanisms
- Real price effects

Linked appendices
005 Cost efficiency

13 Innovation

Linked appendices
008 Innovation

14 Competition

Linked appendices
010 Procurement & native competition

Our business plan is supported by another 1,600 pages of detailed analysis and explanation across 26 appendices linked to the chapters in our plan. These are further supported by 146 engineering justification papers (EJPs) and 135 cost benefit analysis (CBA) that cover the projects and programmes of work identified throughout our plan.

Cost and financial information

15 Forecasting and scenarios
- Consistent view of the future

Linked appendices
005 Cost efficiency

16 Investment summary
- 16a Totex summary
- 16b Traces and Sensitivities
- Outputs to costs mapping

17 Workloads and activities
- Repex
- Emergency repair and maintenance
- Transmission network integrity
- Distribution network integrity
- Network connections
- Delivering capacity
- Fleet
- Property
- Operating expenditure
- SIUs

Linked appendices
021 Transmission Integrity
019 Repex
016 Asset management
012 Distribution, integrity & governors
025 Fleet
002 Property
015 Work management business support
026 Electrical & instrumentation
017 SIUs
013 Emergency service
014 Repair service
018 Capacity management
020 Connections

18 Financing information

Linked appendices
Financeability
005 Cost efficiency

We have mapped each individual output with the costs set out across our plan at section 16.7.

1 Introducing SGN

We provide over 14 million people in homes and businesses across Scotland and southern England with warmth; by delivering a safe, reliable and efficient supply of natural and green gas. We manage the networks and distribute gas to some of the most remote and most densely populated parts of the country. These include Scotland's Highlands and Borders, and the London Boroughs of Lambeth and Southwark, which are among the top ten most densely populated local authorities in the UK.

1.1 About SGN

Created in 2005, Scotia Gas Networks (SGN) was established when National Grid Transco sold four of its eight gas distribution networks. Today, our two networks cover the whole of Scotland, South London and the South East of England; from Banbury to Lyme Regis and the Isle of Wight, and to Margate on the south coast. We are owned by SSE plc, OMERS Infrastructure, Ontario Teachers' Pension Plan Board Investments (UK) Ltd and Abu Dhabi Investment Authority.

In Scotland, our network delivers gas to 75% of Scottish households and businesses, serving around 1.8 million customers across the whole of Scotland through over 26,000km of pipeline. We also operate five standalone and remote Scottish networks known as Scottish Independent Undertakings. Our Scottish customers have given us the highest satisfaction scores of any gas network for the last three years.

In the South, our network delivers gas to around 90% of homes and businesses, serving around 4.1 million customers through over 48,000km of pipeline. We serve large numbers of customers living in London's densely populated urban communities, as well as many customers living in county towns and rural villages across the South East of England.

Our relentless focus on safety, reliability of supply and customer service drives a strong culture of care and concern in all our teams for their local communities.

Key facts

We directly employ **3,900 people**, including highly skilled engineers, analysts, technicians and support staff to ensure our networks run reliably, safely and efficiently **24 hours** a day

We have recruited **251** apprentices, trainees and graduates since 2013, investing in our skills base to maintain and manage the network in the future

Achieve industry-leading **customer satisfaction scores**, and recognised as the leading gas network for stakeholder engagement for the last two years

Invested **£2.3bn** in our networks during the first six years of GD1

Made **26,094** Help to Heat connections since the start of GD1 (to March 2019), taking people out of fuel poverty

Connected **35** biomethane production plants to our network since 2010. We are currently providing enough green gas to supply **199,000** properties

We are forecasting a **7% real reduction** in customer bills during GD1

133,485 new connections made since the start of GD1

220,000 gas emergencies attended each year

74,000km of pipes, including **3,122km** of high pressure transmission pipeline

136TWh gas transported in 2018/19 (**6.6% decrease** over 2017/18)

£5.7bn regulatory asset value (March 2019)

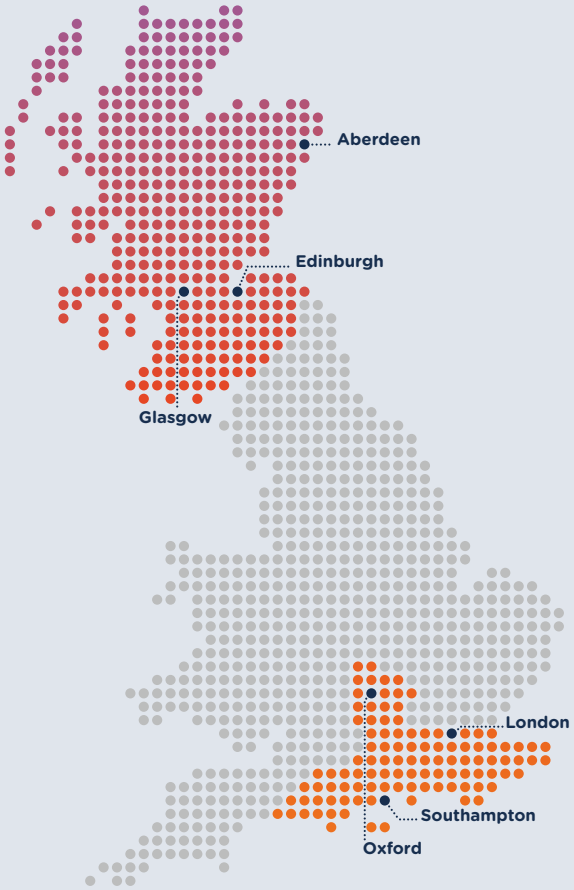
1.2 Two geographies, two networks, one company

We embrace the challenge of safely operating two of the largest gas networks, positioned at either end of the UK and separated by some 400 miles. We work with stakeholders across both our regions to understand the similarities and differences in political, business and community perspectives. Working in two very different regions gives us the opportunity to learn from stakeholders and transfer learnings between regions, facilitating overall improvements for the UK.

Policy and legal requirements set by Scottish and UK parliaments create differences in how we meet our obligations in our two regions. For example, Scottish Government grants are available for all in-home measures to lift houses out of fuel poverty – a far greater problem in Scotland than in the South. And Scotland has led UK ambition on climate change, being the first nation to announce support for net zero carbon by 2045, ahead of the current 2050 target set by Westminster. We have adopted this faster ambition across both our networks, accelerating towards 2045 net-zero. Streetworks and environmental regulations are other areas where regional differences in legislation and policy require a tailored response according to their different legislative underpinnings. For example, the recently passed Transport (Scotland) Bill gives Scottish Ministers the powers to set emissions standards, exempt vehicle types and decide on penalty charges relating to streetworks in different parts of the country.

Despite the physical separation of our regions and differences in terrain, infrastructure and even climate, we very much remain one company operating over two distinct footprints.

All our engineers are trained to a very high standard, with mirrored apprentice schemes and identical technical training programmes. Assets and equipment are common to both which ensures their skill-sets and professionalism are completely transferable. Whether they are in Aberdeen or Dover our engineers will follow exactly the same procedures and practices to handle a gas escape, with the sole aim of safeguarding people and property. When we experience situations that need a speedy injection of additional labour, we can deploy engineers from across our regions to where they are needed. This ensures the fastest skilled response for our customers.



Our senior engineers responsible for each network ; John Lobban, Managing Director of Scotland & Northern Ireland and Glenn Norman, Director of Operations for Southern, describe their regions below.

> "Keeping our most vulnerable customers safe is a priority"

SGN's Glenn Norman (left) and John Lobban (right)

1.2.1 SGN in Scotland

Firstly, John explains what sets Scotland apart, not just from the South but from the other networks across England and Wales.

"Our network in Scotland covers the largest area of any UK gas network which brings challenges for accessibility and reaching our customers in the most remote areas. Our engineers often live in the communities where they work. This can be a real advantage as it means they quickly understand the dynamic of a gas escape, tapping into known local networks to keep communities informed and to support any vulnerable customers. However, the sparser population may also mean traveling longer distances to provide the same level of service and our engineers have to be trained to manage a greater variety of potential incidents.

Beating the one-hour target for reaching an uncontrolled gas escape in an isolated community is something we pride ourselves on, but it can prove a challenge where long-distances over sea and land are involved. While we do our best to strategically locate our emergency and repair workforce across our depot regions, we have to accept distance can be an issue.

The weather in Scotland can also prove highly challenging. With the coldest weather in the UK, and winter temperatures capable of dropping to well below zero, often for days on end, we not only have to maintain our network to high standards to keep the gas flowing, but we have to reach remote communities where there are customers with vulnerabilities. We work closely with other social support agencies in order to ensure the most vulnerable in our society are looked after. Scottish communities are strong and caring, with positive attitudes and often genuine appreciation for our engineers doing their best to help them.

In the central belt region we look after two of the UK's largest cities - Glasgow and Edinburgh, with areas of Glasgow being some of the poorest and most deprived in the country. A high concentration of high-rise flats across the city also puts gas safety high up the agenda and our role is to alleviate the concerns residents may have. We work closely with the city authorities to ensure safety is never compromised."

1.2.2 SGN in southern England

Glenn explains the different dynamics of our southern operating area.

"It's no secret the road networks across the south of England are often stretched to their limit and we experience traffic congestion seven days a week. In London, TfL found the average speed to be just 16.5 miles per hour, which falls to 7.4 miles per hour in busier parts of the city. That gives us a challenge getting to gas escapes, even if logistically we have an engineer within a few miles when the call comes in. Negotiating the traffic in time to meet our standards is not always easy. As a utility we're conscious of the role we can have in causing disruption to the flow of traffic, so we are pleased that we've just signed a new street works charter with TfL along with other utilities, committing to taking less time working in the roads to help reduce congestion. But congestion isn't confined to London and our engineers have experienced travel related issues right across our region, particularly during rush-hours.

"Providing a safe gas supply to flats in high-rise developments brings its own set of challenges. Part of our gas mains replacement programme involves replacing 'gas risers' in South London where there's a very high number of buildings with five or more storeys. A similar housing profile exists in Brighton, where there are many council-owned high-rise blocks in the city centre.

Property prices in some parts of our southern region are among the highest in the country. Critical workers, including our own emergency service engineers, are less likely to live in the communities that they work in. The higher density of customers and workload means that specialised teams can focus on key tasks, like riser maintenance, which would not be an efficient use of resources in Scotland.

"Keeping our most vulnerable customers safe is a priority and our engineers are trained to recognise cases of dementia, mental illness or if a vulnerable customer simply needs some extra help. They can do this through agency referrals and many of our engineers have received training in communication specifically to recognise and address sensitivities when serving vulnerable or hard to reach customers. With full employment in our region and high costs of living, we have to work hard to find and keep the right people who are committed to providing a great service for all our customers.

"New developments in London and the South East continue apace with developers and builders alike demanding fast response and quick gas connections. Keeping these customers satisfied means concentrating efforts and applying innovative ways of working."

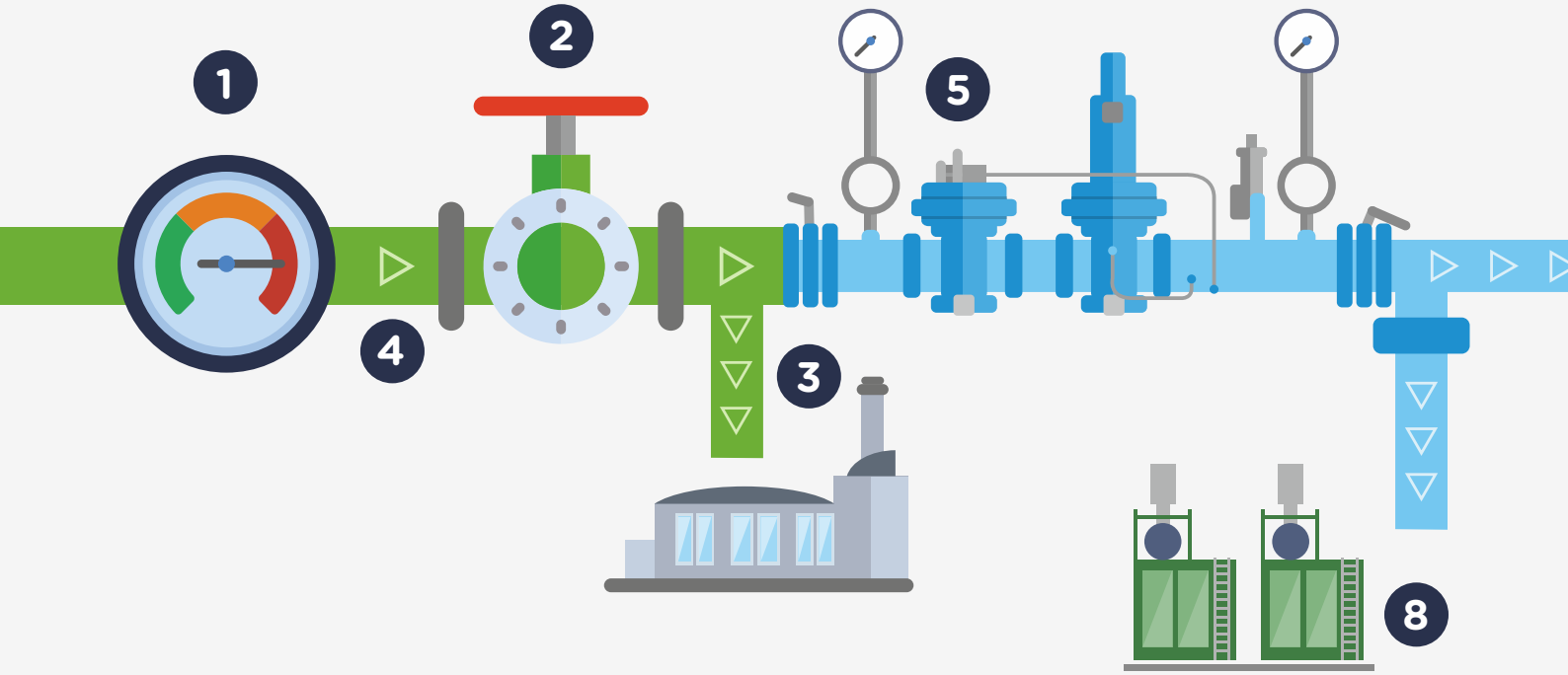
1.3 Our culture

Our people view their role as delivering an essential public service, keeping customers safe and warm 24 hours a day, in all weather. We have a long heritage of care and concern for our customers, particularly those in vulnerable circumstances, and we go above and beyond to provide extra help where we can. We also provide charitable support, volunteering and donations of up to £500k a year (see section 6.14 for more details).

As we adapt to society's changing expectations and priorities, we are preparing our organisation and people for a decarbonised future, increasing agility and responsiveness as well as learning new skills necessary to support the right future heat solution for customers, delivering the government's ambition for net-zero. The essence of our company - safety, concern for customers, innovation and operational excellence - continues to drive our culture.

SGN
Your gas. Our network.

1.4 A guide to the major components and functions of the gas network



Key

1 National Grid's transmission system

National Grid's transmission system delivers natural gas under high pressure to 30 offtakes on both our networks.

2 Offtakes

The primary role of the offtakes is to meter the gas for volume and energy as it comes onto our Local Distribution Zones (LDZ). They are also the point at which odorant is added to the gas for safety.

3 Gas fired power stations

We supply the gas for Shoreham Power Station in West Sussex which produces 420MW of flexible electricity, able to power more than 700,000 households.

4 High pressure pipes

We manage around 3,100km of Local Transmission System (LTS) pipelines of between 100mm and 1,200mm diameter, carrying gas at higher pressures of between 14barg and 85barg.

5 Pressure Reduction Stations (PRS)

PRSs reduce the pressure from the LTS into the intermediate (7barg), medium (2barg) and low (75mbarg) distribution systems, using a series of mechanical processes and assets.

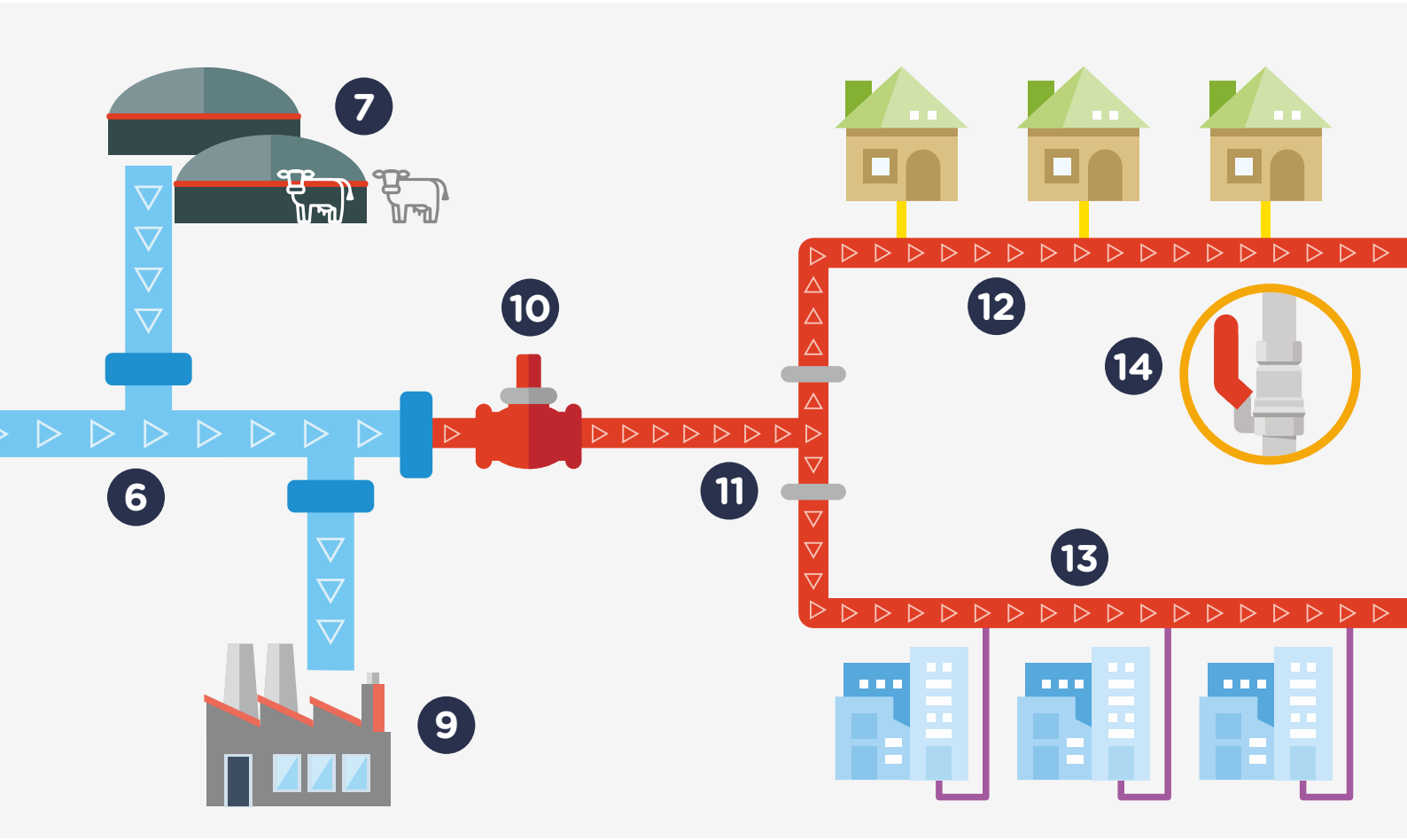
6 Distribution system pipes

These pipes of varying diameter carry gas from the higher-pressure transmission network, managing the reduction in pressure as it travels around our network to local communities. A 30-year programme of replacing the old iron pipe network with polyethene (PE) started in 2002 and will ensure long-term safety and reliability and will help prepare the networks for low carbon gas in the future.

7 Biomethane manufacturing plants

These plants process organic material such as farm and food waste to create biomethane, which is then injected into our network. We have already facilitated connections for 33 biomethane plants on our network in GD. Currently, the 30 operational plants supply enough green gas to heat 199,000 homes.* More are planned, making biomethane a valuable component in a future decarbonised heat solution.

*We use a standard formula to convert volumes of biomethane (measured in standard cubic meters) into the equivalent numbers of homes being powered by green gas. Ofgem's 'Typical Domestic Consumption Values' are based on actual usage data and are the industry's standard values for the annual energy usage of a typical domestic consumer. The data for gas consumption shows a range of between 8,000kWh and 17,000kWh per year, with the median – which is the figure we use - being 12,000kWh per year.



8 Peaking plant

Small gas power units designed to help balance electricity supply and demand. They can be fired-up and producing power in under two minutes, providing vital support to the electricity network. The UK's growing use of renewable but intermittent wind and solar power makes supply and demand matching more challenging. Demand for peaking plant generation is growing and we expect many more units to be connected to our network in the years ahead.

9 Industrial factories

Industrial and commercial customers connecting to our network can demand large volumes of gas, used to power or heat large factories and industrial sites, new housing or retail developments, or for other high-volume use. If not managed through reinforcement work, connecting these customers can result in capacity and supply issues to other customers on the same part of the network.

10 Governors

A gas governor or pressure reduction installation (PRI) is essentially a large mechanical valve operating like a tap, which takes a higher inlet gas pressure and reduces it. We have 7,477 Governors across the different pressure tiers of our Distribution Network.

11 Low pressure pipes

Distribution pipes at lower pressure take the gas closer to where it is needed.

12 Service pipes

Service pipes, shown as yellow, carry the gas at low pressure to people's homes and workplaces.

13 Gas risers

Gas risers, shown as purple, connect a large number of our customers who live or work in high rise and multi-occupancy buildings with their gas supply. It refers to the pipe system taking gas up through the floors to join with the smaller pipes that connect to the homes or offices at each level.

14 Emergency control valves (ECV)

ECVs are the safety device located at the end of the service that is used to isolate the gas supply and stop it from entering the property.

2 Strong track record against GD1 targets and incentives

Linked appendices

- GD1 Experience

- **We have held the number one position for customer service for the last three years**
- **We were recognised as the best gas network for stakeholder engagement for each of the last two years**
- **We have made the most fuel poor connections of any network**
- **We are one of the most efficient networks in our totex benchmarking**
- **We have made a voluntary contribution of £145 million to customers in GD1 demonstrating our strong sense of responsibility and public conscience**
- **Our use of innovation has already saved over £125 million for customers**
- **We are forecasting an overall 7% reduction to customer bills during GD1.**

The three commitments driving our GD2 plan are a natural evolution from our current approach. Our track record in GD1 and the earlier price control periods shows how we have always delivered for our customers.

2.1 GD1 performance

We are proud of what we have achieved for our customers and the communities we serve. GD1 has, and continues to, deliver strong and enduring customer benefits: improved safety and efficiency, improved customer service and lower cost.

We have worked with our stakeholders and customers throughout GD1 to establish their priorities and improve in areas that were important to them. The quality of this ongoing engagement, listening to the feedback and acting upon it, has supported our successful performance - with the highest scoring customer service and stakeholder engagement of all the gas networks. We are grateful to our customers and stakeholders for their significant contributions that have challenged us to continue to improve and excel in all areas.

Our culture is built around our care and concern for all our customers. During GD1 we have provided extra help for customers in vulnerable circumstances, going above and beyond business-as-usual by working with partners to provide additional services. We included our stakeholders and frontline engineers in designing our extra support package, including training our people in awareness of dementia and other types of vulnerability.

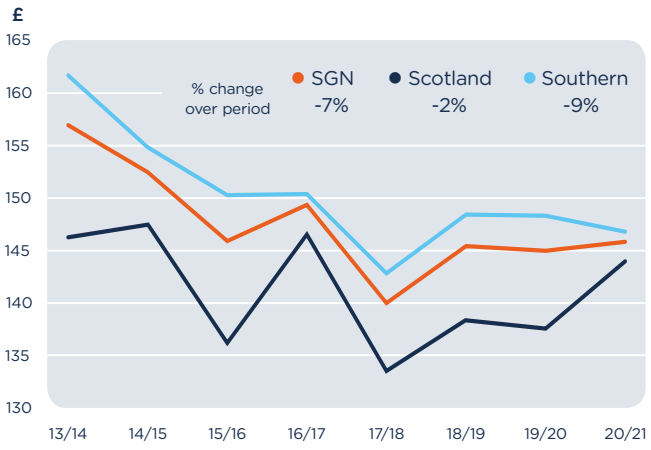
Ofgem asked network companies to take on a greater challenge and deliver more fuel poor network connections in 2015. We rose to that challenge and took on more than half of the national increase, so we now have 30% of the total target. Today, we have already exceeded our fuel poor connections target in Scotland and expect to deliver our Southern target by the end of GD1.

We are just as proud of our leading work on decarbonisation: we were the first network to inject biomethane into the grid back in 2010, and have already facilitated connections to 33 plants on our network in GD1. There are currently 30 operational plants supplying the equivalent of 199,870 homes with green gas. Our ambition remains unchanged – collaborating across the industry to find future net-zero solutions for heat, building the evidence to demonstrate a pathway towards the decarbonisation of the gas networks.

Our leading performance on innovation and efficiency during GD1 has driven significant financial benefits for our customers.

In real terms we forecast a 7% reduction in our share of customers' bills during GD1 at an SGN level (2% reduction in Scotland and 9% reduction in Southern).

Figure 2-1 Customer bill impacts during GD-1 (real 2019 values)



The customer bill impacts are presented in real terms and include the impact of tax changes during GD1.

2.2 GD1 performance against outputs

The table below shows our performance against all our outputs.

Table 2-1 Outputs targets

GD1 outputs targets performance to date

Output category	Output	Industry	Cadent East of England	Cadent London	Cadent North West	Cadent West Midlands	Northern Gas Networks	SGN Scotland	SGN Southern	Wales and West
Safety	Emergency response – 97% controlled gas escapes									
	Emergency response – 97% uncontrolled gas escapes									
	12 hour escape repair requirement									
	Repair risk									
	Major accident prevention									
	Iron mains reduction									
	Sub-deducts networks off-risk									
Reliability	Loss of supply									
	Achieving 1 in 20 obligations									
	Maintaining operational reliability									
Connections	Guaranteed standards of performance									
	Introduce distributed gas entry standards									
Customer service	Planned interruptions satisfaction									
	Emergency response and repair satisfaction									
	Connections satisfaction									
	Complaints metric									
	Stakeholder engagement									
Social obligations	Fuel poor connections									
	Carbon monoxide awareness									
Environmental	Leakage									
	Biomethane connections information									

Source: Ofgem RIIO-GD1 Annual Report 2017/18-https://www.ofgem.gov.uk/publications-and-updates/riio-gas-distribution-annual-report-2017-18

Our performance relating to each output category is described in the following pages, with further detail, evidence and analysis available in the GD1 Experience appendix. The performance statistics we have used below are from 2018/19 figures. Where we are drawing comparisons with other GDNs we use the latest publicly available figures from 2017/18.

2.2.1 Output category: safety

Safety outputs are critical and our highest priority. There are seven outputs in this category, and we are achieving significantly better performance against critical safety targets than the all-network average so far over the five years of GD1.

Data tables tracking our annual performance since 2014 (including forecasts to the end of GD1) against all safety outputs are available for Scotland and Southern in the GD1 Experience appendix.

Output: emergency response - 97% of controlled gas escapes within two hours
+ Performing better than the average for other networks
SGN performance: Scotland 99.41% Southern 99.25%. Average for other networks: of 99.0%

Output: emergency response - 97% uncontrolled gas escapes within one hour
+ Performing better than the average for other networks
SGN performance: Scotland 98.59% Southern 98.34%. Average for other networks: 98.3%

Output: 12-hour escape repair requirement
+ Best performance of all gas networks
Gas escapes prevented within 12 hours: Scotland 70% Southern 64%. Average of other networks: 51%.

Output: repair risk
+ Performing better than the average for other networks
Our performance in Scotland is a positive variance of 30%, and in Southern a positive variance of 44%. Other networks report an average positive variance of 9%.

Output: major accident prevention
The two deliverables for this output are Gas Safety (Management) Regulations (1996) (GS(M)R) and Control of Major Accident Hazards (1999) (COMAH). In both cases we are compliant with our safety case and COMAH report reviewed and accepted by the HSE. There are two COMAH safety reports in place in Scotland, one for each of the COMAH upper tier sites at Stornoway and Provan.

Output: iron mains reduction
+ Best performance of all gas networks
In GD1 we were targeted to reduce our safety risk on our iron mains network by 34% in our southern network and 28% in our Scotland network.
By the end of GD1 we are forecasting an outperformance of this target by reducing our safety risk by 49% in Southern and 51% in Scotland. The significant reduction in safety risk has been achieved largely due to the flexible iron mains risk reduction strategy we have adopted. A detailed explanation with charts showing our annual risk reduction since 2013 are available in the Repex appendix. A critical measure of network safety is pipe failures caused by fractures and corrosion. In GD1 we studied trends in the impact of weather on the network, using predictive analytics to identify and target those assets most likely to be at risk of causing a problem. This unique approach has led to a substantial reduction in safety incidents.

Output: sub-deduct networks off-risk
A sub-deduct network comprises a primary meter, pipes and one or more secondary meters. The owner and operator of these networks is not always clear, presenting a potential safety risk. Risk can be removed by reengineering the pipes and meters, or by establishing that a third party formally accepts responsibility for them.

At the start of GD1 there were 23 sub-deduct sites in Scotland and 294 in Southern, connected to our network. Over the last six years we have identified a further site in Scotland and five further sites in Southern. We have already completed all sites in Scotland and only one site remains to be completed in Southern, which we expect to complete before the end of 2019.

Although we will have completed all known instances on our network, sub-deducts continue to be identified by customers and shippers. Any newly discovered sub deducts will be removed in accordance with our procedures and we expect to have minimal on our networks by the end of GD1.

2.2.2 Output category: reliability

Customers demand reliability and our customers currently experience an interruption only once every 50 years on average. However, we continue to seek ways to reduce the inconvenience of loss of supply.

Interruptions to customers' supplies have **fallen by 29% during GD1**. This is due to:

- improving how we plan and carry out our planned replacement work
- increasing the use of live mains insertion techniques
- increasing the use of innovative technology, for example microstop, to allow replacement of services without interrupting customers' supplies.

We are on track to deliver our reliability targets for the number and duration of planned interruptions and unplanned interruptions. Our average performance over the six years of GD1 to date compared with an annualised target is shown in table 2-2.

Table 2-2 Loss of supply

	Southern		Scotland	
	Actual	Target	Actual	Target
Number of planned interruptions	84.7k	88.5k	27.4k	29.7k
Number of unplanned interruptions	17.9k	20.3k	4.9k	6.0k
Duration of planned interruptions (million minutes)	32.4	34.8	10.3	11.4
Duration of unplanned interruptions (million minutes)	20.0	22.1	3.4	6.4

Does not include data from incidents.

Our three outputs in this category relate to loss of supply, achieving 1 in 20 obligations, and maintaining operational performance. We have met or exceeded our targets in each case.

Actual and forecasted data relating to our performance around loss of supply (interruptions) for each year of GD1, for Scotland and southern networks, are available in GD1 Experience appendix section 2.2.2.

2.2.3 Output category: connections

Our two outputs relating to connections are **guaranteed standards of performance** and **introduction of gas entry standards**.

Over the first six years of GD1 we have made an additional 79,476 connections to our network in Southern and 54,009 in Scotland, comprising new and existing housing (numbers include reconnections), fuel poor and non-domestic connections.

This resulted in capacity growth of an additional 5,438 gigawatt hours (GWh) over the period. These figures include Independent Gas Transporter (IGT) customers, who we record as one connection, but would normally provide gas to many more customers who each draw a gas supply from our network.

Our performance relating to fuel poor network extension scheme (FPNES) connections is provided below, under fuel poor connections.

Output: guaranteed standards of performance
The standards we must achieve when managing connections are defined under specific Guaranteed Standards of Performance (GSOPs). These are listed with associated data tables in the GD1 Experience appendix (section 2.2.3).

If we fail these standards the customer is entitled to compensation as set out in the GSOP. We would incur fines imposed by Ofgem if we failed to achieve the standards in more than 90% of instances. We have not incurred a fine for any GSOPs during GD1.

Output: distributed gas entry standards
The GDNs have collectively agreed voluntary standards of service for distributed gas connections for the services which cannot be provided competitively. These are 15 working days from initial enquiry and 30 working days for capacity studies.

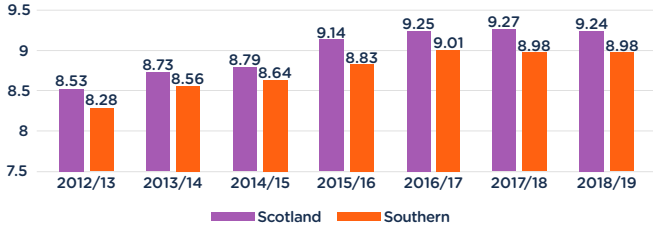
We have published online our comprehensive guide to distributed gas connections, including standards and expected service levels for customers. The guide – **SGN distributed gas connections guide (2017)** - is available on our website.

2.2.4 Output category: customer service

+ Best performance of all gas networks

We are proud of the achievements we have made to improve our customer service since the start of GD1. Our Scotland network remains the UK's number one gas network for customer satisfaction for the third year running and in each of the last two years we were recognised as the leading gas network for stakeholder engagement.

Figure 2-2 SGN Customer satisfaction performance



Overall, our customer satisfaction scores have increased by over 8% since the start of GD1, with both our Scotland and southern networks improving at a similar rate.

Data tables are available in the GD1 Experience appendix, showing average customer satisfaction survey score ranking since 2014 for all GDNs, highlighting our comparative performance to date.

We regularly review our customers' experience to identify opportunities for innovative ways of improving our communication and service. We have created a culture that puts our customers' concerns at the forefront of our efforts to improve our service, and our three-year customer experience transformation programme delivered a great customer service experience. We continue to leverage digital technology to enhance this, including 'Live Chat', and the use of video updates, allowing customers to see footage of our work when they are not present.

We report on three elements of a broad measure of customer satisfaction:

1. customer satisfaction relating to planned interruptions; emergency response and repair (unplanned interruptions); and connections;
2. complaints metric; and
3. stakeholder engagement.

Table 2-3 below provides our scores for customer satisfaction for Scotland and Southern from 2017-2019. Complaints metric and stakeholder are shown below. We continue to achieve excellent performance scores for each of these outputs.

Table 2-3 Breakdown of customer satisfaction

Scores out of 10	Scotland 2017/18	Scotland 2018/19	Southern 2017/18	Southern 2018/19
Planned interruptions	8.96	8.95	8.70	8.78
Unplanned interruptions	9.48	9.49	9.34	9.40
Connections	9.36	9.27	8.89	8.77

Output: customer complaints performance
Customer complaints are down by 76% so far during GD1.

Table 2-4 highlights current volumes of complaints, including a further significant reduction in the number we received during 2018/19, mainly within our southern network.

Table 2-4 Customer complaints volumes

Volumes of complaints	2017/18	2018/19
Scotland	361	262
Southern	1,503	1,015
SGN	**1,864**	**1,277**

Complaints performance is incentivised through penalties for poor performance. We have not been penalised during GD1, and plan to maintain this level of performance. A weighted complaint score is calculated and penalties are imposed if our score is 11.57 or more. Both our networks have been performing at substantially below that target score throughout GD1 with current scores shown below.

Table 2-5 Complaints metric performance

Scores out of 10	Scotland 2017/18	Scotland 2018/19	Southern 2017/18	Southern 2018/19
Complaints metric	2.08	2.06	4.35	3.62

Further analysis of our complaint performance is available in the GD1 Experience appendix.

Output: stakeholder engagement
+ Best performance of all gas networks
An independent panel of experts assesses the performance of the gas and electricity distribution and transmission networks to determine the effectiveness of their engagement with stakeholders. We have been the leading gas network for the last two years. Comparative scores for the gas distribution networks are shown below with additional data in the GD1 Experience appendix.

Table 2-6 Stakeholder engagement performance

Company	2018/19 score	2018/19 position	2017/18 score	2017/18 position
SGN	6.76	1	6.25	1
Cadent	6.33	2	6.0	3
NGN	5.96	3	6.15	2
WWU	5.43	4	5.0	4

2.2.5 Output category: social obligations

As a regulated utility we recognise the importance of the social contract we have with our customers. We have improved safety and customer service, raised our targets for fuel poor connections in Scotland and Southern, developed broad and deep services for vulnerable customers, and we were the only Gas Distribution Network (GDN) to provide a voluntary contribution to customers. Our specific targets in this category relate to our performance with **fuel poor connections** and **carbon monoxide awareness**.

Output: fuel poor connections
+ Highest performance of all gas networks

In the outputs table we can be clearly seen as delivering all of our outputs, the one exception is fuel poverty connections in Southern, which is rated amber/green against the full eight-year target. We are over-delivering against our target in Scotland, but we are facing a greater challenge in our southern region.

There are three main reasons for this: we took on higher targets for both regions at the end of 2015; there were subsequent changes to the scheme that restricted the eligibility criteria; and there is a lack of financial support for the cost of first-time central heating in the South.

- In Scotland, fuel poverty affects a greater proportion of households and the Scottish Government ensures a joined-up service that assists households to access funding for all in-home measures, including central heating. Households in Scotland receive a holistic support package.
- In England, this holistic approach has not been adopted. In our southern footprint we have built 30 partnerships with organisations that are able to offer the level of advice and support needed for households to coordinate the connection of mains gas and subsequent support with funding and installation of heating systems. However, there remains a significant challenge to find funding for central heating.

We have committed our own funds to address the issues above as part of our voluntary contribution made at the end of 2017, and our shareholders have dedicated £20m to assisting fuel poor households. This contribution was to support over-delivery in Scotland and to support delivery in Southern through a central heating grant fund. This financial support coupled with the strong partnerships we have forged across our southern region now means that we consider ourselves on target to deliver our eight-year target for the end of GD1. We saw a substantial increase in connections in 2018/19 in the South, helping 1,626 households out of fuel poverty, the highest number achieved in any year of GD1 and almost double the prior year.

Output: discretionary reward scheme including carbon monoxide awareness
Carbon monoxide (CO) poisoning accounts for 40 recorded deaths each year (Department of Health, 2015/16), and as many as 4,000 visits to A&E. We continue to work across the industry and forums to raise awareness to the threats it creates. We focus on three key areas to raise awareness and reduce risk associated with CO – driving behaviour change, grassroots awareness and partnership working.

We continue to deliver our mixed and targeted programme of activity to highlight the risks and improve awareness around CO for our customers. A comprehensive report expanding on our activity and programmes highlighted above is available in the GD1 Experience appendix, sections 5.1 and 5.2

2.2.6 Output category: environmental performance

There are two GD1 outputs relating to this category, leakage and biomethane connections. We also set a number of environment related KPIs to measure the performance of our environmental improvement plan, called Greenplan, over the course of GD1.

Output: leakage
Gas that escapes the network unintentionally is referred to as network leakage[1] and accounts for the vast majority of our own carbon footprint. Across all UK gas networks leakage accounts for approximately 1% of GBs total greenhouse gas emissions.

Since 2008/9, we have reduced leakage by 22% as a result of progress we have made in a number of areas. For example, our mains replacement programme accounts for most of the leakage reduction as plastic pipe (PE) does not leak in the same way old iron does. We have removed over 5,700km of old iron mains off the network since 2013 and expect to remove a further 1,800km by the end of GD1. Improving how we manage system operating pressure and replacing old or obsolete equipment helps as well. A full description of our related activity appears in the Repex appendix.

Data reporting on our leakage reduction performance for GD1 is available in the GD1 Experience appendix, for both Scotland and Southern.

Case study

Preventing leakage from damaged pipes

Stakeholders have told us damage prevention is important to keep the gas flowing safely and to reduce our environmental impact.[2]

In response, during 2017 we introduced a tailored self-service website, 'line search before you dig' (LSBUD), to provide instant on-line access to our mapping data. After a year in operation we saw an increase in enquiries from 2,500 a month to 47,300 and response time reduced from 15 days to two minutes. We experienced a significant 43% drop of in unplanned interruptions caused by third parties in the first year of use, from 9,834 events in 2017 to 5578 in 2018. We have also focused on educating the farming community through our partnership with Scotland's rural colleges. We developed training about pipeline safety which is now being delivered across all six rural colleges, educating future landowners about pipe risk.

Overall, we have seen a 7% decrease in damage (unplanned interruptions) caused by third parties since 2015 through the work of our Damage Prevention Group, with a corresponding reduction in carbon emissions from gas escapes. Supporting data tables are available in the GD1 Experience appendix, section 2.2.8.

Reducing gas theft
Leakage, gas theft and own use gas consumption are combined into a single 'shrinkage' figure. Delegates attending our Moving Forward Together workshops in 2015 asked for more to be done to address gas theft. This feedback was consistent with other stakeholder comments so we tackled the problem by working with industry partners to develop a process to 'back bill' for this gas. Through measures we have implemented, including addressing high priority sites, we have achieved recovery from 60% of the 7,000 sites in our network, worth £1.7m in recovered payments.[3]

[1] Leakage is one component of an overall 'shrinkage' figure that includes theft and our own use gas consumption. Leakage accounts for 95% of this total shrinkage figure.
[2] MFT Workshops London & Edinburgh, March 2016 (ref 006, 007)
[3] SGN's annual RRP, tab 3.12a

Output: biomethane connections information
Throughout GD1, we have grown biomethane connections and increased the number of customers supplied with biomethane gas. We have developed our connections process throughout the period by publishing connections guides for potential customers. These guides explain not only the connection to the network processes, but a background to the biomethane industry. We have facilitated 33 new connections during GD1 delivering 41k Scm/h of biomethane entry capacity onto our network. There are currently 30 connections flowing biomethane onto our network which have supplied the equivalent of 199,000 domestic customers with low carbon renewable energy in GD1. We're commissioning 7 plants and forecasting a further 5 connections before the end of GD1.

Our Greenplan for GD1
Our Greenplan was introduced with GD1 in 2013 aligned to five environmental goals; reduce gas emissions, reduce carbon emissions, increase energy efficiency, eliminate waste to landfill and increase resource efficiency.

We set a number of environmental sustainability key performance indicators (KPIs) for GD1 in addition to reduced leakage. We met four of our nine targets and know that we must do better. Our performance to date against each of the nine Greenplan KPIs is available in the GD1 Experience appendix. Our experience and lessons learned from are discussed in our environmental action plan (chapter 9).

Gas holder dismantling
We will have completed the phased dismantling programme of 55 gas-holders (50% of the total) by the end of GD1. For the remainder, we assessed each site according to whether the site was operationally important to the network or not. Sites that are not operationally important have been transferred to an unregulated company at an independent market value. There is a legal obligation on the acquiring company to deliver the necessary criteria of the dismantling programme in-line with Ofgem's requirements.

NTS exit incentive
The National Transmission System (NTS) exit incentive covers the flat capacity bookings for each local distribution zone (LDZ) made by networks to National Grid Gas UK Transmission on an annual basis. Bookings are required to ensure we are able to meet the peak 1 in 20 demand scenario. Our performance is assessed each year against a benchmark figure calculated at the start of GD1 with lower bookings being incentivised.

All related revenue earned through the incentive through our contracting efficiency is shared with end users within our operating area to help reduce customer bills. In 2018/19 the incentive in Southern saw an increase in monetary value due to an administrative error. In the 2019 RRP we have proposed that Ofgem refunds this consequential increase to customers during GD1.

2.3 Putting customers and stakeholders at the heart of our business

Our management and depot structure provide a line-of-sight through the business to delivery on the ground. We have local staff taking care of their local community with the autonomy to decide how they deliver the best customer service. During GD1 we implemented a three-year customer experience programme to support our operational teams with the systems, training, and tools to deliver higher levels of service with investment in technology and people. Further details are included in our Customer and vulnerability appendix.

Case study

Changing our approach for customers and stakeholders in Peckham, south London

Our £2.6m Rye Lane upgrade was carefully planned with six phases to minimise disruption and was expected to take 56 weeks but was instead completed in 22 weeks. The road closure required the diversion of 54 buses an hour, carrying around 22,000 passengers over a 12-hour period, with cycle and pedestrian diversions also impacting local businesses. We carried out extensive engagement at each phase of the plan, making individual visits to some 350 local traders as well as holding events, public meetings and having many discussions with councillors, the local highways authority, bus companies and schools. The main concerns of stakeholders collected from this engagement related to the impact of our works on local businesses and the public over such a long programme of works.

We responded to the community's concerns by rethinking our entire plan. Recognising the complexity of this project and the need to make decisions quickly to avoid any unnecessary delays, we employed a dedicated onsite project manager and provided innovative tools to support decision-making. We changed our engineering approach using a number of innovative techniques and the work was completed in 22 weeks instead of the planned 56-week programme.

We inserted the main live from only three push locations and used an innovative Geco pump which was beneficial to the environment and customers as it allowed the gas to be pumped into a live main instead of the atmosphere.

"My thanks to all involved for pulling out all the stops to minimise the adverse impact of these works on traders."
Council Cabinet Member, London Borough of Southwark

Case study

Extensive engagement to support customers with smart meters

We led the way in supporting the delivery of the smart meter roll-out across the country, guiding our colleagues from other network companies through the complexities of the programme, to ensure customers, particularly vulnerable customers, were not adversely affected. Our smart metering operations team see GDN collaboration as critical to ensuring the successful roll-out of the programme.

We led on the preparation of guidance material for all smart metering installers on behalf of network operators which clearly defines who has responsibility for what when installing a smart meter. We also created a smart customer information leaflet which is distributed to all our customers when completing mains replacement or connections work.

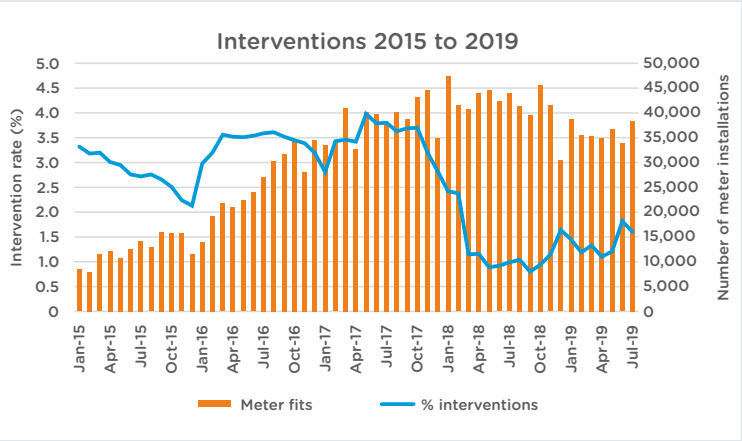
We played a leading role through membership of smart metering steering, delivery and operations groups reporting to the Energy Minister and the SEC-Smart Security Committee, covering all cyber security matters associated with smart meters. We led conversations with training providers to discuss workmanship issues with smart meter installers resulting in emergency calls.

We were the first GDN to set up a triage process to support our smart metering work and assist with the increase in emergency call volumes resulting from smart meter installations. The triage process, implemented in 2017, deals with emergency calls for front line engineers and has led to a number of changes and enhancements to our service provision:

- recruitment of ten new smart metering advisory staff and communications system;
- move to a seven-day shift pattern to match supplier roll out plans and customer need;
- customers are contacted directly to arrange a timed appointment if deemed necessary; and
- highly skilled engineers are embedded in the team to help to quickly resolve technical issues first time.

Figure 2-3 illustrates the positive impact our triage desk has had on smart meter interventions since its implementation in 2017.

Figure 2-3 Interventions and smart meter installations



2.3.1 Additional support for vulnerable customers

We prioritise the needs of customers in vulnerable circumstances, by training our people, providing additional services and making sure our communication and processes are accessible to everyone. We provide training for our operational teams, including videos to showcase best practice. These training videos are designed to help colleagues understand how to interact effectively with those in vulnerable circumstances; we are a dementia friendly organisation with 2439 employees already trained in awareness and service enhancements for this group of customers.

Our engineers have practical guidance that helps them identify those in vulnerable circumstances on the doorstep. They are all empowered to consider each customer as unique and determine the right course of action based on what they find and individual circumstances.

We provide alternative heating and cooking facilities when we interrupt the gas supply to vulnerable customers, as required by GSOPs. If necessary, we will also provide alternative accommodation, hot food or other services where gas outages are prolonged. Our engineers and support teams will always prioritise the needs of customers in vulnerable circumstances during incidents and emergencies.

We established a specialist panel of stakeholders for each network, to focus on supporting those customers at risk. They have helped us define and deliver extra value by connecting these customers to other energy or safety service partners. In winter 2018 we began trialling a referral service, used by our engineers to refer customers to a range of additional services from partners. These include fire and safety visits, energy efficiency advice, locking cooker valve installation, priority services registration and a winter voucher for vulnerable home owners whose appliances are disconnected on safety grounds.

We pioneered the locking cooker safety valve, designed to help customers with dementia live safely at home for longer, providing reassurance to family and carers that the gas cooker is safely turned off when they leave. We are working with community groups, social services and emergency services to identify more vulnerable customers who would benefit, and we have teamed up with the other GDNs to provide this free service nationwide.

We continue to tailor our support for a wide range of customers, linking up with partners to understand, signpost and refer those who need extra help. Our focus is in three areas:

- additional support for those in fuel poverty
- frontline support for vulnerable customers
- partnerships to deliver social outputs.

A report on our initiatives, services and achievements for each area is available in GD1 Experience appendix.

2.4 Historic cost performance: expenditure v allowances for GD1

We expect to deliver an average reduction in customer bills of 7%, from £152 a year in 2013/14 to £141 a year by the end of GD1. In addition, we are forecasting an expenditure that is approximately 15% below our approved GD1 allowance by the end of March 2021. This efficiency gain is shared with customers during GD1 and passed on to customers when allowances are reset at the start of GD2.

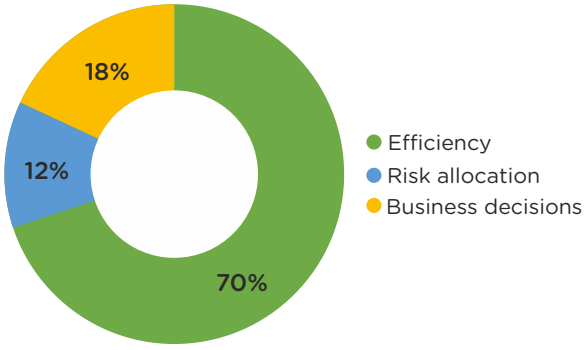
Table 2-8 Headline Financial Performance

£m 2018/19 prices		GD1 (first 6 years)		
		Allowance	Actuals	Difference
Southern	Operating expenditure	987	773	22%
	Replacement expenditure	1,302	1,095	16%
	Capital expenditure	447	412	8%
	Total	2,736	2,280	17%
Scotland	Operating expenditure	565	414	27%
	Replacement expenditure	465	370	20%
	Capital expenditure	327	299	9%
	Total	1,356	1,082	20%
Total		4,092	3,362	18%

For the first six years of GD1 the variance between allowances and actuals is 18% (17% in Southern and 20% in Scotland). However, increasing cost pressures already coming through our contractor cost base, known wage settlements (described in more detail in section 16a) and larger more complex projects, will reduce the total variance from 18% to 15% by the end of GD1. In figure 2-4 we have separated the contributory factors into efficiency, risk allocation and business decisions where:

- efficiency variances are directly attributable to an investment, process change or management changes we have implemented;
- risk allocation variances are attributable to a forecast or expectation set at the start of GD1 (ie weather or economic growth); and
- business decision variances are directly attributable to a strategic decision that we made that created a variance (i.e. maintaining meter work as a service or identifying more cost-effective enduring solutions for the SIUs).

Figure 2-4 Drivers of totex variance in GD1



Efficiency gains have contributed over two thirds of the variance achieved by us for customers. The main drivers have been the application and roll out of innovation, introduction of management changes, improved processes, frontier performance / efficient business model and improved contracting strategies. We have targeted significant productivity savings in GD2 on our actual expenditure levels at the end of GD1. However, as explained in section 13.2 we will not be able to repeat the step-change in efficiency that we have achieved during GD1 since we have already realised the one-off opportunities available, for example by increasing live insertion rates to close to the maximum achievable.

Other examples of our efficiency step-change are given below.

- **Improved planning.** Introducing a single planning department to oversee activity across multiple areas has led to reduced costs, removal of silos to give greater visibility to the interactions between activities and by creating a culture of cost benefit analysis to inform the right decisions every time.
- **Innovation.** Our approach to innovation has led to the deployment of robotic technology to repair our large diameter mains under live conditions, reducing the impact in densely populated communities. In our innovation appendix we attribute savings directly to the repex and opex lines and together these account for £125m of savings.
- **Local accountability.** We have clear local depot accountability, meaning services and customer service levels are optimised and delivered by teams for the diverse communities they serve.
- **Improved data analytics.** We were the first gas network to adopt predicative analytics and to develop a flexible strategy on the iron mains risk reduction programme (repex). We have developed an extensive analytics capability that has allowed us to target the pipes that pose the highest safety risk.
- **Contracting strategy.** We have moved away from the larger first tier contractors to smaller second and third tier contractors and have absorbed a proportion of management and general overheads.

Efficiency savings result from a combination of good practice and innovation with significant additional benefits for customers. For example, in pioneering the use of live insertion techniques to reduce excavation and the associated cost of trenching, we also improved the customer experience by halving the number of visits and reducing the associated costs.

Similarly, we pioneered the first combined core cutting and vacuum excavation (core & vac) vehicle for highly efficient excavation and repair work. It allows a small hole to be dug into the street rather than a trench with vastly reduced impact on the road and the road user and a reduction in costs.

Another example of innovation which is relatively simple but very impactful is self-amalgamating tape. It has led to a number of business and management process revisions that have fundamentally changed our approach to gas risers. Rather than having to cut customers off while we make a situation safe, we can implement and monitor a temporary repair while we secure the necessary planning permission to replace the faulty riser. Once the new solution is in place we can move customers across with minimal disruption and at a significantly lower cost.

Extensive and detailed analysis of our cost performance in GD1 for Scotland and Southern is available in the GD1 Experience appendix. This additional information includes headline financial performance against forecast for repex, opex and capex; impact of real price effects, regressions, a breakdown of our voluntary contribution, and detailed variance analysis for Scotland and Southern. Explanation for why expenditure has varied from the original plan is also provided in detail in the same appendix.

2.5 GD1 returns earned and level of profit distributed to investors

Return on Regulatory Equity (RORE) is calculated for each network at the end of the year and is an estimate of the average annual return that shareholders could expect over the eight-year price control period.

The figures in table 2-9 are based on the totex forecasts for GD1. Over the eight years we are forecasting a return on regulated equity of 11.1% across our two networks compared to a base cost of equity of 6.7% (real post tax). The difference between the two relates to our strong operational and incentive performance.

Table 2-9

Performance (£m 18/19 prices)	Scotland	Southern	SGN
	8 yr average	8 yr average	8 yr average
Totex variance to allowance	42	61	103
Incentive income	3	13	16
IQI reward	3	4	7
Less sharing/tax	(17)	(25)	(42)
	31	**53**	**84**
Performance return on equity (£m)			
Performance relative to allowance	31	53	84
Equity (based on notional gearing)	590	1,312	1,902
Performance returns	5.2%	4.1%	4.4%
Base cost of equity	6.7%	6.7%	6.7%
Total RORE (pre financing)	**11.9%**	**10.8%**	**11.1%**

During GD1 this return equates to around £210m a year. This is built up of £125m notional return as set in the cost of equity and £84m through various incentive mechanisms.

2.6 GD1 performance and achievements linked to incentive mechanisms

Our performance in GD1 has resulted in average incentive income earned each year of £16.9m. Details of our activities and the outputs associated with each incentive mechanism are included in earlier sections of this chapter. A breakdown of the overall incentive income earned in each year is shown in the table below.

Table 2-7 GD1 incentive performance

SGN incentive (£m)	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19
Shrinkage	0.8	0.8	0.6	0.8	0.9	1.2
Environmental emissions	2.4	3.7	3.4	4.7	4.5	5.0
NTS exit incentive	2.6	1.1	1.9	5.5	6.0	9.7(*)
Customer satisfaction	4.2	5.3	5.2	5.3	5.3	5.5
Customer complaints	0.0	0.0	0.0	0.0	0.0	0.0
Stakeholder engagement	2.1	2.4	1.8	3.2	2.3	3.0
Discretionary reward scheme (every 3 yrs)	-	0.7	-	-	0.5	-
Total	**12.1**	**14**	**12.9**	**19.5**	**19.5**	**24.4**

(*) 2018/19 National Transmission System (NTS) Exit capacity incentive in southern saw an increase in monetary value due to an administrative error. In the 2019 RRP submission we have proposed to Ofgem to refund this consequential increase to customers during GD1.

Further detail is provided in appendix 001, GD1 Experience.

2.7 Impact of GD1 performance on GD2

Through our proposed GD2 plan we have reflected on what worked well, and what did not work as well in GD1, and taken forward the lessons learned into our GD2 plan. These are set out in each of the technical appendices that accompany the submission, including those listed below.

- The appropriate balance of risk on uncontrollable outcomes - there were areas in GD1 where we made forecasts based on the best available given information, and out-turn was significantly different. We have reflected on these areas and proposed uncertainty mechanisms where appropriate.
- Stakeholder insights and understanding - listening to feedback, observing the experience of other networks and responding positively to lessons learned from GD1 is at the heart of our stakeholder strategy in GD2, and is set out in chapter 4b.
- Embedding customer feedback in the plan - the customer engagement and dialogue surrounding the GD2 plan has provided a much greater level of scrutiny and challenge over the plan and will lead to a better outcome. Our technical experts have been challenged and responded with a higher quality explanation or changed their approach as a result.
- Deploying innovation - these transformative innovations have been implemented since the early stages of GD1 and as a result our insertion rates are now over 90%. We rarely cut off supply to a gas riser, and core & vac is now extensively deployed. These efficiencies are enduring and will continue to benefit customers in GD2 and beyond, both in terms of costs saved as well as reduced environmental impacts. While further benefits will flow through to GD2, as we have progressed through GD1, the incremental benefit of new innovation projects is reducing, and the focus of innovation is moving towards energy system transition and decarbonisation innovation.

We are not expecting any work planned for in GD1 to be deferred to GD2. The gas mains replacement programme (repex) will result in a number of ongoing projects being carried over from the end of GD1, simply as work in progress projects spanning the end of the fiscal year (31 March 2021 – 1 April 2021). However, the associated costs in such cases will be apportioned to the period in which the actual work is completed.

3 Our business plan commitment and assurance

Our GD2 plan has been reviewed extensively by customers, stakeholders, independent experts, the customer engagement group and the SGN board. This has contributed to an ongoing process of business plan development and refinement across the July and October draft submissions to ensure that our plan is in the best interests of current and future customers.

Through a detailed internal review and challenge process supported by extensive third-party assurance we have ensured the accuracy and completeness of our plan, to support Ofgem in its evaluation.

Given the long-term challenge of delivering decarbonisation, and its importance to our customers, we need to ensure that the plan is ambitious and sustainable. Our plan has to be ambitious in its delivery in the GD2 period, and to provide an appropriate cost of equity that will support long-term investment. The plan and our working assumptions deliver this. Together these attributes provide a plan that the SGN board and the senior management team will be proud to deliver.

Under Ofgem's working assumption our proposals are also financeable on an actual and notional basis but we do not believe this would be beneficial to customers over the longer term or deliver the investment necessary for decarbonisation.

3.1 Aligning reward and delivery

Currently, the long-term incentive plan (LTIP) scheme, open to executives and our most senior managers, is based on financial returns and safety measures. We have agreed at our board's People and Remuneration Committee that a broader set of measures will be adopted for the LTIP scheme for FY2021/22 and throughout GD2.

In March 2019, the LTIP for 2021/22 was based on the seven customer priorities identified directly in customer research for phase one of the business planning process. This ensured a better alignment to support delivering what matters to our customers.

A summary of the changes are included below.

- The weighting of the financial measures is reduced so that financial and non-financial measures receive equal weighting.
- Targets for safety are retained, reflecting the fundamental importance of keeping our customers safe.
- Other measures now taken into account when calculating LTIP payments include:
  - a target to minimise our environmental impact (reducing our carbon footprint);
  - a target related to the development of future energy solutions (demonstrating hydrogen);
  - targets to provide excellent service and support vulnerable communities (customer satisfaction ratings, stakeholder satisfaction scores and fuel poor targets); and
  - people targets, relating to workforce resilience indicators such as talent and succession, diversity and inclusion and employee engagement - workforce resilience is an essential component of our customers' priority to keep the gas flowing.

This balanced scorecard approach will continue after 2021/22, and financial targets will be amended to take account of the GD2 determination and aligned with the delivery of outputs, once they are confirmed.

3.2 Our assurance process

The submission of our plan has been supported through a rigorous process that involves four lines of assurance, below, which cover all aspects of our plan.

First line assurance. The subject matter experts delivering our existing data assurance and governance processes maintained day-to-day responsibility, with review and approval by their senior managers and executive sponsors.

Second line assurance. Internal challenge provided by the price control team and through regular cross functional workshops to provide consistency, accuracy and check for deliverability.

Third line assurance. Extensive engagement during business plan development and formulation by independent consultants to provide advice, challenge and feedback.

Fourth line assurance. PwC, Arup and Gartner were engaged to undertake a detailed risk-based review of the plan for the executive sponsors and the board.

These lines of assurance have tested the plan to ensure it is achieves the following criteria.

3.2.1 A plan that is in the interests of consumers

The priorities of our customers and future customers run throughout our plan, informing our decision making and the outcomes that we will deliver. We have tested our plan directly with customers who have confirmed high levels of acceptability and value for money.

Throughout this process we have benefited from the challenge and scrutiny provided by the Consumer Engagement Group (CEG), who have challenged us on our proposals, the supporting evidence we have provided and whether our plan truly reflected customer insights, perspectives and priorities.

3.2.2 A high quality plan

In developing this business plan there has been a robust process in place to ensure the accuracy and quality of information appearing in the plan. That has been supported through a clear governance structure with a clear line of sight from the board down to the price control team. This has been led by the board of directors and involved the finance committee and our executive team who have met regularly throughout the plan's development to provide challenge, guidance and insight.

Our plan has been through a robust internal challenge from each member of the executive to support the provision of clear and high-quality information which is

relevant to the operation of the business and changes that are likely to have a material impact during GD2. Challenges from the CEG and the RIIO 2 Challenge Group were logged and responded to.

3.2.3 A robust plan and assurance process

The development of our plan involved extensive detailed analysis, based on known engineering data associated workloads and resource requirements. Our plan has been through robust internal challenge from each member of the Executive to support the provision of high-quality information and ensure that our outcomes are deliverable. Our plan has also gone through an extensive internal and external four 'lines of assurance' process with all major components of the plan subject to an independent assurance process.

More than 200 internal subject matter experts were engaged in this process, through planning workshops at depot and department level. This identified the right projects and programmes to be delivered in GD2 that will help us deliver our ambitions and meet our customers' priorities.

This process of checking and rechecking involved senior managers and directors from the outset and has established joint ownership of the plan across SGN. Through embedding teams with operational, major projects and senior management experience, we have honed the projects in our plan to ensure they are deliverable and provide value for money.

A dedicated assurance team was set up in July 2019 from outside the GD2 price control team to review, challenge and co-ordinate the assurance approach. Overall responsibility for this work was assigned to SGN's Director of Legal and Compliance, who is independent from the GD2 price control team.

3.2.4 An ambitious plan

We worked with our customers to specify a range of enhanced services that deliver ambitious outcomes to meet expectations at a price customers' are prepared to pay. Our levels of ambition are driven by our customers, with their particular focus on the challenge of decarbonisation, the environment and vulnerable customers. These are ambitions that the board shares.

Specifically, we have responded, through our environmental action plan (EAP) and our innovation strategy, to the clear expectation that we do more to reduce our impact on the environment, focusing on reducing leakage, reducing emissions from fleet, and moving rapidly to assess the decarbonisation pathway and reduce the risk of asset stranding.

For vulnerable customers we have maintained extremely challenging targets for reducing fuel poverty and we will continue to serve our customers with our current very high standards.

3.2.5 An efficient plan

In GD1 we have delivered strong efficiency savings on which we base our GD2 business plan and deliver long-term value to customers through lower bills. Building on this, we are committed to delivering a further £76m productivity gains in GD2, a rate three times the national average forecast by the Bank of England. We believe that this will maintain our position among the most efficient networks in the sector.

3.3 A financeable plan

Without prejudicing our perspective on the finance methodology and working assumptions used by Ofgem, we have presented a plan that is financeable on a notional and actual basis. We believe that these assumptions are not in the interests of future consumers as by penalising equity investors today, it will make it more challenging and costly to attract the equity investment required to decarbonise the energy network in the future.

3.4 Our acknowledgment

We remain extremely grateful to the CEG for their detailed feedback and constructive challenge provided throughout the business planning process. We have reflected this in our plan which is better for it. We also thank our assurance providers at PwC, Arup and Gartner, and the extensive network of financial, economic, technical and legal advisors that have supported this plan submission.

3.5 Role of independent non-executive directors

Our non-executive directors have had a material impact on this plan. Both independent Directors drew on their knowledge and experience to critically assess the proposals put forward, ask questions to ensure that the plan and associated costs have been tested for accuracy, ambition and efficiency. They ratified the appointment of our CEG chair and one of our statutory independent directors has retained an ongoing liaison role with the CEG and its chair.

3.6 Board assurance statement

We, the Board of Directors of SGN, confirm that we have taken collective ownership for the strategy and direction of the Business Plan. We fully support the plan submitted and have taken responsibility for assessing whether it is: accurate, robust, ambitious, efficient and financeable; and that it is in the interests of, and represents good value for, both existing and future consumers.

Our board has been engaged at all stages of the development of our GD2 business plan. In doing so, board members have had an active involvement in defining the rigorous assurance framework that has been applied throughout and managed by an independent team, to ensure that high-quality information has been used and included with the submission.

Throughout the business planning process, we sought to promote continuous review and challenge, with executive sponsors required to explain the proposals put forward by their teams and the steps taken to assess whether the business plan would be complete, accurate, robust, ambitious, efficient and in the interests of, and representing good value for, consumers. The executive committee were then required to provide formal assurance on these points to the board. Financeability was reviewed on a frequent basis by the board from May 2019 onwards and was the primary focus of eleven ring-fenced board meetings from August 2019 until submission of the final business plan on 9 December 2019.

In addition to this, we engaged a number of external consultants and advisors over the course of the business planning process; with Frontier Economics and Arup being embedded with business teams to assist with the

development of a robust plan. External assurance providers were also engaged at the end of the business plan drafting process. Such external providers were required to demonstrate that the same points had been considered and tested during their assurance activities, where relevant.

Our full board assurance statement is submitted with our plan. It provides an overview of the governance structure, the assurance framework in place, the challenge and review process followed, and the evidence and assurance provided. These have been relied on by the board to reach its conclusions.

Our board confirms that:

After consideration of the evidence and assurance provided to us, we are satisfied that our business plan submitted on 9 December 2019 is:

- *in the interests of both existing and future customers and represents good value for money;*
- *accurate, unambiguous, complete, concise and contains high-quality information to enable Ofgem to make decisions which are in the interests of existing and future consumers;*
- *robust, including the quality assurance process;*
- *ambitious; and*
- *efficient.*

Separately, we consider our plan to be financeable on a notional and actual basis under Ofgem's working assumptions (noting our views on Ofgem's working assumptions on financeability set out in Chapter 18).

3.7 Summary of material changes between drafts

As requested by the RIIO Challenge Group we have very few material changes between the October draft and this formal submission to Ofgem. The most material of these changes was an additional cost of £1.5m for fatigue that we identified but had not quantified in the October plan. The changes that have occurred between drafts and to this submission are set out in chapters 16 and 17.

Chairman of the SGN Board, Gregor Alexander, with SGN CEO John Morea

4a Enhanced engagement

Linked appendices

- Enhanced engagement
- Stakeholder engagement
- Customer and vulnerability plan

Listening to our customers and stakeholders was a vital step in creating our business plan. Their priorities flow through our plan and are visible in our three commitments – to make a positive impact, build a shared net-zero future, and deliver a safe and efficient service.

Our plan has benefited from high quality individual interactions with over 23,000 customers and stakeholders. We have reached out to one million people through our targeted online campaign and our extensive insight inventory includes reports from 104 different engagement events, research programmes and interactions that have all fed into our plan.

Our customers' priorities, needs and expectations are at the heart of our GD2 proposals. In quantitative acceptability testing of our final plan, 85% of domestic customers in our southern region and 88% in Scotland found our plan acceptable.[1]

Customer and stakeholder expectations will continue to drive our business during GD2 through our strong commitment to ongoing engagement at all levels of our business.

4.1 Customers at the heart of our business and our plan

Our commitment to customers and stakeholders runs throughout our business and underpins our plan. Our CEO leads a culture of responsiveness and transparency, regularly engaging with a broad range of stakeholders, participating in focus groups and hearing directly from customers, frequently reviewing customer satisfaction data and leading our response to customers' concerns.

This commitment to positive engagement and concern for our customers is mirrored by staff at all levels and across all functions. Our staff respond to the needs of all our customers, particularly those who are vulnerable, with training, systems and processes in place to put the concerns of customers at the heart of our business.

Throughout GD1 we built and expanded a programme of engagement, creating an environment for lively dialogue, stakeholder input, opportunities for challenge, review and iteration. We built on these experiences and insights when designing a 4-phase programme of enhanced engagement for our GD2 business plan development process.

We approached our business planning process by first understanding the priorities of our customers and stakeholders.

4.2 Understanding what matters: customer priorities

At the very start of our planning process we reviewed the insight from all our previous engagement with customers and stakeholders. Building on that solid base and before putting pen to paper on our plan, we asked our customers what was important to them and what their expectations of us were for the future. We talked to a wide range of different customers across both our networks - domestic, small businesses, future customers, rural, urban, vulnerable - with a mix of gender, age, ethnicity and income levels. These detailed, qualitative conversations were supplemented by our analysis of our everyday customer interactions, building a rounded picture of our customers' priorities.

We then broadened the conversation to include our stakeholders, sharing what we had learned from our customers and building our understanding of their different perspectives. Through webinars, workshops, roundtables and quantitative research we added the specialised interests and expectations of our stakeholders to provide comprehensive insight as the foundation on which to build our plan.

In these listening phases, we collected the views of more than 12,500 individual stakeholders, customers, future customers and customer representatives through workshops, panels, roundtables, research, customer interactions, focus groups and other face-to-face meetings.

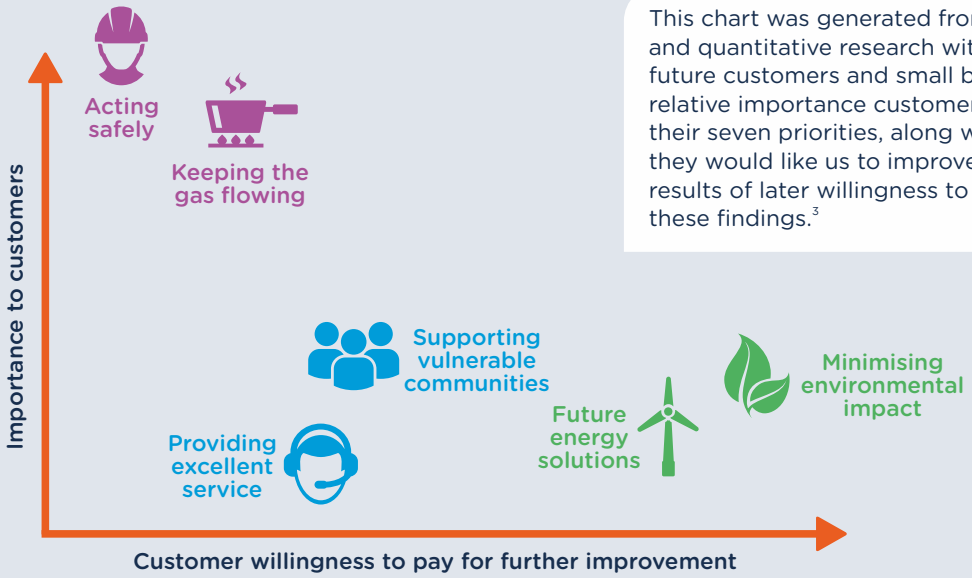
Results of the engagements in our Scotland and southern regions were largely consistent.

Overall, seven customer priorities emerged which resonated with stakeholders and which we built into our three commitments and the ambitions set out above in the Executive summary.

[1] Business Plan Acceptability Testing Phase 2 (ref 079)

Our three customer commitments:

- To align with our customers' priorities that we provide an excellent service and support vulnerable communities **we commit to making a positive impact**
- To align with our customers' priorities that we keep the gas flowing, act safely and keep costs down **we commit to delivering a safe and efficient service**
- To align with our customers' priorities that we minimise environmental impact and investigate future energy solutions **we commit to creating a shared net-zero future**



This chart was generated from our early qualitative and quantitative research with domestic customers, future customers and small businesses. It shows the relative importance customers placed on each of their seven priorities, along with the areas in which they would like us to improve our performance.[2] The results of later willingness to pay research reinforced these findings.[3]

Keeping costs down, minimising environmental impact and investigating future energy solutions are the areas where customers would like us to invest more effort. Acting safely is the highest priority for customers, but they would like us to continue to maintain our current high levels, rather than investing significantly more in this area.

Customers appeared very supportive of vulnerable communities when we asked them to rank practical and explicit examples of activities we could invest in, with two of the top five priorities relating to support for vulnerable communities.[4]

Our customers' overarching priorities were shared widely among our leadership team and subject matter experts at a very early stage of the plan's development. Later phases of engagement continued to build the whole team's understanding of customers' more detailed views.

We summarise below the overarching priorities of our customers and stakeholders that informed the creation of our initial plan.[5]

4.2.1 Keeping the gas flowing

Customers recognise the need to maintain the current infrastructure to provide a consistent and reliable supply. Customers also support increased investment in innovation and see it as a good opportunity to minimise disruption.[6] Stakeholders recognise the importance of safeguarding and securing our assets from both physical and cyber threats.[7]

4.2.2 Acting safely

We must keep our customers, employees, contractors and the public safe by responding to gas escapes quickly and repairing and upgrading pipes to make them safer. Customers perceive safety as paramount and believe we are performing well.[8]

4.2.3 Keeping costs down

Along with acting safely, 'keeping costs down' rates as the top priority for customers. They expect us to achieve this through operational efficiency, new technology, and collaboration. We should continue to invest in innovation to improve efficiency and reduce the cost of transporting gas.[9]

2 Stage 1: Explorative Qualitative Workshops and Interviews (Exploratory Phase) (ref 002), Stage 2: Max Diff Prioritisation Phase (ref 003, 004)
3 Stage 3: Conjoint & WtP summary report (Valuation Phase) (ref 005)
4 Stage 2: Max Diff Prioritisation Phase (ref 003, 004)
5 Stage 1: Explorative Qualitative Workshops and Interviews (Exploratory Phase) (ref 002), MFT Workshops November 2018, London & Edinburgh (ref 013, 014)
6 Shaping the Business Plan Qualitative workshops - Sharing Financial Risk. Innovation Investment (ref 083)
7 MFT Workshops November 2018, London & Edinburgh (ref 013, 014)
8 Stage 1: Explorative Qualitative Workshops and Interviews (Exploratory Phase) (ref 002)
9 Stage 1: Explorative Qualitative Workshops and Interviews (Exploratory Phase) (ref 002), Shaping the Business Plan Qualitative workshops - Sharing Financial Risk. Innovation Investment (ref 083)

Stakeholders expect us to make safe investment decisions and avoid asset stranding (where an asset becomes obsolete sooner than anticipated causing early write-down in its valuation). However, they are also concerned about minimising the total cost of our works, now and in the future.[10]

4.2.4 Delivering energy solutions for the future

Stakeholders want us to work collaboratively with others across the whole energy system. They want us to invest in research to validate future low or zero-carbon solutions for heat and prepare our networks to transport alternative gases.[11] Customers also want us to continue exploring the use of greener gases such as biomethane and hydrogen.[8]

4.2.5 Minimising environmental impact

Our customers have told us minimising our environmental impact is an important consideration, and they want us to focus on reductions in carbon emissions.[8] Stakeholders with expertise in the field of sustainability have told us to concentrate on reducing natural gas leakage from our network.[12]

4.2.6 Providing excellent service

Analysis of our regular customer contacts tells us communication, timescales and site tidiness are all areas of concern for customers.

Customers and stakeholders tell us about the importance of offering easy ways to engage with us, and we should be keeping pace with new ways of communicating so customers stay informed and their inconvenience is minimised.

Customers acknowledge we are doing a good job generally and recognise the improvements we have made over GD1.[8]

4.2.7 Supporting those vulnerable in the community

Customers and stakeholders want us to play a role in supporting vulnerable customers, including free gas connections to low income households and by offering extra support services to potentially vulnerable customers.[13]

Stakeholders created and prioritised a range of ideas for additional support for vulnerable customers.[14] Customers and stakeholders want us to do more to build awareness of the priority services register and join-up our support for vulnerable customers with other utilities and referral networks.[15]

4.3 Our programme of engagement

We structured our customer and stakeholder engagement programme into four phases, completing the first three phases by October with the fourth phase refining this final version of the plan.

- ✓ Phase 1 is described above (section 4.2) and underpinned the creation of our draft business plan
- ✓ Phase 2 tested and iterated elements of the plan
- ✓ Phase 3 engaged on the first full draft of the plan
- ✓ Phase 4 iterated and refined the plan.

More details of our engagement, research and insights generated can be found in our Enhanced engagement appendix.

4.3.1 Phase 2 engagement

At the start of phase 2 we published our initial thinking in "Planning for our shared future" to share what we had learned about our customers' expectations and to suggest potential ways of enhancing our services to meet those expectations.

This public document was supported by an extensive digital media campaign which reached more than one million people, ensuring customers and stakeholders had the opportunity to see and engage with the ideas and commitments within.[16] Our consultation website: sgnfuture.co.uk has become our landing page for our GD2 business plan submission, where we host this document, its supporting appendices and access to the rest of our Ofgem submission.

Our phase 2 engagement programme included a number of elements, listed below.

- ✓ Quantitative customer research using willingness to pay analysis to understand how much, if anything, domestic and small business customers would be prepared to pay for improvements and enhancements to our services, helping us to prioritise additional investments.[17]
- ✓ Additional willingness to pay investigations with harder to reach groups through trusted intermediaries.[18]
- ✓ Qualitative workshops with customers to explore our ambitions and potential options for inclusion in the plan.[19] These events covered very broad subject areas and informed our approach to full acceptability testing carried out in phase 4. We (and our CEG) did not consider these qualitative workshops provided sufficient evidence to justify additional work packages or bespoke outputs, an issue we rectified in phase 3.
- ✓ Collaborative research with other gas networks to explore future energy solutions and the needs of vulnerable customers.[20]
- ✓ Desktop analysis of the volume and nature of vulnerability among our customers.[21]

[10] MFT Workshops Jan/Feb 2019 London & Glasgow (ref 016, 017)
[11] Future of heat specialist panels Edinburgh 1&2 (ref 023, 024)
[12] Sustainability Roundtables – London & Glasgow (ref 065, 066)
[13] Stage 1: Explorative Qualitative Workshops and Interviews (Exploratory Phase) (ref 002), MFT Workshops 2016, 2017, 2018 & 2019 (ref 006, 007, 008, 009, 010, 011, 012, 013, 014, 016, 017), Specialist panels - Supporting those at risk 1&2 (ref 020, 021)
[14] MFT Workshops November 2018, London & Edinburgh (ref 013, 014)
[15] MFT Workshops November 2018, London & Edinburgh (ref 013, 014), Shaping the Business Plan Qualitative workshops - Customer Service & Supporting Vulnerable (ref 085)
[16] 7,816 people engaged with our online campaign content
[17] Stage 3: Conjoint & WtP summary report (Valuation Phase) (ref 005)
[18] LSx - hard to reach full report (ref 077)
[19] Business Plan Acceptability Testing Phase 1 (ref 078)
[20] ENA Future of gas report (ref 070), Guaranteed Standards of Performance – Phase 1 report (ref 097)
[21] Frontier work on vulnerability (ref 092)

- ✓ Specialist panels on the future of heat in Scotland, vulnerability and fuel poverty in Scotland and Southern.[22]
- ✓ Stakeholder workshops to discuss the criteria for our decision making on engineering decisions relating to our replacement pipe programme. We also worked with stakeholders to co-create and prioritise potential vulnerability initiatives.[23]
- ✓ Quantitative research and a live event to understand the perspectives and priorities of customers who engage with us through our third-party connections application process.[24]
- ✓ Cross-sector roundtable events with specialist stakeholders on sustainability and separately on safety.[25]
- ✓ Quantitative research and follow up interviews with large gas users.[26] We also carried out individual discussions with large users about decarbonisation plans and opportunities.[27]

4.3.2 Phase 3 engagement

We engaged extensively and analysed views from more than 4,000 customers and stakeholders between July and October. Key elements of the engagement programme are listed below. Some of the ways in which we changed our plans as a result of feedback from customers are included in sections 4.7.1 and 4.7.2 as well as in the detailed outputs sections in chapters 6 to 10.

Our engagement programme included:

- ✓ Six qualitative workshops with customers covering one of three different topics:
  - our environmental action plan[28];
  - customer service and vulnerable customer initiatives and targets[29]; and
  - trade-offs between payment mechanisms and outputs, certainty, timing and risk.[30]
- ✓ Four independently facilitated specialist stakeholder workshops:
  - two covering our positive impact ambitions and plans;
  - one covering our shared future ambitions and plans; and
  - one covering our safe and efficient ambitions and plans.

  The agenda for each workshop was to test whether informed, knowledgeable stakeholders believed we had got our business plan proposals about right on their specialist topics of interest.[31]
- ✓ Further analysis of willingness to pay research.
- ✓ A cross-sector roundtable on measurement of social value led by Hazel Blears with specialist stakeholders from HM Treasury, Department of Culture, Media and Sport, construction, housing, energy and the third sector. These expert participants called for greater use of social value as an evaluation tool, a common approach and highlighted the potential of regulators to act as a catalyst.[32]
- ✓ Two workshops with biomethane producers discussed the results of a biomethane producers survey and made recommendations for further engagement at a working level, which we are adopting.[33]

4.3.3 Phase 4 engagement

As part of an iterative process, engagement activities between October and December continued to refine our business plan, to reflect the views of another 5000 customers and stakeholders we engaged with during this time through the activities listed below.

- ✓ A second round of willingness to pay research to quantify customers' appetite for specific environmental initiatives.
- ✓ Further work on a potential social value ODI building on the expert roundtable we held in September, including customers' willingness to pay for social improvements.
- ✓ Customer and expert stakeholder engagement about financeability.
- ✓ Ongoing engagement with our online panel of informed customers.
- ✓ Research with local authority energy teams to help us finalise our proposals and respond to Ofgem's guidance about LAEPs. Additional direct engagement with local authorities in areas covered by SIUs.
- ✓ Further engagement with large users and analysis of their use of gas.
- ✓ Two roundtable events to review and expand our carbon monoxide (CO) plans with input from expert stakeholders.
- ✓ Quantitative acceptability testing of the plan with customers (section 4.3.4).

[22] Future of heat specialist panels Edinburgh 1&2 (ref 023, 024), Specialist panels - Supporting our communities (Scotland) 1 & 2 (ref 018, 019), Specialist panels - Supporting those at risk (South) 1 & 2 (ref 020, 021), Specialist panels - Fuel poverty (South) (ref 022)
[23] MFT Workshops 2016, 2017, 2018 & 2019 (ref 006, 007, 008, 009, 010, 011, 012, 013, 014, 016, 017)
[24] Third Party Connections workshop 2019 report (ref 069) & Third Party Connections Survey Full Report Jan 2019 (ref 067)
[25] Safety & Sustainability roundtable events, London & Glasgow (ref 065, 066, 068)
[26] Large gas user survey results (ref 076)
[27] Engaging directly with Diageo, Siemens, Drax, Shell, Uniper
[28] Shaping the Business Plan Qualitative Workshops - Environmental Action Plan (ref 084)
[29] Shaping the Business Plan Qualitative Workshops - Customer Service & Supporting Vulnerable (ref 085)
[30] Shaping the Business Plan Qualitative Workshops - Sharing Financial Risk. Innovation Investment (ref 083)
[31] Positive Impact roundtable event - (London combined with Scotland) (ref 088), Safe & Efficient roundtable event - London (ref 089), Shared Net Zero Future roundtable event - Scotland (ref 090)
[32] Simetrica Social Value Roundtable Event Report (ref 096)
[33] Biomethane and Gas Entry connections roundtable event (ref 095)

4.3.4 Customer acceptance of our plan

We asked domestic and smaller business customers whether our final plan was acceptable to them. First, we presented the cost without an explanation of service levels (uniformed acceptability). In follow-up question we provided more explanation of our plan to provide us with an informed acceptability metric. We explained costs would reduce due to changes in the cost of capital (based on the SGN scenario), and we set-out the additional costs that would impact customers as a result of the enhanced services we have included in our plan. We also included an explanation of the cost of our innovation funding proposals before asking customers for their overall informed view of the acceptability of our plan. A large majority (95%) of customers told us they found the acceptability questions clear and understandable.[34]

We received a very high level of support for our plans in Scotland and Southern, as shown in table 4-1, with acceptability rising slightly once we had provided a fuller explanation to customers. Once we explained our plan, 86% of customers responding in Southern and 92% of customers responding in Scotland found our plan to be acceptable (rising from 85% in Southern and 88% in Scotland before explanation).

To benchmark this level of acceptability, we looked at the water industry, and the research carried out by the Consumer Council for Water, comparing plan acceptability rates between water companies.[35] The range of informed acceptability achieved by water companies for their 2019 plans was between 72% and 90% with an average of 84%.

Our overall plan acceptability rate from informed customers in Scotland was higher at 92% than achieved by any water company. In Southern our acceptability rate from informed customers was 86%, a step above the average for water companies.

Table 4-1 Percentage of respondents who found our plan acceptable

	Southern	Scotland
Without detailed explanation (uninformed acceptability)	85%	88%
After more detailed explanation (informed acceptability)	86%	92%

4.3.5 Customer affordability and value for money

We also tested how affordable customers found our final plan proposals, and whether they thought our plans represented good value for money. As the table below shows, a large majority of customers believe our plans are both affordable and value for money, although a proportion of customers did not express a strong opinion, neither agreeing nor disagreeing.[36]

Just 6% of customers in both Scotland and Southern disagreed with the statement that our plan was good value for money.

Table 4-2 Percentage of respondents who agreed our plan was affordable and value for money

Percentage of customers	Southern	Scotland
Affordability		
Agreed our plan was affordable to them	70%	76%
Neither agreed nor disagreed	26%	19%
Disagreed that our plan was affordable to them	4%	5%
Value for money		
Agreed our plan represents good value for money	62%	73%
Neither agreed nor disagreed	32%	22%
Disagreed that our plan represents good value for money	6%	5%

As before, we have benchmarked against 2019 water company plans which show a range of 55% to 80% positive customer agreement that proposed plans were affordable, with an average of 73%.[37] We are close to the water company average for affordability rates for informed customers in Scotland and in Southern.

4.4 Determining the effectiveness of our engagement

4.4.1 Inclusive participation

Our customers and stakeholders represent a wide range of different needs and priorities that we recognise and must address in our plan. We work hard to overcome barriers to participation, encouraging everyone who wants to be heard by us to have their say on issues that affect them.

For both vulnerable and harder to reach customers we tailored our research methods. For example, we used one-to-one in-depth interview techniques for vulnerable customers and worked through trusted intermediaries to solicit the views of harder to reach groups, such as those with mental health illnesses, carers and people for whose first language is not English.[38]

We look for differences in our customers' views by region, age, gender, income levels, faith, ethnicity and other demographics. However, we have been surprised that despite differences in the strength of feeling between some customer groups, prioritisation of key issues and concerns has largely been consistent.

[34, 36] Business Plan Acceptability Testing Phase 1 and 2 (ref 078, 079)
[35, 37] https://www.ccwater.org.uk/wp-content/uploads/2019/10/CCWDDThames-Water.pdf
[38] LSx - hard to reach full report (ref 077)

Encouraged by our CEG, we further explored regional differences between customers in our Scottish and Southern networks, looking at quantitative differences in our customers' willingness to pay for additional services. This analysis demonstrated there was no statistically significant difference in willingness to pay for any of the additional services proposed.[39] We have therefore based much of our plan on a common approach.

4.4.2 Stakeholder mapping and segmentation

For all our key decisions we mapped key stakeholders with high levels of interest and who would be significantly impacted by our proposals. We then designed mechanisms to engage with those stakeholders as described above. By publishing our early thinking at the start of phase 2 of our engagement, and promoting discussion on social media, we tried to ensure we were reaching out to new stakeholders and customers who would otherwise have been unaware of our engagement process. Our digital campaign reached a well-targeted audience of more than one million people, with more than 7800 choosing to interact with our campaign online.

4.4.3 Judging effectiveness of our engagement

We created and then discussed with the CEG a scoring mechanism to evaluate the effectiveness of our engagement mechanisms in answering the key decisions we are making throughout the creation of our business plan. We judged our effectiveness on a scale of one to five, based on factors including sample size, representation, inclusivity, methodology and stakeholder feedback.

Although our scoring mechanism is subjective, we have found it useful as a tool to discuss internally any limitations to the research or engagement we have carried out.

All the engagement mechanisms used in phase 1 were scored at three or above, with the two main customer research programmes considered 'extremely effective' (scored five). In phase 2, the majority of mechanisms were rated as 'effective' (scored four) or 'extremely effective' (scored five) with only one set of qualitative workshops with customers[40] scored as 'somewhat effective' (scored three). This is described further in section 4.3.1.

In phases 3 and 4, all but two of our mechanisms were scored as 'extremely effective' or 'effective', with the main quantitative customer research programmes scored as 'extremely effective' (scored five).

We rated our engagement about financeability with our informed online customer panel as only 'somewhat effective'. The topic was complex and the panel discussion format was helpful but the panel was not representative of all our customers. However, the information generated was used to triangulate the findings from other sources. Our shared future stakeholder workshop[41] in August 2019 was also rated only 'somewhat effective' because stakeholders would have liked more information about the costs of relative options for decarbonisation.

An independent assessment of our overall engagement performance is tracked using our stakeholder satisfaction survey, first run in July 2018. We have maintained or improved our scores across key metrics since then. Stakeholders tell us our engagement is 'continuously improving' by focusing on topics they care about.

Between August 2018 and March 2019, we saw increases in the percentage of stakeholders agreeing with the statements below:[42]

- **SGN continuously improves its engagement** with customers and shareholders. 71.3% of stakeholders agreed in March 2019, up 14.1ppts
- **SGN focuses on the material issues** stakeholders care about. 74.7% of stakeholders agreed in March 2019, up 13.1ppts.

Our CEG has developed its own evaluation criteria to provide an independent assessment of the effectiveness of our engagement and research and will include this assessment in its report to Ofgem.

As part of our overall assurance process, we asked PwC to independently assure our engagement process and provide fourth line assurance to the SGN Board. PwC's report assesses our performance against its independent, eight-dimension framework for evaluation of engagement, based on cross-sector regulatory experience and best practice review. PwC found no critical issues or significant exceptions against its best practice evaluation framework and rated the majority of assessment categories as green.

4.5 Our Customer Engagement Group

Our CEG began operating in September 2018 and has added significant value as we have developed our thinking and refined our plans. We responded iteratively to 12 formal challenges from the CEG and almost 40 written questions raised outside CEG meetings over the last 12 months.

The CEG's role is to provide assurance to Ofgem on two key elements of our business planning process:

- insight – ensuring customer and stakeholder perspectives and priorities are understood
- challenge – ensuring we take account of customers' perspectives and priorities

4.5.1 Composition and recruitment of CEG

Recruitment for our Customer Engagement Group (CEG) took place in summer 2018. Maxine Frerk was appointed as the Chair in early summer, subsequently resigning from our Stakeholder Advisory Panel (SAP) which she had chaired since December 2016. She was interviewed by our independent directors and her appointment was validated by Ofgem.

The CEG Chair subsequently selected members supported by a specialist recruitment consultancy to provide assurance of a blend of independence, knowledge and expertise.

The CEG consists of 17 members, described below.

- Deputy Chair for Scotland and Deputy Chair for Southern: candidates were identified by our independent recruitment agency against an agreed role profile that included significant consumer advocacy experience.

[39] CEG Research update regional differences (ref 099)
[40] Business Plan Acceptability Testing Phase 1 (ref 078)
[41] Shared Net Zero Future roundtable event – Scotland (ref 090)
[42] SGN Stakeholder Satisfaction Waves 1, 2 & 3 (ref 071, 072, 073)

- Market research expert: candidates were identified through the Chair's contacts in Ofgem and in the water sector, with three candidates interviewed by the Chair.
- Fuel poverty/vulnerability: we suggested nominees from our stakeholder pool.
- Business representatives: we suggested a nominee for Scotland from our stakeholder pool; The Federation of Small Businesses (FSB) was asked to nominate someone for the South.
- Local authority representatives: we suggested a nominee for Scotland.
- Citizens Advice and Citizens Advice Scotland: both organisations were invited to nominate individuals who were appointed.
- Future consumers: we and the Chair acknowledged this as a historically difficult but vital perspective to include. The agreed solution was to bring in young energy academics to cover this angle. The Chair identified candidates through her contacts in universities.
- New business model/community energy: the recruitment agency identified candidates.
- Two additional members were appointed to further strengthen the independence of the panel drawing on the Chair's contacts and bringing experience of southern local authorities and the water sector price control.

4.6 Engagement with the CEG

We have aligned our interaction with the CEG to four stages of a plan members developed to manage their work:

1. Getting up to speed (to December 2018)

We provided an extensive insight bank to the CEG to consolidate existing stakeholder and customer research into one document. The insight bank consolidated insight from 47 existing research and engagement reports into one fully referenced 150-page summary. The insight bank has been continually extended as our engagement has progressed and now covers 104 research and engagement reports.

Other topics discussed during this first phase included further plans for customer and stakeholder engagement and our track record and learning from GD1.

At its induction and subsequent meetings, the CEG spoke directly to our subject matter experts who were able to answer questions and build the knowledge and capacity of CEG members to scrutinise and challenge our plan in subsequent phases.

At the end of the first phase the CEG set out the key issues and questions it expected us to answer in developing the plan.

2. Scrutiny of building blocks of the plan (early 2019)

At a two-day workshop in February, the CEG provided early feedback on our initial thinking for large areas of the plan, including repex, transmission and distribution, operations, customer service and our stakeholder strategy. Subsequent meetings reviewed decarbonisation and whole systems, uncertainties, innovation, IT and cyber, workforce planning, GSOPS and assurance. Several of these topics were discussed more than once as our planning evolved in response to the CEG's scrutiny and challenge. Progress and plans for stakeholder and customer research and engagement were shared at each meeting.

3. Scrutiny of initial plan (mid 2019)

We provided the CEG with a draft of our initial plan for its June meeting, which was updated shortly after by the July draft submitted to the CCG and shared with the CEG. The CEG produced detailed and summary written feedback, which the Chair gave directly to the SGN Board. We responded to this feedback confirming how we would progress the issues raised (see Enhanced engagement appendix). Plans for further customer research and stakeholder engagement were also discussed frequently with CEG members with research expertise during this phase.

4. Scrutiny of how our plan evolved based on consultation / engagement (late 2019)

We continued to update the CEG as our plan evolved in-line with customer and stakeholder feedback, including from the CCG. Additional research with customers since October has informed this final version of our plan.

Throughout this process we have engaged with the CEG through their regular monthly meetings and with 'deep dives' on particular topics of interest. These deep dives allowed us to provide a greater level of detail to a subset of CEG members, with an interest in the specific topic. The sessions gave CEG members the opportunity to hear directly from independent research agencies and/or internal subject matter experts on a range of topics, including:

- a customer research day, covering the insights that informed the initial creation of the plan;
- investment deep dive, covering repex, transmission and distribution;
- research with vulnerable customers and harder to reach customers;
- future customer research;
- willingness to pay research;
- large gas users and third parties who connect to our networks;
- Scottish Independent Undertakings;
- local authority research and engagement; and
- business plan acceptability testing.

CEG members have attended a wide range of our stakeholder and customer engagement events and heard direct reports from independent research agencies following the customer workshops held in August. We have provided access to all the detailed research and engagement reports from the 104 sources referenced in our insight inventory.

4.7 Responding to the CEG's insight and challenge

Our development of the plan has been highly iterative, with ongoing CEG engagement and feedback playing an integral role in shaping our thinking and our proposals. In addition to this very valuable ongoing process recorded in CEG minutes, the CEG has also produced more formal feedback to which we have responded as we have developed our plan. This formal written feedback includes:

- 12 formal challenges recorded on the CEG challenge log;
- question log of 38 questions asked by individual CEG members;
- end of phase 1 report setting out the key issues and questions the CEG expected us to answer in developing the plan (see Enhanced engagement appendix);
- report on our initial July business plan at summary and detailed level;
- feedback on our draft October business plan at summary and detailed level; and
- draft overall report based on October draft business plan.

The Chair has direct access to our CEO and independent directors and has regularly attended meetings with the SGN Board.

Overall, we believe we have responded to all the CEG's concerns, although we recognise there are areas in which some members of the CEG would have welcomed even more ambitious plans. Summaries of key challenges and observations from the CEG which have strongly influenced our plan are explained below.

4.7.1 CEG scrutiny of insight gathering and engagement

The CEG identified areas of our engagement we could improve to ensure we had sufficient depth of understanding of the views of our customers and stakeholders.

- The CEG encouraged us to ensure we had sufficiently understood the views of
  - large gas users
  - local authority energy teams
  - larger users of our SIU networks
  - biomethane producers

We created research and engagement processes to fill each of the gaps identified (section 4.3).

- The CEG asked us to ensure we thoroughly test our proposals with customers and stakeholders, building in time and enough information for deliberation, and not relying on the qualitative customer workshops held in April/May 2019 which covered a very broad range of subjects. The extensive additional programme of engagement we carried out in August/September (section 4.3.2) produced significant changes to some of our proposals as a result of the customer and stakeholder feedback gathered. Examples include increased targets for fuel poor connections, the design of our framework for vulnerability initiatives, removal of the option for additional customer liaison officers, re-focusing of our ambition to reduce interruptions on third party damage – all in response to the very detailed engagement carried out in-line with the CEG's challenge.
- The CEG considered we should investigate further the concerns of future customers and explore the trade-offs between future and current customers.
  We explored some complex topics with future and current customers using a range of techniques explained below.
  - In detailed workshops and in-depth interviews customers explored the pros and cons of different payment mechanisms for managing future uncertainties. We interpreted the views of future customers gathered in this research with care, since younger people with less experience of household bills and expenditure found the content challenging. However, current customers were broadly comfortable we were using uncertainty mechanisms such as volume drivers, reopeners and use-it-or-lose-it allowances appropriately, rather than fixed allowances.[43]
  - We also discussed the potential risks, benefits and timing of innovation. Customers and future customers broadly supported our proposal for some funding of early innovation projects, paid for now but which may deliver benefits for future customers. They did however want us to contribute to that funding.[43] We have acted on this customer feedback and this draft plan includes an SGN contribution to innovation funding.
  - Future customers were represented in all our quantitative and qualitative research, and we analysed their views separately, looking for differences and similarities between current customers, particularly on topics such as inter-generational fairness and bill fluctuations related to the cost of capital.[44]

4.7.2 CEG challenge to ensure we have responded to the insight gathered

The CEG highlighted a number of areas where members believed we had not responded sufficiently to insights gathered from our customer and stakeholder engagement. In each case we have provided our response below.

- Our CEG challenged us to improve our ambitions on efficiency, given customers' overarching priority that we keep costs down.

  Our response. We saw additional cost pressures as we refined our cost estimates between July and October. We therefore increased our ambition on productivity from 0.6% to 1% in this plan to absorb the additional cost pressures.

- Customers (and particularly future customers) told us minimising our environmental impact and finding future energy solutions were very high priorities for further investment. Our CEG challenged us to do more on decarbonisation and the environment.

  Our response 1. We confirmed through additional engagement with customers and stakeholders that they would like us to implement high levels of ambition

[43] Shaping the Business Plan Qualitative Workshops - Sharing Financial Risk. Innovation Investment (ref 083)
[44] Business Plan Acceptability Testing Phase 2 (ref 079)

for leakage, fleet, site energy supplies and biodiversity.[45] We amended our environmental action plan (chapter 9) to reflect higher ambitions and targets in all these areas.

Our response 2. We have responded to the CEG's specific challenge around our ambition for biomethane connections by increasing our target from an equivalent of 400,000 homes to 450,000 homes. This is above the 'high' level scenario created by the Anaerobic Digestion and Bioresources Association and therefore we believe represents significant ambition.

- During engagement with customers and stakeholders over the summer, we heard very strong feedback that we should focus more effort on leakage, and with the encouragement of the CEG we have increased our focus on leakage in our plan (section 9.5).

  Our response. Part of our response has been to include an accelerated tier 1 replacement pipe programme above that mandated by the HSE. This was also supported by stakeholders.[46]

- Keeping the gas flowing safely is viewed by customers as the most important priority for us to focus on. However, given our track record on safety and reliability, customers do not see it as a high priority for investment to improve performance. The CEG challenged the inclusion in the July plan of potential additional options to invest in improving safety and reliability worth £100+m.

  Our response. We have narrowed down the potential additional service options through engagement with customers and stakeholders, through cost benefit analysis (CBA), willingness to pay research and technical assessment. The enhanced services included in the October draft plan relating to safety and reliability were reduced to £15m, which we believe are necessary to keep our network as safe as it is today.

  The highest proportion of enhanced services included in the October draft and this final plan are aligned to our commitment to create a shared net-zero future by minimising environmental impact or by focusing on future energy solutions. These are our customers' highest priorities for investment.[47] We have reduced the total value of enhanced services (above our like-for-like expenditure) in this plan from £152m to £54m in-line with our customers' desire to keep costs down.

4.8 Engagement with the RIIO-2 Challenge Group

We have welcomed the opportunity to engage with the RIIO-2 Consumer Challenge Group (CCG) through a series of meetings at key points in the development of our plan. We have also responded to the CCG's guidance and requests for information, which have shaped our thinking and planning assumptions.

- We worked with the other gas and electricity distribution and transmission networks to agree a common scenario and set of assumptions for GD2. This work was shared with the CCG between November 2018 and March 2019 and was a useful step to inform our initial planning from a common scenario. This work also fed into discussions with our CEG. It has been further developed by our analysis of National Grid's 2019 future energy scenarios (FES) and the impact of the net-zero target subsequently set by the UK Government. We have set-out in section 15.2 the differences in assumptions between the common scenario, the updated scenario that underpins our plan and the impact this will have on investment in GD2.
- In December 2018, we welcomed the opportunity to meet with CCG members and discuss our early insight into our customers' priorities and how we were responding in our plan with our three customer commitments. We set out our early thinking which built on our track record of performance in GD1 and was aligned to the priorities of our customers. A wide range of questions from CCG members provided challenge and useful debate.
- In March 2019 we responded to the CCG's request to provide information on our track record of past expenditure and an explanation of the reasons why expenditure may have varied from the original plan. We also responded to 17 supplementary questions. Useful discussion and robust challenge took place at our April meeting with a subgroup of the CCG. We followed up with additional performance data on 2018/19, sharing draft information to ensure we were facilitating the work of the CCG prior to the data completing internal assurance processes.
- We submitted and presented our first and second draft business plans to the CCG in July and October, with our CEO and three directors attending to lead the discussions of our plan. In July we identified areas where work was still being undertaken to reflect Ofgem's June business plan guidance and areas where we were continuing to develop the plan and gain further stakeholder feedback. Questions and comment from CCG members during our meeting were supplemented by written feedback in mid-August.
- We have responded to the CCG's feedback on the July and October versions of our plan, with a summary of changes made and the rationale included in an accompanying addendum.
- In keeping with the CCG's request, we have not made substantial changes between the October draft of our plan and this final version. Refinements have been made where additional information has become available, where Ofgem has clarified its requirements, or in response to additional customer, stakeholder, CEG or CCG feedback.

[45] Shaping the Business Plan Qualitative Workshops - Environmental Action Plan (ref 084)
[46] MFT Workshops Jan/Feb 2019 London & Glasgow (ref 016, 017)
[47] Stage 3: Conjoint & WtP summary report (Valuation Phase) (ref 005)

4b Our stakeholder engagement plan for GD2

4.9 Our commitment to ongoing engagement with stakeholders

Meeting the evolving expectations of our customers and stakeholders is a responsibility we take seriously. We believe we make better decisions in the interests of customers and all stakeholders when we understand the full range of their requirements, distinct needs and priorities, in both our network areas, placing their interests at the heart of our business.

One of our corporate priorities is to keep pace with the increasing expectations of all our stakeholders as technology, energy and society evolve.

Our commitment to engagement is led by our CEO, who engages personally with a diverse range of stakeholders; from UK and Scottish government ministers, to fuel poverty partners and individual customers. His approach defines the model for day-to-day stakeholder engagement from all teams across both our network areas and is the template for increasing engagement during the creation of future plans.

Performance related pay for senior managers is linked to the priorities of our customers and stakeholders. The CEO and executive team meet regularly with external members of our SAP who offer advice, challenge and an external perspective on our business.

We are committed to continuing and growing our stakeholder engagement throughout GD2 to deliver real benefits that are valued by our customers, stakeholders and across our business.

4.10 Our stakeholder engagement journey in GD1

We have made a good start on our journey of increasing engagement with stakeholders in GD1. We have seen a growing volume of stakeholder input and influence within our decision making at both strategic and operational levels.

The GD1 stakeholder engagement incentive has allowed us to invest in developing specialist expertise. We have put in place new systems and processes to improve our engagement with stakeholders and to capture feedback to inform our plans. Alongside our strategic managers and our insight and communications specialists, we have dedicated regional resources in Scotland and Southern to support the business in ensuring we reflect the unique and evolving needs of our stakeholders in different local areas.

4.10.1 Lessons learned

We learned a number of lessons in GD1 listed below which we are taking forward in our GD2 strategy.

A. We achieved better outcomes by working with a range of expert partners to deliver customer benefits in their areas of expertise. Joining up with other utility companies also provided valuable increases in scale and learning.

B. Formal partnership agreements proved a useful mechanism for setting and managing expectations, in order to deliver and report on concrete outcomes. For example, in delivering energy efficiency advice or providing appliance servicing to vulnerable customers.

C. Systematic processes have been effective in supporting cultural change and embedding a consideration of stakeholder views in decision making. For example, by including the potential impact on stakeholders in our Investment Committee's appraisal of new projects, or by systematically engaging with all local authorities to ensure our network plans are aligned to local development plans.

D. Engagement with specialist stakeholders on defined topics of interest to those stakeholders delivered the greatest value to the business and to stakeholders. We have therefore increased the proportion of our engagement taking place through specialist panels, workshops or webinars.

E. The policy landscapes for Scotland and England have increasingly diverged, requiring specifically tailored engagement on topics such as decarbonisation and fuel poverty.

F. Community based organisations worked with us to reach stakeholders and customers we could not otherwise have engaged with, broadening the views and inputs we were able to access.

G. Engagement with stakeholders at an early stage of decision making, sharing challenges and working together on solutions, provided us with new ideas, offers of help and ultimately better solutions.

H. Stakeholders increasingly welcomed digital contact and information. However, when topics were complex, well facilitated face-to-face interaction was appreciated by stakeholders.

I. By sharing increasing amounts of information over time, we were able to discuss increasingly complex dilemmas with stakeholders, extending the areas of decision-making they were able to influence.

J. Embedding new stakeholder engagement activities across our business has taken time, particularly in operational areas. However, the benefits are significant. Senior management support, simple processes and leadership from local stakeholder managers, have been essential to achieve an environment where stakeholder engagement is embedded. For example, involving local communities before all planned work projects, or introducing a process for our engineers to refer vulnerable customers for additional services from partner organisations.

We have learnt many lessons and made much progress, but we recognise we can go further. Our own assessment is that during GD1 we have moved from a basic, ad hoc level of stakeholder engagement to a more systematic, planned programme of engagement.

We started GD1 as the lowest ranked gas network in Ofgem's assessment for the stakeholder engagement incentive. Since then, we have regularly appeared in the top three and have been the leading gas network for the past two years. However, three electricity networks can demonstrate greater progress, and we know there are many organisations demonstrating best practice outside the energy sector we can learn from.

4.10.2 Lessons learned from best practice in other sectors

We have identified below a number of lessons learned from outside the energy sector in GD1 which we are taking forward in our GD2 strategy.

K. We found that other sectors, particularly local government, construction and social housing, were measuring the social value of engagement outcomes and using this social value framework as a proactive decision-making tool when making investment commitments. The Treasury Green Book defines social value to cover financial and wellbeing benefits. We have begun to develop our own social value framework, starting with measuring the social value of vulnerable customer initiatives, with plans for further extension in the lead up to and during GD2.

L. We found public sector and non-government organisations focused on capacity building for both organisations and their stakeholders. We have adopted this approach by creating regular forums and specialist panels, where we can share increasingly complex challenges. Our enhanced engagement to create our GD2 business plan has helped us see the opportunities and build capacity with customers by using our online customer panel, an idea adopted from the water industry. We will continue this approach to build capacity with stakeholders and customers as part of our ongoing engagement programmes.

M. We learned from Anglian Water's approach, which helped them understand and value the negative impacts of their activities. We have applied a similar method of regression analysis using ONS statistics to understand the impact of our works on people living nearby.

N. We learned from the award winning community engagement for the 2011 Census, creating a systematic way of engaging with local communities, while tailoring for local circumstances. We are adopting a similar engagement blueprint across our depots.

4.11 Our ambitions for GD2

We anticipate new technology, evolving national policies, social concerns and ambitions for decarbonisation will drive changes in both the expectations and priorities of stakeholders during GD2. Within this broader context, and building on what we have learned, we have discussed and refined our principles of engagement with input from our SAP.

4.11.1 Principles of engagement

These principles are aligned with the Accountability AA1000 Stakeholder Engagement Standard and were also reviewed by our CEG. They are reviewed annually by our SAP, most recently in November 2019.

1. Delivering measurable benefits: we will engage directly with customers and stakeholders to embed their interests in our decision-making and deliver valued, measurable benefits, working with partners where we can (building on lessons learned A, B, C, K and M).
2. Focusing on material issues: customers and stakeholders will have a say in the issues they care about and which have the most impact on them both now and in the future (building on lessons learned D and E).
3. Driving inclusivity and diversity: engagement with customers and stakeholders will be broad and inclusive; we will seek out the diverse perspectives of challenging and hard to reach groups and ensure complex issues are communicated in a way that is easily accessible and understandable (building on lessons learned F).
4. Providing ongoing opportunities for challenge and collaboration: engagement will be tailored to the needs of stakeholders to ensure genuine opportunities for ongoing dialogue, challenge, review, mutual education and collaboration are created (building on lessons learned G and H).
5. Being responsive and transparent: explaining how the views and priorities of stakeholders have influenced decision making, and how we have balanced the needs of different stakeholders (building on lessons learned I, J and N).
6. Continually improving: developing our engagement with customers and stakeholders, finding new and more innovative ways to respond to their changing needs (building on lessons learned K, L and M).

4.12 Priorities of our stakeholders and customers driving our engagement

4.12.1 Customer priorities

Domestic and small business customers in Scotland and Southern expressed similar priorities, with the highest importance placed on keeping the gas flowing safely and keeping overall bills down (section 4.2).

Vulnerable customers were particularly concerned about interruptions and time off supply.[48] We are focusing our day-to-day activities on making sure we mitigate the impact of any planned supply interruptions through early impact assessment and community engagement. We are also building resilience partnerships to ensure extended support is available through partners in the event of emergency interruptions.

Reducing the impact of interruptions is particularly important for **industrial users**; 70% told us they would feel a significant impact within two hours of a supply interruption.[49] This understanding is driving our work with stakeholders to try to reduce third party damage to our network and reduce the number of interruptions for all our customers. Small and medium businesses are also concerned about the impact of interruptions, particularly vulnerable traders.[50]

Large industrial users and **customers who connect to our network (including biomethane producers)** also want us to focus on providing excellent service, with 25% of large users asking for more dialogue with us.[51] Our CEG noted this as an area of potential improvement early in the GD2 planning process. We have increased our programme of engagement with these customers[52] to ensure we deliver a service in line with their priorities.

While all customers want us to keep our network safe, reliable and efficient, they also want us to focus

[48] Stage 3: Conjoint & WtP summary report (Valuation Phase) (ref 005)
[49] Large Gas User survey results (ref 076)
[50] Shaping the Business Plan Qualitative Workshops - Customer Service & Supporting Vulnerable (ref 085). In GD1 engagement we spoke in person to 380 small traders in Rye Lane, Peckham during a large planned workwho were considered particularly vulnerable by the local council.
[51] Biomethane and Gas Entry Connections customer survey (ref 082)
[52] Biomethane and Gas Entry Connections roundtable event (ref 095)

additional resource on finding future energy solutions, minimising our environmental impact and supporting vulnerable communities. **Rural domestic customers** in particular value the importance of support for vulnerable communities, and **urban domestic customers** have a higher focus on minimising environmental impact.[53] Among society's harder-to-reach groups, such as people with mental health problems, carers or people who are linguistically diverse, customers wanted us to focus on reducing disruption and providing support for vulnerable communities.[54] Current high levels of satisfaction mean customers do not prioritise improvements in our overall service level, although customers in our southern region would like us to reduce the gap between satisfaction levels in Scotland and the South.[55]

Future customers share similar priorities to current customers, with a slightly stronger emphasis on minimising environmental impact and finding future energy solutions.[56] Significant elements of our engagement plan focus on these areas of importance to our future customers.

4.12.2 Stakeholder priorities

Government ambitions for decarbonisation are higher in **Scotland**, with a net-zero target five years ahead of the overall target for the **UK**. In response, our engagement on the future of heat is bespoke to each of our network areas, with a specialist Scottish panel of stakeholders helping us to design an ambitious pathway towards decarbonisation.[57]

Key **stakeholders in the South**, such as Transport for London, Greater London Authority and other metropolitan local authorities, focus on the impact of our works on traffic disruption, and there is increasing interest in joined-up working across utilities.[58]

There are strong stakeholder concerns in **both Scotland and the South** about customers in vulnerable circumstances.[59] Our engagement with charitable partners, non-government organisations and local authorities on vulnerability is tailored to the different regional challenges and support networks. There is a strong focus on fuel poverty from Scottish government, driven by higher fuel poverty rates and resulting in a joined-up strategy and support network.[60]

4.12.3 Keeping abreast of changing stakeholder and customer priorities

We must remain up-to-date with what matters to stakeholders and customers, investing time and resource in regular proactive listening and insight gathering. We have listed below a number of mechanisms in place to achieve this.

- Our CEO and members of our Executive team regularly engage directly with stakeholders and customers.
- Our SAP includes six external members who have direct access to the CEO and Executive team members to provide advice and challenge on all areas of the business.
- We have a stakeholder relationship management system in place for our externally facing colleagues, including the field force, ensuring insight is easily accessible across the organisation.
- We have created a stakeholder research insight team to carry out an ongoing programme of research and manage the process of ensuring insight from the many engagement and research mechanisms available for business decision-makers. We are also developing a future research and insight plan.
- We test and iterate customer facing changes directly with customers, building their priorities into the design of our customer experience.
- We are building greater ongoing engagement with large industrial users and their trade bodies, understanding their use of natural gas, appetite for decarbonisation and the potential for energy efficiency or energy reduction. Large industrial users have asked for further engagement with us and our CEG has also encouraged this dialogue.
- We have increased our engagement with local authority energy teams and other players to keep us close to Local Area Energy Plans as they develop, including the Local Heat and Energy Efficiency Strategies in Scotland. We expect the pace of change to increase and significant engagement will be needed to keep up-to-date with developments.
- We will focus on building capacity among stakeholders and customers with regular forums to discuss increasingly complex topics over time. This takes forward our learning from GD1 and is encouraged by our CEG. Further details of the forums and mechanisms of engagement are contained in the Stakeholder engagement appendix.

4.13 Our approach in GD2

Our approach to ongoing engagement is underpinned by our understanding of customer and stakeholder priorities and is based on the six principles of engagement listed in section 4.11.1. There are two elements to our strategy.

1. We will continue to learn and improve stakeholder engagement in our everyday business as usual activities.
2. We will work collaboratively to contribute to solving long-term complex challenges, such as the energy transition and social disadvantage for vulnerable households. This responds directly to feedback from our stakeholders, including our SAP and our CEG.

Our approach, performance commitments and measures have been reviewed by members of our CEG and SAP and shared more widely by SAP members with their peers.

[53] Stage 1: Explorative Qualitative Workshops and Interviews (Exploratory Phase) (ref 002), Stage 3: Conjoint & WtP summary report (Valuation Phase) (ref 005)
[54] LSx - hard to reach report (ref 077)
[55] Shaping the Business Plan Qualitative Workshops - Customer Service & Supporting Vulnerable (ref 085)
[56] Shaping the Business Plan Qualitative Workshops - Environmental Action Plan (ref 084)
[57] Future of heat specialist panels Edinburgh 1&2 (ref 023, 024)
[58] Mayor's Infrastructure High Level Group https://www.london.gov.uk/what-we-do/business-and-economy/better-infrastructure/mayorsinfrastructure- high-level-group
[59] Stakeholder Satisfaction Wave 1 (ref 071), Stakeholder Satisfaction Wave 2 (ref 072), Stakeholder Satisfaction Wave 3 (ref 073), Supporting our communities (Scotland) 1 and 2 (ref 018, 019), Supporting those at risk (South) 1 and 2 (ref 020, 021), Fuel poverty (South) (ref 022) Positive Impact roundtable event - (London combined with Scotland) (ref 088)
[60] https://www.gov.scot/publications/draft-fuel-poverty-scotland-2018/ and Positive Impact roundtable event - (London combined with Scotland) (ref 088)

4.14 Proactive engagement as part of our day-to-day business

4.14.1 Making a positive social impact: supporting vulnerable communities

We will work in partnership with stakeholders to facilitate the safety and well-being of our customers, particularly those in vulnerable circumstances.

- **Fuel poor connections.** Partnerships and multi-agency, well-coordinated projects have proved to be the most effective way of finding and providing support for fuel poor households and we plan to continue this approach. Policy and funding arrangements for fuel poverty are different in our two network areas, requiring a tailored approach to our engagement to support those living in fuel poverty. In the South, in order to identify fuel poor households, we will make extensive use of our mapping tool, sharing our learning with other gas networks and partners and working collaboratively to find better ways of reducing fuel poverty.

  We have discussed our fuel poverty targets extensively with stakeholders and with our CEG. Stakeholders recognise the challenge of defining a target given the large number of policy uncertainties. For example, the future of ECO from 2022, the Scottish Fuel Poverty Strategy expected imminently, the potential impact of net-zero ambitions plus climate emergencies and many other uncertain factors. More details of our fuel poverty network extension scheme and targets can be found in section 6.4.

PERFORMANCE COMMITMENT ONE. We will continue to develop an evidence base and practical tools to support identification of fuel poor households. We will make our progress against fuel poor targets transparent and accountable. On the suggestion of stakeholders and our CEG, we will facilitate regular reviews with specialist stakeholders in both Scotland and Southern to monitor our progress against our respective fuel poor connections targets and build mutual understanding of the appropriateness of the targets in light of any changes to the policy context for the scheme.

Measure: regular review of the appropriateness of the fuel poor targets in Scotland and Southern and our progress against them.

- **Finding new ways of supporting vulnerable customers.** We will continue to work with partners – charities, community organisations, public bodies, utilities and other businesses - to collaborate in providing solutions to the energy challenges faced by customers in vulnerable circumstances, helping them to use energy safely, easily and affordably. More details of our plans are included in section 6.4 and in our Customer and vulnerability plan appendix.
- **Carbon monoxide (CO) safety awareness.** We will increase collaboration and targeted campaigns to build awareness of the dangers of CO. More details of our plans are contained in section 6.5.3 and in our Customer and vulnerability plan appendix.
- **Building life and work skills.** We will work with partners and our own employees to extend opportunities for individuals further away from the labour market. For example, working with organisations that support veterans, the homeless or disadvantaged young people. Through mentoring, work preparation programmes, and work experience we will build life and work-related skills in our local communities. Partnership programmes to encourage a diverse range of people into the gas industry will also have positive benefits for us, attracting new talent and supporting workforce resilience (section 8.10).

PERFORMANCE COMMITMENT TWO. We will increase the value derived through partnership working as we extend our activities to support vulnerable and disadvantaged communities.

Measure: the social value generated by our activities and those of our partners to support vulnerable and disadvantaged communities (section 6.14.2). We will also report against the requirements for the reputational output delivery incentive for vulnerability and CO awareness including Ofgem's common vulnerability metrics (once defined) and create a collaborative annual showcase (section 6.7).

4.14.2 Making a positive social impact: providing excellent service

We will proactively share the information customers and stakeholders need, keeping pace with preferred communication routes and seeking partner channels to increase our reach.

- **Roadworks, interruptions and incidents.** We will forge communication partnerships with community organisations, other utilities and local authorities to increase the reach of our messages to all our customers, including those who are harder to reach or vulnerable. We will continue to provide regular, proactive updates on our works using one.network (formally known as Roadworks.org), our own website and other communication channels. We will also maintain collaborations with resilience partners such as the local police, fire services and Neighbourhood Watch teams, to provide important safety and security information to local communities; our Neighbourhood Alert service is one example of such a collaboration.

PERFORMANCE COMMITMENT THREE. We will reduce negative impacts and promote positive benefits by communicating effectively across multiple channels, and by providing easy opportunities for customers to reach us.

Measure: specific targets for reach and interaction will be set for each campaign or engagement activity with reference to industry averages. A linked performance measure is the communication element of customer satisfaction (section 6.10).

4.14.3 Delivering a safe and efficient network: keeping the gas flowing

We will focus on engaging effectively in our business as usual activities to mitigate the impact of interruptions to customers' supplies, in line with customers' most important priority - that we keep the gas flowing.

- **Planned work projects.** With strong support from our stakeholders,[61] we will continue the approach we piloted in GD1. This ensures we consider the needs of communities in advance when we plan works and we tailor our project plans to the needs of those communities. We call this process tailored project delivery. All planned work projects will be assessed to understand the potential impact on local communities

[61] MFT Workshops 2016, 2017, 2018 & 2019 (ref 006, 007, 008, 009, 010, 011, 012, 013, 014, 016, 017)

and the levels of engagement required. By working with local community organisations to communicate and engage with local people while we are planning works, we are able to tailor our project plans to unique local needs. This might include changing timings, tailoring access arrangements or providing advance communication to mitigate the impact of our works on local traders, residents, vulnerable customers and commuters. This proactive approach reduces the need for local residents to contact us and has helped significantly reduced complaints in GD1.

PERFORMANCE COMMITMENT FOUR. We will assess the community impact from all our planned work projects and where the potential impact is high, engage with local communities to create tailored project plans.

Measure: number and proportion of planned work projects assessed, and resulting changes made to project plans. A linked performance measure is customer satisfaction scores for planned work (section 6.10).

- **Unplanned interruptions and incidents.** We will continue our collaboration and joint contingency planning with local resilience partnerships and take advantage of shared communication mechanisms to extend our reach and the support we are able to offer to customers impacted by incidents. We will continue to develop and share our incident app with our resilience partners and local authorities, working with them to further develop the app's capabilities to help identify and provide support for vulnerable customers during an incident. We will also participate in mock incidents run by resilience partners.

PERFORMANCE COMMITMENT FIVE. All our depots will continue to participate in the external Resilience Direct communication network to ensure we are accessible and responsive to resilience partners. We will implement a three-year plan to host mock incidents with resilience partners from each of our depots, allowing us to collaborate and improve our processes.

Measure: progress against our three-year resilience partnership plan.

- **Avoiding third-party damage.** We will team up with relevant training providers to raise awareness of the dangers of working in the vicinity of our pipelines and reduce inadvertent third-party damage to our network. We will continue to collaborate with other utilities, promoting the online pipeline search tool LinesearchbeforeUdig, to reduce injuries and interruptions, costly damages and methane emissions.

PERFORMANCE COMMITMENT SIX. Our engagement will facilitate fewer interruptions to customer supplies as a result of third-party damage, working collaboratively towards a 15% reduction.

Measure: percentage reduction in interruptions due to third party damage.

4.14.4 Building a shared net-zero future: minimising environmental impact

We will work with stakeholders to minimise our environmental impact and work towards the decarbonisation of heat, while recognising the tension between network growth and decarbonisation in our business as usual decisions.

- **Future capacity planning.** We will build on the systematic engagement and data sharing that we put in place in GD1 with local authority planning teams which aligned our network plans to local development plans. We will extend our engagement to include local authority energy teams, aligning our network modelling with future infrastructure and local energy planning.

  We will collaborate with regional growth and infrastructure delivery groups, from the Greater London Authority Growth & Infrastructure Initiatives, to the Scottish Government Infrastructure Delivery Group. Investment decisions made by our formal Investment Committee will continue to include consideration of stakeholder impacts.

PERFORMANCE COMMITMENT SEVEN. We will systematically engage with each authority to refine our network plans in synergy with local development and energy plans, ensuring that we have data sharing agreements in place with all local authorities in our footprint. This performance commitment continues engagement piloted during GD1 and is extended to include local energy teams and Local Area Energy Plans (LEAPS), including the Local Heat and Energy Efficiency Strategies (LHEES) in Scotland, in-line with suggestions made by our CEG.

Measure: number of LAEPs and LHEES collaborations we proactively engage with.

- **Facilitating biomethane connections to our network**. We discussed with biomethane producers at roundtable events in Scotland and in Southern, how and why they would like to engage with us.[62] As a result of their feedback we are developing an ongoing engagement process that focuses on:
  - broader collaborative engagement with other gas networks and trade bodies;
  - engagement with engineering experts; and
  - engagement at a strategic level to tackle barriers to connection.

This ongoing process of engagement already underway in GD1 will help us build a better understanding of this community's requirements as we focus on barriers to connection, for example by standardising requirements and building biomethane capacity heat maps.

PERFORMANCE COMMITMENT EIGHT. We will deliver an agile three-pronged engagement plan with practical outputs valued by biomethane producers, such as capacity heat maps.

Measure: progress against engagement plan to support the growth of biomethane capacity on our network, to reach our ambition of the equivalent of 450,000 homes supplied by the end of GD2.

4.15 Engaging to find solutions to complex challenges

In addition to supporting our everyday decision-making with robust stakeholder engagement, we propose collaborative action on some of the long term, complex challenges, as raised by our stakeholders, SAP and CEG.[63]

[62] Biomethane and Gas Entry connections roundtable event (ref 095)

[63] MFT Workshops 2016, 2017, 2018 & 2019 (ref 006, 007, 008, 009, 010, 011, 012, 013, 014, 016, 017), Supporting our communities (Scotland) 1&2 (ref 018, 019), Supporting those at risk (South) 1&2 (ref 020, 021), Fuel poverty (South) (ref 022), Future of heat specialist panels Edinburgh 1&2 (ref 023, 024), and SGN's customer engagement group meetings

We have proposed 10 areas of extra focus to engage with stakeholders and customers for the first two years of GD2. These complex challenges are aligned to our three commitments to customers, but with a greater emphasis on creating a shared net-zero future and making a positive impact, since those are the areas where customers would like us to do more (section 4.2).

We will use the mechanisms listed in section 4.12.3 to ensure our areas of focus remain aligned to the interests of customers and stakeholders.

Making a positive impact: areas of focus for engagement

1. Collaborating to find alternative heat solutions for all households, in particular fuel poor households.
2. Finding ways to support vulnerable communities to engage with decarbonisation.
3. Contributing ideas and collaborating on better ways to measure social impact.
4. Seeking input to find additional services for vulnerable customers.
5. Encouraging customers to protect and prevent the dangers of CO.

We discussed these five proposals with specialist stakeholders at two events themed around 'making a positive social impact' and all five proposals received some support.[64] In addition, stakeholders in Scotland were keen to focus on resilience while those in Southern suggested we work to improve outcomes for young people. Both of these elements are included in our business as usual engagement (section 4.14).

Delivering a safe and efficient service: areas of focus for engagement

6. Collaborating with other utilities on planned works and projects.

There are logistical and legal challenges to overcome in working collaboratively with other utilities. In GD1 the Croydon in Collaboration project demonstrated joint working, however planning across different utilities did take significantly longer and increased the cost of planning and coordination between companies. However, there is a benefit to local communities because disruption and impact is reduced. Customers would like us to carry-out more work with other utilities,[65] and we have received strong feedback from stakeholders, particularly in London, that we should pursue partnerships with other utility companies which are also trying to engage with hard-to-reach groups. This approach lessens the burden on stakeholders and customers.

We are proposing a social value collaboration incentive (section 6.14) to drive behaviour change and embed collaborative working. Effective engagement with other utilities and local authorities will be an essential ingredient to deliver the related benefits for customers and local communities.

Building a shared net-zero future: areas of focus for engagement

7. Contributing ideas and collaborating to find ways to decarbonise heat.
8. Contributing ideas, data and collaborating to support the broader energy transition, including contributing to Local Area Energy Plans.
9. Providing information and evidence to support decision makers to make the best use of gas networks in a decarbonised future.
10. Seeking input into our decision making to produce better environmental outcomes for the business and our stakeholders.

Customers would like us to invest extra time and resource in finding future energy solutions and minimising our environmental impact.[66] Stakeholders at specialist events have challenged us to ensure we are making a strong contribution to the decarbonisation of heat[67, 68] and we are being sufficiently ambitious in our proposals to minimise our environmental impact.[66]

PERFORMANCE COMMITMENT NINE. Our 10 areas of focus (above) are long-term complex challenges, so we are not likely to achieve measurable outcomes quickly. We propose that for each challenge we agree a relevant expert interest group to review our progress in the light of external developments, in a spirit of accountability and transparency.

Measure: regular independent review of the appropriateness of the challenges and the contribution we have made towards them. As a minimum, we would expect to undertake activity on all 10 challenges each year and to make significant progress on five.

This performance commitment is proposed as a bespoke output for the reputational stakeholder engagement incentive (section 6.8).

4.16 Delivery plans

We are following a six-stage cycle to create our stakeholder engagement plan and deliver our strategy. Our engagement cycle was reviewed in 2018 by our SAP and CEG.

64 Positive Impact round table event – London combined with Scotland (ref 088)
65 Stage 1: Explorative Qualitative Workshops and Interviews (Exploratory Phase) (ref 002), Shaping the Business Plan Qualitative Workshops - Customer Service & Supporting Vulnerable (ref 085)
66 Stage 3: Conjoint & WtP summary report (Valuation Phase) (ref 005)
67 Future of heat specialist panels Edinburgh 1&2 (ref 023, 024)
68 Shared Net Zero Future round table event - Scotland (ref 090)

Details of our first-year plan aligned to the cycle above can be found in the Stakeholder engagement appendix which identifies our key stakeholder groups, our planned engagement mechanisms and outputs.

We have highlighted below specific elements of our systematic engagement cycle that members of our CEG have encouraged us to focus on.

4.16.1 Identifying our stakeholders

We will increase our engagement with all business customers in GD2, including large users, small and medium businesses, to fully understand their diversity and identify their needs, priorities and vulnerabilities on an ongoing basis. We will make good use of our regular engagement with small business traders during planned works to support this broader understanding of vulnerability among our business customers.

Future customers will be a continued focus during GD2 as we explore the nuanced views held within this group, particularly in relation to long-term and complex challenges. We will regularly review our stakeholder database to identify and fill gaps and explore ways to facilitate engagement by stakeholders who are less active or harder to reach.

4.16.2 Tailoring our engagement methods

We will continue to build our expertise to understand the preferred and most effective engagement methods used to gain systematic insights from harder to reach customer groups, undertaking outreach activities with stakeholders who are unable to participate in formal events. We will continue to look beyond our industry for innovative ways to engage with stakeholders and customers.

4.16.3 Listening and engaging with a purpose

We have created a research and insight plan covering both our customers and broader stakeholder groups to build our understanding and to underpin ongoing decision-making.

4.16.4 Responding

During GD1 we have worked with stakeholders on an ongoing basis to build their knowledge and capacity to influence our approach. We have been able to share increasingly complex challenges with positive results for the business and for stakeholders. We will extend this approach to further build capacity among our customers during GD2, to enable them to increase their influence on our thinking at an early stage. We are reviewing our informed online customer panel and other mechanisms to identify effective ways of working with customers in this way.

Our CEG is also encouraging us to share learning between Scotland and Southern stakeholders, to transfer good practice gained from each region to add value and improve knowledge in the other, across all areas of engagement.

4.17 Measuring our progress

4.17.1 Delivering our performance commitments

We have described nine performance commitments in sections 4.14 and 4.15, and we will monitor and publish our annual performance against these commitments and against our six principles of engagement that align to the Accountability AA1000SES.

We will report transparently on our progress against our performance commitments, with a clear explanation of any under-delivery. Where commitments have not been met, we would expect to discuss our performance with knowledgeable stakeholders to understand the expectations of topic experts and agree a suitable action plan.

4.17.2 Ongoing role for the CEG

We support an ongoing role for our CEG, both in assuring the performance commitments and outputs included in our plan and in supporting an assessment of our performance as part of the reputational ODI for stakeholder engagement. We would expect the CEG to meet at least twice a year in a formal capacity to review progress. We anticipate that the size of the CEG would be reduced for this ongoing role from its current membership of 17, while still maintaining a balanced mix of expertise and regional knowledge.

We also propose that members of all the network CEGs fulfil an oversight role for a common, industry-wide measurement framework for outcomes (section 4.17.4).

We plan to continue to work with our SAP to provide us with advice, support and challenge on an ongoing basis. We anticipate that members of our SAP will join the Steering Group for Vulnerability and CO (sections 6.5.6 and 4.14.1 for fuel poverty) and the Steering Group for Environmental Action (see chapter 10). In an individual capacity, members of the CEG may also have expertise to contribute to these groups or to our Technical Training Steering Group (section 8.5). We will facilitate good communication flows between our CEG, SAP and steering groups.

4.17.3 Effectiveness of engagement

We will continue to use external benchmarking and accreditation to evaluate our performance. We engaged external accreditors in 2018 to independently review our process against the Accountability AA1000 Stakeholder Engagement Standard (SES). This latest review demonstrated significant progress since our first review in 2016, with no significant gaps identified between our practice and the standard. We will conduct and publish independent evaluations of our progress at least every two years.

We are building a systematic programme to regularly measure the quality of relationships with our stakeholders and to better understand the drivers behind measures of stakeholder satisfaction. We benchmarked our scores in July 2018[69] and have set a provisional improvement target of around 10% in stakeholder satisfaction by the end of GD2.

We developed a rating scale of one to five to assess the effectiveness of individual engagement mechanisms against a comprehensive set of criteria in order to achieve the stated objective. We shared this rating scale

[69] SGN Stakeholder Satisfaction Wave 1 (ref 071)

with our CEG and will continue to use it for larger scale engagements, with a target score of four plus for at least 70% of those engagements.

The Stakeholder Engagement Strategy will be reviewed at least every two years. Our annual plan of stakeholder engagement activities to implement the strategy and progress against this plan will be reviewed regularly throughout the year by the SAP.

4.17.4 A measurement framework for outcomes

We recognise the challenge of measuring the outcomes of engagement and have begun a journey to find best practice approaches to add to our existing methods and improve our measurement framework.

Using our project assessment tool, we identify in advance the outputs we expect to deliver from new stakeholder engagement initiatives. We are now developing a framework to measure the outcomes derived from these outputs (section 6.14.2).

We worked with a leading social impact research consultancy and a small steering group of external stakeholders, including members of our SAP, to learn from best practice in estimating social value generated in third sector organisations. We developed a social value bank of financial and wellbeing outcomes applicable to our services for vulnerable customers. Examples of financial benefits include securing the warm homes discount, or cost reductions from tariff switching. Examples of wellbeing benefits include being able to keep a home warm enough, feeling safe at home and being able to obtain advice locally. This approach to estimating social value is endorsed as best practice for the evaluation of social policy by HM Treasury.

We continue to work with our expert agency to develop the social bank further and cover more potential outcomes from a broader range of engagements. By the start of GD2 we aim to have an extensive social bank to support our evaluation of outcomes of engagement, considering both anticipated outcomes before a project starts, and in the follow-up assessment afterwards. We have begun to work collaboratively with UK Power Networks to explore the potential for a shared social value framework applicable to gas and electricity networks.

4.18 Proportionate, cost efficient engagement

As we transition from GD1 to GD2, much of the engagement we describe in section 4.14 has become business as usual. At the start of GD1, we created a centralised stakeholder resource to support teams across the business in engaging with local and national stakeholders. Increasingly, local engagement for our works is becoming embedded across the business, and we will accelerate this trend in the remaining months of GD1.

The planned cost of the team and stakeholder activities in the business plan is £2m in 2021, (a reduction of 1% from 2018/19 levels) with an ongoing assumption of 1% productivity, reducing the cost throughout GD2. The way in which we deliver value for money through careful and proportionate use of resource is described below.

- A very small specialist team build the jigsaw of partnerships needed to deliver 3,600 fuel poor connections each year, facilitating financial value for our fuel poor customers of £4.4m and social value of £1.9m each year[70]
- A small team of seven locally focused stakeholder managers is geographically aligned to support our operational depots. In recent years our local stakeholder managers have focused on engagement before planned works – a significant part of our GD2 business as usual activities. This proactive engagement at the start of planned work projects has driven a significant reduction in complaints, freeing-up time and resource in depots to carry out proactive engagement, with less support needed from the dedicated stakeholder team. In GD2, the small team of geographically aligned stakeholder managers will switch their focus to building vulnerability partnerships and solutions which will be tailored to local needs and service availability.
- This provides value for money for customers by maximising the benefit of the new flexible use-it-or-lose-it allowance for vulnerable customers, with no increase in the resource required to manage the process. It facilitates a financial value for our vulnerable customers of £3.3m and social value of £17.3m each year (section 6.5.4)
- A small central team focuses on national stakeholder engagement for Scotland and the UK prioritising research and insight gathering, continuous improvement, evaluation and reporting. This team will lead the implementation of the new vulnerability requirements and opportunities, as well as focusing on strategic and complex long-term challenges, supporting colleagues in the business to engage on the issues which stakeholders and customers care about (section 4.15).
- Costs not relating to staff include partnership costs, engagement mechanisms and events, communication channels, technology, data and monitoring tools, and independent research agency costs procured by competitive tender.

Engagement with stakeholders delivers significant value for customers, facilitating better business decisions aligned to customer interests and building partnerships that improve outcomes for society. Clearly not all outcomes are measurable, however we are able to demonstrate that our stakeholder engagement resource is proportionate and provides value for money for customers. As a minimum, the £2m annual investment in engagement resource facilitates the delivery of annual financial benefits to customers of £7.7m and social value of £19.2m.

In our fourth line assuarance PwC reviewed our stakeholder engagement against their experience of other utility companies and compared it with their independent eight dimension model. When reviewing whether our engagement was appropriate, PwC rated our performance as green giving us confidence that we are pursuing a proportionate approach that delivers value for our customers.

[70] Based on analysis of Scenario 2 from SIA Partners report on FPNES commissioned by Ofgem

5 Customer Value Proposition

We have clearly aligned our plan with the priorities of our customers, providing a service to keep pace with their increasing expectations and generating significant extra value.

Delivering for vulnerable customers. Concern for vulnerable customers runs from the very top of our company, through all our engineering, front-line and administrative workforce. Our people care about the impact they have and want to do the right thing for customers in vulnerable circumstances, and we train them to be able to do just that. We provide additional solutions that match the particular needs of individual customers, including overnight accommodation and transport if needed when supplies are interrupted. We have set ourselves challenging targets for the fuel poor network extension scheme (FPNES), helping more people out of fuel poverty.

Delivering great customer service. We have delivered great customer service in GD1 and performed better than any other network. In GD1 we have exceeded our 9 out of 10 ambition in Scotland and reached it in Southern. Changes in customer expectations and survey methodology for GD2 are likely to make scores more challenging to achieve, however we are committed to keeping-up our efforts to maintain or improve our current scores. We will continue our 9 out of 10 ambition for GD2 which has driven such high levels of customer satisfaction in GD1.

Delivering a better outcome for less. We have clearly identified customer outcomes with 50 specific outputs, 19 uncertainty mechanisms and approximately 144 named and identified projects and programmes. These are supported by our customers and we will commit to delivering them at a cost that will reduce our portion of each customer's bill when compared with GD1.

Delivering a decarbonisation pathway. We have set out a strategy that will determine whether decarbonisation using the gas network is a viable option for the UK and our work will start to shed light on the likely costs. By the end of GD2 we will have an operational hydrogen network to support this learning. This will provide significant value for future customers by enabling informed decisions on future decarbonisation of heat by policymakers during the price control period.

Delivering environmental benefits. We are committed to delivering the 2045 carbon reduction target set by Scotland and matching this in Southern. We will do this by reducing our business carbon footprint by more than 25%. We will also ensure we are improving the natural capital of our sites and we will support this positive approach to the environment across our supply chain.

Delivering greater transparency. Through our open data programme, we will deliver greater transparency of network data and our networks' performance. We will work with our customers, stakeholders and across networks to ensure high quality and useful data is provided to our stakeholders. Our vulnerability plans, stakeholder engagement strategy and environmental action plan describe the specialist steering groups holding us to account on areas of our business, such as fuel poverty, vulnerability, engagement and environmental progress. With greater accountability and transparency, we will ensure we continue to focus on delivering the outcomes customers value.

Delivering the right investment. As part of our long-term focus on customer value we recognise the risk of asset stranding - that investment may not be supported in a decarbonised energy market. On this basis we have put forward the right investment to maintain network safety. Where possible, we have identified uncertainty mechanisms so customers only pay for the outputs delivered.

Delivering a whole system approach. Currently, the majority of our expenditure is to maintain a safe network. As the decarbonisation pathway becomes established, we will need to trace a much clearer path of investment alongside the electricity networks, ensuring a coordinated approach to delivering energy. Our whole systems charter will help achieve this coordination.

Delivering long-term legitimacy. Our shareholders have a long-term interest and recognise the importance of social legitimacy. In GD1 we demonstrated this by being the only gas distribution network to make a voluntary contribution of £145m to customers. We retain this spirit and public service ethos as we present our GD2 plan.

The value we provide for customers includes all of the above points and more, some are quantifiable, but many are not.

Notwithstanding that, in table 5-1 we have quantified components of additional value which will accrue to current, vulnerable and future customers with methodologies and sets of assumptions to support the value derived.

5.1 Our quantified additional customer value proposition (CVP)

For the points of customer benefit we can value, we have estimated that this plan will deliver additional value of £719m as a result of investments and actions taken over the next five years.

Table 5-1 Anticipated customer value generated over the GD2 period

Measure	Vulnerable customers (£m)	Current customers (£m)	Future customers (£m)	Total (£m)	Summary
Productivity delivered over GD2	0	59	157	217	Value of our stretching target of 1% productivity in GD2, over-and-above economy-wide productivity of 0.3%
Absorbed weather risk	0	7	0	7	Estimated value to customers of SGN adopting the risk of assuming mild GD1 winters as the baseline for our cost forecasts
Aligning allowances with workload	0	96	0	96	Identifying options through which we are able to align workload and allowances more precisely through a series of price control deliverables, volume drivers, use-it-or-lose-it mechanisms and reopeners.
Environmental action plan initiatives	0	18	39	56	Identified as the difference between our customers' stated willingness to pay for environmental measures and the actual cost of the measures incurred.
Bespoke safety and reliability outputs	0	37	13	50	The present value associated with bespoke outputs identified in the plan.
Additional information and granularity in CBAs	0	3	0	3	Additional information associated with providing CBAs down to a £500k threshold rather than the £2m threshold.
New services for vulnerable households – financial benefits	40	0	0	40	Initiatives such as energy advice and efficiency measures, appliance repairs and servicing provide direct financial savings for vulnerable customers on energy costs.
New services for vulnerable households – social benefits	81	0	0	81	Health and well-being benefits of the proposed vulnerability initiatives (excludes direct financial savings).
Community action projects	3	0	0	3	The direct financial impact and social value generated by our community investment programme.
Innovation funding	0	20	12	31	Value to society of SGN-funded innovation under this business plan, based on our direct contribution of 10% of innovation spend (both BAU and non-BAU).
Open data	0	2	1	3	Estimated value of open data in contributing to economic growth, by enabling others to use the data more freely
Supporting decision making	0	0	5	5	Supporting effective engagement with Local Authorities and Governments to provide high quality robust data from which decisions can be taken
GSMR standards	0	0	101	101	We are promoting a change in GSMR standards supported by the evidence generated during our 'opening the gas market' project, which is expected to substantially reduce ballasting costs.
Hydrogen standards	0	0	26	26	An estimate of SGN's contribution to specifying technical standards for hydrogen (based on Committee on Climate Change scenario projections of the value that could be realised through a hydrogen decarbonisation pathway).
Total	**124**	**241**	**354**	**719**	

6

Our commitment to customers: making a positive impact

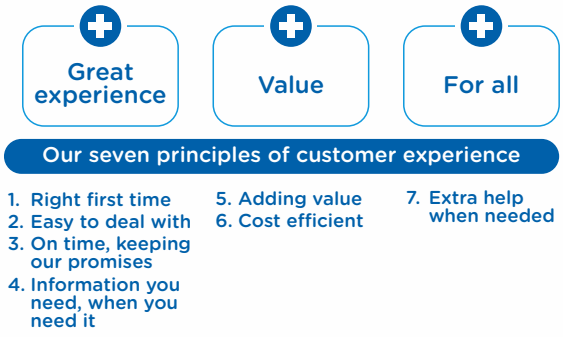
In order to deliver the best positive impact for our customers and communities, our people strive to provide the highest levels of service and value, including dedicated support to help customers in vulnerable situations.

1. We will make a positive impact by helping 250,000 vulnerable customers use energy safely, efficiently and affordably

Our people have a strong day-to-day commitment to care for all our customers, especially those in vulnerable circumstances. We strongly welcome Ofgem's additional focus in this area. We have based our plan on ideas co-created with stakeholders to deliver valuable initiatives, targets and output measures.

2. We will make a positive impact by providing a great service to our customers, scoring higher than 9 out of 10 every year

Our customer experience strategy is to deliver a great service for all, underpinned by the seven principles of customer experience set out in the diagram.



Customer expectations continue to increase each year and we have set ourselves the challenge of exceeding 9 out of 10 satisfaction levels across both our networks throughout the five years of GD2. By capturing and valuing feedback from our customers, we will work to improve our processes and engagement in ways that our customers want. Using this insight, we will prioritise the improvement opportunities that are most valued by customers; particularly around communication, timescales and quality of work. By continuing to work in an agile way, we adapt to change efficiently and keep our service costs low. We will also invest in interactive technology and employee training, optimise our work sites and improve our daily interactions with our customers.

We have not proposed additional outputs or incentives for customer service as we believe existing outputs and incentives are working well. However, we have heard from customers that they are concerned about the impact of disruption. Customers challenged us to work collaboratively to reduce the disruption of our works on local residents and communities. We are therefore proposing a bespoke social value collaboration incentive to respond to this customer challenge and to lead behaviour change across the utility sector.

More details of our customer experience strategy can be found in appendix 023, Customer and vulnerability plan.

What consumers want and value from networks: meeting customer needs

Linked appendices

- Customer and vulnerability plan
- Connections
- Stakeholder engagement
- Emergency service

6.1 Positive impact: sector and bespoke outputs

A summary of our output proposals to make a positive impact follows:

Sector outputs		GD2 output category	Uncertainty mechanism	GD1 first 6 years		GD1 last 3 years		GD2		BPDT
Section	Output			Annual measure	cost £m/yr	Annual measure	cost £m/yr	Annual measure	cost £m/yr	
6.2	Minimum standards: consumer vulnerability	LO				BS18477 accreditation		BS18477 accreditation		
6.3	Minimum standards: vulnerability GSOPs	LO						Ofgem to determine		
6.4	Fuel poor connections	PCD	12.3.4	4,328 connections	£6.1	3,318 connections	£4.7	3,600 connections	£6.8	3.04
6.5	Flexible services: vulnerability and CO allowance	PCD		Discretionary Reward Scheme		Discretionary Reward Scheme		Value delivered	£1.2	2.01
6.6	Flexible services: innovation	NIA						Value delivered		5.11
6.7	Consumer vulnerability reputational incentive	ODI (Rep)						Annual showcase and common metrics	£2.0 covering both vulnerability and stakeholder engagement	2.01
6.8	Stakeholder engagement reputational incentive	ODI (Rep)		6.4 average score	£1.2	6.4 average score	£2.0	10 stakeholder commitments		
6.9	Emergency response time - controlled	LO		99%	£8.1	98%	£8.5	Minimum of 97%	£8.3	2.01
6.9	Emergency response time - uncontrolled	LO		98%	£14.7	98%	£15.7	Minimum of 97%	£15.0	2.01
6.10	Customer satisfaction	ODI (Fin)		8.9 out of 10	£6.0	9 out of 10	£6.0	9+ out of 10	£6.0	2.01
6.11	Complaints metric financial penalty	ODI (Fin)		5.37 score	Included above	2.5 Score	Included above	Ofgem to determine	Included above	2.01
6.12	Guaranteed standards of performance	LO						Standards tightened, payments increased and automated		
6.13	Average restoration time: unplanned interruptions* financial penalty	ODI (Fin)		1,157 minutes (Southern)		1,421 minutes (Southern)		1,581 minutes (Southern)		5.09
				763 minutes (Scotland)		829 minutes (Scotland)		1,312 minutes (Scotland)		5.09
Bespoke outputs										
6.14	Bespoke: social value collaboration incentive	ODI (Fin)								

* GD2 target figures have been updated for large incidents to match templated approach in BPDT

6.2 Minimum standards for vulnerable services: licence obligations

We estimate there are around one million households in vulnerable circumstances served by our networks.[1] Led by the personal commitment of our CEO, our people demonstrate a culture of care and concern and will always prioritise and respond to the specific needs of customers in vulnerable circumstances.

With support from stakeholders at our specialist panels and workshops[2] we have agreed simple guidance to help our engineers identify vulnerability. All of our front-line staff have been trained and are empowered to spot signs of vulnerability and refer customers for additional support. Each situation is assessed on its own merit with our employees putting in place additional support as and when required. Full details of our business-as-usual services for customers in vulnerable circumstances are

[1] Frontier work on vulnerability (ref 092)
[2] MFT Workshops 2016, 2017, 2018 & 2019 (ref 006, 007, 008, 009, 010, 011, 012, 013, 014, 016, 017)

included in our Customer and vulnerability appendix. Business-as-usual services for GD2 include GD1 engagement activities, such as fitting locking cooker safety valves for customers who suffer from dementia and running a dedicated telephone care line for customers who need additional help.

Processes, procedures and tools to address vulnerability are accredited to the British Standard Institute's standard for vulnerability BS 18477.

Our business-as-usual practices were developed during GD1 with input from expert stakeholders.[3] For GD2 we reviewed them with representative groups of customers and expert stakeholders who were supportive of our approach.[4]

6.3 Minimum standards for vulnerable services: guaranteed standards of performance (GSOP)

We provide alternative cooking and heating appliances for customers in vulnerable circumstances during supply interruptions as required under GSOP3. In GD2 we will automate the compensation payments we must make if we fail this minimum standard.

We are working with Ofgem and other gas networks to consider whether additional GSOPs are required for vulnerable customers. Firstly, evidence of need is being investigated for additional services such as provision of hot food, showers or alternative accommodation during large incidents. Our customers, stakeholders and CEG have indicated that one size does not fit all, therefore an appropriate package of services determined by need during an incident may be a better approach than an enhanced GSOP.[5]

The second step would be an assessment of customers' willingness to pay for additional minimum standards to be implemented across all the networks. Initial results from our customers show that providing additional services to vulnerable customers in an incident ranked fifth out of seven potential areas of service improvement.[6] We are using our customer and stakeholder insights in this area to inform our ongoing conversations with Ofgem.

6.4 Minimum standards for vulnerable services: fuel poor network extension scheme (FPNES)

Our commitment to supporting households living in fuel poverty continues in our planning for GD2. In January 2019 we began conversations with stakeholders about how to set stretching, achievable targets for the FPNES.

There is an inherent difficulty in setting targets for the FPNES. This is due to the reliance of the scheme on the availability of funding for first-time central heating systems, and the uncertain nature of a range of potential policy interventions around decarbonisation, energy efficiency and fuel poverty. These potential policy interventions and the availability of funding differ significantly between Scotland and England.

In our July business plan, we included provisional five-year targets of 5,000 connections in Scotland and 1,000 connections in Southern. At the time we acknowledged the recent clarification of the FPNES in the Sector Specific Methodology Decision, and that targets were likely to increase during a process of further stakeholder engagement over the summer.

In revisiting our targets, we followed the methodology suggested by stakeholders at our earlier workshops. One stakeholder summarised the target-setting process by explaining "the upper bound is clearly 'how many people could we help'. The lower bound is to look at the ECO market projections for first-time central heating. And somewhere in between is where the target should be, bearing in mind funding challenges."[7]

We followed this approach suggested by stakeholders and proposed targets of 13,130 in Scotland and 4,742 in Southern.[8] At expert stakeholder workshops in both our networks, we shared our methodology for calculating the maximum number of people in fuel poverty, a list of the potential policy enablers and potential restricting factors.

Scotland. Stakeholders in Scotland fully recognised the difficulty in setting targets ahead of the Scottish Government's new Fuel Poverty Strategy. They were broadly in agreement with our methodology for target setting, although some suggested that given the likely change in the definition of fuel poverty in Scotland, our proposed target of 13,130 was too ambitious. We subsequently changed our target to 13,000. We recognise the risk that with a new fuel poverty definition our target may still be too ambitious, however we have accepted this risk given the scale of fuel poverty in Scotland and the importance to stakeholders.

Southern. Again, stakeholders acknowledged the difficulty of target setting. Some stakeholders broadly supported our proposed target of 4,742, however there were also calls from some expert stakeholders for us to be more ambitious based on an alternative method of calculating the maximum number of people in fuel poverty. We followed-up with these three expert stakeholders after the workshop to better understand their views. Consequently, we increased our target to 5,000.

We believe our fuel poor connection targets are very ambitious. The combined target of 3,600 a year is higher than the 3,318 we are achieving in the last three years of GD1. The qualifying criteria for the FPNES have changed significantly several times since the start of GD1, when people over 70 on low incomes were included, and we were able to achieve higher rates, averaging 4,328 over the first six years of GD1. We are achieving our current rate with the support of our shareholders who have provided a first-time central heating grant fund for customers in Southern as part of our £145m voluntary contribution to customers in GD1. Our stretching ambition is to deliver more connections in GD2 than we are currently achieving, without direct financial support from our shareholders.

[3] Supporting our communities (Scotland) 1 and 2 (ref 018, 019), Supporting those at risk (South) 1 and 2 (ref 020, 021), Fuel poverty specialist panel (ref 022), MFT Workshops 2016, 2017, 2018 & 2019 (ref 006, 007, 008, 010, 011, 012, 013, 014, 016, 017)
[4, 8] Positive Impact round table event – London combined with Scotland (ref 088)
[5] MFT Workshop November 2018 London and Edinburgh (ref 013, 014)
[6] Stage 3: Conjoint & WtP summary report (Valuation Phase) (ref 005)
[7] MFT Workshop January 2019 London (ref 016)

Our CEG members have confirmed their support for our FPNES targets. However, recognising the difficulty in setting these targets, they proposed we continue the dialogue about appropriate target levels with our expert stakeholders on a regular basis as policy uncertainties are resolved. This will put our performance into context and ensure we are held accountable by knowledgeable stakeholders. It will also help us (and our stakeholders) to understand whether the targets remain realistic and achievable over time as external factors change. We have included this suggestion as part of our approach to stakeholder engagement (section 4.14.1).

6.4.1 Targeting and delivery of FPNES connections

In GD1 we followed the advice of our specialist stakeholder panel members to improve targeting of the FPNES by using all available datasets to map and find households living in fuel poverty. We worked in partnership with the Energy Saving Trust in 2017/18 to create an online mapping tool which combines small area datasets for property, household, and vulnerability characteristics with information about proximity to the gas network. We will make extensive use of our mapping tool in GD2, continuing to share our learning with partners and other gas networks.

Partnerships and well-coordinated multi-agency projects have proved to be the most effective way of funding and providing support for fuel poor households. We plan to continue this approach with a dedicated team to create coordinated projects with partner organisations such as local authorities, housing associations, landlords and ECO agencies. (section 4.18)

Finding alternative heat solutions for fuel poor households is one of ten complex challenges we have identified which we will work on collaboratively as part of our stakeholder engagement strategy (section 4.15).

6.5 Supporting flexibility in vulnerable service provision: use-it-or-lose-it allowance

We strongly support Ofgem's allowance for gas networks to provide additional services for customers in vulnerable circumstances. We explained our high level of ambition in the July business plan: to help 500,000 people in vulnerable circumstances to use energy safely, efficiently and affordably. We have subsequently amended this ambition and will provide greater depth in our vulnerability support, in-line with stakeholder feedback as explained below.

We believe the value of the use-it-or-lose-it allowance for vulnerability and CO initiatives will equate to around £1.2m a year for SGN, with an additional £400k ringfenced outside our totex, to be directed towards collaborative initiatives with other gas and electricity networks.

6.5.1 Building on our experience in GD1

In addition to our business as usual services for vulnerable customers (section 6.2) we have worked with partners in GD1 to significantly increase the additional services we are able to provide. Table 6-1 highlights the scale and growth of our activities in the last two years.

Table 6-1 Increasing support for households in vulnerable circumstances

	2017/18 Number of households supported	2018/19 Number of households supported	Increase in activity
Energy efficiency advice and measures	499	2,859	473%
Referrals for safe and well visits, appliance repairs and locking cooker valves	163	263	61%
TOTAL extra services	**662**	**3,122**	**372%**

We counted the installation of locking cooker safety valves for customers with dementia as additional services during GD1. However, we explain in section 6.2 that this will become business as usual in GD2.

We developed an evaluation methodology in GD1, combining different approaches to assess the additional services we deliver including the degree of stakeholder support, customer willingness to pay, outputs, cost and social value outcomes delivered. A summary of our evaluation methods is shown in table 6-2 applied to the additional services we delivered in 2018/19.

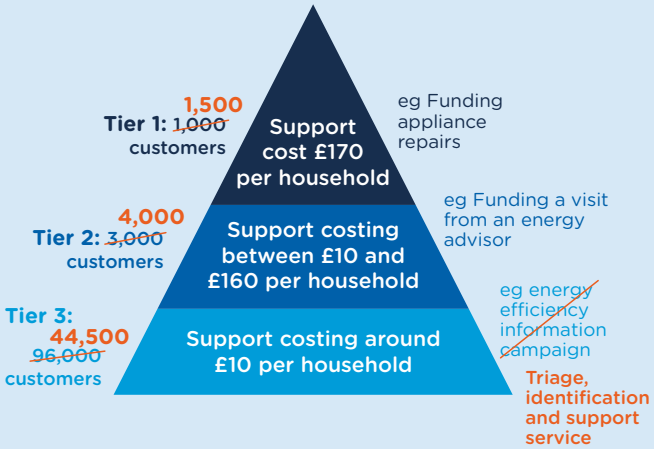
Table 6-2 Evaluation of additional Services delivered 2018/19

Pre-project assessment score (maximum 50)	Stakeholder support	Customers' willingness to pay	Outputs delivered	Cost of additional services per customer	Social value outcome	External accreditation or validation
Five schemes to provide extra services for vulnerable customers each scored over **35** and were approved	**98%** of stakeholders supported expansion of the services provided to vulnerable customers	**£1.26** for extra services for vulnerable customers	**3,122** extra services provided	The total cost of the extra service initiatives of **£107,748** would equate to **£0.02** on each customer's bill	**£4,148,489** social value generated by extra service initiatives	British Standards Institute Vulnerability Standard BS 18477: 2010

6.5.2 Developing our overarching approach for GD2

Working with our stakeholders we co-created a long list of more than 20 potential initiatives[9] **over and above the business as usual activities** described in section 6.2. We then analysed the potential costs of implementation based on our experience gathered in GD1. We created a three-tier pyramid framework of support to enable us to test our ambition and discuss examples of the different levels of support that we could offer with customers and stakeholders.

Figure 6-1 Initial and final pyramid proposal



A consensus emerged from two stakeholder workshops and from two customer workshops[10] that our ambition to support 100,000 vulnerable people each year would be better expressed as an ambition to provide deeper levels of support for fewer people. Following our Southern stakeholder workshop, a small group of experts from fuel poverty and disability organisations subsequently followed-up by bringing forward their own proposal for discussion. We have adopted two of this group's suggestions: replacing the lower tier with a triage, identification and support service; and focusing our support on helping 50,000 people a year (250,000 in total over GD2).

Additional feedback from stakeholders emphasised the importance of partnerships to increase the value of our allowance in generating positive outcomes for customers.[11] This feedback was reflected in the examples below of potential initiatives discussed with customers.

- **Potential tier 1 initiatives.** Referral for appliance servicing, dedicated vulnerable customer liaison officers in multi-occupancy buildings during supply interruptions, alternative accommodation and additional support during supply interruptions.
- **Potential tier 2 initiatives.** Additional services through referral partners such as energy efficiency advice and measures, food banks providing energy vouchers, extending the use of locking cooker safety valves to include those with autism, learning difficulties or in assisted housing, face-to-face appointments before planned works and coordinating gas safety visits with Fire and Rescue home safety checks.
- **Potential tier 3 initiatives.** Triage, identification and support service, referral for installation of CO alarms, participation in the development of a cross-sector PSR, CO awareness campaigns for caravan parks and holiday homes, energy efficiency campaigns.

Domestic customers generally favoured the mid-tier or tier 1 initiatives in order to make a real difference. This was especially the case in Scotland. The change between our initial proposal and our revised proposal in figure 6-1 reflects these views.[12]

Our CEG has confirmed its support for the engagement process we followed, our more targeted ambition and the revised pyramid framework.

6.5.3 CO awareness and advice

We are proposing a provisional sum of around £200k for CO awareness work from our £1.2m use-it-or-lose-it allowance. In discussions with stakeholders, some expressed less support for this than for investment in support for vulnerable customers.[13] We will therefore keep this amount under review, ensuring all initiatives are subject to robust benefit assessment (section 6.5.6).

We are refining our 2018 CO strategy[14] for GD2 with additional support from stakeholders. The strategy builds on extensive appliance data that we collected from more than 7,500 properties to understand the condition of appliances, frequency of servicing and use of CO alarms.

Five key issues and potential solutions are identified in our strategy. We are updating the solutions to these issues with expert input from stakeholders, based on detailed discussions at two roundtable events.[15] We will also regularly review sources of data that provide additional information about other emerging issues.

The five main issues identified from our extensive data gathering are:

- encouraging older people to service their appliances regularly;
- the dangers of CO alarms fitted in cupboards;
- classification of CO detection;
- targeting specific demographics – the young and the old; and
- low customer awareness that different types of appliance can create different levels of risk.

For the first two years of GD2, we propose to target spending from our allowance on the issues identified above, followed by a rolling review of emerging issues.

[9] MFT Workshops 2016, 2017, 2018 & 2019 (ref 006, 007, 008, 009, 010, 011, 012, 013, 014, 016, 017)
[10] Shaping the Business Plan Qualitative Workshops - Customer Service & Supporting Vulnerable (ref 085), Positive Impact round table event - London combined with Scotland (ref 088)
[11] Positive Impact round table event – London combined with Scotland (ref 088), Agility eco report (ref 091)
[12] Shaping the Business Plan Qualitative Workshops - Customer Service & Supporting Vulnerable (ref 085)
[13] Shaping the Business Plan Qualitative Workshops - Customer Service & Supporting Vulnerable (ref 085), Positive Impact round table event - London combined with Scotland (ref 088)
[14] https://www.sgn.co.uk/uploadedFiles/Marketing/Pages/Publications/Docs-Stakeholder/SGN-CO-Strategy-2018.pdf - 2018 Carbon Monoxide Strategy
[15] CO Specialist round table event - combined report (ref 102)

6.5.4 Assessing anticipated outcomes

Working within the pyramid framework described above, both customers and stakeholders highlighted the need for a robust benefit analysis of potential initiatives to ensure we deliver valuable outcomes for vulnerable customers.[16]

We developed an evaluation methodology in GD1 to assess the outcomes of initiatives developed with stakeholders to support vulnerable customers as part of the financial stakeholder engagement incentive reward (section 6.5.1). We used this evaluation methodology and examples of actual initiatives we delivered in 2018/19 to assess the likely costs and potential outcomes of our three-tier framework for vulnerability initiatives.

Table 6-3 Cost and outcome analysis for vulnerability initiatives

Vulnerability allowance	Tier 1	Tier 2	Tier 3	Total per annum
Approximate funding	£255,000	£300,000	£445,000	£1m
Approximate number of households supported	1,500	4,000	44,500	50,000
Target cost per household	£170	£75	£10	
Target direct financial benefit per household	£1,100	£300	No comparator in GD1. Target to recover cost = £10	
Target social value per household	£7,500	£1,300	No comparator in GD1. Target to provide social value of twice cost = £20	
Total of direct financial benefits to households	£1.65m	£1.2m	£0.45m	£3.3m
Total of social value to all households	£11.25m	£5.2m	£0.9m	£17.3m

We have described the development of our social value measurement in our approach to stakeholder engagement (section 4.17.4), including our ambition to collaborate with other gas and electricity networks and Ofgem to create common social value measures.

Working with external experts, we will extend the social value measurement to include a social value for the prevention of CO poisoning before the start of GD2.

In addition to the overall targets identified above, we are contributing to Ofgem's development of common vulnerability metrics, which are not yet defined.

6.5.5 Value for money

The £1m cost of the vulnerability use-it-or-lose-it allowance equates to 17p on each customer's bill. In willingness to pay research, customers were prepared to pay an additional £1.26 for additional tier 2 services to be provided to customers in vulnerable circumstances and an additional £2.11 for tier 3 services.[17] Customers ranked additional services for vulnerable customers fourth in a list of seven priorities for additional expenditure. In customer workshops, at which more information was shared about our plans, customers felt the vulnerability allowance was not enough to help those genuinely in need[18] and they would be prepared to pay more on their bills to provide additional support.

Our target for the direct financial benefits delivered to customers in vulnerable circumstances resulting from our £1m vulnerability allowance is £3.3m each year.

This delivers total lifetime customer value of £40m in direct financial benefits over GD2 (using a lifespan of 1-5 years for different tiers of initiatives (chapter 5).

6.5.6 Delivering target outcomes

We will create a **Steering Group for Vulnerability and CO** including members of our Stakeholder Advisory Panel to support the selection of appropriate initiatives, drawing on the expertise of external stakeholders. As recommended by our CEG, we will ensure that the work of the steering group is informed by the direct views of customers. This steering group will provide a process of oversight and governance for the vulnerability and CO allowance, ensuring that our approach remains best practice.

As part of our ongoing stakeholder engagement strategy (chapter 4b) we will continue to work with external members of our specialist panels who have experience of working with communities, fuel poverty, carbon monoxide and supporting those at risk. These forums provide us with opportunities to co-create solutions and for the development of partnerships to provide additional services for vulnerable customers and CO safety.

Following discussions with stakeholders[19] we have subsequently developed principles (listed below) to steer our activity, which will be reviewed regularly by the Vulnerability and CO Steering Group.

1. We will understand and target harder-to-reach or underrepresented individuals.
2. We will prioritise according to need with a higher focus on provision during the winter. Our CEG has asked us to ensure that we take due account of the relative levels of need in Scotland and Southern.

[16] Shaping the Business Plan Qualitative Workshops - Customer Service & Supporting Vulnerable (ref 085), Positive Impact round table event - London combined with Scotland (ref 088)
[17] Stage 3: Conjoint & WtP summary report (Valuation Phase) (ref 005)
[18] Shaping the Business Plan Qualitative Workshops - Customer Service & Supporting Vulnerable (ref 085)
[19] MFT Workshops 2016, 2017, 2018 & 2019 (ref 006, 007, 008, 009, 010, 011, 012, 013, 014, 016, 017), Supporting our communities (Scotland) 1 and 2 (ref 018, 019), Supporting those at risk (South) 1 and 2 (ref 020, 021), Fuel poverty specialist panel (South) (ref 022)

3. We will focus on our first interaction with customers to identify those in vulnerable circumstances.
4. We will provide a flexible service according to need, working with partners to refer vulnerable customers for appropriate additional support.
5. We will research best practice and update our approach regularly.

In line with Ofgem's 2019 Consumer Vulnerability Strategy, we will ensure that we pay due attention to vulnerabilities arising from mental health, disability, age related vulnerabilities and low income. However, we will also take a broad, dynamic approach as we fulfil our first principle of building our understanding of hard to reach groups. We will take into account regional differences between Scotland and Southern that will influence our approach to assessment of need, that we will carry out with partners and stakeholders.

We plan to use the decision-making tool we established in GD1 to assess new ideas proposed by our colleagues or designed in partnership with stakeholders. The tool assesses the cost of initiatives compared with the anticipated benefits, scored against the six criteria below.

- Does the activity fit with the overarching approach?
- What measurable benefits would be delivered? Is the initiative likely to meet the three tier target outcomes above and any common vulnerability metrics defined by Ofgem?
- How innovative is the thinking?
- What degree of support or partnership does the activity have from stakeholders or customers?
- What is the potential for embedding this activity in processes within our business?
- What is the potential for replicating the initiative across industry? Or is it already the result of learning from others?

6.5.7 Collaboration with other gas networks

We have built collaboration with partners and with other networks into our proposals for the £1.2m vulnerability and CO allowance included in our totex. For example, partnership working is a principle which will steer our activity and is also a criterion for benefits assessment.

In addition, we have begun discussions with other gas networks about the funding Ofgem has ring-fenced for collaborative initiatives. Together, we have set up a GD2 consumer vulnerability group collaborating with WWU, Cadent and NGN. Initial meetings outlined the responsibilities of the group and links with existing collaborative groups. Our meeting in October set out terms of reference and the governance process.

6.6 Supporting flexibility in vulnerable service provision: innovation

We support Ofgem's proposal to include a focus on projects addressing customer vulnerability in a reformed Network Innovation Allowance. More details of our innovation strategy can be found in chapter 13.

We have an established process to develop innovative ideas and programmes to assist customers living in vulnerable circumstances, by planning collaboratively with stakeholders, generating ideas, piloting initiatives and embedding those that are successful across our business (section 13.3).

Building on our many previous discussions with vulnerable customers and representative organisations,[20] we created provisional areas of focus for innovation which we then tested and refined with stakeholders.[21] Further details of the areas of innovation finalised with support from expert stakeholders can be found in section 13.4.3 and our Customer and vulnerability appendix. We are proposing that our Vulnerability and CO Steering Group described in section 6.5.6 has an oversight role in the selection of third-party initiatives for the NIA focus on vulnerability.

6.7 Consumer vulnerability reputational incentive

6.7.1 Annual showcase

We will work with other gas networks, partners and expert stakeholders to develop an annual showcase event for vulnerability and CO initiatives. We propose an ongoing role for CEG members or other external stakeholders to form a steering group to ensure a high standard of best practice sharing and challenge.

6.7.2 Common performance metrics

We have discussed the development of common performance metrics for vulnerability with our stakeholders,[22] our Stakeholder Advisory Panel (SAP) and our CEG. We are conveying these views to Ofgem as it develops the common metrics.

Fuel poverty experts on our SAP expressed concern about a common measure around the efficiency of targeting of fuel poor network connections. Firstly, additional intrusive income enquiries and bureaucracy may reduce the number of households helped. Secondly, given the churn in and out of fuel poverty, households who were just on the cusp would not be helped, but could meet the formal definition very shortly afterwards. The SAP suggested an alternative common metric of the percentage of FPNES connections target achieved.

Members of the SAP and our CEG welcomed any common metrics that were focused on outcomes rather than just counting numbers. Our proposal to create a common, industry-wide measurement framework for social value was positively viewed (section 4.17.4).

[20] MFT Workshops 2016, 2017, 2018 & 2019 (ref 006, 007, 008, 009, 010, 011, 012, 013, 014, 016, 017), Supporting our communities (Scotland) 1 and 2 (ref 018, 019), Supporting those at risk (South) 1 and 2 (ref 020, 021), Fuel poverty specialist panel (South) (ref 022)
[21] Positive Impact round table event – London combined with Scotland (ref 088)
[22] Shaping the Business Plan Qualitative Workshops - Customer Service & Supporting Vulnerable (ref 085), Positive Impact round table event - London combined with Scotland (ref 088)

6.8 Stakeholder engagement reputational incentive

Our approach to ongoing stakeholder engagement is contained in chapter 4b and has been reviewed by our SAP and members of the CEG. The strategy covers engagement as part of our business as usual activities (4.14) and additional engagement focused on ten long-term complex challenges (4.15), which we believe will add value to customers, future customers and society. We have included eight performance commitments which will enable us to achieve business as usual engagement, and a specific performance commitment to measure additional engagement focused on complex challenges.

6.8.1 Bespoke output for reputational stakeholder engagement incentive

We propose making the performance commitment for additional engagement on our ten complex challenges (performance commitment nine in section 4.15) into a bespoke output for the reputational stakeholder engagement incentive. We would expect to undertake activity on all ten challenges each year and to make significant progress on five. We propose that for each challenge we agree a relevant expert interest group to review our progress in the light of external developments.

We recognise stakeholder and customer priorities will change over time and have therefore proposed to focus on our ten complex challenges for the first two years of GD2. We propose our CEG has a continuing role in overseeing a midpoint review of the complex challenges to ensure they remain relevant or are replaced with other areas of focus if appropriate.

Section 4.17 includes a number of measures of the effectiveness of our engagement which will cover both our business as usual and additional engagement.

6.9 Emergency response time

During GD1 we have strived to exceed all output targets where possible. This culture of continuous improvement is embedded within our organisation. Our emergency response time licence obligation has a target of 97%. We have exceeded the 97% standard in all years, responding within the defined timescale in more than 98% of occasions in all years for uncontrolled gas escapes and 98.5% for all controlled gas escapes.

In GD2 we expect both our networks to show a reduction in public reported escapes, continuing the trend which began in GD1. At the start of GD1 there were 233,000 reported escapes, by the end of GD1 we expect this to reduce to 189,000 escapes and by the end of GD2 we anticipate this will reduce to 159,000. While this brings down overall costs, it also increases our risk exposure to the impact of an extreme weather event or major incident on our 97% standard of service. Such an event would form an increased share of our overall emergency workload volumes.

Secondly, the full roll-out of smart metering is not now expected until the end of GD2, but with 85% saturation expected by 2024.[23] The impact of smart meters on our workloads and efficiency is discussed in appendix 013, Emergency service.

6.10 Customer satisfaction

Customers are at the core of our long-standing mission; to keep our customers safe and warm by leading the way in energy delivery. By anticipating and responding to all our customers' needs and expectations, we increase our effectiveness and create better outcomes for our business and wider society: providing excellent service to all our customers makes good business sense and is simply the right thing to do.

We have been working proactively with Ofgem and other gas networks to refine the methodology and content of the common postal customer satisfaction survey used to measure the performance of gas networks. All networks are currently undertaking trials of alternative contact methods, including phone, text and email, giving customers a choice of ways to complete the survey.

6.10.1 Our ambitions for customer experience

At the start of GD1, we set ourselves the challenge of achieving 9 out of 10 in both our networks. We explained our ambition in the July plan, to continue with that minimum target throughout GD2 despite increasing customer expectations and changes in methodology. At the end of 2018/19 our scores were: Scotland 9.24 out of 10 (ranked number one of all gas networks) and Southern 8.98 out of 10.

We discussed our ambition and overall customer experience plan with customers and stakeholders during the summer of 2019.[24] Customers said expectations around levels of service are increasing across all industries. With the wide scale adoption of social media and online review platforms it has become easier for customers to give negative feedback. Small businesses also noted their own customers were setting higher expectations for customer experience and service levels.

Overall customers felt they would like us to aim for continuous improvement, yet they understand achieving 10/10 is not possible all the time. Particularly in the South, customers would like us to continue to improve satisfaction levels, which we have reflected in our target.[24] There was general support from stakeholders at workshops held in Scotland and Southern that the proposed approach *"seems about right"* and a minimum ambition of 9/10 is acceptable. Stakeholders also acknowledged the challenge of maintaining current satisfaction scores in light of increasing customer expectations.[25]

6.10.2 Our customer strategy

We explained our strategy to customers - to deliver a great service for all, underpinned by our seven principles of customer experience. We follow a systematic and continuous loop of engagement, insight gathering and improvement using a range of tools to understand the changing perspectives and priorities of our customers (section 4.12.3).

By continuing to develop a deeper understanding of our customers' needs, we prioritise the most important improvement opportunities, based on the value to our customers and our business.

[23] Appendix 013 – SGN – Emergency Service, section 6.8
[24] Shaping the Business Plan Qualitative Workshops - Customer Service & Supporting Vulnerable (ref 085)
[25] Positive Impact round table event - London combined with Scotland (ref 088)

Analysis of all the contact we have with customers has underpinned our customer experience plan for GD2. The plan focuses on three themes prioritised by our customers: communication, timescales and quality of service.

Improved communication. We will evolve our communication, investing in line with customer demand and new technology. By further exploring the use of online technologies and artificial intelligence we will give our customers more opportunities for self-service. Better online application services, which are easier and faster to use for domestic and non-domestic customers, will give us faster routes to communicate proactively with customers. With improved data analytics we will learn from a better understating of on-line journeys and will respond quickly to any frustrations customers might have. While improving digital communication is important, we will not forget about those who choose to interact with us in other ways. In particular we are working closely with advocacy organisations to try to overcome any barriers to communication with us – an important point reinforced by feedback from our customers.[26]

One enhancement to direct communication that we discussed with customers was the addition of Customer Liaison Officers during larger emergency and repair situations. Employees with customer and community facing expertise could provide improved communication and service to residents, and ensure local customers, local charities, and other service companies are kept informed. Many customers did not support this additional investment, some of those that did suggested it should be focused on vulnerable customers. We have acted on this feedback and removed the proposal from our plan. We will assess whether additional face-to-face support for vulnerable customers would provide value under the flexible use-it-or-lose-it allowance, analysing costs and benefits with the Vulnerability and CO Steering Group, alongside other potential initiatives.

Certainty on timescales. We will explore ways of using innovative technology to keep our customers informed about the timescales of our works at all stages, learning from other industries to understand how customers are able to track progress.

One option we will discuss with customers is the creation of new processes and booking systems to allow customers to plan ahead and book convenient daily time slots for new gas connections and meter alterations work.

Quality of service. We will enhance our training relating to customer experience, seeking out new techniques, technology and skills to better equip our people and our contractors. By investing in interactive technology, we will create real-time interactions, avoiding costly repeat visits and inconvenience. We will find new ways of ensuring our customers are happy with the quality of our work, our service and the tidiness of our sites.

6.10.3 Agile implementation plans

The importance of our continuous insight and improvement loop is that it drives us to adapt and implement changes that are outcome focused, rather than fixing a plan up front for many years ahead.

We have described examples of the types of improvement activity we plan to undertake for customers, although we know that many of these ideas will be superseded by better solutions before or during GD2: technology will move on; we will learn new solutions from others; the expectations of our customers and stakeholders may change, and we may find more cost-effective ways of achieving the same outcomes.

Our customer and IT teams follow an agile way of working and we have strengthened the teams' capabilities in testing, piloting, evaluation, project and change management. Our plan includes annual investment in technology of £500k, continuing at GD1 levels to ensure that we keep pace with evolving customer expectations for ease, convenience and automation and continue to deliver a great customer experience. This is captured in our operational IT plan and described in chapter 17.

Stakeholders were broadly supportive of our continued investment in IT development to enable these service enhancements.[27]

6.10.4 Customer feedback on our plans

Our early research into customer expectations[28] told us we should maintain our strong track record of achieving high levels of customer satisfaction and continue to provide excellent customer service. In willingness to pay research,[29] we found customers give a higher priority to initiatives that support vulnerable customers than they do to overall service improvement initiatives for all customers.

In our workshops dedicated to discussions about customer service, customers told us our principles of customer service were comprehensive and that our plans for improvements were in-line with what other companies are offering. Customers in our southern network placed a higher importance on investing in customer service than those in Scotland.[26]

Customers also suggested we should focus on collaboration with other utilities. We have taken this feedback on board in our plan by including collaborative working as one of the themes of our ongoing stakeholder engagement (chapter 4b). We have also reframed our ambition on emergency repair interruptions; now focusing on raising awareness and facilitating fewer interruptions to customers' supplies as a result of third-party damage, working collaboratively towards a 15% reduction. Our proposal for a social value collaboration incentive (section 6.14) also responds to this feedback from our customers.

[26] Shaping the Business Plan Qualitative Workshops - Customer Service & Supporting Vulnerable (ref 085)
[27] Positive Impact round table event – London combined with Scotland (ref 088)
[28] Stage 1: Explorative Qualitative Workshops and Interviews (Exploratory Phase) (ref 002)
[29] Stage 3: Conjoint & WtP summary report (Valuation Phase) (ref 005)

6.11 Complaints metric

Our holistic approach to delivering a great customer experience includes the principle of *right first time*. We discussed our customer service principles with customers who agreed that our approach was comprehensive.[30]

However, despite our best intentions, there are occasions when our service does not meet a customer's expectations, and we take our responsibility for resolving any issues very seriously. Our performance in GD1 has been consistently and significantly above Ofgem's threshold for complaint handling and we can demonstrate a 76% reduction in the number of complaints so far since the start of GD1.

We have achieved this strong performance by embedding very efficient processes for handling complaints across our business, with a small dedicated team supporting customers and our operational depots to resolve any complaints quickly and fairly on a daily basis.

Although we have a very good track record of resolving our customers' complaints, we know that is not enough. We want to make sure our customers do not need to complain by getting it right first time. We take proactive steps to listen to our customers and understand any concerns that they may have at an early stage. We can then respond to those concerns during our interactions with them and provide the levels of service they expect. This principle of listening and responding early to any customer concerns has been implemented throughout our business, for example:

- We introduced real time monitoring of customer feedback through our 10/10 customer app on our engineers' tablets. This gives customers a direct feedback channel and allows us to quickly identify when our work is falling short of their expectations. We can then act to put things right straight away.
- Over the last two years we have embedded a systematic approach to customer and community engagement before beginning our planned replacement projects. We engage through local community groups and communication channels to understand the impact that our works will have, and wherever possible we make amendments to our plans to accommodate the needs of customers and stakeholders. For example, we may alter the timing of our plans, make special access arrangements or bespoke plans for vulnerable groups. Our customers and local stakeholders are appreciative of this proactive approach with many of them taking the time to write in and thank us unprompted. Last year this unprompted positive feedback outweighed the negative feedback that we received for our planned works. The number of complaints across more than 1000 planned works projects fell by 45% to 581 and we received 609 unsolicited thank you notes.

In GD2 we will continue this twin approach of quickly resolving any complaints made, while proactively listening to customers and getting our service right first time.

6.12 Guaranteed standards of performance (GSOPs)

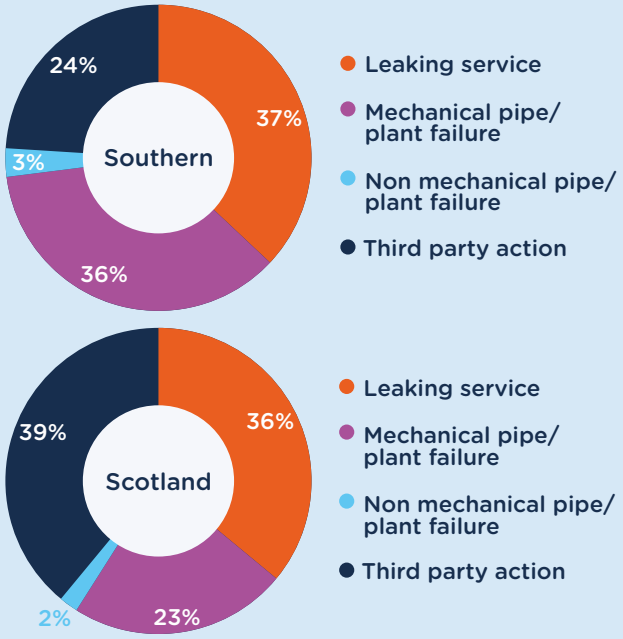
Changes have been made to tighten a number of GSOPs and increase compensation payments. In particular, the minimum notice period for planned interruptions has been extended by Ofgem from five to seven days (GSOP13). This will have an impact on our business processes and on the processes and costs of our contractors due to increased scheduling, planning and associated unproductive time. We have decided that we will absorb this cost increase through improvements in operational practices.

We will also develop processes and systems to automatically pay compensation to our customers through their supplier if we fail to meet the standard.

6.13 Average restoration time for unplanned interruptions

We engaged with our stakeholders, customers and CEG to develop targets for a new penalty-only financial incentive for average restoration time for unplanned interruptions.[31]

Figure 6-2 Causes of unplanned interruptions

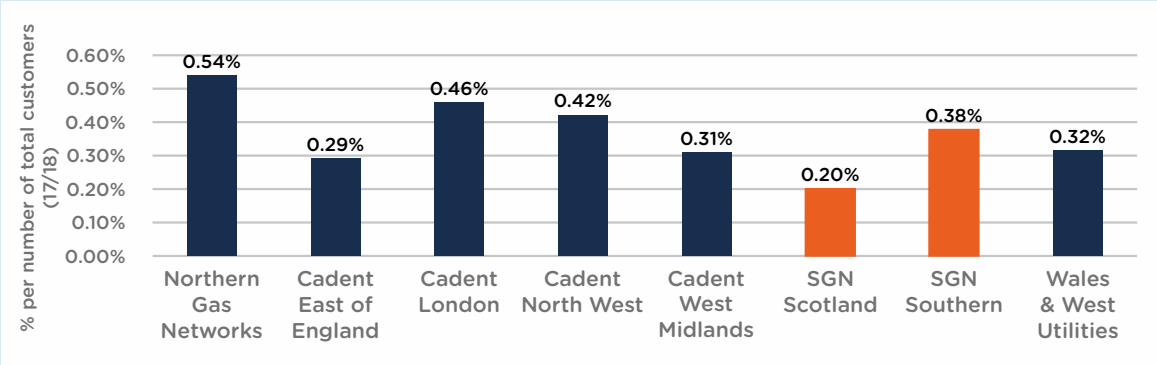


We have more influence over the duration of unplanned interruptions than their frequency. However, there are multiple factors outside of our control which can extend the duration. These could include the requirement for specialised equipment or the imposition of working restrictions when we are excavating on the strategic road network. We avoid these issues as far as possible by performing proactive assessments and refurbishment, which has been particularly effective with our approach to risers in multi-occupancy buildings. We also aim to reconnect customers at a time convenient to them and will postpone night-time works until the morning to avoid noise and disruption, both of which impact interruption times.

[30] Shaping the Business Plan Qualitative Workshops - Customer Service & Supporting Vulnerable (ref 085), Positive Impact round table event - London combined with Scotland (ref 088)

Figure 6-3 shows that as a percentage of our customer base, our customers experience among the lowest number of unplanned interruptions of any GDN.

Figure 6-3 Interruptions per number of total customers (%) 2017/18



We held two in-depth workshops for customers and two for stakeholders. During these events we provided information on our past performance and trends, other networks' performance and the appetite of our customers for change as measured by a quantitative willingness to pay study.

Past performance and trends. Average unplanned interruption time in Scotland (an average of 12.3 hours over the last three years and 11.9 hours over GD1) is significantly lower than in the South (an average of 23 hours over the last three years and 19.4 hours since the start of GD1).

Comparisons with other networks. The difference between our two service areas and the other gas networks was highlighted to customers and stakeholders and explained largely by the predominance of gas risers serving customers in high rise multi-occupancy buildings in London. These often require complex planning consent and bring engineering challenges which have a significant impact on average interruption time in Southern (covering south London). Comparisons with the north London network run by Cadent are therefore more relevant for our southern network than comparisons with other geographies. Average restoration time for unplanned interruptions in north London are eight times those in our southern network.

Customer appetite for change. A willingness to pay study[31] demonstrated investment in improving the unplanned interruption time was the lowest of seven possible alternative investment priorities for customers, although customers were prepared to pay a small amount (56p) for a three-hour reduction.

The proposal we made to stakeholders and customers was to set the target at the average of the last three years' performance for each network.

At the customer workshops there was a mixed response to whether we should try to reduce our restoration times. Some customers wanted to see improvement, others wanted to see no deterioration in the average times. Customers in Scotland were more likely to be satisfied; customers in Southern understood that restoration times would be longer than in Scotland.

At stakeholder workshops in Southern, after discussion, the overall consensus was the target to maintain the average restoration time achieved over the last three years "was about right". In Scotland, stakeholders would have preferred a continuous improvement in targets, however stakeholders at both events emphasised the experience during an interruption may be more important than the duration.[32]

The majority of the CEG accepted our proposal to maintain targets at the average of the last three years' performance. We clarified the correlation between a lower number of shorter duration jobs in recent years and the increase in average performance time between the last three years and the full GD1 period.

Taking into account the range of feedback from customers, stakeholders and our CEG, we have maintained our initial proposal of average performance over the last three years.

Target definition. We highlighted in our October draft plan that our engagement with customers and stakeholders focused on average restoration times excluding large incidents, while discussions with Ofgem and other GDNs focused on methodologies for the inclusion of interruptions from large incidents into the measures and targets.

Large incidents (defined as impacting more than 250 customers) occur infrequently but can have a significant impact on restoration times in any one year. Large incidents may be caused by failure of our own network, but incidents with the biggest impact on our customers are often the result of third-party damage, particularly those that result in water ingress. Water incidents can impact many hundreds of customers for several days while the water is located and removed.

This output is an annual penalty-only ODI with a maximum potential penalty of up to £6m a year. Ofgem's templated approach includes an allowance for the impact of large incidents which we believe to be appropriate because of the uncertainty around the likelihood and precise timing of a large incident in any particular year of GD2.

[31] Stage 3: Conjoint & WtP summary report (Valuation Phase) (ref 005)
[32] Shaping the Business Plan Qualitative Workshops - Customer Service & Supporting Vulnerable (ref 085), Positive Impact round table event - London combined with Scotland (ref 088)

The methodology we have applied to define the impact of large incidents within the ODI target is to assess the average annual impact of the largest incident caused by third party damage, over the previous ten-year period. Over the five years of GD2, there is a 50% probability that this scale of incident will happen again as a result of third-party damage, but it is not possible to predict in which year.

The table below shows a breakdown of the target for average restoration times without the inclusion of large incidents in line with our stakeholder discussions. It also shows the additional impact of large incidents included in Ofgem's BPDT requirements.

Table 6-4

	Scotland	Southern
Targets for average restoration times for unplanned interruptions (without large incidents)	Average of performance over the last three years 739 minutes	Average of performance over the last three years 1,379 minutes
Large incident impact (included in Ofgem's BPDT)	573 minutes	202 minutes
Total	**1,312 minutes**	**1,581 minutes**

We will put in place processes to identify and report on MOB interruptions in a clear and consistent manner and have incorporated the cost to do so in our IT technology readiness PCD (10.9) as part of our overall data collection project which we will implement to respond to new requirements in GD2.

6.14 Social value collaboration incentive

We heard from our customers that they are concerned about the wider social impacts of what we do. Customers tell us about negative impacts such as inconvenience, noise, pollution and the physical impact of our works. However, customers also recognise the positive social impacts we can have by creating opportunities for young people, disadvantaged groups and communities.[33]

With encouragement from our SAP and members of our CEG, we are proposing to drive significant change in our own company and among other utilities to reduce the negative impacts of works on the wellbeing of our customers and communities. We have led the way in collaborative working with other utilities, playing a significant role in the two largest, successful projects completed over the last ten years. We propose to continue to play a leading industry role in overcoming barriers to joint, cross-sector working, enhancing the wellbeing of our customers and communities.

Building on best practice in the public and voluntary sector, we developed a method of measuring the wider impacts of our activities using social wellbeing analysis and piloted the approach in GD1. This approach aligns with the Scottish Government's new national performance framework and HM Treasury Greenbook.

We are now proposing a broader scale roll-out that would bring together our industry-leading approach to collaboration with social value modelling to deliver the benefits listed below.

- Driving cultural and behavioural change within SGN and across utility partners.
- Developing and proving new ways of working to overcome barriers to joint works projects.
- Embedding open data practices with other utilities.
- Demonstrating the application of a social value wellbeing analysis, stimulating the development of a common industry-wide approach to measurement and evaluation.
- Providing measurable benefits, with an overall reduction in duration of works and corresponding positive impact on the wellbeing of customers and communities.

6.14.1 Defining social value

Social value is defined as the total impact on quality of life and can be evaluated using HM Treasury Green Book methodology covering positive and negative financial, environmental and wellbeing impacts.

We worked with an expert consultancy to define positive and negative measures of social value that are relevant to a gas network, and which can be monetised, to help us understand the wider impact that customers experience, measured in a consistent manner over time. More details of our research and approach can be found in our customer vulnerability plan (appendix 023).

6.14.2 Building a social value framework

Working with advice from stakeholders, during GD1 we made progress towards the measurement of positive social impacts, establishing benchmark social values for many of our proactive initiatives to support vulnerable customers and communities. In preparation for GD2 and aligned with our customers' priorities[34] we extended this analysis to consider the negative social impact of our works.

Positive social impacts

- **Vulnerability initiatives:** we identified the financial and wellbeing values of the additional services we provide to vulnerable customers including, for example, energy efficiency advice, locking cooker valves, or referrals to other agencies. Our trials in GD1 have enabled us to set realistic targets for the social value that we will generate from the vulnerability use-it-or-lose-it allowance in GD2 (section 6.5.4).
- **Building life and work skills:** our ongoing stakeholder engagement plan (chapter 4b) summarises the collaborative partnerships that will create life and work opportunities for local people who are detached from the labour market. We will measure the social value generated from these activities and report it as part of the reputational stakeholder incentive (section 4.14.1).
- **Community action projects:** in line with London Benchmarking Group methodology, we have assessed the direct financial impact and social value generated by our community investment programme. The investment programme includes charitable support and community action projects through which our people make a difference to a local community by carrying out a project to meet a social need. (section 5.1).

[33] Stage 1: Explorative Qualitative Workshops and Interviews (Exploratory Phase) (ref 002)
[34] Stage 1: Explorative Qualitative Workshops and Interviews (Exploratory Phase) (ref 002), Shaping the Business Plan Qualitative Workshops - Customer Service & Supporting Vulnerable (ref 085)

- **Potential for a broader industry-wide approach:** we continue to work with our stakeholders, specialists from other industries and the public sector, to extend the scope of the activities we measure and to develop our measurement toolset in line with best practice in social valuation. Our ambition (supported by our SAP and CEG) is to facilitate the development of an industry-wide social value bank to allow common evaluation of outcomes between energy networks (section 4.17.4).

Negative social impacts of our works

Learning from work undertaken by Anglian Water to investigate the impact of flooding, our expert consultancy used regression analysis to isolate the negative impact from our activities on customers' reported wellbeing. Six years of SGN data covering the location of our works (250,000+ data records) were matched to 100,000+ respondents to the ONS Annual Population Survey which measures life satisfaction.[35] This identified a statistically significant negative impact on the life satisfaction of people who lived within 500m of our works, when measured within 30 days.

This negative social value could be caused by inconvenience, including access issues, visual and physical impact, dust and noise pollution for local residents. Our valuation of social impact does not include traffic disruption for commuters from outside the 500m zone. A number of local authorities have evaluated the additional negative social impact of traffic disruption due to utility works. However, this commuter impact has been excluded from our analysis following Ofgem's business plan guidance, which suggests traffic disruption is a matter for Highways Agencies.

6.14.3 Listening to our customers' suggestion to reduce the negative social impact of our works

We have heard a strong message from our customers throughout our engagement[36] that they want us to collaborate with other utilities and reduce our combined impact by working on joint projects to dig once.

We have a track record of collaborative working, with two successful, award-winning projects completed. However, despite good intentions, there are significant barriers and costs to working collaboratively. Our most recent collaborative project in Epsom Road, Croydon in 2018, working with Thames Water and Croydon Borough Council took more than two years to plan and we incurred net additional coordination costs of over £400k. However, the combined duration of works by all utilities involved was reduced by 85 days[37] providing a significant social benefit to nearby residents.

After the project, 94% of Epsom Road residents agreed that companies coordinating their works was a good idea and that it should happen elsewhere.[38]

An earlier collaborative project between SGN, UKPN, TfL, BT, Thames Water and British Rail in 2009 reduced overall duration of works by 384 days.[39]

In willingness to pay research, our customers confirmed that they are prepared to pay to increase collaborative working. Domestic customers are willing to pay £1.69 to increase the number of collaborative projects we carry out from 1 to 20 a year.[40] This equates to a total of £9.9m that our customers would be prepared to pay.

6.14.4 Financial incentive to change behaviour and drive collaborative working

The challenges and barriers to collaborative working are significant and include a number of important categories.

- **Health and safety:** legal compliance, construction, design and management (CDM) liabilities, site responsibilities, permitting, safety systems
- **Financial and commercial:** procurement, aligning contracts, engaging the supply chain
- **Behavioural and cultural:** short/long term thinking, perception of misaligned standards, customer service and local engagement, appreciation of benefits, new protocols and training, relationship building and trust.

We have played a pivotal role in progressing collaborative working, with the GLA recognising our leading contribution.[41] However, due to the barriers above and associated costs we have completed only two projects nine years apart. There are some smaller cost benefits to collaborative working, such as shared traffic management application costs, however these are far outweighed by the additional coordination and planning costs.

We propose a bespoke financial incentive mechanism to facilitate behaviour change and provide funding to overcome the high initial costs. This incentive would support our ambition to respond to customers' priorities and align with their willingness to pay for improvement.

The value of the incentive payment would be linked to the social value generated for customers by the overall reduction in duration of collaborative works. This wellbeing valuation equates to £305k for our benchmark collaborative project.[42]

As our experience develops, our net additional costs will reduce. However in the early years of GD2 we anticipate that net additional costs (£400k for each project) will exceed the value of the incentive payment generated (£305k for each project), thus providing a catalyst for long-term thinking, faster action and efficiencies. Given the longer-term investment needed before financial reward is achieved and the low level of existing performance across the whole utility industry, we do not believe that a financial penalty for non-delivery would be appropriate. We have instead built several safeguards for customers, to ensure that the level of incentive reward is proportionate to the benefits we deliver.

[35] Data analysis on the impact of supply interruptions was also carried out, but no statistically significant impact on customer wellbeing was identified. The vast majority of interruptions are short and affect small numbers of people.

[36] Stage 1: Explorative Qualitative Workshops and Interviews (Exploratory Phase) (ref 002), Shaping the Business Plan Qualitative Workshops - Sharing Financial Risk. Innovation Investment (ref 083), Shaping the Business Plan Qualitative Workshops - Environmental Action Plan (ref 084), Shaping the Business Plan Qualitative Workshops - Customer Service & Supporting Vulnerable (ref 085)

[37] Epsom Road - Wrap-Up, GLA

[38] Epsom Road - Opinion Research results, GLA

[39] http://streetworks.org.uk/wp-content/uploads/2016/11/51_-_Borough_High_Street_Blueprint.pdf

[40] Stage 3: Conjoint & WtP summary report (Valuation Phase) (ref 005)

[41] "SGN has also been setting an example for industry in supporting a new project to trial a dig-once approach to streetworks that has significant potential to minimise the disruption caused by investment and maintenance works." *Madalina Ursu, Senior Manager, Growth & Infrastructure, Greater London Authority*

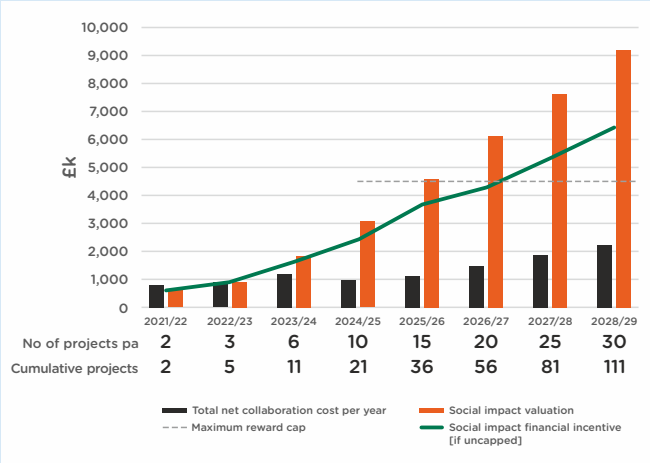
[42] We have used Epsom Road as a benchmark project, claiming conservative benefits based on 85 days reduction in duration. Other projects may achieve larger reductions in duration as demonstrated by the 384 day reduction achieved in Borough High Street. Given the high planning and set up costs, collaborative projects are likely to be large.

We recognise the uncertainty around the pace of behaviour change and are therefore proposing to cap the incentive payment at a maximum annual reward of £4.5m, reached at 20+ projects a year, which is less than half of the amount customers told us they were willing to pay.[43]

We are also proposing a series of scale thresholds that will be triggered by the cumulative number of collaborative projects carried out by us during GD2. Once we have experience of 10 successful projects, the proportion of social value generated that is payable to us would be reduced by a scale discount factor of 0.9 recognising that social value can also be attributed to collaboration partners. The scale discount factor applied to the social value generated would be further increased at 20 and 40 cumulative projects.

Recognising the long-term nature of behaviour change and uncertainty about the pace of change achievable, the scenario below covers potential performance over eight years. However, this could be accelerated at no additional financial risk to customers, given the annual maximum reward cap.

Figure 6-4 Social value collaboration scenario



6.14.5 Customer benefits

The social value collaboration incentive would provide a catalyst for behaviour change that would provide significant short, medium and long-term benefits to customers and communities.

- The social value delivered will exceed the cost of the financial incentive once a cumulative threshold level of ten collaborative projects is reached. Before that threshold the social value delivered will be equivalent to the cost of the incentive.
- Building experience and ways of working with collaboration partners will have an enduring impact beyond GD2 for SGN and all its partners.
- A ripple effect through collaboration partners will drive behaviour change in other utility sectors on a much broader scale.
- Additional social benefits such as traffic disruption are not counted in the incentive model but will occur and are valued by stakeholders, communities and commuters.

6.14.6 Stakeholder and customer support

We shared our approach to valuing the negative social impacts of our works at a recent cross sector roundtable we organised for stakeholders. Attendees included representatives from HM Treasury, the Department for Digital, Culture, Media and Sport, as well as from the housing, construction, energy and third sectors. The roundtable was chaired by Rt. Hon Hazel Blears MP and called for increased adoption of social valuation, noting the potential role of regulators acting as a catalyst to drive positive change.

At detailed discussion workshops, most customers accepted a role for financial incentives in driving additional motivation to improve performance and customers were positive about social incentives.[44] We have discussed the principle of a social value collaboration incentive with the Greater London Authority, TfL and our Stakeholder Advisory Panel and received strong support. Our CEG have encouraged our work around social value measurement in general, as well as supporting our proposal for a social value collaboration incentive mechanism.

6.15 Other bespoke incentives

In our July plan we described three potential incentives that we believed would also drive changes in behaviour and deliver outcomes that were beneficial to stakeholders and to society.

- Quality of open data incentive
- Responsive network incentive
- Reduction in peak demand incentive

Stakeholders expressed some support for the incentives in principle, however the challenge of quantification and calibration in the time available means that we have not included these proposals in this final December plan.

[43] Stage 3: Conjoint & WtP summary report (Valuation Phase) (ref 005)
[44] Shaping the Business Plan Qualitative Workshops - Sharing Financial Risk. Innovation Investment (ref 083)

7

Our commitment to customers: delivering a safe and efficient service

Delivering a safe and efficient service fully aligns with our customers' priorities. They want us to keep the gas flowing, act safely and keep costs down.

1. We will deliver a safe and efficient service by keeping our network as safe and resilient as it is today

We do what is needed to keep our network safe and resilient from asset deterioration, physical and cyber threats. Doing this fulfils our legal duties and our essential social purpose to make sure our customers are safe and warm, and our industrial and commercial customers have the energy that they require.

With an ageing asset base, investment is essential to maintain the integrity of our assets, critical to achieving the necessary high standards of safety and reliability. Our 4Rs strategy (see 7.2) is to repair or refurbish if possible, before escalating to more costly replacement of components, or finally resorting to a full site rebuild if circumstances dictate.

2. We will deliver a safe and efficient service by reducing like-for-like customer bills

Our plan produces a like-for-like reduction in customer bills of 10% in Scotland and 6% in Southern, achievable through efficiency and productivity gains across all our investment areas (chapter 18)

The value created for customers from each investment project or programme costing over £500k has been defined in one of 146 engineering justification papers (EJPs) and 135 associated cost benefit analysis (CBA) which accompany this plan.

3. We will deliver a safe and efficient service by facilitating fewer interruptions to customers' supplies as a result of third-party damage, working collaboratively towards a 15% reduction

Our customers have been clear in their feedback about the importance of collaboration to reduce disruption. We have responded by changing the focus of our ambition, to reduce emergency repair interruptions caused by third party damage to our pipes through improved collaboration with relevant third parties. Although not directly under our control, we believe proactive engagement will help reduce instances of accidental damage and provide extra value that customers want through fewer interruptions, as well as a reduction in carbon emissions.

What consumers want and value from networks: maintaining a safe and resilient network

Linked appendices

- Repex
- Transmission integrity
- Distribution integrity
- Emergency

7.1 Managing integrity and resilience

To ensure our customers are safe and warm we must keep gas in our pipes at the right pressure. To deliver this essential service in all areas, at all times, we need to manage the integrity and resilience of our assets.

Integrity is addressed through our highly disciplined and proactive management of the different asset groups that make up a gas distribution network.

Resilience is achieved through effective and efficient network planning, ensuring we can deliver gas to our 5.9 million customers on the coldest winter day.

Our effective management of integrity and resilience is the reason our customers can take their gas supply for granted. Our success is built on our asset management strategy, incorporating a detailed understanding of our assets to ensure that we only carry out the work that is needed, when it is required.

7.1.1 Investment drivers: legislation

We have a legal obligation, as set out in the **Pipeline Safety Regulations** to ensure all our pipes are maintained in an efficient state, in effective working order and in good repair. This is an absolute duty in law.

Due to the safety risks posed by iron pipes, the Health and Safety Executive (HSE) requires us to decommission all small diameter iron pipes within 30m of property by the end of March 2032, as set out in its **Iron Mains Risk Reduction Programme (IMRRP)** section 17.1.

There are numerous other regulatory and legal requirements that mandate how we manage and maintain the network, and which help determine the level of investment in our plan. These requirements are set out in the appendices, with the most important highlighted below.

The Pressure Systems Safety Regulations (PSSR) cover the safe design and operation of pressure systems.

The Gas Act states we must provide a connection to a building within 23m of an existing relevant gas main.

Gas Safety Management Regulations (GSMR) covers the safe management of gas flowing through our network and includes a duty to minimise the risk of a gas supply emergency. Gas transporters are required to submit a safety case to the HSE for operating and maintaining the network.

1-in-20 licence condition. The main driver for network reinforcement is the need to maintain a safe operating pressure to meet a 1-in-20 peak day demand, defined as the highest demand statistically expected to occur once every 20 years.

The New Roads & Street Works Act 1991 (NRSWA). This ensures co-ordination of utility works by local authorities. It sets out the objectives of the co-ordination to ensure safety; to minimise inconvenience to people using a street, including a specific reference to people with a disability; and to protect the structure of the street and the apparatus in it.

This is a small selection of the relevant regulations our asset management strategy and practice must comply with.

7.1.2 Investment drivers: physical change

Physical drivers can be divided into asset deterioration (ageing), weather and environmental impacts, and accidental damage caused by third parties.

Asset deterioration

The majority of our transmission network was built 50 years ago with a 40-year design life. Today its age is apparent in the deterioration of protective coatings, increased corrosion, and increased incidence of faults. All the component parts must be regularly assessed to ensure their condition remains safe for continued use. As a result, the majority of our capex spend in GD2 is on asset integrity, replacing or refurbishing assets that are in a deteriorated state, rather than on new connections or reinforcement. Without these interventions, deteriorating assets will create a significant risk of failure with associated safety consequences.

Other assets, such as electrical and instrumentation (E&I) components require continuous investment to manage obsolescence and maintain protection against cyber risk.

Continued investment is required to maintain levels of safety and reliability from these ageing assets, while still balancing the overall cost. Our ambition is to maintain our excellent, safe and reliable service today while preparing our network for the future.

Environmental exposure

Responding to climatic change is an increasingly important driver of investment in the network. Impacts on our networks occur either through extreme hot or cold weather, or increased erosion exposing previously buried pipelines.

Unpredictable weather has become more frequent and is adversely affecting both our Scotland and southern networks. Cold weather spells have been followed by high summer temperatures, causing damage over a period of time. Ground movement as a consequence of weather causes damage to structures and foundations whilst changing weather patterns have significantly contributed towards accelerated pipe corrosion and deterioration.

Case study

River Tay erosion

Our gas pipeline serving Dunkeld and other local communities in Scotland runs close to the bank of the River Tay. Various flood events and extensive bank erosion have left our pipeline exposed in a number of areas. Climate change is likely to contribute to further erosion, but the scale and power of the river makes it impossible to accurately forecast when or where the pipeline might become exposed. The increased likelihood of climate change related flood events is making it unsustainable to continue to manage the risk through erosion protection measures.

7.1.3 Investment drivers: customer demand

The main driver for investing in additional network capacity is new connections that come onto our networks and their associated demand. Where there is sufficient resilience in the network, this additional demand can be absorbed. Where there is insufficient resilience (to ensure a 1-in-20 peak demand is delivered) pipes will need to be reinforced to provide additional capacity.

The extent of new connections will depend in part on economic growth, the location of that growth and local and national policy that determines the impact of growth on our network as set out in sections 17.5 and 17.6.

7.1.4 Investment drivers: stakeholder insights

Customers want us to maintain the safe, reliable service that we currently provide and recognise that we need to invest to maintain the gas infrastructure. However, customers also feel strongly that we should play our role in decarbonisation and want us to keep our overall costs down, now and in the future.[1] Stakeholders recognise the importance of safeguarding and securing our assets from both physical and cyber threats.[2]

We must balance these essential and sometimes-competing priorities within our asset strategy.

7.2 Strategic response

Our asset management strategy is driven by making the right intervention at the right time, a principle that is embedded in our business through our 4Rs strategy. This approach minimises investment and maximises efficiency through the selection of the most appropriate intervention:

- **repair:** cost-effective remedial steps to repair existing assets, enabling them to remain operable
- **refurbish:** such as renewal of parts as well as shot-blasting and re-painting
- **replace:** replacing elements of the equipment within the overall installation
- **rebuild:** complete re-build of an entire installation.

This is the right strategy to respond to our customers' priorities given the uncertainty inherent in determining the most effective pathway for decarbonising heat. Our commitment is to make the minimum necessary expenditure to keep the network safe until its role in a decarbonised future is clearer. It is important to emphasise however, that whilst there is gas in the network, it is our obligation to keep it in the network and to keep our customers safe.

The 4Rs strategy enables us to choose the right intervention for the elements of the network that we can control. We also recognise elements out of our control, such as demand growth, environmental change or new connections. As such we have set out a series of uncertainty mechanisms in chapter 12 that we believe provide the right balance of risk between ourselves and the customer.

[1] Stage 1: Explorative Qualitative Workshops and Interviews (Exploratory Phase) (ref 002)
[2] MFT Workshops Jan/Feb 2019 London & Glasgow (ref 016, 017)

7.3 Safe and efficient: output summary

We have summarised the safe and efficient outputs for GD2 by type, along with a relevant point of comparison from historical GD1 data.

Table 7-1 Safe and efficient outputs

Sector outputs		GD2 output category	Uncertainty mechanism	GD1 first 6 years		GD1 last 3 years		GD2		BPDT
Section	Output			Annual measure	cost £m/yr	Annual measure	cost £m/yr	Annual measure	cost £m/yr	
7.4.1	Repex: tier 1 mains replacement	PCD		911km	123.7	798km	123.4	833km	126.6	4.01
7.4.2	Repex: tier 2a volume driver		12.2.1	4km	2.6	10km	7.6	3.2km	2.6	4.02
7.4.3	Repex: less than 2" steel volume driver		12.2.4	53km	4.8	48km	7.1	50km	7.2	4.01
7.4.4	Repex: Service replacement	NARMs		95,931 services	77.1	83,447 services	67.5	90,375 services	76.2	4.07
7.4.5	NARMs: transmission assets	NARMs						£7.1m risk removed	23	-
	NARMs: asset management repex	NARMs						£10.8m risk removed	100	-
	NARMs: distribution assets	NARMs						£0.2m risk removed	10	-
7.4.6	Gas holder dismantling	PCD		7 holders dismantled	7.2	7 holders dismantled	3.2			-
7.4.7	Land remediation	PCD		0.4km^2	4.0	0.44km^2	5.3	0.25km^2	4.7	2.20
Bespoke Outputs										
7.5.1	Accelerated tier 1 mains replacement	PCD						40km	9.8	4.01
7.5.2	Proactive steel mains replacement	NARMs						32km	4.6	4.04
7.5.3	Tier 1 iron stubs	PCD	12.2.3					211 stubs	1.7	4.04
7.5.4	Intermediate pressure services	NARMs						103 sites	0.7	4.07
7.5.5	Kings Ferry and Cams Hall	NARMs						Named projects	1.3	4.04
7.5.6	Responsible demolition	PCD						4 sites	1.0	2.04
7.5.7	Record keeping (MOBs) >6 storey	PCD						6,500 sites	0.5	2.04
7.5.8	Additional riser inspections: <6 storey buildings	PCD						25.5k sites	3.8	2.04
7.5.9	Riser isolation valves inspection	PCD						135 valves	0.0	-
7.5.10	Record keeping other records	PCD						2 external audits	0.0	2.01
	NTS exit	ODI		Under discussion with Ofgem						

7.4 Safe and efficient: sector outputs

We have set out below our approach to each of the sector outputs in Ofgem's sector specific methodology.

7.4.1 Repex sector output: tier 1 mains replacement – PCD

We are committing to decommissioning 214km of tier 1 iron pipes a year in Scotland and 619km a year in Southern (total 833km a year). For GD2 we anticipate this workload will be delivered at a unit cost of £152/m (average over five-year period) compared with a unit cost of £154/m (average over last three years of GD1). This is set out in appendix 019, Replacement Expenditure, section 6.2. In principle, we agree with the Sector Specific Methodology Decision (SSMD), that any under-delivery would be subject to HSE penalties, in addition to us returning relevant allowances to customers.

We propose to continue our GD1 approach into GD2,[3] by targeting the 20% of pipes with the highest risk score for replacement. This provides the operational flexibility to determine the right approach for the remaining pipes to meet our risk reduction targets. This more strategic approach also minimises customer disruption and reduces leakage rates. We expect to reduce leakage by 30ktCO_2e a year over the course of GD2.

We are proposing to set a tolerance banding around tier 1 diameter pipes decommissioned that provides sufficient flexibility to optimise design and maintain high levels of insertion. We need to guard against a return to less efficient like-for-like replacement and the associated higher costs to consumers.

7.4.2 Repex sector output: tier 2a mains and services – volume driver

All tier 2 mains identified using the Mains Risk Prioritisation System (MRPS)[4] as exceeding the HSE agreed risk action threshold will have been replaced during GD2. However, pipe risk scores fluctuate over time as circumstances change, a process known as dynamic growth. In GD2 some tier 2 pipes may go over the risk-action threshold and will require replacement. These are referred to as tier 2a.

Volumes of tier 2a are difficult to forecast because of fluctuating pipe risk scores due to unpredictable events. Such events include pipe leakage, new houses being built near our pipes and changes in the ground conditions – for example, the ground being paved over increases the risk of a gas leakage entering a property. For these reasons we agree the existing volume driver arrangements should remain in place for GD2. This is set out in section 12.2.1 and appendix 019, section 6.8.

Historically, annual dynamic growth has accounted for 0.5km a year for Scotland and 2.7km a year for Southern. On that basis, over the course of GD2 we would expect to complete 16km of tier 2a pipe. In GD1, excluding services, the workload has been completed at a combined unit cost (for mains and services) of £737 per metre (last three years) and in GD2 we expect the unit cost to be £806 per metre. This rise in cost is a result of known increases on contractor rates and changes in the diameter mix. We set out the diameter band assumptions and contractor evidence base in the appendix 019.

7.4.3 Repex sector output: less than or equal to 2" steel mains – volume driver

Pipes that are <=2" steel are classed as mandatory and should be decommissioned as soon as possible once discovered. Our current records show we have 311km in Scotland and 267km in Southern. These assets are geographically dispersed and will be replaced when other works are undertaken within the same area. During GD1 our workload has moved from areas with a high density of <2" steel to areas with a lower density. The associated workload has decreased over that period from 59km to 48km a year.

We have based our current GD2 forecast on the last three-year run-rate of GD1, where we will deliver 48km a year of <=2" steel at an average cost of £148 a metre. This is the lowest run-rate in the GD1 period.

In GD2 our workload is expected to move to areas such as Glasgow, Dundee and the south-coast of England where we anticipate finding a higher density of <=2" steel. However, given the density of <2" steel is not accurately mapped there is significant uncertainty. As such we have assumed a broadly constant run rate of 50km a year at a slightly lower average unit cost of £147 a metre and propose a volume driver to cover this workload, as set out in section 12.2.4, and appendix 019, section 6.8.

7.4.4 Repex sector output: steel service replacement and PE transfers – NARMs

Service pipes supply gas from the distribution main to the customer's emergency control valve – the entry point to their property. As we work through the iron mains replacement programme these service pipes are either re-laid or transferred. In addition, we continue to replace steel services when responding to reported gas escapes.

We have detailed models that provide us with an accurate forecast of the number of services we expect to find and replace over the course of GD2, according to the area where we expect to undertake work. On this basis we forecast we will replace 90,375 services a year (68,565 in Southern and 21,910 in Scotland), slightly fewer than the 92,573 services replaced in GD1. To deliver this we expect to spend £76m a year in GD2 at a unit cost of £844 per service.[5] This compares to a total GD1 expenditure of £67m a year in the last three years at a unit cost of £809 per service. This workload will be covered by a NARMs output (explained in chapter 8a) and is set out in appendix 019, section 6.4.

7.4.5 Network asset risk metric (NARM)

Our approach to NARMs is set out in more detail in section 8a on asset resilience and the output deliverables are summarised below. Outputs are defined according to a monetised risk model where measures are taken to maintain risk at an appropriate level. Feedback from customers is that while safety is considered very important, they consider the level of safety we have delivered during GD1 appropriate (section 7.1.4).

Transmission assets output

Transmission outputs covered through NARMs relate to nine asset classes established during GD1. During GD1 we

[3] This is supported by the EJP: SGN Repex – 001 tier1So – EJP Dec 19 and SGN Repex – 002 tier1Sc – EJP Dec 19

[4] The MRPS is a shared model across all GDNs that estimates the level of risk of an incident for each km of mains a year. The risk score represents the likelihood of an incident arising from a failure of a pipe section and enables us to weigh the relative priority of pipe selection.

[5] These are supported by EJPs 'SGN Repex – 014 Bulk ServicesSo – EJP Dec 19' and 'SGN Repex – 014 Bulk ServicesSc – EJP Dec 19'

will have invested £31m a year and delivered a reduction in risk from £191m at the start of GD1 to £141m by the end. In GD2 we expect to invest £23m a year which will keep monetised risk broadly maintained over GD2 at £153m.[6]

Repex asset management outputs

Repex asset management covers tier 2b, tier 3, >2" steel, iron mains further than 30 metres away from a building, and other conditional mains, diversions and risers.

We estimate that at the start of GD1 our monetised risk was £181m rising to an expected £187m by the end. In GD2 we anticipate the monetised risk score will increase from £317m to £328m. Discussions relating to the format of NARMs targets are ongoing with Ofgem. More information is set out in section 8.2.1 and appendix 019, section 6.4.

Distribution assets output

The monetised risk assessment for our distribution assets includes governors for which we estimate that we have kept monetised risk broadly constant in GD1 at around £11.5m. For GD2 the monetised risk score is expected to increase from £30m at the start of GD2 through to £33m by the end. This increase is across all categories and shows a slight reduction in GD1 from £11.5m to a monetised risk valuation of £11.4m.

7.4.6 Capex sector output: gas holders

At the start of GD1 we had 111 gas holders across our portfolio, 21 in Scotland and 90 in Southern. A 16-year dismantling programme began in 2013 (to cover two eight-year price controls) with the expectation we would dismantle half in GD1 and the remainder in the following eight years. Allowances were awarded for the first half of the programme in GD1. We have dismantled 45 gas holders to date and are on course to complete 55 by the end of GD1.

Following discussions with Ofgem, we have transferred all but six of the remaining gas holder sites out of the regulated business and put in place the appropriate contractual assurances to ensure gas holders will be removed within the time period allowed.

For the six remaining sites retained in the regulated business for operational reasons, five gas holders will be dismantled in GD1 and the sixth, at Provan, is a listed structure. Projects relating to the PRS and above ground pipeline at Provan, but not directly impacting the gas holders are set out in section 8.1.2 and identified as a separate project in appendix 021, Transmission integrity.[7]

7.4.7 Opex sector output: land remediation

Our land remediation and regeneration activities will ensure that we proactively address hazards or contaminants and make the best, most environmentally-beneficial use of redundant land. Further details of our approach and the innovative techniques we implemented in GD1 are contained in our Property appendix.

We will continue to manage the statutory contaminated land risks associated with our land portfolio. The process of site investigation, monitoring, risk assessment and remediation is detailed in our Site Assessment and Remediation procedure and broadly follows the principles defined by the Environment Agency (and adopted by SEPA) in Model Procedures for the Management of Land Contamination (CLR 11) and the CIRIA document Contaminated Land Risk Assessment – A guide to good practice (C552).

We used an external environmental consultancy to review existing site data and historical site plans across our portfolio and support the determination of the existence of statutory risk and assessment of site remediation costs. Total land remediation cost also includes the site-specific investment required to relocate gas plants prior to the remediation works being undertaken. Further details of the £23.4m proposed expenditure are included in the Property appendix in section 6.2 and the accompanying annex D.

7.5 Safe and efficient: bespoke outputs

Our business plan includes additional bespoke outputs which are supported through our stakeholder engagement activities,[8] or because they are necessary to maintain the safety of the network.

In general, our customer research suggested strong support for safety related work with 83% of customers strongly or slightly supporting safety measures that would add an additional £1.33 a year to their gas bill.[9]

7.5.1 Bespoke repex output: accelerated tier 1 mains replacement – PCD output

During the development of our GD2 plan we have reviewed and tested many strategies to provide the right balance between safety, environmental benefits and deliverability. We have consulted extensively with stakeholders on the opportunity to deliver above the linear trajectory to deliver the HSE target, explained in section 7.4.1, and have proposed to accelerate the pace of decommissioning tier 1 mains.

We have secured strong stakeholder support for accelerating the delivery of the repex programme, due to the reduced risk of contractor shortages and elevated prices towards the end of the programme, the clear environmental benefits and our stakeholders' focus on reduced leakage (appendix 019, section 7 stakeholder annex). The increased costs to customers would lead to an approximate increase in bills of 12p a year for every additional £5m spent on repex in GD2.

In our bespoke output we are committing to decommissioning a further 15km of tier 1 iron pipes a year in Scotland and 25km a year in Southern above the tier 1 target set out in 7.4.1, and to maintain the same unit rate. We expect that any over or under-delivery will be treated as a NARMs output and subject to the same delivery incentives (positive and negative). As a result of this workload we expect to reduce leakage by a further 3.6ktCO_2e over the course of GD2.[10]

In order to maximise the benefits realised from this increased workload, we will target the towns and cities which we believe are most likely to convert to hydrogen.

7.5.2 Bespoke repex output: proactive steel mains replacement – NARMs output

In recent years we have seen an increase in the failure rate of >2" steel mains as a result of extensive corrosion. This has resulted in regular repair and associated disruption in specific locations where the pipe has reached the end of its operational life.

[6] The difference in risk valuation between the end of GD1 and the start of GD2 reflects a refinement of the model for NARMs at the start of GD2.
[7] This is set out in SGN – Trans – 022a Prov – EJP
[8] Safe & Efficient round table event - London (ref 089)
[9] Stage 3: Conjoint & WtP summary report (Valuation Phase) (ref 005)
[10] A full evaluation in set out in the Engineering Justification Paper: SGN Repex - 001 Tier 1So - EJP Oct19

In recognition of this increased rate of failure in >2" steel over GD1 we have undertaken a collaborative piece of research with other GDNs to understand in more detail the rate of deterioration in the steel asset population, the likelihood of failure and the impact on our customers.

We have discussed this research with the HSE, setting out its implications and our proposed actions to ensure we continue to fulfil our statutory legal duties under the pipeline safety regulations. The HSE is supportive of this research and acknowledges the need to take a more proactive approach to replacing steel pipes that are at risk of failing.

We have also tested our proposed proactive approach with customers through our customer acceptability testing. Improving reliability in areas that repeatedly suffer from interruptions and enhancing the safety of our network were identified as priority areas of investment to include in our business plan.[11]

As we set out in appendix 019, section 6.4 we have used the research to identify the steel pipes which should be prioritised for replacement according to their anticipated condition. We have identified 32km of >2" steel pipes that we propose to decommission each year of GD2 (10km in Scotland and 22km in Southern). This workload is targeted at the steel pipes that have the highest failure rates.

We are proposing this is included in the 'asset management' NARMs output and subject to the same delivery incentives. As a result of this workload we expect to reduce leakage by 7.6ktCO_2e over the course of GD2. This is set out in appendix 019, section 6.5,[12] and demonstrates an NPV of £22m in Scotland with a payback of 13 years and an NPV of £51m in Southern with a payback of 30 years.

7.5.3 Bespoke repex output: tier 1 iron stubs – PCD (use-it-or-lose-it)

Prior to GD1 we were working on a programme to replace all iron within 30m of a property by March 2032, regardless of whether it was tier 1, 2 or 3. As a result, rather than replace short lengths of small diameter iron (iron stubs) connected to the larger tier 2 and 3 mains, it was deemed appropriate to wait until the larger diameter main was to be replaced and to complete the connected small diameter iron at the same time. At the start of GD1 the HSE policy changed so that tier 2 and tier 3 were no longer considered mandatory, and their removal was to be determined according to an assessment of risk and condition of the pipe and subject to cost benefit analysis.

Without a mandatory requirement to replace tier 2 and tier 3 there is no natural driver to decommission these stubs. The GDNs have jointly commissioned a piece of work with an external engineering consultancy to complete a risk assessment for the stubs. The report has been submitted to the HSE for consideration and is described in more detail in appendix 019, section 6.8.

From our asset records we are aware of 1,625 iron stubs (1,094 in Southern and 531 in Scotland). This may be an underestimate as records dating back to the 1970s when mains replacement began can be less reliable. In GD2, we plan to decommission or replace 1,056 of these at a cost of £8.7m, a unit cost of £8,239 per stub. This would deliver replacement of 65% of the stubs in GD2 and the remaining 35% in GD3. There is not a comparable output measure or workload in GD1.

We are currently in discussion with the HSE regarding the best approach to managing these stubs with other GDNs and in section 12.2.3 have proposed an uncertainty mechanism to accompany this output.

7.5.4 Bespoke repex output: intermediate pressure (IP) reconfigurations – NARMs

The supply of gas to a property through an IP supply pipe is a legacy issue arising when an IP supply pipe terminates with a pressure regulator and valve immediately outside a building. These pipes are not compliant with current industry standards, which state IP services must not be installed within three metres of a building. This output, which is set out in appendix 019, section 6.4, represents a structured programme of proactive management and risk removal. It will reduce the risk to affected customers and if there is a gas escape it will reduce the length of time that they may be without gas.

There are many benefits from a service renewal programme which promotes a safe and reliable network: reduced risk, improved pressure and lower risk of interruption to customer supplies. As a result, we are proposing a programme to reconfigure 103 installations a year in Scotland a total of 515 installations over GD2 at a total cost of £3.7m. As assessed under the EJP, IP reconfigurations have an NPV of £200k with a 26 year payback.[13] We anticipate this output will be covered by NARMs and subject to the same incentives used for over or under-delivery.

7.5.5 Kings Ferry and Cams Hall – NARMs

Kings Ferry and Cams Hall are two named projects set out in appendix 019, Replacement expenditure, section 6.4. They have been included alongside IP reconfiguration (section 7.5.4) due to the atypical costs of these unique repex projects. Both projects are supported by an EJP[14] and associated CBA. Each project is described in more detail section 8.2.1.

7.5.6 Responsible demolition - PCD

As a part of our bespoke outputs in GD2 we intend to remove vulnerable redundant assets which no longer carry a live supply. Typically, these are above ground pipes attached to bridges, crossing roads, rail or rivers but which no longer carry gas. In past years when a replacement pipe was laid, the decision was taken to leave the redundant pipe in situ as at the time its removal may have increased the cost or risk of the programme. Removal of the pipes is now recommended as maintenance on these pipes – and on any supporting structures - continues to be required despite no longer being live. There is also the risk that should a supporting structure like a bridge fail, the pipe could fall onto the road or railway line below, causing disruption and a significant safety risk.

Through our condition reviews, we have established a risk prioritised programme to identify the minimum number of priority pipes for recommended removal, as well as calculating the cost of a full removal programme. This is set out in appendix 016, Asset maintenance, section 6.1.

[11] Business Plan Acceptability Testing Phase 1 and 2 (ref 078, 079)
[12] A full evaluation in set out in the Engineering Justification Paper: SGN Repex - 007 SteelSc - EJP Oct19 and SGN Repex - 007 SteelSc - EJP Dec19
[13] A full evaluation in set out in the Engineering Justification Paper: SGN Repex - 013 IP ServiceSo - EJP Dec19
[14] A full evaluation in set out in the Engineering Justification Paper: SGN Repex - 011 Kings FerrySo - EJP Dec19 and SGN Repex – 012 CamsHallSo - EJP Dec19

The average costs estimated for our Scotland network are higher than those for Southern due to the shorter lengths which we are targeting for removal. In Scotland, our minimum removal project would demolish 192m of pipeline, spread over 13 sites, with an average length of 14.8m and an average cost of £19.5k a metre. This compares with a total of 404m in Southern across 19 sites, where the average length is 21m, with an average cost of £3.3k a metre.

We propose to invest £5.1m across GD2 to remove these redundant pipes, established as a PCD for each given that the cost of removal is very site-specific. The removal of redundant assets was one of the examples identified in our business plan acceptability testing,[15] in which customers strongly supported an improvement in the reliability and safety of the gas pipes.

7.5.7 Opex sector output: record keeping (multi-occupancy buildings)

The population of gas risers supplying high rise (six storeys and above) buildings is currently 11,588 in Southern and 5,593 in Scotland.

We discussed asset record keeping with customers and stakeholders within the broader context of safety measures in multi-occupancy buildings.[16] Customers and stakeholders support suggestions to increase safety of multi-occupancy buildings (MOBs)[17, 18, 19] with customers seeing record keeping specifically as an area for inclusion in the plan. Further details of stakeholder insight are contained in our Asset maintenance appendix (016), and this insight has also been shared with our CEG.

We will continue to undertake planned gas riser inspections across both networks, in accordance with our management procedures, and this will drive our replacement expenditure in GD2. This predominantly covers the existing asset base of six storey and above buildings but includes a proportion of below six storey buildings that have previously been captured largely through reactive circumstances or as requested by stakeholders.

The number and cost of anticipated surveys in GD2 for this ongoing programme is anticipated to be 10,000 surveys in Scotland over GD1 at a cost of £150k a year and 22,500 surveys in Southern at a cost of £340k a year. This is set out in greater detail in appendix 016, Asset maintenance section 6.1.

7.5.8 Additional riser inspection surveys <6 storey buildings – PCD

We have also estimated asset volumes for medium rise buildings of 3-5 storeys by working with third party consultancies to cross reference our supply point data, riser models and external geographical data sets.

To enhance and maintain our multi-occupancy building and riser records, we need to extend our ongoing riser survey programme to include four and then three storey buildings. The ongoing programme (7.5.7) is currently focused on >6 storeys, although given the relatively low population of five storey buildings we should be able to cover them as well in GD1. The results of these surveys and associated risk will support our plans for GD3 and beyond by informing our risk prioritisation programme for replacement for many years, due to the high volumes involved.

Estimating each of these buildings will have two risers on average, the quantity and costs of surveying these are shown in the table below. The average riser survey is estimated to cost £75. We propose completing these surveys would be a PCD. This is set out in more detail in appendix 016, section 6.1.

Table 7-2 Riser quantities and costs

Risers (No.)	4 storey	3 storey
Scotland	15,536	47,035
Southern	6,576	58,821
Total	22,112	105,856

Costs (£m)	4 storey	3 storey
Scotland	£2.33m	£7.06m
Southern	£0.99m	£8.82m
Total	£3.32m	£15.88m

7.5.9 Riser valves inspection and repair

In addition to the riser inspections described in 7.5.7 and 7.5.8, following the Building Regulations and Fire Safety review undertaken by Dame Judith Hackitt we are also proposing to introduce a fixed interval investigation and repair of pipeline isolation valves to multi-occupancy buildings above six storeys. This will ensure the continuing accessibility of riser isolation valves located outside of the building that can be operated, if required, in an emergency situation whether directly gas related or otherwise. These surveys will confirm that each valve can still be identified on site and remains accessible which may not be the case if work by other parties has inadvertently compromised access. We will specifically target external valves on new riser installations where the riser risk survey is undertaken every ten years and this interim valve inspection will be undertaken at a five-year interval.

We propose to inspect and make necessary repairs to 135 valves a year, 675 in total as part of the riser inspection surveys above which include the cost of the valve inspection and repair.

More details can be found in appendix 019, section 6.

7.5.10 Bespoke output: record keeping other records (not MOBs)

We recognise the data used to populate the NARMs models and subsequently our regulatory returns must be as accurate as possible and consistent with DAG procedures.

To this end, we propose to extend the scope of our annual asset management external audit and assurance process which is currently undertaken by Lloyds Register against the ISO55001 asset management standard. This would include additional days on the annual audit programme to include data assurance linked to the NARMs modelling, as well as ad-hoc and more focused sessions on the components of NARMs during the year.

We propose exploring this scope further with our current provider to develop a more detailed proposal. Currently we anticipate that additional costs in the region of £20k a year would be a reasonable forecast, based on our known costs for independent inspection work.

[15] Business Plan Acceptability Testing Phase 2 (ref 079)
[16] Business Plan Acceptability Testing Phase 1 (ref 078), Stage 3: Conjoint & WtP summary report (Valuation Phase) (ref 005), MFT Workshops November 2018 London & Edinburgh (ref 013, 014)
[17] Business Plan Acceptability Testing Phase 1 (ref 078)
[18] Stage 3: Conjoint & WtP summary report (Valuation Phase) (ref 005)
[19] MFT Workshops November 2018 London & Edinburgh (ref 013, 014)

8 Resilience

Linked appendices

- Asset maintenance
- Workforce management
- IT and Cyber resilience
- Property

Our networks must be robust enough to keep the gas flowing safely at all times. We keep customers warm on the coldest winter days and ensure industry, institutions and commercial customers are able to go about their business uninterrupted. This requires resilience and security in our key assets, workforce, sites and IT infrastructure.

We recognise the impact a supply interruption can have on our customers. Unlike other utility networks, such as water and electricity which can be turned back on, a supply interruption to the gas networks requires engineers to disconnect each property until the repair has been made. Then, they must arrange a follow-up visit to each property to purge and re-light the heating systems and conduct a safety-check on appliances. As a last resort, our engineers may need to gain access to a vacant property to ensure safety is maintained. We work hard to ensure that gas interruptions rarely occur: statistically our customers will experience just one gas supply interruption every 50 years.

8a Asset resilience

Our approach has been tested with stakeholders and customers through specialist work groups and round table events. At an early stage of the planning process our customer research identified the need to maintain safety levels and a broad recognition that safety levels were at a high standard today[1]. Customers told us we should continue to improve but did not consider it necessary for a step-change in investment. At later stakeholder events[2] with more specialist panels, the majority of participants supported the principles of our asset management strategy, but found it challenging to comment on specific proposals. Stakeholders also highlighted the importance of cyber risks to resilience[2] which are covered in section 8b.

As we explained in section 7.2, our 4Rs asset strategy describes how we intervene where necessary to maintain safety and reliability. We follow comprehensive procedures to continually monitor and evaluate the state of our networks; we have an active programme of surveys and inspections to make sure we monitor the condition of our assets and undertake the relevant interventions to ensure resilience.

These inspections form the basis of the asset interventions being proposed for GD2. Each asset is covered by the network asset risk metric (NARMs) methodology, developed with Ofgem through the Safety and Reliability Working Group (SRWG). We have applied the model in accordance with Ofgem's requirements and the associated working assumptions developed at the SRWG.

The interventions to reduce asset risk are set out in the engineering justification papers (EJPs). The associated costs and the durability of the intervention are then assessed against the value of the risk removed through a cost benefit analysis (CBA).

The NARMs and CBA methodologies are important decision support tools. However, the ultimate responsibility for the safety of the network and our customers remains with us.

There are some exceptions where decisions will be made on the basis of engineering judgement, where it is felt that NARMs or CBA methodologies do not appropriately reflect the risk involved. This risk could sit outside the model, for example the impact of major road and rail disruption. We have robust governance in the form of our Condition Review Group to manage these situations. In each case a decision will be clearly documented setting out the rationale for any intervention. It may then be appropriate to reflect that risk with either the CBA or the NARMs methodology, although in many instances the risk is specific to that location.

Table 8-1 shows the level of investment covered by NARMs, a named project or a named programme exceeding the £500k threshold. Other projects or programmes are individually identifiable but do not exceed the £500k threshold. The next section describes how the risk removed score is calculated as an annual measure which accrues over the lifetime of the intervention.

[1] Stage 1: Explorative Qualitative Workshops and Interviews (Exploratory Phase) (ref 002)
[2] Safe & Efficient round table event - London (ref 089)

Table 8-1 Asset resilience outputs

Section	Output	GD2 output category	GD1		GD2	
			Delivery in period	Cost £m a year	Delivery in period	Cost £m a year
8.1	**Transmission**					
8.1.1	NARMs	NARMs	£396m risk removed	30.9	£35.7 risk removed	23.2
8.1.2	Named projects and programmes	PCD	Not captured	0	27 projects	10
8.1.3	Other projects and programmes	n/a	Not captured	5.7	51 projects	14.7
8.2	**Repex**					
8.2.1	NARMs	NARMs	£42m risk removed	104.2	£53m risk removed	100
8.2.2	Named projects and programmes	PCD	3 projects	133.5	6 projects	149
8.2.3	Other projects and programmes	n/a	0 projects	13.4	1 project	14
8.3	**Distribution**					
8.3.1	NARMs	NARMs	£1.5m risk removed	9.1	£1m risk removed	10
8.3.2	Named projects and programmes	PCD	not captured	3.9	22 projects	7
8.3.3	Other projects and programmes	n/a	not captured	0	0 projects	0

Monetised risk methodology

Monetised risk is a measure of the likelihood of an asset's failure multiplied by the consequence of that failure. For example, a pressure reducing governor serving a local town will have a higher financial cost associated with its failure compared with a governor that serves a local village. By understanding the health of the asset (including reliability and condition) we are able to forecast the probability it might fail, and therefore understand the monetised risk of the failure.

By calculating the monetised risk of a large proportion of the assets on the network we can arrive at an overall indicator for the health of the network and monitor how it changes over time through deterioration. This allows us to calibrate all assets on the network to give a consistent indication of risk according to the outcome of a failure, not just the physical impact on the asset.

In GD1, network output measures (NOMs) only provided targets for transmission assets. Our GD2 plan extends these targets to our distribution assets, with figures derived from the NOMs methodology in place in GD1. In its May 2019 SSMD, Ofgem confirmed its objective to move from NOMs to NARMs to provide a longer-term measure of risk. We will review our figures appropriately once the methodology has been established.

In GD1 the NOMs methodology[3] is applied to eight categories of assets, which encompass greater than 95% of relevant capex expenditure for all operational assets on the networks. The relevant asset categories are shown in the table below.

Table 8-2 Monetised risk asset categories (covered by NARMs)

Transmission assets			Distribution assets		
Primary assets	Secondary asset	Units	Primary assets	Secondary asset	Units
LTS pipelines	LTS pipelines - piggable	km	Distribution mains	Iron mains	km
	LTS pipelines - non piggable	km		PE mains	km
Offtake/PRS filters and pressure control	Offtake filters	Systems		Steel mains	km
	PRS filters	Systems		Other	km
	Offtake slamshut/regulators	Systems	Services		Number
	PRS slamshut/regulators	Systems	Risers		Number
Offtake/PRS pre-heating	Offtake pre-heating	Systems	Governors	District governors	Number
	PRS pre-heating	Systems		I&C governors	Number
Offtake odorant & metering	Odorisation & metering	Systems		Service governors	Number

8.1 Transmission assets

Our transmission asset resilience programme is set-out in appendix 021, Transmission integrity and appendix 026, Electrical and instrumentation. Transmission investment is predominantly covered by the NARMs methodology and includes 31 projects with an annual investment of £23m a year, £120m over the GD2 period. There are two projects for

[3] A secondary deliverable output under the RIIO framework, NOMs as defined within Special Condition 4G

transmission resilience, that have both been assessed through CBAs. Overall, 98% of transmission integrity investment is directly related to either a NARMs output or has a dedicated EJP and CBA.

In contrast, electrical and instrumentation (E&I) investment, although critical for asset resilience and with a strong overlap with OT cyber resilience, is not covered by NARMs. However, nearly 90% of the related investment is identified as a named project or programme.

The remaining investment that is not covered by either a CBA or through NARMs is typically ongoing validation and inspection projects.

8.1.1 Transmission asset monetised risk

Transmission asset output categories cover nine asset classes. These include piggable and non-piggable high pressure pipelines; offtakes, including filters, pre-heating, slam-shuts, regulators, metering and odorisation, and pressure reduction systems (PRS), which also include filters, pre-heating, slam-shuts and regulators. During GD1 the monetised risk methodology and risk reduction targets were applied to transmission assets. Our performance against these targets is set-out below.

Table 8-3 Actual delivery for transmission assets (£m)

SGN assets	Units	2013	2021 without investment	2019 actual	Actual change	Target 2021	Target change in risk by end of GD1
LTS pipelines	km	64.3	402.6	55.9	346.7	57.3	345.3
Offtakes	# of	17.2	17.6	15.6	2.0	12.4	5.2
PRS	# of	109.6	116.8	68.0	48.8	71.4	45.4
Total		**191.1**	**537.1**	**139.6**	**397.5**	**141.2**	**395.9**

The monetised risk score is split approximately 35:65 for Scotland:Southern. The large risk in 2021, without intervention for LTS pipelines, was primarily due to a capacity constraint on the Northern Transmission System between Aberdeen and Inverness. The system comprises a single spine operating near to capacity. Until 2016, seven large users held interruptible contracts that allowed us to call for a cessation of supply at peak demands if necessary. An industry codes modification allowed these users to revert to firm contracts causing a serious capacity constraint. This was rectified with appropriate reinforcement measures and accounts for £345m of risk reduction for LTS pipelines.

For GD2, there are ongoing discussions to develop targets that consider long-term risk which relate to the format of the NARMs methodology. The parameters of these targets need defining further before they can be operationally introduced, meaning that targets for risk reduction will only be finalised after we have submitted our business plan. GD1 targets consider the change (delta) in total risk in the final year of the price control (2021). The equivalent figures for GD2 are as follows:

Table 8-4 Proposed monetised risk value for SGN transmission assets (£m) – Scotland and Southern

	2021	2026			
Asset category	Without intervention	Without intervention	With intervention	Delta	BPDT
LTS pipelines (piggable)	57.6	57.8	57.8	0	5.17-Row12
LTS pipelines (non-piggable)	10.9	11.0	4.3	6.7	5.17-Row13
Offtake filters	1.3	1.6	1.6	0	5.17-Row20
PRS filters	31.3	40.8	34.7	6.1	5.17-Row21
Offtake slamshut/regulators	2.4	2.8	1.8	1.0	5.17-Row22
PRS slamshut/regulators	18.9	19.9	17.6	2.4	5.17-Row23
Offtake pre-heating	8.3	15.6	7.6	8.0	5.17-Row24
PRS pre-heating	17.3	32.3	20.7	11.6	5.17-Row25
Odorisation and metering	5.1	6.6	6.6	0	5.17-Row26
Totals	**153.0**	**188.3**	**152.6**	**35.7**	

8.1.2 Transmission assets: named projects

We have completed CBAs for all projects and programmes over £500k on the local transmission system (LTS). Altogether, 33 projects have been individually named and have an associated EJP. Only two of these are not covered by NARMs, and relate to the refurbishment of our turbo-expander at our St Mary Cray site.[4] They are covered by a single EJP for the CHP and the boiler replacement.

For E&I investment, 13 projects are named and have an associated CBA and EJP. These are outside of the NARMs methodology and include telemetry upgrades, metering upgrades and metering data loggers.

All projects are listed in section 17.2.4 with their associated value and payback. We have provided a number of examples of these named projects (all covered by NARMs) below.

[4] 'SGN-Trans-016SMCT-EJP Dec19' and 'SGN-Trans-016SMCT-EJP Dec19'

1. **Offtake – site A.**[5] Delivers gas to over 30,000 customers in the Dumfries and Galloway region of Scotland. It feeds gas from the NTS into our LTS, reducing pressure down to 70barg and is a single source supply to the pipeline that runs for over 90km. The site has serious control issues and obsolete slam-shuts and regulators which has caused reoccurring faults that overhauling and servicing have not been able to resolve. The project is estimated to cost £1.7m with an NPV of £8.4m and a payback period of 15 years.
2. **Offtake – site B.**[6] Delivers gas to almost 140,000 customers on the south coast. Built in 1978, the water bath heaters managing the temperature of the gas are now obsolete. Replacing them with new heating equipment and associated E&I will reduce maintenance costs, provide greater energy efficiency and a reduction in environmental impact, caused currently by the risk of antifreeze solution leaking on site. A lack of replacement parts availability could cause significant supply issues should a failure occur. The project is estimated to cost £6.1m with an NPV of £326m and a payback period of one year (on a simple cashflow basis). The reason why such high values are generated is explained in the NARMs and CBAs box below.
3. **PRS – site C.**[7] The site dates back to the 1900s when it provided gas through the coking of coal. Today, the site feeds gas to more than 157,000 customers and provides a storage facility that is a crucial part of the LNG supply chain for four SIUs (section 17.11). The project's scope includes a full rebuild, involving heating, filtration, pig-trap and pressure control. It also includes a replacement of existing above ground pipework with buried cathodic protection and all above ground assets will be rationalised to within the fence line. The project is estimated to cost £14.4m with an NPV of £23m and a CBA payback period of 17 years.
4. **PRS – site D.**[8] The project will replace the heat exchangers and defective site filter systems which are currently on a more regular inspection programme due to a known fault. Replacing these faulty parts will return the PRS to normal service, ensuring it maintains the integrity of the gas supply. The project is estimated to cost £3.2m with an NPV of £6.4m and a CBA payback period of 12 years.
5. **LTS – site E.**[9] This stretch of two high pressure gas pipelines crosses the London to Brighton rail lines on two bridges. Detailed condition surveys of the pipeline and bridges provide clear evidence of significant deterioration, paint loss and corrosion. Losing the bridge would significantly impact the transmission network in the South East. The project is estimated to cost £2.3m with an NPV of £8.7m and a CBA payback period of nine years.

For the above NARMs related investment the CBA has been generated directly from the outputs of the NARMs methodology, which quantifies the change in the monetised risk between two intervention strategies: the minimum intervention represents the ongoing repair of the asset and the preferred intervention option.

NARMs and CBAs.

Moving from an estimate of monetised risk as a single point estimate, to a relative reduction of long-term monetised risk as describe in the SSMD,* creates a strong dependency on the anticipated rate of asset degradation. The graphs below show the monetised risk associated with two components of the site B offtake according to their asset degradation curves. This offtake is a critical point of the network which at times of high demand acts as a single feed. While at times of lower demand there is greater resilience, the monetised risk should be consistent with the worst-case outcome.

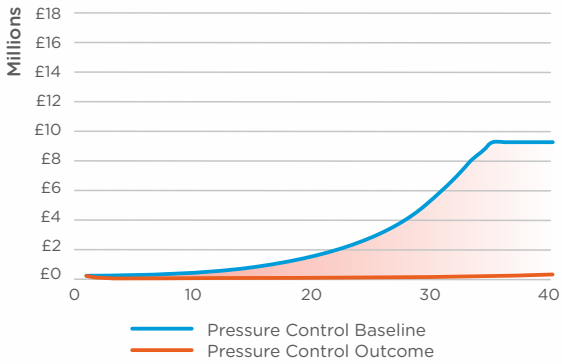
These graphs show the pressure control and the pre-heating at site B. The dark blue line is the 'do nothing' baseline and shows an increased value of monetised risk over time. The preferred option is the lower orange value which immediately reduces monetised risk and then gradually increases over time. The area between the two lines is the long-term monetised present value of risk avoided.

For the pre-heating we identify the value attributed to social, environmental and health costs rapidly build from £4m up to £16m a year. This is artificially capped within the model, otherwise it would continue to increase.

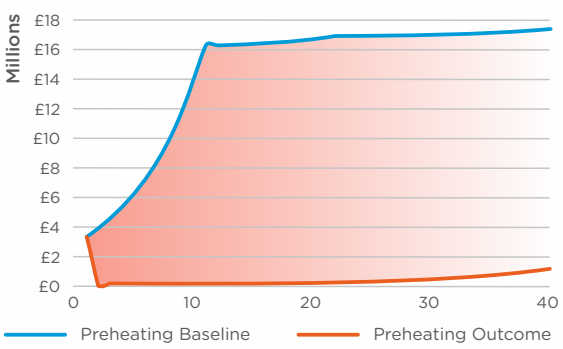
The long-term monetised present value of risk is therefore highly dependent not only on the location of the asset on the asset degradation curve (which we calculated based on condition monitoring), but also the shape of the asset degradation (which is more uncertain as we have limited probability of failure data for critical assets particularly towards the end of the degradation curve) and a judgement call on what is the appropriate way to cap the model.

Site B feeds 135,000 domestic customers, 2,500 commercial customers and nearly 1,000 critical customers. There would therefore be a serious cost associated with a critical incident. Using the current NARMs methodology this serious cost impact is rolled into a single present value.

Pressure control – monetised risk



Preheating – monetised risk



8.1.3 Transmission projects: other projects and programmes

In addition to the projects covered by NARMs or individual CBAs, we have 51 transmission integrity projects and programmes which have a value of less than £500k a year. This gives an average cost of £1.3m a year. This is higher than £500k due to some large mandatory inspections and revalidation programmes, such as the revalidation of water bath heaters, ac/dc current monitoring and online inspections.

8.2 Repex asset resilience

Our replacement programme is set out in appendix 019, Replacement expenditure, section 6.4. This describes our £1.3bn investment strategy for the distribution network, an average expenditure of £263m a year. Of this, we will invest £100m a year in NARMs related projects and £149m a year in named projects that are not covered by NARMs. The remaining £14m a year will be covered by projects that are not covered by either NARMs or a CBA.

8.2.1 Repex assets: monetised risk

Table 8-5 identifies whether an investment is driven by NARMs or if it is covered by an existing PCD or volume driver. This investment strategy is determined by regulations set out by the HSE regarding the risk posed by iron mains. For each line we have referenced where the investment can be identified in the Business Plan Data Template (BPDT).

Table 8-5 Repex asset monetised risk categories

Asset group	Mains	BPDT	Steel services	BPDT
Tier 1 iron mains	PCD	4.01	NARMs	5.17
T1 iron mains stubs	PCD (# of stubs)		n/a	5.17
Tier 2A iron mains	Volume driver	4.02	Volume driver	5.17
<=2" steel mains	Volume driver		NARMs	5.17
Tier 2B iron mains	NARMs		NARMs	5.17
Tier 3 iron mains	NARMs		NARMs	5.17
>2" steel mains	NARMs		NARMs	5.17
Iron mains >30m	NARMs		NARMs	5.17
Mains diversions	NARMs		NARMs	5.17
Risers to MOB properties	NARMs		NARMs	
PE service transfers	NARMs			
Bulk service renewals	NARMs			
Named projects	NARMs			
IP Reconfiguration	NARMs			

[5] Set out in 'SGN Trans – 021Lock – EJP – Dec19a' and 'SGN Trans – 001Lock – CBA – Dec19a'
[6] Set out in 'SGN Trans – 001Mapp – EJP – Dec19a' and 'SGN Trans – 001Mapp – CBA – Dec19a'
[7] Set out in 'SGN Trans – 022Prov – EJP – Dec19a' supported by two CBAs 'SGN Trans – 022aProv – CBA – Dec19a' and 'SGN Trans – 022bProv – CBA – Dec19a'
[8] Set out in 'SGN Trans – 012Read – EJP – Dec19a' and 'SGN Trans – 012Read – CBA – Dec19a'
[9] Set out in 'SGN Trans – 020Hool – EJP – Dec19' and 'SGN Trans – 002Hool – CBA – Dec19'
* RIIO -2 Sector Specific Methodology – Core Document, Ofgem, 24 May 2019

As with transmission, discussions relating to the format of NARMs targets for GD2 are ongoing. As a result, the figures shown in table 8-6 give the GD1 equivalent NOMs targets.

Table 8-6 Repex GD1 realised asset monetised risk delta values

SGN assets	Units	2013	2021 without investment	2019 actual	Actual change	Target 2021	Target change in risk by end of GD1
Mains	km	108.9	136.3	105.9	30.4	104.0	32.3
Services	# of	68.8	89.2	78.8	10.4	81.8	7.4
Risers	# of	2.7	3.8	1.6	2.2	1.1	2.6
Total		**180.5**	**229.3**	**186.3**	**43.0**	**187.0**	**42.3**

For GD2 the monetised risk score is separated between six asset categories covering mains and services. These are shown in table 8-7 for each asset category from the start to the end of GD2, with and without an intervention. There is a significant change in the monetised risk between the GD1 and the GD2 figures because the model which forms the basis for GD1 has been rebased for GD2.[10]

Table 8-7 Repex proposed GD2 asset monetised risk delta values

	2021	2026			
Asset category	Without intervention	Without intervention	With intervention	Delta	BPDT
Iron mains	187.7	234.1	192.9	41.2	5.17
PE mains	12.9	13.8	14.6	-0.8 (*)	5.17
Steel mains	46.3	54.7	49.7	5	5.17
Other mains	0.5	0.5	0.5	0	5.17
Services	64.5	72.5	65.2	7.3	5.17
Risers	5.3	6.2	5	1.2	5.17
Totals	**317.2**	**381.8**	**327.9**	**53.9**	

(*) the negative value for PE mains is due to the changing population of PE as we replace iron mains with PE mains

Within NARMS we have also identified three projects that are unique in their cost characteristics, listed below.

1. Repex - site 8.[11] A single supply intermediate pressure steel gas main that runs under the river Swale in the deep service tunnel arrangement. This pipeline has been assessed and the section in the service tunnel requires replacement due to its condition. The pipeline is the single source of supply and its failure would lead to the loss of supply to approximately 11,000 customers and three prisons. The project replaces the existing IP with a new IP gas main costing £4.9m. Our CBA shows a payback within a 12-year period and a £5m NPV.
2. Repex - site G.[12] An IP steel pipeline . Appropriate inspection work cannot be undertaken due to remedial work completed over 25 years ago when parts of the tunnel were fully filled with concrete, but to an unknown extent. A failure in this asset would lead to a loss of supply to over 12,500 customers, with significant risk to life and travel disruption. We are proposing to decommission the existing main and lay a new pipe at a cost of £1.4m. The CBA assessment shows a payback within a 12-year period with a £1m NPV. This was set out in section 7.5.5 along with Kings Ferry.
3. Repex – IP reconfigurations to domestic properties.[13] This is to resolve a legacy issue of IP supplies to domestic properties, where we are proposing to replace 515 supplies in Scotland at a cost of £4m. The CBA assessment shows a payback within 26 years with an NPV of £200k, as set out in section 7.5.4.

8.2.2 Repex: named programmes (with a value greater than £500k)

Named projects that are outside of NARMs include the majority of the mandatory workload that we have to complete under the HSE Iron mains replacement programme. These all have associated CBAs an EJPs and the associated outputs are identified in section 7.4 and 7.5.

8.2.3 Repex: other projects and programmes

The remaining expenditure of £14m is associated with smaller projects that are less than £500k. These make up approximately 5% of total annual expenditure.

[10] The GD1 model data can only be changed through a defined material change process. As it is not a reporting output in GD1 we have provided it for reference of how risk has changed on a comparable basis, the updated risk is incorporated in the GD2 model.
[11] Set out in 'SGN Repex – 011 Kings FerrySo – EJP – Dec19a' and 'SGN Repex – 011 Kings FerrySo – CBA – Dec19a'
[12] Set out in 'SGN Repex – 012 Cams HallSo – EJP – Dec19a' and 'SGN Repex –012 Cams HallSo – CBA – Dec19a'
[13] Set out in 'SGN Repex –013 IP ServiceSo – EJP – Dec19a' and 'SGN Repex – 013 IP ServiceSo – CBA – Dec19a'

8.3 Distribution asset resilience

Our distribution asset resilience programme is set-out in appendix 012, Distribution integrity and governors. This details our £84m investment strategy for maintaining the operational integrity of the local distribution network, an average expenditure of £17m a year. Of this, NARMs applies to governors which account for £11.5m a year out of the total: a CBA covers approximately £8m, with the remaining £6m split across identified programmes, supported with CBAs and EJPs.

8.3.1 Distribution: monetised risk

As with repex, the NARMs methodology has only been recently extended to cover distribution assets. Rolling the analysis back over activities completed in GD1 shows that our investment strategy largely offsets any change in risk during GD1.

Table 8-8 Distribution GD1 realised asset monetised risk delta values

SGN assets	Units	2013	2021 without investment	2019 actual	Actual change	Target 2021	Target change in risk by end of GD1
Governors	# of	11.5	12.9	12.3	0.7	11.4	1.5
Total		**11.5**	**12.9**	**12.3**	**0.7**	**11.4**	**1.5**

For GD2 the risk profile of the governors is expected to increase from £30m to £33m.

Table 8-9 Distribution proposed GD2 asset monetised risk delta values

	2021	2026			
Asset category	Without intervention	Without intervention	With intervention	Delta	BPDT
District governors	25.4	28.8	28.1	0.7	5.17
I&C governors	1.1	1.2	1.2	0.0	5.17
Service governors	3.6	3.7	3.5	0.3	5.17
Totals	**30.2**	**33.7**	**32.7**	**1.0**	

8.3.2 Distribution assets: named projects and programmes (with a value greater than £500k)

We have identified 22 programmes on the distribution network that are not covered by NARMs but are significant enough to reach the £500k threshold for CAB and EJPs. Comprising new work and the continuation of ongoing programmes, all are fully supported by EJPs and CBAs and available in the Distribution integrity appendix. Examples of projects include the following.

- Coastal erosion.[14] We maintain over 1,000 below ground river crossings. In the last four years there have been four major incidents where pipes have become exposed. We have identified ten river crossings requiring remediation work in GD2 at a cost of £1.4m.
- Railways crossings.[15] The electrification of existing and new rail lines introduces a heightened risk of corrosion on nearby metallic pipes. The solution is location dependent involving either moving the gas mains or making sure appropriate cathodic protection is in place. We are proposing to invest £4.2m on necessary remedial and diversionary work to maintain network integrity.
- Solar PV on profiling governors.[16] A small number have been installed to date, successfully reducing energy imports and increasing our self-sufficiency by reducing our reliance on batteries and associated hazardous waste. We are proposing to invest £3.4m across governor sites once site-specific surveys have confirmed they are appropriate. This is written-up in more detail in our environmental action plan (section 9.6.5).

Altogether, these named projects and programmes account for over 41% of asset investment anticipated in the distribution network.

[14] SGN Dint – 013 CoastEros Sc - EJP Dec19 and SGN Dint – 002 CoastEros So - EJP Dec19
[15] SGN Dint – 015 CathProt Sc - EJP Dec19 and SGN Dint – 015 CathProt Sc - EJP Dec19
[16] SGN Dint – 019 SolPV So - EJP Dec19 and SGN Dint – 009 SolPV So - EJP Dec19

8b Business IT security and cyber resilience

Our IT systems, services and infrastructure underpin the resilience of our network management, as well as our ability to provide emergency response and serve our customers. UK Government and Ofgem, along with our stakeholders and advisers, recognise the scale of cyber threat to critical national infrastructure and UK utilities, and the need to substantially increase cyber security. In GD1 we have invested accordingly. A portion of the £145m voluntary customer contribution we made was specifically targeted at improving physical and cyber security across our entire estate.

We have been recognised externally at the 2018 UK IT Industry Awards where we won Cyber Security Project of the Year. We take all necessary action and measures to comply with the Network and Information Systems Directive (NISD), to manage risks posed to our network and information systems security. We work closely with the National Cyber Security Centre (NCSC), Ofgem's cyber resilience team and have used the Cyber Assessment Framework (CAF) to identify any areas of weakness in our capability for the avoidance of disruption to services. Guiding strategies are included below.

- **The UK national cyber security strategy 2016-2021**[17] identifies that cyber-attacks are growing more frequent, sophisticated and damaging. The strategy sets out a plan to defend systems and infrastructure, deterring adversaries, and developing capability.
- **Network and information systems regulations 2018 NIS regulations (NIS-D).**[18] In 2013 the EU put forward a proposal to improve preparedness for a cyber-attack that became the Directive on the Security of Networks and Information Systems (the NIS Directive) in August 2016. We have been party to several meetings with Ofgem to define and agree this framework and its application to the GD2 price control mechanism.
- **Energy Emergencies Executive Committee Cyber Security Task Group** provides evidence and real examples of the level of industry engagement and workload required to adequately address and continually improve cyber security looking across the supply chain.

When considering our approach to security we maintain Ofgem's clear distinction between IT (information technology) and OT (operational technology). This is not to diminish the growing and important overlap between the two, but recognises there is a risk that OT receives less investment and management attention than its IT counterpart. Coupled with a slower rate of redundancy and increased connectivity, OT can create greater levels of exposure to cyber threats.

We view cyber resilience according to a number of considerations.

Operational technology (OT) – current. The risk from cyber security incidents in gas control and wider operational environments is set to remain. Such incidents could threaten lives as well as damage equipment, infrastructure and the environment. The blurring of previously distinct IT and OT environments is set to continue with more connected 'things' using cloud services over the internet. This is true of our distribution and transmission networks and not solely related to CNI assets. This more complex and fragmented network will require additional security coverage as identified in the IT appendix, section 5.1.

Operational technology (OT) – future. More than in most other sectors, cyber-security incidents in industrial environments can result in physical consequences that can threaten lives, damage equipment, infrastructure, and the environment. It is the physical manifestations and impacts of OT security incidents that continue to be a risk priority for us and other GDNs. These are over and above the traditional IT-related security threats in industrial environments that we have to manage. The convergence of IT technologies and the OT space comes with the benefits of increased accessibility and a larger base of skilled operators relative to nonstandard and proprietary communication methods. However, this also increases vulnerabilities as more OT becomes more accessible and widely known, making security a major concern.

Information technology (IT) – current. Our GD1 IT expenditure has been independently assessed and evaluated in detail by an independent and globally recognised technology research and advisory company, comparing us against like-for-like companies, i.e. UK asset-based utilities. This analysis has found that throughout GD1, we have demonstrated "best in class" cost efficiency. We have achieved this while providing globally leading IT services, as evidenced in our advisory papers submitted with our plan.

Information technology (IT) – future. The response time faced when dealing with cyber threats has shortened from 12 months at the beginning of GD1 to less than a fortnight. Companies now need a cyber security capability to protect and respond in a matter of hours across their entire IT estate.

Threats – current. Historically, attackers were skilled individuals with deep knowledge of technology and the systems they were attacking. However, as technology has advanced, tools have been created to make attacks much easier to carry out. These tools have become more broadly available and easier to obtain.

Threats – future. A new and increasing threat is the sophistication of nation state targeted attacks, either meant deliberately to affect operations or as staging posts for future disruption. Nation states attacks described as Advanced Persistent Threats (APTs) are predicated to continue. NCSC and the US cert have issued several advisories during 2017/18 identifying APT attack patterns moving across the supply chain. The supply chain remains a prioritised risk for GDNs across their IT and OT estate.

As well as the direct threat to cyber security we must increasingly be aware of the penalties that may arise if standards are not delivered. General Data Protection Regulations (GDPR) expose companies to fines of up to 4% of revenue for a breach in security assurances around

[17] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/567242/national_cyber_security_strategy_2016.pdf
[18] https://www.ncsc.gov.uk/guidance/introduction-nis-directive

personal data. The EU NIS Directive exposes network companies, such as SGN, to fines of up to 4% of revenue for disruption to services caused by cyber breach. Ofgem are proposing additional reporting and assurance on the EU NIS-Directive and potentially additional enforcement actions if deemed to be non-compliant prior to any breach occurring.

Cyber security incidents in our industrial environments and day-to-day operational IT systems, such as our emergency gas response service, can result in physical consequences that can threaten human lives, as well as damage equipment, infrastructure and the environment. While there are certainly traditional IT-related security threats in industrial environments, it is the physical manifestations and impacts of the operational technology security incidents that continue to be a risk priority with the potential risk of a major disruption of the gas supply within the UK energy sector. In addition to physical damage, operational interruptions have occurred in the utility sector outside the UK due to cyber security incidents.[19]

8.4 Business IT security plan

Our framework is driven by four objectives (listed below) covering the entire breadth of our cyber security management approach across all our estates, aligning with stakeholders' expectations, mandatory compliance standards and behaviours demanded in this area.

- **Managing security risk** - we will have appropriate management policies and processes in place to govern our approach to the security of network and information systems
- **Protecting against cyber-attack** - we will define, implement, communicate and enforce appropriate policies and processes that direct our overall approach to securing systems and data that support delivery of essential services
- **Detecting cyber security events** - we will monitor the security status of the networks and systems supporting the delivery of essential services to detect potential security problems and track the ongoing effectiveness of protective security measures
- **Minimising the impact of cyber security incidents** - we will have well-defined and tested incident management processes in place, that aim to ensure the continuity of essential services in the event of system or service failure. We also have mitigation activities designed to contain or limit the impact of a compromise should it occur.

We operate a centralised IT and cyber security operations model which we believe has proven to be the most cost effective and efficient support model to ensure adequate service support. As a part of this centralised operations model we have invested heavily in cyber security to ensure coverage of OT cyber risks such as dedicated monitoring of SCADA systems, infrastructure asset protection and cyber risk monitoring. Security logging, incident alerting and incident management remain a centralised service via our managed security service provider. In addition, platform services like end user computing device encryption, virus scanning, network security monitoring and firewall management costs are classified as IT costs but underpin our ability to provide these services across our OT assets.

This centralised approach ensures we maintain consistent continuity of security monitoring and response operations. A cyber security breach on an IT system can be as detrimental to customer outcomes as a breach on the OT system, as was demonstrated by the WannaCry virus in 2017.

It is important to bear in mind that the interconnected nature of IT and OT means that at a technical and physical level, the cyber risks facing both are shared. External attacks on vulnerabilities in desktop or laptop operating systems can be used to exploit our control room. Compromise of our active directory, business IT security, could result in escalation of privileges that compromise the OT cyber resilience.

Recruiting and retaining key security staff and skills to deliver both OT and IT cyber security requirements is also challenging. We are in a highly competitive cyber security skills market which underlines the importance of creating and maximising opportunities to collaborate and share information and support across the sector.

This collaboration will drive an effective and collective response that maximises expertise and the learning potential for all. Our plans include investment to significantly improve this internal capability and skill level covering both business IT security and cyber resilience. We have applied a notional percentage of this investment in capability to OT however we believe that the greatest benefit will be driven by singular and centralised resource to maximise potential and efficiency.

We have provided a detailed and well justified list of all areas of expenditure relating to business IT security in our associated EJP and accompanying CBA.

To manage our ever-increasing cyber risk profile across our entire IT estate, we have proposed doubling the size of the security team over the course of the next five years to supplement all five domains of Identify, Protect, Detect, Respond, Recover. This investment will also support the delivery of Ofgem's NIS-D requirements as defined and communicated prior to September 2019 and has been separated out accordingly through the provision of two sets of business plan data templates for OT cyber security (BPDT 5.12) and one for IT cyber security (BPDT 5.13).

To provide a higher level of confidence on the proposed investment strategy for GD2 we have listed in detail all of the areas we intend to invest in and provided an accompanying EJP on cyber security.[20] The EJP covers both IT and OT, as set-out in section 8.5. The OT component is based on our plans to date and does not reflect any additional Ofgem driven requirements identified post September 2019. We have set out in section 12.2.12, a bespoke reopener that enables us to adjust the plan to account for any significant changes in these requirements.

It is also important to note that this investment is based on our understanding of today's requirements and will change during GD2 as new threats emerge and regulatory requirements are introduced. We have discussed our plan with specialist stakeholders such as NCSC, E3CC advisory group and we have been guided by their feedback. We will continue to liaise and listen to the important feedback from these groups on an ongoing basis both pre GD2 and throughout this period.

[19] Examples: 2000, sewage control system of Maroochy Shire in Queensland, Australia, was hacked into remotely and released 800,000 litres of sewage into the surrounding waterways. 2015, the control systems of the Ukrainian power distribution operator were remotely accessed by attackers, causing an outage that lasted several hours and resulted in days of degraded service.

[20] The engineering justification paper is SGN IT – 007 Cyber EJP Dec19 and is accompanied by SGN IT 007 Cyber – CBA Dec 19

Recognising this changing risk environment we agree with proposals from Ofgem for a mid-period reopener, section 12.3.5.

In GD2 we will continually assess and confirm the right areas of investment by using our Cyber Assessment Framework (CAF), and through interaction with industry and advisory bodies such as the E3CC group, cyber security advisors and specialist vendors via our cyber security group which contains all our key security service providers covering both IT and OT.

We will continue to develop and improve our internal key performance indicators (KPIs) to continually assess and ensure investment in cyber security is appropriately targeted and effective. KPIs for cyber security measures are listed below.

Operational security metrics:
- patch coverage and latency, for example number of critical patches applied within a period
- antivirus coverage, for example percentage coverage of antivirus across the estate

Security incident management:
- total number of security incidents reported monthly
- total number of incidents addressed within agreed timescales

Compliance:
- percentage of total number of critical systems or processes audited
- number of high or very high-risk issues as an outcome of audits

Access control:
- number of privileged access accounts that have been inactive for a set number of days
- number of accounts that have not been disabled for leavers

External threat level:
- global security threat levels
- UK utilities threat level

The metrics above are a subset of operational reports in line with current governance structures and are not exhaustive. We have currently identified £3.6m per year for our business IT security plan. This is separate from our cyber resilience (below) and business as usual IT investment that is included in section 17.9.

8.5 Cyber resilience plans

The operational technology (OT) cyber resilience plan is specifically focused on the cyber resilience of physical equipment that is located on the network for example, remote telemetry units, micro-boxes and their associated connectivity, used to provide information and control functions to aid the operation of the network, as well as the supervisory data acquisition and control systems (SCADA) and the associated supporting systems, necessary to process information received from the equipment and manage the day-to-day control of our gas network.

Communication networks to remotely monitor OT have been used in industrial environments for decades. These systems have typically been standalone and physically isolated from the traditional IT enterprise networks in the same companies. This network separation originally led to the independent evolution of IT and OT networks protected by an air gap, keeping the two systems apart.

In practice, today's OT is rarely as clearly distinct, and while there is a varying amount of interconnection between OT and IT network environments, there is an ever-increasing number of IT technologies in the OT space to improve the accessibility and pool of skilled operators to draw from. This trend will continue through GD2.

In-line with the guidance we have received from Ofgem as part of our plan review and consultation, we have attempted to delineate and separate business IT security costs and cyber resilience costs. We highlight that there is a level of judgement applied in the allocation and delineation of services and costs that are centralised and shared in practice. Privileged access management as an example, is a centralised solution, cost and capability that sits across our entire estate. We have however apportioned a percentage of these costs to managing our OT estate.

In line with Ofgem guidance, we have separated the specific projects that only and solely relate to OT. This amounts to circa 10% of our total cyber security investment plans. We have also allocated a percentage of the remaining investment costs to OT cyber resilience to recognise the shared and centralised nature of our cyber security management. These costs however, must be looked at jointly to ensure cost efficiency and shared, centralised capability development which if reduced in one area, will impact the other.

In conjunction with Ofgem and other gas network companies, we have developed an extensive and comprehensive cyber security framework to be reported on by us to Ofgem as part of evidence of NIS-D compliance. This will be linked to the GD2 outputs framework.

The proportionality and appropriateness of measures have been captured within the parameters defined by Ofgem as part of the NIS-Directive and documented in our CAF. Specifically CAF 'section 2.6: Proposed improvements' - was developed by following Ofgem guidance to determine proportional measures. CAF 'section 2.7: mitigation priorities', was developed following Ofgem guidance covering the appropriateness of our cyber risk register. This may give rise to organisational changes required to support future OT management.

Compliance and risk identification have been captured within the parameters defined by Ofgem as part of the NIS-Directive and documented in our CAF 'Section 2.2: Compliance and risk identification', was developed by following Ofgem guidance to determine compliance measures and CAF, 'Section 2.3: Risk assessments', were developed by following Ofgem guidance to determine risk identification based on sources of threat intelligence.

We have detailed our current risk assessment and linked proposed initiatives to each risk as shown within our Cyber security EJP and accompanying information. We have also provided low-level and very detailed cost estimation information for each initiative to evidence our funding request for GD2.

Based on these assessments we have identified specific initiatives to help manage threats identified in line with our CAF. These are set-out in supporting documentation and will be subject to the reopener mechanism.

We have identified £800k per year for OT cyber resilience that we expect to be subject to a reopener. We have put the Business IT security and cyber resilience plan in the context of total IT expenditure in the table below. This contrasts with the figures set-out in section 16 where IT costs have been allocated to the business according to use. There is not a direct comparator to GD1, as the costs were not allocated in this way.

Table 8-10 Business IT security and cyber resilience plan (unallocated)

IT capex and opex costs	Business plan section	Cost £m a year	Total cost £m	BPDT
Business IT security plan	8.4	3.6	18.1	5.13
Cyber resilience plan	8.5	0.8	4.2	5.12
Additional outputs (DCC, Open data, technology readiness)	10.7-10.10	4.4	22.1	3.05 & 2.07
Mandatory IT	17.9	9.4	47.2	3.05 & 2.07
Investment run	17.9	3.7	18.4	3.05 & 2.07
Licencing, ongoing and staff costs	17.9	29.4	147.0	3.05 & 2.07
Total IT		**51.4**	**256.9**	

8c Workforce planning

Running our network requires a highly skilled workforce. Our employees are central to delivering our three customer commitments: keeping our networks as safe and resilient as they are today, helping the UK Government create a sustainable, affordable and reliable future for heat and increasing our positive impact on society.

Our people strategy will help us respond effectively to the challenges ahead in a rapidly changing world and ensure our workforce is fit for the future. We will keep our plans up to date and agile, engaging with external stakeholders throughout the transition of the energy system towards net-zero.

Over the course of GD1 we have maintained a direct workforce of around 3,900 employees and over 2,500 of these employees are directly engaged in operational activities. Independent analysis identified the challenges in maintaining workforce resilience, with significant numbers of retirements and increasing churn rates forecast over GD2 and out to 2035. The analysis concluded 1,861 employees would leave us during GD2 (around 400 more than during the first 5 years of GD1), mainly due to increased levels of churn.

We are proposing to broadly maintain the same direct employee headcount in GD2 to enable us to deliver the additional outputs in our plan and reduce our dependency on contracted staff. We think this is important to maintain essential skills in a workforce that we anticipate will have an increasing churn rate.

Our people strategy brings together our overall ambition to ensure that SGN is a great place to work, with the practical focus on the recruitment, retention, training and development essential to build a diverse, productive and sustainable workforce.

Key elements of our strategy are described below (in sections 8.6 to 8.13) and include:

- maintaining our high quality, highly skilled workforce through recruitment and training
- providing stable, secure employment with a fair reward
- offering good opportunities for development and progression
- caring for the safety, health, well-being and work-life balance of our employees
- acting as a responsible and ethical employer, making a positive impact on society
- developing great managers, who are skilled at motivating teams and driving performance, while at the same time maintaining employee engagement and commitment
- building a diverse workforce that represents the communities we serve, where all employees feel welcome, valued and listened to
- promoting, flexibility and agility and preparing our people with the skills they need to transition towards a decarbonised future

Our workforce strategy supports the close monitoring and maintenance of the standards of service that keep our customers safe. It also enables us to more effectively roll out innovation and new processes into delivery, building the agility we will need to support the energy transition.

8.5 Engaging with stakeholders

Encouraged by our CEG, we have built on early engagement with stakeholders[21] and started to consult widely to discuss future skills requirements, particularly technical skills requirements with the EU Skills Delivery Board, IGEM, other gas networks, Gas Network Skills Forum and the Hydrogen Transformation Group. We also engage with fellow members of the Engineering Council, the Engineering Equipment Materials User Association and the UK Onshore Pipeline Operators Association. Recognising the importance of ongoing engagement

[21] MFT Workshops November 2018 London & Edinburgh (ref 013, 014)

throughout GD2, particularly as skills requirements change, we are setting up a Technical Training Steering Group which will bring together representatives from expert external organisations and key leaders from within the business.

Given other future skills requirements such as cyber, digital and leadership, our intention is to broaden out the technical steering group during GD2 and hold an annual Skills Update Forum to ensure our people development strategy is aligned with latest thinking.

We engage with trade union representatives on an ongoing basis and discussed the development of the plan with the Joint Consultative Committee (JCC) in July 2019[22] Members of the JCC expressed overall support for our approach, with many members of the group speaking in favour of investment in apprenticeships and trainees. Members also recognised the importance of diversity and encouraging more women into the industry, suggesting we increase the emphasis on diversity in the business plan, which we have implemented (see section 8.12). Representatives also wanted us to reflect the challenges and opportunities of decarbonisation for the company and its people and the importance of well trained and skilled colleagues to be able to move towards this new future for the industry (see section 8.13).

At our Moving Forward Together stakeholder workshops in November 2018,[21] we discussed the importance of investing in people's skills to develop competent engineers who will maintain a safe and resilient network. Stakeholders agreed apprenticeships are a good way of attracting new people to our business and help to mitigate the risk arising from significant numbers of our most highly trained and experienced employees leaving us over GD2. They also made it clear that apprenticeships are not just for young people - the opportunity to retrain should be extended to people with previous experience and transferrable skills, such as former members of the armed forces. We agree, and were recently awarded the Ministry of Defence's gold award in recognition of our support for the military veteran community.

Stakeholders were keen to explore ways in which we can reduce churn and improve staff retention; developing current employees by moving them into different roles is a good starting point but we should also communicate the value of the exciting future careers available as the energy industry transitions.

To widen our talent pool as far as possible, again encouraged by our CEG, we are refining our diversity and inclusion strategy for GD2, engaging with stakeholders with expertise in disability and ethnic diversity. We have created an ongoing engagement programme, (see our Workforce resilience appendix) which we will continue to iterate with input from our Technical Training Steering Group and annual Skills Update Forum.

8.6 Maintaining our highly skilled workforce

The highly skilled nature of our workforce is important and must be maintained so we can continue to meet our obligations to our customers; working safely, effectively and to all required standards.

8.6.1 Maintaining a resilient workforce

We have summarised below the conclusions from an independent assessment we commissioned in 2018 to forecast changes in our workforce:

- increased numbers of employees are likely to leave us during GD2 (nearly 400 more during GD2 compared to the first 5 years of GD1, mainly down to increased churn)
- to maintain our current direct workforce size, we will need to replace these leavers with around 1,861 new employees during GD2
- this means we are likely to face a significant increase in recruitment and training and development effort over GD2, compared to GD1

We used this analysis to inform our workforce planning, alongside our assessment of reductions in workload that we expect to occur during GD2 resulting from lower repair, replacement, reinforcement and meter work. We also considered the skills and flexibilities of our existing directly employed operational workforce to take on additional duties.

With increasing churn levels, we believe that the retention of our existing direct operational workforce at its current level will enable us to better maintain our current commitments to safety and customer service. It will also provide a greater resilience for maintaining our standards of service during periods of high demand, for example for a gas supply incident or extreme weather conditions. By ensuring our resources are cross-skilled we will be able to transfer them to other productive work during periods such as the summer months when workloads may be lower, as described in our Emergency service appendix.

From our workforce modelling, we estimate our total requirement is 2,792 appointments, of which 895 could be fulfilled through internal upskilling.

8.6.2 Regional differences between labour markets

Our approach to filling these roles will depend on their location;

Southern. Our southern network operates in some of the most densely populated urban environments in the UK. Skilled labour is in high demand from utilities and other employers, not just within the London and the M25, but over the majority of the South East and M4 corridor as well as for large construction projects such as HS2 and Crossrail. The London influence now stretches well beyond the M25, with a greater mobility and willingness to commute. Over GD1 we have experienced increasing difficulties in recruiting and retaining skilled and trained employees. Large parts of our southern network operate in areas with the highest levels of employment and pay, and lowest levels of unemployment. This has made recruitment for suitable employees difficult in key towns such as Oxford, Reading, Guildford, Sevenoaks and Dartford.

Scotland. Conversely in Scotland, our network operates in a more sparsely populated environment than any other gas network. This has implications for attracting local workers in some of the most remote areas, as well as finding and retaining appropriately skilled employees in the more densely populated and complex areas like Edinburgh or Glasgow. In these regions we compete with other utilities for a much smaller talent pool.

[22] JCC Meeting minutes 9 July 2019

We plan to continue to deliver our replacement programme in GD2 primarily by contracted resources. In our southern region we depend upon contracted resources to deliver the majority of the workload due to the scale of the delivery challenge. In Scotland the workload is mixed with approximately half being delivered through contracted resources. The same regional pressures that are affecting recruitment, retention and costs of direct labour are also affecting our contractors and therefore our costs. However we have taken strategic steps to mitigate these increases as well as safeguard our service levels by bringing contractor supervision in-house, as described in our Work management and business support appendix.

8.6.3 Sustaining skills

We commissioned an independent report to better understand the labour market and competition for skills, which listed a number of key findings, including:

- anecdotal evidence from employers, corroborated by national statistics, indicates the skilled technical and engineering labour market is effectively at full employment;
- skills shortages in the gas industry are at 44%, nearly twice the national average and driving higher salary demands;
- an expected £600bn plus investment in essential infrastructure over the coming five years means challenging labour market conditions are likely to prevail for the years ahead;
- a dramatic fall in the number of EU citizens coming to the UK for work since 2016, combined with an increase in numbers leaving the UK; and
- the apprenticeship levy available in Southern, is not available in Scotland.

These regional factors are described further in section 12.4.

Of the estimated 1,900 external roles, we expect over 1000 will be from outside the sector, for roles that do not require skill sets specific to the gas industry including digital and cyber security (section 8.6).

In our Workforce management appendix 009, section 5.1, we have set out the training requirements for filling these roles. This will include graduate-level roles and trainee team managers, then a balance of trainees on shorter one to three-year schemes and apprenticeships on two to four-year schemes.

We recognise that apprenticeships are widely valued, attract good quality applicants and produce employees with formal qualifications and a well-rounded knowledge of gas distribution engineering. In the plan and following discussion with stakeholders and the CEG we have tried to balance these broader benefits with their higher associated costs of learning and development.

Following these discussions, we have proposed 185 apprenticeship across SGN. We believe this provides the right balance between developing the skills we need, providing a well-rounded workforce and delivering the broader social benefits of supporting structured investment in core STEM skills, while maintaining costs at an appropriate level. It reflects views expressed by our stakeholders[23] as well as current, future and small business customers, who were supportive of investment in training to build skills for the future in workshop discussions.[24]

Table 8-11 Training resource and cost of our workforce plan

	Annual Averages	GD2 Total
Apprenticeships (2 – 4 years)	37	185
Trainees (1 – 3 year schemes)	95	477
Graduates (2 year schemes)	4	22
Trainee team managers (2 year scheme)	32	159
Other external appointments	211	1,054
Internal upskilling	179	895
Total numbers of people	**558**	**2,792**
Cost training £m	7.9	39.6
Cost of maintaining existing competencies £m	0.5	2.6
Cost of SGN training team £m	2.1	10.7
Total cost included in totex	**10.6**	**52.9**

8.7 Stable employment for a fair reward

Our aspiration is to continue to be an employer that provides secure, long-term employment and fair, competitive, market-rate reward. We align our executive, senior leader and other bonus arrangements to the achievement of targets important to our stakeholders, and our overall ambition balances the need to ensure value for money for our customers.

We will keep our reward packages and employment costs under review over GD2, through effective benchmarking and analysis of leaver trends and regional factors. Our aim will be to control costs to provide good value for money for customers and stakeholders, while providing fair and competitive market-rate remuneration for current and future employees. We are proposing a number of changes in our approach for GD2, as well as a continuation of work already underway.

- We will use appropriate mechanisms to retain scarce talent, incentivise and reward employees, adding value, driving performance and shaping long-term thinking.
- We will continue to review our gender pay performance and adjust as necessary to ensure we are attracting and retaining the talent we need.
- We will seek accreditation as a living wage employer.
- We will continue to collectively bargain pay deals and other significant changes to terms and conditions with our recognised trade unions. Competition for skills, record employment, pressure on wages and the changing nature of our workforce will almost certainly increase expectations and demands among our employees, particularly in the South where wages and cost of living are higher. We agreed a four-year above inflation pay deal in 2018 with particular focus on those with the highest skills in critical areas however our benchmarking partner confirms that the salaries we pay are still only market median in the South.

[23] MFT Workshops November 2018 London & Edinburgh (ref 013, 014), Safe & Efficient round table event - London (ref 089)
[24] Business Plan Acceptability Testing Phase 1 (ref 078)

8.8 Opportunities for development and progression

Talent and succession are top priorities for the remainder of GD1 and into GD2. We are developing several initiatives that include:

- embedding talent review processes within the business for all managerial and critical technical roles;
- embedding effective management training for all new and existing managers to strike the right balance between effective performance and people management, maintaining a committed, engaged workforce, and upholding our company values;
- establishing robust succession plans and associated development plans for regular review at Executive and Board level;
- embedding new systems to improve the way we manage performance, succession planning and employee development;
- transforming learning by moving towards blended learning solutions and aiding knowledge capture and transfer through knowledge banks, video, e-learning, virtual reality and enhanced visualisation packages; and
- continuing to learn from others and evolve our thinking, working with external stakeholders including our Technical Training Steering Group, supplemented by our planned annual Skills Update Forum. We are currently consulting with specialist consultants to develop our thinking on leadership.

8.9 Safety, well-being and work-life balance

8.9.1 Employee safety

Keeping our workforce safe and healthy is simply essential for our people and our business.

With a mantra of *everyone home safe and well*, we focus on the safety of our colleagues, our contractors and members of the public. We measure ourselves against this standard, counting the number of safe days on which we have no injuries, no road traffic collisions, no injuries to members of the public and no cable strikes. Safe days require continual and vigilant effort with performance driven by leading tactical objectives and lagging indicators. We display our performance in office and depot locations to ensure it is forefront in our collective focus.

As part of a hazardous industry we have an outstanding accident frequency rate of 0.09. This metric is widely used but little understood. The rate measures accidents over 100,000 days, which is the average working life. A rate of 0.09 is predicting a colleague stands a 9% chance of being injured whilst working for SGN during their working life. The rate has been decreasing over the past four years and is testament to the importance SGN places on the safety of colleagues.

Two years ago, we undertook a rigorous and thorough review to measure our safety culture – the way that we do things. We collected the perceptions of over 3000 direct and contract colleagues in five key areas of procedures, communication, competence, safety vs productivity and learning from incidents. An ongoing programme is in place to improve safety culture, with early signs that we are making progress in many of our depots.

Good progress has also been made in the area of health. Employees are faced with many physical hazards during their work, such as noise, dust and vibration. We plan to further reduce the impact of these hazards during GD2 by using technology and changing working practices, utilising and if need be developing new solutions. This requires a vision that challenges the accepted norm, SGN aspires to lead the way in becoming a vibration free organisation.

8.9.2 Well-being and work-life balance

It is not just physical hazards that need attention, mental health is key to overall wellbeing. We have trained over 70 mental health champions to identify and act as guides for colleagues to use the various tools on offer such as counselling. We researched key triggers in this area and financial stress was identified. We now offer financial wellbeing support to colleagues, from money management to offering short term loans, helping staff to reduce money induced stress.

We have established effective partnerships to deliver services and advice to employees for example our employee assistance line, a free of charge telephone line available to our employees. With the support and input of an employee wellbeing group we plan to extend these services in GD2.

Developing a more accessible occupational health service will support a more focused, consistent and proactive management of employees' health. We will continue to develop our current focus on better management of stress and mental health, supporting employees, removing stigma and investigating the provision of additional support to help employees remain in their substantive roles. A final example of how we will extend our services to employees is through the continued development and improvement of wellbeing policies related to work-life balance, making them more accessible to all our people and complementary to our employees' lifestyle.

We aim to support a better work-life balance for our employees, to reduce the likelihood of them working long hours and potentially being affected by fatigue. Long working hours are a historical challenge in the utilities sector and need to be addressed if we are to improve the overall employee experience and retain key workers.

We explained in the October draft of our plan our that we were engaging with unions, employee representatives and the HSE about new working patterns and we anticipated additional cost pressures in the region of £1.5m a year in GD2. We cautioned that this cost increase was not included in our totex in October while discussions were continuing with employees. Since October this cost has been confirmed at £1.5m and added to this final version of our plan. It reflects the importance we place on continuing to meet our standards of delivering a 24/7 emergency service and maintaining on-hand skilled engineers who can be deployed during an unplanned interruption or an extreme weather event to provide the service our customers need.

Revised working patterns have been designed to engineer out the possibility of employees working more than 16 hours, including standby or call out, in any 24 hours. The HSE is continuing industry-wide consultations and it is not yet clear whether they may in future require us to implement a lower limit on working hours. Given the current uncertainty we have proposed a re-opener to cover any HSE regulatory change.

8.10 A socially responsible employer

Our primary societal responsibility is the delivery of a safe, reliable and efficient gas network, at good value for money for our customers and stakeholders.

However, we also recognise our broader responsibilities to society and engagement with stakeholders and customers demonstrates this is important to them, too. Stakeholders focused on the importance of bringing younger people into the industry, providing training and development opportunities, and building an inclusive culture of performance and reward.[25] Customers are willing to pay £1.48 for us to support the development of life and work skills for young people and £1.78 for us to work with partners to increase work opportunities for disadvantaged groups in society such as young homeless people and ex forces personnel.[26] We have built this focus into our plans.

- We will work with partners and our own employees to extend opportunities for those further away from the labour market, for example working with organisations that support veterans, the homeless or disadvantaged young people. Through mentoring, work preparation programmes, and work experience we will build life and work-related skills in our local communities. Partnership programmes to encourage a diverse range of people into the gas industry will also have positive benefits for SGN, attracting new talent and supporting workforce resilience.
- We will continue to operate our Community Action Programmes, through which our people spend a work day voluntarily completing a local project, working with their colleagues to respond to a local community need and build social value. We are part of the London Benchmarking Group and follow their best practice guidance. Through our broad community investment programme we have made contributions averaging £500k a year during GD1.
- Our culture is built on a long-standing public service ethos. We balance the needs and expectations of our customers, our employees, our shareholders and other stakeholders in an ethical way. We adopt the high standards that all our stakeholders rightly expect, for example introducing a modern slavery policy and committing to achieving the living wage.

8.11 Engaging and motivating employees

Employees who believe their views count feel valued and are more likely to want to stay. We are passionate about listening to our people and acting on their feedback to continually improve the way we all work.

Our recent employee opinion survey in September 2019 demonstrated we have an engaged workforce when measured against comparative benchmarks, with an engagement index of 79% calculated by our external partner. We know that we can always improve, and we are analysing all the survey results with a particular focus on leadership and building an inclusive culture.

The employee opinion survey and resulting action plan supplement the many ways in which we listen to our employees in business as usual activities, for example through face to face team briefings, let's chat sessions, through our interactive app available to all employees on mobile devices. Our CEO leads a culture of two-way senior manager engagement, with frequent site visits, regular blogs inviting comment and an approachable attitude.

The majority of our employees are members of a trade union, and we will continue to recognise unions and afford them and their members the treatment expected in law, in accordance with good practice. We have always endeavoured to maintain good working relationships with our trade unions and have largely been successful. We have a quarterly national Joint Consultative Committee, Safety and Environment Committee and local joint industrial and non-industrial committees to discuss business matters. These formal meetings are supplemented by regular informal meetings, ensuring a continuous and constructive dialogue.

8.12 Building a diverse workforce and inclusive culture

Encouraged by our CEG we recently engaged with stakeholders to help us to refresh and simplify our diversity and inclusion strategy. Our revised strategy builds on our approach in GD1. We will continuously review progress, engaging with relevant stakeholders and refocusing as new insight and priorities emerge.

Our ambition is for our people to feel valued and supported, delivering a shared future together. We recognise the benefits to our business of creating an inclusive workplace where everyone is valued, respected and encouraged to do their best. In addition, by bringing together diverse perspectives we will enable innovation and truly reflect the interests of our customers and communities.

We recognise our sector is not representative of the UK workforce for gender, BAME, disability and under 24s, and much of our workforce is male and white. We are making progress in GD1 on addressing the gender imbalance in our own workforce with the proportion of women increasing year-on-year since 2013, as reported in our 2018 gender pay gap figures.[27] Our gender pay gap is 8.8%, down by 1% from 2017/18 and significantly below the national average of 17.3%.[28] We are working with expert external advisors and all directors have plans in place to listen, innovate and improve diversity and inclusion among their teams.

Through engagement with stakeholders we are refining our longer-term strategy to broaden our focus with initiatives to attract, develop and retain all under-represented groups. Our approach will also be informed by data and an assessment of the areas of greatest potential impact. When developing initiatives, for example to attract and retain BAME groups, given the working population in Scotland is currently 3% BAME, whereas London is 38% BAME, our efforts will be targeted first towards increasing the diversity of our workforce in London. This approach has been recommended following recent discussion with some of our BAME stakeholders.

To deliver our strategy throughout GD2, and beyond, we are maintaining our focus on both diversity and inclusion with a clear strategy: Engage, Educate and Embed, underpinned by communication and measurement.

[25] MFT Workshops March 2018 London & Edinburgh (ref 011, 012)
[26] Stage 3: Conjoint & WtP summary report (Valuation Phase) (ref 005)
[27] https://online.flowpaper.com/784b0757/SGNgenderpaygapreport/#page=2
[28] https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/earningsandworkinghours/bulletins/genderpaygapintheuk/2019

We recognise the value that external stakeholders can bring to inform our strategy and actions to improve diversity and inclusion. Our planned engagement process (see Workforce management appendix section 5.6) continues throughout the rest of GD1 and into GD2 as we refine and iterate our plans. Engagement with individual stakeholders and expert groups will be supported by the annual Skills Update Forum of stakeholders (see section 8.5) ensuring that our thinking stays up to date.

8.13 Upskilling and flexibility supporting transition to a decarbonised future

We have always encouraged a flexible and agile working culture within our workforce. Employees who demonstrate flexibility become involved in varied types of work which enriches their employment experience with us and can enhance their careers. A flexible workforce allows us to respond more effectively and dynamically to changing work priorities.

Section 8.6 describes how reducing workloads will increase capacity among direct operational employees, enabling them to carry out alternative productive work or displace contract labour, reducing overall cost without negatively impacting the overall resilience of our workforce.

This flexibility is supported by our longstanding programme of upskilling. For example, we use our current emergency resources to undertake meter work in the unregulated part of our business. This results in optimal usage and reduced cost of our emergency service. As meter work reduces with the roll out of the Smart programme, we plan to use emergency resources to fulfil an increase in scheduled surveying of network assets. And with further multi-skilling training, repair teams will be used to replace existing contract teams in our replacement or new connections work.

The longer-term transition to a decarbonised future offers challenges and opportunities to our business and our people and will require continued flexibility and adaptability.

As the nature of the gas contained within our networks changes; equally so will engineering policy, knowledge requirements and procedures, compounding the talent recruitment and retention challenges that we face. The extensive research and development proposed in GD2 to create a pathway towards potential long-term adoption of 100% hydrogen will deliver of proof-of-concept and additional understanding of the skills, competencies, training and upskilling that will be needed by our future workforce. Stakeholders[29] also helped highlight that the potential hydrogen pathway will result in a greater need for skills not currently available in the business.

Opportunities for decarbonisation will result in increased need for graduate engineers, project managers and other technical skills to feed the talent pipeline. We recognise the lengthy timelines for the development of further and higher education programmes including standards for hydrogen apprenticeships, with additional time required for employees to follow a defined route to competence. New learning technologies such as augmented and virtual reality create increased opportunities for collaboration across all GDNs and perhaps wider into cross sector energy and utility alliances. We are supporting this broad and collaborative approach to industry-wide resilience.

We are developing our five-year talent and succession plans within this context, also recognising that expert skill shortages may impact our organisational capacity for upskilling. Our annual Skills Update Forum will provide ongoing input from stakeholders to support business and industry-wide solutions. We will also continue our ongoing programme of engagement with experts and associations (see the Workforce management appendix section 3.5.3).

Worthy of note in our future skills strategy is the scenario of ‘decommissioning parts of the network’, which may result from future heat policy decisions, made either locally or nationally. Our view is that the current skillsets in the business could decommission the network as required, however the full implications for resourcing would be considered during GD2 as government net-zero planning takes shape.

8d Physical security

By the end of GD1 we expect to deliver, or be close to delivering, all the agreed physical security upgrade programme (PSUP) across the sites that were deemed as critical national infrastructure (CNI). Security includes all guarding and maintenance support costs for non-operational gas sites. One additional site has been re-designated and will be upgraded to CNI category 3 status. To ensure the continued security of our transmission system, we also plan to enhance security at 23 sites (CNI category 2 and other targeted sites). These PSUP costs are detailed in our Transmission integrity appendix and there is an associated confidential PCD.

Security remains a priority consideration for our business and involves regular campaigns to improve employee awareness of the issues, and support for new security measures. This and other security expenditure for GD2 is discussed in section 17.8.

[29] MFT Workshops November 2018 London & Edinburgh (ref 013, 014)

9

Our commitment to customers: building a shared net-zero future

Delivering energy solutions for the future and minimising our environmental impact are clear customer priorities. We have set out a series of outputs in our Environmental Action Plan (EAP) with stakeholder support for our high levels of ambition to minimise our environmental impact. Our collaborative hydrogen pathway provides the opportunity and evidence for no-regrets decision-making for future heat decarbonisation.

We will build a shared net-zero future by

1. Helping UK Government create a future for heat, power and transport that is low disruption, affordable and reliable, building relevant and impartial evidence towards net-zero, including 100% hydrogen demonstration

   Our proposal for the energy systems transition innovation competition is described in the plan (chapter 13) but not included in our funding proposals. We agree with our CEG's suggestion of a broader debate about funding for larger energy system transition projects.

2. Increasing the amount of greener gas in our network, to supply the equivalent of 450,000 households with biomethane.

   Our EAP describes our work to reduce the carbon content of gas in our network today, working with biomethane producers to increase the volume of biomethane in our network.

3. Reducing our business carbon footprint on a trajectory to reach net-zero by 2045

   This chapter sets out our comprehensive EAP which is strategically aligned with the UN's sustainability Development Goals. It describes the reductions in our total carbon footprint, with a specific focus on leakage from our pipes in line with our customer and stakeholder feedback. Specific outputs will be found in chapter 10.

Collaboration will be critical to achieving net-zero, and chapter 11 explains our interactions with whole energy system partners to create the best overall outcomes for customers; opportunities that we expect to build on and improve as we progress through GD2.

Our environmental plan for a shared net-zero future

Linked appendices

- Energy futures
- Energy system transition

We present our environmental plan within the context of a longer-term vision beyond 2026, aligned to the United Nations' Sustainable Development Goals (UN-SDGs) and our long-term commitment to a net-zero future. Minimising environmental impact and delivering energy solutions for the future are clear customer priorities for further investment and stakeholders including our CEG have encouraged our ambitions.

Our EAP has been created following extensive stakeholder engagement, and it is clear that the environment, sustainability and climate change have risen rapidly up the public agenda. At the start of GD1 customers were supportive of a strategy that delivered modest improvements to our carbon footprint; concentrating more on the traditional aspects of environmental management such as increased recycling or ISO14001 compliance. Today, customers are more aware of climate change and have higher expectations of our performance to deliver carbon reductions. There is now an expectation of firm and compelling action, and we are responding to those expectations by focusing on reducing our own carbon footprint in-line with our ambitious long-term target to achieve net-zero emissions by 2045.

We present the initiatives and actions contained in our EAP across the three impact areas identified in Ofgem's business plan guidance and listed below.

A. **Decarbonising our network** with a focus on business carbon footprint and embedded carbon

B. Reducing the **other environmental impacts** of our network

C. **Supporting the transition to an environmentally sustainable low-carbon energy system**

Our EAP brings together our environmental approach and impacts from across our business into a single, coherent plan. Delivery of the plan is the responsibility of the teams across the business - property, network maintenance, network strategy procurement or fleet, ensuring ownership of the plan's delivery.

9.1 Our environmental impacts

Identification and measurement of our environmental impacts in this EAP builds on our longstanding record of ISO14001 certification, first achieved in 2003. This requires our environmental risks to be identified and managed through an Aspects and Impacts (A&I) register, which quantitatively scores our environmental risks and informs how we manage all material environmental impacts for the business, according to:

- potential to cause environmental harm;
- size and frequency of the aspect;
- importance to the stakeholders of the organisation; and
- requirements of relevant environmental legislation.

Our ISO14001 certification is audited annually assessing our performance against the standard, and ensures significant environmental A&Is are properly identified against our register and appropriately monitored. In GD1 this register identified the following environmental aspects in order of importance to us:

1. land pollution
2. natural gas emissions
3. water pollution
4. carbon dioxide and other greenhouse gas emissions
5. water consumption
6. unsustainable use of natural resources
7. destruction of habitat
8. production of solid and liquid waste
9. pollution – dust odour and noise.

This formed the base of our Greenplan in GD1 and a solid foundation on which to build our more ambitious EAP.

9.2 Learning lessons from GD1

We set up Greenplan at the start of GD1 to target the priority impact areas above. We identified nine targets and have so far achieved four of them. Highlights include a 21% reduction in natural gas emissions, reaching almost zero waste by reducing landfill created by offices and depots by almost 99%, and a 24% reduction of our energy consumption at operational sites. As a result, we won two environmental best practices Green Apple awards with several of our initiatives also recognised through other external awards:

- **Carbon savings on our liquid natural gas (LNG) tanker transport.** We reflected the rising importance of environmental considerations by increasing the environmental weighting on a procurement tender for LNG transportation. The contract was awarded to a company that prioritised rail transport over road which has significantly reduced our related carbon emissions. Between August 2017 and the end of January 2018 we saved over 88,000 road miles by implementing the new rail contract, resulting in cost and carbon savings of over £1.1m and over 373tonnes CO_2e respectively. Road mileage has continued to come down, with the contractor also increasing the length of the rail journey up to Inverness (a further 173 miles per journey). We were shortlisted with our contract partner for Transport Project of the Year 2018 at the Business Green Leaders Awards.
- **Reduced resource use.** Our innovations over GD1 have led to environmental, efficiency and safety improvements. Two award-winning projects have helped us minimise our use of resources - CISBOT (Cast Iron Sealing roBOT) and 'Core & Vac'. The environmental benefits for reduced resource use are significant, therefore in GD2 we will to move to the next phase of development.
- **Carbon Trust standard.** We have held the Carbon Trust standard since 2011 and have reduced our carbon footprint year on year. At the last audit in 2017 we achieved an 8.4% reduction based on our 2015 standard.
- **Plan Bee (community project).** Our sponsorship of two bee hives at a local Glasgow school has allowed the school to successfully introduce beekeeping into the curriculum. We have also installed two bee hives in our Glasgow depot and have run beekeeping lessons for employees. The initiative was shortlisted at Edie Sustainability Awards.

Our performance to-date against the complete list of Greenplan KPIs is available in appendix 003, Environmental Action Plan, section 3.3.

In summary, while Greenplan delivered some goals and reduced our impact in GD1 we know we can do better. Our approach in GD2 requires a more comprehensive, transparent, structured and ambitious strategy to respond to the expectations of our customers and stakeholders.

9.3 Stakeholder and customer perspectives

Minimising our environmental impact and pursuing decarbonised energy solutions are the two highest investment priorities for our customers.[1] This is a consistent finding throughout our customer research and engagement. In detailed discussion workshops, customers were clear that we should focus particularly on leakage and pursue high levels of ambition in other areas of environmental impact.[2]

In January 2019 we held two sustainability round tables with expert stakeholders[3] and hosted follow- up workshops in August.[4] Stakeholders wanted to see greater assessment of our impact and our ability to be part of the circular economy, keeping resources in use for as long as possible, as well as the difference we can make to a sustainable society, considering our broader impact in cities and communities.

Stakeholder input, particularly from our roundtables on sustainability, was informative and instrumental in the development of our environmental strategy, supporting assessment of the scope of impacts included in our EAP.

Input from our customers and stakeholders has led us to adopt a greater level of ambition for our carbon footprint, and a longer-term vision which takes us through and beyond the next price control. We received firm support for a number of strategies in particular: to reduce leakage, to transition to low emission vehicles, to deploy renewable energy and to reduce environmental impacts by working collaboratively with other utilities and the supply chain.

We have subsequently assessed our customers' willingness to pay for environmental initiatives which reinforced earlier qualitative research showing customers strongly supported investment to minimise environmental impacts and to support the decarbonisation of heat.

Under our first round of willingness to pay research we tested customers' willingness to pay to reduce our operational carbon footprint by 10% and 20% and to invest in enabling 20% and 40% green gas penetration on our network. These two questions were each awarded the highest value out a total of seven questions, with values of £3.2 and £5.2 to reduce operational carbon footprint and £3.4 and £5.3 for enabling green gas.

In a second round of research,[5] we tested customers' willingness to pay for three attributes;[6] the first was to reduce emissions from our fleet by replacing 50% or 100% of existing vehicles with ultra-low emission vehicles which customers valued at £3.36 and £5.05. The second was to use either 40% or 80% renewable electricity for our business. Customers were willing to pay £3.0 and £5.4 for this. The final question asked about opportunities to enhance the natural environment and create habitats for wildlife. Customers were prepared to pay £2.42 and £3.77 to enhance the environment at 15 sites and 30 sites respectively. In summary, customers are prepared to make significant investment for environmental initiatives.

1 Stage 1: Explorative Qualitative Workshops and Interviews (Exploratory Phase) (ref 002), Stage 2: Max Diff Prioritisation Phase (ref 003, 004), Stage 3: Conjoint & WtP summary report 1 and 2 (Valuation Phase) (ref 005, 094), Shared Net Zero Future round table event – Scotland (ref 090)
2 Shaping the Business Plan Qualitative Workshops - Environmental Action Plan (ref 084)
3 Sustainability specialist round tables – London and Glasgow (ref 065, 066)
4 Shared Net Zero Future round table event – Scotland (ref 090)
5 Stage 3: Conjoint & WtP summary report (Valuation Phase) (ref 005)
6 Stage 3: Valuation Phase (Conjoint & WtP) Summary report (ref 094)

9.4 Our broader vision and strategy

Responding to stakeholder inputs, we are developing a new sustainability strategy which sits alongside the EAP but with a broader focus aligned with the widely adopted framework of UN-SDGs. UN member states have agreed to achieve the goals by 2030 which supports our longer-term view beyond GD2. We have made an additional commitment to net-zero by 2045. Aligning with the UN-SDGs to support our longer-term commitment has been welcomed by our CEG.

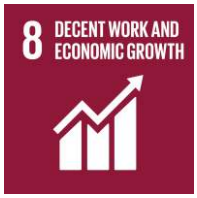
During 2018 we conducted three materiality reviews with key internal stakeholders to identify which of the UN-SDGs are important to our business, and which are important to our key external stakeholders. The workshops included a comprehensive review of all the UN-SDGs and the key targets underpinning each goal. Following this, we selected eight of the seventeen goals which directly apply to our business. Initial KPIs associated with each of the UN-SDGs are highlighted below, and more detail on each can be found in relevant sections of our plan.

- Support everyone going home safe and well
- Support health surveillance (8.9.1)
- Wellbeing of our employees (8.9.2)

- Continue CAP days and community engagement programmes (8.10)

- Reduce the number of people living in fuel poverty (6.4)
- Increase the amount of generated renewable energy across our estate (9.6.5)

- Increase energy efficiency in our building and on sites (9.6.4)
- Work with our supply chain to reduce impact on the environment (9.10)
- Reduce waste in offices and depots (9.8)



- Stable and fair employment (8.7)
- Inspire young people to consider STEM careers (4b)
- Become a living wage employer (8.10)
- Support new and existing talent through training schemes and support (8.8)

- Reduce our carbon footprint (9.6)
- Reduce the volume of shrinkage (9.5)
- Develop a climate change adaptation plan (9.9)

- Support trials of innovative products, services, tools and equipment (13)
- Use collaboration to deliver improvements (13.1.4)
- Facilitate the introduction of low carbon fuel into our gas network (9 part C)

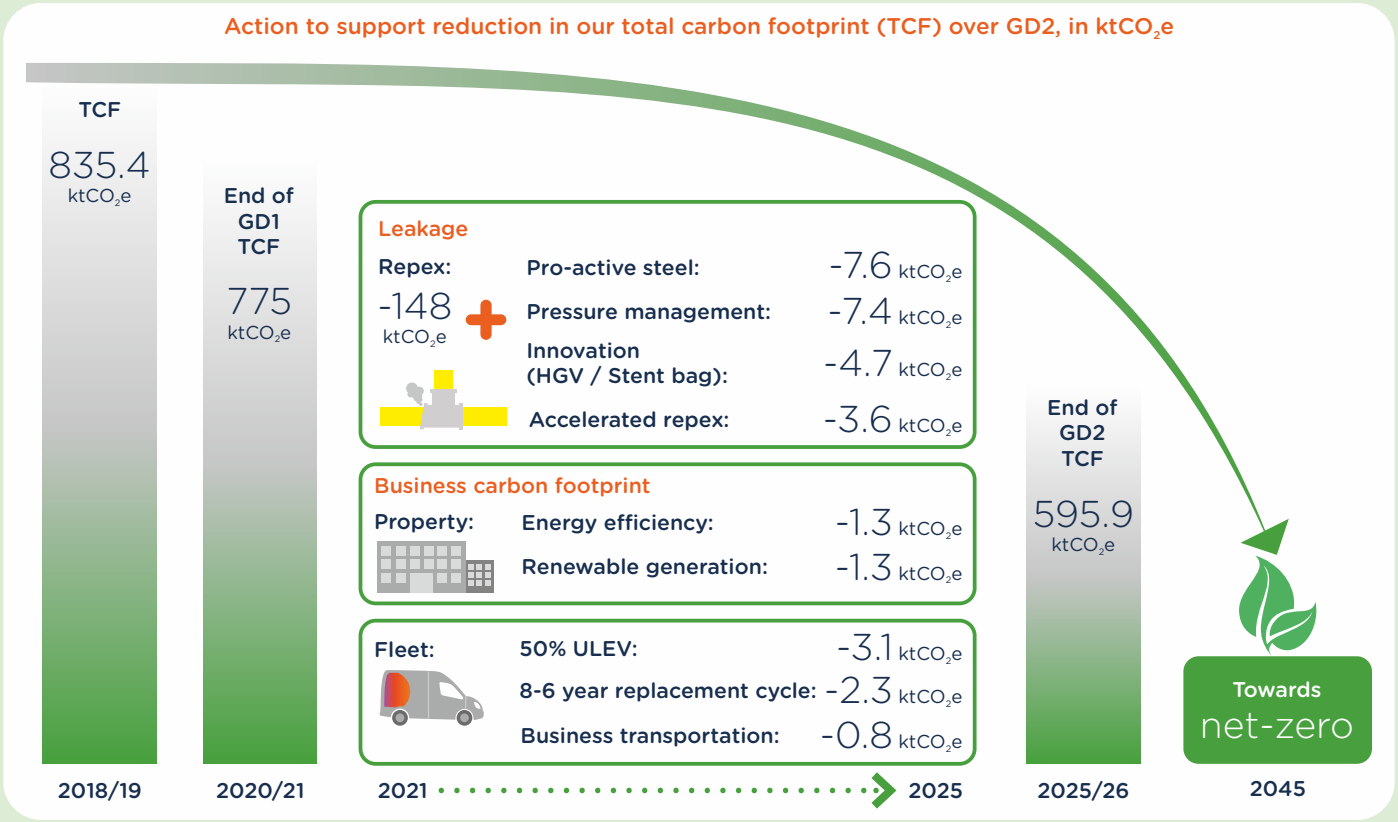
- Create a positive impact on the environment (9.7)

9.4.1 Steering group for environmental action

Our ambition to accelerate towards a 2045 net zero is strongly linked to external policy and our customers' appetite. To manage uncertainty in our EAP outputs in this context, we need to consider the appropriate level of ambition over time, given the political direction, the pace of underlying technological change and the associated consumer costs. We are therefore proposing to draw on the expertise of an independent Steering Group for Environmental Action to challenge and inform our investment decisions, helping to foster the right balance between ambition and cost-efficiency, in line with customer interests. We consider this Steering Group particularly important for the effective oversight of use-it-or-lose-it uncertainty mechanisms (section 12.2.10). We will build on the support and challenge that stakeholders have provided during the development of our EAP and apply the customer evidence to date to measure our progress and the appropriateness of our ambition and our cost-effectiveness (section 4.17.2). We will report annually on our progress to stakeholders (10.3).

Part A: Decarbonising our network

We will reduce our total carbon footprint (TCF) by focusing on leakage and our business carbon footprint (BCF) scope 1, 2 and 3 emissions.



Our total annual saving by 2025/26 is 180ktCO$_2$e, of which 127ktCO$_2$e is covered by 73 (out of 135) CBAs submitted with our plan.

9.5 Reducing leakage

Customers and stakeholders expressed the strong view[7] that we should focus on reducing leakage. Total gas lost from our network is described as shrinkage and combines leakage, our own-use gas and theft. Of these, leakage is the major volume component, making up 95% of the total of gas lost from our network. Leakage is significantly more important for its environmental impact and its long-term global warming potential. Natural gas released into the atmosphere is approximately 25 times[8] the global warming potential of carbon dioxide released when it is burnt.

A large proportion of our leakage arises from poorly sealed joints on aged assets. When it was constructed, most of our distribution low pressure network was cast iron mains, jointed using a lead yarn which remained tight due to the moisture content in the town gas used at the time. With the introduction of natural gas, with its lower moisture content, the yarn has contracted and in combination with age and corrosion, weaknesses have been created through which natural gas leaks to atmosphere.

There are three main activities we manage to address this problem: replacing the old cast iron pipes, managing the gas pressure in the pipe, and where appropriate, injecting a fluid to keep the yarn in good order.

We will continue to build on our strong track record of effective management of leakage, which began before the start of GD1 and we will continue into GD2.

Prioritising the right pipes for replacement. In GD1 we were the first network to use predictive data analytics to prioritise the pipes we should replace. As safety is closely correlated with the volume of gas leaking from the network, by deploying predictive analytics we were able to target and prioritise those pipes most at risk of leaking, with an associated safety and environmental impact. In our approach to GD2 we have been able to extend our insights analysis to identify "hotspots" on gas services. We have also led the industry in the use of robotic technology to repair large cast iron main joints, completing repairs to approximately 15,000 joints using this technique since 2013.

In GD2 we expect to reduce emissions from leakage by nearly 30ktCO$_2$e each year on average, so that by the end of GD2 we expect our annual emissions to be 148ktCO$_2$e lower through our repex programme. We are also proposing to increase the rate of steel replacement and accelerate the repex programme. Together, these save a further 2.2ktCO$_2$e each year so that by the end of GD2 we expect our emissions to be 11.2ktCO$_2$ lower.

Furthermore, by targeting our accelerated programme (section 7.5.1) in areas that are more likely to be early converters to hydrogen, we could facilitate the creation of a hydrogen-ready network sooner, which would enable more substantive reductions in emissions in the future.

Optimising pressure management. Across our network there are thousands of small leaks which are largely undetectable. By reducing the gas pressure in the network, we can reduce the flow of gas through points of

[7] Shared Net Zero Future round table event – Scotland (ref 090), Shaping the Business Plan Qualitative Workshops - Environmental Action Plan (ref 084)

[8] Natural gas comprises approximately 80% methane and 20% other gases. The methane component is 28 times more potent in its climate change impact than carbon dioxide on a 100-year basis, on a shorter lifecycle basis it is significantly higher still.

leakage to the atmosphere. However, the gas pressure needs to be maintained at a sufficient level to meet customer demand. Previously, we had winter and summer settings. These have been replaced by active pressure management techniques which enable us to profile demand patterns and optimise the right pressure in the pipes to meet customer demand and minimise leakage to the lowest possible levels. During GD2 we plan to further refine our active pressure management regime which we hope will allow greater granularity and responsiveness in pressure management.

However, our opportunity to reduce pressure further is restricted by the need to maintain a safe pressure for the end customer. Prior to and during GD1, we made substantial progress in optimising pressure across the network throughout the year with the introduction of improved control techniques. In GD2 we expect to see a trend towards higher pressures as a result of more instantaneous sources of demand such as domestic combination boilers and our increased adoption of live insertion leading to smaller diameter pipes.[9] It is because of these changes we anticipate leakage associated with pressure management will increase in GD2 relative to GD1 (section 10.2.2)

To try to constrain this, a more active pressure management approach will be piloted in our southern network leading to a potential reduction of 7.4ktCO_2e. We are also expecting to adopt an innovative short-term solution from Cadent to boost the pressure for customers experiencing poor pressures, allowing us time to investigate and take remedial action, without increasing overall pressures. In addition, we are proactively discussing assured pressure levels with independent gas transporters (IGTs), to understand whether they can be reduced.

These programmes describe measures that we are undertaking to reduce leakage as measured through modelling. The models are detailed and robust, although they will not reflect all the measures we are implementing to reduce leakage in GD2. We have identified below a number of additional measures which reduce leakage but are not currently directly quantifiable.

Responding rapidly to implement repairs. An important indicator of the amount of gas emitted to atmosphere is how quickly a repair is made once a gas escape has been identified. A measure of this is the 12-hour standard, which records the percentage of gas escapes repaired within 12 hours. In GD1 we have had the highest targets and achieved the best performance of all the GDNs with over 70% of gas escapes repaired in 12 hours in Scotland and 63% in Southern – the two highest performing networks. In GD2 we will look to sustain and improve on this performance (10.4.3).

Reducing third party damage. Our ambition to facilitate a reduction in third party damage of 15% in GD2 (section 4.14.3) will contribute to our leakage reduction programme and reduce gas emission to the atmosphere, however this will not be reflected in modelled leakage figures.

Deploying innovation. Similarly, the deployment of new innovations such as the GECO pump, stent bags or the high-volume gas escape toolkit will reduce actual emissions, but these benefits will not be picked up in modelled leakage figures. However, we estimate that these innovations (excluding GECO pump), each described below, could help to reduce leakage during a gas escape by 4.7ktCO_2e in GD2.

- **High volume gas escapes toolbox (HVGET).** High volume gas escapes carry considerable risk, so we have been exploring alternative methods to reduce the volume of released gas. We have developed sealing tools and plugs to physically stop the gas from escaping, along with an increase in monitoring sensors to aid rapid identification of escapes.
- **Stent bags.** The stent bag is the remote insertion of a sealing stent system into the gas main at a distance from the gas escape. The stent bag is then pushed to the point of the leak and expanded to temporarily seal the leak while a repair is undertaken. Our tests demonstrated that leakage could be vastly reduced or stopped without disrupting the gas flow.
- **Gas eco (GECO) gas pumps.** Historically, when decommissioning and abandoning gas pipes and holders the gas contained was vented to atmosphere. We have worked with a third party to develop a protype gas pump to pressurise the remaining gas prior to decommissioning and to inject it back into the network. The GECO pump has been successfully used in Scotland and in Southern (our Rye Lane case study, section 2.3). This will be extended to other projects.

Recognising the importance of the leakage issue to our customers, during GD2 we will look for better ways of estimating the benefits of reducing leakage associated with innovations not currently captured by the leakage model. We will review progress with stakeholders through the Steering Group for Environmental Action.

9.6 Reducing our business carbon footprint

Over the last two years, we have worked closely with the Carbon Trust to verify the accuracy of our carbon footprint and to provide expert input to our plans for carbon reduction. We were the only utility company to take part in the first year of the Carbon Trust's Carbon Leadership Framework. This Carbon Trust initiative was designed for companies to support a detailed understanding of their carbon planning and changes that should be made to deliver the science-based targets[10] based on a 2017 business carbon foot print (BCF) as the baseline year. We explain below our updated, more ambitious targets net-zero targets.

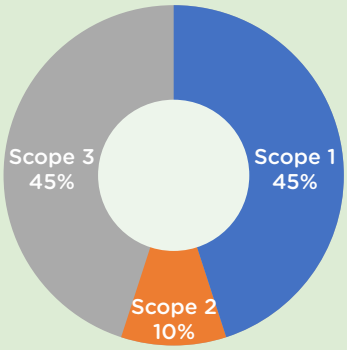
Our BCF is divided between scope 1, 2 and 3 - as set out by the Greenhouse Gas (GHG) Protocol and covers the carbon emissions of our operational business, excluding shrinkage.[11] We have measured the scope of each category since the start of GD1 and will continue measuring through GD2. At the end of 2018/19 our BCF is 38.6ktCO_2e. We have focused our EAP on scope 1 and 2 although we have also reported on scope 3 since the start of GD1 and will continue to report scope 3 during GD2. This will be enhanced by our plans to report on embedded carbon (9.11).

[9] Live insertions reduce interruptions for customers, but to deliver this a smaller diameter of main is inserted into a wider diameter main, and is likely to require a higher operating pressure.

[10] Carbon reduction targets are considered science-based if they are in line with the level of decarbonisation required to keep the average global temperature increase well below 2°C compared to pre-industrial temperatures as described in the Assessment Reports of the Intergovernmental Panel on Climate Change (IPCC).

[11] http://ghgprotocol.org/sites/default/files/standards/ghg-protocol-revised.pdf Fugitive emissions should be included in Scope 1 based on GHG protocol, but we report them separately under the RIIO Framework, so have maintained this separation.

Figure 9-1 Breakdown of business carbon footprint by scope



Based on our work with the Carbon Trust, our initial science-based targets indicated that we would need to reduce scope 1 and scope 2 emissions by 68% by 2050/51.

However, following the Government's announcement and the adoption of net-zero by 2050 into the Climate Change Act,[12] we have committed to reach net-zero greenhouse gas emissions by 2045, in-line with the Scottish government's target set earlier this year. We propose our whole business follows this more ambitious target, not just in Scotland. To deliver net-zero the reduction would have to reduce to zero by 2045, substantially lower than the science-based targets expressed above.

To set an appropriate benchmark for GD2, to deliver net-zero by 2045 we have assumed a simple pathway by reducing our business carbon footprint by 1.3ktCO_2e a year in scope 1 and scope 2 emissions.

Comparing our proposed measures against this pathway suggests that if everything is implemented successfully we will be on track to achieve this simple pathway. We believe this significant ambition reflects the strength of stakeholder opinion, however we recognise that reductions will become increasingly challenging as we progress towards 2045.

Figure 9-2 Net-zero trajectory and expected delivery

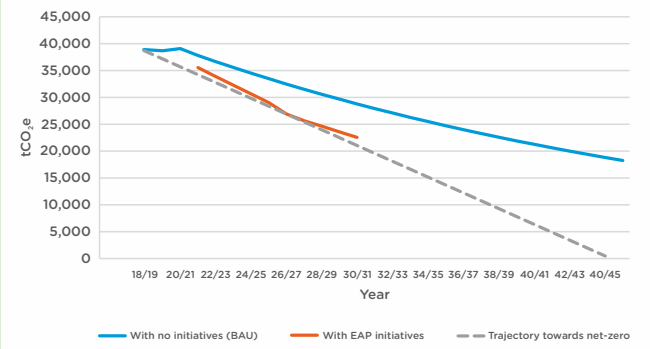


Table 9-2 shows reduction in business carbon footprint (excluding leakage).

Our GD2 plan would achieve a total reduction of 8.8ktCO_2e from our 2018/19 benchmark with a 2.6ktCO_2e reduction for buildings and a 6.2ktCO_2e reduction for commercial vehicles and company cars. The measures we will implement to deliver this are set out in the following sections.

9.6.1 Commercial vehicle fleet

The largest contributors to our BCF are emissions from our commercial vehicles, including company cars (scope 1), electricity usage (scope 2) and indirect greenhouse gas emissions which occur in our value chain and are not directly in our control (scope 3). Our commercial vehicle fleet accounts for 77% of our combined scope 1 and 2 BCF (excluding shrinkage) and is one of the areas where we can make a significant change thanks to technological advancements and societal drivers. We have assessed our current fleet according to the availability of alternative fuel choices.

How our vehicles are driven also has an impact on emissions performance and customers highlighted the importance of taking behaviour into account in reducing environmental impact.[13] Our current standards include all commercial vehicles being speed-limited to 62mph. Telematics installed in commercial vehicles record driver behaviour for speeding, harsh braking, acceleration, and cornering. The data is used to give drivers a score using a traffic light system, with reports published internally in the form of league tables for the prior month. Driver performance has shown a slight improvement over the last 12 months and we are focused on improving engagement levels further with team leaders.

A real-time system is in development which will have the capability to report on fuel consumption to enable earlier intervention. Once this system is in place it will help us address poor driving and high fuel consumption and support training to improve the environmental performance of our drivers.

Our fleet will be very different at the end GD2 when compared with today, but quite how different depends on many factors, some of which are out of our control. Variables include the number and location of electric vehicle charging points and alternative fuel stations, as well as the future mileage range of alternative fuelled vehicles and their availability. In 2019 much of the relevant technology is still in development but is expected to have an impact during GD2. This project should see the introduction of alternatively fuelled vehicles to our commercial fleet and we recognise the big opportunity this gives us in GD2 with a number of ultra-low emission vehicles (ULEVs) contributing to reductions in our BCF.

However, many variables remain. For example, if we provide a mobile worker with an electric vehicle (EV) then they should be able to recharge at home, but that is dependent on whether they have a driveway to install their own charger. Operational considerations of this kind will in large part dictate where we can deploy alternative fuel vehicles.

Charging points would be installed at key sites across our business, with additional infrastructure to add more charging points to support the growing number of hybrid and electric cars onto the fleet. We will need more units and more locations – future proofing us for both CNG and EV charging at all our locations. This is further discussed in appendix 025, Fleet.

[12] Climate Change Act 2008 (2050 Target Amendment) Order 2019
[13] Shaping the Business Plan Qualitative Workshops - Environmental Action Plan (ref 084)

Our plan includes additional measures for increasing the carbon efficiency of our fleet:

- **vehicle use** - we will introduce a driver training course and other communication tools to deliver driver performance improvements, eco training tips and fuel-efficient vehicle maintenance (i.e. keeping tyres inflated)
- **transport demand management and planning** - we will continue to reduce mileage and adopt efficient journey planning techniques by ensuring optimum routes are being used
- **alternative tooling** - we will develop alternate methods of tooling and operating that are much less reliant on vehicles to power equipment, giving us the flexibility to use more environmentally friendly vehicles and technologies
- **operational changes to operate a 'smarter' fleet.**
- **increasing the vehicle replacement rate** – we have a fleet of over 2,000 vehicles that are currently replaced on an eight-year replacement cycle which will see just over a half of the vehicles replaced during GD2. By increasing the replacement rate to six years nearly three quarters of vehicles will be replaced. We estimate this will deliver a combined saving of 2.3ktCO_2e[14] for the whole of GD2 (section 10.4.3).
- **replacing with ultra low emission vehicles (ULEV)** – some types of vehicles used in our operational vehicle fleet are more amenable (in terms of the availability of technology and their use patterns) to conversion than others. Small and medium vans and some maintenance vehicles are probably the most appropriate vehicles to convert to ULEVs. Large vans and support vehicles are more challenging, although we anticipated that the technology will continue to develop rapidly. We propose 50% of the vehicles being retired in GD2 are replaced with ULEVs. We estimate this will deliver a combined saving of 3.1ktCO_2e[15] for the whole of GD2 (section 10.4.4).

Recognising the importance of market changes, we have initiated a six-monthly review process which will be maintained throughout GD2 to understand the new technology available to allow our vehicles to be fuelled differently. This will include collaboration with other fleet operators across numerous industries working on the same challenges as us. We will conduct trials of new ULEVs before deploying these widely to reduce risk and will review plans with our Steering Group for Environmental Action to ensure we effectively balance timing, cost and environmental benefits.

We believe that this transition to ULEVs is supported by our stakeholders who have raised it as a consideration and our customers who have identified the transition to ULEVs as one of the highest willingness to pay values.[16] We will prioritise cities and towns on our networks to help reduce the direct impact of air pollution as well as reducing greenhouse gas emissions.

9.6.2 Company cars

We operate a company car scheme for employees who need a vehicle for business travel which is independent of our commercial fleet. Our ambition for the company car fleet will mirror the commercial fleet by moving to cleaner alternative fuelled cars to reduce CO_2 emissions. The first step has been to limit available cars to 130gCO_2/km, with this limit reviewed annually. We are also adding additional incentives to encourage greener choices, such as an enhanced allowance for lower emission cars (a sliding scale that increases company contribution in-line with improved CO_2 performance). We anticipate a reduction of 5g/km CO_2 for each year of GD2.

9.6.3 Properties, buildings and electricity

Our approach in GD2 will be to reduce consumption and install renewables to support the decarbonisation of our electricity supply. Our stakeholders and customers are fully supportive of this approach, as detailed in appendix 003, Environmental Action Plan, section 4.1.

As already noted, behavioural change is essential for reducing energy needs and driving down emissions. We will be exploring different incentives with and for our employees to encourage and nudge them toward making improvements to reduce energy consumption.

9.6.4 Energy efficiency

To reduce our gas and electricity consumption, we will install building energy management systems (BMS) and LED lighting across selected occupied sites on our estate. This will most likely focus on large and medium sites to optimise cost savings and maximise efficiencies. We estimate our proposals will deliver a carbon saving of 265 tonnes CO_2e per annum, a reduction of approximately 1.3ktCO_2e over the course of GD2.[17]

9.6.5 Direct generation of renewable energy

Electricity usage from our occupied and operational sites currently makes up 9% of our BCF. We are assessing the potential to reduce this by installing solar panels across all large and medium offices and on a selection of operational governor sites. Additional advantages to solar panel installation include reduced electricity costs and an increase in our self-sufficiency at these sites. We have proposed three options of renewable installation at different funding levels. Customers and stakeholders want us to aim high with an ambitious installation programme that will support our net-zero by 2045 objective.[18]

Wind energy will be kept under review during GD2 and assessed according to planning permission constraints and time to progress. Installing renewable energy on occupational sites would result in a total carbon saving of 1.3ktCO_2e over GD2[19].

9.6.6 Purchasing renewable energy

While we do not consider it directly equivalent, an immediate initiative is to reduce our CO_2e with a positive impact on scope 2 by switching our main gas and electricity tariffs to 100% renewable tariffs.

We are currently exploring our options in a transition period to GD2 by speaking to several suppliers who offer both 100% renewable electricity and green gas. We would expect our switch to green energy to happen before 2021 and to cover all our occupied sites.

[14] This set out in 'SGN Fleet BAU EJP' and 'SGN Fleet – 001BAU – CBA Dec19'
[15] This set out in 'SGN Fleet EAP EJP' and 'RIIO-GD2_CBA Fleet EAP V7'
[16] Shared Net Zero Future round table event - Scotland (Ref 090), Stage 3: Conjoint & WtP summary report (Valuation Phase) (ref 005)
[17] 'SGN Prop 004 Energy Management and Utility Reduction – EJP Dec19' and 'SGN Prop 004 EnergyMang + Utilred – CBA Dec19'
[18] Shaping the Business Plan Qualitative Workshops - Environmental Action Plan (ref 084)
[19] SGN Prop 003 Renewable Energy - EJP Dec19' and 'SGN Prop 003 Renewable Energy – CBA Dec19'

Part B: Reducing other environmental impacts

9.7 Biodiversity and natural capital

A UN backed report[20] reveals species are declining globally at the fastest ever rate due to human actions, with around a million species threatened with extinction. Butterflies are often used as an indicator species for the health of our wider environment. Defra's 2018 biodiversity indicators show that since 1976, the Habitat Specialists Butterflies index has fallen by 77%. Additionally, the decline in the diversity and abundance of bees would have a serious impact on how our natural world functions.

We can play our part in reversing the loss of biodiversity by committing land in our company portfolio to biodiversity enhancement projects that will improve ecosystem resilience. This will be part of the systemic changes we will drive through our engagement with the UN-SDGs.

The aim of this programme is to establish the existing biodiversity profile on our land sites through a series of surveys and then, as appropriate, implement enhancement programmes to increase the biodiversity of their natural ecosystems. This can be met by;

1. understanding the existing biodiversity profile across our identified sites;
2. safeguarding species and habitats of principal importance and improving their management;
3. increasing resilience by restoring degraded habitats and creating new ones; and
4. improving our evidence base to better understand and monitor biodiversity.

To achieve this, we have identified land management, property (occupied sites) and major projects as key parts of the business with suitable opportunities for biodiversity enhancement. Combined, these amount to 153 sites[21] which will be surveyed in years one and two of GD2, to identify the most suitable biodiversity enhancement measures to implement. We expect many sites will only require a habitat survey and a National Vegetation Classification (NVC) survey to be able to identify the opportunity and suitability for improvement (section 10.5.1).

9.8 Resource use and waste

Our offices and depots have almost reached zero waste to landfill during GD1. In GD2 we propose to expand the scope to include other business areas.

Waste to landfill performance has improved from 14% of waste sent to landfill to 0.27% since the start of GD1. This remaining small percentage comes from our Scottish Independent Undertakings (SIUs). These sites are reliant on local councils for weekly waste collections and they have limited, if any, recycling facilities. This results in a high proportion of SIU waste being sent to council landfill sites. Where possible we will work with the local councils to identify any areas of improvement that can be made.

The other business areas we will include in GD2 are reinstatement, major projects and holder demolition. Landfill is no longer economically or environmentally viable for the majority of products. Stakeholders and customers are very supportive of our work to identify closed-loop processes and opportunities for the circular economy; promoting maintaining, re-using, refurbishing or remanufacturing to extend the lifecycle of a product, part or service, which ultimately reduces the resource strain on the planet.[22]

However, for hazardous waste there are limited disposal routes: reusing, recycling or incinerating may be a challenge. Examples of where we can reduce hazardous waste include the installation of solar PV panels on network maintenance sites to replace batteries. We will integrate circular economy principles across selected key waste streams by working with suppliers (the embedded carbon project) and we are also considering external verification, such as the Carbon Trust Standard for Waste, which recognises organisations that take a best practice approach to waste management and actively divert all appropriate waste streams from landfill.

We have set targets and will report on percentages of actual waste to landfill, recycling and reuse as part of our annual environmental report (10.3).

9.8.1 Hazardous excavation waste

We are currently preparing for the withdrawal of the Regulatory Position Statement 211 (RPS 211): Excavated Waste from Utilities Installation and Repair, in April 2020. RPS 211 applies to all utilities and businesses who deal with excavated waste from roadworks. We will work with other utilities to develop an appropriate alternative waste classification methodology based on an industry understanding of risk. This will help us improve how we manage and identify waste being sent to landfill, to identify potential opportunities to reduce it and to budget accordingly to support our ongoing focus on minimising our environmental impact.

For additional information, please refer to section 12.2.9, and appendix 014 Repair section 6.8.

[20] IPBES' 2019 Global Assessment Report on Biodiversity and Ecosystem Services.
[21] 'SGN Prop 001 biodiversity – EJP Dec19'
[22] Sustainability Roundtable - London & Glasgow (ref 065, 066)

9.9 Climate change adaptation

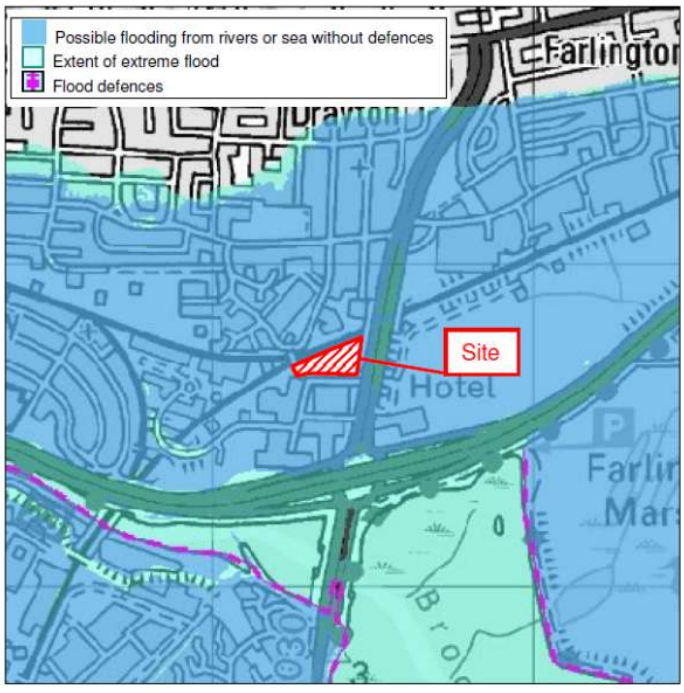
We have proposed an uncertainty mechanism to manage the direct impact of climate change on our network (section 12.2.11)

Our highest potential climate change risks are flooding, coastal and river erosion and extreme temperatures. Our assets most at risk are those found above ground, typically large Pressure Reduction Installations (PRIs), critical sites such as data and gas control centres and pipelines at river crossings. In addition, prolonged periods of extreme weather could have a significant impact on our workforce, particularly our field-based engineers, and affect our ability to conduct business as usual.

In GD1 we focused largely on flood mapping for operational assets and on surveys of pipelines at river crossings. These activities allowed us to highlight assets at risk. In order to protect our assets we have also procured mobile flood defence barriers. The costs for the relocation of certain operational assets in GD2 due to increased risk of climate change have also been included within the Transmission and Distribution appendices.

We are less clear on the risks to our occupied sites and need to broaden our understanding of climate change adaptation. We intend to carry out climate change adaptation surveys during GD2 at our occupied sites. This will be a multi-stage process, including a review of the sites, assessment of their vulnerabilities, production of risk assessments and proposal of recommendations. This process will be carried out by a specialist consultant and will highlight sites at risk and the remedial actions needed.

We are including the survey and mapping costs as part of our GD2 base allowance (a cost of approximately £500k) and based on the report findings we propose to introduce a use-it-or-lose-it mechanism to carry out the work (section 10.5.2).



9.10 Working with our supply chain

Engagement with our supply chain is critical for the successful delivery of our EAP.

We are committed to achieving relationships with suppliers that are mutually beneficial and promote best practice and continuous improvement throughout our operations. Our sustainable, responsible and ethical approach to procurement is detailed in our Responsible Procurement Charter described further in our Procurement and native competition appendix 010.

We will use GD2 as an opportunity to strengthen the work we have done to ensure that we and our suppliers operate with minimum levels of environmental impact. We will work with both internal and external stakeholders to further develop a sustainable procurement strategy and update our procurement processes to embed circular economy principles.

Building a better understanding of the goods and services we use will be a critical part of our approach to sustainability, so that we can fully calculate the environmental impact of our services.

We are developing a new Supplier Code of Conduct and have completed a benchmarking analysis and review of international environmental standards outlined in both the UN-SDGs and the UN Global Compact.[23]

Using existing good practice, external benchmarking and continued stakeholder engagement we will incorporate this into a sustainable procurement strategy and process. Our approach to engaging with the supply chain has received support from some of our stakeholders and customers, while others expressed concern that small suppliers with fewer resources would not be able to meet our increased requirements.[24] In response we are proposing to support our supply chain with training opportunities and engagement days, delivered in partnership with expert third parties such as the Supply Chain Sustainability School.

We propose targeting more than 80% of our suppliers (by value) to meet the Supplier Code of Conduct by the end of GD2 (98 of our suppliers). We will report annually on the actual percentage of suppliers meeting the code, as part of our annual environmental report. Appendix 010, Procurement and native competition appendix contains more detail on this.

We are not proposing any capital expenditure associated with improvements linked to our supply chain. The estimated operational cost is £1m in total to carry out increased engagement, providing training and supporting suppliers' ambition to be low carbon providers. This is the direct operational cost to us and does not include any supply chain impacts.

[23] UN Global Compact is a voluntary initiative based on CEO commitments to implement universal sustainability principles and to take steps to support UN goals.

[24] Shaping the Business Plan Qualitative Workshops - Environmental Action Plan (ref 084), Shared Net Zero Future round table event – Scotland (ref 090)

9.11 Embedded carbon

We will develop a mandatory requirement for our suppliers through the Supplier Code of Conduct, to report on the carbon emissions of the materials we purchase. Once this has been calculated, we will use the first set of results as a baseline. We would then set appropriate reduction targets for the next phase.

We will focus on some of the key materials we use within our operations, measuring embedded carbon across three main products which represent our biggest spend on materials; PE pipe, concrete and asphalt, and steel pipes and fittings.

We will implement this approach in new projects and identify an appropriate tool or software for measuring and reporting embedded carbon. This will feed into our annual environmental report to stakeholders.

9.12 Additional reporting

Throughout GD2 we will measure and report on several more attributes and work more closely with our supply chain than has previously been the case. To carry out this reporting function we have made allowance in our plan for additional resource to manage, support and report on the initiatives set out in the EAP.

Our annual environmental report (10.3) will include our progress against targets we have set, and will stimulate a transparent debate on our progress with our Steering Group for Environmental Action and with broader stakeholders.

Part C: Supporting the transition to an environmentally sustainable low-carbon energy system

We have maintained the main focus of our EAP on projects that will have a direct environmental impact in GD2 and which we are confident of delivering, although there may be uncertainty surrounding the associated cost.

However, alongside our ambitious EAP for GD2, we have longer-term ambitions to support the decarbonisation of energy required to meet net zero by 2045. We have carefully considered low and no regrets projects (9.14) and the research and development needed to decarbonise the gas in our network (9.15).

9.13 Biomethane and embedded entry

We have consulted widely with our biomethane stakeholders and had detailed conversations[25] on the primary barriers for future and current injection of decarbonised gases. We continue to work with biomethane producers at an operational level to understand their requirements and needs. We have consulted with industry stakeholders involved in the process of injecting distributed gas to the grid, focussing on a number of barriers, listed below, relating to distribution networks.[26]

- Capacity constraints on the distribution network lead to high connection costs when connecting where there is sufficient capacity. Entry capacity constraints also limit and impact on sites currently connected.
- Connection costs remain high, in part due to the lack of standardisation of GDN connection design specifications.
- Gas regulation standards requirements for injection to the distribution network lead to high propanation costs.

Capacity constraints. The maximum injection capacity offered to biomethane producers is limited to the demand downstream from the potential gas entry point. Demand can be highly variable, both geographically and at different times in the year depending on the weather. Compression assets and pipelines can be installed to take the gas from where it is produced to a higher-pressure tier with greater downstream demand. However, the asset and pipeline costs necessary to achieve this can deter prospective producers.

With a decreasing number of low-cost injection opportunities available on some networks, more innovative methods of managing supply and demand will need to be implemented to unlock the full potential supply of distributed gas sources. Innovation, such as our biomethane hub at Portsdown Hill near Portsmouth which became operational during GD1, has allowed biomethane producers to transport their gas by tanker to an appropriate entry point.

Connection costs. We are working to standardise equipment with market providers which will lead to lower connection costs, and to support innovative commercial solutions, like our Portsdown Hill project, designed to help overcome the network constraints described above.

Gas regulation standards. Following on from our Opening the Gas Markets study in Oban we continue to work with IGEM to promote changes to gas regulation standards to allow a broader spectrum of gases to enter the distribution network. We are also exploring further network management options to reduce the amount of propane required.

[25] Biomethane and Gas Entry connections round table event (ref 095)

[26] These barriers were also discussed with the biomethane industry through our participation in the Energy Networks Association Biomethane Workgroup. Our proposals have also been shared at the UK AD Expo. www.biogastradeshow.com

Case study

Green billing for industry example

We are working with an independent Scottish distiller that is also one of the largest biomethane entry points on our network, supplying 3,500 standard cubic metres per hour (scm/h) of green gas. Our proposals on a revised spectrum of permitted gases would mean we could reduce or eliminate the volume of propane injected to enrich the distillery's green gas to meet the prevailing gas quality for billing purposes. By deploying some of the sensor installations developed under the Real Time Networks innovation project (such as bidirectional flow metering) we hope to offer a significant reduction in propane enrichment and green the gas even further.

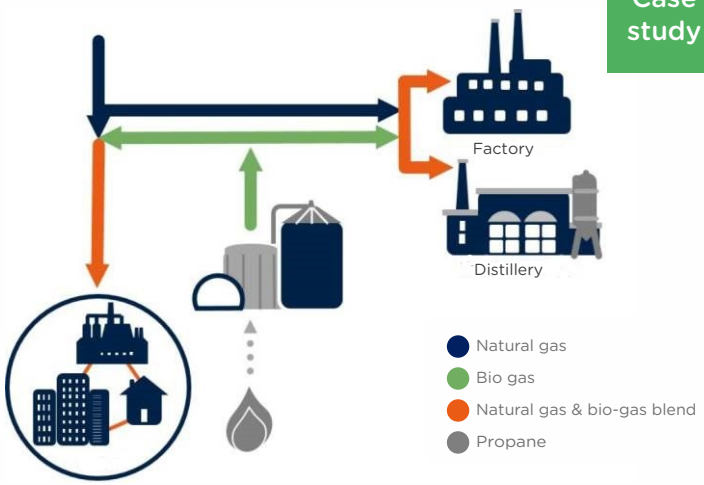


Figure 9-3 Avoided propanation example

Since commissioning, approximately three million standard cubic metres of propane has been injected at the biomethane plant to meet the current standard, costing approximately £2.3m.

Below we present three examples of how we are working to improve network capacity for biomethane producers in GD2.

Ebbsfleet example for smart control of biomethane in the network

We are in discussions with the producer at Ebbsfleet biomethane facility in Kent to trial a new pressure management and control technology we have developed in GD1.[27] This smart remote pressure management solution allows automated set-point control of the injection facility, which works in conjunction with the district governors (the pressure control systems supplying the local network).

This would maximise the injected flow rate from the biomethane entry points by prioritising biomethane injection over traditional gas entry from our pressure reduction stations.

Figure 9-4 Remote pressure control and management

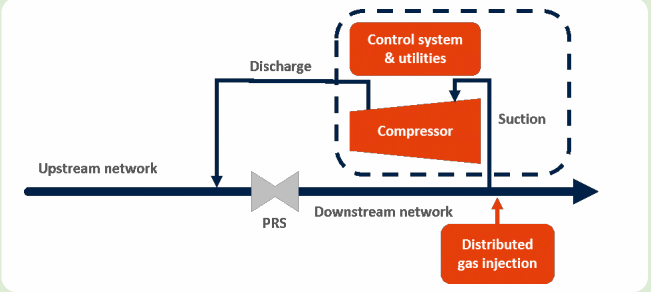
Gore Basin - Isle of Wight example of reverse compression optimised capacity

The constraint issues relating to insufficient demand described above could be solved using other methods. There are various theoretical solutions to this issue, for example 'line-packing' of the immediately accessible system, however this would only lead to a slight increase in injection capacity for a limited period.

One possible solution is to install compressor equipment at an existing PRS and compress gas to the higher-pressure tier upstream. This is essentially expanding the accessible mains network in which the distributed gas can be supplied as the higher-pressure tier networks have a much larger demand base.

The project will look at the various elements in compressor design, installation and control, including dynamic simulation of the compressor operation in a stable manner with optimal compressor capacity, electrical demand and connection and site location.

Figure 9-5 Schematic of the gas injection and compression concept



[27] Pressure management and control project, SGN

Other biomethane sites

In addition, we are actively working with our existing biomethane producers who have requested an increase to the volume of green gas entering the network. Currently we have 30 sites connected and flowing into the network (section 2.2.6). Many of these customers have already increased their network capacity, and several are requesting further capacity studies. We want to ensure we support and provide technical solutions to enable the increased flows from these sources to be accommodated, allowing customers on our network to benefit from more green gas. Our three blueprint projects in GD1 will evidence how these needs can be met.

The total cost for biomethane projects in GD2 is £2m with a planned rollout in the first year of GD2.

We also propose to undertake three further feasibility studies to assess the viability of biomethane (or potentially hydrogen) feeding our SIU networks (see also 11.7.2).

9.14 Low and no-regrets heat decarbonisation projects

When developing our approach to heat decarbonisation we have reviewed opportunities for investing more on a project today if we think it could facilitate decarbonisation of heat, or reduced environmental impact at some point in the future.

For example, we assessed the opportunity for using valves today that would support the future roll-out of hydrogen, while undertaking our repex programme. This would avoid the additional cost of installing them at later date should hydrogen's role be confirmed in the heat decarbonisation pathway. For the same reason, we considered the additional cost of installing sensors with hydrogen monitoring capability compared to a standard sensor today. For both of these examples we concluded that on balance, the scale of additional cost required today outweighed the benefits of intervention later.

The one low regrets project that we have progressed is the acceleration of the repex programme. This will have the immediate impact of reducing methane emissions (section 7.5.1) and we believe it to be justified on this basis. Our accelerated repex approach received significant scrutiny from customers and stakeholders and is broadly supported.

9.15 Accelerating the decarbonisation pathway towards 2045 net-zero

In chapter 11 we discuss our contribution to a whole systems approach to decarbonisation. In chapter 13 we set out our innovation strategy, a major part of which is determining the role of hydrogen in the provision of decarbonised heat. We see our role as providing high quality and robust evidence, quickly, to reduce the risk of stranded assets or inefficient investment paths (section 13.4.4).

Innovation projects related to the energy system transition are set out in section 13.6 and those involving the whole system for energy in section 11.7.

We think our approach to innovation will minimise the risk of asset stranding and enable the networks to respond most effectively to the challenge of decarbonisation. It will provide customers today and in the future with the right balance of ambition and protection from unnecessary expenditure.

10 What consumers want and value from networks: building a shared net-zero future

Linked appendices

- Environmental action plan

The table below brings together the outputs that we are proposing to meet our customer commitment that we will help to build a shared net-zero future. It includes the deliverables from our EAP (chapter 9), and the enabling technologies and activities that will support our ambition to accelerate towards a 2045 net-zero.

We have addressed significant levels of cost uncertainty relating to our bespoke outputs through the use of uncertainty mechanisms (chapter 12). For our shared future outputs, uncertainty includes the political direction and pace of underlying technological change, which will impact the balance of ambition, cost-efficiency and deliverables in line with customer interests.

10.1 Shared net-zero future: sector and bespoke outputs

A summary of our output proposals to build a shared net-zero future follows

Sector outputs		GD2 output category	Uncertainty mechanism	GD1 first 6 years		GD1 last 3 years		GD2		BPDT
Section	Output			Annual measure	cost £m/yr	Annual measure	cost £m/yr	Annual measure	cost £m/yr	
10.2	**Shrinkage and environmental emissions**									
10.2.1	Leakage reduction: repex (including accelerated and proactive steel)	See 7.4		-34.5ktCO_2e		-28.9ktCO_2e		-31.9ktCO_2e		2.17
10.2.2	Leakage impact: pressure management and MEG	ODI (Fin)		-3.6ktCO_2e		1.9ktCO_2e		3.0ktCO_2e		2.17
10.2.3	Other activities: theft and own use	ODI (Rep)		-0.6ktCO_2e		-0.4ktCO_2e		-0.5ktCO_2e		2.17
10.3	**Annual environmental report**	LO								
Bespoke Outputs										
10.4	**Environmental action plan initiatives part A**									
10.4.1	Remote pressure management pilot	PCD						Implementation in London and Southern	0.7	3.05
10.4.2	Leakage reduction innovation roll-out	PCD	12.2.10						0.4	3.05
10.4.3	Constraining leakage: 12 hour repair standard									
10.4.4	Increased fleet replacement	PCD						310 vehicles	2.4	3.06
10.4.5	Low emission vehicles	PCD	12.2.10					155 vehicles	1.9	3.06
10.4.6	Renewable energy: installation of PV	PCD	12.2.10					9 buildings and 480 sites	1	3.05
10.5	**Environmental action plan initiatives part B**									
10.5.1	Biodiversity improvements	PCD	12.2.10					31 surveys completed	0.9	3.05
10.5.2	Climate change adaptation	PCD	12.2.10					9 surveys and remedies	2.1	3.05
10.6	**Environmental action plan initiatives part C**									
10.6.1	Biomethane capacity ambition (equivalent households)	ODI (Rep)		33,595 households		32,722 households		40,000 households		
10.6.2	Biomethane studies at SIUs	PCD						0.6 feasibility studies	0.1	3.05
10.6.3	Biomethane improved access trials	PCD						3 trials in total	0.5	3.05
10.6.4	Biomethane: improved access roll-out	PCD	12.2.10					Roll out of improved access trials	2.0	3.05
IT enabling outputs										
10.7	**DCC membership**	PCD						Membership	1.1	3.05
10.8	**Cyber resilience**	PCD							4.5	3.05
10.9	**IT technology readiness**	PCD							2.3	3.05
10.10	**Open data sharing**	PCD							1.1	3.05

10.2 Sector output: shrinkage and environmental emissions

The shrinkage and environmental emission targets are divided into three categories:

- the change in leakage brought about through investment in the replacement of assets;
- change in leakage brought about by improved pressure management; and
- change in shrinkage brought about by reduced theft and own-use gas.

10.2.1 Reduction in leakage through mains replacement

The most significant impact on these targets is the reduction in leakage brought about through investment in the replacement of assets. We anticipate this will reduce emissions by 31.9ktCO_2e a year during GD2. Full details of our replacement outputs can be found in section 7.4

10.2.2 Impact on leakage of pressure management and gas conditioning (MEG)

It will be a significant challenge to further reduce leakage through the use of pressure management in GD2, as pressures are already optimised to minimise leakage throughout the year (section 9.5). With changing demand patterns we anticipate that GD2 will see a continuation of the current trend towards an increase of pressure, however we will constrain the increase to 3ktCO_2e a year.

10.2.3 Change in shrinkage from theft and own gas use

Reducing theft of gas is something we have focused on in GD1 in line with feedback from stakeholders attending our Moving Forward Together workshops.[1] To date, we have recovered over £1.7m which has been returned to customers. In 2018 we introduced a new customer relationship management (CRM) system. This has improved our access to information relating to theft of gas cases. As a result, we have more than doubled the number of identified cases from nearly 1,000 in 2017/18 to over 2,000 cases to date in 2019/20. We will continue to focus on this issue and share best practice with other networks in GD1 and through GD2.

10.3 Sector output: annual environmental report

Our EAP (chapter 9) identifies a number of key deliverables and targets for GD2. Our annual environmental report will include how we are progressing against these targets and ambitions, the measures that we have implemented and the measures we propose to implement. Progress against our environmental targets including our business carbon footprint will be reviewed by our Environmental Steering Group and published in our annual report to promote under debate and accountability.

10.4 Bespoke outputs: environmental action plan initiatives

We worked with our stakeholders and customers to design initiatives and bespoke outputs which will allow us to monitor our delivery against Ofgem's three-part action plan guidance

Part A: Decarbonising our network and reducing total carbon footprint

Part B: Reducing other environmental impacts

Part C: Supporting the transition to a low-carbon energy system

Further details of all the initiatives are included in our EAP, summarised in the three parts of chapter 9 and described in our EAP appendix.

10.4.1 Bespoke output: remote pressure management pilot

In our EAP appendix and section 9.5 we describe the innovative initiative we are proposing to undertake in our southern network to reduce our leakage through smarter network control and remote management. Further detail is available in the Network integrity appendix and associated EJPs.[2]

10.4.2 Bespoke output: leakage reduction innovation roll out

There are a number of innovations developed in GD1 which have a direct environmental impact or reduce emissions, but where the value of those emissions is not captured through the existing leakage model (section 9.5 and the EAP). The first of three immediately identifiable innovations is the stent bag, which is inflated in the pipe to provide a temporary seal while a repair is carried out. Secondly, our high-volume gas escape toolkit identifies methods for early identification of escapes, seals structures and plugs gaps to reduce the extent of the escape. The third is the gas GECO pump that stores gas under pressure having extracted it from a pipe prior to it being replaced, before returning it to the pipe once the project has been completed. Prior to this innovation, gas would have been vented to atmosphere.

Our level of confidence in both the cost and the effectiveness of the technology varies according to the innovation, so we have proposed a use-it-or-lose-it mechanism (12.2.10) to enable the effective recovery of costs for innovation roll-out, where the benefits of the innovation are predominantly focused on environmental impact and the reduction of actual emissions to atmosphere from our network.

10.4.3 Bespoke output: constraining leakage 12 hour standard

We will maintain our leading performance in repairing gas escapes within 12 hours (9.5) and Replacement expenditure appendix.

[1] MFT Workshops London, Portsmouth & Edinburgh March 2017 (ref 008, 009, 010)
[2] Utonomy – South London LP Networks and Utonlom – Southern LP Networks

10.4.4 Bespoke output: increased fleet replacement rate

Our current fleet of over 2,100 vehicles typically operate on an average of an eight-year replacement cycle, with further consideration given to vehicle distance and usage patterns. Our EAP assesses the impact of alternative investment plans, such as changing the replacement cycle to consider either extending it to 10 years or bring it forward to six years.[3]

Our assessment showed there was no financial benefit to increasing the length of the replacement cycle as after year eight the cost of repair begins to exceed the value of the vehicle.

Conversely, the impact of bringing the replacement cycle forward to six years would increase the cost, but it would also create the environmental benefit from moving to cleaner and more efficient engine types more rapidly (section 9.6.1).

Moving to a six-year replacement cycle across our fleet will increase our capital expenditure by £2.4m a year. However, we would avoid costs of £1m a year on average associated with reduced maintenance and avoided fuel costs.

10.4.5 Bespoke output: replacing existing vehicles with low emissions alternatives

As well as a revised replacement cycle we have also assessed the option of replacing our vehicles with ultra-low emission vehicle (ULEV) alternatives – either CNG, electric, hydrogen or hybrid vehicles.

Appropriate ULEV alternatives for all our vehicle types are not readily identifiable in today's market (section 9.6.1). However, vehicle technology is developing very rapidly, and while we cannot determine the pace of change, by introducing our own ambitious programme of change we can support it.

We have proposed a high ambition target of replacing approximately half our fleet with ULEVs by the end of GD2 and to introduce the necessary refuelling infrastructure to maintain our operational effectiveness. To achieve this, we estimate we would need to spend approximately £1.9m a year on the vehicles themselves and the charging infrastructure necessary to ensure reliable operation. We estimate by applying this revised replacement cycle and investing in low emission vehicles we would save 5.4ktCO_2e from our fleet by the end of GD2. This investment is supported by EJPs and CBAs.[4]

>> As the market develops the costs associated with ULEVs and their associated infrastructure is expected to reduce substantially over time. Given the combined uncertainty of technical capability and the cost, we are proposing a use-it-or-lose-it mechanism (section 12.2.10).

10.4.6 Bespoke output: installation of solar photovoltaic (PV)

We have identified two programmes for the deployment of PV. The first is across existing office buildings where, with the support of independent consultants, we have carried out an assessment of the opportunities for PV across our sites. We identified 45 sites categorised by size and have included them as part of our EAP (section 9.6.5). The total cost of installation is estimated at £1.7m with each site's costs varying according to size.[5]

The second programme is the deployment of PV on selected profiling governors across our distribution network. We have an estimate 2,400 sites where these installations could create 24kW needed to power monitoring and control equipment.[6] If proven to be successful, we would install these systems as standard practice at new or replacement sites at a cost of £3.4m over GD2.

As full site surveys have not been completed we are recommending this is a use-it-or-lose-it allowance. That means if a site is not appropriate for the installation of PV due to site specific considerations, the allowances are returned to the customer.

[3] 'SGN Fleet BAU EJP', 'RIIO-GD2_CBA Fleet V4 – SGN'
[4] 'SGN Fleet EAP EJP', 'RIIO-GD2_CBA Fleet EAP – SGN'
[5] 'SGN Prop 003 Renewable Energy – EJP Dec 19', 'SGN Prop 003 Renewable Energy – CBA Dec 19'
[6] 'SGN DInt 009 SolPV So – EJP Dec 19', 'SGN DInt 009 SolPV So - CBA Dec 19'; 'SGN DInt 019 SolPV Sc – EJP Dec 19', 'SGN DInt 019 SolPV Sc - CBA Dec 19'

10.5 Bespoke outputs: part B environmental action plan

Outputs from part B of our EAP relate to reductions in other environmental impacts. More details of our proposals can be found in chapter 9 part B.

10.5.1 Bespoke output: biodiversity improvements

Over the course of GD2 we plan to improve our understanding of the biodiversity across our sites to increase the resilience of our natural environment, to safeguard any species or habitats of principal importance and to monitor how they change over time. We therefore propose to undertake a survey of the 153 sites to establish a phase 1 baseline, from which we can then develop and implement a biodiversity improvement strategy (section 9.7).

Initial survey costs will vary depending on complexity, location and site size. We would carry out surveys at all the 153 selected sites prior to determining the most suitable biodiversity improvement strategy and measures for each.

We are proposing an allowance for the surveys and strategy development of £2m to cover the 153 sites as a PCD, and a use-it-or-lose-it uncertainty mechanism (12.2.10) of £2.5m for the identified improvement and enhancement measures.[7]

10.5.2 Bespoke output: climate change adaptation

We propose to complete a climate change adaptation and flood survey for all occupied sites (i.e. including above ground assets but not including the mains) and to identify associated mitigation measures, so remedial actions can be completed as necessary (section 9.9).

The proposed cost for this output totals £500k for the survey only.[8] The recommended remedial costs identified by the survey are highly uncertain, ranging from site relocation, to flood protection schemes, solar shading or increased drainage. We have proposed an uncertainty mechanism to manage the actual adaptation work (section 12.2.10). The consultancy supporting us on this project has suggested an up to £10m (£2m a year) would be considered an appropriate amount.

10.6 Bespoke outputs: part C environmental action plan

Outputs from part C of our EAP support the transition to an environmentally sustainable low-carbon energy system. More details of our proposals can be found in chapter 9 part C.

When considering network innovation projects relating to heat decarbonisation, our strategic approach has been to build the necessary evidence base to gain a better understanding of the cost-effectiveness of different heat decarbonisation pathways (section 13.4.4 onwards). These innovation projects are related to activities described in section 11.6 and 11.7 which set out the whole system interactions that will enable networks to respond most effectively and minimise the risk of asset stranding.

10.6.1 Bespoke output: biomethane capacity ambition

We have set out a number of proposals in our EAP to support the deployment of biomethane. These are based on regular discussions with biomethane producers to identify the interventions which would support the expansion of existing facilities, their productivity, and encourage new producers coming onto to the network (section 9.13).

Our proactive approach taken with biomethane producers has been central to our ambition of achieving the equivalent of 450,000 households supplied by biomethane by the end of GD2 for which we are proposing a reputational ODI.

10.6.2 Bespoke output: SIU decarbonisation

We are proposing a use-it-or-lose-it mechanism for three feasibility studies to promote biomethane injection (or potentially hydrogen) at our SIU locations, Oban, Wick and Thurso. We have already completed a biomethane feasibility study at Campbeltown with the Scottish Government, which assessed the full range of requirements needed to locate and operate a biomethane plant on the gas network. We estimate each study would cost in the region of £100,000. The importance of decarbonising the SIUs was raised directly by discussions with stakeholders in the SIUs and Scottish members of our CEG in the July 2019 report.[9] More details of our SIU future projects can be found at 9.13 and 11.7.2.

10.6.3 Bespoke output: biomethane improved access trials

We have identified three trial projects in our EAP which we think have the potential to significantly increase the amount of biomethane able to enter the gas network from existing sites, as well as reduce the cost of new biomethane sites (section 9.13). The trials will demonstrate technologies for maximising injection flow rates onto our network, for reverse compression to expand the accessible mains network and for creating local billing zones in areas of high biomethane concentration.

Each trial has a CBA and EJP associated with it[10] and we have proposed PCD for the delivery of each project. This means that in the event of a technical barrier or other reason why a project cannot be delivered, the allowances are returned to customers.

7 SGN Prop 001 biodiversity – EJP Dec19'
8 'SGN Prop 002 Climate Change Adaptation – EJP Dec 19'
9 Scottish Independent Undertakings Summary (ref 087), Biomethane and Gas Entry connections round table event (ref 095)
10 'SGN EAP – 001WGC – CBA Dec2019', 'SGN EAP – 001UTO – CBA Dec2019', 'SGN EAP – 001PRO – CBA Dec2019'

10.6.4 Bespoke output: biomethane improved access roll out

Assuming that the trials above are successful, we have identified a number of additional sites that could benefit from these technologies. We are therefore proposing to establish a use-it-or-lose-it allowance (12.2.10) to deploy these technologies on our network through GD2 in order to maximise the volume of biomethane transported on our network. This is explained in detail in appendix 006, Energy system transition, section 4.2.

10.7 Bespoke IT enabling output: DCC membership

The UK Government has indicated there may be an expectation for GDNs to make use of consumption data from smart meters to improve management of shrinkage, leakage, theft of gas and forecasting. Costs have been prepared to estimate the investment required in setting up systems and the associated interfaces to interact with the DCC, plus the ongoing cost of DCC membership based on published price-lists. We have set out the costs and benefits, including some barriers-to-benefit, in the EJP.[11] The benefits we are expecting to realise are speculative but we hope to see evidence of value created once we start to use the data and the roll-out process is completed. We are currently talking to a Dutch utility about how they are using smart meter data to improve their network. We expect to be able to learn from them and better understand the possibilities for our own network operations.

We estimate that to realise the benefits we need a high penetration (around 95%) of smart meters, expected to be achieved towards the end of GD2. However, we recognise that there is uncertainty in this schedule, and that potential benefits are subject to change. We therefore propose that DCC membership is a PCD. We estimate this will require a £5m initial capital investment followed by an ongoing cost of £100k a year.

10.8 Bespoke IT enabling output: cyber resilience

There is a constantly evolving cyber threat requiring our response to protect the company and the network from attack and harm (section 8b). We are proposing to invest £4.5m[12] a year to provide an appropriate level of protection from cyber threats and the supporting EJP provides a detailed list of technical initiatives that cover both IT and OT. As we progress into an OT reopener (12.2.12) we would aim to provide clarity over funding sources by separating these initiatives according to those categories.

10.9 Bespoke IT enabling output: IT technology readiness

Our stakeholder research has emphasised the need for us to keep pace with technological change, with 78% of stakeholders expecting us to use the latest technology, and only 38% thinking we currently do so.[13] Utilising a combination of current trends and expert technology advice and research, we have identified the Industrial Internet of Things (IIoT) and analytics (including artificial intelligence, machine and derived learning) as the two areas most likely to have the greatest impact. We have therefore set out £2.3m a year investment proposal[14] to support this changing technology requirement. As set out in section 6.14, this includes funding for multi-occupancy building readiness.

10.10 Bespoke IT enabling output: open data sharing

In-line with the strong guidance from the Energy Data Task Force (EDTF), we have seen increasing pressure and opportunity to share our data with other entities for the benefit of customers and stakeholders, for example, roadworks information with TfL. Our proposals for digitalisation to support a whole systems approach can be found in section 11.5. We have provided a high-level capital cost estimate of £3.8m and an annual operating cost of £1.1m to provide suitable IT platforms and changes to meet the needs defined by the EDTF. These costs have been based on our historical costs to build and utilise our own analytics platforms This level of investment is to enable the development of a data architecture framework that provides the basic structure in which data can be sourced, managed, shared and accessed. The structure, plan, associated costs and alternative strategies are assessed in the supporting EJP that covers analytics and open data.[15]

[11] 'SGN IT - 009 DCC EJP Dec19 v1.2', 'SGN IT - 009 DCC - CBA Dec19'
[12] 'SGN IT – 007 Cyber EJPDec19', 'SGN IT – 007 Cyber CBA Dec19'
[13] Stakeholder Satisfaction Wave 1 (ref 071)
[14] 'SGN IT – 014 IIOT EJP Dec 19', 'SGN IT 014 IIOT – CBA Dec19'
[15] 'SGN IT - 016 OpenData EJPDEC', 'SGN IT - 016 OpenData - CBA Dec19'

11 Enabling whole system solutions

Linked appendices

- Energy futures
- Whole systems and scenarios

System boundaries are beginning to be broken down, improving opportunities to deliver clean, secure and affordable energy to customers. But this combined, or 'whole systems approach' is highly complex and requires a multitude of bespoke solutions.

Energy systems, networks and related economic impacts are becoming increasingly interlinked. As the interaction between heat, electricity and transport become stronger, so too does the value of cooperation between the networks that deliver this energy. Improved coordination between network companies and system operators will ensure that more options are available to ensure low carbon energy is delivered to customers at lowest cost.

To build a shared future in line with our customers' priorities, we are -

Minimising our current environmental impact (chapters 9 and 10)

- Reducing carbon emissions through leakage, our business carbon footprint and embedded carbon (chapter 9A)
- Reducing other environmental impacts (chapter 9B)
- Reducing the carbon content of gas in our network by enabling increased biomethane volumes (chapter 9C).

Accelerating towards 2045 net-zero (this chapter and 13)

- Pursuing opportunities for optimum decarbonisation routes through whole systems thinking (explored below)
- In parallel, evidencing innovative decarbonisation solutions for energy and preparing for future roll out (explored in chapter 13 Innovation).

This chapter explores our plan to accelerate towards net-zero in 2045, matching the Scottish Government's ambition for both our network areas. Funding requirements for the net-zero acceleration programme are summarised in the Innovation chapter, section 13.4.

11.1 Accelerating towards 2045 net-zero: enabling whole system solutions

As we approach GD2 it is important that we work closely with other parts of the energy system to improve operational interfaces across our shared network areas. Coordination will need to be stepped up to meet the net-zero challenge and changing customer needs and priorities. This will require co-ordination with the four network sectors (transmission and distribution for electricity and gas) as well as the system operators (electricity, gas and distribution). This is set out in appendix 007, Energy Futures – whole systems and scenarios, section 1.2.

Whole energy systems can deliver short and long term benefits to GB energy customers. Following extensive stakeholder engagement, we have developed a whole systems charter and portfolio of projects to ensure these benefits can be realised throughout GD2 and beyond. Our proposed charter has been further developed with the electricity networks (DNOs) in our footprint and shared with the Energy Networks Association (ENA) for wider engagement. The charter aims to develop and exploit open data between energy systems, share progress with decarbonisation options, allow for key interfaces and governance to be developed and advance dynamic whole systems planning.

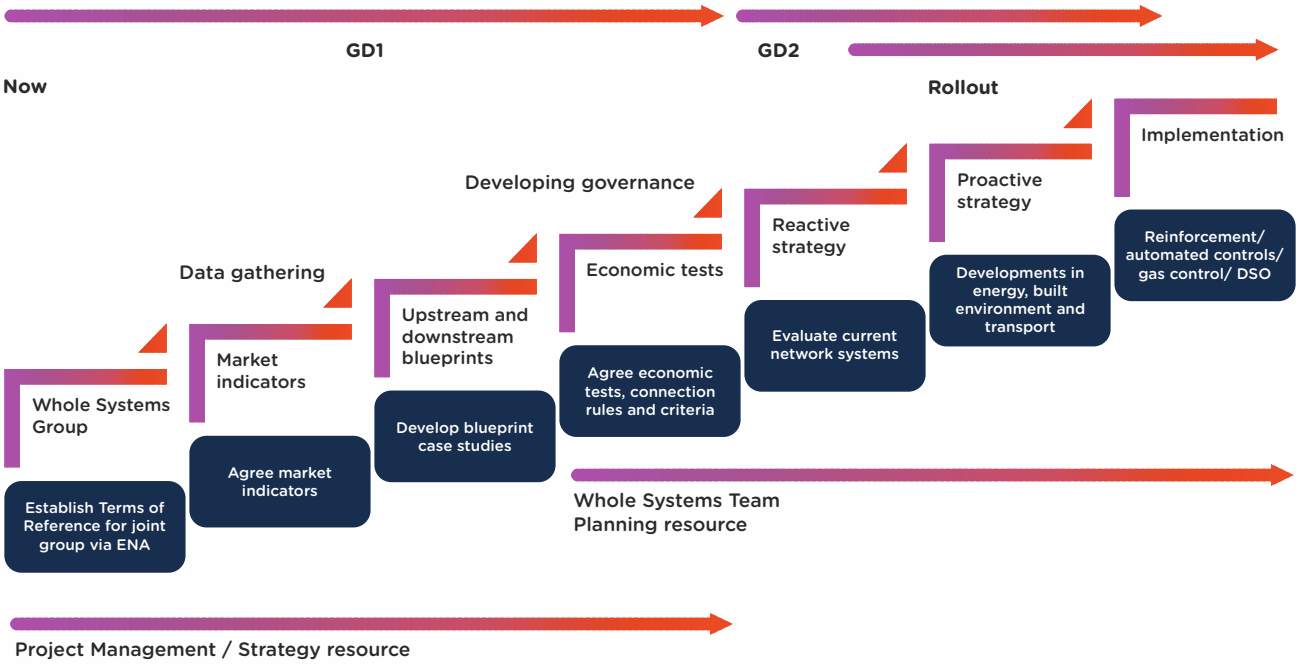
11.2 Whole systems charter

A common set of structures for sharing information between local networks will be instrumental to creating an enduring whole systems approach during GD2. Our decarbonisation challenge is to transport renewable energy to every part of the whole system in a way that is reliable, safe, affordable and practical. Breaking down the barriers that currently restrict a whole systems integrated approach is a critical step in achieving this.

The charter sets out a series of eight commitments defining how we will work together during GD2.

1. Developing and sharing a set of market indicators that improve GDN/DNO ability to forecast gas and power demand.
2. Holding a joint annual review to share planning assumptions prior to publication of our respective annual long term development statements.
3. Developing a joint scenario planning process to be used for the GD3 price control.
4. Sharing our annual investment plans for those assets with whole system implications, including network reinforcements to support gas-fired generation assets, large load connections and other assets that bridge the interface between gas and electricity.
5. Developing a large load connection process across the GDN/DNO boundary to help customers secure the energy connection best suited to their needs, at the lowest cost to them and the wider network.
6. Working together in GD2 to develop and implement an operational planning and information sharing protocol between GDNs and DNOs.
7. Developing a trial mechanism in GD2 for sharing real time operational data for assets of common interest, primarily gas-fired generation assets.
8. For any substantial gas or power network outage, early information on scale, location and likely duration will be exchanged between the GDN and DNO to allow system impact planning to minimise customer disruption.

Figure 11-1 Whole system strategy



Our broad plans for engagement with stakeholders on the complex long-term challenge of decarbonisation are summarised in section 4.15 and covered in more detail in the Stakeholder engagement plan appendix.

11.3 Improved whole systems planning

It is increasingly evident gas networks can no longer be developed and operated in isolation from other energy systems – and if they are, this is not in the best interest of the customer.

To explore the whole system landscape more systematically, we have adopted a systems engineering approach, framed largely around the Future Power Systems Architecture (FPSA) project (IET and Energy Systems Catapult, 2017). Using four planning timescales identified by the FPSA project, we have identified a series of drivers that will enable the development of a whole systems approach to energy modelling and management.

Drivers of new gas system functionality include:

- flexibility to meet changing but uncertain requirements
- change in mix of gas sources
- change in mix of electricity generation
- use of price signals
- emergence of new participants
- active management of networks, generation, storage and demand
- need for coordination across energy vectors.

This analysis has a number of implications for GD2.

- Improved system scenario development is required to be carried out on a regional basis with appropriate DNOs and other energy system actors.
- Scenarios need to be translated into demand profiles which are used as a common basis for investment planning across both gas and electricity networks.
- Integrated planning needs to extend through to real-time operation, to give gas network operators improved visibility of GDN connected generation assets.
- Energy connection requests for large loads need to be considered by both local electricity and gas networks to ensure the lowest cost solutions are identified.

Improved integration between gas and electricity networks will require a range of innovation projects (section 11.7) to develop the tools and processes needed across the price control period. Depending on the outcome of innovation trials, a number of real investment projects will be needed to embed the processes.

Case study

Pathfinder model applied to Edinburgh and Brighton

We have worked with partners to conduct system modelling for Edinburgh and Brighton, to illustrate the potential impacts of different decarbonisation pathways at a local level and to improve our understanding of the potential implications for gas and electricity network system planning. We used the Pathfinder model[1], which represents the hourly balance of supply and demand across gas and electricity networks to be forecast over the course of a year. The two sites were chosen as being representative of towns and cities in Scotland and our southern region.

We modelled a number of 2030 scenarios, including a constrained peak-demand, high energy efficiency, electrification, green gas and reference scenarios for both cities.

Despite important regional differences, we demonstrated the green gas and electrification pathways for Edinburgh and Brighton to support customer demand, illustrating the challenge of achieving the 2030 targets. While a full-cost comparison is not possible with the model, assessing the comparative disruption to customers from each approach is clear. Considerably fewer customers would be disrupted by the development of a green gas solution than would be by a green electricity one. In that scenario, potentially tens of thousands of air source heat pumps would need to be installed, and significant changes would need to be made to heating systems in each customer's home.

In reality, a combination of both approaches will be required to deliver the optimal whole system solution, but the ongoing need for a comprehensive and reliable gas network to meet peak energy demand is clearly demonstrated.

[1] Model created by Delta-EE with WWU.

11.4 Local area energy plans (LAEPs)

We have undertaken extensive engagement and research with local authorities around our network regions, to understand their growth plans and infrastructure needs. We are proactively extending our engagement to include emerging local decarbonisation strategies, including the Local Heat and Energy Efficiency Strategies (LHEES) in Scotland.

Our initial goal was to explore ways to develop a more integrated approach to planning and sharing of data across both planning platforms. We have a high proportion of data sharing agreements in place covering 109 local authorities in our operating regions.

Common themes emerging from that engagement have included:

- the importance of working together in a joined-up way;
- the value of sharing development plans to ensure infrastructure providers are aware of these plans and they have adequate funding to support their delivery;
- ensuring infrastructure providers will not become a 'blocker' to timely construction and delivery of local authority plans;
- the desire for increased coordination between infrastructure providers to minimise disruption; and
- ongoing engagement needed as stakeholders develop a clear, longer-term strategic vision for decarbonisation, as delivery plans are currently at a very early stage of development.

By establishing a clear picture of long term business requirements and an understanding of the vision for local community growth, we can ensure larger scale projects can be delivered in a timely manner, avoiding capacity constraints becoming a restriction to development. Local authorities want to ensure we are able to support their plans, which are critical to the future economic wellbeing and enhancement of their area.

We have been a key contributor in the consultation process for the Greater London Authority's Infrastructure & Coordination Initiative. This will develop options to optimise the coordination of organisations needed to support the planned rate of development in London over the coming years.

New housing is a typical growth driver for us and local authorities, especially in our southern network regions. The Mayor of London's High-Level Infrastructure Group, of which our CEO is a member, has said:

> *"SGN has been a key contributor in the consultation process aimed at developing options to meet the coordination challenge associated with the planned rate of development in London, where a requirement for approximately 66,000 new homes per annum has been identified. It is recognised greater coordination is needed to support this aim to ensure more efficient delivery for London and Londoners."*

We have extended our engagement and are exploring how we can develop a more integrated approach to planning, which will give us a clear view of local governments' decarbonisation strategies and how we can support their growth.

This includes proactive participation with a number of organisations.

- Scottish Government Initiative - Infrastructure Delivery Group.
- Steering group for the Greater Brighton LAEP covering the triangular area between Lewis, Worthing and Crawley.
- Glasgow City Region Operational Infrastructure Group.
- National Improvement Service for Scotland facilitating a national data hub for all Local Authorities in Scotland, including the collation of all local development plans on a single GIS platform.

We are offering our expertise on the role gas networks play in providing homes, businesses and industry in the region with heat and warmth, as well as our role in the opportunity to decarbonise local areas at the lowest cost and with the least disruption.

Further details of our plan to engage with local stakeholders in the creation of LEAPs and LHEES are included in section 4.14.4 which includes a performance commitment and measure covering systematic engagement across both our regions. This performance commitment forms part of our reputational stakeholder engagement incentive.

11.5 Modernising energy data (digitalisation strategies)

The ready availability of quality network data will be critical to achieving net-zero through the successful decarbonisation of our energy system.[2] Improvements to energy data, combined with greater collaboration between networks and systems that have previously been discrete, will require essential investment to take forward the Energy Data Task Force (EDTF)[3] recommendations. Doing this will open the door to shared opportunities and deliver efficiencies not only for customers, but to facilitate the wider whole system environmental, economic and customer benefits.

The ENA has established a new data working group that incorporates gas and electricity networks (distribution, transmission and ESO), including, in its terms of reference, how we can collectively:

- deliver against the objectives above;
- work with Ofgem, BEIS and InnovateUK to assist in the delivery of the EDTF recommendations; and
- progress the themes set out in paragraphs 2.36-2.47 of Ofgem's business planning guidelines.

We will support and work closely with the ENA and its digitalisation strategy, designed to provide a consistent view of modernising energy data across all energy networks. Our own digitalisation strategy is and will be further developed in alignment with our other whole system partners, ensuring customer needs and expectations remain at the forefront of our ambition. The ENA will lead a stakeholder event with all the networks on 12 March 2020 to showcase the networks' digitalisation strategies and initiatives in progress and to enable stakeholder engagement and feedback.

Progress to date

The table below from the ENA summarises the work already underway as the industry works toward the recommendations set out in the EDTF report.

1. Digitalisation of the energy system	Ofgem/BEIS/Innovate UK are working to develop best practices for digitalisation which will be outcomes-based. Networks and the ENA expect to contribute to the collaborative development of best practices and then the responsibility and timing for the implementation of those outcomes will need to be agreed. This initiative also delivers against recommendation 2 below.
2. Maximising the value of data	Open data: the ENA is embedding the principles of open data into its Open Networks developments and is committed to opening data where it is in consumers' interests. We will continue to look for opportunity for system changes to increase accessibility of data, and to understand further the implications of the EDTF's concept of presumed open. Common data: the ENA has begun work to try and standardise data formats and data sharing processes under Open Networks. These developments began with data exchanges between transmission and distribution electricity networks but has now begun to consider planning and operational data exchanges between electricity and gas networks. We expect this work will continue through GD1 timescales with the implementation of systems change in GD2 timescales. Best practices: as above in recommendation 1.
3. Visibility of data **4. Coordination of asset registration** **5. Visibility of infrastructure and assets – a digital system map**	We understand Innovate UK is planning an industry competition to develop a digital architecture to deliver the building block recommendations in 3-5 by bringing different data together from disparate systems. ENA proposes to actively participate in the competition and development of building blocks so that we can plan cost-effective implementation. Visibility of data includes a data index which we expect will draw on network data. ENA Open Networks has established a system-wide resource register providing visibility of electricity distribution connected assets and the expectation is this will be built on with further data sets in the future to contribute towards this. On top of the digital architecture, we will work towards consistent data between all networks. ENA proposes to work with industry stakeholders to deliver the proposed digital system map to increase visibility of the energy system infrastructure and assets. We expect to take an incremental approach to delivery of the map so that we can achieve visibility of key data early and then build from there. This should start to deliver benefits early.

We constantly seek ways to improve our network data, to increase the inter-operability between our own systems and the other GDNs, National Grid and the ESO. Ofgem's Business Plan Guidance of September 2019 included a new section specifically asking for our commitment and plans to address this opportunity for greater whole-system alignment through digitalisation.

We are committed to the practical implementation needed to make change happen for GD2 and the longer term. We will consider how digitalisation can bring about cost savings by improving data availability, supplier service standards and new sector innovations. We have worked jointly to clarify and set out the necessary funding arrangements to deliver our plan, building the costs into our open data and whole system cost estimates. We have made good progress on our Digitalisation strategy and it is available in full on our website and included with our GD2 submission to Ofgem.

[2] https://www.gov.uk/government/news/uk-becomes-first-major-economy-to-pass-net-zero-emissions-law
[3] https://es.catapult.org.uk/news/energy-data-taskforce-report/

11.6 Whole system interactions

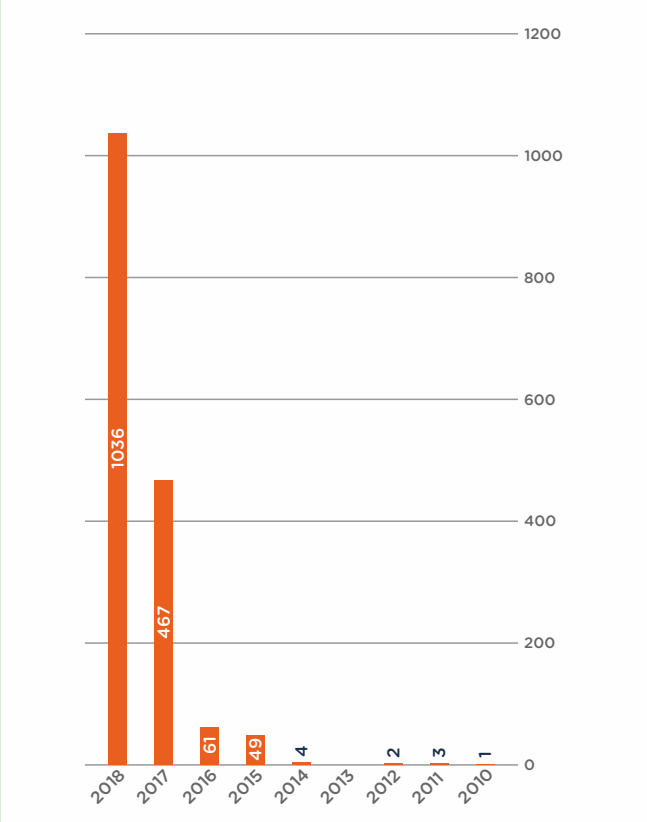
We continue to collaborate with stakeholders, customers and partners, working on initiatives that support efficiency and sustainability across the whole energy system. Examples of these ongoing interactions are shown below.

11.6.1 Peaking generation

The electricity system has changed considerably as it responds to new and emerging climate change policies and a greener public agenda. Previously, thermal generation largely took place at transmission level through large centralised plants. This traditional approach is being replaced as more variable renewables are connected at both distribution and transmission level. This has resulted in operational challenges and volatility for the electricity system.

Increasingly, we are seeing a trend towards new, compact thermal generation taking place at distribution level, with the construction of flexible 'peaking' plants able to respond at short notice to ensure electricity supply and demand remains in balance.

Figure 11-2 Peaking plant enquiries



We experienced a sharp upturn in peaking plant connection enquiries in recent years, ranging from four enquiries in 2014 to 1,036 enquiries in 2018. Each peaking plant needs to be considered with due regard to network capacity, as just one plant typically has the equivalent load of 5,000 homes.

We expect peaking plant distributed generation to increase rapidly on the distribution system over the coming years, driven primarily by the growth of renewables on the electricity network and the closure of existing large scale thermal generation, such as coal.

When combined with an increase in electric vehicles (EVs) and a move towards electrification of heating, peaking plant growth rates may accelerate further, at least in the short term until other forms of rapid responsiveness become established.

Enquiries to date have been distributed across our Scotland and Southern regions as developers search out optimal locations according to the cost of the gas, electricity connections, the revenue streams they can secure and the costs of site-based factors, such as access and land.

We are working closely with a leading independent consultancy to develop forecasts for the growth of peaking plant generation. Their 2030 reference case forecasts an increase of between 1.5GW and 7GW over GD2.

Through our whole systems charter we will work closely with our electricity network counterparts to explore ways to use available capacity most effectively. We are also planning to work with other gas distribution networks to ensure the economic test provides an appropriate economic signal for these plants alongside other new connections.

11.6.2 District heating and multi-occupancy buildings

It is a legal obligation that all customers with an existing connection have a right to maintain that connection. When we consider the risk management and potential decommissioning of gas pipes supplying customers in high rise multi-occupancy buildings, this obligation presents an ongoing challenge.

For example, if one customer in a multi-occupancy building chooses to stay on gas, we would need to maintain the supply to that customer and take into account potential future customers when completing our pipe design. A design may include a new pipe to a customer on the top floor of a building, but sized for the potential for other customers in the building to connect at a later date if they wanted. We would have ongoing responsibility to survey, risk assess and maintain this new pipe.

We currently operate an informal buy-out policy which offers appropriate funding for the resident to change to alternative heating and cooking arrangements. This is more cost effective overall, as the conversion of a small number of customers to electricity would cost the networks significantly less than installing and maintaining a gas riser. During GD2, we will work with Ofgem and local authorities to formalise this arrangement. We are recommending any additional savings made from decommissioning and removing a gas riser pipe without replacement, are made available to support the increased costs to the customers affected.

11.6.3 Transport

As noted above, the transport sector is a significant energy user and contributor to carbon emissions and air quality issues. EVs are currently expected to dominate the domestic market in the future, while compressed natural gas (CNG) and hydrogen fuel cell vehicles will provide a potential route to decarbonisation of the transportation of heavy goods, rail and marine transport. We have already participated in successful vehicle trials, including the Aberdeen Hydrogen Bus Project and delivering CNG in Reading to fuel the largest fleet of gas buses in the UK.

We have received enquiries from commercial developers with ambitious plans for GD2, resulting in a number of projects currently underway. We expect further rounds of talks and new projects as the technology becomes more mature.

11.6.4 Waste

In the production of biomethane, the effective and appropriate management of existing waste streams to produce valuable energy products is something that should be supported and encouraged as far as possible. In Port Gordon we have been working with a biomethane operator and in conjunction with a distillery, have been focusing on the utilisation of industry waste streams to generate valuable green gas. The distillery has created a priority for utilisation of waste for energy by offsetting its own process energy use where possible by exporting green gas onto the network. We are also working with them to create green energy transport hubs for their road fleet by using the gas network to supply biomethane for this purpose.

11.7 Innovation projects supporting whole systems

The value to customers of a whole systems approach is not quantifiable now, but our proposal in GD2 supports the development of a joined-up strategy that will define customer value and how to deliver it. The projects listed below illustrate the potential for collaboration across the whole system to create customer value. The projects are including in our proposals for innovation funding in sections 13.5 and as such full cost benefit analysis is not yet appropriate.

11.7.1 Research and development projects

We have designed a portfolio of 18 research and development projects to demonstrate the benefits of whole systems throughout GD2. Details can be found in appendix 007 - Energy futures whole systems.

The majority of projects we are proposing for GD2 are feasibility studies. These will help identify optimal solutions to deliver net benefits to existing and future customers in the relevant sector. The whole systems charter (section 11.2) sets a helpful precedent for shared learning and process development with the power networks.

Examples of the feasibility studies we plan to develop include: strategic temporary units for EV charging; hydrogen rail network transport hubs; hydrogen marine transport hubs; offshore vs onshore hydrogen generational regional analysis; whole systems planning tools; local authority whole systems projects, operational and real time information sharing protocols and electrolyser integration. These feasibility studies would be funded through innovation funding for the energy system transition. As such they are included in the funding expectations in section 13.5 for NIA. We will work with other networks in accordance with our whole systems charter to bring about projects like these as efficiently as possible.

Three examples of our innovation projects that explore the boundaries between energy systems are described below.

11.7.2 Whole systems project: Scottish Independent Undertakings

Our Scottish Independent Undertakings (SIUs) are located in five towns across the north and west of Scotland and are not directly connected to the main natural gas network. These independent networks are supplied with liquified natural gas (LNG) delivered by road tanker, or liquefied petroleum gas (LPG) in Stornoway. The networks provide excellent statistically representative systems, as demonstrated in our Opening up the Gas Markets project in Oban and the follow-on work at each of the mainland towns.

These networks also offer an opportunity for the roll-out of decarbonisation technologies to a customer base of nearly 10,000 meter points. Introducing biomethane or blending 20% hydrogen, where possible, into all gas supplied to the towns would reduce carbon dioxide emissions. Hydrogen could be fully green, utilising the renewable generation from wind which is predominant in these areas. An alternative option would be to fully decarbonise the networks in these towns with 100% hydrogen, using what we have learned from the H100 demonstration and trials. We estimated this would lead to a carbon reduction of 50ktCO_2e a year.

There may also be benefits realised through the decarbonisation of the transport system. Introducing a hydrogen infrastructure would provide a means for fuel cell vehicles to be used across the public transport system, as well as privately owned vehicles. Wider transport decarbonisation using hydrogen may be achieved with fuel cell ferries, and the possible linkage with rail services using fuel cell trains.

Building on our earlier electrification case study, our proposal in GD2 is to involve the local community and undertake a feasibility and FEED study for each SIU, to ascertain the most economical way to decarbonise each gas network using hydrogen or biomethane (section 9.13).

In addition to reductions in CO_2 emissions and improvements to air quality, these local communities could experience economic benefits linked to the development of a hydrogen system in their local area. The learning developed throughout our H100 project (see 13.6.1) could be used in this project to take us further along the gas decarbonisation pathway.

Case study

Electrification of SIUs

Partnering with SSE, we explored the conversion of current gas customers in four of our five Scottish Independent Undertakings (SIUs) - Wick, Thurso, Campbeltown and Oban – to use electricity for heating and cooking. We wanted to understand the implications of decommissioning and removing the gas network, the impact for the electricity network and connections to people's homes.

Network impacts

We found the impact on the existing electricity network when the heat load is added is significant. Working with SSE we were able to analyse the full scale of the effect. While each of the four SIU networks had different requirements, all would need an upgrade to the existing 33kV network from the grid supply-point to the primary substation and switchgear; the 11kV network, the installation of new secondary substations and upgrades to all low voltage underground networks in areas where the gas network would be removed. These works are substantial and would carry significant disruption in the local area.

Conversion of domestic heating

Domestic property conversion is also a significant challenge. Stakeholder engagement identified customers in Scotland rely on multiple energy sources, more so than other UK customers and often due to the harsher weather conditions. We reviewed the available solutions and other credible options, including storage heating combined with air and ground source heat pumps.

- Ground source heat pumps. The cost of installation was prohibitive and installation time would be significant. We identified challenges relating to access to suitable sites for the assets required for the heat exchange process. The installation and the indoor heat exchanger are very expensive, but ground source heat pumps benefit from performance which is not affected by seasonal weather changes. This feature keeps operational costs low when the conditions for operation are favourable.
- Air source heat pumps. These require sufficient space for an external heat exchanger which looks and behaves similar to a domestic boiler. Residents told us they would be reluctant to have such a unit on the exterior of their property. Furthermore, there are challenges for heat pumps in very cold weather where the heat output available falls and significantly more energy input is required to deliver the same output (this was also evidenced in both our Real-Time Networks project and Freedom, WWU). In very cold temperatures, the heat output could fall and be unable to provide sufficient heating, which was an unacceptable risk for customers.
- Storage heating. An established technology where modern systems are more efficient than previous versions. However, they still operate by charging up overnight for heating the next day, limiting their responsiveness to customers' needs. In addition to the radiator installation, significant rewiring would be required within each property adding to overall costs. These factors contribute to a generally poor reputation for storage heaters among customers in the SIUs.

Generally, customers also face the financial impact of moving from gas to more expensive electricity tariffs with any electrical solution. While the use of off-peak tariffs minimises this price exposure for customers, transition to electric heating still carries a premium. This issue was at the forefront of concerns for MPs and MSPs, particularly with regard to customers who were already struggling with high energy costs.

Conversion of non-domestic properties

Non-domestic properties also presented a significant challenge. Businesses operating with higher energy consumption felt they were unlikely to have their needs met by electricity. While low in number, SIU located businesses would require bespoke individual assessments to identify the right tailored solution. Some told us they may require conversion to LPG and freestanding storage tanks, but in some areas this may not be practical. For example, a restaurant in a town centre where there is insufficient space for such a system. It should be recognised these customers also face a higher financial impact of moving from gas to more expensive electricity tariffs.

Conclusions

Our analysis with SSE has concluded the upgrade of the power system network infrastructure would cost over £10k per customer, this excludes maintenance and operating cost, work in the customer's premises (around £8k per customer) and the difference in energy price (roughly 4x, assuming cost of additional local generation does not affect the price to customers in the area). As such conversion to electricity was discounted as one of the options for our SIUs.

11.7.3 Whole systems project: East Neuk – power to hydrogen for Fife

Following our GD1 NIA study of hydrogen from renewables in East Neuk, we will develop an East Neuk hydrogen pilot project during GD2.

Our proposal involves a combination of investments and allied service offerings, including hydrogen refuelling stations, a fleet of fuel cell electric vehicles and a newbuild hydrogen grid to 300 homes (or possibly conversion of a section of existing natural gas grid). The newbuild hydrogen grid may be an extension to the H100 hydrogen grid.

The use of curtailed renewable energy to produce hydrogen is a way of increasing the amount of renewable energy on the network. This has clear benefits to customers in terms of air quality, decarbonisation and reduced constraint payments to curtailed renewable electricity generators. Research suggests that constraint payments, ultimately paid for by customers, totalled £108 million in 2017.[4] Closer collaboration between GDNs and DNOs could lead to a more cost effective, resilient network and ultimately benefit energy customers.

11.7.4 Whole systems project: control systems

The increase in intermittent renewable electricity generation and shift from coal fired generation has led the electricity system operator to purchase an increasing volume of ancillary services to help manage the electricity system. These services are increasingly met by small, distributed gas-fired generators, such as peaking plant (11.6.1).

There is currently no mechanism for sharing real time operational data between GDN and DNO control rooms. Few distributed gas fired generation assets are SCADA connected to the GDN control rooms, meaning there is limited visibility of when these assets are being used. Real time visibility of local system management could be used to optimise flows and system pressures and to provide better offtake profile notices to the ESO.

Our proposed project will investigate areas where there is a lack of coordination between gas and electricity networks and consider how instrumentation and communications systems can be developed for whole systems optimisation. Improved controls and coordination will result in more efficient gas and electricity networks, improved system security and reduced cost to customers.

11.8 Accelerating towards 2045 net-zero: Evidencing a decarbonisation pathway

The longer term whole systems pathway is critically intertwined with the decarbonisation pathway and the role of gas networks in the transportation of decarbonised energy (section 13.4.4).

The decarbonisation of the gas networks already underway is expected to accelerate further through measures set out in our EAP: to facilitate biomethane connections (chapter 9C), reduce the requirement to add propane, and improve the capability of the network through our real-time networks project and Cadent's future billing methodology project.

Many of these regulatory changes when made will make the roll-out of lower carbon gases easier.

GD2 will be a critical period when we will complete the necessary stages of the pathway to evidence the safe operation of a decarbonised gas grid. It requires the acceleration of research and the development and demonstration of hydrogen as a viable energy vector.

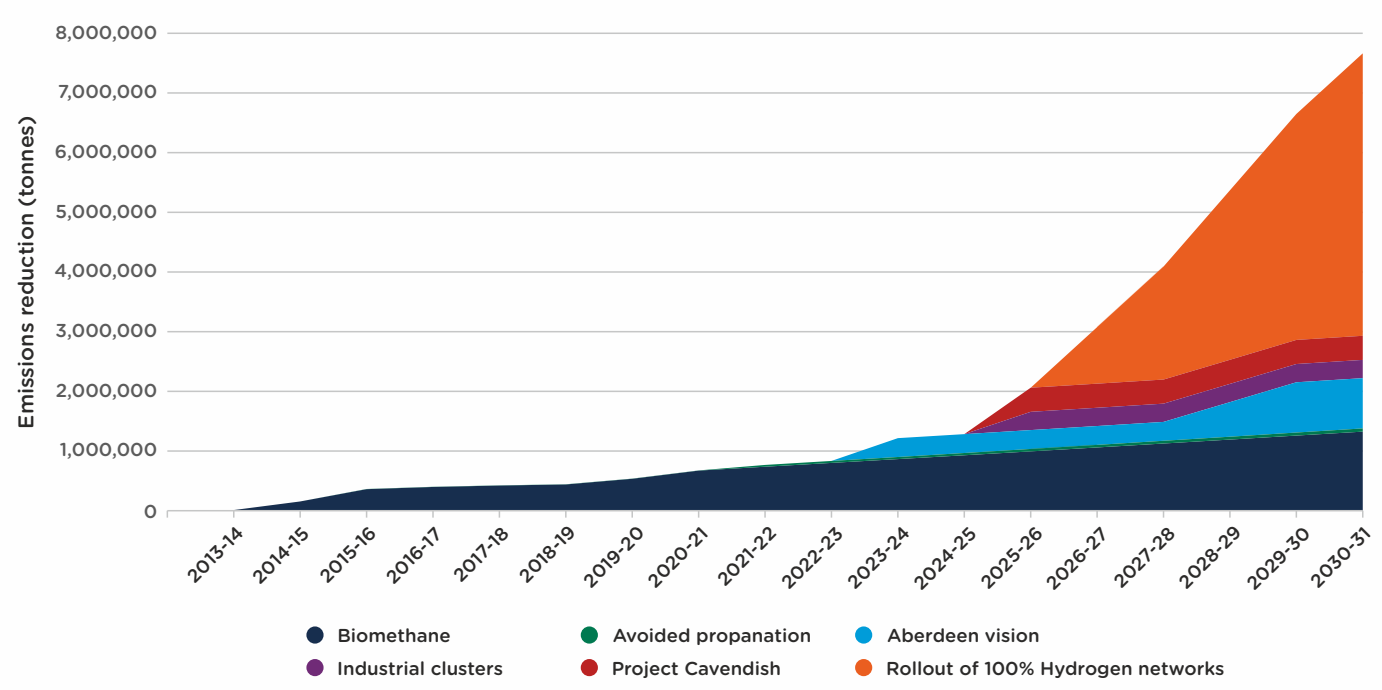
The pathway to decarbonisation is shown in 13.4.4. Subject to the success of the research and development stages, we are proposing a bespoke energy system transition re-opener (12.2.13) to support the roll-out of hydrogen in our network. As part of a whole systems approach this would include using industrial by-products and blends of hydrogen in project such as Aberdeen Vision (13.6.3) and Project Cavendish (13.6.2).

By facilitating and supporting this pathway in GD2 we believe we can reduce the emissions from the energy we transport by 1,200ktCO_2, providing the evidence base needed to enable the significant roll-out of 100% hydrogen networks across a number of cities and towns in our regions in GD3, subject to policy decisions related to the decarbonisation of heat.

We forecast nearly an 8,000ktCO_2 reduction in the carbon contained in the gas we transport by the end of GD3 (figure 11-3), by replacing it with hydrogen if innovation is successful. That equates to a 25% reduction in combined emissions associated with the gas we transport. We aim to provide the evidence base for hydrogen so that in GD3 conversion of further customers to 100% hydrogen will be largely business as usual, paving the way to achieve decarbonisation targets in-line with government policy.

[4] https://www.telegraph.co.uk/news/2018/01/08/wind-farms-paid-100m-switch-power/

Figure 11-3 Potential carbon savings pathway for transported gas (post combustion)



11.8.1 Zoned decarbonisation pathways

Understanding and evidencing the role of hydrogen and biomethane in decarbonisation is critical to knowing its impact on whole systems and how electricity, gas and transport systems interact.

Our vision is to develop a flexible and adaptable future network that will build on our successful GD1 legacy, enabling multi-source gases to be safely and efficiently transported. Such a network will support a broad range of energy injection, storage and customer needs, including transport, heat and power generation. It will play its part in a UK wide system that delivers energy to customers in a clean, secure and affordable way.

Delivery may require the zonal conversion of regions to decarbonised energy sources according to the local geographic attributes. This could see areas of Scotland and London being converted to hydrogen, while more rural areas may either be dominated by biomethane and electricity through the use of hybrid heat pumps, or electricity only with dedicated heat pumps.

The recently published ENA Pathways to Net-Zero report, which details the pathway to the decarbonisation of the gas networks, includes regional summaries on how dominant biomethane and hydrogen is likely to be in different parts of the UK's gas networks. This analysis is based on a number of factors, such as potential for large scale industrial hydrogen production, carbon capture and storage availability, biomethane production feedstock and renewable energy resource.

We have identified several frontier towns which we believe will be the first in the UK to transition to hydrogen. These include the Medway towns, Aberdeen and Edinburgh in GD2, due to their proximity to industrial clusters and the prevalence of proposed strategic projects in these zones (e.g. Aberdeen Vision, Industrial Clusters and Project Cavendish). In GD3 and beyond, we have identified further frontier towns that are likely to be suitable for conversion to hydrogen.

It is too early to identify with confidence both the practicality and the extent of different zones, so we have proposed two uncertainty mechanisms to support delivery at low risk to customers. The first covers where there is a pilot project to decarbonise an area, such as Aberdeen Vision, where we propose a bespoke energy system transition reopener (section 12.2.13). And where there is a decision to decommission the gas network in area, we suggest this should be part of the future-of-heat reopener (section 12.3.2).

12 Managing uncertainty

Linked appendices

- Cost efficiency

A key consideration in the development of our business plan has been how we balance financial risk between our business and our customers. We have reviewed our GD1 experience and identified areas of significant difference between our forecast and actual expenditure and have assessed where similar variations could occur in GD2.

Our plan is structured so that customers will not be disadvantaged by a change in forecasts. We have challenged ourselves at every opportunity to apply the available uncertainty mechanisms, identifying workloads and customer value points from across our business where forecasted allowances risk being different to our actual investment.

Our plan recognises the uncertainty around the role of the gas networks in a decarbonised energy system, managing the implications through our business as usual (BAU) approach. In particular, our embedded 4Rs strategy is a no-regrets approach to investment: we minimise expenditure on our assets by prioritising repair or refurbishment, before more expensive rebuilds or full replacements only when absolutely necessary.

On certain workloads we have identified where there is a risk of costs changing over the course of GD2 relative to average inflation. In section 12b we have identified those costs that we think should be indexed separately to average inflation.

As well as a change in costs, we have assessed the probable increase in productivity and efficiency gains we expect to deliver over the five-years of GD2. We are stretching ourselves to deliver an efficiency improvement three times greater than forecast for the rest of the economy, explained in section 12c.

12a Uncertainty mechanisms

Uncertainty mechanisms are important tools for us to use as we balance financial risk between our company, our customers and stakeholders. Where costs relating to a future workload or requirement are unclear, and we have limited control on the outturn, we have considered using one of Ofgem's designated uncertainty mechanisms; either a volume driver, a use-it-or-lose-it allowance or a reopener.

We have listened to customers through workshops[1] and in-depth interviews in Scotland and Southern, to understand customers' and SME's views on sharing financial risk. Customers agree with the need for flexibility in how we are funded. They support a 50:50 balance of a fixed/volume driven funding structure, but fixed budgets should be used for BAU activity. They also liked the idea of ring-fenced funding (use-it-or-lose-it) for managing cost uncertainty, but were concerned that we would need to demonstrate how we always operated in the most efficient way possible.

A key consideration when applying an uncertainty mechanism is its design. We must ensure the correct mechanism is applied in the right circumstances and appropriate to the uncertainty we are facing, to create a fair balance of risk between customers and our company, while maintaining our incentive to deliver efficiently. To achieve this, we have used Ofgem's three categories of uncertainty mechanisms for identifying areas which are outside of our control, to align allowances with delivery, and to support a substantial change in policy.

The proposed uncertainty mechanisms, categorised under each of these headings, are set out in table 12-1. We have then identified the design structure we think is correct, subject to appropriate thresholds and materiality.

[1] Shaping the Business Plan Qualitative Workshops - Sharing Financial Risk. Innovation Investment (ref 083)

Table 12-1 Uncertainty mechanisms for GD2

Plan section	Uncertainty mechanism (UCM)	GD2 expected annual cost - £m			GD2 expected total cost - £m			Business plan data templates (BPDT)
		Included in totex		Additional	Included in totex		Additional	
		Volume driver *Mid est*	Use-it-or-lose-it *Upper est*	Reopener *Upper est*	Volume driver *Mid est*	Use-it-or-lose-it *Upper est*	Reopener *Upper est*	
	Risk outside of network companies' control							
12.1	Sector uncertainty mechanisms: pass through							
	Aligning allowances with delivery							
12.2.1	Sector UCM: tier 2a volume driver	2.2			11.0			4.01
12.2.2	Sector UCM: smart meter							
12.2.3	Bespoke UCM: tier 1 iron stubs		1.4			6.9		4.04
12.2.4	Bespoke UCM: <=2" steel	5.7			28.5			4.01
12.2.5	Bespoke UCM: new connections	7.2			36.3			3.04
12.2.6	Bespoke UCM: below 2 bar reinforcement	10.7			53.3			3.02
12.2.7	Bespoke UCM: greater than 2 bar reinforcement			11			55	
12.2.8	Bespoke UCM: process safety		3.0			14.8		3.01
12.2.9	Bespoke UCM: street works (total)			**14.3**			**71.4**	3.02
	of which							
	permitting and lane rental			*13*			*65*	3.02
	hazardous waste management			*1.3*			*5*	3.02
12.2.10	Bespoke UCM: environmental action plan (total)		**7.7**	**4.5**		**38.7**	**22.5**	3.05
	of which							
	EAP - Biodiversity		*0.5*			*2.5*		3.05
	EAP - Climate change adaptation		*2.0*			*9.8*		3.05
	EAP - Property PV		*0.3*			*1.7*		3.05
	EAP - Biomethane roll-out		*2.0*			*9.8*		3.05
	EAP - Governors PV		*0.7*			*3.4*		3.05
	EAP - Deployment of innovation		*0.4*			*2.0*		3.05
	EAP - Low emission vehicles		*1.9*			*9.5*		3.06
	EAP - CCS from biomethane sites			*4.5*			*22.5*	
12.2.11	Bespoke UCM: external and environmental resilience			3.0			15.0	
12.2.12	Bespoke UCM: cyber assessment framework			0.8			4.2	5.12
12.2.13	Bespoke UCM: energy system transition			44.6			223.2	
	Supporting substantial changes in policy							
12.3.1	Sector UCM: HSE policy changes							
12.3.2	Sector UCM: heat policy							
12.3.3	Sector UCM: whole system coordination mechanism							
12.3.4	Sector UCM: fuel poor network extension			5.2			26.0	3.04
12.3.5	Sector UCM: cyber security							
12.3.6	Bespoke UCM: legislative and regulatory change							
	Total value	**25.8**	**12.1**	**83.5**	**128.9**	**60.4**	**417.3**	

Please note, where a row has no value, it is considered too speculative to sensibly estimate or quantify.

We have specifically identified all practical areas in our plan where a volume driver, use-it-or-lose-it, or a PCD or named project can be implemented, making our plan very lean and better value for customers. This has been possible thanks to our profound understanding of our assets, their condition and the work necessary to keep them safe and functioning correctly. However, this approach restricts flexibility for moving investment between expenditure categories during the price control should something unanticipated occur.

As such, by proposing a high proportion of our allowances as uncertainty mechanisms we are reducing our customers' exposure to costs relating to workloads that are not delivered. However, it increases the risk to equity investors that the funding for additional workload may not be recovered. Given the low cost of equity proposed in the working assumptions there is not an appropriate reflection of this risk. As a result, we are proposing to reduce the threshold from 1% in GD1 to 0.5% on allowed revenue for each reopener (a £5m materiality threshold) with an over-arching reopener with 1% on allowed revenue as a combined reopener threshold. With the exception of the cyber assessment framework reopener and the hazardous waste reopener, we would propose a reopener window in 2024.

12.1 Risk outside of network companies' control

These are cross-sector and sector uncertainty mechanisms which include items passed through at cost and have been identified by Ofgem in the sector methodology decision document. Such pass-through items include business rates, licence fees, theft of gas, Xoserve, tax and supplier of last resort costs. We believe these remain appropriate pass-through items for GD2.

12.2 Uncertainty mechanisms to align allowances with delivery

The majority of uncertainty mechanisms we are proposing are to focus on aligning costs with delivery.

12.2.1 Sector uncertainty mechanisms: tier 2a – mains and services volume driver

Given the unpredictable volumes it is appropriate to continue with the current mechanism for tier 2a iron pipes by using a volume driver (section 7.4.2). These are expected to be relatively low volume activities that are hard to forecast but where replacement has a relatively high unit cost. Tier 2a pipes are mandatory for us to replace when we find them. Given the potential for forecast error we propose managing under the existing volume driver. In appendix 019, Replacement expenditure, section 6.8, we have forecast our expected workload for GD2 based on historical evidence and set out our unit costs by diameter band, excluding any central costs. These forecasts are included in our totex forecasts.

12.2.2 Sector uncertainty mechanisms: smart meter - reopener

The issue that we are addressing with the smart meter reopener is the lack of clarity around the timing and implications of the smart meter roll-out. In appendix 013, Emergency service, section 6.8, we have set out the impact on intervention rates under the smart meter roll-out achieved to date. We demonstrate the impact of workloads and the mitigating actions we have undertaken, and the impact of the most up-to-date meters (SMETs2) on intervention rates.

The pace of smart meter roll-out and the complexity of their installation are two reasons why we expect the number of interventions will increase as we approach 85% smart meter saturation by 2024. As such, we are forecasting an increase in interventions from the current 2% for the remainder of GD1 and the first years of GD2, rising 4% to 6% as the programme reaches its conclusion. These interventions rates are included in our totex forecasts.

We recognise the uncertainty in this forecast, given the actual intervention rate will be dependent on the quality of the installations through the supplier-led smart meter roll-out programme, and the pace at which roll-out occurs. In GD1 we have been successful in minimising interventions (chapter 2) and we will continue to work across industry to keep intervention rates as low as possible.

There may also be a request for networks to play a more active role in the roll-out programme but there is no evidence at present.

To address this uncertainty we support either a volume driver or re-opener. However, the incremental cost of a smart meter intervention is not easily calibrated due to the complex relationship with waiting time in the emergency process (i.e. because a large proportion of this work is carried out by emergency operatives, a reduction in smart metering workload is likely to lead to increased waiting time in the emergency process which does not impact on overall totex). In addition, networks have set themselves up differently in GD1 to deal with the balance of meterwork and emergency work. Therefore, we believe a mechanism should be developed ahead of initial determination with all industry participants. This will ensure that these complexities are fully understood in order that incentives remain for companies to manage these activities efficiently whilst ensuring the optimum balance of risk is achieved.

12.2.3 Bespoke uncertainty mechanisms: tier 1 iron stubs – use-it-or-lose-it

We have worked with other GDNs and an independent engineering company to develop risk management proposals for iron stubs and submitted them to the HSE for consideration (section 7.5.3). This is set out in appendix 019, Replacement expenditure, section 6.8.

Depending on the outcome, it may be possible to defer work on 1,056 (65%) of these short length stubs beyond GD2, as they will be deemed to form a part of the large diameter parent main, if the HSE accept our proposals. The remaining 569 (35%) would need to be delivered in GD3, however, we are exploring innovative solutions that may enable us to manage the risk of the remainder.

Given the direct link to HSE policy we would propose tier 1 should be defined as a PCD on the number of stubs with an associated use-it-or-lose-it uncertainty mechanism, based on an average unit. If the HSE accept the proposal, this may allow us to reduce the workload accordingly. Currently we have included £1.4m a year for this mechanism (excluding overheads).

12.2.4 Bespoke uncertainty mechanisms: less than 2" steel – mains only volume driver

Less than 2" steel mains are mandated to be replaced when found. The highly localised occurrence of these pipes has led to a substantial change in workload over GD1 (section 7.4.3). In the first six years of GD1 we have seen workloads reduce from 59km to 47km a year. On the basis of our asset models we anticipate this workload increasing back up to 60km a year.

However, as our asset models may not fully reflect the instances of less than 2" steel in the ground and the HSE has mandated their replacement when found, we have proposed to implement less than 2" steel as a volume driver at a fixed unit rate. This is set out in appendix 019, Replacement expenditure, section 6.8.

We believe this would reduce the risk to customers from an incomplete asset model, which would be the case under an ex-ante allowance, while a defined unit cost would enable an annual reconciliation.

We have included an annual cost of £5.7m a year (excluding overheads), based on the workload of 50km a year. Our asset records indicate an actual workload of 60km a year is more likely, costing of £8.7m a year.

We think a volume driver provides the most appropriate balance of risk between customers and network companies for this category of work. Without it, we would need to forecast on the basis of our asset record systems and apply the necessary costs in accordance with that anticipated workload.

12.2.5 Bespoke uncertainty mechanisms: new connections – volume driver

We have proposed a volume driver for new connections where there is a defined unit cost for each new connection – for new and existing housing - according to its geographic connection. This is set out in appendix 020, Connections, section 6.8. Under the Gas Act, gas networks have an obligation to connect properties within 23m of an existing gas main, and the costs are socialised

across all customers. However, with the move to net-zero there is a potential that connection volumes may change significantly towards the end of GD2. To mitigate this risk, we have proposed a volume driver to align the totex allowances with delivery.

We have included an annual cost of £7.2m a year in our BPDT to deliver 17,000 connections a year. This does not include industrial and commercial customers as they cover the direct cost of their connection. Where these connections make reinforcement necessary, they will be covered through the <2bar distribution reinforcement uncertainty mechanism (section 12.2.6).

As this can be easily established as a unit cost and volume driver, we think it reduces the risk to the customer of a sudden change in the demand for new connections.

12.2.6 Bespoke uncertainty mechanisms: <2bar reinforcement – volume driver

The new connections described in the previous section may require further reinforcement elsewhere on the distribution network, to accommodate the growth in demand. This will depend on the resilience of the network in a specific area and changes in demand from growth and improved efficiency. Based on current forecasts, we anticipate an annual investment of approximately £10.7m a year.

For GD1 we had forecast new reinforcement based on the prevailing economic trends which did not hold after the 2008 financial crisis (appendix 018, section 3). For GD2 we have engaged extensively with our stakeholders to create a robust forecast of capacity growth on our network, but significant uncertainty remains (appendix 018, section 6.2).

To address this economic uncertainty, we have proposed a volume driver for distribution reinforcement, covering the costs of new governors and associated mains. We have set out the anticipated unit-rate structure, separating low and medium pressure mains and distribution governors by size (appendix 018, section 6.8). We propose final costs are determined through a procurement event that we will run in early 2020. The mechanism would apply an annual adjustment against forecast workload.

In creating this uncertainty mechanism, we recognise there could be a perceived risk that projects required for maintaining network integrity and covered by existing allowance allocation will be rebranded as reinforcement. To avoid this, we will provide an evidence pack for each project to demonstrate the link between the application for a new connection and the reinforcement work required, with an accompanying evaluation of why the work was necessary. The pack will include all considered options and will be made available for third party scrutiny.

Our proposal recommends that the scope of this volume driver should be up to a 2 bar threshold. Above this threshold we have less confidence that a robust unit cost figure can be defined as there is a lower volume of work undertaken and the projects become more bespoke.

We think this structure will give greater confidence that allowances will reflect the actual workload. There is a risk that network companies will be less incentivised to deliver projects innovatively and with greater design efficiencies, when compared with GD1.

12.2.7 Bespoke uncertainty mechanisms: greater than 2 bar reinforcement

We have identified a number of upgrade projects through our local authority engagement strategy that respond to local plans and developments on the distribution network, as well as requirements for reinforcement on the high pressure and intermediate pressure system (appendix 018, section 6.1). As we explained in 12.2.5 and 12.2.6, there is uncertainty around new connections and below 2 bar reinforcement that make it impossible to determine the amount of reinforcement work needed on the greater than 2 bar network.

For below 2 bar reinforcement, there is a sufficient volume of work and consistency in project types to define a robust average unit cost. For greater than 2 bar reinforcement (the intermediate and high pressure network) each project becomes more bespoke around the required engineering, the dependency on local geography, and the necessary specialised skill-sets. Therefore, setting a unit cost becomes more challenging due to greater variation in these areas, with a risk that actual costs could differ significantly from any average derived. In the appendix, we have identified projects where costs can vary from £500k to £5m.

As a result of these uncertainties, we do not think a fixed 'unit cost' volume driver would be effective. Rather we would consider an uncertainty mechanism based on either a 'project assessment' volume driver, or a reopener to be more appropriate.

Under the 'project assessment' based volume driver, each reinforcement project would be assessed using a recognised industry network capacity model. This would demonstrate the needs case for the project against industry standards.

Once a need for reinforcement has been demonstrated, a technical and financial appraisal of different options would be undertaken to establish the least-cost option. Each stage could be independently assessed by Ofgem either on an individual project level, for larger projects, or on an audit basis for smaller projects. Cost estimates would be based primarily on either specific market tenders or framework contract prices.

We think this structure preferable to a broader reopener, which would require a similar review to be undertaken but through a single action, as it would provide more opportunity for scrutiny and refinement of the assessment process as we progress through the price control period.

As with the uncertainty mechanisms in section 12.2.5 and 12.2.6, this approach would remove the forecast risk from customers and provide a closer alignment between workload and allowances.

Our anticipated workload is based on assumptions made for growth in local industry, agricultural facilities and distilleries. One particular element of uncertainty is the scale of gas network reinforcement necessary to support connections for new peaking plant generation, used by the electricity markets (section 11.6.1). A single peaking plant can be the equivalent of increase in load from over 5,000 houses, and independent forecasts suggest total capacity could increase by 6GW nationally. Under a high growth scenario, anticipated investment could be £25m a year or higher. Alternatively, if growth is limited, then additional investment could be minimal. In table 7-1 we have assumed a value of £11m a year.

12.2.8 Bespoke uncertainty mechanisms: process safety – use-it-or-lose-it

During GD1, we have significantly enhanced our procedures to identify both reliability and condition-based defects in our assets. As a result, GD2 projects above £500k are derived from an objective review of operational defects and comprehensive asset condition surveys. This is set out appendix 021, Transmission Integrity, section 6.8.2.

However, there is still the realistic if unforeseen possibility that new defects impacting asset reliability or condition may be exposed during GD2. Examples from GD1 are given in appendix 021, showing an investment of £5m a year required to address such issues.

While we have confidence in our asset records, we cannot exclude further type defects or volume defects identified in GD2. For this reason, we are proposing a use-it-or-lose-it allowance, where necessary efficient costs are permitted to resolve a critical defect, with any unused allowance being returned to Ofgem / customers.

The uncertainty around forecasting for unforeseen defects, and related workloads, makes it difficult to correctly estimate the required allowances. Excessive allowances would benefit the company, while insufficient allowances could compromise safety. Since asset health-related defects are driven primarily by duty, age and environment, it is appropriate to claim only the costs of actual interventions.

The defects identified in GD1 now form part of the workloads set out in our GD2 business plan. We also have confidence in our enhanced inspection procedures which are improving our ability to prioritise sites and forecast workloads. It is therefore unlikely that a sum as high as that incurred in GD1 would be required in GD2. However, we have included a sum of £15m allocated between Southern and Scotland networks as a reasonable amount to cover the risk of urgent unforeseen work. Applying a use-it-or-lose-it allowance would ensure customers are not adversely impacted. We would provide supporting evidence during the GD2 close-out process for the expenditure of allowances.

12.2.9 Sector uncertainty mechanisms: street works

We have proposed a single reopener for street works in general that covers three specific areas of uncertainty; permitting and lane rental, reinstatement liabilities, and hazardous waste management.

We propose a common approach to a street works reopener across all GDNs and determined through the Cost Assessment Working Group.

Permitting and lane rental

Our repair and replacement activities often require us to work on gas mains located underneath or close to the public highway, requiring us to put in place the relevant permits and local licences. We explain how traffic management regulations differ between our Scotland and southern regions in the Repair appendix 014, section 6.8.

In Southern, the 'Traffic Management Act 2004' (TMA) established a permit scheme and enabled the piloting of lane rental on the most traffic sensitive areas of London (TfL) and Kent. Local authorities have already indicated their intent to apply the charges, but it is unclear when they will be introduced, the parameters of the scheme or the level of charges.

In Scotland the Transport (Scotland) Bill was passed on 10 October 2019. The Bill addresses roadworks and low emission zones, two areas that will have implications for how we deliver necessary planned or unplanned work on network assets in Scotland. At this stage, the cost impact of the Bill is uncertain and not likely to be fully realised until the start of GD2.

Given the uncertainty around how our costs and operations may be impacted as street works and low emission zone legislation evolve, we propose a reopener implemented in 2023. In our baseline forecasts we have included the anticipated cost for London and Kent.

There is a risk that with a reopener we would not be incentivised to manage costs appropriately. However, as we have included London and Kent schemes in our baseline expenditure, these will provide good benchmarking data by which to assess and minimise comparable costs in other regions.

We estimate an additional £13m a year (£6m a year in Scotland and £7m a year in Southern) if lane rental and a more stringent street works regime in Scotland is rolled out across local authorities.

Figure 12-1 Lane rental and permit authorities currently operating in Southern

Reinstatement costs

Whenever we excavate in the roadway we reinstate the surface to an enduring high-quality standard that should be free from defects. This is governed by the Specification for the Reinstatement of Openings in Highways (SROH). Currently these reinstatement works are guaranteed for a two-year period, however the Department for Transport is consulting on extending this to a five-year period. If the defect liability period is extended, then we would expect our contractors to include the additional cost of this liability in their contract terms.

Hazardous waste management

Treatment of excavation waste from unplanned installation and repair work is currently governed by an Environment Agency Regulatory Position Statement RPS 211. This allows appropriately classified waste to be designated non-hazardous (appendix 014, section 6.8)

The Environment Agency has questioned the effective application of this guidance and expressed its intention

to withdraw RPS 211 in 2020. There is currently a pilot assessment underway in the utilities industry, aimed at gaining a greater understanding of the practical implications of this change. However, the hazardous waste component could be between 9% and 18% of all excavated material and the cost of disposal could be between £300/tonne and £1,500/tonne.

Given this uncertainty we have assumed a £550/tonne average should be applied to planned work carried out through the repex contract, with an assumption that approximately 1-1.5% is classified as hazardous waste (included within the BPDT). This will need to be applied across other operational activities and will become more stringent.

Final arrangements are unlikely to be agreed with the Environment Agency until 2020, when the breadth and financial implications are fully appreciated. Assuming we have greater confidence around the potential impact and the associated unit cost of treatment prior to our final proposal, we would prefer to present this as a volume driver reflecting the significant uncertainty around the quantity of material identified as hazardous.

However, without confidence in the key variables - the cost to treat or the percentage of waste arising - we propose an early re-opener in 2022 once the new regulations have become operational and a robust sample of costs have given confidence in allowances for the remainder of GD2.

12.2.10 Bespoke uncertainty mechanisms: environmental action plan

Our environmental action plan (EAP) includes a number of measures we think are important to deliver as we progress through GD2 (chapter 9). However, given the scale of our ambition and the pace of change in certain key technologies, we do not have the confidence that our ambition today will still be considered ambitious at the end of GD2, or that our costs and preferred solutions will still be optimised.

As a result, we have proposed a series of measures which we think are most appropriate for a use-it-or-lose-it uncertainty mechanism. However, we recognise that unlike other uncertainty mechanisms environmental measures include uncertainty relating to appropriate ambition, as well as cost and workload. To help us apply the right level of ambition, we will convene a steering group of specialist stakeholders to challenge our decision-making process. We believe this approach will provide customers with the greatest confidence that we are cost-effectively delivering appropriate environmental goals. We propose a use-it-or-lose-it uncertainty mechanism for a number of environmental workloads, listed below.

- **Improving biodiversity.** We have high confidence in our costs to complete the necessary survey work across our sites in GD2. However, we are less certain about the cost of remediation measures identified and the implementation time required to have the greatest impact with least disruption.
- **Climate change adaptation.** A climate change adaptation survey will highlight which of our property assets are most at risk, providing the necessary insight to improve measures to reduce our exposure. We have received independent advice recommending up to £10m (£2m a year) to manage this risk.
- **Renewable energy deployment (PV).** We have categorised renewable energy deployment according to whether it is on an existing building or occupied premises, or whether it is on an existing maintenance site. We estimate we would need £5.1m (£1m a year) to deploy solar panels (PV) across both categories. However, we have not completed detailed site assessments, so it is uncertain if the sites will be appropriate for deploying PV.
- **Biomethane roll-out.** We have identified three near commercial innovation projects to support the deployment of biomethane on our network. Anticipating these will be successful we propose £2m a year to support biomethane roll-out across the network in GD2 (appendix 006, Energy Futures – Energy System Transition, section 5.2), subject to an appropriate financial case being developed, associated CBA and justification.
- **Deployment of innovation.** In additional to biomethane, we have also proposed specific projects to support the reduction of leakage through new innovations. In these cases, the relevant CBAs are uncertain as the effectiveness of the technology and their cost efficiency is still to be determined. Technologies include stent bags, pressure management technology, eco pumps and high volume gas escape technology. We anticipate the deployment of these innovations in GD2 will cost a combined £2m (£400k a year).
- **Low emission vehicles.** We set out the options for converting our fleet to low emissions alternatives by the end of GD2 in section 10.4.4. This is a high ambition output as our ability to implement will be subject to the auto industry's technical advances, new capabilities of vehicles coming to market, as well as the viability of our operational fleet strategy. While we have included a base investment of £9.9m a year, we propose an additional £1.9m a year for investment in ultralow emission vehicles. Applying a use-it-or-lose-it mechanism, coupled with external scrutiny set out in our EAP, would provide an appropriate balance between the ambition and desire expressed by our customers and stakeholders, against ensuring cost effectiveness and scale of organisational change necessary to maximise transition to a low emission fleet.
- **Carbon capture and storage (CCS) from biomethane sites.** CCS from biomethane sites is an established technology and currently operational on a commercial basis for non-waste feedstocks, with the quality of the gas generating a commercial return in the food and medical sectors. However, for biomethane produced from food waste the available market is small and prices depleted. This makes it commercially non-viable to implement CO_2 capture from these sites. Subject to the legal and regulatory challenges being overcome, we consider that with an estimated 11-16 year payback and using standard cost of carbon assumptions, it would be appropriate for the network to invest and dispose of the carbon in a CCS location. Given the uncertainties surrounding this, we have proposed it as a reopener once the legal and regulatory considerations can be managed.

12.2.11 Bespoke uncertainty mechanisms: external and environmental resilience – reopener

The external resilience reopener covers the impact of environmental change or external direction that requires

a substantial change in our assets. Such a change might include a coroner's report, HSE direction or easement rights and legacy 'lift and shift' clauses (appendix 021, transmission).

The major uncertainty relates to climate change and its impact on existing assets leading to their immediate risk of failure unless we act. We give examples in the appendices of projects in GD1 that were directly impacted as a result of erosion and flooding, including the Burn of Tynet, South Esk, Memory Lane, Scotstown, Langston Harbour and Newton Stewart (appendix 021, section 5.3 and 012, section 3.6).

In the EAP we have proposed to risk assess our assets and improve their resilience (12.2.10). In baseline allowances we have included the known project at Dunkeld and costal erosion.[2] We have not included in our base allowances any funding to rectify further external and environmental resilience issues that may arise over the course of GD2. We fully expect issues to arise requiring us to act to maintain the safe operation of the network.

Given the uncertainty of the impacts, introducing this as a reopener would provide an appropriate basis for assessment of a diverse range of potential costs once they have occurred. Alternative structures such as an ex ante allowance or volume driver will rely on the accuracy of the forecast cost impact.

Based on our GD1 experience, we are confident that new projects will arise in GD2 needing our response. We consider £3m a year to be an appropriate sum to cover the risk. This estimate is not included within the BPDT.

12.2.12 Bespoke reopener: Cyber assessment framework (CAF)

It is important to note that due to the timing of publication, our GD2 plans have not incorporated the recent changes to Cyber Resilience guidelines and scope definition issued by Ofgem as part of its consultation in October 2019. Therefore, we expect to request a reopener for new, future requirements or the consequential impact of these in the early stage of GD2. These may include:

- new, additional or significant changes in reporting requirements;
- changes in the assessment mechanism;
- changes in scope of the assessment framework and/or its application within distribution networks;
- changes to inspection, auditing and remediation processes; and
- compliance and enforcement action changes.

The above have not been included within our current plans and therefore we expect to utilise the reopener mechanism under the above conditions. We envisage using this reopener during GD2 in relation to OT Cyber Resilience.

12.2.13 Bespoke reopener: energy system transition

This reopener proposal is for funding the large innovation roll-out projects which are potentially too large to fund through the proposed NIC. It would also address some of the intergenerational implications of funding large projects through short-term adjustments although we accept this needs to be discussed more broadly prior to any decision (sections 13.5 and 11.8).

As such the values provided are indicative to give a sense of scale and prioritisation before a political decision being taken about the most appropriate charging structure (appendix 006, Energy Futures: Future Energy Transition, section 2.1).

12.3 Uncertainty mechanisms to support substantial changes in policy

We have identified a number of reopeners below which we think are important for reflecting substantial changes in policy.

12.3.1 Sector uncertainty mechanisms: repex HSE policy changes reopener

We have a primary duty to ensure that our pipeline systems are designed and managed for security and reliability, keeping the gas flowing for all of our 5.9 million customers, even during the most severe of winter conditions when gas demands are at their highest. Changes to the statutes we conform to (section 7.1) would require a trigger to ensure our compliance as duty holders can be maintained.

Any material changes in the HSE's enforcement policy for the IMRRP, or additional HSE requirements not yet identified (e.g. risers), should also be subject to an uncertainty mechanism which could be triggered at any point in GD2.

Our view is if HSE policy changed resulting in increased costs for us to remain compliant, we would expect those costs to be fully funded by customers. As such, we agree with Ofgem's decision to put in place a reopener mechanism for any change by the HSE to the Pipeline Safety Regulations (1996) or the IMRRP.

12.3.2 Sector uncertainty mechanisms: heat policy reopener

We agree with the SSMD that a reopener for wider heat policy decisions is appropriate, so that we can adjust our investment profile accordingly (either positively or negatively).

We think it is too early to determine whether decarbonisation of heat is going to progress in a highly planned zonal manner, or through a more gradual national transition (section 11.8.1). It is likely to depend on the costs of technology, the capacity of the networks and social acceptability of different decarbonisation pathways.

In order to build the demonstration for the first practical roll out of hydrogen as a decarbonisation pathway it will be necessary to implement significant investment (chapter 15). We would suggest the reopener mechanism may be an appropriate structure through which those projects are funded to enable the conversion of an area or locality to decarbonised heat.

Given that heat policy may be defined regionally or nationally we think that the trigger for a reopener should also be either regional or national policy. We also recognise that if a heat policy requires radical transformation over a short period of time, the reopener should be able to accommodate the planning costs

[2] £1.4 is identifiable under the EJP papers 'SGN DINT – 002 CoastEro So – EJP Dec 19' and 'SGN DINT – 013 CoastEro Sc – EJP Dec 19' with associated CBAs.

[3] This became apparent in conversation during November, by which time it was too late to remove the figures from BPDT and maintain an effective assurance process.

associated with preparing for that transformation, as well as the capital costs of the transformation itself.

12.3.3 Sector uncertainty mechanisms: whole system coordinated adjustment mechanism

Given the uncertainty around the future of heat, we see the most likely requirements of the whole system coordination adjustment mechanism being linked to the future of heat reopener. Only a small proportion of our overall investment is linked to capacity reinforcement, and this is accommodated in the reopener mechanism described above.

12.3.4 Sector uncertainty mechanisms: fuel poor network extension reopener

The fuel poor network extension is a PCD where we expect to complete 3,600 fuel poor connections a year across Southern and Scotland, with an average annual cost of £6.8m a year and an average cost of £1,880 per connection. There is a high administrative cost associated with fuel poor connections which is only partially dependent on the number of connections completed. We propose the uncertainty mechanism should cover the variable component of the fuel poor network connection cost and the cost of the actual connection. This would reduce the variable component to £5.2m a year or the equivalent to £1,445 per connection.

If there is substantial change or political intervention in fuel poor connection policy that leads to a significant change in the volume, we would expect this to be accommodated through a reopener as proposed by Ofgem in the sector specific methodology decision.

12.3.5 Sector uncertainty mechanisms: cyber security

We agree with the cyber security proposals set out in the sector specific methodology decision. Changes to legislation may require a substantive additional investment to meet the ever-changing needs of cyber risk management as technology evolves over the GD2 timeframe.

We would expect substantive changes in the approach and potential investment requirements to achieve the same level of cyber resilience expected by government and customers over GD2. We would propose that the reopener should be triggered on a percentage increase or decrease basis over and above cumulative allowances to date based on changes to:

- national or international threat to utilities that require a substantial improvement in cyber security;
- significant change in third party or activist group and/or exposure of technology third party vulnerabilities that requires an immediate and/or substantive change;
- a major shift in technology adoption (including operational technology) that was not widely anticipated at the time of business plan submission; and
- a significant change in legal or regulatory requirements that warrant a substantial shift in the organisations approach to cyber security.

12.3.6 Bespoke uncertainty mechanisms: legislative and regulatory change

We think that it is also very important to have a broader legislative change reopener. We have major political parties proposing significant changes to working time expectations, and potential changes that may come through the HSE as a result of investigations. There is also a regular risk of legislative change as the government responds to challenges created by the gig economy and open data, and these may have unanticipated impacts on our own business model. As a specific example we have within the plan accommodated the latest discussions on working hours and fatigue. It may be that legislative change or HSE guidance, such as for the management of fatigue and the potential for a maximum 12-hour limit for safety critical roles, requires further changes in working hours that reduces the availability of trained staff and increases overall costs.

Given the pace of change and political uncertainty at the moment we think it is important to maintain a general reopener in order to accommodate the cumulative impact of legislative or regulatory change from either government or the HSE.

12b Real price effects

12.4 Direct labour, contract labour and materials

Real price effects (RPEs) describe categories of costs where our exposure to that cost category differs to the exposure of the typical UK household, as is measured under CPIH. For gas networks these RPEs exist in at least three areas: direct labour, contract labour and materials.[4] Combined, these costs make up a significant proportion of our total expenditure.

- Spending on direct labour makes up 23% of our total expenditure. Of that, we have found that roles representing over 80%[5] of our wage bill have experienced wage growth faster than CPIH during GD1.
- Contract labour makes up 43% of our totex. A study of our repex contracts (more details below) has found that of 115 rates reviewed, 72% outstripped CPIH. We believe that our opex and capex contractor spend is experiencing similar pressures.
- Materials make up 31% of our totex. Our most substantial materials category is PE plastic pipe, which made up around 23% of our materials cost in 2018. We have found that PE pipe costs increased by 4.1% (annualised) between 2013 to 2018, outstripping CPIH over the same period by 2.56%. We believe similar cost pressures have been experienced across other material costs.

[4] To date, we have focused on the most material input cost categories. However, Ofgem made an allowance for plant and equipment for RPEs in GD1

[5] This proportion has been calculated conservatively, excluding apprentices and employees who have not been grouped into any of the key roles identified, as these roles contain too few employees to be sure that increases in average wages have been driven by wage inflation, rather than by changes in the composition of the groups over time.

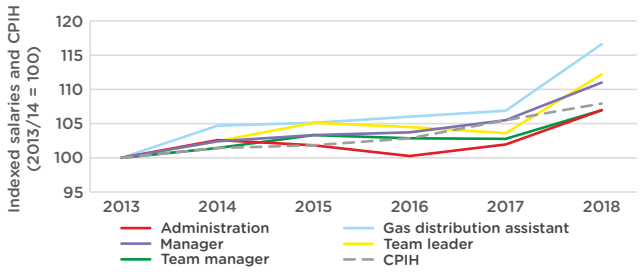
Ofgem's current planning assumption is to use CPIH as the general measure of inflation in GD2 creating the baseline against which RPEs will be assessed. However, as explained above, the historical evidence shows significant cost pressures over and above baseline CPIH inflation over the course of GD1. The majority of these cost pressures are driven by market conditions that we expect to continue into GD2. Each category is set out below with supporting information in the Cost efficiency appendix.

12.4.1 Direct labour

At approximately 23%, direct labour costs make up almost a quarter of our totex. We have assessed growth in our direct labour costs against growth in CPIH over the course of GD1 and found evidence of RPEs (figure 12-2). Across the period, wage inflation overall has outstripped CPIH. The weighted average salary (across five key roles representing 80% of our expenditure on wages) has increased by 2.6% between 2013-14 to 2018-19, compared to a much lower increase in CPIH of 1.5% over the same period. The chart also shows that there have been some significant increases in wages from 2018-19, when the previous four-year pay deals were renegotiated, as set out in section 8.7.

This trend of wage cost pressures in excess of CPIH is consistent with the broader experience of the UK employment market (ONS statistics) and is a trend that we expect to continue through GD2.

Figure 12-2 Direct labour cost pressures by role



12.4.2 Contractor labour

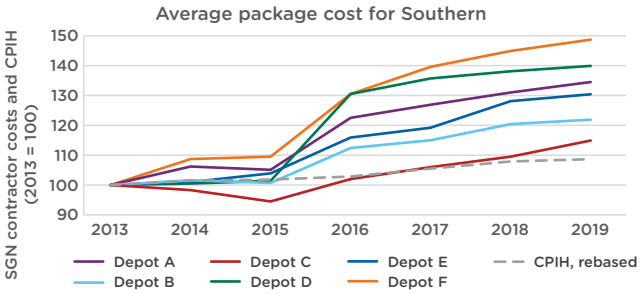
Contractor labour costs make up approximately 43% of our totex. Changes in the contracting strategy have been set out in the Procurement and native competition appendix. This builds on independent evidence provided by a cost consultancy, that assessed the impact of cost increases across various contracts during GD1.

The consultancy focused on engineering and building projects to assess the actual impact of increases in our repex contracts over GD1. We issued a significant number of contracts relating to repex and related works. Framework contracts, extended from 2016 onwards, included amendments to the rate structure and rate inclusions, so it is not possible to undertake a consistent analysis of the change in individual rates beyond September 2016. Given this, our consultancy partner carried out two separate assessments to analyse:

- the average total cost of a typical package of work using various contractors from 2013 to date, for each of our depots in Southern as shown in figure 12-3
- individual contractor rates for high volume activities up to September 2016.

Both sets of analysis show that we have experienced significant contractor labour cost pressures. We have included this evidence in the appendix.

Figure 12-3 Contract labour cost pressures



Proposed index for labour

We have carried out a detailed evaluation of a number of possible indices which could be utilised for the purposes of indexing RPEs for GD2. Our proposals are based on assessing a long list of potential indices against a set of criteria which broadly reflect CEPA's proposals in Ofgem's cost assessment consultation, namely criteria of materiality, accuracy and usability/credibility. We expect to continue evaluating these indices and engaging with Ofgem directly on proposals for appropriate indices.

For direct and contract labour, the following indices appear to be suitable on the basis of our assessment against criteria:

- ONS – AWE Private sector including bonus (NSA)
- ONS – AWE Construction, including bonuses (NSA)
- BCIS Labour cost index.

Given that there are multiple indices which appear to be suitable, Ofgem could use an average basket of the indices that pass the criteria. This would be similar to Ofgem's approach for GD1 and reduces the risk of cherry-picking specific indices to support a preferred outcome, or relying on a single index which might be exposed to the cyclicality of a particular sectors. It combines economy-wide and more sector-specific indices which reflect the actual cost pressures faced by GDNs.

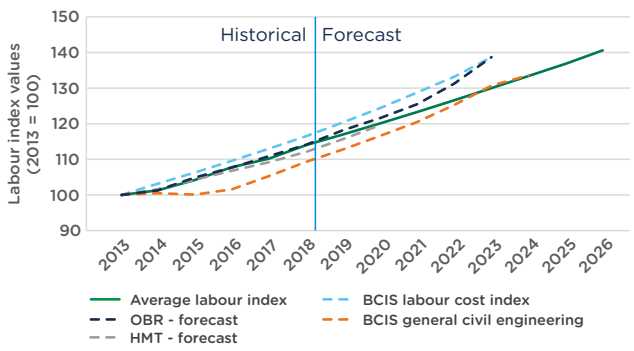
Proposed forecasts for labour

Our proposed forecast for labour RPEs is based on a linear extrapolation of an (unweighted) average of those listed above.

The forecast is set out in the chart below, and compared to other available forecasts from the HMT, OBR and BCIS (the BCIS Labour Index forecast and the BCIS General Civil Engineering forecast). The chart shows that our proposed average labour index is on the conservative end of the range of forecasts in line with the HMT consensus forecast and conservatively below the OBR forecast.

Average labour index is based on an unweighted average of the following indices: 1) ONS – AWE private sector including bonus (NSA), 2) ONS – AWE Construction, including bonuses (NSA); and 3) BCIS labour cost.

Figure 12-4 Labour RPE forecasts



12.4.3 Materials

In the Cost efficiency appendix we provide an assessment that suggests that the four indices for which we have data could be suitable for indexing RPEs:

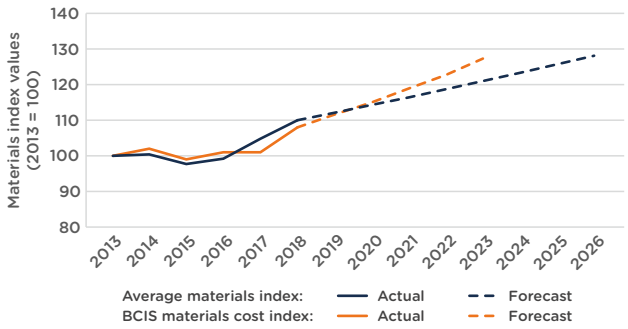
- ONS Basic Metals PPI
- BCIS Materials Cost Index
- BCIS Construction Material Price Index
- ONS Machinery and Equipment Output PPI.

Proposed RPE forecasts for materials

Our proposed forecast for materials RPEs is based on a linear extrapolation of an (unweighted) average of the indices listed above. The chart below shows our initial proposed average materials index and forecast, as compared to the BCIS materials forecast. We note that our proposed forecast is conservative, and lower than the BCIS forecast.

While our proposed basket of indices includes the two high-level BCIS indices listed above, we have not been able to access the more granular BCIS indices for steel, plastic or copper as used by Ofgem in GD1. We propose that Ofgem considers these indices. If they meet the key criteria around materiality, accuracy and usability, we recommend combining them with the indices listed above to give a basket of indices. This approach reduces the risks identified above and reflects the various sources of cost pressures faced by GDNs, as discussed in the Cost efficiency appendix. We would recommend that the forecast shown above is reviewed and updated to account for these additional indices if they are found to be suitable.

Figure 12-5 Material RPE forecasts



Average materials index is based on an average (unweighted) of the following indices: 1) ONS Basic metals PPI; 2) BCIS Materials cost index; 3) BCIS – Construction Material Price Index; 4) ONS – Machinery and Equipment Output PPI

12c The efficiency of our plan

12.5 Our efficiency across both our networks

We have analysed our current efficiency using comparative data over the first five years of GD1. This allows us to assess our performance relative to other GDNs and to review how that performance has changed over time. We show that:

- SGN has been outpacing the sector average efficiency performance throughout GD1
- SGN remains at or above the industry average, with efficiency scores of 98% for Scotland (4th) and 97% for Southern (3rd) in 2017-18 based on our proposed totex benchmarking methodology.

The tables below summarise the efficiency results using both SGN's assessment of Ofgem's totex methodology from the GD1 review, as well as updating that methodology to factor in our new proposals for the GD2 benchmarking approach. Our new proposals take into account some of the changes we think should be implemented based on our knowledge today. A score below 1 means the network is better than the average sector performance, while a score greater than 1 is less efficient than average. The row at the bottom identifies the upper quartile (UQ), which is set between the second and third most efficient company.

This demonstrates that:

- Scotland and Southern are better than average in all years and under both models, with the exception of one year for Southern under the Ofgem model, where it is at the average.

Table 12-2 Benchmarking analysis

	Standardised Efficiency Score SGN Proposed methodology				
	2013/14	2014/15	2015/16	2016/17	2017/18
EoE	1.07	1.06	1.07	1.13	1.08
Lon	1.09	1.04	1.10	1.05	1.06
NW	1.03	1.10	1.08	1.03	1.01
WM	0.98	1.03	1.02	0.99	0.99
NGN	0.88	0.90	0.93	0.92	0.95
SC	0.95	0.92	0.89	0.93	0.98
SO	0.95	0.93	0.93	0.98	0.97
WWU	1.05	1.03	0.99	0.97	0.97
UQ	**0.95**	**0.92**	**0.93**	**0.96**	**0.97**

	Standardised Efficiency Score Ofgem GD1 methodology				
	2013/14	2014/15	2015/16	2016/17	2017/18
EoE	1.06	1.06	1.06	1.13	1.08
Lon	1.10	1.05	1.10	1.05	1.06
NW	1.02	1.10	1.08	1.02	1.00
WM	0.98	1.03	1.01	0.98	0.98
NGN	0.87	0.88	0.92	0.92	0.94
SC	0.96	0.93	0.91	0.94	0.96
SO	0.95	0.93	0.94	0.99	1.00
WWU	1.05	1.02	0.98	0.97	0.98
UQ	**0.96**	**0.93**	**0.94**	**0.96**	**0.97**

It is likely that different GDNs will use different underlying modelling techniques and/or make different adjustments to input data to perform benchmarking analysis in their GD2 business plans. Similarly, Ofgem's previous publications (e.g. the GD1 annual reports) have set out some of Ofgem's initial analysis. We consider that our results are robust, and we have given the full detail on our proposed methodology and any data adjustments in appendix 005 Cost efficiency. We expect any differences in the results relative to Ofgem or other GDNs to be discussed in full as part of the GD2 review.

- Scotland exceeded the upper quartile position in all years under both models, with the exception of one year under the SGN methodology where it is slightly below upper quartile.
- There is firm evidence that SGN's overall cost base is efficient and when combined with our strong output performance demonstrates we are delivering industry leading value for money for customers.

External drivers of cost differences need to be controlled for in order to achieve an accurate comparison of cost efficiency between networks. If they cannot be controlled for, there is a risk that rather than identify genuine differences in managerial efficiency, the regression analysis instead identifies differences driven by external factors or spurious correlation.

In its cost assessment consultation, Ofgem set out a number of criteria to consider when selecting models; the economic or technical rationale that supports the model, the transparency of the data used, the ease of interpreting results and the robustness of the model in terms of its statistical significance.

In order to achieve these criteria, we need to be certain that the data has been thoroughly investigated, ensuring there is consistency across organisations in the cost drivers employed. We need to make sure that the model gives plausible results, in terms of the range and volatility of efficiency scores over time. Significant differences in efficiency scores, either between companies or for a single company over time, would suggest statistical weakness rather than genuine differences in managerial efficiency. On a bottom up basis, many of the GD1 benchmarking models show these characteristics – for example large swings in results year-on-year which are wider than our broad rule of thumb of +/- 20%.

We have provided a full breakdown of our analysis in appendix 005 Cost efficiency which sets out the impact of alternative regression methodologies and the different assumptions.

In this appendix we discuss the impact of comparing companies on a top-down or a bottom-up approach. We identify that a top-down approach enables a more complete assessment, which is less susceptible to distortion by individual data points or accounting practices. We consider it appropriate that a greater emphasis should be placed on the overall value for money test, using a totex benchmark, rather than the conclusions drawn from any specific disaggregated model (or set of disaggregated models).

However, we recognise bottom-up techniques can provide helpful points of reference regarding the performance of companies on individual cost lines, as long as the conclusions are appropriately caveated that poor data quality at this level elevates the risk of misleading or poor quality results. In our analysis we identify the workloads we consider to be particularly susceptible to poor data quality issues.

We also identify some adjustments that could be made to the bottom-up models to enable better quality modelling. These would improve the performance of the models against Ofgem's evaluation criteria and include: using publicly reported escapes as the driver in emergency costs, incorporating new operational techniques like CISBOT on the repex regression and ensuring data consistency around the repairs model.

We believe output quality provides a vital sense check to ensure efficiency benchmarks are not set at a level that lowers the bar on quality. We continue to actively engage with Ofgem's cost efficiency working group on this.

12.5.1 Controlling for regional factor

It is clear that regional variations in cost exist and are driven by external factors outside of GDNs' control. There is substantial regulatory precedent and evidence of these factors and they need to be accounted for in the benchmarking analysis to give results that accurately reflect company performance and efficiency of delivering an output. In the appendix 005 Cost efficiency, we have set out an evidence base that continues to justify the adjustments made at GD1 against Ofgem's proposed criteria in the following areas:

- London-specific costs
- sparsity costs in Scotland

We have quantified the additional costs of operating on the Isle of Wight.

We have also identified a number of other potential sources of regional cost variation, although these have not been quantified.

12.5.2 London specific costs

For GD1, Ofgem made two specific adjustments across all GDNs, one for labour cost differences across licence areas, and another for differences in urban profile. Both of these adjustments were mainly accounting for the higher costs of operating within the M25. This needs to be refined for GD2 as it is now clear the additional costs of working in London extend well beyond the M25. Compared to other parts of the UK the South East has elevated wages, cost pressures and raised customer expectations. These additional challenges need to be taken into account to create a fair reflection of relative efficiency.

We have evidenced this through an independent assessment of the impact of regional costs in our southern region. It looks in depth at the key factors affecting the cost of performing utility services in London, as compared to other parts of the country, and quantifies the effect of these differences. In particular, the paper identifies that SGN incurs material incremental costs to operate in London to the order of £30m a year (labour and urbanity).

12.5.3 Sparsity

Our Scotland network operates in a significantly more sparsely populated environment than other GDNs. This creates additional costs caused solely by our operating environment. In particular, in order to meet emergency standards, we need to station FCOs (first call operatives) and managers at depots within a one-hour travel radius of all populated areas. However, depots in sparsely populated regions will have lower utilisation rates, leading to higher labour costs relative to the number of emergencies and repairs carried out.

Over the course of GD1, we have upskilled all of our FCOs to undertake activities that are beyond their core emergency role. This includes, for example, supporting repex activities (e.g. extending customer pipework or installing steel risers); supporting maintenance activities (e.g. service regulator maintenance) and supporting capex activities, including customer connections work. However, in sparse areas even these types of work can be limited.

The impact of sparsity was assessed by an independent consultant during GD1. We have updated that analysis using the same methodology but with the most recent data, and we calculated that sparsity increases Scotland's labour-related costs by £3.4m a year.

12.5.4 Cost associated with operating on the Isle of Wight

Our southern distribution area includes the Isle of Wight (IoW). Operating a gas distribution business on the IoW comes with several challenges not experienced in other parts of mainland network operations. These factors are not due to sparsity, as described above, but are as a result of the island being geographically disconnected from the mainland. Factors include reduced competition between suppliers in tender events, a minimum resource requirement to be sustained on the island to ensure a 24-hour emergency service and an additional cost associated with transportation. In many ways the IoW has common characteristics with the operational challenges of the SIUs that are removed prior to regression to ensure they do not distort the results.

12.5.5 Other sources of regional costs

There are a range of other potential sources of additional costs in Scotland in particular. Some of these areas are identified below. It should be noted that we have not yet sought to quantify these (or other) potential sources of incremental cost.

- Scottish Government policy deviations from the wider UK which may lead to the later introduction of schemes, such as lane rental or low emission zones.
- Harsher weather conditions versus the rest of the UK can hamper productivity, impact travel and prevent reinstatement work.
- Contractor numbers and the level of competition as set out in the Procurement appendix.

12.5.6 Productivity assumption

Historically, regulators have tried to forecast productivity based on observations of historical productivity growth rates in industries with similar characteristics.

There has been a marked slowdown in productivity across many industries in the UK and globally since the 2008 financial crisis. Total factor productivity (TFP) growth estimated by the Bank of England (BoE) shows that productivity growth rates – which were averaging 1% a year before 2007 dropped below zero after the financial crisis. Although productivity in the economy has improved slightly since 2015, it remains considerably below pre-2008 levels, and is forecast to remain low until at least 2022 by the BoE. The implication is that the economy has reached a new steady-state level of productivity which is likely to persist.

The feeling that there may have been a paradigm shift has prompted the BoE and the OBR, among others, to significantly reduce their short-term forecasts of productivity growth. The BoE's February 2019 forecasts for total factor productivity growth are reproduced below:

	1998-2007	2008-10	2011-14	2015-18Q3	2018Q4-22Q1
TFP growth	1.0%	-0.6%	0.1%	0.2%	0.3%

The reasons for stalled productivity in the UK and across many other western economies are not well understood. Possible explanations that have been put forward include:

- firms choosing to deleverage rather than invest in new productive capacity
- whether loose monetary policy has artificially supported firms that would otherwise have gone out of business
- a reduction in competitive tension
- a slowing rate of technological productivity gain.

Despite this, our plan aims to achieve more than three times the productivity rate forecast by the BoE. On top of our existing efficient performance, we factor in an additional average £15.2m (annual average in GD2) of stretch targets over GD2, generated through productivity and efficiency.

We plan to achieve this through a combination of innovation savings rolled forward from GD1 and process efficiency. In particular we plan to absorb some of the impact of increased unproductive time in emergency following the loss of legacy meter work contracts. These assumptions are stretching in the context of cost pressures such as the loss of meter work and the wider productivity slowdown.

12.5.7 Productivity included in our plan

Our business plan takes as its starting point our existing efficient performance. On top of this, we factor in an additional £15.2m a year of stretch targets, to be generated through productivity and efficiency. This is equivalent to 1.4% a year on opex (£7.7m saving a year), 0.7% on capex (£2.6m saving a year; and 0.7% on repex (£4.9m saving a year) – giving a total productivity assumption across the cost base of 1.0% a year. This means, at the end of the next price control, we will save customers £76m relative to today.

12.6 Highly anticipatory investment

We do not propose to make any highly anticipatory investment in GD2.

13 Innovation

Linked appendices

- Innovation
- Energy futures - transition
- Future of energy - whole systems and scenarios

Innovation is a means to develop new solutions to problems which exist now, or which we anticipate we will face in the future. Projects designated as innovation allow us to improve our understanding of new technologies and how they benefit the customers using our network, and potentially society as a whole: innovation will ensure we are able to support the transition to a smarter, more flexible, sustainable energy system.

The UK and Scottish Governments' approach encompasses a range of programmes and initiatives, underpinned by innovation and 'learning by doing'.[1] This aligns with the approach we have taken to date and propose to continue into GD2, where demonstration, evidence gathering and enabling change are key outputs.

We have already saved customers £125m in GD1, and our use of innovation is recognised for challenging convention and pioneering new approaches in all areas of our network. It is vital we continue to invest in R&D to explore new ideas in GD2, and not rely on existing or new-to-market technology to meet the net-zero challenge.

We have carried out a wide-range of stakeholder engagement activities[2] with the objective of informing our decision-making processes relating to innovation; and to find out what innovation our stakeholders and customers want to see from us. Stakeholders want us to do more with innovation, prioritising research into low carbon gases and collaborating with academic and commercial partners.[3]

We will use our GD1 experience to highlight why we believe disruptive innovation funding should continue through GD2 (section 13.4.2). We embrace the concepts of innovation and creativity at all levels of our business to help us solve the most challenging issues we face, both as a company and as an industry. In GD1 innovation has been transformational in a number of key areas.

- **Minimising disruption:** embedding our Core & Vac fleet into our southern network operations to speed up essential works and minimise our environmental impact. Our five CISBOT robots have travelled over 39km, reducing road disruption and our environmental impact by 56% through removing the need for 531 excavations.
- **Supporting vulnerable customers:** innovative repair techniques, such as self-amalgamating tape, have transformed our approach to riser pipe risk management, significantly reducing the number of disconnections, particularly in high rise buildings that are more likely to be occupied by vulnerable customers.
- **Improving our service:** live main insertion techniques have significantly reduced the duration of customer interruptions.

13.1 Building on lessons learned in GD1

A significant innovation portfolio has been established under GD1 with innovation ranging from operational and process changes through to future networks, industry standards and decarbonisation. Using the allowance mechanisms available, innovation and technology has delivered operational excellence and other benefits to customers.

Innovation over GD1 has generated savings of over £125m which will be passed on to customers in full in GD2. Key highlights are summarised below.

- A total of 137 projects to date, with 122 delivering some benefit (table 13-1).
- 36% (50 projects) were carried out in collaboration with another network.
- 79 have been completed and are either implemented or delivering research outputs being used elsewhere.
- 14 have not been implemented as they did not demonstrate immediate value for the problem identified (although they may show value again later).
- 59 are live proposals and are currently being either developed further or are in the final stage of efficiency gain.
- Combined they generated £125m of savings from an initial expenditure of £24.9m.

As identified within the Gas Network Innovation Strategy, published on the Energy Networks Association (ENA) website[4], we identify projects against a number of key themes. Our work so far since the start of GD1 is shown in table 13-1 along with the attributed financial benefit. We do not currently have effective data on environmental, social and safety benefits to show what these projects have also delivered.

1 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/766109/decarbonising-heating.pdf
2 MFT Workshop March 2016 London & Edinburgh (ref 006), Shaping the Business Plan Qualitative Workshops - Sharing Financial Risk. Innovation Investment (ref 083), Stage 1: Explorative Qualitative Workshops and Interviews (Exploratory Phase) (ref 002)
3 MFT Workshops March 2016 London & Edinburgh (ref 006)
4 http://www.energynetworks.org/assets/files/Gas%20Network%20Innovation%20Strategy%20Final%202018.pdf

Table 13-1 Innovation benefits from GD1

Strategy theme	NIA		NIC		Total	
	No.	Benefit (£m)	No.	Benefit (£m)	No.	Benefit (£m)
Environment and low carbon	7	0.19		-	7	0.19
Future of gas	14	3.89	3	8.16	17	12.05
Mains replacement	23	49.74		-	23	49.74
Reliability and maintenance	30	12.29		-	30	12.29
Repair	27	13.37	2	-	29	13.37
Safety and emergency	16	38.01		-	16	38.01
Grand Total	**117**	**117.49**	**5**	**8.16**	**122**	**125.65**

The success of our innovation programme in GD1 was achieved through a number of enablers which we will take forward into GD2 and are discussed below.

1. A strategic approach to innovation
2. Collaboration with third parties
3. An innovation culture driving effective implementation and embedding.

13.1.1 Strategic approach to innovation in GD1

The Gas Network Innovation Strategy[5] agreed between all the GDNs sets out the key focus areas for delivering additional value to customers from innovation projects; and how we will share the lessons learnt through the process with other GDNs. The strategy is structured around seven innovation themes listed below.

- Future of gas
- Safety and emergency
- Reliability and maintenance
- Repair
- Distribution and mains replacement
- Environment and low carbon
- Security

Our strategic approach to innovation within SGN is also clearly aligned to the development of a whole systems approach and the broader energy system transition. Chapter 11 sets our whole systems approach and 11.7 includes the innovation projects that support it. Further details are also given in our Whole systems and scenarios appendix and our Energy systems transition appendix.

Innovation projects are rarely developed in isolation. Normally, they depend on a family of supporting innovations, where each one is seen as a strategic component of the whole, complementing each other to deliver a better customer outcome. Lead innovations enable either a significant evolution in a process or a change to the way that we deliver our projects. Their realisable benefits and their links to supporting innovations are described in more detail in the Innovation appendix.

In section 9 of the Innovation appendix, we have set out innovation clusters according to their operational impact. For example, the innovation cluster 'replacement of mains using trenchless technology' describes the combination of innovation projects that enable live insertions to take place. Effective deployment of the lead technology, the synthoscope camera, is supported by 14 other innovation projects carried out by us and other networks.

13.1.2 Collaboration with third parties

Through collaboration and shared learning, we are driving innovation forward in our industry. We could not achieve what we do without the support and expertise of all our project partners, colleagues and the other network licensees that support our diverse portfolio. This includes collaboration on initiatives with key industry bodies such as the Institution of Gas Engineers and Managers (IGEM), ENA, Gas Innovation Governance Group (GIGG), Pipeline Industry Guild (PIG), Energy Innovation Centre (EIC), SMEs and larger companies.

Innovations we have led, such as Core & Vac and CISBOT, are now widely deployed across other network companies. CISBOT, for example, was being used by National Grid in the US. We brought it to the UK and adapted it for operation on the UK's gas networks. We are active participants in the innovation networking and knowledge exchange between companies, and build on the progress made by others to support our own lead innovations.

We have also kicked-off the initial concept phases of other successful innovation projects, such as System Two Assess & Seal Solution (STASS) and Beyond Visual Line of Sight (BVLOS), which have since been further developed by other networks. We remain committed to supporting their eventual implementation within our own network if viable. This open approach to innovation has also led to recent live field trials of innovation projects, such as Cadent's ServiBoost which can maintain pressures for customers while a pressure problem is investigated, and a solution implemented.

The scale of our pioneering and ambitious NIC projects, and how their successful delivery could potentially benefit domestic and international stakeholders, is a strong incentive for us to share progress and keep the rest of our industry informed. We achieve this through making available full project reports, running and participating in workshops, attending conferences and collaborating with industry bodies.

[5] http://www.energynetworks.org/assets/files/Gas%20Network%20Innovation%20Strategy%20Final%202018.pdf

13.1.3 Fostering ideas

The SME and industrial communities have been an important channel for sharing ideas and concepts during GD1. We have built an active engagement programme with these companies, achieving ongoing and open dialogue to discuss ideas, develop applications and give practical advice on how obstacles to deployment could be overcome. We have strong working relationships with over 137 SMEs that account for almost 80% of the partners we work with, as well as many multinational organisations based in Europe and North America, built over many years of collaboration on multiple projects. These project partners give us flexibility and diversity. During GD1, 62% of NIA funding was spent through 15 leading SMEs, with a further 19% through large independent companies.

Innovation showcase events are arranged at our regional depots to both demonstrate our innovative projects and directly engage our project partners. Attendees and exhibitors include a range of our SME partners, internal colleagues, our board, Executive team and operational employees. These events generated positive feedback further promoting our culture of innovation.

In GD2 we will continue to promote the involvement of third parties in the development of new innovations. In particular, by facilitating safe access to our network and by supporting testing and innovation trials in a safe and controlled environment. This approach will also drive innovation projects linked to our ambition to provide 250,000 vulnerable customers with extra support in GD2.

Case study

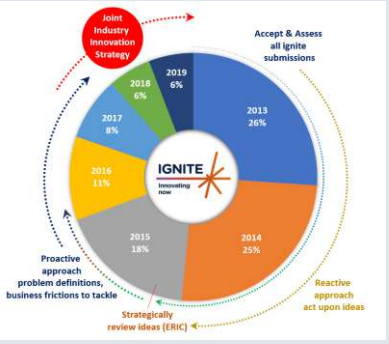
Innovation case study: IGNITE

One of our strategic incentives is to continue to reinforce a culture of innovation and development in our business. 'IGNITE', a reward-based suggestion system for our people, has been central to the development of this innovative culture. Our focus is on the encouragement, progression and implementation of ideas from everyone (internal and external) to improve our thinking, products and processes.

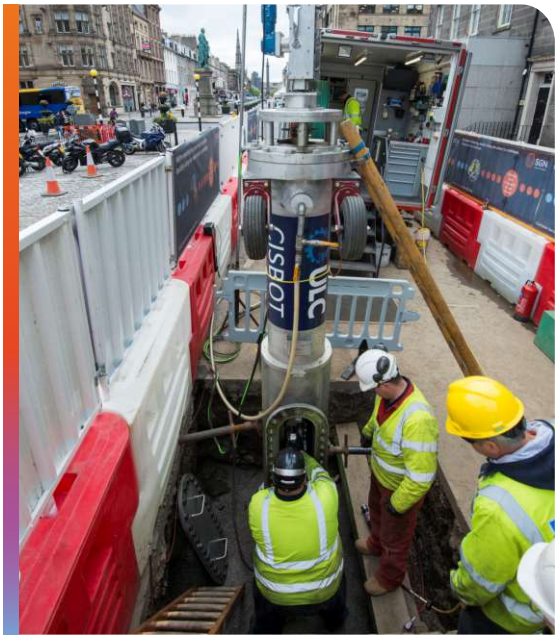
Introduced before GD1, this sustained approach to engagement saw the number of ideas submitted from our workforce increase from an average of 11 submissions a month in 2008/09, to well over 50 submissions a month in GD1. The total number of ideas submitted so far in GD1 is over 5,800. Our suppliers also participate in the scheme and are actively encouraged to bring us the latest thinking and advances in their markets.

Today's submissions are debated openly and a case for progression built. Ideas are assessed with support from multi-functional teams and acted upon based on the proposed value. As a standard way of working, good ideas are now assessed, validated and deployed into the business. This assessment process over time has reduced the volume of ideas but increased their quality.

SGN's innovation team picks up the ideas of value which require more development work, following our innovation development process to ensure a fundamental level of compliance and best value are assessed and can be achieved. We believe that this approach enables us to open our innovation ideas to third parties (SME tenders), ensuring we maximise development knowledge and leverage technical and financial risk, where appropriate.



In 2015, strategic priorities were added to the submission criteria for 'IGNITE' utilising the 'ERIC' principles *(Eliminate, Reduce, Innovate & Control)*. The process matured at this time, ideas evaluated by a business area that had limited scope beyond that area could be implemented as business as usual accelerating efficiencies as part of an overall culture of continuous improvement.



13.1.4 Embedding innovation

Innovation is embedded within our culture and is contained within our operational excellence strategic roadmap. Our people are encouraged to put ideas and solutions forward and we instinctively collaborate with industry peers.

In order to realise the potential value from innovation it is important to take it into commercial deployment. Stages of innovation are often described according to their Technology Readiness Level (TRL), with TRL1 being early stage/concept research, and TRL9 being close to full commercial deployment.

Once a technology is near to commercial deployment there remains an extensive process of putting in place technical assurance, policy changes and other necessary documentation prior to implementation. These are required to develop the processes needed to embed the innovation in a safe manner in a live gas environment. Depending on the complexity of the innovation, typical timescales are anything between three to nine months before new processes are ready to be deployed. Once the processes are in place, operational teams will then need to receive training as necessary and roll-out needs to be monitored and managed.

We actively manage the deployment and monitoring of successful innovation projects.

1. **Strategic, high level focus.** Operational excellence is one of SGNs six corporate priorities with executive team sponsorship and a workstream dedicated to innovation. A strategic roadmap sets out the ambitions, timelines and expected benefits.
2. **Leadership responsibility and common processes.** We have dedicated senior management resource responsible for the roll-out of proven innovation projects in Scotland and Southern, supported by tracking and monitoring processes that apply across both networks.
3. **Acceleration of success.** Innovation trials may be carried out in either network area, but once proven successful, the innovations are adopted in both areas, shortening the time to deployment.
4. **Engagement and training.** Engagement of operational teams is a critical enabler. Innovation breakfasts and strategic innovation workshops are used to gather ideas from employees at all levels and as a catalyst for successful roll-out.

13.2 Carrying forward innovation into GD2

Innovations originally developed under the IFI structure for GDPCR1 have led to some of the benefits delivered in GD1. In the same way, we anticipate benefits associated with innovation funding in GD1 will lead to benefits in GD2.

We have demonstrated in table 13.1 that innovation stimulated through NIA and NIC has provided significant customer benefits in GD1. In the first year of GD1 we achieved a benefit from innovation of approximately £16.4m as a result of delivering quick wins. As we move into GD2, the majority of the savings achieved during GD1 have been incorporated into the baseline at 2018/19 prices and are fully recovered by customers. In addition, the quick wins have been identified and the efficiency gains remaining are more incremental.

In simple terms, the greatest efficiency savings are achieved by reducing the amount of excavation work. Through innovations such as CISBOT, Core & Vac, and the development and improvement of insertion technology (where a new pipe is threaded through an existing pipe rather than re-laid) we have vastly reduced the volume of excavation and further benefits are harder to achieve.

In GD2 the benefits of innovation are becoming more incremental and we will be unable to deliver the same step change in performance as we experienced at the start of GD1. Based on the remaining projects we expect to implement over the remainder of GD1, we anticipate a further £2.2m a year of financial benefit will be carried forward into GD2.

13.3 Collaborative approach to innovation in GD2

We described the fundamental importance of collaboration to our GD1 innovation programme in 13.1.2. We will continue to collaborate with project partners and broader stakeholders to ensure we deliver effective and appropriate outcomes for consumers during GD2.

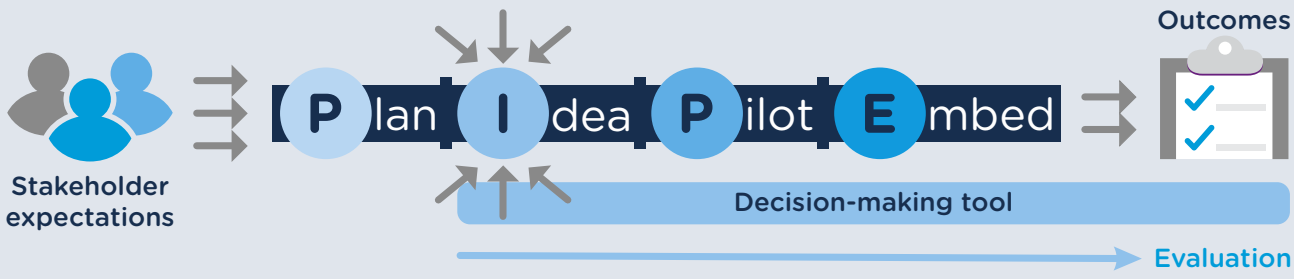
In formulating our GD2 innovation strategy (section 13.4) we consulted extensively with stakeholders, building on the engagement already undertaken in GD1, as set out in section 4 of the Innovation appendix. Innovation is an area stakeholders ask us to scale up further, engage more with universities and other third parties and increase our focus on the use of lower carbon gases in our network.[6]

We have responded by building on our existing GD1 strategy while also increasing our emphasis on decarbonisation and support for the early determination of the low carbon pathway. By validating the decarbonisation pathway as quickly as possible we aim to minimise the risk of stranded assets and de-risk investments for future consumers.

We are currently working with other GDNs to develop a new innovation strategy for release in 2020. The process includes extensive engagement with the electricity DNOs, innovators, academics, SMEs and consumers, with stakeholder workshops planed for January 2020.

We will continue with our collaborative approach established in GD1, working with a broad range of colleagues, external stakeholders and partners to generate innovation ideas and contribute throughout our innovation process.

We set out further details of specific collaboration mechanisms for the NIA and NIC in GD2 in 13.4.2 to 13.4.4.



[6] MFT Workshops March 2016 London & Edinburgh (ref 006), Shaping the Business Plan Qualitative Workshops - Sharing Financial Risk. Innovation Investment (ref 083)

13.3.1 High quality outcomes for customers

We recognise the importance of driving high quality outcomes from innovation in the interests of current and future customers by reducing longer term expenditure or giving greater long-term certainty in investment.

From the outset, projects will be designed to maximise the potential benefits, avoid duplication with existing projects in the UK and internationally, and provide an appropriate balance between third party and network involvement in the project partnership.

Our process is underpinned by ongoing evaluation as ideas move through further development to trials and pilots before roll-out and embedding.

13.3.2 Considering the impact of innovation on vulnerability

Innovation should benefit all our customers and we need to minimise the risk of negative impacts on vulnerable groups, particularly during the energy system transition. By engaging with stakeholders and directly with customers throughout our innovation process we will work to mitigate any negative consequences of all our projects.

As we set out in section 4.15, we have proposed collaborative action on complex challenges through discussions with specialist stakeholders. This process will also help us to consider and mitigate the potential impact of broader innovation projects on customers in vulnerable circumstances.

- Through regular engagement with expert stakeholder and customer panels we will highlight innovation projects and deepen our understanding of potential impacts on vulnerability.
- Our innovation project approval process will include specific consideration of the potential impact of the proposed project on vulnerability.
- As part of our consumer vulnerability reputational incentive we will report annually on our innovation projects to improve vulnerable services, and also on the potential impact (and mitigation) of broader innovation projects on vulnerability.
- Our ongoing stakeholder engagement (see 4.15) will focus on finding ways to support vulnerable communities to engage with decarbonisation. We will report on our progress against this long-term complex challenge in our annual engagement report for the reputational stakeholder incentive (section 6.8.1).

13.3.3 Rolling out and monitoring benefits of innovation in GD2

Section 13.1.3 explains the four building blocks of our framework for rolling out proven innovation into the business, which we developed during GD1 and will continue to evolve in GD2.

During GD2 we will also continue to work with other networks and stakeholders to develop the innovation and benefits reporting framework that is being developed through the Energy Innovation Centre (EIC), set out in the Innovation appendix, section 3.9. The model focuses on strategy, organisation and culture, capability and technology, and outcomes over the staged timeline of innovation. We are actively collaborating with our network partners to iterate and refine the model to provide a format for innovation reporting, enabling comparison between network companies.

13.3.4 Dissemination and sharing

We will continue to play a very proactive role in sharing our learning from innovation. We attend conferences such as Utility Week Live and the Low Carbon Network Innovation conference, using the opportunity to disseminate to a wide range of interested partners, stakeholders and like-minded companies. Funding new solutions with similar challenges ensures that our innovation activities deliver the best joined-up value for customers.

13.4 Innovation strategy for GD2

We have separated our innovation strategy into four categories below, BAU innovation (which is funded by directly by SGN) and three other categories of innovation, low TRL, vulnerable customer and energy system transition, discussed at 13.4.2 to 13.4.4 below.

13.4.1 BAU innovation funded by SGN

BAU innovation covers projects at a late stage of commercial development, which could be successfully rolled-out and do not require additional funding through customer bills. We actively encourage adoption of new technology as an internal BAU process, continually reviewing the market for new products we think will deliver value to our current business processes. Previously, we have deployed new technologies on a BAU basis such as main bursting techniques, gas trackers, plant location technology and magnetometers.

However, the BAU innovation strategy takes place against a challenging regulatory backdrop; a short regulatory period in which to make a commercial return, a low totex incentive rate and a cost of equity that does not reward risk.

Given these factors, we will embrace a BAU strategy focusing on implementing new products, processes and services with the greatest commercial benefit coupled with the most rapid deployment potential.

The selection process for BAU innovation projects will be directly aligned to what the market has to offer. Our focus for expenditure will be on developing the internal processes to ensure products can be deployed safely within an operational environment.

The BAU approach will be led by a workplace innovation engagement programme to build and sustain the innovation culture created in GD1 (see 13.1.3). Increased workplace engagement in the BAU process should open the potential to high volume innovation, which in practice can lead to significant benefits through high numbers of incremental innovations normally focused on business efficiencies.

13.4.2 Lower TRL innovation in GD2 (NIA)

Low TRL innovation is a not a category that is recognised by Ofgem, however our customers recognise the benefits innovation can bring. We discussed the concept of 'early' (low TRL) innovation at in-depth workshops and found that customers were prepared to pay for this type of innovation to increase operational efficiency and reduce customer bills in the long term, provided that the company also made a contribution to the funding.[7]

We propose to use the NIA mechanism to continue innovation for disruptive lower TRL projects, (projects that start at or below TRL4) to provide a conveyor belt of emerging ideas, concepts and innovations. Lower TRL research and development projects of this nature are inherently riskier and the benefits take longer to realise.

Without these low TRL R&D projects, our ability to deliver projects for BAU implementation will be significantly hindered. The potential benefits of projects that start with a low TRL will only be realised when they are commercially ready to deploy. As an example, when we introduced CISBOT, the project was supported through NIA funding from TRL4 up to level 8. We supported the full deployment and demonstrated the widespread use of the technology, realising efficiency benefits and reducing disruption. This also highlights the benefits of retaining the funding allowance for this type of innovation, as outputs are shared with all network companies. Cadent has now introduced CISBOT and will be able to benefit from our operational experience.

These benefits would not have been realised in the absence of appropriate funding mechanisms for lower TRL innovation. If this funding were not to progress, we expect a less attractive market would lead to SMEs reducing their focus on efficiency-based innovation as we head into GD2.

13.4.3 Vulnerable customer innovation allowance (NIA)

The vulnerable customer innovation allowance is focused on improving outcomes for vulnerable customers. We held workshops in August 2019 in both our network areas[8] at which stakeholders helped us to refine our areas of focus for innovation through:

1. mitigating the risk of the energy transition;
2. joining up information flows to provide better service;
3. finding new ways to minimise the impact of supply disruptions; and
4. adopting new solutions through inclusive design to improve the identification of customers with additional needs; access to services, security and peace of mind, and affordability.

Our broader plans to support vulnerable customers in GD2 are set out in section 6.5 and in the Customer and vulnerability appendix. Our proposals for innovation in vulnerable service provision through the NIA mechanism (section 6.6) include the full spectrum of TRL levels, including the lower levels of research and development and disruptive proposals.

We will continue to work with our stakeholders and customers on an ongoing basis. By building on the specialist stakeholder panels and an extended customer panel initiated in GD1, we will generate ideas and co-create possible solutions through inclusive design. We also work with advocacy and representative groups and are building on our learning from GD1 to ensure that we tackle barriers and impact on wellbeing in innovation projects.

Our Steering Group for Vulnerability and CO (see 6.5.6) created to support the implementation of the vulnerability use-it-or-lose-it allowance, will also have an oversight role in the selection of third-party initiatives for the vulnerable customer innovation allowance.

13.4.4 Energy system transition allowance and competition (NIA and NIC)

The decarbonisation pathway in figure 13.2 underpins our energy systems transition innovation strategy for GD2. The pathway illustrates the key technical steps to achieving 100% decarbonisation together with the research and development that will provide evidence underpinning each step change. The first three steps are concerned with securing the gas supply, removing barriers and enabling change. The next three steps will stimulate the hydrogen economy by developing and implementing strategic projects to blend hydrogen. The need for increasing quantities of green hydrogen will, in turn, stimulate the renewable power generation sector. The final step is a strategic conversion from natural gas to 100% hydrogen.

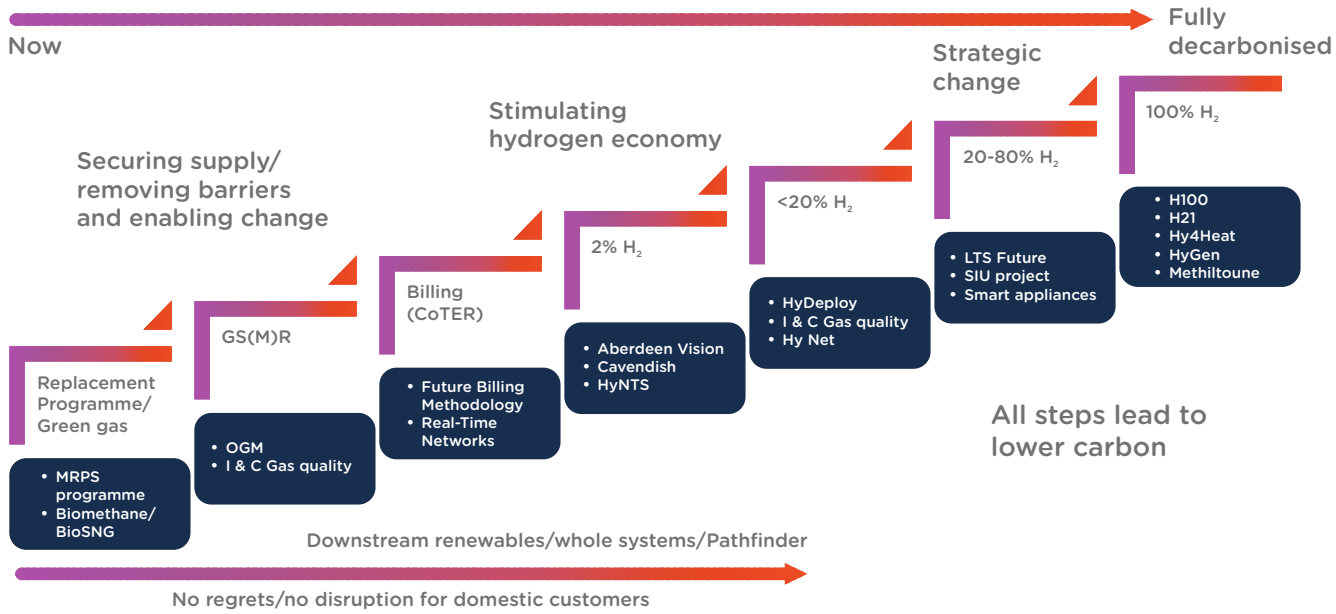
The pathway was developed by the gas transporters in collaboration with key industry stakeholders[9], Scottish Government and UK Parliamentarians, and set up to provide technical and academic challenge and review. The pathway's role is to separate opinion from fact, using science to provide unambiguous evidence to inform the most efficient and effective route to decarbonisation.

The steps are now recognised collectively by policy-makers and the gas networks as being necessary for moving towards decarbonisation.

[7] Shaping the Business Plan Qualitative Workshops - Sharing Financial Risk. Innovation Investment (ref 083)
[8] Positive Impact stakeholder workshop – London combined with Scotland (ref 088)
[9] Future of heat specialist panels, Edinburgh Aug/Dec 18 (ref 023, 024)

The pathway is based on a philosophy of evidenced steps which prepare the gas infrastructure for transition before carefully introducing hydrogen. As the evidence base is built, and the hydrogen chain becomes established, the transition can be accelerated or slowed as appropriate. At the beginning of the pathway, there is very little extra expense, but midway through the pathway, when we need to stimulate the hydrogen economy there will be additional costs. This is a least regrets route – it avoids stranding gas network assets and does not preclude other solutions. The pathway is not time-limited, but research and development is time-constrained as BEIS requires the evidence for the decarbonisation of heat and energy to be ready by 2023/24.

Figure 13-2 Decarbonisation pathway



The safe and reliable increase in hydrogen concentration on the pathway needs to be underpinned by R&D and investment in strategic projects. Government policy makers are also awaiting the outcome of industry R&D to provide options for the decarbonisation of heat, as outlined in the BEIS[10] Clean Growth report and the Scottish Government energy strategy. We are collaborating with the other gas networks and industry to deliver the R&D needed by 2023/24. Following agreement of the pathway an independent academic review concluded in principle, that it was robust.

At each stage of the pathway we have identified example projects that are either underway or being initiated. All the GD2 pathway projects set out in Annex A of the Energy systems transition appendix have been developed through discussion with third parties, and this will continue as the projects are refined and alternative projects proposed.

The design and outcomes of funded innovation will be open, transparent, and exposed to impartial scrutiny and assessment. This is important given the scale of funding necessary and the economic importance of basing the decarbonisation of heat policy on the most robust evidence base available.

This pathway underpins our approach to NIA and NIC energy systems transition funding in GD2. The steps on the pathway typically progress through the feasibility and design stage utilising energy systems transition NIA funding, before moving towards a more robust demonstration funded through the energy systems transition NIC funding proposal.

NIA. We have identified 67 NIA projects as part of our Energy Future programme for GD2. These will be designed to provide the information we need to advance along the decarbonisation pathway and establish hydrogen's role as a cost-effective energy vector. They will help enable whole system thinking and modelling, improve demand forecasting and implement emerging decarbonisation technologies.

Ten of these NIA project streams include front-end engineering design or feasibility studies. Successful projects will eventually become one of ten identified NIC projects.

NIC. We have identified collectively ten strategic R&D projects that we will seek funding for from the reshaped NIC. These will either be carried out directly by us or in collaboration with other networks. Of the ten NIC projects, two are part of whole systems (control systems and Methilltoune) and the full list is provided in Appendix 006, Energy system transition.

As with all other major projects, we would anticipate working with industrial and academic partners to support timely delivery. Similarly, we will source additional funding where possible, as we have in the case of our Methilltoune project. Such funding structures often come with requirements or extra risks that are not compatible with our existing licence or the price control structure.

Reopener. As we progress along the decarbonisation pathway we recognise that the scale of pilot projects increases the scale of funding required and the current NIA and NIC may not be appropriate. As such we are proposing an energy system transition reopener, to enable the deployment of hydrogen into the gas blend from four SGN projects; Project Cavendish, Aberdeen Vision, Industrial By-Product and our 100% Hydrogen Conversion Demonstration, described in section 12.2.13.

Further details of key energy system transition projects can be found in the whole systems chapter at 11.7.3 and at 13.6.

[10] BEIS clean growth – transforming heating report December 2018

13.5 Innovation funding in GD2

Innovation funding needs to be considered as part of the whole price control package, with an appropriate sharing of overall risk and return between investors and customers. The return on equity must reflect the level of risk undertaken, including innovation risk. Assuming an appropriate balance can be achieved, in principle we propose the following annual funding structure for innovation.

- BAU funding (safety, efficiency and environment): SGN will fund 100% and has an aspiration to invest £1.5m subject to the identification of projects that provide an appropriate balance of potential return and level of risk in deployment. As stated in 13.4.1 we anticipate this will focus on later TRL innovation which is expected to achieve a return in the price control period. We propose to directly link the amount of BAU funding provided by SGN to a proportion of the funding provide through the NIA funding structure for low TRL and vulnerable customers, as set out in table 13-2 below.
- NIA Funding (early TRL innovation, energy system transition and vulnerable customers). Stakeholder evidence suggests there is support for us to provide a contribution towards early stage TRL innovation[11] that creates efficiency, safety and broader environmental improvements. For earlier stage innovation (at or below TRL 4) and for innovation funding to support better outcomes for vulnerable customers we have an ambition to contribute 10% of the costs, subject to an appropriate risk-return package in the price control structure.
- Energy system transition competition (NIC). Given the diversity of EST competition projects that we have identified above we do not think that there is a single SGN funding solution that is appropriate to cover all projects. Instead the scale, the nature of the project and the role of the network will need to be considered in order to determine the appropriate level of our contribution.
- Energy system transition reopener. As outlined in section 12.2.13. we are proposing a reopener mechanism to facilitate the rollout of hydrogen in the gas network following appropriate heat policy decisions made in early GD2. We believe this mechanism is necessary to rollout the work from our Energy system transition NIA and NIC programme to blend hydrogen into our gas network to achieve the potential carbon savings and decarbonisation progress as shown in section 11.8. Values provided are indicative.

We believe this approach provides the right balance between customer benefit, associated risk and the longer-term business benefit. However, this will remain under review while the overall price control package and the rules of innovation funding are established. We have summarised this in table 13-2.

Table 13-2 Annual innovation funding proposal

Investment by funding type (£m a year)	SGN funding	2021/22	2022/23	2023/24	2024/25	2025/26	Annual average
BAU	100%	1.5	1.5	1.5	1.5	1.5	1.5
NIA (vulnerable and low TRL)	10%	2.9	2.9	2.9	2.9	2.9	2.9
NIA Energy system transition	10%	14.5	13.6	10.4	5.8	7.1	10.3
Total NIA	**10%**	**17.4**	**16.5**	**13.3**	**8.7**	**10.0**	**13.2**
NIC Energy system transition	By project	8.0	33.0	13.2	20.7	40.7	23.1
Energy system transition reopener	2023/24	0.0	7.0	100.0	64.6	51.6	44.6

[11] Shaping the Business Plan Qualitative Workshops - Sharing Financial Risk. Innovation Investment (ref 083)

13.6 Energy system transition key projects

We have highlighted in 11.7, the whole system innovation projects that we are proposing to support acceleration towards 2045 net-zero. Below we highlight key innovation projects that we propose as part of the decarbonisation pathway. In practice, we progress all of these innovation projects as part of our energy futures programme, and both are included in the innovation funding proposals at 13.5.

Further details of all the projects, timelines and a breakdown of cost estimates can be found in our Energy systems transition appendix.

13.6.1 EST project: H100 and community demonstration

A gas grid delivering 100% hydrogen is the ultimate and necessary goal if the Scottish and UK decarbonisation targets are to be met, whilst continuing to make full use of the extensive GB gas grid assets. Our Hydrogen 100 project, initiated in 2016, has been designed to demonstrate the safe, secure and reliable distribution of hydrogen. H100 is a feasibility study building on prior work and developing site specific evidence to support the construction of a physical 100% hydrogen demonstration. This will culminate in construction at one of three Scottish locations: Levenmouth, Aberdeen and Machrihanish as a scalable demonstration network.

Levenmouth: In 2014, Bright Green Hydrogen, Fife Council and Toshiba collaborated to develop the Levenmouth Community Energy Project on the south coast of Fife. Funding was awarded for an integrated microgrid consisting of a 7MW wind turbine, solar PV, and 250kW PEM electrolyser to convert hydrogen for storage and use in a 100kW PEM fuel cell. This would be used to power the grid during times of low renewable generation, as well as a local fleet of hydrogen-electric and hydrogen-diesel vehicles.

The Levenmouth H100 option will build on this infrastructure by installing an additional electrolysis plant and the construction of a hydrogen network serving 300 domestic properties. The proposed Neart Na Gaoithe (NNG) wind farm array expansion off the Fife coast, which is currently electricity grid constrained, could be developed to provide additional power for local hydrogen production. There is also scope to expand hydrogen production using industrial by-product H2 from the nearby Fife Ethylene Plant (FEP) at Mossmoran.

Machrihanish: Located near the tip of the Mull of Kintyre, Machrihanish has an abundance of renewable generation located within the vicinity of the site but is remote from existing gas infrastructure. The H100 demonstration project would involve the construction of a hydrogen grid to serve Campbeltown Airport business park and approximately 300 domestic and small commercial users. It would link to the existing SIU at Campbeltown, an isolated network well suited for renewable gas injection and offering the possibility of future expansion.

Aberdeen: The third option is Aberdeen, where there is the opportunity for a hydrogen grid to link into our Aberdeen Vision project. The proposed site forms part of the old Aberdeen Exhibition Centre, undergoing redevelopment for new housing. Working with Aberdeen City Council, the planning and development of new housing infrastructure would include a new 100% hydrogen network. This links in with the ambitions of Aberdeen City Council, with its existing hydrogen infrastructure for public transport and fleet of hydrogen fuel cell buses and cars.

To support and align with the BEIS Hy4heat project a community demonstration of 100% hydrogen will be required. We will take the H100 project further with the conversion of an existing section of the network, supplying approximately 300 further properties with 100% hydrogen. This project and the demonstration stages that follow will play a key role in proving the potential of a hydrogen network adoption and conversion.

13.6.2 EST project: Cavendish - 20% blend into Medway network

Cavendish, in the South East of England, is the second key project for hydrogen injection that National Grid is leading with SGN, Cadent and Arup. The Cavendish project will use the existing Isle of Grain LNG infrastructure and storage facility and leverage this with hydrogen to overcome the challenge of air quality in London using the gas distribution network. Project Cavendish assumes:

- import/production of hydrogen at/to the Isle of Grain LNG terminal
- provision of a dedicated hydrogen transmission line from Grain LNG to East London
- local distribution system feeding hydrogen hubs for transport in East London
- use of hydrogen in Greenwich power station to provide power for TfL
- 20% blend of hydrogen into the Medway gas network.

A feasibility study undertaken by Arup has been commissioned using GD1 NIA funding. It has been broken down into a number of phases of discovery, design, modelling and data analysis which should be completed by the end of Q4 2019.

Assuming we are successful in taking Cavendish through the FEED stage in GD2, we will enter into detailed design, construction and operation of the pipeline to Greenwich using funding under either the energy system transition reopener mechanism, or the energy transition competition.

13.6.3 EST project: Aberdeen Vision - 20% blend into Aberdeen LDZ

Aberdeen Vision is another project using GD1 NIA funding to demonstrate the commercial viability of injecting hydrogen into the gas grid. St Fergus gas terminal, located 40 miles north of Aberdeen, is well suited as a hydrogen development location with the construction of an SMR plant producing hydrogen from natural gas.

CO_2 released from the gas during this process would be captured and exported to the proposed Acorn CCS project for offshore sequestration, while the hydrogen would be exported to Aberdeen as a 2% blend into the NTS and in a dedicated 100% hydrogen pipeline.

Hydrogen is already in use for transport in Aberdeen where a fleet of hydrogen powered buses and three refuelling stations are currently in operation. Proposals are in progress to double the capacity. Hydrogen delivered to a hub at Aberdeen could supply these refuelling systems, blended up to 20% into the local natural gas network.

We have been leading the project feasibility study since Q4 2018 and we expect to complete it by the end of 2019.

13.6.4 EST project: future local transmission system (LTS)

One area that has received less attention to-date has been the assessment of potential hydrogen storage and transportation options. The pathway to decarbonisation of the LTS requires a robust and scientific review to ensure all critical technical, operational and safety challenges and risks have been considered. The objective is to understand the opportunities for the LTS as a hydrogen storage and transportation solution, to inform ongoing research activities relating to the distribution and transmission systems.

The first phase of this project is currently under development with the Health & Safety Laboratory (HSL) and will be a combination of desktop study and consultation. This will evaluate existing technical information, guidance and standards while also engaging with industry. This initial phase will conclude with a 'Go/No Go' decision on whether further GD2 phases of the project will be relevant. It will depend on the outcome of the assessment of a case study at Grangemouth-Granton.

Subsequent phases would include laboratory and offline testing, integrity testing, hydraulic testing, online integrity inspection of the pipe wall and assessment of the condition of pipeline coating via cathodic protection inspection analysis and assessments. This work enhances the evidence for the safety case which proves the safe transportation of H_2 through the gas network.

13.6.5 EST project: custody transfer for hydrogen

A fiscal metering system oversees gas flow measurement into the distribution network. It allows us to determine the volume and value of the gas flowing through our network. Specific types of meters are used for different applications, but a move to 100% hydrogen gas within the network would require a change to the meters currently in place. This study will investigate the viability of different fiscal metering options (including ultrasonic flow meters and differential pressure meters) to determine the optimal solution for a 100% hydrogen network.

13.6.6 EST project: Methilltoune

Methilltoune is a proposal for the resilient supply of zero carbon hydrogen to support the demonstration of a scalable 100% hydrogen distribution network. The project was awarded £500k Phase 1 funding by BEIS under the Hydrogen Supply Programme to carry out the conceptual and detailed design of a hydrogen generation and storage system.

Project Methilltoune Phase 2 seeks to prove the resilient bulk supply of zero-carbon hydrogen. The Phase 2 funding will allow for the construction and demonstration of hydrogen production and storage from offshore wind, which will generate critical knowledge and infrastructure to support an end to end demonstration. The combined Methilltoune and H100 system will evidence how bulk hydrogen production can be produced in a scalable manner through electrolysis of renewable sources to meet the demands of domestic heating. The system will also identify and demonstrate the associated cost reduction pathways while maintaining a resilient and secure supply of energy.

The Methilltoune and H100 projects form key evidentiary projects in the pathway to decarbonisation, removing barriers, securing supplies, stimulating the hydrogen economy and delivering a zero-carbon option.

We believe that benefits to customers of hydrogen appliances (which has been widely recognised as relatively lower cost and lower disruption than other decarbonisation solutions), needs to be tested to inform key decisions on the future of energy in the GB.

This is the first of a kind demonstration that requires end to end process co-ordination.

14 Competition

Linked appendices

- Procurement & native competition

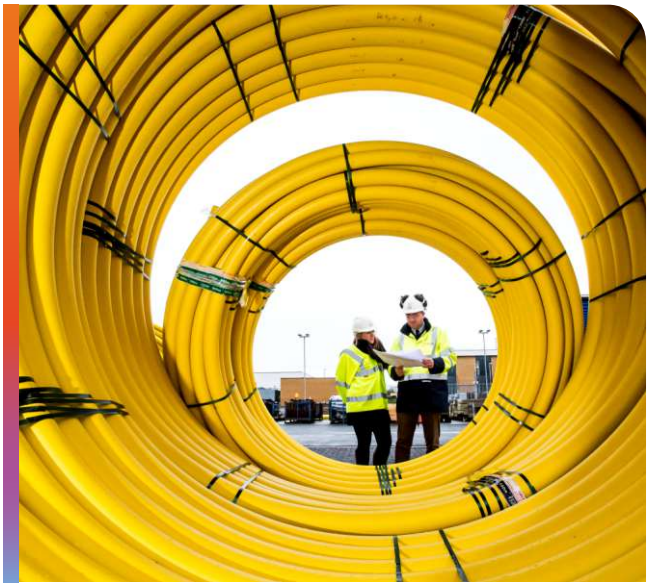
Through GD1 we have built and improved our procurement strategy to enable us to enter our GD2 native competition plan from a robust base of supply chain competition and comprehensive procurement practices. Currently, 73% of annual expenditure is attributed to competitively tendered projects. This compares to a world-class measure for this KPI of 85%[1] and we are therefore aiming for this standard in GD2 as we develop our procurement strategy. As we progress through GD2 we will continue to be ambitious by exploring and improving our native competition approach to deliver the best consumer outcomes and balance the benefits of flexibility in a changing policy landscape with greater contractual certainty, quality and lower costs. Our approach to sustainable procurement is one such example.

14.1 Native competition plan

Our native competition plan is set out in the Procurement and native competition appendix and is determined by six best practice principles, listed below.

- **Comprehensive procurement** - utilisation of competitive processes for all projects and tenders except where potential benefits are outweighed by the costs.
- **Robust competition** - the competitive process must be robust, transparent and ensure equal treatment for potential bidders, it must protect information appropriately.
- **Efficient operating model** - the complexity of the competitive process used should be proportionate to the value and time sensitivity of the project or system in question.
- **Transparency** - the same information must be provided to all tendering parties and any conflicts of interest should be appropriately managed.
- **Fairness** - licensees should be agnostic to technology and bidder type.
- **Customer outcomes** – competitions should be structured to generate outcomes in the interests of existing and future customers.

Each of the above principles is explained further in the sections below.



14.1.1 Comprehensive procurement

The legislative requirements are set out through the Utilities Contracts Regulations (UCR) 2016 and the Utilities Contracts (Scotland) Regulations (UCSR) 2016, which revoke and replace the 2006 regulations. The regulations apply where the estimated value of a proposed contract, or total cumulative value, exceeds either £363k for supplies and service contracts, or £4.5m for works contracts.

In addition to EU legislation, our procurement and commercial department ensures that these positive obligations are upheld in more general procurement events which do not exceed the stated thresholds. Procurement policies and procedures govern all types of procurement activity and are maintained by a standards and assurance team within the department and are supported by a documented audit programme.

The best practice set out in the procurement policies and procedures ensures compliance with UCR/UCSR, promotes competition in the supply chain and drives value for money. To support this ethos, our policy is for all requirements over £10,000 to be routed to the procurement and commercial department. This practice also helps to maintain direct competition, build market knowledge and identify alternative proposals and reduce the commercial exposure to poor terms and conditions.

We currently have 73% of our total expenditure covered through a competitive procurement as we will look to build this towards the world class KPI of 85% in GD2.

14.1.2 Robust competition

We have gone beyond the Utilities Contracts Regulations to make all tenders issued to the market, regardless of value, available via an e-platform. We believe this approach supports transparency and rigour within our procurement process and encourages the market at all contract levels.

Making the right information available and accessible is critical, but we also support competition in a number of other ways.

Pre-procurement market engagement. This can include requests for information (RFIs); public events such as supplier days, or attendance at local authority and enterprise forums to promote SGN as a potential client as well as bespoke sessions for specific projects.

[1] Sourcing and Procurement report: Top 10 KPIs to benchmark your Sourcing & Procurement function performance, Jean-Philippe Massin;

Formalising purchasing strategies. Our strategies detail how we optimise our approach to competition, ensuring we obtain competitive pricing and the required level of quality. They address other procedural requirements, such as formally advertising opportunities directly on the Official Journal of the European Union (OJEU) using the Achilles supplier database.

Selection and award criteria. Careful consideration of selection and award criteria ensure price and quality weightings are appropriate and do not exclude potential suppliers, wherever possible.

As an example, we recently attended a 'Meet the Buyer' event, organised with North Lanarkshire Council. The event gave us the opportunity to interact with over 200 suppliers from various sectors and share information about upcoming tender opportunities and the process required to become our supplier. This event led to the identification of eight new suppliers that could potentially support major project activity. We received pre-qualification submissions from three of these suppliers in relation to a mechanical and civil framework opportunity.

We find this external engagement is particularly important for encouraging participation in tender events, particularly from SMEs.

In addition to supporting competition for individual tender events, we also consider it important to support competition into sections of the market where there is an over reliance on a restricted supplier base. There have been numerous instances where we have worked with the supply base to promote new entrants and drive competition in order to avoid dependency on a single supplier to strengthen supply chain resilience and increases efficiency and we provide further examples later in this chapter. We will continue to promote effective and robust competition through our supply in GD2.

14.1.3 Efficient operating model

We recognise that there is a cost associated with the procurement activity from both the supply chain and the corporate centre. We need to ensure the correct balance between the strength of the procurement processes and the value of the contract being awarded. We achieve this by organising the procurement team into three areas directly linked to business needs.

1. Purchase to pay, low value / transactional procurement support and data analytics.
2. (Strategic) category management.
3. Commercial management and high value bespoke major works contract.

As we have developed our strategy we have also focused on the use of framework agreements with multiple suppliers rather than awarding to a single supplier. We believe this has several benefits ultimately leading to added value and obtaining the best possible price for the consumer, while securing supply and reducing the administrative and cost burden of individual contracting.

14.1.4 Transparency

Transparency is embedded into internal processes and provides consistency when information is shared and distributed through recognised portals and during tender evaluation stages.

14.1.5 Fairness

As part of ensuring we do the right thing through fair and reasonable processes, there is an expectation the supply chain will do likewise to ensure people and customers are at the heart of what we do. There are a number of policies set out in section 6.1 of the Procurement and native competition appendix in place to support this, such as the responsible procurement charter.

14.1.6 Customer outcomes

We operate on the basis of the Most Economically Advantageous Tender (MEAT) to set headline award criteria according to price, qualitative aspects, environmental aspects, and social aspects. These are defined and specified in advance according to the subject matter of the contract while ensuring all parties are equally treated and have an equal opportunity.

Although quality and price ratios are included and evaluated during tender events, it is not always the case that the lowest cost provides for the best customer outcome. Within the tender process, we are required to stipulate criteria for both price and quality and ensure this is clearly set-out in advance. Including the price and quality ratio determines the most competitive cost by taking into account the full life cycle of the procured good, works or services.

There will still be instances where the quality component does not change the overall award and the lowest tender will be successful. Further evidence of this is set-out in the Procurement and native competition appendix.

As we progress into GD2 we are re-evaluating the weighting of the quality aspects of the tender evaluation process to bring the weighting of the environmental components and circular economy principles in line with the customer feedback that we have received.

In addition, as we set out in section 9.10 on the EAP we are increasing our ambition around sustainable procurement through our supplier code of conduct as set out in the Procurement and native competition appendix. This will ensure that our procurement strategy meets the needs of both current and future customers.

14.2 Effective native competition

The Procurement and native competition appendix provides evidence to illustrate how using competition ensures that the customer gets the best price and explains the market-tested benchmarks we apply. Together, we believe this information forms the basis of a high confidence business plan submission. We have provided recent market tender information for the major contracts that have been let for the repex programme (including risers and PE pipes and fittings), governors, and transmission major projects. We have set out the contracting experience for each of these categories to explain how we have promoted competition and the impact that it has had on prices.

14.2.1 Repex

Our contracting strategy has changed from an Engineering, Procurement & Construction (EPC) model, with sole suppliers in the South covering 95% of mains replacement activity and in Scotland covering approximately 50% of mains replacement activity, to a framework contracting model.

With this shift we have seen more small and medium sized contractors respond. While these firms generally do not have the same financial standing as their predecessors, this approach avoids an over-reliance on individual contractors, stimulates the market and enables a more agile structure. As such we find that this structure affords a closer relationship to drive innovation and improve performance. This has resulted in a step change in Repex costs in GD1 which has been a key driver in our performance against allowances (see section 2 for more details).

We believe this has enabled greater diversity and responsiveness in the supply chain structure. As an example, throughout various contracts in Scotland and Southern, we have provided flexibility by operating as the principal contractor and supporting contractors to take on principle contractor responsibilities under the Construction (Design and Management) regulations (CDM) to support smaller contractors.

All repex framework contracts include regular contract performance reviews. These have standard agendas covering customer care, safety and performance.

Customer care. All aspects of the contractor's work is directly linked through customer management and care. Associated customer experience officers will provide feedback on audits and joint customer visits will be carried out with the contractor.

Safety. Meetings include updated safety procedures and a full review of current working practices.

Performance. Each depot is responsible for all works in their geographical area and as such there is strong local managerial ownership and accountability. This localised approach also enables stronger comparison and performance management on the required delivery programme.

The Procurement and native competition appendix explains the framework contracts which currently govern delivery of the Scotland and Southern repex programme. It identifies some of the unique characteristics of the Scottish contractor markets compared to the southern market. Establishing effective competition may be more challenging in more sparsely populated areas typical in Scotland. As an example, our contract strategy for risers differs due to the volume of work that can supported in Southern relative to Scotland.

14.2.2 Governors

We are currently progressing the invitation to tender stage for distribution governors with the intention to create a new multi-supplier framework agreement for up to five suppliers. This new strategy was initially progressed in 2018 following over-dependence on a restricted supply chain by trialling other suppliers on lower value contracts with the intention of supporting greater competition. The approach has had a positive impact on driving lower costs and increasing programme responsiveness.

14.2.3 Major projects and E&I

Currently all major framework contracts for mechanical and civil contractors, design services, E&I installations, boiler houses and skid unit supplies have either been recently awarded or are in process of being retendered. With mechanical and civil contractors, supplier engagement attracted new entrants into the market which has had a beneficial impact on the price secured. For example, similar changes have resulted in single one-off contracts moving to longer term framework agreements which have reduced the tendering timelines and costs for multiple skid unit purchases.

There has been a substantial change in the approach to risk employed in these contracts over the course of GD1. Historically, risk considerations such as groundwork risk were typically borne by the contractor. Through GD1 we have considered risk allocation and potential cost impacts and have devised our strategy to ensure appropriate value is maintained across multiple and varying projects.

We will always learn from experience. In order to improve forecasting capability, we have assessed outturn costs across various workstreams in both Scotland and Southern. The purpose of this review was to ensure that the approach taken to cost new projects considers previously experienced change-drivers, which resulted in variations against Project Authorised Total (PAT). Although under constant review, trend analysis highlights which areas are more susceptible to variation and what further mitigations can be put in place either during front-end sourcing or post-contract management.

14.3 Early competition

We do not have projects identified that either exceed or have the potential to exceed the £50m threshold identified for early competition within the main body of the business plan. This will be reviewed as we progress towards a decarbonised pathway, potentially with projects presented under 12.2.13 Energy System Transition reopener which involve a significant introduction of hydrogen onto the network.

14.4 Late competition

We do not have projects identified that either exceed or have the potential to exceed the £100m threshold identified for late competition. Given the safety critical nature and the associated legal costs of late competition we do not believe there would be a consumer benefit of introducing late competition into any of the projects being proposed for GD2.

We will continue to ensure all investments, regardless of size, achieve the best consumer outcome through the implementation of our competition plan.

14.5 Reporting

During GD2 we will continue to post all tenders on publicly accessible websites and continue to foster competition by engaging with the market where procurement levels are lower than expected.

We will report annually on the procurement activity that passes through our e-tender site, highlighting successes that demonstrate the effectiveness of this process. We would expect to include the level of interest shown in pre-tender documentation, bids submitted and shortlisted for all major contracts, and the number of bids submitted for the less major contracts.

15 Forecasting and scenarios: a consistent view of the future

Linked appendices

- Cost efficiency

The investment costs and attention we dedicate to maintaining and running our gas network in GD2 are essential, so we can preserve optionality for the decarbonisation pathway. We must ensure our legislative requirements for delivering gas safely and securely are met. We must also ensure investment only takes place when the risks of asset stranding are fully understood, should an alternative decarbonisation pathway be determined as the most cost-effective.

In 2018 we designed and delivered a series of specialist panels on the Future of Heat.[1] These panels were designed to build our knowledge of the challenges and opportunities ahead and sit alongside our broader engagement work. Such activities have included our Moving Forward Together workshops[2] and the extensive collaboration we have with partners from across the five regulated energy sectors of gas distribution, gas transmission, electricity transmission, electricity distribution and system operations.

While regional variations in approach such as customer demand, population density and local policy inform our delivery, our shared consensus is gas networks will have a core role in the decarbonisation of heat over the coming decades. And this brings clear benefits to customers - from the role gas plays in supporting electricity generation to delivery of low-carbon and blended gases as well as the opportunities for buses and HGVs to have hydrogen fuel delivery systems – improving the worst polluting vehicles on our roads.

Linked to this is the consideration of how low carbon heat can be supported. In the Chancellor of the Exchequer's 2019 Spring Statement,[3] there was a clear indication of the need to accelerate the decarbonisation of gas supplies by increasing the proportion of green gas in the grid, helping to reduce dependence on burning natural gas in homes and businesses and meeting climate targets.

15.1 Consistent view of the future in context

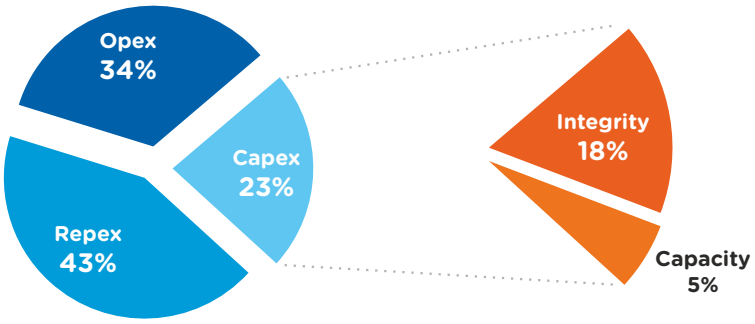
It is important to recognise while gas is in the network, the network has to be maintained to ensure customer safety and that demand can be delivered when it is required. This is the primary focus of our business plan.

As a result, approximately 95% of our planned investment is associated with either improving network safety through the repex programme, maintaining operational safety through the opex programme or managing risk through the capex programme. Only 5% of the total expenditure is associated with new connections and associated reinforcement work to manage network capacity.

We will still be cautious about the level of investment in our network and ensure we have no regrets over the amount we spend today if the decarbonised heat pathway for our network does not transpire. This approach means we are able to deliver the outcomes intended by the repex programme today, while future-proofing the network to allow the delivery of low carbon gas.

We have also considered a series of low-regrets investments –investing a little more today to save considerable necessary investment in the future. Low-regrets investment options considered included the early adoption of hydrogen sensors and hydrogen valves. However, the potential benefits for both did not outweigh the costs of action today and the uncertainty associated with realising those benefits in the future (section 9.14).

Figure 15-1: Capacity investment as a share of totex



1 Future of heat specialist panels, Edinburgh Aug/Dec 18 (ref 023, 024)
2 MFT Workshops 2017 & November 2018 (ref 008, 009, 010, 013, 014)
3 https://www.gov.uk/government/speeches/spring-statement-2019-philip-hammonds-speech

15.2 Common scenario

We recognise there are multiple different scenarios and potential views of the future. These are influenced by the pace of decarbonisation, the cost of technologies and the policies that deliver that decarbonisation pathway. It is important for the consumer that network companies have consistency in the scenarios that guide their investment approach and that they are able to reflect on the available evidence and update their perspective accordingly.

Along with other gas and electricity networks we formulated a common scenario based on National Grid's 2018 Future Energy Scenarios (FES). The FES scenarios were selected as the basis of the common scenario as they provided the widest recognition and the broadest stakeholder input into the formulation.[4]

The FES work consists of a list of 70 assumptions, of which 46 were selected as having a potential material impact on the investment decisions of networks. Of these, a number were identified as having a specific impact on gas distribution networks.

The ENA Common RIIO-2 Scenario Report was developed prior to Ofgem's request to set out how business plans are able to flex to support the delivery of net zero targets. As a result, in the table below we have compared the common scenario with the net-zero implications for each potential supply assumption, to obtain a revised scenario. We have made an assessment of the potential to impact investment for each revised scenario; in the majority of cases the impact is muted by the sharing of connection costs.

Table 15-1 Common scenarios

Assumption	Common scenario	Implication of net-zero target	Scenario used	Impact on GD2 investment
Shale gas entry	5–15 billion cubic metres (bcm) of domestically produced shale gas by 2030.	In the 2019 FES scenarios the highest scenario of shale deployment in 2030 has nearly halved. Significant volumes are not consistent with net-zero target.	Given the confirmation by the Scottish and UK Governments that shale gas production would not now take place, we do not anticipate any connections.	All gas entry requirements are funded by the connecting party. As such no additional allowances are requested for shale gas entry.
Biomethane (and bioSNG)	The collective view was between 0.8-1.8 bcm would be deployed nationally.	In the 2019 FES scenarios the highest scenario of green gas has increase by a third to 3.1bcm. Increasing volumes of green gas consistent with net-zero target.	From the Common Scenario we could expect 0.07-0.15bcm in Scotland and 0.15-0.33bcm in Southern. Given net-zero targets and supportive policy statements in the Spring Statement. We believe we could be at the higher end of this range.	All gas entry requirements are funded by the connecting party. As such no additional allowances are requested for shale gas entry. In section 9.13 we have requested additional funding associated with decarbonisation to support lower cost and increased volumes of biomethane deployment.
Hydrogen	A specific range was not defined for 2030 on the basis that during this period hydrogen developments would be based on individual projects, each with their own specific funding streams.	The 2019 FES scenarios have introduced ranges with up to 9TWh of consumer demand met by hydrogen. This would be consistent with net-zero.	We have not assumed the deployment of hydrogen in base allowances.	We have proposed funding for innovation in section 13.5. We propose to enable a rapid deployment of hydrogen through an energy system transition reopener (section 12.2.13).
Flexible generators/ decentralised generation	We identified a range of between 1.3-2.3GW of decentralised gas generation to be built on our network, 0.4-0.7GW in Scotland and 0.9-1.6 GW in Southern.	The 2019 FES scenarios have significantly increased the top-end of their range to an additional 6GW by 2030. Very high growth may be consistent with net-zero as a temporary measure to enable more renewables.	We have assumed no connections within our base allowances but given the range and uncertainty have asked for a volume driver (12.2.7).	Costs would be shared between the networks and the connecting party as set out in charging methodologies. Due to their scale there can often be additional associated reinforcement costs.

[4] The FES 2019 scenario is available from http://fes.nationalgrid.com/fes-document/ archives documents for 2018 and earlier scenarios are available from http://fes.nationalgrid.com/fes-document/fes-archives/.

Assumption	Common scenario	Implication of net-zero target	Scenario used	Impact on GD2 investment
Combined transport effects	For gas or hydrogen vehicles the collective view was between 48,000 and 104,000 vehicles would be operating by 2030 and needing to connect to the distribution network. This suggests between 4,000 to 8,000 will be operating in Scotland and 9,000 to 19,000 in Southern.	The 2019 FES scenarios have reduced this range to 32,000 to 70,000 by 2030. Both ranges are consistent with net-zero and depend on the economics of alternatives.	We have not allowed for specific funding for transport connections in our base allowance for GD2. We have assumed the lower end of deployment.	Costs would be shared between the networks and the connecting party as set out in charging methodologies. Currently we do not see filling station capacity having a significant impact on our investment in GD2.
District heat and CHP	An expected range of 2.1-2.2GW by 2030 with an anticipated 0.17-0.18GW of capacity in Scotland and 0.39-0.41GW of capacity in Southern.	No significant change if FES 2019 scenarios for gas CHP. Net-zero likely to increase renewable CHP expectations.	Low scenario is assumed by default although the impacts are not a substantial enough to impact overall forecasts.	Allocation of connection costs determined by current charging methodologies. Currently not a significant impact on our investment in GD2.
Peak demand (1-in-20 peak day)	For a one-in-twenty peak-day demand in 2030, there was general consensus that peak-day demand would be greater than 5,000GWh nationally, of which we'd expect around 300GWh in Scotland and 680GWh in southern.	Peak demand appears broadly consistent in FES 19 between scenarios. Net-zero likely to lead to lower peak demand, associated timing is not clear.	Currently we maintain a forecast 1-in-20 peak demand of 355GWh in Scotland and 806GWh in Southern in 2028/29.	No impact on investment as investment decisions are based on local demand and supply balances and local capacity constraints.
Hourly peak demand	Gas hourly peak demand is not a scenario currently covered by the FES but it is important for network planning. The general consensus among networks was that gas peak hour in 2030 would be 220-230GW, of which we anticipate an 18-19GW peak for Scotland and a 41-43GW peak for Southern.	Net-zero likely to lead to lower peak demand, associated timing is not clear.	Peak-hour demand is 42GW peak for Southern and 18.6GW peak for Scotland.	Impact on investment will depend on local demand and supply balances. While peak demand reductions will enable more capacity availability on a local basis.

Peak demand forecast outlined in National Grid's FES scenarios does not align with the values we use in our Long Term Development Statement (LTDS). Our LTDS is a tool for forecasting the need to book capacity on the National Transmission System in the short-term and to indicate long-term trends for future capacity planning.

Investment for reinforcement is driven by local demand growth patterns and their impact on the capacity of individual assets, rather than national trends. These drivers are set out in chapters 7 and 8. It is these local growth requirements that may drive local reinforcement work on the transmission network. This is a bottom-up based assessment identifying which assets need to be reinforced, rather than a top-down approach which would not have the same level of precision.

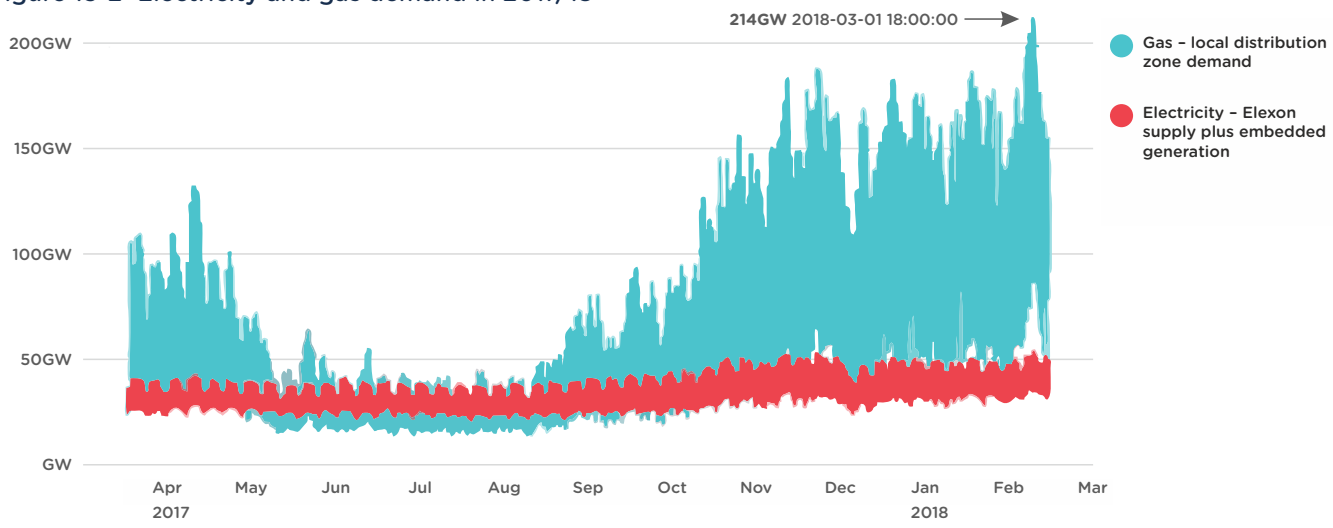
Moving forward, we have responded to feedback from our CEG and will be moving to a scenario-based approach to the LTDS, where one of those scenarios will be consistent with the FES.

15.3 Forecasting network investment

Although heat demand is highly variable it is, by and large, forecastable. Every day, there are two heat demand peaks (often referred to as the diurnal profile), one in the morning and one in the evening. Between 5am and 8am, the ramp-rate is extreme with demand typically increasing by over a 100GW over a period of two to three hours. There is also a far larger seasonal swing with the typical winter gas demand of 200GW being four to six times that of the summer low. In comparison, the electricity network load varies from 30-50GW during the year and typically sees a swing of 11GW during the times of 5am to 8am.

The gas network currently accommodates swings in demand with a combination of line-pack on the distribution networks, through storage, regasification from LNG terminals, and import/export through the interconnectors on the transmission network. This is shown in figure 15-2 below.[5]

Figure 15-2 Electricity and gas demand in 2017/18



We have a statutory duty to ensure we keep sufficient network capacity to maintain supply in 1-in-20 demand conditions that may arise during a winter period.

In this 1-in-20 peak day our network is designed and managed to meet a peak six-minute demand. If we do not have sufficient capacity at times of peak demand then demand will exceed supply and pressures will drop, resulting in security of supply issues and associated safety issues. We cannot connect a new customer unless we are comfortable the 1-in-20 requirement is deliverable, and there are areas, particularly in Scotland, where demand is suppressed because of network constraints.

This security of supply standard is essential for our customers; without this standard there is a clear risk of direct health implications and potentially fatalities, with the most vulnerable in society being the most exposed.[6] Recent examples of such extreme weather include the 'Beast from the East' in 2017/18 which bought us close to our 1-in-20. In 2009/10 we exceeded the 1-in-20 threshold in Scotland.

During these extreme events our three local distribution zones (LDZ) Scotland, South and South East, coped very well with the level of demand experienced. Our forecast requirements based on our 1-in-20 models provided an accurate correlation between forecast and actual demand.

The table below shows the peak demand experienced in 2018 (the 'Beast from the East') and how this converts to a maximum day peak demand. This is then compared with the forecast peak (as set out at the start of the year) and the corrected peak (which takes account of actual variations in the largest loads on the network).

This gives forecast accuracies of 98-99.8% dependent on the LDZ for the extreme weather event in April 2018, as shown in table 15-1 below.

Table 15-2 Regional peak gas demand forecast compared with actual during 2018

LDZ	Max day experienced GWh	Max day converted GWh	Forecast 2018 peak day GWh	2018 peak day GWh (corrected)	% accuracy
Scotland	303.5	353.8	356.1	354.8	99.7
South East	418.4	445	466.6	453	98.2
South	301.7	336.1	330	336.8	99.8

[5] UKERC - Challenges for the Decarbonisation of Heat: Local Gas Demand vs. Electricity Supply Winter 2017/2018, Wilson et al 2018
[6] Findings on the determinants of indoor temperatures in English dwellings during cold conditions, Hamilton et al 2017

On an annual basis, the accuracy of actual demand data can also be compared with forecast data to show a similar level of accuracy. Table 15-2 shows the original forecast and adjusted forecast allowing for major load variations (such as Shoreham Power station and the Fawley Refinery), and realised fuel price variations and customer numbers.

Table 15-3 Regional annual gas demand forecast compared with actual during 2018

LDZ	Actual annual demand GWh	Forcast annual demand GWh	Adjusted forecast annual demand GWh	Forecast % accuracy	Adjusted forecast % accuracy
Scotland	49,370	48,402	48,689	98.0	98.6
South East	55,308	57,432	54,597	103.8	98.7
South	39,134	38,600	39,250	98.6	100.3

This top down approach takes into account the leading economic indicators (GDP, output indexes, employment and household growth) to provide a robust forecast, however the approach is not conducive to major economic shocks that suddenly alter demand. Forecasting accuracy is invariably less robust as we move beyond the next five years.

On our high-pressure local transmission network (LTS), we capture significant data in relation to flow, pressure, temperature and gas quality, linked through SCADA to our gas control centre. Reinforcement on the LTS is less common and will be driven primarily by demand on the local distribution network. Larger customers drawing gas from our network, such as a peaking plant or industrial facility, are likely to connect to our intermediate pressure network. The connection request will trigger an assessment of whether capacity reinforcement is required to maintain guaranteed pressures from the point of connection, potentially through our high-pressure and up through to National Grid's high-pressure network. If reinforcement is required, the associated cost will be shared with the applicant according to the rules in an economic test common to all networks. The applicant pays for the connection and any additional reinforcement costs not covered by the test. Where it is an entry onto the network, for example biomethane the applicant will cover the full costs of all entry components, connection, measurement and reinforcement.

During GD1 we have worked with industry to modify industry codes to allow for the more effective utilisation of network capacity during the summer months, leading to more accurate capacity bookings. We continue to offer interruptible contracts; in 2008 we were one of the only networks to have customers connected following revisions to the UNC interruption rules. Those eight operational interruptible contracts have now reversed their decision as the cost of interruption in the winter of 2009-10 was prohibitively high. Since 2008, we have opened 16 tender windows and apart from the initial contracts, have been unable to secure sufficient capacity to offset further reinforcement. During GD2 we will continue to work to make changes to codes that enable the most effective use of capacity and the most appropriate allocation of costs.

For our lower pressure distribution system, we need to ensure current and future demands can be met in compliance with IGEM standard, IGE/GL/1, and our obligation to protect customer interests through security of supply as detailed in the Gas Act. For these systems, maximum demand is defined as the appropriately diversified 1-in-20 peak six minute demand expressed as an hourly rate.

To determine the probable peak demand for each connected property we employ an algorithm that derives the demand from the projected annual consumption, nominated by the shipper, and applies a probability of coincident utilisation by customers. Certain commercial and industrial demands are atypical in demand profile so each operation requires individual consideration. We apply these demands within a sophisticated network modelling software tool called Synergi[7] and this allows us to determine the size of pipe and associated equipment for any capital investment activity. The Synergi modelling system is a steady state network analysis tool, one that simulates the network's operation a 1-in-20 scenario.

15.4 Forecast sensitivities

15.4.1 Energy efficiency

When considering forecast sensitivities, it is important to differentiate between annual average demand and peak demand. For the purposes of network planning we have to plan according to peak demand, which shows some correlation with annual average, but there is typically a 4:1 or 5:1 relationship between annual and peak demand.[8] This means it takes four to five units of reduction in annual average demand to realise one unit's reduction in peak demand. As such, while energy efficiency is clearly important, it is not considered a particularly strong sensitivity in network investment requirements.

We continue to sustain this relationship in our long-term forecasts, recognising there may be localised impacts that are more substantive on the distribution network.

15.4.2 Economic growth

The rate of new connections and the location of those connections is strongly influenced by economic growth and the rate of new builds. The impact of economic growth on new connections will become more unpredictable as GD2 progresses, amplified by the intention to prevent new build houses from connecting to the gas network for heating by 2025.[9] As the timing and the extent of the impact is uncertain, we have proposed a volume driver around new connections to protect customers from any early adoption. We have set this out in section 12.2.5, Bespoke uncertainty mechanism: new connections volume driver.

[7] https://www.dnvgl.com/services/pipeline-integrity-management-software-synergi-pipeline-1363
[8] FES 2018 comparison of annual and peak demand scenarios
[9] https://www.gov.uk/government/speeches/spring-statement-2019-philip-hammonds-speech

District heating and community heating are key focus areas for the Government. Their use is likely to increase at pace given the above policy direction. As it stands however, 90% of district heating plants use natural gas as their primary fuel source.

15.4.3 Decarbonisation policy

Adapting today's gas delivery infrastructure for clean gas is a clear pathway to decarbonisation. However, there is still uncertainty around the cost-effectiveness of this pathway relative to the electrification of heat and transport. In our energy system transition programme (section 11.8), we are proposing ambitious and pioneering activities designed to provide the evidence to customers, stakeholders and key decision makers to support the development of the decarbonisation pathway. Our investment plans will vary in line with decisions taken, to either reduce or increase the pace of investment in line with the desired pathway. In section 12.3.2 Heat policy reopener, we discuss the option for a reopener around decarbonisation policy and how it may work in practice.

15.4.4 Transportation requirements

A growing area of focus is the use of Compressed Natural Gas (CNG) for transport, and potentially how this could become green CNG. We are in regular communication with potential providers to understand their requirements and how we can provide support. However, as things currently stand it is too early to explicitly represent CNG in our forecasts.

15.4.5 Whole systems impacts – peaking generation

The pace at which peaking plant (flexible generation) connect to our network represents significant uncertainty. Connections will depend on the interactions between the electricity and the gas market, and economic signals sent out by the electricity market for the value of responsive electricity generation, coupled with the relative economics of storage and thermal generation. The increase in the number of enquiries and connections is discussed in more detail in section 11.6.1. In our base-case forecast, we have only committed where the connection offer has been accepted, in the absence of firm evidence that accurately forecasts how much new demand will materialise. However, we are confident higher demand will materialise (section 12.2.7) and suggest a reopener as the most appropriate structure for managing this.

15.4.6 Climate change and weather-related impacts

As set out in section 7.1.2 climate change is altering seasonal norms and presenting us with more extreme weather events. These have direct impacts on our operational business and reducing costs and as a result we have changed the basis on which we plan this business from a historical average of the last 20 years, to the average of the first five years of GD1.

For network investment, extreme weather events demonstrate the 1-in-20 cold weather event remains relevant and appropriate. In section 12.2.11 uncertainty mechanisms, we have proposed a use-it-or-lose-it mechanism to cover integrity projects that may be required as a result of extreme weather events commonly associated with climate change.

As a part of our environmental action plan (section 9.9) we have also set out the need to undertake climate change adaptation studies to improve our resilience going forward.

15.5 Forecast accuracy

We continue to evolve and improve our forecasting techniques as there is always the potential to allocate capacity with greater accuracy and to improve the forecasting of loads on our network. This is being examined through our Real-time Networks Project which will provide a better understanding of energy flows in and out of the network, to enable a step-change in network management, advanced forecasting and support accurate customer billing. This project is delivering some of the most meaningful gas demand research carried out in the last 40 years, providing more detailed information about energy usage on our network, and allowing greater visibility on whole systems opportunities.

Improving modelling accuracy will ensure the network is utilised more efficiently and any reinforcement requirements are more clearly defined with greater confidence. It is not possible to establish the extent of this impact, but the benefits will be captured in part through less expenditure in our network capacity and reinforcement cost, and through the re-opener being proposed.

We are proposing to undertake strategic research to better understand how markets, technology and customer behaviour impact on our demand forecasting, as set out in our chapter on innovation.

15.6 Network investment decisions and the pathway to net-zero

As identified at the start of this chapter, over 95% of our proposed investment is to support the operational integrity of our network, leaving approximately 5% for load related reinforcement and connections.

15.6.1 Reinforcement and connections

In the previous section we identified a number of sensitivities and associated flexibility mechanisms that will enable the investment we undertake to flex - according to the pathway to net-zero and the speed with which that change occurs.

Significant investment to support flexible generation could become inefficient in the event of a rapid move towards net zero. However, this will depend on the economic alternatives in the short and medium-term to deliver electricity system stability. The optimal economic solution may be for flexible thermal generation (peaking plant) to be used in the interim while we wait for other storage and grid stabilisation technologies to become more cost-effective. We have proposed a flexible mechanism to enable our investment to respond accordingly.

Other investments, such as new connections to the domestic or commercial market, may also become inefficient in the event of a rapid shift to net zero. However, under statute we are obliged to offer connections to all parties on a non-discriminatory manner: we can respond to the market but we are not in position to determine it. Again, our proposed uncertainty mechanisms must ensure the customer will not be worse off, should a rapid transition occur.

15.6.2 Integrity related investment and repex

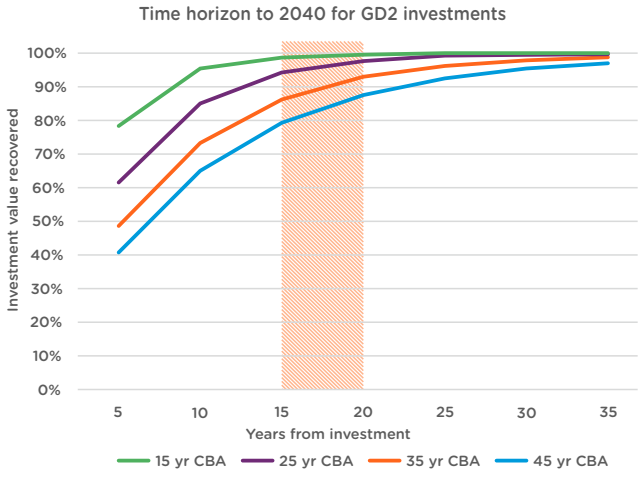
The repex programme involves upgrading the network from iron mains to polyethylene (PE) for safety reasons. A safe PE network has lower rates of methane leakage and is more appropriate for transporting low carbon gases such hydrogen. As such, it should not be a technical barrier to the net-zero pathway. The programme is mandated by the HSE, and in the event of a derogation by the HSE then it would be possible to adjust the repex programme to align it more fully to a decarbonisation pathway, if gas networks were no longer required on either a national or a local scale. This is set out in chapter 12, Managing uncertainty.

For other integrity related investments, we have based our analysis on the expectation that heat decarbonisation through the transportation of hydrogen is a viable option. We have reflected this in our CBAs by adjusting the methane content of the gas we transport in line with delivering a 2045 zero carbon gas network.

We recognise the risk that zero-carbon heat may only be achievable through electrification or regional centres of biomass or hydrogen. As such we have assessed the value at risk associated with this scenario, by assuming a decision on technical feasibility and cost effectiveness of decarbonising energy is taken in the mid 2020s, followed by a confirmed conversion roadmap to move heat to a decarbonised source from 2030 through to 2050. Under this scenario we are suggesting that in 2040 there is a 50% probability that the asset will not be required. This indicates under a 25-year CBA, between 94% and 98% of the asset value will be recovered depending on whether the investment is made at the start or the end of GD2, and the associated value at risk is between 1% and 3% of the asset value. For a 35-year CBA the equivalent value at risk is between 3.5% and 7% of the asset value.

We have set out the percentage of the original asset value recovered under different investment appraisal periods in figure 15-3.

Figure 15-3 Value at risk under different payback periods

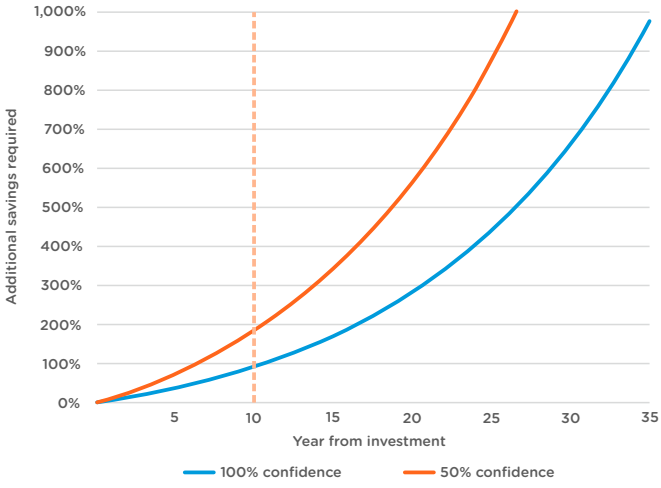


We have assessed the NPV over a 35 year period. For an asset with a life of 35 years the value at risk will be no greater than 3.5% of the asset value.

For an asset with a life of less than 35 years we would have the opportunity not to reinvest. Therefore the value at risk can be reassessed at the time of reinvestment. On this basis we have carefully considered the reason for any interventions with a simple payback of greater than 35 years.

This does imply there are investments that would be economic to undertake today, if there was high confidence of them being utilised under a decarbonised pathway. However, we consider this appropriate given the uncertainty on decarbonisation and the potential an investment today may not be appropriate for the transportation of hydrogen in the future.

Figure 15-4 Additional value requirements of low-regrets investment



The second consideration is the extent to which we should engage in low-regrets investment, assuming it is more cost effective to invest a small incremental amount today than it is to offset a larger investment in the future. We have applied a similar process to establish the value of additional savings we would need to realise to make the additional investment worthwhile. In figure 15-4 we have mapped the additional savings required according to the time in which they are expected to be realised. On this basis, a benefit expected to be realised in ten years would need to find double (100%) the savings achieved today and if there was a 50% probability of realising those savings then that threshold would be increased to 200%, a tripling of savings.

16a Totex summary

Linked appendices

- Business plan data templates

16.1 Totex headlines

Our investment proposal for GD2 will deliver our core service (like-for-like, which is broadly comparable with GD1) and the enhanced service outputs developed with customers to deliver additional outcomes aligned to their priorities.

Our like for like totex is broadly comparable with the average of the first six years of GD1, and below the average of the last three years of GD1 during which we have experienced significant cost pressures.

Our totex proposals are built on the efficiencies genarated in GD1, from which customers will benefit throughout GD2 and beyond. Further productivity improvements of 1% a year have been made during GD2.

Table 16-1 Totex headline comparison

	SGN (£m 2018/19 prices)				
	GD1 6 year actuals	GD1 last 3 years	GD2: like-for-like	GD2: enhanced outputs	GD2: total
Opex	189	196	193	13	206
Capex	115	118	120	22	143
Repex	244	270	244	19	263
Totex (Excl Xoserve)	**548**	**584**	**557**	**54**	**612**
Xoserve	13	6	6	0	6
Totex	**561**	**590**	**563**	**54**	**618**

16.2 Background and context

On the tables below we provide a summary of the total investment proposal in a structure that aligns to the information presented in the business plan data templates. This separates expenditure into capital expenditure (capex), replacement expenditure (repex) and operating expenditure (opex). This is the final submission of the Business Plan, we have explained in 16.4 how the headline figures have changed from our second draft.

16.2.1 Comparators for GD1

In order to provide a baseline for comparing GD2, we have a series of data points in GD1:

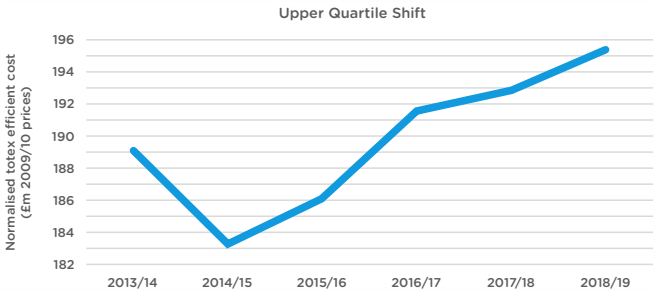
Table 16-2 GD1 comparisons

SGN £m (2018/19 prices)	GD1 8 years	GD1 6 years actuals	GD1 last 3 years
Opex	198	198	201
Capex	116	118	119
Repex	251	244	270
Totex	**564**	**561**	**590**

The first half of GD1 was characterised by low cost pressures and a benign economic environment where we were able to deliver strong outputs and able to offset any economic impacts through organisational cost savings and deployment of innovation. This relatively benign environment dominates the 'GD1 first six years' with an average investment of £561m a year over that period.

This starts to unwind from 2015 onwards and we believe that the last three years, provides a more reflective base from which the GD2 figures should be compared. The GD1 last 3 years column above takes into account the costs pressures that we have seen building since year four and that are now built into our contracted prices. As such, whilst they are forecasts, many of the contract prices and the wage agreements are known and have been agreed. Labour costs make up approximately 70% of the overall costs. These cost pressures increase the average annual totex by £29m to an average of £590m a year over that period.

This trend is evidenced in the chart below which tracks the upper quartile of the totex regression for the eight GDNs (with a constant scale driver over the period).



Whilst we believe the last three years provides the most appropriate GD1 base the RIIO Challenge Group have also requested that the first six years of GD1 should be the basis of comparison. Therefore, in the rest of this section, we have shown both views as a GD1 baseline.

16.2.2 Like for like comparison

In GD2 we have separated out the enhanced service outputs (16.3.3) we are proposing to delivering for our customers. This leaves a GD2 like for like position which we believe is more comparable with the core GD1 base.

16.3 SGN totex summary

The table below summarises the December final business plan submission at a combined SGN level.

Table 16-3 SGN totex summary

SGN (£m 2018/19 prices)	GD1 first 6 years	GD1 last 3 years	GD2 underlying	GD2 enhanced outputs	GD2 data templates
LTS, storage and entry	38	40	52	0	52
Connections	20	21	20	0	20
Mains reinforcement	8	12	9	4	13
Governors (replacement)	9	9	11	0	11
Other capex	39	36	27	18	45
of which IT	14	10	4	12	15
of which vehicles	8	5	7	4	12
TOTAL CAPEX	**115**	**118**	**120**	**22**	**143**
HSE driven mains and services	188	187	193	13	205
Non-HSE driven mains and services	42	66	34	5	39
Risers	14	17	17	0	17
Other repex (emerging asset issues)	0	0	0	2	2
TOTAL REPEX	**244**	**270**	**244**	**19**	**263**
Work management	37	38	36	1	37
Holders and land	10	9	6	0	6
Emergency	23	24	23	0	23
Smart metering interventions	0	2	2	2	4
Repair	30	28	25	0	25
Maintenance	29	30	31	5	36
SIUs	10	7	7	0	7
Other direct acts	4	4	5	1	6
Business support	21	26	25	1	26
IT	15	21	22	2	24
Training and apprentices	10	7	11	0	11
TOTAL CONTROLLABLE OPEX (excl Xoserve	**189**	**196**	**193**	**13**	**206**
TOTAL CONTROLLABLE TOTEX (excl Xoserve)	**548**	**584**	**557**	**54**	**612**
Reclassification of Xoserve	13	6	6	0	6
TOTAL CONTROLLABLE TOTEX	**561**	**590**	**563**	**54**	**618**

Notes

1. *Xoserve was part of controllable totex in GD1 but has been reclassified as pass through in GD2*
2. *GD2 excludes any new RPEs*

Before new, enhanced outputs, the above shows an average totex of £563m before the reclassification in Xoserve in GD2, this is 4.5% lower than the last three years of GD1 and broadly in line with the first six years' totex average of GD1. Despite additional cost pressures, the reducing workload in larger diameter replacement, repair and a 1% a year productivity target has more than offset these pressures. These areas are expanded on in the rest of this chapter.

In addition, we have identified £54m a year of enhanced service outputs giving an overall GD2 totex of £618m a year average, before the reclassification of Xoserve. With the reclassification of Xoserve, GD2 totex is £612m a year. This compares with average annual allowances of £665m awarded in GD1.

16.3.1 Scotland totex summary

The table below summarises the December final business plan submission for SGN's Scottish gas network.

Table 16-4 Scotland totex

Scotland (£m 2018/19 prices)	GD1 first 6 years	GD1 last 3 years	GD2 underlying	GD2 enhanced outputs	GD2 data templates
LTS, storage and entry	20	20	28	0	28
Connections	8	8	8	0	8
Mains reinforcement	3	5	3	3	5
Governors (replacement)	3	2	3	0	3
Other capex	15	12	11	6	17
of which IT	5	4	1	4	6
of which vehicles	4	1	3	1	5
TOTAL CAPEX	**49**	**46**	**52**	**9**	**61**
HSE driven mains and services	49	47	49	4	53
Non-HSE driven mains and services	11	18	8	1	9
Risers	2	3	3	0	3
Other repex (emerging asset issues)	0	0	0	1	1
TOTAL REPEX	**62**	**68**	**60**	**6**	**66**
Work management	13	11	11	0	11
Holders and land	2	3	3	0	3
Emergency	6	7	7	0	7
Smart metering interventions	0	0	0	1	1
Repair	7	7	7	0	7
Maintenance	10	11	11	3	14
SIUs	10	7	7	0	7
Other direct acts	2	1	2	0	2
Business support	7	9	9	0	9
IT	5	7	8	1	9
Training and apprentices	4	2	4	0	4
TOTAL CONTROLLABLE OPEX (excl Xoserve)	**66**	**66**	**67**	**5**	**73**
TOTAL CONTROLLABLE TOTEX (excl Xoserve)	**177**	**180**	**179**	**20**	**200**
Reclassification of Xoserve	4	2	2	0	2
TOTAL CONTROLLABLE TOTEX	**180**	**182**	**181**	**20**	**201**

Before new, enhanced outputs and the reclassification of Xoserve, the above shows an average totex of £181m in GD2. This is in line with the last three years of GD1 and a 0.4% increase on the first six years of GD1. Despite additional cost pressures, the reducing workload in larger diameter replacement and a 1% a year productivity target has offset these pressures.

In addition, we have identified £20m a year of enhanced outputs giving an overall GD2 totex of £201m a year average, before reclassification of Xoserve. With the reclassification of Xoserve, GD2 totex is £200m a year. This compares with average annual allowances of £219m awarded in GD1.

16.3.2 Southern totex summary

The table below summarises the December final business plan submission for SGN's Southern gas network.

Table 16-5 Southern totex

Southern (£m 2018/19 prices)	GD1 first 6 years	GD1 last 3 years	GD2 underlying	GD2 enhanced outputs	GD2 data templates
LTS, storage and entry	17	20	25	0	25
Connections	12	14	12	0	12
Mains reinforcement	5	8	7	1	8
Governors (replacement)	7	7	9	0	9
Other capex	24	24	16	12	28
of which IT	9	6	2	7	10
of which vehicles	5	4	4	3	7
TOTAL CAPEX	**66**	**72**	**68**	**13**	**81**
HSE driven mains and services	139	140	144	8	152
Non-HSE driven mains and services	32	48	26	4	30
Risers	12	14	15	0	15
Other repex (emerging asset issues)	0	0	0	1	1
TOTAL REPEX	**183**	**202**	**184**	**13**	**198**
Work management	25	27	25	1	26
Holders and land	8	6	3	0	3
Emergency	16	17	17	0	17
Smart metering interventions	0	1	1	2	3
Repair	23	22	19	0	19
Maintenance	19	19	20	2	23
SIUs	0	0	0	0	0
Other direct acts	2	3	3	1	4
Business support	14	17	17	1	17
IT	10	14	14	1	16
Training and apprentices	6	4	7	0	7
TOTAL CONTROLLABLE OPEX (excl Xoserve)	**122**	**130**	**126**	**7**	**133**
TOTAL CONTROLLABLE TOTEX (excl Xoserve)	**371**	**404**	**378**	**34**	**412**
Reclassification of Xoserve	9	4	4	0	4
TOTAL CONTROLLABLE TOTEX	**380**	**408**	**382**	**34**	**416**

Before new, enhanced outputs, the above shows an average totex of £382m in GD2. This is 6.4% lower than the last three years of GD1 and is broadly in line with the first six years totex average of GD1. Despite additional cost pressures, the reducing workload in larger diameter replacement, repair and a 1% a year productivity target has more than offset these pressures.

In addition, we have identified £34m a year of new outputs giving an overall GD2 totex of £416m a year average before the reclassification of Xoserve and £412m after the reclassification of Xoserve to non-controllable. This compares with average annual allowances of £446m awarded in GD1.

16.3.3 Enhanced service outputs

In July we identified £152m of potential new outputs a year to enhance our services for customers. Following customer and stakeholder engagement we have reduced this to £54m a year in line with our customers' priorities and willingness to pay.

The table below provides a breakdown of these new outputs by activity and by customer priorities as follows:

Table 16-6 Enhanced service options

Enhanced outputs	Capex	Repex	Opex	Totex	Positive impact	Safe and efficient	Shared future
Cyber	2.9	-	1.5	4.5			X
IT technology readiness	2.0	-	0.3	2.3			X
Open data / whole systems / capacity mapping	0.8	-	0.3	1.1			X
DCC membership	1.0	-	0.1	1.1			X
Riser surveys	-	-	3.8	3.8		X	
Responsible demolition	-	-	1.0	1.0		X	
Maintenance opportunities (bio gas maintenance)	-	-	0.2	0.2			X
Smart meter interventions	-	-	2.3	2.3	X		
Vulnerable customer allowance	-	-	1.2	1.2	X		
Accelerated tier 1	-	9.8	-	9.8			X
Stubs	-	1.7	-	1.7		X	
Kings Ferry / Cams Hall	-	1.3	-	1.3		X	
Intermediate pressure configurations	-	0.7	-	0.7		X	
Hazardous waste	-	1.3	-	1.3			X
Proactive steel	-	4.6	-	4.6	X		
Pressure management rollout	-	-	-	-			X
Growth - additional base for volume driver	4.2	-	-	4.2	X		
LAEP officers	-	-	0.6	0.6			X
Environmental personnel	-	-	0.4	0.4			X
Reduced leakage project	0.7	-	-	0.7			X
Fleet	4.3	-	-	4.3			X
Renewable energy - occupied/operational	0.3	-	-	0.3			X
Renewable energy - maintenance sites	0.7	-	-	0.7			X
Energy utility reduction	0.3	-	-	0.3			X
Biomethane	0.5	-	0.1	0.6			X
Supply chain / embedded carbon	-	-	0.2	0.2			X
Biodiversity	0.5	-	0.4	0.9			X
Climate change adaption	2.0	-	0.1	2.1			X
Innovation rollout - stent/HVGE	0.4	-	-	0.4			X
Roll out of biomethane/pressure management	2.0	-	-	2.0			X
Record keeping other records	-	-	0.0	0.0		X	
Enhanced outputs	**22.5**	**19.4**	**12.6**	**54.5**	**12.2**	**8.6**	**33.6**

16.4 Changes from the July submission

As a recap, from a base of the first 6 years of GD1, our July plan identified cost pressures in GD2 of £9m, which were offset by improved efficiencies, with a plan to deliver new enhanced outputs increasing investment by £25m.

Table 16-7 July draft submission

1st of July submission					
SGN (£m 18/19 prices)	GD1 6 year actuals	Cost pressures/ reductions	Enhanced outputs	Efficiencies	GD2
Opex	198.0	8.4	11.3	-4.2	213.6
Capex	118.4	-3.2	8.1	-1.6	121.7
Repex	244.1	3.8	5.7	-3.4	250.2
Totex	**560.6**	**9.0**	**25.2**	**-9.2**	**585.6**

In July we also presented £127m of additional options that we were consulting on.

Since July, as we have been finalising cost benefit analysis and engineering justification papers we have identified increased project costs as well as increasing our commitment to fuel poor connections. Across totex, this has resulted in an increase of £6m a year. However, we have committed to stretch ourselves further to absorb these additional cost pressures with a further £6m of savings that we will look to deliver over GD2.

In the July submission we also identified further investment options with a value of £152m. We included £25m of these options in our July plan and have further consulted with stakeholders and customers and of the remaining options, we have the necessary support for progressing with additional outputs requiring a further investment of £31m.

The October draft submission therefore suggested a GD2 Totex of £616m a year.

Table 16-8 July to October

Changes from 1st of July to 1st of October					
SGN (£m 18/19 prices)	July GD2 submission	Changes to workload	Enhanced outputs	Increased eficiencies	GD2
Opex	213.6	-2.8	2.3	-3.6	209.5
Capex	121.7	10.0	12.5	-1.0	143.2
Repex	250.2	-1.2	15.6	-1.5	263.3
Totex	**585.6**	**6.0**	**30.5**	**-6.1**	**616.0**

Table 16-9 October to December submission

Changes from the 1st of October to the 9th of December							
SGN (£m 2018/19 prices)	October GD2 submission	Reclassification of Xoserve	Revised October GD2 submission	Changes to workload/ costs	Enhanced outputs	Efficiencies	GD2
Opex	209.5	-5.4	204.1	2.2	-0.9	0.2	205.5
Capex	143.2	-0.8	142.5	-1.6	1.8	0.0	142.7
Repex	263.3	0.0	263.3	2.0	-2.0	0.0	263.3
Totex	**616.0**	**-6.2**	**609.9**	**2.5**	**-1.1**	**0.2**	**611.5**

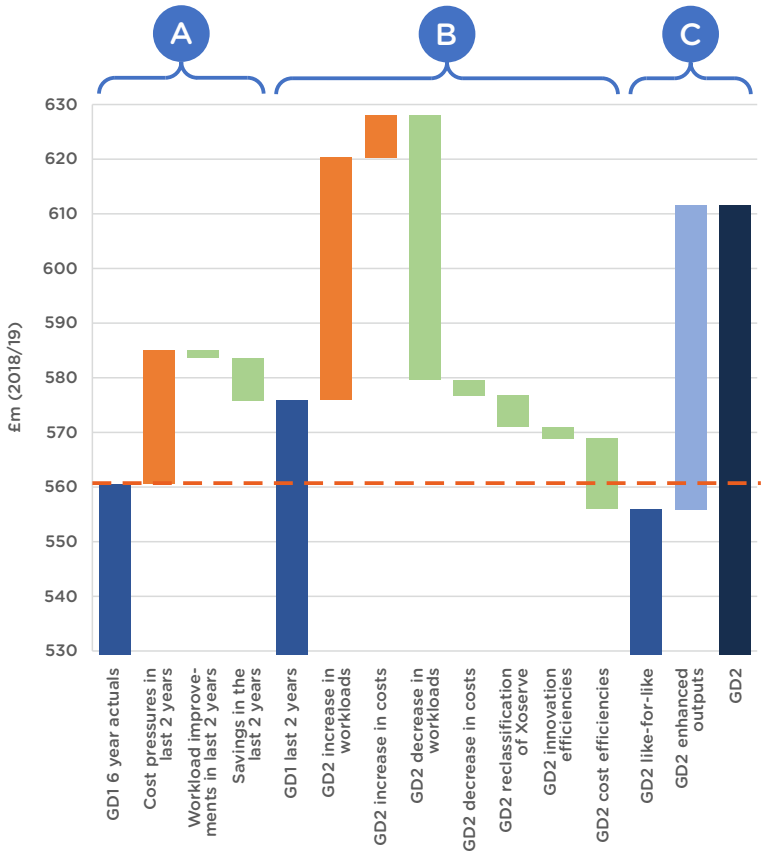
This final business plan submission includes an average totex of £612m a year. After the reclassification of Xoserve, this represents a £2m increase in totex compared to our October plan. Whilst there are several offsetting items, this increase is primarily driven by the £1.5m increase resulting from our assessment of fatigue management which was flagged up in the draft October submission. Offsetting changes include a £1.5m reduction in connections costs following a review of workload and additional costs in association with the roll out of biomethane/smart pressure management innovations and environmental personnel as a response to the growing environmental reporting priorities.

16b Traces and sensitivities

16.5 GD1 to GD2 trace

The trace below summarises the movement form the initial £561m base of the first six years of GD1 to the totex submission of £612m a year in GD2:

Figure 16-1 totex trace from first 6 years GD1 to GD2 (2018/19)



Breaking this down into the movements of the key data points in figure 16-1 in blue, we can see the impact of cost pressures and cost reductions.

A **Movements in the final two years of GD1 compared to the first six years**

This has been driven by a 4% increase (£24m a year) of cost pressures, followed by a 0.3% (£1m a year) reduction in workload and 1.4% (£8m a year) savings. The cost pressures are due to the SGNC pay deal that was awarded in 2018/19 and increases in contractor rates.

B **Movements from GD1 to GD2 (excluding new outputs)**

This is a combination of an increase of 7.7% (£44.2m a year) due to an increase in workloads and a further 0.9% (£5m a year) in costs. This is then offset by an 8.2% (£47.1m a year) reduction of workloads and a further 2.7% (£15.2m a year) reduction in costs predominately due to efficiency savings. Finally, there has been a reduction of 1% (£5.5m) due to the reclassification of Xoserve.

C **Enhanced outputs in GD2**

An increase of £54.5m a year associated with additional outputs such as increased IT, cyber, environmental and accelerated replacement programmes which were not in place in GD1.

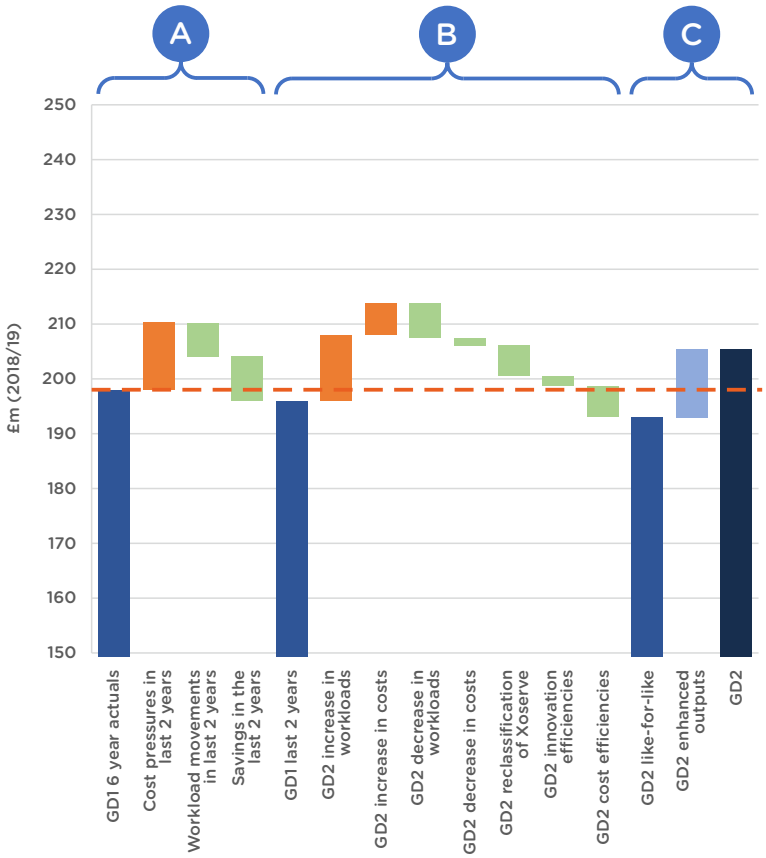
We split this into the totex components on the following pages.

16.5.1 SGN – operating expenditure (opex) cost changes

When considering the operating costs, we can see that between the first six years and the last two years of GD1 we have successfully managed to offset increasing cost pressures with improvements in efficiency and changes in workloads.

In GD2, additional cost pressures have been largely offset by emergency and repair workload decreases driven by the repex programme and 1% a year efficiency savings. Therefore, opex increases in GD2 are driven by our enhanced outputs of £13m a year to a GD2 position of £206m a year.

Figure 16-2 opex trace from first six years GD1 to GD2 (2018/19)



These changes can be summarised as:

A Movements in the final two years of GD1 compared to the first six years

This has been driven by a 6.2% increase (£12m a year) of cost pressures primarily due to our new cloud based IT solutions and recent pay negotiations, partially offset by a 3.2% (£6m a year) reduction in workload (front end loaded holder demolition costs) and 4% (£8m a year) savings from new SIU and Xoserve arrangements. This gives a GD1 base position of £196m going into GD2.

B Movements from GD1 to GD2 (excluding new outputs)

This is a combination of a net change of workloads of 2.8% (£5.5m a year) due to an increase in IT cloud costs and levels of apprentices, partially offset by lower repair workloads as a result of the repex programme. There is also a 3% increase in cost (£5.8m a year) due to cost pressures in the emergency process following the expected loss of legacy meter work contracts. These increases in GD2 will be largely offset by a 3.9% (£8m a year) improvement in cost efficiencies and innovation (equivalent to a 1% per annum productivity improvement) and cost decreases of 3.5% (£6.8m) predominately driven by the reclassification of xoserve. Overall, there is a decrease in costs of 1.6% from the last two years (£3m a year).

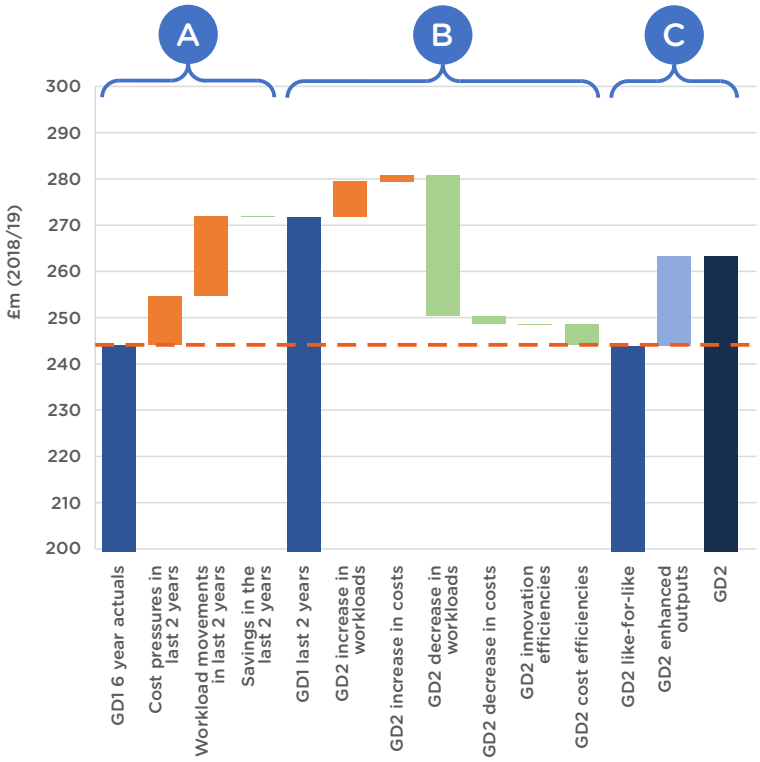
C Enhanced outputs in GD2

£13m a year associated with additional outputs such as increased surveys of multi-occupancy buildings, IT, cyber, removal of legacy assets and customer vulnerability initiatives which were not in place in GD2.

16.5.2 SGN – replacement expenditure (repex) cost changes

We can see a significant increase in repex costs between the first 6 years and the last 2 years of GD1 through contractor cost pressure and higher diameter workload. Whilst the impact of higher contractor costs has flowed through into GD2 (note, as per the Business Plan Guidelines, we have not included any new RPE increases in GD2), the higher diameter workload has been reversed. Together with productivity increases this creates a GD2 position on a like-for-like basis that is slightly lower than the first 6 years starting position. We have also identified enhanced outputs of £19m a year to deliver the GD2 starting position of £263m a year.

Figure 16-3 repex trace from first 6 years GD1 to GD2 (2018/19)



These changes can be summarised as:

A Movements in the final two years of GD1 compared to the first six years

This has been driven by a 4.3% increase (£11m a year) of cost pressures, followed by a 7% (£17m a year) increase in workload. The workload movements are due to an increased focus on larger diameter pipes, and the increased cost pressures are due to new contractor rates feeding through.

B Movements from GD1 to GD2 (excluding new outputs)

This is a combination of a net reduction in workloads of 8% (£23m a year) driven by lower tier 2 and 3 workloads and increased cost efficiencies 1.8% (5m a year). This is an overall reduction in costs of 10% from the last two years of GD1 (£28m a year).

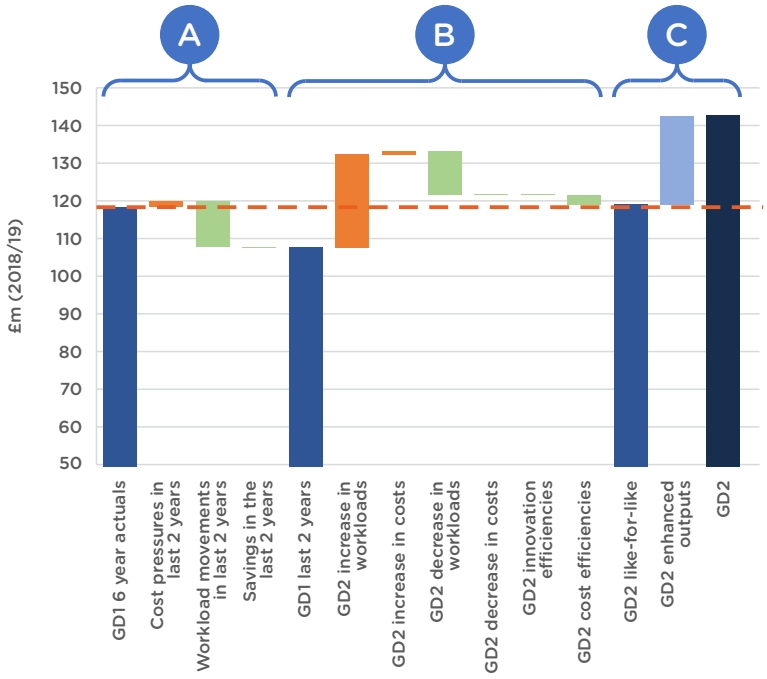
C Enhanced outputs in GD2

An increase of £19.4m a year associated with additional outputs driven by environmental savings associated with accelerated tier 1 repex and more proactive steel replacement.

16.5.3 SGN – capital expenditure (capex) cost changes

Capex is historically 'lumpy' and we have seen a reduction in capex costs between the first 6 years and the last 2 years of GD1 which has been reversed to create a GD2 position on a like-for-like basis that is slightly higher than the first 6 years starting position. This has then been complemented with further outputs of £22m a year to deliver the GD2 starting position of £143m a year.

Figure 16-4: capex trace from first 6 years GD1 to GD2 (2018/19)



These changes can be summarised as:

A Movements in the final two years of GD1 compared to the first 6 years

This has been driven by a 1.3% increase (£1.5m a year) in labour cost pressures, followed by a 10% (£12.2m a year) decrease in workload. The decrease in workload is driven by phasing of the LTS work, the IT programme and the vehicle replacement.

B Movements from GD1 to GD2 (excluding new outputs)

There is a significant increase in workloads in GD2 compared to the last two years of GD1, primarily due to timing of major LTS work with a 23% increase in associated costs (£25m a year). This partially offset by other workload reductions of 10% (£10m a year) in areas such as Reinforcement (where we are introducing a volume driver) and 0.7% a year cost efficiency of 2.5% (£2.6m a year).

C Enhanced outputs in GD2

An increase in new stakeholder driven outputs of £22m a year due to additional commitments associated with environmental, cyber and data initiatives.

16.6 Sensitivities

We have been requested by the RIIO Consumer Challenge Group to assess the impact of 2% and a 4% sensitivity on our forecasts from a baseline of the first six years. After applying our cost pressures, which we have identified for the last two years of GD1 and reducing by 2 - 4% a year, this creates a significant gap to our GD2 business plan submission (£69m and £101m a year respectively) which already includes a 1% a year efficiency assumption. As detailed below:

Table 16-10 Impacts of sensitivities on forecasts

Movement	2% CCG scenario	4% CCG scenario
GD1 - first 6 years	561	561
Cost pressures from last 2 years of GD1	15	15
2/4% p.a. reduction	(-34)	(-66)
CCG base	**542**	**510**
GD2 business plan (pre efficiencies)	627	627
1% efficiency saving	(-15)	(-15)
GD2 business plan submission	**612**	**612**
Sensitivity proposed by challenge group	(-69)	(-101)

This can only be delivered by reducing workload and headcount, this will inevitably lead to reduced standards, reduced consumer outcomes and safety concerns. This could also lead to a potential breach of licence and associated impacts on debt covenants. To implement any of these changes will require a full impact assessment and may lead to additional costs, such as fines, compensation or penalties.

Further details of these sensitivities can be found in the annex to appendix 022, Enhanced engagement.

16.7 Mapping of outputs to costs

Costs as set out in chapters 1-15	£m/yr	Chapter	Costs as set out in chapter 17	£m/yr	BP Ref
Reopeners	77*	12a			
Energy system transition (reopener)	45	13			
Vulnerable and low TRL (NIA)	3	13			
Innovation (NIC)	10	13			
Innovation (NIA)	30	13			
Positive impact outputs	39	6	Connections - fuel poor	7	17.5
			Emergency	23	17.4
			Work management - customer satisfaction survey	6	17.10
			Business support - reputational incentive and vulnerable allowance	3	17.10
Shared future outputs	22	9	Fleet capex	4	17.7
			IT capex	7	17.9
			IT opex	2	17.9
			Property capex	3	17.8
			Distribution network integrity - <7 bar asset integrity	1	17.3
			ODAs - environmental opex	1	17.8
			Other capex - biomethane	2	
			Other capex - leakage reduction innovation roll out	0	17.10
Safe and efficient outputs	173	7	HSE driven mains and services	162	17.1
			Other repex (emerging asset issues)	1	17.1
			Work management - land	5	17.1
			Maintenance - surveys and responsible demolition	5	17.4
Safe and efficient/asset resilience outputs	67		HSE and non HSE driven mains and services	62	17.1
			Other repex (emerging asset issues) - IP reconfigurations	1	17.1
			Non HSE driven mains and services - >2" steel	5	17.1
Asset resilience outputs	66	8	Transmission network integrity	23	17.2
			Distribution network integrity - governors	10	17.3
			Non-HSE driven mains and services	15	17.1
			Risers	17	17.1
Workforce resilience outputs	11	8	Business support - training	11	17.10
Uncertainty	12		Connections other	13	17.5
			Delivering capacity - mains and governors	13	17.6
			Delivering capacity - LTS	5	17.6
Not assigned to specific output	222		ODAs	5	17.4
			Work management	87	17.10
			Work management - allocations out	-55	17.10
			SIU	7	17.11
			Maintenance	31	17.4
			Business support	33	17.10
			Property opex	12	17.8
			IT opex	34	17.9
			Business support - allocations out	-34	17.10
			Fleet opex	14	17.7
			Transport, plant and tools	9	17.10
			Transport, plant and tools - allocations out	-23	17.10
			Emergency - smart metering interventions	4	17.4
			Repair	25	17.4
			Fleet capex	8	17.7
			IT capex	8	17.9
			Property capex	3	17.8
			Distribution network integrity - <7 bar asset integrity	5	17.3
			Transmission network integrity	22	17.2
			SIU capex	3	17.11
			Distribution network integrity - governors	1	17.3
			Other capex	4	
Total	612		Total	612	

* Of the uncertainty mechanisms, Fuel poor and Hazardous waste are already included in totex.
The items listed in this table are the additional reopeners outside of totex.

Costs as set out in chapter 16/BPDT	£m/yr	BP DT
Connections	7	3.04
Emergency	23	2.01
Work management		2.01
Business support		2.01
Other capex - vehicles		3.06/5.18
Other capex - IT		3.05/5.18
Other capex		3.05/5.18
Other capex		3.05/5.18
Other capex		3.05/5.18
Other capex		3.05/5.18
Other capex		3.05/5.18
Other capex		3.05/5.18
HSE mains and services - tier-1	201	4.01
HSE mains and service - tier-2A	3	4.02
Non HSE mains and services - other policy and conditions (inc. MDPI)		4.04
Land remediation	5	2.01
Maintenance - surveys and responsible demolition	5	2.01/5.18
Non HSE mains and services - services not associated with mains replacement		4.07
Non HSE mains and services - mains commissioned: replacing steel		4.04
LTS, storage and entry		3.01
Governors (replacement)	11	3.03
Non HSE mains and services tier-2B	7	4.03
Non HSE mains and services tier-3	4	4.03
Non HSE mains and services - other policy and conditions (inc. MDPI)	13	4.04/4.06 4.06
Non HSE mains and services - services not associated with mains replacement	18	4.07
Risers/multiple occupancy buildings (MOBs)	17	4.08
Business support - training and apprentices	11	2.01/2.14
Connections	13	3.04
Mains reinforcement	13	3.02
LTS, storage and entry		3.01
Other direct acts	6	2.01/5.18
Work management	37	2.01
Holders	2	2.01
SIUs	7	2.01/2.21
Maintenance	32	2.01/2.04
Business support	26	2.01
Business support		2.01
Business support - IT opex	24	2.01/5.18
Business support		2.01 3.06
Smart metering interventions	4	2.01
Repair	25	2.01
Other capex - vehicles	12	3.06/5.18
Other capex - IT	15	3.05/5.18
Other capex	18	3.05/5.18
Other capex		3.05
LTS, storage and entry	52	3.01
LTS, storage and entry		3.01/2.21
Governors (replacement)		3.03
Other capex		3.05
Total	612	

BP Ref > Business plan reference

BP DT > Business plan data template

17 Workloads and activities

Linked appendices

- Transmission Integrity
- Repex
- Asset management
- Distribution, integrity & governors
- Fleet
- Property
- Work management business support
- Electrical & instrumentation
- SIUs
- Emergency service
- Repair service
- Capacity management
- Connections

This chapter covers the projects and programmes of work we will deliver over the course of GD2.They have been categorised according the asset types and functions that make up our network, its operation and maintenance.

The following table lists these categories as they appear in this chapter:

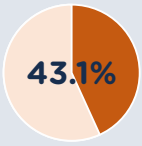
At the start of each category we list the specific asset type or activity described in that section, ending with the cost breakdown and how investment proposals have changed since the original July submission. In each case we will explain how we demonstrate our costs are efficient and high confidence.

Our high confidence approach is supported by the 135 CBAs and 146 engineering justification papers (EJPs) we have submitted covering the majority of our asset replacement activities.

Through all of our investment activity we are balancing the need to operate safely today with the uncertainty over the future role of the gas network. This uncertainty will remain until government policy on pathways to the decarbonisation of heat become clearer.

17.1 Repex

Percentage of totex in GD2



Change in like-for-like expenditure from GD1

Our repex programme is set out in more detail in appendix 019, Replacement expenditure, which covers our approach to pipe risk management and asset management on iron and steel pipes on our network.

In 2002, the Health and Safety Executive (HSE) introduced the iron mains risk reduction programme (IMRRP) which required GDNs to decommission all iron pipes within 30m of a property by March 2032. The most recent update for the period of GD1 placed the focus on smaller diameter iron pipes of 8" diameter or less.

Our repex programme will ensure we meet this mandated requirement while supporting our overarching aim to continue to operate a network that is both safe and highly reliable, in line with customer priorities. This is set out in the following sections;

17.1.1 Regulatory drivers

Our management of pipe risk is guided by a suite of legislation, primarily encompassing pipe risk management activities as described in section 7.4.1 and in more detail in the supporting appendix 019. It is our legal obligation to ensure all of our pipes are maintained in an efficient state, in effective working order and in good repair.

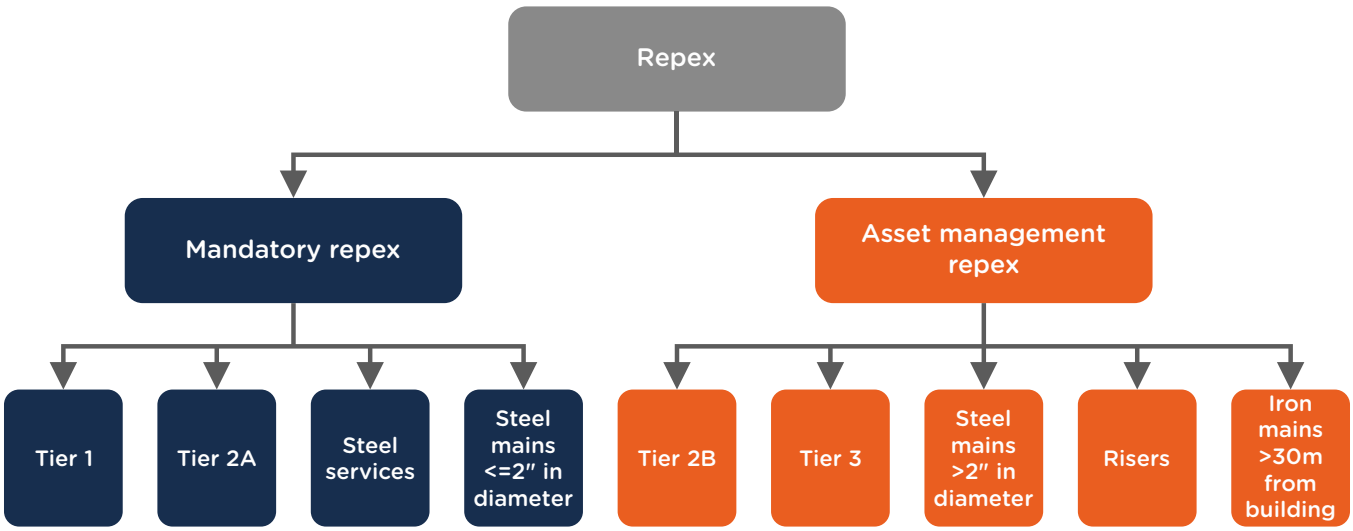
In addition to the small diameter pipes identified under the IMRPP we also assess the safety of pipes outside the IMRRP and we repair, refurbish or replace these as required, subject to a safety, stakeholder and cost benefit analysis. The table below compares our total pipe decommissioning workload in GD1 with our proposals for GD2.

GD1 pipe risk management programme	GD2 risk management programme
Iron length decommissioned **7,474km** (Ave **934km**)	Planned iron to be decommissioned **4,488km** (Ave **898km**)
Other length decommissioned **785km** (Ave **98km**)	Planned other to be decommissioned **646km** (Ave **129km**)
Total decommissioned **8,259km** (Ave **1,032km**)	Total decommissioned **5,133km** (Ave **1,027km**)

17.1.2 Our strategy for managing pipe risk in GD2

The GDNs, along with the HSE and Ofgem, have jointly agreed the two broad categories of mandatory workloads and asset management activities for pipe risk management. Mandatory workloads have been specified by the HSE and need to be delivered regardless of cost benefit analysis (CBA) outcome. The asset management category covers mains that are not mandatory, but where investment is based on an assessment of the risk and associated CBA. The separation of assets by category is shown in Figure 17-1.

Figure 17-1 Repex asset strategy



Whilst our plan is predominantly focused on iron pipes, we also consider it our absolute duty to manage the risks across the entire range of metallic pipes which currently have a total length of 14,613km in Southern and 5,801km in Scotland.

Our investment plan includes costs associated with managing pipe risk around:

- iron mains population – tier 1, tier 2 and tier 3;
- steel mains and services;
- non-standard materials, >30m iron mains and diversions; and
- riser pipes supplying multiple occupancy buildings.

17.1.3 Tier 1

Plan sections: 7.4.1, 7.5.1
App. 019, section 6.8
BPDT: 4.01, 4.05, 4.06

Tier 1 iron mains (mandatory)

All GDNs share a common pipe risk assessment model known as the Mains Risk Prioritisation System (MRPS). This model guides our intervention strategy covering iron as well as steel distribution mains of 3" diameter or more and up to an operating pressure of 7 bar.

The MRPS estimates the level of risk of an incident for every kilometre of mains each year. The risk score represents the likelihood a failure of a pipe section where leaking gas has entered a property and ignited, leading to an explosion.

Each pipe is individually assessed and assigned a risk score, using historical performance data for key failure rates, (fractures, corrosion, joint failures etc) along with site environmental data (proximity to property, amount of open ground, cellars etc). This allows us to prioritise the mains that we will replace. This is supported by our predictive analytics modelling of pipe failures which we were the first GDN to deploy.

Through our work in GD1, the remaining population of pipes are generally approaching a point of relatively similar incident risk. Although, there are still some significantly higher risk pipes that need to be targeted early in the GD2 period. Any one of these pipes could give rise to an incident.

Plan sections: 7.5.3, 12.2.3
App. 019, section 6.8
BPDT: 4.04

Tier 1 iron stubs (mandatory)

The HSE policy for tier 1 iron mains requires that they are all decommissioned by March 2032. Prior to GD1 it was common practice across all GDNs to leave short lengths of small diameter iron where it was connected to a larger diameter iron pipe, so that it could be decommissioned at the same time as the larger main. These short lengths are known as 'stubs'. A change in policy means that tier 2 and tier 3 iron mains no longer have to be replaced for 2032, although the stubs coming off these mains do need to be replaced. From our records, we are aware of over 1,600 iron stubs.

17.1.4 Tier 2 iron mains

We classify tier 2 pipes as 2a and 2b according to their risk score.

Plan sections: 7.4.2, 8.2.1
App. 019, section 6.8
BPDT: 4.02, 4.05, 4.06

Tier 2a iron pipes (mandatory)

All pipes identified by the MRPS model and found to be exceeding the HSE approved risk-action threshold will have been replaced during GD1. However, pipe risk scores fluctuate over time as circumstances change - this is known as dynamic growth. In GD2 some tier 2 pipes may go over the risk-action threshold and require replacement.

Plan sections: 8.2.1
App. 019, section 6.8
BPDT: 4.03, 4.05

Tier 2b iron pipes (asset management)

Iron pipes below the HSE risk action threshold, are non-mandatory tier 2b. When planning for tier 1 projects in GD2, we have considered opportunities for strategic design linked to the replacement of non-mandatory tier 2b iron pipes and look for opportunities to design iron risk out of a network area entirely to reduce disruption and cost in the future.

17.1.5 Tier 3 iron pipes (asset management)

Plan sections: 8.2.1
App. 019, section 6.8
BPDT: 4.03, 4.05

Tier 3 pipes are non-mandatory and included in our plan as part of our programme of pipe risk management, incorporating refurbishment or decommissioning to manage the integrity of these pipes.

We have a successful innovation programme for iron pipes in all tiers which we will continue into GD2, specifically targeting tiers 2 and 3 pipes where decommissioning costs are greater. Innovations used currently include the large diameter internal joint sealing robot, CISBOT, as described in our appendix 008, Innovation.

We have used CISBOT for planned refurbishment on many of our high joint failure tier 3 mains in GD1, reducing leakage across the network. In GD2 we will use CISBOT as business as usual on emerging pipe joint failures alongside conventional pipe replacement, ensuring we continue to manage the risk of deteriorating pipe as efficiently and effectively as possible. Current trials being undertaken through the H21 NIC hydrogen project led by NGN at the HSE facility in Buxton, will establish the suitability of these refurbished joints for hydrogen.

Asset projects for tier 2 and tier 3 pipes have been identified based on current pipe condition. These projects include assets where a failure could be potentially catastrophic, for example in pipes under railways, in tunnels, rivers, canals and over bridge crossings. They are supported by an engineering justification paper (EJP) and CBA.

17.1.6 Steel and non-standard materials (mandatory)

Our steel intervention strategy is a mix of mandatory work and safety driven work underpinned by CBA. Much of it is closely aligned with our iron mains programme. Non-standard materials, such as PVC, are replaced when found and volumes are very low. When possible, we aim to complete this work alongside iron replacement projects, providing an opportunity to reduce disruption and improve efficiency.

Plan sections: 7.4.3, 12.2.4
App. 019, section 6.8
BPDT: 4.01, 4.06

<=2" steel pipes (mandatory)

Pipes that are 2" in diameter steel or less (<=2") are classed as mandatory and must be decommissioned when encountered. When we locate buried <=2" steel mains during routine and emergency operations, the pipes will be decommissioned as quickly as possible. We estimate that 50% of our 2" or below steel population is unrecorded which makes this workload more uncertain.

Plan sections: 7.5.2
App. 019, section 6.8
BPDT: 4.04, 4.05, 4.06

>2" steel pipes (asset management)

A significant proportion of our above 2" diameter steel mains pipes are already in a deteriorating condition and will reach the end of their useful life during GD2. We now have significant supporting data to develop a >2" steel risk management approach, as set out in the repex appendix.

The evidence shows that current reactive workloads are unable to keep up with the rate of pipe deterioration, resulting in a growing number of steel pipe repairs impacting customers and local communities.

17.1.7 Other assets

In addition to the above there are a number of other situations where our intervention is governed by the workload frameworks.

Plan sections: n/a
App. 019, section 6.8
BPDT: 4.04, 4.05, 4.06

Non-standard materials (mandatory)

Non-standard material pipes are those made from materials other than PE including steel, cast iron, spun iron, ductile iron or copper. The HSE approved policy is to decommission non-standard material pipes when found, giving rise to a small annual workload. The larger population of PVC pipes should be decommissioned in parallel with the iron mains programme.

Plan sections: n/a
App. 019, section 6
BPDT: 4.04, 4.05

Iron pipes more than 30m away from property (asset management)

As explained above, the HSE's focus is on iron pipes within 30m of a property. However, we also have a smaller population of iron pipes beyond the 30m boundary that present both operational and loss of supply risks when they fail. These pipes are becoming a safety concern, leading to increased risks for our teams working on them and for the communities they supply.

Some of these pipes operating at higher pressures can be corroded to such a degree that when our workforce excavate to gain access for repairs there is a risk of total pipe failure. When a pipe is the only feed – as seen in small towns or villages - failure could also lead to loss of supply.

Plan sections: 8.2.2
App. 019, section 6
BPDT: 4.01

Inadequate integrity (asset management)

We are tracking several integrity issues which we expect to give rise to small volumes of part renewals, a notable factor is ground service entries - where we part-renew the remaining part of the service. Sometimes, the condition of a main is found to be in such a state of deterioration it is not possible to carry out required works. When this happens, we replace the short section as necessary, digging further back around the main until a safe point has been identified where it is strong enough to connect, without another failure occurring.

Plan sections: 7.4.5
App. 019, section 6
BPDT: 4.05

Mains diversions (asset management)

A number of mains diversion projects are completed each year on our below 7bar distribution network. They relate to the need to divert a part of our gas mains pipe network allowing for other development on the same land.

Most, but not all diversions can be recharged. For some legacy easement or wayleave agreements in England, or deeds of servitude in Scotland, there is a lift and shift component within the legal agreement that requires us to relocate the pipe at our cost within a given period of time and is incorporated.

The New Roads & Street Works Act 1991 (NRSWA) states when diversionary works, including the removal, alteration and protection of assets, are owned and required by an GDN (Undertaker), some recovery of costs are allowed.

It is usually possible to recharge for mains diversions subject to NRSWA and National Joint Utilities Group (NJUG) agreements. The highway authority may share with the GDN the allowable costs of diverting (or protecting) the GDN's assets because of the major highways works. This is known as the standard cost sharing principle which states that the GDN may be asked to pay 18% of the highway authorities allowable costs relating to the diversion measures.

Workloads vary each year and typically we see on average around 12km a year in Scotland and Southern of pipe decommissioned and replaced along an alternative route. The treatment of associated services is the same as for other mains decommissioned.

Plan sections: n/a
App. 019, section 6
BPDT: 4.07

Bulk Service Renewals (Not associated with mains replacement)

We use a service insight tool, developed using data analytics, to identify emerging problems relating to services on the network, specifically those having higher than average failure rates. As part of our strategy for GD2 we are proposing to create projects for these service renewals.

These projects fall outside of the normal planned mains replacement programme and are better described as bulk service renewals. For instance, these services may be already connected to a PE main with steel tails contained within their construction, or steel services connected to tier 2 or tier 3 iron mains.

Plan sections: 7.5.4
App. 019, section 6
BPDT: 4.07

IP/LP mains and service regulators (asset management)

When SGN was formed in 2005 we inherited a number of intermediate pressure (IP) steel service pipes that included a service regulator, terminating at the boundary wall of a domestic property. These were generally installed in the 1970s. During GD1, we have seen an increase in the number of reported gas escapes traced to a leaking IP service or service regulator.

Plan sections: 8.2.1
App. 019, section 3.6, 6, 6.8
BPDT: 4.08

Risers (asset management)

A riser is a configuration of vertical and horizontal pipes, typically steel, providing gas supplies to multi-occupancy high-rise buildings of three stories and above. There are 11,588 gas risers on our southern network and 5,593 on our Scotland network in buildings typically greater than six stories.

Although they form part of the overall pipe system, we have developed discrete asset management procedures and a separate risk model for risers. We first introduced this procedure and risk model in 2010-11 and it was the first riser risk model to be developed within the gas industry.

Our management procedure and riser risk model (RRM) have been developed in conjunction with a technical services consultancy. This allows us to risk score risers accordingly and take a prioritised risk-based approach to planned interventions.

Taking this approach has led to a significant amount of riser replacement work over the course of GD1. Our proactive approach has enabled a switch from unplanned to planned replacement, meaning fewer customers have had their supplies interrupted for longer than 24 hours. We intend to continue with our existing risk management programme during GD2.

Today, there is greater public awareness of the safety implications for gas supplies in high-rise buildings. We have responded quickly and comprehensively to numerous enquiries and requests for safety visits, ultimately to satisfy concerns that risers and related pipework are safe and that we continue to monitor and replace as necessary. We work closely with local authorities and other stakeholders to respond to and address their concerns.

We anticipate that this heightened awareness will change the industry, buildings or fire regulations – there will be more focus on buildings of ten stories or more which will require further stakeholder liaison around riser installations, including details of any safety and isolation devices and details of our ongoing inspection regime. We agree with proposals to put in place a reopener mechanism to reflect any legislative changes.

Our outputs relating to risers and multi occupancy buildings are listed in table 7-1 in chapter 7, and explained in sections 7.5.7 to 7.5.9.

17.1.8 Investment appraisal

We have gathered strong supporting evidence for each investment area, allowing us to explore the different investment options and find the most effective approach for any project or programme that is greater than £500k. Altogether the CBAs account for £1,150m out of a total replacement expenditure of £1,317m over the five years of GD2, almost 90% of total investment. Along with the CBAs we have submitted engineering justification papers (EJPs) which support the methodology behind each investment decision. These are listed in table 17-1 along with the CBA payback period we have for each investment.

It is notable from the paybacks that there are atypicals in the data (such as risers in Scotland and Southern). These differences are due to the unique physical characteristics of each asset. In Scotland, more risers are installed within the building resulting in a higher risk profile than if they had been installed externally, which is more often the case in Southern. This gives a higher risk benefit associated with an intervention and lower payback.tion and lower payback.

Table 17-1 Repex investment appraisals

Network	Asset	Repex (£m)	NPV (£m)	Payback (yrs)	Engineering Justification Paper
Southern	Tier 1 Iron	715	244	28	SGN Repex - 001 Tier 1So - EJP Dec19
Scotland	Tier 1 Iron	240	3	39	SGN Repex - 002 Tier 1Sc - EJP Dec19
Southern	Tier 2 Iron	24	76	23	SGN Repex - 003 Tier 2So - EJP Dec19
Scotland	Tier 2 Iron	10	17	25	SGN Repex - 004 Tier 2So - EJP Dec19
Southern	Tier 3 Iron	15	131	8	SGN Repex - 005 Tier 3So - EJP Dec19
Scotland	Tier 3 Iron	7	10	22	SGN Repex - 006 Tier 3So - EJP Dec19
Southern	>2" Steel + Iron >30m	32	51	30	SGN Repex - 007 SteelSo - EJP Dec19
Scotland	>2" Steel + Iron >30m	7	22	13	SGN Repex - 008 SteelSo - EJP Dec19
Southern	Riser	73	14	32	SGN Repex - 009 RisersSo - EJP Dec19
Scotland	Riser	14	56	12	SGN Repex - 010 RisersSo - EJP Dec19
Southern	Kings Ferry Bridge	5	5	12	SGN Repex - 011 Kings FerrySo - EJP Dec19
Southern	Cams Hall Tunnel	1	1	12	SGN Repex - 012 Cams HallSo - EJP Dec19
Scotland	IP Service Reconfiguration	4	0.2	26	SGN Repex - 013 IP ServiceSo - EJP Dec19
Southern	Bulk service renewals	5	1.3	25	SGN Repex - 014 Bulk Services So - EJP Dec19
Scotland	Bulk service renewals	2	0.3	29	SGN Repex - 014 Bulk Services Sc - EJP Dec19
Grand total		**1,154**	**631**		

Plan sections: 14.1, 12.4
App.019 section 6.7, 005 section 4.3.2

17.1.9 High confidence and efficient costs

Repex accounts for 43% of totex. The vast majority of all repex work is undertaken by external contractors who have entered into a competitive tendering process for the work, as set out in appendix 019, section 6.9. The long-term nature and the scale of the programme over multiple years, along with contracting rounds, gives us the confidence our unit costs are robust and can be used as the basis of the allowance allocation for GD2.

The current contracting strategy for GD1 is built on a series of framework agreements (chapter 14). We expect to continue this as an appropriate way for delivering value-for-money during GD2. Due to diversity in requirements and geographical terrain across Scotland and southern regions, separate contracting strategies exist.

This ongoing engagement with external contractors also highlights how prices have changed over the course of GD1. The appendix 019, section 6.7 analyses real price effects in some detail, showing contractor rates are approximately 30% higher now, compared to the start of GD1.

In order to drive efficiency we also utilise internal teams, particularly in the summer months when emergency and repair workloads are lower. Repurposing our employees is possible as a result of the cross-training programmes we have implemented (section 8.6.1).

Our proposal for GD2 is based on our forecast unit costs at the end of GD1 and projecting these forwards with workload forecasts. We have not applied any new real price effects in GD2 (we forecast these to be just over 1% a year above CPIH). We have built in an efficiency assumption in GD2 of 0.7% a year for repex, which will save customers approximately £24m over GD2 relative to today.

We have compared our efficiency relative to other networks using the industry benchmarking models, appendix 005, cost efficiency. However, the results highlight the challenge of achieving an accurate comparison that is not distorted by the impact of different contracting strategies and allocations together with volatilities within particular years. As an example, we do not believe it is credible for large and rapid year-on-year swings of 10-15% in efficiency scores given that the current repex regressions are fundamentally a comparison of unit costs.

17.1.10 Investment proposal

As set out above, the mandatory workloads have increased with the proposed accelerated repex programmes. This is coupled with a reduction in non-mandatory repex as well as a consistency in the expectations for risers. The figures in Table 17-2 include £19m a year of additional outputs proposed associated primarily with the accelerated programmes. Our outputs relating to the repex programme are listed at table 7-1 at section 7.3.

Table 17-2 Repex investment proposal

SGN (£m)	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	21/22	22/23	23/24	24/25	25/26	GD2 ave
HSE driven mains and services	190	187	180	194	194	184	190	187	206	207	205	204	205	205
Non-HSE driven mains and services	30	32	36	38	52	65	66	66	40	40	38	38	37	39
Risers	12	13	13	15	13	17	18	17	17	18	17	17	17	17
Other repex									7	1	1	1	1	2
Total	232	232	229	247	259	266	274	270	270	264	262	260	260	263

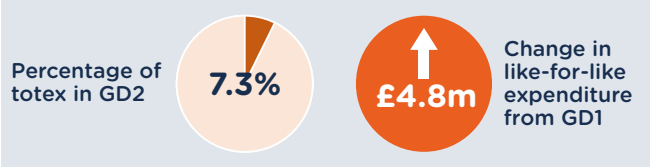
17.1.11 Cost changes since July submission

Between the July and October draft submissions we made a number of workload adjustments identified in table 17-3 with an explanation included in the October draft. There has not been any change in headline figures between the October draft and our final plan.

Table 17-3 Repex trace from July

Cost activity	Units	July	Oct	Variance	Cause of change July-Oct	Dec	Variance
HSE driven mains and services	£m	194	205	12	> Increased volume of T1 iron (T1 acceleration) > Increased costs resulting in changes to GSOP13 arrangements (5 to 7 day customer notification) > T1 stubs costs moved from the 'Other repex' investment line	205	0
Non-HSE driven mains and services	£m	35	38	4	Increased volumes of >2" steel and bulk service replacement	38	0
Risers	£m	17	17	0	No change	17	0
Other repex	£m	5	2	-2	T1 stubs costs moved into the 'HSE driven' investment line	2	0
Total	**£m**	**250**	**263**	**13**		**263**	

17.2 Transmission network integrity



Our transmission assets began life over 50 years ago during the introduction of North Sea gas. As a result, the primary driver for investment is to manage the degradation of an asset's condition over time and to mitigate the risk of reduced reliability. This fully aligns with our stakeholders' priorities around safety and efficiency and it meets our legislative and statutory obligations, bringing down overall costs for customers.

Prior to GD1, we commissioned a major site based inspection of all offtakes and PRSs to inform our business plan. We developed this further in 2015, introducing a management procedure that specifies the detailed inspection of assets. Initially our inspections were scheduled on a risk basis, taking into account our existing knowledge of the condition and configuration of sites. These major site based inspection reports have informed our plans for GD2.

Outputs from these reports are also directly linked to our monetised risk targets, since asset condition is a key driver for asset health. For GD2 we have categorised the following workloads:

- maintaining and repairing – compliance activity, revalidation and remedial work for offtakes, PRSs and LTS pipelines
- investment in our assets - these are the larger capital projects relating to offtakes, PRS and pipeline investment, with important replacement projects and two rebuild projects
- electrical and instrumentation upgrades - provision of monitoring and support for the preheating and flow of natural gas through offtake sites, PRSs, biomethane entry points and cathodic protection transformer rectifier (CPTR) locations.

17.2.1 Maintaining and repairing our transmission assets

Plan sections: n/a
App. 021 section 6.1 and 6.2
BPDT: 3.01, 2.04 (maintenance side)

Compliance with gas safety regulations, knowing our assets and ensuring they are able to withstand the higher internal gas pressures they have been designed for is critical. A substantial part of our investment activity is ensuring that assets are inspected appropriately, maintained and repaired to ensure that we remain compliant with legislation. For GD2 we have created named programmes for refurbishment and replacement activity relating to the sites identified for work in GD2. The full list is set out in appendix 021, Transmission integrity and compliance, section 6.2.

- **CM/4 Inspections and remediation.** Our compliance driven inspection procedure requires consistent, periodic assessments of all above 7 bar assets. This inspection process ensures a detailed level of knowledge is collected for all sites, enabling the early identification and prioritisation of defects in a remediation plan.
- **Pigging of high-pressure pipelines.** Below ground assets can only be assessed through the use of intelligent internal inspection – called pigs - allowing us to measure the internal surface profile of the pipeline wall. Expert analysis is used to assess this and determine the quantity and nature of any defects in order to determine any necessary remediation.
- **AC/DC current monitoring and mitigation.** Cathodic protection systems are used on buried steel pipelines to substantially mitigate the risk of corrosion caused by overhead power lines running in parallel to a buried pipeline. This can create corrosion in areas where the AC potentials leave the pipeline to return to source.
- **Revalidation of high-pressure filters.** Pressure reduction stations (PRSs) and offtakes feature at least two high pressure filters designed to remove contaminants carried in the gas flow. These need to be maintained and regularly inspected.
- **Revalidation of water bath heaters.** These are used to pre-heat the inlet gas prior to a substantial change in pressure to counteract the Joule-Thomson effect which would otherwise lead to the pipe freezing.

Overall, we have 26 separate programmes of compliance, inspection and maintenance for GD2 across Southern and Scotland where we expect to invest approximately £9m a year on the associated costs of repair and refurbishment.

Plan sections: 8.1.1, 8.1.2
App. 021, section 6.2
BPDT: 3.01

17.2.2 Investment in our transmission assets

Our investment strategy is structured to align with different types of transmission assets, identified below.

- **Offtake projects –** there are 30 points (12 offtakes in Southern and 18 in Scotland) where we take gas off the NTS onto our Local Distribution Zones (LDZ). On these sites we meter the volumes and characteristics of the gas as it transfers onto our network, reduce the pressure and to adding odorant for safety.
- **PRS projects –** reduce the pressure from the LTS into the intermediate (7barg), medium (2barg) and low (75mbarg) pressure distribution systems by using a series of mechanical processes and assets. In GD1, under monetised risk trading, we refocused a significant proportion of our investment activity from LTS pipelines to PRS projects. We are retaining this focus for GD2.
- **LTS pipeline projects -** we manage 3,122km of LTS pipelines of between 100mm and 1,200mm diameter, operating between 14barg and 85barg. The assets include pig traps, exposed and buried crossings and support structures - valves, posts, sleeves, cathodic protection, as well as other ancillary control systems.

We have separately identified 74 investment projects and programmes of investment in GD2 across Southern and Scotland where we expect to invest approximately £37.3m a year on the associated costs of revalidation, refurbishment, component replacement and rebuild. This is a total investment of £187m across GD2 of which £120m (65%) is directly covered through the NARMs methodology.

Plan sections: n/a
App. 026, section 6
BPDT: 3.01

17.2.3 Electrical and instrumentation (E&I) upgrade

As set out in appendix 026, Electrical and Instrumentation, E&I assets require continuous investment to manage their lifecycle and obsolescence. Much of our E&I equipment on our network is computer based making obsolescence a significant consideration in our plan. Additionally, advancements in technology can also provide an opportunity for malicious cyberattacks. That means all our computer based equipment must be as current as possible to accept the latest security patches and upgrades as new threats emerge.

Maintaining the safety, reliability and performance of the networks during GD1 has required us to deliver a number of metering projects, as well as other equipment upgrades across the portfolio. This necessary work has been prioritised following site surveys to assess condition, performance and equipment obsolescence. A number of workstreams have been identified through a combination of internal reviews, external stakeholder engagement and analysis of historic and current data and fault reports. Our GD2 plan identifies 12 workstreams, of which the five most significant are listed below.

- **Telemetry replacement.** Telemetry provides the capability from a distance to monitor and control features of operational gas sites. Ulysses, our current telemetry system, is now at the end of its product lifecycle and spares are not available. We propose to replace the current telemetry systems with a range of devices across 165 sites to improve communication.
- **Non-telemetered sites.** We have identified 14 sites with preheating (without backup power supply) which are not monitored using telemetry. Recent safety studies we have undertaken have highlighted significant associated risks and we propose to upgrading these 14 sites.
- **Metering upgrade programme.** We have carried out a metering review and identified where the existing offtake metering systems were not designed to operate with additional biomethane sources of gas to the local downstream network and need to be upgraded.
- **Electrical, instrumentation and control upgrade programme.** An ongoing compliance programme to remove older electrical equipment that contains asbestos, and which does not have appropriate isolation structures as required by our safe isolation procedure.
- **Industrial and commercial metering data loggers.** We need to replace faulty devices and achieve aggregate targets set by the Central Data Services Provider (CDSP) Committee. This project will replace obsolete hardware and software, while reducing the number of faults.

In total, we have identified 11 projects in appendix 026 with a value greater than £500k that account for £7m per year of investment, 95% of the total E&I investment of £7.4m.

17.2.4 Investment appraisal

Investment in transmission accounts for approximately 8% of totex. Every transmission integrity project has been identified and scoped based on the results of inspections and surveys, with details provided in EJPs and CBAs. Out of the £186m proposed investment in transmission integrity, the CBAs account for £123m (65%). For E&I, the total proposed expenditure is £37.2m, of which 95% (£35.3m) is supported by CBAs. These are set out in the table below and are submitted along with the CBA payback period we have for each investment area. With our current investment decisions, all our asset groups are passing a CBA at a maximum of a 30-year payback period.

Table 17-4 Transmission and E&I investment appraisals

Network	Asset	Capex (£m)	NPV (£m)	Payback (yrs)	Engineering justification paper
Southern	Mappowder	6.1	325.8	1	SGN Trans – 001Mapp – CBA Dec19
Southern	Winkfield – System 1	8.2	12.9	18	SGN Trans – 002Wink1 - CBA Dec19
Southern	Winkfield – System 2	7.8	11.8	17	SGN Trans – 003Wink2 – CBA Dec19
Southern	Aylesham	1.3	-0.9	50	SGN Trans – 004Ayle – CBA Dec19
Southern	Battle – System 1	1.1	17.7	3	SGN Trans – 005Batt1 – CBA Dec19
Southern	Battle – System 2	2.6	85.0	1	SGN Trans – 006Batt2 – CBA Dec19
Southern	Boxhill	1.6	4.8	9	SGN Trans – 007Boxh – CBA Dec19
Southern	Braishfield C	1.2	21.4	4	SGN Trans – 008Brai – CBA Dec19
Southern	Godstone	1.7	1.4	21	SGN Trans – 009Gods – CBA Dec19
Southern	Hillside	1.9	20.0	5	SGN Trans – 010Hill – CBA Dec19
Southern	Hurst Green	1.7	3.7	15	SGN Trans – 011Hurs – CBA Dec19
Southern	Reading A	3.2	6.4	12	SGN Trans – 012Read – CBA Dec19
Southern	Shalford	4.2	62.3	2	SGN Trans – 013Shal – CBA Dec19
Southern	Shatterling	1.4	4.0	14	SGN Trans – 014Shat – CBA Dec19
Southern	Smarden	1.5	1.4	20	SGN Trans – 015Smar – CBA Dec19
Southern	SMC 1 – Boiler & CHP	4.4	8.0	4	SGN Trans – 016SMCT – CBA Dec19
Southern	Westerham – System 1	3.1	11.0	9	SGN Trans – 017West1 – CBA Dec19
Southern	Westerham – System 2	2.6	18.3	6	SGN Trans – 018West2 – CBA Dec19
Southern	Woking	2.3	101.5	0	SGN Trans – 019 Woki – CBA Dec19
Southern	Hooley Pipe Bridge	2.3	8.7	9	SGN Trans – 020Hool – CBA Dec19
Scotland	Lockerbie Rebuild	1.7	8.4	15	SGN Trans – 021Lock – CBA Dec19
Scotland	Provan System 1	7.2	10.3	17	SGN Trans – 022aProv – CBA Dec19
Scotland	Provan System 2	7.2	12.9	17	SGN Trans – 022bProv – CBA Dec19
Scotland	Waterfoot TRS	4.27	24.4	9	SGN Trans – 023aNewt – CBA Dec19
Scotland	Newton Means	4.27	27.3	10	SGN Trans – 023bNewt – CBA Dec19
Scotland	Georgetown Rebuild	3.4	16.0	15	SGN Trans – 024Geor – CBA Dec19
Scotland	Fairmilehead - System 1	1.8	10.0	8	SGN Trans – 025aFair – CBA Dec19
Scotland	Fairmilehead - System 2		7.0	10	SGN Trans – 025bFair – CBA Dec19
Scotland	St Andrews	2.6	17.9	8	SGN Trans – 026StAn – CBA – Dec19
Scotland	Airth	1.2	29.0	2	SGN Trans – 027aAirt – CBA Dec 19
Scotland	Lauder	1.1	7.5	13	SGN Trans – 027bAirt – CBA Dec 19
Scotland	Carleith (TRS) - System 1	0.42	30.0	1	SGN Trans – 028aCarl – CBA Dec19
Scotland	Carleith (TRS) - System 2	0.42	1.3	7	SGN Trans – 028bCarl – CBA Dec19
Scotland	Aberdeen (Craibstone)	0.6	0.2	21	SGN Trans – 028cCarl – CBA Dec19
Scotland	Granton TRS - System 1	0.7	0.2	15	SGN Trans – 028dCarl – CBA Dec19
Scotland	Granton TRS - System 2		0.1	24	SGN Trans – 028eCarl – CBA Dec19
Scotland	Dunkeld Diversion	25.8	98.7	4	SGN Trans – 029Dunk – CBA Dec19
Southern	Telemetry	4.3	6.1	1.0	SGN E&I – 001 Tele – CBA Dec19
Southern	CPTR	0.7	2.1	0.0	SGN E&I – 003CathProt – CBA Dec19
Southern	Metering Uncertainty	0.3	5.6	0.0	SGN E&I – 004Meter – CBA Dec19
Southern	EC&I Upgrades	5.8	5.3	9.0	SGN E&I – 005E&IUpgrades – CBA Dec19
Southern	I&C Metering Dataloggers	4.5	5.5	0.0	SGN E&I – 006ICMDatalog – CBA Dec19
Southern	E&I Minor Works Programme	1.5	2.2	9.0	SGN E&I – 007MinorW – CBA Dec19
Southern	Non-Telemetered sites	1.5	0.8	15.0	SGN E&I- 002NonTele – CBA Dec19
Scotland	Telemetry	4.2	5.9	0.0	SGN E&I – 001 Tele – CBA Dec19
Scotland	CPTR	0.3	0.8	0.0	SGN E&I – 003CathProt – CBA Dec19
Scotland	Metering Uncertainty	4.2	0.2	26.0	SGN E&I – 004Meter – CBA Dec19
Scotland	EC&I Upgrades	2.4	2.4	0.0	SGN E&I – 005E&IUpgrades – CBA Dec19
Scotland	I&C Metering Dataloggers	3.1	2.9	0.0	SGN E&I – 006ICMDatalog – CBA Dec19
Scotland	E&I Minor Works Programme	0.5	2.5	0.0	SGN E&I – 007MinorW – EJP Dec19
Total		156.0	1,068.7		

17.2.5 High confidence and efficient costs

We have completed a feasibility study for each of the identified named projects and programmes. These have included conceptual design and have been completed by external suppliers who bring considerable design experience and local knowledge, as well as their experience of working with us in GD1. For smaller projects we reviewed actual costs of delivery in GD1 with what we are proposing for GD2.

All major project activities, such as procurement for the fabrication of key components and works contracts, will be competitively sourced through specific tendering exercise (section 14.1). Some packages of work, such as project design, are procured under framework agreements. These arrangements were successfully deployed in GD1 and our cost estimates for GD2 are based on the outcomes of these and similar exercises in GD1. There have been some inflationary pressures on tendered rates in GD1 due to the limited availability of contractors. We anticipate comparable pressures will be evident in GD2, especially since workload levels are similar, additionally there is some uncertainty about the impact of other large scale external works that raise demand for contractors, such as the HS2 rail project. On this basis, costs are expected to reflect performance in GD1.

All of the materials and works required to deliver this plan will be obtained either by individual or programme tender. Suppliers are not regionally focused and there is widespread movement of resources. As such, there are fewer regional differences in costs.

17.2.6 Investment proposal

Table 17-5 Transmission investment proposal

SGN (£m)	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	21/22	22/23	23/24	24/25	25/26	GD2 ave
Compliance									8	9	8	9	10	9
LTS pipeline	8	11	2	14	15	20	4	3	2	8	10	11	1	6
Offtakes	1	0	1	1	2	6	14	11	2	5	9	7	1	5
PRS	4	14	24	37	27	30	19	11	10	18	27	20	14	18
Storage	7	1	2	1	0	-	-	2	0	0	0	0	0	0
Embedded entry	-	1	0	-	-	0	-	-	0	0	0	0	0	0
E&I - offtakes									4	3	3	3	4	3
E&I - PRSs									4	4	4	4	4	4
Total	**21**	**27**	**28**	**53**	**45**	**56**	**37**	**27**	**30**	**46**	**61**	**55**	**32**	**45**

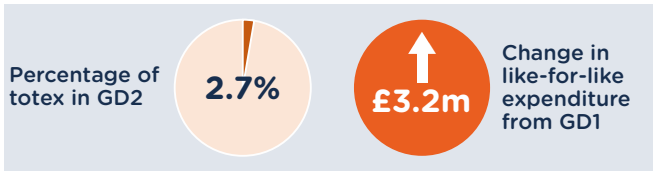
17.2.7 Cost changes since July submission

Between the July and October draft submissions, we made cost adjustments identified in table 17-6 and explained in the October draft. There has only been a minor change in headline figures between the October draft and our final plan.

Table 17-6 Transmission trace from July

Cost activity	Units	July	Oct	Variance	Cause of change July-Oct	Dec	Variance
Compliance	£m	43	44	0	No change	44	0
LTS pipeline	£m	29	31	2	No change	31	0
Offtakes	£m	24	24	0	> Introduction of use-it-or-lose-it mechanism	24	0
				0	> Reevaluation of site costs		
PRS	£m	67	87	6	> Introduction of use-it-or-lose-it mechanism	88	1
				15	> Reevaluation of site costs		
Storage	£m	0	0	0	No change	0	0
Embedded entry	£m	0	0	0	No change	0	0
E&I - offtakes	£m	18	17	-1	> Tender information and workload adjustments	17	0
E&I - PRSs	£m	21	20	-1	> Tender information and workload adjustments	20	0
Total	**£m**	**202**	**223**	**21**		**224**	**1**

17.3 Distribution network integrity



This section summarises our investment plans for below 7bar distribution network integrity covering both distribution assets (classified as other capex in chapter 16) and governors. The profile of our distribution assets includes a wide range of materials and components of different ages.

Plan sections: 8.3.3
App. 012, section 6.1
BPDT: 3.05

17.3.1 Distribution network integrity

Our approach in GD2 is to deliver the core requirements of safety and resilience, to support decarbonisation of the network and to prepare for larger scale delivery, subject to the evidence and policy base. In section 8.3 we identify two named projects for crossings and ten named programmes. These include crossings, valves, cathodic protection, nitrogen sleeves and data loggers. Greater detail is provided in the Distribution integrity and governors appendix, section 6.1 and the associated EJP and CBAs which cover over 75% of the total investment proposal. A number of the programmes are continuation from GD1 into GD2. These include:

Asbestos management[1]**:** continuing work to ensure we comply with relevant asbestos legislation. We propose investing a further £2m remediating over 3,000 units in GD2.

Model validation loggers[2]**:** an ongoing programme on over 30,000 units at a cost of £1.7m, ensuring the ongoing availability of appropriate and accurate critical pressure data.

Nitrogen sleeves[3]**:** ongoing monitoring and associated remediation programme for re-pressurising nitrogen levels if they fail to maintain protection levels. We plan to invest £1.5m to remediate 19 sleeves in Southern.

IP Marker posts[4]**:** a replacement programme of 1,900 network identification posts costing £1.1m.

CP systems[5]**:** we have nearly 2,500 CP systems with a 15 to 25-year operational life. This programme will continue to invest in refurbishment, maintenance and validation of existing CP systems requiring an investment of £4.2m in GD2.

Below ground governor security[6]**:** ongoing replacement programme for Gatic covers that provide protection to below ground assets. These are subject to change due to manual handling requirements. The fixed unit cost and programme of replacing 114 Gatic covers over the course of GD2 will cost £6.9m.

Network valves[7]**:** to maintain an ongoing valve remediation programme of 1,700 valves at a cost of £5.3m. We will apply a risk-based approach to target the highest priority valves.

17.3.2 Governor integrity

Plan sections: 8.3.1
App. 012, section 6.2
BPDT: 3.03

A governor is mechanical valve which takes a higher inlet gas pressure and reduces it. We have 7,477 governors (5,146 in Southern and 2,326 in Scotland) across the different pressure tiers of our distribution network. Generally, governors which are well protected and maintained have a working life of around 45 years.

We have an ongoing programme of governor replacement work, prioritising assets that are identified as obsolete, in poor mechanical condition or have reached the end of their safe working life. Our GD2 governor investment strategy has been guided by our inspection regime which provides a thorough assessment of an asset's condition. The results of this condition assessment are provided in appendix 012, Distribution integrity and governors, section 6.2, where we have identified interventions on nearly three thousand domestic service regulators, approximately 260 district governors and 185 governor kiosks.

1 SGN GOV – 008 Asbest Sur Sc – EJP Dec19 and SGN GOV – 008 Asbest Sur So – EJP Dec19
2 SGN Dint – 017 ModValLog So - EJP Dec19 and SGN Dint – 007 ModValLog So - EJP Dec19
3 SGN Dint – 005 NitrSlev So - EJP Dec19
4 SGN Dint – 003 IPMarker So - EJP Dec19 and SGN Dint – 014 IPMarker Sc - EJP Dec19
5 SGN Dint – 004 CathProt So - EJP Dec19 and SGN Dint – 015 CathProt Sc - EJP Dec19
6 SGN GOV – 009 Sec Bel Gro So – EJP Dec19
7 SGN Dint – 018 NetVal So - EJP Dec19 and SGN Dint – 008 NetVal So - EJP Dec19

17.3.3 Investment appraisal

Investment in distribution integrity and governors accounts for approximately 3% of totex and is separated into a series of named projects that are individually identified and supported by an EJP and a CBA. Combined, these make up approximately 35% of distribution integrity expenditure. Work on governors accounts for the remaining 65% and is managed through NARMs. The investment decisions are supported by 14 EJPs and CBAs. These are set out in table 17-7 and are submitted along with the CBA payback period we have for each investment area. With our current investment decisions, all our asset groups are passing a CBA at a maximum of a 38-year payback period .

Table 17-7 Distribution integrity and governor investment appraisals

Network	Asset	Capex (£m)	NPV (£m)	Payback (yrs)	Engineering Justification Paper
Scotland	Temple Tunnel	0.1	1.4	1	SGN Dint – 012 TempTun Sc - CBA Dec19
Scotland	Coastal Erosion	0.7	1.2	7	SGN Dint – 013 CoastEros Sc - CBA Dec19
Scotland	IP Marker Posts	0.3	0.2	12	SGN Dint – 014 IPMarker Sc - CBA Dec19
Scotland	Management of CP Systems	1.4	64.4	35	SGN Dint – 015 CathProt Sc - CBA Dec19
Scotland	Network Pressure Logger (PMAC)	1.4	3.7	9	SGN Dint – 016 ModProLog Sc - CBA Dec19
Scotland	Model Validation Loggers (New & Batteries)	0.7	12.3	13	SGN Dint – 017 ModValLog Sc - CBA Dec19
Scotland	Network Valve Remediation (Incl I&C)	2.2	1.5	13	SGN Dint – 018 NetVal Sc - CBA Dec19
Scotland	Renewable Network Maintenance Pressure Loggers	1.3	3.2	2	SGN Dint – 019 SolPV Sc - CBA Dec19
Southern	Shalford Pipe Bridge	1.6	22.9	1	SGN Dint - 001 ShalBrid So - CBA Dec19
Southern	Coastal Erosion	0.7	1.3	7	SGN Dint – 002 CoastEros So - CBA Dec19
Southern	IP Marker Posts	0.8	0.3	18	SGN Dint – 003 IPMarker So - CBA Dec19
Southern	Management of CP Systems	2.7	204.1	10	SGN Dint – 004 CathProt So - CBA Dec19
Southern	Nitrogen Sleeves	1.5	0.6	19	SGN Dint – 005 NitrSlev So - CBA Dec19
Southern	Network Pressure Logger (PMAC)	2.5	0.8	28	SGN Dint – 006 ModProLog So - CBA Dec19
Southern	Model Validation Loggers (New & Batteries)	0.9	18.9	13	SGN Dint – 007 ModValLog So - CBA Dec19
Southern	Network Valve Remediation (Incl I&C)	3.2	2.3	13	SGN Dint – 008 NetVal So - CBA Dec19
Southern	Renewable Network Maintenance Pressure Loggers	2.1	5.5	1	SGN Dint – 009 SolPV So - CBA Dec19
Southern	Remote Pressure Management South	1.6	4.0	6	SGN Dint – 010 RemMonLon So - CBA Dec19
Southern	Remote Pressure Management Southern	1.8	4.4	5	SGN Dint – 011 RemMonSouth So - CBA Dec19
Scotland	ERS Replacement	1.8	42.0	4	SGN GOV - 001 ERS Repl Sc - CBA Dec19
Scotland	I&C Governor Replacement	0.4	0.9	9	SGN GOV - 002 I&C Repl Sc – CBA Dec19
Scotland	MP Governor Replacement	4.1	28.1	8	SGN GOV - 003 MP Repl Sc – CBA Dec19
Scotland	Service Governor Replacement	0.5	-0.1	37	SGN GOV – 004 Serv Repl Sc – CBA Dec19
Scotland	Governor Abandonment	0.1	1.9	5	SGN GOV – 005 Aband Gov Sc – CBA Dec19
Scotland	Governor Named Projects	5.7	0.1	29	SGN GOV – 006 Named Proj Sc – CBA Dec19
Scotland	Governor Refurbishment	1.2	55.4	3	SGN GOV – 007 Refurb Sc – CBA Dec19
Scotland	Asbestos Management	0.3	0.3	14	SGN GOV – 008 Asbes Man Sc – CBA Dec19
Southern	ERS Replacement	11.4	221.8	5	SGN GOV - 001 ERS Repl So - CBA Dec19
Southern	I&C Governor Replacement	0.3	0.9	8	SGN GOV - 002 I&C Repl So – CBA Dec19
Southern	MP Governor Replacement	11.3	86.7	8	SGN GOV - 003 MP Repl So – CBA Dec19
Southern	Service Governor Replacement	2.1	0.4	29	SGN GOV – 004 Serv Repl So – CBA Dec19
Southern	Governor Abandonment	0.3	4.9	5	SGN GOV – 005 Aband Gov So – CBA Dec19
Southern	Governor Named Projects	8.4	48.1	10	SGN GOV – 006 Named Proj So – CBA Dec19
Southern	Governor Refurbishment	1.1	58.8	2	SGN GOV – 007 Refurb So – CBA Dec19
Southern	Asbestos Management	1.7	0.8	19	SGN GOV – 008 Asbes Man So – CBA Dec19
Southern	Below Ground Governor Security	6.9	6.2	14	SGN GOV – 009 Sec Bel Gro So – CBA Dec19
Total		**85**	**910**		

17.3.4 High confidence and efficient costs

At the start of the GD2 planning process we carried out an analysis and review of all our distribution asset classes to assess their condition and integrity. This enabled us to identify our assets most at risk, and those that were coming towards the end of their asset life. The information has formed the basis of our GD2 plan and investments. The options have been defined alongside CBAs, risk assessments and other data sources, allowing us to identify and understand the most cost effective and optimum investment choice.

Our approach to the CBAs was to consider as many options as possible to understand how they met the NPV. An example of this was Temple Tunnel in Scotland. Initially, our preferred option was to replace the mains at a cost £500k. However, the CBA showed simply refurbishing the brackets and pipe supports was more cost-effective and would extend the life of the asset. This has now become our preferred option.

A large proportion of this work has been contracted out. Our procurement and commercial departments have implemented a robust tendering strategy for both integrity and governors. The strategy considers historical usage and current ways of working for the proposed GD2 outputs. Furthermore, we have assessed how to encourage competition and promote innovation in the marketplace. As an example, the invitation to tender for the supply and delivery of distribution governors for both our Scotland and southern networks will shortly be published. The result of this process will be a multi-supplier framework agreement, with up to five suppliers contracted for the last year of GD1 and the whole of GD2.

With GD2 and beyond in mind, we are currently trialling two prototype governors progressed through the GD1 Network Innovation Allowance (NIA). These are the first maintenance-free governors, potentially decreasing costs over their lifespan. Trials are ongoing and initial results are positive, suggesting that they may perform better than traditionally designed units.

Installation works for governors are currently conducted in-house or using a separate works framework agreement. Framework agreements allow us to achieve more competitive pricing as we are able to aggregate installations with other maintenance required throughout the networks, where governor installation is a relatively small proportion of the overall cost.

An example of integrity innovation in GD1 is improved maintenance of Orpheus governors. Using the NIA we developed a 3D corrosion mapping system to assist engineers in assessing and monitoring for defects found on a buried vessel, without needing to excavate. Shortly, we will be implementing the system with our maintenance teams on Orpheus units, with noncompliant cathodic protection. We are currently negotiating a supplier framework agreement to use scanning services for module inspection. By introducing this technology we have saved costs on each inspection, and have seen an environmental benefit in the form of a greatly reduced carbon footprint and reduced waste, as the need to excavate is no longer necessary.

17.3.5 Investment proposal

It is not possible to compare the different costs expected in GD2 like for like with those in GD1, as they have not been separated out in GD1 in a comparable manner. In table 17-8 we have provided as clear an allocation as possible.

Table 17-8 Distribution investment proposal

SGN (£m)	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	21/22	22/23	23/24	24/25	25/26	GD2 ave
Crossings									1	1	0	0	0	0
Protection									2	2	2	2	2	2
Data loggers									1	1	1	1	1	1
Valves									1	1	1	1	1	1
Environmental									2	2	1	1	1	1
Governors									11	11	12	12	12	11
Governors & Integrity GD1	9	20	11	9	11	15	14	13						
Total	**9**	**20**	**11**	**9**	**11**	**15**	**14**	**13**	**18**	**18**	**16**	**16**	**16**	**17**

17.3.6 Cost changes since July submission

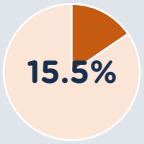
Since our July submission our total investment expectation for distribution network integrity has reduced due to the revaluation of costs associated with valves, however this has in part been offset by the inclusion of environmental initiatives.

Table 17-9 Distribution trace from July

Cost activity	Units	July	Oct	Variance	Cause of change July-Oct	Dec	Variance
Crossings	£m	2	2	0	No change	2	0
Protection	£m	8	8	0	No change	8	0
Data loggers	£m	6	6	0	No change	6	0
Valves	£m	19	5	0	> Revaluation of costs	5	0
Environmental	£m	0	7	7	> Inclusion of Environmental Initiatives	7	0
Governors	£m	58	58	0	No change	58	0
Total	**£m**	**92**	**85**	**7**		**85**	**0**

17.4 Emergency, repair, maintenance and other direct activities

Percentage of totex in GD2



Change in like-for-like expenditure from GD1*

Our operating expenditure (opex) is divided between the direct work necessary to respond to and make safe gas escapes and the work to maintain our above ground equipment. These core operational activities are emergency, repair and maintenance.

- **Emergency** - responding immediately to gas escapes and CO related calls on a 24 hour basis, appendix 013, Emergency services.
- **Repair** - assessing and making longer term repairs as the result of an emergency call out from an external gas leak, appendix 014, Repair.
- **Maintenance** - inspection of pipelines and above ground equipment, including alterations and repairs in event of a fault, appendix 016, Asset maintenance.

Whilst the underlying trend in emergency and repairs workload is driving down costs (£2.6m a year), the impact of smart meter roll-out and new bespoke outputs in maintenance have resulted in an overall increase of £3m a year in GD2. The remainder of this section covers this in more detail.

17.4.1 Maintaining an efficient emergency service

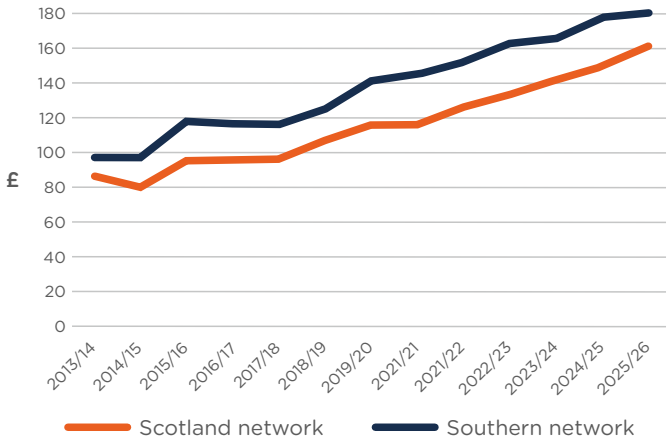
Public reported gas escapes broadly fit into two categories – internal escapes within customer premises and external escapes from mains and services. Overall, we expect fewer external public reported escapes annually as a result of our repex programme. However, as we focus on replacing tier 1 pipes, the higher diameter and higher cost tier 2 and tier 3 mains will become an increasing proportion of the overall mix. However, the vast majority of gas escapes attended by our emergency engineers are internal and outside of our control, this will dampen the impact of a decline in external escapes.

As the majority of escapes occur during cold weather (when heating is turned on), we need to maintain a skilled emergency workforce to cover these winter peaks. During the summer months we have been able to utilise this same skilled employee pool to productively deliver legacy meter work programmes. However, as smart meters become widely adopted, there will be fewer legacy meters so we will incur the cost of additional unproductive time.

We can trace how these costs have changed over the course of GD1 and the implication of the above trends on unit cost over GD2.

Plan sections: n/a
App. 013, section 6.1, 6.7
BPDT: 2.00, 2.01, 2.03, 2.22

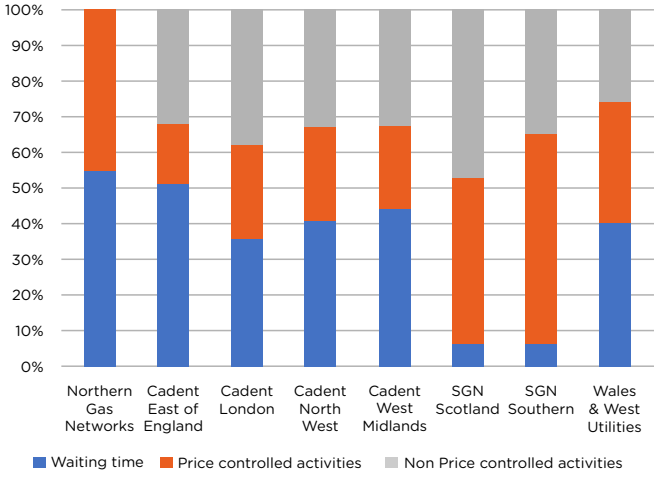
Figure 17-2 Emergency unit costs



This shows the underlying trend of increasing costs with the phasing out of legacy meter work and other cost pressures, such as labour costs. In order to minimise the impact of these cost pressures we are proposing to absorb 40% of the loss of legacy meter work (appendix 013, section 6.1).

While this trend impacts all networks, our success at filling the Summer waiting time during GD1 with legacy meter work has left us more exposed to their completion. This was demonstrated in the latest RRP submission, where Scotland unit costs are £20 per unit below the next lowest network, which is Southern (appendix 013, section 6.7).

Figure 17-3 Emergency service resource utilisation



Source: 2017/18 RRP

During GD1, we have delivered the emergency service function using a mix of direct labour and external contractors. We have then used competitively tendered rates to benchmark our internal direct labour unit costs to improve efficiency. It is however a highly transferable skillset, and with challenging labour market conditions, it is hard to recruit and easy to lose skilled staff (chapter 8c).

In GD2 our emergency service workload is anticipated to fall by approximately 3% a year, which coupled with our decision to absorb the risk of return to colder winters, demonstrates the stretching nature of costs in this area.

* Note that xoserve has been removed from the like for like expenditure for comparable purposes

Plan sections n/a
App 014 section 3.1, 6.8, 6.9
BPDT 2.01

17.4.2 Implementing effective repairs

Our emergency teams will make an escape safe, and if they are able to repair then they will, if not our repair teams will return to implement an effective repair. A key metric is the repair to report ratio which sets out the number of repairs completed according to the number of reported gas escapes. During GD2 we expect this to remain broadly constant and comparable with GD1, so the repair work will reduce in-line with the external escapes volume.

However, moving to large diameter pipes will mean the overall unit cost of repair will rise. This is due to the size of the excavation and the traffic management requirements, along with the increase in specialist skills and time required to complete the work. This has corresponding implications for the costs associated with traffic management restrictions relating to when work can be undertaken and lane rental charges (appendix 014, section 3.1 and 6.8).

We will minimise the number of escapes as far as possible by replacing the assets described in the previous chapter and by pro-actively engaging with land owners, tenants and the construction industry to address the issue of third-party interference and damage. We actively encourage third parties to identify the location of any gas mains before any work takes place; this includes using clear markers and making online information readily available through www.linesearchbeforeudig.co.uk.

Currently there are no providers of general repair contract work on our network. Where there is a specialist requirement we will contract out to specialists, such as on reinstatement, where it makes sense to do so. For example, we held a competitive tender for Scotland in 2018 which awarded work to five contractors, adding to the three reinstatement contractors in place in Southern (appendix 014, section 6.9).

We have set out how falling workloads (by approximately 3% each year of GD2), coupled with increasing cost pressures and our decision to absorb the impact of colder winters, gives the stretching nature of overall costs in this area (appendix 014, section 6.7).

17.4.3 Effective maintenance

Plan sections: 7.5.7, 7.5.8, 7.5.9, 7.5.10
App. 016, section 3.1, 6.7
BPDT: 2.00, 2.01, 2.04

Our maintenance approach is informed by three primary asset monitoring strategies:

1. Reliability centred maintenance (RCM) - active monitoring according to the asset condition
2. Condition monitoring approach (CMA) - inspection at fixed intervals and includes CM/4 surveys that provide the majority of high-quality base date that informs this plan
3. Calendar based monitoring (CBM) – mandated monitoring at fixed intervals.

The information from these monitoring activities populates our asset management repository which also supports the scheduling of inspection regimes. The strategy and the maintenance regimes are set out in more detail in Appendix 016, asset management, section 3.1.

In GD2, whilst our underlying maintenance activities are broadly flat, we have proposed approximately £5m a year of new bespoke activities relating to 3-5 storey riser surveys and responsible demolition of redundent assets. Outputs relating to this area are listed in table 7-1 at section 7.3.

As our monitoring and inspection regimes are expected to be largely unchanged when carried forward from GD1, we have a high confidence based on historical workloads and tendered unit costs, which drive the cost forecast in GD2.

17.4.4 Other direct activities

We have included other direct activities that include the cost of odorant, loads and consumables.

17.4.5 Investment proposal

Our emergency, repair and maintenance investment requirements remain broadly constant on a like-for-like basis, with reducing workloads offset by labour cost pressures and the impact of smart metering.

The investment also includes £7m a year of new outputs which are primarily riser survey work in maintenance and the anticipated increase of smart metering interventions.

Table 17-10 Emergency, repair, maintenance and other direct activities proposal

SGN (£m)	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	21/22	22/23	23/24	24/25	25/26	GD2 ave
Emergency*	22	20	25	24	24	24	26	26	26	27	27	28	28	27
Repair	34	33	26	28	28	29	28	28	27	26	25	24	24	25
Maintenance	36	27	27	29	26	32	29	30	36	36	36	37	37	36
Other Direct Activities	15	13	17	13	10	9	8	10	8	5	5	5	5	6
Total	**106**	**93**	**94**	**94**	**88**	**95**	**92**	**93**	**98**	**95**	**94**	**94**	**93**	**95**

**Includes Smart Metering Interventions*

17.4.6 Cost changes since July submission

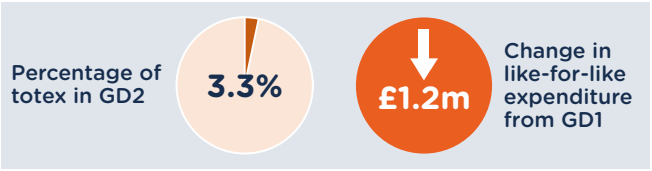
Movements from July were as a result of changes to the replacement programme and smart metering profiles. An additional change has been seen from the October to December submission, predominately driven by the inclusion of fatigue as discussed in the October business plan.

Table 17-11 Emergency, repair, maintenance and other direct activities trace from July

Cost activity	Units	July	Oct	Variance	Dec	Variance	Cause of change July-Dec
Emergency	£m	142	134	-8	136	1	>Review of workload expectations
Repair	£m	124	124	1	126	2	>Review of workload expectations
Maintenance	£m	179	182	3	182	0	>Riser Surveys and Responsible demolition
ODAs	£m	51	52	0	29	-23	>Removal of Xoserve
Total	**£m**	**496**	**492**	**-4**	**473**	**-19**	

Plan sections 12.2.5, 15
App 020 section 6.2
BPDT3.04

17.5 Network connections



In GD1 we provided on average 22,000 connections a year; 13,000 in Southern and 9,000 in Scotland. All connections are open to competition with independent connections providers (ICPs) who typically focus on new housing and industrial sites and provide approximately 60% of new connections.

As we set out in 12.2.5 we propose that new connections will be covered by a volume driver. When managing connections, we work to guaranteed standards defined under specific Guaranteed Standards of Performance (GSOPs). These include:

- GSOP 4 – currently to provide a standard quotation within six working days of receiving a request, this will be reduced to four working days
- GSOP 5 – to provide a non-standard quotation within 11 working days of receiving a request
- GSOP 6 – to provide a non-standard quotation for larger sites within 21 working days of receiving a request
- GSOP 7 – to provide accurate quotations and to refund any over charge
- GSOP 9 and GSOP 10 – to provide planned start date and substantial completion date for the works within 20 working days of receipt of a customer acceptance of a quotation; note this has been reduced to 17 days for smaller loads
- GSOP 11 – to substantially complete the works on or before the date agreed with the customer.

If we fail these standards on an individual customer basis then the customer is entitled to compensation, and we could incur fines imposed by Ofgem.

In appendix 020, Connections, we have forecast new connections according to separate reporting lines. Funding for each type of connection differs according to the amount directly recoverable from the customer. For all domestic properties within 23 metres of a relevant gas main, the Domestic Load Connection Allowance (DLCA) is applied.

17.5.1 Biomethane connections

Plan sections: 9.13
App. 006, Energy system transition
BPDT: 3.05

As we set out in the EAP, section 9.13, we have been at the forefront of bringing biomethane onto the gas network. In conjunction with other networks, biomethane developers and operators, we have developed a framework to facilitate new biomethane connections and manage the ongoing injection into the grid. This includes self-imposed standards of service in the provision of detailed capacity studies and network connection agreements. Once the agreement is signed we support the design and delivery of the project; moving through various design and commissioning phases to ensure final gas to grid timescales are met. After commissioning, we support the ongoing operation of the site - including processes such as changing injection levels, as well as assessing and developing options to improve the potential flows of green gas to the network.

Additionally, we have developed network management solutions to make further capacity available to biomethane gas producers; for example we have facilitated a connecting pipe to widen the zone of influence of a biomethane producer.

17.5.2 Gas connection work types

Plan sections: 12.2.5
App. 020, Connections, 6.2
BPDT: 3.04

Working closely with stakeholders to understand their plans for connections and their ambitions for low carbon energy, such as for district heating solutions, is set out in appendix 020, Connections, section 4. It is not clear which solutions will be adopted during GD2 so we have proposed a volume driver (section 12.2.5) for new connections. More detail on each of these connections is set out in appendix 020, section 6.2.

- **Existing housing.** Customers wanting new connections to existing housing situated within 23 metres of an existing gas main only pay after the first ten metres. As a result of this charging structure, we expect just over half of the costs of the connection will be funded through our allowances, the remaining will be funded by the customer. Typically we expect to complete approximately 9,000 connections per year though we believe there will be more uncertainty towards the end of GD2.
- **New housing developments.** Throughout GD1, we have seen a rise in the number of projects accepted for new housing. When it is a large development then there is active competition in the market and independent gas transporters (IGTs) and utility infrastructure providers (UIPs) typically compete to provide a more economically attractive multi-utility solution to developers. Where it is a smaller site, IGTs and UIPs may be less willing to offer a solution. Many of these smaller sites are in built-up areas following demolition works or the sale of a small parcel of land, often with existing infrastructure close by. We anticipate new housing connections will reduce from 8,900 a year to 6,600 a year by the end of GD2 and also note the intended policy to stop gas connections to new housing over a similar timeframe.
- **Industrial and commercial.** Investment for new services to industrial and commercial properties is fully funded by the customer. New connections for this category are steady at around 1,100 a year and will continue with similar numbers throughout GD2. We have seen some large loads coming onto the network which lead to additional reinforcement works on the network.

- **Fuel poor network extensions.** Fuel poor network extensions are important to our customers and stakeholders and an area where a supportive policy environment would allow us to deliver our aspiration. We have proposed a target of 1,000 households a year in Southern and 2,600 households a year in Scotland.
- **Infills.** These refer to areas with no gas, where the cost of provision is shared among all those that benefit from the new supply. Infills are relatively few in number.
- **Service alterations.** Service alterations are carried out when we need to make a change to an existing customer's connection, either for safety reasons or at the customer's request. The majority of service alterations are requested directly by the customer and paid for accordingly, although there are instances where a customer is vulnerable and requiring a change in their service which we will fund from our allowance base. We are forecasting just under 7,000 service alterations a year for GD2.
- **Capacity increases.** Capacity increases are predominantly funded by the customer. These are relatively few in number (< 450 a year) and can sometimes be due to customers upgrading their appliances to more energy efficient alternatives, which results in higher instantaneous peak-load but lower average consumption.
- **Disconnections.** These are fully funded by the customer and over the course of GD2 we expect the workload to be relatively constant and similar to GD1 at 1,650 a year.
- **Other gas entry.** Given the recent Government's decision to halt all UK shale exploration indefinitely (pending new science and assurances) we do not anticipate receiving shale gas entry enquiries in GD2.

17.5.3 High confidence and efficient costs

The majority of costs associated with new connections (56% of current forecasts) are directly chargeable to the customer and the majority of work is completed within a competitive environment. The remaining costs are funded through allowances which are broadly divided between domestic housing and fuel poor connections.

Predicted expenditure is based on actual costs from 2018/19. Contractors and direct labour are performance monitored and pricing is reviewed annually. Our pricing is calculated for work such as new domestic standard connections, domestic alterations and disconnections using standard charges as well as schedule of rates which include labour, materials, reinstatement, waste and traffic management costs.

As of February 2019, we logged over 46,000 calls for connections projects on our customer enquiry system, 13,500 calls for connections quotations and 7,500 calls relating to acceptances. We continue to review changes to our systems leading to improvements in customer service. We are proposing IT systems investment in GD2 to allow for service level improvements in-line with customer expectations.

17.5.4 Investment proposal

Anticipated investment costs are broadly in line with historical costs, with a tapering off of costs for new and existing houses towards the end of GD2 due to policy changes.

Table 17-12 New connections investment proposal

SGN (£m)	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	21/22	22/23	23/24	24/25	25/26	GD2 ave
New housing	4	1	4	3	4	4	4	4	4	4	4	4	4	4
Existing housing	8	9	3	10	10	12	12	12	10	10	9	9	8	9
Fuel poor	7	7	7	6	5	5	4	4	7	7	7	7	7	7
Non-domestic	1	1	5	1	0	1	1	1	0	0	0	0	0	0
Total	21	18	20	21	20	22	21	21	21	21	20	19	19	20

17.5.5 Cost changes since July submission

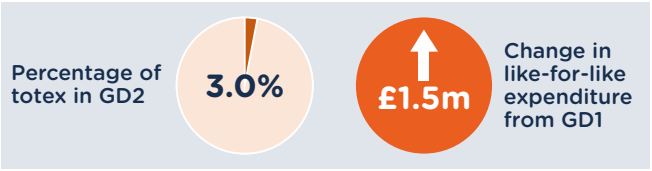
From our July submission there was an increase in the fuel poor workloads as a result of further stakeholder consultation. A revaluation of costs and workloads associated with the activities resulted in a reduction in costs from the July to the October submission.

Table 17-13 Connections trace from July

Cost activity	Units	July	Oct	Variance	Dec	Variance	Cause of change July-Dec
New housing	£m	26	25	-1	20	-5	> revaluation of costs
Existing housing	£m	46	41	-5	46	6	> revaluation of costs
Fuel poor	£m	13	42	28	34	-8	> Increase in fuel poor workloads following stakeholder consultation with revaluation of costs
Non-domestic	£m	0	0	0	0	0	No change
Total	**£m**	**86**	**107**	**22**	**100**	**-7**	

Plan sections 12.2.5, 12.2.6, 15
App 018 section 4.2, 6.2
BPDT 3

17.6 Delivering capacity



Reinforcement is necessary to ensure we have the right capacity available in the right locations to deliver our statutory obligations, the most important being our 1-in-20 licence condition (chapter 15).

There may be areas of the country where demand has reduced over time and there is spare capacity on the network, but reinforcement work is still likely to be required in other areas which are experiencing growth. As set out under legislation, networks are not allowed to discriminate in the provision of connection services.

Where a connection makes it necessary to reinforce the network, the associated costs are determined through an economic test. The direct cost of the connection is funded in full by the requesting customer. Reinforcement costs necessary to maintain 1-in-20 peak, which are less than the allowable investment following the connection of a new load, are recovered through customer bills over the lifetime of the asset.

If the cost of reinforcement exceeds the allowable investment determined by the test, then the additional amount is charged to the customer.

This section covers distribution mains reinforcement (plus associated new governors) and also capacity driven investment in the LTS, Storage and Entry category.

17.6.1 Meeting the changing needs of local communities

Plan sections: 12.2.6, 12.2.7, 15
App. 018, Capacity, 6.2, 6.8
BPDT: 3.01, 3.02

In GD2 we will invest on the basis of local demand growth and our specific concerns regarding resilience of the network, where an unexpected event or unanticipated third-party damage could have a high impact on customers.

In developing the reinforcement projects presented in our investment plan we have engaged extensively with local authority planning and energy strategy departments (examples given in appendix 18, capacity management, section 4.2). This extensive work has informed a view of each development with a probability of progression – highly probable, probable, good prospects and poor prospects which we define in detail in appendix 18, section 6.2.

Where projects are identified as highly probable, we are extremely confident a planned development will happen during GD2. Projects marked probable indicate that uncertainties remain but can be easily lifted. Projects identified as good prospects have an estimated 50% probability of being progressed before the end of GD2. Poor prospects are considered to have less than 50% probability of being progressed.

Scotland
We have met with local authorities in Scotland to discuss their plans in detail for developments we identify as high probability projects. On this basis, we anticipate the need to add approximately 73km of additional length (31 km <180mm mains and 42km >180mm mains) to the network to enable new connections. We also expect to replace approximately 23 existing district governors due to the increased capacity required from this expected growth. The forecast growth on the distribution network is expected to trigger four named projects on the local transmission network. The investment required would be £3m a year.

Southern
In Southern we have met with local authorities to discuss and assess their plans for development. We anticipate needing to add approximately 68km of additional length to the network to facilitate new connections. We also expect to replace approximately 37 existing district governors due to the increased capacity requirements required from this expected growth.

The forecast growth on the distribution network is expected to trigger two named projects on the local transmission network. The investment required would be £1.8m a year.

Policy change and net-zero
This was the basis of our forecast for reinforcement work as we developed the plan. Through the planning process the May 2019 Spring Statement, Future Homes Standard and the focus on net-zero have increased the uncertainty surrounding the pace of development. We have responded to this by proposing an uncertainty mechanism, section 12.2.6 and 12.2.7 for reinforcement on the less than 2bar and greater than 2bar network. We think these will work effectively in conjunction with the uncertainty mechanism for new connections, section 12.2.5.

17.6.2 Investment appraisal

Investment in capacity management accounts for approximately 3% of totex. We have identified and scoped 13 distribution and five transmission named projects based on anticipated growth forecasts and the subsequent necessary reinforcement work. These are detailed in the EJPs. Unlike the other investments these are not covered by a CBA methodology.

Table 17-14 Capacity investment plans

Network	Asset	Capex (£m)	NPV (£m)	Payback (yrs)	Engineering Justification Paper
Scotland	Luffness Mains – 2021	1.0			SGN Reinf – 001 CPM5070 Luffness Mains – EJP Dec19
Scotland	South East Wedge - 2022	2.3			SGN Reinf – 002 CPM7996 South East Wedge – EJP Dec19
Scotland	Aberdeen City – 2022	0.9			SGN Reinf – 003 CPM7459 Aberdeen City – EJP Dec19
Scotland	Amisfield Mains – 2022	0.6			SGN Reinf – 004 CPM1062 Amisfield Mains – EJP Dec19
Scotland	Bridgend Mains – 2023	1.5			SGN Reinf – 005 CPM7708 Bridgend – EJP Dec19
Scotland	Kingslaw Mains – 2024	1.4			SGN Reinf – 006 CPM6728 Kingslaw – EJP Dec19
Southern	Bicester – 2021	0.8			SGN Reinf – 007 CPM6595 Bicester MP – EJP Dec19
Southern	Brackley – 2022	0.9			SGN Reinf – 008 CPM6843 Brackley – EJP Dec19
Southern	Mitcham: Common - 2022	1.3			SGN Reinf – 009 CPM5288 Mitcham Common CGS – EJP Dec19
Southern	Mitcham: Depot – 2022	1.5			SGN Reinf – 010 CPM5290 Mitcham Depot CGS – EJP Dec19
Southern	Marden - 2022	1.0			SGN Reinf – 011 CPM7607 Marden MP – EJP Dec19
Southern	Uckfield – 2024	0.6			SGN Reinf – 012 CPM6992 Uckfield – EJP Dec19
Southern	Wivelsfield - 2024	0.7			SGN Reinf – 013 CPM6944 Wivelsfield – EJP Dec19
Southern	Newbury DPG - 2023	3.0			SGN Reinf – 014 CPM6564 Newbury DPG – EJP Dec19
Scotland	Transmission Capacity - 2022	14.7			SGN Trans – 030 Capa – EJP Dec19
Southern	East Morden PRS	4.5			
Southern	Wavendon PRS	4.3			
Total		37.9	n/a	n/a	

17.6.3 High confidence and efficient costs

All costs estimates used are based on historically tendered rates. In GD2 we will continue to work closely with the new connections infrastructure providers and enhance the customer experience for the UIP and iGT community. We will do this by agreeing to a limited capacity prior to completion of necessary reinforcement, renegotiating connection pressure for established sites. We will also offer the opportunity for third parties to construct contiguous reinforcement, and funding investment within third party sites where it may develop a more cost effective solution.

We are open to an increase in the level of works being carried out by UIPs and iGTs, as this will improve the overall delivery experience for customers and develop optimum, fully efficient solutions.

17.6.4 Investment proposal

Whilst our base case investment has increased relative to recent years, the risk of this not being realised is accommodated through our use of uncertainty mechanisms (chapter 12).

Table 17-15 Delivering capacity investment proposal

SGN (£m)	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	21/22	22/23	23/24	24/25	25/26	GD2 ave
Mains	3	5	9	7	12	13	10	9	12	12	11	10	9	11
Governors	1	0	1	1	0	0	2	4	2	4	3	1	3	3
Growth LTS	0	0	0	0	0	0	0	0	5	13	6	0	0	5
Total	**3**	**5**	**9**	**8**	**12**	**13**	**12**	**12**	**18**	**30**	**20**	**11**	**11**	**18**

Note: For GD1 Growth LTS included in the Transmission Network Integrity tables above

17.6.5 Cost changes since July submission

There have been cost changes made between the July and the October submission based on our assessment of risk and where costs could be more appropriately covered by a reopener or uncertainty mechanism. There was a movement of costs between the <7 bar reinforcement (governors below) and the Growth LTS due to a reclassification on project type. There are no material changes between our October draft and our final plan.

Table 17-16 Delivering capacity trace from July

Cost activity	Units	July	Oct	Variance	Cause of change July-Oct	Dec	Variance
Mains	£m	41	53	12	> Revaluation of project costings	54	1
Governors	£m	6	15	9	> Revaluation of project costings	13	-3
Growth LTS	£m	20	21	1	> Revaluation of project costings	24	3
Total	**£m**	**67**	**89**	**22**		**90**	**1**

17.7 Fleet

Percentage of totex in GD2 (all capex) **1.9%**

£2.5m Change in like-for-like expenditure from GD1

Plan sections: 10.4.4, 10.4.5, 12.2.10
Appendix 025, Fleet
BPDT: 3.06

Our commercial fleet is made up of a number of different categories of vehicle, especially chosen and configured to optimise performance and efficiency for our teams involved with first call emergency response, maintenance and repair, and other support functions using specialised equipment.

In many ways, the infrastructure that supports our ability to manage and run our networks is as critical to our operation as the pipes and components that make up the network itself. This section describes our investment proposals for our fleet assets, required to maintain an effective, reliable and efficient network capability.

17.7.1 Commercial fleet

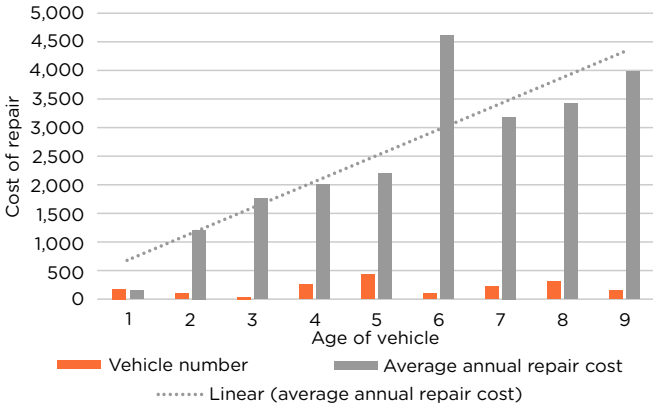
Our current commercial fleet consists of over 2,000 vehicles of different types used for different functions, as shown in table 17-17. This does not include our fleet of LNG and LPG fuel tankers which serve our Scottish customers connected to our five SIU networks (section 17.10) or the company car fleet for our employees.

Table 17-17 Commercial vehicle fleet

Vehicle type	No. of vehicles	Current fuel type
4x4	42	Diesel
FCO	494	Petrol / Diesel
Maintenance	125	Diesel
Repair	825	Diesel
Small van	153	Petrol / Diesel
Support	9	Diesel
Support - dropside	216	Diesel
Support - HGV	42	Diesel
Hired	207	Petrol / Diesel

Our largest planned investment is the cost of replacing our current commercial fleet when vehicles come to the end of their economic lives. If we maintain replacement on a like-for-like basis as compared with GD1, then our expected expenditure is £60m over the course of GD2 (approximately £12m a year). This is separated into capital expenditure of £37m and maintenance expenditure of £23m. Figure 17-4 shows the trend in repair costs over time.

Figure 17-4 Repair costs according to age



Our strategy takes into account the age of the vehicle, the condition, mileage, maintenance spend, and the operational criticality of a vehicle's role. This gives us the flexibility to replace critical vehicles that have become unreliable or require expensive major repairs, with the option to retain older vehicles with low mileage which are less critical and in good condition. For GD2 we will implement our EAP, reducing emissions through a faster replacement recycle (6-year cycle rather than the current 8-year) and the introduction of ultra-low emission vehicles (ULEV).

The other significant consideration concerns the ability of the vehicle to safely manage maximised loads on the engine, such as air compressors and lighting rigs.

There is a constant tension between the trend in new vehicles becoming heavier as a result of additional components to reduce emissions, and the ability to carry necessary equipment for our teams to complete their job. In section 9.6 we have set out our proposals for accelerating the replacement of vehicles and the roll-out of vehicles with Euro VI classified engines.

This interaction between tooling, vehicle specification and environmental standards will become an important strategic challenge as we implement our EAP with the roll-out of ULEVs (section 9.6.1)

Our EAP's objectives are partially dependent on the pace of technological change and its associated cost, which we have addressed through a proposed uncertainty mechanism (section 12.2.10).

17.7.2 Company car scheme

Our EAP explains how our company car scheme limits the selection of cars on the list according to CO_2e, currently set at 130g/km and reducing annually to reach 95g/km by the end of GD2. We offer larger allowances to incentivise employees to choose greener options which sit alongside benefit in kind taxation savings supported through reduced employer national insurance contributions. We are rolling out EV charging points on our key sites and plan more as uptake of hybrid and electric cars by employees increases. We are proposing to introduce an electric pool car at our major sites for local business journeys.

17.7.3 Other wheeled plant

We operate a small number of wheeled plant vehicles such as mobile excavators. While we have trialled an electric excavator recently, we have not included plans to switch over from diesel to alternative fuels during GD2, given the low overall contribution of 145 tonnesCO_2e.

17.7.4 High confidence and efficient costs

Historically, to ensure best value for money, capital fleet replacement has been carried out as a one-off tender. We are now in the process of moving towards framework contracts involving four suppliers. Mini-competitions are held more regularly to ensure that costs remain sharp.

We will conduct a six-monthly review as we approach GD2 with senior operations and commercial managers, including the fleet manager and head of department. The review process will help us identify any new vehicle technology available in the market, that we ensure cost effectiveness and meet our own operational challenges, and that we monitor progress towards the targets set out in our EAP. We are proposing that the outputs should be fed through to the environmental steering group.

17.7.5 Investment proposal

CBAs and EJPs have been completed for both fleet options, summarised in the table 17-18.

Table 17-18 Fleet investment appraisals

Network	Asset	Capex (£m)	NPV (£m)	Payback (yrs)	Engineering Justification Paper
Sc & So	Electric vehicles	9.5	22	0	SGN Fleet – 001EAP - CBA Dec19
Sc & So	Replacement rate	12.1	31	0	SGN Fleet – 001EAP - CBA Dec19
Total		**21.6**	**53**		

These have fed into the investment below which assumes we are delivering our EAP ambitions.

Table 17-19 Fleet investment proposal

SGN (£m)	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	21/22	22/23	23/24	24/25	25/26	GD2 ave
Capex	6	21	10	2	4	7	5	3	12	13	11	12	11	12
Opex	20	17	16	15	14	16	16	15	16	15	14	13	12	14
Total	**26**	**38**	**26**	**17**	**18**	**23**	**21**	**18**	**28**	**28**	**25**	**24**	**23**	**26**

17.7.6 Cost changes since July submission

There have been substantial changes made between the July and the October draft submissions as we have reviewed the impact of the EAP and the level of ambition our customers and stakeholders are requesting.

Table 17-20 Fleet trace from July

Cost activity	Units	July	Oct	Variance	Cause of change July-Oct	Dec	Variance
Vehicle capex	£m	43	57	14	> Inclusion of electrification of vehicles and accelerated replacement	59	2
Total	**£m**	**43**	**57**	**14**		**59**	**2**

17.8 Property

Our property portfolio includes critical national infrastructure (CNI), large offices, main depot facilities and stores with medium to high occupancy, and satellite sites – smaller occupied premises and stores facilities with lower occupancy.

We undertake to ensure we always provide a safe working environment for our people and meet all relevant compliance and legislative requirements. Our GD2 plan includes property management and compliance (maintenance), upgrades and integration into the objectives of the EAP.

Plan sections: 9A, 10.4.6, 10.5.1, 10.5.2, 12.2.10
App. 002, Property section 6.2, 6.3
BPDT: 2.08, 3.05

We have brought a previously fragmented set of property related activities together over the last five to six years, allowing us to streamline a number of processes and improve efficiency. Our property department manages five workstreams, as described below.

- **Property development.** Our development team manage professional services along with acquisitions, leases and disposals of land and buildings.
- **Property management.** This workstream ensures our worksites are fit-for-purpose, meet health and safety standards and operate efficiently. In GD2 we will build on the strategy of a centralised operating model started in GD1 to ensure standardisation, increase efficiency and reduce risks.
- **Land regeneration.** Like other GDNs, we manage the legacy of our historic gas infrastructure, most visibly in the form of gas-holders in and around towns in our two regions.
- **Land remediation.** Our statutory role is to take all steps to detect, investigate and address hazards or contaminants on our land. We have based the planned work for GD2 on external advice.
- **Estate management.** This function manages the health, safety and compliance costs associated with all land in Scotland and Southern to prevent overgrowth, concealed hazards, trespassing or fly-tipping.

These include measures for additional outputs and deliverables set out in the EAP on biodiversity (section 9.7), climate change adaptation (section 9.9) and renewable energy (section 9.6.5).

17.8.1 Security

The installation of enhanced security on 14 category three / four Critical National Infrastructure sites (under BEIS assessment) will be fully implemented by the end of GD1. Our security is based around the principles of deter, detect, delay and deny. Our GD2 plan has reassessed our sites and identified 23 where security improvements are required (chapter 8d). These sites include those considered category two under the BEIS assessments – meaning they would have a significant impact associated with a loss of supply for greater than 14 days (appendix 002).

17.8.2 Property upgrades

We maintain an ongoing programme of work that outlines the principles of the intended end of life asset upgrade and replacement for property assets based on legislative requirements, industry data and asset condition. For GD2, we want to deliver a better workplace environment for employees as well as a higher degree of energy efficiency, sustainability, innovation and carbon footprint reduction - in line with customer and stakeholder priorities. Our work programmes are broken down into the categories set out in Appendix 002, section 6.2 and include sub/superstructure assets, fabric and fittings, services, access and environmental measures.

17.8.3 High confidence and efficient costs

Our cost projections for property management, including security, are based on industry standard costs and validated using procurement data from projects delivered in GD1. Cost projections use a combination of SPONs, Architects and Builders Price Book 2019 data and benchmarked data from procured projects delivered in GD1, as well as independent consultancy expertise for specialist services. This provides a reliable and robust source of data for operating costs.

17.8.4 Investment proposal

We have supported our investment proposal with a set of CBAs and EJPs for the major developments where we will respond to our stakeholders to deliver the level of ambition we have set out with the investment proposal. Where there is not a CBA due to lack of information we have provided an EJP to define the scope of the project.

Table 17-21 Property investment appraisals

Network	Asset	Capex (£m)	NPV (£m)	Payback (yrs)	Engineering Justification Paper
Sc & So	Property Management and Projects	12.6	11	0	CBA - SGN Prop 005
Sc & So	Biodiversity	N/A	-	-	EJP – SGN Prop 001
Sc & So	Climate Change Adaption	N/A	-	-	EJP – SGN Prop 002
Sc & So	Renewable Energy	1.7	2	12	EJP – SGN Prop 003
Sc & So	Energy Management and Utility Reduction	1.6	1	11	EJP – SGN Prop 004
Total		**15.8**	**13.9**		

These have fed into the investment summary (table 17-22) which assumes we are delivering our EAP ambitions.

Table 17-22 Property investment proposal

SGN (£m)	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	21/22	22/23	23/24	24/25	25/26	GD2 ave
Property capex	2	4	6	5	3	3	6	7	5	6	6	6	5	6
Property opex	10	11	11	12	10	11	10	10	11	12	12	12	12	12
Land and holders	4	7	14	7	10	18	4	4	8	11	6	4	4	6
Environmental opex									3	0	0	0	0	1
Total	**16**	**22**	**31**	**24**	**23**	**32**	**20**	**21**	**27**	**29**	**24**	**21**	**21**	**24**

17.8.5 Cost changes since July submission

Since our July submission, our investment proposal has changed as a result of additional measures introduced in the EAP and a shift in strategy in property management from acquisition to leasing for changing depot requirements. Overall, there has been a change from capex to opex related expenditure during GD1, although total expenditure is broadly equivalent. The move to opex is due to future uncertainty and not wanting to invest in property.

Table 17-23 Property trace from July

Cost activity	Units	July	Oct	Variance	Cause of change July-Oct	Dec	Variance
Capex	£m	31	29	2	> Inclusion of of environmental initatives	28	0
Opex	£m	65	57	8	> Changes of property strategy and realignment of costs	59	2
Holders and land	£m	32	32	0	No change	32	0
Total	**£m**	**128**	**118**	**10**		**119**	**1**

17.9 IT systems

Investment in IT supports the whole of our business. Applying the right level of investment is essential to maintaining the levels of safety, resilience and customer satisfaction expected. Given the complexity of IT and the multiple outcomes it delivers, we have used Gartner, an independent specialist, to evaluate and assess our IT expenditure during GD1 to-date. It compared our IT costs as a percentage of revenue against other asset based utilities in the UK, finding we are 16% lower than the industry peer average and we demonstrate best-in-class cost efficiency for IT. In 2018 we were recognised by the UK IT Industry Awards for the Best Use of Cloud Services, Cyber Security Project of the Year, and Highly Commended in the category of IT Project Team of the Year (appendix 011, section 3).

Plan sections: 10.7 to 10.10, 11.5
App. 011, IT Cyber Security 6.1-6.6, 6.10
BPDT: 2.07, 3.05

17.9.1 Maintaining effective and reliable IT Systems

When considering our IT investment in GD2 we have allocated it across the five categories of work listed below, and in detail in appendix 011, sections 6.1 to 6.6.

1. **IT run costs** - costs associated with day-to-day services, including servicing and support for over 5,000 end user devices, 650 terabytes of storage across 1,300 servers and 47 billion security logs. We mitigate 1,200 potential security incidents a year. Our expenditure in GD2 accounts for an average operational cost of £32.8m a year and the Gartner assessment demonstrates our services are run very efficiently.
2. **Mandatory IT investment** - these are the costs to maintain the IT estate and ensure a continuity of service throughout GD2. We view this as mandatory investment because without it, we would experience a rapid deterioration in our ability to operate and maintain our licence obligations to run a safe and reliable network. Our investment in GD2 across capex and opex accounts for an average of £8.9m a year.
3. **Customer driven investment** - standing still is not an option when our stakeholders and customers expect us to keep pace with increasing customer standards and the digital economy. The investment needed to support this accounts for £500k a year.
4. **Cyber security investment** – this is set out in section 8b.
5. **Future technology readiness** - as well as customer expectations driving change, industry participants, stakeholders and policy decision makers have expectations on how we should be performing with IT. They need us to produce higher quality data, on a near real-time basis, in order to improve network control and to support and facilitate decarbonisation. That will be achievable either through the implementation of the Industrial Internet of Things (IIoT) or improved analytics to include AI, machine learning and derived learning. We propose to invest £2.3m a year developing these opportunities.

We have included two bespoke PCDs for DCC membership and Open Data in section 10.10.

17.9.2 High confidence and efficient costs

We have taken our GD1 2018-19 costs as the baseline for our ongoing GD2 run costs. The Gartner benchmarking assessment demonstrates our existing IT services run extremely efficiently at below average costs when compared to industry peers (appendix 011, section 6.10).

Every project proposed in GD2 will be assessed for value-for-money, applying the most appropriate methodology to ensure high cost efficiency in delivery and the prevention of stranded or under-utilised IT assets and services. We follow a PRINCE2 approach to projects, ensuring rigour around governance, financial tracking and benefits realisation.

At each stage, project artefacts will be reviewed and checked, and the business case will be revisited to ensure it remains robust. Solutions will be built in line with our IT strategy while ensuring architectural principles and security standards are adhered to, unless a clear exemption is provided. Our IT strategy outlines a cloud first and 'build not buy' approach - ensuring that the total cost of ownership of all solutions is the most appropriate for the size and scale of change. Procurement thresholds will be market-tested through a transparent and open tender process.

17.9.3 Investment appraisal

For each of the main components of our business plan we have undertaken a full review and set out an EJP and associated CBA to clearly establish the proposed scope of the investment and its associated cost. These are identified in table 17-24 for IT systems.

Combined these CBAs make up 36% the total IT systems expenditure in GD2.

Table 17-24 IT systems investment appraisals

Network	Asset	Capex (£m)	NPV (£m)	Payback (yrs)	Engineering Justification Paper
Sc & So	Application refresh	2.5	108	3	SGN IT - 001 AppRef EJPDecc19
Sc & So	Back office replacement or redesign	4.0	102	3	SGN IT - 002 BO EJPDecc19
Sc & So	Business as usual consumables and break-fix devices	6.1	95	3	SGN IT - 003 BAU EJPDecc19
Sc & So	Comms refresh	6.0	96	3	SGN IT - 004 Comms EJPDecc19
Sc & So	Control room replacement or redesign	8.0	88	3	SGN IT - 005 ContRm EJPDecc19
Sc & So	Customer experience and stakeholder	2.5	1	15	SGN IT - 006 CustSk EJPDecc19
Sc & So	Cyber investment	22.3	75	3	SGN IT - 007 Cyber EJPDecc19
Sc & So	Data governance and quality	0.5	Opex only	-	SGN IT - 008 DataGov EJPDecc19
Sc & So	DCC membership	5.5	-13	50	SGN IT - 009 DCC EJPDecc19
Sc & So	Device refresh	6.0	95	3	SGN IT - 010 DevRef EJPDecc19
Sc & So	Financial planning and reporting tools	0.5	95	4	SGN IT - 011 FinPlan EJPDecc19
Sc & So	Front office replacement or redesign	6.0	95	3	SGN IT - 012 FO EJPDecc19
Sc & So	Future Technology Readiness - analytics, AI and machine learning	5.0	99	21	SGN IT - 013 AI EJPDecc19
Sc & So	Future Technology Readiness - Internet of Things, Ot/It, remote comms	6.3	95	3	SGN IT - 014 IIOT EJPDecc19
Sc & So	Integration including replacement / refresh	1.1	114	3	SGN IT - 015 Integ EJPDecc19
Sc & So	Open data	5.3	20	3	SGN IT - 016 OpenData EJPDecc19
Sc & So	Regulatory and mandatory change	2.0	95	3	SGN IT - 017 RegChg EJPDecc19
Sc & So	Telemetry refresh	2.0	110	3	SGN IT - 018 Telem EJPDecc19
Total		**91.6**	**1,368.5**		

17.9.4 Investment proposal

Table 17-25 shows that levels of investment are higher in GD2 as a result of new requirements, including cyber, DCC membership and open data initiatives driving the change. The move from capex to a more opex driven cloud solution will require comparators between GD1 and GD2 to be taken at a totex level.

Table 17-25 IT systems investment proposal

SGN (£m)	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	21/22	22/23	23/24	24/25	25/26	GD2 ave
Total capex	13	23	13	7	16	13	12	5	15	15	16	15	16	15
Total opex	21	23	24	27	28	37	33	29	32	34	36	37	39	36
Total	**34**	**46**	**37**	**34**	**44**	**50**	**45**	**34**	**47**	**48**	**52**	**53**	**55**	**51**

17.9.5 Cost changes since July submission

Our investment proposals have remained broadly in-line with the July submission on a like-for-like basis. We have included some additional outputs, mainly in the availability of open data.

Table 17-26 IT systems trace from July

Cost activity	Units	July	Oct	Variance	Cause of change July-Oct	Dec	Variance
Capex	£m	69	81	12	> Inclusion of stakeholder driven initatives incl open data and DCC membership	77	-4
Opex	£m	178	175	2	> Increase in efficiencies applied	178	2
Total	**£m**	**246**	**257**	**10**		**255**	**-1**

Plan sections n/a
App 015 section 3.1, 6.6
BPDT 2.01

17.10 Operating expenditure: managing our business

This section captures the costs associated with all the critical functions underpinning our core gas engineering expertise. Non-frontline employees make up a significant proportion of our costs, but we also invest in procurement, logistics and other support functions to ensure we are aligned with best practice.

17.10.1 Work management

Work management covers the costs for our work execution activities supporting front-line operational staff. It includes the salaries of general managers, performance managers, depot managers, team managers and administrative employees. It does not include the time and costs of any frontline operatives, engineers or specialists whose costs are allocated to the work they are involved in.

This category accounts for approximately 18% of our overall opex costs and includes the cost areas listed below, which are given in more detail in appendix 015, section 3.1.

- **Asset management.** Employee costs associated with managing our pipes and associated equipment. This includes network planning, gas quality monitoring, network capacity evaluation, investment, analysis, policy and procedures.
- **Operations management.** Costs associated with managing the delivery of our core services that are primarily in our depots. They include first-line management and supervision, business performance managers and associated costs for health, safety, scheduling, plant protection, record keeping and data quality.
- **Customer management.** These are employee costs associated with the team responsible for engaging with customers. The customer experience team is responsible for supporting customers and colleagues, providing communication and motivating our people to deliver an excellent customer service. It includes the 0800 number call handling charges and contract management.
- **System control.** Staff costs associated with running our system control function and ensuring appropriate pressures to maintain safety and minimise leakage.

17.10.2 Business support

Business support costs are incurred on business operations which are not directly associated with day-to-day activities. They include employee salaries as well as contractor or professional costs associated with work carried out by external parties. Business support (including IT) accounts for approximately 25% of overall opex costs and includes the cost categories listed below.

More detail is given in appendix 015, section 3.1.

- **Property management.** Includes costs relating to providing and maintaining property and premises not directly involved in asset operations (i.e. stores, offices, depots and training centres).
- **Audit, finance, insurance and regulation.** Costs associated with statutory and regulatory performance reporting and the financial and regulatory compliance activities for the networks.
- **CEO and group.** Costs of senior management including legal team, corporate communications, group strategy, risk compliance, investor relations and board governance.
- **Procurement.** Costs for the procurement of goods and services to support business operations, through the management of procurement contracts with suppliers.
- **Stores and logistics.** Costs associated with central stores and the delivery of material, including the monitoring of stock levels and quality testing.
- **IT and telecoms.** Costs relate to the provision of IT and telecoms services for day-to-day service delivery and include the purchase, installation and maintenance of computer and telecoms systems that are not directly related to operational activities.
- **HR and stakeholder.** Costs relating to the provisions of our HR functions associated with payroll, performance, policies and procedures and stakeholder engagement.

These costs are allocated out across the business according to the work undertaken. We follow a consistent allocation methodology that is covered by external auditing and submitted to Ofgem as a part of our annual regulatory returns. The allocation methodology is reviewed on a regular basis to ensure it remains consistent with the work we carry out (appendix 015, section 3.1).

17.10.3 Efficiency of performance

During GD1 our work management and business support teams have supported the delivery of all our annual outputs to ensure we are reliable and efficient. Analysis by an independent consultancy has benchmarked our pre-allocation work management and business support costs and concluded that we have identified an optimal balance when compared to other utilities and gas networks (appendix 015, section 6.6).

Operations management is delivered differently according to geographic region. Maintenance activities in Scotland are decentralised to deliver a better customer outcome in a sparser network, while in Southern we find a centralised maintenance approach can drive efficiency, consistency and a better customer outcome in urban settings.

Operational structures are also determined by workload. Southern workloads for repex and risers are sufficient to have dedicated depots and teams, however in Scotland, lower workloads require more cross-training and greater adaptability of the team. Independent analysis comparing our opex-per-customer and opex-per-kilometre with other networks confirms we deliver highly efficient operating costs in comparison, operating within the 90th percentile of the benchmarking sample. This is attributed in part to our contracting strategy which allows us to draw effective performance benchmarks for services delivered, while varying our approach according to local requirements.

17.10.4 Investment proposal

The investment proposal set out in table 17-27 is for the total costs associated with work management and business support before they are allocated to different business units. Whilst we are seeing reductions in repair workloads in GD2, most of the workloads associated with repex and capex remain similar to GD1. In fact, there will be more requirements relating to compliance activities and the step up we have seen in the second half of GD1 in areas such as stakeholder engagement, legal and HR are expected to be enduring. Therefore, we are seeing a broadly similar level of expenditure in GD2 compared to GD1 with the exception of increased IT and training requirements, as set out under the workforce planning (section 8c).

Table 17-27 Work management and business support investment (pre allocation)

SGN (£m)	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	21/22	22/23	23/24	24/25	25/26	GD2 ave
Asset management	16	17	19	19	17	16	17	17	17	16	16	15	15	16
Land and holders	4	7	14	7	10	18	4	4	8	11	6	4	4	6
Operations management	64	63	61	63	64	69	69	66	67	69	67	66	70	68
Customer management	6	5	5	5	5	6	6	6	6	6	6	6	6	6
System control	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Total work management	**93**	**96**	**101**	**97**	**98**	**111**	**98**	**95**	**100**	**105**	**98**	**94**	**97**	**99**
IT and telecoms	21	23	24	27	28	37	33	29	32	34	36	37	39	36
Property	10	11	11	12	11	11	10	10	12	12	12	12	12	12
HR	2	4	4	4	4	6	5	5	7	6	6	6	6	6
Finance and regulation	20	22	22	23	23	23	27	26	23	23	24	25	24	24
Procurement	3	3	3	4	5	7	7	7	7	7	7	7	7	7
Training	6	9	14	13	9	6	7	7	9	11	11	11	10	11
Total business support	**64**	**71**	**79**	**83**	**79**	**89**	**90**	**85**	**89**	**93**	**96**	**98**	**98**	**95**
Transport, plant and tools	31	28	24	23	23	27	25	23	24	24	23	23	23	23
Total	**188**	**195**	**204**	**203**	**200**	**226**	**212**	**204**	**213**	**222**	**217**	**215**	**218**	**217**

Allocation of costs out of work management and business support opex to other cost categories average £55m and £34m a year in GD2 respectively.

17.10.5 Cost changes since July submission

The investment proposals in this area have increased by £1m per annum from the July to October submission as a result of additional initatives in IT and LAEP officers. From the October to December submission there has been a small decrease bringing the total submission back inline with the July submission.

Table 17-28 Operating expenditure: managing our business

Cost activity	Units	July	Oct	Variance	Cause of change July-Oct	Dec	Variance
Work management	£m	497	497	0	> Inclusion of EAP measures, offset by increased productivity	493	-4
Business support	£m	471	473	2	> Inclusion of stakeholder driven initatives incl open data and DCC membership	475	2
Total	**£m**	**968**	**969**	**1**		**968**	**-2**

Plan sections: 10.2.3, 11.7.2
App. 017, SIUs 6.1
BPDT: 2.21

17.11 Scottish Independent Undertakings (SIUs)

The five independent gas networks we own and operate in the more remote parts of Scotland are known as the Scottish Independent Undertakings or SIUs (referred to as Statutory Independent Undertakings by Ofgem) – each with approximately 2,000 customers.

The SIUs are unique in being too remote to be connected to the main gas network. As a result, four of the networks, at Campbeltown, Oban, Thurso and Wick, were converted to run on liquified natural gas (LNG) with the fifth network at Stornoway on the Isle of Lewis receiving Liquid Petroleum Gas (LPG). Both the LNG and the LPG have to be transported to the site by road and rail to local storage facilities. Combined, the five sites serve a relatively stable total number of approximately 9,000 mainly domestic customers.

Resilience issues are critical for our SIU sites, for both the supply of fuel - where roads can be impassable - but also for the small number of highly trained employees who have to respond to all possible challenges of operating in isolated, highland locations.

These networks help us understand the benefits of broadening gas standards through the 'Opening the gas markets' NIC project in GD1. As a result, we have a limited HSE exemption to nitrogen ballasting on the sites, reducing investment in new plant and expensive processes.

Our proposed core investment plan for our SIUs covers the minimum workload necessary to maintain a safe and reliable network, the primary driver being the mitigation of risk associated with ageing and degrading assets, as well as working to minimise the risk of a reduction in reliability. These stand-alone networks are managed in the same way as every other part of our network, applying the same risk management procedures and processes to ensure on-going safety, reliability and efficiency (appendix 017, SIUs).

17.11.1 LNG transportation strategy

Following the closure of Avonmouth all LNG comes from National Grid's Isle of Grain facility (the history of the supply to SIUs is available in appendix 017, section 3.2). This is the major cause of the steep reduction in costs during GD1. The majority of the LNG arrives in tankers, although in 2018 we began our first trial of LNG transported by rail, with a view to driving cost efficiency, improving safety, environmental impacts and reducing risks associated with delivery.

In January 2018, we engaged external consultants to complete a logistics study to determine our optimal vehicle strategy. The study concluded that to meet peak demand, our existing fleet of nine road tankers and 16 ISO tankers should be increased by another 12 full tankers retained at Provan near Glasgow.

We continue to engage with the market regarding the viability of alternative sources of LNG and ways to reduce transportation requirements.

Our plan has reassessed the alternative options available to supply energy to the SIUs, refreshing both the costs and the assumptions that underpin them (appendix 017, Annex B). This reaffirms that all alternative options, apart from the current arrangements for LNG sourced from the Isle of Grain - would require substantial capital investment and carry greater risk associated with their delivery.

17.11.2 Ongoing operational costs for GD2

Over GD1 we have delivered efficiency benefits by training and multi-skilling our on-site work teams. The ongoing operational costs associated with the five SIUs can be categorised as:

- human resource (managers, employees and field workforce);
- operating/maintenance costs;
- LNG haulage costs, including fleet maintenance costs, shipper servicing and tanker loading costs; and
- gas quality – costs associated with maintaining the requirements of the HSE GS(M)R exemption.

As a broad rule we do not expect any growth on the SIUs in GD2. New domestic customers do connect, but the LNG volume impact is balanced-out by existing customers installing more efficient boilers, thereby maintaining the supply and demand balance. The limited growth rate results in relatively stable haulage and shipping costs.

In GD2 we see a greater opportunity to maximise the use of biomethane with the SIUs. We have put forward proposals to engage in detailed feasibility design work to support biomethane development, or to blend hydrogen into the network through electrolysis from renewable energy (section 11.7.2).

17.11.3 Cost recovery

While the SIUs have largely the same operational and network integrity considerations as Southern and Scotland, their size, remoteness and fuel arrangements give them higher than average costs. These costs are recovered through an alternative funding arrangement where the additional costs are spread across the broader UK customer base, collected through National Grid Transmission's transportation charges. We continue to engage with Ofgem and BEIS on the operation of this funding mechanism during our GD2 business plan process. Historically, these arrangements have limited the ability of residents to change suppliers, however, recently introduced code arrangements have created the potential for switching suppliers and this is an option we are progressing with Ofgem.

17.11.4 Investment appraisal

For GD2 we have identified 13 separate projects and provided separate investment proposals for each in the appendix. For our five larger projects, with a value greater than £500k, we have carried out full EJPs and CBAs. These are listed in table 17-29. In total the EJPs support 56% of the total capital expenditure of £11.7m.

Table 17-29: SIU investment appraisals

Network	Asset	Capex (£m)	NPV (£m)	Payback (yrs)	Engineering Justification Paper
Scotland	Campbeltown - replace atmospheric vaporisers	0.9	-0.3	50	SGN SIU 001 EJPDec2019
Scotland	Campbeltown - E&I upgrade	1.4	3.6	0	SGN SIU 003 EJPDec2019
Scotland	Campbeltown - vessel replacement	1.3	1.1	12	SGN SIU 002 EJPDec2019
Scotland	Oban - replace hot water vaporiser	1.6	2.4	9	SGN SIU 004 EJPDec2019
Scotland	Fleet - revalidate/replace road fleet	4.7	0.5	21	SGN SIU 005 EJPDec2019
Total		**9.9**	**7.3**		

17.11.5 High confidence and efficient costs

Our strategy for opex is to maximise competition in the provision of services and we intend to reissue the tender for LNG gas shipper services in 2020 to the wider market. In the previous tender (issued in 2015 to take effect in 2016), we received several tender responses to provide LNG capacity at the Isle of Grain and other European ports. Now the operation of this complex tendering arrangement is established we have a greater understanding of the LNG market and will be able to structure the tender to maximise involvement from the gas shipper community.

We also intend to reissue the contract to provide LPG for Stornoway before the start of GD2. As previously stated, we will issue this tender to the wider LPG market which is well-established in Scotland. We will also ask if LPG suppliers will be able to include an element of bio-LPG in their submissions, helping to reduce the overall environmental impact of our network in Stornoway.

We plan to issue the LNG and LPG haulage contracts in 2022 and will specify cost effective, environmentally friendly modes of transport, including increased use of rail as an alternative to road transport (sections 9.2 and 17.7.1).

As with other parts of the network we have completed a CBA for all projects requiring an investment of more than £500k.

17.11.6 Investment proposal

Table 17-30 shows we achieved significant efficiency in the cost of fuel in the first few of years of GD1. Since then, costs have remained broadly consistent and we expect that to continue through GD2 (dependent on the derogation continuing).

Table 17-30 SIU investment proposal

SGN (£m)	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	21/22	22/23	23/24	24/25	25/26	GD2 ave
Total capex	2	3	5	3	1	2	3	3	3	3	3	3	3	3
Total opex	12	13	14	9	7	7	7	7	7	7	7	7	7	7
Total	**15**	**16**	**20**	**12**	**8**	**8**	**10**	**11**	**10**	**9**	**9**	**10**	**10**	**10**

17.11.7 Cost changes since July submission

There was no material changes between the July and October submission, the December submission reflects a small increase in capital expenditure as a result of further cost assessments.

Table 17-31 SIU trace from July

Cost activity	Units	July	Oct	Variance	Cause of change July-Oct	Dec	Variance
Capex	£m	14	15	0	No material changes	15	0
Opex	£m	33	33	0	No material changes	33	0
Total	**£m**	**48**	**48**	**0**		**48**	**0**

18 Financing information

Linked appendices

- Financeability
- Cost efficiency

18.1 Introduction and overview

It is important that Ofgem, regulated companies and interested stakeholders all work towards a price control that is financially sustainable in the short and long term. This will protect the interests of current and future customers, and the need to invest in future decarbonisation as customers have asked us to do.

In assessing financeability and our appropriate credit rating thresholds, we have also considered:

- the value to customers of a strong credit rating, a benefit which has been recognised by a range of different stakeholders;
- intergenerational fairness – avoiding burdening consumers in the longer term given that decarbonisation investment for GD3 and beyond will be significant, increasing the critical importance of attracting appropriate investment at good value for customers;
- long term financial sustainability of our company, including the ability to attract equity in future price controls;
- stability and predictability of customer bills in the future to avoid the need for steep increases; and
- linked to all of the above, investor appetite and confidence (both debt and equity) ensuring that our critical infrastructure investments are supported by strong credit metrics is a crucial plank of building confidence and reducing financing costs for consumers today and into the future.

The company and the board have examined carefully whether the company is financeable in GD2 using Ofgem's working assumptions. We conclude in this chapter that, based on the totex, outputs and incentives put forward in this plan, the notional company is financeable under Ofgem's working assumptions for GD2.

We explain why Ofgem's working assumptions would put increasing financial pressure on the actual company compared to GD1 and significantly weaken the credit quality of the energy sector at a time when we are facing unprecedented challenges and political risks.[1] They would also materially worsen the position of the company compared to GD1 and risk undermining our ability to invest in the future in decarbonisation. SGN considers that these increased financial pressures are being introduced without adequate justification from Ofgem.

The actual company, using Ofgem's working assumptions, would fall short of the credit metrics we require to achieve our planned minimum credit rating. However, the company has a wide range of financing mitigating options available and these can be used to achieve the planned minimum credit rating. None of these mitigating options have a direct impact on customer bills in GD2, but they are costly for the company to implement and alter the risk profile of the company. Therefore, they do not deliver the wider and longer-term objectives set out above.

In light of our strong objections to Ofgem's working assumptions, we set out our alternative case for cost of capital and financeability assessment in a separate Finance appendix 004i SGN Alternative Cost of Capital Assumptions. We believe a higher cost of equity is required (as we have independently justified) that meets the longer-term requirements above. Customer value is important, and we consider that our alternative financeability criteria delivers excellent customer value without creating the long term issues outlined above. We commit to reducing our share of customer bills on average by 7% on the basis of these alternative assumptions in GD2 while maintaining and enhancing our high standards of safety, service and investing in decarbonisation at an appropriate cost of equity and debt.

Our approach to considering financeability can be summarised as follows. In line with business plan guidance, we have assessed financeability in GD2 against Ofgem's working assumptions based on the notional and actual company. We have determined whether revenues and cash flows are sufficient to pay our investors and lenders and have assessed potential mitigations to aid financeability. This assessment is set out in section 18.5. In practice, financeability judgements also require evidence of whether the company can meet qualitative and quantitative thresholds, based on the way credit rating agencies assess whether a company is investment grade, given the expected cash-flows generated by the regulatory price determination. In our view, financeability assessments should include the following:

- robust working assumptions on the cost of capital
- demonstrating the ability, with no out / underperformance of the regulatory settlement, to secure appropriate credit ratings, efficient debt, equity finance and adequate liquidity
- demonstrating sufficient headroom above sub-investment grade triggers to absorb key risks/shocks
- identifying credible, economic and value adding mitigations to improve financeability if required
- striking appropriate balance for consumers, debt holders and equity providers

As part of our work on financeability, we have engaged a range of expert financial stakeholders[3] on various aspects of the GD2 regulatory methodology and current market conditions. With regards to financeability, most stakeholders considered that the risk associated with investing in energy networks has increased across the last 5 years and many raised concerns about the scale of Ofgem's proposed reduction of the cost of capital from GD1, as highlighted in section 18.2. The ratings agencies view this as detrimental to the credit position of gas distribution companies as a whole and are of the opinion that it poses significant financeability challenges.[2] Additionally, debt investors suggested that proposed regulatory changes will make it harder for the industry to attract debt capital at companies' current credit ratings, with the impact of these changes likely to be experienced as an increase in the cost of debt.

[1] As evidenced by an unprecedented increase in the volatility of energy stock returns relative to the FTSE 350 over the last 3 years. See Financeability appendix 004B for further details.

[2] Moody's: UK gas distribution networks facing lower returns, weaker credit quality in Ofgem's RIIO-2, 14 February 2019 and Moody's: Rock of low returns meets hard place of covenants, 8 October 2019

[3] Financial stakeholder engagement - summary of findings (ref 098)

Table 18-1 Ofgem's and SGN's views on the cost of capital against GD1

	GD1	Ofgem Sector Specific Decision (working assumptions)	SGN Proposal
Cost of equity (CPIH deflated)	7.7%	4.3%	6% at 60% notional gearing / 6.9% at 65% notional gearing
Cost of debt	10 year trailing average	11 year trailing average tromboning to 15 years	15 year trailing average tromboning to 20 years
Notional gearing	65%	60%	65%
Cost of capital (CPIH deflated)	4.8%	2.9%	4.0%

Ofgem's working assumptions are assessed in this chapter and further details of SGN's alternative approach to estimating the cost of capital are provided in separate Finance appendix 004i Alternative cost of capital assumptions, in line with the business plan guidelines. The consequence of the allowed cost of capital being set too low, is that the ability of the business to secure debt and equity finance at efficient levels is at risk. This risk was also highlighted by financial stakeholders, with the majority of equity investors stating that the UK energy sector is not currently an attractive investment opportunity (see 18.2). Debt investors are more optimistic about companies being able to secure debt financing, but most expected the cost of debt to increase for UK regulated utilities.

In addition to challenging Ofgem's proposed cost of capital, we note that it is possible to obtain inappropriate and misleading results from the financial metrics. We demonstrate this by considering four situations set out in Table 18-2 below.

Table 18-2 Setting and appropriate cost of capital

	Allowed cost of capital assumptions	Credit agency financial metrics	Implications
1	At the cost of capital	At or above appropriate credit thresholds	The company is financeable.
2	At the cost of capital	Below appropriate credit thresholds	The company is not financeable and will need to implement mitigating levers to improve its position.
3	Below cost of capital	At or above appropriate credit thresholds	The results artificially show the company is financeable while being detrimental to financing the business. This is credit negative and creates intergenerational distributional issues.
4	Below the cost of capital	Below appropriate thresholds	The company is not financeable.

- Situation 1 above is a desired outcome
- Situation 2 reflects the outcome which financeability assessments are designed to identify
- Situations 3 and 4 are of greater concern as unrealistic assumptions for the allowed cost of capital may appear to show the company passes target minimum credit metric thresholds. It is possible to use very low notional cost of capital assumptions and still achieve acceptable notional financeable ratios. This is because many financeability metrics are driven by the ratio of the cost of equity to the cost of debt. Similarly, it is possible to use an artificially low notional gearing figure and financeability metrics will appear much healthier. To avoid this, it is important that the allowed cost of capital assumptions are set in line with market evidence and are achievable in practice.

As set out in the separate Finance appendix 004i , we believe the working assumptions for the allowed returns proposed by Ofgem are below the cost of capital of the business, thus transferring risk from debt holders to equity holders and raising concerns as per the financeability matrix above.

18.2 Stakeholder feedback

Recognising the specialist and technical nature of financeability considerations, we have tailored our engagement approach to help us understand the views of both our customers and stakeholders who have knowledge and expertise in this field. We therefore commissioned two separate pieces of stakeholder engagement to gain feedback on key financeability issues. Below we set out the approach taken and main findings from our engagement with both stakeholder groups.

18.2.1 Engagement with expert finance stakeholders

We commissioned PwC to engage with finance stakeholders with involvement in the UK utilities industry to gather their views on various aspects of the GD2 regulatory methodology and current market conditions. Fifteen detailed interviews were conducted with subject matter experts including, UK and international equity investors, equity analysts, debt providers and credit rating agencies.

Key findings include:

Increased risk of investing in UK utilities

- All fifteen expert stakeholders interviewed identified that there had been an increase in the risk associated with investing in UK utilities over the past five years. Of the 15 stakeholders interviewed, 10 believed that the risk had materially increased, and the remaining five considered that it had somewhat increased.
- The three factors most frequently cited as driving this increased risk are the proposed changes to the regulatory regimes in both RIIO-2 and PR19, renationalisation policies of the UK Labour party and broader political pressure to deliver pro-consumer policies. Interviewees also identified the particular risk in the gas distribution industry from the uncertain Government policy of decarbonising heat and associated increased risk of asset stranding.
- There is concern among stakeholders that there is a 'race to the bottom' on setting the cost of capital across UK regulators. Several commented that these reductions are inconsistent with (and in fact contradict) the increased risk position.
- With a number of new regulatory mechanisms that depart from previous price controls, most interviewees considered that the profile of prospective risks in the energy sector is skewed to the downside. Stakeholders also considered that these changes have made the regulatory regime for UK energy networks less predictable and stable.

The financial parameters of RIIO-2 price controls

- Most stakeholders consider that Ofgem's proposed allowed return on equity (4.3% real, CPIH) is too low to compensate investors for the risk associated with investment in energy networks.

- Several interviewees considered that Ofgem had been selective by using different time periods to estimate different WACC components, that the proposed betas were too low and the assumed expected return of 50 bps. expected outperformance is conceptually invalid. Conversely, two interviewees considered the cost of capital components to be broadly in the right region at the upper end of Ofgem's range.
- Stakeholders commented that setting such a low WACC would force companies to focus on short-term financial targets, making it harder for companies to make long-term plans, passing the risk and expense of solving future challenges onto future generations. Several stakeholders suggested that Ofgem could do more to enable companies to deal with longer-term industry risks, such as asset stranding for gas distribution networks.

Equity market conditions

- Most equity investors stated that the UK energy sector is not currently an attractive investment opportunity. Those currently invested in the sector (with more direct experience and insight into current policy issues) were more pessimistic, whereas those who are not currently invested in UK utilities were less pessimistic and saw some continuing equity demand.

Debt market conditions

- Overall, the rating agencies and debt investors did not currently foresee any major issues with energy companies refinancing debt over GD2. However, most debt investors commented that the proposed regulatory changes of RIIO-2 will make it harder for the industry to attract debt capital at companies' existing credit ratings; although the impact of these changes is likely to be experienced as an increase in the price of debt rather than its availability.
- Debt investors and ratings agencies generally agreed that appropriate credit ratings for the sector should be around the lower end of the A rating band and upper end of the BBB rating band in order to provide sufficient headroom above investment grade (for the company) and liquidity (in the debt capital markets) and consistent with current market data on issuance. The expert stakeholder engagement is found in 'Financial Stakeholder Engagement for SGN's RIIO-GD2 Business Plan'.

18.2.2 Engagement with customers

An important part of our financeability assessment has been engaging customers, through a range of approaches to obtain their views on financeability issues. This is a complex topic and initial advice from our CEG was that domestic customers may find the issues too challenging for meaningful engagement. However, we heeded Ofgem's business plan guidance to engage directly with customers and have therefore used a range of research techniques (see below) to inform and educate our customers and build their capacity to engage on the topic. Our CEG has commended our efforts to discuss complex topics with customers.[4]

1. In August 2019, with the support of a specialist agency, in-depth discussions were held with 60 participants representative of our domestic current and future customers and smaller businesses. Discussions focussed on customers' views of the sharing of financial risk between the company and our customers. Customers would like debt repayments to be lower and emphasised the need for the company to invest in decarbonisation in the future.[5]
2. Building on this broader conversation, in September 2019 we engaged with well-informed customers through an online customer panel that has been running since March 2019. The panel is an enduring engagement mechanism through which we can test a variety of ideas with customers who already have a good understanding of our business. We provided well-informed customers with information about aspects relating to financeability, hosted online discussions and an online quantitative survey completed by 108 panel members.
3. In October 2019 we commissioned quantitative research from an independent research agency to ask 3,005 customers about whether investment costs should be borne by current or future customers. We also asked whether customers would prefer a lower bill now, with a risk that future bills may be higher.
4. Similar questions were covered in our business plan acceptability testing in November 2019 carried out by a different independent research agency and covering an additional 1,842 domestic and smaller business customers. There was a high degree of consistency between the results of the engagement and research that we carried out with customers. A very high proportion (95%) of customers said they had found the questions in the acceptability testing research understandable.[6]

In summary the conclusions of our research were

- **Customers would prefer a lower reduction in their bill now, to avoid a reduction in the company's credit rating that might increase the risk of bills increasing later**
  The majority of customers indicated they would be willing to forgo an additional £7 annual bill saving (a BBB+ rating costs the average consumer approximately £7 extra per year compared to BBB-), for the company to maintain a good credit score and maintain a stable future bill. This suggests that consumers strongly favour SGN targeting a BBB+ credit rating to minimise risk exposure. Results from our three quantitative research surveys representing the views of 4,955 customers and future customers showed that at least three quarters supported this view.[7]
  (While this is considered the optimal credit rating, as explained in section 18.4.1 we are able to accommodate, if necessary, a minimum credit rating of BBB/Baa2 – i.e. one notch lower than the notional company.)
- **Overall, the majority believe that current and future customers should pay their fair share of long-term investments**
  Results from our customers panel survey and willingness to pay showed that customers were split with equal numbers believing that the cost of long-term investments should be borne by future customers and by current customers. The business plan acceptability research (67% Domestic Southern, 72% Domestic Scotland, 74% SME Southern and 70% SME Scotland) and the customer panel survey (82%) demonstrated a strong majority who would like current and future customers to pay their fair share.

[4] Customer engagement group meeting minutes
[5] Shaping the Business Plan Qualitative Workshops - Sharing Financial Risk. Innovation Investment (ref 083)
[6] Business Plan Acceptability Testing Phase 1 and 2 (ref 078, 079)
[7] Stage 3: Conjoint & WtP summary reports (Valuation Phase) wave 1 and 2 (ref 005, 094), Business Plan Acceptability Testing Phase 1 and 2 (ref 078, 079), Shaping the Business Plan Qualitative Workshops - Sharing Financial Risk. Innovation Investment (ref 083)

- **Customers have a preference for stable bills over the longer term**
  All elements of our research demonstrated customers' preference for stable bills in the longer term. A strong majority of the customer panel (92%), and respondents in the acceptability testing survey (85% domestic Southern, 89% domestic Scotland, 87% SME Southern and 90% SME Scotland) thought it was important that their bill was stable rather than highly variable over time.

We generated additional insight as a result of the more in-depth information sharing and discussions with informed customers and future customers on our panel.

- There was strong agreement (88% in agreement) that a company which is lowering gas bills and performing well should receive a fair return[8]
- The majority agreed (93% in agreement) that it is important to have long term investors who are able to fund the green energy solutions that customers want[8]
- The majority agreed we should maintain a good credit rating to minimise risk exposure[8]
- The majority agreed that we should pay a fair return to shareholders and investors[8]

18.3 Importance of attracting and maintaining investment in the energy sector

There are unprecedented political and economic challenges ahead (see Financeability appendix 004 section B for further details) as well as significant transition risks as the energy sector decarbonises. Some of these challenges are unique to the gas sector and we firmly believe that Ofgem should take a longer-term perspective with respect to these critical networks consistent with its duties to future consumers. We believe this is all the more true given the need for the sector to invest to meet its net zero carbon emission obligations in an uncertain regulatory environment, particularly with respect to gas.

To align with customer expectations, the sector and SGN require:

- the ability to maintain current rating levels of strong BBB+/Baa1 (at the top end of the rating category) – Weakening of the sector credit quality would be very damaging given that SGN needs to raise £2.6bn of debt in GD2 and the costs of doing so would increase;
- a cost of debt allowance that covers historically efficient debt issuance dating back to 2005 (Moody's recent publication of 8th October confirms SGN have issued debt broadly in line with the notional energy company);
- the ability to attract and retain long term equity investors, striking an appropriate risk / reward balance; and
- delivery of the best long-term value to customers.

However, Ofgem's working assumptions are instead providing the sector, investors (and ultimately customers) with:

- a cost of equity allowance almost halving while simultaneously implicitly assuming the availability of a 5% (£300m for SGN) equity injection and significantly lower dividend yields;
- a cost of debt allowance that does not sufficiently cover our historically efficient debt issuance;
- credit metrics at the notional company that signal considerable credit weakening from GD1.

18.4 Our approach to financeability

Having set out the importance of carrying out a financeability assessment using a reasonable cost of capital allowance, this section sets out an overview of our financeability assessments of the notional and actual company based on Ofgem's working assumptions (with a fixed cost of equity). The results of these assessments are provided in section 18.5. We also show the impact of an alternative independently evidenced cost of capital proposed by SGN in a separate Financeability appendix 004 Alternative cost of capital assumptions.

18.4.1 Credit Metrics

Compliance with rating agency methodology

It is important that debt financeability assessments are consistent with rating agency methodologies and published thresholds. Our financeability assessment, wherever possible, seeks to take into account credit rating agency methodologies.

Where revenues are insufficient to meet financeability thresholds, some levers proposed by Ofgem to mitigate this position (such as capitalisation or depreciation rates) may be inconsistent with credit rating agency treatment (who might 'look through' these timing adjustments), and thus these levers would not remedy the problem. For example, decreasing capitalisation rates may help to improve liquidity but it does not enhance creditworthiness.

Rating thresholds

We have reviewed guidance published by the credit rating agencies and have sought input from them on credit metric thresholds which provide ranges that incorporate a weighting of qualitative and quantitative factors. We have set out in the table below our understanding of the appropriate thresholds for the key credit metrics for each of Moody's, Fitch and S&P, (assuming that the qualitative assessments do not deteriorate):

Table 18-3 Minimum Target Thresholds

Rating Agency	Ratio	BBB+/Baa1	BBB/Baa2	BBB-/Baa3
Moody's	AICR	>1.4	>1.2	>1.1
Fitch Ratings	PMICR - Senior Unsecured	>1.5	>1.3	>1.1
	PMICR - Issuer Default Rating	>1.7	>1.5	>1.3
S&P Global	FFO / Net Debt	>9%	>6%	>5%

For the purposes of assessing Fitch's PMICR credit metric within the finaciability assessments we take the issuer default threshold for the BBB- trigger and the average of the senior unsecured and issuer defaults rating thresholds for the other triggers.

Details of the credit metric calculations and ratings thresholds are found in the Financeability Appendix 004i.

Appropriate minimum credit rating

Given the current economic and political environment, it is extremely important for regulated network companies to be able to achieve strong credit ratings in order to facilitate efficient access to debt capital markets allowing them to maintain existing capital structures and attract further investment to meet the long-term challenges faced by the energy sector. Achieving strong credit

[8] Customer Panel - financeability report (ref 093)

ratings is also firmly supported by consumers, with the majority of respondents to our consumer panel agreeing that it is important for the company to maintain strong credit ratings, so we can borrow funds when needed at an efficient cost. Indeed, the majority also indicated that they would be willing to forgo an additional £7 annual bill saving for SGN to maintain strong credit ratings and to keep future bill costs down.[9]

In addition, strong credit ratings are particularly important given the changes in the regulatory environment which could result in credit negative actions. The financial stakeholders with which we have engaged considered that cuts to allowed returns will make it harder for companies to achieve the A/BBB rating level that Ofgem uses to benchmark the cost of debt allowance, with some interviewees suggesting that firms would find it difficult to secure the financing needed at ratings lower than BBB(flat)/Baa2 due to less liquidity below this rating.

We consider that the appropriate rating for the notional company should be consistent with the index rating that is used to set the allowed cost of debt (i.e. the iBoxx A/BBB non-financials index). Therefore, the notional company will need a rating at the upper/middle end of the BBB+/Baa1 band.

Minimum rating for the notional company

Taking into account the factors in Table C1 in the Financeability appendix 004 section C, which summarises the impacts of BBB+/Baa1, BBB/Baa2 and BBB-/Baa3 across a series of criteria, we consider that the minimum rating for the notional company should be a strong BBB+/Baa1. Importantly, this rating provides sufficient headroom to protect the notional business, customers and investors against adverse shocks, while maintaining a robust rating required for an industry benchmark (therefore accommodating different capital structures such as quoted companies). It is also consistent with recent regulatory precedent as well as with the ratings of many UK corporates, so is therefore a more liquid part of the UK corporate debt market, an important factor in the ability of a company to continue to raise debt efficiently. This rating also closely aligns to the mid-point of the A/BBB iBoxx cost of debt index used by Ofgem to set the cost of debt allowances.

Both consumers and financial stakeholders agreed that a strong rating was important.[10]

Minimum rating for the actual company

The notional company is a regulatory standard which accommodates different actual capital structures within the sector. However, companies are free to choose an appropriate structure that matches the risk profile chosen by its Board. SGN's Board has opted for a capital structure with a level of gearing above that assumed at the notional company, to maintain a more efficient capital structure. Private shareholders may be willing to accept a lower minimum credit rating compared to the notional company (based on no outperformance on allowed and expected returns) recognising this may require a flexible approach to returns for instance in the event of operational shocks.

The SGN board considers it could continue to securely finance the business at a credit rating, which is at least two notches above sub-investment grade as there is sufficient (albeit reduced) liquidity and demand from debt investors at this credit rating (as evidenced by BBB/Baa2 corporate debt issuance); and it has the benefit of a privately held ownership structure which is able to provide more rapid additional financial support, (if required) in the event of a downside scenario, than a comparable listed UK company. We therefore set a minimum credit rating of BBB/Baa2 for the actual company as a prudent planning assumption.[11]

We do not consider that a BBB-/Baa3 rating is appropriate for either the notional or actual company in GD2. This rating provides very limited headroom against negative shocks and it would significantly increase the cost of debt compared to Ofgem's benchmark for the cost of debt – we estimate this could be around 60bps which would cost consumers in the longer term £25m per annum for SGN (2.5% on bills). Furthermore, given the criticality of the networks, we do not believe it is appropriate to run the company at this rating with insufficient headroom to maintain operational integrity. There is also far less liquidity and demand from investors for credit at BBB-/Baa3 compared to the other notches within the BBB range. The financial stakeholders we engaged had similar views and suggested that financing would be difficult at this rating given its proximity to sub-investment grade.

Further rationale for our minimum credit ratings are detailed in the Financeability appendix 004 section C.

18.4.2 Stress testing

We have undertaken stress tests on the notional and actual company to assess whether they remain investment grade under defined downside scenarios. As per Ofgem's Sector Specific Methodology Decision, we have undertaken the following stress tests and upside scenarios:

Performance

- totex performance: +/- 10% underperformance
- -2% change in RoRE from base assumption (modelled through changes in incentive income as per Ofgem's model)

Macro-economic

- interest rate scenario: +/- 1% compared to base case forward rates (iBoxx, Libor and RFR)
- CPIH Scenario: +/- 1% in each year
- RPI-CPIH divergence scenarios: +/- 0.5% from assumed wedge
- proportion of inflation linked debt: +/-5%

The results of these stress tests are explained in Financeability appendix 004 section E.

Combined Downside

This is an additional scenario which we believe is justified as it represents a combination of significant but plausible downside risks, and tests SGN's financial resilience against the combined impact of a number of the above Ofgem individual stress tests over the GD2 period. Its impact is primarily driven by a -1.3% RORE sensitivity (post 50bps outperformance assumption being removed) combined with the sensitivities below;

- -0.75% change in interest rate (for RFR, Libor and iBoxx inputs)
- -1% change in CPIH from 2% base assumption

[9] Customer Panel - financeability report (ref 093)
[10] Customer Panel - financeability report (ref 093), Financial stakeholder engagement - summary of findings (ref 098)
[11] 'Our dividend policy across the Group is to manage the level of distributions after taking into consideration the expected cash flows and investment plans across the Business, the level of committed facilities across the Group as well as the gearing covenants and targets set by Board' – SGN Annual Report & Financial Statements 2019

18.4.3 Mitigations

Where the financeability assessment does not meet the appropriate rating metric thresholds, SGN has assessed a range of mitigating levers available which can improve the credit metrics:

- acceleration of existing interest cash flows
- changes to funding mix (tenor and inflation base)
- liability management
- interest profiling
- natural de-gearing
- new OpCo equity
- amended capital structure – whole business securitisation

An explanation of each of these potential mitigating levers is found in the Financeability appendix 004 section E.

All of these levers are costly to the company and involve various implementation challenges, including: uncertain rating agency treatment, cost of delivery, execution risk, and impact on risks and ongoing costs for future price controls. We have ruled out changes that advance revenues from future price controls as a financeability lever (e.g. fast/slow money splits) due to concerns over credit rating agency treatment,[12] as set out in the Financeability appendix 004 section A. Whilst this also applies to changes in asset lives for financeability reasons, we look at asset lives later in the chapter.

18.4.4 Qualitative assessment of the notional company

Qualitative assessments are considered alongside quantitative assessments by the credit rating agencies. An important aspect of this is the stability and predictability of the regulatory regime. There has not been any published change in the qualitative ratings at present, but Moody's have commented on several potentially credit negative aspects of the RIIO2 regime that could lead to future ratings action.[13]

Given that the qualitative assessment accounts for a large proportion of the overall credit rating agency assessment, Moody's methodology attributes 60% weighting for example, SGN's overall rating is very sensitive to a negative movement in this area. This further strengthens the need to be at the top end of the BBB+/Baa1 range of the credit metric thresholds for the notional company rather than simply just within the range.

We consider the qualitative factors could change across GD2 in the following areas (further details can be found in the Financeability appendix 004 section D, using Moody's qualitative framework, as an example, and based upon SGN's most recent rating).

- Moody's have noted that interventions arising from further political pressure could weaken the transparency, stability and predictability of the regulatory regime. We view that this could result in a downgrade of this factor from Aaa to Aa, as it has in the water sector. In water, Moody's concurrently tightened ratio guidance for a given rating level by approximately 1/2 a notch to reflect the increased business risk.
- The asset ownership model rating factor is currently rated Aa, but this could be at risk from the renationalisation policy of the Labour party (potentially increased since the recently announced general election).
- The cost and investment recovery and timeliness factor is currently rated as A and we do not consider this likely to change over GD2.
- The revenue risk factor is currently rated Aa. Moody's recent report[14] has signalled revenue pressures from lower returns, and energy policy risks. We consider this is at risk of downgrade to A rating.
- The scale and complexity of capital programme is currently rated A and we do not consider this is likely to change over GD2.
- The financial policy factor is currently rated Ba. While SGN's gearing is currently higher than the Ofgem notional company, SGN's OpCo's benefit from regulatory ring-fencing provisions which partly insulate it from the credit quality of the SGN MidCo. We retain the Aa rating for the notional company for this factor.

Overall, we believe that the qualitative factors will either weaken or, at best, stay the same and SGN has little influence on these as they are driven by factors out of our control.

18.5 Financeability assessment – Ofgem's working assumptions

Not-withstanding our strong concerns over Ofgem's working assumptions explained more fully in a separate Financeability appendix 004i SGN Alternative Cost of Capital Assumptions, in this section, we set out below our financeability analysis based on the working assumptions put forward by Ofgem. We first present the notional company and then the actual company – the credit metrics shown are average forecast levels for GD2, and include both a base case (Scenario A1) which incorporates Ofgem's working assumptions including 50 bps incentive income as well as an additional scenario (Scenario A2) with no incentive income.

18.5.1 Notional company

Table 18-4 Notional company financeability assessment

CPIH deflated	BBB/ BBB- Thresholds	SCENARIO A1 Ofgem's WAs (50bps incentive income)		SCENARIO A2 Ofgem's WAs (no incentive income)	
Notional Gearing		60%		60%	
Cost of Equity		4.3%		4.3%	
Cost of Debt Trailing Av.		11-15 Yrs		11-15 Yrs	
Cost of Debt		1.93%		1.93%	
WACC		2.9%		2.9%	
		SO	SC	SO	SC
	BBB+ / Baa1				
Base Case AICR	> 1.4	1.48x	1.47x	1.39x	1.38x
Base Case PMICR	> 1.6	1.53x	1.56x	1.44x	1.47x
Base Case FFO:Net Debt	> 9%	10.2%	10.2%	9.8%	9.9%
	BBB- / Baa3				
Stress Test AICR	> 1.1	1.16x	1.16x	1.16x	1.16x
Stress Test PMICR	> 1.3	1.21x	1.25x	1.21x	1.25x
Stress Test FFO:Net Debt	> 5%	8.7%	8.9%	8.7%	8.9%

Note – Green represent top half of appropriate credit rating band, Amber is bottom half of appropriate credit rating band and red represent falling short of appropriate band.

[12] Moody's: 'Regulator's proposals undermine the stability and predictability of the regime' 22 May 2018; Moody's: 'Speed of money cannot address potential financeability concerns' 16 May 2013.

[13] Moody's: UK gas distribution networks facing lower returns, weaker credit quality in Ofgem's RIIO-2, 14 February 2019 and Moody's: Rock of low returns meets hard place of covenants, 8 October 2019.

[14] Moody's: Rock of low returns meets hard place of covenants, 8 October 2019.

Financeability appendix 004 section E sets out the notional company financeability assessment using Ofgem's working assumptions for all of Ofgem's stated financial ratios and each year of GD2 and shows the impact of all Ofgem's scenario tests.

As we have outlined previously, we consider that it is important for the notional company to achieve strong BBB+/Baa1 credit ratings. In scenario A1, using Ofgem's working assumptions, including assuming a 50-basis point assumed outperformance, the key financial metrics are close to the bottom end of the BBB+/Baa1 credit metric thresholds. The GD2 average AICR is slightly inside the Baa1 threshold of 1.4x, but the GD2 average PMICR is below the 1.6x credit metric threshold. The GD2 average FFO/net debt is within the BBB+ credit metric range. When the combined stress test is applied, the notional company's credit ratios under scenario A1 are forecast to be above the sub investment grade thresholds for AICR and FFO/net debt. Overall, based on the primary rating agency credit metrics, we confirm the notional company in scenario A1 could achieve a weak BBB+/Baa1 ratio with two of the credit rating agencies.

Whilst our analysis takes into account (and our Board assurance is based on) Ofgem's working assumptions which includes a 50bps outperformance wedge in line with Ofgem's guidance, we believe there is no justification for this wedge (further evidence set out in Financeability appendix 004i). If the wedge is removed, this would leave a 4.8% allowed and expected return, a WACC of 3.1% and the same resulting credit metrics.

However, if the 50 basis points assumed outperformance is not delivered, the notional company's financial metrics deteriorate. In particular, the AICR is below the BBB+/Baa1 threshold, joining the PMICR. In overall terms the credit metrics under Scenario A2 fail to achieve target thresholds even at the bottom end of the range for a BBB+/Baa1 credit rating.

Our analysis takes into account (and our Board assurance is based on) Ofgem's working assumptions which implicitly assumes the availability of a £300m equity injection (across both our Networks) in line with the 5% reduction in notional gearing; however, given the return to equity investors has halved since GD1, we consider such an equity injection would be extremely challenging to obtain.

18.5.2 Notional company mitigations

We note that Ofgem has effectively already applied significant mitigations to the working assumptions employed in GD1 in order to improve financeability under its stricter GD2 assumptions. These include a notional equity injection of £300m, lowering dividend yields to 3% and an immediate move to CPIH. Further details and our assessment of the GD1 vs GD2 position are set out in separate appendix 004i. Technically, the notional company therefore achieves our target credit rating without mitigating actions.

While we consider the proposed cost of equity is set at an unreasonable level, there are some alternative levers that can be considered to improve financeability under Ofgem's working assumptions. However, we believe they have limitations (these would not be required in Ofgem's base case scenario A1 but would be required under the stress test scenario A2). As discussed earlier in this chapter, we do not consider levers that accelerate revenues from future price controls acceptable to rating agencies. This leaves a further drop in notional gearing as the only other potential lever. However, we would also have major concerns about imposing this (as set out in a separate Financeability appendix 004i SGN Alternative Cost of Capital Assumptions).

18.5.3 Actual company

Table 18-5 Actual Company Financeability Assessment

CPIH deflated	BBB/ BBB- Thresholds	SCENARIO A1 Ofgem's WAs (50bps incentive income)		SCENARIO A2 Ofgem's WAs (no incentive income)	
Notional / Actual Gearing		60% / 73%		60% / 73%	
Cost of Equity		4.3%		4.3%	
Cost of Debt Trailing Av.		11-15 Yrs		11-15 Yrs	
WACC		2.9%		2.9%	
Customer Bill Change		SO	SC	SO	SC
GD1 last 3 Yrs Avg to GD2 Avg		-13%	-16%	-13%	-16%
	BBB / Baa2				
Base Case AICR	> 1.2	1.12x	1.12x	1.05x	1.05x
Base Case PMICR	> 1.4	1.15x	1.17x	1.09x	1.11x
Base Case FFO:Net Debt	> 6%	7.1%	7.0%	6.8%	6.7%
	BBB- / Baa3				
Stress Test AICR	> 1.1	0.91x	0.91x	0.91x	0.91x
Stress Test PMICR	> 1.3	0.95x	0.99x	0.95x	0.99x
Stress Test FFO:Net Debt	> 5%	6.6%	6.9%	6.6%	6.9%

The actual company at the 4.3% cost of equity plus 50bps outperformance achieves FFO/Debt within the range consistent with a BBB credit rating under S&P's metric guidance but lands below mid-range BBB. However, AICR is below the range consistent with a Baa2 credit rating under Moody's metric guidance and lands at the top end of Baa3. Finally, PMICR is below the range consistent with a BBB credit rating under Fitch's metric guidance and lands within BB+.

The actual company at the 4.3% cost of equity with zero outperformance achieves FFO/Debt within the range consistent with a BBB credit rating under S&P's metric guidance and lands below mid-range BBB+. However, AICR is below the range consistent with a Baa2 credit rating under Moody's metric guidance and lands within Ba1 and PMICR is below the range consistent with a BBB credit rating under Fitch's metric guidance and lands within BB+.

Under both scenarios, the stress tests applied result in the actual company being sub-investment grade.

Financeability appendix 004 Section E sets out the actual company financeability assessment of Ofgem's working assumptions for all Ofgem's stated financial ratios (illustrating each year of GD2) and shows the impact of all Ofgem's scenario tests.

The remainder of this section assesses the mitigating measures that can be applied to enable the actual company to achieve our planned credit rating using Ofgem's working assumptions. It provides a set of measures, analyses the trade-offs that exist in terms of cost, complexity, execution risk and intergenerational considerations.

18.5.4 Actual company mitigations

Based on our analysis, the key financial ratios on the actual company would need to improve by the amounts below, to achieve the bottom-end and mid-range of the credit metric thresholds under both the A1 and A2 cost of equity scenarios:

Table 18-6 Improvement required in credit rating metrics

Base case	So		Sc	
Mid-range	A1	A2	A1	A2
AICR	0.18x	0.25x	0.18x	0.25x
PMICR	0.35x	0.41x	0.33x	0.39x
FFO / Net Debt	0.40%	0.70%	0.50%	0.80%

Base case	So		Sc	
Bottom-end	A1	A2	A1	A2
AICR	0.08x	0.15x	0.08x	0.15x
PMICR	0.25x	0.31x	0.23x	0.29x
FFO / Net Debt	n/a	n/a	n/a	n/a

To improve credit metrics to meet the required thresholds to achieve credit ratings at the minimum level we have considered a wide range of mitigating factors under the A1 (including assumed outperformance) and A2 cost of equity scenarios. We first consider a range of financing mechanisms. These include acceleration of existing interest cash flows, tenor of funding mix and inflation base of funding mix and liability management. None of these mechanisms impact the notional company, or customer bills in GD2, but in our view have impacts on the company with potential intergenerational effects. In the table below we set out the potential credit ratio and rating improvement and the wider impacts.

To ensure that we have at least two credit ratings at the appropriate level we have specifically focused on the Moody's AICR and mitigating levers that help support credit metrics consistent with the Baa2 range as a minimum – the impact of measures that could be implemented are shown below on both A1 and A2 scenarios.

A brief explanation of each of the levers and the challenges involved with implementation of these are detailed below:

Acceleration of existing interest cash flows:
Explanation. Acceleration of interest cash flows that are due across GD2 (and beyond) to be settled in the current price control.

Implications:

- requires acceleration of existing cash flows currently scheduled for later price controls that would need to be funded by equity or debt settled in cash ahead of GD2, which will impact equity returns or leverage (and therefore financeability in the longer term);
- acceleration of contractual cash flows will incur break costs as a premium so increased cost for the business;
- represents an amendment to a reasonable risk management approach taken in 2005 ahead of debt issuance.

Funding mix – tenor:
Explanation: Issuance of debt at a shorter tenor than is a natural fit for sector assets and shorter than the tenor assumed in the cost of debt allowance. This is likely to achieve marginally lower credit spreads and is based on the shorter end of interest yield curves so will reduce forecast interest cost in GD2 versus the forecast iBoxx.

Implications:

- increased interest rate exposure is introduced into the risk management approach as a result of a basis mis-match with the regulatory allowances;
- increased refinancing risk as a result of the group's maturity profile being more concentrated at the short end of the range;
- increase in cost of carry and issuance costs as debt is refinanced more frequently and in larger amounts;
- execution risk for the volume of debt required given the reduction in demand from investors who are focused on longer dated tenors (e.g. pension funds) as a more natural fit for their liabilities;
- assuming a normal upward sloping forward interest curve (i.e. interest rates rising over the long-term),

Table 18-7 Assessment of potential mitigating actions

	Moody's				Negative impact					
	AICR improvement		Rating impact		Intergenerational cost	Material cost to implement	Execution uncertainty	CRA treatment	Company risk profile	Equity financiability
	So	Sc	So	Sc						
Cost of Equity 4.8%										
Acceleration of existing interest cash flows	*0.05x*	*0.04x*			✓	✓	✓			✓
Funding mix - tenor	*0.01x*	*0.01x*			✓		✓	✓	✓	
Funding mix - inflation base	*0.09x*	*0.14x*			✓			✓	✓	
Combined (incl. synergies)	***0.16x***	***0.21x***	*Baa2*	*Baa2*						

	Moody's				Negative impact					
	AICR improvement		Rating impact		Intergenerational cost	Material cost to implement	Execution uncertainty	CRA treatment	Company risk profile	Equity financiability
	So	Sc	So	Sc						
Cost of Equity 4.3%										
Acceleration of existing interest cash flows	*0.05x*	*0.04x*			✓	✓	✓			✓
Funding mix - tenor	*0.01x*	*0.01x*			✓		✓	✓	✓	
Funding mix - inflation base	*0.09x*	*0.14x*			✓			✓	✓	
Liability management	*0.06x*	*0.04x*			✓	✓	✓	✓		✓
Combined (incl. synergies)	***0.22x***	***0.26x***	*Baa2*	*Baa2*						

higher interest costs are pushed into later price controls creating intergenerational concerns;
- risk that credit rating agencies treatment does not achieve the ascribed benefits.

Funding mix of debt – inflation base:
Explanation: Maintain existing RPI-linked debt through to maturity and issuance of RPI-linked debt (as opposed to CPIH-linked debt) during GD2 (where asset growth will be linked to CPIH) to maintain 25% of debt in index-linked;

Implications:
- increased inflation exposure is introduced into the risk management approach as a result of a basis mis-match with the regulatory allowances;
- assuming inflation basis remain at current levels (i.e. RPI lower than CPIH over the long-term), higher interest costs (as a result of inflation) are pushed into later price controls creating intergenerational cost concerns;
- risk that credit rating agencies treatment does not achieve the ascribed benefits.

Liability management:
Explanation: Repurchase and cancellation of existing higher coupon debt by tendering for and paying the current market price (which is above par) and a premium to incentivise bondholders to sell bonds whilst issuing further debt in replacement at current (lower) market interest rates ahead of GD2.

Implications:
- requires an upfront cash payment of cash flows currently scheduled for later price controls that needs to be funded by equity or debt, which will impact equity returns or leverage (and therefore financeability);
- acceleration of contractual cash flows will incur break costs as a premium so increased cost for the business for embedded debt that was issued efficiently in previous price controls;
- execution uncertainty as precedent transactions have limited take-up (typically 30-40%) and there is no guarantee that forecast premiums will be sufficient to incentivise bondholders to sell their bonds;
- risk that credit rating agencies treatment does not achieve the ascribed benefits.

We are concerned that the wider and longer-term costs and risks of implementation could significantly outweigh the perceived benefit of such a stringent cost of capital allowance, negatively affecting SGN's shareholders and (we assume) the shareholders of the rest of the industry. The additional strain put on equity investors will store up issues for the future in terms by increasing financing costs and reducing investor appetite which will ultimately result in higher costs to consumers in the future.

Following implementation of the mitigating measures, the actual company metrics are as follows:

Table 18-8 Actual Company Financeability Assessment post mitigations

CPIH deflated	BBB/ BBB- Thresholds	SCENARIO A1 Ofgem's WAs (50bps incentive income)		SCENARIO A2 Ofgem's WAs (no incentive income)	
Notional / Actual Gearing		60% / 73%		60% / 73%	
Cost of Equity		4.3%		4.3%	
Cost of Debt Trailing Av.		11-15 Yrs		11-15 Yrs	
WACC		2.9%		2.9%	
Customer Bill Change		SO	SC	SO	SC
GD1 last 3 Yrs Avg to GD2 Avg		-12%	-15%	-13%	-16%
	BBB / Baa2				
Base Case AICR	> 1.2	1.28x	1.33x	1.27x	1.31x
Base Case PMICR	> 1.4	1.31x	1.38x	1.32x	1.36x
Base Case FFO:Net Debt	> 6%	7.3%	7.2%	7.2%	7.1%
	BBB- / Baa3				
Stress Test AICR	> 1.1	1.16x	1.19x	1.16x	1.19x
Stress Test PMICR	> 1.3	1.20x	1.25x	1.20x	1.25x
Stress Test FFO:Net Debt	> 5%	6.5%	6.5%	6.5%	6.5%

The credit metrics reach a level consistent with the minimum credit rating of BBB / Baa2 for Moody's and S&P, albeit in the bottom half of the range for the Southern network. Applying the stress test, the metric remains investment grade.

In addition to the financial mechanisms set out above, SGN has other levers available to support financeability. SGN could take a 'dividend holiday' or reduce dividends in order to lower gearing. Given the lower dividend yield of 3%, which is significantly lower than historic assumptions, this would only have a relatively small and gradual impact on credit metrics. SGN's board are not currently supportive of a shareholder equity injection as a lever for supporting financeability, given the significant reductions in returns proposed by Ofgem's working assumptions for cost of equity (in light of the additional equity risk being faced in GD2). The SGN board firmly believe that Ofgem should be calibrating the allowed returns appropriately to support financeability as putting pressure on the balance of risk and return for equity investors will store up problems for future price controls which will ultimately impact consumer bills. As an alternative, SGN could consider a capital restructuring in the form of a HoldCo financing or a whole business securitisation (WBS), however each of these would carry risk on implementation, credit rating uncertainty and would represent a material cost to the business.

As a consequence, we would prioritise implementing, as required, the four financial mechanisms set out above to maintain financeability. These are each covered in more detail in Financeability appendix 004 section E.

6 Ofgem (2019), 'Regulatory Finance Performance Annex to RIIO-1 Annual Reports – 2017-18', para 1.30

18.6 Customer bill impact

The following table sets out the bill impact (SGN's share of the overall customer bill) using Ofgem's working assumptions. The separate appendix 004i SGN Alternative Cost of Capital Assumptions includes a comparison of the bill impact under our alternative assumptions, and using these, bills are still reduced by 7% from GD1 while still providing the best long-term value to all stakeholders.

Table 18-9 Customer Bill Impact

	SCENARIO A1 Ofgem's WAs (50 bps outperformance wedge applied)		SCENARIO A2 Ofgem's WAs (No outperformance wedge applied)	
Notional Gearing	60%		60%	
Cost of Equity (CPIH deflated)	4.3%		4.3%	
Cost of Debt Trailing Avg	11 - 15 Yrs		11 - 15 Yrs	
Cost of Debt (CPIH deflated)	1.93%		1.93%	
WACC	2.9%		2.9%	
Customer Bill Change	SO	SC	SO	SC
GD1 last 3 Yrs Avg to GD2 Avg	-13%	-16%	-13%	-16%
Average Bill in GD1 last 3 years	£147	£146	£147	£146
Average Bill in GD2 *	£129	£123	£127	£122

* Excludes NTS Exit and Innovation, includes SIUs
Calculation based on the actual company

Lower totex allowances compared to GD1 and lower tax allowances are the two largest drivers contributing to the reduced bills in GD2. Whilst the reduced return also drives bills lower, this is largely offset by the move to CPIH indexation which accelerates cashflows into GD2.

We have proposed an innovation package that has a programme that we believe is appropriate for energy system transition work that is required in GD2. We estimate the NIA funding, which is directly funded by the network, would add £2 a year on a domestic customers bill. We have also proposed a national programme for NIC which, we expect to be funded through NTS charges across all GB customers. The package put forward by SGN would add a further £3 a year to consumer bills.

A breakdown of allowed revenue (including the impact of NTS Exit and Innovation) and costs to customers is found in Financeability appendix 004 section G.

18.7 Other finance issues

Key assumptions
Our assumptions for the following key parameters are set out in Financeability appendix 004 section H:

- asset lives and depreciation
- totex allowances and capitalisation rates
- GD1 close out mechanisms
- totex performance and incentive assumptions

As discussed earlier in the chapter, we have ruled out changing asset lives for the basis of financeability. We have also considered whether the asset lives should be changed in light of the future of gas scenarios. However, this uncertainty was recognised in GD1 with a move to front loaded depreciation and we believe any further change should be reviewed at the start of GD3 when more information on the energy pathway is expected to be available.

We have therefore maintained asset lives at 45 years. Finance Appendix 004 Section H also explains in more detail why we have maintained the capitalisation rate at the natural levels of 64% (Scotland) and 68% (Southern).

Financing strategy
The SGN group funding strategy has been put in place to achieve an appropriate investment grade rating through an efficient capital structure that achieves sufficient investor demand whilst managing financing risk such as inflation/interest rate exposure. We also plan to maintain sufficient liquidity headroom.

Further details of our financing strategy are found in the Financeability appendix 004 section I, Financial projections.

Financial projections
For financial projections, including allowed revenue breakdowns and summary financial statements, please refer to Financeability appendix 004 section J.

Dividend yield
We consider Ofgem's dividend yield working assumption of 3.0% to be too low, as it represents a significant fall from the 5% assumed in GD1, without adequate justification for this reduction. We believe the dividend yield should be set in line with the returns on equity and wider market expectations.

Our dividend policy is based on the principle that all parties should benefit from good performance. This means customers benefit from better service and lower bills, while investors can earn a reasonable return. Details of our dividend and equity issuance policy are found in the Financeability appendix 004 section K, Equity issuance.

Equity issuance costs
Ofgem's working assumption of 60% notional gearing implicitly assumes a significant equity issuance to move from the GD1 notional gearing level of 65%, to 60% in GD2. For SGN the incremental 5% equity issuance would equate to circa £300m. We do not consider there has been adequate justification provided for this shift.

Evidence from UK equity issuances since 2016 shows an average total cost of issuance of 5% (for transactions of £250m-£750m) in line with Ofgem's working assumption and the allowance for RIIO-GD1. Further details are found in Financeability appendix 004 section L, Key assumptions.

RORE
It has not been possible to assess the potential RORE package from the Sector Specific Decision document because no details of the incentive package for GD2 have been made available. We think the RORE range in respect of performance against allowances is limited, further suggesting that notional gearing should not reduce from the GD1 level of 65%, as this would reduce the RORE potential even further.

Furthermore, the cost of equity has been adjusted downwards for an assumed outperformance wedge of 50bps when the potential for outperformance is being significantly reduced in GD2. This is through a number of measures including cost indexation, relative and dynamic targets, a higher level of penalties and tightening of licence obligations.

Pensions
Details of pension policy is found in Financeability appendix 004 section M, Pensions.

Tax
Details of our views on tax policy are found in Financeability appendix 004 section N, Tax policy.

18.8 Conclusion

In arriving at their working assumptions, Ofgem have taken the significant short term financeability benefit of advancing cashflows through the immediate move to CPIH together with, in our opinion, unjustified, unrealistic and costly levers such as assuming a £300m notional equity injection in order improve the debt financeability of the notional company for GD2 at the expense of equity investors.

We accept that the notional company under Ofgem's working assumptions including a 50-basis points outperformance achieves credit metrics commensurate with weak BBB+/Baa1 credit ratings (albeit we believe this should sit higher up within the BBB+/Baa1 rating band due to the weakening of qualitative measures). However, we suggest this is a reflection of inappropriate working assumptions rather than the financial strength of the notional company. For example, we note that with zero outperformance, the notional company no longer achieves credit metrics in the range for BBB+/Baa1 credit rating. Alternatively, if the outperformance wedge was removed (as we believe should be the case) and both the allowed and expected returns were 4.8% under Ofgem's working assumptions, the credit metrics would return back to BBB+/Baa1.

Ofgem's working assumptions put increasing financing pressure on the actual company compared to GD1, and under these working assumptions, fails to achieve investment grade credit ratings with two credit rating agencies. Our analysis shows that it is possible to achieve BBB/Baa2 credit rating metrics against Ofgem's working assumptions for GD2, provided certain mitigating actions are implemented. However, we have concerns that these measures are not in the best interests of customers and stakeholders as they introduce costs, longer term risk and disproportionately impact equity investors in the short and longer term. This represents significant challenges for equity investors, as well as intergenerational concerns that future customers will be forced to pay the price for the strict criteria that Ofgem is advocating.

We have separately, assessed financeability against independent analysis on a more appropriate alternative cost of capital. Our assessment of the notional and actual company demonstrates that a solid financeable position can be reached whilst still delivering on average a 6% - 10% bill reduction in GD2 (SGN's share of the overall customer bill).

It should be noted that the financeability assessment is based on our business plan submission assuming totex and outputs are set as allowances / targets. Any change to these parameters or the wider RIIO framework would require us to reassess.

We believe SGN's alternative assumptions provide the best value for money for consumers as they allow for bill reductions, and for maintaining a strong credit rating, whilst ensuring we retain an environment to secure and attract equity investors now and for the future. SGN's alternative assumptions also reduce the need for significant mitigating actions, which may technically deliver the required ratings, but are not in stakeholders' best interests and will damage investor confidence in what is already a challenging time for the sector. From extensive stakeholder and customer engagement, we believe SGN's approach is supported.

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