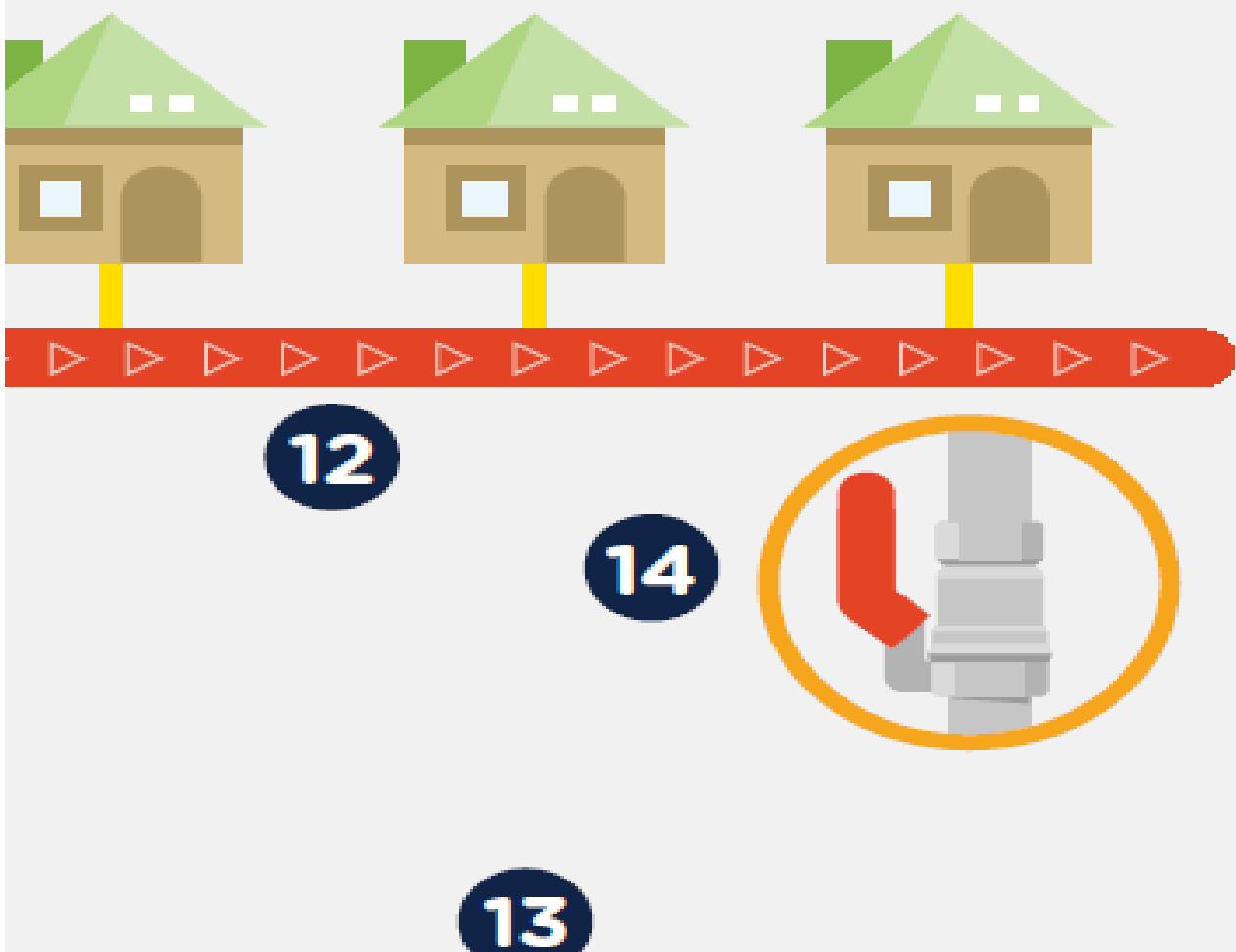


RIIO GD2 Business Plan Appendix

Domestic and Commercial Connections



Complete network diagram with explanations in Chapter 13



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Contents

1	Overview	1
2	Connections within the business plan	3
3	GD1 Performance and learnings.....	4
3.1	Overview of service delivered	4
3.2	Legislative background	4
3.3	GD1 output delivery	6
3.4	GD1 customer experience	6
3.5	GD1 allowances and expenditure.....	8
3.6	GD1 lessons learned	9
4	Stakeholder insight	10
4.1	Positive impact	10
4.2	Shared future.....	10
4.3	Safe and efficient.....	11
5	GD2 cross-sector issues	12
5.1	Decarbonisation and whole system	12
5.2	Innovation.....	13
5.3	Resilience.....	15
6	GD2 activity breakdown	17
6.1	Approach to GD2	17
6.2	GD2 outputs and price control deliverables.....	17
6.3	Bespoke outputs.....	25
6.4	Investment in existing assets.....	25
6.5	Engineering justification papers (EJPs).....	25
6.6	Investment in new assets	25
6.7	Cost efficiency	26
6.8	Managing uncertainty: volume driver	26
6.9	Competition.....	27
6.10	Real price effects	27
6.11	Financial summary.....	27
6.12	Assurance	28
7	Stakeholder supporting evidence.....	30
7.1	Providing excellent Connections services to our customers.....	30
7.2	Addressing fuel poverty.....	31

1 Overview

Scope of this appendix

We are a provider for any residential or business customer requiring a new gas connection, a service alteration or capacity increase to an existing gas service or a disconnection to an existing gas service and we operate throughout our Scotland and Southern network areas.

Depending on the type of connection, a component of the cost is charged directly to the customer and a component is socialised across all customers through our allowance allocation. This appendix covers all customers who may look to connect to our network, whether domestic, industrial, commercial, a power generator or even those looking to connect to our network to supply gas to others, such as biomethane producers.

This appendix also covers the delivery of the fuel poor network extension scheme (FPNES) and the funding of aspects of that scheme. The customer and stakeholder insights and the policy framework that determine the number of fuel poor network extension to be completed, is described in our Customer and Vulnerability Plan appendix (023).

Alteration to existing gas services and service disconnections are also detailed within this appendix, however the costs of these are covered under our Asset Maintenance appendix (016).

Impact

Our connections business is one of our main points of direct customer interface, and as such it is important we provide an excellent customer service experience, ensuring our customers receives information which is helpful to them in making a decision in a timely manner and also enabling us to deliver on that decision in the most appropriate way. The connections quotation and acceptance processes are ISO9001 (Quality Management Standard) accredited to ensure consistency and clarity.

Approach to GD2

Our approach to GD2 is to set out the investment required for the GD2 period based up on our experience from GD1 and taking into account the market changes we are aware of. Central to our approach is the requirement set out in the Gas Act (1986) for all gas networks to provide a connection to any domestic or light commercial/industrial premises within 23 metres of an existing gas main. For domestic premises, any costs covering private land and the costs of connection in excess of 10 metres on public land will be covered by the customer.

For this appendix we have categorised connection costs according to:

- 'New housing' - A new build property looking to have a connection to the gas network;
- 'Existing housing' - An existing property which currently is not connected to the gas network and requires a connection;
- 'Fuel poor' - An existing property which currently is not connected to the gas network where the home owner or tenant qualifies for financial assistance to get a connection, through our Help to Heat scheme;
- 'Alteration' - The customer requests us to make an alteration to an existing connection;
- 'Capacity increase' - The customer requests us to increase the capacity of an existing connection;
- 'Non-Domestic' - Connections to industrial and commercial properties;
- 'Infill projects' - An area of existing housing without a gas main and the customer looking for us to extend the network to make a gas connection to the property; and
- 'Disconnections' - The customer requests for the gas service to be isolated/disconnected.

Given the experience of GD1 and the uncertainty surrounding new connections in GD2, we propose a volume driver would be more appropriate for these costs to provide an appropriate balance of risk between ourselves and the customer. The detailed structure of this volume driver can be found in section 6.8.

Forecast investment

Table 1 below demonstrates our proposed investment for the GD2 period, by network and at an SGN level:

Table 1: GD2 investment proposal

SGN (£m)	21/22	22/23	23/24	24/25	25/26	Total
New housing	12.70	12.90	11.82	10.79	9.91	58.11
Existing housing	15.94	15.55	14.03	12.66	11.57	69.76
Fuel poor	7.31	7.31	7.25	7.21	7.28	36.36
Capacity increase	1.48	1.48	1.48	1.48	1.48	7.40
Non-domestic	5.30	5.27	5.25	5.22	5.19	26.23
Infills	0.12	0.12	0.12	0.12	0.12	0.60
Total	42.84	42.63	39.95	37.48	35.56	198.46
Scotland (£m)	21/22	22/23	23/24	24/25	25/26	Total
New housing	2.31	2.44	2.26	2.07	1.90	10.97
Existing housing	4.73	4.71	4.27	3.88	3.56	21.15
Fuel poor	4.89	4.89	4.84	4.81	4.86	24.29
Capacity increase	0.60	0.60	0.60	0.60	0.60	3.00
Non-domestic	2.10	2.09	2.09	2.09	2.08	10.45
Infills	0.06	0.06	0.06	0.06	0.06	0.30
Total	14.69	14.78	14.12	13.50	13.06	70.17
Southern (£m)	21/22	22/23	23/24	24/25	25/26	Total
New housing	10.38	10.46	9.56	8.72	8.01	47.14
Existing housing	11.20	10.85	9.76	8.78	8.01	48.6
Fuel poor	2.42	2.43	2.41	2.40	2.42	12.07
Capacity increase	0.88	0.88	0.88	0.88	0.88	4.40
Non-domestic	3.20	3.18	3.16	3.14	3.11	15.78
Infills	0.06	0.06	0.06	0.06	0.06	0.30
Total	28.15	27.85	25.83	23.98	22.50	128.30

Please note that for Business Plan Data Template (BPDT) reporting, existing housing; capacity increase and infills are combined under the existing housing category.

2 Connections within the business plan

This Connections appendix provides an explanation of where we expect to see new connections on our network based on the work undertaken with local authority planning departments, discussions with developers and taking into account historical trends.

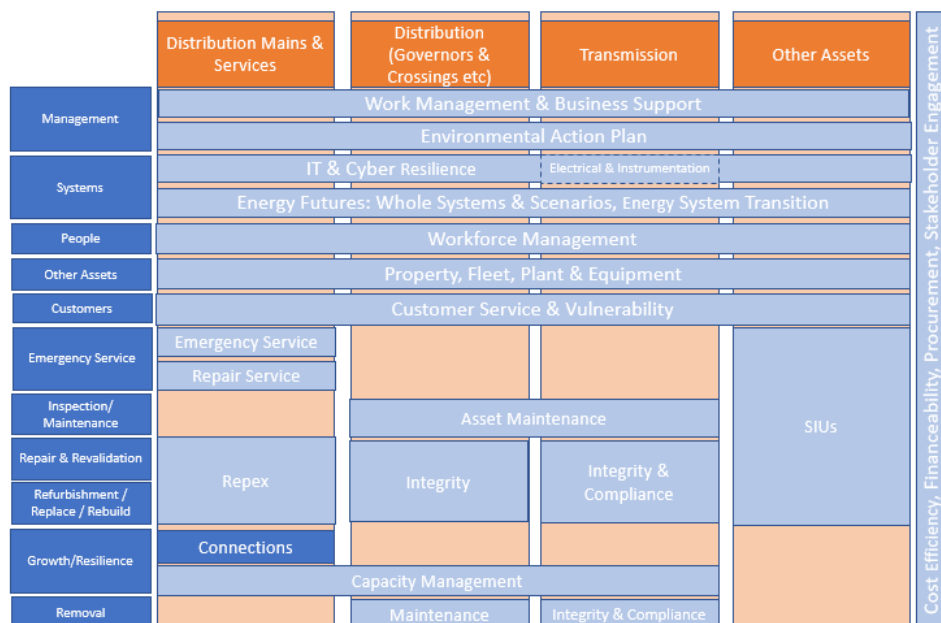
In this appendix we have set out the main points of investment which we undertook in GD1 and the investment which we are proposing to undertake in GD2. For connection investment the cost is shared with, or fully absorbed by the customer. We have set-out how the connection costs are split between the customer requesting a connection and ourselves.

Over the course of GD2 expenditure on connections is forecast to make up 3.3% of total SGN expenditure.

Our Capacity Management appendix (018) covers reinforcement requirements associated with the Connections within this appendix as well as all other network connections from independent connections providers.

Alterations and Disconnections costs are covered under our Asset Maintenance appendix (016).

Figure 1: Appendix structure



3 GD1 Performance and learnings

3.1 Overview of service delivered

In GD1 we provided typically 22,000 connections on an annual basis, with approximately 12,000 a year in Southern and approximately 10,000 a year in Scotland. Of these approximately half are connections to 'existing housing'. All connections work is contestable by Independent Connection Providers (ICPs), however typically these organisations focus on new housing and industrial, with existing housing remaining relatively uncontested.

Table 2: Numbers of new connections by type

Number of Connections		13/14	14/15	15/16	16/17	17/18	18/19
Scotland	New housing	629	848	1,222	1,232	1,398	1,431
	Existing housing	5,277	4,725	4,219	4,097	3,635	3,962
	Non-domestic	385	361	390	391	363	366
	Fuel poor	4,983	3,749	2,686	2,946	2,412	2,302
	Capacity increase	77	65	92	91	84	90
	Total	11,351	9,748	8,609	8,757	7,892	8,151
Southern	New housing	4,435	5,787	6,090	6,182	6,592	6,503
	Existing housing	5,564	5,442	5,437	5,997	5,603	5,390
	Non-domestic	428	612	629	645	632	492
	Fuel poor	1,175	1,208	1,160	1,007	840	1,626
	Capacity increase	134	163	198	226	207	210
	Total	11,736	13,212	13,514	14,057	13,874	14,221
Total SGN		23,087	22,960	22,123	22,814	21,766	22,372

New housing connections in our region are substantially greater than these figures, but as they are carried out by ICPs and therefore not included in these figures

In the BPDt section 3.04 connections, existing housing and capacity increase workloads are combined. SIU services are reported separately so are split.

In addition to these we also provide adjustment and alterations to existing connections and disconnect existing gas services where required for demolition etc. for which the cost is held within opex and covered in our Asset Maintenance appendix (016).

Table 3: Numbers of Alterations and Disconnections

Number of Connections		13/14	14/15	15/16	16/17	17/18	18/19
SC	Alterations	1,393	1,420	2,234	1,609	2,244	2,401
	Disconnections	435	375	404	380	391	412
	Total	1,828	1,795	2,638	1,989	2,635	2,831
SO	Alterations	2,414	3,556	4,164	4,673	4,433	5,287
	Disconnections	1,147	1,170	1,211	1,175	1,190	1,319
	Total	3,561	4,726	5,375	5,848	5,623	5,287
Total SGN		5,389	6,521	8,013	7,837	8,258	8,100

3.2 Legislative background

The core legislation is set out under the Gas Act 1986 which states as a gas transporter, we must provide a connection to any domestic or light commercial/industrial premises within 23 metres of an existing gas main. Of this any costs on private land and the costs in excess of 10 metres on public land will be covered by the customer. The Domestic Load Connection Allowance (DLCA) covers the cost of the first 10 metres, for which we will not charge. DLCA as per definition can be used for new connections to properties that are situated within 23m of a relevant main and are wholly or mainly used for domestic purposes.

Where a connection exceeds either the distance or the annual consumption threshold of 73,200kWh as set out in

the Gas Act, the charge that is made to the customer is determined based on the bespoke costs to undertake the works. Where there is predicted to be insufficient network capacity available at the point of proposed new connection, network reinforcement will be required. The economic test, explained in our Capacity Management appendix (018), will determine the level of contribution required from the customer to fund the reinforcement if required.

For connections which are categorised under the fuel poor network extension scheme, the network is able to recover the cost of the works up to the available allowance, with any additional costs being recovered directly from customers. The scheme is agreed with Ofgem and the allowance is updated regularly to reflect current costs, details of which are published in our Connections Service charges document on our website¹.

The standards we must achieve when managing connections are defined under specific Guaranteed Standards of Performance (GSOPs):

- GSOP 4 - to provide a standard quotation within six working days of receiving a request;
- GSOP 5 - to provide a non-standard quotation ($\leq 275\text{kWh}$) within 11 working days of receiving a request;
- GSOP 6 - to provide a non-standard quotation ($> 275\text{kWh}$) within 21 working days of receiving a request;
- GSOP 7 - to provide accurate quotations and to refund any over charge;
- GSOP 9/10 - 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; and
- 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 as set out in our licence. If we do not to achieve them in more than 90% of instances as a network, then we would be exposed to fines specified by Ofgem.

¹ <https://www.sgn.co.uk/reports-publications>

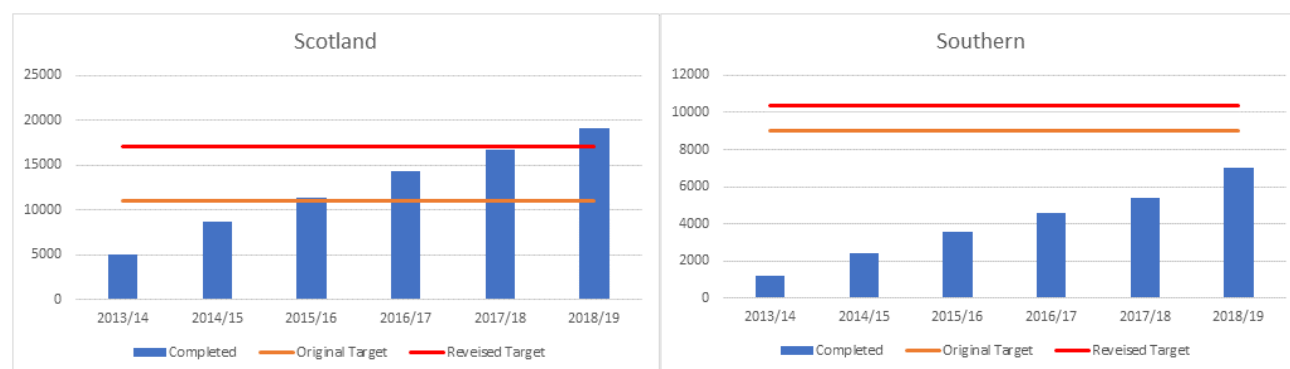
3.3 GD1 output delivery

Fuel poverty

At the end of GD1 year six (2018/19) Scotland has passed the GD1 target of 17,130 having completed 19,078 so far. In Southern the current total is 7,016 out of a target of 10,367 and we are confident of completing the remaining connections by the end of GD1.

The fuel poor targets were increased from 11,000 in Scotland and 9,000 in Southern as part of our GD1 midpoint review. Figure 2 below shows accumulative performance for GD1 against original and revised targets up to the end of 2018/19.

Figure 2: Fuel poor targets and performance



Guaranteed standards of performance (GSoP)

In GD1 we have out-performed all GSoP targets to date with average performance greater than 98% compared to a 90% minimum standard, as shown in Table 4: below.

Table 4: Connections GSoP Performance

		2013/14	2014/15	2015/16	2016/17	2017/18	Five year average
Scotland	GSOP 4	99.83%	99.50%	99.72%	99.29%	99.53%	99.6%
	GSOP 5	99.16%	99.28%	99.33%	99.34%	99.62%	99.3%
	GSOP 6	98.73%	100%	99.78%	98.29%	97.18%	98.8%
	GSOP 9/10	98.94%	99.31%	99.83%	99.87%	99.82%	99.6%
	GSOP 11	98.20%	97.73%	98.22%	98.75%	97.86%	98.2%
Southern	GSOP 4	99.79%	99.65%	99.55%	99.43%	99.74%	99.6%
	GSOP 5	99.46%	98.38%	98.22%	99.24%	99.34%	98.9%
	GSOP 6	99.01%	99.22%	98.18%	98.37%	96.11%	98.2%
	GSOP 9/10	99.66%	99.70%	99.89%	99.92%	99.81%	99.8%
	GSOP 11	98.46%	99.00%	98.58%	99.02%	94.95%	98.0%

3.4 GD1 customer experience

Competition

We do not actively compete to secure new connections. Rather, we ensure our service is available and clearly identifiable for our customers and respond to requests received. As a result, the connections market is highly competitive, with approximately 60% of connections being provided by independent Connections Providers (ICPs).

We anticipate any new large development or redevelopment, greater than 20 properties to have their connection delivered by an ICP as they can provide a multi-utility approach and provide gas, water and electricity at the same time and their business model is very focused on delivering that specific service.

Where a connection is more challenging, either a single-service, or involves smaller numbers of properties, then this may be an area of less focus for the ICPs. As a consequence, we tend to receive more requests for such quotations and have a higher acceptance rate. Table 5: below shows the project workload volumes, acceptances and customer contribution so far in GD1:

Table 5: Connections quotations and acceptance rates

		2013/14	2014/15	2015/16	2016/17	2017/18	Five year Total
Scotland	Quotations	13,271	13,093	13,191	12,730	11,807	64,092
	Acceptances	7,285	7,247	7,314	7,449	6701	35,996
	Acceptance rate	54.89%	55.35%	55.45%	58.52%	56.75%	56.20%
	Customer contribution	£9.6m	£8.2m	£7.7m	£6.6m	£7.8m	£40.0m
Southern	Quotations	25,214	25,525	26,911	27,108	25,592	104,784
	Acceptances	12,154	12,398	13,623	14,208	13,528	65,911
	Acceptance rate	48.20%	48.58%	50.62%	52.41%	52.86%	50.50%
	Customer contribution	£14.4m	£16.6m	£16.1m	£16.4m	£16.4m	£79.8m

This shows that both the number of quotations and the acceptance rate (>50%) has been reasonably consistent over the GD1 period.

The numbers above will not match BPDts as they include service alteration and disconnection quotations which are not reported under 3.04 Connections. The BPDt also does not have a section to record the number of fuel poor quotations.

Fuel poor

Eligible customers can obtain a fuel poor network connection by applying either directly to us, or through one of our partner organisations. We have 35 partners all of whom are registered with Ofgem. Our approved partners include local authorities, housing associations, local energy advice networks, the Energy Saving Trust, Warmworks, YES Energy Solutions and AgilityEco. The referral partner will undertake a home visit to provide energy efficiency advice, to consider alternative sources and to check whether gas based central heating is the most appropriate choice for that customer.

If the household is in Scotland then our referral partner will signpost the customer to Warmworks who administer the Scottish Government's Home Energy Efficiency Programme, set up in September 2015 and through which funding for central heating systems is available.

The approval form requires the partners to demonstrate how they will source funding for in-house measures. In fulfilling their obligations, these partner organisations facilitate funding for central heating from different sources, for example ECO funding, their own funding, NEA Warmer Homes Funding, the new Affordable Warmth Solutions fund, the local Central Heating Fund or our own central heating grant scheme, which was established as a part of our voluntary contribution.

Due to the centralised structure provided by Warmworks in Scotland, we find the process is significantly smoother and less challenging than in our Southern network, which tends to involve a more complex set of interdependencies. In Scotland we have also hit and are looking to surpass our target for fuel poverty. We are currently working hard to achieve our target for fuel poor connections in our Southern network and have invested additional funding of £10m to assist our customers in fuel poverty.

Figure 3 and Figure 4 below demonstrate our performance against target in each network:

Figure 3: Scotland fuel poverty performance

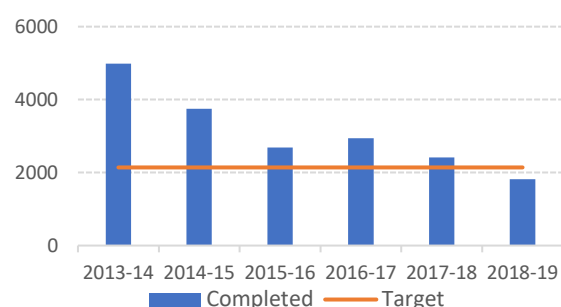
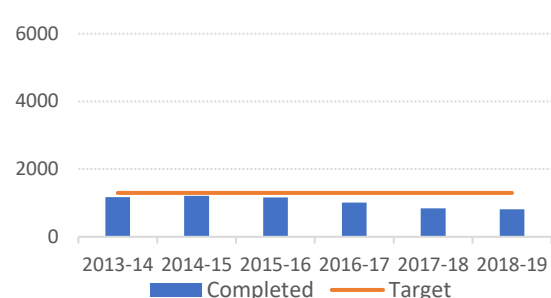


Figure 4: Southern fuel poverty performance



Customer satisfaction

We work hard to ensure our customers are satisfied, and we place a lot of emphasis on our Depot managers to respond and resolve customer concerns quickly.

Within GD1 to date (end of 2018/19) we have managed to achieve full reward within customer satisfaction and our scores have improved year on year. This has been supported by new initiatives undertaken in GD1 such as the new website upgrade which has allowed our customers to generate a 'self-quote' for a new domestic single service, service alteration or disconnection. This has been beneficial for both the customer and us as the customer is able to obtain a quick estimate of cost without us having to raise a project and carry out a site survey. Initiatives like this have helped to deliver a rise in customer satisfaction since implementation. For more information on this see our Customer and Vulnerability Plan appendix (023).

Our connections team has also achieved excellent scores for complaint handling. By improving our customers' experience, we have reduced the number of complaints originally received and an increased our focus on resolving any complaints within D+1 where possible, as shown in Table 6: below:

Table 6: Complaints numbers/performance

Year	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19
Complaints	251	195	82	52	57	46
Resolved in D+1	36	19	58	46	46	42
D+1 %	14%	10%	71%	88%	81%	91%

3.5 GD1 allowances and expenditure

Table 7: below shows our forecast expenditure in comparison to our GD1 allowances. In Southern we have exceeded the allowances received.

One of the contributing factors to the overspend in Southern has been the pressure and availability of manpower resource, which has resulted in an increased labour cost and which was unforeseen at the beginning of GD1. Other factors include the difficulties in forecasting a customer-driven work-stream in a competitive market over an eight-year period and during a period of economic and political uncertainty.

Table 7: Allowances verses expenditure for connections

		2013/14	2014/15	2015/16	2016/17	2017/18	Five year Total
Scotland	Allowance	9.8	9.6	10.8	10.9	10.6	51.7
	Expenditure	8.0	9.1	7.0	7.8	7.0	38.9
	Variance	1.8	0.5	3.8	3.1	3.6	12.8
Southern	Allowance	7.8	8.1	8.7	8.6	8.6	41.8
	Expenditure	12.6	8.6	12.6	13.1	12.9	59.8
	Variance	-4.8	-0.5	-3.9	-4.5	-4.3	-18.0

Table 8: provides a detailed comparison of our forecast expenditure against allowances. This includes new services, infrastructure, fuel poor, infills, alterations, disconnections and modifying the Emergency Control Value (ECV), but does not include allowances for all the components of connections which are discussed within this appendix.

Table 8: Funding of workload customer vs allowance splits

	Southern					Scotland			
Investment category	Opex or capex	Workload (No. services or projects)	Investment (£m)	Customer funded (£m)	Allowances (£m)	Workload (No. services or projects)	Investment (£m)	Customer funded (£m)	Allowances (£m)
New services	Capex	50,400	111.2	64.8	46.4	40,000	79.2	42.4	36.8
Infrastructure	Capex	200 (projects)	30.4	30.4	0.0	200 (projects)	6.8	6.8	0.0
Fuel poor	Capex	9,000 (10,367*)	22.1	0.0	22.1	11,000 (17,130*)	22.5	0.0	22.5
Infill	Capex	Not reported	0.1	0.1	0.0	Not reported	0.05	0.05	0.0
Alterations/ upgrade	Opex	Not reported	36.8	36.8	0.0	Not reported	12.0	12.0	0.0
Modifying ECVs	Opex	Not reported	1.6	0.0	1.6	Not reported	0.52	0.0	0.52
Disconnections	Opex	Not reported	6.8	6.8	0.0	Not reported	2.8	2.8	0.0
Total			209	139	70		124	64	60

These target workloads were increased significantly in the early stage of GD1 to be more ambitious targets

3.6 GD1 lessons learned

Throughout GD1 many factors have impacted the economy, such as the recession, Brexit and the Scottish independence referendum, which has resulted in fluctuating workloads and increased costs. This combined makes accurate forecasting very difficult. We therefore suggest a volume driver mechanism rather than an ex-ante allowance, as used in GD1, would eliminate any under/over claims for these works in the future.

In Scotland there is a contract in place with an agreed schedule of rates for when using contract labour to carry out the work where direct labour is not available. This has proved to be an efficient way of controlling and forecasting future costs. At present there is no such contract in place within our Southern network which has resulted in costs being higher than anticipated in GD1. A similar set-up or increased use of direct labour would enable costs to be controlled and keep customer contributions to a minimum.

4 Stakeholder insight

We have undertaken a comprehensive programme of engagement with customers and stakeholders throughout the development of our GD2 business plan, helping us to better understand their priorities and test our proposals. This is described in more detail in chapter 4 of our business plan and the Enhanced Engagement appendix (22).

We have categorised the key issues stakeholders and customers have identified in relation to Connections under our three commitments of; making a positive impact, building a shared future and delivering a safe and efficient service.

4.1 Positive impact

Our stakeholders and customers have told us customers' expectations are evolving and increasing, which is particularly relevant to our Connections activities²³. Through our programme of stakeholder and customer research and engagement we have sought to understand what areas are most important and drive high levels of satisfaction. Better access to information and quality of communication have consistently been identified as key areas⁴. This has been confirmed by our customer research, customer satisfaction surveys, customer focus groups, stakeholder satisfaction surveys and bespoke engagement with business customers who connect to our network⁵.



Delivering the Fuel Poor Network Extension Scheme (FPNES) allows us to play an important role in helping to lift customers out of fuel poverty and is a key component of the service we offer to support customers in vulnerable circumstances. We have engaged with stakeholders to explore our role in addressing fuel poverty at our Moving Forward Together workshops, and at specialist panels on fuel poverty in Southern and supporting our communities in Scotland⁶. This has included views on how we most effectively work with partners and target households most in need.

Section 7 gives more information on how our customers and stakeholders have shaped our thinking in relation to supporting those vulnerable in the community and providing excellent service for connections customers.

Our Customer and Vulnerability Plan appendix (023) includes full explanation of past performance, future targets and methodology in helping to reduce fuel poverty.

4.2 Shared future

Stakeholders at both our engagement events and collaborative workshops undertaken with other gas network companies have raised the important consideration the path to decarbonisation needs to consider the cost implications for customers, particularly those who are vulnerable or in fuel poverty and therefore least likely to be able to afford it⁷. Decarbonising gas so customers can continue to use their existing gas heating may prove to be a lower cost option when compared to alternatives⁸.



Our business customers indicated at our 'Connecting to our network' workshop, their greatest requirement for us in GD2 was to invest to ensure network capacity is available to allow them to keep serving their customers, and in the case of peaking plant operators, energy from gas⁹. They would also like to see us continue to offer gas

² MFT Workshop November 2018 London & Edinburgh (013,014)

³ Shaping the Business Plan Qualitative workshops - Customer Service & Supporting Vulnerable (ref 085)

⁴ Customer Service key driver analysis (ref 075)

⁵ SGN Stakeholder Satisfaction Wave 1 & 3 (data only) (ref 071, 073) Third Party Connections survey Full Report Jan 2019 (ref 067) Third Party Connections Jan 2019 report (ref 069) Stage 1: Explorative Qualitative Workshops and interviews (ref 002) Biomethane and Gas Entry connections round table event (ref 095)

⁶ Moving forward together workshops 2016,2017,2018,2019 (ref 006,007,008,009,010,011,012,013,014,016,017) Specialist panel - fuel poverty (south)(ref 022), Specialist panels (supporting our communities)(ref 018,019) Specialist Panel Southern - Supporting those at risk (ref 020,021)

⁷ ENA Future of gas report (ref 070)

⁸ Specialist panels: Future of heat, Edinburgh 1 & 2 (ref 023,024)

⁹ Third Party Connections survey Full Report Jan 2019 (ref 067,069)

connections to households in fuel poverty. Stakeholders including biomethane plant operators at our Distributed Entry Connections workshops expressed a desire to continue to connect to our network during GD2¹⁰.

Our Enhanced Engagement appendix (022) and Stakeholder Engagement Plan (024), include more details of our engagement with stakeholders and the associated outputs.

4.3 Safe and efficient

Our customers rate keeping costs down a top priority¹¹. Gas is normally a cheaper method for heating when compared to alternatives such as electricity. Helping more customers connect to gas is one of the most effective means we can provide customers with the opportunity to reduce the amount of energy they use, and experience lower bills. Customer satisfaction survey results have demonstrated the skill and professionalism of our people, and overall quality of work, are among the most important factors in driving high levels of satisfaction¹².



¹⁰ Biomethane and Gas Entry connections round table event (ref 095)

¹¹ Explorative Qualitative Workshops and interviews (Exploratory Phase) (Ref 002)

¹² Customer Service key driver analysis (ref 075)

5 GD2 cross-sector issues

5.1 Decarbonisation and whole system

There are clear links between the number of connections, decarbonisation and whole-system developments. These are expanded upon in our Energy Futures - Whole Systems and Scenarios appendix (007) and our Energy Futures – Energy System Transition appendix (006) but include:

- The pace of energy efficiency improvements in heat provision in existing housing stock and the amount of capacity this makes available to accommodate new connections;
- The pace of energy efficiency improvements in new housing stock and the additional demand this puts on the network;
- The link between peaking plant and economic revenue drivers created in the electricity market;
- The pace and location of biomethane developments and the policies providing support; and
- The pace and location of shale gas extraction sites.

Hydrogen boilers

During our engagement activities, it was clear both customers and stakeholders were excited by the opportunity to replace the natural gas supply with hydrogen or hydrogen/natural gas blends. However, feedback suggested it was unclear how the gas networks would accommodate this change and how this could be communicated in a way to support UK and Scottish Government policy. Hydrogen has the potential to significantly decarbonise the nation's heat, while minimising disruption and costs to customers.

Hydrogen is both the simplest chemical element and the most abundant in the universe. On Earth, hydrogen is found in the greatest quantities in the form of either water or hydrocarbons such as methane. It can be generated from water using electrolysis or from hydrocarbons using a steam reforming process. It is a versatile compound and is widely used as a feedstock and intermediate in the chemical industry. When hydrogen is combusted, it only produces water as a by-product to heat energy. When generated through the electrolysis of water using renewable electricity, it is known as green hydrogen. Studies such as our HyGen study and Dolphyn project suggest Green Hydrogen can be cost comparable with Natural gas at GWh scale.

If generated from natural gas through steam methane reformation, as long as the carbon dioxide is captured, it offers a carbon-free at point of use, high intensity energy vector with the potential to decarbonise the gas grid. This is known as blue hydrogen. By generating blue hydrogen centrally, we have the potential to capture emissions from over 23 million GB gas customers with further benefits such as decarbonisation of transport (through refuelling stations for fuel cell electric vehicles) and a route to market for curtailed or dedicated renewable electricity generation (through electrolysis). See section 3.8 of our Energy Futures - Energy System Transition appendix (006) for more information.

Biomethane connections

We have been at the forefront of connecting new biomethane connections to the distribution network since the UK's first successful connection at Didcot in October 2010. In conjunction with the other distribution network operators, the Energy Networks Association and biomethane developers and operators, we have developed a framework to facilitate not only new biomethane connections, but to successfully manage the ongoing injection into the grid which is paramount to the continued economic success of these decarbonisation projects. See our Energy Futures - Whole Systems and Scenarios appendix (007) and our Energy Futures - Energy System Transition appendix (006) for more information.

Other gas

We are aware of several shale gas sites which are currently in exploration or at pre-approval stage within the footprint of our Southern network. We are not currently aware of any shale sites wishing to connect to our network to inject gas, however this may change throughout the GD2 period as sites develop and technologies become more refined. In line with current licence obligations we would be required to facilitate entry connections to the network where entry capacity was available. We are cognisant of the current Scottish Government view on

planning applications for shale gas sites in Scotland and as such do not expect entry connection enquiries until the position changes.

Flexible generators (Peaking plant)

Flexible generators are relatively small modular electricity generation units typically fuelled by natural gas and designed to help balance the fluctuating power requirements of the electricity grid. Flexible generators are designed to respond to electricity market signals and when on standby these plants can be called upon and ramp up to full capacity in less than two minutes.

Connections for these customers have a significant impact on the network and as such they are progressed through our Network Management section and further details are provided within our Capacity Management appendix (018) and our Energy Futures Whole Systems and Scenarios appendix (007).

5.2 Innovation

Some examples of innovative tools and techniques we have utilised within our connections workstream are described below and are set-out in more detail in the Innovation appendix (008).

Core and Vac excavation machines

The aim of this project was to develop new techniques, products and methods which reduce or eliminate the requirement for: excavation; significant operational footprint; multi-stage reinstatement; complex traffic management; and disruption to our customers, while maintaining safety and efficiency.

In 2012 we pioneered the first combined core and vacuum excavation (core & vac) vehicle and end-to-end process for repairing our assets. We also gained the first agreements with local authorities for the use of keyhole reinstatement methods in Glasgow and London.

Figure 5: Excavation in progress



Figure 6: Guarded excavation



Excavating and reinstatement is an inconvenience to our customers and is also a high cost to our business.

Traditional methods typically consist of hand or mechanical, full size or mini excavators used to carry out excavation (above right). Most commonly, the team will complete the repair work and leave the excavation guarded until the backfill and reinstatement process is complete, and the barriers removed (above left).

The core & vac technique (shown below) involves two main operations: the coring operation to cut and open the top surface of the carriageway; and the vacuum operation to remove the sub base and expose the gas main. This is followed by reinstatement using the original core & vac equipment.

Figure 7: Coring operation



Figure 8: Vacuum operation



With this system, an operation that would normally take three to five days, can be carried out in a matter of hours. Apart from the obvious time and cost savings, additional benefits include reduced width of road closure, less delay to road users, the road can be reopened in a shorter time if circumstances change, reduced material costs, higher workforce skill levels and a higher quality of reinstatement.

We are widening the capability of core and vac through several projects and investing in ambitious new technology including robotics to aid in minimising the size of streetworks activities. Some of the follow-on projects include:

- Core Drill Flow-Stop - This project looks to develop equipment to allow both core drilling and flow-stop operations to be carried-out without the need for large excavation. This project aims to reduce the impact on our customers, the environmental issues and the associated costs;
- Olympic Rings - There are occasions, however, when a single (600mm diameter) core hole may be insufficient to access a pipe failure and/or carry out the repair and requires a 'multiple overlapping core' approach (multiple hole); and
- iCore - With iCore, we have developed in partnership with TRACTO-TECHNIK tools and equipment to significantly extend the range of distribution network operations that can be undertaken in keyhole excavations. This project concentrated on network improvements including insertion of PE in iron mains, trenchless insertion of PE services, and making service connections to facilitate our significant mains replacement programme.

Advanced minibag This project enhanced a previous project to use the Mini-Bag Tool as a method to exchange meter service Emergency Control Valves (ECVs). The additional development of the Advanced Mini Bag Kit facilitates the exchange of ECVs, located in semi-concealed meter boxes where the ECV is a 90° type.

This equipment enables the replacement of the faulty ECV under live gas conditions, eliminating the need for any excavation to be carried out. As this tool can be used by a trained First Call Operative (FCO) it eliminates the need for sending two-person repair teams during the replacement process. The replacement process fully eliminates the need to excavate and physically isolate the gas service.

The Advanced Mini Bag kit is 'user friendly', lightweight and a controlled solution for semi-concealed and historic ECVs.



Microstop

Pipe Tech Ltd provided the Microstop system which facilitates flow-stopping operations to be undertaken on small diameter network risers and laterals in multiple occupancy dwellings. This had not been possible before and flow stopping operations were limited to larger diameter mains or polyethylene pipe using a squeeze-off technique.

The key advantages of the Microstop system are:

- Reduction in customer interruption when installing a new service off an existing riser;
- Improved speed of operation;
- Resolves aesthetic issues with other live transfer techniques;
- Full bore bypass system, supporting replacement of the below ground riser section through insertion of carrier pipe; and
- Supports development of new PE materials, such as 40mm PE Serviflex.



The Microstop system has proven itself to be an ideal tool that supports the partial replacement of network risers (below ground) where the above ground section of pipework is found to be in satisfactory condition. Through its use we have been able to significantly improve the customer experience by reducing disruption and the time customers are without a gas supply.



5.3 Resilience

Our Connections work provides resilience simply through adding new customers to the network. For example by linking-in flexible generators which then provide resilience to the electricity network through their connecting to our network. For these customers we ensure we have the appropriate capacity in the network to ensure we can sustain pressures during the worst 1-in-20-year winters.

We plan to continue to employ directly the majority of our workforce on this activity rather than through external

contractors. We have always followed this strategy and believe it gives us a more engaged and committed workforce and better control over the safety and quality of our operations. It also recognises the increasing costs and risks associated with engaging large numbers of contractors.

Our Workforce Management appendix (009) has detailed information of our business strategy in this area.

6 GD2 activity breakdown

6.1 Approach to GD2

Gas mains central heating has always been the fuel of choice for most home owners in Great Britain. As well as cheaper running costs, shown in Table 9 from the Energy Saving Trust¹³, a property with gas mains central heating will be valued around £5k higher and in some cases up to 5% of the property value. The installation of mains gas to existing properties will reduce customers' costs to heat their homes and provide fuel poor potential.

Funding in GD2 will allow us to meet our obligations to connect new customers onto our network, to sustain the delivery of fuel poor network connections and maintain the high level of customer service standards which we have delivered over GD1.

Table 9: Average fuel prices

Fuel	Cost per kWh
(Mains) gas	3.74p per kWh
Heating oil	5.24p per kWh
LPG gas	6.86p per kWh
Wood pellet	4.45p per kWh
Electricity	15.75p per kWh (standard rate)
Coal/solid fuel	4.00p per kWh

6.1b Policy

Future of heat

The Chancellor's announcement in the Spring Statement of 2019 regarding the ending of fossil-fuel derived heating systems in new homes in 2025 could have an impact on the forecasted workload. Given the impact is currently anticipated in the final year of GD2 and there is significant uncertainty surrounding how the policy will be implemented, we think it is too early at the moment to make any adjustment to our final year 'new housing' forecast.



6.1c Scenarios and sensitivities

As Connections is a customer driven competitive environment, there will always be a degree of uncertainty in regard to future planning. Government policy around the future of heat, Brexit and Scottish independence could all have an impact and have been considered, however no major adjustments have been made.

Trend analysis has been used as the main basis for forecasting and adopting a volume driver financial mechanism will manage uncertainty impact (see section 6.8).

6.2 GD2 outputs and price control deliverables

Below we go through each of the major connections types, giving an expectation of the number of connections (services) delivered over the five years of GD2, the total investment which is required to deliver those connections and how costs are divided between the customer and our allowances.

Tables within section 6.2 can be found within chapter 16 of the business plan and table 3.04 Connections of the BPDTs.

¹³ <https://www.energysavingtrust.org.uk/about-us/our-calculations>

Existing housing

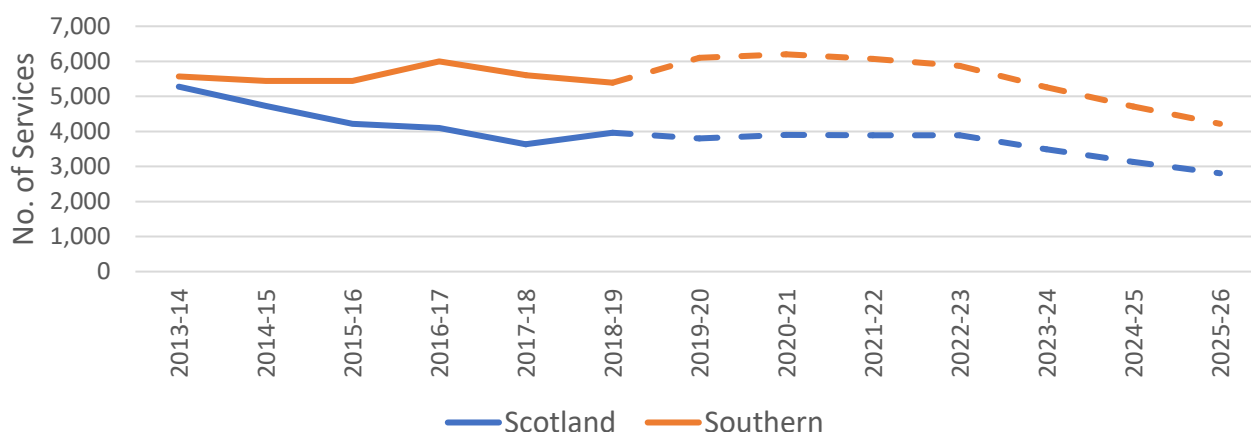
Existing housing investment is part funded by the customer and supported by the DLCA.

Table 10: Existing housing connections – Expected numbers of service and investment

	2021/22	2022/23	2023/24	2024/25	2025/26	Total No. services	Total investment (£m)	Customer funded (£m)	Allowance (£m)
Southern	6,070	5,870	5,260	4,711	4,217	26,128	48.60	18.36	30.24
Scotland	3,890	3,890	3,490	3,130	2,806	17,206	21.15	7.47	13.68

The graph below shows the trend of GD1, on which the GD2 projected workload proposals have been based. New services to existing properties have always been quite steady in Southern and it is expected this will continue throughout GD2. There was a slight decline in GD1, mainly in Scotland but this is due to the recording of a proportion now being captured under our fuel poverty figures. With the removal of IMD (Index of Multiple Deprivation) criteria by Ofgem where a property could qualify based on the post code, this should increase and level-out throughout the rest of GD1 into GD2. Due to uncertainty and government policy around the future of energy and achieving net-zero carbon we have forecasted a decline towards the end of GD2.

Figure 9: Existing housing



Capacity Increase needs to be added to existing housing to match the figures detailed within table 3.04 Connections BPDTs. Services to the SIUs are reported separately within the BPDTs so the two are added to match the totals above.

New housing

New housing investment is part funded by the customer and supported by the DLCA.

Table 11: New housing connections – Expected numbers of service and investment

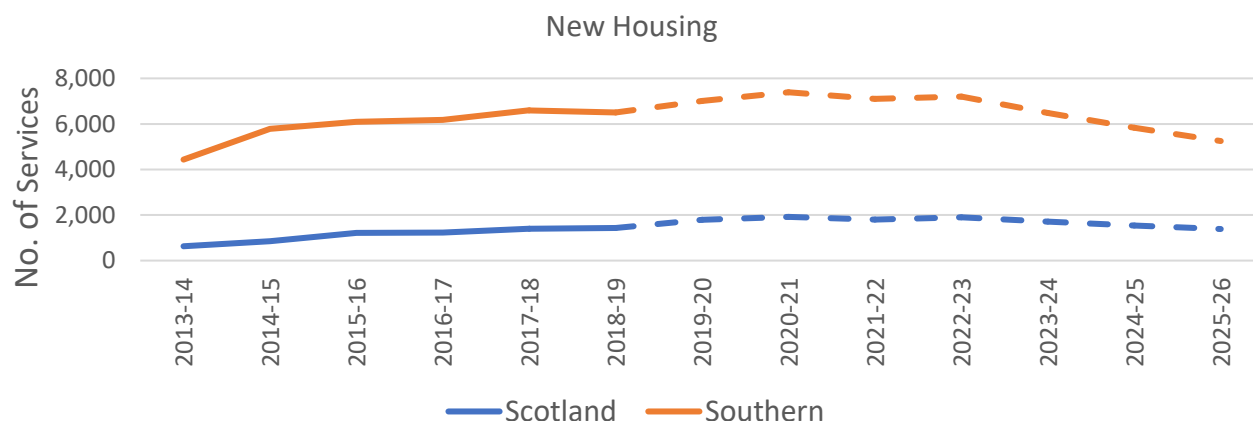
	2021/22	2022/23	2023/24	2024/25	2025/26	Total No. services	Total investment (£m)	Customer funded (£m)	Allowance (£m)
Southern	7,100	7,200	6,480	5,832	5,249	31,861	47.4	28.9	18.5
Scotland	1,800	1,900	1,710	1,539	1,385	8,334	10.97	9.2	1.77

We have seen a rise in the number of projects accepted for new housing throughout GD1. While our Connections usually miss out on larger sites to other ICPs who lay multi utility, we do receive a lot of acceptances for smaller developments which are within 23m of a gas main. With the DLCA applied, we are competitive in this market and we would expect this trend to continue through GD2.

Based on our predicted growth forecasts we would expect to see connection numbers increase at the beginning of GD2 before declining in the later years. In the first five years of GD1 we have seen an increase in services for

new housing in both networks. Figure 10 below shows the trend of GD1 on which the projected workload proposals have been based.

Figure 10: Predicted growth: new housing



In the 2019 Spring Statement, the Chancellor of the Exchequer stated the Government would be mandating the end of fossil fuel heating systems in new homes from 2025, the last year of GD2. While there is a clear policy intent, it is not currently clear the legislative form which will support this or how it will be achieved from an operational perspective. As such we have forecast a decline towards the end of GD2 and would propose an uncertainty mechanism to capture any sudden change (either early adoption, or rush prior to a deadline).

Non-domestic

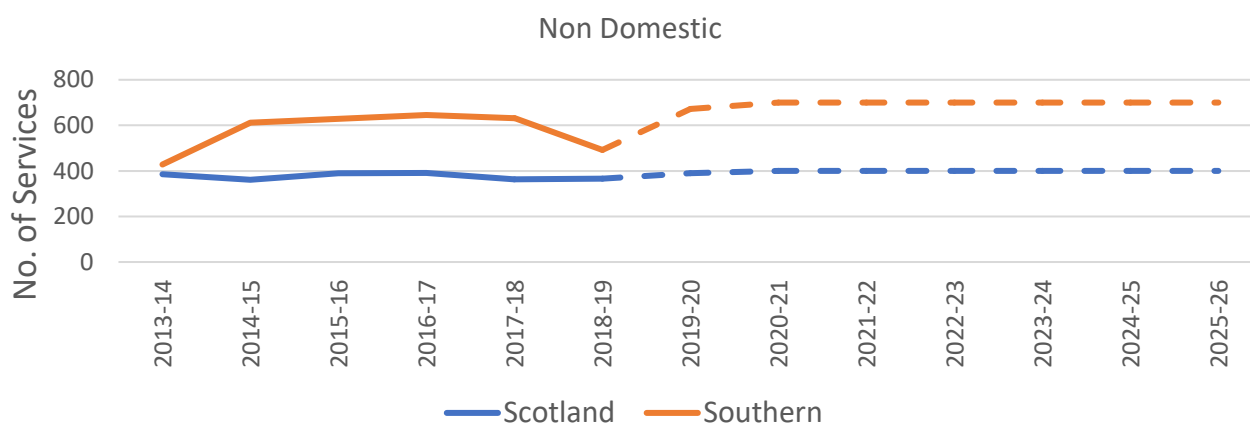
Investment for new services to industrial and commercial properties is fully funded by the customer.

Table 12: Non-domestic connections - Expected numbers of service and investment

	2021/22	2022/23	2023/24	2024/25	2025/26	Total No. services	Total investment (£m)	Customer funded (£m)	Allowance (£m)
Southern	700	700	700	700	700	3,500	15.78	15.78	£0
Scotland	400	400	400	400	400	2,000	10.45	10.45	£0

New connections for industrial and commercial properties are very steady and will continue with similar number throughout GD2. We have seen some large loads coming through, increasing reinforcement works required on our network. 0 below shows the trend of GD1 which the projected workload proposals have been based on. The workload in Southern is expected to follow the consistent trend prior to 2018/19.

Figure 11: Predicted growth: industrial and commercial



Services to the SIUs are reported separately within the BPDTs so the two are added to match the totals above.

Infills

Infill projects give areas with no gas an opportunity to extend the network at a more affordable cost as the mains cost is shared amongst the scope of those that benefit. Each customer within the scope pays their contribution to the mains extension plus any service cost, rather than one customer contributing the full cost of the mains extension.

While we would be looking for a sizable uptake up-front before this would be considered viable (usually 40%) the additional costs for laying the mains would be picked up by us.

As any new infill would be live for 20 years, we would be unlikely to recover all expenditure within GD2. However as this is fully funded by the customer, the DLCA does apply for the service but this is captured under existing housing. The mains contribution income from existing live infills will likely cancel out the expenditure on any new infrastructure laid within GD2.

We expect any sums associated with infills to be relatively small and fully funded by the customer.

Infills are included within Existing Housing section of the BPDT table 3.04 Connections.

Fuel poverty

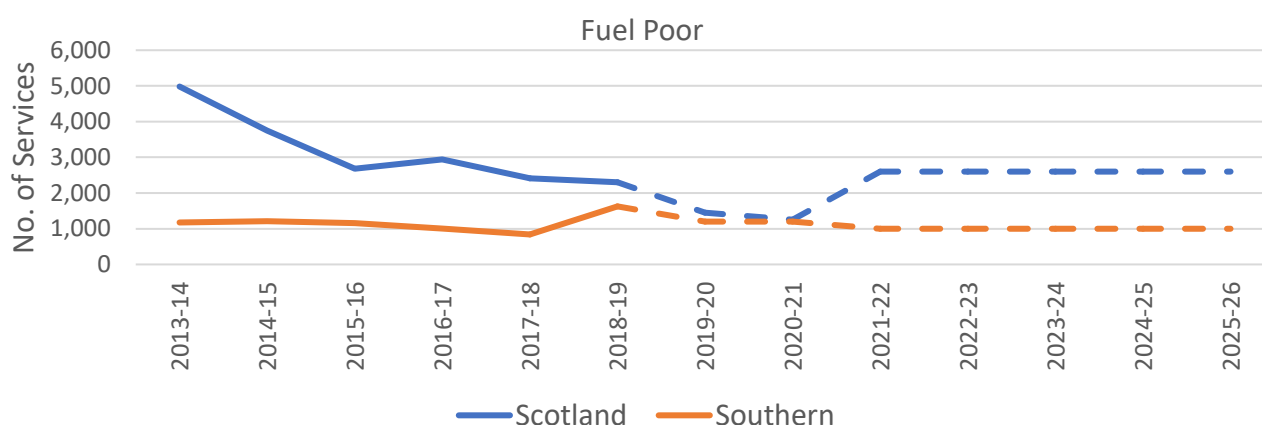
Investment for properties within fuel poverty is mainly funded by the fuel poor allowance with the difference allocated as a charge to the customer. Table 13: shows figures for single domestic properties only. District heating supplies can also be covered by the fuel poor voucher for which a separate calculator is used.

Table 13: Fuel poverty - Expected numbers of service and investment

	2021/22	2022/23	2023/24	2024/25	2025/26	Total No. services	Total investment (£m)	Customer funded (£m)	Allowance (£m)
Southern	1,000	1,000	1,000	1,000	1,000	5,000	12.07	1.2	10.87
Scotland	2,600	2,600	2,600	2,600	2,600	13,000	24.29	1.3	22.99

The projected workload proposals have been based on the trend set out in figure 12 below, however this assumes fuel poverty will look as it does now, and these trends do not allow for the recent changes in eligibility criteria. These figures are indicative and will be adjusted according to stakeholder feedback and agreement with Ofgem.

Figure 12: Fuel poor workloads



Projections for the remaining years of GD1 are based on the allowance value as it stands now, £2,446 for Scotland and £2,637 for Southern, plus in-house measures will still be available in Scotland and not in Southern. The numbers are based on individual supplies only. The calculator for district heating supplies can generate higher overall values, but we can only claim one supply on the RRP (Regulatory Reporting Pack provided to Ofgem annually) as this is to a single meter point, even if it feeds hundreds of properties.

We have explored the considerations relating to setting fuel poverty targets with our stakeholders, as described in section 7. Further details of how the target was calculated can be found within our Customer and Vulnerability Plan appendix (023).

The trend analysis from GD1 shows the fuel poor numbers can change year-on-year. We have forecast our target to be spread evenly throughout GD2, the reasons behind this are:

1. Our one-off customer requests for new gas services are consistent each year, we expect the percentage of those that qualify to be the same throughout;
2. Projects driven by local authority are based on an annual budget, we would expect a steady approach each year in-line with their budget and for heating installation to their housing stock; and
3. Because of operational resource and customer requirements around delivery, this is an ideal approach for us to work to.

Service alterations

Service alteration investment is mainly funded by the customer, but an allowance should be made for service alterations where we carry out the works for our vulnerable customers for safety reasons as in our licence conditions.

Table 14: Service alterations - Expected numbers of service and investment

	2021/22	2022/23	2023/24	2024/25	2025/26	Total No. services	Total investment (£m)	Customer funded (£m)	Allowance (£m)
Southern	4,700	4,700	4,700	4,700	4,700	23,500	17.9	16.4	1.5
Scotland	2,200	2,200	2,200	2,200	2,200	11,000	7.7	7.2	0.5

The service alteration investment figures are based on expenditure plus overheads for completed projects within 2018/19.

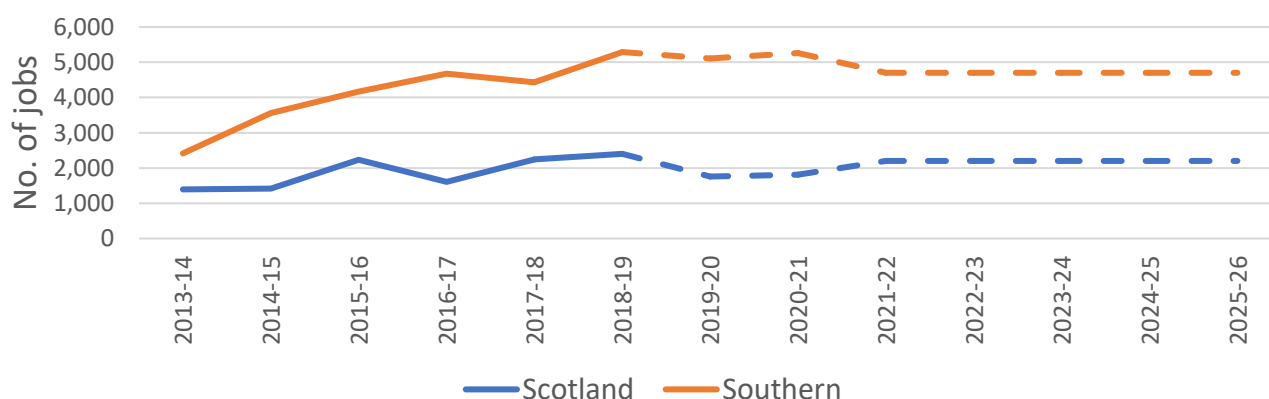
The allowance permits us to meet the requirements of our license condition 6 from Schedule 2 of the Gas Act 1986 (Meters for disabled persons), to ensure our more vulnerable and less mobile customers are able to access their emergency control valve to isolate their gas supply if necessary. Under this condition we forecast we will alter 2,000 services in our Southern network and 750 in Scotland at no cost to our customers, under this condition based on GD1 actuals to date. See table below.

Table 15: Alterations for vulnerable customer (free of charge)

	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	Average
Scotland	173	165	181	167	149	144	163
Southern	510	423	465	503	404	339	441

Consideration has been made within the replacement proposals for policy service renewals associated with customer requested alterations, which can be found in our repex appendix (019). We envisage 15% of service alterations within GD2 will result in a service renewal based on asset data and historical performance within GD1. The graph below shows the trend of GD1 on which the projected workload proposals have been based.

Figure 13: Service Alterations



The cost associated with service alteration works is included in the maintenance workstream as this is an opex cost. Further details can be found in our Asset Maintenance appendix (016) and on table 2.04 of the BPDs.

Capacity increase

We receive on average around 2,000 GT1 requests (service capacity checks) a year across our networks. We are able to accommodate over 80% of these requests however, if the capacity is not available then a request to upgrade the existing gas service is required to meet the revised demand.

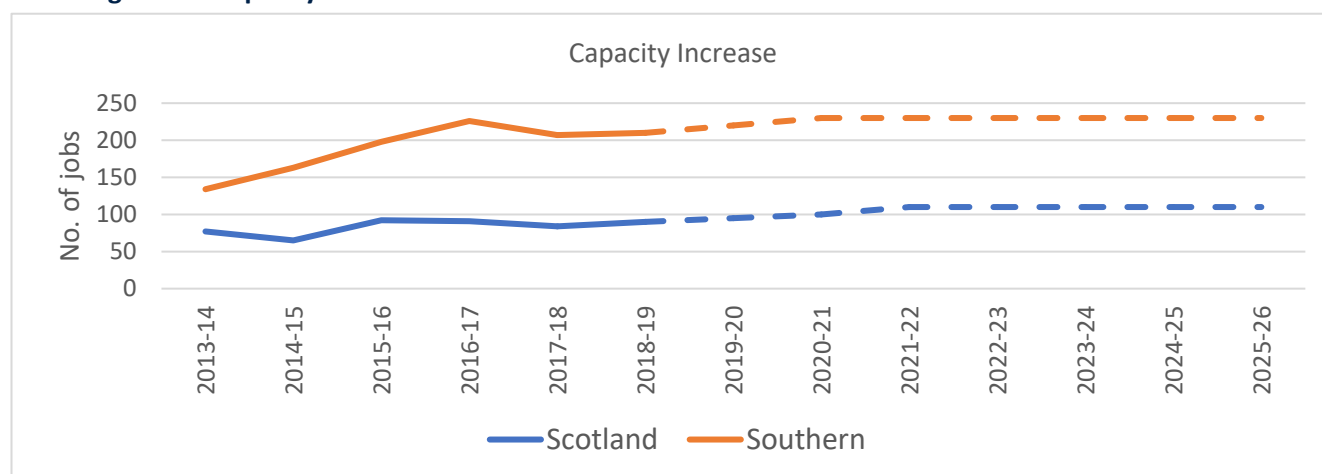
Requests for service capacity increases are mainly funded by the customer, but an allowance is necessary to allow for works where we carry out service upsize works at our cost in accordance with our licence conditions i.e. where the estimated annual usage is still less than 73,200kwh.

Table 16: Capacity increase – Expected numbers of service and investment.

	2021/22	2022/23	2023/24	2024/25	2025/26	Total No. services	Total investment (£m)	Customer funded (£m)	Allowance (£m)
Southern	230	230	230	230	230	1,150	4.4	2.93	1.47
Scotland	110	110	110	110	110	550	3.0	2.0	1.0

We have seen a rise in capacity increase requests when our customers are replacing/upgrading their appliances to be more energy efficient and support business growth. When replacing the existing system, these installations are generally more efficient over 12 months, but they often require a higher peak-load to start up, meaning the service and meter often needs upsized. If the new estimated annual usage is less than 73,200kwh, then the renewal of the service is at no cost to the customer. Figure 14 below shows the trend of GD1 on which the projected workload proposals have been based.

Figure 14: Capacity increase workloads



The above workload is included within existing housing section of the BPDT table 3.04 Connections

Disconnections

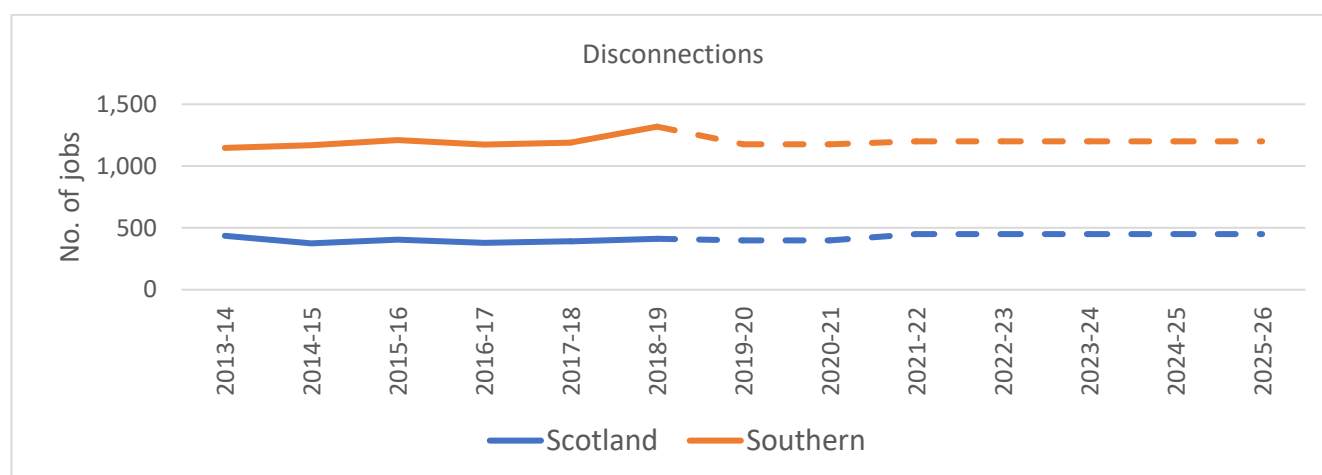
Our forecast for GD2 is that the disconnections number will remain largely flat based on our experience and the performance over GD1.

Table 17: Investment for disconnection of gas service/mains is fully funded by the customer

	2021/22	2022/23	2023/24	2024/25	2025/26	Total No. services	Total investment (£m)	Customer funded (£m)	Allowance (£m)
Southern	1,200	1,200	1,200	1,200	1,200	6,000	8.1	8.1	0
Scotland	450	450	450	450	450	2,250	2.1	2.1	0

Currently disconnection works are not part of GSOP or customer satisfaction. This has been discussed as part of Customer Experience Strategy Paper and with the other GDNs as something which could be added to the current criteria. Figure 15 below shows the trend of GD1 on which the projected workload proposals have been based.

Figure 15: Disconnections workload



The cost associated with disconnection works are fully funded and included in the maintenance workstream as this is an opex cost. Further details can be found in our Asset Maintenance appendix (016) and on table 2.04 of the BPDTs.

Predicted workload for gas mains network extensions

Analysing historical data from GD1 we have calculated our forecasted mains workload based on the total length of gas mains laid against the number of services for each category. The average length of main for each service, along with the forecasted number of services was then multiplied to provide an estimated length of gas mains to be laid in GD2.

Table 18 summarises the breakdown of the proposed total investment for capex connections workload.

Table 18: Summary of investment proposal capex

Investment category	Southern					Scotland			
	Opex or capex	Workload (No. services or projects)	Investment (£m)	Customer funded (£m)	Allowances (£m)	Workload (No. services or projects)	Investment (£m)	Customer funded (£m)	Allowances (£m)
New housing	Capex	31,861	47.1	28.8	18.3	8,334	11.0	9.2	1.8
Existing housing	Capex	27,278	53.3	21.6	31.7	17,756	24.5	9.8	14.7
Fuel poor	Capex	5,000	12.1	1.3	10.8	13,000	24.3	1.3	23.0
Non-domestic	Capex	3,500	15.8	15.8	0	2,000	10.4	10.4	0
Total		67,639	128.3	67.5	60.8	41,090	70.2	30.7	39.5

6.3 Bespoke outputs

Bespoke outputs are not applicable to connections.

6.4 Investment in existing assets

Investment in existing assets is not applicable to connections pipe assets as this is customer funded. See our Capacity Management appendix (018) which discusses the impact of new connections to the network.

6.5 Engineering justification papers (EJPs)

Engineering Justification Papers are not required for connections as all work is initiated by the customer and not driven by us.

6.6 Investment in new assets

Not applicable to connections pipe assets as this is customer funded. See our Capacity Management appendix (018) regarding impact of new connections to the network.

We will consider upgrading our IT systems to allow us to improve the customer service that we provide. This will be key to ensuring we continue to be able to meet our customers' expectations and GSOPs, not just as it looks now but moving forward where this is likely to be changed.

In 2018/19 we received 62,483 calls for connections projects and logged 50,236 on our customer enquiry system. To improve the service to our customer we are consulting on changes to our systems, such as:

- Online application available to complete and submit for all customers;
- Portal available for our customer to be able to log in and view key information without having to call e.g. quotation, plan date, MPRN and list key contact for each part of the process;
- Option available for all customers to view and accept their quotation online and make payment; and
- Add our maps to our website so that customers can view our mains location in relation to their property.

Stakeholders and customer insight on these options are discussed in section 7.

Currently no feasibility study has been carried out to consider the cost benefit analysis of implementing any of the changes to our systems due to the uncertainty around energy futures.

6.7 Cost efficiency

Predicted expenditure is based on actual costs from 2018/19. Contractors and direct labour are performance monitored and pricing reviewed annually.

Our pricing is calculated for work such as new domestic standard connections, domestic alterations and disconnections using standard charges and a schedule of rates that include:

- Labour costs, including traveling to and from the site;
- Materials - pipe, meter boxes, fittings etc;
- Reinstatement - asphalt, concrete, sand, etc;
- Waste management charges - disposal of spoil for recycling;
- Traffic management charges;
- Cost of traffic lights and controls; and
- Overheads - which include fuel, equipment, protective equipment, supervisory staff, site visits and associated administration costs.

See our Procurement and Native Competition appendix (010) for further information

6.8 Managing uncertainty: volume driver

Forecasts for new connections are based upon our knowledge acquired from stakeholders and local authorities about their development plans. With the move to net-zero, as announced in the 2019 Spring Statement, and as local authorities examine how they are going to respond to the climate emergency, it is likely expectations will change, and developers and local authorities may choose to adopt earlier targets.

Depending on the solutions developed by local authorities in their energy efficiency and energy action plans, this may lead to fewer connections and lower capacity management costs, depending on which solutions are adopted.

We believe a volume driver should cover the majority of new connection costs. We are currently expecting to invest approximately £20m a year on new connections which can be defined as a unit cost subject to the domestic load connections allowance or fuel poverty allowance.

New connections - Fuel poor

For each connection under the Fuel Poor Network Extension Scheme (FPNES) we receive an allowance of £2,168 for each connection in Southern and £1,769 per connection in Scotland. This allowance is to cover the cost of the connection (including fixed and variable overheads).

We have put forward an ambitious FPNES target on the basis it is a without penalty PCD of 3,600 connections a year and our totex allowance is based on the expectation it will be delivered. For the volume driver we have only included the variable cost of £1,720 for Southern and £1,340 for Scotland.

An important facilitator in delivering fuel poor connections is the availability of additional support to fund in-home measures, which is more readily available in Scotland than it is currently in Southern.

As such we can accept more challenging targets in Scotland to reflect this. Should the policy change and support for in-home measures was provided in Southern, the PCD would limit our ability to fund the delivery of a greater ambition. If the policy was withdrawn in Scotland and our ability to meet the target was constrained, then we would return the allowances to customers in line with the unit costs set out above.

New connections - New and existing connections

The forecasts for new connections are based upon our knowledge acquired from stakeholders and Local

Authorities (LAs) about their development plans. With the move to net-zero - as announced in the 2019 Spring Statement and as LAs examine how they are going to respond to the climate emergency and net-zero imperative, it is likely developers and LAs may choose to adopt earlier targets.

Depending on the solutions chosen and developed by LAs in their energy efficiency and energy action plans, this may lead to fewer connections and lower capacity management costs.

We believe this volume driver should cover the majority of new connection costs. These are largely divided according to existing housing, new housing and fuel poor connections, with approximately a third of the costs allocated to fuel poor connections, a half to existing housing and the remaining to new housing. This uncertainty mechanism covers new and existing housing.

For each of these categories we have separated the volume driver into a unit cost associated with the connection and a fixed cost associated with providing the service. We believe this provides the most appropriate balance of risk between the network and the customer regarding the actual workload to be experienced, while maintaining an incentive on the network to improve their processes and the efficiency with which the service is delivered. The fixed cost assumption should be reconsidered if there is a significant policy change under either the future of heat or the fuel poor reopener which leads to a fundamental difference in overall workload.

The current approach for new and existing properties is similar. For new properties there is an average requirement for £504 for each connection through the domestic load connection allowance. With the volume driver we have only included the variable unit cost of £188 for each connection, the remaining £316 being the fixed cost component. We would expect this uncertainty mechanism to be applied from the start of GD2 even though our work with stakeholders and local planning authorities give us a high level of confidence in the first two years of the price control.

For existing housing connections, the average cost per connection is £1,035 of which £627 is considered variable and the remaining £408 fixed. As with new properties, we would expect this uncertainty mechanism to be applied from the start of GD2.

We have not included industrial and commercial customers in this proposal as the direct cost of their connection is fully funded by the customer.

Where a connection leads to a reinforcement then it will be covered through the <7bar distribution reinforcement uncertainty mechanism.

Our business plan section 12.2.5 Uncertainty Mechanisms: New Connections and 12.3.4 Fuel poor network extension refers

6.9 Competition

When evaluating the GD2 business plan, options such as outsourcing our connections design and construction works were considered. We have currently discounted this option as there were significant risks associated, including a loss of control and influence over critical points of customer service i.e. customer satisfaction, complaints, fuel poverty etc.

We do not actively go out to compete to secure new connections but ensure our service is available and clearly identifiable for our customers. We also do not promote our services but respond to requests. As a result, the connections market is highly competitive, with approximately 28,000 (60%) of connections being provided by ICPs.

Procurement will review, renew and tender for materials and contractors to ensure our costs are competitive. See our Procurement and Native Competition appendix (010) for further information.

6.10 Real price effects

The main factors which will potentially increase the costs are direct labour, contract labour and materials including reinstatement. Investment in IT may reduce overheads.

6.11 Financial summary

For the purposes of the business plan submission we have made our current forecast on the following basis:

- Costs for existing, new and industrial and commercial connections are based on historical precedence, existing and new housing connection cost are 15% lower than those experienced in the last five years of GD1. Non-domestic connection costs are 5% higher: and
- These costs do not include the change to our licence conditions regarding GSOPs. Any increase in standards will need to be assessed in terms of their associated costs.

Table 19: GD2 forecast investment profile (Allowances only)

SGN (£m)	21/22	22/23	23/24	24/25	25/26	Total
New housing	4.2	4.2	4.1	3.9	3.7	20.1
Existing housing	10.3	10.1	9.4	8.5	8.0	46.3
Fuel poor	6.8	6.8	6.8	6.7	6.7	33.8
Non-domestic	0.0	0.0	0.0	0.0	0.0	0.0
Total	21.3	21.1	20.3	19.1	18.4	100.2
Scotland (£m)	21/22	22/23	23/24	24/25	25/26	Total
New housing	0.3	0.3	0.4	0.4	0.4	1.8
Existing housing	3.2	3.2	3.0	2.7	2.5	14.6
Fuel poor	4.6	4.6	4.6	4.6	4.6	23.0
Non-domestic	0.0	0.0	0.0	0.0	0.0	0.0
Total	8.1	8.1	8.0	7.7	7.5	39.4
Southern (£m)	21/22	22/23	23/24	24/25	25/26	Total
New housing	3.9	3.9	3.7	3.5	3.3	18.3
Existing housing	7.1	6.9	6.4	5.8	5.5	31.7
Fuel poor	2.2	2.2	2.2	2.1	2.1	10.8
Non-domestic	0.0	0.0	0.0	0.0	0.0	0.0
Total	13.2	13.0	12.3	11.4	10.9	60.8

The above investment table can be found within our business plan section 16.5.7 and within the BPDT tables 3.04 Connections.

6.12 Assurance

Our Business Plan, including Appendices, has been subject to a rigorous assurance process which is detailed in Chapter 3 of the Plan and the Board Assurance Statement.

Our Network & Safety Director was appointed as the Sponsor for the Connections appendix and the associated Business Plan Data Templates (BPDTs); which have been through the following levels of review and assurance:

First line

This was undertaken at project level by the team producing the document, as a regular self-check or peer review.

Second line

This was undertaken independently within the organisation to review and feedback on product development, including a GD2 workshop on capex. Internal Audit reviewed the third line assurance work conducted by Ove Arup and Partners against scope.

Both senior manager and director sign-off was obtained and our GD2 Executive Committee: (i) considered the appropriateness of assurance activity for the appendix and (ii) provided assurance to our Board that the Business Plan meets Ofgem's assurance requirements.

Third line

This was undertaken by external advisors and groups providing critical challenge during the development of products within the business plan. In addition to the feedback and challenge provided by the Customer Engagement Group (CEG) and Customer Challenge Group (CCG) this appendix was developed after consultation with and advice from:

Advisor/group	Contribution
Ove Arup and Partners	Consultancy support to enable development of an evidence based high quality business plan draft by acting as an expert challenge group through independent peer reviews against Ofgem Business Plan Guidance.

Fourth line

This was undertaken by independent and impartial external providers, who provided a detailed and comprehensive report to both the Executive Committee and Board of Directors:

Advisor/group	Contribution
Ove Arup and Partners ('Clean' Team)	Review of appendix against Ofgem's assurance requirements.
PwC	Business Plan Data Template review: Connections, reliability and streetworks

7 Stakeholder supporting evidence

7.1 Providing excellent Connections services to our customers

Our programme of customer research showed customers view providing ‘an excellent service’ as of medium importance relative to other priorities. When specifically asked to rank an attribute relating to ‘the ease of access to information’, it fell towards the lower end of the scale of importance¹⁴.



Breaking down the topic areas into attributes and using max diff analysis, shows SGN customers' priorities vary by specific improvement initiative

Key Insight: Reliability and cost savings are important, but supporting those vulnerable in the community, future energy solutions and environmental priorities are higher than most keeping costs down ideas.



Source: Max diff analysis, August 2018, Impact Research SGN customers N = 511

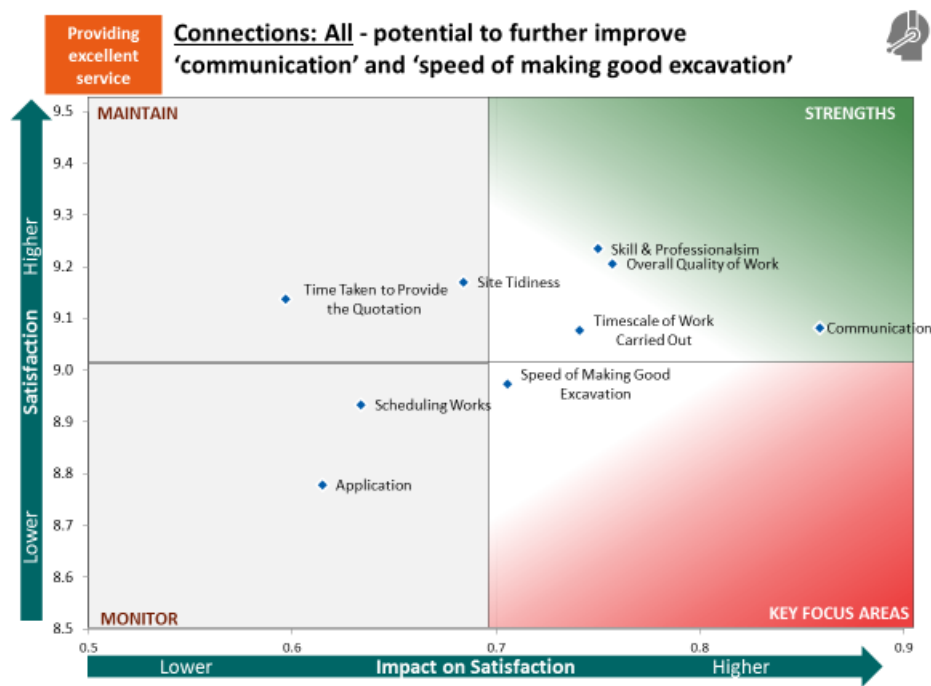
No statement on acting safely was included. It was felt that this will be a default priority and would therefore likely skew results if included.

Analysis of all Customer Satisfaction results for 2017/18 identifies each area the survey queries as to satisfaction, it's relative positioning on a high/low scale of impact on customer satisfaction, and our current performance in that area¹⁵. There are regional differences between our Scotland and Southern networks, and between domestic and business customers. However, the analysis shows that overarchingly ‘Communication’ is the key area which has the highest impact on satisfaction. Improvements in the delivery of work completed on site was also shown to

¹⁴ Stage 2: Max Diff Prioritisation Phase (ref 003)

¹⁵ Customer Service key driver analysis (ref 075)

be important, with results indicating that ‘timescales of work being carried out’ and ‘greater speed of making good excavation’ will bring greater satisfaction.



We asked our stakeholders their perceptions of changing customer and stakeholder expectations at our Moving Forward Together workshops in March 2018¹⁶. Some advised their expectations vary, with the perception being expectations are higher among younger people than older people, and that while embracing new technology is important, this should not be to the exclusion of customers who do not use digital platforms. Other views provided included that ‘omni-channel’ communication is now expected, and attention spans are shorter, so answers are expected almost instantaneously. Customers at our qualitative workshops in September 2019 reinforced these views¹⁷.

Wave 1 of our stakeholder satisfaction survey (August 2018) asked the question: ‘What is the single most important thing that SGN could do to improve its service to you/your stakeholders in the future?’ Many responses related to communication and speed of response, highlighting customer service as an area where we could improve.

Customers were asked a question in relation to growing and reinforcing our network in response to customer demand for more gas in our quantitative acceptability testing. Acceptability from domestic customers in Scotland was highest, at 77%; while domestic customers in Southern scored this 9% lower at 68%. Results from SME business customers in Scotland and Southern were broadly similar, at 75% and 73% respectively. These results indicate customers recognise and accept we need to invest in this area to continue to provide new connections¹⁸.

7.2 Addressing fuel poverty

Please refer to our Customer and Vulnerability Plan appendix (023) for more detail.

¹⁶ MFT Workshop March 2018 London & Edinburgh (ref 011,012)

¹⁷ Shaping the Business Plan Qualitative workshops - Customer Service & Supporting Vulnerable (ref 085)

¹⁸ Business Plan Acceptability Testing Phase 2 (Ref 079)

Our customers initially viewed ‘supporting communities’ as a lower priority relative to others (see graph above)¹⁹. Once this message was refined for greater clarity to ‘supporting those vulnerable in the community’ it was viewed as far more important by customers. This is illustrated by the Max Diff prioritisation results, where customers rated ‘providing low income households with help to heat their homes more affordably’ as the third highest attribute (see chart above)²⁰.

In our first wave of customer willingness to pay research, one improvement our customers were asked to value was in relation to supporting people in fuel poverty. The results indicated that domestic customers would be willing to pay up to £2.16 a year on their gas bill for a best-level of support to fuel poor or vulnerable customers. This would include an FPNES connection, plus referral to partners who can provide support (for example repair heating appliances, install carbon monoxide alarms, provide energy efficiency advice, etc.) and an additional hardship fund to pay for the services needed.

These results demonstrated a moderate appetite from customers to support these initiatives, when compared to other business improvements tested in the research²¹, although in qualitative workshops customers are far more supportive of activities to support vulnerable customers^{22 23}. In our quantitative business plan acceptability testing research, customers were asked a question in relation to providing additional support to 250,000 vulnerable customers. This was well-supported by customers, with Southern domestic customers giving this additional element of our plan an acceptability score of 79%. Scotland’s domestic and SME business customers gave even higher acceptability scores of 86% and 87% respectively, making this the second highest scoring element of our plan for these customer groups. Acceptability was lowest among Southern SME businesses at 75%²⁴.

Our stakeholders have told us addressing fuel poverty is important. At our Moving Forward Together events in January and February 2019 we asked stakeholders’ views on how we should set targets for supporting households in fuel poverty, and what those targets should be²⁵.

There was a general consensus in England it is hard to set targets without confidence the whole heating solution (i.e. the central heating system) is fully funded i.e. ‘a gas central heating system would generate more connections than a connection would generate gas central heating’. Stakeholders suggested the upper boundary is how many off-gas fuel poor people could we potentially help. The lower boundary is to look at the ECO market projections for first time central heating. Somewhere in between is where the target should be, bearing in mind funding challenges. Having gained this insight from stakeholders we further refined our target setting and tested this with stakeholders at our August 2019 positive impact specialist workshops²⁶.

Stakeholders suggested the approach in Scotland would be a good model to learn from in England, but that much of this was outside of our control. It was suggested others in the energy sector, such as ECO obligated energy suppliers, are perhaps better placed than us to offer additional ‘whole-house’ solutions to make properties more energy efficient. Stakeholders do expect us to work collaboratively with others, including local authorities and suppliers, to deliver fuel poverty solutions to customers in need, and taking a holistic view to supporting a customer in need brings ‘stackable’ benefits such as improved health. This may mean fewer households targeted, but to a higher quality.

¹⁹ Stage 1: Explorative Qualitative Workshops and interviews (ref 002)

²⁰ Stage 2: Max Diff Prioritisation Phase (ref 003)

²¹ Stage 3: Conjoint & WtP Summary report (ref 005)

²² Business Plan Acceptability Testing Phase 1 (Ref 078)

²³ Qualitative workshops - Customer Service & Supporting Vulnerable (Ref 085)

²⁴ Business Plan Acceptability Testing Phase 2 (Ref 079)

²⁵ MFT Workshop January 2019 London & Glasgow (ref 016,017)

²⁶ SGN Positive Impact round table event - (London & Scotland) (ref 088)