RIIO GD2 Business Plan Appendix

Asset Maintenance

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1 Overview

Scope of this appendix

SGN owns and operates nine different classes of assets within our distribution (<7barg) and local transmission (>7barg) networks. This appendix sets out the maintenance regime undertaken in order to maintain a safe and reliable network, as well as the steps we take to make sure that efficient investment is made to ensure our assets remain functional and fit for purpose.

Our maintenance activities strongly influence all customer priorities identified through our recent stakeholder research and discussed in our Enhanced Engagement appendix (022). For example – a robust maintenance regime ensures that the network remains fit for purpose, therefore impacting ‘acting safely’ and ‘keeping the gas flowing’. By managing effective maintenance procedures, we maximise the lifespan of our network assets, keeping options open for ‘future energy solutions’. Our proposed bespoke programmes of work, such as Responsible Demolition and Proactive Riser Surveys, ensure the ongoing safety of our customers and reduce the risk of unplanned disruption, therefore ‘supporting communities’.

Impact

Our maintenance activities are undertaken throughout the year by our maintenance teams. The frequency and specific action undertaken varies according to each asset class, based on a methodology driven by our legislative obligations and our responsibilities as a conscientious network operator.

Approach to RIIO-GD2

In GD2 we are looking to sustain our efficient approach to Asset Maintenance to support the reliability and integrity of the network. Our maintenance plans are designed to minimise opex costs while maximising the life of the asset. This appendix gives further detail of how our maintenance activities support SGN’s ‘4Rs’ strategy, discussed in section 2, to minimise opex costs.

We will continue to deliver our GD1 outputs:

- **Telemetered faults** (Critical and High Priority Faults and reported as ‘Now’ Faults), which measure the average hours of fault per telemetered site per annum.
- **Pressure Systems Safety Regulations (PSSR) faults**, which measure the number of PSSR faults identified against the total PSSR site population.
- **Offtake meter errors**, which measure the volume of offtake meter errors in comparison to network throughput.

In addition to the work continued from GD1, we are also proposing three additional programmes of work – Responsible Demolition, Riser Inspection Surveys and Facilitation of Biomethane Connections. The first two programmes will continue the safety critical ‘ringfenced’ activities that were started in GD1, while the third will contribute to future energy solutions and continue to reduce our environmental impact. Detail of these programmes is given in this appendix.

This appendix also gives information on how innovation projects and efficient working practices have enabled SGN to be in first and second place of the regression table in relation to efficiency of maintenance costs, despite the challenging nature of work in the densely populated areas surrounding London and the distributed nature of our assets in some of the most remote areas of Scotland.

Forecast Investment

Table 1: below demonstrates our proposed investment for the GD2 period, by network and at an SGN level. The table shows that the majority of costs are directly comparable with their GD1 values. The exception to this is an increase in contractor labour as a result of anticipated additional survey work, discussion of which is included later in this appendix.

Table 1: SGN GD2 investment proposal[1]

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
Net staff costs	18.9	18.5	18.6	17.5	17.7	20.4	19.7	19.6	19.8	19.8	19.8	19.8	19.9
Contractor Labour	6.3	3.9	4	7.3	3.1	4.2	5.7	6	10.6	10.7	10.8	10.7	10.8
Materials	11.2	7.1	6.2	6.9	7.7	8.2	6.4	6.8	7.4	7.4	7.5	7.5	7.5
Non Salary Staff Costs	0.4	0	0.6	0.5	0.5	-	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Transport and Plant	4.7	3.8	4.5	3.8	3.9	5.2	3.8	3.8	3.8	3.8	3.8	3.8	3.8
Gross Maintenance Costs	**41.6**	**33.2**	**33.8**	**36.1**	**32.8**	**37.9**	**36.1**	**36.8**	**42.2**	**42.3**	**42.5**	**42.4**	**42.6**
Income (Alterations, Disconnections)	-6	-6	-7.2	-6.7	-6.5	-6.1	-6.7	-6.9	-6	-5.8	-6.2	-5.9	-6
Total Maintenance Costs	**35.6**	**27.2**	**26.6**	**29.4**	**26.3**	**31.8**	**29.4**	**29.9**	**36.2**	**36.4**	**36.2**	**36.5**	**36.6**

Table 2: Scotland GD2 investment proposal

Scotland (£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
Net staff costs	**5**	**5.2**	**5.3**	**4.9**	**5.4**	**6.5**	**6.2**	**6.2**	**6.2**	**6.2**	**6.2**	**6.2**	**6.2**
Contractor labour	**1.5**	**1.4**	**1.4**	**2.6**	**0.8**	**2.2**	**2**	**2.1**	**4.3**	**4.3**	**4.3**	**4.4**	**4.4**
Materials	**4.2**	**3.2**	**2.5**	**2.7**	**3.1**	**4**	**2.2**	**2.3**	**3**	**3**	**3**	**3**	**3.1**
Non salary staff costs	**0.2**	**0**	**0.2**	**0.2**	**0.2**	-	**0.2**	**0.2**	**0.2**	**0.2**	**0.2**	**0.2**	**0.2**
Transport and plant	**2.2**	**0.9**	**1.3**	**1.1**	**1.2**	**2.2**	**1.3**	**1.3**	**1.3**	**1.3**	**1.3**	**1.3**	**1.3**
Gross maintenance costs	**13.1**	**10.8**	**10.7**	**11.5**	**10.7**	**14.9**	**11.9**	**12.1**	**14.9**	**15**	**15**	**15.1**	**15.1**
Income (alterations, disconnections)	**-2.2**	**-1.5**	**-1.7**	**-1.6**	**-1.7**	**-1.8**	**-1.5**	**-1.5**	**-1.5**	**-1.4**	**-1.5**	**-1.5**	**-1.5**
Total maintenance costs	**10.9**	**9.2**	**9**	**9.8**	**8.9**	**13.1**	**10.4**	**10.6**	**13.5**	**13.6**	**13.5**	**13.5**	**13.6**

Table 3: Southern GD2 investment proposal

Southern (£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
Net staff costs	13.8	13.3	13.2	12.6	12.3	13.9	13.5	13.5	13.6	13.7	13.7	13.7	13.7
Contractor labour	4.8	2.4	2.6	4.7	2.3	2	3.7	3.9	6.3	6.3	6.4	6.3	6.4
Materials	7	3.8	3.7	4.2	4.6	4.2	4.2	4.4	4.4	4.4	4.5	4.4	4.5
Non salary staff costs	0.3	0	0.3	0.3	0.3	-	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Transport and plant	2.5	2.9	3.2	2.8	2.7	3	2.6	2.6	2.6	2.6	2.6	2.6	2.6
Gross maintenance costs	**28.5**	**22.5**	**23.1**	**24.6**	**22.1**	**23**	**24.2**	**24.7**	**27.3**	**27.3**	**27.5**	**27.3**	**27.5**
Income (alterations, disconnections)	-3.8	-4.5	-5.5	-5.1	-4.8	-4.3	-5.2	-5.3	-4.6	-4.4	-4.8	-4.4	-4.5
Total maintenance costs	**24.7**	**18**	**17.6**	**19.5**	**17.3**	**18.7**	**19**	**19.3**	**22.7**	**22.9**	**22.7**	**22.9**	**23**

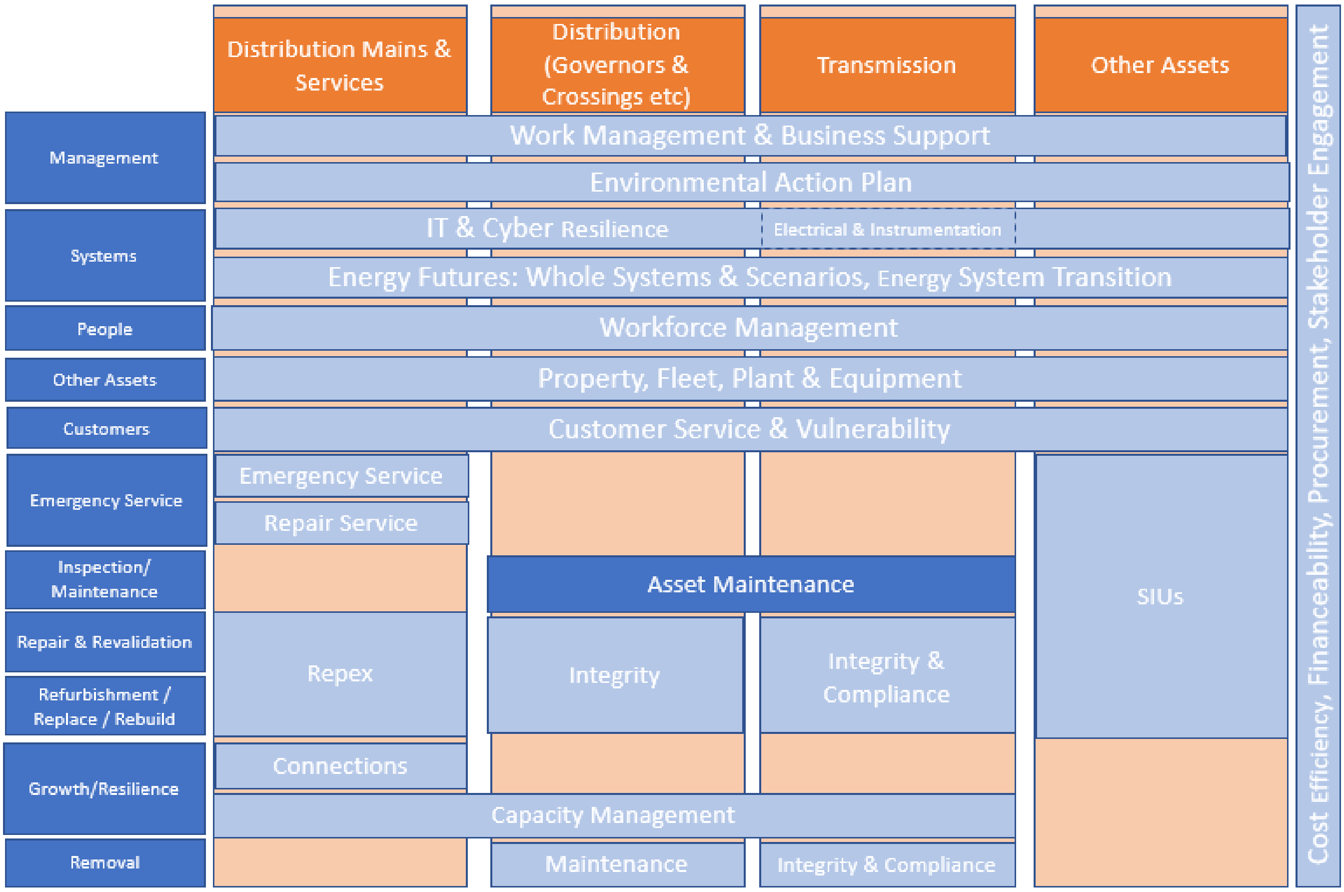
References to the Business Plan Data Templates (BPDTs) can be found in section 6.11.

[1] All costs shown are in 2018/19 prices

2 Maintenance within the Business Plan

This appendix provides an explanation of the maintenance regimes which we undertake in order to ensure our network assets are safe, fit for purpose and subject to appropriate investment decisions. Maintenance workloads are driven by a variety of factors, predominantly legislative requirements, asset class, age, condition and location.

Figure 1: Appendix structure



As discussed in the Business Plan document, investment plans are driven by our '4Rs' strategy, which enables us to identify the most appropriate intervention, informed by our inspection and maintenance priorities, in relation to a given asset:

- **Repair** – cost-effective remedial steps to repair existing assets. This could be repairing a small area of coating damage on district governor pipework at the time of inspection, or the use of self-amalgamating tape to repair a riser installation following a REP/3 survey.
- **Refurbish** – such as renewal of parts. This could be renewing components within a governor installation, shot-blast and re-paint of a pressure vessel or the strip down and rebuild of a slam shut valve.
- **Replace** – replacing elements of the equipment within the overall installation. This could be replacing the pre-heat boiler but leaving the existing operational filters and regulators in place as they are not yet at the end of their useful life.
- **Rebuild** – complete re-build of an entire installation.

The operating costs in this appendix include the cost of inspections to assess the condition and functionality of the assets, and the costs associated with a 'repair' intervention as described within the above strategy. It should be noted that these repair (remediation) activities are distinct from those which occur as a result of a public reported escape, which are covered in our Repair appendix.

An individual site may require multiple interventions. For example, following a condition assessment (which is a maintenance activity), a site may require refurbishment of one element, but repair or replacement of another, as defined by the above strategy. SGN Asset Managers take tactical steps based on clear processes and procedures to ensure that any intervention is undertaken in the most appropriate manner, which dictates whether it becomes capital or operational expenditure.

Where a maintenance survey identifies a more substantial intervention, this is likely to be included as capital expenditure in the integrity expenditure as set out in the Distribution and Transmission Integrity and Compliance appendices.

Over the GD1 period, maintenance activities accounted for approximately 5% of total expenditure.

3 GD1 performance and learnings

3.1 Service overview

SGN owns and operates nine different classes of assets within our distribution and transmission networks. More information on each of these asset classes and their maintainable assets is given below:

- **National offtakes** – These are located where gas comes into the SGN network from the National Grid Gas Transmission System at pressures between 70barg and 85barg. There are 12 offtake sites on the Southern network and 18 in the Scotland network. The network boundary between National Grid Gas Transmission and SGN generally occurs at the downstream flange or weld of the first valve after the pig trap arrangement or offtake tee. Telemetry at these sites connects to the SGN Gas Control Centre, and valves are in place to protect the SGN network from out of specification or over pressurised gas. Pressure reduction equipment at these sites controls the flow and pressure of gas entering the Network.
- **High pressure pipelines that make up the local transmission system (LTS)** – The SGN networks have 3121km of high pressure pipelines. These were mostly laid since 1960 when natural gas produced began to be supplied. The pipelines are of welded steel construction and are protected against corrosion by coating materials and Cathodic Protection (CP) systems.
- **Pressure reduction stations (High Pressure)** – These installations are present on the network to control the pressure, and most include valves, filtering equipment, gas heating facilities, pressure regulator streams, telemetry and instrumentation equipment. There are generally multiple streams at each site, which ensures that capacity is available in the event of failure of the working stream.
- **District governors** – 7,000 district governors control pressure on the below 7barg networks. They generally contain inlet and outlet valves, filters, slam shut valves, pressure regulators and stream selection. The majority have duplicate streams to provide capacity in event of failure. Most control to a fixed set point that is adjusted seasonally but a number of sites are fitted with pressure management systems which control the station outlet pressure to meet a pre-determined pressure profile or maintain a minimum system pressure at low points within the LP networks.
- **Below 7barg distribution mains** – The remainder of the distribution network is split into distribution mains operating at three pressure tiers:
    - Intermediate Pressure (IP) operating between 7barg and 2barg;
    - Medium Pressure (MP) operating between 2barg and 75mbarg; and
    - Low Pressure (LP) operating below 75mbarg.

  Intermediate pressure systems comprise steel and high-density polyethylene (HDPE) mains. Medium pressure systems are constructed of polyethylene (PE), cast iron, steel and a small amount of ductile iron. By far the most extensive part of the network lies in the low pressure (LP) system. The LP network in any area is likely to be a complex structure and it is from these mains that the vast majority (98%) of connections for service pipes are taken. As noted above, the 'repairs' referred to in this appendix arise only due to an inspection or monitoring regime, any repairs that arise from a Public Reported Escape (PRE) are set out in the Repair appendix.
- **Gas risers** – Gas risers generally supply multi-occupancy buildings. These buildings can be high or low rise. They are generally constructed of steel, polyethylene (PE) or copper, and the nature of the installation brings significant inspection and maintenance challenges.
- **Gas services** – The final part of our gas network is our service pipes that are connected to our mains pipes and routed to be adjacent to the consumer meter installations, where we fit an emergency control valve (ECV), which typically identifies the end of the network. Until the early 1970s, most service pipes were constructed using steel

pipe. As a result of the extensive replacement programme, a significant proportion of all service pipes now are polyethylene (PE).

- **Service regulators** – Service regulators control the pressure to the consumer when they are fed directly from an MP or IP main.
- **Biomethane entry points** – Biomethane production plants have grown in Great Britain and SGN has a number of entry points into our networks. The relationship between owner, developer and operation/maintenance for these plants varies between each site. The minimum amount of maintenance undertaken by SGN on these plants is that of the Remotely Operated Valve (ROV) acting as the entry point into the Network, however on some sites there are more assets that fall under SGN maintenance responsibility. We now operate a business approach of minimum connection ownership and work closely with the producer to ensure suitable and sufficient control on the biomethane entry equipment.

Number of assets

Each of the asset classes described above vary in complexity, volume and frequency of inspection or maintenance. Table 4: below quantifies the scale of our asset base:

Table 4: SGN asset base (2018/19 RRP)

	Scotland	Southern
National offtakes	18	12
Local Transmission System (LTS) pipeline	1,374km	1,747km
Pressure Reduction Stations (PRS)	131	157
District governors	2333	5146
Below 7bar distribution mains	23,565km	48,205km
Gas risers	5,593	11,588
Gas services (excluding risers)	2,148,074	4,166,010
Service regulators	3,482	25,697
Biomethane entry points	15	20

Asset monitoring

Our maintenance approach is informed by three primary asset monitoring strategies, which reflect maintenance guidance provided by the Institution of Gas Engineers and Managers (IGEM) and are applied through SGN policies and procedures.

Reliability Centred Maintenance

Reliability Centred Maintenance (RCM) is an active monitoring cycle that is based on the condition and consequent reliability of an asset at a point in time. At the time of assessment, either an intervention is determined to be necessary, or a new date is established when the asset should be reassessed. This date is determined according to the reliability at the time of the asset. RCM is used across the majority of pressure regulating equipment that operates with inlet pressures under 7barg. The RCM review for a particular piece of equipment includes a review of the fault data and gives a frequency for a functional check to be performed. This functional check ensures that the working and standby equipment is performing at the desired level and is in a satisfactory condition – particularly with regards to the safety devices and the ability of the standby stream to respond quickly to a fall in outlet pressure on the working stream to avoid low pressure issues on the network. Any faults discovered through asset inspections are captured using the Fault/1 process that is embedded within our asset management database – Maximo. Once captured, this fault data is analysed to determine any changes to the RCM frequencies to ensure they are appropriate to the performance of the asset.

The use of this RCM methodology means that major overhauls are only scheduled if failure or impending failure is detected during the functional check or PSSR inspection, thereby reducing non-value adding work.

Condition-based monitoring approach

Condition-based monitoring is the assessment of an asset condition at fixed intervals. This approach is based on three main techniques:

- **In Line Inspection**. ILI involves the evaluation of pipes and pipelines using 'smart pigs' that utilise non-destructive examination techniques to detect and size internal damage. ILI measures and records irregularities in pipelines including corrosion, cracks, deformation and other defects. The frequency of ILI is determined using the gas industry tool Intervals2 package which considers factors such as the condition of the pipeline at the previous inspection and the Cathodic Protection (CP) in place to determine the interval before the next inspection. Additional inspections are programmed if external activities, such as Alternating Current (AC) interaction, are influencing the pipeline. ILI, while a type of maintenance activity, is capitalised and therefore does not contribute to the costs within this appendix. ILI is further discussed the Transmission Integrity and Compliance appendix.
- **Over-line inspections** such as Closed Interval Polarised Potential Survey (CIPPS) are methods of identifying the location of coating faults and whether these points are adequately protected through CP systems. These surveys take place in the intervening period between two ILIs if the pipeline is suitable for ILI. For pipelines not suitable for ILI these take place at regular calendar intervals.
- **CM/4 surveys**. A key development in GD1 was our programme of detailed condition surveys undertaken in accordance with our internal SGN/PM/CM/4 procedures. Many of the gas distribution assets are ageing and are showing signs of deterioration in condition. These surveys provide a detailed report of the asset condition and include a scoring mechanism to categorise the deterioration of both paint condition where relevant and corrosion condition of the mechanical assets or civils and security of a site. This allows us to allocate an overall health score. The surveys are undertaken using a mobile app to capture the information but also with the added benefit of photographs built into the reports which allow the reviewer to compare the recorded results against a visual image. Examples of these are shown below in Figure 2:. There are also visual examples of the various condition scoring categories set out in the form of a pocket guide as an aide memoir for surveyors, which can also be accessed electronically within the mobile app. These surveys are vital in identifying the presence of condition defects and in allowing us to take timely remedial action and to support a programme of future interventions. The surveys and the remedial actions are identified separately in the Transmission Integrity and Compliance and Distribution Integrity and Governors appendices. CM/4 surveys can be undertaken up to every 12 years but may be more frequent if additional monitoring is required based on assessed conditions.

Figure 2: Survey Photographs

Corrosion condition 1

- Surface structurally 'as new'
- Surface corrosion only of no measurable depth

Corrosion condition 5

- Any corrosion of measureable depth:
  - ≥ 1mm for D ≤ 150mm (6")
  - ≥ 2mm for D ≥ 200mm (8")
- P/20 or P/11 required

CM/4 condition monitoring is ideally suited to a risk-based maintenance regime; the condition of the asset and the growth of condition defects can be measured, and their forecast growth can be predicted. This allows for future inspections to be scheduled according to the rate of deterioration in the asset, and a timelier intervention implemented.

All our major assets have an element of telemetry associated with them so that their condition and performance can be remotely monitored and assessed. Where this indicates a possible problem with an asset, then an inspection will be undertaken as a result.

Calendar based monitoring

A third monitoring technique, calendar based monitoring, is required where there is insufficient data for predictive maintenance regimes, or where legislative requirements mandate a frequency. For higher risk assets, the visit frequency will be increased, for lower risk assets this may extended. For example, the frequency of functional checks never extends beyond eight years.

For each inspection there will be a defined defect threshold, and when this is exceeded then the repair, replacement, or refurbishment of the asset will be undertaken. Typical assets for this type of monitoring regime include high pressure PRSs.

Calendar based approaches can include:

- **Inspection monitoring**. Visual inspection of assets to determine their condition. This can either be an intrusive or a non-intrusive inspection. An intrusive inspection will involve removing some protective coverings and lagging to check underneath, which would otherwise remain in place during a non-intrusive inspection.
- **Functional testing**. A set of tests designed to determine whether or not the equipment is operating at the specified design parameters. For example, a slam-shut valve will be tested for the speed at which the valve operates and whether that is to specification.

The above monitoring activities inform the intervention strategy subsequently deployed and can lead to both routine and non-routine maintenance work. If it is a minor project, then it will be completed directly under the authorisation of the site manager or operative. Where a maintenance intervention is more substantial then it will be completed in dialogue with the area asset manager who will confirm the scope of work and the appropriateness of the intervention. This distinction creates a threshold at which significant expenditure is subject to robust challenge and the requisite senior approvals, while empowering site managers and technicians to undertake minor tactical activities without creating undue or inefficient delay. For example, on a PRS installation, a minor intervention could be replacing a low value component such as a ½" valve due to corrosion with stock held within the operative's vehicle. Conversely, an intervention requiring approval from the Asset Manager could be the identification of faults on an installation that would be more suitable for full refurbishment or replacement – such decisions would be made by the appropriate asset manager taking account of all available data to assess the most appropriate option.

Intervention assessment methodology

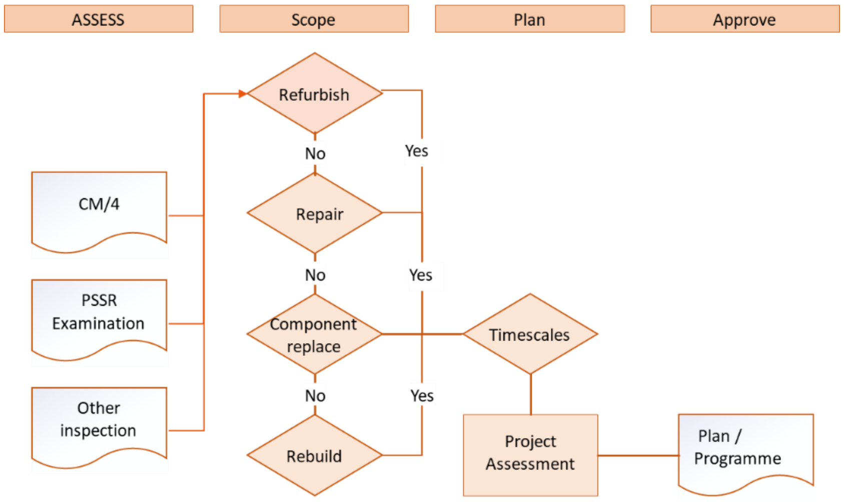
Asset failure rates can be predicted by a number of age versus reliability models that depend on the asset type. For many of these models, there is a high risk of failure immediately after the installation of a new piece of equipment or a new refurbishment while any manufacturing defects, installation errors or misalignments are identified and corrected. This is akin to the defects or 'snagging' that is identified shortly after occupying a new build property. On mechanical assets, once the asset is fully installed and operating, then the reliability rates are generally more predictable. As a mechanical asset reaches the end of its useful life, deterioration rates can rise quickly and, in some models, unpredictably. This can make it more difficult to schedule maintenance effectively and more intrusive interventions, such as refurbishment or replacement, become necessary.

The majority of maintenance is designed to identify operational faults that may be remediated by means of a simple repair to the specific component (for example, the replacement of a diaphragm in a gas regulator). Conversely, the 'end-of-life' condition is brought on by serious life limiting condition defects, such as cracks, corrosion or wear/erosion and obsolescence. In such cases, only replacement or complex refurbishment will improve the health of the asset.

Where we identify, following an inspection, that work on an asset is required, then the intervention will depend upon the scale of the work involved. Where the intervention is relatively straightforward the best course of action will be agreed at site-level with the highly skilled and competent maintenance team that is present.

Where a more considered intervention is required, or there is an uncertainty associated with the intervention, then the intervention will be authorised by the Area Maintenance Manager. If the intervention is more substantive or is outside of the authorisation levels of the Area Maintenance Manager, then the Asset Manager will recommend a course of action to senior management and ultimately through to the Network Director for authorisation. This recommendation will be supported by a paper setting out the intervention assessment, the scope of work required and the plan for remediation subject to approval. Figure 3: below outlines the assessment process:

Figure 3: Assessment process



Maintenance work scheduling

We use Maximo Asset Management as our asset repository for all our assets. This also supports the scheduling of inspection regimes according to the management procedures and permissible windows in which work must be undertaken. This is supplemented by further workforce scheduling software 'Click' to optimise workloads and issue work orders to the field operatives.

At the time of an inspection the intervention is categorised according to one of four categories:

- E1 (critical) work meets legislative obligations, such as PSSR and must be delivered within a defined tolerance.
- E2 (important) work achieves key deliverables on the asset, such as functional checks, and must be delivered within the tolerance plus a small allowable extension.
- E3 (general) work has a longer allowable extension.
- E4 (other) work has the lowest importance.

This categorisation allows the most important work to be prioritised and ensures delivery of all maintenance work. All work orders are then monitored on a real time basis, to identify whether an engineer is on site, en-route or a task has been completed.

The operational delivery of maintenance work for the transmission assets (>7barg) is completed by specialist teams in each network that have the appropriate training and competency to undertake such work. Distribution maintenance activities, such as riser inspections, are primarily undertaken through the depot structure, and are managed on a local network-specific basis. An exception is district governors, which remain with the centralised maintenance teams, as a more standardised approach is appropriate for such assets. Although the depots undertake the majority of distribution maintenance, the approach varies between our Scotland and Southern networks. This enables local planning and resource availability to be considered and ensures the most appropriate response. Through cross-skilling, local depots can utilise First Call Operatives (FCOs) to undertake activities such as riser, Mains Risk Prioritisation System (MRPS) and leakage surveys, allowing maintenance teams to focus on more complex and specialised maintenance activities.

The following are examples of typical maintenance regimes:

- **Offtakes and PRS.** Functional testing and condition monitoring are generally on calendar-based frequencies and by the requirement for examinations under PSSR. For example, examination of slam-shut safety devices is required every 12 months under PSSR, with an intervening functional check every six months under maintenance procedures. Revalidation of filters under PSSR are scheduled every six years, while gas pre-heating systems are revalidated every 10 years. These revalidations are detailed within our Transmission Integrity and Compliance appendix. We also conduct detailed condition-based surveys of pipework and components every 12 years in accordance with Management Procedure, *SGN/PM/CM/4 part 1 – Management Procedure for condition assessment and defect reporting of above 7barg assets*. These surveys are detailed within the Transmission Integrity appendix.
- **LTS pipelines**. ILI is scheduled in accordance with PSSR and intervals are as detailed above. ILI examinations are detailed within our Transmission Integrity and Compliance appendix. Where ILI is not possible due to the small diameter of the pipe or the low flow of gas, overline inspection is undertaken to meet the requirements of PSSR. We also undertake line-walking on LTS pipelines – where pipeline engineers are required to physically walk the route of a pipeline to identify any features that may have an impact on the safety of the pipeline. Cathodic protection systems are monitored to ensure LTS pipelines remain adequately protected against corrosion – this monitoring is increasingly completed remotely.
- **Distribution mains.** We carry out a variety of surveys on distribution mains, including annually and as required. MRPS surveys are carried out on metallic mains, which provide us with a risk score to allow the assets to be prioritised in the mains replacement programme. Some mains will also cross a feature such as a river or rail crossing, and these mains crossings are visually inspected to ensure their integrity is maintained. These inspections are prioritised by the associated risk and future inspection intervals determined by our internal management procedure SGN/PM/MAINT/14. These inspections also incorporate the inspection of access prevention measures where relevant to ensure the safety of the general public is not at risk. We also conduct proactive and reactive leakage surveys throughout the year, determined by our internal management procedure *SGN/PM/LC/18 – Management Procedure for Leakage Survey*. These are typically walking surveys but where practical a vehicle survey can be undertaken. Some examples of these are:
  - Winter survey – carried out to detect significant leakage during periods of low temperature
  - Triggered survey – for all mains with a risk score greater than the trigger risk value and where trigger criteria has been met
  - Summer survey – all mains with a risk value of 190 or higher, must be surveyed once during the summer
  - Additional leakage surveys – precautionary surveys where a product or installation defect has been identified and it is suspected that other failures may have occurred
  - Supplementary surveys – where a vulnerable building has been identified as part of an MRPS survey
- **Risers.** Gas risers supplying multi-occupancy buildings are inspected periodically in line with our internal management procedure *SGN/PM/REP/3 – Management Procedure for Risk Assessment and Risk Management of Network Risers*. As these are above ground assets we carry out a visual condition assessment as far as reasonably practicable, but we also capture a wide variety of other factors relating to the environment of the pipework, the building being supplied, the standards of the installation and anything that could impact on the overall integrity of the pipework. The surveys are input into a risk modelling decision support tool, which was independently developed by a leading engineering consultancy, to determine the appropriate asset intervention covering full replacement to refurbishment. The results of these inspections also inform us of the next inspection interval.
- **Governors**. We apply RCM, which generally comprises functional checks, to these assets. Faults found during functional checks are reported centrally, from which Failure Finding Intervals (FFIs) are calculated for specific asset types and configurations. These FFIs, which identify the expected period until the next failure, then form

the basis of future inspection frequencies. Previously, FFIs were calculated every three years. However, in GD1 we increased this analysis to every six months in order to maximise operating efficiencies. RCM is applied to around 90% of governor assets. At network sales, the cap for RCM inspection was two years, however, upon analysing inspection frequencies, it was clear that over 80% of inspections were undertaken at the cap rather than at a risk-based frequency. We reviewed and agreed an extension to the cap to eight years so that over 80% of assets are now inspected on a risk-based schedule. This does mean that routine inspections are still required to monitor site husbandry and general up-keep of the installation, but these can be undertaken at minimum cost during other activities. We also conduct periodic, detailed condition-based surveys of pipework and components in accordance with *Management Procedure, SGN/PM/CM/4 part 2 – Management Procedure for condition assessment and defect reporting of below 7barg assets*.

- **Pressure management equipment** (including Pressure Data Loggers, and Automated Pressure Management Systems). The life span of a logger battery is typically from 1.5 to 5 years depending on usage. Batteries will be replaced as and when identified through site planned visits or alarm management. The failure to replace failing profilers and batteries in a profile controlled low pressure gas network could lead to higher than necessary outlet pressures. This increase district outlet pressure in the network being controlled by the profiler. The consequence of this pressure rise could result in an increased number of PREs. It may also impact network 'shrinkage' (lost gas to SGN).

In Table 5 below, we have set out examples of maintenance work, whether they are calendar or reliability centred approaches and whether they are included in the Transmission Integrity and Compliance appendix, or in this appendix.

Table 5: Types of inspection regime

	Calendar	Reliability Centred
Offtake and PRS (as set out under PSSR)	Included in Transmission Integrity and Compliance appendix (Capex) - Slam shut safety devices (12 monthly PSSR) - Revalidation of filters (six years) Included in this appendix - Slam shut safety devices (six monthly maintenance) - Inspections to comply with Electricity at Work Regulations (annual visual inspection and two yearly full inspection and test)	Included in Distribution Integrity and Governors Appendices - CM/4 Surveys for Pipework and components (12 years with potential for condition-based inspections more frequently)
LTS Pipelines	Included in this appendix - Cathodic Protection - CIPPS (midway between ILI inspections) - Line walking (four years unless an alternative frequency has been justified by risk assessment) - Fortnightly aerial surveillance	Included in Transmission Integrity and Compliance appendix - ILI
Distribution Mains	Included in this appendix - Distribution Mains Surveys - Surveys of Rail or River Crossings	

Risers	Included in this appendix - Riser Surveys	
Governors		Included in this appendix - Functional Checks
Data pressure loggers	Included in this appendix - Logger batteries	

Operational delivery of maintenance

Our asset repository and our scheduling processes are consistent between both Scotland and Southern.

Operational delivery of our transmission maintenance is not managed through the depot structure but through a single team across both networks. This centralised approach is appropriate due to the specialist skills required to maintain these above 7barg assets, for which it would not be efficient to maintain the required qualifications, experience and equipment across numerous depots.

However, as noted earlier, the majority of distribution maintenance activities, such as riser inspections, are undertaken through the depot structure and as such are managed on a local network-specific basis. This decentralised approach is appropriate as it facilitates the use of localised knowledge and empowers depots to most appropriately manage their resource allocation.

3.2 Legislative background

Operational assets are maintained primarily to ensure the integrity of the assets and their fitness for purpose to maintain a safe and reliable network and security of supply, and to meet core legislative requirements. An example of such legislation is the Pipeline Safety Regulations 1996, which designates Local Transmission System (LTS) pipelines as Major Accident Hazards. Other legislation, such as the Pressure Systems Safety Regulations 2000 (PSSR), prescribes the need for Written Schemes of Examination (WSoE) for relevant assets.

The legislation, however, is not prescriptive in detailing the required maintenance and inspection regimes.

Guidance from industry bodies: The Health and Safety Executive (HSE) looks to recommendations from industry bodies, such as the Institution of Gas Engineers and Managers (IGEM), for guidance as to the required minimum standards for gas network operators. For example:

IGEM/TD/13 – *Pressure regulating installations for Natural Gas, Liquefied Petroleum Gas and Liquefied Petroleum Gas/Air* describes the aim of operation and maintenance being as to ensure that the PRI:

- Operates in a safe and environmentally sound manner
- Offers sufficient reliability for the operating conditions within which it is used and will continue to operate until its next maintenance
- Is in sound mechanical condition
- Operates at the appropriate set points
- Is installed correctly

IGEM/TD/13 also states that the period between overhaul and inspection may be varied according to the requirements of the systems, experience gained locally or manufacturer's specific recommendations (particularly with reference to elastomeric components).

IGEM/TD/13 also highlights significant risks with a 'fix on failure' maintenance policy, and states this should only be adopted after a detailed assessment such as reliability centred maintenance (RCM), failure modes, effects and criticality analysis (FMECA) or failure simulation testing.

IGEM/TD/13 also gives the following guidance on condition-based monitoring: "The condition of the PRI or individual equipment should be assessed, in order to determine the optimum time to replace/repair components. Operational parameters should be monitored regularly by local inspection, or remotely by telemetry, for signs of deterioration. It is essential that inspections are carried at such intervals that will enable the necessary repair/replacement works to be undertaken before failure occurs."

We are also required to create, maintain and operate within a safety case, which is regularly reviewed by the HSE.

Electricity at Work Regulations 1989

The regulations apply to all electrical systems and equipment whenever manufactured, purchased, installed or taken into use even if its manufacture or installation pre-dates the regulations. Where electrical equipment pre-dates the regulations this does not of itself mean that the continued use of the equipment would be in contravention of the regulations.

It is relevant to all work activities and premises and of particular relevance to duty holders, it is also be of interest and practical help primarily to engineers (including those involved in design, construction, operation or maintenance of electrical systems and equipment), technicians and their managers.

Pressure Systems Safety Regulations 2000 (PSSR)

The PSSR cover the safe design and operation of pressure systems to reduce the risk of failure of a pressure system or one of its components that could give rise to a major hazard. PSSR require that operators document and adhere to a Written Scheme of Examination (WSoE) for all pressure systems, including safety devices and key vessels, in conjunction with an appointed Competent Person. We meet this requirement through our Management Procedure, SGN/PM/PS/3. Any postponements of examinations under the WSoE must be notified in writing to the HSE. Further information in relation to our activities in line with this legislation can be found in the Distribution, Integrity and Governors appendix.

Pipeline Safety Regulations 1996 (PSR)

The PSR provide an integrated, goal-setting risk-based approach to the management of pipelines. The regulations cover design, construction, operation, maintenance and decommissioning activities. Regulation 13 includes the absolute requirement to ensure our distribution network is maintained in an efficient state, in efficient working order and in good repair. We demonstrate 'best practice' through the adherence to industry recommendations, including those of the Institution of Gas Engineers and Managers (IGEM). The following recommendations and guidance provide the core structure for our operations:

- IGEM/TD/3 - –Steel and PE pipelines for gas distribution
- IGEM/TD/13 – Pressure Regulating Installations for Natural Gas, Liquified Petroleum Gas and Liquified Petroleum Gas/Air
- IGEM/SR/25 – Hazardous Area Classification of Natural Gas Installations

These recommendations are implemented through our safety management system, via a number of management procedures, work instructions and specifications. These have been developed to ensure compliance and confirm continued fitness for purpose while incorporating best practice. Further information in relation to our activities in line with this legislation can be found in the Distribution, Integrity and Governors appendix (012).

Dangerous Substances and Explosive Atmosphere Regulations (DSEAR) 2002

The Dangerous Substances and Explosive Atmospheres Regulations 2002 are concerned with protection against risks from fire, explosion and similar events arising from dangerous substances used or present in the workplace and require employers to control the risks to the safety of employees and others from these hazards.

They set minimum requirements for the protection of workers and are goal-setting regulations which are supported by an Approved Codes of Practice that provides practical advice on how to comply.

Application of legislation and industry guidance to maintenance at SGN

SGN operates within a Safety Case, required under legislation and which is accepted by the HSE. The Safety Case specifies all our working arrangements, and reflects our Safety Management Framework, which contains all our engineering and safety policies and procedures.

3.3 GD1 output delivery

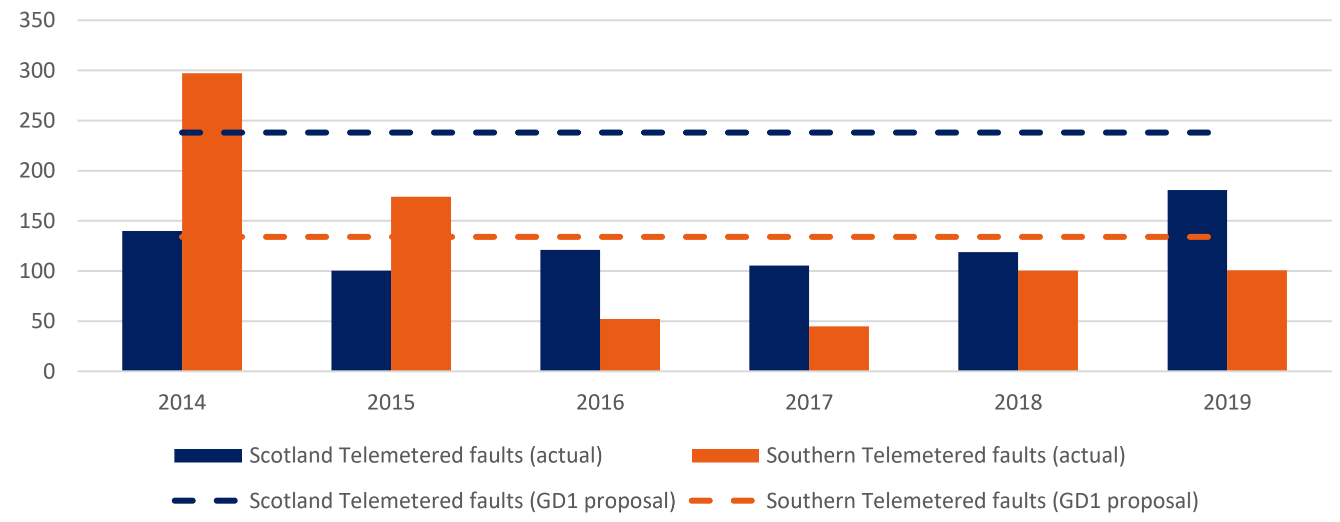
During GD1 we have successfully delivered against three primary outputs:

Telemetered faults (critical and high priority faults and reported as 'now' faults)

The duration of a fault is calculated from the point of origin of the fault (the alarm being activated, or a fault status being received by our Gas Control Centre) to the time the fault was cleared following repair. The sum of all times is then divided across the total number of telemetered sites across the network.

Such faults indicate non-standard conditions which require on-site attendance by an engineer to ensure security of supply. There are prescribed SLAs for attendance at these sites during fault conditions and we currently report 'now' faults as part of the RIIO framework as a primary output. Our performance in this area is shown in Figure 4: below:

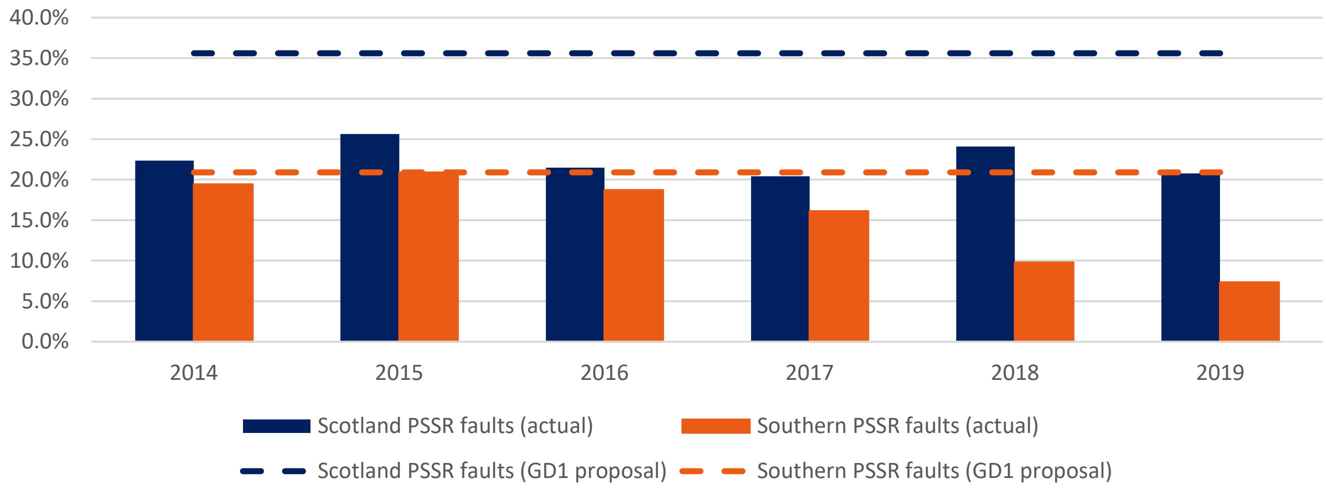
Figure 4: Telemetry fault hours per site



Pressure Systems Safety Regulations (PSSR) Faults

The aim of these regulations is to prevent serious injury from the hazard of stored energy as a result of the failure of a pressure system or one of its component parts. PSSR faults are identified during planned inspections and are recorded as a proportion of our Written Scheme of Examination. Our performance in this area is shown in Figure 5: below:

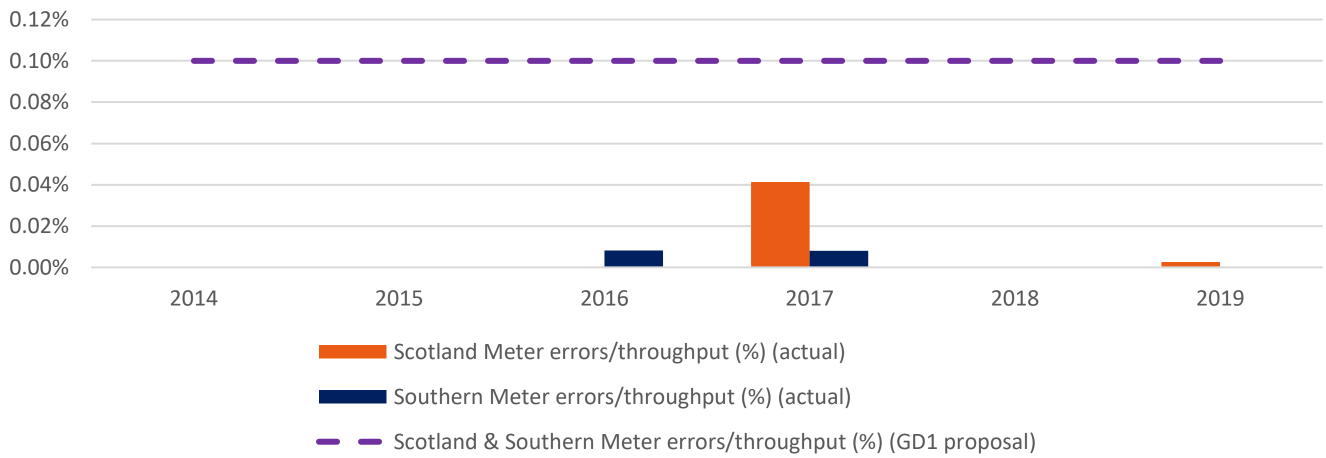
Figure 5: PSSR faults per site



NTS offtake meter error reports

An offtake meter error can be identified during a planned inspection or during a scheduled meter re-validation exercise. It is important that meter accuracy is maintained to ensure accurate transportation charging, energy allocation and the monitoring of shrinkage on the network. Meter errors are reported as part of the RIIO framework as a primary output. They are recorded as a percentage of throughput because the impact of an error increases as the throughput increases. Our performance in this area is shown in Figure 6: below:

Figure 6: NTS offtake meter error reports



It should be noted that the scale of impacts from meter errors are typically extremely low – as demonstrated by the y axis in Figure 6: above.

3.4 GD1 customer experience

The operations of our Maintenance teams generally go unnoticed by our customers, yet they are critical to the ongoing safe operation of our networks and ensure customers continue to receive a reliable gas supply.

The interaction between our Maintenance teams and customers tends to be focussed on particular groups:

- Landowners, such as local authorities, Network Rail, Forestry Commission, Canal and River Trust and Scottish Canals, national parks
- Large industrial users
- Agricultural communities
- Developers

Effective engagement with these groups is important to ensure the efficient delivery of our operations and to protect our assets.

During GD1 we have taken steps to proactively engage with these groups, for example:

Landowner liaison officers

We have created landowner liaison officer roles in each network to engage with landowners who are impacted by our cross country LTS pipelines and to administer our GDPR compliant landowner database. This database holds the contact details should our pipeline engineers need to contact the local landowner to gain access or discuss any concerns. In addition, the database is used to identify those who must be sent our annual calendar and accompanying letter, see Figure 7: below, to comply with our internal procedure *SGN/PM/MAINT/5 – Management Procedure for Maintenance of Pipelines Operating Above 7bar*.

Figure 7: Standard letter for annual calendar

Mr F Armer
Blythe Farm
Newton

Contact details
incl address/tel
Date

Dear Mr Armer,

HIGH PRESSURE GAS PIPELINE(S) ON YOUR LAND

I am pleased to enclose a copy of the Scotia Gas Networks calendar, which I hope you will find useful throughout the coming year.

I would also like to remind you that if, at any time in the future, you are planning to carry out any activities such as excavation work, building work, fencing, new gate posts, ditching/drainage, deep cultivation, tree planting etc. in the vicinity of the pipeline then please contact the above number to arrange for a representative to visit site. **This is a free service where we will locate the position of the pipeline on site and be able to give guidance to ensure that all work is carried out safely and efficiently.**

If you have any particular issues that you wish to discuss personally then please contact me on the above number and I will be happy to discuss these with you or make a visit accordingly.

May I take this opportunity to wish you and your family a very Merry Christmas and a Happy and Prosperous New Year.

Yours sincerely

Each year we make positive contact with every landowner on our database to re-confirm their contact details and update any changes of ownership. At this time, we remind landowners that should they intend to undertake excavation work, building work, fencing, new gate posts, ditching/drainage, deep cultivation, or tree planting then we offer a free service to attend site and offer safe working advice.

LTS line walking

We have also implemented a programme of line walking our LTS pipeline assets. To support our engineers with this activity we have developed an app that allows field-based users to quickly record pipeline or landscape features that may be of interest to our asset managers.

Damage prevention operatives

We have created the pipeline damage prevention operative role to work alongside third-party contractors while they are working in the vicinity of our assets. This is a proactive measure taken to prevent avoidable and costly damage to our assets.

Engagement with educational bodies

We have worked with Scotland's Rural College (SRUC) to develop a module that teaches future landowners and farm operators about our business and assets. Following the successful work with SRUC, we have also delivered the damage prevention safety module to 65 students and employees at Borders College who are studying SVQ Landscaping, Amenity Horticulture or SVQ Agriculture. Feedback from students was positive, with the college requesting that we also deliver the module material to their construction students.

We have worked with the National Farmers Union to develop a similar partnership and developed a 'grantors charter' to agree roles and responsibilities when working in the vicinity of our assets. The Grantors Charter will be issued this year alongside our annual calendar, so it reaches the 6,022 landowners we have on our register. We also have a partnership with the Scottish Association of Young Farmers to further enhance the relationship with our maintenance departments primary customer base.

Engagement with agricultural community

SGN regularly attends agricultural events supported by both operational colleagues from the maintenance function and our stakeholder relations team. This is seen as an opportunity to improve awareness of our business, our assets and to make us more accessible to harder to reach customers.

SGN has carried out training sessions to deliver pre-harvest training to farmers, and a total of 200 farmers were given briefings regarding plant protection.

Further to this, SGN has been working with National Association of Agricultural Contractors, who have included relevant plant protection information into their bulletins, with plans to have our plant protection information embedded on their website.

3.5 GD1 allowances and expenditure

In general, our GD1 expenditure has been less than the allowance allocated in Southern, but slightly greater in Scotland. Overall, we are forecasting an underspend for the end of GD1 of 8.7% (£22.6m). During this price control we have taken strategic steps to manage our expenditure and seek to drive efficiency savings wherever possible, for example:

Reviewing and refining inspection regimes

During GD1 we have made specific improvements to the inspection regime to make it more robust and more cost effective without compromising safety. An example of this is reviewing the application of caps. At the start of GD1 many procedures had caps where, for example, an ILI would have to be undertaken every 15 years, even if the available evidence suggested that the pipeline condition was sufficiently robust that the next survey could be extended beyond that date. These survey intervals were often based on highly cautious values dating back to pre-network sale and historic procedures. As a part of our approach to maintenance in GD1 we reviewed these caps according to the technical evidence that is available and, with the support of independent expertise, determined whether the cap could be extended based on the accuracy of the assessment process. This was then fully reviewed with the HSE before implementation. As a result, this generated an efficiency saving by increasing the time that can elapse between inspections for known high quality pipe assets.

Pressure management to minimise shrinkage/leakage

Shrinkage forms the majority of a gas distribution network companies' business carbon footprint and accounts for around 1% of Great Britain's total greenhouse gas emissions[2]. Reducing losses minimises the emission of harmful methane gas and aligns with achieving the UK government's emissions target, as well as contributing to reducing customer bills.

In GD1 we have rolled out active pressure management procedures over a large proportion of our network. This pressure management strategy includes both targeted financial investment in new (and ongoing maintenance of existing) pressure management equipment.

Table 6 below demonstrates the success of our strategy, as we have been able to make year-on-year reductions in network pressures, delivering a reduction in emissions of approximately 24ktCO_2e in the first six years of GD1.

Table 6: Actual average system pressures across RIIO-GD1

	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19
SO	28.20	27.08	26.67	26.57	27.01	26.93
SE	27.13	26.56	26.49	26.31	26.41	26.55
SC	27.01	26.78	26.71	26.53	26.54	26.42

Average pressures at LDZ level for ***all low-pressure networks***

It is SGN's intention to finish GD1 as close as possible to optimum average system pressure levels.

Optimising workforce deployment

Further efficiency gains were delivered through the deployment of more effective scheduling software to optimise workforce deployment, accompanied by process improvements and introducing measurable expectations on visit durations and time allocated to each work order.

[2] P45 https://www.ofgem.gov.uk/sites/default/files/docs/2015/06/energy_efficiency_directive_report_-_final_for_publication.pdf

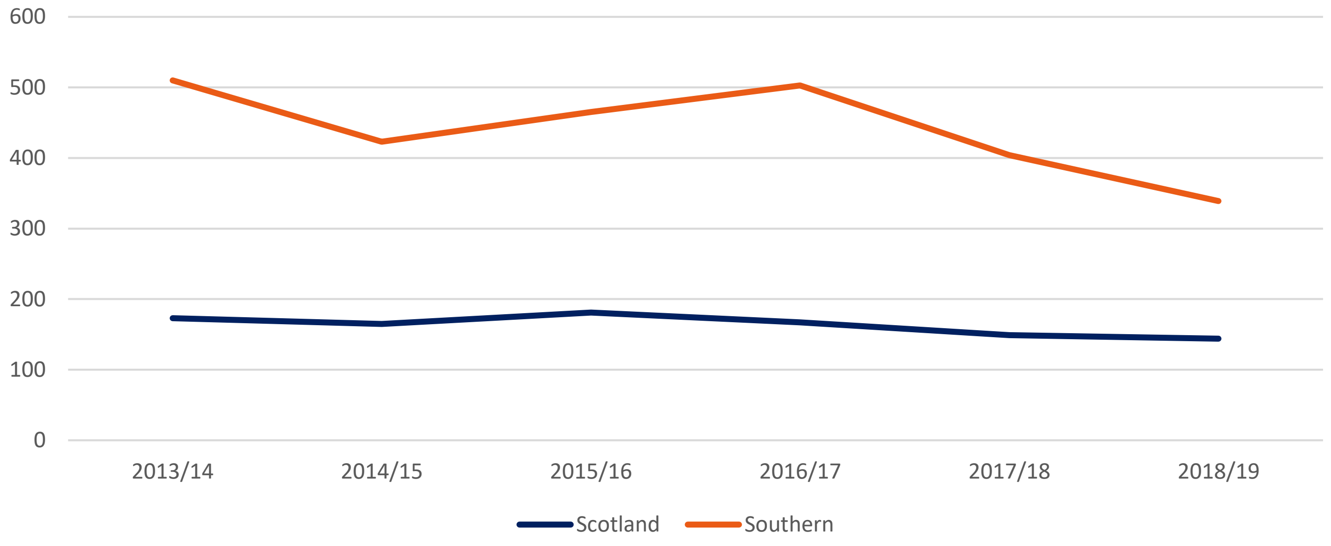
Table 7: Maintenance expenditure versus allowances £m (2018/19 prices)

		13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	GD1
SGN	Expenditure	35.6	27.2	26.6	29.4	26.3	31.8	29.4	29.9	236.2
	Allowance	31.6	31.9	32.0	31.9	32.5	32.9	32.7	32.4	257.9
	Variance	**-4.0**	**4.7**	**5.4**	**2.5**	**6.2**	**1.1**	**3.3**	**2.4**	**21.7**
Scotland	Expenditure	10.9	9.2	9.0	9.8	8.9	13.1	10.4	10.6	82.1
	Allowance	8.3	8.4	8.6	8.8	9.2	9.6	9.6	9.5	72.0
	Variance	**-2.6**	**-0.8**	**-0.4**	**-1.1**	**0.2**	**-3.5**	**-0.8**	**-1.1**	**-10.1**
Southern	Expenditure	24.7	18.0	17.6	19.5	17.3	18.7	19.0	19.3	154.1
	Allowance	23.3	23.5	23.4	23.2	23.3	23.3	23.2	22.9	186.0
	Variance	**-1.4**	**5.5**	**5.8**	**3.6**	**6.0**	**4.6**	**4.2**	**3.6**	**31.9**

Due to the wide range of work types undertaken under the maintenance umbrella, operating expenditure has been impacted by several factors to varying degrees across both of our networks. Both networks are focussed on a drive to improve performance towards frontier levels, which is a particular challenge in our Scotland network. Factors which have driven increases in our expenditure during GD1 are as follows:

- **District governor surveys.** *CM/4 part 2 (Procedure for the Condition Assessment and Defect Reporting of Below 7bar Assets)* surveys on district governor sites were started towards the end of 2017 and are continuing.
- **Damage prevention procedures.** The introduction of our new SW/2 procedure in 2017/18 drove an increase in pro-active damage prevention activities on high pressure pipelines. The procedure necessitated the recruitment of five additional Pipelines employees in each network.
- **Increased instrumentation costs.** Repairs undertaken on local gas treatment and gas quality equipment on the national offtake sites has been subject to increasing instrumentation costs. This equipment was typically installed during the 1990s when the odorant injection points were moved from the import terminals to the national offtake sites. Therefore, all this equipment has aged at a similar rate.
- **Free of charge service alterations. Figure 8:** below shows the number of service alterations for each of our networks in the GD1 period to the end of 2018/19. This illustrates a relatively steady workload for free alterations for our vulnerable customers. We have managed the expenditure in this area to ensure efficiency has been managed through increased focus on cost control in the operational depots. Delivering free of charge service alterations for our vulnerable customers is directly aligned with our customer priority of supporting those in the community who need it most, as well as meeting the requirements of section 6 of Schedule 2 of the Gas Act 1995.

Figure 8: Service alterations workload for vulnerable customers throughout GD1



In order to mitigate the impact of the above cost drivers, we have taken strategic decisions which have successfully delivered maintenance expenditure savings during GD1:

- **Water ingress.** The winter in 2014/15 had lower levels of rainfall than in previous years, and no widespread flooding as experienced in 2013/14. This reduced the levels of water ingress experienced in our Networks, especially in our Southern Network. We also reduced the prevalence of water ingress issues through improvements to the network facilitated by our replacement programme.
- **Gas holder mothballing.** Both networks have realised savings by mothballing all of our directly connected gas holders, significantly reducing the associated maintenance costs.
- **High pressure storage.** In our Southern network we have realised savings by mothballing high pressure storage sites, significantly reducing the associated maintenance costs.

These factors, along with ongoing initiatives and efficiency drives, have been key to our Southern network performing below allowances. Although our expenditure in Scotland is still higher than allowances, we continue to place an emphasis on performance management to drive towards frontier efficiency. Within both our networks, we forecast our total maintenance costs over RIIO-GD1 to increase compared to the prior year forecast, reflecting our revised expectations around maintenance workloads, such as the valve replacements discussed above.

Regression analysis

In both networks our primary maintenance expenditure relates to employee costs. The cost of labour varies due to regional differences, and as such we currently have three key labour rates (London; Greater London and Southeast; Scotland and the rest of Southern). Our direct labour maintenance employees are supported by contractor labour, which is primarily utilised for specialist activities (for example pre-heater boilers on the transmission system). This is a more efficient approach than retaining the skillset in-house, as the requirement to maintain relevant qualifications and experience is not justified by the relative cost. This overall approach is supported by industry benchmarking and regression analysis as set out in the Cost Efficiency appendix and seen in Table 8 below.

The regression analysis demonstrates that our networks are in first and second place in relation to efficiency of maintenance costs. This is an improvement in comparison to our position at the start of GD1, demonstrating that the steps described above have been successful in improving our efficiency over the course of the price control. This is despite our networks typically having more challenging characteristics than seen in the other GDNs – for example, in our Southern network we observe a higher incidence of governor installations in pits than other networks. Such installations are more complex and time consuming to maintain due to their location and so reduce our efficiency in terms of time taken per visit. Similarly, both our Scotland and Southern networks have high concentrations of risers which, with the exception of Cadent, is not reflected in the other networks and again could give the impression of being less efficient when we are delivering more outputs. At present the costs of such challenges are included within the regression analysis, despite not necessarily being common or equal across comparators.

Table 8: Regression analysis

	Standardised Efficiency Score				
	2013/14	2014/15	2015/16	2016/17	2017/18
EoE	1.14	1.17	1.21	1.26	1.26
Lon	1.08	0.96	1.27	1.09	1.17
NW	1.17	1.17	1.43	1.34	1.37
WM	0.85	1.00	0.98	1.05	1.07
NGN	0.75	0.84	0.80	0.79	0.85
SC	0.97	0.84	0.72	0.76	0.68
SO	1.09	0.81	0.71	0.78	0.72
WWU	0.95	1.20	0.89	0.92	0.87

3.6 GD1 lessons learned

Through the course of GD1 we have reviewed existing practices in addition to emerging requirements, and as such have been able to implement the following steps in order to continue our best-practice maintenance activities:

Increased focus on stakeholder engagement

The activities described within section 3.4 have improved our relationships with key stakeholders, both existing and emerging. For example, over the course of the price control, we have increased our engagement with the biomethane community by undertaking annual reviews at all biomethane sites involving our Maintenance team, Distribution Entry Connections team, the plant operator and often the plant investor. SGN leads these sessions which bring together all interested parties, and include a review of maintenance requirements, use of innovation, any incidents/errors and any future capacity requirements. Furthermore, we have recently undertaken industry stakeholder events in London and Edinburgh, including attendees from existing and prospective biomethane sites, to discuss the future of biomethane including capacity availability and seeking feedback on our connections processes. This proactive approach to engagement has contributed to the on-going safe operation of our network, one of the key priorities for our customers.

Procedure reviews

Throughout GD1 we have reviewed our policies and made amendments or introduced new procedures where required. For example, the introduction of our SW/2 policy in relation to damage prevention measures, as discussed in section 3.5. Furthermore, we have amended the frequency at which we calculate FFIs in order to maximise operating efficiencies, as discussed in section 3.1. Lastly, the biomethane engagement activities described in section 3.4 are included within our SGN/Bio-3 Specification, demonstrating that internal policies are used to ensure adoption of updated best practice.

Although mainly safety driven, these steps have reduced the risks for all parties of mechanical damage on LTS pipelines. There has been an initial routine cost for SGN, however as a result of the implementation of SW2, this cost would be significantly less year on year in comparison with the overall financial and reputational impacts of a major incident on a high pressure pipeline.

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 (022).

As detailed below, our asset maintenance activities impact upon all three commitments at the heart of our business plan; making a positive impact, building a shared future and delivering a safe and efficient service.

4.1 Positive impact

Investment in our maintenance activities has an indirect effect on making a positive impact for our customers and stakeholders.

Our customers have told us that keeping the cost of their energy bills down is their top priority[3]. As described elsewhere, an effective maintenance regime helps ensure we prolong the life of assets and avoid potentially more costly capital replacement costs. Maintenance of our assets is essential to ensuring our network remains reliable, which is another very high priority for our customers. Our customer research has indicated that keeping the gas flowing is especially important for customers in vulnerable circumstances[4].

4.2 Shared future

Customers consistently rate future energy solutions as a high priority for further investment,[5,6] and stakeholders expect us to further develop and understand our role in a future decarbonised energy system[7,8]. Maintaining our existing network in a safe and reliable condition is important if we are to explore the opportunity to use it more flexibly in the future as part of a decarbonised energy system.

4.3 Safety and efficiency

Engagement with our customers and other stakeholders has consistently shown that maintaining a safe and resilient network is of paramount importance. Our customer research has indicated that customers expect us to maintain the level of safety and reliability we currently achieve. When specifically asked to rank attributes relating to different topics, our customers strongly rated ensuring gas supplies are reliable as the most important priority. There was a broad and high agreement that we need to maintain a safe and efficient supply, and this priority was ranked highest by customers across all our networks[9]. Our research revealed that customers

[3] Explorative Qualitative Workshops and interviews (Exploratory Phase) (Ref 002)

[4] SGN Business Plan Acceptability Testing Phase 1 (Ref 078)

[5] Explorative Qualitative Workshops and interviews (Exploratory Phase) (Ref: 002)

[6] Conjoint & WtP Summary report (Valuation Phase) (Ref: 005)

[7] Future of Heat specialist panel Aug 2018 (Ref 023)

[8] Collaborative future of gas networks workshop (Ref 070)

[9] Stage 2: Max Diff Prioritisation Phase Report (ref 003)

are happy with the current reliability they receive as very few have experienced issues, believing we should be ensuring maintenance of the gas infrastructure continues.

This view is supported our stakeholder satisfaction surveys. In a recent survey, 87% of stakeholders felt we were performing well or excelling in relation to acting safely and in reliability & availability of supply. 97% of stakeholders rated these two areas as fairly or very important, which supported the findings of previous engagements such as our Moving Forward Together stakeholder workshops in 2017[10]. The reliability of gas supplies is especially important to specific stakeholders such as large gas users[11].

At our Moving Forward Together events in November 2018 we asked stakeholders their views in relation to making our network more resilient and undertaking more surveillance of gas risers.

Stakeholders viewed the option to increase our survey programme so that it includes medium-rise buildings as something we should be doing[12]. There was a range of views as to whether we should introduce other safety measures on risers, which are discussed in more detail in the Replacement appendix (019).

We also asked customers for their views in relation to making gas risers safer through willingness to pay research and business plan acceptability testing, including customers' level of support for improving the accuracy of our records. The results of our engagement showed that stakeholders and customers are generally very supportive of these initiatives that will make our network even safer, with 81% of customers were prepared to pay an additional 11p for these options.[13]

At our safe and efficient workshop event in August 2019 we tested our approach to asset management with expert stakeholders, the majority of whom supported our proposals [14].

Since late 2018, we have also been engaging with the HSE as part of their programme of multi-occupancy-buildings (MOBs) high rise inspections being carried out across all GDNs. As part of these inspections we have satisfied them that our policies, processes and management systems are effectively managing the MOB records. We have also discussed with them in detail our operational processes and practices, which included site visits of inspected risers as well as recently replaced risers and this gave assurance that our procedures are adequately carried out. We have also undertaken an increasing level of engagement with other relevant stakeholders, including local authorities, housing associations and private residents' associations. This has involved face to face meetings to discuss some of the specific requirements and challenges.

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

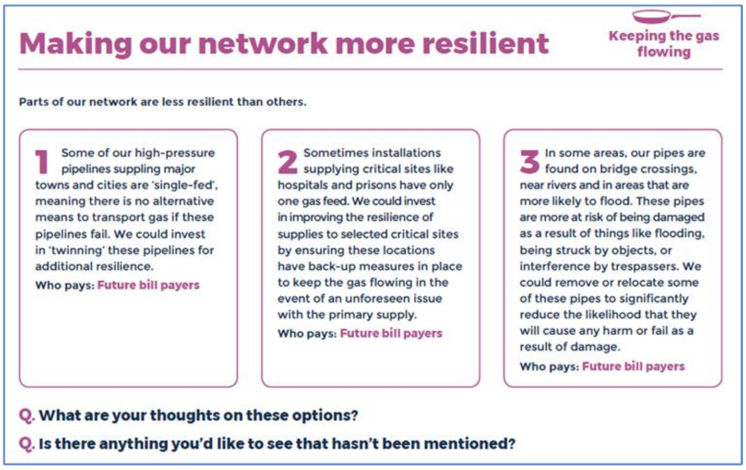
[11] Large Gas User survey results 2019 (ref 076)

[12] MFT Workshop November 2018 London & Edinburgh (ref 013,014)

[13] Stage 3: Conjoint & WtP Summary report (Valuation Phase) (ref 005)

[14] Safe & Efficient round table event – London (ref 089)

At our Moving Forward Together workshops in November 2018 we asked stakeholders for views on improving resilience and safety. This included a conversation with stakeholders to better understand if they supported relocating vulnerable or high-risk assets. Stakeholders suggested that removal of these vulnerable assets seemed to be a sensible option. Other stakeholders expressed the view that they would expect us, as the engineering experts, to make a reasonable decision as to whether this was necessary based on the potential risks involved and consequences of failure.



Through our programme of research, we have explored with customers their views on making additional investment in assets where we see changes in risk resulting from factors such as environmental changes or removing redundant assets. In our first wave of willingness to pay research customers were asked to what extent they supported relocating pipes to reduce the risk of damage (an extra 30p per year on their gas bill). 83% of respondents were supportive of this option, with 5% of the remaining 17% strongly opposed to it. In addition, customers were asked a question in relation to improving the reliability and safety of gas pipe in our quantitative acceptability testing. Customers exhibited high levels of acceptability for our proposals to enhance the reliability & safety of gas pipes, for example by removing steel tails from gas services, removing redundant pipework and doing more inspections of medium-rise block of flats. This additional element attracted the highest acceptability levels of all the options tested in this phase of research, scoring 85% in total for southern customers and 89% in total for customers in Scotland. [15]

[15] Business Plan Acceptability Testing Phase 2 (Ref 079)

5 GD2 cross sector issues

5.1 Decarbonisation and whole system

Maintenance workloads are focused on keeping the network safe and well maintained. By doing so we are keeping the gas, in particular methane which is a potent greenhouse gas, within the transport network. Effective maintenance regimes minimise not only the risk of gas escapes but also the amount of leakage – i.e. lost gas – which occurs on our network, therefore limiting the impact of methane on the environment.

5.2 Innovation

We are currently developing a number of innovative solutions which can positively impact our maintenance regimes going forwards. Further detail of our wider innovation developments can be found in our Innovation appendix.

Remote data loggers

The use of remote data loggers to collect and deliver both pressure and cathodic protection data from site to base has been widely utilised during GD1.

Opex savings have been achieved through the removal of the need for technicians to visit a test post on each of the impressed current schemes. Readings can be collected remotely at the required frequencies. It is also possible to switch Transformer Rectifier units remotely (for majors and CIPS) thus reducing the travel needs to each relevant installation. Improved approaches in remote monitoring is currently being rolled out that enable the reading of additional data types. Adopting this approach has also resulted in a reduced work load for administration employees.

Automated regulator maintenance

This system is an Electronic Regulator Diagnostics system that can be operated both remotely and manually to further improve the operational safety and efficiency measures, as well as modernise the capabilities of our maintenance activities. The aim of the project is to trial the Plexor inspection system on a regulator stream ranging in pressures from 0.4 to 75barg, semi-automatically onsite and remotely using Global Positioning System (GPS) as a location mark.

Remotely operated regulator

We currently rely on several pressure control systems to manage our distribution networks, however, some of this existing technology is becoming outdated and relies on a single service provider. As such we are currently working with several organisations to develop more solutions in the market and to encourage competition between providers, thus creating efficiencies while reducing our supply chain risk. The technology solution involves the fitting of an ‘electronic actuator’ to the regulator pilot which will ultimately be able to remotely control/adjust the governor setting in ‘real time’, thus dispensing with the need to attend site to manually adjust settings and extending the site population on which the equipment could be installed.

Smart paint

We have many above ground assets that require on-going surface maintenance with paint or other coating systems to protect them from the elements and prevent corrosion. New coating systems frequently enter the market, and as such we assess their suitability for use on our network. Our existing trial has been extended to include the full repaint of three transmission sites in our Scottish Network. No two paint/coating manufacturers work to the same performance standards and this creates a problem. We began trialling selected coatings on a variety of pipe surfaces above and below ground before carrying out accelerated corrosion and abrasion testing in a laboratory, the outcome of which will be selection of the most suitable products for our network.

As more modern paint systems come to the market, the need has been identified to assess them for their suitability on the gas network and to review and update existing industry specifications to align them with currently available new technologies, products and suppliers. This project therefore informs the Asset Health and Criticality Indices that are currently being reviewed and developed under various other projects.

Corrosion mapping for buried Commerci regulator modules

This project enabled the internal long-range NDT inspection of buried Commer regulator modules without having to excavate or grit-blast the pipework. This eliminates environmental concerns arising from waste disposal issues caused by grit blasting and associated excavation materials.

Buried Commer regulator modules have a history of failed CP and currently need to be excavated and exposed to allow the vessel and its associated pipework to be grit-blasted to prepare the surface for inspection and testing. The work involved with this process is usually extensive and protracted, taking around three weeks to complete the task. To minimise the completion time and the operational activities associated with this process, the project has developed a technique that required no excavations or grit blasting and can also carry out internal long-range NDT inspection of affected Commer regulator modules.

Commercial valve bolt replacement

We have identified that some of the bolts on our Commercial ball valves are suffering from corrosion and need replacement. These ball valves are small in size, typically ½" BSP – 2" BSP and are used in purge and vent lines on Pressure Reduction Installations (PRI) operating at pressures up to 70barg. The valve body comprises three main components which are held together by four bolts and can be located either above or below ground.

Current methods for replacing the corroded bolts involve a temporary bypass which avoids what could otherwise be an extremely costly and time-consuming operation.

Magnetic filtration in medium to low pressure networks

Mains dust is a hard contaminant commonly found in natural gas distribution systems caused by corrosion of the internal walls of cast iron and steel pipelines. Mains dust develops mainly in old pipelines that do not present any internal coating to reduce abrasion and corrosion. Thus, a certain amount of mains dust may keep circulating in the distribution system even after replacement of old pipelines with new polyethylene (PE) pipes.

This project is to investigate the latest developments in magnetic filtration technology for use on SGN plant. This would allow the potential for utilising alternative methods of gas filtration on the network pressure regulating stations, with the potential to remove the restriction on low pressure networks, returning the systems to their full operating parameters.

5.3 Resilience

Through our maintenance programme, we looking to improve resilience by delivering a more reliable network and to capture any issues before they arise. We are working to ensure that our customers are safer, and that the environmental emissions are lowered, thereby improving our customers' experience and the 'here-and-now' resilience of the network. By effectively maintaining our network assets, we are also facilitating the move towards a net-zero future as set out in our Environmental Action Plan (EAP), for example by enabling biomethane connections.

In GD1, we have responded to emerging issues which may compromise our network resilience – for example as a result of climate change we are observing an increased incidence of erosion which leads to exposed pipework. If left unresolved this could lead to the pipeline becoming buckled or compromised as the supporting ground around it is removed. In order to ensure our network resilience and to mitigate this risk we either divert the supply, for example as we did at Security

In GD1, we have managed an apprenticeship scheme to ensure our future organisational resilience and a similar pipeline of skills and succession is planned for GD2. Further information can be found in our Workforce Resilience appendix.

6 GD2 activity breakdown

6.1 Approach to GD2

We have a strong approach to asset management and governance across our asset groups and we consider that we are proposing the appropriate balance between our opex and capex requirements. This is demonstrated by our ability to name projects and programmes of work under both opex and capex, and our ability to identify the core activities required.

6.1 (b) Policy

At present, we do not anticipate any major changes in legislation that would drive changes to maintenance processes with the exception, perhaps, in relation to risers in multi-occupancy buildings. Therefore, our GD2 plan is based on existing legislative requirements, where any changes could significantly impact our maintenance activities and as such could require a reconsidered position.

Our core plan for GD2 continues a maintenance regime based on the existing GD1 frequencies and parameters. For example, not extending or shortening the calendar maintenance, and retaining the existing measures in relation to risk-based maintenance. We propose consistent level of planned and ad-hoc maintenance, reflecting stable capex investment to maintain existing levels of asset reliability.

GD2 will also include three additional programmes of work – Responsible Demolition, Riser Inspection Surveys and facilitation of biomethane connections – supported by stakeholder insight as described in section 4.

Responsible Demolition

We are seeking to remove vulnerable redundant assets which no longer carry a live supply. Typically, these are above ground pipework arrangements that are attached to bridges crossing road, rail and rivers but no longer carry gas. At the point when a replacement asset was laid, the decision was taken to leave the redundant assets in situ, as at the time their removal may have increased the cost and or risk of the programme. Removal of the assets is now recommended as, despite no longer being live assets, maintenance continues to be required on the assets as well as any structures – for example support brackets. There is also the risk that, should the supporting structures fail, an asset could fall onto the road or railway line below, causing disruption and also a potential safety risk.

Table 9: Scotland – Responsible Demolition

Sum of Crossing Length	Count of Sites	Removal of priority Assets
192.5	13	£3.75m

Table 10: Southern – Responsible Demolition

Sum of Crossing Length	Count of Sites	Removal of all Assets
404	19	£1.33m

Through our condition reviews and desktop assessment we have established a risk prioritised programme.

In Scotland, following a review of 41 candidate assets (totalling a crossing length of 824m), we have been able to identify 13 priority assets recommended for removal.

In Southern, following a review of 41 candidate assets (totalling a crossing length of 510m), we have been able to identify 19 priority assets recommended for removal.

The costs estimated for our Scotland network are significantly higher than those for Southern, despite the latter involving a greater total length of pipeline. Rather than being driven by length, the costs of removing an asset are driven by the complexity of the removal work, which varies with each particular asset, and can also include costs incurred through arrangements with third parties (such as rail networks). As such, while Scotland has a shorter total length, across more sites, the anticipated complexity is driving a higher forecast than the equivalent Southern value.

The proposed investment to support our Responsible Demolition programme is supported by a Cost-benefit Analysis (CBA) and Engineering Justification Paper (EJP) in relation to each network. These papers identify the specific assets for which we recommend removal and the associated costs incurred. These papers also set out the requirements of the programme and consideration of alternative solutions, as well as demonstrating how the programme aligns with our identified stakeholder priorities of 'Keeping Costs Down' and 'Supporting Communities'.

Stakeholder insight into this option is described in section 4.

Riser inspection surveys

During GD1, we have undertaken a comprehensive review of our riser records, systems and associated processes, involving internal workstreams including Network, Operations, Policy, Training and IT.

We have carried out reviews of policy documents and work instructions and updated these where necessary, maintaining compliance with the current review of IGEM standard IGEM/G/5. In addition, we have updated training requirements and material for those involved in installation and survey of riser assets to further enhance their knowledge and ability to consistently capture information.

We have also carried out a detailed review of our riser risk model in conjunction with our technical services consultancy, which has led to some process changes. This includes capture of additional safety related data as well as a slight change to our methodology and the data score weightings for calculating the risk associated with each riser asset, enabling us to take a prioritised approach to interventions.

Business processes have been reviewed and updated or developed to ensure ownership and consistency, plus internal reports have been further enhanced or newly developed to give better visibility of key data or trends relating to these assets. This includes newly defined process safety measures that have been introduced following a detailed bow tie analysis of this asset group. These measures will allow us to monitor trends or identify any areas at risk.

In addition, we have enhanced our audit activities in relation to the data, both from a desktop perspective as well as on site survey audits, to give us further assurance on the data quality.

We are also undertaking an ongoing review of records in relation to high rise buildings. The latest building data sets have also been analysed for medium rise buildings (three to five stories), which we have already started to survey and capture during GD1. Looking into GD2, we will continue to undertake planned gas riser inspections across both networks, in accordance with our management procedures, which will drive our replacement expenditure. This is predominantly the existing asset base of >6 storey buildings but does include a proportion of <6 storey buildings that have previously been captured largely through reactive circumstances. We will also continue to undertake reactive gas riser inspections as and when necessary, in accordance with our management procedures, or as requested via an external stakeholder.

The number and cost of anticipated surveys for >6 storey buildings, within GD2, is as follows:

Table 11: Riser inspection surveys >6 Storeys

Survey Volumes	2021/22	2022/23	2023/24	2024/25	2025/26	Total
Scotland	1,500	1,750	2,000	2,250	2,500	10,000
Southern	3,500	4,000	4,500	5,000	5,500	22,500
Costs (£m)	**2021/22**	**2022/23**	**2023/24**	**2024/25**	**2025/26**	**Total**
Scotland	0.11	0.13	0.15	0.17	0.19	0.75
Southern	0.26	0.30	0.34	0.38	0.41	1.69

In order to enhance and maintain our multi-occupancy building and riser records, we will also include four storey and then three storey buildings within the riser survey work already commenced in GD1 and expected in GD2 (currently limited to greater than six storeys).

Candidate buildings have already been identified by working with a third-party geographical information consultancy who use various data sources from Ordnance Survey including address information, topography and building height data. This is also cross matched against our Xoserve gas supply point data. Based on current data sets available, the number of potential buildings containing risers is as shown in the table below. The results of these surveys and associated risk are essential for supporting our plans for GD3 and beyond as this would inform our risk prioritisation programme for replacement for many years due to the volumes involved.

Estimating that, on average, each of these buildings will have two risers the quantity and costs of surveying these are shown in Table 12: below. The average riser survey is estimated to cost £75. We anticipate that, due to the low number of five storey risers, we will complete these within GD1 and as such they are not included in the tables.

Table 12: Riser inspection surveys <6 storeys

Risers (#)	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

Lastly, GD2 will also include facilitation of biomethane connections, in line with the commitments we have made as part of our Environmental Action Plan.

Facilitating biomethane connections

Our EAP sets out our steps to support the transition to an environmentally sustainable low carbon network, by enabling the connection of biomethane to provide an additional 450,000 domestic houses with green gas.

Our Asset Maintenance forecast includes the provision for an additional 720 and 360 FTE days in Southern and Scotland respectively, to carry out pressure adjustments on our network in order to facilitate maximising of the biomethane producers' output. This equates to an additional cost of £132k per annum in Southern and £64k per annum in Scotland.

The inclusion of biomethane facilitation in our plans, and therefore the associated additional maintenance workload activities, is supported by feedback from our customers that they expect organisations such as SGN to deliver carbon reductions as part of managing our carbon footprint and wider decarbonisation of the network. Such activities also tie in with the stakeholder priorities of 'future energy solutions' and 'minimising environmental impact'. Further discussion of our stakeholder insight can be found in the EAP.

6.2 GD2 outputs and price control deliverables

We anticipate that our primary outputs will remain the same, and do not anticipate any of the investment proposed within this appendix being defined as a price control deliverable.

6.3 Bespoke outputs

We do not propose any bespoke outputs for GD2.

6.4 Investment in existing assets – CBAs/NARMs

Our Asset Maintenance (opex) activities are not subject to Network Asset Risk Metrics (NARMs).

CBAs have been completed in relation to our Responsible Demolition programmes and can be found as supporting documents alongside this appendix. A summary of the CBA payback period is detailed in Table 13 below in section 6.5.

6.5 Engineering Justification Papers

Engineering Justification Papers (EJPs) in relation to our Responsible Demolition programmes can be found as supporting documents alongside this appendix.

Table 13: Asset Health Engineering Justification Papers (EJPs) & CBAs

Network	Asset	Project Spend (£m)	NPV (£m)	CBA Payback (years)	Engineering Justification Paper
Southern	Abandoned Crossing	1.33	5.97	4	SGN Aman – 001 AbanCross So EJP Dec 19
Scotland	Abandoned Crossing	3.76	2.52	12	SGN Aman - 001 AbanCross Sc EJP Dec 19

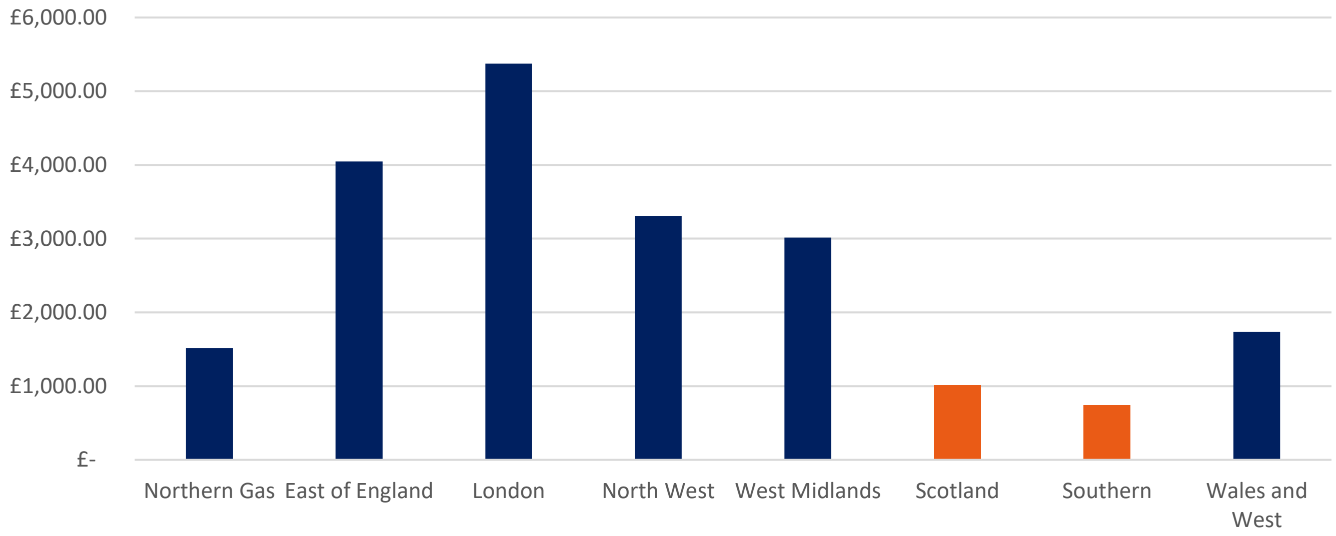
6.6 Investment in new assets

Section 6.1 sets out our intended activities in GD2, with 01 demonstrating our anticipated expenditure in the period. Our core plan for GD2 continues a maintenance regime based on the existing GD1 frequencies and parameters. For example, not extending or shortening the calendar maintenance, and retaining the existing measures in relation to risk-based maintenance. As such, our Asset Maintenance workloads are expected to remain stable and in line with comparable GD1 levels, supporting the 'Four Rs' strategy discussed in section 2. We intend to complement this strategy by undertaking specific programmes of work (such as Responsible Demolition and Proactive Riser Surveys) to further enhance our asset base and records. This is in addition to environmental measures such as facilitating biomethane connections, which will contribute to the wider resilience and preparedness of our network for the future energy landscape.

6.7 Cost efficiency

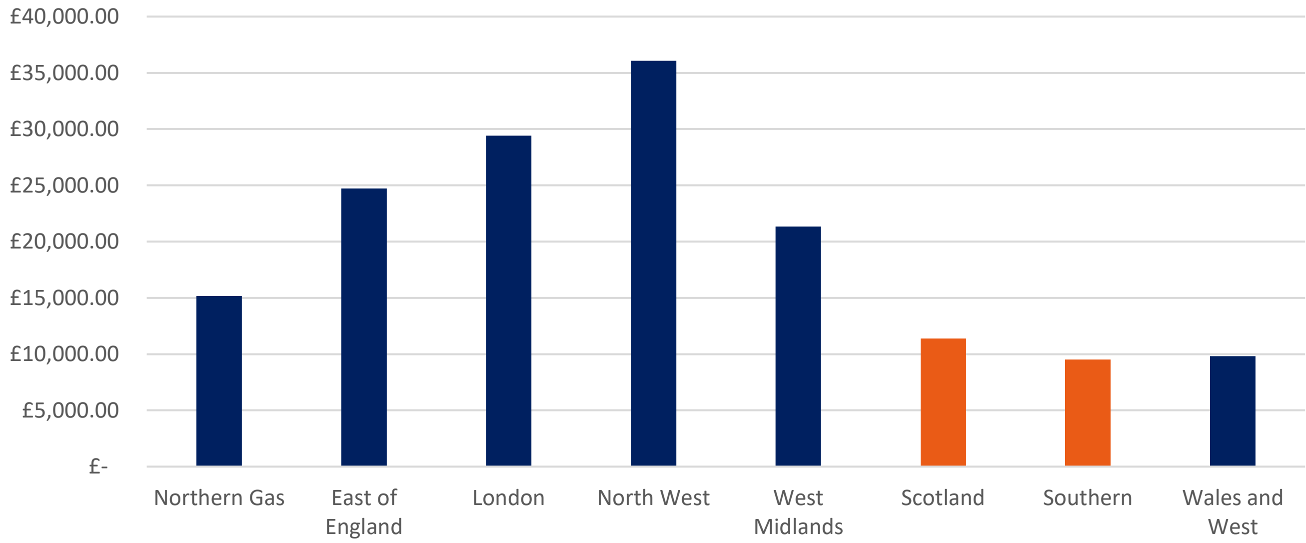
Due to the diverse nature of each network, it is difficult to draw direct comparisons between each GDN in relation to their relative efficiency of operating costs. However, unit rates can be calculated to create comparisons where possible – for example, approximately 46% of maintenance expenditure by the GDNs in 2017/18 was associated with LTS and PRS assets. Figure 9: below demonstrates that SGN's networks have the lowest maintenance cost per kilometre of LTS pipeline, while Figure 10: demonstrates that SGN's networks have the first and third lowest maintenance cost per PRS. These unit rates demonstrate that that SGN performs well in these areas, suggesting that our asset management strategy and resource model is effective and efficient.

Figure 9: Maintenance cost per KM of LTS pipeline



Costs above relate to 2017/2018

Figure 10: Maintenance cost per pressure reduction station



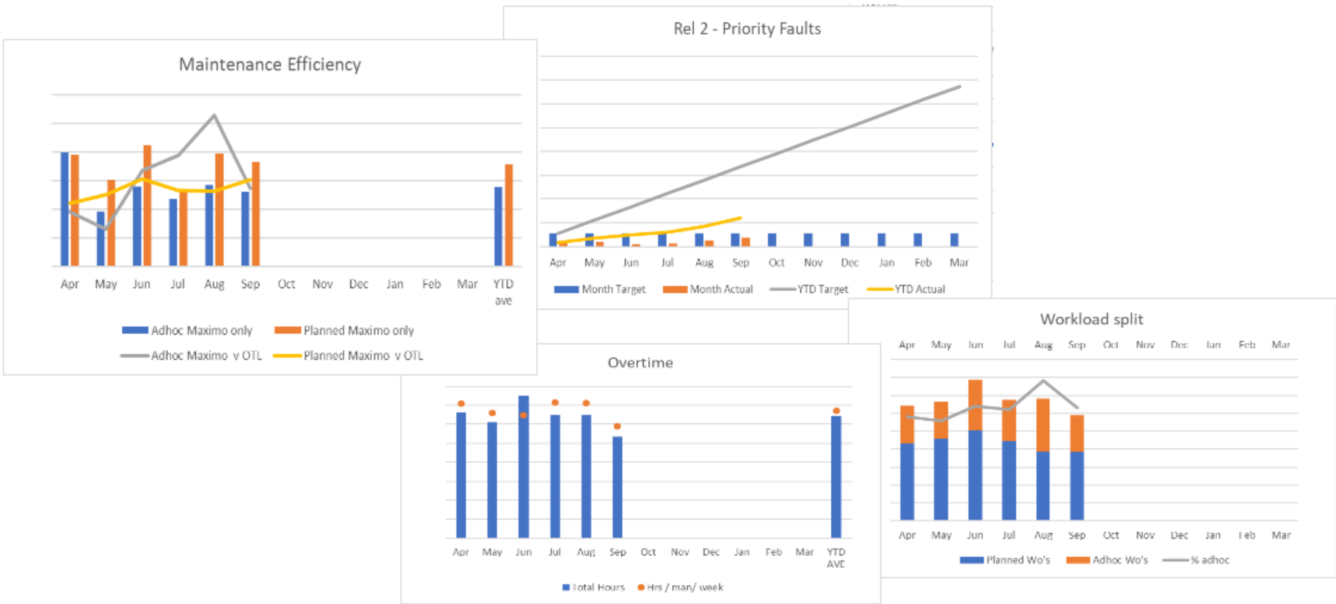
Costs above relate to 2017/18

The above comparison of unit rates enables us to benchmark our expenditure against external comparators.

Internal benchmarking of our Asset Maintenance costs is undertaken through the production and monitoring of monthly dashboards, reviewed by our Maintenance Operations Managers.

These dashboards, an example of which is shown in Figure 11, include monitoring of our output performance and also operational efficiency, by capturing data relating to our workload split and the use of overtime. This enables us to benchmark our internal costs and efficiency against expected levels, previous levels, and comparable levels within the rest of the network. Within the dashboard a specific commentary is provided on any work orders outstanding, any specific issues (noted by location) and any impacts on our outputs.

Figure 11: Asset Maintenance Management information dashboard



6.8 Managing uncertainty (use-it-or-lose it, volume drivers and reopeners)

We have considered a reopener in relation to the installation of methane detectors and remotely operable valves in multi-occupancy buildings (risers). However following discussion with stakeholders and taking on their feedback, we will not be pursuing this activity due to the high expense.

6.9 Competition

Most of our maintenance operations are undertaken by direct labour engineers. Where applicable, we utilise a small number of contractors to supplement our direct labour activities either to support specific project work or because they provide specialised skills that SGN does not retain.

Examples of this are contractors sourced through competitive tender to undertake civil construction works, governor replacement or electrical system upgrade work. Agricultural maintenance activities are predominantly carried out by contractors. Additionally, we have contracts to support the maintenance of pre-heating equipment. Discussion of our labour contracting approach, as well as the steps we take to encourage tender response rates and mitigate market constraints, is included in our Procurement and Native Competition appendix.

This document also includes specific discussion of our Governor Strategy, whereby we developed a robust procurement strategy to address our medium- and long-term equipment requirements. This was a collaborative exercise between our Procurement, Commercial, Asset Management, Asset Maintenance and Policy teams, and sought to address challenges associated with a potential over-reliance on certain suppliers and the associated risks of delay which production issues caused to our R6 governor replacement schedule. This exercise led to a framework agreement which not only resolved our supply issues but also delivered a cost saving.

As discussed in section 5.2, we have leveraged Network Innovation Allowance (NIA) funding to develop new technology with previously unknown suppliers which generates a greater degree of competition in the market.

6.10 Real price effects

Our GD2 asset Maintenance forecasts do not include any anticipated real price effects.

Ofgem has determined that the GD2 price control will use CPIH as the measure of inflation through which allowances should be adjusted year on year. While we consider CPIH to be a reasonable indicator of overall prices, SGN's purchasing approach to goods and services differs from that of the domestic sector. As such, we have experienced real price effects in excess of those which would be applied through CPIH. We discuss this further, and propose alternative indices, in our Cost Efficiency appendix.

Costs in this appendix are shown in 2018/19 prices (unless otherwise stated), with cost pressures and funding rationale discussed in section 6.11.

6.11 Financial summary

Funding rationale

For the purposes of the Business Plan submission on 9 December 2019, we have made our current forecast on the basis of consistent mix of normal/premium time and the existing level of contractors is retained.

Based on seasonal norms, we would expect that winters may return closer to historical average temperatures, and we may also see an increase in extraordinary winter weather events, both of which would increase workloads and drive up costs. This can be through increased workload volumes or the challenge of reaching our assets during periods of extreme weather. In addition, when temperatures decrease significantly from the seasonal norm, we experience freezing of our above ground assets such as pressure regulating equipment which drives cost into our maintenance operations. While all GDNs are susceptible to such difficulties, the issue is more pronounced in our Scotland network. As such, we consider extremely cold weather conditions to be a regional factor specific to Scotland. However, in order to avoid including any risk premium within our costs, and as part of our ongoing commitment to the stakeholder priority of 'keeping costs down', we are prepared to accept the uncertainty associated with extreme temperature variations that may be experienced during GD2 and any consequential impact.

The opportunities which we recommend pursuing, and therefore have included in our forecast, are discussed in section 6.1 and are as follows:

- **Responsible Demolition** – Removal of the priority abandoned assets, therefore enhancing the safety of the network and reducing future maintenance costs. This protects the customer priorities of 'keeping the gas flowing safely' and 'keeping costs down', as well as 'supporting communities' by removing potential hazards.
- **Riser surveys** – The extension of riser surveys could further enhance the security of supply for relevant customers and support risk prioritisation of replacement and refurbishment. This would enable a greater proportion of interventions to be planned rather than unplanned, thus minimising interruptions. Therefore, this supports the 'keeping the gas flowing safely' and 'providing excellent service' priorities.

- **Facilitating biomethane connections** – In support of the commitments we make in our EAP, our forecast includes a provision to support biomethane connections and maximise the input from producers through pressure management, which is a maintenance activity. Facilitation of biomethane connections could contribute towards decarbonisation of the network and improve our environmental impact. This would also maintain future security of supply, therefore supporting the 'future energy solutions' and 'minimising environmental impact' priorities.

In the table below the majority of costs are directly comparable with their GD1 values. The exception to this is the increase in contractor labour, which is a result of the additional riser survey work which will be undertaken.

Table 14: RIIO-GD2 forecast expenditure profile.

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
Net Staff Costs	18.9	18.5	18.6	17.5	17.7	20.4	19.7	19.6	19.8	19.8	19.8	19.8	19.9
Contractor Labour	6.3	3.9	4.0	7.3	3.1	4.2	5.7	6.0	10.6	10.7	10.8	10.7	10.8
Materials	11.2	7.1	6.2	6.9	7.7	8.2	6.4	6.8	7.4	7.4	7.5	7.5	7.5
Non Salary Staff Costs	0.4	0.0	0.6	0.5	0.5	-	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Transport and Plant	4.7	3.8	4.5	3.8	3.9	5.2	3.8	3.8	3.8	3.8	3.8	3.8	3.8
Gross Maintenance Costs	41.6	33.2	33.8	36.1	32.8	37.9	36.1	36.8	42.2	42.3	42.5	42.4	42.6
Income	- 6.0	- 6.0	- 7.2	- 6.7	- 6.5	- 6.1	- 6.7	- 6.9	- 6.0	- 5.8	- 6.2	- 5.9	- 6.0
Total Maintenance Costs	35.6	27.2	26.6	29.4	26.3	31.8	29.4	29.9	36.2	36.4	36.2	36.5	36.6

Scotland (£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
Net Staff Costs	5.0	5.2	5.3	4.9	5.4	6.5	6.2	6.2	6.2	6.2	6.2	6.2	6.2
Contractor Labour	1.5	1.4	1.4	2.6	0.8	2.2	2.0	2.1	4.3	4.3	4.3	4.4	4.4
Materials	4.2	3.2	2.5	2.7	3.1	4.0	2.2	2.3	3.0	3.0	3.0	3.0	3.1
Non Salary staff Costs	0.2	0.0	0.2	0.2	0.2	-	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Transport and Plant	2.2	0.9	1.3	1.1	1.2	2.2	1.3	1.3	1.3	1.3	1.3	1.3	1.3
Gross Maintenance costs	13.1	10.8	10.7	11.5	10.7	14.9	11.9	12.1	14.9	15.0	15.0	15.1	15.1
Income	- 2.2	- 1.5	- 1.7	- 1.6	- 1.7	- 1.8	- 1.5	- 1.5	- 1.5	- 1.4	- 1.5	- 1.5	- 1.5
Total Maintenance Costs	10.9	9.2	9.0	9.8	8.9	13.1	10.4	10.6	13.5	13.6	13.5	13.5	13.6

Southern (£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
Net Staff Costs	13.8	13.3	13.2	12.6	12.3	13.9	13.5	13.5	13.6	13.7	13.7	13.7	13.7
Contractor Labour	4.8	2.4	2.6	4.7	2.3	2.0	3.7	3.9	6.3	6.3	6.4	6.3	6.4
Materials	7.0	3.8	3.7	4.2	4.6	4.2	4.2	4.4	4.4	4.4	4.5	4.4	4.5
Non Salary staff Costs	0.3	0.0	0.3	0.3	0.3	-	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Transport and Plant	2.5	2.9	3.2	2.8	2.7	3.0	2.6	2.6	2.6	2.6	2.6	2.6	2.6
Gross Maintenance Costs	28.5	22.5	23.1	24.6	22.1	23.0	24.2	24.7	27.3	27.3	27.5	27.3	27.5
Income	- 3.8	- 4.5	- 5.5	- 5.1	- 4.8	- 4.3	- 5.2	- 5.3	- 4.6	- 4.4	- 4.8	- 4.4	- 4.5
Total Maintenance Costs	24.7	18.0	17.6	19.5	17.3	18.7	19.0	19.3	22.7	22.9	22.7	22.9	23.0

Business Plan data templates

Below we have included direction to the relevant section of the BPDTs on a summary and activity-specific basis. We have included references to overall Asset Maintenance costs as well as the proposed additional programmes – Proactive Riser Surveys and Responsible Demolition. Where possible, we have also included reference to the rows in which total values can be found. Where this is not possible, for example with Proactive Riser Surveys and Responsible Demolition, the activity is included in overall costs. Cost influences and trends are discussed above in in section 6.11.

Category	Summary	Activity-specific
Total Asset Maintenance	2.01 Row 160	2.04 Row 11
Proactive Riser Surveys	2.01	2.04 Row 54
Responsible Demolition	2.01	2.04 Row 55 (Southern) Row 52 (Scotland)

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 Director was appointed as the Sponsor for the Asset Maintenance Appendix and the associated Cost Benefit Analyses (CBAs), Engineering Justification Papers (EJPs) and 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 Operational Expenditure (OPEX). 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 RIIO-GD2 Executive Committee: (1) considered the appropriateness of assurance activity for the Appendix and (2) provided assurance to SGN's 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: Maintenance, Reliability

7 Glossary

All acronyms and associated descriptions can be found within the Glossary appendix.