Sub Appendix

A19:C

NGN RIIO-GD1 Network Integrity Capital Expenditure

Contents

A19A-1: Offtake and PRI Utilisation Capacity Upgrading Programme

1.1 Introduction

National Transmission System (NTS) Offtakes enable gas to be taken from the National Grid NTS system into NGN's high pressure pipeline network. Pressure Regulator Installations (PRIs) enable transportation into the network's below 7Bar pressure tiers and ultimately to customers. The following areas have an impact on the requirements to increase the capacity of Offtakes and PRIs:

- The introduction of Unified Network Code (UNC) modification 90 'Interruption Reform' in 2011/12, which has increased the peak day flows required to be entered into and utilised through the NGN network. Interruptible demands were, prior to this UNC change, not assessed at peak. Supplying interruptible at peak day increases peak day demand by approximately 10% equating approximately seven years normal growth in peak day demands.
- The introduction of UNC modification 0195 AV 'Offtake Reform' in 2012/13 presents changes in how NGN takes both flexible capacity (storage) and flat capacity through the NTS Offtakes. Contractual arrangements with NTS are embodied in the Offtake Capacity Procedure (OCS) dictate that NGN's Offtakes and PRIs have the capacity to utilise gas supplied in the most efficient manner without altering agreed contractual operating parameters.
- The removal of NGN's LP gasholders which has increased the quantity of NTS flexible capacity (storage) which has to be entered into the system at the Offtakes and distributed into the downstream system via the PRIs. This equates to approximately 10 years growth in peak day demands.

The impacts of UNC mod 90, UNC mod 0195 AV and the gasholder demolition programme are the main changes which impact on RIIO-GD1 compared with GDPCR1 in respect of the capacity utilisation outputs.

1.2 RIIO-GD1 Investment Requirements

Throughout GDPC1 the network has upgraded 12 PRIs and four NTS Offtakes which were identified as requiring intervention. A new PRI at Tyresal is due for completion in 2012. During the RIIO-GD1 period NGN will undertake capacity upgrading work at seven Offtakes and 15 PRIs. The expenditure over the plan period is detailed in Figure 1.1 below.

£m 2009/10 Prices	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	Total
Offtake & PRI	3.5	3.7	3.9	3.4	3.4	4.1	1.8	2.8	26.7

Figure 1.1: RIIO-GD1 Offtake and PRI upgrade expenditure

Additional details of sites, financial information and capacity assessments are recorded in templates 3.2 LTS & Storage and 3.16a Capacity Utilisation.

1.3 The Investment Journey

a) Criticality Assessment

Offtakes and PRIs are critical assets; it is fundamental that they have the required capacity to ensure NGN meets 1 in 20 supply obligations and complies with this license condition.

Offtake or PRI capacity is typically determined by any one or more of the following:

- Regulator capacity;
- Metered limit;
- Meter capacity;
- Pipework velocities (Filter inlet, inlet header, outlet header); and
- Outlet temperature.

Outright failure of either a high capacity Offtake or PRI could impact on a large number of end users. This could result in a gas supply emergency where load shedding may be necessary to maximise the number of customers being supplied and ensuring the cessation of gas supplies to customers is minimised. The installations are designed to operate at full capacity on one of the two streams. Without intervention units could operate on two streams (twinning). In terms of capacity utilisation this may not affect supplies but would indicate the unit is non-compliant and requires upgrading. Due to the specialist nature of Offtake and PRI upgrading and the long lead time for materials and legal consents, projects take three to four years from project initiation to completion. Decisions have to be taken in a timely manner to enable a works programme to be deliverable.

b) Health Assessment

The primary driver for this work is capacity, whilst the being the condition of the equipment is a secondary driver. Where condition/serviceability is the primary driver, consideration is given to aligning capacity requirements. For example a site which is showing restrictions in capacity which is also in poor condition or has non serviceable regulators would take priority over a site in good condition which only has capacity issues.

Prism and Graphical Falcon (GF) network analysis modelling tools have been used to assess capacities of this plant over the current GDPCR1 and RIIO-GD1 periods. Fixed parameters of inlet and outlet Pressure are used to determine the maximum flow capacity for each Offtake or PRI.

Maximum Capacity is then compared against expected maximum flow data to give a current utilisation percentage. This data generally obtained from Pk6 data for PRIs and Local Transmission Systems (LTS) planning models for Offtakes.

Forecast demand growth was considered and showed that the selected Offtakes and PRIs either had reached or were anticipated to reach in excess of 90% of their capacity within the RIIO-GD1 price control period. This assessment identified that seven Offtakes out of the total population of 23 and 15 PRIs out of a total population of 192 will require intervention during the RIIO-GD1.

Details of the GF network analysis outputs are shown in Figure 1.2. The screen display shows the minimum pressure output at the Carcroft PRI.

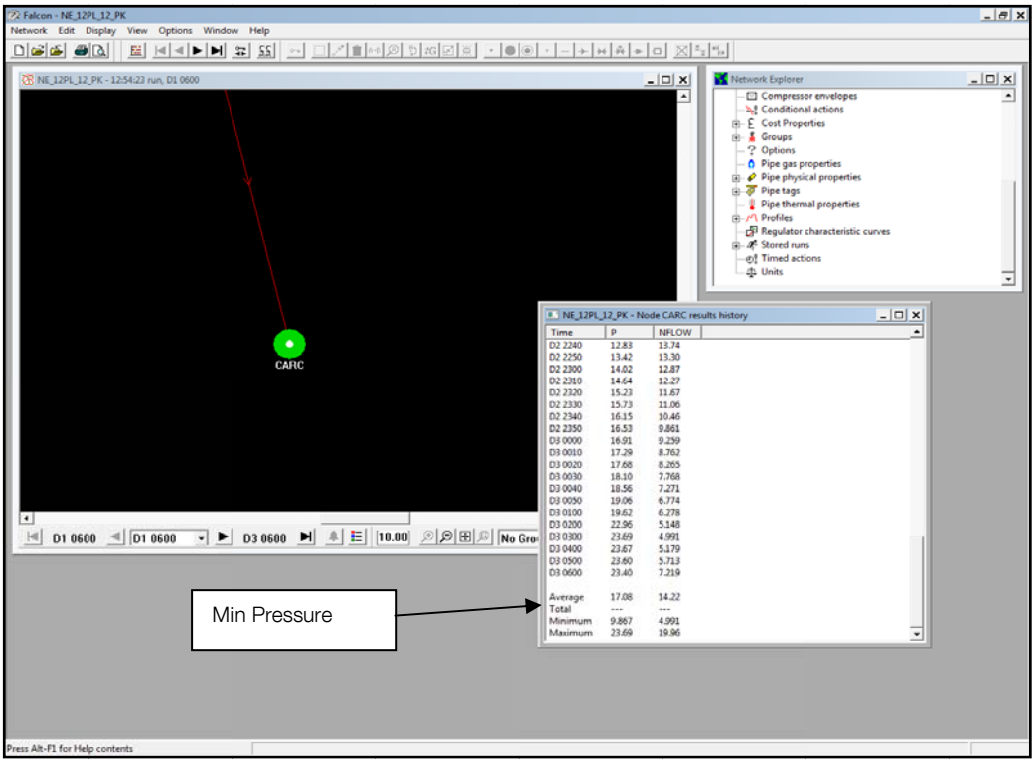


Figure 1.2: Example of GF network analysis outputs.

Details of Prism Network Analysis outputs are shown in Figure 1.3 below. The screen display shows issues with high outlet header velocities.

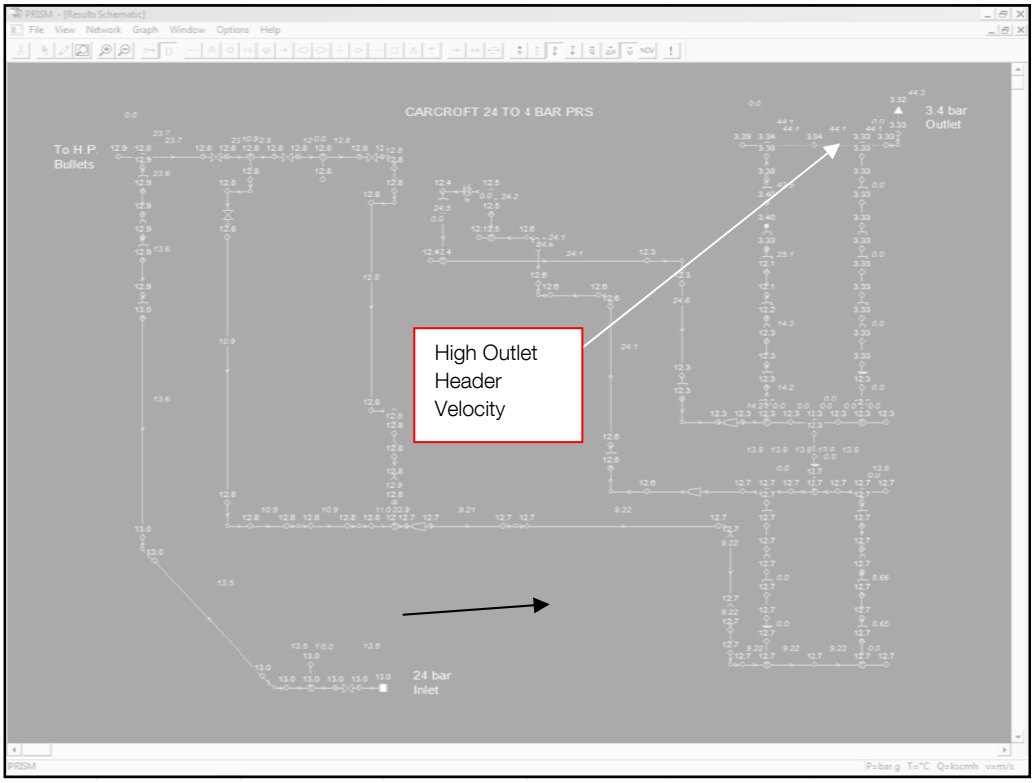


Figure 1.3: Network analysis outputs – high outlet header velocities

Details of summary data for all PRIs and Offtakes is shown in Figure 1.4 below. The worksheet is populated with analysis results for all PRIs and Offtakes as part of the normal LTS planning process. Highlighted below are the 22 sites earmarked for upgrading. Above the red line shows sites that are above or approaching 90% capacity and are to be targeted for upgrading. This approach aligns to NGNs principles of investing in upgrades and replacement of assets at the latest opportunity, avoiding under utilisation caused by investing too early but preventing loss of supply by leaving the investment late.

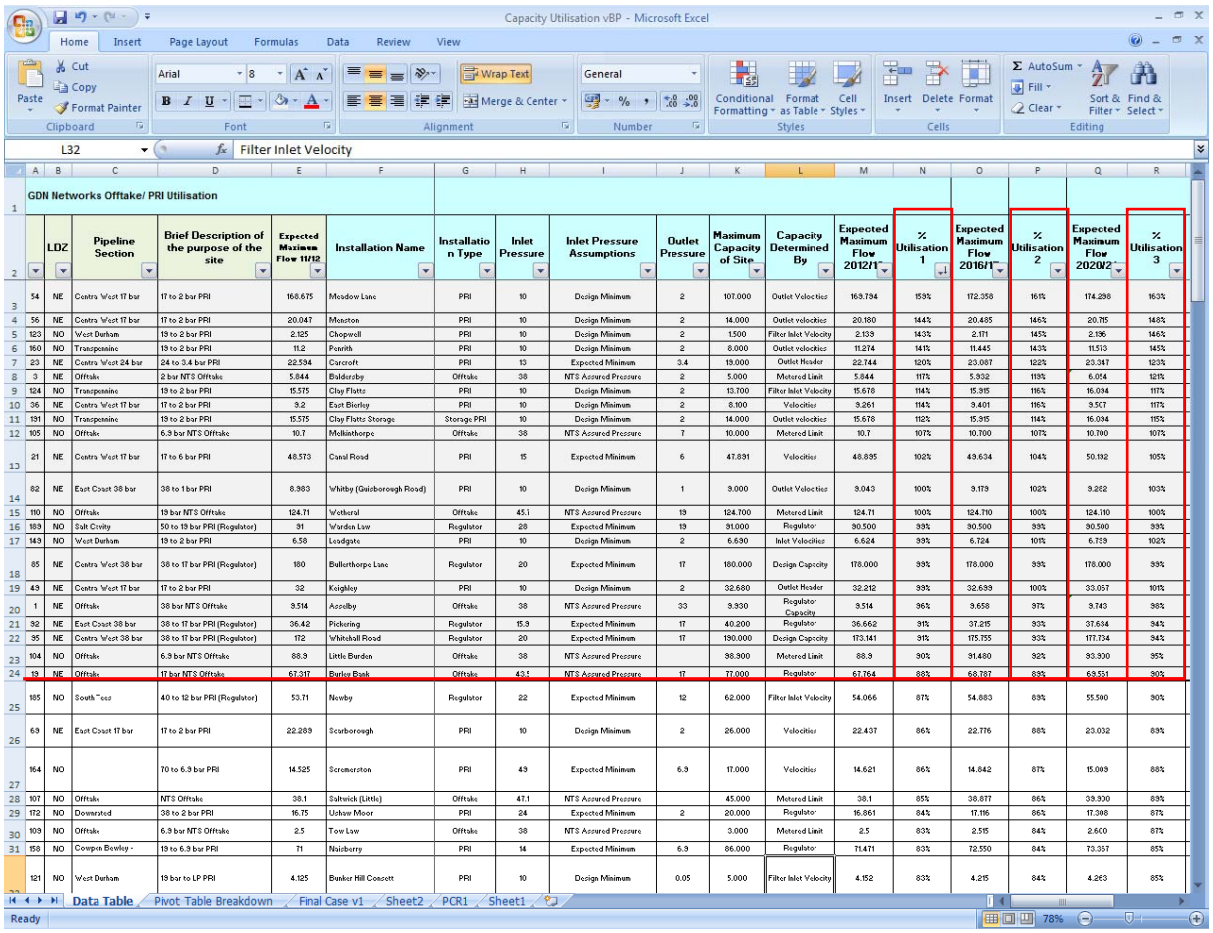


Figure 1.4: Summary of PRI & Offtake Analysis

c) Network Risk

In order to meet NGN's 1 in 20 peak day supply obligations timely capacity upgrading of NTS Offtakes and PRIs needs to be undertaken. All PRIs and Offtakes are capacity assessed annually. The upgrading list is amended annually and in the most part remains unchanged. However, major infrastructure developments such as new factories, urban developments and the like could require changes to the upgrading plan. Specific site upgrading work is established prior to the construction year when a detailed design assessment is completed. PRI/Offtake upgrading work can take three/four years from initiation to completion. It is essential that upgrading plans are established as soon as possible and a rolling programme is continually assessed so the capacity utilisation outputs can be delivered in a timely manner.

The following specific risks are detailed in the following table:

- PRI/Offtake upgrading work is highly specialised and there is limited availability of resources to complete this work. NGN's proposals have taken this into consideration and the work output programme has been set at a maximum of four sites per annum.

- Most of the materials required to support the construction work havee long lead time items. NGN has built this into the outputs delivery plan.
- The assessment of the work involved at each location can only be accurately determined at detailed design stage. Historic costs have been used and NGN believe this assessment is appropriate.

d) Investment Options

Do Nothing

Successful completion of the upgrade work will ensure NGN meets the 1 in 20 peak day supply requirement. Therefore the 'do nothing' option is not acceptable.

Undertake Optimum Offtake and PRI Upgrading Work

This is the preferred option costing c.£27.25m and will allow the gasholder demolition programme to proceed.

Undertake Minimum Offtake and PRI Upgrading Work

Undertaking the minimum amount of work required would reduce associated costs from c.£27.25m to c.£11.45m. However, this option has been discarded as it would not enable the gasholder demolition programme to proceed over two RIIO periods.

Undertake Full Upgrading of Identified Offtakes and PRIs

This would entail the full upgrade of the Offtakes and PRIs which have been identified as exceeding 90% capacity. Associated costs range from c.£27.25m to c.£40.0m. This option has been discarded as being an over engineered solution.

Undertake Minimum Offtake and PRI Upgrading Work and Construct Storage Pipelines

The possibility of installing HP Storage Pipelines to replace the lost storage consequential to the gasholder demolition programme was also considered. This option would cost in excess of £60.0m and the construction of one or several pipelines in the locations required may not be possible. This option has been discarded on both costs and deliverability.

Measure	Option One (do Nothing)	Option 2	Option 3	Option 4 (Full Upgrading)	Option 5 (Min Upgrading + Pipelines)
Recommended Asset Upgrades RIIO-GD1	0	Optimum Upgrading of 7 Offtakes and 15 PRI's	Minimum Upgrading of 7 Offtakes and 15 PRI's	Full Upgrading of 7 Offtakes and 15 PRI's	Min upgrading of 7 Offtakes and 15 PRIs and lay several HP storage pipelines
Financial	1 in 20 Peak Day supply obligations will not be met	Total investment c.£27.25m	Total investment c.£11.45m	Total investement c.£40m	Total investment of above £60m
Safety	Safety is a principle driver for this investment as the safe supply of gas to end users at all demand conditions is a fundamental Gas Transporters License Obligation.				
Security of Supply	1 in 20 License supply obligations will not be met and the gasholder demolition programme could not proceed	Peak Day 1 in 20 supply obligation will be met without the gasholders operating	Peak Day 1 in 20 supply obligations would not be met without the gasholders operating	Peak Day 1 in 20 supply obligation will be met without the gasholders operating	Peak Day 1 in 20 supply obligation will be met without the gasholders operating.

Measure	Option One (do Nothing)	Option 2	Option 3	Option 4 (Full Upgrading)	Option 5 (Min Upgrading + Pipelines)
Environmental	Environmental risks would be significant in respect of noise from High flows at PRIs/Offtakes in additional to all issues with holders.	Environmental risks presented by the gasholders would be removed. Upgraded units would be designed for min environmental impact.	Environmental risks would be significant in respect all issues with holders.	Environmental risks presented by the gasholders would be removed. Upgraded units would be designed for min environmental impact.	Environmental risks presented by the gasholders would be removed. There would be an increased environmental risk by constructing pipelines
Level of Risk	Very high and increasing throughout RIIO-GD1	Acceptable risk retained by network	High risk retained by network	Minimal risk retained by network	Minimal risk retained by network
Comments	Not recommended – unacceptable level of risk	Acceptable solution where the network retains a managable level of risk	Unacceptable to the network as the gasholders could not be removed	Acceptable to the network but not to the customer as this is an over engineered solution	Acceptable to the network but not to the customer as this is an over engineered solution
Decision	N/A	1	4	2	3

Figure 1.5: Investment Options

The chosen solution is to undertake the optimum level of upgrading works which will enable 1 in 20 peak day supply conditions are met and enable the gasholder demolition programme to be completed. Details of the site locations, scale of upgrading work and cost assessments are shown in Figure 1.6 below.

Details of the site locations, scale of upgrading work and cost assessments	
Undertake Major * (see note below) upgrading work at the following Offtakes:	Wetheral and Pickering.
Undertake Intermediate upgrading work of the following Offtakes:	Asselby, Baldersby, Burley Bank Little Burdon and Melkinthorpe.
Undertake Major upgrading work at the following Pressure Reduction Installations (PRI's):	Bullerthorpe Lane, East Bierley, Warden Law, Whitehall Road, Chopwell, Leadgate and Meadow Lane.
Undertake intermediate upgrading work at the following PRI's:	Canal Road, Carcroft, Clay Flatts Storage, Clay Flatts, Keighley, Menston and Penrith.
Undertake minor upgrading work at:	Whitby (Guisborough Road)

Figure 1.6: Site locations, Upgrade Requirements and Cost Assessment

*The type of upgrading work is classified as minor, major and intermediate. This is based on the scale of works required for minor work e.g. regulators only may require changing. Major works would require full site rebuilding pipework building heating controls regulators and other equipment. Intermediate upgrading work would fall somewhere in between major and minor works.

e) Selection Criteria and Innovation

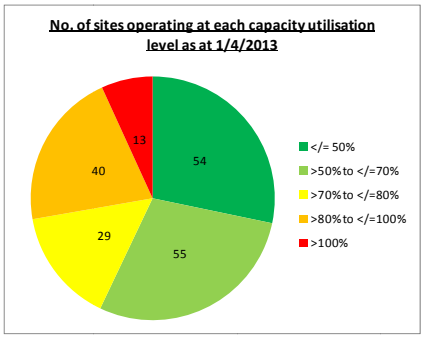
Network analysis techniques are used to determine the ability of the PRIs and Offtakes to provide the necessary capacity to meet NGN's supply obligations. This working list is updated annually. The scale of

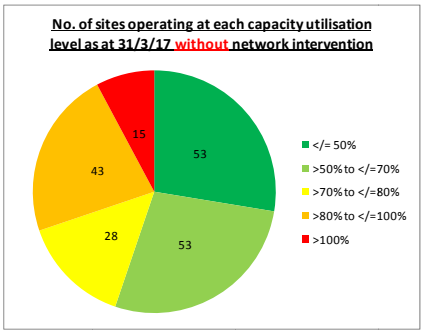
the upgrading work is determined by detailed design work which is undertaken prior to the construction year.

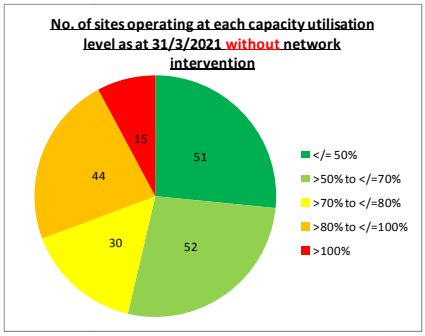
Consideration will be given to all innovative options at the detailed design stage for example installing 'turbo expanders' or 'wind turbines' to generate electricity and 'ground source heat pumps' to reduce preheating costs.

f) Output Deliverables

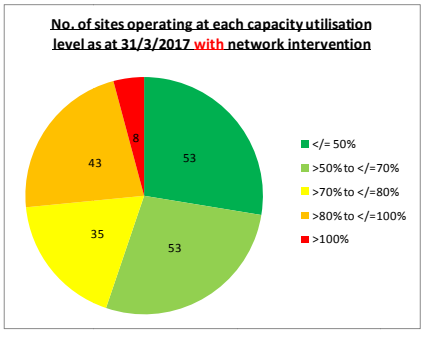
Capacity utilisation measures – the following charts detail how the Offtakes and PRIs are being utilised at the start middle and end of the RII0-GD1 without undertaking any work.

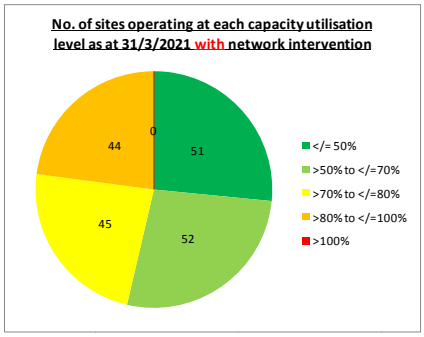






The focus in RIIO-GD1 will be improving asset health and to have full compliance in terms of capacity and utilisation. The charts below show the capacity utilisation at 31/03/2017 and 31/03/2021 at the mid and end point of the plan period with the detailed upgrading works undertaken. The capacity utilisation takes into consideration the demand and growth forecasts as laid out in the main body of the business plan.





A19A-2: Pre-Heating

2.1 Introduction

Within the NGN network we currently have 108 Waterbath Heaters (WBH) and 40 boiler packages which are used for pre-heating gas as defined under the requirements of the IGEM standard IGE/TD/13. Pre-heating on gas pressure reduction stations is required to mitigate the effects of gas temperature loss when the pressure is reduced (the Joules-Thompson effect).

A large number of pre-heating plant on gas sites are now approaching the end of their useful life due to deterioration causing condition and reliability issues and lack of spare parts driven by obsolescence. NGN have made every effort to maintain these assets by using spares from redundant equipment, however we have now exhausted all our spare parts stock and are unable to repair to a satisfactory and safe level. WBH are fairly crude in design with no provision to suit the modern requirements of efficiency and environmental performance. Replacement of these WBH units will normally be by the use of a package boiler and heat exchanger, rather than a like for like replacement. This will give better performance and efficiency savings, utilising modern burner management systems and controls. In addition to the WBHs several of the networks boiler packages have also reached the end of their useful life and require upgrading/replacing.



Throughout GDPCR1 the network has focused on upgrading all its sites in line with the requirement asset out in IGEM/ IGE/TD/13. This has generally involved the installation of new pre-heating systems on six sites (Penrith, Haltwistle, Dalston, Keswick, Eltringham, Gretham). NGN have also replaced two WBHs with a boiler package on Scremeston as part of a total site rebuild and added a single new WBH at Pannal. Over the current price control NGN has a adopted a strategy of 'sweating' the current pre-heating assets to ensure the network has optimised its use.

2.2 RIIO-GD1 Investment Requirements

Within the RIIO-GD1 period NGN proposes to replace 32 WBHs (30%) of the population, upgrade/replace 26 boiler packages (65%), and install three new boiler packages on existing sites. All the pre-heating investment is driven directly by Asset Health category 17 'Offtakes' and category 18 'above 7Bar PRIs'.

This translates to the investment profile identified below:

£m (2009/10 prices)	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	Total RIIO-GD1
Pre-Heating Expenditure	2.1	2.1	2.4	3.1	3.0	2.9	2.3	2.0	20.1

Figure 2.1: RIIO-GD1 Pre Heating Expenditure

2.3 The Investment Journey

a) Criticality Assessment

Pre-heating is a critical activity on gas pressure reduction facilities and the consequences of failure can be significant. If the pre-heating fault is not able to be rectified, i.e. fix on fail is not possible, replacement of these assets can take from 6 to 24 months based on the complexities of a design and build programme.

Consequences of failure include potential loss of supply and environmental and safety impacts:

Freezing of Outlet Pipework: Loss of Supply

Freezing of the outlet pipework can lead to a potential loss of gas to the downstream system through freezing of control pilots.

Frost Heave: Environmental Damage

The longer the pre-heating on site is non-operational the more significant the problems of frost heave can become. Frost heave results from ice build-up around buried pipelines, i.e. on the outlet of PRIs when the gas is below freezing, if left the consequences can become catastrophic not only damaging the site but also pavements, roads and other third party land which the pipeline passes under.

Increase PREs in MP / LP systems: Safety

If the PRI is close enough to the LP (Low Pressure) system, meaning gas cannot recover heat through the ground; cold gas may enter the MP/LP network. This would affect the physical characteristics of different pipe materials. For example cast/ductile iron become more brittle at lower temperatures resulting in more escapes.

Examples of the consequence of pre-heating failures on NGN assets are demonstrated below:

b) Health Assessment

NGN determines the health of its pre-heating assets using a wide range of data and information including fault data, age, physical condition, subject matter expert assessment and manufacturer's guidelines.

Fault Data

Analysis of historic fault data of NGN's pre-heating assets identified some clear trends which could be used to develop assumptions on asset health.

Based on this analysis a threshold against quantities of faults was established which acts as a 'tipping' point' for the asset health assessment. For all pre-heating assets this threshold occurs when 40 faults within a five year period are reached. After this point there is an ongoing significant deterioration in the asset.

For WBHs at this threshold, historic performance data indicates that, even with ongoing maintenance and remedial action, deterioration will increase at a rate of an additional 40 faults each year (Figure 2.2 below). For package boilers operating at the 40 faults in five year threshold deterioration will increase at a rate of an additional eight faults per year.

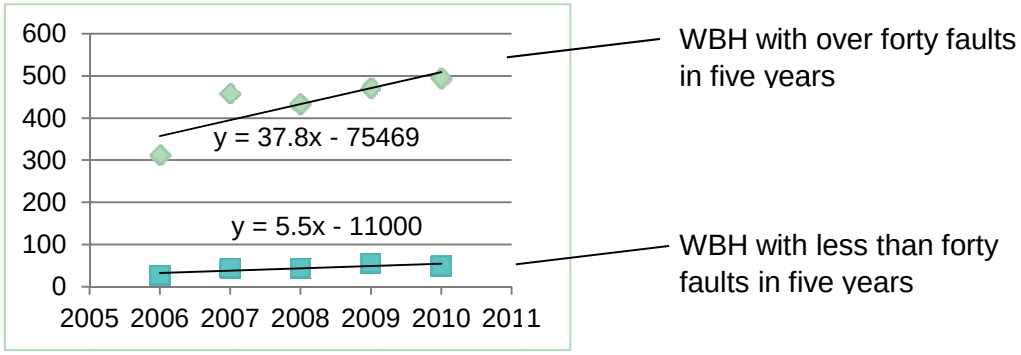


Figure 2.2: Deterioration Rates - WBH

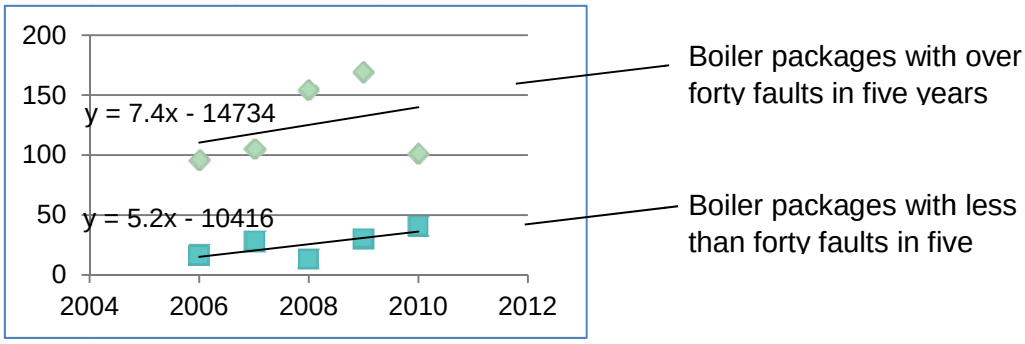


Figure 2.3: Deterioration Rates Boiler Packages

Following this analysis NGN has identified each pre-heating asset and the number of faults per asset within the last five years. An example of the data is provided in Figure 2.4 below.

LDZ	Pipeline Section	Brief Description of the purpose of the site	Installation Name	No Sites	Pre Heating	No WBH	No HE	Faults in five years	CRITICALITY
NO	Salt Cavity	50 to 19 bar PRI (Regulator)	Cowpen Bewley Regulator		WBH x4	4		644	vh
NO		50 to 19 bar (Regulator)	Teal Sands Regulator (19 bar)		WBH x2	2		314	vh
NO	South Tees	40 to 2 bar PRI	Thornaby Vale		WBH x2	2		170	vh
NO	South Tees	40 to 0.45 bar PRI	Wilton Westgate		WBh x2	2		120	vh
NO	Downrated	38 to 19 bar PRI (Regulator)	Tanfield		WBH x2	2		107	vh
NE	Central West 17 bar	17 to 2 bar PRI	Chapel Haddlesey		HE x1		1	94	h
NE	Central West 17 bar	17 to 2 bar PRI	Keighley		HE x1		1	91	h
NO		38 to 6.9 bar PRI	Hazelrigg		HE x2		2	88	vh
NO	South Tees	12 to 0.28 bar PRI	Bluebell		HE x2		2	81	h
NO		17 to 2 bar PRI	Low Thornley (Rowlands Gill)		Elec x1		1	81	h
NO		70 to 19 bar PRI (Regulator)	Hepscott Regulator 19bar		WBH x2	2		62	vh
NO		70 to 2 bar PRI	Catterick		HE x2		2	61	vh
NE	Central West 17 bar	17 to 2 bar PRI	Crossgates		HE x1		1	58	h
NO	South Tees	40 to 6.9 bar PRI	Kirkleatham		WBH x2	2		55	vh
NO		70 to 6.9 bar PRI	Scremerston		WBH x2	2		55	vh
NO	Downrated	38 to 2 bar PRI	Ushaw Moor		WBH x2	2		55	vh
NO	Salt Cavity	50 to 19 bar PRI (Regulator)	Warden Law		HE x2		2	51	vh
NE	East Coast 38 bar	38 to 17 bar PRI (Regulator)	Pickering		WBH x2	2		50	vh
NO	South Tees	19 to 10 bar PRI (Regulator)	Durham Lane		WBh x2	2		49	h
NO	South Tees	40 to 2 bar PRI	Brotton		HE x2		2	48	vh
NE	Central West 17 bar	17 to 2 bar PRI	Dewsbury		WBH x1	1		46	h
NE	East Coast 38 bar	38 to 17 bar PRI (Regulator)	Saltend		WBH x2 HE x2	2	2	45	vh
NE	Central West 38 bar	38 to 7 bar PRI	Whinny Gill		HE x2		2	45	vh
NO		70 to 2 bar PRI	Springwell Lane		HE x2		2	42	vh
NO		17 to 6.9 bar PRI	Blaydon Regulator		WBh x2	1		41	h

Figure 2.4: Data Sample Example (PRI's)

When considering how to set the fault threshold NGN considered several options which would allow the network to optimise the pre-heating asset life whilst maintaining an acceptable level of risk. These options are detailed further on in this report.

Age / Obsolescence

With the exception of one WBH within the network all other WBH are over 40 years old. As part of NGN's asset health assumptions we considered any WBH over 30 years old to be categorised as HI4 on the asset health indices.

With the exception of one Italian company (Fiorentini) WBH are no longer manufactured. Like-for-like replacement of a WBH is not an option, they are inefficient and unsupported items of plant and modern solutions to pre-heating are far more beneficial from an environmental and safety point of view.

It is worth noting that within the current GDPCR1 the network installed a single WBH at Pannal to supplement the pre-heating already on site. This proved to be an expensive option and has been fraught with difficulties to get the WBH fully functional. From experience NGN, considers replacement/addition of a single or bank of WBHs with like-for-like is not an effective option to this pre-heating problem.

For the current boiler package population NGN has records of all installation dates many of which will exceed 20 years old over RIIO-GD1.

Physical Condition

Other than fault data, physical condition of the asset has been determined through subject matter expert assessment. This will be supplemented with field surveys which are currently ongoing in 2012.

Subject Matter Expert Opinion

There are only 106 WBHs on the network and, as a result of the high fault frequencies and scheduled maintenance the operational staff are very familiar with these critical assets. Pre-heating has been maintained for several years to allow NGN to maximise the asset life and effectively 'sweat' the asset to prolong the life and ensure replacement timescales were optimised. Over the years the operational staff have cannibalised WBH parts to ensure these assets are kept operational. The strong view of the network engineers is that the opportunities to keep maintaining/fixing these assets are becoming limited and failure to replace will lead to an exponentially increasing risk to their successful operation.

Manufacturers Guidelines

All the network boiler packages are currently provided by Pottertons (as is the case across the industry). Pottertons guidelines recommend a design life of 15 years for one of their boiler packages.

c) Network Risk

Following the criticality and asset health assessments undertaken by NGN the asset health tables were populated for PRIs and Offtakes.

Offtakes

Asset Health and Criticality - Current Condition

Asset categories		Criticality Index	Asset distribution based on estimated asset health index at 31 March 2011				
			Asset health index				
			HI1	HI2	HI3	HI4	HI5
17	NTS Offtakes	Low					
	Offtakes – Pre-heating	Medium					
		High					
		Very High	1	1	3	41	

Asset Health and Criticality - Without Investment

Asset categories		Criticality Index	Asset distribution based on estimated remaining useful life at 31 March 2011				
			Remaining Useful Life Expected (50%)				
			HI1	HI2	HI3	HI4	HI5
17	NTS Offtakes	Low					
	Offtakes – Pre-heating	Medium					
		High					
		Very High		1		23	22

NGN has assumed, without investment six boiler packages and 16 WBHs would be at the end of their useful lives by the end of RIIO-GD1.

In 2012, based on a fault threshold of 40 faults in five years, NGN would have 20 WBHs and five boiler packages in need of replacement. If the network extrapolated the current fault data and deterioration rates throughout RIIO-GD1 it would indicate all Offtake pre-heating would need to be replaced (39 WBHs and six boiler packages). Having consulted with the network engineers this is not felt to be an accurate reflection in reality. Instead NGN believe that through targeted replacement and maintenance 16 WBHs and six boiler packages would be beyond their useful lives without investment.

PRI's

Asset Health and Criticality - Current Condition

Asset categories		Criticality Index	Asset distribution based on estimated asset health at 31 March 2011				
			Asset Health Index				
			HI1	HI2	HI3	HI4	HI5
18	PRI's above 7 Bar	Low					
	PRI's – Pre-heating	Medium					
		High		1	2	10	
		Very High		10	9	66	

Asset Health and Criticality - Without Investment

Asset categories		Criticality Index	Asset distribution based on estimated remaining useful life at 31 March 2011				
			Remaining Useful Life Expected (50%)				
			HI1	HI2	HI3	HI4	HI5
18	PRI's above 7 Bar	Low					
	PRI's – Pre Heating	Medium					
		High				6	7
		Very High				56	29

NGN has assumed, without investment 20 boiler packages and 16 WBHs would be at the end of their useful lives by the end of RIIO-GD1.

In 2012, based on a fault threshold of 40 faults in five years, NGN would have 27 WBHs and 12 boiler packages in the need of replacement. If the network extrapolated the fault data and deterioration rates throughout RIIO-GD1 it would indicate all PRI pre-heating would need to be replaced (69 WBHs and 34 boiler packages). Having consulted with the network engineers this is not felt to be an accurate reflection on reality. Instead NGN believe that through targeted replacement and maintenance 16 WBH and 20 boiler packages would be beyond their useful lives without investment.

d) Investment Options

The investment options considered by NGN are summarised below.

Option 1: Do Nothing

The network considered a 'do nothing' option for pre-heating but it considered the level of risk to security of supply, safety and environmental considerations would be unacceptable.

Option 2: Set the Five Year Fault Threshold at 40

Setting the fault threshold at 40, based on actual fault data this year and taking no account of future deterioration, the number of pre-heating replacements would be:

- WBHs requiring replacement = 40
- Boiler packages requiring replacement = 16

Option 3: Set the Five Year Fault Threshold at 50

Setting the fault threshold at 40, based on actual fault data this year and taking no account of future deterioration, the number of pre-heating replacements would be:

- WBHs requiring replacement = 34
- Boiler packages requiring replacement = 12

Option 4: Set the Five Year Fault Threshold at 100

Setting the fault threshold at 100, based on actual fault data this year and taking no account of future deterioration, the number of pre-heating replacements would be:

- Water bath heaters requiring replacement = 22
- Boiler packages requiring replacement = 10

Each of the options has been evaluated in Figure 2.5 below:

e) Investment Decision

Measure	Option One (Do nothing)	Option 2 (40 Faults in five years)	Option 3 (50 Faults in five years)	Option 4 (100 Faults in five years)
Recommended Asset Upgrades (taking into account deterioration throughout RIIO-GD1)	0	WBH – 40 Boiler Packages – 26*	WBH – 32 Boiler Packages – 26*	WBH – 28 Boiler Packages – 26*
Financial	Ongoing increasing maintenance costs and substantial unquantifiable costs if a pre-heating asset is unrepairable. These assets will also still need replacing at some point in the near future.	Total investment circa £25m	Total investment circa £21m	Total investement circa £19m
Safety	Safety is not the principle driver for this investmetn however failure to replace these asset coudl have safety impact on operational staff through night time call outs and manual 'relights'			
Security of Supply	Signifiant increase in risk to supply throuogh catestropic failure of a critical heater	Signifiant increase in risk to supply throuogh catestropic failure of a critical heater	Signifiant increase in risk to supply throuogh catestropic failure of a critical heater	Signifiant increase in risk to supply throuogh catestropic failure of a critical heater
Environmental	WBH are highly inifficent resulting in high gas use. Also signifiat CO2 emmissions from extra fault call outs.	Signifiant reduction in WBH heater gas use and reduction in CO2 from fault call outs	Signifiant reduction in WBH heater gas use and reduction in CO2 from fault call outs	Signifiant reduction in WBH heater gas use and reduction in CO2 from fault call outs
Level of Risk	Very High and increasing throughout RIIO-GD1	Minimal risk retain by network	Accpetable level of risk retained by network	Unacceptable level of risk retained by network
Comments	Not recommended – too much risk	Ideal solution for the network but not for the customer. The netowrk also feels it coudl manage this level of risk throughout RIIO-GD1.	Acceptable solution where the netwrok retains a managable level of risk	Unaceptable solution it is antipated the network would not be able to manage the risk at this level and there would still be a signifiant chance of catestropic failure of the asset.
Decision	N/A	2	1	N/A

Figure 2.5

*boiler packages remain constant based on the current age profile of all boilers and the potential rapid deterioration throughout RIIO-GD1.

Investment Decision: Option 3

NGN believes the recommended option is option 3 above being the optimum solution for management of the pre-heating assets. It allows the network to mitigate the risk to an acceptable level whilst maintaining enough risk to benefit the customer.

NGN believes that adopting this strategy will allow the network to remove the highest risk WBH and continue to cannibalise the parts to ensure the retained WBH population will remain operation throughout RIIO-GD1.

This solution is a conservative approach to the pre-heating problem facing the network and, through utilisation of the skills of the network engineers to sweat these assets, it is considered the optimum solution.

Offtakes - With Investment

Asset categories		Criticality Index	Asset distribution based on estimated remaining useful life at 31 March 2011				
			Remaining Useful Life Expected (50%)				
			HI1	HI2	HI3	HI4	HI5
17	NTS Offtakes	Low					
	Offtakes – pre-heating	Medium					
		High					
		Very High	23			23	

16 WBH, six boiler packages. (Note one new boiler package was installed during GDPCR1)

PRI's - With Investment

Asset categories		Criticality Index	Asset distribution based on estimated remaining useful life at 31 March 2011				
			Remaining Useful Life Expected (50%)				
			HI1	HI2	HI3	HI4	HI5
18	PRI's above 7 Bar	Low					
	PRI's – Pre Heating	Medium					
		High	7			6	
		Very High	32			53	

16 WBH, 20 boiler packages. (Three new package boilers also need installing over RIIO-GD1)

2.4 Selection Criteria

In order to manage the risk appropriately NGN is developing a selection criteria methodology for prioritising heater replacement based on a culmination of factors. Although the detail is not finalised it is envisage that the following factors will be considered in the criteria.

- Faults data;
- Operating pressure tier;
- Pressure cut;

- Flow;
- Distance to next pressure reduction station; and
- Number of customers.

The remaining WBH population (76%), which include many assets of a similar age and type, will be managed effectively through an ongoing maintenance and where required, repair programme. Utilisation of these assets will be extended for at least another nine years out to 2021.

2.5 Innovation

NGN are committed to innovation and as part of this investment we are currently considering a range of alternative options that use alternative technologies to provide some or all of the pre-heating requirements on site. These include:

- Use of Anaerobic Digestion (AD) plant to generate biomethane to fuel boilers/WBHs and potentially a small Combined Heat and Power (CHP);
- Biomass boiler for pre-heating;
- Partnering with biomass production facilities to provide heat requirements to sites (e.g. Bishop Auckland);
- Turbo expander technology;
- Ground/air source heat pumps/Photo Voltaic (PV) cells; and
- Identify how we may decide to take these forward through our innovation strategy.

2.6 Output Deliverables

Policy Area	Primary Outputs
Environmental (broad measure)	N/A
Environmental (narrow measure)	Increased efficiency of new boiler packages over WBH's
Customer Service	N/A
Social obligations	N/A
Customer Connections	N/A
Safety	Increase safety of maintenance for operational engineers
Reliability	Security of supply maintained
Broad approach to asset management	N/A

Figure 2.6: Pre-heating Output Deliverables

A19A-3: Electrical and Instrumentation (E&I) Site Upgrades

3.1 Introduction

E&I systems and equipment are utilised across the network to provide control, telemetry, heating, lighting, communications, metering to ensure safe, secure and compliant transportation of gas from the NTS Offtakes to the consumer, providing key information on odorisation, flow, pressure, energy and gas quality used for network control and customer/shipper support.

There are 250 sites with E&I equipment providing a diverse range of applications and are crucial to manage the network on a daily/hourly basis, many of these systems utilise specialist techniques to ensure safe operation within a hazardous area. These sites are comprised of:

- 89 below 7Bar sites;
- 138 above 7Bar sites; and
- 23 Offtake sites.

Basic E&I equipment and infrastructure on these sites are over 35 years old and use outdated technology. They have not needed much capital investment over that period, a small number of sites have had the E&I equipment replaced during major Above Ground Installation (AGI) rebuilds, and over the last two years specific projects have been developed to address the long term infrastructure issues with six sites being refurbished/upgraded to the latest legislative requirements.

Many of the systems and equipment have now reached the end of their useful life and are deteriorating to a point where there is a potential safety issue. It is intended to assess each site to replace equipment to meet current legislative requirements, there is no single solution to apply at each location, each site will be individually redesigned to minimise cost and maximise the future life of the equipment. Following upgrade it is expected that sites will not require major investment for a further 30-40 years.

The drivers for this project are safety and security of supply, new designs will be done to minimise components and standardise design. Due to increased metal theft from sites careful consideration will be given to methods of installation and protection to discourage attempted theft.

Examples of the current condition of specific E&I installations are shown below:

3.2 Current Price Control Run Rates

Basic E&I equipment and infrastructure on these sites are over 35 years old and have had little capital investment over that period, a small number of sites have had the E&I equipment replaced during major AGI rebuilds, and over the last two years specific projects have been developed to address the long term infrastructure issues with six sites being refurbished/upgraded to the latest legislative requirements.

3.3 RIIO-GD1 Investment Requirements

Within the RIIO-GD1 period NGN proposes to replace and upgrade electrical systems on 125 out of 250 sites and replace/upgrade Instrumentation systems on 94 out of 250 sites. The E&I investment is driven directly by Asset Health Category 22 "Telemetry and Control Above 7Bar" and Category 4 "Telemetry and Control Below 7Bar".

This translates to the investment profile identified in the follow asset health tables and Figure 3.1 below:

(2009/10 prices)	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	TOTAL
Telemetry & Control)	1.1	1.4	1.3	1.2	1.3	1.1	1.1	1.1	9.6

Figure 3.1: RIIO-GD1 Telemetry & Control Expenditure

3.4 The Investment Journey

a) Criticality Assessment

Sites are now beginning to degrade to a point where they can be a potential safety risk to both staff and members of the public and also have security of supply implications if power were to be lost to the site. There are also issues associated with the Cathodic Protection (CP) system and electrical earthing where compatibility conflicts needs to be addressed to ensure integrity of CP system and safety of electrical systems. If CP systems are non-compliant it can lead to potential corrosion problems and if electrical earthing is non-compliant the safety of staff is jeopardised and could lead to potential ignition sources within hazardous areas.

Basic monitoring instrumentation systems are now obsolete on a number of sites and pressure fittings corroding, these need to be replaced, failure could lead to security of supply issues. This will cause network control issues in managing the gas network to optimise storage and control or potential failure of a pressure containing part. A number of sites were upgraded between 20 and 25 years ago, these sites are in a moderate condition and will not be replaced within the RIIO-GD1 period.

NGN considers a 'do nothing' for the specific assets identified above is unacceptable. It is a requirement of the Electricity at Work Regulations that NGN has a duty holder role to maintain its sites in a safe state. Regulation 4(3) requires that every work activity, including operation, use and maintenance on or near systems shall be carried out as not to give rise, so far as is reasonably practicable, to danger.

b) Health Assessment

Initial plans have highlighted sites with known and immediate safety requirements and obsolescence. Ongoing site audits will clearly risk assess remaining sites to further prioritise work. The most urgent sites are already in NGN's Capex plan for 2012 and are part of this ongoing rolling programme of work.

The electrical assets have been assessed by subject matter experts who carry out site audit and maintenance work. Specific priority has been assigned to a number of sites where it is known there are safety issues with badly corroded main site distribution cabinets which have direct public access. Recent site refurbishments have identified that the electrical earthing system and site CP systems are not compatible predominantly in the North of the network. These sites are not to the required standards to protect staff or maintain corrosion protection, all relevant sites will be upgraded to comply.

The upgrade of electrical and instrumentation assets will ensure that the network control system remains, robust, maintainable, compliant and safe, while ensuring the site infrastructure is upgraded to meet legislative compliance. The proposals allow for phased upgrade targeting higher risk sites first, ensuring infrastructure meets current design criteria allowing rationalisation of our distribution system. This strategy may also deliver reduction in maintenance activity by the installation of new and advanced technology.

c) Network Risk

Following the criticality and asset health assessments undertaken by NGN the asset health tables were populated for E&I Below 7Bar, E&I Above 7Bar and E&I Offtakes. Deterioration rates for all these categories have been based on subject matter expert assessment.

E&I below 7Bar Electrical Systems

Asset Health and Criticality - Current Condition

Asset categories		Criticality Index	Asset distribution based on estimated asset health index at 31 March 2011				
			Asset health index				
			HI1	HI2	HI3	HI4	HI5
4	Telemetry & Control	Low					
	LTS – Electical Systems	Medium			39		50
		High					
		Very High					

Asset Health and Criticality – Without Investment

Asset categories		Criticality Index	Asset distribution based on estimated remaining useful life at 31 March 2011				
			Remaining Useful Life Expected (50%)				
			HI1	HI2	HI3	HI4	HI5
4	Telemetry & Control	Low					
	LTS – Electical Systems	Medium				39	50
		High					
		Very High					

E&I below 7Bar - Instrumentation Systems

Asset Health and Criticality - Current Condition

Asset categories		Criticality Index	Asset distribution based on estimated asset health index at 31 March 2011				
			Asset health index				
			HI1	HI2	HI3	HI4	HI5
4	Telemetry & Control	Low			54	35	
	LTS – Instrumentation Systems	Medium					
		High					
		Very High					

Asset Health and Criticality - Without Investment

Asset categories		Criticality Index	Asset distribution based on estimated remaining useful life at 31 March 2011				
			Remaining Useful Life Expected (50%)				
			HI1	HI2	HI3	HI4	HI5
4	Telemetry & Control	Low				54	35
	LTS – Instrumentation Systems	Medium					
		High					
		Very High					

E&I above 7Bar - Electrical Systems

Asset Health and Criticality - Current Condition

Asset categories		Criticality Index	Asset distribution based on estimated asset health index at 31 March 2011				
			Asset health index				
			HI1	HI2	HI3	HI4	HI5
22	Telemetry & Control	Low					
	LTS – Electrical Systems	Medium	10		78		55
		High					
		Very High					

Asset Health and Criticality - Without Investment

Asset categories		Criticality Index	Asset distribution based on estimated remaining useful life at 31 March 2011				
			Remaining Useful Life Expected (50%)				
			HI1	HI2	HI3	HI4	HI5
22	Telemetry & Control	Low					
	LTS – Electricl Systems	Medium	10			78	55
		High					
		Very High					

E&I above 7Bar - Instrumentation Systems

Asset Health and Criticality - Current Condition

Asset categories		Criticality Index	Asset distribution based on estimated asset health index at 31 March 2011				
			Asset health index				
			HI1	HI2	HI3	HI4	HI5
22	Telemetry & Control	Low	12		86	45	
	LTS – Instrumental Systems	Medium					
		High					

Asset categories		Criticality Index	Asset distribution based on estimated asset health index at 31 March 2011				
			Asset health index				
			HI1	HI2	HI3	HI4	HI5
		Very High					

Asset Health and Criticality - Without Investment

Asset categories		Criticality Index	Asset distribution based on estimated remaining useful life at 31 March 2011				
			Remaining Useful Life Expected (50%)				
			HI1	HI2	HI3	HI4	HI5
22	Telemetry & Control	Low	12		86		45
	LTS – Instrumental Systems	Medium					
		High					
		Very High					

E&I above 7Bar - Offtakes Electrical Systems

Asset Health and Criticality - Current Condition

Asset categories		Criticality Index	Asset distribution based on estimated asset health index at 31 March 2011				
			Asset health index				
			HI1	HI2	HI3	HI4	HI5
22	Telemetry & Control	Low					
	Offtakes – Electrical Systems	Medium					
		High	3			20	
		Very High					

Asset Health and Criticality - Without Investment

Asset categories		Criticality Index	Asset distribution based on estimated remaining useful life at 31 March 2011				
			Remaining Useful Life Expected (50%)				
			HI1	HI2	HI3	HI4	HI5
22	Telemetry & Control	Low					
	Offtakes – Electrical Systems	Medium					
		High		3			20
		Very High					

E&I above 7Bar - Offtakes Instrumentation Systems

Asset Health and Criticality - Current Condition

Asset categories		Criticality Index	Asset distribution based on estimated asset health index at 31 March 2011				
			Asset health index				
			HI1	HI2	HI3	HI4	HI5
22	Telemetry & Control	Low					
	Offtakes – Instrumental Systems	Medium	3			20	
		High					
		Very High					

Asset Health and Criticality - Without Investment

Asset categories		Criticality Index	Asset distribution based on estimated remaining useful life at 31 March 2011				
			Remaining Useful Life Expected (50%)				
			HI1	HI2	HI3	HI4	HI5
22	Telemetry & Control	Low					
	Offtakes – Instrumental Systems	Medium		3			20
		High					
		Very High					

NGN has assumed, without investment 20 boiler packages and 16 WBHs would be at the end of their useful lives by the end of RIIO-GD1.

d) Investment Options

The investment options considered by NGN are summarised in Figure 3.2 below.

		Site Upgrades			
		Option 1	Option 2	Option 3	Option 4
Below 7Bar	Electrical	0	40	50	65
	Instrumentation	0	10	35	50
Offtakes	Electrical	0	15	20	15
	Instrumentation	0	14	14	14
Above 7Bar	Electrical	0	45	55	70
	Instrumentation	0	30	45	65
	TOTAL	**0**	**154**	**219**	**279**

Figure 3.2: Investment Options

Option 1: Do Nothing

The network considers a 'do nothing' for the specific assets identified above is unacceptable. It is a requirement of the Electricity at Work Regulations that NGN has a duty holder role to maintain its sites in a safe state, Regulation 4(3) requires that every work activity, including operation, use and maintenance on or near systems shall be carried out as not to give rise, so far as is reasonably practicable to danger.

Option 2: Reduce the Number of Site Upgrades

Reducing the number of total upgrades is an option which would allow the highest risk sites to be upgraded but would leave some risk, and sites not planned would continue deteriorating and have an increasing risk.

Option 3: Preferred Option

Following the asset health review option three is seen as the best compromise program to ensure the safety of critical assets which are known to be in a poor condition and through further detailed asset health survey identify other sites by priority; subject matter experts have developed the numbers from extensive knowledge of these sites.

Option 4: Increase the Number of Site Upgrades

Increasing the number of sites above the preferred option is seen as unnecessary and does not add value, assets above this number are believed to have a life greater than this formula period.

Each of the options has been evaluated in Figure 3.3 below:

e) Investment Decision

Measure	Option 1 (do nothing)	Option 2 (reduce site upgrades from 219 to 154)	Option 3 (upgrade 219 site)	Option 4 (Increase site upgrades from 219 to 300)
Recommended asset upgrades (taking into account deterioration throughout RIIO-GD1)	0	150	219	279
Financial impacts	Some increase in maintenance costs. These assets will also still need replacing at some point in the near future.	Total investment reduced from £9.8 to £7m	Total investment circa £9.8m	Total investement circa £12.5m
Safety	This work is safety and compliance driven and as such safety risk is high			
Security of Supply	Minimal risk to security of supply but will be issues with network control as electrical systems & telemetry systems fail	Minimal risk to security of supply but will be issues with network control as electrical & telemetry systems fail	Minimal risk to security of supply will alow critical sites to be prioratised	Minimal risk to security of supply will alow critical sites to be prioratised earlier in the plan
Environmental	N/A	N/A	N/A	N/A
Level of Risk	Very high safety to staff and public, HSE intervention	High safety to staff and public, HSE intervention but would remove highest risk	Accpetable level of risk retained by network	Network risk reduced
Comments	Not recommended – too much risk	Risk levels would need to be assessed to ensure critical sites are done and no risk of HSE intervention	Acceptable solution where the networkcan demonstrate it is managing the risk	This solution is seen as unnessesary as sites with considerable life would be upgraded unnessesarily.
Decision	Unacceptable	Unacceptable	Acceptable	Unacceptable

Figure 3.3: Summary of Evaluation of Investment Options

Investment Decision: Option 3

NGN believes that option three is the optimum solution for management of the E&I assets. It allows the network to mitigate the risk to an acceptable and demonstrable level whilst maintaining legislative compliance.

NGN believes that adopting this strategy will allow the network to remove the highest risk sites and extending the asset life considerably.

Due to the nature of the gas infrastructure development a large number of assets were built in a similar period and have been sweated to a point the assets are at the end of their life, this is considered the optimum solution.

E&I Below 7Bar - LTS

Electrical Site Upgrades

Asset categories		Criticality Index	Asset distribution based on estimated remaining useful life at 31 March 2011				
			Remaining Useful Life Expected (50%)				
			HI1	HI2	HI3	HI4	HI5
4	Telemetry & Control	Low					
	LTS – Electrical Systems	Medium	50			39	
		High					
		Very High					

Instrumentation Site Upgrades

Asset categories		Criticality Index	Asset distribution based on estimated remaining useful life at 31 March 2011				
			Remaining Useful Life Expected (50%)				
			HI1	HI2	HI3	HI4	HI5
4	Telemetry & Control	Low	35			54	
	LTS – Instrumental Systems	Medium					
		High					
		Very High					

E&I Above 7Bar - LTS

Asset categories		Criticality Index	Asset distribution based on estimated remaining useful life at 31 March 2011				
			Remaining Useful Life Expected (50%)				
			HI1	HI2	HI3	HI4	HI5
4	Telemetry & Control	Low					
	LTS – Electrical Systems	Medium	65			78	
		High					
		Very High					

Asset categories		Criticality Index	Asset distribution based on estimated remaining useful life at 31 March 2011				
			Remaining Useful Life Expected (50%)				
			HI1	HI2	HI3	HI4	HI5
4	Telemetry & Control	Low	57		86		
	LTS – Instrumental Systems	Medium					
		High					
		Very High					

E&I Above 7Bar Offtakes`

Asset categories		Criticality Index	Asset distribution based on estimated remaining useful life at 31 March 2011				
			Remaining Useful Life Expected (50%)				
			HI1	HI2	HI3	HI4	HI5
4	Telemetry & Control	Low					
	Offtakes – Electrical Systems	Medium					
		High	14	3			6
		Very High					

Asset categories		Asset distribution based on estimated remaining useful life at 31 March 2011				
		Remaining Useful Life Expected (50%)				
		HI1	HI2	HI3	HI4	HI5
4	Telemetry & Control					
	Offtakes – Instrumental Systems	20	3			

Asset categories		Asset distribution based on estimated remaining useful life at 31 March 2011				
		Remaining Useful Life Expected (50%)				
		HI1	HI2	HI3	HI4	HI5

3.5 Selection Criteria

In order to manage the risk appropriately NGN is developing an asset health audit framework, immediate priority work has been identified through maintenance and audit visits, the asset health framework will develop a risk scoring mechanism for prioritising E&I upgrades based on a culmination of factors. Although the detail is not finalised it is envisage that the following factors will be considered in the criteria:

- Physical protection;
- Circuit protective devices;
- Short circuit protection;
- RCD/Earthing standard;
- CP compliance;
- Electrical containment;
- Obsolete;
- Corrosion;
- Support structures; and
- Safety (access/egress).

3.6 Innovation

Each site will be designed individually to produce the most cost effective solution for that particular site, standard types of equipment will be used and rationalised where possible to minimise the amount of equipment.

Where practical equipment/cable will be designed and installed so as to minimise the increasing risk of metal theft.

3.7 Output Deliverables

Policy Area	Primary Outputs
Environmental (broad measure)	Less power useage
Environmental (narrow measure)	N/A
Customer Service	Reliable and accurate Offtake metering and energy data for the shipper comunity
Social obligations	Reliable telemetry communications ensures security of supply through System Control Network management
Customer Connections	N/A
Safety	Ensures safety of staff and public, compliance with Electricity at Work Regulations
Reliability	Essential for delivery of gas through network Offtakes & LTS, security of supply, visibility of site problems/conditions.

Broad approach to asset management	N/A

Figure 3.4: Output Deliverables

A19A-4: Pipeline Re-life

4.1 Introduction

Pipeline re-life is the term used to describe how NGN ensures those protective measures continue to provide fitness for purpose of our pipeline systems.

Throughout the RIIO-GD1 period, a range of pipeline re-life works is required, covering IGE/TD/1 pipeline infringements, CP, ground beds and transformer rectifiers. The drivers for this work are either statutory requirements or the need to maintain the effectiveness of equipment.

The investment required to re-life pipelines is shown in Figure 4.1 which sets out our overall forecasts for 'LTS and storage investment' and shows how the investment is broken down over the RIIO-GD1 period:

£m 2009/10 prices	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	Total
Pipeline Re-life Expenditure	0.8	0.7	0.6	0.6	0.6	0.6	0.6	0.7	5.1

Figure 4.1: Pipeline Re-life Expenditure

The process required to re-life the pipelines consist of the three elements set out in the following sections:

a) IGEM/TD/1 Pipeline Infringements

Pipeline infringement is when unauthorised work or buildings are carried out within the pipeline 'wayleave' or easement. Typically, this is the zone within which the pipeline operator has legal rights, including a requirement by the landowner to notify planned work.

Once identified, assessment needs to be carried out to demonstrate that the infringed pipeline can be operated safely. Often this will include complicated risk analysis.

NGN complies with the industry standard IGE/TD/1 for the maintenance of its pipelines. The latest edition of this is Edition 5. This edition has proximity distances acceptable for such new technologies as wind farms, some of which have been built for many years now but new pipeline standards mean that we now maintain our pipelines to these standards and therefore have to address these infringements as we carry out our pipeline audits.

Often the assessment can accept the infringement with additional protection measures such as concrete slabs or the risk is accepted 'As Low As Reasonable Practicable' or we may have to compensate the owner for possible loss of earnings. Worst case scenario is that we have to divert our pipeline, which is the most costly option.

All of these factors have a trade-off and therefore the value of good assessment is vital in ensuring the best value for money option is selected. Based on previous spend , forecasted pipeline infringements and evaluation of compliance to new standards, the table below shows NGN's anticipated spend on this

element of re-life as the most efficient option and follows a minimal spend approach by using complex independent analysis to demonstrate legislative compliance and acceptable levels of risk.

£m (2009/10 prices)	2013	2014	2015	2016	2017	2018	2019	2020	Total
TD1 Infringements Expenditure	0.20	0.20	0.10	0.10	0.10	0.10	0.10	0.10	1.00

Figure 4.2: RIIO-GD1 TD1 Infringements Expenditure

b) Cathodic Protection (CP)

To ensure a high level of safety and reliability in operation, it is essential that buried steel pipework associated with the transmission and distribution of natural gas is designed, installed and commissioned to withstand the potentially harmful effects of corrosion. NGN's approach to this is to apply good quality protective coatings, backed up by effective CP systems.

The main advantage of CP over other forms of anti-corrosion treatment is that it is applied simply by maintaining a DC circuit and its effectiveness may be monitored continuously. These CP systems can be either Sacrificial Anode or Impressed Current applied.

Sacrificial Anode (SA): SA systems are primarily used in built-up areas to reduce the likelihood of electrical interaction with other nearby buried structures/services and for the protection of pipework having a limited surface area. SA systems involve fitting magnesium/zinc anodes directly to the pipeline (connection in test post). There is no requirement for an external power source.

Impressed Current: Impressed Current systems are primarily used with pipelines of significant length and on sites with complex buried pipe arrays and extensive earthing systems. Many kms of pipeline can be protected by a single 'groundbed' with an external power source and therefore these systems are ideal for cross country pipelines.

Transformer Rectifiers (TR's) change the current from AC to DC and provide the power for groundbeds.

There are 208 TR's in the network providing impressed current CP to our steel pipelines and over 14,000 test facilities on our CP database that provide information on the condition of our CP systems.

Figure 4.3: Typical air cooled TR unit in need of upgrade

Both CP systems work on the principle of converting the pipeline to a 'cathode' which in turn receives charged ions through the soil from the 'anode'. Because of this electro-chemical process, the anodes deteriorate and require renewal when signs of their current outputs drop to a state where the pipeline no longer complies.

Current Run Rates

Aging pipeline coatings require higher current outputs which in turn reduce the life of CP anodes and equipment, therefore the re-life of this equipment is critical to the condition of the pipelines.

Historical spend has shown that an average TR replacement at current costs is c.£13k. In addition to this, new power supplies are required for these to incorporate safety requirements under electrical regulations and to facilitate remote monitoring facilities.

Additional costs of anode replacement, groundbeds, test post remote monitoring units, cabling, database improvements and other items, based on these assumptions, we anticipate the following spend on CP to be:

£m 2009/10 prices	2013	2014	2015	2016	2017	2018	2019	2020	Total
CP Expenditure	0.50	0.30	0.30	0.40	0.40	0.40	0.40	0.40	3.10

Figure 4.4: RIIO-GD1 Cathodic Protection Expenditure

c) Other

In order to achieve effective CP and maintain safe pipelines, there are other measures that require ongoing investment such as the protective coatings, paint systems and electrical isolation that is needed to separate various electrical systems. These additional elements have been categorised in this section as 'Others'.

As AGI's and pipe systems are updated with E&I equipment, the need to upgrade CP systems to overcome these additional 'current drain' seen on the anode supply.

Based on experience, the anticipated spend on these elements is shown in Figure 4.5 below:

£m (2009/10 prices)	2013	2014	2015	2016	2017	2018	2019	2020	Total
Other Expenditure	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.30	1.00

Figure 4.5: RIIO-GD1 other pipeline expenditure

4.2 Investment Driver

LTS Pipelines are NGN's link between the NTS and the network's distribution system for pressure reduction onwards to our customers. There is currently 1,200km of HP pipelines (>7Bar) in the network. These pipelines are inspected periodically, using appropriate inspection techniques.

The operation of pipelines is a compliance issues and the operation of all pipelines must meet the requirements of the Pipeline Safety Regulations 1996.

Consequence of Failure

The two biggest influences on HP Pipeline failure are third party damage and corrosion. The requirements in IGE/TD/1 are to ensure that pipeline infringements and corrosion control techniques are managed efficiently to ensure that pipeline integrity is maintained. Consequences of failure include:

- Loss of multiple life;
- Destruction of property; and
- Loss of gas supply to customer.

Condition Assessment

LTS Pipelines are generally in a good condition. The majority of them are in the HI2 category. Most pipelines have exceeding 40 years continual service. Integrity of these assets is managed through periodic in-line or over ground inspections.

Asset categories		Criticality Index	Asset distribution based on estimated asset health index in current reporting year				
			Asset health index				
			HI1	HI2	HI3	HI4	HI5
1	LTS Pipelines	Low	0	1	0	0	0
		Medium	0	0	0	0	0
		High	23	242	25	17	0
		Very High	2	443	277	164	0

Deterioration:

Pipelines are maintained in accordance with IGE/TD/1. The main cause of deterioration to pipelines is due to corrosion, the deterioration rate due to this factor varies dependent upon ground condition, coating type, effectiveness of the CP system and pressure cycling fatigue, among other factors. Since construction, most pipelines have experienced some deterioration but this has been managed effectively, with regular maintenance and monitoring, investment in remote CP monitoring and CP system upgrades. The largest risk to pipelines is by third party infringement and damage, this risk is managed through the effective application of IGE/TD/1.

The life of CP systems and anodes reduces as current outputs increase in order to protect deteriorating coatings. Repairs are ongoing to maintain coatings to keep current outputs as low as possible in order to reduce interference with other utilities. Aging TR's require maintenance to satisfy electrical regulations and ensure safety to personnel maintain such equipment.

Introduction in new energy sources and changing planning authorisation continue to affect how we operate our pipelines safely. Wind Farms are such an example and these are often built in proximity to our HP pipelines and require assessment of this impact on such pipelines.

b) Cost Benefit Analysis

The cost benefit to carry out this re-life offers the most efficient solution to the alternative of expensive renewal of pipelines.

The benefits/outputs of investing in these assets are as follows:

- Environmental – No disruption to the environment from construction of a new pipeline in the future. No loss of containment from pipeline failure.

- New TR will have remote monitoring facilities with operation from office. This will reduce excessive travel to monitor TR performance and hence a benefit in the carbon footprint with reduced vehicle emissions.
- **Customer** – Continual security of supply across the network.
- **Safety** – Risk mitigation and reduction of major accident hazard pipelines across the geographical area of the network, in both rural and urban locations.
- TR's monitoring carries the risk of exposing personnel to two different earthing systems. Remote monitoring facilities at replaced equipment reduce the need for regular monitoring visits and therefore improve the safety to personnel.
- **Compliance** – Pipelines must be compliant with Pipeline Safety Regulations 1996 and Pressure Systems Safety Regulations (PSSR) 2000.

c) Other Options Considered

Do Nothing:

The option to 'do nothing' is not viable option. As can be seen from the Asset Health tables below, without investment, more pipelines would slip into the HI4 and HI5 categories. This would eventually lead to pipeline failure and the probability of:

- Loss of Supply;
- Loss of Life;
- Destruction to Properties;
- Breach of Regulations;
- Loss of License to Operate; and
- Damaged Reputation.

Asset Health and Criticality - With Investment

Criticality Index	Asset distribution based on estimated asset health index at 31 March 2017					Asset distribution based on estimated remaining useful life at 31 March 2021				
	Asset health index					Remaining useful life				
	HI1	HI2	HI3	HI4	HI5	HI1	HI2	HI3	HI4	HI5
Low	0	1	0	0	0	0	1	0	0	0
Medium	0	0	0	0	0	0	0	0	0	0
High	19	227	27	19	0	19	229	29	0	0
Very High	2	533	300	67	0	2	592	322	0	0

Asset Health and Criticality - Without Investment

Criticality Index	Asset distribution based on estimated asset health index at 31 March 2017					Asset distribution based on estimated remaining useful life at 31 March 2021				
	Asset health index					Remaining useful life				
	HI1	HI2	HI3	HI4	HI5	HI1	HI2	HI3	HI4	HI5
Low	0	1	0	0	0	0	1	0	0	0
Medium	0	0	0	0	0	0	0	0	0	0
High	19	220	27	19	7	19	200	29	22	7

Criticality Index	Asset distribution based on estimated asset health index at 31 March 2017					Asset distribution based on estimated remaining useful life at 31 March 2021				
	Asset health index					Remaining useful life				
	HI1	HI2	HI3	HI4	HI5	HI1	HI2	HI3	HI4	HI5
Very High	2	454	300	120	26	2	414	322	149	29

4.3 Selection Criteria

The type of investment chosen to re-life pipelines has been selected to provide the safest, most environmentally friendly and using the latest technologies available in the solution which provides our customer with the overall best value for money, and allows us to operate our pipelines safely both for our customers and our personnel working on them.

4.4 Innovation

As technologies advance, then NGN will apply the latest most innovative solution available which demonstrates the best value for money.

In the re-life of CP systems and TR's, we have incorporated remote monitoring facilities into the design, which provide us with improved results at a more frequent rate than would have been collected by manual means. This has enabled us to proactively monitor the state of our pipelines and react faster to faults as they occur. This alone will enhance the life of our pipelines and their protective systems.

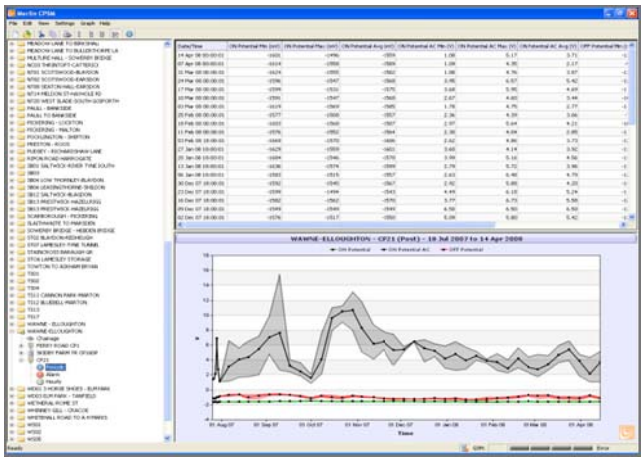


Figure 4.6: Remote Monitoring Database

Remote monitoring can also monitor AC interference as well as DC potentials providing better data more frequently to enable us to assess asset health and maintain accordingly.

As coatings improve, so has the increased evidence of AC interference as utilities continue to share common corridors. Remote monitoring is seen as a way of ensuring that AC corrosion is constantly monitored and that we are protected from this issue.

Figure 4.7: Remote monitor in shared utility corridor

Remote monitoring has also been effective in enabling us to analyse the data received and understand such issues as power supply failure, which in turn can reduce the effectiveness of impressed current CP systems. By renewing such power supplies or challenging power supplier companies, we are showing best value for money for our customers.

A19A-5: Offtake Meter Upgrades Including Low Flow Metering

5.1 The Specific Requirement throughout RIIO-GD1

Within the RIIO-GD1 period NGN has made a provision of 6.2m to enable NTS Offtake metering to meet the UNC compliance in terms accuracy +/- 1% at all expected flow ranges.

a) Expenditure Forecast

Year	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	Total
Offtake Meter Upgrades Including Low Flow Metering	0.3	0.5	0.6	0.5	0.9	0.8	1.2	1.3	6.0

Figure 5.1: RIIO-GD1 Offtake Meter Upgrades Including Low Flow Metering

Workload throughout the RIIO-GD1 plan period has been assessed at 13 sites with a unit cost of approximately £0.5m. Detailed design work which will be completed in 2013/4 will establish the full plan programme. Corbridge has been identified along with Baldersby and Coldstream to be completed in the early plan years.

5.2 Investment Driver

UNC requirement: It is essential that Shippers are billed correctly by NGN and they in turn are able to recover these costs from their end users. This has continued to be made very clear to NGN at the Stakeholder Engagement sessions. Ofgem requires NGN to ensure Offtake Metering is within an acceptable level of accuracy and Ofgem undertake annual audits to ensure UNC metering accuracy requirements. NGN has 23 Offtakes which are audited by Ofgem over a ten year period equating to approximately two/three sites per year.

Flexibility to change Offtake flows: The introduction in 2012/13 of Offtake Reform (UNC Mod 0195 AV) has resulted in the need to have more flexibility within the network to operate Offtakes at Low Flows. This would normally be, but not confined to, Summer periods. Flat and flex commitments as detailed in the Offtake Capacity Statements Process (OCS) present a contractual obligation between NGN and NTS. NGN needs to ensure that any changes to flat and flex Offtake flows are within agreed contractual parameters. In order to comply with the above conditions it is essential to have maximum flexibility to change flows at Offtakes. This could result in metering inaccuracies as some meters (Orifice Plate Meters) do not have the capacity to record accurately when changing flows (turndown ratio) or during low flow conditions.

5.3 Current Price Control Run Rates

Up to the introduction of UNC mod 0195AV work on Offtake Metering was condition driven, prompted by faults or in association with increasing the capacity of the Offtake. When Offtake capacity upgrading was the main driver advantage was taken to concurrently upgrade/replace the Offtake Metering. Ultrasonic meters USM in most but not all cases are used to replace orifice plate meters as they are more accurate over a wider range of flows. USM have been installed at Pannal, Elton, Thrintoft and Humbleton. Bishop Auckland will commence in 2012 and be completed in the first year of the RIIO-GD1.

Consequence of Failure

The failure of Metering to accurately measure volumes at the NTS Offtakes could result in significant errors in the shipper billing and reconciliation process. This could result in shippers paying transportation charges which they are unable to recover from the end user metered energy. This is in strong conflict with UNC requirements.

Cost Definition

Sites are identified from:

- Ofgem audits;
- Data analysis and extracts from the HP Management Information System (HPMIS). This is primarily to examine the sites which have operated at below 20% flow ranges; and
- Corbridge, Baldersby and Coldstream have been identified to commence early in the plan period. Corbridge as a follow up to an Ofgem Category one audit finding.

Supplier costs are available for meters. An estimate has been made for the associated labour and E&I costs will be extracted from recent installation costs for Pannal, Elton, Thrintoft, Humbleton and Bishop Auckland.

A full detailed assessment of all sites will be undertaken early in 2013 to finalise the scale and cost of the work required within the plan period.

5.4 Cost Benefit Analysis

NGN need to ensure that the Offtake Metering is compliant with UNC. Sites are being selected to reduce the target population and ensure compliance at minimum cost. The design assessment which will be completed in 2013 will establish the minimum number of sites which require alterations to orifice plate metering (OPM), replacement with USM or no changes to the existing metering arrangements.

a) Other Options Considered

All the sites with OPM could be replaced with USM. This would be at much higher cost and has been rejected as it would not ensure the optimum use of resources/finance.

5.5 Selection Criteria

Specific sites will be established following completion of detailed design work in 2013/14.

5.6 Innovation

Every effort will be made at the detailed design stage to look at innovative ways to ensure the Offtake Metering is UNC compliant within the current and future operating environment. This may involve changing NGN's operating procedures to ensure best match of Metering, Low Flows and turn down impacts. This will ensure the minimum workload/expenditure on replacing Offtake Meters throughout the RIIO-GD1 period.

A19A-6: Energy Flow Measurement

6.1 The Specific Requirement throughout RIIO-GD1

Across the NTS Offtakes there are 12 Calorimeters, 12 Calorimeter Controllers and 25 Omni Flow Computers which are all critical for the accurate compulsory measurement of energy flow.

These complex systems are over 17 years old and similar to other electronic equipment are at the end or approaching the end of their operable life, it is therefore intended to implement a phased replacement program to ensure these critical systems remain operational and have a new asset life.

There are three main elements to critical energy/flow measurement:

- Calorimeters – The Calorimeters on the network are approaching obsolescence. It is expect that before the end of the regulatory review all 12 calorimeters will need major intervention.
- Calorimeter Controllers – RIIO-GD1 are now obsolete and unsupported and need replacement.
- Omni Flow Computers – Are now obsolete, there are some spares available but it is expected that a total replacement will be required towards the mid-point of the RIIO-GD1 period. This also allows upgrade as directed by Ofgem to upgrade the flow calculation to ISO 5167:2003

The Energy Flow measurement investment required is shown in Figure 6.1 below which sets out our overall forecasts for 'Telemetry & Control (above 7Bar)' and shows how the investment is broken down over the RIIO-GD1 period;

£m 2009/10 Prices	2013	2014	2015	2016	2017	2018	2019	2020	Total
Energy Flow Measurement	0.0	0.1	0.1	0.1	0.4	0.4	0.4	0.4	1.9

Figure 6.1: RIIO-GD1 Energy Flow Measurement Expenditure

6.2 Current Run Rates

The various elements of the energy measurement equipment have intermittent faults and failures, some spares have been cannibalised but it is becoming increasingly difficult to find spares for these systems which require specialist contractors to repair, fault data is not collated at this level.

6.3 Investment Driver

Energy Flow Measurement equipment cannot be maintained on a 'replace on fail' methodology because it must operate 24/7 to avoid possible meter errors on gas entering the network at the Offtake sites. This equipment is also essential to allow System Control to monitor and control the flow of gas into the network and also a critical part of the odorisation system which is used to ensure the gas has the correct smell and as such a safety critical application.

Consequence of Failure

Failure of one of these assets will lead to failure of the Offtake Metering and Flow Weighted Average Calorific Value process and odorant injection equipment.

System Control would not be able to control the flow of gas into the network correctly, meter reconciliation procedures would be instigated to try to calculate unaccounted gas, odorant injection systems would need manual setting to ensure safe levels of odorant are present in gas delivered to the consumer, due to the near obsolescence such faults can take time to resolve and to mitigate this sites can be shut down but only if demand in the network of the existing equipment.

Condition Assessment

All the assets are of known age and condition, the assessment of useable spares and available specialist contractors has been by suitable subject matter experts in determining the proposed program, which is phased to meet replacement by criticality of spares/function.

Asset categories		Criticality Index	Asset distribution based on estimated asset health index in current reporting year				
			Asset health index				
			HI1	HI2	HI3	HI4	HI5
22	Telemetry & Control	Low					
	Offtakes – Energy Flow Meaasurement	Medium					
		High					
		Very High				23	

6.4 Cost Benefit Analysis

The Energy Flow Measurement equipment assets are at the end of their life or expected to be by the end of RIIO-GD1, it is critical to the networks control and safety systems that these assets are replaced in a structured program to mitigate these risks.

The benefits/outputs of investing in these assets are as follows:

- Customer – Security of supply, Shipper data, Ofgem Data;
- Environmental – Reduce the number of faults and hence site visits (reduced carbon footprint with reduced vehicle emissions), reduced usage of helium carrier gas in the calorimeter;
- Safety – Ensure gas meets critical odorisation levels; and
- Compliance – Compliance with licence obligations.

a) Other Options Considered

Do Nothing:

The option to 'do nothing' is not viable option, this equipment will fail at some point and NGN must be able to demonstrate plans to keep the systems operational.

Long Term Phased Implementation

Phased implementation over a longer period has been considered. This would require cannibalisation of replaced equipment and cannot be done for the Omni Flow Computers which are being replaced to meet new accuracy requirements set by Ofgem.

Long term phased implementation is not considered practical for this small number of assets.

Asset Health and Criticality - With Investment

Criticality Index	Asset distribution based on estimated asset health index at 31 March 2017					Asset distribution based on estimated remaining useful life at 31 March 2021				
	Asset health index					Remaining useful life				
	HI1	HI2	HI3	HI4	HI5	HI1	HI2	HI3	HI4	HI5
Low	0	0	0	0	0	0	0	0	0	0
Medium	0	0	0	0	0	0	0	0	0	0
High	0	0	0	0	0	0	0	0	0	0
Very High	0	0	0	23	0	23	0	0	0	0

Asset Health and Criticality – Without Investment

Criticality Index	Asset distribution based on estimated asset health index at 31 March 2017					Asset distribution based on estimated remaining useful life at 31 March 2021				
	Asset health index					Remaining useful life				
	HI1	HI2	HI3	HI4	HI5	HI1	HI2	HI3	HI4	HI5
Low	0	0	0	0	0	0	0	0	0	0
Medium	0	0	0	0	0	0	0	0	0	0
High	0	0	0	0	0	0	0	0	0	0
Very High	0	0	0	23	0	0	0	0	0	23

6.5 Selection Criteria

The replacement of the equipment has been phased based on immediate obsolescence.

6.6 Innovation

This is a very specialist market and only Ofgem approved equipment can be used.

A19A-7: PRI Condition Upgrades

7.1 The Specific Requirement throughout RIIO-GD1

PRI Condition Upgrades cover those items of plant on PRIs and Offtakes that could fail PSSR inspections or have become obsolete or in a state of disrepair. The RIIO-GD1 investment has been based on current run rates and subject matter expert opinion. The investment includes the replacement of only 70 assets in total out of an asset base of over 3,000 individual units. In total the investment is based on the following upgrade assumptions:

Offtakes:

- Filters x 4 (c.2 sites);
- Slamshuts x 2 (c.1 site); and
- Regulators x 4 (c.1 site).

PRI's above 7Bar:

- Filters x 22 (11 sites);
- Slamshuts x 10 (5 sites); and
- Regulators x 28 (7 sites).

The costs associated with this schedule of work are shown below:

2009/10 Prices £m	2013	2014	2015	2016	2017	2018	2019	2020	Total
PRI condition upgrades	0.1	0.2	0.9	0.7	1.1	0.9	0.6	0.1	4.6

Figure 7.1: RIIO-GD1 PRI condition upgrades Expenditure

This investment profile shown above does not include those sites/assets which are updated as a result of capacity drivers, it is solely based on condition and deterioration driven upgrades. As such, out of such a large asset base (based on individual units) conservative assumptions have been made.

Examples of potential condition upgrades are shown below;



7.2 Justification for Investment

a) Current Price Control Run Rates

NGN are gathering asset health data to support a robust asset health matrix and deterioration rate mechanism for these assets. As such it is currently undertaking surveys of all its sites and continues to work on deterioration rate data and methodology throughout 2012/13. Currently the network has invested an average c.£500k pa on this type of condition replacement. The run rates forecast in RIIO-

GD1 have been based on extrapolation of existing trends supported by subject matter expert assessment.

Consequence of Failure

The criticality of these major assets is important to ensure customer supplies, safety and integrity of the gas system is maintained. All the assets in this category are vital to the network is pressure reduction stations and failure could lead to loss of supply and serious environmental and safety implications. Should these assets fail, replacement can take up to 12 months based on availability of parts, design implications and long lead items to delivery. As such, it is vital to replace assets at the end of their useful lives prior to failure. Our Offtakes and PRIs supply between 1,000 & 600,000 consumers and the principles of determining asset condition are critical to our investment program.

7.3 Selection Criteria

NGN are currently undertaking site surveys to better understand the current condition of all these assets. Once complete a clear methodology for prioritisation will be established based on site and equipment physical characteristics including, number of customers and condition.

7.4 Innovation

NGN are committed to innovation and as part of this investment we will challenge conventional replacement and we continue to consider a range of alternative options.

7.5 Benefits / Outputs

The benefits/outputs of investing in these assets are as follows:

- Safety – Compliance with the PSSR regulations;
- Reliability – Security of supply to our customers; and
- Environment – Replacement of aged WBH, with efficient package design boilers ensuring running and maintenance efficiencies.

A19A-8: Odorant Upgrades

8.1 The specific requirement throughout RIIO-GD1

Gas delivered from the NTS has no smell, odorant is injected at the 23 Offtakes (24 systems) to give the gas a distinctive smell. It is critical to the safe and efficient operation of the network that this odorant injection system operates correctly to precise concentration levels.

Key electronic components within the Odorisation Injection System have been obsolete for a number of years with no direct replacement. The N200 Controller is a critical component within the Odorant Injection System and is now obsolete, four sites were upgraded around four years ago which provided a number of spares but these are now exhausted within the network. It is proposed to start a phased replacement of all Controllers to ensure continuity of operation moving forwards.

8.2 Asset Health

Electronic equipment becomes obsolete as components stop being manufactured and supported and no direct replacement is available. The N200 Controller is a critical component within the Odorant Injection System and is now obsolete, some spares are available but a phased replacement needs to be undertaken to ensure continuity of supply. To date four sites have been upgraded leaving 19 sites outstanding. As a result, from a telemetry & controls perspective, the Odorant Tanks asset health index has been classified as HI4 for the 19 outstanding sites and HI1 at this current point in time for the four upgraded sites.

The Odorant Upgrade investment required is shown in Asset Health 22 which sets out our overall forecasts for 'Telemetry & Control (above 7Bar)' and details the investment required over the RIIO-GD1 period:

2009/10 Prices £m	2013	2014	2015	2016	2017	2018	2019	2020	Total
E&I odorant system upgrade	0.2	0.2	0.2	0.2	0.0	0.0	0.0	0.0	0.7

Figure 8.1: RIIO-GD1 E&I Odorant System Upgrade Expenditure

8.3 Current Run Rates

The Odorant Injection Systems are complex electro/mechanical systems with numerous critical components, most components are still available or have direct replacements allowing NGN to manage spares to meet operational requirements, as parts fail in service, there is no direct replacement for the N200 Controller, the system has to be redesigned to fit a new controller as spares of the N200 are now exhausted.

8.4 Justification for Investment

The gas entering the Network must be odorised to comply with our licence obligations and ensure customer safety and as such must be able to maintain this equipment, replacement of the N200 Controllers is essential to manage this risk in a demonstrable way.

a) Consequence of Failure

Failure of Odorisation equipment would lead to the gas not having a distinct smell, consequence depends on the time of year and criticality of the Offtake, if possible the offtake can be shut down to allow repair as mentioned above, the N200 Controller simply cannot be repaired and must be replaced by a different design, which as outlined would take a number of months to implement, failure during high demand would clearly invoke an incident and consideration would have to be given to allow flow of gas

which is underused or risk losing gas to large parts of the Network both are major safety issues which is clearly unacceptable..

b) Asset Health Condition

All the assets are of known age and condition, the assessment of useable spares and available specialist contractors has been made by suitable subject matter experts in determining the proposed program.

Asset Health Current Year

Asset categories		Criticality Index	Asset distribution based on estimated asset health index at 31 March 2011				
			Asset health index				
			HI1	HI2	HI3	HI4	HI5
22	Telemetry & Control	Low					
	Offtakes - Odourant Tanks	Medium					
		High					
		Very High	4			20	

c) Cost Benefit Analysis

Given the Odorant N200 Controllers are obsolete, it is critical to the safety that these assets are replaced in a structured program to mitigate these risks.

The benefits/outputs of investing in these assets are as follows:

- Customer – Security of supply;
- Environmental – Not applicable;
- Safety – Ensure gas has distinctive smell; and
- Compliance – With licence obligations and GSMR.

d) Other Options Considered

Do Nothing

The option to 'do nothing' is not viable option, this equipment will fail at some point and NGN must be able to demonstrate plans to keep the systems operational.

Long Term Phased Implementation

Phased implementation over a longer period has been considered, but discounted as the existing equipment is obsolete and spares are not available this is not considered practical for these small number of assets

Asset Health and Criticality - With Investment

Asset categories		Criticality Index	Asset distribution based on estimated asset health index at 31 March 2021
			Asset health index Expected (50%)

			HI1	HI2	HI3	HI4	HI5
22	Telemetry & Control	Low					
	Offtakes - Odourant Tanks	Medium					
		High					
		Very High	24				

Asset Health and Criticality – Without Investment

Asset categories		Criticality Index	Asset distribution based on estimated asset health index at 31 March 2021				
			Asset Health Index Expected (50%)				
			HI1	HI2	HI3	HI4	HI5
22	Telemetry & Control	Low					
	Offtakes - Odourant Tanks	Medium					
		High					
		Very High		4			20

8.5 Selection Criteria

The replacement of the equipment has been phased based on immediate obsolescence.

8.6 Innovation

This is a very specialist market and only one manufacturer is available.

A19A-9: High Pressure Storage

9.1 The Specific Requirement throughout RIIO-GD1

Within the RIIO-GD1 period NGN proposes to remove all High Pressure (HP) storage vessels from the network. There are only two HP sites in the network.

The Carcroft site is no longer required and will be decommissioned in 2013 before a full revalidation is required.

Clay Flatts supplies 39,000 scm of usable storage. Due its location, on the extremity of a supply system in West Cumbria it is critical to security of supply. Vessel 2 with known internal flaws requires revalidation in 2016 with a risk that the vessel can no longer be used. This will reduce the storage capability of the site by 25% creating a security of supply issue during peak demand conditions if not addressed. It is proposed that additional line pack storage is constructed to facilitate the removal of the Clay Flatts site.

2009/10 Prices £m	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	TOTAL
High pressure storage strategy	0.0	0.2	6.0	0.1	0.0	0.0	0.0	0.0	6.4

Figure 9.1: RIIO-GD1 High pressure Storage Strategy Expenditure

9.2 Justification for Investment

a) Current price control run rates

The Carcroft vessels will be no longer required. The site requires a full revalidation in 2013. The estimated revalidation costs are c.£400k for the Carcroft vessels alone which will then be removed during 2013.

The Clay Flatts vessels are 44 years old and have previously held town gas and therefore could be subject to stress crack corrosion. Vessel 2 has a known defect which reduces its cycle life and requires a full revalidation in 2016. The estimated revalidation costs are c.£880k for the Clay Flatts vessels.

Figure 9.2: Clay Flats HP storage site

Consequence of Failure

The Clay Flatts HP storage vessels are a very high critical site to ensure customer supplies are maintained in West Cumbria. The cost of re-establishing customer supply is significant should these assets fail.

Other consequences of failure include:

- Loss of life;

- Significant damage to property;
- Significant disruption to the local area;
- Reputational impact on NGN; and
- Reputational impact on the UK gas supply industry.

Condition Assessment

HP vessels are maintained in serviceable condition as per the PSSR. The regulations require:

- Annual external visual inspection of vessels, associated pipework and structures by a Competent Person; and
- Duty based (20 year maximum) external visual examination plus internal inspection and full NDT inspection.

The Control of Major Accident Hazards (COMAH) Regulations sites require:

- Demonstration that all reasonable measures have been taken for major accident prevention and mitigation in the form of a Safety Report;
- Development and three yearly testing of emergency plans in conjunction with the Local Authority; and
- Production of a Major Accident Prevention Policy (MAPP) for sites containing between 50 and 200 tonnes of natural gas.

NGN maintains its gasholders in line with the institution of Gas Engineers and Management document IGE/SR/14– Safety Recommendations: High Pressure Gas: Part 1: Above Ground Storage Vessels and internal procedures NGN/PR/MAINT/4 – Maintenance of High Pressure Storage Installations. This policy requires:

- Task A - Weekly visual inspection;
- Task C – Quarterly valve operation, interlock check, earthing check, ground movement check, functionality check of water deluge system; and
- Annual inspections under PSSR.

GL Noble have also carried out independent integrity reviews of the Clay Flats site in July 2011. The four Clay Flatts vessels are currently around 44 years old. They were designed with a 40 year fatigue life. Although it may be considered that the 40 year period has now passed, it has been considered appropriate within UK safety recommendations, (since 1993) to determine the remaining life of a given pressure vessel according to the condition of the vessel and the remaining fatigue life rather than a simple calendar based approach.

The previous vessel examinations were undertaken during the period 2001 to 2004. Within the current review process it has been determined that storage vessel 2 is the principal life limiting vessel due to flaws associated with internal stiffening structures. A recent review of actual pressure cycle counts experienced up to 2011 for vessel 2 has concluded that it is expected to require examination during 2016 due to 25% of the fatigue life having elapsed at this time. Due to the phasing of previous vessel inspections and the likelihood of the next inspections for vessels 1, 3 and 4 being driven by the 20 year cap rather than fatigue cycle duty.

There is an obvious risk that the revalidation exercise may prove if a vessel is at the end of its life and therefore cannot be re-commissioned. This risk is greater for vessel 2 given that has identified internal flaws.

Loss of vessel 2 will create the following issues:

- Storage capacity of the site will be reduced by 25% therefore creating a major security of supply issue in West Cumbria during the winter period;
- Remaining 3 vessels would see an increase in there cycling and therefore the revalidation period would be significantly reduced; and
- As the revalidation period would be brought forward the likelihood is that the remaining life of the three remaining vessels would be reduced or come to an end as similar type flaws could be found.

9.3 Cost Benefit Analysis

The programme as proposed removes risk, COMAH compliance, societal risk, security concerns, HSE interventions and significantly improves security of supply, benefiting our customers.

An associated Opex efficiency saving of c.£0.1m pa will be delivered along with total vessel revalidation costs estimated at £0.88m over RIIO-GD1. This cost excludes any remediation required, following revalidation or hydro tests should it be required, which could push this overall cost to be in excess of £1m.

The linepack project is required before revalidation in 2016 commences to ensure optimum cost efficiency outputs can be delivered.

The “with investment” option presented is directly linked to our RIIO-GD1 outputs, safety, reliability and that broad approach to asset health now being pursued by NGN.

a) Other Options Considered

Do Nothing:

The network considers a ‘do nothing’ for the specific assets identified above is unacceptable as it would be non-compliant with PSSR.

Build New HP Storage Facility:

This option has been discounted. As the existing site is critical to the security of supply a complete new site would have to be built. The difficulties around gaining planning permission for such a site are enormous. Permission to build a new COMAH site would have to be sought from the HSE. Considerable Stakeholder consultation would have to take place and this could lead to considerable public opposition and delays. As these vessels are aging assets the potential risks for delays in the project starting and coming online could therefore impact significantly the security of supply for West Cumbria. The societal risk would also remain an issue.

9.4 Innovation

NGN are committed to innovation and as part of this investment we have considered an alternative option of using an Absorbed Natural Gas storage solution. Unfortunately this is now viewed unviable due to the operating pressure of the site’s inlet pipeline.

A19A-10: PIG Trap Facilities

10.1 The Specific Requirement throughout RIIO-GD1

The preferred method of Condition Monitoring pipelines is by using internal inspection gauges known as 'PIGS'. The technique is called "In Line Inspection (ILI)".

Developments within ILI capabilities now mean that 6" pipelines are capable of having an ILI. Currently these pipelines are inspected externally by carrying out over the line surveys which really only give information of the pipelines CP system and coating condition. ILI are preferred to external inspections, as they provide more detailed data on the condition of the pipeline. The analysed data is used to set inspection frequencies by a risk based approach in NGN's internal database.

Funding is proposed to install 'PIG' Traps on sites that have been identified as suitable to allow a number of 6" pipelines to have in line inspections. PIG Traps are facilities attached to the end of the pipelines being inspected to allow for launch and receiving PIGs.

This project will require procuring PIG Traps suitable for 6" inspection tools. The subsequent fittings and pipe work has also been included in our expenditure forecasts.

A list of pipelines have been analysed to determine if they have the correct flow rate to ILI. Following this, relevant sites will be assessed for their ability to have PIG Traps installed. When all preliminary work has been undertaken, PIG Traps can then be installed.

2009/10 Prices £m	2013	2014	2015	2016	2017	2018	2019	2020	Total
Install pig traps facilities on 6" high pressure pipelines	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	1.2

Figure 10.1: RIIO-GD1 Install pig traps facilities on 6" high pressure pipelines

Figure 10.2: PIG Trap and Inspection PIG

10.2 Justification for Investment

Legislation requires NGN to inspect pipelines periodically through either above ground surveys ILI. Industry standards such as IGE/TD/1 as well as the HSE itself, recommend ILI where possible. Data collected from an ILI is more accurate and can give NGN a better understanding of the condition of the pipeline. It may help save money, by not having to over invest on a pipeline.

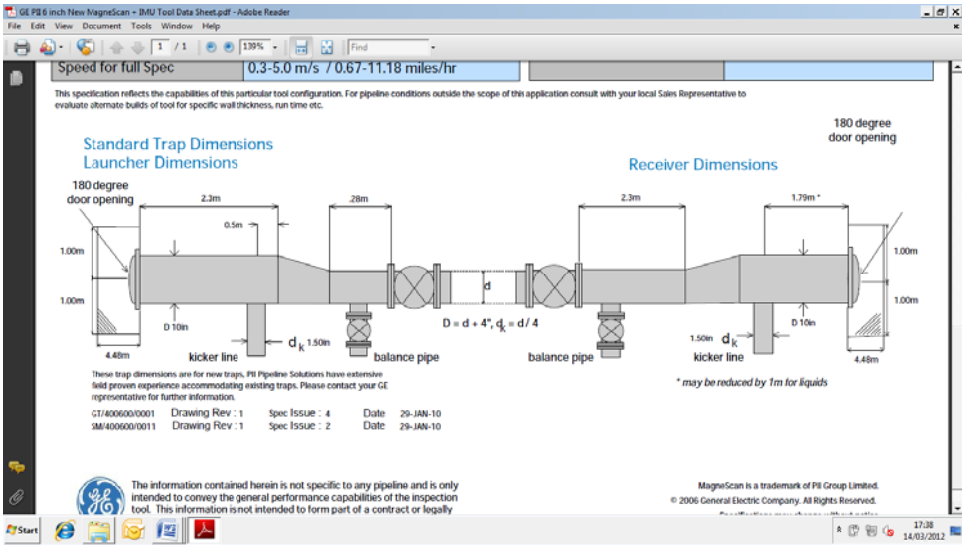


Figure 10.3: Pig Trap installation

a) Current Run Rates

NGN has not installed any PIG Traps on 6" pipelines in the current GDPCR1 price control period. A number of pipelines are unable to be ILI due to insufficient flows.

Without the ability to inspect the pipeline by ILI, NGN will need to continue to carry out over the line CP and coating surveys at a maximum of five years frequency. This involves negotiations with land owners over access and often results in compensation for damaged crops. The information received from CP surveys is very limited.

Additional information benefits are also provided by ILI which include:

- Data quality;
- Metal Loss Features;
- Gouges & Dents;
- Girth Weld Anomalies;
- Metal Object Report;
- Eccentric Casing Report;
- Pipeline Repairs; and
- Pipeline Anomalies.

The data also includes full details of any faults and includes in depth analysis of the faults reported. Inspection sheets are produced for each of the identified and reportable features including the following feature description:

- Type feature (e.g. Metal Loss);
- Orientation;
- Axial length;
- Circumferential width;
- Depth – Peak;
- Feature Selection Rule;

- Nominal Pipe wall thickness for spool;
- Absolute Distance from Launch;
- Comments;
- The Feature Location is also quoted with reference to Strip Map Number and references such as nearby Girth Welds;
- Contour plots and depth based Histograms of each reported feature are provided to aid analysis; and
- Full Pipeline listings are included showing features that have not been reported but may aid future analysis.

b) Consnsequence of Failure

When HP pipelines fail the consequences are significant in terms of loss of supply to thousands of customers and the associated risk to life and property.

ILI allows us to gain data that enables the revalidation of the condition of the pipelines and prove their continued fitness for purpose.

c) Condition Assessment

6" pipelines currently have above ground surveys to monitor the level of CP on the pipeline. This indicates that the pipeline is protected from corrosion by having effective CP, but no indication of dents of weld defects which we can get from ILI data.

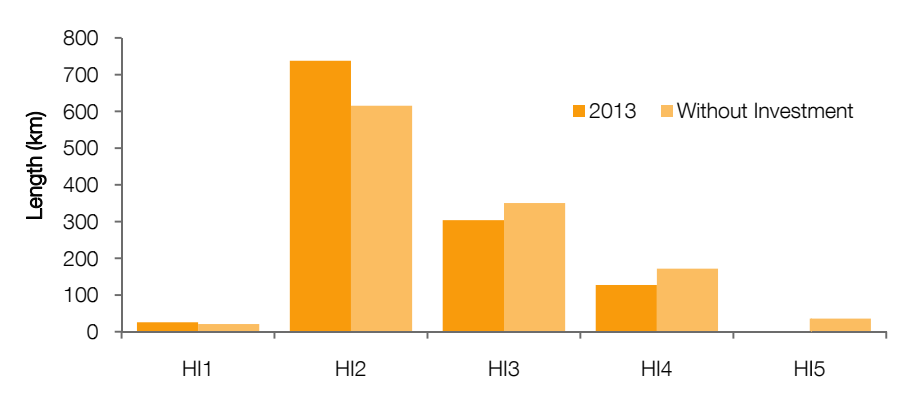


Figure 10.4: Deterioration Rates

It is proposed that without investment HP pipelines could deteriorate at the level shown in the Figure 10.4 above. ILI will help us prevent deterioration rates by better analysis of the data provided compared to the current limited data we get from over the line inspections. ILI will further enable the revalidation of the pipeline with proven results leading to extended life of the asset, which clearly represents best value for customers.

10.3 Cost Benefit Analysis

It is estimated that to install a PIG Trap at a site will cost approximately c.£0.1m. The associated Opex cost for the inspection alone is c.£35K for a 15km pipeline length.

The key benefits of the programme are improved inspection quality and the improvement in data we have for these pipelines and therefore a more informed approach to monitoring and managing these assets going forwards.

Investment for remedial work can then be focused on a specific area where we discover an issue. Currently any potentially issue discovered through above ground surveys requires extra assessments to identify the problem which incurs additional costs.

a) Other Options Considered

Do Nothing:

It is a requirement to inspect and maintain our pipelines, thus a 'do nothing' approach would result in NGN not complying with current legislation. Also pipeline defects could go unnoticed and result in pipeline failure which could result in loss of supply, loss of life, damage to property and such like.

10.4 Selection Criteria

Currently all HP pipelines above 6" have ILI in NGN's network. The data that has been received from these inspections has been used for investment decisions for remedial work. ILI is the preferred inspection method of Industry experts and the HSE.

10.5 Innovation

ILI is a broad term used for using an intelligent PIG to travel the length of the pipeline using the gas flow to propel itself. It is proposed that initially the PIG will be equipped with geometry and magnetic flux leakage capabilities. There is potential in the future to utilise new technologies such as ultrasonic, mapping capabilities and strain analysis. Some of these are not proven technologies as yet but as developments progress we will have the facilities to utilise them as they come online.

A19A-11: River Bank Erosion

11.1 The Specific Requirement throughout RIIO-GD1

Within the RIIO-GD1 process, NGN will be required to invest in the effects of environment change with regards to river bank erosion.

Over the last 45 years there is evidence that there have been more extreme rainfall events. UK flooding was the worst for 270 years in some areas in 2009, like Cumbria, flood damage now costs the UK about £1 billion pa.

NGN carry out routine inspections of HP pipeline river crossings to ensure stability of river bed and banks. We have seen an increase in river bank erosion over the last few years.

Figure 11.1 below shows our anticipated spend over the RIIO-GD1 period.

£m 2009/10 prices	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	Total
River bank erosion	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	2.3

Figure 11.1: RIIO-GD1River Bank Erosion Expenditure

11.2 Justification for Investment

Many pipelines cross a watercourse on their route. Rather than building an over-crossing, they are submerged beneath the river. Changes in climatic conditions are affecting these crossings more regularly. These conditions are exposing our pipelines further to the elements, therefore increasing the risk of damage and interruption to the supply our customers.

Increasing changes to the environment have shown a change in the river bed and banks that protect our pipelines that lie within them. We therefore need to invest to counteract the impact of erosion.

Figure 11.2 below shows what was once a dry fell-spring following the extreme floods in Cumbria. The pipeline was left uncovered by the force of the water, which in turn carried large boulders that caused denting into the pipeline. The stream was diverted in order to allow repairs to be carried out to the damaged HP pipeline.

Figure 11.2: Pipeline uncovered by flooding

a) Current Run Rates

River Crossing Erosion - Asset Health

Location	Name of River	Cost of Remedial Work £m	Year
Lazonby, Cumbria	Rive Eden	£0.26m	2008
Wyke Beck, West Yorks	Halifax	£0.05m	2010
Worington, Cumbria	River Derwent	£0.3m	2011

Figure 11.3: GDPCR 1 Expenditure

There have been a further three major erosion issues identified in 2011/12 which are currently being scoped and priced as schemes. The historical spend above coupled with those identified this year, evidences our anticipated spend over the RIIO-GD1 period.

There are over 60 HP river crossings within our network alone and these are inspected on a risk based frequency. Some of the recognised remedial actions consist of more frequent inspections which are the most efficient form of ongoing maintenance for some of these crossings.

Consequence of Failure

River erosion can remove the surrounding earth that gives our pipelines protection from damage. When pipelines span within a river, great stresses are placed upon the pipeline which can result in failure of the pipeline. Failure of a pipeline can result in:

- Loss of Supply;
- Loss of Life;
- Destruction of Property; and
- Non Compliance with Regulation.

Condition Assessment

Pipeline river crossings are subject to inspection by engineering divers who carry out inspections to determine changes of the river bed from the original which may adversely affect the condition of the pipe and to determine the precise location of the pipeline using topographical and hydrographic surveys. The results of these surveys are used to assess the criteria of protection applied or required.

Figure 11.4: River Bank Inspection

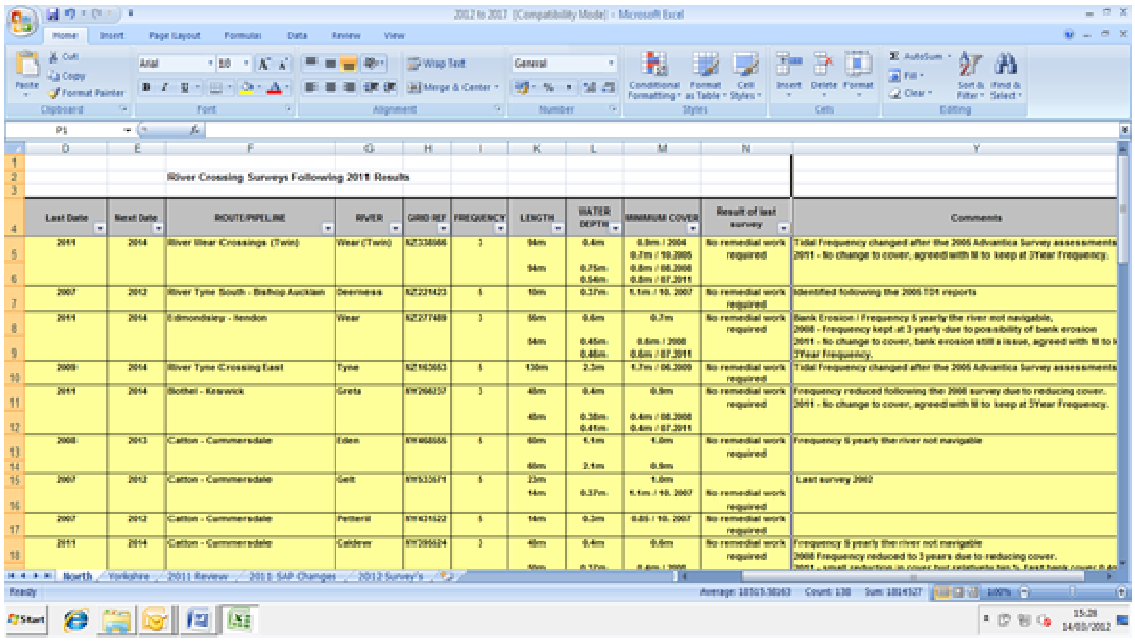


Figure 11.5: Screenshot of Database used to Assess Criteria for Inspection Frequency & Maintenance Regime:

b) Other Options Considered

Do Nothing:

The option to 'do nothing' is not a viable option. Pipelines are protected by the surrounding earth that they are laid in. When that environment changes, pipelines become vulnerable to damage or if the pipeline is allowed to span in the fast flow of the river, increased stresses are placed on the pipe and its welds and ultimately, failure could occur.

Divert Pipeline:

Pipeline diversions are very costly and are only a viable option when other measures will not work. This is the main reason for choosing the option above and provides the most efficient solution for our customers.

Benefits / Outputs:

The benefits/outputs of investing in these assets are as follows:

- Environmental – No disruption to the environment from construction of a new pipeline in the future. No loss of containment from pipeline failure. River banks assessed and reinstated with agreement of Environment Agency.
- Customer – continual security of supply across the network.
- Safety – Risk mitigation and reduction of major accident hazard pipelines across the geographical area of the network, in both rural and urban locations.
- Compliance – Pipelines must be compliant with Pipeline Safety Regulations 1996 and Pressure Systems Safety Regulations (PSSR) 2000.

11.3 Innovation:

The latest technology in materials and methods are used and agreed with Environment Agencies to ensure the least disruption to wildlife, flora and fauna occurs.

NGN are working with Environment Agency to apply known data of flood plains within a database to assist in determining at risk river crossings as shown below in Figure 11.6.

Figure 11.6: Flood plains linked to database

A19A-12: Compensation Payments

12.1 The Specific Requirement throughout RIIO-GD1

Within the RIIO-GD1period NGN has made a provision of £8.4m for compensation payments to third parties. This item is usually associated with HP Pipelines laid in private land under easement. Historic data has been used to establish the future value of compensation payments. Details of expenditure phasing throughout the plan period is shown below in Figure 12.1 but has been straight-lined across RIIO-GD1.

2009/10 Prices £m	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	Total
Compensation Payments	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	8.2

Figure 12.1: RIIO-GD1 Compensation Payments Expenditure

12.2 Justification for Investment

Pipeline easement deeds often contain "lift and shift" and/or loss of development clauses. NGN frequently has to relocate the pipeline or pay a loss of development compensation payment to the landowner/developer. Claims of this nature can be received from a variety of sources; builders/developer, quarries/mines etc. An assessment is undertaken to validate the claim and ensure the minimum cost solution is found, this is detailed in the flow chart shown in Figure 12.2 overleaf.

For valid claims which cannot be repudiated the outcome of this assessment could be:

- Install Barrier protection on the pipeline;
- Divert the pipeline;
- Pay compensation; and
- A combination of all of the above.

a) Current Run Rates

Historic data and cost information has been used to estimate the future liabilities in this area. Current claims under review include four limestone quarries, one developer and one wind farm.

Consequence of Failure

HP Pipelines are critical assets and essential for the safe supply of gas under all demand conditions. The failure of a HP Pipeline would have severe safety and gas supply impacts and NGN cannot allow this to happen. The payment of compensation will result in developments or mineral extractions being restricted so they have no material impacts on the pipeline. As part of the assessment full consideration is given to ensure third party works are risk assessed so the integrity of NGN's HP Pipelines are not compromised.

How have we assessed the value of these claims?

NGN's Property Function with the support of our Legal Department review each claim. The first stage involves examining the deed and establishing if NGN has a case to answer. The next stage would be with the assistance of mineral extraction, or housing development experts to then validate the claim. At this stage discussions could result in the claim progressing, reduced in financial impact or cancelled. Historical costs are used to establish the cost of anticipated diversion work. The lowest cost stable solution is chosen.

The high level process for the assessment is detailed below in Figure 12.2.

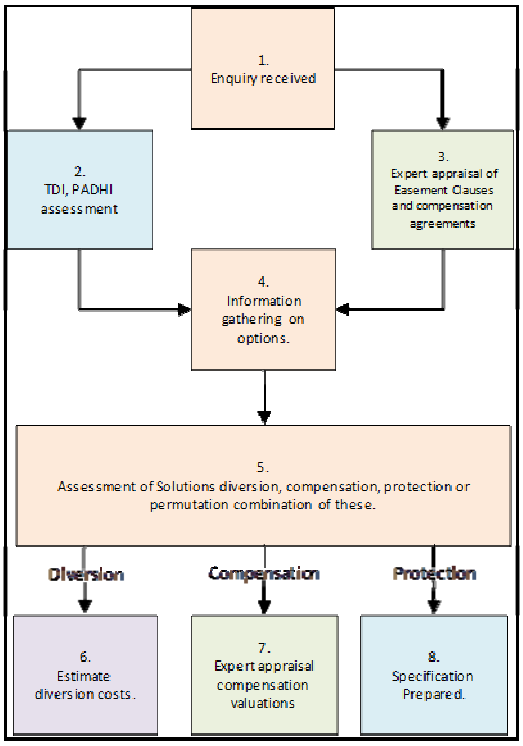


Figure 12.2: Process for Evaluating Claims

b) Cost Benefit Analysis

The assessment is undertaken to establish minimum cost solution that is acceptable to all parties. The work is mandatory and a legal requirement which NGN has to comply with.

c) Other Options Considered

The options are established at the assessment stage and the minimum cost solution is chosen. Paying compensation is always assessed against the lowest cost solution to be given consideration.

12.3 Selection Criteria

As above minimum cost solution is selected where viable.

12.4 Innovation

At all stages within the assessment stage full consideration will be given to using innovative solutions.

A19A-13: Sleeves

13.1 The Specific Requirement throughout RIIO-GD1

Sleeves have been used on pipelines where they cross major obstacles such as roads, rails etc. or for construction purposes. The main types of sleeve in use are nitrogen filled sleeves or non-nitrogen filled sleeves. Sleeves have proved to be problematic to maintain and are generally not used in modern day construction, the preference now being thicker wall pipe.

Throughout the RIIO-GD1 period, NGN has identified an investment of £1.9m for LTS sleeves. This investment is split between nitrogen and non-nitrogen sleeves.

2009/10 Prices £m	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	Total
Sleeves	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	1.9

Figure 13.1: RIIO-GD1 Sleeves Expenditure

a) Nitrogen Sleeves

Investment is being used to install remote monitoring on nitrogen sleeves. This will allow nitrogen pressure to be monitored constantly and alarmed when the pressure changes from set parameters. This will allow us to determine any decay and react accordingly to ensure that they are maintained in their best possible condition.

There will also be investment to upgrade nitrogen sleeves that are identified, requiring remediation. This is estimated to be 12 sleeves, reflecting historical trends.

b) Non-Nitrogen Sleeves

Investment is being targeted at accurately identifying the condition of sleeves and then implementing appropriate remedial work to upgrade them. This will involve excavating to reveal the sleeves, grouting of vacant sleeves and re-wrapping. This is estimated to cost c.£20K per sleeve (historical cost), with approximately 80 sleeves in total.

13.2 Justification for Investment

NGN is currently working in collaboration with other networks to produce a uniform management procedure for sleeves. This 'best practice' procedure is new to the industry and its aim is to reduce the risk from these assets. Currently there is no clear management procedure for non-nitrogen sleeves across the industry. It is recognised that sleeves are important for protecting mains and pipelines at vulnerable locations such as road and rail crossings and they are important for prolonging the life of this section of pipe.

Nitrogen sleeves not holding their charge more frequent checks need to be made ensuring the maintenance of a positive nitrogen pressure within the annulus, or alternative solutions need to be explored. The nitrogen provides an inert atmosphere where corrosion cannot take place. If nitrogen seals leak and water and oxygen replace the nitrogen, corrosion can occur and is very difficult to identify.

Non nitrogen sleeves require a fill of some conductive material and non-pipe contact to allow CP to protect the parent pipe and the sleeve. It is often difficult to identify issues with these.

a) Current Run Rates

Nitrogen Sleeves

There are 96 nitrogen filled sleeves in the network. In the last 2 years programme of works was undertaken to remediate nitrogen sleeves. £100K was invested in 2010 and £400K in 2011 replacing

these sleeves and upgrading the sleeves to a suitable standard, following an independent review by GL Noble Denton. Ongoing investment will be for any issues that are expected to arise over the RIIO-GD1 period.

Non-Nitrogen Sleeves

There are 526 other sleeves within the network. There is no specific set of works for non-nitrogen sleeves, other than when a specific issue arises, this will then be repaired as part of Opex expenditure. Going forward, it is intended to grout more sleeves to revalidate them and excavating more sleeves to determine their condition.

Consequence of Failure

It is unlikely that failure of a sleeve will result in failure of the carrier pipe and as such there will be no loss of supply, however if water were able to enter the sleeve, it could accelerate deterioration rates, particularly the rate of corrosion on the pipeline, as the water becomes trapped in the sleeve. Also the pipe is more vulnerable to third party damage, particularly at rail and road crossings.

Condition Assessment

Nitrogen Sleeves

NGN commissioned technical experts GL Noble Denton to analyse all nitrogen sleeves in the network and provide remedial actions. These actions were then completed and the sleeves are monitored to ensure they are holding pressure. Nitrogen sleeves are also maintained in accordance with NGN Policy NGN/PM/MAINT5 in accordance with IGE/TD/1.

Non-Nitrogen Sleeves

A common sleeve management procedure is under development as part of NGN's involvement with UKOPA. Part of the investment now proposed will be used for applying this management procedure and gathering more information on our sleeve population. This will enable NGN to accurately assess the condition of sleeves. Currently, ILIs and CIPs surveys allow us to determine if there are any issues along the route of the pipeline incorporating the sleeve.

Sleeves are expected to deteriorate at a level similar to pipelines. An estimation of future deterioration rates was predicted based on historical data as shown below without investment.

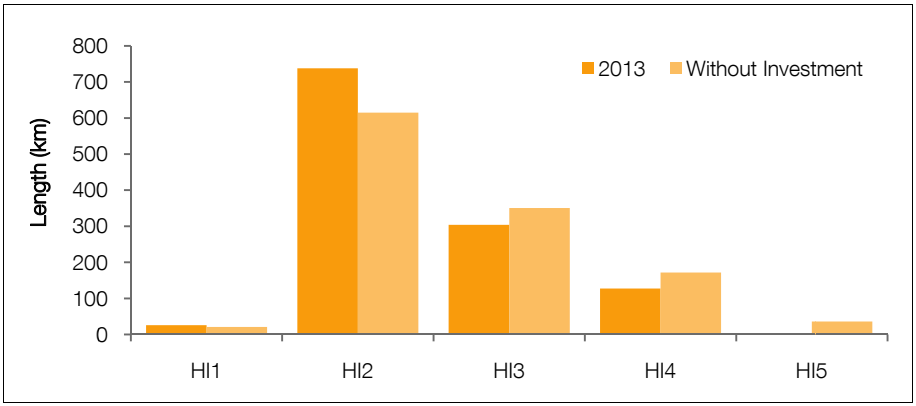


Figure 13.2: Deterioration Rates

b) Other Options Considered

Do Nothing:

Nitrogen Sleeves

A ‘do nothing’ approach is considered unacceptable for nitrogen sleeves. The inert atmosphere created by the nitrogen is important to protect the pipeline from corrosion. This section of the pipe will not be protected by CP and relies on the inert atmosphere to prevent corrosion.

Non-Nitrogen Sleeves

It has been noted that if left to their own devices, some sleeves can become more of a hindrance to the pipeline as water accelerates corrosion and increases deterioration of the carrier pipe.

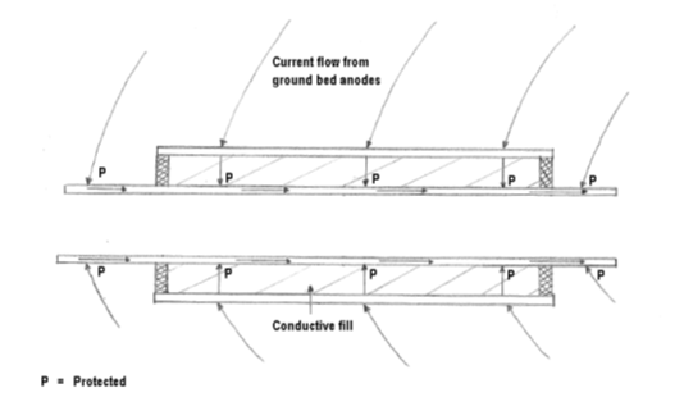


Figure 13.3: Pipe Sleeve Configuration

Grout or other conductive material is required within the annulus to ensure that CP can protect the parent pipe from corrosion. Any metallic short between pipe and sleeve can leave the pipe vulnerable to corrosion.

Replace Pipeline Section:

Replace the section of pipe with thick walled pipe, to protect it from third party damage. This option is very expensive and impractical for a large number of sleeves and this is why we chose the options stated offering best value for money and efficiency for our customers.

13.3 Innovation

NGN have considered other options for upgrading sleeves, these include:

- There are some alternatives to grouting including ‘gels’ that can be used to fill some sleeves. This option is environmentally friendly and it has to be proven that will prevent deterioration of the carrier pipe.
- Remote monitoring is a new technology to the industry, allowing us to constantly monitor the pressure in sleeves, which gives confidence that the carrier pipe is protected and determines the rate of decay so that nitrogen fill can be maintained. This will ensure our assets are better protected.

Remote monitoring measures the sleeve pressure automatically, checks that it is within specification and reports immediately if an alarm threshold is exceeded. It communicates (via either an internal or external antenna) using the GSM network and is installed in the same way, simply requiring a mobile phone.

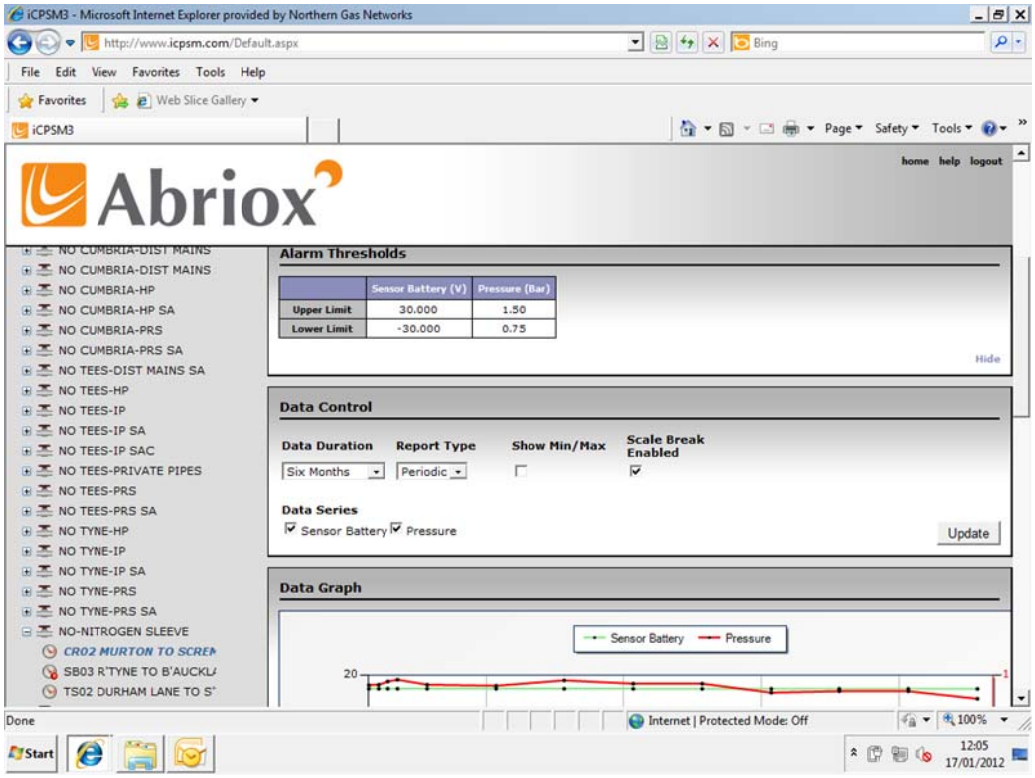


Figure 13.4: Example of the front screen used for monitoring nitrogen pressures in sleeves.

A19A-14: LTS Pipeline Replacement

14.1 The Specific Requirement throughout RIIO-GD1

HP Pipelines are usually constructed in private land under easement. Within the RIIO-GD1 period NGN believe it requires £10.9m to enable the construction of HP Pipeline Diversions. This equates to one small HP diversion per year and a major scheme at mid plan point. Detail of the expenditure and phasing are shown below in Figure 14.1. NGN take a very proactive approach when negotiating LTS diversion requests and ensures that all options are explored with the land owner to mitigate either compensation payments or physical diversion, risks assessments are always undertaking as the first priority to identify if low cost risk mitigation such as concrete slab protection can be installed.

2009/10 Prices £m	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	Total
LTS Pipeline Replacement	0.8	0.8	0.9	5.3	0.8	0.8	0.8	0.8	10.9

Figure 14.1: RIIO-GD1 LTS Pipeline Replacement Expenditure

14.2 Justification for Investment

NGN may have to relocate and fund High Pressure Diversions in the following circumstances:

- If the easement deed contains clauses which if invoked would enforce the relocation of the pipeline by NGN. These clauses are known as 'lift and shift clauses.' This is usually prompted by development by the land owner for housing or mineral extraction from a quarry owner.
- Where the pipeline cannot be operated because of safety issues. This could be for a number of reasons e.g. landslips.
- Where Planning Advise for Developments near High Pressure Installations (PADHI) allows a development to proceed which may conflict with IGE/TD/1. This is usually confined to high density housing (high rise) which increases the societal risk and may result in the pipeline being relocated. This may change the classification from Suburban to Town environment classification as detailed in TD/1 the pipeline design code. HP Pipelines should not be constructed in T areas. The options available in this scenario would be at the worst to relocate or down-rate the pipeline. This is the main driver for identifying one large HP diversion mid-term in the RIIO-GD1 plan.

HP Pipelines are critical assets and essential for the safe supply of gas under all demand conditions. An assessment is undertaken ensure the minimum cost solution is found. This could be to divert the pipeline, pay compensation or a combination.

a) Current Run Rates

Historic data and cost information has been used to estimate the future liabilities in this area. Schemes dating back to 2001 have been used this information is detailed in Figure 14.2 below. Current claims under review include four limestone quarries, one developer and one wind farm.

Consequence of Failure

HP Pipelines are critical assets and essential for the safe supply of gas under all demand conditions. The failure of a HP Pipeline would have severe safety and gas supply impacts and NGN cannot allow this to happen. The payment of compensation will result in developments or mineral extractions being restricted so they have no material impacts on the pipeline. As part of the assessment full consideration is given to ensure third party works are risk assessed so the integrity of NGN's HP Pipelines are not compromised.

How have we assessed the value of these claims?

NGN's Property Function with the support of our Legal Department review each claim. The first stage involves examining the deed and establishing if NGN has a case to answer. The next stage would be to with the assistance of mineral extraction, or housing development experts to then validate the claim. At this stage discussions could result in the claim progressing, reduced in financial impact or cancelled. Historical costs are used to establish the cost of anticipated diversion work. The lowest cost stable solution is chosen.

When the scheme is defined following detailed assessment, specific costs are prepared in some instances at the earlier stages cost curve data may be used. A print off of a generic scheme is shown in Figure 14.2 below.

An assessment of the cost per annum has been generated by examining past schemes which are detailed below in Figure 14.2. The major schemes have been removed to establish the minimum annual base cost for the plan period.

NGN expects one large scheme to be required during the RIIO-GD1 plan period from either external impacts (landslips/river bed erosion) or building encroachment TD/1 or PADHI conflicts in respect of high density multi-occupancy developments near HP Pipelines.

LTS Diversions Non rechargeable - Lift and shifts, mineral loss, building proximity annual costs assessment

No	Title	Scope			Costs						Comp
		Length	Dia	Pressure	Materials	Contract Lab	Bought in S	Direct Lab	Total	2011 price	date
1	Benrydding landslip temporary	0.35	600	38bar	145	476	98	7	726	921	2001
2	Benrydding landslip permanent	0.76	600	38bar					871	1,104	2002
3	Selby Canal Bridge	0.15	200	17bar	22	199	70	0	291	347	2006
4	Darrington Quarries	0.75	600	38bar	149	818		8	975	1,135	2007
5	Potland Burn	2	150	19bar	274	827	7	163	1,271	1,366	2010
6	Pond Quarry Hipperholme	0.14	300	17bar	39	391	1	87	518	518	2011
7	Wellington Place, Leeds	1.3	400	5bar	335	1260	0	8	1,603	1,603	2011
8	High Haswell Windfarm	1.06	300	50bar	188	473	3	117	781	781	2012
9	Spalding Moor Windfarm - Goole								600	600	2012
10	Ledston Luck Colliery	1.2	250	38bar	109	602	6	53	770	770	2012
11	Catton to Wetheral	30.8	450	19bar	5732	13997	2478	7	22,214	22,214	2012
12	Holbeck	1.7	450	17bar	765	2016	0	10	2,792	2,792	2013
13	Holbeck	1.1	300	17bar	255	1167	0	10	1,433	1,433	2013
									Duration/yrs		12

Annual Expenditure Assessment			762
Excluding Catton to Wetheral &			
Holbeck			

Figure 14.2: Historic HP diversions

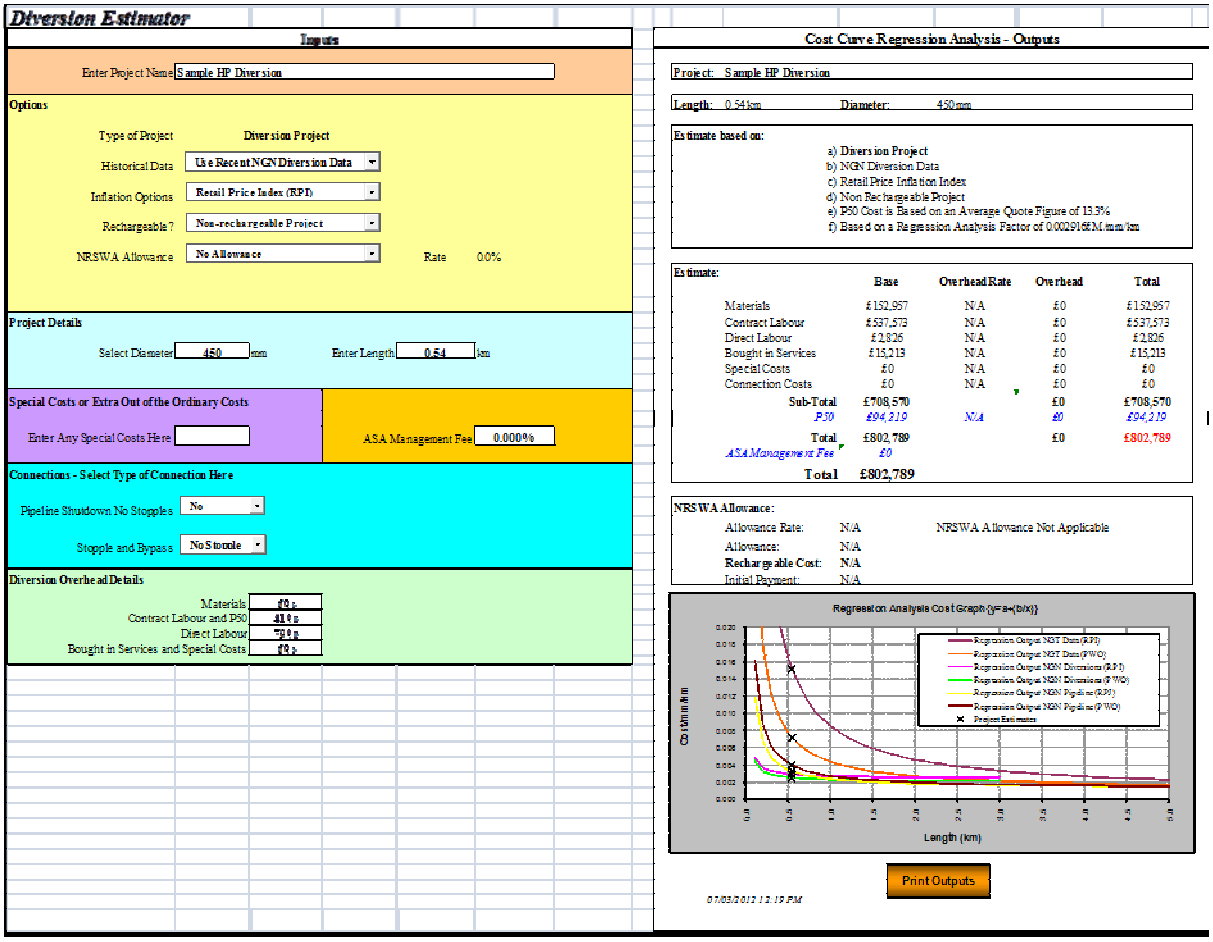


Figure 14.3: Cost Curve Generic Sample Print out

b) Cost Benefit Analysis (CBA)

The assessment is undertaken to establish the minimum cost solution. The work is mandatory and a legal requirement which NGN has to comply with. Where an enhancement to the minimum cost option is proposed i.e. upsizing then a full detailed CBA is prepared prior to Business Case approval.

c) Other Options Considered

The options are established at the assessment stage and the minimum cost solution is chosen. Options are repudiate (if a loss claim), compensate, install barrier protection, divert or a combination of all the aforementioned.

14.3 Selection Criteria

As above minimum cost solution is selected.

14.4 Innovation

If a diversion option is deemed the minimum cost solution then consideration will be given wherever appropriate to innovation in respect of construction methods and potential for new Bio-methane sources near to the proposed diversion routes.

A19A-15: Reinforcement Mains

15.1 Introduction

Investment in network reinforcement ensures NGN operates, and continues to operate, a safe, economic, efficient and reliable gas transportation system thereby meeting the requirements of relevant regulatory and legislative obligations placed upon it.

Reinforcements are typically divided between the below 7bar network and the higher pressure, above 7bar network ,and reinforcements are categorised as general or specific . Within the general category we have negated the need to undertake wide spread below 7Barreinforcement schemes by analysing future demand and growth data. Therefore we will concentrate on localised schemes which are still general in nature but are designed to offset particular pressure constraints on the network. Specific reinforcements are those schemes that are driven by third party connection requests or increase in demands for example new domestic housing builds or industrial and commercial developments, these projects are subjected to NGNs Economic test model and may require funding in full or part by the requester. For both categories NGN undertake Engineering for Value approach whereby the optimum solution is developed to ensure outputs that deliver value for money, security of supply and minimise impact on the environment.

The simple diagram below details the dependencies and integrated processes attributable to the ~~localised~~ reinforcement stream. And demonstrates the interactions between reinforcement, replacement, pressure management and leakage control.

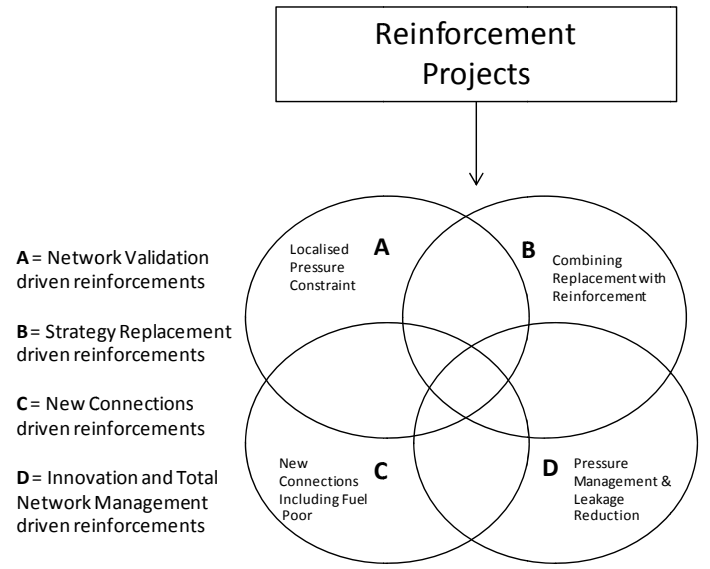


Figure 15.1: Mains Reinforcement Investment Drivers

Failing to continue with investment in mains reinforcements will result in either:

- System constraints such as extremity pressures being breached resulting in poor pressures to customers, or
- Source pressures increasing to ensure system constraints are satisfied. As these source pressures increase NGN could be in breach of its Policies and/or see a higher average system pressure on its networks. This will likely have the effect of increasing the volume of gas escapes thus impacting on the other expenditure streams.

Whilst the 4 areas (A-D) in Figure 15.1 above are discrete processes with NGN, they combine together under our Total Network Management (TNM) philosophy to provide integrated fit for purpose reinforcement solution for the network.

Under current NGN policy for <7Bar Network Analysis (NGN/PL/NP/16), Network Analysis models must be created to determine whether a reinforcement strategy is required during the next five years. These models must undergo a revalidation every three years at a maximum. This validation process involves ensuring the models provide an accurate representation of the live assets thus giving confidence in all design and system modification simulations.

Furthermore NGN/PL/NP16 sets out policies which are consistent with IGE/GL/1 "Planning of Gas Distribution Systems Operating at Pressures Not Exceeding 7Bar".

Each network has a declared Maximum Operating Pressure (MOP) "this is the set of maximum source pressures above which NGN is not prepared to operate, and at which it is prepared to fund investment in order not to exceed these pressures. The maximum operating pressure for each network must be declared, and recorded".

Exceeding MOP's in preference to investment in reinforcement will generate increased costs as leakage and their associated repair costs will increase. In addition average system pressures will increase.

The validation process not only ensures that system constraints can be met during the next winter period but also the Year five winter period (increasing to 10 years for more complex designs). Where system constraints cannot be met even with sources set at MOP then a reinforcement solution must be devised to remedy the situation.

During the mains replacement programme (strategy) NGN face major delivery and safety challenges. To ensure that the annual replacement targets are achieved with minimal impact on customer disruption and with maximum efficiency, NGN maximise the use of "no-dig" techniques to expedite the replacement process. Typically this can introduce a mains downsizing with a resultant gradual deterioration of extremity pressures. Whilst individual project analysis ensures that minimum extremity pressures are maintained with source pressures not exceeding MOP's, an element of the schemes designed within the validation process will be as a result of the mains replacement programme.

In addition and within the Strategy pipe replacement designs, opportunities present themselves to enhance the project to incorporate a reinforcement option. Taking a TNM approach these opportunities offer maximum benefit to the network with minimal investment (one project will provide both a replacement and reinforcement solution).

New connections driven reinforcements (also referred to as specific reinforcements) are those reinforcements that need to be built in order to supply a new load request or an increased load to an existing supply point/site. NGN policy document NGN/SP/NP/14 details tables that are used to base whether any of the resultant reinforcement works are rechargeable to the end customer.

Upon acceptance of any quotation, further network analysis is carried out to identify any enhancements that are needed to the original reinforcement scheme. NGN has a requirement to develop an economic and efficient network and must take into account future potential loads and other changes that may affect the network e.g. future mains replacements. Any enhancement costs are funded by NGN.

Integrated with the above processes, NGN are also identifying additional reinforcement schemes that purely target reductions in average system pressures. These schemes return favourable CBA's when measured against reductions in lost gas due to leakage and repairs. They provide a further example of our TNM approach to reinforcement.

All four elements interact to ensure the optimum reinforcement solutions are prepared and implemented.

15.2 RIIO-GD1 Investment Requirements

2009/10 Prices £m	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	Total
Reinforcement Mains & Governors	5.4	5.3	5.2	5.2	5.0	4.8	4.7	4.5	**40.1**

Figure 15.2: RIIO-GD1 Reinforcement Mains & Governors

Reductions in annual and peak demand in GDPCR1 have not led to significant reductions in the requirement for localised network reinforcement to ensure security of supply during 1 in 20 winter levels of demand. We are currently carrying out around 60-100 reinforcement projects a year of this nature. We continue to evaluate the most cost effective solution between increasing pressures and system reinforcement.

However, as many parts of our network are operating at or close to the maximum operating pressure, RIIO-GD1 will require ongoing reinforcement of the network to meet localised load pressure restrictions even within an overall profile of falling demand. We forecast to invest c. £40m during the period (average £5.11m pa) on localised reinforcement projects including a number of governors which will ensure we meet our capacity obligations during 1 in 20 winter demand conditions.

15.3 The Investment Journey

The principles within NGN Policies surrounding network planning, network analysis and model validation have been in place for many years in their present form. NGN are satisfied that they provide a robust platform to operate a safe, secure and efficient gas network. There are no proposals to move away from position.

As such, historical costs for Capex mains provide an accurate predictor of future costs likely in this category over the RIIO-GD1 period.

Figure 15.3 below from the RIIO-GD1 business plan details NGN expenditure over GDPCR.

£m 2009/10 prices	2008/9	2009/10	2010/11	2011/12	2012/13	Total
Mains and Governors	4.0	6.9	4.8	4.9	8.5	29.1

Figure 15.3: GDPCR1 Mains and Governors Expenditure

GDPCR1 Total Capital Investment

Average annual investment over this five year period equates to £5.8m/pa.

15.4 Network Risk

Under NGN Policy the requirement to maintain system constraints without exceeding the system MOP are mandatory. A number of options are considered to the reinforcement investment over the RIIO-GD1 period as follows:

- A “do nothing” option. This will require associated increases in source pressures above MOP to maintain system extremity pressures above the minimum. This approach does not comply with NGN Policy and would also have a negative impact on the lost gas emissions and leakage repair activity expenditure.
- Annual Investment in line with historical averages under GDPCR1 of c.£5.82m/pa. As discussed previously reductions in annual and peak demand over GDPCR1 have been experienced. Whilst these have not led to significant reductions in localised reinforcement, it is anticipated that over the RIIO-GD1 period its impact will be visible. Added to this, NGN have embraced Total Network Management and effectively manage reinforcement from a holistic perspective thereby ensuring

the most efficient investments are made. In summary NGN's future investment within this category can have an efficiency applied to reflect the proposed investment of c.£5.11m/pa over RIIO-GD1 period.

15.5 Investment Decision

Reinforcement designs are derived from within the Validation, Connections or Distribution Strategy teams. Subject matter experts are involved in ensuring the schemes derived deliver the best/optimal solution for the project in hand. As a further check all schemes are reviewed within the Distribution Strategy team to ensure the proposals complement the TNM approach being applied to the replacement programme.

NGN Policy states that; replacement and reinforcement projects must be developed using a holistic approach taking due account of the way the system has and will be operated. It must also be assessed to ensure that the most efficient and economic design is identified.

Reinforcement projects are reviewed within the Distribution Strategy section to ensure that represent the most effective scheme with regards to future replacement plans within that area. This helps underpin the TNM approach across all design teams.

A19A-16: Replacement Governors

16.1 Introduction

NGN operates and maintains a large range of Governors, these include:

- 2,355 District Governors, of these 2,221 operate at a pressure below 2Bar and the remaining 134 operate at a pressure above 2Bar;
- 240 Industrial and Commercial (I&C) Governors; and
- 2,968 Service Governors.

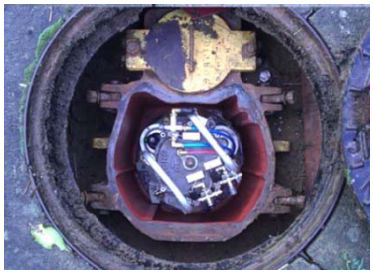
Of the District Governor and I&C Governor population there are a conservative number of units that, through asset health assessment, the network has determined will need replacing through RIIO-GD1. The drivers for replacement are primarily increased RCM maintenance frequencies. Increased maintenance frequencies have been required based on an analysis of risk to the network which includes, but is not limited to:

- Increase fault frequency;
- Single feed governors, i.e. not twin stream;
- Capacity of the unit;
- Physical condition of the unit;
- Policy compliance; and
- Obsolescence of equipment.

Within the Governor population the network operates a number of buried ERS modules. Many of the early developed modules (1980's) now require specialist maintenance which is inefficient and expensive. Some of these modules are also situated in flood plains which creates additional risk on gas supply and safety. Within RIIO-GD1 the network is targeting the removal of all high risk 'out of date' ERS modules.

For the Service Governor population NGN has adopted the policy of replacement after 30 years with a fix on fail maintenance strategy. Currently, only 6.5% of the population of Service Governors are new and by 2021 50% of the population will be over 30 years old.

District and I&C Governors



Service Governors

16.2 RIIO-GD1 Investment Requirements

Within the RIIO-GD1 period NGN proposes to replace a significant number of Governors, this is driven directly by Asset Health Category e.g. 19, 20 and 21. Figure 16.1 below provides a breakdown of the number of Governors that will be replaced during the RIIO-GD1 period:

Replacement Governor	Total Population	RIIO-GD1 Period	Per Year	% of total population	% of total Investment
District Governor below 2Bar (including ERS modules)	2,221	240	30	11%	77%
District Governor above 2Bar below 7bar	134	16	2	12%	5%
Industrial & Commercial Governors	240	24	3	10%	6%
Domestic Service Governors	2,968	1,200	150	40%	12%
Total		1,480	185	N/A	100%

Figure 16.1: Replacement Summary

Expenditure (£M) (in 2009/10 prices)	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	Total
<2Bar District Governors	1.4	1.4	1.3	1.3	1.3	1.4	1.3	1.3	10.7
>2 - <7Bar District Governors	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.7
I&C Governors	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.8
Domestic Service Governors	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	1.8
Total	1.8	1.8	1.8	1.8	1.8	1.8	1.7	1.7	14.0

Figure 16.2: Investment Forecast – RIIO-GD1 Governor expenditure forecast

16.3 The Investment Journey

a) Criticality Assessment

Criticality assessments for District Governors has been considered against the relevant classes within this category, these include;

District Governors

District Governor criticality assessment varies based on whether they are part of a multi-feed network or a single feed network as determined by network analysis modelling. In a multi-feed network the area the District Governor supplies could be supported via other Governors for a short period in an emergency. In a single feed network there is no alternative to supplying gas to the area. Criticality has then been considered against the actual physical quantities of customers relating to specific Governors after establishing single or multi-fee criteria.

This allows the network to target the highest priority (single feed, large numbers of customers) Governors for replacement.

Industrial & Commercial I&C Governors

Security of supply for I&C Governors is vital as they feed important commercial operations. Loss of supply could affect processes and production and have serious reputational, financial and public relations implications consequences to both the network and its customers.

Domestic Service Governors

Service Governors generally supply single customers up to a maximum of 10, they fail safe and as such the network considers them low risk assets. As a result the network has adopted a fix on fail maintenance policy and a replace after thirty years policy which is considered the optimum solution from both a financial and safety perspective.

The consequence of failure of all these assets is a loss of supply to the customer.

b) Health Assessment

District Governors

NGN has determined the health of its below 2Bar District Governor population (2,221 units) predominantly based on its RCM maintenance frequencies. The network considers this to be a robust approach to health categorisation as it takes account of all the factors affecting RCM namely:

- Increase fault frequency;
- Single feed governors, i.e. not twin stream;
- Capacity of the unit;
- Physical condition of the unit;
- Policy compliance; and
- Obsolescence of equipment.

Figure 16.3 below summarises the current RCM frequencies within the network:

240 RIIO replacement priorities

Maintenance Frequency below 2Bar	Total	Number in Category	Obsolete
RCM Gov Maintenance - 4M	15	40	40
RCM Gov Maintenance - 6M	7		
RCM Gov Maintenance - 8M	18		
RCM Gov Maintenance - 10M	8	544	29
RCM Gov Maintenance - 11M	49		
RCM Gov Maintenance - 12M	473		
RCM Gov Maintenance - 15M	14		
RCM Gov Maintenance - 18M	40	97	0
RCM Gov Maintenance - 21M	57		
RCM Gov Maintenance - 24M	1,540	1,540	122
Grand Total	2,221	2,221	191

Figure 16.3: RCM distribution

Above 2Bar Governors and I&C Governors

Asset Health of the above 2Bar District Governors (134 units) and I&C Governors (240) is currently quantified by PSSR frequencies and obsolesce data. The numbers established for replacement are

based on historic run rates, consideration for localised capacity increase requirements and interpretation of subject matter expert assessments.

NGN is undertaking a survey of all its District Governor population in 2012 to help establish a clear methodology for prioritisation of these assets throughout RIIO-GD1.

Service Governors

NGN has adopted a fix on fail maintenance policy and a replace after 30 years policy which is considered the optimum solution from both a financial and safety perspective. This policy was supported by an independent review commissioned by NGN and undertaken by Enzen Global. A short exert from Enzen Global report is included below.

Independent Report by Enzen Global

"Initially design lives and technical asset lives may be considered identical. A norm is to consider design life as 50 years as product testing to simulate ageing for longer service lives is not well defined. However with long term assets used in gas transportation networks actual technical asset lives can be considerably shorter. Enzen recommends that NGN define a technical asset life for its Service Regulators that is based upon NGN's requirements in terms of serviceability i.e. continuance of gas supply at an appropriate flow rate and pressure coupled to minimum intervention maintenance."

"In Enzen's experience a technical asset life of 25 to 30 years may be considered reasonable and broadly fits with that used in other countries."

c) Investment Options

Service governor replacement is based on current policy compliance so the figure remains constant for all options.

Option One: Do Nothing

This will lead to increased maintenance frequencies and a significant increase in risk to the network to security of supply and high risk of non compliance with health and safety legislation.

Replacement Governor	Total Population	RIIO-GD1 Period	Per Year
District Governor below 2Bar (including ERS modules)	2,221	0	0
District Governor above 2Bar below 7bar	134	0	0
Industrial & Commercial Governors	240	0	0
Domestic Service Governors	2,968	1,200	150
Total		1,200	150

Figure 16.4: Option 1 Workload Volumes

Option Two: Maximum Below 2Bar Governors

Replacement assumptions – replace all below 12 month RCM governors, and assume minimum requirements for I&C and District Governors.

Replacement Governor	Total Population	RIIO-GD1 Period	Per Year
District Governor below 2Bar (including ERS modules)	2,221	584	73
District Governor above 2Bar below 7Bar	134	5	2
Industrial & Commercial Governors	240	10	3

Domestic Service Governors	2,968	1,200	150
Total		1,799	228

Figure 16.5: Option 2 Workload Volumes

Option Three: Conservative Assumption for District Governors and Minimum Assumptions for Above 2Bar and I&C Governors

Replacement Governor	Total Population	RIIO-GD1 Period	Per Year
District Governor below 2Bar (including ERS modules)	2,221	240	30
District Governor above 2Bar below 7Bar	134	5	2
Industrial & Commercial Governors	240	10	3
Domestic Service Governors	2,968	1,200	150
Total		1,480	185

Figure 16.6: Option 3 Workload Volumes

Option Four: Minimum Assumptions for all Governors

Replacement Governor	Total Population	RIIO-GD1 Period	Per Year
District Governor below 2Bar (including ERS modules)	2221	240	
District Governor above 2Bar below 7Bar		30	
Industrial & Commercial Governors	134	16	2
Domestic Service Governors	240	24	3
Total	2968	1200	150

Figure 16.7: Option 4 Workload Volumes

Option Five: Conservative Assumption for District Governors and Minimum Assumptions for Above 2Bar and I&C Governors

Replacement Governor	Total Population	RIIO-GD1 Period	Per Year
District Governor below 2Bar (including ERS modules)	2,221	160	20
District Governor above 2Bar below 7Bar	134	5	2
Industrial & Commercial Governors	240	10	3
Domestic Service Governors	2,968	1,200	150
Total		1,375	175

Figure 16.8: Option 5 Workload Volumes

d) Investment Decision

Measure	Option One (Do nothing)	Option 2 (Maximum investment DG's minimal other)	Option 3 (Conservative & minimal investment)	Option 4 (Conservative investment)	Option 5 (Minimal investment)
Total Asset Upgrades	1,200 Service Governors	584 DG's, 5 >2Bar District Governors, 10 I&C, 1,200 Service Governors	240 €, 5 >2Bar District Governors, 10 I&C, 1,200 Service Governors	240 District Governors, 16 >2Bar District Governors, 24 I&C, 1200 Service Governors	160 District Governors, 5 >2Bar District Governors, 10 I&C, 1,200 Service Governors
Financial	Total investment £1.8m	Total investment circa £24m	Total investment circa £12m	Total investement circa £14m	Total investment Circa £9m
Safety	Safety is not the principle driver for this investment				
Security of Supply	Signifiant increase in risk to supply through failure of a governor	Minimal risk to below 2Bar District Governors average to high risk above 2Bar and I&C governors	Manageable risk below 2Bar District Governors medium to high risk above 2Bar and I&C District Governors	Manageable risk for all District Governors	Medium to high risk for all District Governors
Environmental	Environment is not the principle driver for this investment although reductions in CO2 emmissions will be achieved through removal of high frequnecy maintenance governors.				
Level of Risk	Very High and increasing throughout RIIO-GD1	Minimal	Medium	Medium tending to low	Medium tending to high
Comments	Not recommended – too much risk	Over engineering solution also unachievable programme and no risk retained by the network	Potential solution but considered high risk retention for network against above 2Bar and I&C customers	Optimal solution retianing an appripriate level of risk across the asset base.	Acceptable solution but the network considers it would retain too much risk
Decision	Not acceptable	Not acceptable	2	1	3

Investment Decision: Option Four

NGN believes option four is the optimal solution which allows the network to retain an acceptable level of risk whilst replacing the highest risk assets to benefit the customer.

This option is a conservative approach that only requires the network to update/replace 10% of its Governor population over the eight year RIIO-GD1 period.

16.4 Selection Criteria

In order to manage the risk appropriately NGN is developing selection criteria that will allow the Governors which pose the highest risk to be prioritised for replacement. This will essentially involve appraising the current RCM data and overlaying this with an assessment on the physical characteristics of each individual Governor. For example this could include number of customers, commercial sensitivity (for I&C customers), and operational assessment of condition.

16.5 Innovation

Whilst replacing these Governors we will ensure that we use manufacturers that use the same equipment as those which are more reliable and consistent with a smaller amount of spares and less diverse skills required to maintain them, this will in also mean that any control equipment required to assist the network in minimising pressures can be more consistent, with again less spares required to maintain effectively.

As part of our TNM approach an assessment will be made across the whole network as to the most appropriate solution. This could include reinforcement and removal, repositioning to new location to enable rationalisation of network and optimisation of pressures.

a) Output Deliverables

The benefits/outputs of investing in these assets are as follows:

District Governor Benefits

- Environment – As faults occur, this type of equipment is designed to fail safe that could result in unnecessary increases in network pressures, increasing leakage for the system.
- Safety – Removing non-standard or limited type equipment will result the likelihood of human error incidents occurring.
- Reliability – Security of supply via these district governors is vital as these feed directly into the low pressure networks failure to have readily available spare parts will delay restoration of supplies. Fault data gathered over time highlights regulators that may fail in the near future these require more frequent maintenance to prevent failure.
- Although there are significant costs in the replacement of these district governor sites there is also immediate savings in operational, legislative compliance, maintenance and painting costs. The network currently has over 1,200 District Governors that are maintained due to their configuration at frequencies less than the current maximum of 24 months, some of these are maintained as often as 4 monthly, as the RCM risk template has the mean time between failures for these units less robust and of less well defined failure reasons then those which are maintained less frequently.

Industrial & Commercial Governor Benefits

- Environment – As faults occur, increased venting to atmosphere and possible purging of supply is required to undertaken maintenance and repair.

- Safety – Loss of supply to a major customer could lead to a fatality due to failure to meet requirements.
- Reliability – Security of supply via above 2bar I&C Governors are vital as they feed important commercial operations loss of supply could affect processes and production. Loss of supply could have serious reputation and media exposure implications leading to substantial costs. Fault data gathered over time highlights regulators that may fail in the near future these require more frequent maintenance to prevent failure.

Domestic Service Governor Benefits

- Customer – Expectations that supply would be continuous. These can often be in remote locations and single source supply and will take longer to restore than normal LP supply.
- Safety – Loss of supply to a remote venerable customer could lead to a fatality due to failure to meet requirements.
- Reliability – Security of supply via these small Governors is vital to small numbers of customers as an alternative to lay low pressure mains. Replacement is a more realistic option than maintenance due to the low cost of a new asset as opposed to the time spent maintaining on a regular basis.
-

A19A-17: Aggregated (Other Expenditure) (Projects <£0.5m)

17.1 The Specific Requirement throughout RIIO-GD1

This section is made up of a number of lines with all for projects costing less than £500K, but which have been identified as beneficial to the network to be carried out.

(2009/10 prices £m)	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	TOTAL
Block Valve (Civils)	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.4
PIG Traps (Civils)	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.3
<7 Bar Sleeves	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.3
E&I Telemetry Communications (<7 bar)	0.00	0.00	0.22	0.22	0.00	0.00	0.00	0.00	0.4
High Rise Building Valves	0.10	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.2
Total	0.2	0.2	0.3	0.3	0.1	0.1	0.1	0.1	1.6

Figure 17.1: RIIO-GD1 Aggregated (Other Expenditure) (Projects <£0.5m)

17.2 Justification for Investment

For each of the assets above NGN has justified the drivers for needing this investment to be carried out over the RIIO-GD1 period:

a) Block Valves

Block Valves are an essential part of being able to operate the network safely, as they allow shutdowns for planned work and emergencies to enable sections of pipe to be isolated. Investment of £400K over RIIO-GD1 will be targeted at associated Civils work with 10 (20% of population) Block Valves to make sure they are accessible and function correctly. This will involve excavating to reveal the Block Valve and construction of a chamber to house the Block Valve at a unit cost of £40K. This expenditure will be distributed evenly throughout the period to allow for a rolling programme of work.

Civils work associated with Block Valves include; excavating a pit to reveal the Block Valve, construction of a new chamber to house the Block Valve, or new covers for protection.

Criticality

Criticality for Civils on block valves has been classed as medium, as it has no direct impact on the Block Valve, but is necessary to maintain the Block Valve in the future.

Asset Health

There has been no major work on Block Valves in the past 10 years. As such Block Valve Civils has been categorised as HI3.

Expenditure Forecasts

2009/10 prices £m	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	TOTAL
Block Valve	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.4

Figure 17.2: RIIO-GD1 Block Valve Expenditure

It is estimated 20% of Block Valves (10) will need major Civils work such as; valve pits, covers and excavations at an average cost of £40K each. The work to improve the health of a Block Valve may not be as extensive as that on the pipeline. The expenditure will be targeted at excavations to reveal the valve, construction of new chambers and new covers to protect the valve and prevent it from flooding.

RIIO-GD1 Benefits / Outputs

The benefits/outputs of investing in these assets are as follows:

- Environmental – Reduction in leakage through valve.
- Customer Service – Block Valves enable pipelines to be split into sections, therefore allowing part of pipeline to be isolated if required. This can result in less disruption to supply.
- Safety – Allows sections of pipeline to be safely isolated in event of an emergency

Capital Expenditure on Block Valves equipment is included in Pipeline Re-life section of this submission.

b) PIG Traps

Some of the Civils work associated with the PIG Trap sites have not been upgraded in the past 10 years and therefore are classed as deteriorating, requiring assessment or monitoring. This would typically entail the replacement of concrete pipe supports, roadway access, and hard standing for inspection vehicles, etc.

Criticality

All Civils associated with PIG Trap sites have been classified as low on the criticality index.

Asset Health

PIG Trap site Civils that have not been replaced or significantly modified in the last ten years have been categorised as HI3.

Asset Health and Criticality - Currently in GDPCR1

Without investment 20% of the sites would degenerated to HI4.

Financial

It is estimated that a full site Civils refurbishment on a PIG trap site would cost £40k per site.

2009/10 prices £m	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	TOTAL
Civils Refurbishment – Pigh Traps	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.4

Figure 17.3: Civils Refurbishment – Pigh Traps Expenditure

RIIO-GD1 Outputs

- Security of supply

c) <7Bar Non-Nitrogen Sleeves

It is estimated there are 16 <7Bar non nitrogen sleeves in the network. NGN are currently working in collaboration with other networks to produce a uniform management procedure for sleeves. Investment of c.£0.3m over the RIIO-GD1 period will be used to accurately identify sleeves which need remedial work and implementation. This includes grouting sleeves which are currently vacant and restoring resistive bonds between pipes and sleeves.

The condition of non N2 sleeves is expected to deteriorate at a similar level to pipelines with corrosion.

Criticality

Sleeves are critical to maintain the integrity of a pipeline and thus allow it to continue transporting gas to customers; however if a sleeve were to fail there would be no direct loss of supply consequence. Therefore sleeves have been assigned a medium criticality.

Financial

2009/10 prices £m	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	TOTAL
<7 Bar Sleeves	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.3

Figure 17.4: RIIO-GD1 <& Bar Sleeves Expenditure

£40K per year has been allocated for non-nitrogen sleeves. According to asset health indices 16 non nitrogen sleeves will need remediating over the RIIO-GD1 period, with an estimated cost of £20K per sleeve.

Investment will be targeted at accurately identifying the condition of sleeves and then implementing appropriate remedial work. This will involve excavating to reveal the sleeves, grouting of vacant sleeves and re wrapping. This is estimated to cost £20K per sleeve. Overcrossings may require re painting, re wrapping and being reinforced.

RIIO-GD1 Outputs

- Safety – sleeves protect pipes at vulnerable crossings, they are therefore essential to the integrity of the pipeline; and
- Reliability – Security of supply through integrity of the pipeline.

d) Telemetry

Telemetry exists on 89 below 7Bar sites across the network. Although the current system is fully functional it is outdated. The network would like to review current telemetry operations to see if a smarter way of communications is available. In the first half of RIIO-GD1, a feasibility study will be undertaken to review the existing system and identify if a total system upgrade would add significant benefit. If upgrade is found to be an option it is anticipated this would cost circa £5k per site. This scheme would only be undertaken in line with the above 7Bar telecommunications section in our Asset Health Category 22, and is scheduled for only a two year period to coincide with other surveys.

Criticality

This asset has been categorised as C4 as loss of telemetry would have no detrimental effect on safety, environment or supply while it is being repaired.

Asset Health

The system is currently fully functional but aging. As such it has been categorised as H12.

Financial

In the first half of RIIO-GD1, a feasibility study will be undertaken to review the existing system and identify if a total system upgrade would add significant benefit. If upgrade is found to be an option it is anticipated this would cost circa £5k per site. The feasibility study is expected to cost £50K, but is covered in Asset Health Category 22. Total cost for this investment would be £445K.

2009/10 prices £m	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	TOTAL
E&I Telemetry Communications (<7 bar)	0.00	0.00	0.22	0.22	0.00	0.00	0.00	0.00	0.4

Figure 17.5: RIIO-GD1 E&I Telemetry Communications (<7 bar)

RIIO-GD1 Outputs

The suggested options cover the following primary outputs:

- Environmental – better telecommunications should lead to reduced visits reducing the carbon footprint; and
- Reliability – security of supply.

e) High Rise Building Valves

It has been identified following an extensive survey of these types of properties that a number of High Rise Building exist within the network that do not have satisfactory service valves should it be necessary to quickly close off the gas supply to the building.

These buildings were mainly constructed in the 1960's era, and surveys have identified that a number of service valves need to be fitted. This strategy has been agreed with the HSE and these valves will be installed at a total cost of £200K.

In order to comply with IGE/G/5 this work will be necessary to meet the requirements.

Consequence of Failure

In the majority of these cases then no immediate effect will be seen on the network by failure of any of the items listed, they would continue to be repaired on an as required basis. However, they are all deteriorating and have not been fully addresses for some time. It is felt this expenditure will significantly enhance the network, as well as allowing current operating requirements to be met. All are classed as Medium or Low criticality.

Condition Assessment

Other than fault data physical condition of the asset has been determined through subject matter expert assessment. This will be supplemented with field surveys which are currently ongoing in 2012.

f) Other Options Considered

Do Nothing:

The option to 'do nothing' in these cases is a viable one, and has been adopted for a number of years. However, the assets will continue to deteriorate until such time as expenditure will be necessary. This programme aims to plan this as a phased expenditure on a proportion of these over this period.

17.3 Innovation

Innovation in how we tackle these remedial works will be considered, particularly in the cases of the nitrogen sleeves with remote monitoring and the E&I telemetry works identified.

Remote monitoring on sleeves measures pressure automatically, checks that it is within specification and reports immediately if an alarm threshold is exceeded. It communicates (via either an internal or external antenna) using the GSM network and is installed in the same way, simply requiring a mobile phone.

A19A-18: Rationalise Mains & Governors to Support Storage Strategy

18.1 The Specific Requirement throughout RIIO-GD1

Within RIIO-GD1, NGN plans to rationalise the local network surrounding gasholders either in preparation for demolition of the Holder. As part of NGN's TNM approach this rationalisation will assess the impact on the whole network and adopt innovative approaches where appropriate. Before gasholders are physically disconnected from the system and then demolished it will be necessary to ensure the surrounding distribution network is capable of meeting gas demands and flow requirements in the absence of the diurnal storage facility. This will require rationalisation, upgrading and on occasions replacement of existing infrastructure which will be unique to each individual site location.

2009/10 Prices £m	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	Total
Rationalise mains and governors to support storage strategy	0.4	0.4	0.5	0.6	0.7	0.7	0.8	0.8	**4.9**

Figure 18.1: RIIO-GD1 Rationalise mains and governors to support storage strategy Expenditure

18.2 Justification for Investment

a) Current Control Run Rates

Demolition has only taken place recently where the gasholder has been structurally unsound and equipment has remained within the existing land footprint.

Consequence of Failure

The infrastructure around gas holder's sites is deemed to be at the higher end of the criticality index in that it incorporates the larger diameter trunk mains that feed through to the sub networks within a township. Therefore failure within this part of the network will have a material impact on both security of supply and safety of the general public.

Condition Assessment

A desktop assessment has been undertaken on the likely rationalisation needed around the site to remove equipment and maintain existing demand. As this is a desktop exercise and uncertainty exists around which sites will be made available and when at this early stage NGN believe the costs are likely to increase through the RIIO-GD1 period.

This is based on the assumption that early removal will be done on those with less engineering difficulty accessibility to equipment and forecast changes on the whole network.

Out of our 35 sites, we believe 15 will not require off site adjustments and 20 will require some level of rationalisation.

Location	M&G Rationalisation Cost	Comments
Hendon Commercial Road	£0	Site assesment and Analysis required to determine costs, atthe moment costs unlikley
East Hull - St Marks Street	£0	Site assesment and Analysis required to determine costs, atthe moment costs unlikley
Moorfield Road Bridlington	£0	Site assesment and Analysis required to determine costs, atthe moment costs unlikley
South Gosforth	£0	Site assesment and Analysis required to determine costs, atthe moment costs unlikley
South Shields	£0	Site assesment and Analysis required to determine costs, atthe moment costs unlikley
Keighley	£0	Site assesment and Analysis required to determine costs, atthe moment costs unlikley
St Anthonys	£0	Site assesment and Analysis required to determine costs, atthe moment costs unlikley
Clay Flatts HP and LP storage	£0	Site assesment and Analysis required to determine costs, atthe moment costs unlikley
Carcroft HP Bullets	£0	Site assesment and Analysis required to determine costs, atthe moment costs unlikley
Ripon Road Harrogate	£0	Site assesment and Analysis required to determine costs, atthe moment costs unlikley
Rome Street Carlisle	£0	Site assesment and Analysis required to determine costs, atthe moment costs unlikley
Jarrow	£0	Site assesment and Analysis required to determine costs, atthe moment costs unlikley
Blyth	£0	Site assesment and Analysis required to determine costs, atthe moment costs unlikley
Elswick	£0	Site assesment and Analysis required to determine costs, atthe moment costs unlikley
North Shields	£0	Site assesment and Analysis required to determine costs, atthe moment costs unlikley
Sheepscar - Barrack Street	£23,570	Divert 25m of 30"
Canal Road Bradford	£30,554	Divert 40m 24"
Birkshall - Bradford	£47,140	Divert 50m 36"
Cleckheaton	£74,330	Rationalise Governors from 2 to 1 by relocating Governor and amending pipework
Goole Andersen Road	£82,790	Cut off Holder outlet mains rationalise governors 2 to 1 by relocating to rationalised Fan booster location.
Bishop Auckland	£82,790	Divert 120m of 24"
Old London Road Penrith	£98,348	Cut off 10/12" LP main and rationalise safety and station governors.
Hull Bankside Clough Road	£146,675	Divert 150m of 12" CI LP in 355mm
Huddersfield	£187,744	Divert 200m of 36" CI
York	£193,476	Divert 2 mains each 206m in length. Size 24" and 16"
Stockton	£253,636	Divert 332m of 24"
Mulcture Hall Halifax	£263,601	Divert 150m of existing 24" in 630mm PE LP
New Wortley Wellington Rd	£273,405	Divert 210m and 80m of 36" totalling 290m
Redheugh Gateshead	£306,258	Divert 230m 24" CI LP, 50m 14" SI MP, 150m 300mm DI MP
Darlington	£371,578	Cut off Holder outlet/inlet mains rationalise governors 2 to 1 at same location please note the governor source is remote from holders site 429185, 515533 Divert 394m of 30"
Crossgates	£413,950	Divert 22m of 20" unprotected steel
Ayres Quay Sunderland	£442,373	Divert 200m of 15"
Howdon	£1,349,999	Divert 230m of 10" MP, 24" MP 24" LP(2) 400LP (1)
Meadow Lane Leeds	£1,416,167	Divert 250m section of 17 bar pipeline around site perimeter in
Cannon Park Middlesbrough	£1,968,838	Cut off 24" LP main and rationalise 2 governors. Additional costs for offsite diversions for new roundabout. Divert 70m of 450mm Ductile Iron
Total	£8,028,223	

Figure 18.2: Assessment of gasholder sites requiring M&G investment

b) Cost Benefit Analysis

The CBA undertaken has taken full consideration of:

- Efficiency of the Network;
- Ability to reduce average system pressure;
- Reduced Maintenance & Repair Costs;
- Minimise future possible reinforcement; and
- Combine with other Network Management Process.

c) Other Options Considered

Do Nothing:

Site remains a gas hazard site situated in an inappropriate location. Network pressures and flows are not optimised.

18.3 Selection Criteria

Expert knowledge of gasholder locations, surrounding sizes and flows of network. Likely requirements to remove equipment off site.

18.4 Innovation

To form part of the TNM approach.

A19A-19: Gascoseekers

19.1 The Specific Requirement throughout RIIO-GD1

The existing Gascoseekers used by our workforce are due for replacement early in the RIIO-GD1 period as they have been in operation since 1983 and are becoming obsolete due to not being able to get spare parts, replacements etc. As set out in Section six of the RIIO-GD1 Business Plan, we plan to replace them with equipment which incorporates the capability to undertake CO detection alongside natural gas. There was strong feedback from our stakeholders that our emergency staff should have this capability and are currently trialling suitable equipment. Within the RIIO-GD1 period NGN proposes to replace all current Gascoseekers with a newer model that monitors not only gas but also Oxygen and Carbon Monoxide readings. All the Gascoseeker investment is driven directly by Section 7.5.6 within the RIIO-GD1 business plan:

£m 2009/10 prices	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	Total
Gascoseeker replacement with CO detection capability	1.2	1.2	0.0	0.0	0.0	0.0	0.0	0.0	2.4

Figure 19.1: RIO-GD1 Gascoseeker replacement with CO detection capability Expenditure

19.2 Justification for Investment

a) Environment

The environmental benefit of this proposed replacement programme is with the unit being re-chargeable it creates an instant saving on battery waste. Analysis on this has been done for the period 01/11/2011 – 30/01/12 where we saved a total of 1040 batteries. If rolled out across the whole network this would have been a total saving of £4,800 for the same reporting period.

b) Safety

Presently operatives rely on the skills and competence as responding engineers to determine if a property is safe to enter when responding to public reported escapes (PRE), this is aided by the use of the current issue GASCO detection equipment. This equipment currently only detects methane. By adding further capabilities to the new equipment, engineers will be able to assess the content of both carbon monoxide (CO) and oxygen (O2) in the atmosphere as well as methane.

Currently we are completing a gas detection equipment trial that involves one operational area of the business within the network which has a higher than average number of CO incidents. This is a proactive approach by NGN to ensure a more customer focused solution is being applied to CO detection. The primary purpose of the trial is to identify any operational issues which would result in NGN's proposal requiring amendment or not being feasible. In the absence of any contentious issues we will work towards the full implementation of our proposals during RIIO-GD1.

- Active Alarm – This is where a PRE with CO has been reported and the CO Alarm IS sounding;
- Inactive Alarm – This is where PRE with CO has been reported but the CO Alarm IS NOT sounding;
- Battery Fail – This is where a PRE with CO has been reported as the result of a Alarm BATTERY FAIL; and
- No Alarm – This is where a PRE with CO has been reported where NO CO ALARM fitted in the property.

What happens if one of these assets fails?

We have already accounted for any Gascoseekers failures by carrying spares within the trial area, this process would still be followed should this be rolled out across the whole network, ensuring that all operatives in all areas are able to use the same Gascoseeker model in order to continually give the most safety comprehensive service possible.

Condition Assessment

NGN determines the health of each Gascoseeker by using a wide range of data and information including Age, Model, Operating Conditions, Calibration Date and Impact of Failure on key output deliverables. The existing Gascoseekers used by our emergency workforce are due for replacement early in the RIIO-GD1 period. As set out in Section 6 of the RIIO-GD1 Business Plan, we plan to replace them with equipment which incorporates the capability to undertake CO detection alongside natural gas.

c) Cost Benefit Analysis

The technology offers the potential to reduce the use of throwaway battery detectors, which are effected by cold weather, and usage times. The use of rechargeable units will use the operator's vehicles to recharge as they travel between jobs, also negating the negative effects cold weather temperatures have and draining standard battery cells currently used.

d) Financial Analysis

Roll the new equipment out across the network the following costs would be incurred:

- 1200 extra Gascoseekers at £1,400 per unit = £1,680,000
- 800 engineers training = £266,480
- Vehicle Upgrades (Fit Charging Unit) = £240,000

Total Cost = £2,186,480

e) Other Options Considered

Do Nothing

- Do nothing. This would result in no change to existing process and could incur cost associated with aging and well-used equipment some of which is approximately 25 years old and used daily; and
- Not meeting stakeholder expectations.

Summary

To Summarise, we believe there are significant advantages to the proposed initiative, as detailed with the following points:

- Increase the safety of our engineers when entering potentially harmful atmospheres;
- Offer customers additional confidence in our actions in their properties;
- Deliver additional confidence in our engineers' assessment that properties are free from CO;
- Increase awareness in our own engineers of CO which will be passed to customers;
- Increase the amount of accurate information available on the extent of CO in properties. This will provide the opportunity for more thorough data analysis which can be used to inform further appropriate steps to be taken by NGN and/or other agencies to address issues surrounding CO; and

- No duplication of monitoring equipment, NGN attends around 120,000 gas emergencies each year. We plan to carry out tests for CO, as appropriate, and annually publish the results of our findings.

19.3 Innovation

We plan to continue to play an active role in raising the awareness of the risks of CO. Our stakeholders have indicated very clearly that they believe we have a greater role to play in addressing the issue, including the distribution of information and advice and the provision of CO monitors to vulnerable customers when attending a gas emergency. Raising the awareness of CO continues to be a key part of NGN's strategy and approach to delivering gas safety advice to our customers and to aid this have developed a Smartphone application relating to gas safety which is due for release in 2012

Our activities include the following:

- Press releases across the year with a seasonal campaign. The seasonal campaign in 2010 generated 12 articles in newspapers across our region with a combined circulation figure of more than 164,000;
- We continue to provide funding and resources to campaigns delivered by the Kirklees Carbon Monoxide Awareness Group (KCOAG); and
- We continue to provide CO information leaflets to fire and rescue services in our region who distribute them as part of their public information road shows.

Recognise our role in promoting CO awareness and agree that it is a critical output for RIIO-GD1.

a) Alternatives Considered

The current Gascoseeker equipment used by NGN Operation engineers is up for renewal as the current model has been in service since 1983 and is increasingly hard to find spare parts gradually becoming more and more obsolete. Therefore, NGN consulted GMI are one of the network leader is Gascoseeker technology. The other models which NGN reviewed and considered were:

Gasurveyor 3-500

The rugged design enables the Gasurveyor 3-500 to be used in harsh environments.

Gasurveyor 6-500

The Gasurveyor 6-500 compliments both the Gascoseeker and the Gasurveyor 3-500 instrument with a similar performance, measuring % LEL and % volume flammable hydrocarbons, but with the addition of carbon monoxide.

Gasurveyor 11-500

The Gasurveyor 11-500 compliments both the Gascoseeker, Gasurveyor 3-500 and the Oxygas instruments with a similar performance, measuring % LEL and % volume flammable hydrocarbons, but with the addition of oxygen. The Gasurveyor 11-500 is designed for either gas/air or gas/nitrogen/air purging, with the ability of the Gascoseeker and the addition to measure oxygen during a nitrogen purge

After review NGN decided to trial the 7B-500R with the benefits of

- Re-chargeable batteries; and
- Functionality of being able to measure for Carbon Monoxide.

Consideration to trial other units has not been discounted and will be based on operational requirements and functionality of available units.

A19A-20: Over Crossings

20.1 The Specific Requirement throughout RIIO-GD1

An above-ground crossing is defined as; “an exposed pipe, or pipe within a sleeve, that crosses a particular feature or facility, above ground level”. NGN are in the process of assessing the status of all overcrossings in the network. This work is ongoing; therefore the asset health indices for overcrossings are likely to change by 2013. Preliminary reports indicate there are; 1700 below 7Barovercrossings throughout the network.

Investment of £2.4m over RIIO-GD1 will be targeted at approximately 140 overcrossings (8% of the total population), at a cost of between £5k and £35K per overcrossing. Overcrossings will deteriorate over time due to weather erosion and flooding events, this investment is required to maintain the overcrossings to an acceptable level including their support mechanics, coating and wrapping, protection from flooding etc.

£m 2009/10 prices	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	Total
Over crossings	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	2.3

Figure 20.1: RIIO-GD1 Over crossings Expenditure

Figure 20.2: Over crossing examples

20.2 Justification for Investment

Overcrossings are critical assets, simplistically they are the same criticality as a pipeline, in real terms they are the points in which the pipeline surfaces from the ground. Additional to pipelines overcrossings pose a significant increase safety risk as failure would not only affect supply but could have serious consequences to the surrounding vicinity.

A project is currently underway to better understand and quantify the health of the networks overcrossing population. Currently assumptions are based on visual inspections and subject matter expert assessment. Accurate information is available for > 7Barcrossings and the network is extending this to all overcrossings in 2012/13. The investment requirements identified within RIIO-GD1 are based on current run rates.

a) Benefits / Outputs

The benefits/outputs of investing in these assets are as follows:

- Customer Service – Continuity of supply (less risk of pipeline not being able to transport gas); and
- Safety – Overcrossings carry live gas often the crossing can be road, rail etc.

Consequence of Failure

Over crossings are pipelines that cross bridges, railways and rivers etc. above ground and are exposed to the elements and also the public. Often they are attached to bridges and cross ravines, rails at great height making inspection access to them difficult.

Without adequate investment the risk is that a pipeline will fail catastrophically with loss of supply, and risk to life, property.

Condition Assessment

Figure 20.3: Example of Poor Condition Over Crossing

Visual inspection is carried out to assess the condition and protective measures on overcrossings. The results from these inspections is analysed to determine frequencies and maintenance required. The data will enable NGN to prioritise maintenance regimes and repairs to these assets.

b) Overcrossing Database

As part of this ongoing development NGN are currently in the process of creating a database of all overcrossings within the network. The database will hold inspection data and link to bridge structure assessment, flood risk and gas supply criticality to risk rank all of these crossings.

This will enable to prioritise work and ensure security of supply and safety within the network, representing value for money to our customers.

The overcrossing database will enable NGN to have prepared back up plans for the highest risked over crossings. In preparing the database future enhancements are being considered which could include additional pipeline information gleaned from TD1 affirmation records, for example,

- pipeline sleeve location, description & maintenance records;
- pipeline repair clamp locations & records;
- pipeline damage location & records; and
- pipelines location/route with P18 precautions.

Over Crossing Assessment

Inspection carried out by :- Don Allday Date :- 22/02/11

Pipeline Name :- Cowpen Bewley to Nunthorpe CH11
Location of Crossing :- Eastings :- 448357 Northings :- 525908

Access Details :-
Cowpen Country Park, Cowbridge Beck

General description of the over crossing
- Type of crossing — Water
- length of crossing — 34 m
- Digital photographs taken — Yes

Over crossing inspection completed over entire length — Yes
- Percentage of crossing not inspected — 0%

Inspection Detail:
General condition of the supporting structure — Poor
- Corrosion can be seen — Yes
- Paint work discolouration — Yes
- Sign of any movement in supporting structure — No
- Carrier pipe supports in good condition — No

General condition of the carrier pipe — Poor
- Evidence of mechanical defects present — No
- Corrosion can be seen — Yes
- Paint work discolouration — Yes

Pipeline Identification
- Gas pipeline marker present — No
- Aerial markers present — No

Security
- Is the crossing protected against unauthorised access — No
- Is access protection sufficient and in good condition — No

Vegetation
- Does the crossing require vegetation to be cleared — Yes

Recommendation:
That the crossing be re-inspected (max 2 years) — Yes

Additional assessment required
Civil engineer — No

Remedial action required

15m of pipe to grit blast and recoat with 2 pack. Remove layers of brick supports and fit new stands. Install Aerial Markers

Figure 20.4

For each overcrossing location the following information will be recorded;

- Pipe asset i.e. material, diameter, length, & operating pressure at each location;
- Network map showing the extent of the gas supply system fed from the crossing location;
- OS map showing the crossing location;
- Each location is linked to Google Earth to allow the user to view satellite image;
- Each location is linked to the Environmental Agency Flood Risk website to allow the user to view extent of flood risk;
- Each record has a section to store document i.e. inspection reports, photographs & other document of interest; and
- Each crossing is scored to establish a risk profile based on flooding, bridge condition, & consequence of supply loss.

c) Other Options Considered

Do Nothing:

This is not a viable option. An overcrossing is a pipeline above ground that requires maintaining as a safe and reliable pipeline. If investment is not made over the RIIO-GD1 period, there is a significant risk in these pieplines failing.

Replace Overcrossing:

This option is very expensive and should only be carried out when other options are not viable. The option chosen offers the best value for the Customer.

A19A-21: Remote Pressure Monitoring and Control Process

21.1 The Specific Requirement throughout RIIO-GD1

Within the RIIO period NGN proposes a new Remote Pressure Monitoring and Control strategy. NGN has over 1600 governor sites that require manual pressure setting by an operative visiting site to reset pressures for winter, spring, summer and autumn demand profiles. New and emerging technologies offer the possibility of a more cost effective solution to controlling pressure regulators and monitoring network pressures without the need to visit site, and will provide NGN with a 24/7 pressure control system where governors can react instantaneously to demand profiles thereby ensuring network pressures are maintained at the optimum level to maintain security of supply and minimise gas leakage.

2009/10 Prices £m	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	Total
Remote Pressure Monitoring & Control	0.7	2.5	2.4	2.4	0	0	0	0	8.0

Figure 21.1: RIIO-GD1 Remote Pressure Monitoring & Control Expenditure

21.2 Justification for Investment

- Stakeholders require NGN to operate efficiently and use innovation to reduce its visible operational impact. The cost of visiting site to download data, install or remove logging equipment, adjust pressure regulators is not insubstantial remote monitoring and control has the potential to remove a lot of these processes, without impacting on the safe operation of the network;
- Reducing average system pressure to reduce the amount of gas leaking while ensuring NGN maintains a reliable system that meets all demand conditions, including peak winter conditions, is a major objective. Monitoring network pressure and having the ability to adjust supply regulators, using our existing analysis system, could effectively address this challenge;
- Managing network pressures currently requires a large number of manual interventions, setting pressures to meet seasonal demands requires an operative visiting regulators to adjust pressures and the fitting of pipeline logging equipment each winter to ensure network compliance. Reducing driving to and from site will reduce the likelihood of road traffic accidents; and
- Remote Monitoring and Control of network pressure will bring a significant part of our pressure management operations into System Control team and providing 24/7 visibility of the distribution network and remote control of governors therefore providing a holistic approach across both the above and below 7Barsystems.

a) Current Price Control Run Rates

During GDPCR1 we have installed a new system that centralises data from all pressure control and monitoring locations without the need for personnel to return to a depot. This new pressure monitoring system provides NGN with the opportunity to adopt a new pressure management and control strategy. This strategy moves from the control being undertaken on site by an operative to one of controlling pressure settings remotely by a centralised team. This will result in a more dynamic and proactive response to matching supply needs based on short term forecasting projections.

b) Existing Process

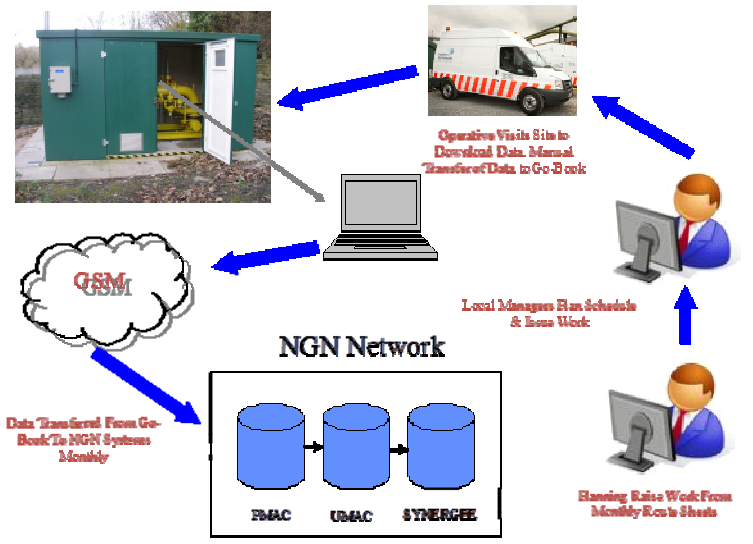


Figure 21.2

Condition Assessment

The key driver of this investment is to improve on the current operation with new technology that offers a more cost effective solution to controlling pressure regulators and monitoring network pressures without the need to visit site.

c) Cost Benefit Analysis

- Instant remote control of pressure regulator equipment, the aim would be to reduce average system pressure by a minimum of 10%;
- Reduction in carbon emissions resulting from reduced leakage and reduced travel;
- 3mbar reduction in Average System Pressure resulting a projected: - 30GWH/year;
- Seasonal settings based on short term demand and weather forecasting;
- Immediate control of regulators for planned shut downs;
- Operational savings after full implementation;
- Extremity pressure monitoring providing system resilience;
- Immediate resolution to pressure report issues;
- Incorporate knowledge with RCM requirements to review maintenance schedules; and
- Optimisation of pressure monitoring and running of the network via a centralised MI solution providing the use of SynerGEE for Active Network Pressure Management.

Detailed below are the cost of each Governor Control Unit supplied and installed:

	Cost
Cost of Control Board and assembly of equipment	£1,800.00
Cost of Installation	£900.00
Pressure Control Equipment (Autogas Newlog4, Battery, Modem etc)	£1,700.00
Total Cost Per Installation	£4,400.00

Figure 21.3: Governor Control Unit costs

d) Other Options Considered

Implement full self-learning profiling systems - A number of these have been installed in the past and other Networks are adopting this approach. These systems when installed correctly will optimise pressures, however, they are more expensive to install, they use fixed telephone lines and more expensive to maintain.

Due to the long term impact this solution is not recommended.

21.3 Selection Criteria

Remote Pressure Monitoring and Control Process – it is recommend that the network adopts a strategy that will move to remote monitoring and control of all pressures within the below 2Bar system. This strategy will lead to an ultimate investment of approximately £8m over a four year period, if the proposed trial proves successful.

Proposed Process:

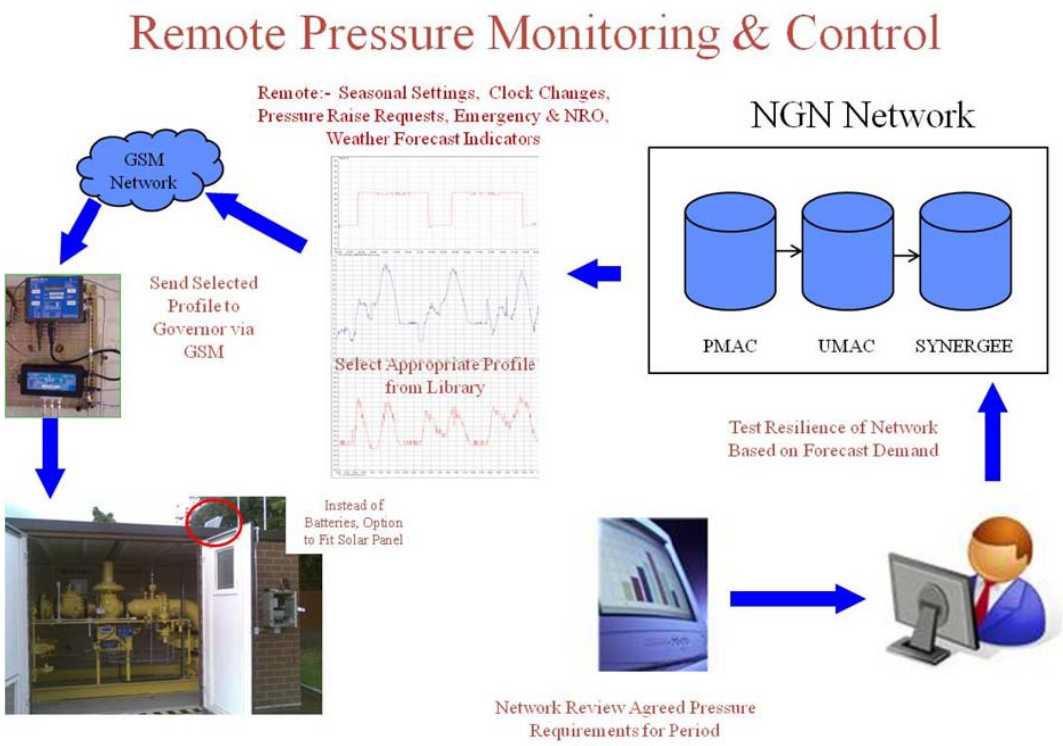


Figure 21.4 Remote pressure monitoring control process

21.4 Innovation

NGN see this process as a new innovative approach to pressure management within the network.

A19A-22: Replace Network Loggers

22.1 The Specific Requirement throughout RIIO-GD1

Within the RIIO-GD1 period NGN proposes to install 'Fit and Forget' Network Validation Loggers. We currently use network validation loggers which are moved from site to site to deliver the requirements of the validation process. NGN plan to purchase additional loggers to provide equipment at all sites, to reduce costs and improve compliance and integrity.

2009/10 prices £m	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	Total
Replacement Network Loggers	0.7	0.7	0.7	0	0	0	0	0	£2.2M

Figure 22.1: Replacement Network Loggers Expenditure

22.2 Justification for Investment

- By installing GSM enabled loggers, in addition to the low point loggers, onto the network that do not require moving, visiting to download and remain available all year would provide the network with a number of key benefits, including savings of around £100,000/annum opex costs.

a) Current Price Control Run Rates

The network currently has approximately 2,600 Network Validation points on the low pressure network. These monitor pressures over the winter period to enable Network Analysis models to be updated in compliance with NGN Planning Policy. These are strategic points on the network that best represent the condition of the whole network and allow pressure management to be set against actual demand on a three year review programme.

The network owns around one third (850) of its full Network Validation Loggers which it moves to selected networks to meet the validation process requirements, in line with the three year planning process. These are generally fitted late October in preparation for the winter and removed once the coldest day has been experienced usually around early March. Each fitted logger is visited each month by Operations to download the pressure data.

What happens if one of these assets fails?

A failure in the asset would result in areas of in correction and the actual mains pressure would be uncertain.

Condition Assessment

The key driver of this investment is to improve on the current operation with new technology that offers a more cost effective solution to the management of loggers, installation and collection of data.

b) Cost Benefit Analysis

- Pressure Monitoring and Control effectiveness will be increased due to more monitoring points attached to the Network. Hence reducing overall average system pressure while ensuring supply compliance;
- Network Analysis models can be used to set pressures over varying temperature & demand conditions over the whole network;
- Network Validation programme can be dictated by risk to network rather than a fixed three year rolling plan. Due to constant monitoring an annual risk assessment can take place to measure changes;

- Validation of network can commence the day after the “coldest day” rather than waiting for downloads;
- Poor pressure reports can be accurately determined as to whether it is a result of supply (governor operation) or localised (water ingress). Better information available to teams during urgent works;
- Proactive management of poor pressure issues to ensuring GSMR requirements are met without increasing leakage elsewhere on the network;
- Loggers can be accurately positioned using GSM on the network and tracked should they be removed or damaged;
- Average system pressure developed from actual pipe pressures are recorded over the year rather than an analysed model taken from estimated demand sets;
- Pressure parameters can be sent to these loggers to inform the network should these settings be exceeded. A daily (365) record of pressure and battery life condition sent to network allowing better management; and
- Opex saving from the management of loggers (prior to installation and following collection) installation and collection of data.

A GSM enabled logger has been estimated to cost around £850.00 this is approximately twice the price of an existing manual logger but less than a more sophisticated Cello type logger.

Figure 22.2 details the current costs of the process:

Activity	Costs
Install	£20
Installation Check After Two Weeks	£20
Monthly Download * 3	£60
Removal	£20
Cost per logger location	£120
850	£102,000
Management prior to and following winter	£3,300
Total Cost/year	£105,300

Figure 22.2: Current Process Costs

c) Other Options Considered

- Replace all network validation loggers in line with the three year programme as recommended.
- Phase roll out over longer period to make use of existing manual loggers – This would result in not having useable items with no obvious us. But would limit the benefits highlighted above and result in have a two tiered process that could cause issues. Options for use of manual loggers can be discussed separately.
- Do nothing – This would result in no change to existing process and limit the benefits of Remote Monitoring and Control to one or two single points on the network.

22.3 Selection Criteria

To purchase and install ‘Fit and Forget’ Network Validation loggers over a three year period.

NGN has around 267 Low Pressure networks that it revalidates on a three yearly programme each network has a validation pressure recording points at strategic locations. These points currently capture

the data purely for Network Validation at a single point over the winter when at its most extreme conditions to ensure compliance with licence conditions.

New technology is being developed that would remove the need to visit these points to download the data. It will also remove the need to install and remove twice a year. By having these permanently fitted network analysis models can be used to model network under very different demand conditions based on actual pressures being experienced on a daily basis rather than theoretical conditions.

Pressures can be adjusted more accurately removing the need to estimate governor pressures during routine or non-routine operations. By having a large number of available monitoring points rather than one or two remote pressure management becomes proportionally more sophisticated. This would be a differentiator over self-learning profiling system as “whole network” pressure management becomes possible.

A19A-23: Buildings / Civils Rebuild and Refurbishment

23.1 Introduction

Every operational site within the network is impacted by Civils. There are over 3000 above ground installations (AGI's) in the network. These include:

- 23 Offtakes;
- 143 Above 7Bar PRI Sites;
- 2,595 Domestic Governors;
- 240 I&C Governors;
- 32 gasholder Sites;
- 2 High Pressure Bullet Sites;
- 25 PIG Trap Sites; and
- 48 Block Valve Sites.

These sites all contain equipment essential for the safe transportation of gas. Each site contains various civil structures required for support, protection and access to the gas equipment. Civils have been categorised into two areas:

- Buildings
- 'Other Civils' which comprise non-building or fence line Civils on site. For example, valve pits, hard standings, pipe supports, ductwork, roadways, drainage etc.

Figure 23.1: Examples of Poor Condition Buildings

Figure 23.2: Examples of Poor Condition Other Civils

a) Current Price Control Run Rates

NGN's average yearly investment in below 7Bar civil works is currently c.£1m. This includes work on below 7Bars PRIs and district governors and ranges from pipe supports modifications, replacement of doors and roofs, replacement of kiosks, upgrade of duct work etc. Within the current PCR investment has been almost exclusively targeted at below 7Bar assets and often involves the replacement of doors/ roofs or a replacement GRP kiosk installed where appropriate.

Over the last few decades NGN has adopted a strategy to repair and maintain above seven bar civil assets. Following several independent surveys undertaken by Advantica and Faithful and Gould and reports back from the field NGN now recognise the need to adopt a more proactive replacement/modification strategy. The key drivers behind this change in strategy are:

- Legislative compliance, DSEAR;
- Ageing assets with deteriorating condition;
- Asbestos on buildings;
- Noise reduction; and
- Safety and security.

23.2 RIIO-GD1 Investment Requirement

Within RIIO-GD1 NGN has proposed to invest £15.4m on civil based projects. 57% of this investment is identified for below 7Bar Civil works and is in line with current price control run rates. The remaining 43% will allow NGN to initiate a targeted above 7Barcivil programme as summarised in Figure 23.3 below.

Most of NGN's above seven bar site were uilt 40 to 50 years ago and as such are in a similar condition. NGN believe delivering the recommended civil programme will take account of economies of scale grouping these assets into efficient projects and ensuring the longevity of NGN's civil asset base. Considering the overall significance and range of civil aspects on every site, the network considers this to be highly conservative programme.

Civils	Total (£M)	Number of Upgrades
Civils – Buildings(Offtakes)	2.0	11
Civils – Other (Offtakes)	1.6	8
Civils – Buildings (PRI >7Bar)	1.0	40
Civils – Other (PRI >7Bar)	2.0	40
Below 7Bar civils	8.6	In line with current run rate
TOTAL	15.1	N/A

Figure 23.3:RIIO-GD1 Buildings & Civils Expenditure Summary

23.3 The Investment Journey

Criticality Assessment

The two categories for Civils on site, buildings and 'Other', have been classified as medium and low on the criticality index respectively. This is based on an average assessment of risk. Specifically buildings are classified as medium criticality as a result of the security impact and the protection they provide to the assets contained within them. Others have been categorised as low based on the perceived minimal impact to safety for operatives working on site.

It is worth noting that NGN does not consider applying a generic/average criticality across such a diverse range of assets as a true reflection of risk. As such as part of the networks ongoing asset health development NGN will be assessing criticality based on each individual asset characteristics. For

example, what is contained within each building, what is the area like where the PRI is situated i.e. high theft risk etc.

b) Health Assessment

Health assessment has been based on the following areas:

- Legislative compliance;
- Ageing assets with deteriorating condition;
- Asbestos on buildings identified on above 7Bar sites;
- Noise reduction; and
- Safety (particularly at above 7Bar sites, with valve pits, roadways and curbing).

Legislative compliance

When undertaking modifications to buildings and/or equipment within them, the building must be brought in line with current DSEAR legislation. This often requires removing roofs, to replace with explosion relief roofs, inserting new ventilation or replacement with modern GRP kiosks. Many of the buildings on NGN's sites need bringing up to standard and as a part of other projects i.e. where equipment within building s is being modified the building itself will require modification.

Ageing assets with deteriorating condition

Most of NGN's above seven bar site were built 40 to 50 years ago and as such are in a similar condition. NGN recognises the network has reached a tipping point in its approach to these assets and as such maintenance is no longer considered the best option. In many instances it is no longer possible to 'repair' these assets.

Asbestos on buildings identified on above 7Bar sites

NGN has several buildings on above seven bar PRIs containing asbestos as indicated on the networks asbestos register. Many of these buildings need modifications or the equipment within them needs upgrading and/or relocating. When undertaking work in these building the asbestos will become damaged and as such NGN will need specialist contractors to facilitate its safe removal. In the majority of cases the issue is so significant (for example asbestos E&I Kiosks) that a new building will need to be built and parallel equipment installed before the old building and equipment can be removed/demolished.

Noise reduction

Over time regulators have been upsized as a result of increased capacity requirements. In some cases following these upgrades the buildings housing the regulators no longer provide adequate sound proofing and noise levels have reached unacceptable levels. New buildings and/or modifications to existing buildings will be designed to allow the correct level of noise suppression and retrospective mitigation measures will be introduced such as padding and sound proof kiosks where appropriate.

Safety / security

Accesses on site and good condition of general site Civils is important to the safety of operatives working on the site. In addition in many cases Civils provide the main security measure for the site equipment for example buildings, valve covers, ductwork etc. Independent surveys have found that general Civils on sites are now falling to below acceptable levels.

Field based health evidence

In addition to the independent site surveys undertaken by faithful and Gould and previously Advantica NGN has multiple sources of field information which supports its appraisal of its current asset health assessment. NGN are also engaging on series of site surveys in 2012 to further define asset health and

allow it to establish a clear prioritisation methodology for this work. The methods used to assess health include:

Modus:

On a daily basis photos are uploaded to a server using the MODUS mobile phone technology. Real time photos of sites are can be used to support investment decisions. Kiosks in bad condition are identified as well as doors, roofs and pathways/ducting. Subsequently a number of larger buildings on PRIs and Offtakes have been identified for complete renewal.

VS02 Inspection:

All sites receive a visual inspection in line with the VS02 standard. It is a requirement of the Pressure Systems Regulations and is part of NGN's maintenance policy. This will highlight issues with corroded pipe stands on Offtakes and PRIs as well as aspects of Civils which directly affect the safe transportation of gas.

Independent surveys

NGN have had a number of sites assessed by construction consultants Faithful and Gould. This was intended as a sample of the sites across the network. Many of the sites were constructed around the same time and as such can be assumed to be in a similar condition.

Subject matter expert opinion

Consultation with operatives working on site daily and contractors help to build up a better picture of these assets. It is the opinion of the SME's that these assets are in need of intervention.

c) Network Risk

Following the criticality and asset health assessments undertaken by the NGN the asset health tables were populated for PRIs and Offtakes. Civils were a sub category of these two primary asset health categories. Civils works associated with district governors is not included within the asset health tables.

Offtakes

Civils on Offtakes have been considered to include buildings (one per site) and other Civils (roads, valve pits, ductwork, curbing etc.) at one per site. Therefore for the purposes of this report this gives a count of two civil assets per site.

Asset Health & Criticality – Current Condition

Asset categories		Criticality Index	Asset distribution based on estimated asset health index in current reporting year				
			Asset health index				
			HI1	HI2	HI3	HI4	HI5
17	NTS Offtakes	Low			21		
	(Civils)	Medium			23		
		High					
		Very High					

Asset Health and Criticality - Without Investment

Asset categories		Criticality Index	Asset distribution based on estimated remaining useful life at 31 March 2021				
			Asset health index				
			HI1	HI2	HI3	HI4	HI5
17	NTS Offtakes	Low			13	8	
	(Civils)	Medium			17		6
		High					
		Very High					

Investment on Offtakes will include 11 buildings (this is likely to be 6 sites) and, eight 'other Civils' on sites. Building upgrades are estimated at a unit cost of £200k per building; Cowpen Bewley and Elton are expected to cost £582K and £684K respectively. 'Other Civil Works' per site are estimated at a unit cost of £200K per site. Deterioration has been based on an assessment of current condition and assumptions on a profile of deterioration.

d) PRI's

There are 143 above 7Bar PRI sites. Civils on PRIs have been considered to include, buildings (one per site) and other Civils (roads, valve pits, ductwork, curbing etc.) at one per site. Therefore for the purposes of this report this gives a count of two civil assets per site.

Asset Health & Criticality - Current Condition

Asset categories		Criticality Index	Asset distribution based on estimated asset health index in current reporting year				
			Asset health index				
			HI1	HI2	HI3	HI4	HI5
18	PRI's above 7 bar	Low			143		
	Civils	Medium			143		
		High					
		Very High					

Asset Health 7Bar Criticality - Without Investment

Asset categories		Criticality Index	Asset distribution based on estimated remaining useful life at 31 March 2021				
			Asset health index				
			HI1	HI2	HI3	HI4	HI5
18	PRI's above 7 bar	Low			63	80	
	Civils	Medium			63	80	
		High					
		Very High					

Building upgrades are estimated at a unit cost of £25k per building and other civil works per site are estimated at a unit cost of £50k per site. Asset health tables indicate that 80 sites would need investment, however with more accurate data collection, we feel this figure is conservative. NGN intend to upgrade 40 buildings across PRIs and 28 'other' civils on sites.

NGN recognises that the asset health tables for civil works need more development but the network is very confident in its assessment of requirements for RIIO-GD1.

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NGN recognises that the asset health tables for civil works need more development but the network is very confident in its assessment of requirements for RIIO-GD1

e) Investment Options

Option One: Do Nothing

The network considers a 'do nothing' approach for the specific assets identified unacceptable. Buildings another Civils are now at a point where capital investment is required for legislative, safety, condition and security reasons as sited above.

Costs associated with any of the catastrophic failure mechanisms are very subjective and difficult to quantify. A simple CBA analysis for this type of equipment is not practical as the key driver is managing the risk of asset failure. This investment has been driven by the networks management of risk.

Option Two: Top Tier Approach

Investment to upgrade/replace buildings on 80 PRI sites and upgrade/replace 'other' Civils on 80 PRI sites. Also upgrade/replacement of all 'other' Civils and buildings on Offtakes.

There will be continued investment on smaller District Governors in line with the current price control period.

This would require £28m investment.

Option Three: Middle Tier Approach

Investment to upgrade/replace buildings on 40 PRI sites and upgrade/replace 'other' Civils on 40 PRI sites. Also upgrade/replacement of 11 buildings on Offtakes and 'other' Civils on eight Offtake sites.

There will be continued investment on smaller District Governors in line with the current price control period.

This would require £15.4m investment.

Option Four: Low Tier Approach

Investment to upgrade/replace buildings on 20 PRI sites and upgrade/replace 'other' Civils on 20 PRI sites. Also upgrade/replacement of eight buildings on Offtakes and 'other' Civils on four Offtake sites.

There will be continued investment on smaller District Governors in line with the current price control period.

This would require £13m investment.

f) Investment Decision

Measure	Option 1 (do Nothing)	Option 2 (Top Tier Approach)	Option 3 (Middle Tier Approach)	Option 4 (Low Tier Approach)
Recommended Asset Upgrades (taking into account deterioration throughout RIIO-GD1)	0	80 PRI sites ('Other' Civils and Buildings), All Offtakes. District Governors in line with current PCR	40 buildings on PRI sites, 40 'other' civils on PRI sites. 11 buildings on Offtakes and eight 'other' civils on Offtakes. District governors in line with current PCR	20 buildings on PRI sites, 20 'other' civils on PRI sites. eight buildings on Offtakes and four 'other' civils on Offtakes. District governors in line with current PCR
Financial	Ongoing increasing maintenance costs and potential indirect costs through theft and damage to toher equiement.	Total investment: £28m	Total Investment: £15.4m	Total investment: £13m
Safety	NGN's Health & Safety policy is reduce risk to as low as reasonably practible. Some areas need improving to achieve this. Legislative compliance requires safety upgrades. (DSEAR).			
Security of Supply	Slight increase in risk of loss of supply, particularly deteriorating pipe stands and housing which could impact the gas supply equipment	Security of supply maintained, with all civils on major sites improved to 'as new' condition	Security of supply maintained, with critical civils on major sites improved to 'as new' condition	Security of supply maintained at critical sites. Other sites monitored for deterioration. Failure can affect supply.
Environmental	N/A	N/A	N/A	N/A
Level of Risk	Reasonably High, increasing through RIIO-GD1.	Risk as low as possible.	Accpetable level of risk retained by network. Risk level reduced through RIIO-GD1.	Unacceptable level of risk retained by network, increasing through RIIO-GD1.
Comments	Not recommended – too much risk and would result in extra workload after RIIO-GD1. Potential breeches of legeslation and H&S implications.	Ideal solution for the network but not for the customer. The network also feels it could manage this level of risk throughout RIIO-GD1. High workload.	Satisfies customer and network with risk redcued, but at a cost which will not impact customer. Considered the optimum solution.	This is unacceptable from a safety and security aspect and would not allow legeslative upgrades to buildings to take place.
Decision	N/A	2	1	3

Figure 23.4: Investment decision for A19A-23: Buildings/Civils Rebuild and Refurbishment

Investment Decision: Option Three

The network believes that this is the best option for the customer and for the network. This option will allow the network to bring sites in line with legislation where applicable, provide critical updates to ensure safety and security of sites and will allow the removal and upgrade of critical equipment.

g) Offtakes

With Investment

Asset categories		Criticality Index	Asset distribution based on estimated asset health index in current reporting year				
			Remaining Useful Life Expected (50%)				
			HI1	HI2	HI3	HI4	HI5
18	PRI's above 7 bar	Low	8		13		
	Offtakes – Civils	Medium	11		22	5	
		High					
		Very High	16			5	

h) PRI's

With Investment

Asset categories		Criticality Index	Asset distribution based on estimated remaining useful life at 31 March 2011				
			Remaining Useful Life Expected (50%)				
			HI1	HI2	HI3	HI4	HI5
18	PRI's above 7 bar	Low	40		63	40	
	PRI's – Civils	Medium	40		63	40	
		High					
		Very High	90		11	42	

23.4 Selection Criteria

A selection criteria will be used to prioritise work. A combination of the condition of the asset, combined with the criticality of the site will be used to assign workloads . For example, analysis of the condition of the buildings on Offtakes is determined from surveys undertaken by NGN's Asset Health and Data department, this can be used by the Asset Risk Management team to prioritise the work.

Data gathered from Modus and Visual inspections will be used to support these decisions.

23.5 Innovation

NGN are committed to innovation and as part of this investment we are currently considering a range of alternative options that use alternative technologies to provide some or all of the pre-heating requirements on site. These include:

- Smart Water to deter entry to the site. We have contract negotiated with smart water to cover a number of our sites with security risks;
- Plastic pipe stands, to prevent corrosion spreading to the pipeline;

- Different manufacturers of GRP Kiosks to determine which can withstand increasingly hazardous weather; and
- Various types of ducting to prevent copper theft.

Offtake Location	Size	Buildings				Bund covers
		Kiosk	Small	Medium	Large	
Coldstream	S		1			
Humbleton	S		2			
Guyzance	S			2		
Saltwick	L			1		2
Corbridge	M			2		
Thrintoft	M		1		1	
Wetheral	M			1		2 (11m long)
Melkinthorpe	M			1		
Keld	S		1	2		
Bishop Auckland	NG LOCATION					4 (small rolling tent type)
Cowpen Bewley	L			2	1	
Little Burden	L		1	1		
Elton	L		2		2	
Tow Law	S		1			
Baldersby	M	1	1			
Pickering	L	1			1	4 (8m long)
Burley bank	S		1		1	
Pannal	L					2 (10m long)
Towton	L	1		1		5 (3 - 8m long, 2 - 6m long)
Asselby	L	1		2		
Rawcliffe	M	1	4			
Paull	NG LOCATION					2 (Large rolling tent type)
Ganstead	L	1	2			4 (2 - 12m long, 2 - 9m long)
Total		6	17	15	6	

Figure 23.5: Offtake buildings know to contain asbestos

A19A-24: Gas Treatment

24.1 The Specific Requirement throughout RIIO-GD1

Within RIIO, NGN plans to upgrade existing gas treatment plant and equipment and install new equipment to ensure the optimum level of MEG saturation levels and continued successful leakage reduction from the lead/yarn joints in the iron mains population. In addition the implementation of the Gasholder demolition strategy will require equipment to be relocated.

2009/10 prices £m	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	Total
Gas treatment	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.8

Figure 24.1: RIIO-GD1 Gas Treatment Expenditure

24.2 Justification for Investment

a) Current Price Control Run Rates

Gas conditioning treatment has proved an effective method of leakage control for over 40 years since the introduction of Natural Gas. However, since a large sections of networks are now PE, which does not require treatment, a wholesale review of conditioning is now required.

Monoethylene Glycol (MEG) units have remained in place for a considerable amount of time and their effectiveness on the network has reduced, developments and innovation in equipment our ability to better understand flows and dropout rates provide NGN with an opportunity to undertake a detailed review.

Consequence of Failure

These aging assets often fail or become ineffective the result is reduction of percentage MEG in the cast iron system leading to increased leakage and possible external PRE's.

Condition Assessment

- Monoethylene Glycol (MEG) has leakage reduction properties when saturation levels exceed 50% and the optimum average saturation level is deemed to be 40%;
- The aim would be to review how these levels are achieved, maintained or achievable. Given that these levels are or were achieved how effective are they in a mixed material network in reducing leakage?
- Would increased saturation levels actually reduce leakage? What has been the impact of long term low level saturation on lead yarn joint and were would it be economical to reseal joints;
- What would be the environmental benefits in using an alternative to MEG;
- Fixed conditionings are aging assets full assessment is required on maintenance costs and compliance with maintenance regimes. Consideration into what would be the implications of replacement, refurbishment, relocation and effectiveness of this equipment;
- Current maintenance costs are not fully understood to a sufficient level to undertake a full financial. A through financial assessment must be undertaken covering this and alternative approaches;
- PE installation has an impact on the flow of gas as does low demand levels resulting in "drop out" undertake a network analysis assessment on flow levels for existing equipment;
- Gas Conditioning currently attracts regulatory incentives investigation will take place into maximising effective gas treatment to ensure reduction in emissions while still achieving the incentive;
- Research condition of existing joints removed as part of mains replacement programme to assess saturation, leakage prevention and sealant effectiveness;

- Targeted mains spraying has undergone some significant develop over recent years and is no longer purely MEG based, more environmental friendly and less harmful to staff; and
- Delivery systems have also much improved over the past 20 years. Investigation is to take place on increasing the use of this technology as an alternative to wholesale MEG conditioning.

24.3 Cost Benefit Analysis

Requirements	Networks	Number Per Network	Unit Cost	Total Cost
Installation of new Fogger Units	30	2	5,500	330,000
Road Side Fogger Unit	30	1	7,000	210,000
Mobile Spray Unit		3	8,000	24,000
Move sample points	30	7	1,100	231,000
Total cost:				£795,000

Figure 24.2: Cost Benefit Analysis

Out of 265 Low Pressure Networks NGN propose only to assess around 30 of the leakiest networks that MEG can have a significant impact. These will be the larger network with significant CI lead yarn joints with a high population of larger diameter pipes. We also wish to deploy 3 mobile spray units to target small but leak hotspots around the whole network this will have an immediate impact on escapes and allow effective planned replacement.

- Security of supply to our customers;
- Safety, Reduced leakage;
- Reliability, effective management of aging mains; and
- Leakage reduction incentives.

24.4 Other Options Considered

Do Nothing

Cost effectiveness of current practice becomes less and impact of MEG becomes negligible leading to increased leakage.

24.5 Selection Criteria

Wholesale review will inform NGN on focused approach.

24.6 Innovation

As part of the Total Network Management approach a review will also take place on the use of new technology and the development of roadside units without the need for electricity supplies being need. We will also look at the most effective use of mobile units adopting new or innovative materials.

2	Gas Conditioning Study (MEG) – To optimize the use of Monoethylene Glycol (MEG) as a joint swellent on the netork and maximise the benefit that is achieved through the use of MEG	Apr 13/2 years	Environmental – reduce the amount of waste MEG disposed of annually by the Network. Optimising its use to reduce leakage and impact on environment. Safety – reduction in escapes. Efficiency Benefits – reduction in cost assoicaited with repairs.	Safety Asset Management Environment	£50,000	Suppliers of Equipment & Material, UK and Internationally

A19A-25: Site Security Rebuild and Refurbishment

25.1 Introduction

The network has a large number of sites spread over a large geographical area including both urban and rural locations. Due to this spread of assets, locations are under varying levels of threat from illegal activities in and around the locations. Should people succeed in breaching security measures they are at risk of injuring themselves, but also pose a risk to the public at large and a very real threat to the supply and control of the gas distribution system. With increased value of metals random and opportune break-in are increasing across all industries, to deter this, the business is continually investigating ways to stop or deter such attacks on our assets.

NGN has maintained its security equipment throughout PCR1 using existing industry standards this predominately focused on standard perimeter fencing. However in recent years the national focus on security has increased the concerns on gas infrastructure sites and subsequently we have received formal communications and advice from CPNI on the both the level of security measures and the type of equipment to install.

Pannal and Bishop Auckland Offtakes have been listed and recognised as a Category three locations by the Centre for Protection of National Infrastructure (CPNI) and as such fall under the remit of The Department for Energy and Climate Change (DECC) interest to improve security and deterrent to possible terrorist attack. Security Strategy for all sites is to reduce perimeter breaches and theft. This would include the installation of passive detection devices and surveillance equipment to site. This would need to be monitored and maintained.

2009/10 prices £m	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	Total
Site security	2.0	5.0	0.9	0.9	0.9	0.9	0.9	0.9	12.6

Figure 25.1: RIIO-GD1 Site Security Expenditure

a) CPNI locations

Following the national categorisation of all locations in the UK critical to National Infrastructure (CNI) NGN has two locations with the network designated as category three sites (Pannal and Bishop Auckland (Offtakes) Bishop Auckland is wholly contained within a higher category National Grid location so has no further requirements for additional work by NGN. Pannal is an NGN asset. As part of the CNI process, the CPNI visits the site annually. This visit has resulted in a recommendation to upgrade security and counter terrorism measures significantly, including the design and build of an Alarm Receiving Centre (ARC) to monitor site-specific alarms and threats.

b) CCTV

Discussions with police and security forces have indicated that the use of CCTV devices could decrease the risk of third party entry and theft from site. NGN has acknowledged that a more proactive and cost effective measure should be taken to reduce intrusion, theft and damage from its critical locations (Offtakes). This programme is aimed at fitting suitable devices to all of the Offtake locations across the network and assessing the impact with possibilities of continued roll out throughout other vulnerable locations after RIIO-GD1. This programme will utilise the capabilities of the ARC installation to monitor images from the CCTV system.


Figure 25.2: Fencing condition examples

c) Current Price Control Run Rates

NGN has been working over previous years to renew its perimeter fencing stock to current approved levels. As the fence lines have deteriorated due to repeated repairs and exposure to the elements, and as recognition of increased threat of damage and theft from locations. Policies and site requirements are reviewed and sites evaluated by operational staff (and security advisers if required).

25.2 RIIO-GD1 Investment Requirement

Within RIIO-GD1 NGN has proposed to invest £12.8m on security improvement projects. This includes the replacement/upgrade of the following:

No.	Description	Cost
1	Pannal Offtake in line with CNI requirements and including the alarm response centre:	£6.5m
2	Seven fences on Offtake sites unit cost £100k per fence	£0.7m
3	35 fences on above 7Bar PRI's, unit cost £50k per site	£1.7m
4	Below 7Bar PRIs and CCTV provision	£3.7m
Total:		£12.6m

Figure 25.3: Security Upgrades Summary

This expenditure will be phased in line with the following below;

Phasing	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21
Cat 3 DECC Requirement (Pannal offtake Site)	2.0	4.0						
Civils – fences (Offtakes)		0.1	0.1	0.10	0.10	0.10	0.10	0.10
Civils – fences (>7Bar PRI)		0.25	0.20	0.20	0.20	0.20	0.20	0.20
Civils – fences (<7Bar) and CCTV		0.25	0.60	0.60	0.60	0.60	0.60	0.60
Capex	2.0	5.0	0.9	0.9	0.9	0.9	0.9	0.9

Figure 25.4: RIIO-GD1 Security Upgrade Expenditure Brekadown

The Pannal CNI security upgrade project finance has been established based on the previous costs of upgrading a site of this size undertaken by National Grid. These costs break down against the following criteria:

Cat 3 DECC Requirement (Pannal Offtake Site)	Costs
Technical Design	£140,000
Civil Design	£160,000
Technical Construction	£2,100,000
Civil Construction	£3,100,000
ARC Design/Construction	£1,000,000
TOTAL	£6,500,000

Figure 25.5: Typical CNI Site Security Upgrade Cost

Only 30% of this investment is based on condition upgrades of existing fence lines. All other aspects of this investment are third part driven or influenced.

25.3 The Investment Journey

The predominant driver behind this investment is the CNI upgrade work and the CCTV work. Asset health only account for approximately 30%.

a) Criticality Assessment

Fencing on sites has been classified as very high on the criticality index. Fencing forms the primary boundary for security, failure of the fence line can lead to significant problems through danger to unauthorised individuals gaining access to site and loss of gas supply through damage, theft and misuse of operational equipment.

b) Health Assessment

Health assessments for this asset are based on inspection reports received from the field and subject matter expert assessment.

c) Ageing Assets with Deteriorating Condition

Many of the fence lines within the network are now at the end of their useful lives and are showing significant signs of deterioration. In addition due to the increased security threat being experienced by the network as a result of the current economic climate and price of metal many of the fences need to be upgraded to a high security specification in line with NGN's policy requirements and advise gain through discussions with external security experts.

The information gathered on fence health is predominantly through subject matter expert assessment supported by independent surveys and field based evidence. Field based evidence provided via NGN's MODUS system. This system provides daily real time photos transmitted via mobile phones which can be used to support investment decisions.

25.4 Network Risk

Following the criticality and asset health assessments undertaken by the NGN the asset health tables were populated for PRIs and Offtakes. Civils were a sub category of these two primary asset health categories. Fencing associated with belwo seven bar sites is not included within the asset health tables and investmetn shas been based on current run rates.

a) Offtakes

Current Condition

Asset categories		Criticality Index	Asset distribution based on estimated asset health index in current reporting year				
			Asset health index				
			HI1	HI2	HI3	HI4	HI5
18	Offtakes	Low					
	Offtakes – Civils	Medium					
		High					
		Very High	10			11	

Without Investment

Asset categories		Criticality Index	Asset distribution based on estimated remaining useful life at 31 March 2011				
			Remaining Useful Life Expected (50%)				
			HI1	HI2	HI3	HI4	HI5
18	Offtakes	Low					
	Offtakes – Civils	Medium					
		High					
		Very High	10			3	8

Deterioration rates have been based on subject matter expert assessment based on historical trends and current condition.

b) PRI's

Current Condition

Asset categories		Criticality Index	Asset distribution based on estimated asset health index in current reporting year				
			Asset health index				
			HI1	HI2	HI3	HI4	HI5
18	PRI's above 7Bar	Low					
	PRI's – Civils	Medium					
		High					
		Very High	50		51	42	

Without Investment

Asset categories		Criticality Index	Asset distribution based on estimated remaining useful life at 31 March 2011				
			Remaining Useful Life Expected (50%)				
			HI1	HI2	HI3	HI4	HI5
18	PRI's above 7Bar	Low					
	PRI's – Civils	Medium					
		High					
		Very High	50		11	47	35

Deterioration rates have been based on subject matter expert assessment based on historical trends and current condition.

c) Investment Options

Option One: Do Nothing

This would result in an unacceptable level of risk on the network and no reduction in intrusion, theft and damages and a possible increase entry by unauthorised persons. It would also mean non-conformance of recommendations from Government Security Services in relation to assets of CNI.

Option Two: Upgrade:

- 10 Offtake fences to ensure all are in the HI1 asset health bracket at the end of RIIO-GD1;
- Pannal CNI;
- 50 above 7Bar PRI fences;
- Increase the current below 7Bar run rate to upgrade a significant amount of fences to an enhanced standard; and
- Retain CCTV provision.

Investment cost: circa £17m

Option Three: Upgrade:

- Seven Offtake fences to ensure all are in the HI1 asset health bracket at the end of RIIO-GD1;
- Pannal CNI;
- 35 above 7Bar PRI fences;
- Retain the current below 7Bar run rate; and
- Retain CCTV povision.

Investment cost: circa £12.8m

Option Four: Upgrade:

- Three Offtake fences to ensure all are in the HI1 asset health bracket at the end of RIIO-GD1;
- 15 above 7Bar PRI fences;
- Retain the current below 7Bar run rate; and
- Retain CCTV povision.

Investment cost: circa £10m

d) Investment decision

Measure	Option 1 (Do Nothing)	Option 2	Option 3	Option 4
Recommended Asset Upgrades (taking into account deterioration throughout RIIO-GD1)	0	10 Offtakes, Panal CNI, 50 above 7Bar PRI's, increase below 7Bar run rate, retain CCTV provision	7 Offtakes, Panal CNI, 35 above 7Bar PRI's, retain below 7Bar run rate, retain CCTV provision	Three Offtakes, Panal CNI, 15 above 7Bar PRI's, increase below 7Bar run rate, retain CCTV provision
Financial		Total investment: £17m	Total Investment: £12.8	Total investment: £10m
Safety	If this investment is not adequate there are significant safety implication from insufficient security on site.			
Security of Supply	Significant increase to loss of supply through third party damage theft or interference.	Minimal potential to impact security of supply	Risk to security of supply manageable	Significant increase to loss of supply through third party damage theft or interference.
Environmental	N/A	N/A	N/A	N/A
Level of Risk	Increase theft and potential damage to equipment, non compliance with government CNI standard.	Low	Medium	High
Comments	Not recommended – too much risk and non compliance	Ideal solution for the network but not for the customer. The network also feels it could manage this level of risk throughout RIIO-GD1. High workload.	Risk can be managed to an acceptable level.	his is unacceptable from a safety and security aspect.
Decision	N/A	2	1	3

Figure 25.6: Investment decision A19A-25: Site Security Rebuild and Refurbishment

25.5 Investment Decision: Option Three

The network believes that this is the best option for the customer and for the network. This option will allow the network to ensure security of the sites are maintanced as weel as detering the increasing risk from theft and site breakins. It will also allow the network to undertake the CNI upgrade works.

a) Offtakes

With Investment

Asset categories		Criticality Index	Asset distribution based on estimated remaining useful life at 31 March 2011				
			Remaining Useful Life Expected (50%)				
			HI1	HI2	HI3	HI4	HI5
18	Offtakes	Low					
	Offtakes – Civils	Medium					
		High					
		Very High	18			3	

b) PRI's

With Investment

Asset categories		Criticality Index	Asset distribution based on estimated remaining useful life at 31 March 2011				
			Remaining Useful Life Expected (50%)				
			HI1	HI2	HI3	HI4	HI5
18	PRI's above 7 bar	Low					
	PRI's – Civils	Medium					
		High					
		Very High	85		11	47	

25.6 Selection Criteria

A selection criteria will be used to prioritise work. A combination of the condition of the asset, combined with the criticality of the site will be used to assign workloads. The network is currently undertaking site surveys on all it's above 7Bar sites to better define the asset condition. This will then be coupled with the individual site caracteristics. For example the are the sites is located in (vanaddlisum/theft risk), the criticality of the site (how many customers, the equipment on the site (Offtake vs PRI etc).

NGN currently has a rolling programme for fencing upgrades and it is envisaged that this process will enhance the current selection methodology.

25.7 Innovation

NGN are committed to innovation and as part of this investment the network will consider the latest most appropriate technology for fencing upgrades.

A19A-26: Alarm Management

26.1 The Specific Requirement throughout RIIO-GD1

Within the RIIO-GD1 period NGN proposes to replace the current alarm management software used in System Control and develop a new automated reporting application. All alarm settings will be reviewed to ensure they align to safe and efficient performance recommendations.

2009/10 prices £m	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	Total
Alarm Management	0.60	0.90	0.00	0.40	0.20	0.00	0.00	0.00	2.1

Figure 26.1: RIIO-GD1 Alarm Management Expenditure

26.2 Justification for Investment

a) Current Price Control Run Rates

During the transfer of control from National Grid Gas (NGG) to NGN System Control (NGNSC) an alarm settings review was carried out by a number of different individuals in Hinckley, both NGN and NGG staff. This resulted in a number of inconsistencies in the current alarm settings.

A number of bespoke legacy systems are in use to manage alarm settings and an offline alarm reporting tool has been developed in another different system to provide management information. Recently, the legacy database has been reviewed by internal audit who have recommended its' replacement. It has also been observed that the reporting tool is extremely time consuming and at risk of error due to significant manual input required to produce the reports.

The fragmented nature of the current systems falls outside industry best practice as documented by the Engineering Equipment and Materials Users' Association (EEMUA). NGNSC have developed Alarm Management Framework documentation which follows the EEMUA guidelines and identified the need for an integrated approach.

Consequence of Failure

It is important that all alarms received in System Control are firstly, necessary at all, then have the appropriate level of importance and finally are responded to correctly. A slam shut alarm at a national Offtake is certainly necessary, will have a high importance, compared with other alarms generated at the same time and will engender an more immediate response by all parties, than a gasholder site ambient temperature low alarm, which may not be necessary at all.

A well-managed, correctly designed, alarm management system provides online operational information on the overall health and performance of the asset. Offline analysis can also identify multiple failures of critical equipment, leading to improved and timely investment decisions.

One of the current alarm reports identifies the top 20 telemetry points, by type, which can assist with a decision to prioritise resources to reduce alarms, as well as potentially identify reoccurring faults on critical equipment. An example of the report is shown below.

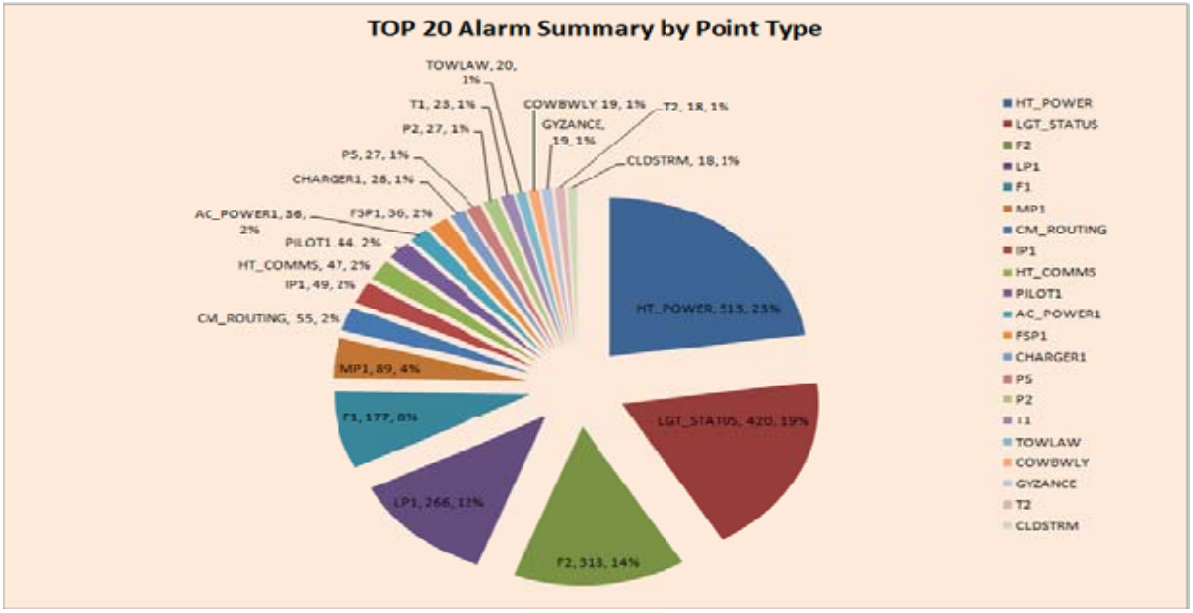

Figure 26.2: Top 20 alarm summary by point type

Condition Assessment

Alarms can be an indication of deteriorating asset performance, as demonstrated within our Pre-heater Asset Health program and can occur before an equipment fault is manifest. The key benefits of good alarm management are that it leads to a pro-active approach to maintenance planning, resulting in efficient investment decisions.

Another key benefit is the reduction in the number of alarms being presented to the operator at any one time. The number of alarms presented to an operator is the subject of significant industry debate following the impact of poor alarm management in recent serious incidents in the oil and gas industry.

As a result of the work carried out to date by NGNSC, the number of alarms presented and the alarms being repeatedly generated by faults of the assets, has reduced but further work is necessary to maintain and improve this position. Alarm activity, shown on the right hand axis in the chart below, rose in 2011 due to the implementation of the new System Control software during June and July, but the trend is now returning to 2010 levels.

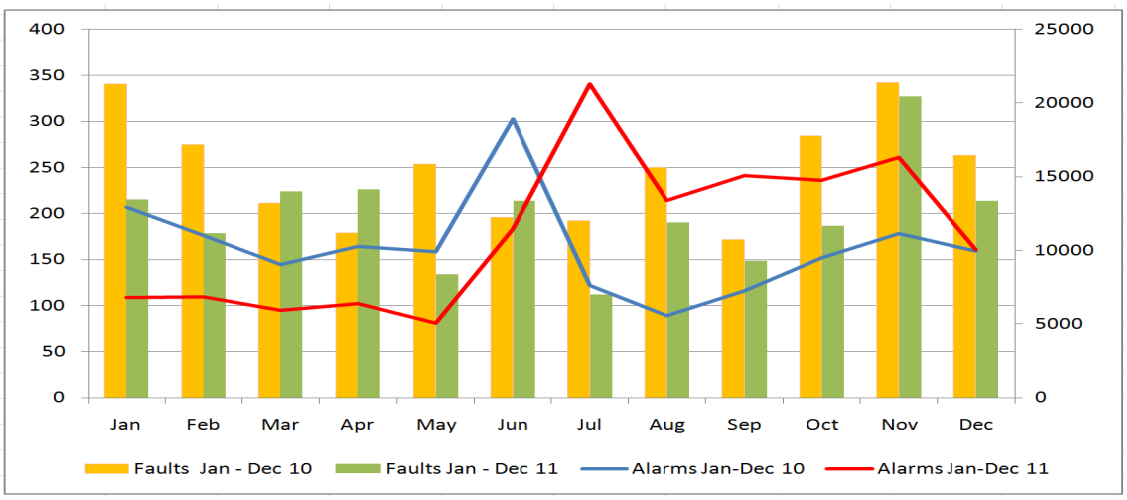

Figure 26.3: Alarm Activity 2010-2011

The focus is now also beginning to be directed to system performance alarms and is expected to include alarms indicating excursions outside commercial incentives in the future. This is leading to the need for a complete review and further investigation into the classification and prioritisation of alarms to achieve optimum performance of the network and an improved alarm management application to manage this workload.

The current software tools used to manage the alarm setting process and report on received alarms are not integrated within the operational control system. Management information is currently produced manually and outside the existing control software. It is extremely time consuming to produce this and other management data. It is therefore necessary to develop and build an improved, integrated alarm management application.

The knowledge of the processes is within System Control but the development of integrated software within the existing control system program will mean the engagement of a third party software developer.

The project is expected to be delivered in a phased manner and takes account of a planned telemetry review, resulting in an expenditure profile shown below. Budget costs have been compiled using third party contract rates from recent projects associated with SOMSA Exit.

26.3 Cost Benefit Analysis

The procedure of selecting which data points to alarm and the then setting appropriate alarms drives the activity by control room. Each alarm has a specific response which is currently designed to promote action by operational staff. This may be a call out to attend a fault or provide additional information which supports the case to replace obsolete equipment in a timely manner.

The correct alarm processes and procedures leads to the efficient management of both resources and finance. Unnecessary call outs and investment expenditure in equipment at the wrong time, both have a negative impact on the business which good alarm management can mitigate.

It is also becoming evident that the control software will be important in the emerging commercial environment in which System Control will play a significant role. The selection of new commercial data points and the choice of correct settings to provide information to operators will become increasingly important. It is important that users have the correct management tools to mitigate the potentially significant commercial costs.

a) Other Options Considered

Continue to develop off line systems. This is discounted because of the inherent risk of data corruption while manually extracting data from the online system and importing into an off-line product. Significantly, it would not provide any real time commercial information.

Do Nothing:

This is discounted because of the reputational risk which would be in jeopardy with the HSE who expect to see industry best practice in alignment with EEMUA 191 and other industry documents.

26.4 Selection Criteria

Initial discussions have taken place with the developer of the existing operational control product SCX6 and also with the software developer who designed the business applications for NGNSC. It will be necessary to carry out a feasibility study to define the business requirements and produce a detailed design specification for the new alarm management software before selecting an suitable developer to complete the work.

26.5 Innovation

EEMUA have produced two guiding documents for alarm management, EEMUA 191 and 201, which are recognised as industry best practice by the HSE who wrote the forward to each publication. NGN are coorporate members of EEMUA and NGNSC are a member of the technical standards committee. This committee has reviewed EEMUA 191 and the latest edition includes specific guidelines for utility companies with disparate assets, rather than the traditional chemical process industry. The industry members of EEMUA make this organisation leading edge in the field of alarm management and novel proposals are discussed at organised events and training sessions at which NGN have presented material and taken part in discussion forums .

The alarm management policy should be used to develop alarms on the asset which inform the business, when the operation reaches the limits of normal performance. It is feasible that an alarm management application could autogenerate fault reports based on operator actions and issue a text or e-mail to responsible engineers and avoid duplication of effort and reduce errors. This innovation is in it's early stages but the importance of good alarm management is essential to continue with this development.

A19A-27: Project 12: Demand Management

27.1 The Specific Requirement throughout RIIO-GD1

Within the RIIO-GD1 period NGN proposes to replace the current Time to Fail software used in System Control and develop a new integrated application. The primary driver is the safe operation of the network. However the application will also consider the cost implications of new commercial regimes of Interruption and Exit.

2009/10 prices £m	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	Total
Demand Management	0.60	0.90	0.00	0.40	0.20	0.00	0.00	0.00	2.1

Figure 27.1: RIIO-GD1 Demand Management Expenditure

27.2 Justification for Investment

a) Current Price Control Run Rates

The current application used by System Control is product previously used by National Grid Gas (NGG) in their Control Room. The product was adopted by NGN System Control (NGNSC) to reduce business risk during SOMSA Exit and no allowance was made to facilitate development or replacement of the Time to Fail application in the current PCR.

Consequence of Failure

The management of reduction in gas demand, either as 1:20 peak day demand is approached, or under a major local or national emergency, is carried out by System Control. The existing offline programme, Time to Fail, uses a data file from the control system to forecast when, during the day, there would be insufficient gas to meet forecasted demand. The operator can then calculate the gas volume reduction required to ensure the safe operation of the gas network.

Previously the network had a large number of interruptible contracts which could be used to initially manage this demand reduction. Interruption Reform was introduced in October 2011 whereby many of the existing sites with interruptible contracts became firm supplies and a significant amount of interruptible gas volume, previously used at the outset to manage demand reduction, was effectively lost from that management process.

NGN have procured interruptible contracts at locations of LDZ capacity constraint who can be contacted and asked to stop using gas. However, these are geographically dispersed and few in number and unlikely to provide sufficient reduction during either high demand or emergency conditions. Consequently, firm load shedding is required at a much earlier stage in the demand reduction process. The significance of the management of demand reduction under these circumstances will therefore be heightened because of Interruption Reform and relying on the existing off line Time to Fail spreadsheet platform is not acceptable.

Condition Assessment

The Time to Fail product is 15 years old and is in need of a complete upgrade. It was designed and developed by National Grid Gas (NGG) and it has not been possible to receive any supporting documentation for the offline, unsupported, excel spreadsheets. A new integrated application is required on a supported platform and will need to take into account the new commercial aspects of interruption and exit reform. The reputational impact to NGN of unnecessary interruption and preventable firm load shedding needs to be managed, also taking account of the isolation and restoration costs, necessary to

maintain a safe system. Decisions taken must be based on accurate information and be able to stand scrutiny by external parties.

27.3 Cost Benefit Analysis

The network only has a small number of interruptible contracts. However the cost of interruption can still be significant. One contract has an associated cost of £175K per day. The total contract risk to the business is £3.8M. Therefore when calling for interruption the network has to be confident in that decision and have the management information available to defend the decision if required to do so.

Firm load shedding is, because of the Interruption Reform, by definition more likely. It is important to recognise that it is those companies which were interruptible before the reform, that NGN will be contacting to stop using gas, under the firm load shedding process. These companies have paid significant sums of money to convert to a firm supply and consequently the decision to firm load shed has to be one made with business confidence. The reputational cost of a wrong decision will be significant.

a) Other Options Considered

Enhance the existing product. The current Time to Fail is a legacy spreadsheet developed by a now dispersed team within National Grid. Documentation is not available to understand the functionality of the programme and it is unclear whether suitable enhancements could be developed. This option is therefore discounted.

Do Nothing:

Discounted because the existing spreadsheet is not fit for purpose and excludes commercial impacts. It exists as an unsupported programme outside the operational control software.

27.4 Selection Criteria

It will be necessary to carry out a feasibility study to define the business requirements and produce a detailed design specification for the new Time to Fail Application before selecting a suitable developer to complete the work.

27.5 Innovation

The new integrated application will improve System Control's effectiveness in managing demand reduction by providing a decision support tool to mitigate the cost of unnecessary interruption and by minimising the need for firm load shedding. Including the application within the operational software is something new to the management of demand reduction and by using online data decisions can be taken with greater clarity, improving overall efficiency.

A19A-28: Offtake Reform

28.1 The Specific Requirement throughout RIIO-GD1

Within the RIIO-GD1 period NGN proposes to develop the existing control software to provide an application to manage the compliance and commercial implications of Offtake Reform.

2009/10 prices £m	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	Total
Offtake reform	0.60	0.90	0.00	0.40	0.20	0.00	0.00	0.00	2.1

Figure 28.1: RIIO-GD1 Offtake Reform Expenditure

28.2 Justification for Investment

The procedures and control software applications used in System Control are currently designed to ensure operational safety and efficiently. The business applications developed as part of SOMSA Exit maintained that position but did not take into account the new compliance and commercial implications of the Offtake Reform, Flat and Flex Capacity arrangements.

Revisions to Section I and J of the Uniform Network Code now document the commercial relationship between NGN and National Grid Gas with regard to the exchange of information and agreed operational parameters. These specifically relate to NGN's management of gas offtaken from the National System. The new application is required to manage these obligations.

a) Current Price Control Run Rates

No allowance was made to facilitate development of the above applications in the current PCR.

Consequence of Failure

Each year NGN System Control (NGNSC) negotiate to receive capacity, flows and pressures from NGG, to meet forecasted LDZ demands and on a daily basis inform NGG, by way of Offtake Profile Notifications (OPN), how they intend to physically take the gas through each offtake. There are agreed incentive rules about both the content and the timings of each OPN submitted to NGG and not operating in accordance with these rules is viewed as non-compliance and reported to Ofgem.

In addition, the commercial aspect of this relationship involves the daily charges to be imposed for excursions above the agreed quantities of two products. Flat Capacity which is the daily quantity and Flex capacity which is the variation from the flat volume up to 22:00hrs in any one day.

The charges for NTS Exit (Flat) are known and will be in place in October 2012. NGNSC have calculated the impact to the business, if the charges had been in place over the last two years of operation. The results are shown in the financial analysis section of the document.

The charges for NTS Exit (Flex) are as yet unknown but expected to be introduced within the PCR period.

To comply with Sections I and J of the UNC, and mitigate the cost of overrun charges proposed by Offtake Reform, it is necessary to develop the existing System Control functionality.

Condition Assessment

To fully understand the implications of these new commercial arrangements it will be necessary to involve a 3rd party developer.

Budget costs have been compiled using third party contract rates from recent projects associated with SOMSA Exit. The phasing is planned to take into account the introduction of NTS Exit (Flex) charges.

This will ensure a complete solution to the Network Code obligations and commercial impact on the NGN business.

28.3 Cost Benefit Analysis

Any Overruns in NTS Exit (Flat) bookings will be charged based on the highest of the following prices:

- 8 * highest price paid in any of the release mechanisms at that Exit Point;
- 8 * highest reserve price at that Exit Point; and
- 1.1 * the highest price paid for Exit Capacity through an Exit Capacity Management Action.

Recent analysis of historical date has indicated that the following charges would have been incurred by NGN, if the proposed Offtake Reform charges had been in place.

- 2009/10 - £2.2M;
- 2010/11 - £0.9M.

a) Other Options Considered

Develop offline solutions outside the existing control software. This has been discounted due to lack of in-house software design capability and an expectation from recent discussion with the HSE that they wish to see integrated system with a consistent user interface. This is the preferred best practice as described in the industry guideline EMMUA 201.

Do Nothing

Discounted because of the cost risk to the incurring overrun charges which could be significant to the business.

28.4 Selection Criteria

It will be necessary to carry out a feasibility study to define the business requirements and produce a detailed design specification for the new application before selecting a suitable developer to complete the work.

28.5 Innovation

It is envisaged that this application will inform the operator to the likelihood of a flat capacity overrun and the consequential charge to the business. With this information the operational strategy for the day can be changed to avoid the cost impact. Currently NGNSC carry out after the day analysis of Offtake performance against agreed Flat and Flex quantities, but the new application will provide the information allowing a proactive intervention to moderate the daily operational strategy.

A19A-29: Telemetry & Hilltop Upgrades

29.1 The Specific Requirement throughout RIIO-GD1

Telemetry is used on 148 above 7Bar sites to provide key information to System Control, allowing management of gas flows and monitoring of the network for faults.

There are two main areas of the telemetry system (not including System Control), the site "Telemetry Outstation" and the "Communications System".

The Site Telemetry Outstation is obsolete but considered quite reliable, the outstation is a critical component and we must be able to demonstrate long term viability, it is proposed to replace all the outstations on these sites which will free up spare units which will then be used to support the outstations on the below 7Bar network to ensure NGN has a long term viable structured replacement philosophy.

The Communication system links the site outstation to NGN System Control and utilises UHF radio links to "Hilltop" hubs or satellite. The UHF scanning system is 30 years old and currently serves its purpose but significant changes have evolved with communication systems over this time and it is proposed to review the existing communications system to see if a smarter system could be introduced to utilise the latest technologies.

The Telemetry Outstation and Communications investment required is shown in Asset Health 22 which sets out our overall forecasts for 'Telemetry & Control (above 7Bar)' and shows how the investment is broken down over the RIIO-GD1 period:

2009/10 Prices £m	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21
E&I Comms	0.05	0.05	0.037	0.037	0	0	0	0
E&I Outstations	0	0	0.15	0.14	0.15	0.15	0	0
TOTAL	0.05	0.05	0.187	0.177	0.15	0.15		

Figure 29.1: RIIO-GD1 Telemetry & Hilltop Upgrade Expenditure

a) Current Run Rates

All Electronic equipment becomes obsolete as components stop being manufactured and no direct replacement is available. The Ulysses outstation was a bespoke system and is now not supported, there are a small number of different suppliers of new equipment on the market. The outstation is quite reliable but there are small number of failures each year, it is proposed to replace all above 7Bar sites so a large stock of spares can be kept to support below 7Bar sites well beyond the next regulatory period, while ensuring the more critical sites utilise a supported current product.

The hilltop communication system utilises very old radio communications equipment which is becoming more difficult to support, this equipment will need replacing but the intention is to completely review the existing system and look at new technologies to replace it.

29.2 Justification for Investment

NGN must be able to monitor and control gas distribution through System Control these elements are key to this, by ensuring NGN has a structured philosophy to ensure these key assets are managed in the long term to comply with our licence obligations and ensure security of supply, site safety and shipper confidence.

Consequence of Failure

Failure of a telemetry outstation can lead to gas supply issues and safety concerns, the Offtake data is critical to allow System Control to manage the networks flows, pressure and storage, failure of an

outstation leads to no site data being available, faults not being detected and requiring site visits, remote monitoring of the odorant injection is critical safety information which would be lost.

Condition Assessment

All the assets are of known age and condition, the assessment of useable spares, manufacturers support has been done by suitable subject matter experts in determining the proposed program.

Asset Health Current Year

Asset categories		Criticality Index	Asset distribution based on estimated asset health index at 31 March 2021				
			Asset Health Index				
			Expected (50%)				
			HI1	HI2	HI3	HI4	HI5
22	Telemetry & Control	Low		125			
	E&I Telemetry comms	Medium		23			
		High					
		Very High					

Asset categories		Criticality Index	Asset distribution based on estimated asset health index in current reporting year				
			Asset Health Index				
			Expected (50%)				
			HI1	HI2	HI3	HI4	HI5
22	Telemetry & Control	Low				125	
	Outstations	Medium				23	
		High					
		Very High					

29.3 Cost Benefit Analysis

The equipment is obsolete and considered critical to operate the Network safely, opportunity are now to be considered to utilise new technologies and ensure that these assets are replaced in a structured program to mitigate risks.

The benefits/outputs of investing in these assets are as follows:

- Customer – Security of supply;
- Environmental – NA;
- Safety – Security of supply, safe site equipment; and
- Compliance – Compliance with licence obligations and GSMR.

a) Other Options Considered

Do Nothing:

The option to do nothing is not viable option, this equipment will fail at some point and NGN must be able to demonstrate plans to keep the systems operational.

Long Term Phased Implementation

Phased implementation over a longer period has been considered, but discounted as the systems need to be upgraded all together, though spares will be made available for below 7Bar sites to ensure there long term viability without any cost.

Asset Health and Criticality – With Investment

Asset categories		Criticality Index	Asset distribution based on estimated asset health index at 31 March 2021				
			Asset Health Index				
			Expected (50%)				
			HI1	HI2	HI3	HI4	HI5
22	Telemetry & Control	Low	125				
	E&I Telemetry comms	Medium	23				
		High					
		Very High					

Asset categories		Criticality Index	Asset distribution based on estimated asset health index in current reporting year				
			Asset Health Index				
			Expected (50%)				
			HI1	HI2	HI3	HI4	HI5
22	Telemetry & Control	Low	125				
	Outstations	Medium	23				
		High					
		Very High					

Asset Health and Criticality - Without Investment

Asset categories		Criticality Index	Asset distribution based on estimated asset health index at 31 March 2021				
			Asset Health Index				
			Expected (50%)				
			HI1	HI2	HI3	HI4	HI5
22	Telemetry & Control	Low			125		
	E&I Telemetry comms	Medium			23		
		High					
		Very High					

Asset categories		Criticality Index	Asset distribution based on estimated asset health index in current reporting year				
			Asset Health Index				
			Expected (50%)				
			HI1	HI2	HI3	HI4	HI5
22	Telemetry & Control	Low					125
	Outstations	Medium					23
		High					
		Very High					

29.4 Selection Criteria

The replacement of the equipment has been phased based on an intial system review/design report to obtain the best long term solution and identify the best fit equipment.

29.5 Innovation

This is a very specialist market all available communications systems/strategy's will be reviewed to come up with the most cost effective solution.

A19A-30: C28: Plant and Equipment

30.1 The Specific Requirement throughout RIIO-GD1

Plant and equipment will typically include those mobile assets and tools used to support operational activities, and include water pumps, pressure gauges, hand tools, flow stopping equipment, and metering gauges, etc.

The investment identified is £600,000 per year over the period to replace items identified as other Capex.

£m 2009/10 prices	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	Total
Plant and equipment	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	4.8

Figure 30: RIIO-GD1 Plant & Equipment Expenditure

30.2 Justification for Investment

In order to maintain the network in a fit for purpose condition, items of plant not directly associated with the gas supply system will be required to be replaced as they wear out or break down. These items will typically include mobile assets and tools used to support operational activities.

This category of equipment covers all aspects of the network's activities in running a modern gas distribution network, and includes Installation, Operation, Emergency, Repair and Maintenance activities. It does not include the major items of operational plant on the network, but rather the tools and equipment used by the operatives on the network, and any related items to assist them in their tasks. Typically this equipment would include hand tools such as may be found in a craftsman's possession, and associated items of plant to enable them to carry out work safely on the network, such as flow stopping equipment, joint fusion equipment, pressure gauges, specialist maintenance equipment for regulator maintenance, as well as some items to monitor equipment performance. These tools do require replacement on a regular basis as they become worn or damaged in use, and when beyond economical repair, they are replaced. As well as this the network has recently embarked on a process of recruiting Apprentices over the coming years. As these Apprentices become qualified, they will require sets of tools, and equipment, to enable them to carry out their duties in the various functions where they will be employed.

New technologies and ways of working often involve investment in new plant and equipment as well as replacement through wear and tear.

a) Current Price Control Run Rates

To suitably assess the amount of investment required for this sector we reviewed spends in 2009, 2010 & 2011 to identify an accurate 2012 figure:

Year	Total Spend
2009	£338,788.00
2010	£273,809.00
2011	£350,000.00
2012	£660,000 (Budget)

Figure 30.1: GDPCR1 Plant & Equipment Expenditure

Based on the historical data provided, the expenditure on replacement of plant & equipment as described in the previous section, once they are past economical repair, is the order of £600K per annum.

This increase to circa £600,000 budget each year during RIIO-GD1 is because of the following reasons:

- Recent apprentice intake program therefore all will require to be fully equipped once trained;
- Replace obsolete equipment within the current workforce; and
- Higher specification equipment required due to more Innovative working methods.

Consequence of Failure

If an item fails, then it could mean that it is unavailable for use, and may prolong jobs unnecessarily whilst a replacement is sought. If one fails in service, this could result in leakage or an emergency procedure having to be put in place. For non-gas items, failures usually result in the item not being available and jobs may have to be rescheduled once a replacement is available. In some cases, failure of items of plant may result in injury to operatives. The network does not generally carry a stock of spare items for use.

Condition Assessment

These assets are inspected as part of a maintenance regime, and repaired where economically viable. However, all assets will require replacement at some point, to prevent failures in service, and be cost effective in their use.

30.3 Cost Benefit Analysis

The cost benefit will be assessing the criticality of the item to be available when needed, and the costs of repair versus costs of replacment. Also, the option of hiring equipment will be considered when doing any “one-off” maintenance or installation work.

a) Resources and Purchasing

Purchasing will be via the Procurement section using only approved suppliers. Any training will be carried out by individual suppliers owing to the numbers of certain items purchased, and the need for specialist training on items of plant and equipment to ensure its safe and efficient use in the field by the operatives..

Do Nothing:

As indicated above, assets will eventually fail, even when maintained at a high level. If they are not replaced, then this will result in jobs being cancelled and tools and equipment not being available when needed. For this reason, then a do nothing option is considered as not acceptable and does not demonstrate value for money for our customers.

30.4 Innovation

New tools and improved ways of working are always being considered by NGN as part of their innovation process. In some instances, plant may be replaced where it is found to be more economical to do so, and new techniques have been introduced to support the drive to higher cost efficiencies.

Data capture in the field with PDA’s and mobile technology is at the very forefront of our field work and is seen as a way of getting data back to support office as quick as possible. IT equipment does tend to become outdated quicker than mechanical or legacy systems that it replaces, and requires update and replacement of items to enable technology to keep pace with developments.

A19A-31: Auxiliary Equipment

31.1 The Specific Requirement throughout RIIO-GD1

Throughout the RIIO-GD1 period, NGN will need to invest in various protective measures of its distribution network consisting of mains >2Bar (Intermediate Pipelines) which are predominately Steel and require ongoing upgrading of Cathodic Protection (CP) systems to ensure that these assets continue to be fit for purpose.

Coatings need to be maintained and improved to ensure that they protect the asset whether this is below ground coating or above ground paint systems, to ensure that the CP remains effective in resistance to corrosion. Where we have CP systems installed then remote monitoring systems will be applied where beneficial.

Pipe systems are supported above ground by pipe stands and these are exposed to the elements and require attention to ensure that they move when required and to ensure that they do not hold water and become corrosion traps.

Where different materials are in direct contact, we need to ensure electrical isolation through Isolation joints or kits and where isolation is not possible for safety reasons, we need to ensure CP insulators are fitted and effective.

Anticipated spend over the RIIO-GD1 period is:

£m 2009/10 prices	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	Total
Auxillary equipment	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	2.1

Figure 31.1: RIIO-GD1 Auxiliary Equipment Expenditure

31.2 Justification for Investment

To ensure a high level of safety and reliability in operation, it is essential that buried steel pipework associated with the distribution of natural gas is designed, installed and commissioned to withstand the potentially harmful effects of corrosion.

NGN philosophy for this is to apply good quality protective coatings, backed up by effective Cathodic Protection (CP) systems.

As coatings age they deteriorate thus the protective measures such as CP systems and equipment's life is reduced as CP current increases to protect the coatings. The ongoing investment cycle increases as assets age.

Pipe stands corrode and become water traps under the pipe and become corrosion hot spots. Above ground pipe open to the elements requires regular paint maintenance.

Electrical legislation requires equal potential bonding between metals and this drains the CP system so isolation and decouplers need to be fitted where appropriate.

Due to ongoing investment in this asset category these assets are in a good and serviceable condition. Our current assessment of > 2Bar mains is shown below.

Asset Categories		Criticality Index	Asset distribution based on estimated asset health index at 31 March 2021				
			Asset Health Index				
			HI1	HI2	HI3	HI4	HI5
11	Mains above 2Bar	Low	0	0	0	0	0
		Medium	0	0	0	0	0
		High	132	283	0	0	0
		Very High	75	187	0	0	0

Consequence of Failure

These assets usually fail as a leak. The consequences of which can be:

- Loss of life;
- Damage to property; and
- Disruption to life.

Deterioration

Without effective CP, steel systems will corrode. Coatings need to be maintained in order to have effective CP and keep Current Outputs at acceptable levels.

TR's and anodes need replacing as they end their life and electrical isolation from other metals/materials needs to be maintained and monitored to ensure their effectiveness.

Asset Health and Criticality - With Investment

Asset categories		Criticality Index	Asset distribution based on estimated asset health index at 31 March 2017					Asset distribution based on estimated remaining useful life at 31 March 2021				
			Asset health index					Remaining useful life				
			Expected (50%)					Expected (50%)				
			HI1	HI2	HI3	HI4	HI5	HI1	HI2	HI3	HI4	HI5
11	Distribution Mains > 2Bar	Low										
		Medium										
		High	132	283				132	283			
		Very High	75	187				75	187			

With investment over the RIIO-GD1 period the steel mains population will remain within the HI2 category.

Asset Health and Criticality - Without Investment

Asset categories		Criticality Index	Asset distribution based on estimated asset health index at 31 March 2017					Asset distribution based on estimated remaining useful life at 31 March 2021				
			Asset health index					Remaining useful life				
			Expected (50%)					Expected (50%)				
			HI1	HI2	HI3	HI4	HI5	HI1	HI2	HI3	HI4	HI5
11	Distribution Mains > 2Bar	Low										
		Medium										
		High	132		260		23	132			243	40
		Very High	75		172		15	75			161	26

Condition Assessment

Steel pipeline systems are monitored for effective CP to ensure compliance with Policies & Procedures. CP database store and report on non-compliance, from this data, we can assess the condition of these assets.

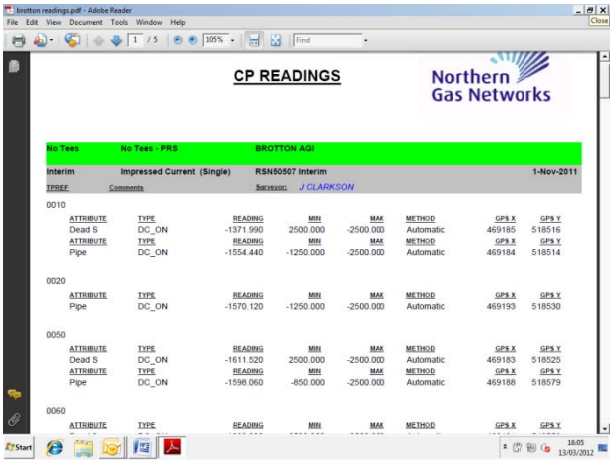

Figure 31.2: CP monitoring Database

When these assets fail, an exception report is produced within the database. The data is analysed to produce effective maintenance and monitoring regimes. Often early detection and simple action will save expensive work or replacemnt at a later date.

Paint systems, coating faults and pipe stands are picked up during inspections and audits and fault data is used to assess future maintenance requirements.

Figure 31.3: Typical seized pipe stand

b) Other Options Considered

Do Nothing:

The Do Nothing option is not viable because without effective CP, steel systems will corrode and lead to pipeline failure resulting in:

- Loss of Supply;
- Loss of Life;
- Damage to Buildings & Property; and
- Non Compliance with regulation.

This is the reason for chosing the option above.

31.3 Innovation

NGN will deploy remote monitoring where a benefit is recognised. Remote monitoring of CP systems allow proactive monitoring enabling us to react instantly to faults as they occur, saving time and money which represents best value to the customer.

Remote monitoring reduces our Carbon Footprint as vast distances are driven by technicians to carry out manual monitoring of CP systems.

Safety is another factor as most of these test facilities are at road side locations leaving 'lone workers' more vulnerable to accidents.

Figure 31.4: Typical test post remote monitoring unit.

A19A-32: Land Remediation Statutory Liability / Risk Expenditure

32.1 History

Since the formation of NGN in 2005, NGN has taken a responsible, though principally reactive, approach to managing its land portfolio. To date we have been successful in managing the regulators expectations, avoiding statutory remediation and hence minimised expenditure.

32.2 Forecast

The most recent regulatory contact related to the NGN site at Penrith. This resulted in an intrusive site investigation being undertaken by the regulator. Results and decisions are awaited.

a) Current Formula Period

NGN forecast, during the remaining years of the current formula period, a further cost of £1 million will be incurred. This is in response to increased regulatory action and reflects a more proactive approach to managing the risk associated with the statutory liability of the contaminated land portfolio.

b) RIIO-GD1

Expenditure identified for RIIO-GD1 is £12.5 million.

The break-down of this expenditure consists of:

- £8.5m for the statutory remediation of high and medium/high risk environmentally sensitive sites;
- £2m for statutory remediation of any lower risk sites identified and 'forced' by the regulators;
- £1m for monitoring; and
- £1m for decommissioning/re-commissioning of plant associated with remediation projects.

Expenditure will be spread evenly across the formula period.

Year	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21
Expenditure	£1.5	£1.5	£1.5	£1.6	£1.6	£1.6	£1.6	£1.6

Figure 32.1: RIIO-GD1 Statutory Land Remediation Expenditure

A19A-33: Fuel Poor Forecasts

33.1 Summary

We have increased the number of fuel poor customers we will aim to connect to mains gas during the RIIO-GD1 period from 6,500 to 12,000. We have reduced the unit cost of connection based on our current actual costs rather than the maximum potential value of the fuel poor voucher. The net result of these changes is that our forecast costs remain largely unchanged at £14m.

a) November Business Plan Forecasts

When we prepared our November Business Plan submission there were a number of uncertainties surrounding our future poor work. These included changes to our primary partner and the underlying processes for identifying our one-off fuel poor customers, demand from social housing providers given the present economic climate and the future of various funding mechanisms used to support fuel poverty work.

As set out in our business plan in 2010 we commissioned a detailed survey from the Energy Audit Company which compared at a post code level and local authority level the incidence of fuel poverty and correlation with the presence of the gas network. The results of this survey (shown below) clearly demonstrated significantly higher instances of fuel poverty in areas without gas than areas with gas. One of the contributory factors is that gas clearly remains the cheapest source of heating for domestic premises.

Year	Households	In Fuel Poverty	%
"Off Gas" Areas	142,661	55,094	38.6
"Mixed Off/On Gas" Areas	247,103	65,668	26.6
"On Gas"	2,396,846	541,845	22.6
Overall	2,786,610	662,607	23.8

Figure 33.1: Fuel poor forecasts

This analysis showed a potential population of 120,000 fuel poor customers that could be considered for connection to gas mains and eligible for the fuel poor voucher to fund this connection. With the uncertainties that existed we took a conservative view that we would target connecting around 5% of this population during RIIO-GD1. We were also mindful of the overall costs of the scheme particularly in light of the approach we were taking to the forecast unit costs of connection.

Given the change to the price control treatment of fuel poor connections Capex we used the value of the fuel poor voucher to derive the unit cost of connection as this is the maximum amount NGN would be obliged to fund for each connection. This value significantly exceeds our current actual unit costs of connection for fuel poor customers. We took the view that as we were obligated to fund up to the voucher value, this was not in our direct control and therefore it was not appropriate for us to carry this risk. Any difference between our actual costs and the voucher value would be subjected to the IQI efficiency incentive and shared with customers.

b) Developments since November

Towards the end of 2011 we made changes to the delivery partner and processes for identifying eligible one-off fuel poor customers. As a result we have seen a significant increase in the volumes of such customers we have been able to connect. In addition, demand for community based schemes continues to expand geographically across parts of our area where we have never previously undertaken projects. As a result we are now forecasting that during the 2011/12 and 2012/13 we will connect 1,500 and

1,800 customers respectfully, up from our November forecasts of just over 1,200 for each of these two years.

We have also compared our November business plan to those of the other GDNs and noted that NGN forecast to connect the fewest amount of fuel poor customers of any GDN despite the fact that the North East has the highest proportion fuel poverty in England.

Whilst uncertainties remain amount the future of certain elements of government funded fuel poverty programmes it is clear this still remains an area of focus. Market intelligence from our fuel poor provider Community Energy Solutions and discussion with gas suppliers indicates there will continue to be strong demand under the scheme for the foreseeable future.

c) April 2012 Business Plan Forecasts

In light of these developments we have now increased our target from 5% to 10% of the potential population resulting in the forecast number of fuel poor customers to be connected in the RIIO-GD1 period increasing from 6,500 to 12,000. We are currently seeing an increase in demand for community schemes as the deadline for CESP funding approaches. This is reflected in our increased forecasts for 2011/12 and 2012/13. Going forward into the RIIO-GD1 period we are forecasting there will be a move towards more one-off connections and fewer community based programmes as a result of the ending of CERT and CESP.

The breakdown of this forecast workload is shown below:

No. of Fuel Poor Connections	11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	Total for RIIO-GD1
Community Based Connections	731	1024	350	350	350	350	350	350	350	350	2800
One Off Connections	668	738	1000	1000	1000	1000	1000	1000	1000	1000	8000
UIP/IGT Connections	168	100	150	150	150	150	150	150	150	150	1200
Total	1567	1862	1500	1500	1500	1500	1500	1500	1500	1500	12000

Figure 33.2: Fuel poor connections summary

To reduce the overall cost to customers of the programme we have reduced our average forecast unit cost of connection from £2,190 to £1,180 based on our actual costs of connection rather than the voucher value. For community based connections and UIP/IGT connections we forecast the unit cost will rise over time as more challenging schemes are undertaken and cost will move towards the voucher value. We don't expect the unit costs associated with one-offs will follow the same trajectory as physically these schemes involve far less onsite works and do not involve laying new gas mains.

We still remain concerned that any movement towards the voucher value above what we have forecast would not be fully recoverable by NGN and believe consideration should be given to not applying the IQI incentive rate to any overspend in this area if the sole reason was due to the eligibility of the schemes being undertaken for the full voucher value.