Engineering Justification Paper

EAP – Green billing for industry – Biomethane propane reduction and management

Version: Final

Date: December 2019

Classification: Highly Confidential

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2 Introduction

SGN currently has 35 connected biomethane plants operating throughout Scotland and Southern Gas Networks' footprint with a potential hourly injection rate of approximately 27k scm/h which is an annual equivalent energy value of 107,000 MWh per annum. Currently under the Gas (Calculation of Thermal Energy) Regulations 1996 (GCTER), SGN has in place a Letter of Direction from Ofgem for each biomethane injection point which provides direction to SGN to determine a calorific value (CV). This calorific value must be maintained in line with the flow weighted average CV (FWACV) for the Local Distribution Zone (LDZ) the biomethane plant injects gas into. To maintain the biomethane's CV so it does not fall 1 mega joule (MJ) below the FWACV the biomethane plant is required to blend propane gas into the biomethane to increase its energy content. The addition of propane to the biomethane is a cost to the biomethane producer and also displaces the volume of biomethane entering the network. Propane is also a non-renewable greenhouse gas with a substantially higher CO_2 emission rating than the equivalent volume of biomethane. This environment action plan (EAP) initiative looks to fund the role out of a trial propane reduction project at a biomethane site in our Scotland Network which will reduce the volume of propane being injected into the network and maximise the available volume of biomethane. The project looks to establish a propane management and reduction solution onto the SGN network at a specific biomethane site. By monitoring directional flow and energy content of the biomethane flowing to specific customers the aim of the project is to eliminate the requirement to blend propane into biomethane at times when the gas is flowing just to these specific supply points. The further area of the project addresses the billing aspect to ensure that the consumers are billed for both energy and transportation charges based on the lower energy content of the gas they receive. Recent stakeholder discussions on this subject have repeated previous concerns around both the costs associated with propane injection and the environmental impact of the gas on the ability for the UK to meet CO_2 reduction targets. This project is in direct response to these stakeholder concerns and may prove to be a quick and efficient method to address these concerns.

2.1 General Background

Following several stakeholder interactions from biomethane operators on SGN's network it has become increasingly clear that the requirement to blend propane into biogas to make biomethane is unpopular both from an environmental aspect and as a cost burden on the biomethane industry. On average a biomethane operator is required to blend up to 4% by volume of propane into biogas to manufacture biomethane gas. This process involves taking upgraded biogas which has had CO_2, O_2, H_2O, N and H_2S removed from its raw state and adding propane stored as LPG on site to the gas. This has the effect of increasing the biogas' energy content from circa 37MJ per cubic metre up to the required FWACV of the network, which varies between 39MJ per cubic metre up to 40MJ per cubic metre. The propane's CV is much higher than that of the biogas (between 93 and 95MJ per cubic metre) and therefore has the effect of increasing the blended biogas' energy content up to the required CV to maintain the FWACV of the LDZ. The resulting product 'biomethane' is therefore 4% by volume propane.

2.2 Site Specific Background

The workload associated with this investment pertains to a single site which has a potential volume injection rate of Commercial C Scm/h of biomethane of which currently approximately 140Scm/h consists of propane. The project focuses specifically on this biomethane site located in Girvan in Scotland however the potential for further deployment at specific sites exists across the SGN footprint. The biomethane site at Girvan currently injects into the 19barg SGN transmission network with two large industrial / commercial customers downstream of the injection point. The position on the network of the injection point determines that the biomethane can flow in one of two directions, either to the two industrial / commercial supply points or in the direction of the wider network. The two supply points in question are currently connected to the SGN network and total an exit capacity in excess of the biomethane's entry capacity total of Commercial C Scm/h. The two industrial / commercial supply points are process loads which require a constant gas supply and therefore provide a flat profile of gas consumption on the network, except in production shut down periods for planned maintenance. The biomethane plant itself has been live since December 2014 and utilises agricultural crops and waste distillery to produce biogas.

Figure 1 – Aerial view of Commercial Confid biomethane site and surrounding commercial supply points.

3 Equipment Summary

Between Southern and Scotland Local Distribution Zones (LDZ) SGN has a total of 27 connected biomethane entry points which are flowing biomethane onto the SGN network, all of which currently have propane blending equipment installed. The entry capacity associated with these 27 plants totals 27,069Scm/h or an annual equivalent of 237,124,440Scm of biomethane injection capacity. The annual volume of propane associated with this entry capacity is 9,484,977Scm or 4% of the total entry capacity volume. The energy associated with the propane element of the biomethane flow is 250GWh of energy at a CV of 95Mj per metre cubed. The potential displaced biomethane volume of 9,484,977 Scm would provide approximately 97GWh of energy if the volume of propane were not required.

The project would look to install equipment which is currently operating on the SGN network to measure gas quality (including energy content), flow volume and direction measurement in the network and assets to regulate the volume of propane injected into the network. A control system would measure these data inputs and control the injection of propane. These assets would comprise of Gas PT analysers located at strategic points on the network to measure the energy and gas quality aspects of the injected biomethane to determine the precise energy delivered to the downstream supply points. The flow metering would measure the volume and directional flow of the biomethane in the network to determine the flow of biomethane into the network which in turn would control the injection rate of the propane. The full equipment summary is currently subject to a design study which is being undertaken by Orbital to establish the precise design configuration and mode of operation.

4 Problem Statement

Reasons for managing and reducing propane injection at biomethane entry points.

The operational cost to biomethane operators of blending propane into biogas to produce biomethane is cost which is not directly recoverable from their business operation. The volume of propane required to increase the energy content of biogas up to the level to produce biomethane is approximately 4% by volume and costs the biomethane producer on average 4.65 pence per KWh, however this is variable depending on market conditions and the ability of the biomethane operator to achieve bulk purchase discounts.

The volume of propane injected into biogas to produce biomethane is separately metered and is a requirement of the government's Renewable Heat Incentive (RHI) tariff rules. The biomethane operator does not recover a subsidy element associated with this 4% volume of biomethane injected into the grid, although a market price of gas will be achieved for this volume of approximately 1.5 pence per KWh. Therefore, the introduction of propane into the biogas is wholly a loss making activity in its own right. In relation to the overall viability of the biomethane operation the requirement to blend propane into biogas can lead to the overall viability of the project being placed in jeopardy or certainly less likely to proceed from initial concept and financial due diligence.

The CO2 emissions associated with propane are also considerable higher than that calculated for biomethane, the equivalent rating of propane being 0.2303Kg / KWh compared to biomethane at 0.0002Kg / KWh (source Gov.uk Greenhouse Gas reporting – conversion factors 2019). This leads to two problems associated with utilising propane as an energy source to increase the CV of the biomethane. The first being the direct additional CO2 emissions associated with the burning of the propane by end consumers and also the displaced volume of biomethane not entering the grid taken up by the propane gas volume. Biomethane producers have considered the use of bio-propane to replace traditional supplies of fossil fuel propane, however the widespread availability of bio propane is currently limited and there is a small premium associated with the purchase of this fuel. The RHI subsidy would still not payable on the use of bio-propane and therefore would still be cost prohibitive to use.

The Gas (Calculation of thermal energy) Regulations 1996 (GCTER) requires the holder of the Letter of Direction (SGN) to provide for either declared values or a Flow Weighted Average Calorific Value (FWACV) methodology to be applied to calculate a CV for a charging area. The GCTER regulations allow the Networks to define the charging areas and method of allocating CV to the charging area, declared or FWACV. FWACV is calculated from daily calorific values, which are measured at the relevant inputs to and outputs from a particular charging zone, which in turn are based on individual determinations of calorific value made by gas transporters using instruments approved by Ofgem.

The location and manner of determination of calorific value is formally prescribed through Letters of Direction from Ofgem to the gas transporters. The Letter of Direction requires the use of instruments that are approved by Ofgem and this approval is formally given by Ofgem to the gas transporters through the use of a Letter of Approval. Ofgem has decided to allow flow weighted average calorific value to be used, but it was capped to a maximum of 1 MJ/m3 above the lowest calorific value of gas being transported in the area. The agreed, and current, way of applying FWACV is as that GDNs have to use the lower of either the flow weighted average calorific value or a figure obtained by adding one mega joule per cubic metre to the lowest CV flowing into the charging area. This ensures that there are no large swings between in CV between end users. Without the addition of propane to biomethane the resultant CV would be too low to come within the FWACV calculation.

The implications of a biomethane plant injecting biomethane 1MJ below the FWACV for the LDZ would be to create an LDZ CV capping incident which would reduce the overall CV of the LDZ to the lowest CV of the gas input into the LDZ across the relevant period. These rules were designed to protect customers from receiving gas with an energy content below the declared CV for their area and also the CV for the gas they were actually paying for.

SGN recognises the importance of protecting customers from shortfalls of the energy content of the gas that is delivered to them, however it is viewed that the rules designed to protect customers were structured when the gas fed into the distribution systems came in its entirety via the National Transmission System and not via direct input points embedded in the distribution network. SGN is aware of industry discussions to modify these arrangements which are also linked to the Cadent Network Innovation Competition project (Future Billing Zones) which focuses on smaller billing zones in an attempt to facilitate different types of gas being injected into the distribution system. The Cadent project looks at measuring energy at different points in the network rather than calculating energy on an LDZ wide basis. The SGN innovation project 'Real time networks' looks at the flow energy throughout the network to better understand how modelling techniques can be updated to support the future billing of energy.

These current projects are comprehensive in their nature and are looking to deliver solutions on a GB scale. Modification of regulations and national systems which process energy recordings on the gas network require comprehensive industry discussion and agreement which can lead to long lead times before results can be delivered and subsequently filter down to customer levels. This project aims to deliver the ability for propane reductions to be realised whilst maintaining protections for customers in relation to assured energy levels.

Why are we doing this work and what happens if we do nothing?

SGN are undertaking this work to provide a solution to the cost impact and environmental impact of blending propane into biomethane gas. The current legislative requirements detailed in the GCTER sit with the gas distribution company via the letter of direction and therefore there is a requirement for SGN to drive forward solutions to resolve the issue of blending propane with biomethane. This project will realise benefits in terms of reduced costs to biomethane producers making plants more economical viable and ensuring their longevity. Roll out of propane reduction projects will also provide benefits to new biomethane plants by reducing the overall capex investment costs and on-going operation costs associated with propane injection, increasing the likelihood of new projects going ahead. The project will also deliver positive results in relation to increased volumes of green gas injected onto the grid by replacing the volumes of propane currently injected with biomethane and thus reducing the CO2 emissions associated with natural gas usage. The reduction of propane injection would also reduce the CO2 emissions associated with this fossil fuel gas. The overall objective associated with this project is to increase the number of customers supplied with renewable, low carbon energy in the form of biomethane assisting with the drive to net-zero UK CO2 emissions' targets.

What is the outcome that we want to achieve?

The outcome linked to the project would be to reduce the requirement to inject propane to zero during periods when the two supply points downstream of the biomethane injection point are flowing at a rate in excess of the biomethane plant. During periods when the biomethane is flowing to the wider network the propane control system would monitor the CV in the network and manage the propane injection accordingly.

How will we understand if the spend has been successful?

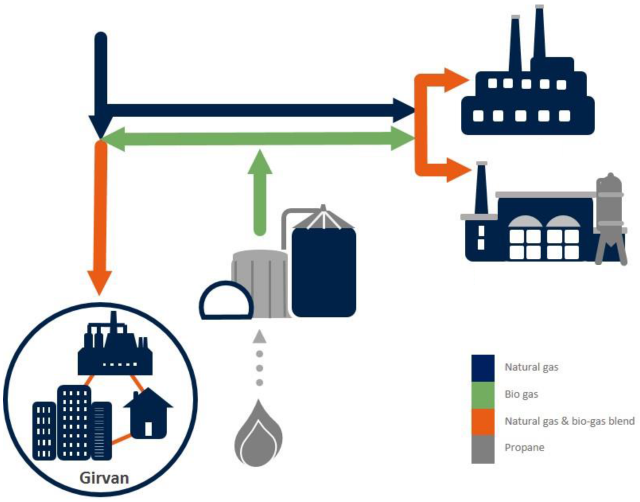
Reports from the plant which monitor the volumes of propane injected would demonstrate the reductions in propane across the year. SGN Gas Control reports would also detail the biomethane injection rates which would be compared against records of propane injection to calculate the volumes of biomethane injected which were free of propane gas. From these reports it would be derived the overall increase in propane free biomethane volumes and the overall reduction in CO2 emissions associated with the actual propane reduction and the displaced volumes of natural gas.

4.2 Narrative Real-Life Example of Problem

The Commercial Confidentiality biomethane plant has the capability to inject Commercial C Scm/h of biomethane into the Scotland high pressure transmission system. The Commercial Confide connection is one of a handful of high pressure biomethane injection points in the UK and due to the relatively constant demand levels on the transmission system has the potential to inject renewable biomethane gas across the year even at periods of low demand. Stakeholder feedback from the wider biomethane community as well as direct feedback from the operators of the site indicates that the requirement to add propane into the biomethane is cost prohibitive and has the real potential to restrict further projects on this scale by increasing costs. SGN are also aware of a genuine negative view of adding a fossil fuel gas into a low carbon renewable energy source such as biomethane. The potential flow at Commercial Confide facility is in the region of 30m cubic metres of biomethane per year with a total energy potential of 315m KWh without the addition of propane. Currently 4% of this volume flow rate is taken up by propane to increase the sites' biogas energy content from circa 37MJ / M3 up to the LDZ FWACV of between 39MJ & 40 MJ / M3. The cost of blending propane into biomethane at these volume flow rates is estimated to be £1.5m per annum which is a direct cost to the biomethane producer and removes potential investment from additional biomethane projects on the Scotland network. We further estimate that the blending of propane into the biomethane at this site releases upward of 10 thousand tonnes of CO2 into the atmosphere on an annual basis which contributes towards increases in greenhouse gases and further depletes the effectiveness of utilising the biomethane as means to reach net zero CO2 targets. The current requirement to blend propane into the biomethane results from the requirement to maintain calorific values in line with the FWACV of the network to ensure customers are provided with an assured level of energy at their supply point. The project looks to deliver an assured level of measured energy to the two downstream supply points without the requirement to add additional propane into the biomethane.

4.3 Spend Boundaries

The project looks to invest in equipment to manage the injection of propane into the biomethane at the Commercial Confic biomethane injection point by monitoring the direction of flow of the biomethane from the biomethane plant into the SGN network. The current configuration of the network at this location is such that the biomethane gas flows downstream to two specific customer supply points located at the extremity of the network.



Commercial Confidentiality

The project would look to control the injection of propane into the biomethane gas at times when the biomethane gas was only flowing to the two specific supply points (Commercial Confidentiality). At these times propane blending would be shut off which in turn would facilitate pure biomethane only to both of these customers. When the gas supply requirement of these two supply points reduced below the injection rate of the biomethane plant the addition of propane would be re-instigated. As the demand at the two supply points reduced the flow into the network would change direction and start to supply additional supply points throughout the network. The project would concentrate on ensuring that the when the un-propanated biomethane was flowing only to the two supply points the energy contained within this gas was accurately billed to both customers. This encompasses the second part of this project which would involve Xoserve carrying out an off-line billing process to correct both energy billing and transportation charging.

The current spend associated with this project is estimated at £500K to deliver both the engineering solution and the Xoserve element of the process. The project is currently being assessed via a feasibility study to determine the high-level costs associated with implementation, however the design is likely to rely on existing gas quality measurement equipment (Orbital gas PT2s), ultrasonic metering, an intelligent propane control system, gas flow monitoring equipment at the two supply points and an overall control system to manage data inputs from these devises. SGN have already undertook initial discussions with Xoserve regarding the introduction of a supporting process to manage the changes in energy billing and transportation charging. This is to ensure the two supply points are accurately billed for the reduced energy they receive and are confident at this stage that this element of the project can be implemented at relatively low cost.

5 Probability of Failure

The technology associated with this project is already in widescale use throughout the networks and has proved resilient. Propane control technology is also a well-developed technology in use at all biomethane plants to ensure the correct level of propane is injected into the network. The technology associated with managing propane blending through the incorporation of other data points such as the exit flows from the two supply points downstream of the Commercial Confic injection point will also be covered by the feasibility study which is currently underway.

5.1 Probability of Failure Data Assurance

This will be provided within the scope of the feasibility study which will cover the sensor technology and propane management equipment. The design of the solution will ensure that the technology associated with the solution fails safe to maintain FWACV values of the biomethane injected to prevent CV capping incidents occurring on the network. The network and customers are ultimately protected by the remotely operated valve located on the outlet of the NEF which will close where the energy content of the biomethane is insufficient to maintain FWACV values on the network.

6 Consequence of Failure

The consequence of failure of propane blending equipment currently installed on biomethane injection points results in the remotely operated valve closing on the sites' injection point to prevent gas flowing onto the network below the required energy levels. The same requirements would be applied to this project to ensure that biomethane flowing onto the network would only be carried out when the directional flow of the un-propanated gas was such that it flowed solely to the two supply exit points subject to green billing arrangements. Were the technology to fail to manage the propane blending to the required level the biomethane site would be required to flare biomethane produced until the issues / failure had been rectified. This would therefore lead to an environmental impact of increased methane and CO2 emissions.

Loss of Supply to Customers

There would be no impact on supply to customers as the existing natural gas supply would provide gas supply in the event that the biomethane sites' flow was curtailed.

Safety Impact of Failure

In the event of a propane management system failure the remotely operated valve would shut ensuring that the flow of biomethane to the network was curtailed and the energy value of the gas in the LDZ was maintained at the FWACV.

Environmental Impact

System failure leading to the closure of the ROV would require the biomethane plant to flare gas and ultimately reduce production of biomethane. This would result in increased consumption of natural gas and an increase in associated CO2 emissions. The flaring of biomethane would also result in CO2 emissions and a waste of renewable energy.

7 Options Considered

Baseline - Do nothing.

Continued injection of propane into biomethane reduces the overall green credentials of the biomethane gas and reduces the overall ability of the biomethane gas to meet CO2 reduction targets going forward in to RIIO-GD2. Continued propane injection also adds substantial costs to the biomethane industry and reduces overall viability of existing and the likelihood of new projects progressing going forward. The volume of biomethane displaced by the volume of propane blended also decreases the impact the biomethane is able to have on reduced CO2 emissions and impacts on SGNs target to supply 450K customers with biomethane prior to the end of RIIO-GD2.

Option 1 - Propane management and reduction – 'green billing' (Option 2 – Preferred Option)
This option has the potential to deliver managed levels of propane reduction at the Grant's biomethane injection point using existing technology controlled in a new and innovative way to deliver cost reductions to the biomethane industry and environmental benefits in the form of CO2 reductions. SGN recognise the importance of ensuring end consumers receive the energy they pay for and through projects such as Real Time Networks and Future Billing Zones there will be a wider network solution to address these issues, however in the short term a solution which takes into account network configurations which could benefit from a simpler solution would deliver real benefits in a much shorter timescale.

7.1 First Option Summary - Propane management and reduction – 'green billing'

Option 1
Introduced in the first year of RIIO-GD2 the propane management project would take the learnings from the feasibility study and implement a working solution onto the network. As there are uncertainties at this stage as to the RIIO GD2 innovation allowance structure SGN are requesting funding to implement this project as part of our Environmental Action Plan. We estimate the costs associated with implementing the technology to control propane blending to be in the region of £500K covering the purchase of two gas quality monitoring devices, an ultrasonic meter, flow direction recording devices, flow recording devices to be installed at customer premises and an intelligent propane management system to manage propane blending into biomethane for injection into the SGN network.

The technical detail of the option i.e. capacity, system rating, availability etc.

The option covers the installation of the necessary equipment on the network location at the Commercial Confi biomethane site to control the propane management at the Commercial Confi biomethane entry point. As the project design is currently being progressed by Orbital Ltd the specific elements associated with the management of propane at the site are being established, however the assets required will include two gas monitoring devices likely to be Gas PT2 devices, an ultrasonic flow meter, flow direction recording devices, flow meters at each of the two downstream supply points and a propane blending management system to control the necessary blending percentage into the biomethane gas. The option also covers the estimated Xoserve costs associated with an offline billing solution to facilitate reconciled gas transportation charges and energy allocation to the relevant gas shipper registered at the two supply points downstream of the supply point.

The basis for the cost estimate/unit cost

At this time the cost estimate is based on previous SGN costs associated with the purchase of this equipment at other SGN site locations.

The perceived benefits of the option

The option will introduce intelligent propane management control at the Commercial Confi biomethane plant enabling the level of propane to be reduced significantly depending on the downstream demand prevailing at the two supply points detailed. Currently the propane injection rate is based on maintaining the LDZ FWACV which requires the CV of the injected biomethane to be within 1 MJ of the forecast FWACV for the gas day.

Delivery timescales

It is likely that once the detailed design is complete and the necessary SGN compliance authorisations have been obtained the project will be implemented during the first year of RIIO GD2.

Key assumptions made

1. Downstream supply points – it has been assumed that the two downstream supply points will continue in operation and will continue to consume their current levels of gas. This assumption is important as the volumes of biomethane which can be injected into the network without propane are linked to the volume of gas consumed downstream.
2. Downstream supply point CV – it has been assumed following discussion with customers downstream of the biomethane injection point that the lower energy content of the biomethane supplied to the supply point (likely to be 37MJ per cubic metre rather than 39MJ per cubic metre) will not impact on the operation of their downstream plant and equipment. Discussions with the distillery have indicated that this reduced energy content will not prove to have a detrimental impact on their process requirements.
3. Letter of direction – it has been assumed that Ofgem will modify the letter of direction for the biomethane injection point to take into account the propane management system / solution.

Any other items that differentiate the option from the others considered

N/A.

7.2 Options Technical Summary Table

Table 1 – Options Technical Summary

Option	First Year of Spend	Final Year of Spend	Volume of Interventions	Equipment / Investment Design Life	Total Cost
Do nothing	2022	2022	0		0.00
Option 1	2022	2022	1		0.50

7.3 Options Cost Summary Table

Table 2 – Cost Summary

Option	Template	Cost Breakdown	Total Cost (£m)
Option 1	Propane management equipment	Equipment Civils Engineering Costs Contingency	
		Total	**0.50**

8 Business Case Outline and Discussion

The business case for the installation of propane management equipment and the creation of a green billing process with Xoserve is key to reducing biomethane industry costs by reducing propane blending into biomethane gas. These costs create a substantial bottom line cost to the biomethane industry which cannot be directly recovered as the propane is not a recoverable RHI element and only adds to the energy content of the gas injected onto the network, which in turn has a recoverable cost based on the National Balancing Point (NBP) tariff for natural gas (lower than the cost of propane). The business case for this project however is built on the CO2 reductions and the cost of carbon associated with eliminating the propane from the biomethane blend. The displaced biomethane which is currently replaced by propane also has a carbon reduction benefit which is realised if the propane is reduced / removed from the biomethane. By reducing or eliminating the propane from biomethane the resulting CO2 reductions from both the burnt biomethane as opposed to burnt natural gas and the burnt propane has a monetary value.

8.1 Key Business Case Drivers Description

The key business case drivers for the proposed options can be seen below:

Option 1 (Baseline) – Do Nothing:
Maintaining the status quo would continue the requirement for propane injection at the Grant's biomethane injection point into RIIO-GD2 until the potential for project deliverables emanating from the Real Time Networks and Future Billing Zones projects are delivered. Propane injection will result in continued CO2 emissions resulting from the actual burning of the propane element at customer appliances and also the CO2 reductions resulting from the use of natural gas fossil fuels will continue rather than the potential benefit in CO2 reductions from the additional biomethane injection volume.

Option 2 – Install Propane management and reduction technology.
The implementation of the propane management and reduction project will provide the opportunity to reduce propane blending at the Commercial Confide biomethane injection point and at certain points throughout the day reduce the requirement to zero. The reduction in the volume of propane being blended into the renewable biomethane gas will reduce the overall CO2 emissions resulting from end consumers burning the biomethane in their appliances. A further important benefit is derived from the additional volume of biomethane which can be injected by displacing the propane volume element. The project would require the finalisation of the current feasibility study which is under way which would establish the precise engineering design for the equipment which is currently forecast to be in the region of £500K. The project scope will include flow measurement equipment in the form of an ultrasonic meter and two gas quality measurement devices (Orbital Gas PT2s) and flow measurement equipment at the two supply points downstream of the biomethane injection point.

Table 3 – Summary of Key Value Drivers

Option No.	Desc. of Option	Key Value Driver
1	Propane management and reduction – 'green billing'.	Manage propane blending with biomethane gas at the Commercial Con biomethane injection point to minimize propane injection, maximise biomethane volume flows on to the network and reduce CO2 emissions associated with both propane and natural gas consumer consumption.

Table 4 – Summary of CBA Results

NPVs based on Payback Periods (absolute, £m)								
Option No.	Desc. of Option	Preferred Option (Y/N)	Total Forecast Expenditure (£m)	Total NPV	2030	2035	2040	2050
Baseline	Do Nothing / Do minimum	N	0.00	-31.23	-4.70	-7.47	-10.66	-17.52
1	Option 1 Absolute NPV	Y	-0.50	-0.63	-0.38	-0.43	-0.46	-0.49
2	Option 2 Absolute NPV		0.00	0.00	0.00	0.00	0.00	0.00
3	Option 3 Absolute NPV		0.00	0.00	0.00	0.00	0.00	0.00
1	Option 1 NPV relative to Baseline	Y	-0.50	-0.63	4.32	7.05	10.20	17.03
2	Option 2 NPV Relative to Baseline		0.00	0.00	4.70	7.47	10.66	17.52
3	Option 3 NPV Relative to Baseline		0.00	0.00	4.70	7.47	10.66	17.52

8.2 Business Case Summary

Table 5 - Business Case Matrix

	Option 1
GD2 Capex (£m)	0.50
Number of Interventions	1.00
Carbon Savings ktCO2e (GD2)	0.00
Carbon Savings ktCO2e /yr	0.00
Carbon Emission Savings (35yr PV, £m)	0.00
Other Environmental Savings (35yr PV, £m)	21.68
Safety Benefits (35yr PV, £m)	0.00
Other Benefits (35yr PV, £m)	0.00
Direct Costs (35yr PV, £m)	-0.50
NPV (35yr PV, £m)	21.18
High Carbon Scenario	
Carbon Emission Savings (35yr PV, £m)	0.00
High Carbon NPV (35yr PV, £m)	21.18

9 Preferred Option Scope and Project Plan

9.1 Preferred option

The preferred option is to install a propane management system and associated assets at a suitable location on the network at the Commercial Confi biomethane injection point and downstream network locations to facilitate a managed propane injection volume into the biomethane injected gas.

9.2 Asset Health Spend Profile

Asset Health Spend Profile (£m)						
	2021/22	2022/23	2023/24	2024/25	2025/26	Post GD2
Option 1	0.50	0.00	0.00	0.00	0.00	0.00

Table 6 – Asset health spend profile

9.3 Investment Risk Discussion

The risk of failure associated with the preferred option is restricted to the level of propane blended into the injected biomethane flow from the Commercial Confi biomethane site. The site is currently established and has equipment to ensure the flow rate of biomethane is curtailed if the energy content of the gas is below the required FWACV of the LDZ. With this option the propane injection level would either fail safe to ensure the blended level of propane maintained the FWACV or the remotely operated valve would shit to ensure that no LDZ capping incident occurred.

	Low	Mid	High
GD2 Capex (£m)	0.49	0.50	0.55
Number of Interventions	1	1	1
Carbon Savings ktCO2e (GD2)	-	-	-
Carbon Savings ktCO2e /yr	0	0	0
Carbon Emission Savings (35yr PV, £m)	0.0	0.0	0.0
Other Environmental Savings (35yr PV, £m)	21.25	21.68	23.85
Safety Benefits (35yr PV, £m)	0.0	0.0	0.0
Other Benefits (35yr PV, £m)	0.0	0.0	0.0
Direct Costs (35yr PV, £m)	-0.5	-0.5	-0.5
NPV (35yr PV, £m)	20.8	21.2	23.3

Table 7 – Capex sensitivity – sensitivity results.

Project payback has not been carried out as part of this analysis due to the effect of the Spackman approach. For a cash-flow traditional project payback period please see scenario 4 of our Capitalisation Sensitivity table.

Low Case: SGN have applied a reduction of 2% CAPEX costs – this can be applied if SGN achieve greater than expected discounts on material purchase and also if greater efficiencies can be achieved in projects delivery that haven't already been fed into the costs – this would be process improvements and streamlining working practices to reduce mobilisation time on site.

Mid Case: no changes have been applied, this is the expected output required for the RIIO GD2 time period.

High Case: SGN have applied an additional 10% on the capex expenditure, as this is believed to be the potential cost increase if SGN do not go to tender and achieve best possible market prices. The costs associated with this project have already be ascertained in conjunction with Remote Pressure Management and are likely not to incur additional costs. This increase in cost also allows for any issues in obtaining generic designs for the full volume of works or SGN not being able to delivery these projects efficiently due to internal processes which would increase contract labour and material costs.

<u>Capitalisation Sensitivity Analysis</u>

Consumers fund our Totex in two ways – Opex is charged immediately though bills (fast money – no capitalisation) and Capex / Repex is funded by bills over 45 years (slow money – 100% capitalisation). The amount deferred over 45 years represents the capitalisation rate. Traditionally in 'project' CBA's the cashflows are shown as they are incurred (with the investment up front which essentially is a zero capitalisation rate). Therefore, we have developed scenarios that reflect both ways of looking at the investment – from a consumer and a 'project'.

The scenarios are summarised as follows:

- Scenario 1 - we have used the blended average of 65%, used in previous iterations of this analysis.
- Scenario 2 - we have represented the Capex and Opex blend for the Scotland network, as per guidance.
- Scenario 3 - addresses our concerns on capitalisation rates where by Repex and Capex spend is deferred (100% capitalisation rate) and Opex is paid for upfront (0% capitalisation rate).
- Scenario 4 - this reflects the payback period in 'project' / cash-flow terms and provides a project payback.

We have taken a view of the NPV in each of the scenarios, with the exception of scenario 4, at the 20, 35 and 45 Year points, to demonstrate the effect of Capitalisation Rate on this value.

Scenario	1	2 SC	3	4
Capex (%)	65	46	100	0
Opex (%)	65	46	0	0
Repex (%)	100	100	100	0
Output				
NPV (20yr PV, £m)	10.88	10.87	10.83	
NPV (35yr PV, £m)	21.19	21.18	21.18	
NPV (45yr PV, £m)	27.70	27.69	27.66	
Payback	0.00	0.00	0.00	0.00

Table 8 – Capitalisation Rate variation.

Appendix A - Acronyms

Acronym	Description
barg	Bar gauge
CV	Calorific value
CO2	Carbon dioxide
FWACV	Flow weighted average calorific value
GCTER	Gas (Calculation of Thermal Energy) Regulations 1996
GWh	Gigawatt hour
H2S	Hydrogen Sulphide
KWh	Kilowatt hour
LDZ	Local Distribution Zone
M3	Metres cubed
MJ	Megajoule
MWH	Megawatt hour
NBP	National balancing point
Scm/h	Standard cubic metres per hour