Engineering Justification Paper

Tanker Fleet Replacement / Revalidation

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Classification: Highly Confidential

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2 Introduction

This project covers part of capital investment requirements for the Scottish Independent Undertakings (SIU) during RIIO-GD2. This investment is required to ensure continued transport security of LNG by Tanker to each of the four mainland SIU LNG sites in Campbeltown, Oban, Wick and Thurso. The project has a capital investment value of £3,750,000 to replace the ageing SIU tanker fleet with 25 high capacity LNG ISO (International Organisation for Standardardisation) Tanks. The existing fleet requiring replacement consist of five 20 tonne road tankers and twenty ISO tanks at 15.5 tonne capacity, these tanks were manufactured in 2012 and 2013 respectively. An LNG logistics study was undertaken by DNV GL, which dictates that the fleet is required to be this size to ensure security of supply on the most efficient basis.

The road tanker and ISO tank assets are indispensable for the delivery of LNG to the SIU sites and enabling SGN to supply gas under 1 in 20 conditions during peak winter demand. During RIIO GD2 these assets will have been in operation for over 12 years and will be considered to be at the end of their lifecycle. It is proposed that the most commercially viable option is to replace these tanks with 19.1 tonne 45-foot ISO Tanks for £3,750,000. Consideration has been given to undergo a full refurbishment on the existing tanks at a capital investment of £2,525,000, however this option has been discounted as it does not provide the opportunity to reduce operational costs by £220,000 annually through logistics efficiencies and a reduction in maintenance costs. Furthermore, it is known that utilising LNG road and ISO tankers beyond a 12 year operational lifecycle results in an increase in critical failures of the pressure containing equipment used to safely contain the LNG in transit, as well as the running gear used to transport the tanks across the UK's road network - with higher rates of failure resulting in: expensive ongoing repair costs; decreased ability to meet LNG demand requirements at the SIUs; and an increase in risk to the public whilst transporting the LNG by road and rail.

2.1 General Background

The SIU tanker fleet currently consists of thirty 15.5 tonne ISO Tanks and nine 20 tonne road barrels that deliver LNG from the Isle of Grain in Kent up to the four mainland LNG SIU sites which supply approximately 7,500 customers delivering approximately 10,000 tonnes of gas per annum. LNG is also transported to the LNG storage site situated in Provan near Glasgow which acts as a buffer site to provide the SIUs with additional LNG stock during times of high demand. The tanks have been designed to comply with ADR, RID and IMDG regulations meaning the tanks can be transported by road, rail and sea.

The 12-year asset replacement strategy for LNG road barrels and ISO tankers is based on decreasing opex costs (by using high capacity ISO tanks – logistics and maintenance efficiencies) and through reducing risk by replacing aging assets.

During RIIO GD2, a large proportion of the SIU tank fleet will have been in operation for 12 years and will be at the end of their lifecycle. The strategy of replacing tanks with new 19.1 tonne ISO Tanks has already been accepted by SGN's investment committee with four new tanks being ordered in 2019/2020 - the foundation for the 12 year replacement strategy is to reduce risk and decrease operational expenditure. Therefore, it is proposed to replace twenty-five of these ageing assets with new high capacity ISO tanks at a capital investment of £3,750,000.00 which in turn results in annual opex savings totalling £220,000.00

2.2 Site Specific Background

The Tanker fleet has no site specific location themselves however this fleet ensures continued security of supply by Tanker to each of the four mainland SIU LNG sites in Campbeltown, Oban, Wick and Thurso.

3 Equipment Summary

The SIU fleet that requires replacement during RIIO GD2 consists of five 20 tonne LNG road barrels manufactured by M1 Engineering and twenty 15.5 tonne ISO tanks which have been constructed by Wessington Cryogenics and Indox Cryo Energy respectively. These tanks are double skinned vacuum insulated vessels that were manufactured in either 2012 and 2013; additional tank information is given in Table 1.

Table 1 – Information on SIU Fleet requiring Replacement

Type	Manufacturer	Fleet Numbers	Year of Construction	Amount to be Replaced	Payload (ton)
	Indox	T910 - T923	2012	14	15.5
	Wessington	T924 – T929	2 x 2012 4 x 2013	6	15.5
Road barrels	M1 Engineering	T804 – T808	2012	5	20.0

Specification

The ISO tanks and the road barrels are constructed to the following specification shown in Table 2.

Table 2 - ISO tank and road barrel specification

MAWP	8.62 bar
Inner & Outer Vessel Design Code	BS EN 13530:2002
Pipework Design Code	ASME B31.3
Applicable Legislation	ADR/RID/IMDG
Inner Vessel Design Temperature	-196 to +50^{0}C
Outer Vessel Design Temperature	-20 to +50^{0}C

4 Problem Statement

It is proposed to replace twenty-five of the ageing SIU tanker fleet with new ISO tanks that are constructed to comply with all current UK and EU Legislation. The existing assets are required to be replaced as they will approach 12 years in service during RIIO GD2. It is estimated the road tankers have each covered between 500,000 and 1,000,000 road miles and it should be noted that many of these miles have been on some of Scotland's worst roads, such as the A9, hence increasing wear and tear. These vehicles (ISO tanks, trailers and road tankers) transport approximately 10,000 tonnes of LNG to the SIUs per annum, including storage at Provan (15.5 tonne ISO only at Provan). The tanks and accompanying trailers are required to remain fit for purpose. The requirement is to be compliant with ADR (Carriage of Dangerous goods) and also meet the safety standards for the sites that are loaded and unloaded at.

LNG Road barrels Replacement

Currently, SGN receive LNG from the Isle of Grain terminal in Kent which is then transported to the four mainland SIU sites. This leads to round trips of more than 1,400 miles for a delivery up to Thurso resulting in high opex costs. Replacing the five road barrels with high capacity ISO tanks which are intermodal will allow for a significant leg of the journey to be covered on the rail network.

When considering transporting LNG to SGN's Thurso site, 964 road miles can be eliminated in favour of transportation by rail, resulting in a safer, more cost effective, and more environmentally friendly logistics option. The marked up map, and accompanying table below illustrate the 964 road miles which can be eliminated in a routine return trip between Thurso and SGN's LNG source at the Isle of Grain in Kent, England.

Figure 1: Information on Logistic Chain from Isle of Grain to Thurso

Section	Transport method	Mileage (round trip)
Isle of Grain to Daventry	Truck	300 miles
Daventry to Inverness	Train	964 miles
Inverness to Thurso	Truck	218 miles

LNG ISO Tank Replacement

SGN's 15.5 tonne ISO tank fleet will also reach 12 years' service during RIIO GD2 and will require a full replacement or refurbishment. This will be assessed on a case by case basis. As tanks age they will be inspected and assessed as to whether replacement or refurbishment is required, the latter meaning pipework and trailers as a minimum would be replaced.

If this work is not carried out SGN will not be able to maintain security of supply in 1 in 20 conditions. The outcome of this project is to maintain security of supply and customer safety. This project will be deemed as successfully when security of supply can be maintained.

4.1 Narrative Real-Life Example of Problem

The LNG road barrel and ISO tank assets experience high levels of stress through transportation on the road and rail networks. This section details critical failures experienced due to equipment fatigue and highlights the importance of a 12-year asset replacement strategy to improve operating efficiencies and reduce overall risk.

As the tanks age the following risks increase: loss of vacuum, aging pipework and technology of tank/trailer (the trailer system is compatible with current standards for tractor units, standards are upgraded regularly) all increase. This has been seen in the current 20 tonne road fleet, with pipework failures and trailers showing signs of fatigue.

4.2 Spend Boundaries

This program of work is for the replacement or revalidation (refurbishment) of the LNG fleet. The project will require a capital investment of £3,750,000.00 (£150,000.00 per unit). A detailed breakdown of these costs can be found in section 7.

5 Probability of Failure

When considering the possible failure modes that could occur, there are different categories in which these failure types can be grouped. The most credible forms of failure are given below:

Release of Liquefied Natural Gas:

Liquid Line Leaks: This type of failure may result in a release of liquid due to mechanical failure in the liquid pipework upstream of the first isolation valve. The main mechanical failures that would lead to a release of liquid would be due to the leakage of mechanical joints such as valve stems and pipe flanges. There will be a higher potential with this as the assets age, with a higher probability of stress induced pipework cracks and fractures from vibration during transportation, particularly on the road. Worst case incident would be an uncontrolled release of up to 20 tonnes of LNG, which could potentially occur on the public road network.

Over pressurisation:

Vacuum Failure: If the vacuum were to fail this would result in heat leak into the tank and will increase the amount of boil-off gas in the vessel. If the pressure in the vessel reaches an unsafe level, emergency action will be required to ensure there is no loss of supply and to minimise the risks of over pressurisation.

Relief Valve Lifting: The relief valves in the vessels are set to lift at a set pressure of 8.6 bar and would result in a release of LNG vapour. A likely cause of this would be due to mechanical failure of the vessel or piping system causing over pressurisation.

5.1 Probability of Failure Data Assurance

The NARMs methodology and the method of using the Commercial C System to calculate monetised risk values and their impacts on the CBA cannot be applied to the SIUs as the SIUs were omitted from the methodology and model. However, the principals of NARMS Commercial Confidentiali are attempted to be aligned with the SUIs.

6 Consequence of Failure

When evaluating the potential failure modes that could occur, the main categories to consider include:

- Safety Impact
- Security of Supply
- Environmental Impact

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Table 3 - potential failure modes and the consequences

	Failure Consequence		
Failure Mode	**Security of Supply**	**Safety Impact**	**Environmental Impact**
Liquid Leak from mechanical failure or damage	If there is a liquid leak this will affect the security of supply as this could result in full loss of containment in the tank. This may lead to sites struggling to keep up with demand especially during peak times.	Depending on where in the logistics chain the leak occurs, this could affect both personnel and members of the public. The LNG in the tanks are un-odorised and it may not be clear that there is a leak. Furthermore, there is a high potential of ignition due to rapid vaporisation.	Carbon emissions proportionate to the volume of gas released.
Vacuum Failure (Over Pressurisation)	N/A if emergency actions take place and LNG in the tank is not lost.	If the pressure in the tanks, particularly the Indox tanks, raises at a high level, emergency actions will be required such as emergency depressurisation of the tank.	N/A if there is no liquid lost.

Safety Impact

If there was a leak or rupture in the liquid pipework upstream of the first isolation valve, this would lead to an escape of LNG and could affect anyone within the proximity of the escape, be it personnel or members of the public if it were to occur due to mechanical damage or failure.

The primary risks associated with this include:

- Risk of fire in the presence of an ignition source in the correct concentration
- Risk of injury from dangerous release of pressure energy
- Cold Contact Burns on frozen pipework
- Asphyxiation – LNG transported to the SIU sites is un-odorised and so members of the public would be unaware of a gas escape

Environmental Impact

If there is an escape of LNG, SGN may have a penalty imposed by Ofgem and this will be proportional to the volume released into the atmosphere. The value of these fines is determined by the societal impact of the carbon that has been released. As it is proposed that these tanks be replaced, this can result in 19.1 tonnes of LNG being released if there was a catastrophic failure in the tank.

7 Options Considered

Do Nothing

If the assets do not undergo either a full refurbishment or replacement it is expected this will result in asset failures with a higher risk of road side breakdowns and pipework failures. This would result in additional repair costs, as well as increased ongoing maintenance costs. There would be no OPEX saving available through reduced logistics costs, and there would be an increase in risk to security of supply as well as an increased risk of a serious equipment failure on the assets whilst on the public road and rail networks. Therefore, this option is not viable and should not be considered as a solution.

Replace Fleet with High Capacity ISO Tanks and Refurbish

This option considers that the five road barrels should be replaced with 19.1 tonne ISO tanks as they approach 12 years in operation. Even though the payload is slightly lower than the current road barrels, there would be opex savings through decreased maintenance costs as well as logistics savings, as these tanks will now be able to be transported by rail and by road also resulting in carbon savings. This option also considers refurbishing ISO tanks that could be refurbished with minimal cost.

Refurbish Road tankers

This option is to fully refurbish the 5 road barrels. This option will mean that the LNG will continue to be transported by road for the full journey, from the Isle of Grain to the SIU sites, and there will be no operational savings through decreased maintenance and reduced logistics costs. If this option was progressed, there would be an increased risk of security of supply to our customers due to asset downtime (roadside breakdowns / pipework and pressure vessel failures). Furthermore, for the vessels to undergo a full refurbishment, it is expected that the vessels will be out of service between 3 to 4 months to allow the refurbishment to be completed, this would provide a strain on the remaining assets (and increase the risk to security of supply) as the fleet size would be dramatically reduced to allow work to be completed on all the assets. Furthermore, there will be no opex savings through reduced maintenance costs and reduced transportation costs if the refurbishment option was selected.

Replace Road tankers and ISO Tanks with High Capacity ISO Tanks and ISO tanks

This option considers that the five road barrels should be replaced with 19.1 tonne ISO Tanks as they approach 12 years in operation. Even though the payload is slightly lower than the current road barrels, there would be opex savings through decreased maintenance costs as well as logistics savings, as these tanks will now be able to be transported by rail and by road also resulting carbon savings. This option also looks at replacing the ISO fleet at it approaches 12 years old.

Refurbish ISO Tanks

This option again includes a full refurbishment of the ISO tanks which will include full pipework modifications, as well as a new frame and cabinet. These tanks do not have any running gear, but a new trailer will also be purchased as part of the project. By keeping these tanks on the road, the payload will remain the same after a full refurbishment (15.5 tonne) and so there will be no opex savings in terms of maintenance or logistics costs.

Replace ISO Tanks

This option is to replace the 15.5 tonne ISO Tanks with new 15.5 tonne ISO tanks. The larger capacity ISO is not considered for this option as the larger tank cannot be legally operated in Provan. If this licence condition can be re-negotiated, then 19.1 tonne ISOs might be considered as the additional payload would mean the tanks can now carry 23% more LNG per tank and fewer tanks would need to be purchased. This will result in OPEX savings as there will be a reduction in the number of trips required, as well as a reduction in maintenance costs because of the smaller fleet.

7.1 Option 1 - Replace Fleet with High Capacity ISO Tanks and Refurbish Summary

The preferred option is to replace the ageing SIU Road tanker fleet with new high capacity 19.1 tonne LNG ISO tanks (15.5 tonne where necessary). This will be completed in RIIO GD2 at a total cost of

£3,750,000.00 or £150,000.00 per tank. This is the recommended option as this capital investment also results in annual opex savings totalling £220,000.00 due to the reduction in trip costs and maintenance costs. These costs are estimated on nearly fifty years of fleet maintenance and operation and based on the tanker purchase paper approved in 2019 for four new high capacity ISO tanks to replace four 20 tonne road barrels. This option is preferred as some of the existing 15 tonne ISO tanks may be suitable for refurbishment. This would appear to be cost effective as the 15 tonne ISO fleet are stored at Provan and refurbishing would eliminate the purchase of new COMAH compliance systems for new ISO tanks. This however is a decision that needs to be made when the vessels are approaching twelve years old as the LNG market is growing and the cost might be lower for ISO tanks when the current ISO are approaching 12 years old.

7.2 Option 2 - Replace Road tankers and ISO Tanks with High Capacity ISO Tanks and ISO tanks Summary

This option considers that the five Road barrels should be replaced with 19.1 tonne ISO tanks as they approach 12 years in operation. Even though the payload is slightly lower than the current road barrels, there would be opex savings through decreased maintenance costs as well as logistics savings, as these tanks will now be able to be transported by rail and by road also resulting carbon savings. This option also looks at replacing the ISO fleet at it approaches 12 years old.

7.3 Options Technical Summary Table

Table 4 – Options Technical Summary

Option	First Year of Spend	Final Year of Spend	Volume of Interventions	Equipment / Investment Design Life	Total Cost (£m)
Option 1 - Replacement and Internal inspection with full refurb	2022	2022	0	12	2.75
Option 2 - Replacement of Five Road tanker with ISO tanker	2022	2023	5	12	4.56*
Option 3 - Replacement and Revalidation validation	2022	2023	5	12	4.7**

* Total costs of £4.56 m have been derived by combining directly estimated costs with allowance for efficiencies, overheads and other project specific factors.

**Total costs of £4.7 m have been derived by combining directly estimated costs with allowance for efficiencies, overheads and other project specific factors.

7.4 Options Cost Summary Table

Table 5 – Cost Summary

Option	Cost Breakdown	Total Cost (£m)
Option 3 - Replacement and Revalidation validation	The cost based on a mixture refurbishment and purchase of new vessel, the ratio of which need to be decided near the time For individual cost please see Table 6 and Table 7	4.56*
Option 2 - Replacement of Five Road tanker with ISO tanker	The cost based on purchase of new vessels, For individual cost please Table 8	4.7**

* Total costs of £4.56 m have been derived by combining directly estimated costs with allowance for efficiencies, overheads and other project specific factors.

**Total costs of £4.7 m have been derived by combining directly estimated costs with allowance for efficiencies, overheads and other project specific factors.

Table 6 - Refurbishment of Road Barrel

Refurbishment of Road Barrel	Cost/Tank
Nitrogen Purge, based on price from April 2017	
Full Refurbishment including new valves/pipework, cabinets, running gear, lights, full paint and BV approvals.	Commercial Confidentiality
BTS Pre-Commissioning Inspection	
Haulage Cost (Provan to M1 in Bradford) - price based on return journey	
RTS Certificate	
Total Cost (Per Unit)	**£100,950.00**

Table 7 - Refurbishment of Road Barrel of ISO Tank

Refurbishment of Road Barrel of ISO Tank	**Cost/Tank**
Nitrogen Purge based on price from April 2017	
Full Refurbishment including new valves/pipework, cabinets, lights, full paint and BV approvals.	
Cost of new 40ft Trailer	
BTS Pre-Commissioning Inspection	Commercial Confidentiality
Haulage Cost (Provan to M1 in Bradford) - price based on return journey	
RTS Certificate	
Total Cost (Per Unit)	**£99,450.00**

Table 8 Purchase of New ISO Tank

Purchase of New ISO Tank	**Cost/Tank**
Nitrogen Purge based on price from April 2017	Commercial Confidentiality
Total Cost (Per Unit)	**£99,450.00**

8 Business Case Outline and Discussion

8.1 Key Business Case Drivers Description

Table 9 – Summary of Key Value Drivers

Option No.	Desc. of Option	Key Value Driver
1	Replace Fleet with High Capacity ISO Tanks and Refurbish	Ageing Assets, Opex Saving, reduction in fleet size
2	Replace Road tankers and ISO Tanks with High Capacity ISO Tanks and ISO tanks	Ageing Assets, Opex Saving, reduction in fleet size

Table 10 – 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	-10.60	-48.74	**-10.50**	**-15.76**	**-22.33**	**-32.92**
1	Option 2 Absolute NPV	N	-12.36	-52.37	**-11.55**	**-17.09**	**-24.15**	**-35.43**
2	Option 3 Absolute NPV	Y	-12.06	-47.41	**-11.12**	**-16.62**	**-22.47**	**-32.43**
1	Option 2 NPV relative to Baseline	N	-12.36	-52.37	**-1.06**	**-1.33**	**-1.81**	**-2.51**
2	Option 3 NPV Relative to Baseline	Y	-12.06	-47.41	**-0.62**	**-0.85**	**-0.13**	**0.49**

8.2 Business Case Summary

This project is driven by the requirement to ensure security of supply to the SIUs. Additionally, the desired option to purchase new ISO tanks and refurbish other will result in Opex and carbon savings.

Table 11 - Business Case Matrix

	Replacement of Five Road tanker with ISO tanker	Replacement and Revalidation
GD2 Capex (£m)	4.56	4.70
Number of Interventions	30.00	20.00
Carbon Savings ktCO2e (GD2)	0.00	0.00
Carbon Savings ktCO2e /yr	0.00	0.00
Carbon Emission Savings (35yr PV, £m)	0.37	0.41
Other Environmental Savings (35yr PV, £m)	0.00	0.00
Safety Benefits (35yr PV, £m)	0.00	0.00
Other Benefits (35yr PV, £m)	0.00	0.00
Direct Costs (35yr PV, £m)	-3.03	0.09
NPV (35yr PV, £m)	-2.66	0.50
High Carbon Scenario		
Carbon Emission Savings (35yr PV, £m)	0.55	0.62
High Carbon NPV (35yr PV, £m)	-2.47	0.71

9 Preferred Option Scope and Project Plan

9.1 Preferred option

The preferred option is to Replace Fleet with High Capacity ISO Tanks and Refurbish other ISO tanks. This option gives the most flexibility given the changing LNG market in the UK.

9.2 Asset Health Spend Profile

Table 12 – Asset Spend Profile

Asset Health Spend Profile (£m)						
Pre GD2	2021/22	2022/23	2023/24	2024/25	2025/26	Post GD2
0	0.94	0.89	0.88	0.96	1.02	0

9.3 Investment Risk Discussion

Some Investment Risks exist that could influence projects being delivered within the defined timescales and budget.

SGN does not have direct control over market forces that can cause contractor and material costs to fluctuate (these can be influenced by national events including Brexit).

A reasonable allowance for uncertainty has also been included to mitigate against the remainder of this risk.

Sensitivities have been applied to the SIU CBAs as follows:

- Variations in Capex project cost have been applied for the range -10% to +20%. These are considered realistic ranges based on our experience in GD1 and the likely pressures on cost in relation to the procurement of materials and main contracts.
- Variations in methane levels (and therefore environmental impact) have been considered to take account of the anticipated introduction of hydrogen. SGN have committed to a 'net zero' carbon network by 2045. In practice that means no methane by that date. Also, while the use of hydrogen in distribution is being actively investigated and hydrogen is currently being introduced into a network for the first time since the conversion to natural gas, it is considered very unlikely that hydrogen will be injected on a wider scale until RIIO-GD3. For these reasons, methane levels have been considered in three ranges: aggressive early transition, mid-case and late transition.

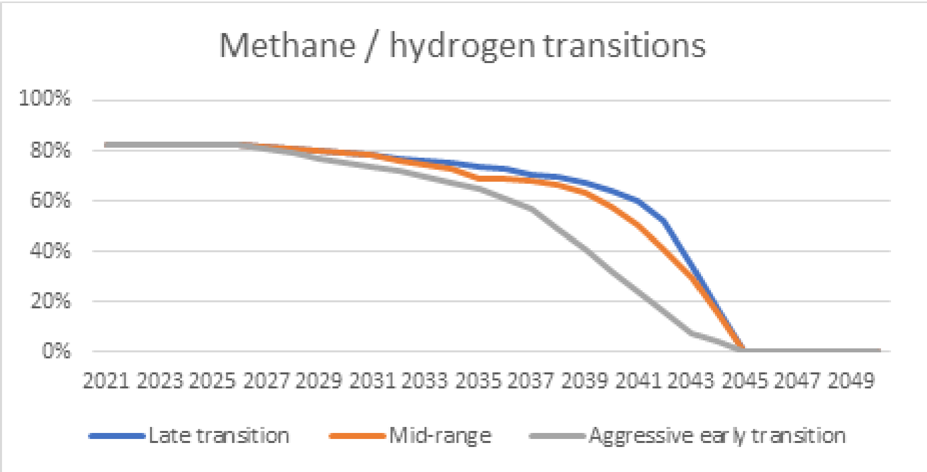

Figure 2 Methane / Hydrogen Transitions

The current version of the CBA template, version 4, already acknowledges that methane is estimated to be 28 times more damaging than CO_2. This figure is taken from the IPCC Fifth Assessment Report published in 2014. Since this figure is derived from the latest science, it is not considered prudent to test for sensitivity in this area.

Sensitivity in the value / cost of carbon is already included within the CBA template with base-case and high-case scenarios mapped out. These sensitivities are considered sufficient in our CBA.

Table 13 Sensitivity Results

	Low	Mid	High
GD2 Capex (£m)	4.23	4.70	5.64
Number of Interventions	20	20	20
Carbon Savings ktCO2e (GD2)	-	-	-
Carbon Savings ktCO2e /yr	0	0	0
Carbon Emission Savings (35yr PV, £m)	0.4	0.4	0.4
Other Environmental Savings (35yr PV, £m)	0	0	0
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)	0.8	0.1	-1.4
NPV (35yr PV, £m)	1.2	0.5	-1.0

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

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 two networks, as per guidance.
- Scenario 3 - addresses our concerns on capitalisation rates whereby 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.

Table 14 - Capitalisation Rate Variation

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)	-0.21	-0.11	12.23	
NPV (35yr PV, £m)	0.47	0.50	9.84	
NPV (45yr PV, £m)	1.36	1.49	8.53	
Payback	25.00	25.00	0.00	21.00

Appendix A - Acronyms

Acronym	Description
ADR	Accord Dangereux Routier (European regulations concerning the international transport of dangerous goods by road)
IMDG	The International Maritime Dangerous Goods (IMDG) code
LNG	Liquefied Natural Gas
MAWP	Maximum Allowable Working Pressure
OPEX	Operating Expenditure
PPE	Personal Protective Equipment
RID	Reglements Internationales Relatif au Transport des Marchandises Dangereuses par Chemin de Fer
RTC	Road Traffic Collision
SIU	Scottish Independent Undertakings