NZASP Submission

Methane emissions Mobile Recompression October 2022

nationalgrid

Document control

Version	Status	Date	Author(s)	Summary of changes
0.1	Draft (trigger document)	July-22	Matthew Williams, Jai Dalal, Simon Kidd, Mark Lees, Guy Pearson, Raveena Virk	
0.2	Draft (final submission – single UM document)	Sept-22	Matthew Williams, Jai Dalal, Guy Pearson, Raveena Virk	Updated to take in Ofgem feedback, revised business cases, refinement of cost data, new executive summary and more complete regulatory input
0.3	Final document	Oct-22	Matthew Williams, Jai Dalal, Guy Pearson, Raveena Virk	Updated to take in Ofgem feedback and first pass of sign-off comments Amendment of submission to split into three by investment theme. Common elements to all themes to be appended to individual theme submission papers.

Supporting Documents

Document	File Name
Director of Regulation Assurance Statement	NG-Asset-GT-MR-COM-001-Assurance Statement
Regulation Table Mapping	NG-Asset-GT-MR-COM-002-Table Mapping
Mobile Recompression Submission Cost Build Up	NG-Asset-GT-MR-MOB-001-CBA inputs
Mobile Recompression Compressor Station CBA	NG-Asset-GT-MR-MOB-002-Compressor station recompression CBA
Mobile Recompression PIG Trap CBA	NG-Asset-GT-MR-MOB-003-PIG trap recompression CBA
Mobile Recompression Pipeline CBA	NG-Asset-GT-MR-MOB-004-Pipeline recompression CBA
Mobile Recompression Small Recompression Unit Quote	NG-Asset-GT-MR-MOB-005-Small recompression unit quote
Mobile Recompression Pipeline Recompression Low Pressure Unit Commercial Quote	NG-Asset-GT-MR-MOB-006-Pipeline recompression low pressure unit commercial quote
Mobile Recompression Pipeline Recompression Low Pressure Unit Technical Quote	NG-Asset-GT-MR-MOB-007-Pipeline recompression low pressure unit technical quote
Mobile Recompression Pipeline Recompression High Pressure Unit Commercial Quote	NG-Asset-GT-MR-MOB-008-Pipeline recompression high pressure unit commercial quote
Mobile Recompression Pipeline Recompression High Pressure Unit Technical Quote	NG-Asset-GT-MR-MOB-009-Pipeline recompression high pressure unit technical quote
Mobile Recompression Data Assurance Guidance Document	NG-Asset-GT-MR-MOB-010-Mobile recompression DAG assurance

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1 Executive summary

This document together with its appendices and attached supporting information comprises National Grid Gas Transmission's (NGGT) document submission under the Net Zero Pre-construction Work and Small Net Zero Projects Re-opener (NZASP) to address methane emissions from operating the gas National Transmission System (NTS). NGGT seeks funding for methane emission reduction equipment across the following theme:

- Mobile Recompression - Additional mobile pipeline recompression capability and new mobile recompression units to capture methane emissions arising from pipeline inspection works and compressor station depressurisations.

Table 1 - Mobile Recompression theme submission value

RIIO-2	22/23	23/24	24/25	25/26	Total
Mobile recompression	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

This investment in mobile recompression will facilitate reduction of up to 15% of NGGTs total methane emissions from operating the NTS, which equates to a monetised carbon emission reduction of £4.37m per annum.

This theme submission should be read in conjunction with the core document providing the common narrative applicable to all.

2 Pipeline recompression

a. Needs case / problem statement.

Problem statement

Pipeline maintenance often requires sections of pipeline to be depressurised to allow work to be carried out safely. The pipeline is depressurised by venting the gas into the atmosphere or using mobile recompression units to re-inject the gas into live sections of pipeline. National Grid currently operates three mobile recompression units that were commissioned in the 1990s and have a suction pressure limit of 7barg. This means that when a recompression operation is undertaken the remaining 7barg in the pipeline at the end of recompression must be vented. Modern machinery is available that can reduce the pipeline pressure to 0.5barg before venting. One such set of equipment was funded in the RIIO-2 final determination and is currently being manufactured. It is expected that the first set of recompression equipment will capture 66% of the emissions from 7barg to 0.5barg in the pipeline venting category from 2024. The remaining 34% is not expected to be captured because recompression must be carried out in early summer prior to the pipeline maintenance work beginning, and one set of mobile pipeline recompression equipment does not have enough capacity to complete all works.

Formulation of scope

Having a second set of mobile pipeline recompression equipment would allow more than 90% of the emissions in this category to be saved, which equates to 490 tonnes of natural gas per annum. Options to modify the existing pipeline recompression equipment have been considered, but the machines are not designed to modern standards and any significant modification would result in them becoming non-compliant.

A project scope document was created for the purchase of the new pipeline recompression machines that are already funded in RIIO-2, the primary aim being to save as much gas from an isolated pipeline section as possible, as well as other technical criteria such as improving the time taken to complete a recompression job and enhancing compliance with safety legislation. For this project, the aim would be the same, ideally purchasing an identical set of equipment to ensure interchangeability between the machines in the fleet and to leverage efficiencies in maintenance, spare parts holdings and operator training. If work forecasts confirm that the two pairs of new machines have the capacity to complete all forecasted future work, the existing machines would be retired from service, once both new sets of pipeline recompression machines have been successfully commissioned.

b. Options and selection methodology

For mobile pipeline recompression we assessed four options.

The baseline option is to stop the investment in the machines that were funded in RIIO-2 and make no investment in mobile pipeline recompression. This option would be a backward step and is only included for comparison purposes.

Option 1 is to invest in the machines that are already funded in RIIO-2 and make no further investment, which is effectively the baseline because the purchase of the machines is already underway and would not realistically be cancelled at this stage. It is included as an option to show the benefit when compared to not investing in any new machinery at all.

Option 2 is to invest in the already funded pair of machines and to also invest in a new high-pressure machine to replace the existing high-pressure machines. This would not create additional emissions savings but would reduce the operating cost of the fleet because one new high-pressure machine could replace two existing high-pressure machines, whilst carrying out recompression work in shorter timescales, and would cost less to maintain.

Option 3 is to invest in another pair of recompression machines that can reduce the pressure of an isolated pipeline section to 0.5barg before venting, thus allowing both further emissions savings in this category and for existing non-compliant machines to be retired from service. These options were compared using a cost benefit analysis approach.

Three options were considered initially but not taken forward and are therefore not reflected in the table below The first of these options was to invest in a low-pressure unit to run in series with the existing machines, to enable them to reach lower pressures before venting. This was discounted because the low-pressure unit would need to be matched to the existing machines and would be at risk of becoming a stranded asset when the existing machines are taken out of service. The flowrates of this configuration would also be much lower than new machines and would increase recompression times significantly. The second of these options was to retrofit one of the existing machines with an extra stage of compression. This option was discounted on technical grounds because the modification would be substantial enough to result in the machine needing to comply with DSEAR/ATEX legislation, which is not achievable. The third option, that was discounted prior to cost benefit analysis, was to delay investment. This was discounted because there are planned pipeline outages in RIIO-3 that will result in the requirement for two recompression jobs to be carried out simultaneously.

Table 2 - Mobile pipeline recompression options.

Option	Preferred	Narrative
Baseline – Do nothing	No	Option discounted because emissions in this category are not addressed. Contracts have already been agreed with a supplier so not all costs would be recoverable.
Option 1 - Invest in already funded pair of machines only, no further investment	No	This option is not preferred because the capacity of one pair of machines is not great enough to capture all the emissions in this category. It is expected that these machines that are already funded under RIIO-2 allowances will capture 66% of the emissions in this category.
Option 2 – Invest in already funded pair of machines, and replace existing high pressure recompression units	No	66% of emissions in this category are captured by the already funded machines. This option also addresses non-compliance and obsolescence risk by replacing the existing high-pressure units. However, this option does not address the remaining 34% of methane emissions from pipeline venting. As with option 1, large volumes of gas would still be vented when there are 2 simultaneous complete depressurisations.
Option 3 – Procure an additional pair of pipeline recompression machines	Yes	The preferred option complements the units being purchased under RIIO-2 allowances. These new units can recompress to 0.5BarG, enabling the greatest saving against the pipeline venting category by giving the fleet the capability to carry out two complete depressurisations simultaneously and save over 90% of the methane emissions in this category.

c. Preferred option

Pipeline recompression

The preferred option for this category is to invest in one pair of pipeline recompression machines to capture a further 24% of the emissions in the pipeline venting category, in addition to the 66% of emissions that will be captured by the pair of machines that was funded in the RIIO-2 final determination.

This additional set of recompression machines will allow NGGT to deploy two recompression fleets, each capable of reducing pipelines to 0.5barg pressure before venting. The current NGGT fleet of recompression units reduce pressure to 7 bar with the remaining natural gas currently being vented to atmosphere. NGGT intends to retire the existing recompression machines when all the new machines are commissioned and

proven in operational service, provided the capacity of the fleet will be great enough to cater for all requirements.

d. Cost benefit analysis (CBA)

Options taken to CBA are all new unit options, and over 90% of the project costs are based on supplier quotations for purchasing the recompression unit/s. Internal costs make up less than 10% of total project costs - these include project delivery and purchase/manufacture of ancillary equipment.

The CBA inputs for expected work volumes, and potential vented gas, are based on historical averages, however, the RIIO-2 plan for 2023, 2024, and 2025 shows significantly increased recompression requirements compared to historical averages, with the potential for the emissions saving to be 3x greater than the figures used in the CBA. The RIIO-3 pipeline outage plan is being developed throughout 2023, and if the workload for recompression is as great as the RIIO-2 plan, there may be justification for further investment in pipeline recompression units.

Quotes received from the supplier in September 2022 amount to [redacted] (2018/19 prices).

Table 3 - Pipeline recompression cost benefit analysis.

Pipeline recompression	Option 3. Procure one high/low pressure pipeline recompression set
Category value (CO2e)	£3.36m
Wholesale gas value	£113k (BEIS high case gas price forecast)
Capex	[redacted] (2018/19 price base)
One off Opex	[redacted] (2018/19 prices) in 2025 to operate and maintain the new machines on projects that already have funding allocated as part of the RIIO-2 asset health business plan.
Annual Opex	N/A - Opex costs will be built into the RIIO-3 in-line inspection (ILI) dig unit cost.
Impact on emissions in this category	24%. The first 66% of emissions in this category (for reductions between 7barg and 0.5 barg) will be captured by the machines that were funded in RIIO-2. The second set of machines increases total emissions capture in this category to 90%+.
Annual benefit & year of impact	£0.76m annual net benefit, first year of benefit is 2025. Expected life of machines is 20 years so benefits to be delivered through to 2045.
Payback period (ROI)	4 years, payback by 2027 assuming investment in 2023.
Assumptions & rationale:	• Assumed that the machines already funded will capture the first 66% of benefits from this emission source. The remaining 34% cannot be captured by the already funded machines due to capacity. A second set of machinery would enable the total capture in this category to be increased to 90%. • It is recognised that NGGT may encounter operational or maintenance issues which could prevent the final 10% of emissions from being captured, but in most years the capture is expected to be above 90%. • The one-off OPEX includes for all maintenance and operating costs of the machines in 2025. From RIIO-3 these costs will be reflected in the ILI dig unit cost.

	• No additional funding is sought for operational resource, which is already in place. • Benefits repeat annually as forecasted work volumes remain flat throughout the remainder of RIIO-2 and RIIO-3.
Risks & further commentary	• Implementation timeline is dictated by procurement and supplier lead-times and the supplier commissioning period. This is estimated at 24 months.

Table 4 - Cost phasing for pipeline recompression preferred option in 18/19 pricing.

RIIO-2	2022/23	2023/24	2024/25	2025/26	Total
Machinery staged payments	[redacted]	[redacted]	[redacted]	£0	[redacted]
OPEX	£0	£0	£0	[redacted]	[redacted]
Total	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

e. Delivery plan

The lead time for the two new recompression units funded in the RIIO-2 final determination is two years. It is envisaged that the pre-tender and tender events will be shorter in our proposed approach as the same tender would be repeated. Tender documentation is already prepared, and suppliers would be expected to update the quotes supplied during the previous tender, rather than repeating conceptual design. The target would be commissioning of the new machines in less than 27 months after the funding is received, with first operational use of the machines in summer 2025.

Table 5 - Pipeline recompression delivery plan.

Financial Year	2021/22	2022/23	2023/24	2024/25	2025/26
Deliverables		Tender of one high/low pressure pipeline recompression set.	Part payment of one high/low pressure pipeline recompression set.	Part payment of one high/low pressure pipeline recompression set.	Commissioned one high/low pipeline recompression set.

In development of the delivery plan, NGGT has utilised its experience from the operation of its existing compression fleet and the procurement exercise conducted to date for the pipeline recompression units already funded in RIIO-2. For example, the tender can be carried out by a small team of people and NGGT has allowed for a 6-month gap from placing an order until process safety assessments start to allow the team to increase resourcing as required. NGGT has high confidence in the deliverability of the plan presented.

The key aim of this investment is to prevent planned venting of large sections of pipeline from 7 bar. The initial output is to purchase the machines, commission them on a trial job on the NTS, then put them into operational service on planned pipeline depressurisations on the NTS.

NGGT will, by the end of the RIIO-2 price control, deliver:

- One additional high/low pressure pipeline recompression set into operational service on planned pipeline depressurisations on the NTS.

To consider this investment successful, the machines should be commissioned by the end of RIIO-2 and in service on pipeline outages for all of RIIO-3 and beyond. Success would be represented by having no planned pipeline vents in RIIO-3 and beyond, and a greater than 90% reduction of emissions in this category.

NGGT will report on progress of operational delivery and emission reduction realised within the regulatory reporting pack (RRP) in the Net Zero strategic narrative for the remainder of RIIO-2.

3 Compressor station and PIG trap recompression.

a. Needs case / problem statement

Problem Statement

Planned depressurisations of compressor stations are required in summer to facilitate maintenance. NGGT currently has no capability to reinject the gas, so it is vented to atmosphere.

ILI (In-Line Inspection) runs require PIGs (Pipeline Inspection Gauges) to be put into the pipeline so they can travel through the pipeline, gathering condition information. At the start and end of an ILI run, a PIG trap door needs to be opened to insert or remove the PIG from the pipeline. This requires the gas in the PIG trap to be vented to atmosphere and NGGT currently has no capability to reduce this emission.

Formulation of scope

NGGT assessed the options available for reducing venting from planned compressor station depressurisations and PIG traps and have selected a preferred technology.

When selecting the preferred technology, the ease of implementation within existing ILI processes was a significant deciding factor because ILI runs often require long working days and recompression is an additional sequential step in the process. The preferred technology will reduce the pressure in a PIG trap to as close to zero as possible before venting, and the time taken to do this will not significantly impact the ILI schedule. This is an important consideration because operational staff will have to wait for recompression to complete before progressing other tasks. If enough machines are purchased to enable recompression to be used on all National Grid's ILI operations, an emission saving of 90% in the PIG trap category is expected, equating to 40 tonnes per annum.

The RIIO-2 and RIIO-3 outage plans indicate that up to 119 tonnes of natural gas could be vented, per year, from compressor station depressurisations. This is an emission source that could also be reduced by small mobile recompression machines. If enough machines are purchased to enable recompression to be used on all planned compressor station depressurisations, an emission saving of up to 98% is possible in this category, equating to 117 tonnes per annum.

Initial analysis of flow rates shows that machines of the same capacity could be used efficiently for PIG trap depressurisations and compressor station depressurisations, so these have been grouped into a single investment theme, due to volume discounts that can be leveraged from the supplier for making a larger single purchase of machines. CBA's have been separated due to different volumes of gas available to be saved and, therefore, different payback periods apply for each emission source.

b. Options and selection methodology

NGGT reviewed the marketplace and identified one supplier that manufactures recompression machines suitable for PIG trap and compressor station recompression. The supplier has two products that are suitable for this purpose. The two products were compared, with one favoured due to it having a compression rate 3x faster than the other, whilst only costing 25% more. Early in its deliberations, NGGT considered a combination of the two different machines, but only the preferred faster recompression technology is now being considered – by considering the unit with faster recompression capability, NGGT is minimising increased indirect costs.

PIG operations often require 12-hour working days. Recompression of the gas in the PIG trap is an additional step that cannot be carried out simultaneously with other tasks, therefore the recompression needs to take as little time as possible. The time taken to depressurise a PIG trap was the main factor considered when developing the options in this category.

For a typical PIG trap (36-inch diameter, 10 metre long), the time taken for a single machine to reduce the PIG trap pressure to 0.2barg is 108 minutes. Recompression is carried out at the PIG launch end and receiving end, so there is a total of 4 hours added to what is often already a 12-hour day. In most cases this would result in needing to split a single PIG run over two days rather than one day as it is currently, and results in a significant unit cost increase for ILI runs. Two machines running in parallel would take 54 minutes, and that would need to be done at both the launch end and receiving end of the PIG run. This additional two hours on the job time is the maximum acceptable increase in a PIG operation. An option for three machines

at either end of the PIG run has also been assessed to further reduce the time taken to depressurise the PIG trap.

Separate machines would be required at each end of the PIG run. Using the same machines at both ends of the pipeline was considered but has been discounted as it involves disconnecting the units from the launch site, moving them to the receiving site, and connecting at the receiving site on each day of the PIG operation. The extra work required to do this significantly increases the OPEX as well as the vehicle emissions that would result from towing two trailers (each weighing 4 tonnes) between the sites for each PIG run. The more significant impact is the additional safety risk that is involved in recommissioning the machines for every operation. This means the minimum number of machines required for each PIG run is four.

For compressor station depressurisations, the time taken is less important because the sites are normally staffed, and technicians/operators would be able to carry out other work in office buildings or on site whilst recompression is ongoing. The time taken to depressurise a compressor station was assessed based on the preferred technology for the PIG trap operations. It is reasonable, ranging from 10 hours for the smallest compressor station to 100 hours for the largest compressor station based on using three machines in parallel. The only impact on the time taken to depressurise is that a project will need to plan the recompression time at the start of the project, but that is not expected to cause an issue. This is because projects that require a compressor station to be depressurised usually have a duration of multiple weeks, so up to 4 days at the start of the project is not a significant increase, and in many cases, there will be preparatory work that can be carried out whilst the compressor station is being depressurised.

Table 6 - Pig trap recompression options.

Option	Preferred	Narrative
Option 1 - Do nothing	No	Option discounted as solutions exist to reduce this methane emission source. Methane emissions from PIG trap venting will remain.
Option 2 – Procure five high power and three low power PIG trap recompression units	No	This was the preferred option in the trigger paper but has now been discounted. The option would enable 90% of the gas in the PIG trap category to be saved. However, a single high-power machine achieves flowrates 3x greater than a single low power machine for only a 25% increase in cost, so the fleet capability would be significantly increased by only purchasing high power machines.
Option 3 – Procure two high power and one low power PIG trap recompression unit	No	Option discounted for the same reason as option 2.
Option 4 – Procure one PIG trap recompression unit	No	Option discounted because only 50% of the gas in the PIG trap category could be saved due to the requirement to not move recompression units between sites during the day.
Option 5 – Procure two PIG trap recompression units	No	More gas can be saved than option 1, but option discounted because working days would be extended by four hours due to recompression taking two hours at each end of the pipeline. This would result in a significant increase in OPEX.
Option 6 – Procure three PIG trap recompression units	No	Option discounted due to total recompression time being 3 hours, significantly extending working days and OPEX.
Option 7 – Procure four PIG trap recompression units	Yes	Preferred option to address PIG trap emissions because a two hour increase to the PIG operation will

		be acceptable in most cases, and the improvement from purchasing more machines begins to diminish once beyond four hours.
Option 8 – Procure six PIG trap recompression units	No	Increasing the number of machines at each end of the pipeline to three results in a time saving of 30 minutes per ILI operation, which does not justify the additional cost of purchasing two more machines and transporting them to each site. Initial analysis of ILI sites also indicates that it may not be possible to set up three machines on some sites.

Table 7 - Compressor station depressurisation options.

Option	Preferred	Narrative
Option 1 – Do nothing	No	Option discounted as solutions exist to reduce this methane emission source. Methane emissions from compressor station depressurisations will remain.
Option 2 – Procure one compressor station recompression unit	No	One machine for compressor station depressurisation is expected to save 90.6% of the gas in the category due to fleet capacity resulting in some jobs being missed.
Option 3 – Procure two compressor station recompression units	No	Two machines for compressor station depressurisation are expected to save 97.4% of the gas in the category.
Option 4 – Procure three compressor station recompression units	Yes	Three machines for compressor station depressurisation are expected to save 98% of the gas in the category.
Option 5 – Procure four compressor station recompression units	No	Four machines would not make a significant difference to the capacity of the fleet and would also be impractical to transport and set up in the recompression bay on compressor stations.

c. Preferred option

Compressor station and PIG trap recompression

In consideration of the preferred option, NGGT has moved in a different direction to the originally preferred approach for this category for two main reasons. Firstly, when the two different machine types were compared technically, there was a clear cost benefit as the higher power machine gives much greater value for money compared to the lower power machine in both initial capital investment and ongoing operational costs. Therefore, the lower power machines were discounted. Secondly, NGGT identified that compressor station depressurisations could be addressed providing more opportunities for the equipment to be utilised, thereby justifying a greater investment value.

The preferred option is to purchase eight small recompression units for compressor station depressurisations and PIG trap recompression. Three units are dedicated to compressor station depressurisations, and four units are dedicated to PIG trap venting. To ensure the maximum possible gas saving, one spare unit has been included to cover maintenance and/or breakdown of a unit.

Three recompression units are dedicated to compressor station depressurisations to ensure that the time taken to reduce pressure at compressor stations is reasonable. The highest Net Present Value (NPV) option

in the CBA is to invest in two units for compressor station depressurisation, but the difference is small and the third machine results in an additional reduction of methane emissions. NGGT also expects that more uses will be discovered when staff become familiar with the operation of the machines.

Four units are dedicated to PIG trap recompression. Four units was the highest NPV option in the CBA.

Using the same machines for these two different purposes provides flexibility within the fleet. On occasions when two compressor stations need to be depressurised at the same time, or when two PIG operations are running simultaneously, the maximum amount of gas can be saved by reallocating machines from one activity to another. If there are more than two simultaneous PIG operations/compressor station depressurisations, and if it is acceptable to increase the duration of the recompression, the number of machines on each assignment could be altered to run three simultaneous operations and save the maximum amount of gas.

d. Cost benefit analysis (CBA)

NGGT carried out a CBA for the investment in recompression units to capture vented emissions from PIG traps and those arising from compressor station depressurisations. Tables 8 and 9 summarise this analysis, alongside commentary on assumptions made and the rationale behind these, and any identified risks. Table 10 summarises the cost phasing of the investment over the RIIO-2 period, in both compressor station depressurisation and PIG trap recompression units.

Table 8 - Pig trap recompression cost benefit analysis.

Pig trap recompression	**Option 7 – Procure four high power PIG trap recompression units.**
Category value (CO2e)	£0.27m
Wholesale gas value	£0.01m
Capex	[redacted] (18/19 prices)
One off opex	[redacted] in 2025 (18/19 prices)
Annual opex	N/A - Opex will be built into RIIO-3 asset health plan
Impact on emissions in this category	90%
Annual benefit & year of impact	£0.17m, from RIIO-2 year 5.
Payback period (ROI)	6 years from investment, 3 years from first operation
Assumptions and rationale:	• Opex has been included for maintenance of the machines and all additional costs required to carry out works including; costs to transport the machines, costs for hazardous area assessments, costs to operate the machines, and costs of PIG staff additional time on site due to waiting for recompression to take place. • Additional funding is sought for extra time taken to carry out recompression in RIIO-2 year 5, which is included in the Opex assessment. • Benefits repeat annually as forecasted work volumes remain flat throughout the remainder of RIIO-2 and RIIO-3.
Risks and further commentary	• Implementation timeline is dictated by procurement and supplier lead-times and the supplier commissioning period. This is estimated at 24 months.

Table 9 – Compressor station recompression cost benefit analysis.

Pig trap recompression	Option 5 – Procure four high power compressor station recompression units, three machines plus one spare.
Category value (CO2e)	£0.74m
Wholesale gas value	£0.03m
Capex	[redacted] (18/19 prices)
One off opex	[redacted] in 2025 (18/19 prices)
Annual opex	N/A - Opex will be built into RIIO-3 asset health plan
Impact on emissions in this category	98%
Annual benefit & year of impact	£0.61m, from RIIO-2 year 5.
Payback period (ROI)	4 years from year of investment, 1 years from first operation
Assumptions and rationale:	• Opex has been included for maintenance of the machines and all additional costs required to carry out works including; costs to transport the machines, costs for hazardous area assessments, and costs to operate the machines. • Additional funding is sought for the extra time required to carry out recompression in RIIO-2 year 5, which is included in the Opex assessment. • Benefits repeat annually as forecasted work volumes remain flat throughout the remainder of RIIO-2 and RIIO-3.
Risks and further commentary	• The implementation timeline is dictated by procurement and supplier lead-times and the supplier commissioning period. This is estimated at 24 months

Table 10 – Cost phasing for compressor station and pig trap recompression preferred option in 18/19 pricing.

Year	2022/23	2023/24	2024/25	2025/26	Total RIIO-2
Machinery staged payments	[redacted]	[redacted]	[redacted]	£0m	[redacted]
OPEX	£0m	£0m	£0m	[redacted]	[redacted]
Total	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

NGGT will check costs prior to award, in order to mitigate risks associated with equipment price changes associated with exchange rate and RPE changes. In addition, once project approval to proceed is received, and third-party contracts are signed, NGGT will aim to place currency hedge(s) for any non-GBP denominated costs in line with our internal Treasury department guidelines. This will help minimise the impact of currency fluctuations over the course of the project, and indirectly provide additional certainty on non-GBP based costs for the consumer.

e. Delivery plan

Following award post-submission, a competitive tender will be carried out, and a market scan conducted, to determine if one supplier continues to be able to provide the recompression units. The tender is expected to

take three months, following which an order will be placed. Expected delivery times are one year, therefore recompression units are expected to be commissioned and available to reduce this source of emissions within the 2025 outage season.

Financial Year	2021/22	2022/23	2023/24	2024/25	2025/26
Deliverables		Procurement of eight small recompression units for compressor station depressurisations and PIG trap venting.	Part payment of eight small recompression units for compressor station depressurisations and PIG trap venting.	Part payment of eight small recompression units for compressor station depressurisations and PIG trap venting.	Commissioned eight small recompression units for compressor station depressurisations and PIG trap venting.

This investment is likely to require additional staff to operate and maintain the machines. The additional Opex requested for RIIO-2 year 5 is for operating, transporting, and maintaining the recompression units. It is expected that the ILI unit cost will increase in RIIO-3, due to the additional time and cost required to carry out the recompression work, and projects that require full or partial compressor station depressurisations will need to increase cost forecasts to pay for recompression.

The outcome of this investment is forecast to reduce emissions from PIG trap venting and compressor station depressurisations by over 95% starting in summer 2025.

NGGT will, by the end of the RIIO-2 price control, deliver:

- Eight compressor station and PIG trap recompression units into operational service to capture vented emissions from PIG traps during pipeline inspection operations and compressor station depressurisations.

NGGT will report on progress of operational delivery and emission reduction realised within the regulatory reporting pack (RRP) Net Zero strategic narrative for the remainder of RIIO-2.

4 NZASP Funding Request

Proposals made in this chapter are intended to apply on a non-precedential basis. This is because future policy clarifications may inform appropriate funding routes and specific regulatory treatments for subsequent project phases. It was agreed during our pre-trigger phase of this re-opener that the NZASP funding route would be adopted.

Cost recovery speed and Totex incentivisation

The methane emission reduction and detection options proposed by NGGT align with the priorities that stakeholders and consumers told us were important in the development of our RIIO-2 business plan. Namely to "care for the environment and communities" and "facilitate delivery of a sustainable energy system". Additionally, our proposals align with the Environmental Action Plan (EAP) theme, "Our Climate Commitment", in which NGGT commits to reducing carbon emissions by 2026, and specifically establishing a baseline for methane emissions gas escapes on the transmission system through improved monitoring during RIIO-2. It will progress NGGT towards the National Grid Group commitment of net zero direct greenhouse gas emissions by 2050 and aligns with the National Grid Group Responsible Business Charter and the NGGT Environmental Action Plan.

NGGT is seeking investment of [redacted] in Totex funding to expand its pipeline recompression capability and introduce new smaller mobile recompression suitable for PIG trap and compressor station vent reduction. In order to mitigate any risk of price fluctuation and to protect GB consumers, NGGT has agreed with Ofgem to provide updated costs, based on revised quotes, latest exchange rates, and the latest price base conversion factor revised by Ofgem, immediately prior to award. Once project approval to proceed is received from Ofgem, and third-party contracts are signed, NGGT will aim to place currency hedge(s) for any non-GBP denominated costs in line with our internal Treasury department guidelines. This will help minimise the impact of currency fluctuations over the course of the project, and indirectly provide additional certainty on non-GBP based costs for the consumer

It has been agreed with Ofgem that our method of reporting against this re-opener will not follow a Price Control Deliverable but will instead be reported through the annual Regulatory Reporting Pack.

- In line with the above, and in reference to the Net Zero Pre-Construction Work and Small Projects criteria, our re-opener application meets the following guidelines: Early development, design and general pre-construction work that will enable the achievement of Net Zero Carbon Targets;
    - Our proposal is aligned with the above as the project is related to methane reductions and in turn reaching the UK's Net Zero Carbon Targets as set out in the COP 26 agreement through the implementation of mobile recompression units.
- Net Zero projects that exceed the £2m materiality cap of the Net Zero and Reopener Development use-it-or-lose-it allowance (NZARD UIOLI) or are otherwise not suitable for the NZARD UIOLI;
    - Our project is above the £2m materiality cap as NGGT is requesting funding of [redacted].
- Net Zero projects that do not meet the materiality threshold for the Net Zero Reopener; and
    - This submission under Mobile Recompression is submitted as a separate application in order to adhere to the materiality threshold.
- Net Zero facilitation (Green Gas and Hydrogen) projects and Hydrogen projects that are required as part of the Department for Business, Energy & Industrial Strategy Hydrogen Grid Research and Development Programme, including projects that may be interpreted as innovative – where there is a clear need, and it is appropriate for network consumers to fund;
    - Our project offers an innovative solution in the green gas zone for the mobile recompression element as described within our needs case.

Allowed revenue and bill impacts

The impact of proposed project costs and regulatory treatment to allowed revenue and consumer bills are less that 1p per household bill and therefore have been determined to be immaterial for further analysis.

5 Glossary of terms

Acronym / term	Definition
BAT	Best Available Technique
CAPEX	Capital expenditure
CBA	Cost Benefit Analysis
COP26	UN Climate Change Conference UK 2021
FEED	Front end engineering design
Fugitive emissions	Gas escapes and other irregular releases of gases from a pressurized containment
GHGIM	Greenhouse Gas Investigative Mechanism
Global Methane Pledge	Pledge to take voluntary actions to contribute to reducing global methane emissions by at least 30% from 2020 levels by 2030
GWP	Global Warming Potential. Developed to allow comparisons of the global warming impacts of different gases
ILI	In-line inspection
Net zero	A target of completely negating the amount of greenhouse gases produced by human activity, where there is a balance achieved between the carbon emitted into the atmosphere and the carbon removed
NGGT	National Grid Gas Transmission. Sole UK gas transmission system network operator
NIA	Network Innovation Allowance
OEM	Original equipment manufacturer
OPEX	Operating expenditure
PIG	Pipeline inspection gauge
RIIO	Revenue = Incentives + Innovation + Outputs. This is the regulatory framework through which funding is set for the business. RIIO-2- covers the period from April 2021 to March 2026
QRA	Quantitative Risk Assessment
TSO	Transmission system operator
UM	Uncertainty mechanism