Appendix A22 – FEED Study Scope Report

Northern Gas Networks

East Coast Hydrogen

FEED Scope of Services

Reference: 293805-ARUP-FEED

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Job number 293805

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Contents

1.	General	1
1.1	Introduction and background	1
1.2	NGN's network area	3
1.3	East Coast Hydrogen partners	4
1.4	Funding	4
2.	Purpose, aim, goals and objectives	4
3.	Timescale	6
4.	Scope summary	7
4.1	Level of detail	7
5.	Key assumptions/ decisions	9
5.1	Domestic Heating	9
5.2	Project Union	9
5.3	Project phases	10
6.	Pricing strategy / details	11
7.	HP/IP Package Technical Consultant Scope Detail	12
7.1	Final options selection post Pre-FEED	14
7.2	FEED deliverables	19
7.3	Scope by others	25
7.4	EPC Scope	26
7.5	Attendance at meetings	26
7.6	Information availability	27
8.	MP Package Technical Consultant Scope Detail	28
8.1	Final options selection post Pre-FEED	29
8.2	FEED deliverables	32
8.3	Scope by others	35
8.4	EPC Scope	37
8.5	Attendance at meetings	37
8.6	Information availability	37
9.	Consenting and Environmental Consultant Scope Detail	39
9.1	2028-2031 delivery phase scope	41
9.2	FEED deliverables	44
9.3	Scope by others	45
9.4	Attendance at meetings	46
10.	Phase 5 Pre-FEED Scope Detail	47
10.1	Scope	47
10.2	Attendance at meetings	51
11.	Close Down Report	52

Table 1: FEED stage timescale 6

Table 2: HP / IP Pipelines 14

Table 3: HP / IP AGIs 17
Table 4: Meeting attendance requirements 26
Table 5: MP Pipelines 29
Table 6: Meeting attendance requirements 37
Table 7: 2028-31 HP pipelines 41
Table 8: 2032 onwards HP pipelines 42
Table 9: 2028-31 delivery AGIs 42
Table 10: Meeting attendance requirements 46
Table 11: Pre-FEED study document requirements 47
Table 12: Meeting attendance requirements 51
Figure 1: ECH proposed network map 2
Figure 2: Areas within NGN's distribution region 3
Figure 4: Project organogram 7
A.1 FEED Master Deliverables Register 53

Acronyms

DESNZ	Department for Energy Security and Net Zero (Formally Business, Energy & Industrial Strategy, BEIS)
ECH	East Coast Hydrogen
HP	High Pressure
IP	Intermediate Pressure
ITT	Invitation to Tender
LP	Low Pressure
LTS	Local Transmission System
MTO	Material Take Off
NGT	National Gas
NGN	Northern Gas Networks
NTS	National Transmission System
AGI	Above Ground Installation
EPC	Engineering, Procurement and Construction
ROI	Return on Investment

1. General

1.1 Introduction and background

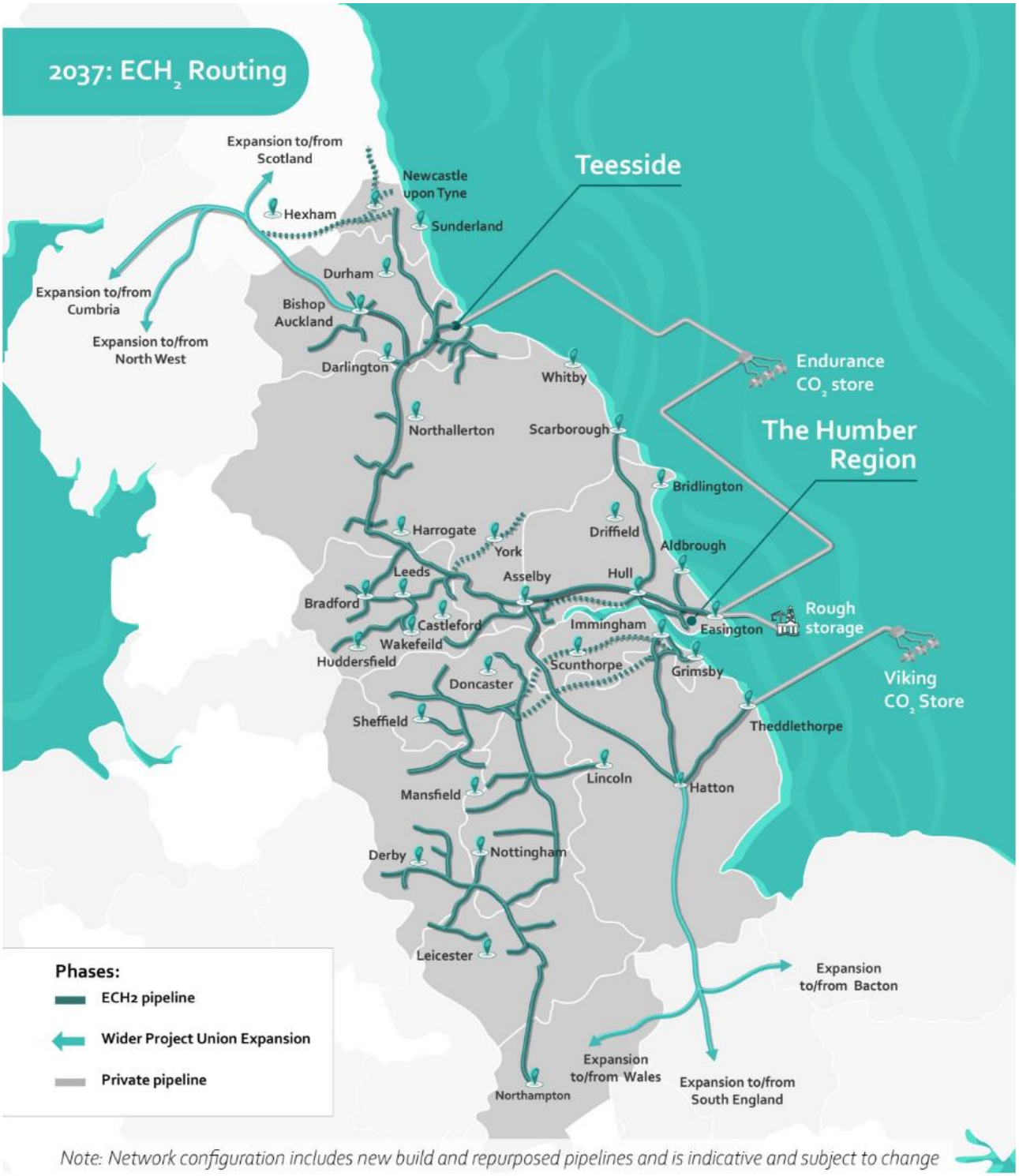
Northern Gas Networks (NGN) distribute natural gas to homes and businesses in the north of England. They are responsible for supplying North, East and West Yorkshire, the Northeast and North Cumbria. The East Coast region is home to the UK's two largest industrial emission clusters (Tees Valley & Humber), hosting concentrated industrial energy demand, significant gas storage and abundant offshore wind power.

The East Coast hydrogen (ECH) project is a first of its kind, 15-year mega infrastructure programme established by Northern Gas Networks (NGN), Cadent and National Gas (NGT), along with a supporting consortium group comprising of partners across the full hydrogen value chain. The ECH network will be an anchor in creating and catalysing the UK low-carbon hydrogen economy by connecting locations of hydrogen supply, demand, and storage through a mixture of repurposed and new pipelines.

ECH will support UK Government policy and Net Zero legislation enabling green job creation, reducing emissions, and creating resilience in the whole energy system. The ECH programme has identified approximately 88 TWh of annual hydrogen production in ECH the region, and over 58 TWh of annual industrial, commercial, and power demands potentially materialising up to 2037.

ECH will enable decarbonisation of industrial and commercial (I&C) and power customers located within industrial clusters as well as those that are scattered outside of the clusters which represent 50% of UK's I&C emissions. It will also offer future optionality to decarbonise transport and heating sectors through effective utilisation of large-scale hydrogen infrastructures, thereby delivering better value for investment.

The ECH project has completed the Pre-FEED stage. This stage has developed a proposed network based upon the demand and production figures obtained. These were then assessed against the feasibility and viability of the required routes to connect the various points of the network. The proposed network for the whole ECH project can be seen in Figure 1.



The routing options presented will be carried forward to the next phase of the Programme for further analysis through Front End Engineering Design (FEED). We will continuously optimise routing to ensure that Programme plans continue to align with both evolving UK Government policy and achieving value for money.

Figure 1: ECH proposed network map

1.2 NGN's network area

This FEED scope report relates to the NGN region of ECH. The NGN scope of ECH can be seen in Figure 2.

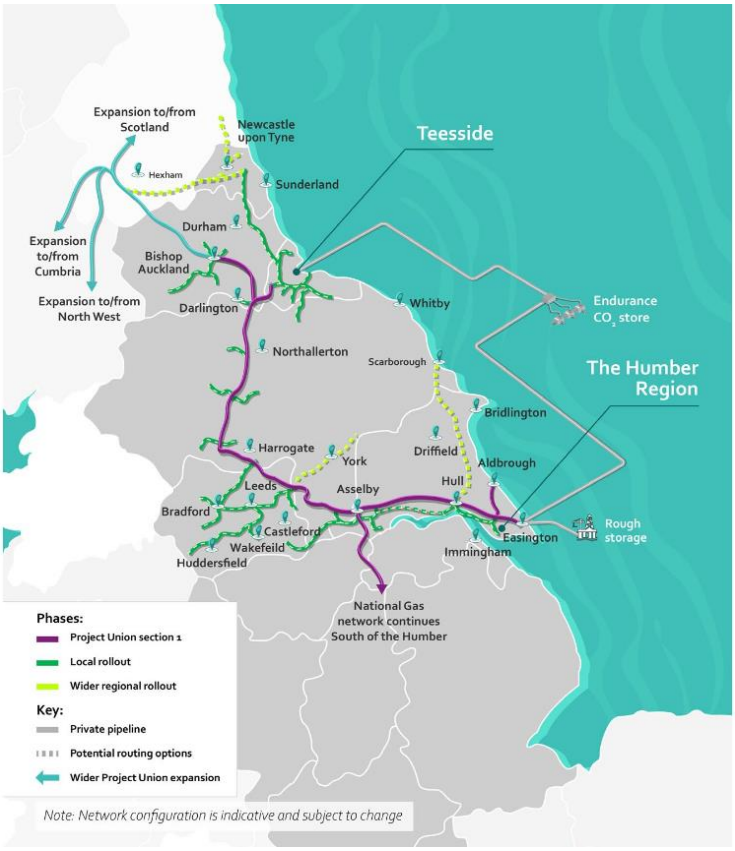


Figure 2: Areas within NGN's distribution region

The initial pre-FEED identified the areas with the most potential in the early stages of the ECH project. This primarily ranged from Humber across to West Yorkshire and up to Teesside. This is the network which will be studied and developed further as part of the FEED scope. Alongside this, a further Pre-FEED study will be undertaken to establish additional parts of the network within the same area and extending to Cumbria, further North of Newcastle upon Tyne.

Please refer to the following reports to gain a full understanding of the project so far.

- East Coast Hydrogen Reopener
- Demand report 293805-ARUP-DMS.
- Storage report 293805-ARUP-STS
- Production report 293805-ARUP-PRS
- Re-purposing strategy 293805-ARUP-RPS
- Existing network study 293805-ARUP-ENS
- Options design basis 293805-ARUP-ODB
- Options and phasing study report 293805-ARUP-OSR
- Final Pre-FEED report 293805-ARUP-PFR
- NGN ECH Pre-FEED Routing.kmz
- East Coast Hydrogen Delivery Plan (November 2023)

- HMG Net Zero Strategy:
- HMG UK Hydrogen Strategy (and update)
- DESNZ Hydrogen Transport and Storage Networks Pathway (December 2023)
- East Coast Hydrogen Feasibility Report
- Leeds City Gate Report
- H21 North of England Report

Copies of these documents will be provided with Invitation to Tender (ITT) packages.

The Government is currently funding multiple blue and green hydrogen production projects. To gain this funding, projects must be standalone, have dedicated hydrogen consumers, and be directly connected to a hydrogen production source through local hydrogen transport infrastructure. There is an acknowledgement from Government that to further develop the hydrogen economy and help to meet net zero targets, the development of integrated hydrogen transport networks is required, this is detailed in the Hydrogen Transport and Storage Networks Pathway document, which strongly aligns with what ECH will deliver.

1.3 East Coast Hydrogen partners

As stated in Section 1.1, the regulated gas businesses involved in ECH are:

- Northern Gas Networks
- Cadent Gas
- National Gas

ECH is also supported by potential hydrogen producers or consumers who support the project. Throughout the Pre-FEED stage, stakeholder engagement has been critical to establishing confidence in the needs case for the network, a large number of producers, consumers and storage providers have been engaged and continuation of this stakeholder engagement will be crucial to the ongoing success of the project.

1.4 Funding

The ECH project FEED stage will be funded through Net Zero Pre-Construction Work and Small Net Zero Project (NZASP) reopener which was created to allow gas transmission and distribution companies to undertake early design, development, general pre-construction work, and net zero facilitation capital projects.

2. Purpose, aim, goals and objectives

Purpose

The Government has set to deliver a decarbonised power sector by 2035 and net zero emissions by 2050. NGN owns 36,000 km of natural gas distribution pipework, and therefore is at risk of a significant reduction in the business and the value of its assets. NGN wish to show the feasibility of much of their assets being transitioned to a hydrogen for energy distribution system with the hope of contributing to meeting the Government's Net Zero Strategy.

Aim

The aim of the FEED stage of the ECH project is to develop a project with the level of detail and cost certainty which would allow it to form the basis of an investment decision under the transport and storage business model.

demonstrate to DESNZ a solution to enable widespread industrial and commercial decarbonisation through development of a hydrogen distribution network, utilising as much repurposed infrastructure as possible.

Goals

The goals of the FEED stage and concurrent Pre-FEED are:

- To develop a feasible network connecting supply, demand and storage
- To enable the decarbonisation of multiple hard to abate sectors
- Support the UK government in achieving low carbon hydrogen and net zero targets
- Provide system resilience and flexibility to the UK energy system
- To catalyse wider system benefits
- Inform final investment decision and a methodology to deliver the project
- Optimise the Return on Investment (ROI) by further optimising the network
- Improve safety outcomes
- Enable application to the anticipated Transport and Storage Infrastructure allocation round.
- Ensure the solution enables the proposed is coordinated of Project Union and development of third-party pipelines.

Objectives

The key objectives to achieve the goals are:

1.) Confirm the existing demand, supply and storage data is still correct and update where required.

2.) Further assess the technical viability of the proposed pipeline routes and further optimise routing corridors to determine final routing. If multiple routes are possible, a cost benefit analysis should be carried out before determining the final routing.

3.) Undertake pipeline design and safety assessments.

4.) Develop designs for the repurposing or development of the required Above Ground Installations (AGIs).

5.) Progress the consultation and environmental assessments of each route and AGI.

6.) Determine project costs to an AACE class 3 estimate to inform final investment decision.

7.) Determine sequence of development and proposed delivery programme.

8.) Develop packages to tender Engineering, Procurement and Construction (EPC) contracts to deliver the network.

9.) Coordinate with all project stakeholders.

3. Timescale

The timetable for the key dates of the project FEED stage of the project with key milestones and their projected completion dates can be seen in Table 1.

Table 1: FEED stage timescale

Ref	Milestone description	Date
1	Start of FEED study; Project management, NGN HP/IP network, NGN MP network, consultation and environmental,	01/06/24
2	Start of Stage 5 Pre-FEED	01/02/2025
3	End of FEED and stage 5 Pre-FEED	01/07/2026

An overall programme for the project FEED and stage 5 Pre-FEED has been developed as part of the Pre-FEED works.

4. Scope summary

The scope of the FEED stage is determined by the purpose, aim, goals and objectives outlined in Section 2. The project has been split into packages to enable the most effective delivery within the timescales whilst maintaining consistency of approach and also competition in the market. The main delivery roles in the project can be seen in the organisation in Figure 3.

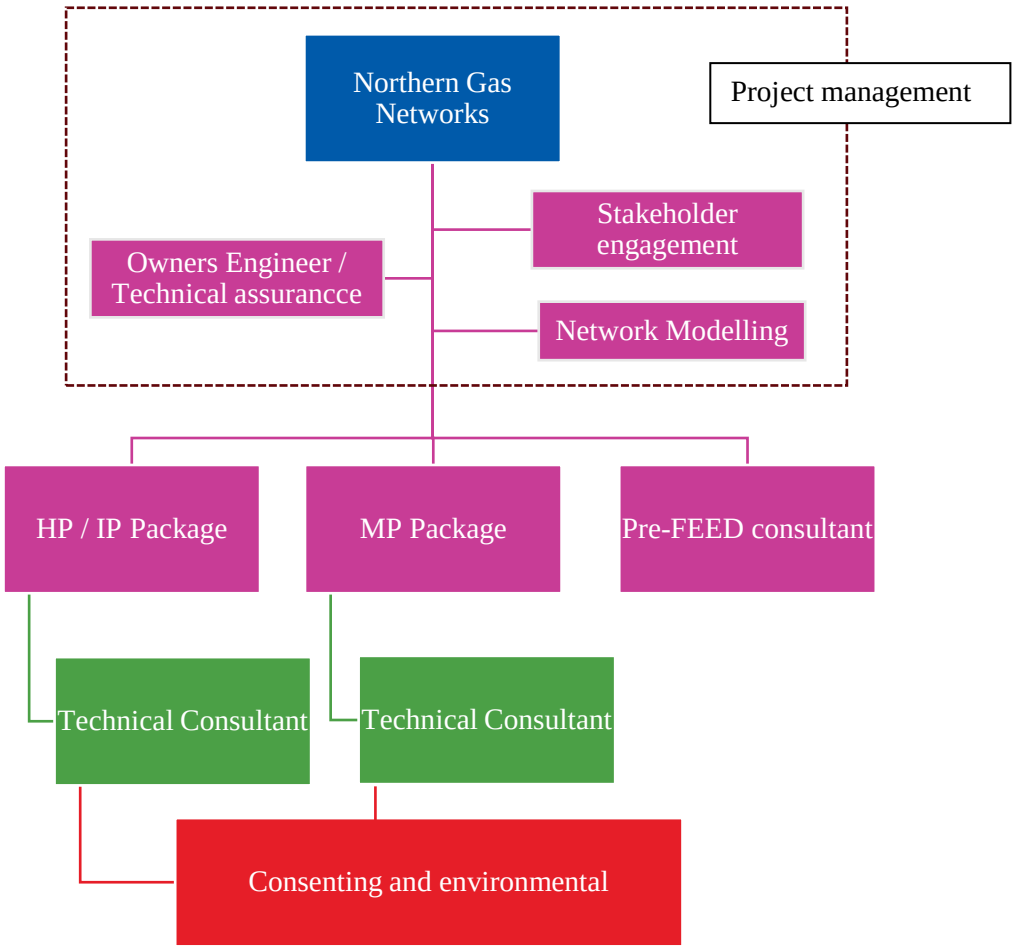


Figure 3: Project organogram

The scope split and proposed programme has been determined to balance delivery timescales and the project risks determined at the Pre-FEED stage. The network development will begin with specific parts of the HP/IP package to enable Project Union as well as the MP package. This will allow further collation and confirmation of information from stakeholders at the production and consumption ends of the network. The HP/IP package will start later once the connection points from the NGT network, and the MP network have reached a greater level of certainty. The consenting and environmental package will begin at the start of the programme due to the large timescales required and the low risk works which can be undertaken at that stage. The stage 5 Pre-FEED works have minor dependencies from the other packages, but that programme is not as programme critical to the project.

4.1 Level of detail

The level of detail required for specific deliverables is defined within the individual scope section of this document. The overarching level of detail to which the contractors should work to for the FEED level design

is to achieve AACE class 3 estimates which will be able to inform a Financial Investment Decision (FID) and also tender the EPC stage of the project.

5. Key assumptions/ decisions

The project assumptions and decisions from the Pre-FEED stage are recorded in the project Key Decisions log (293805-ARUP-KDL). The main ones relevant to this scope of works are detailed below:

- NGT will provide an East to West connection from Newcastle upon Tyne to Carlisle.
- NGT will repurpose Feeder 7 as part of project Union.
- Proposed repurposed lines are suitable (subject to condition surveys) for the transport of hydrogen.
- Pig traps and Pig stations will only require minor modification for conversion to hydrogen.
- Production pressures will meet the requirements of the networks or producers will provide compression.
- AGI sites can have natural gas and hydrogen connections within the same site boundary.
- Routing at Pre-FEED stage was undertaken assuming all lines were HP for a worst case, there is therefore potential for optimisation of MP routing at FEED stage.
- The network was developed on the basis that blending was not allowed in the gas transmission system and that conversion will be to 100% hydrogen. It was also assumed that the Local Transmission System (LTS) would also be converted to 100% hydrogen.
- Hydrogen production and storage projects which have been included in the developed network are identified in the relevant production and storage reports. Due to the fast-paced nature of the industry, additional producers and storage facilities are expected to be developed prior to and during the FEED stage of the project. These shall be considered by the project management team on a case-by-case basis.

5.1 Domestic Heating

The government plans to make a decision on the widescale use of hydrogen for domestic heating in 2026. The plans for village and town trials was stopped by the government in December 2023. The existing networks have been sized to accommodate a transition to provide hydrogen domestic heating. The uptake of hydrogen heating and the relevant demands in ECH regions is detailed within the Pre-FEED documentation. The Pre-FEED assumed hydrogen will ultimately be used for domestic heating but at a reduced level for energy flow.

5.2 Project Union

Project Union, also called the hydrogen backbone, is the National Gas's project for repurposing part of the NTS for hydrogen transport. Project Union Pre-FEED was undertaken in tandem with the NGN ECH Pre-FEED.

Project Union will connect hydrogen production, storage and demand to enable net zero and empower a UK hydrogen economy. Repurposing existing transmission pipelines will create a low-cost hydrogen 'backbone' for the UK by the early 2030s and connect to the proposed European Hydrogen Backbone.

The Project Union Pre-FEED determined which pipelines would be repurposed for hydrogen transmission. The high-level project requirement was to connect the Humber and Teesside industrial clusters using existing NTS infrastructure with expansion into the Cadent East and NGN regions through new build LTS infrastructure, to provide a continued supply of natural gas and seamless conversion to hydrogen. Communication with the Project Union has been undertaken continually throughout the project and shall continue through the FEED stage, to ensure overall project alignment.

5.3 Project phases

The current NGN ECH project has so far been defined through the following project phases:

5.3.1 Network Phase 1 – Production Project Development

Hydrogen Production plants are developing and contracting with local hydrogen consumers. The only hydrogen distribution is via bespoke point to point pipelines developed by the hydrogen production projects.

Those know to be under development are detailed in the Production Report.

5.3.2 Network Phase 2 – Hydrogen Transmission Development

The Project Union team are working to facilitate repurposing of parts of the existing NTS for use with Hydrogen. Works involved in enabling the Project Union will include modifications to offtakes from repurposed Feeder pipelines and construction of new offtakes from existing Natural Gas Feeders where required.

At the end of this stage, it is envisaged that there would be a continuous High-Pressure Pipeline from Cowpen Bewley on Teesside to Elton AGI, connection to Feeder 7 down to Asselby AGI. From Asselby there will be a connection across to the Humber to Aldborough and Easington.

In the phase 2, the private network (localised within some of the industrial sectors) will also be developed and connected to demand.

5.3.3 Network Phase 3 – Hydrogen Distribution Development into main industrial clusters

Initial distribution connections being made from the High-Pressure network to additional large scale industrial and commercial users. Extensions being made to other users from production private networks.

The initial concept is to create main industrial clusters in three areas initially as follows:

3a – Teesside

3b – Humberside

3c – West Yorkshire

3d – North Yorkshire

3e – South of Tyneside

5.3.4 Network Phase 4 – Distribution Hydrogen Area Roll Out (Optional)

Phase 4 is dependent on the hydrogen for heat decision which is expected in 2026. The network has been developed to facilitate this at the LTS level, whilst ensuring routing is viable based on the industrial and commercial connections identified, to ensure project resilience.

5.3.5 Network Phase 5 – Hydrogen Network to areas away from main clusters

This is the expansion of hydrogen to areas away from the initial industrial clusters or the Project Union repurposed Feeder. These areas include Cumbria, North Northumberland and areas of East Yorkshire.

This will vary depending on the decision on domestic heating which will determine the extent of repurposing or new pipeline assets required.

6. Pricing strategy / details

Due to the evolving nature of the industry and the volatility of government decisions, it is appreciated that the full scale of works required to deliver the project is difficult to assess. The scope of works detailed in the subsequent sections should be assessed against the currently proposed networks and therefore the routes identified. Pricing should be itemised in a way in which changes to the pipelines od AGIs can be accounted for accurately in change events. Additional variation to the scope to assess new connections / pipeline sections should be provided as part of the tender return.

Some of the information that will be provided to the Consultants during the project is subject to a Non-Disclosure Agreement (NDA) being in place due to the sensitivity of the third-party information.

Because the Consultants will need access to information from third parties that has been supplied under NDA and MOU's to NGN the Consultants will be required to enter into a confidentially agreement with NGN as a condition of award.

Cost for all software and licences should be included within the relevant sections on the price schedule. A central cost has been allowed for the utilisation of an infrastructure routing software which all parties will have access to. This will combine constructability, environmental, planning and other constraints into software, enabling routing comparisons for each pipeline.

7. HP/IP Package Technical Consultant Scope Detail

The ECH Pre-FEED determined a network based on repurposed and new build pipelines. These pipelines cover the HP, IP and MP pressure tiers within NGNs network. To efficiently deliver the FEED stage of this project, the scope for the delivery of new and repurposed infrastructure has been split into three packages. This package relates to the HP and IP infrastructure which is not included in the Project Union Enabler package.

The scope of this package will include the design of:

- New and repurposed HP and IP pipelines
- New, modified and repurposed HP and IP AGIs including pressure reducing stations, block valve stations
- Disconnecting existing offtake connections from the Feeder 7 and connecting to new natural gas feeders.
- Building new natural gas HP/IP pipelines and AGIs to enable re-purposing of existing NGT pipelines and new build pipelines for H2 transportation.

The network and infrastructure have been identified through the Pre-FEED works, the infrastructure required within this scope is detailed in section 7.1. These will need to be reassessed at the start of the FEED stage to confirm they still align with the proposed network plan for Project Union. The Contractor will be responsible for reviewing the Pre-FEED study in relation to this scope of works and working alongside the Client to identify any required changes to the planned network since the completion of the Pre-FEED due to changes in demand, production or storage schemes which will be outlined by NGN though their stakeholder engagement.

This package of the project interfaces with the MP package, Project Union, Consenting and Environmental consultant and with the Client. The Contractor shall work with all parties to ensure information flow is understood and programmes of work align to meet these requirements, these shall ultimately be coordinated by the Client.

The Contractor shall work collaboratively with the Client to ascertain the priority list for the infrastructure in the FEED stage, this will be based upon the required delivery schedule, which is currently outlined in the phasing plan, and will incorporate updates post Pre-FEED completion. The interfaces between parties are defined within the RACI matrix.

This package of works shall progress the FEED design of the sites and pipelines to a point at which a single option has been selected for each AGI or pipeline and the works can be accurately costed to AACE class 3 estimates for final investment decision and to tender for EPC contracts.

The design works for pipelines and installations shall be in the essence of the process outlined in NGN/SP/TR/23 (Specification for conceptual design of pipelines and installations operating at above 7 barg) but with the deliverables identified in the relevant IGEM standards for Hydrogen pipelines and AGIs.

The Contractor is required to deliver the works to meet the agreed project requirements. Where the Contractor identifies additional works or documentation required to deliver these works, these shall be proposed to the Client during the tender process.

An overview of the HP/IP scope is provided below, with the specific deliverables detailed further in section 7.2.

Project Union is responsible for the transmission of hydrogen to different LDZs throughout the country. While attempting to develop a hydrogen transmission network, Project Union will repurpose and, in some cases, develop new assets to enable the flow of hydrogen gas from production facilities to different LDZs.

To enable the work of Project Union, NGN and / or NG will have to modify the existing Offtakes and AGIs or build new Offtakes and AGIs. The modification will also require sections of new natural gas pipeline and

AGIs for re-purposing of transmission and distribution system to hydrogen. These items will be a priority in the phasing to enable Project union, these have been identified in the “Natural gas” column of Table 2 and Table 3.

7.1 Final options selection post Pre-FEED

The Pre-FEED study has identified the required HP and IP infrastructure to develop the ECH network.

The following tables provides a summary and brief description of project infrastructure requirements within this scope. For full details please refer to the Pre-FEED documentation.

The options below are split into three distinct packages. The pipelines and AGIs have been split this way to align with the anticipated phasing of the project. These project phases are:

1. Project union enabling (natural gas)
2. Project union enabling (hydrogen)
3. Hydrogen network

The Pre-FEED routing can be seen in (NGN ECH Pre-FEED Routing.kmz).

Table 2: HP / IP Pipelines

Area	Start	End	Type	Pipeline Length (km)	Diameter (mm NB)	Natural gas
Hartlepool						
Teesside	[redacted]		Pipeline - Repurposed	7.9	300	
Teesside			Pipeline - New	1.8	300	
Haverton Hill						
Teesside			Pipeline - Repurposed	3.0	300	
BP						
Teesside			Pipeline - New	1.3		
Teesside			Pipeline - New	0.7		
Teesside			Pipeline - New	0.4	300	
Teesside South						
Teesside			Pipeline - Repurposed	13.6	600	
Teesside			Pipeline - New	3.8	300	
Hartlepool South						
Teesside			Pipeline - New	2.7	300	
Barnard Aycliffe						
Bishop Auckland to Pannal			Pipeline - Repurposed	8.6	300	
Bishop Auckland to Pannal			Pipeline - Repurposed	4.2	300	
Bishop Auckland to Pannal			Pipeline - New	0.1	300	
Bishop Auckland to Pannal			Pipeline - New	1.8	300	

Area	Start	End	Type	Pipeline Length (km)	Diameter (mm NB)	Natural gas
Bishop Auckland North						
Bishop Auckland to Pannal	[redacted]		Pipeline - New	2.8	300	
Bishop Auckland to Pannal			Pipeline - New	2.3	600	
Thrintoft						
Bishop Auckland to Pannal			Pipeline - New	5.6	300	
Bishop Auckland to Pannal			Pipeline - New	4.6	300	
Bishop Auckland to Pannal			Pipeline - New	1.3	300	
Harrogate						
Bishop Auckland to Pannal			Pipeline - Repurposed	3.6	450	
Bradford Leeds						
Leeds / Bradford			Pipeline - Repurposed	9.7	300	
Leeds / Bradford			Pipeline - New	2.4	300	
Leeds / Bradford			Pipeline - New	3.6	300	
Leeds East						
Leeds / Bradford			Pipeline - New	9.6	300	
Leeds / Bradford			Pipeline - Repurposed	9.0	600	
Leeds / Bradford			Pipeline - New	4.7	400	
Bradford						
Leeds / Bradford			Pipeline - Repurposed	4.2	450	
Leeds / Bradford			Pipeline - Repurposed	4.1	450	
Leeds / Bradford			Pipeline - Repurposed	0.8	300	
Leeds / Bradford			Pipeline - New	1.5	300	
Leeds South						
Leeds / Bradford			Pipeline - New	2.2	300	
Leeds / Bradford			Pipeline - New	0.6	300	
Pannal Pudsey						
Leeds / Bradford			Pipeline - Repurposed	21.0	600	
Selby						
Towton to Asselby			Pipeline - New	5.7	300	
Towton to Asselby			Pipeline - New	11.6	300	
Towton to Asselby			Pipeline - New	0.7	300	
Towton to Asselby			Pipeline - New	1.8	300	
Towton to Asselby			Pipeline - New	2.2	300	
Goole						
Towton to Asselby			Pipeline - New	2.4	300	
Towton to Asselby			Pipeline - New	3.3	300	
Knottingley						

Area	Start	End	Type	Pipeline Length (km)	Diameter (mm NB)	Natural gas
Towton to Asselby	[redacted]		Pipeline - New	8.9	400	
Towton to Asselby			Pipeline - New	4.6	400	
West Hull						
Humber			Pipeline - Repurposed	17.8	600	
Humber			Pipeline - New	0.9	300	
Humber			Pipeline - New	1.5	300	
Howden						
Humber			Pipeline - Repurposed	6.0	250	
Humber			Pipeline - Repurposed	3.5	125	
Humber			Pipeline - Repurposed	3.6	180	
Humber			Pipeline - Repurposed	1.6	125	
Humber			Pipeline - New	6.2	300	Natural Gas
Humber			Pipeline - New	3.3	250	Natural Gas
Hull						
Humber			Pipeline - Repurposed	8.0	300	
Humber			Pipeline - Repurposed	1.3	450	
Humber			Pipeline - New	0.7	300	
Humber			Pipeline - New	1.7	300	
Humber			Pipeline - New	0.1	300	
Humber			Pipeline - New	1.6	300	
Humber			Pipeline - New	5.6	300	
Humber			Pipeline - New	2.4	300	
Humber			Pipeline - New	6.6	300	
East Riding						
Humber				51.3	300	
Humber			Pipeline - New	2.9	100	Natural Gas
Humber			Pipeline - New	5.9	100	Natural Gas
Tyneside						
Teesside			Pipeline - Repurposed	35.0	300	
Tyneside			Pipeline - Repurposed	10.0	300	

Table 3: HP / IP AGIs

Area	Start	Type	Pressure	Natural gas
Teesside	[redacted]	PRI - Repurposed	HP to MP	
Teesside		Offtake - Modified	HP	
Teesside		Offtake - Modified	HP	
Teesside		PRI - Repurposed	HP to MP	
Teesside		PRI - Repurposed	HP to MP	
Teesside		PRI - New	HP to MP	
Teesside		PRI - New	MP to LP	
Teesside		PRI - Repurposed	HP to MP	
Teesside		Offtake - Modified	HP	
Teesside		PRI - New	IP to MP	
Bishop Auckland to Pannal		Offtake - Modified	HP	
Bishop Auckland to Pannal		Offtake - Modified	HP	
Bishop Auckland to Pannal		PRI - New	HP to IP	
Bishop Auckland to Pannal		Pig Trap - Repurposed	HP	
Bishop Auckland to Pannal		PRI - Repurposed	HP to MP	
Bishop Auckland to Pannal		Offtake - Modified	HP	
Bishop Auckland to Pannal		Offtake - New	HP	
Bishop Auckland to Pannal		PRI - New	HP to MP	
Bishop Auckland to Pannal		Offtake - New	HP	
Bishop Auckland to Pannal		PRI - New	HP to MP	
Bishop Auckland to Pannal		PRI - Repurposed	HP to MP	
Bishop Auckland to Pannal		Offtake - New	HP	Natural gas
Bishop Auckland to Pannal		Offtake - New	IP	Natural gas
Leeds / Bradford		Pig Trap - Repurposed	HP	
Leeds / Bradford		PRI - Repurposed	HP	
Leeds / Bradford		PRI - Repurposed	HP	
Leeds / Bradford		PRI - Repurposed	HP	Modification for continued natural gas distribution
Leeds / Bradford		PRI - Repurposed	HP	
Leeds / Bradford		PRI - Repurposed	HP	

Leeds / Bradford	[redacted]	PRI - Repurposed	HP	Modification for continued natural gas distribution
Leeds / Bradford		PRI - Repurposed	HP	
Leeds / Bradford		PRI - New	HP to MP	
Leeds / Bradford		PRI - New	HP to MP	
Leeds / Bradford		Offtake - New	HP	Natural gas
Leeds / Bradford		Offtake - Modified	HP	
Towton to Asselby		PRI - Extension	HP to IP	
Towton to Asselby		PRI - Repurposed	IP to MP	
Towton to Asselby		PRI - New	HP to MP	
Towton to Asselby		PRI - New	HP to MP	
Humber		PRI - Repurposed	HP to MP	
Humber		PRI - Repurposed	HP to IP	
Humber		PRI - New	HP to MP	
Humber		PRI - Repurposed	HP to IP	
Humber		PRI - Repurposed	HP to MP	
Humber		PRI - New	IP to MP	
Humber		PRI - Repurposed	HP to IP	
Humber		PRI - Repurposed	HP to MP	
Humber		PRI - New	IP to MP	
Humber		PRI - New	IP to MP	
Humber		Offtake - New	HP	Natural gas
Humber		PRI - Repurposed	HP to IP	
Humber		PRI - Repurposed	IP to MP	
Humber		Offtake - New	HP	
Humber		PRI - Repurposed	HP to MP	Natural gas
Tyneside		Offtake - Modified	HP	
Tyneside		Offtake - New	HP	

7.2 FEED deliverables

The following deliverables shall form the output of this scope of works.

7.2.1 General

There general deliverables will form the basis of the network design.

Deliverable	Description
Basis of design	The basis of design document should include all relevant assumptions and decisions made to progress the design. It should detail these alongside suitable references and justification. All applicable codes and standards which have been used during the design should also be listed in the basis of design. This document shall also include the basis of costing identifying the unit costs used to build up CAPEX estimates for each element of this project scope.
Project execution plan	The PEP should detail how the Contractor intends to deliver and manage the project. This should include reference to how the Contractor will manage change and resourcing throughout the project.
Project programme	A project programme shall be provided and updated every fortnight by the Contractor. This shall show key design activities and interdependencies and requirements from other contractors required to fulfil this scope of works.
Piping specifications	The piping specification shall cover all piping systems within this scope of works.
Pipeline specifications	The pipeline specification shall cover all pipeline systems within this scope of works.
Control and instrumentation specification	General control and instrumentation specification to detail the minimum requirements for all instrumentation and control equipment.
Cathodic protection design requirements document	General performance specification outlining the cathodic protection requirements for this scope of works.
Repurposed pipeline requirement blueprint	A blueprint for the repurposing of existing pipelines for hydrogen use. This shall determine the minimum technical requirements which the pipelines will be assessed against to confirm suitability for repurposing.

7.2.2 Site Specific AGI

The Contractor shall design each AGI in accordance with IGEM/TD/13 edition 2 including supplement 1 or IGEM/TD/23, dependant on the site pressure, whether they are new build, repurposed or modified assets or any other internationally accepted standards. The adoption of the Standards should be identified during FEED stage in consultation with the client.

Deliverable	Description	Level of detail and document purpose
AGI location plans	Location plan of each AGI. This shall follow on from assessment by the Contractor to confirm the location along corridor route which is most suitable and practical for installation of new PRS/Transmission Breakdown/Valve infrastructure with an indication of flexibility in location to enable landowner negotiations to continue	There should be sufficient detail to inform costing to AACE class 3. This shall include anticipated land take for new build or extensions to AGIs. Any new civil infrastructure such as access roads shall be identified for costing purposes.

Deliverable	Description	Level of detail and document purpose
AGI plot plan drawings	Plan drawings showing the final design layout of the site.	There should be sufficient detail to inform costing to AACE class 3. This shall include for new build or modified infrastructure, including, but not limited to; buildings, roads, fencing, piping and mechanical infrastructure.
Hazardous area assessment	Preliminary hazardous area assessments based on the specified equipment, to enable the specification of equipment to the required rating.	This shall include for existing Hazardous areas for existing sites. As well as any new hazardous areas associated with new or modified infrastructure.
Preliminary hazardous area drawings	Drawings as an output of the hazardous area assessment.	Preliminary hazardous areas should be shown to inform the specification of plant and equipment as well as the required site boundaries.
Process safety assessment including Hazid, Hazop and SIL assessment	A Hazid shall be undertaken for each site with the Hazid report being the final deliverable. A Hazop shall be undertaken for each site with the Hazop report being the final deliverable. A SIL assessment shall be undertaken to inform the correct specification of instrumented functions.	The purpose of these assessments is to verify the design and ensure that the system design is sufficient and appropriate equipment and instrumentation can be specified. Where similar sites and installations are being assessed, Hazids and Hazops can be assessed by difference to improve efficiency.
Load schedules	Load schedules for each AGI.	
Piping general arrangements	Piping general arrangements for all AGIs showing new and existing pipework and connections to pipelines. The contractor is expected to produce a 3D model for the AGIs where necessary	The piping general arrangements shall show piping routes to allow for costing, construction phasing, planning engagement and to inform the process safety studies.
Preliminary stress analysis and fatigue calculations	Stress analysis of the proposed piping layout to confirm feasibility.	Stress analysis of the proposed system shall be carried out in accordance with IGEM/TD12 or other suitable international standards
Process flow diagrams	Process flow diagrams showing new systems and how they tie into the existing systems.	New or updated diagrams to show the process and interface points with existing or other new build infrastructure.
Pressure systems drawings	System drawings identifying the different pressure systems on the site.	New or updated drawings showing boundaries of pressure systems.
Long lead item identification / schedule	Schedule to identify the items of equipment and materials which have lead times of greater than 3 months from order to delivery.	To include all equipment with long lead times. This should be informed by vendor engagement and will enable programming of the delivery of these works.
Preliminary MTOs	Material Take Off (MTO) for each AGI.	MTO suitable for obtaining AACE class 3 estimates.
AGI operational strategy document	A high-level operation strategy document outlining how the site can be safely operated in line with NGN standards.	

Deliverable	Description	Level of detail and document purpose
Instrument schedules	Schedules of instruments included in the design of each AGI.	A list of all instrumentation referencing datasheets, suitable for obtaining AACE class 3 estimates.
Electrical and instrumentation datasheets	Datasheets for all electrical equipment.	The datasheets shall have sufficient information to be able to engage with suppliers and inform quotations in line with AACE class 3 accuracy.
Equipment schedules	Schedules of equipment included in the design of each AGI.	A list of all equipment referencing datasheets, suitable for obtaining AACE class 3 estimates.
Mechanical datasheets	Datasheets outlining the minimum requirements of equipment which have been assumed during the FEED design phase.	The datasheets shall have sufficient information to be able to engage with suppliers and inform quotations in line with AACE class 3 accuracy.
Process datasheets	Datasheets outlining the minimum process requirements for equipment and instrumentation.	The datasheets shall have sufficient information to be able to engage with suppliers and inform quotations in line with AACE class 3 accuracy.
Noise assessment	A site noise assessment.	The noise assessment shall be suitable for the engagement required by the Environmental and Consenting consultant.
Survey specifications	Specification for survey works identified to confirm the arrangement and condition of existing sites to inform their suitability for repurposing and provide the required information to complete the design works.	
Survey report	Report detailing the findings of the surveys against the specifications. These should detail any deviations found from record information and any information gathered which is prudent to the scope of works.	Of sufficient detail to inform the required design works and capture any survey findings which need to be reported on any other documents, i.e site plans.
Design and condition assessment report	For existing assets which are being repurposed or modified, a report shall be produced detailing the suitability of the existing design and the condition, in line with section 16.5 of IDEM TD/13 ed2 supplement 1.	This document shall include the findings of the study and any survey works undertaken to confirm the works proposed are appropriate and will result in an acceptable scheme, meeting industry standards and guidance.
Individual cost report	A cost report of the proposed design, detailing all procurement and construction costs associated with the full delivery of the scheme.	This should include all items relevant to achieving the AACE class 3 estimate.

7.2.3 Pipelines (Repurposed)

The Contractor shall design each pipeline in accordance with IGEM/TD/1 ed6 including Supplement 2, including confirmation of the pipeline suitability for repurposing against section 13. And if applicable (IP pipelines) IGEM/TD/22 and IGEM/TD/3 ed 5 and / or any other internationally accepted standards. The adoption of the Standards should be confirmed during FEED stage in consultation with the client.

Deliverable	Description	Level of detail and document purpose
Survey specifications	Survey specifications for each repurposed pipeline to obtain the technical information to confirm requirements. This will include pipeline condition survey specifications.	To the required level of detail to inform the Consultants survey contractor or persons undertaking the survey.
RAMs	RAMs for any surveys undertaken.	To the quality required by the Contractors internal procedures.
Survey reports	Reports of any surveys undertaken in relation to this scope of works.	Record of the surveys undertaken and the findings which will be reported in the Material compatibility and assessment criteria report.
Material compatibility assessment and criteria report	This will take the output of the surveys and a desktop study of each pipeline and assess each pipeline against the Repurposed pipeline requirement blueprint. The report will conclude with the suitability of the pipeline for repurposing.	Detail should include whether the acceptability criteria has been met for the pipeline to be repurposed and identify the acceptable operating conditions.
Line capacity assessment	Capacity assessment to confirm the suitability of the pipeline to transport the anticipated demand loads.	
Repurposed pipeline map	1:12,000 strip map of each pipeline route. These should highlight any areas of required works to the pipelines to enable the repurposing.	This should include the routing corridor identified along with any above ground installations. This will be used for the costing build up, EPC tendering and also by the Environmental and Consenting Consultant.
HAZID report	The Contractor shall undertake a Hazard Identification study on each repurposed pipeline route to identify any hazards associated with its repurposing. Attendance at the Hazid shall include for NGN operators. The Contractor shall undertake this with a suitably qualified Hazid chair. The deliverable for this shall be the Hazid report. This shall form the Repurposing risk assessment which shall identify any risk associated with the pipeline and upstream and downstream connections. The risk assessment should be carried out in accordance with the requirements specified in Reference Standard IGEM/H/1 in order to identify any changes in pipeline risk and confirm that these changes are appropriately addressed in relevant management and replacement plans for the pipeline.	The purpose of this assessment is to verify the design and ensure that the system design is sufficient in terms of connections and interfaces as well as any additional impacts from the change of use. Where similar sites and installations are being assessed, Hazids can be assessed by difference to improve efficiency.
Engineering line diagram (ELD)	The ELD shall be updated to show the proposed connection into the existing or future infrastructure and identify any disconnections.	
Fatigue assessment report	Fatigue assessment in accordance with IGEM/TD/1 including supplement 2.	This should detail the findings of the assessment and confirm the suitability of the existing asset for repurposing based on the existing fatigue and with regards to the acceptable fatigue cycles for hydrogen service.

Deliverable	Description	Level of detail and document purpose
Repurposing assessment report	The repurposing assessment report shall draw together all elements of work undertaken and conclude the suitability of the pipeline for repurposing, identifying all works required to achieve that.	This shall be in accordance with section 6.3 of IGEM/TD/23.
Cost report	A cost report of the proposed design, detailing all procurement and construction costs associated with the full delivery of the scheme.	This should include all items relevant to achieving the AACE class 3 estimate.

7.2.4 Pipelines (New build)

The Contractor shall design each pipeline in accordance with IGEM/TD/1 ed6 including Supplement 2, IGEM/TD/3 ed 5 and if applicable (IP pipelines) IGEM/TD/21, or any other internationally accepted standards. The adoption of the Standards should be identified during FEED stage in consultation with the client.

Deliverable	Description	Level of detail and document purpose
New pipeline corridor routing assessment	The corridor assessment shall be suitable for all planning, environmental, consent work. The corridor should be an appropriate width to enable consent to be obtained through surveys and assessment but not overly large (leading to excessive survey and land interest costs) or narrow (leading to construction challenges). The Contractor shall engage with the Environmental and Consenting Consultant during the development of the routing corridor to ensure that the solution proposed balances the constructability, technical viability and cost of the route, against the economic, environmental, socio-economic, political, planning and practical factors.	This should identify all above ground assets and required construction works alongside any constraints, this will be used by the Environmental and Consenting Consultant.
Route corridor map 1:12,000	1:12,000 scale maps of each pipeline routing corridor. These shall be of sufficient detail to enable the required planning, environmental and consenting works to be undertaken. This shall include full route maps and GIS files in agreed NGN format with full access and ownership of relevant data and GIS layers relevant to route design.	This should include the routing corridor identified along with any above ground installations. This will be used for the costing build up, EPC tendering and by the Environmental and Consenting Consultant.
Sizing calculations	Calculations to confirm the required sizing of the pipeline. This shall be based upon the latest demand information which will be provided by the Client at the point the sizing calculation is undertaken.	The calculations shall clearly show all inputs and be suitable to use for verification and justification of line sizing.
Line pressures assessment report	This shall be developed with network modelling input obtained from NGN.	
Survey specifications	Survey specifications for each pipeline to obtain the constructability information required to facilitate design. This shall include areas which call for early ground investigations such as geomorphological or borehole surveys etc.	To the required level of detail to inform the Consultants survey contractor or persons undertaking the survey.
RAMs	RAMs for any surveys undertaken such as walking surveys, and vantage point surveys of key locations	To the quality required by the Contractors internal procedures.

Deliverable	Description	Level of detail and document purpose
	(such as crossings and pinch points) to determine practical viability of proposed pipeline / corridor.	
Survey reports	Reports of any surveys undertaken in relation to this scope of works.	Record of the surveys undertaken and the findings which will inform the design works.
Crossing assessment document per pipeline.	During the Pre-FEED pipelines were assessed using a linear infrastructure routing tool, this determined the required crossings and the installation method which would be applied. During the FEED stage these shall be assessed and verified. The output will be a crossing assessment report for each pipeline which considers multiple factors including (but not limited to) physical obstructions, construction access, assumed ground conditions and topography.	The document should quantitatively assess the different crossing construction methodologies for each crossing and identify the preferred option. This will inform the construction plans and cost assessments.
New pipeline corridor risk assessment	This assessment shall be conducted for each pipeline route, highlighting and factors which may impact upon the viability and constructability of each pipeline route. Each risk shall be scored in terms of its likelihood and severity, mitigations shall be proposed where required.	
Construction approach	A package breakdown of each route considering phases of construction.	The detail should include the construction methodologies throughout the length of the pipeline. This should include access requirements, temporary works and remedial works which would be required to allow CAPEX estimates.
Engineering line diagram (ELD)	The ELD shall be updated to show the proposed connection into the existing or future infrastructure and identify any disconnections.	
Long lead item schedule	The Contractor shall provide a long lead item schedule which encompasses all new pipelines. To populate this, the Contractor shall engage with suppliers to understand the current market position for the provision of the pipelines and equipment required, considering the proposed project programme.	To include all equipment with long lead times. This should be informed by vendor engagement and will enable programming of the delivery of these works.
Material Take Off.	An estimated Material Take Off based on the FEED design of the pipeline. This shall include for all pipelines, equipment and required infrastructure within this scope of works.	MTO suitable for obtaining AACE class 3 estimates.
HAZID report	The Contractor shall undertake a Hazard Identification study on each new build pipeline route to identify any hazards. Attendance at the Hazid shall include for NGN operators. The Contractor shall undertake this with a suitably qualified Hazid chair. The deliverable for this shall be the Hazid report.	The purpose of this assessment is to verify the design and ensure that the system design is sufficient in terms of connections and interfaces. Where similar sites and installations are being assessed, Hazids can be assessed by difference to improve efficiency.
Network model requirements	The Contractor shall provide the Client with the design information required to enable their modelling of the network.	
Preliminary cathodic	This document shall outline the overall project strategy for cathodic protection, with regards to this	

Deliverable	Description	Level of detail and document purpose
protection design basis and report	scope of works. This shall be in accordance with SGN standards. The Contractor shall assess these standards for their suitability with the hydrogen pipelines proposed, any modifications required shall be highlighted to the Client by the Contractor.	
Cost report	A cost report of the proposed design, detailing all procurement and construction costs associated with the full delivery of the scheme.	This should include all items relevant to achieving the AACE class 3 estimate.

Drawings should be provided in AutoCAD and PDF format and all pipeline routes and new assets also in a format to be imported into Google Earth i.e. Shape Files. All drawings shall be created in CAD, “hand markups” will not be accepted as deliverables.

7.3 Scope by others

Throughout the project the Consultant will be required to input into the deliverables being produce by others, this section details the input which should be allowed for.

7.3.1 FEED study programme

The FEED Study programme will be the overall responsibility of the Client. However, the Contractor will be required to provide the required information relating to their scope of works to enable the programme to be updated every two weeks.

7.3.2 Project risk register

The project risk register will be the overall responsibility of the Client. However, the Contractor will be required to provide updates to this document with any identified project risks arising from their scope of works. An update shall be provided by the Contractor every four weeks, to allow the Client to update the document and apply any mitigation required.

7.3.3 Assumption and decision register

The assumption and decision register will be the overall responsibility of the Client. However, the Contractor will be required to provide updates to this document to record assumptions and decisions made during the completion of their scope of works. An update shall be provided by the Contractor every four weeks, to allow the Client to update the document.

7.3.4 Lessons learnt register

The lessons learnt register will be the overall responsibility of the Client. However, the Contractor will be required to provide updates to this document to record and key lessons learned during the completion of their scope of works. An update shall be provided by the Contractor every three months, to allow the Client to update the document.

7.3.5 Project execution plan

The Client will maintain the overall Project Execution Plan (PEP) for the ECH project. The Contractor will be responsible to produce a PEP relating to their scope of works. This shall be provided within four weeks of commencement of the project and updated when any substantial change is made to the scope of works or method of delivery.

7.3.6 Safety Case

The client will be responsible for co-ordinating and delivering the project Safety Case. This will be required since there is no hydrogen specific safety legislation in the UK, the Safety Case will be required to demonstrate that the system can be constructed and operated safely within a given framework. This will include, but is not limited to, developing design standards to cover gaps between those currently used for

natural gas and those required for hydrogen and development of operating procedures and work instructions for the safe operation of facilities. The Contractor will be required to input the required technical information relevant to their scope of works to enable the production of the safety case by the Client.

7.3.7 EPC procurement and tender assessments

One of the key objectives of this scope of works is to develop the required documentation to allow the tendering and procurement of EPC contracts to deliver the project. The procurement exercise will be undertaken by the Client. The contractor will be required to input into the scoping of these contracts, as detailed later in this scope, and the Contractors support will also be required to assist in the assessment of the tender returns were relating to their scope of works.

7.3.8 Environmental impact assessments

A separate consenting, environmental and survey package is being tendered. The Contractor will be required to engage regularly with the consenting, environmental and survey Contractor. This will be required to inform them of design information such as:

- Anticipated land take requirements of any new facilities and the location of these
- Pipeline routing corridors
- Anticipated construction methodologies

7.3.9 Land acquisition and planning strategy

The land acquisition and planning strategy will be undertaken by others. The Contractor for this scope of works will be required to liaise with that party to inform them of design information such as:

- Anticipated land take requirements of any new facilities and the location of these, the layout and height of any required structures and equipment
- Pipeline routing corridors
- Anticipated construction methodologies

7.4 EPC Scope

The culmination of the FEED scope of works will be tendering the project for EPC contracts to deliver the project. The scope of works for the EPC contracts will be supported by the deliverables in this scope work works. The Contractor will also be required to input into the EPC scope document, which will be managed by the Client.

The Contractor shall allow for answering technical questions from the tenderers, assessing the returned tenders and attending tender interviews for the tenderers.

7.5 Attendance at meetings

The Contractor shall allow for attendance at the following meetings throughout the delivery of their scope of works:

Table 4: Meeting attendance requirements

Meeting type	Frequency	Location/ platform	Notes
Kick Off	One Off	Leeds (Thorpe Park)	

Technical Launch	One Off	Leeds (Thorpe Park)	Two-day session in Thorp Park to: - • Meet NGN team • Understand NGN systems • Understand work done to date • Review information available • Meet modelling team
Technical Coordination	Monthly	Teams/	Meeting with other ECH Partners
Catch Up	Weekly	Teams	
Progress meeting	Monthly	Leeds (Thorpe Park)	
Modelling Meeting	As required		Initial meeting in Leeds/Sunderland. Subsequent on teams
Review Meeting	As Req'd	Teams	A review meeting to key deliverables before issue, these can be coordinated to precede or follow the monthly progress meeting

All other meetings deemed necessary to deliver this scope of works should be identified and included by the Contractor in their proposal.

7.6 Information availability

The following information shall be made available to the Contractor for the purposes of completing this scope of works:

- All project information outlined in section 1.2
- AGI ELDs and P&IDs
- Installation record drawings
- Any existing survey results
- Existing pipeline routing drawings

8. MP Package Technical Consultant Scope Detail

The ECH Pre-FEED determined a network based on repurposed and new build pipelines. These pipelines cover the HP, IP and MP pressure tiers within NGNs network. To efficiently deliver the FEED stage of this project, the scope for the delivery of new and repurposed infrastructure has been split into three packages. This package relates to the MP infrastructure which is not included in the Project Union Enabler package.

The scope of this package will include the design of:

- New and repurposed MP pipelines

The network and infrastructure have been identified through the Pre-FEED works, the infrastructure required within this scope is detailed in section 8.1. These will need to be reassessed at the start of the FEED stage to confirm they still align with the proposed network plan. The Contractor will be responsible for reviewing the Pre-FEED study in relation to this scope of works and working alongside the Client to identify any required changes to the planned network since the completion of the Pre-FEED due to changes in demand, production or storage schemes which will be outlined by NGN though their stakeholder engagement.

This package of works shall progress the FEED design of the sites and pipelines to a point at which a single option has been selected for each pipeline and the works can be accurately costed to AACE class 3 estimates for final investment decision and to tender for EPC contracts.

This package of the project interfaces with the HP/IP package, Consenting and Environmental consultant and with the Client. The Contractor shall work with all parties to ensure information flow is understood and programmes of work align to meet these requirements, these shall ultimately be coordinated by the Client.

The Contractor shall work collaboratively with the Client to ascertain the priority list for the infrastructure in the FEED stage, this will be based upon the required delivery schedule, which is currently outlined in the phasing plan, and will incorporate updates post Pre-FEED completion. The interfaces between parties are defined within the RACI matrix.

The design works for pipelines and installations shall be in the essence of the process outlined in NGN/SP/TR/23 (Specification for conceptual design of pipelines and installations operating at above 7 barg) but with the deliverables identified in the relevant IGEM standards for Hydrogen pipelines.

The Contractor is required to deliver the works to meet the agreed project requirements. Where the Contractor identifies additional works or documentation required to deliver these works, these shall be proposed to the Client during the tender process.

An overview of the MP scope is provided below, with the specific deliverables detailed further in section 7.2.

Project Union is responsible for the transmission of hydrogen to different LDZs throughout the country. While attempting to develop a hydrogen transmission network, Project Union will repurpose and, in some cases, develop new assets to enable the flow of hydrogen gas from production facilities to different LDZs.

To enable the work of Project Union, NGN and / or NG will have to modify the existing Offtakes and AGIs or build new Offtakes and AGIs. The modification will also require sections of new natural gas pipeline and AGIs for re-purposing of transmission and distribution system to hydrogen.

8.1 Final options selection post Pre-FEED

The Pre-FEED study has identified the required MP infrastructure to develop the ECH network.

The following tables provides a summary and brief description of project infrastructure requirements within this scope. For full details please refer to the Pre-FEED documentation.

Table 5: MP Pipelines

Area	Start	End	Type	Pipeline Length (km)	Diameter (mm NB)	Natural gas
Hartlepool	[redacted]					
Teesside			Pipeline - New	1.4	300	
Teesside			Pipeline - New	3.8	300	
Haverton Hill						
Teesside			Pipeline - New	1.3	300	
Teesside			Pipeline - New	0.7	300	
Teesside			Pipeline - New	1.5	300	
Teesside			Pipeline - New	2.3	300	
Teesside			Pipeline - New	1.3	300	
Port Clarence						
Teesside			Pipeline - Repurposed	1.2	300	
Teesside			Pipeline - New	2.7	300	
Seal Sands						
Teesside			Pipeline - New	0.0	300	
Teesside South						
Teesside			Pipeline - Repurposed	0.5	500	
Teesside			Pipeline - New	6.0	300	
Teesside			Pipeline - New	3.2	300	
Skinningrove						
Teesside			Pipeline - New	1.6	300	
Barnard Aycliffe						
Bishop Auckland to Pannal			Pipeline - New	5.4	300	
Bishop Auckland to Pannal			Pipeline - New	17.3	300	
Darlington						
Bishop Auckland to Pannal			Pipeline - New	6.6	300	
Bishop Auckland North						
Bishop Auckland to Pannal			Pipeline - New	3.5	300	
Bishop Auckland to Pannal			Pipeline - New	2.2	300	
Thrintoft						

Bishop Auckland to Pannal	[redacted]	Pipeline - New	3.7	300
Bishop Auckland to Pannal		Pipeline - Repurposed	9.1	180
Ripon				
Bishop Auckland to Pannal		Pipeline - New	5.1	300
Bishop Auckland to Pannal		Pipeline - New	11.5	300
Harrogate				
Bishop Auckland to Pannal		Pipeline - New	4.2	300
Bishop Auckland to Pannal		Pipeline - New	4.7	300
Bishop Auckland to Pannal		Pipeline - New	3.2	300
Bishop Auckland to Pannal		Pipeline - New	4.5	300
Bradford				
Leeds / Bradford		Pipeline - New	0.9	300
Leeds / Bradford		Pipeline - New	1.1	300
Leeds / Bradford		Pipeline - New	1.9	300
Leeds / Bradford		Pipeline - New	1.9	300
Leeds / Bradford		Pipeline - New	1.4	300
Leeds / Bradford		Pipeline - New	1.4	300
Leeds East				
Leeds / Bradford		Pipeline - New	1.3	300
Leeds South				
Leeds / Bradford		Pipeline - New	3.5	300
Leeds / Bradford		Pipeline - New	0.8	300
Leeds / Bradford		Pipeline - New	0.6	300
Goole				
Towton to Asselby		Pipeline - New	8.5	300
Tadcaster Sherburn				
Towton to Asselby		Pipeline - New	10.7	300
Towton to Asselby		Pipeline - New	3.5	300
Towton to Asselby		Pipeline - New	0.9	300
Knottingley				
Towton to Asselby		Pipeline - New	7.4	350
Towton to Asselby		Pipeline - New	0.8	300
Towton to Asselby		Pipeline - New	1.6	300
Towton to Asselby		Pipeline - New	3.6	300
West Hull				
Humber		Pipeline - New	2.3	300
Humber		Pipeline - New	3.0	300
Humber		Pipeline - New	0.4	300
Humber		Pipeline - New	2.9	300
Humber		Pipeline - New	0.3	300
Humber		Pipeline - New	0.7	300
Humber		Pipeline - New	2.4	300

Howden	[redacted]				
Humber		Pipeline - New	0.8	300	
Humber		Pipeline - New	2.4	300	
Hull					
Humber		Pipeline - New	2.1	300	
Humber		Pipeline - New	0.8	300	
Humber		Pipeline - New	0.6	300	
Humber		Pipeline - New	1.1	300	
Humber		Pipeline - New	0.5	300	
Humber		Pipeline - New	3.9	300	
Humber		Pipeline - New	0.3	300	
Humber		Pipeline - New	1.0	300	
Humber		Pipeline - New	2.7	550	
Humber		Pipeline - New	0.1	550	
Humber		Pipeline - New	4.9	300	
East Riding					
Humber		Pipeline - New	9.5	200	Natural gas

8.2 FEED deliverables

The following deliverables shall form the output of this scope of works.

8.2.1 General

There general deliverables will form the basis of the network design.

Deliverable	Description
Basis of design	The basis of design document should include all relevant assumptions and decisions made to progress the design. It should detail these alongside suitable references and justification. All applicable codes and standards which have been used during the design should also be listed in the basis of design. This document shall also include the basis of costing identifying the unit costs used to build up CAPEX estimates for each element of this project scope.
Project execution plan	The PEP should detail how the Contractor intends to deliver and manage the project. This should include reference to how the Contractor will manage change and resourcing throughout the project.
Project programme	A project programme shall be provided and updated every fortnight by the Contractor. This shall show key design activities and interdependencies and requirements from other contractors required to fulfil this scope of works.
Pipeline specifications	The pipeline specification shall cover all pipeline systems within this scope of works.
Control and instrumentation specification	General control and instrumentation specification to detail the minimum requirements for all instrumentation and control equipment.
Repurposed pipeline requirement blueprint	A blueprint for the repurposing of existing pipelines for hydrogen use. This shall determine the minimum technical requirements which the pipelines will be assessed against to confirm suitability for repurposing.

8.2.2 Pipelines (Repurposed)

The Contractor shall design each pipeline in accordance with IGEM TD/22.

Deliverable	Description	Level of detail and document purpose
Survey specifications	Survey specifications for each repurposed pipeline to obtain the technical information to confirm requirements. This will include pipeline condition survey specifications.	To the required level of detail to inform the Consultants survey contractor or persons undertaking the survey.
RAMs	RAMs for any surveys undertaken.	To the quality required by the Contractors internal procedures.
Survey reports	Reports of any surveys undertaken in relation to this scope of works.	Record of the surveys undertaken and the findings which will be reported in the Material compatibility and assessment criteria report.
Material compatibility assessment and criteria report	This will take the output of the surveys and a desktop study of each pipeline and assess each pipeline against the Repurposed pipeline requirement blueprint. The report will conclude with the suitability of the pipeline for repurposing.	Detail should include whether the acceptability criteria has been met for the pipeline to be repurposed and identify the acceptable operating conditions.

Deliverable	Description	Level of detail and document purpose
Line capacity assessment	Capacity assessment to confirm the suitability of the pipeline to transport the anticipated demand loads.	
Repurposed pipeline map	1:12,000 map of each pipeline route. These should highlight any areas of required works to the pipelines to enable the repurposing.	This should include the routing corridor identified along with any above ground installations. This will be used for the costing build up, EPC tendering and also by the Environmental and Consenting Consultant.
HAZID report	The Contractor shall undertake a Hazard Identification study on each repurposed pipeline route to identify any hazards associated with its repurposing. Attendance at the Hazid shall include for NGN operators. The Contractor shall undertake this with a suitably qualified Hazid chair. The deliverable for this shall be the Hazid report. This shall form the Repurposing risk assessment which shall identify any risk associated with the pipeline and upstream and downstream connections. The risk assessment should be carried out in accordance with the requirements specified in Reference Standard IGEM/H/1 in order to identify any changes in pipeline risk and confirm that these changes are appropriately addressed in relevant management and replacement plans for the pipeline.	The purpose of this assessment is to verify the design and ensure that the system design is sufficient in terms of connections and interfaces as well as any additional impacts from the change of use. Where similar sites and installations are being assessed, Hazids can be assessed by difference to improve efficiency.
Engineering line diagram (ELD)	The ELD shall be updated to show the proposed connection into the existing or future infrastructure and identify any disconnections.	
Repurposing assessment report	The repurposing assessment report shall draw together all elements of work undertaken and conclude the suitability of the pipeline for repurposing, identifying all works required to achieve that.	This shall be in accordance with section 6.3 of IGEM/TD/23.
Cost report	A cost report of the proposed design, detailing all procurement and construction costs associated with the full delivery of the scheme.	This should include all items relevant to achieving the AACE class 3 estimate.

8.2.3 Pipelines (New build)

The Contractor shall design each pipeline in accordance with IGEM TD/21 or any other internationally accepted standards. The adoption of the Standards should be identified during FEED stage in consultation with the client.

Deliverable	Description	Level of detail and document purpose
New pipeline corridor routing assessment	The corridor assessment shall be suitable for all planning, environmental, consent work. The corridor should be an appropriate width to enable consent to be obtained through surveys and assessment but not overly large (leading to excessive survey and land interest costs) or narrow (leading to construction challenges).	This should identify all above ground assets and required construction works alongside any constraints, this will be used by the Environmental and Consenting Consultant.

Deliverable	Description	Level of detail and document purpose
	The Contractor shall engage with the Environmental and Consenting Consultant during the development of the routing corridor to ensure that the solution proposed balances the constructability, technical viability and cost of the route, against the economic, environmental, socio-economic, political, planning and practical factors.	
Route corridor map 1:12,000	1:12,000 scale maps of each pipeline routing corridor. These shall be of sufficient detail to enable the required planning, environmental and consenting works to be undertaken. This shall include full route maps and GIS files in agreed NGN format with full access and ownership of relevant data and GIS layers relevant to route design.	This should include the routing corridor identified along with any above ground installations. This will be used for the costing build up, EPC tendering and also by the Environmental and Consenting Consultant.
Sizing calculations	Calculations to confirm the required sizing of the pipeline. This shall be based upon the latest demand information which will be provided by the Client at the point the sizing calculation is undertaken.	The calculations shall clearly show all inputs and be suitable to use for verification and justification of line sizing.
Line pressures assessment report	This shall be developed with network modelling input obtained from NGN.	
Survey specifications	Survey specifications for each pipeline to obtain the constructability information required to facilitate design. This shall include areas which call for early ground investigations such as geomorphological or borehole surveys etc.	To the required level of detail to inform the Consultants survey contractor or persons undertaking the survey.
RAMs	RAMs for any surveys undertaken such as walking surveys, and vantage point surveys of key locations (such as crossings and pinch points) to determine practical viability of proposed pipeline / corridor.	To the quality required by the Contractors internal procedures.
Survey reports	Reports of any surveys undertaken in relation to this scope of works.	Record of the surveys undertaken and the findings which will inform the design works.
Crossing assessment document per pipeline	During the Pre-FEED pipelines were assessed using a linear infrastructure routing tool, this determined the required crossings and the installation method which would be applied. During the FEED stage these shall be assessed and verified. The output will be a crossing assessment report for each pipeline which considers multiple factors including (but not limited to) physical obstructions, construction access, assumed ground conditions and topography.	The document should quantitatively assess the different crossing construction methodologies for each crossing and identify the preferred option. This will inform the construction plans and cost assessments.
New pipeline corridor risk assessment	This assessment shall be conducted for each pipeline route, highlighting and factors which may impact upon the viability and constructability of each pipeline route. Each risk shall be scored in terms of its likelihood and severity, mitigations shall be proposed where required.	
Construction approach	A package breakdown of each route considering phases of construction.	The detail should include the construction methodologies throughout the length of the pipeline. This should include access requirements, temporary

Deliverable	Description	Level of detail and document purpose
		works and remedial works which would be required to allow CAPEX estimates.
Engineering line diagram (ELD)	The ELD shall be updated to show the proposed connection into the existing or future infrastructure and identify any disconnections.	
Long lead item schedule	The Contractor shall provide a long lead item schedule which encompasses all new pipelines. To populate this, the Contractor shall engage with suppliers to understand the current market position for the provision of the pipelines and equipment required, considering the proposed project programme.	To include all equipment with long lead times. This should be informed by vendor engagement and will enable programming of the delivery of these works.
Material Take Off	An estimated Material Take Off based on the FEED design of the pipeline. This shall include for all pipelines, equipment and required infrastructure within this scope of works.	MTO suitable for obtaining AACE class 3 estimates.
HAZID report	The Contractor shall undertake a Hazard Identification study on each new build pipeline route to identify any hazards. Attendance at the Hazid shall include for NGN operators. The Contractor shall undertake this with a suitably qualified Hazid chair. The deliverable for this shall be the Hazid report.	The purpose of this assessment is to verify the design and ensure that the system design is sufficient in terms of connections and interfaces. Where similar sites and installations are being assessed, Hazids can be assessed by difference to improve efficiency.
Network model requirements	The Contractor shall provide the Client with the design information required to enable their modelling of the network.	
Cost report	A cost report of the proposed design, detailing all procurement and construction costs associated with the full delivery of the scheme.	This should include all items relevant to achieving the AACE class 3 estimate.

Drawings should be provided in AutoCAD and PDF format and all pipeline routes and new assets also in a format to be imported into Google Earth i.e. Shape Files. All drawings shall be created in CAD, “hand markups” will not be accepted as deliverables.

8.3 Scope by others

Throughout the project the Consultant will be required to input into the deliverables being produce by others, this section details the input which should be allowed for.

8.3.1 FEED study programme

The FEED Study programme will be the overall responsibility of the Client. However, the Contractor will be required to provide the required information relating to their scope of works to enable the programme to be updated every two weeks.

8.3.2 Project risk register

The project risk register will be the overall responsibility of the Client. However, the Contractor will be required to provide updates to this document with any identified project risks arising from their scope of works. An update shall be provided by the Contractor every four weeks, to allow the Client to update the document and apply any mitigation required.

8.3.3 Assumption and decision register

The assumption and decision register will be the overall responsibility of the Client. However, the Contractor will be required to provide updates to this document to record assumptions and decisions made during the completion of their scope of works. An update shall be provided by the Contractor every four weeks, to allow the Client to update the document.

8.3.4 Lessons learnt register

The lessons learnt register will be the overall responsibility of the Client. However, the Contractor will be required to provide updates to this document to record and key lessons learned during the completion of their scope of works. An update shall be provided by the Contractor every three months, to allow the Client to update the document.

8.3.5 Project execution plan

The Client will maintain the overall Project Execution Plan (PEP) for the ECH project. The Contractor will be responsible to produce a PEP relating to their scope of works. This shall be provided within four weeks of commencement of the project and updated when any substantial change is made to the scope of works or method of delivery.

8.3.6 Safety Case

The client will be responsible for coordinating and delivering the project Safety Case. This will be required since there is no hydrogen specific safety legislation in the UK, the Safety Case will be required to demonstrate that the system can be constructed and operated safely within a given framework. This will include, but is not limited to, developing design standards to cover gaps between those currently used for natural gas and those required for hydrogen and development of operating procedures and work instructions for the safe operation of facilities. The Contractor will be required to input the required technical information relevant to their scope of works to enable the production of the safety case by the Client.

8.3.7 EPC procurement and tender assessments

One of the key objectives of this scope of works is to develop the required documentation to allow the tendering and procurement of EPC contracts to deliver the project. The procurement exercise will be undertaken by the Client. The contractor will be required to input into the scoping of these contracts, as detailed later in this scope, and the Contractors support will also be required to assist in the assessment of the tender returns were relating to their scope of works.

8.3.8 Environmental impact assessments

A separate consenting, environmental and survey package is being tendered. The Contractor will be required to engage regularly with the consenting, environmental and survey Contractor. This will be required to inform them of design information such as:

- Anticipated land take requirements of any new facilities and the location of these
- Pipeline routing corridors
- Anticipated construction methodologies

8.3.9 Land acquisition and planning strategy

The land acquisition and planning strategy will be undertaken by others. The Contractor for this scope of works will be required to liaise with that party to inform them of design information such as:

- Anticipated land take requirements of any new facilities and the location of these, the layout and height of any required structures and equipment
- Pipeline routing corridors
- Anticipated construction methodologies

8.4 EPC Scope

The culmination of the FEED scope of works will be tendering the project for EPC contracts to deliver the project. The scope of works for the EPC contracts will be supported by the deliverables in this scope work works. The Contractor will also be required to input into the EPC scope document, which will be managed by the Client.

The Contractor shall allow for answering technical questions from the tenderers, assessing the returned tenders and attending tender interviews for the tenderers.

8.5 Attendance at meetings

The Contractor shall allow for attendance at the following meetings throughout the delivery of their scope of works:

Table 6: Meeting attendance requirements

Meeting type	Frequency	Location/ platform	Notes
Kick Off	One Off	Leeds (Thorpe Park)	
Technical Launch	One Off	Leeds (Thorpe Park)	Two-day session in Thorp Park to: - • Meet NGN team • Understand NGN systems • Understand work done to date • Review information available • Meet modelling team
Technical Coordination	Monthly	Teams/	Meeting with other ECH Partners
Catch Up	Weekly	Teams	
Progress meeting	Monthly	Leeds (Thorpe Park)	
Modelling Meeting	As required		Initial meeting in Leeds/Sunderland. Subsequent on teams
Review Meeting	As Req'd	Teams	A review meeting to key deliverables before issue, these can be coordinated to precede or follow the monthly progress meeting

All other meetings deemed necessary to deliver this scope of works should be identified and included by the Contractor in their proposal.

8.6 Information availability

The following information shall be made available to the Contractor for the purposes of completing this scope of works:

- All project information outlined in section 1.2
- AGI ELDs and P&IDs
- Installation record drawings
- Any existing survey results
- Existing pipeline routing drawings

9. Consenting and Environmental Consultant Scope Detail

The ECH Pre-FEED determined a network based on repurposed and new build pipelines. These pipelines cover the HP, IP and MP pressure tiers within NGNs network. With regards to this scope of work, in accordance with the Town and Country Planning (Environmental Impact Assessment) Regulations, only the HP pressure tier needs to be considered.

The phasing of the project for delivery is based on three time periods; 2028-2031, 2032-2036 and 2037-2042. The consenting and environmental package covers works at two levels of detail. Infrastructure which is designated in the phasing plan for delivery in the 2028-2031 period will require the delivery of works to support and enable the detailed design and construction of assets within this period. This will include the works required to undertake time critical aspects of the works, such as scoping of the environmental survey requirements. For the infrastructure outlined for delivery in the latter two phases, the scope will be limited to minor support of the technical FEED design to highlight any key risks from an environmental and consenting perspective.

This scope requires interfacing with the HP / IP Technical Consultant as well as the Client. The Contractor shall work with all parties to ensure information flow is understood and programmes of work align to meet these requirements, these shall ultimately be coordinated by the Client.

The scope of this package will include the consenting and environmental works associated with:

- New and repurposed pipelines
- New, modified and repurposed AGIs including pressure reducing stations, block valve stations, offtakes and pig trap sites.

The network and infrastructure have been identified through the Pre-FEED works, the infrastructure required within this scope is detailed in Table 7, Table 8 & Table 9. These will need to be reassessed at the start of the FEED stage to confirm they still align with the proposed network plan for Project Union and any further stakeholder engagement by the Client. The Contractor will also be responsible for reviewing the Pre-FEED study in relation to this scope of works and working alongside the Client to identify any required changes to the planned network since the completion of the Pre-FEED due to changes in demand, production or storage.

The Contractor shall work collaboratively with the Client and other Contractors to ascertain the priority list for the infrastructure in the FEED stage, this will be based upon the required delivery schedule, which is currently outlined in the phasing plan, and will incorporate updates post Pre-FEED completion by the Client.

The process for the production of environmental statements shall be in accordance with NGN/SP/TR22 (Specification for environmental statement for pipelines and installations operating at above 7barg). They shall meet the requirements of The Town and Country Planning (Environmental Impact Assessment) Regulations as well as the relevant IGEM standards.

The Contractor is required to deliver the works to meet the agreed project requirements. Where the Contractor identifies additional works or documentation required to deliver these works, these shall be proposed to the Client during the tender process.

The ultimate aim of this package is to develop the planning and consenting works to a sufficient stage to align with the end of design FEED, which allows the overall project delivery schedule, including the EPC stages. The Consultant shall identify in their methodology how they will deliver against this aim and any additional deliverable requirements they foresee to be required which are not already listed in section 9.2.

During the Pre-FEED, the routes were assessed against environmental constraints in GIS layers, each constraint was associated with a penalty score, this was the extent to which the final routeing at the end of Pre-FEED considered environmental constraints. During the FEED stage, the environmental impact of pipelines and AGIs shall be reviewed along with the technical consultant to identify any specific areas of concern with regards to the environmental impact and any controls required. Consultation will be required with third parties to inform this assessment.

The repurposing and modification of AGIs may or may not require extension of the existing site boundary. This will be determined during the FEED design stage, pricing for these works shall be identified in the cost build up, for the scope required if the site is required to be extended or not.

9.1 2028-2031 delivery phase scope

The Pre-FEED study has identified the required infrastructure to develop the ECH network. The following scope of works is for the 2028-31 delivery phase and is included for the scope of works of this Consenting and Environmental package.

The following tables provides a summary and brief description of project infrastructure requirements within this scope. For full details please refer to the Pre-FEED documentation.

The routes in Table 7 are grouped into continual network sections, i.e the Hartlepool section consists of two discrete routes, which will be delivered by the relevant Technical Contractor based on the relevant pressure tier. For the purposes of the Environmental and Consenting scope of works, these should be considered at one pipeline, and deliverables produced for the Hartlepool route as a whole.

Table 7: 2028-31 HP pipelines

Area	Start	End	Type	Pipeline Length (km)
Hartlepool	[redacted]			
Teesside			Pipeline - Repurposed	7.9
Teesside			Pipeline - New	1.8
Haverton Hill				
Teesside			Pipeline - Repurposed	3.0
Skinningrove				
Teesside			Pipeline - Repurposed	13.6
Barnard Aycliffe				
Bishop Auckland to Pannal			Pipeline - Repurposed	12.8
Bishop Auckland to Pannal			Pipeline - New	0.1
Bishop Auckland North				
Bishop Auckland to Pannal			Pipeline - New	5.1
Selby				
Towton to Asselby			Pipeline - New	5.7
Knottingley				
Towton to Asselby			Pipeline - New	13.5
West Hull				
Humber			Pipeline - Repurposed	17.8
Humber			Pipeline - New	2.4
Hull				
Humber			Pipeline - Repurposed	9.3
Humber			Pipeline - New	8.2
East Riding				
Humber			Pipeline - Repurposed	51.3
Humber			Pipeline - New	2.9

Table 8: 2032 onwards HP pipelines

Area	Start	End	Type	Pipeline Length (km)
Teesside South	[redacted]			
Teesside			Pipeline - New	3.8
Thrintoft				
Bishop Auckland to Pannal			Pipeline - New	11.5
Harrogate				
Bishop Auckland to Pannal			Pipeline - Repurposed	3.6
Bradford Leeds				
Leeds / Bradford			Pipeline - Repurposed	9.7
Leeds / Bradford			Pipeline - New	2.4
Leeds / Bradford			Pipeline - New	3.6
Leeds East				
Leeds / Bradford			Pipeline - New	14.3
Leeds / Bradford			Pipeline - Repurposed	9.0
Bradford				
Leeds / Bradford			Pipeline - Repurposed	9.2
Leeds / Bradford			Pipeline - New	1.5
Leeds South				
Leeds / Bradford			Pipeline - New	2.2
Leeds / Bradford			Pipeline - New	0.6
Pannal Pudsey				
Leeds / Bradford			Pipeline - Repurposed	21.0
Tyneside				
Teesside			Pipeline - Repurposed	35.0

The following table identifies the AGIs which are within this scope of works.

Table 9: 2028-31 delivery AGIs

Area	Name	Type	Pressure
Teesside	[redacted]	PRI - Repurposed	HP to MP
Teesside		Offtake - Modified	HP
Teesside		Offtake - Modified	HP
Teesside		PRI - Repurposed	HP to MP
Teesside		PRI - Repurposed	HP to MP
Teesside		Offtake - Modified	HP
Teesside		Offtake - New	MP
Bishop Auckland to Pannal		Offtake - Modified	HP

Area	Name	Type	Pressure
Bishop Auckland to Pannal	[redacted]	Pig Trap - Repurposed	MP
Bishop Auckland to Pannal		Offtake - Modified	HP
Bishop Auckland to Pannal		PRI - New	HP to IP
Bishop Auckland to Pannal		Offtake - Modified	MP
Bishop Auckland to Pannal		Pig Trap - Repurposed	HP
Bishop Auckland to Pannal		PRI - Repurposed	HP to MP
Bishop Auckland to Pannal		Offtake - Modified	HP
Bishop Auckland to Pannal		Offtake - New	MP
Bishop Auckland to Pannal		Offtake - Modified	MP
Bishop Auckland to Pannal		Offtake - New	HP
Bishop Auckland to Pannal		Offtake - New	IP
Leeds / Bradford		Offtake - New	HP
Leeds / Bradford		Offtake - Modified	HP
Towton to Asselby		PRI – Extension & repurposed	HP to IP
Towton to Asselby		Offtake - Modified	MP
Towton to Asselby		PRI - New	HP to MP
Towton to Asselby		PRI - New	HP to MP
Humber		PRI - Repurposed	HP to MP
Humber		PRI - Repurposed	HP to IP
Humber		PRI - New	HP to MP
Humber		PRI - Repurposed	HP to IP
Humber		PRI - Repurposed	HP to MP
Humber		PRI - New	IP to MP
Humber		PRI - Repurposed	HP to IP and HP to MP
Humber		PRI - New	IP to MP
Humber		PRI - New	IP to MP
Humber		Offtake - New	HP
Humber		PRI - Repurposed	HP to IP
Humber		PRI - Repurposed	IP to MP
Humber		Offtake - New	HP
Humber		PRI - Repurposed	HP to MP

9.2 FEED deliverables

The Consultant shall provide a proposed approach which aligns with NGNs ambitions to deliver the project in the stated timescales. It is anticipated that the following tasks and deliverables will be required as a minimum:

- Initial appraisal of existing routes identified through Pre-FEED. This will include a RAG rating looking at key environmental and social constraints. These shall, as a minimum, include the considerations in IGEM/TD/1 section 4.1.2.2. This shall inform the FEED design works.
- Determination of required consents, licences and approvals and appropriate consenting strategy for repurposed infrastructure.
- Determination of appropriate consenting strategy for new infrastructure including the phasing and delivery of the pipeline network considering the use of TCPA local planning applications and/ or DCO as appropriate and considering the use of existing easements, use of existing statutory powers and the lengths and pressures of the different proposed pipelines.
- For new pipelines, route corridor selection and narrowing from a width of 1km for high pressure pipelines to an eventual construction easement of approximately 34m within a consented route corridor of approximately 100m width, narrowed where appropriate due to site specific constraints. This shall include sensitivity analysis of factors not considered in AI, these should be incorporated in the analysis such as public perception, historical incidents, political challenges, human factors etc.
- For new pipelines, carry out high level risk assessment and associated mitigations for corridor options beyond capability of AI software
- Identification and assessment of appropriate locations for any new AGIs, appraisal of environmental effects of extensions to existing AGIs and consideration of other above ground infrastructure if required
- Setting out detailed requirements for the preparation of the consent applications including the Environmental Impact Assessment (EIA) including:
    - Baseline surveys
    - EIA scoping report
    - EIA assessments for scoping in topics including undertaking of environmental surveys of the route corridors
    - Preparation of Environmental Statement
    - Stakeholder engagement with statutory bodies and non-statutory bodies including the local public including leading public engagement through exhibitions, use of website and newsletters as appropriate
    - Identification of affected landowners and land interests
    - Undertaking appropriate land referencing and obtaining land access for surveys including agreement of licence fees for access
    - Agreement of land rights and option agreements for construction and operational easements
    - Planning statement
    - Design and access statement
    - Consultation report

- Setting out detailed requirements for the preparation of any required consent or licence applications for repurposed infrastructure.

Land referencing works may be carried out by NGN, therefore a separate optional cost to undertake this should be provided by the Environmental and Consenting Consultant.

9.3 Scope by others

Throughout the project the Consultant will be required to input into the deliverables being produce by others, this section details the input which should be allowed for.

9.3.1 FEED study programme

The FEED Study programme will be the overall responsibility of the Client. However, the Contractor will be required to provide the required information relating to their scope of works to enable the programme to be updated every 2 weeks.

9.3.2 Project risk register

The project risk register will be the overall responsibility of the Client. However, the Contractor will be required to provide updates to this document with any identified project risks arising from their scope of works. An update shall be provided by the Contractor every four weeks, to allow the Client to update the document and apply any mitigation required.

9.3.3 Assumption and decision register

The assumption and decision register will be the overall responsibility of the Client. However, the Contractor will be required to provide updates to this document to record assumptions and decisions made during the completion of their scope of works. An update shall be provided by the Contractor every four weeks, to allow the Client to update the document.

9.3.4 Lessons learnt register

The lessons learnt register will be the overall responsibility of the Client. However, the Contractor will be required to provide updates to this document to record and key lessons learned during the completion of their scope of works. An update shall be provided by the Contractor every three months, to allow the Client to update the document.

9.3.5 Project execution plan

The Client will maintain the overall Project Execution Plan (PEP) for the ECH project. The Contractor will be responsible for the production of a PEP relating to their scope of works. This shall be provided within four weeks of commencement of the project and updated when any substantial change is made to the scope of works or method of delivery.

9.3.6 Safety Case

The client will be responsible for coordinating and delivering the project Safety Case. This will be required since there is no hydrogen specific safety legislation in the UK, the Safety Case will be required to demonstrate that the system can be constructed and operated safely within a given framework. This will include, but is not limited to, developing design standards to cover gaps between those currently used for natural gas and those required for hydrogen and development of operating procedures and work instructions for the safe operation of facilities. The Contractor will be required to input the required technical information relevant to their scope of works to enable the production of the safety case by the Client.

9.3.7 EPC procurement and tender assessments

One of the key objectives of this scope of works is to develop the required documentation to allow the tendering and procurement of EPC contracts to deliver the project. The procurement exercise will be

undertaken by the Client. The contractor will be required to input into the scoping of these contracts, as detailed later in this scope, and the Contractors support will also be required to assist in the assessment of the tender returns were relating to their scope of works.

9.3.8 Pipeline routing corridor maps

Initial pipeline routing has been undertaken during Pre-FEED stage. This will be further assessed by the relevant Technical Contractor at the beginning of the FEED design stage. This will then form the basis for this scope of works.

9.3.9 Technical

All works listed within the scope of the HP/IP and MP Technical Contractors.

9.4 Attendance at meetings

The Contractor shall allow for attendance at the following meetings throughout the delivery of their scope of works:

Table 10: Meeting attendance requirements

Meeting type	Frequency	Location/ platform	Notes
Kick Off	One Off	Leeds (Thorpe Park)	
Consenting and Environmental Launch	One Off	Leeds (Thorpe Park)	Two-day session in Thorp Park to: - • Meet NGN team • Understand NGN systems • Understand work done to date • Review information available • Meet modelling team
Technical Coordination	Monthly	Teams/	Meeting with other ECH Partners
Catch Up	Weekly	Teams	
Progress meeting	Monthly	Leeds (Thorpe Park)	
Review Meeting	As Req'd	Teams	A review meeting to key deliverables before issue, these can be coordinated to precede or follow the monthly progress meeting

All other meetings deemed necessary to deliver this scope of works should be identified and included by the Contractor in their proposal.

10. Phase 5 Pre-FEED Scope Detail

The existing Pre-FEED for the NGN ECH project was undertaken for specific areas which were identified as phase 3 of the project. Phase 5 contains the remaining area within the NGN geography which includes Cumbira, Northumberland (Tyneside and north) and central East Yorkshire. These areas were not covered initially since they didn't align with the phasing of Project Union, which begins with the transmission network in the Phase 3 geography. The Project Union routing can be assumed to be completed prior to the start of this scope of works, otherwise assumptions on the NTS routeing will be agreed with the client at the start of the project. The following sections outline the scope requirements of this package.

10.1 Scope

The scope of this Pre-FEED study will be similar to that which has already been undertaken for the other NGN ECH geographies. As such, some documents will require an update and others a new document will be required. This is outlined in the below table:

Table 11: Pre-FEED study document requirements

Deliverable	Document requirement
Pre-FEED Study Programme	New
Project Execution Plan	Update
Demand Study	New
Production Study	New
Storage Study	New
Modelling Brief	New
Network Concept report	New
Phasing Plan	New
Routing corridors	New
Options report	New
Project Indicative Cost	New
Final Pre-FEED Report	New
FEED Re Opener Support	New
Project risk register	Update
Assumption and Decisions Register	Update
FEED Study Scope	Update

10.1.1 Pre-FEED Study Programme

The Consultant shall provide a detailed programme for this scope of works within three weeks of award.

This will form the basis of the monthly update. This programme shall be aligned to all activities referenced in the deliverables schedule. This programme shall be updated once the options study has been completed to detail the remaining activities will be completed in line with the project objectives.

10.1.2 Project Execution Plan

The project execution plan should be based upon the project execution plan for the previous project phase. This shall detail the approach to the project and include:

- a detailed description of how the project will be delivered at each stage
- key systems and software etc that will be used to deliver the project
- Detail where the key personnel will be located and what offices will be used to deliver the project

This shall be provided within three weeks of award and updated during any major change to the scope as well as at the end of the project, to capture how the project was delivered.

10.1.3 Demand Study

A new demand study shall be carried out for this scope of works. The existing demand report shall be used as a basis for this.

This study will review the data from consultation with current Natural Gas customers, latest projections on uptake of heat pumps, domestic energy projection and produce a potential hydrogen demand profile. This should consider latest research by others. The demand projection should be for the area within this project scope. The demand study should cover both the build-up of hydrogen demand and the reducing demand for Natural Gas over time.

The data collection exercise will only collect some of the desired data as many organisations are still developing plans. The Pre-FEED Consultant will need to utilise the available data and any other published data on forecast energy usage, switching etc, in order to develop and forecast profile of future hydrogen demand over time and in each area of the NGN network.

Other items that should be considered include:

Power Generation

The potential for new power generation utilising hydrogen as a source of Power.

Transport

It is likely there will be hydrogen transport hubs in all hydrogen generation areas, with hydrogen transported to remote hubs by road, pipeline connections as the networks expand should be incorporated into the Pre-FEED plan. The available information and investment plans should be reviewed to determine the likely demand profile.

Natural Gas Demand

In addition to the profiling of hydrogen demand the report should also analyse the likely profile of Natural Gas at each phase of the project

10.1.4 Production Study

A new production study shall be carried out for this scope of works. The existing production report shall be used as a basis for this.

Detailed forecasts for hydrogen production based on data collected, other studies and forecasts and extrapolation. This should show the anticipated rate of production (by type), location and time. NGN are collecting data from the major known producers and will continue dialogue with these organisations. It should be noted that the data collection will be an ongoing process throughout the project, and it will be necessary to estimate some of the production forecasts based on extrapolation of data available and other studies and communications.

In addition to the actual hydrogen production facilities the report should consider the probability of each developing, the reliability of production and the amount of production that will be available to a wider network.

Part of this study should look at the range of smaller projects that may want to connect to a future hydrogen network and should detail the challenges and potential solutions to allow these connections.

10.1.5 Storage Study

A new storage study shall be carried out for this scope of works. The existing storage report shall be used as a basis for this.

To demonstrate the resilience of the future hydrogen transmission and distribution system, this study will identify the storage requirements at each stage of the project and compare those with available storage being planned by others.

The study should review publicly available information as well as that provided by the Client.

10.1.6 Initial Modelling Brief

Where network modelling work is required, this will be carried out by the Client. The Pre-FEED Consultant shall produce a detailed requirements brief for the modelling support, this should detail the necessary outputs, assumptions to be utilised and the purpose for the modelling work and specify the dates when each of the results are required. It is envisaged that modelling brief will be required to be updated at the following stages:

- Initial design brief – Identifying Data required on current networks and how it operates and known challenges.
- After data collection and analysis – To analyse the impact of the declining demand for natural gas and to identify opportunities for repurposing.
- After initial concept development – To model a number of options for new hydrogen transmission and distribution.
- As part of engineering challenges and final option selection – To resolve specific challenges and develop outline designs further.

10.1.7 Phasing Plan

The phasing plan shall be informed by the data collection and optioneering of the proposed network. This should be produced initially to inform the routing options, once data collection has been undertaken. A further update should be made to determine the final Pre-FEED phasing plan, once the route optioneering has been undertaken.

10.1.8 Routing corridors

For the network developments, the potential routing of new pipeline assets and modifications to existing assets should be detailed, but with the detailed analysis of these routes carried out as part of the work in the Options Report. This routing corridors should evidence decisions based on key constraints to be addressed in i.e. land consenting, environmental, technical and cost challenges.

It is envisaged that at the Pre-FEED stage this would be a desk top exercise using available information rather than requiring any additional survey work.

The report should also look at the requirements for new or expanded above ground installations

10.1.9 Options report

Report that develops the details of each phase of the project covering the elements summarised as follows:

- The preferred hydrogen network at each phase linking the sources of production and consumers of hydrogen
- The reason it is the preferred solution
- Key challenges that need to be reviewed to confirm this selection

- Proposed contingency solutions where significant uncertainties exist
- The extent of new hydrogen pipelines and associated pressure tiers that would be required to meet the project requirements
- Indicative drawings of proposed new/ repurposed assets, these should be to a sufficient standard to communicate the feasibility/ extent of the required projects and aid the FEED scope development
- Update of the Pre-FEED risk register
- Creation of the Environmental Impact register and mitigations required
- Update to the Pre-FEED decision register
- Maps showing the potential hydrogen networks at each stage, these should also be available as files that can be imported into google earth Pro
- Repurposing strategy identifying specific assets for all phases and approach and constraints

The purpose of this report is to table preferred solutions or solution options so they can be communicated with NGN, other ECH partners, ECH consortium members and potential hydrogen consumers.

The report will also be used as the basis for ongoing engagement with DESNZ and Ofgem ahead of a reopener submission to enable funding of the FEED study.

The options report shall support the NGN Engagement process and the subsequent information gathering process.

The options report shall identify the key challenges that should be focused on for the reminder of the project to ensure the viability of the proposed options identified.

10.1.10 Project Indicative Cost

Estimate for the investment required to deliver this phase of East Cost Hydrogen from a distribution network perspective. This should be derived from the options selected in the options study report and the construction of all temporary and permanent infrastructure. The Client will provide cost data input into this.

10.1.11 Final Pre-FEED Report

The existing Pre-FEED report can be used as a basis for this. This should summarise the finding of the Pre-FEED study and highlight how the project objectives have been achieved. It should reference all the detailed reports.

10.1.12 FEED Re Opener Support

The Pre-FEED Consultant shall provide support to the Client in preparing the Re Opener submission for OFGEM. This will be similar in format to the previous Re Opener submission which shall be used as a basis for this. The Consultant will be responsible for inputting into the:

- Full Needs Case
- Cost Benefit Analysis
- Engineering Justification Paper
- Demonstration of net benefit to consumers

These documents will align to the requirements of the Net Zero Pre-construction Work and Small Net Zero Projects Re-opener Governance Document.

10.1.13 Project risk register.

Register of all risks that prevent the project objectives being met along with mitigation measures and status. The Consultant shall allow for a review of the existing project risk register and addition of any project risks which arise as part of this scope of works.

10.1.14 Assumption and Decisions Register

Register of all assumptions and decisions which have been made in order to progress the project. The Consultant shall allow for a review of the existing project assumption and decisions register and addition of any which arise as part of this scope of works.

10.1.15 FEED Study Scope

The Consultant shall produce a FEED study scope in line with the scope document produced for the first ECH FEED study. This shall also include an anticipated FEED schedule and cost.

10.2 Attendance at meetings

The Contractor shall allow for attendance at the following meetings throughout the delivery of their scope of works:

Table 12: Meeting attendance requirements

Meeting type	Frequency	Location/ platform	Notes
Kick Off	One Off	Leeds (Thorpe Park)	
Technical Launch	One Off	Leeds (Thorpe Park)	One-day session in Thorp Park to: - • Meet NGN team • Understand NGN systems • Understand work done to date • Review information available • Meet modelling team
Technical Coordination	Monthly	Teams/	Meeting with other ECH Partners
Catch Up	Weekly	Teams	
Progress meeting	Monthly	Leeds (Thorpe Park)	
Modelling Meeting	As required		Initial meeting in Leeds/Sunderland. Subsequent on teams
Review Meeting	As Req'd	Teams	A review meeting to key deliverables before issue, these can be coordinated to precede or follow the monthly progress meeting

All other meetings deemed necessary to deliver this scope of works should be identified and included by the Contractor in their proposal.

11. Close Down Report

A close-down report with all justifications will be provided at the end FEED study if any section or sections of the agreed scope as detailed in this report cannot be fulfilled.

The money unspent on such condition will also be returned to OFGEM with justification.

A.1 FEED Master Deliverables Register

					RACI R= Responsible, A=Accountable, C=Consulted, I=Informed				
Ref.	Deliverable	Explanation of activity / deliverable	Documents produced	Package Owner	NGN	HP / IP technical consultant	MP technical consultant	Environmental, consenting and surveys	Phase 5 Pre-FEED consultant
0.000	**Project Management**								
0.001	FEED Study Programme	Updated and issued monthly.	FEED Study Programme	NGN	A/ R	C	C	C	C
0.002	Project Risk Register	Updated and issued fortnightly.	Risk register risk management plan?	NGN	A/ R	C	C	C	C
0.003	Assumptions and Decision Register	Updated and issued fortnightly.	Assumptions and Decision Register	NGN	A/ R	C	C	C	C
0.004	Lessons Learnt Register	Updated and issued every 2 months	Lessons Learnt Register	NGN	A/ R	C	C	C	C
0.005	Project Execution Plan - FEED		Project execution plan	NGN	A/ R	C	C	C	C
0.006	Develop commercial interface strategy with key stakeholders / interfaces		Commercial interface strategy	NGN	A/ R	C	C	C	C
0.007	Cost benefit assessment	Assessment of the CAPEX and OPEX of each element of the works against the hydrogen transport associated with those assets.		NGN	R	C	C		C
1.000	**Information Gathering**								
1.001	Demand Report	Update of Pre-FEED report Confirm with individual users the anticipated demand requirement and identify changes from Pre-FEED. Identify any new consumers.	Demand Report	NGN	A/ R	I	I		I
1.002	Production Report	Update of Pre-FEED report Confirm with producers anticipated production and identify changes from Pre-FEED. Identify any new producers.	Production Report	NGN	A/ R	I	I		I
1.003	Storage Report	Update of Pre-FEED report Confirm figures with storage providers and identify changes from Pre-FEED. Identify any new storage providers.	Storage Report	NGN	A/ R	I	I		I
1.004	MOU	Memorandums of understanding with proposed producers, storage providers and users.	MOUs	NGN	A	I	I		I
2.000	**Development of Design Basis**								
2.001	FEED Basis of Design	Develop design basis for Phase 1 scope of works (full FEED), Phase 2 scope - outline FEED and Phase 3 Shallow FEED. As well as the Pre-FEED for Cumbria, East Yorkshire and Tyneside.	FEED basis of design report	NGN	A/ R	R	R	R	I
2.002	Identification and collation of all relevant standards, regulations, policies, specifications, and procedures informing design of project infrastructure deliverables.		Standards / policies / regulations list. to be included in the basis of design report.	NGN	A/ R	R	R	R	I
2.003	Piping specifications	The piping specification shall cover all piping systems within this scope of works.		Technical consultant					
2.004	Pipeline specifications	The pipeline specification shall cover all pipeline systems within this scope of works.		Technical consultant					
3.000	**Phase 5 Areas Pre-FEED**	The pre-FEED stage of NGN ECH was focused on phase 3. Some areas were assumed to not be viable in the timescales of phase 3 and were put into phase 5 which was not studied. As part of this FEED scope, phase 5 should be studied to pre-FEED level.		Pre-FEED consultant	A				R
3.001	Update to the pre-FEED documents	Update to the pre-FEED documents.	Project risk register Key decision log	Pre-FEED consultant	I				A/R
3.002		Detailed programme for this scope of works. This will form the basis of the monthly update. This programme shall be aligned to all activities referenced in the deliverables schedule.	Pre-FEED Study Programme	Pre-FEED consultant	C/I				A/R
3.003		Update to align with this scope of works.	Pre-FEED Project Execution Plan	Pre-FEED consultant	I				A/R
3.004		A new demand study shall be carried out for this scope of works. The existing demand report shall be used as a basis for this.	Demand Report	Pre-FEED consultant	C/I				A/R
3.005		A new production study shall be carried out for this scope of works. The existing production report shall be used as a basis for this.	Production Report	Pre-FEED consultant	C/I				A/R
3.006		A new storage study shall be carried out for this scope of works. The existing storage report shall be used as a basis for this.	Storage Report	Pre-FEED consultant	C/I				A/R
3.007		Where network modelling work is required, this will be carried out by the Client. The Pre-FEED Consultant shall produce a detailed requirements brief for the modelling support, this should detail the necessary outputs, assumptions to be utilised and the purpose for the modelling work and specify the dates when each of the results are required.	Modelling brief	Pre-FEED consultant	I				A/R
3.008		For the network developments, the potential routing of new pipeline assets and modifications to existing assets should be detailed, but with the detailed analysis of these routes carried out as part of the work in the Options Report.	Routeing corridors and Options study report	Pre-FEED consultant	I				A/R
3.009		Estimate for the investment required to deliver this phase of East Cost Hydrogen from a distribution network perspective.	Project Capital Cost report	Pre-FEED consultant	I				A/R
3.010		The phasing plan shall be informed by the data collection and optioneering of the proposed network. The existing Pre-FEED phasing plan shall be used as a basis for this.	Final phasing plan	Pre-FEED consultant	I				A/R
3.011		The existing Pre-FEED report can be used as a basis for this.	Pre-FEED report	Pre-FEED consultant	I				A/R
3.012		The Consultant shall produce a FEED study scope in line with the scope document produced for the first ECH FEED study.	FEED Scope report	Pre-FEED consultant	C/I				A/R
	HP / IP Technical Consultant								
4.00	**General**								
4.001	Basis of design - HP / IP FEED	The basis of design document should include all relevant assumptions and decisions made to progress the design. It should detail these alongside suitable references and justification. All applicable codes and standards which have been used during the design should also be listed in the basis of design. This document shall also include the basis of costing identifying the unit costs used to build up CAPEX estimates for each element of this project scope.	Basis of design - HP / IP FEED	Technical consultant	C/I	A/R		C	
4.002	Project execution plan	The PEP should detail how the Contractor intends to deliver and manage the project. This should include reference to how the Contractor will manage change and resourcing throughout the project.	Project execution plan	Technical consultant	C/I	A/R		C	
4.003	Project programme	A project programme shall be provided and updated every fortnight by the Contractor. This shall show key design activities and interdependencies and requirements from other contractors required to fulfil this scope of works.	Programme	Technical consultant	C/I	A/R		C	
4.004	Piping specifications	The piping specification shall cover all piping systems within this scope of works.	Piping specifications	Technical consultant	C/I	A/R			

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Ref.	**Deliverable**	**Explanation of activity / deliverable**	**Documents produced**	**Package Owner**	NGN	HP / IP technical consultant	MP technical consultant	Environmental, consenting and surveys	Phase 5 Pre-FEED consultant
4.005	Pipeline specifications	The pipeline specification shall cover all pipeline systems within this scope of works.	Pipeline specifications	Technical consultant	C/I	A/R			
4.006	Control and instrumentation specification	General control and instrumentation specification to detail the minimum requirements for all instrumentation and control equipment.	Control and instrumentation specification	Technical consultant	C/I	A/R			
4.007	Cathodic protection design	General performance specification outlining the cathodic protection requirements for this scope of works.	Cathodic protection design requirements document	Technical consultant	C/I	A/R			
4.008	Repurposed pipeline requirement blueprint	A blueprint for the repurposing of existing pipelines for hydrogen use. This shall determine the minimum technical requirements which the pipelines will be assessed against to confirm suitability for repurposing.	Repurposed pipeline requirement blueprint	Technical consultant	C/I	A/R			
4.100	**Site Specific AGI deliverables**								
4.101	AGI location plans	Location plan of each AGI. This shall follow on from assessment by the Contractor to confirm the location along corridor route which is most suitable and practical for installation of new PRS/Transmission Breakdown/Valve infrastructure with an indication of flexibility in location to enable landowner negotiations to continue	Location plans	Technical consultant	I	A/R		C	
4.102	AGI plot plan drawings	Plan drawings showing the final design layout of the site.	Plot plans	Technical consultant	C/I	A/R			
4.103	Hazardous area assessment	Preliminary hazardous area assessments based on the specified equipment, to enable the specification of equipment to the required rating.	Hazardous area assessment report	Technical consultant	I	A/R			
4.104	Preliminary hazardous area drawings	Drawings as an output of the hazardous area assessment.	Hazardous area drawing	Technical consultant	I	A/R			
4.105	Process safety assessment including Hazid, Hazop and SIL assessment	A Hazid shall be undertaken for each site with the Hazid report being the final deliverable. A Hazop shall be undertaken for each site with the Hazop report being the final deliverable. A SIL assessment shall be undertaken to inform the correct specification of instrumented functions.	HAZID report HAZOP report SIL assessment report	Technical consultant	I	A/R			
4.106	Load schedules	Load schedules for each AGI.	Load schedule	Technical consultant	I	A/R			
4.107	Piping general arrangements	Piping general arrangements for all AGIs showing new and existing pipework and connections to pipelines. The contractor is expected to produce a 3D model for the AGIs where necessary	3D model General arrangement drawing	Technical consultant	I	A/R			
4.108	Preliminary stress analysis and fatigue calculations	Stress analysis of the proposed piping layout to confirm feasibility. This should be a preliminary assessment which focusses on high risk aspects of the site.	Stress analysis report	Technical consultant	I	A/R			
4.109	Process flow diagrams	Process flow diagrams showing new systems and how they tie into the existing systems.	Process flow diagram	Technical consultant	I	A/R			
4.110	Pressure systems drawings	System drawings identifying the different pressure systems on the site.	Pressure systems drawing	Technical consultant	I	A/R			
4.111	Long lead item identification / schedule	Schedule to identify the items of equipment and materials which have lead times of greater than 3 months from order to delivery.	Long lead item schedule	Technical consultant	I	A/R			
4.112	Preliminary MTOs	Material Take Off (MTO) for each AGI.	Material Take Off	Technical consultant	I	A/R			
4.113	AGI operational strategy document	A high-level operation strategy document outlining how the site can be safely operated in line with NGN standards.	AGI operational strategy document	Technical consultant	I	A/R			
4.114	Instrument schedules	Schedules of instruments included in the design of each AGI.	Instrument schedule	Technical consultant	I	A/R			
4.115	Electrical and instrumentation datasheets	Datasheets for all electrical equipment.	Electrical and instrumentation datasheets	Technical consultant	I	A/R			
4.116	Equipment schedules	Schedules of equipment included in the design of each AGI.	Equipment schedule	Technical consultant	I	A/R			
4.117	Mechanical datasheets	Datasheets outlining the minimum requirements of equipment which have been assumed during the FEED design phase.	Mechanical datasheets	Technical consultant	I	A/R			
4.118	Process datasheets	Datasheets outlining the minimum process requirements for equipment and instrumentation.	Process datasheet	Technical consultant	I	A/R			
4.119	Noise assessment	A site noise assessment.	Noise assessment	Technical consultant	I	A/R		C	
4.120	Survey specifications	Specification for survey works identified to confirm the arrangement and condition of existing sites to inform their suitability for repurposing and provide the required information to complete the design works.	Survey specifications	Technical consultant	I	A/R		C	
4.121	Survey report	Report detailing the findings of the surveys against the specifications. These should detail any deviations found from record information and any information gathered which is prudent to the scope of works.	Survey report	Technical consultant	I	A/R			
4.122	Design and condition assessment report	For existing assets which are being repurposed or modified, a report shall be produced detailing the suitability of the existing design and the condition, in line with section 16.5 of IDEM TD/13 ed2 supplement 1.	Design and condition assessment report	Technical consultant	I	A/R			
4.123	Individual cost report	A cost report of the proposed design, detailing all procurement and construction costs associated with the full delivery of the scheme.	Individual cost report	Technical consultant	I	A/R			
4.200	**HP / IP Pipelines (Repurposed)**								
4.201	Survey specifications	Survey specifications for each repurposed pipeline to obtain the technical information to confirm requirements. This will include pipeline condition survey specifications.	Survey specifications	Technical consultant	I	A/R		C	
4.202	RAMs	RAMs for any surveys undertaken.	RAMs	Technical consultant	I	A/R			
4.203	Survey reports	Reports of any surveys undertaken in relation to this scope of works.	Survey reports	Technical consultant	I	A/R			
4.204	Material compatibility assessment and criteria report	This will take the output of the surveys and a desktop study of each pipeline and assess each pipeline against the Repurposed pipeline requirement blueprint. The report will conclude with the suitability of the pipeline for repurposing.	Material compatibility assessment and criteria report	Technical consultant	I	A/R			
4.205	Line capacity assessment	Capacity assessment to confirm the suitability of the pipeline to transport the anticipated demand loads.	Line capacity assessment	Technical consultant	C/I	A/R			
4.206	Repurposed pipeline map	1:12,000 strip map of each pipeline route. These should highlight any areas of required works to the pipelines to enable the repurposing.	Repurposed pipeline map	Technical consultant	C/I	A/R			
4.207	HAZID report	The Contractor shall undertake a Hazard Identification study on each repurposed pipeline route to identify any hazards associated with its repurposing. Attendance at the Hazid shall include for NGN operators. The Contractor shall undertake this with a suitably qualified Hazid chair. The deliverable for this shall be the Hazid report. This shall form the Repurposing risk assessment which shall identify any risk associated with the pipeline and upstream and downstream connections. The risk assessment should be carried out in accordance with the requirements specified in Reference Standard IGEM/H/1 in order to identify any changes in pipeline risk and confirm that these changes are appropriately addressed in relevant management and replacement plans for the pipeline.	HAZID report	Technical consultant	I	A/R			
4.208	Engineering line diagram (ELD)	The ELD shall be updated to show the proposed connection into the existing or future infrastructure and identify any disconnections.	Engineering line diagram	Technical consultant	C/I	A/R			
4.209	Fatigue assessment report	Fatigue assessment in accordance with IGEM/TD/1 including supplement 2.	Fatigue assessment report	Technical consultant	C/I	A/R			
4.210	Repurposing assessment report	The repurposing assessment report shall draw together all elements of work undertaken and conclude the suitability of the pipeline for repurposing, identifying all works required to achieve that.	Repurposing assessment report	Technical consultant	I	A/R			
4.211	Cost report	A cost report of the proposed design, detailing all procurement and construction costs associated with the full delivery of the scheme.	Cost report	Technical consultant	I	A/R			
4.300	**HP / IP Pipelines (New-build)**								
4.301	New pipeline corridor routing assessment	The corridor assessment shall be suitable for all planning, environmental, consent work. The corridor should be an appropriate width to enable consent to be obtained through surveys and assessment but not overly large (leading to excessive survey and land interest costs) or narrow (leading to construction challenges). The Contractor shall engage with the Environmental and Consenting Consultant during the development of the routing corridor to ensure that the solution proposed balances the constructability, technical viability and cost of the route, against the economic, environmental, socio-economic, political, planning and practical factors.	New pipeline corridor routing assessment report	Technical consultant	I	A/R		C	

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Ref.	**Deliverable**	**Explanation of activity / deliverable**	**Documents produced**	**Package Owner**	NGN	HP / IP technical consultant	MP technical consultant	Environmental, consenting and surveys	Phase 5 Pre-FEED consultant
4.302	Route corridor map 1:12,000	1:12,000 scale maps of each pipeline routing corridor. These shall be of sufficient detail to enable the required planning, environmental and consenting works to be undertaken. This shall include full route maps and GIS files in agreed NGN format with full access and ownership of relevant data and GIS layers relevant to route design.	Route corridor maps	Technical consultant	I	A/R		C	
4.303	Sizing calculations	Calculations to confirm the required sizing of the pipeline. This shall be based upon the latest demand information which will be provided by the Client at the point the sizing calculation is undertaken.	Sizing calculations	Technical consultant	C/I	A/R			
4.304	Line pressures assessment report	This shall be developed with network modelling input obtained from NGN.	Line pressures assessment report	Technical consultant	C/I	A/R			
4.305	Survey specifications	Survey specifications for each pipeline to obtain the constructability information required to facilitate design. This shall include areas which call for early ground investigations such as geomorphological or borehole surveys etc.	Survey specifications	Technical consultant	I	A/R		C	
4.306	RAMs	RAMs for any surveys undertaken such as walking surveys, and vantage point surveys of key locations (such as crossings and pinch points) to determine practical viability of proposed pipeline / corridor.	RAMs	Technical consultant	I	A/R			
4.307	Survey reports	Reports of any surveys undertaken in relation to this scope of works.	Survey reports	Technical consultant	I	A/R			
4.308	Crossing assessment document per pipeline.	During the Pre-FEED pipelines were assessed using a linear infrastructure routing tool, this determined the required crossings and the installation method which would be applied. During the FEED stage these shall be assessed and verified. The output will be a crossing assessment report for each pipeline which considers multiple factors including (but not limited to) physical obstructions, construction access, assumed ground conditions and topography.	Crossing assessment document	Technical consultant	I	A/R			
4.309	New pipeline corridor risk assessment	This assessment shall be conducted for each pipeline route, highlighting and factors which may impact upon the viability and constructability of each pipeline route. Each risk shall be scored in terms of its likelihood and severity, mitigations shall be proposed where required.	New pipeline corridor risk assessment	Technical consultant	I	A/R		C	
4.310	Construction approach	A package breakdown of each route considering phases of construction.	Construction approach report	Technical consultant		A/R			
4.311	Engineering line diagram (ELD)	The ELD shall be updated to show the proposed connection into the existing or future infrastructure and identify any disconnections.	Engineering line diagram (ELD)	Technical consultant	C/I	A/R			
4.312	Long lead item schedule	The Contractor shall provide a long lead item schedule which encompasses all new pipelines. To populate this, the Contractor shall engage with suppliers to understand the current market position for the provision of the pipelines and equipment required, considering the proposed project programme.	Long lead item schedule	Technical consultant	I	A/R			
4.313	Material Take Off	An estimated Material Take Off based on the FEED design of the pipeline. This shall include for all pipelines, equipment and required infrastructure within this scope of works.	Material Take Off	Technical consultant	I	A/R			
4.314	HAZID report	The Contractor shall undertake a Hazard Identification study on each new build pipeline route to identify any hazards. Attendance at the Hazid shall include for NGN operators. The Contractor shall undertake this with a suitably qualified Hazid chair. The deliverable for this shall be the Hazid report.	HAZID report	Technical consultant	C/I	A/R			
4.315	Network model requirements	The Contractor shall provide the Client with the design information required to enable their modelling of the network.	Network model requirements	Technical consultant	C/I	A/R			
4.316	Preliminary cathodic protection design basis and report	This document shall outline the overall project strategy for cathodic protection, with regards to this scope of works. This shall be in accordance with SGN standards. The Contractor shall assess these standards for their suitability with the hydrogen pipelines proposed, any modifications required shall be highlighted to the Client by the Contractor.	Preliminary cathodic protection design basis and report	Technical consultant	I	A/R			
4.317	Cost report	A cost report of the proposed design, detailing all procurement and construction costs associated with the full delivery of the scheme.	Cost report	Technical consultant	I	A/R			
	MP Technical Consultant								
5.00	**General**								
5.001	Basis of design - MP FEED	The basis of design document should include all relevant assumptions and decisions made to progress the design. It should detail these alongside suitable references and justification. All applicable codes and standards which have been used during the design should also be listed in the basis of design. This document shall also include the basis of costing identifying the unit costs used to build up CAPEX estimates for each element of this project scope.	Basis of design - MP FEED	Technical consultant	C/I		A/R		
5.002	Project execution plan	The PEP should detail how the Contractor intends to deliver and manage the project. This should include reference to how the Contractor will manage change and resourcing throughout the project.	Project execution plan	Technical consultant	C/I		A/R		
5.003	Project programme	A project programme shall be provided and updated every fortnight by the Contractor. This shall show key design activities and interdependencies and requirements from other contractors required to fulfil this scope of works.	Programme	Technical consultant	C/I		A/R		
5.004	Pipeline specifications	The pipeline specification shall cover all pipeline systems within this scope of works.	Pipeline specifications	Technical consultant	C/I		A/R		
5.005	Control and instrumentation specification	General control and instrumentation specification to detail the minimum requirements for all instrumentation and control equipment.	Control and instrumentation specification	Technical consultant	C/I		A/R		
5.006	Repurposed pipeline requirement blueprint	A blueprint for the repurposing of existing pipelines for hydrogen use. This shall determine the minimum technical requirements which the pipelines will be assessed against to confirm suitability for repurposing.	Repurposed pipeline requirement blueprint	Technical consultant	C/I		A/R		
5.100	**MP Pipelines (Repurposed)**								
5.101	Survey specifications	Survey specifications for each repurposed pipeline to obtain the technical information to confirm requirements. This will include pipeline condition survey specifications.	Survey specifications	Technical consultant	I		A/R	C	
5.102	RAMs	RAMs for any surveys undertaken.	RAMs	Technical consultant	I		A/R		
5.103	Survey reports	Reports of any surveys undertaken in relation to this scope of works.	Survey reports	Technical consultant			A/R		
5.104	Material compatibility assessment and criteria report	This will take the output of the surveys and a desktop study of each pipeline and assess each pipeline against the Repurposed pipeline requirement blueprint. The report will conclude with the suitability of the pipeline for repurposing.	Material compatibility assessment and criteria report	Technical consultant	C/I		A/R		
5.105	Line capacity assessment	Capacity assessment to confirm the suitability of the pipeline to transport the anticipated demand loads.	Line capacity assessment	Technical consultant	C/I		A/R		
5.106	Repurposed pipeline map	1:12,000 strip map of each pipeline route. These should highlight any areas of required works to the pipelines to enable the repurposing.	Repurposed pipeline map	Technical consultant	C/I		A/R		
5.107	HAZID report	The Contractor shall undertake a Hazard Identification study on each repurposed pipeline route to identify any hazards associated with its repurposing. Attendance at the Hazid shall include for NGN operators. The Contractor shall undertake this with a suitably qualified Hazid chair. The deliverable for this shall be the Hazid report. This shall form the Repurposing risk assessment which shall identify any risk associated with the pipeline and upstream and downstream connections. The risk assessment should be carried out in accordance with the requirements specified in Reference Standard IGEM/H/1 in order to identify any changes in pipeline risk and confirm that these changes are appropriately addressed in relevant management and replacement plans for the pipeline.	HAZID report	Technical consultant	C/I		A/R		

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Ref.	**Deliverable**	**Explanation of activity / deliverable**	**Documents produced**	**Package Owner**	NGN	HP / IP technical consultant	MP technical consultant	Environmental, consenting and surveys	Phase 5 Pre-FEED consultant
5.108	Engineering line diagram (ELD)	The ELD shall be updated to show the proposed connection into the existing or future infrastructure and identify any disconnections.	Engineering line diagram	Technical consultant	C/I		A/R		
5.109	Repurposing assessment report	The repurposing assessment report shall draw together all elements of work undertaken and conclude the suitability of the pipeline for repurposing, identifying all works required to achieve that.	Repurposing assessment report	Technical consultant	I		A/R		
5.110	Cost report	A cost report of the proposed design, detailing all procurement and construction costs associated with the full delivery of the scheme.	Cost report	Technical consultant	I		A/R		
5.200	**MP Pipelines (New-build)**				I				
5.201	New pipeline corridor routing assessment	The corridor assessment shall be suitable for all planning, environmental, consent work. The corridor should be an appropriate width to enable consent to be obtained through surveys and assessment but not overly large (leading to excessive survey and land interest costs) or narrow (leading to construction challenges). The Contractor shall engage with the Environmental and Consenting Consultant during the development of the routing corridor to ensure that the solution proposed balances the constructability, technical viability and cost of the route, against the economic, environmental, socio-economic, political, planning and practical factors.	New pipeline corridor routing assessment report	Technical consultant	I		A/R	C	
5.202	Route corridor map 1:12,000	1:12,000 scale maps of each pipeline routing corridor. These shall be of sufficient detail to enable the required planning, environmental and consenting works to be undertaken. This shall include full route maps and GIS files in agreed NGN format with full access and ownership of relevant data and GIS layers relevant to route design.	Route corridor maps	Technical consultant	I		A/R	C	
5.203	Sizing calculations	Calculations to confirm the required sizing of the pipeline. This shall be based upon the latest demand information which will be provided by the Client at the point the sizing calculation is undertaken.	Sizing calculations	Technical consultant	I		A/R		
5.204	Line pressures assessment report	This shall be developed with network modelling input obtained from NGN.	Line pressures assessment report	Technical consultant	C/I		A/R		
5.205	Survey specifications	Survey specifications for each pipeline to obtain the constructability information required to facilitate design. This shall include areas which call for early ground investigations such as geomorphological or borehole surveys etc.	Survey specifications	Technical consultant	I		A/R	C	
5.206	RAMs	RAMs for any surveys undertaken such as walking surveys, and vantage point surveys of key locations (such as crossings and pinch points) to determine practical viability of proposed pipeline / corridor.	RAMs	Technical consultant	I		A/R		
5.207	Survey reports	Reports of any surveys undertaken in relation to this scope of works.	Survey reports	Technical consultant	I		A/R		
5.208	Crossing assessment document per pipeline	During the Pre-FEED pipelines were assessed using a linear infrastructure routing tool, this determined the required crossings and the installation method which would be applied. During the FEED stage these shall be assessed and verified. The output will be a crossing assessment report for each pipeline which considers multiple factors including (but not limited to) physical obstructions, construction access, assumed ground conditions and topography.	Crossing assessment document	Technical consultant	I		A/R		
5.209	New pipeline corridor risk assessment	This assessment shall be conducted for each pipeline route, highlighting and factors which may impact upon the viability and constructability of each pipeline route. Each risk shall be scored in terms of its likelihood and severity, mitigations shall be proposed where required.	New pipeline corridor risk assessment	Technical consultant	I		A/R	C	
5.210	Construction approach	A package breakdown of each route considering phases of construction.	Construction approach report	Technical consultant	I		A/R		
5.211	Engineering line diagram (ELD)	The ELD shall be updated to show the proposed connection into the existing or future infrastructure and identify any disconnections.	Engineering line diagram (ELD)	Technical consultant	I		A/R		
5.212	Long lead item schedule	The Contractor shall provide a long lead item schedule which encompasses all new pipelines. To populate this, the Contractor shall engage with suppliers to understand the current market position for the provision of the pipelines and equipment required, considering the proposed project programme.	Long lead item schedule	Technical consultant	I		A/R		
5.213	Material Take Off	An estimated Material Take Off based on the FEED design of the pipeline. This shall include for all pipelines, equipment and required infrastructure within this scope of works.	Material Take Off	Technical consultant	I		A/R		
5.214	HAZID report	The Contractor shall undertake a Hazard Identification study on each new build pipeline route to identify any hazards. Attendance at the Hazid shall include for NGN operators. The Contractor shall undertake this with a suitably qualified Hazid chair. The deliverable for this shall be the Hazid report.	HAZID report	Technical consultant	C/I		A/R		
5.215	Network model requirements	The Contractor shall provide the Client with the design information required to enable their modelling of the network.	Network model requirements	Technical consultant	C/I		A/R		
5.216	Preliminary cathodic protection design basis and report	This document shall outline the overall project strategy for cathodic protection, with regards to this scope of works. This shall be in accordance with SGN standards. The Contractor shall assess these standards for their suitability with the hydrogen pipelines proposed, any modifications required shall be highlighted to the Client by the Contractor.	Preliminary cathodic protection design basis and report	Technical consultant	I		A/R		
5.217	Cost report	A cost report of the proposed design, detailing all procurement and construction costs associated with the full delivery of the scheme.	Cost report	Technical consultant	I		A/R		
6.000	**Environmental and Consenting**								
6.001	Appraisal of Pre-FEED	Initial appraisal of existing routes identified through Pre-FEED. This will include a RAG rating looking at key environmental and social constraints. These shall, as a minimum, include the considerations in IGEM/TD/1 section 4.1.2.2.	RAG register	Environmental and consenting consultant	C/I			A/R	
6.002	Repurposed infrastructure consent, licence and approval strategy.	Determination of required consents, licences and approvals and appropriate consenting strategy for repurposed infrastructure.	Consent, licence and approval strategy	Environmental and consenting consultant	C/I	C	C	A/R	
6.003	New infrastructure consenting strategy	Determination of appropriate consenting strategy for new infrastructure including the phasing and delivery of the pipeline network considering the use of TCPA local planning applications and/ or DCO as appropriate and considering the use of existing easements, use of existing statutory powers and the lengths and pressures of the different proposed pipelines.	New infrastructure consenting strategy	Environmental and consenting consultant	C/I	C	C	A/R	
6.004	Route corridor analysis	For new pipelines, route corridor selection and narrowing from a width of 1km for high pressure pipelines to an eventual construction easement of approximately 34m within a consented route corridor of approximately 100m width, narrowed where appropriate due to site specific constraints. This shall include sensitivity analysis of factors not considered in AI, these should be incorporated in the analysis such as public perception, historical incidents, political challenges, human factors etc.	Consenting strategy Consultation strategy	Environmental and consenting consultant	C/I	C	C	A/R	
6.005	Route corridor risk assessment	For new pipelines, carry out high level risk assessment and associated mitigations for corridor options beyond capability of AI software.	Route corridor risk assessment report	Environmental and consenting consultant	C/I	A/C	A/C	A/R	
6.006	AGI location appraisal	Identification and assessment of appropriate locations for any new AGIs, appraisal of environmental effects of extensions to existing AGIs and consideration of other above ground infrastructure if required.	Location assessment report	Environmental and consenting consultant	I	C	C	A/R	

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6.007	Requirements for new build consent applications	Setting out detailed requirements for the preparation of the consent applications including the Environmental Impact Assessment (EIA) including: - Baseline surveys - EIA scoping report - EIA assessments for scoping in topics including undertaking of environmental surveys of the route corridors - Preparation of Environmental Statement - Stakeholder engagement with statutory bodies and non-statutory bodies including the local public including leading public engagement through exhibitions, use of website and newsletters as appropriate - Identification of affected landowners and land interests - Undertaking appropriate land referencing and obtaining land access for surveys including agreement of licence fees for access - Agreement of land rights and option agreements for construction and operational easements - Planning statement - Design and access statement - Consultation report		Environmental and consenting consultant	C/I	C/I	C/I	A/R	
6.008	Requirements for repurposed consent applications	Setting out detailed requirements for the preparation of any required consent or licence applications for repurposed infrastructure.		Environmental and consenting consultant	C/I	C/I	C/I	A/R	
6.009	Land referencing	Identification of suitable land agent options Identification of landowners along corridor	Land referencing report	NGN	A/R	C	C	C/I	
7.000	**Procurement**								
7.001	Procurement strategy	Development of procurement strategy to inform the requirements of the design packages and development of cost estimates.	Procurement strategy	NGN	A/R	C	C	C	
7.002	Procurement support	Support of tender package collation and tender exercise support	EPC tender packs	NGN	A/R	A/C	A/C	A/C	
7.003	Tender assessments		Tender assessments	NGN	A/R	A/C	A/C	A/C	
8.000	**Final FEED Deliverables**								
8.001	Network map update		Network map update	NGN	A/R	A/C	A/C		
8.002	Overall project programme		Overall project programme	NGN					
8.003	FEED Report	FEED Report to include: Transition plan Phasing plan Network interface summary Project challenges Generic challenges	FEED Report	Technical consultant	C/I	A/R	A/R		
8.004	Overall cost update to AACE Class 3	Cost estimations for each item of scope within the FEED scope definition.	Opex cost estimate Decommex cost report Cost estimate report	Technical consultant	C/I	A/R	A/R		
9.000	**Preparation for Detail Design**								
9.001	Detail design study scope		Detail design study scope	NGN	A/R	C	C	C	
9.002	Detail design indicative programme		Detail design indicative programme	NGN	A/R	C	C	C	