Due to the sensitive nature of information discussed within this document, its direct implications for security and public safety information, we have redacted minor parts of our submission in order to not prejudice any current or future negotiations and to protect commercially sensitive information.

Birkshall rationalisation and relocation works

Net Zero and Pre-Construction Work and Small Net Zero Project

Post-trigger Detailed Assessment Phase

16th August 2024

Northern Gas Networks

Version Control

Version	Date	Author	Changes
1.0	[redacted]		
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Northern Gas Networks

Contents

1 Executive Summary

Purpose of this submission

This is a funding application to Ofgem under the Net Zero Pre-construction Work and Small Net Zero Projects Re-opener ("NZASP") regime. The rationalisation and relocation works ("Works") to NGN's natural gas assets on the former gas holder station in Birkshall, which are outlined below, are essential to enable the Bradford Low Carbon Hydrogen (BLCH) project to proceed. The BLCH project has been awarded a Low Carbon Hydrogen Agreement (LCHA) via the Government's Hydrogen Allocation Round 1 (HAR1) process. The Works outlined in this re-opener submission form a net zero capital project that is:

- Consistent with NGN's RIIO objectives to deliver an efficient, effective low carbon whole energy system
- Aligned with Ofgem's mandate to support the Government to meet its legal obligation to achieve net zero by 2050[1], and aligned with condition 1.1 and 2.2 of the NZASP Re-opener Governance Document[2]
- Set to unlock local, regional and national benefits, including:
    - Clean Air Zone
    - Local business partners, investment and jobs
    - Delivery of Government national hydrogen strategy
    - Achievement of national decarbonisation targets

The importance of the BLCH project

The UK Government is committed to developing a UK hydrogen economy with low-carbon hydrogen critical to the transition to net zero. Examples of key policies and commitments are outlined below:

- 10GW Hydrogen production capacity by 2030[3]
- Net zero electricity grid by 2030 (*under the new Labour Government)*[4]
- All new vehicles must be fully zero emission by 2040, including buses and heavy goods vehicles (HGV)[5]
- Supporting infrastructure needed in the 2020s to support delivery of the 2030 10GW low carbon hydrogen production capacity target[6]
- 20 successful projects announced for the first hydrogen Electrolytic Allocation Around (HAR1) with 11 projects awarded LCHA contracts, including BLCH[7]

The BLCH project is positioned to play a key role in decarbonising our HGV transportation sector, delivering on low-carbon hydrogen commitments, and driving sustainable national growth.

The ask of NGN from BLCH

For the BLCH facility to comply with the relevant engineering and safety standards and create a safe operating environment, approximately 25% additional space is needed on the current Birkshall site. The only means at NGN's or BLCH's disposal to provide additional space is to relocate the Above Ground Installation (AGI) and

[1] Ofgem, "Ofgem welcomes Energy Act getting Royal Assent, available at: https://www.ofgem.gov.uk/press-release/," 2023.
[2] Ofgem, "Net Zero Pre-construction Work and Small Net Zero Projects Re-opener Governance Document," 2023
[3] UK Goverment, "British Energy Security Strategy," 2022
[4] UK Government, "Make Britian a clean energy superpower: Labour Manifesto," 2024
[5] UK Government, "Decarbonising Transport: A Better Greener Britian," 2021
[6] UK Government, "Hydrogen Transport and Storage Infrastructure: Minded to Positions," 2023
[7] UK Government, "Powering Up Britian," 2023

rationalise the natural gas pipework on the Birkshall site. Prior to notification of the BLCH project, NGN had no works planned on these assets for the remainder of RIIO-GD2, with elements of the pressure control system provisionally marked for electrical & instrumentation upgrades during RIIO-GD3.

NGN's proposed solution

NGN commissioned an engineering design consultant to develop a design study for the relocation of the AGI. The study concluded that there are only a limited number of options which are both technically feasible and would satisfy the space requirements of BLCH. A down-selection process led to the emergence of a Preferred Option. In the Preferred Option, NGN assets are relocated to an alternative part of the Birkshall site and re-designed to occupy a smaller footprint, thereby providing a suitable plot of land for the construction and operation of the BLCH facility in line with relevant engineering and safety standards. Assets which are proposed to be relocated include Pressure Reduction Systems (PRSs) and associated equipment, as well as buried pipework and above ground pipework.

The benefits to gas users and the wider energy system

In 2019 Bradford City Council formally declared a climate emergency, and in 2022 announced a city-wide 'Clean Air Zone'. The Works to enable the BLCH project will help ensure that the BLCH facility will achieve its planned decarbonisation equivalent of removing 800 diesel-fuelled buses from the roads of West Yorkshire. Businesses and other users in West Yorkshire will be able to use the refuelling facilities, with distribution arrangements in place to deliver hydrogen to industrial users across the region via road. Additionally, the BLCH project may help mitigate peak energy demands on the electricity grid by providing whole systems benefits. The Cost Benefit Analysis (CBA) indicates that there are significant potential benefits from delivering the Works and enabling the BLCH project to proceed. The Works will deliver a NPV of £136m, primarily due to the societal carbon emissions reduction benefit which enabling the BLCH project will deliver.

Summary of NGN's request to Ofgem

Due to the substantially innovative nature of the overarching needs case for the Works, NGN propose to make a 10% network contribution to the cost of the Works. For the remainder of the funding requirements, NGN are applying for additional Totex funding through the NZASP re-opener. The Works outlined are a net zero capital project that will enable the achievement of national Net Zero Carbon Targets, which satisfy condition 1.1 and 2.2 of the NZASP Re-opener Governance Document[8].

A summary of the cost of the Works is given below in Table 1. These costs are based on a mix of supplier quotations and bottom-up calculated estimates, which were derived using rate cards developed from framework agreements and experience gained from the delivery of similar projects.

	Current values	2018-2019 values
Total cost of Works	**£6,630,285.09**	**£5,204,773.79**
NGN contribution (10%)	**£663,028.51**	**£520,477.38**
Totex funding requested	**£5,967,256.58**	**£4,684,296.41**

Table 1 Cost summary for the Works

The overall project costs are efficient and will provide value for money to the consumer. Throughout the delivery of the project, individual works packages will be competitively tendered or procured through framework agreements which themselves have been competitively tendered.

[8] Ofgem, "Net Zero Pre-construction Work and Small Net Zero Projects Re-opener Governance Document," 2023

2 The needs case

The works to NGN's natural gas assets on the former gas holder station in Birkshall, which are outlined below, are essential to enable the BLCH project to proceed. As outlined in Section 2.2.3, for the BLCH facility to comply with the relevant engineering and safety standards and create a safe operating environment, the relocation of NGN's AGI and rationalisation of natural gas pipework is critical.

The BLCH project has been awarded a Low Carbon Hydrogen Agreement (LCHA) via the Government's Hydrogen Allocation Round 1 (HAR1) process. It was the largest project to be awarded an LCHA via the HAR1 process. The Works outlined in this re-opener submission form a net zero capital project that is:

- Consistent with NGN's RIIO objectives to deliver an efficient, effective low carbon whole energy system (refer to Section 2.3.1)
- Aligned with Ofgem's mandate to support the Government to meet its legal obligation to achieve net zero by 2050, and with condition 1.1 and 2.2 of the NZASP Re-opener Governance Document[9] (refer to Section 2.3.2)
- Set to unlock local, regional and national benefits, including (refer to Section 2.3.3):
    - Clean Air Zone
    - Local business partners, investment and jobs
    - Delivery of Government national hydrogen strategy
    - Achievement of national decarbonisation targets

2.1 Overview of the Bradford Low Carbon Hydrogen (BLCH) project

The BLCH project will be a regionally important hydrogen facility which seeks to address the UK Government's legally binding commitment to achieve net zero carbon emissions by 2050[10]. BLCH will include a green hydrogen production facility which will supply an adjacent hydrogen vehicle refuelling station for local buses, public and private sector fleets. The refuelling facility has the potential to be the North of England's first ever dual energy zero emission refuelling station catering for both battery electric and hydrogen vehicles, delivering significant economic and environmental benefits across the North of England. BLCH will be one of the UK's largest low carbon hydrogen production facilities.

Following the launch of the first Hydrogen Allocation Round 1 (HAR 1) in July 2022, the Department for Energy Security and Net Zero (DESNZ) selected 11 projects to be offered Low Carbon Hydrogen Agreement (LCHA) contracts, totalling 125MW capacity[11] (refer to Section 3.1.2 for further details on critical dates for the LCHA). The BLCH project was the largest of these projects with a capacity of 24.5MW and ability to produce up to 12.5 tonnes of low carbon hydrogen per day. The BLCH project was selected to be awarded Government funding based on a range of assessment criteria including the benefit which the facility would provide to local communities and the suitability of the proposed location.

2.2 Importance of NGN asset relocation in relation to the BLCH project

The BLCH facility will be located at Northern Gas Networks' (NGN's) former gas holder station in Birkshall, situated slightly southeast of Bradford city centre. To enable the construction of the BLCH facility to proceed the entire Birkshall site will need to be re-developed. As outlined in Section 2.2, NGN's remaining operational

[9] Ofgem, "Net Zero Pre-construction Work and Small Net Zero Projects Re-opener Governance Document," 2023
[10] Ofgem, "Ofgem welcomes Energy Act getting Royal Assent, available at: https://www.ofgem.gov.uk/press-release/," 2023
[11] Department for Energy Security and Net Zero, "Hydrogen Production Business Model / Net Zero Hydrogen Fund: HAR1 successful projects (published December 2023)," 2023

assets need to be relocated closer to the perimeter of the site and re-designed such that they have a smaller footprint. This will enable the construction of the BLCH facility and will also ensure the safe operation of both NGN's natural gas assets and the BLCH hydrogen production and refuelling facilities. It is imperative that the site continues to deliver a secure natural gas supply to West Yorkshire during (and after) the construction works.

2.2.1 Overview of the Birkshall site

The site has a history of gas assets lasting over 100 years and although the gas holders were decommissioned and removed in 2022, live natural gas assets remain operational across the site, including High Pressure (HP), Medium Pressure (MP) and Low Pressure (LP) assets, and an AGI. The current AGI is located towards the [redacted] of the site and includes an HP to MP Pressure Reduction System (PRS) and an MP to LP PRS. There is a network of HP, MP and LP pipework around the AGI, some of which is buried and some of which is above ground. There are also two sections of buried HP pipework [redacted] A layout drawing of the current site and natural gas pipework is provided in Figure 1.

Figure 1 Existing HP, MP and LP pipework layout

2.2.2 BLCH design considerations

The BLCH facility needs to be designed such that there is a physical separation between the hydrogen production facility and the hydrogen refuelling facility. This requirement has been stipulated by the Health and Safety Executive (HSE) on the grounds of safety and counter-terrorism. The buried HP pipework, which runs north to south across the Birkshall site, provides a good basis for the physical separation between production and refuelling facilities, by splitting the site into two approximately equally sized pieces of land. In accordance with IGEM/TD/1 Edition 6 Section 6.7, the buried HP pipework itself requires a 7m exclusion zone either side of

the pipework, within which no equipment or plant can be located. This further strengthens the case for this to be used as the separation between production and refuelling.

The land proposed for the hydrogen refuelling facility does not have any above ground or buried gas services[12]. However, the land proposed for the hydrogen production facility has a range of above ground and buried gas services which will prohibit the design and construction of a safe and operable layout for the equipment and plant required to produce hydrogen. The BLCH project team commissioned a specialist consulting engineering firm to develop a conceptual design report for the BLCH facility, which identified the need to relocate the AGI situated on the west of the site. This is necessary to enable the hydrogen production facility to achieve a technically feasible, operable and maintainable layout which both:

- Provides the required physical spacing between equipment and plant, and
- Satisfies all relevant engineering and safety standards (refer to Section 2.2.3 for further details).

These Works need to occur prior to the main construction works commencing for the BLCH facility. A block diagram layout showing the existing NGN assets and proposed BLCH production and refuelling facilities is shown in Figure 2.

Figure 2 Existing HP, MP and LP pipework layout with overlay of planned BLCH facility

2.2.3 BLCH hydrogen production facility layout challenges

The required space around equipment and plant on the hydrogen production facility is specified by the Original Equipment Manufacturers (OEMs). This is overlaid with input from the BLCH design and operations teams regarding constructability and operability considerations, as well as standards for high pressure hydrogen equipment. The required spacing around the hydrogen electrolysers, hydrogen compressors and hydrogen

[12] This excludes buried and above ground pipework which falls within the HP pipeline exclusion zone.

storage tanks and associated vent lines is calculated as per the IGEM/SR/25 Edition 2 hazardous area calculator provided by the Institute of Gas Engineers and Managers (IGEM); this stipulates a minimum separation distance around the electrolysers of 4.5m, and a minimum separation distance around the compressors and storage tanks of 8.5m. Additionally, the noise created by the hydrogen compressors coupled to the requirement for the compressors to be located on the concrete base of the existing gas holder to the northwest of site, further restricts that layout options for the hydrogen production facility.

The current AGI at Birkshall and exclusion zone around the buried HP pipelines have a combined footprint of approximately 8,700m^2. Redesign of the PRS equipment and overall pipework layout, as laid out in NGN's conceptual design report[13], can reduce the combined footprint to approximately 3,800m^2. This would release approximately 4,900m^2 of space, which will be required to accommodate the equipment and plant required for the BLCH hydrogen production facility and hydrogen refuelling facility. Further detail is contained in Table 2.

		Before Works	After Works
Area required for NGN AGI and pipework exclusion zones	m^2	8,700	3,800
Area required for BLCH production and refuelling facilities	m^2	16,500	16,500
Total area required for NGN and BLCH	m^2	25,200	20,300
Area available on plot of land	m^2	20,900	20,900
Commentary		**Insufficient space** to accommodate NGN assets and BLCH facility at Birkshall site	**Sufficient space** to accommodate NGN assets and BLCH facility at Birkshall site

Table 2 Birkshall site, NGN and BLCH space availability and requirements

Without conducting the Works, the Birkshall site will be approximately 4,300 m^2 too small to accommodate NGN's natural gas assets alongside the BLCH facility. Therefore, to comply with all engineering and safety standards and to allow for an operable site, the relocation of the AGI and rationalisation of natural gas pipework are critical to enable the BLCH facility to proceed.

After the Works have been completed, there will be approximately 600m^2 of space onsite which is not at present required by NGN nor BLCH. This area can be used as a buffer, should the BLCH project team identify the requirement for additional space following a detailed review of safety, operability and maintainability considerations.

2.2.4 Additional considerations for BLCH

Given that the BLCH site will store at least 10 tonnes of hydrogen on site, it will be above the thresholds for the Planning (Hazardous Substances) Regulations 2015 and Lower Tier Control of Major Accident Hazards (COMAH) regulations. Therefore, a site-wide Hazardous Area Classification (HAC) and Dangerous Substances and Explosive Atmosphere Regulations 2002 (DSEAR) assessment will be conducted by the BLCH project team

[13] RCS, "Birkshall holder site rationalisation – mechanical conceptual design study," 2024

during the detailed design phase, along with a Hazard Operability Study (HAZOP). This will ensure that the site is certifiable under these regulations once complete.

2.3 Alignment with overall business strategy and commitments

2.3.1 Alignment with NGN's RIIO-2 business plan and obligations

By enabling the timely completion of the BLCH project, NGN will facilitate economic and environmental benefits to the wider West Yorkshire region, increasing employment opportunities within low carbon energy in the region, and helping to put the region at the forefront of the UK's decarbonisation journey. Additionally, the proposed Works outlined in Section 3 would enable longer term cost efficiencies to be realised for gas consumers through replacement, rationalisation and improvement of the existing natural gas assets on the Birkshall site.

As outlined in NGN's RIIO-2 Business Plan Submission Appendix A14 - Our Whole Systems Strategy[14], NGN have four whole system objectives, shown in Figure 3. By providing low carbon hydrogen as a renewable transport fuel for local buses and businesses, the BLCH facility will satisfy at least two of these objectives across sustainable transport solutions and sustainable business solutions. There is potential for BLCH to also satisfy the other two whole system objectives. If the Government passes legislation in favour of hydrogen blending in the gas grid, the BLCH facility will be well positioned to inject hydrogen into the gas grid, thereby satisfying the sustainable heat solutions objective. If the operational strategy adopted by the BLCH facility allows the operation of the electrolyser to be scheduled such that it minimises constraints on the electricity grid, the sustainable power solutions objective will be satisfied.

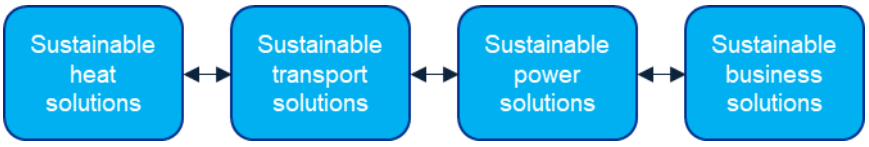

Figure 3 NGN's whole systems objectives

The proposed Works will ensure a continuous and reliable supply of natural gas to the West Yorkshire region, thereby satisfying a critical condition of NGN's licence.

2.3.2 Alignment with Ofgem's strategy and priorities

The proposed Works outlined in Section 3 of this document will assist in the achievement of national net zero carbon targets by enabling the BLCH project to proceed, which satisfy condition 1.1 of the NZASP Re-opener Governance Document[15]. The Works are also consistent with Ofgem's mandate to support the Government to meet its legal obligation to achieve net zero by 2050[16]. By socialising the costs of this project to gas consumers bills, it will enable the DESNZ funded BLCH project to progress on track, whilst ensuring that current gas users are not impacted during the construction period.

2.3.3 Benefit to the local and wider areas

In 2019 Bradford City Council formally declared a climate emergency, and in 2022 announced a city-wide 'Clean Air Zone'. To enable progress towards achieving its ambitious targets and to reduce its carbon emissions, the

[14] Northern Gas Networks, "A14 - NGN RIIO-2 'Our Whole Systems Strategy'," 2019
[15] Ofgem, "Net Zero Pre-construction Work and Small Net Zero Projects Re-opener Governance Document," 2023
[16] Ofgem, "Ofgem welcomes Energy Act getting Royal Assent, available at: https://www.ofgem.gov.uk/press-release/," 2023

Council started working with third parties, [redacted] to explore the possibility of building a renewable energy hub within Bradford. The increasing regional demand for hydrogen means that the BLCH project is widely supported by major stakeholders, aiming to deliver large scale decarbonisation across the North of England, including transportation, hard to abate industries and potentially heat.

Located in the centre of Bradford, the hub will raise the public's awareness of hydrogen as an alternative fuel source, driving interest and adoption of this clean energy carrier. By providing green energy to local businesses capable of operating with hydrogen, the project will help mitigate peak energy demands on the electricity grid.

The BLCH project has partnered with [redacted] to deliver green hydrogen to fuel public transportation in the Bradford region, which is critical to demonstrate the flexibility and practicality of hydrogen in enabling Clean Air Zones and traffic emission reductions. The BLCH facility will achieve the decarbonisation equivalent of removing 800 diesel-fuelled buses from the roads of West Yorkshire. Businesses and other users in West Yorkshire will be able to use the refuelling facilities with distribution arrangements in place to deliver hydrogen to industrial users across the region via road. The project will also demonstrate the ability for Gas Distribution Network (GDN) operators to collaborate with the wider energy value chain to deliver significant net zero infrastructure projects, including enabling the practical re-development of land historically used within the gas industry.

By enabling the BLCH facility to be delivered, the Works will help the UK to achieve its hydrogen production targets, specifically to achieve 10 GW of low carbon hydrogen production by 2030, with at least 1 GW of production capacity by 2025, potentially supporting over 9,000 UK jobs and over £4 billion in investment, as documented in the Hydrogen Strategy[17].

[17] UK Government, "UK hydrogen strategy," 2023

3 Overview of the proposed Works

3.1 Consideration of options and methodology for selection of the preferred option

The fundamental purpose of the Works is to remove and relocate existing natural gas assets on the Birkshall site to clear land for the BLCH project to proceed. Assets to be relocated include an AGI consisting of HP to MP PRSs, MP to LP PRSs and associated equipment, as well as buried pipework and above ground pipework. Network analysis was conducted on the MP and LP systems to provide an indicative view of the essential nature of the assets, which is summarised below:

- [redacted]
- [redacted]

A specialist engineering design consultant developed a conceptual design study for the establishment of a new AGI with PRS and new boiler house. This process identified a Leading Option and two Alternative Options for the design of the AGI and re-routing of pipework. The Alternative Options are described in more detail in Section 5.5.

3.1.1 Limited set of options

There are only a limited number of options which are both technically feasible and would satisfy the space requirements of BLCH. Due to the limited number of potential options and the relatively discrete nature of the scope of works, the differences between the Leading Option and the Alternative Options are relatively minor. Therefore, a detailed statistical analysis of options or market-based option were not practical nor relevant.

3.1.2 'Do minimum' Options

There are potentially two 'Do-minimum' Options which would negate the requirement for the Works outlined in this NZASP submission, but which would require adjustments to the planned BLCH facility as opposed to rationalisation of NGN assets:

i. Reduce the capacity of the BLCH facility
ii. Relocate the BLCH facility

Based on the reasoning outlined below, and in consideration of the UK Government's hydrogen targets as well as NGN's own strategic objectives, NGN do not believe that either of these 'Do-minimum' Options are pragmatic because they would risk the overall viability of the BLCH project. They are also outside of NGN's control and would require a material redesign of the facility and the agreement of all BLCH stakeholders including the project developers and DESNZ. Additionally, as part of the HAR1 evaluation process, initial shortlisting of potential projects was conducted and assessed based on four key factors[18]:

1) Location
2) Affordability

[18] Department for Business, Energy & Industrial Strategy, "Hydrogen Business Model and Net Zero Hydrogen Fund: Electrolytic Allocation Round," 2022

3) Size (MW capacity)
4) Diversity of offtaker / Energy input source / operating model

The additional 'Do-minimum' Options to adjust the capacity or location of the BLCH facility will affect key factors number 1) and 3) and may have implications on the key factors number 2) and 4).

3.1.2.1 Reduce capacity of BLCH facility

The LCHA secured for the BLCH facility is for a production capacity of 24.5MW, which will provide the ability for BLCH to produce up to 12.5 tonnes of low carbon hydrogen per day. A reduction in production capacity reduces the space requirements for the hydrogen production facility. However, the relationship between production capacity (in MW) and space requirement (in m^2) will not be linear, due to the separation distances needed between equipment and overall layout considerations which must factor constructability, operability and maintainability. For example, to achieve a notional 20% reduction in BLCH space requirements, a larger than 20% reduction in production capacity would be necessary.

A reduction in production capacity would likely have an outsized impact on the overall project commercials and business case. For example, a notional 20% reduction in production capacity would yield a <20% reduction in capital expenditure, due to project fixed costs and constriction and equipment costs which do not scale with production capacity. Therefore, reducing the production capacity would negatively affect the BLCH business case, to the point where it may no longer be economically feasible and / or may not provide value for money to the consumer via the LCHA framework.

It is understood that the LCHA includes a provision to allow hydrogen producers to reduce the capacity of their installation, via an "Installed Capacity Estimate Adjustment Notice". However, based on the discussion points outlined above, this is not considered a feasible option. Reducing the production capacity of the BLCH will jeopardise the economic viability of a strategically important low carbon hydrogen project and will not provide value for money to the consumer. Reduction of the BLCH capacity is also outside of NGN's control and not an option it could realistically take without full approval of all stakeholders.

3.1.2.2 Relocate the BLCH facility

Relocation of the BLCH project is not considered feasible due to the following reasons:

- Firstly, it would significantly delay the project design and construction timeline, which in turn could negatively affect the economic viability of the project. Projects which have received funding via HAR1 have a target to achieve commercial operations by June 2027, and a backstop to achieve COD by June 2028 after which their LCHA will be terminated.
- Secondly, it could affect the overall viability of BLCH if a suitable alternative site could not be identified that satisfied the HAR1 requirements and the requirements of BLCH's future hydrogen offtakers.
- Thirdly, the location of hydrogen production facilities was a key factor used by DESNZ to decide which projects to award an LCHA to as part of the HAR1 process, as per the Government's ambition to "*make sure this round has a spread of projects that meet the allocation round's objectives, balanced across the relevant variables*"[19]. It is believed that there is no specific guidance nor precedent for changing the location of a hydrogen production facility after the award of an LCHA. Therefore, there is a risk that

[19] Department for Business, Energy & Industrial Strategy, "Hydrogen Business Model and Net Zero Hydrogen Fund: Electrolytic Allocation Round," 2022

changing the location of BLCH at this stage in the project's development may result in the LCHA being withdrawn, thereby threatening the overall viability of BLCH.

Relocation of the BLCH facility is also outside of NGN's control and requires input and agreement with a wide range of stakeholders.

3.1.3 Elimination process for Alternative Options

The Alternative Options still require relocation of the AGI to the [redacted] of the Birkshall (consistent with the Preferred Option), however involve different routings for the buried pipework. A discussion and assessment of the Alternative Options is presented in full in Section 5.5, and summarised below. This assessment was based on five criteria, which were identified to assess the merits of the Alternative Options on a qualitative basis relative to the Leading Option. These criteria are laid out below, and the outcome of the analysis is presented within Section 5.5:

1) Safety
2) Resilience
3) Operability
4) Stakeholder disruption
5) Costs

For clarity, 'stakeholder' in this context means any of the following: NGN customers; gas customers not supplied by NGN; sites / buildings near the Birkshall site; the BLCH project; and NGN and its affiliates. If an Alternative Option does not provide any tangible benefit relative to the Leading Option, then it will be discounted and not carried through to the Cost Benefit Analysis outlined in Section 6. As discussed in Section 5.5, the Alternative Options provided no tangible benefits and would have come at an extra cost, and had only minor differences to the Preferred Option, so were discounted.

3.2 The Preferred Option

The Preferred Option for the Works required on the Birkshall site to rationalise and relocate NGN's existing natural gas assets involves decommissioning and removal of some existing assets, and construction and installation of new assets. These works are outlined below.

3.2.1 Existing assets to be decommissioned and removed

There are several assets on the Birkshall site which require decommissioning and removal as part of the works, which are documented in Table 3. These assets need to be removed to provide a clear site for the BLCH project construction to proceed.

Category	Description of works
High pressure system	• Decommission of approximately 200m of buried 300mm steel pipeline (within existing site boundary) • Decommission and removal of associated above ground assets
Medium pressure system	• Decommission of approximately 240m of buried 250mm PE pipeline (within existing site boundary & public verge) • Decommission of approximately 60m of buried 18" Steel pipeline (within existing site boundary) • Decommission of approximately 155m of buried 15" Steel pipeline (within existing site boundary & public highway)

	• Decommission of approximately 38m of buried 12” Steel pipeline (within existing site boundary) • Decommission and removal of associated above ground assets
Low pressure system	• Decommission of approximately 32m of buried 630mm PE pipeline (within existing site boundary) • Decommission of approximately 95m of buried 36” Cast Iron pipeline (within existing site boundary) • Decommission and removal of associated above ground assets
Above Ground Installation	• Removal of Pressure Reduction Stations and all associated equipment
Enabling works	• Removal of redundant above ground assets • Project management • Site preliminaries

Table 3 Decommissioning works required for the Preferred Option

Where it is technically feasible, some pipework will be decommissioned and will not be removed from the ground. In these instances, the pipework will be grout filled to mitigate the likelihood of subsidence due to eventual corrosion. Alternatively, pipework may be filled with nitrogen and cathodic protection shall be applied to them, also to safeguard against collapse because of eventual corrosion. The final decision on pipework removal, grout filling or nitrogen filling with cathodic protection will be subject to a review of costs at the detailed design stage.

3.2.2 New assets to be constructed and installed

The Preferred Option removes all NGN assets from the area designated for the BLCH hydrogen production and hydrogen refuelling facilities. This provides a clear plot of land for the unimpeded construction of the BLCH facility, and future operation of the BLCH facility in line with all relevant safety and operability guidelines. The layout of the Preferred Option is shown in Figure 4.

Figure 4 Preferred Option with overlay of BLCH facility

The proposed location of the new AGI is on land in the [redacted] of the Birkshall site, to the immediate [redacted] – Pottery Fields HP pipelines. This area is outside the proposed BLCH hydrogen production facility works whilst still being within the confines of the Birkshall site.

The area is constrained by [redacted] The location is largely void of existing above ground and buried equipment apart from a decommissioned floodlight, a short section of abandoned pipework adjacent to the boundary wall and a redundant concrete base.

The new AGI will include pre-heating and filtration skids, and pressure reduction skids. The pre-heating will ensure that MP and LP outlet gas temperatures are maintained above 0°C, with hot water provided by a modular boiler house located within the new AGI. The existing AGI does not have a pre-heating facility on incoming gas to the pressure reduction skid, therefore the addition of a pre-heating facility to the new AGI will help to improve resilience on the network.

A summary of the new assets and pipework to be installed on the Birkshall site as part of the Preferred Option are given in Table 4.

Category	Description of assets to be installed
High pressure system	• Installation and commissioning of approximately 16m of buried steel pipeline • Installation of associated above ground assets, including pressure control and instrumentation
Medium pressure system	• Installation and commissioning of approximately 40m of buried PE pipeline (within existing site boundary and public highway)

	• Installation and commissioning of approximately 125m of buried PE pipeline (within public highway) • Installation of associated above ground assets, including pressure control and instrumentation
Low pressure system	• Installation and commissioning of approximately 195m of buried PE pipeline (within existing site boundary) • Installation of associated above ground assets, including pressure control and instrumentation
Above Ground Installation	• 2 × HP-MP PRS skids • 3 × MP-LP PRS skids • 2 × HP filter and heat exchanger skids • Boiler house • Control room and valve wheel store • Site roadway and necessary hard standing areas for maintenance • Valve pits
Enabling works	• New perimeter fence and security measures • Concrete slabs, turning circle and traffic safety measures • Permitting, street works and traffic management • Contaminated ground clearance • Project management

Table 4 New assets and construction works required for the Preferred Option

The design of the AGI itself has been through multiple iterations with an engineering design consultant. The primary decision factors behind the chosen layout focused on achieving the highest levels of safety, operability and maintainability, thereby ensuring improvement in network resilience for customers. The proposed layout for the new AGI is included within the Appendix A1 – Proposed AGI site layout.

4 Detailed cost breakdown

This Section details how the cost requirements have been developed for this re-opener submission and how they comply with the requirement of RIIO2. The supporting excel spreadsheet is contained within the Appendix A4 – Project costs.

Costs for the proposed Works at the Birkshall site are split into three key cost areas:

1) Engineering design (refer to Section 4.1.1)
2) Materials and equipment (refer to Section 4.1.2)
3) Construction and installation (refer to Section 4.1.3)

Given that the proposed Works are at concept design stage, NGN have not obtained supplier quotations for all cost areas. Costs for the 'engineering design' and 'materials and equipment' cost areas are largely based upon quotations. Costs for the 'construction and installation' cost area are based on bottom-up calculated estimates, which are baselined against outturn cost data from similar projects that NGN have delivered. In total, 66% of the project costs are based on estimates and 34% of the project costs are based on quotations. A justification of project costs is detailed in Section 4.2.

Following the completion of the detailed engineering design stage, individual works packages will go through a competitive tendering process to ensure value for money for consumers and quality of deliverables.

A risk allowance is included to account for any changes in scope or unforeseen challenges related to the site or Works, this is detailed in Section 4.1.4. An allowance for the internal direct costs that NGN will incur in the delivery of these Works is detailed in Section 4.1.5.

NGN propose to make a network contribution to the costs of the Works of 10%, due to the substantially innovative nature of the overarching needs case for the Works. As outlined in Section 4.3, NGN propose to use the Totex approach to funds these Works.

4.1 Overview and description of key project costs

NGN are requesting £4,684,296.41 (2018-2019 values) of Totex funding for these Works. An overview of project cost is provided in Table 5, in both current values and 2018-2019 values.

Description of cost	Costs (current)	Costs (2018-2019)
Engineering design	£ 123,500.00	£ 96,947.50
Materials and equipment	£ 1,677,094.75	£ 1,316,519.38
Construction and installation	£ 3,342,113.23	£ 2,623,558.89
Subtotal	£ 5,142,707.98	£4,037,025.76
Risk allowance	£ 604,112.94	£474,228.66
Total (construction works)	**£ 5,615,872.47**	**£4,511,254.42**
NGN direct costs	£883,464.16	£693,519.37
Total	**£6,630,285.09**	**£5,204,773.79**
NGN contribution (10%)	**£663,028.51**	**£520,477.38**
Totex funding requested	**£5,967,256.58**	**£4,684,296.41**

Table 5 Overview of key project costs[20]

4.1.1 Engineering design costs

As laid out in Table 6 below, approximately 90% of the engineering design costs are for the development of the 'Detailed design', for which NGN have obtained a quotation. The remaining cost items are relatively minor, and costs for these are estimated based on experience from similar projects.

Description of cost	Costs (current)	Costs (2018-2019)	Source
Detailed design	£110,000.00	£86,350.00	Quote
Support during construction	£12,000.00	£9,420.00	Estimate
Planning permission	£1,500.00	£1,777.50	Estimate
Subtotal	**£123,500.00**	**£96,947.50**	

Table 6 Engineering design costs

4.1.2 Materials and equipment costs

As laid out in Table 7, over 95% of the materials and equipment costs are based on quotations obtained by NGN in H1 2024. Any fluctuations in costs will be covered by the project risk allowance, highlighted in Section 4.1.4.

Description of cost	Costs (current)	Costs (2018-2019)	Source
Pipe	£27,840.00	£21,854.40	Quote
Fittings	£45,250.00	£35,521.25	Quote
Valves	£104,500.00	£82,032.50	Quote
Hot tap tees	£10,850.00	£8,517.25	Quote
Insulation joint	£4,500.00	£3,532.50	Quote
Twin stream HP filter and HEX skid	£352,964.00	£277,076.74	Quote
Twin stream HP / MP PRS	£561,822.00	£441,030.27	Quote
Triple stream MP / LP PRS	£231,913.00	£182,051.71	Quote

[20] These prices have been deflated from current nominal values to 2018-2019 values per the calculation formula stipulated within Sections 2.16 and 2.17 of the RIIO-GD2 Price Control Financial Handbook, and also within Section 2.1.8 of Northern Gas Networks Limited Gas Transport Licence Special Conditions.

MP / LP aux rails	£8,435.00	£6,621.48	Quote
Technology profile control	£11,616.00	£9,118.56	Quote
Documentation and delivery	£7,000.00	£5,495.00	Quote
Boiler house	£120,000.00	£94,200.00	Quote
EV fogger unit	£55,000.00	£43,175.00	Quote
Intake kiosk	£6,500.00	£5,102.50	Quote
E&I kiosk	£25,000.00	£19,625.00	Quote
1:1 transformer	£10,000.00	£7,850.00	Quote
RTU and P&F barriers	£15,000.00	£11,775.00	Quote
Electrical equipment	£30,000.00	£23,550.00	Quote
Northern Powergrid DNO	£4,000.00	£3,140.00	Estimate
SMS meter	£4,000.00	£3,140.00	Estimate
2.5% uplift (sundries)	£40,904.75	£32,110.23	Estimate
Subtotal	**£1,677,094.75**	**£1,316,519.38**	

Table 7 Materials and equipment costs

4.1.3 Construction and installation costs

As laid out in Table 8, the construction and installation costs are estimates. These estimates are based on bottom-up calculations using rate cards from framework agreements with suppliers and contractors. To ensure robustness, the calculations are baselined against outturn cost data from similar projects that NGN have delivered. A justification for the three largest estimated costs, 'AGI rebuild', 'MP / LP main laying' and 'Demolition and site clearance' is included Section 4.2. These three costs account for approximately 90% of the construction and installation costs.

Description of cost	Costs (current)	Costs (2018-2019)	Source
AGI rebuild	£1,133,502.00	£889,799.70	Estimate
MP / LP main laying	£1,377,187,68	£1,081,092.33	Estimate
Demolition and site clearance	£451,422.75	£354,366.86	Estimate
E&I construction	£150,000.00	£117,750.00	Estimate
Arqiva comms	£5,000.00	£3,925.00	Estimate
Brightwell NRO and commissioning	£5,000.00	£3,925.00	Estimate
Project manager	£75,000.00	£58,875.00	Estimate
Project assurance office	£60,000.00	£47,100.00	Estimate
SPI	£32,000.00	£25,120.00	Estimate
Painting and coating inspector	£12,000.00	£9,420.00	Estimate
NRO author and commissioning CP	£41,000.00	£32,185.00	Estimate
Subtotal	**£3,357,000.00**	**£2,623,558.89**	

Table 8 Construction and installation costs

4.1.4 Risk allowance

The risk allowance for the Works is based on a holistic assessment of the commercial risk associated with individual works packages and additional risk factors. An assessment of the likely cost to the project if the risk occurs is multiplied by the likely probability of the risk occurring, to arrive at a P50 value for the likely cost of the risk. The values used are based on judgement drawn from NGN's experience in the delivery of similar projects. The five largest commercial risks are:

1) Delays associated with long lead items
2) Material price increases

3) Unforeseen asbestos clearance
4) Unforeseen ground conditions
5) Adverse weather conditions

A full breakdown of the commercial risks is included within the Appendix A2 – Commercial risk register.

4.1.5 NGN direct costs

NGN direct costs represent the costs incurred by NGN's internal support functions and teams in enabling these Works to proceed in a manner compliant with NGN's licence, and which minimises disruption to gas customers. The costs cover a variety of functions which are laid out in Table 9. The costs are calculated using RIIO-GD2 approved rates for local transmission system diversions and new connections.

Description of cost	Costs (current)	Costs (2018-2019)	Source
[redacted]	£ 222,886.99	£ 174,966.29	Calculated
	£ 46,583.58	£ 36,568.11	Calculated
	£ 288,638.74	£ 226,581.41	Calculated
	£ 73,154.07	£ 57,425.94	Calculated
	£ 159,247.18	£ 125,009.04	Calculated
	£ 92,953.59	£ 72,968.57	Calculated
Subtotal	**£ 883,464.16**	**£ 693,519.37**	

Table 9 NGN direct costs

4.2 Justification of project costs

Approximately 99% of the engineering design costs and materials and equipment costs are taken directly from quotations which NGN have obtained in H1 2024, therefore these costs have sufficient justification for the purposes of the re-opener submission.

Approximately 90% of the construction and installation costs are associated with the following three works packages:

1) AGI rebuild (refer to Section 4.2.1)
2) Pipework laying (refer to Section 4.2.2)
3) Demolition and site clearance (refer to Section 4.2.3)

Given these three areas cover a large majority of the construction and installation works packages outlined in Table 8, a justification of costs for only these works packages is provided. A detailed breakdown of costs for these three works packages is provided in the supporting excel spreadsheet, which is contained within the Appendix A4 – Project costs.

4.2.1 AGI rebuild

The cost of the AGI rebuild is calculated on a bottom-up approach using rate cards covering the following nine areas:

1) Earthworks
2) Pipework
3) Concrete
4) Site works
5) Ducting
6) Lighting columns

7) Steel supports for above ground pipework
8) Grouting
9) Hot tap works

The detailed breakdown of costs across these areas is provided within the Appendix A4 – Project costs. NGN has extensive experience in rebuilding AGI's, and the business has robust models and frameworks in place to accurately price the works required.

A similar project to the proposed Works was delivered at Carcroft gas distribution station in 2018. The AGI rebuild at Carcroft gas distribution station included construction of new PRS skids, heat exchanger and filtration skids and a new boiler house. The estimated costs for the AGI rebuild at Birkshall were sense checked against outturn costs for the AGI rebuild at Carcroft gas distribution station. The bottom-up cost estimate for Birkshall is ~0.6 times the outturn cost for Carcroft, for a site with ~0.7 times the number of skids, as summarised in Table 10.

	Carcroft	Birkshall
Number of PRS skids	6	4
Number of heat exchanger and filter skids	4	2
Numbers of boiler houses	1	1
Cost (2018 values)	£1,434,932	£889,780

Table 10 Comparison of proposed Birkshall AGI to Carcroft AGI

4.2.2 Pipework laying

The cost for pipework laying is calculated on a bottom-up approach using rates cards covering the following seven areas:

1) Labour
2) Vehicles, plant and equipment
3) Reinstatement
4) Excavation and contaminated ground clearance
5) Traffic management
6) Special operations (inc. large diameter flow stop/branch drillings and deep excavation ground support)
7) Miscellaneous items (inc. contaminated ground remedial works)

The detailed breakdown of costs across these areas is provided within the Appendix A4 – Project costs. NGN has extensive experience in laying new pipework, and the business has robust models and frameworks in place to accurately price the laying of new pipework. Approximately 51% of the costs are associated with the LP pipework system, and 49% of the costs are associated with the MP pipework system.

4.2.3 Demolition and site clearance

The demolition and site clearance costs are calculated on a bottom-up approach using day rates and other appropriate rates for materials, waste removal, *etc.* The demolition and site clearance works fall into three categories outlined in Table 11. A detailed breakdown of costs for demolition and site clearance is provided within the Appendix A4 – Project costs.

	Proportion of demolition and site clearance costs
Demolition of above ground pipework	58%

Removal of below ground pipework	32%
Grouting works	10%

Table 11 Demolition and site clearance costs

4.3 Efficient costs

Costs for individual works packages are either based on commercially tendered quotes or are costed by NGN's engineering and commercial teams using rate cards developed from framework agreements and experience gained from the delivery of similar projects. All costs have been checked and scrutinised by the relevant departments within NGN and have been signed off by the appropriate individuals under the NGN's Delegation of Authority (DoA) protocols. Throughout the delivery of the project, individual works packages will be competitively tendered and / or procured through framework agreements which themselves have been competitively tendered. Therefore, on this basis, the rates used and the overall project costs are considered to be efficient.

4.4 Regulatory treatment of funding

This application is necessary under Special Condition 3.9 Net Zero Pre-construction Work and Small Net Zero Projects Re-opener (NZASP) of NGN's Gas Transporters licence[21] as it is a project that will support the achievement of net zero carbon targets. The Works proposed will cause NGN's Licenced Activity and costs to increase during the RIIO-2 Price Control Period.

This funding application is consistent Ofgem's Sector Specific Methodology (SSM) for both RIIO-2[22] and RIIO-3[23], which highlight the use of Uncertainty Mechanisms (UMs) (including the NZASP re-opener) to account for uncertainty relating to the future hydrogen economy under different policy and market pathways for the energy transition. The expenditure is additional to that already provided for by relevant Ex Ante allowances, and there is no other provision available in the regulatory framework to fund and deliver this hydrogen-focused project. As it was contingent on the BLCH project being awarded LCHA through HAR1, it also could not have been foreseen in the preparation of NGN's RIIO-2 plan.

There are several available approaches to Regulatory Treatment of Funding for the project. The table below summarises the potential options and their relative strengths and weaknesses.

Funding Mechanism	Pros	Cons
Ex-Ante Allowance (Additional TOTEX) **Preferred Approach**	• Clear allowance based on forecasts. • Simple / low regulatory burden. • Incentive to outperform cost forecasts and share benefit with customers through the Totex Incentive Mechanism (TIM).	• Partial protection for customers and networks from uncertainty in forecasts.

[21] Ofgem, "Northern Gas Networks Limited Gas Transporter Licence Special Conditions," 2022
[22] Ofgem, "RIIO-2 Sector Specific Methodology Decision," 2019
[23] Ofgem, "RIIO-3 Sector Specific Methodology Decision for the Gas Distribution, Gas Transmission and Electricity Transmission Sectors," 2024

	• Network is liable for overspend (pro and con – less ability to share risk)	
Use It Or Lose It (UIOLI)	• Accounts for Cost Uncertainties. • Flexible Mechanism. • Low Regulatory Burden. • Customer gets all of underspend back.	• ***Not a viable option*** – project exceed maximum cost threshold for single UIOLI project. • Lack of incentive to outperform costs / drive efficiencies. • Network liable for any overspend, may encourage conservative cost forecasts.
Actual Cost Recovery (Pass Through)	• Accounts for Cost Uncertainties. • Flexible Mechanism. • Low Regulatory Burden. • Customer only pays for actual costs incurred.	• Lack of incentive to outperform costs / drive efficiencies. • Open ended risk to customers for overspend.
Price Control Deliverable	• Unused allowances automatically returned to customers. • Specific deliverables linked to funding.	• Lack of incentive to outperform costs / drive efficiencies. • Network liable for any overspend, may encourage conservative cost forecasts. • Requirement to demonstrate deliverables increase regulatory burden, plus challenges in measurement.
Volume Driver	• Not appropriate in this case, due to discrete large-scale project.	• No unit cost / standardised variable volume.
Delay to next price control	• No bill impact in GD2.	• Against GD2 / net zero commitments/ ambitions. • Risks delay, increasing net zero costs for industry / UK as per needs case and CBA.

Table 12 Description of the different funding mechanisms and their suitability to fund this project

NGN support the selection of the most appropriate and least burdensome way to approach regulatory treatment of funding for the Works, which provides value for money to consumers. The approach should fairly share the risks between the network and consumers, whilst incentivising efficient delivery. Given the routine nature of the Works, NGN's preferred approach is to fund the Works via additional Totex allowance through the NZASP. Should the project cost less than forecast, customers benefit from the return of funding consistent with NZASP guidance or any applicable TIM mechanism. Should the project overspend, NGN will be liable for funding this overspend. This approach has the advantage of fairly sharing risks between customers and networks and sharing costs between customers over time due to the partial capitalisation of costs through the Totex revenue mechanism and regulatory asset value. NGN must demonstrate that the project has been

efficiently delivered on its objectives at closeout and Ofgem could recover costs if that wasn't the case. This ensures that customers are adequately protected. This is consistent with NZASP guidance Sections 2.21 and 2.22.

Ex-Ante is the most appropriate and fair regulatory treatment of funding for consumers, therefore NGN propose this approach should be used. However, considering timelines for long lead items and tendering of work packages (refer to Sections 2.2 and 5.7), the Ex-Ante approach may not be feasible. An Ex-Post approach may be necessary to ensure that the Works can be completed in line with the requirements of the BLCH project plan. This would create additional project delivery commercial risks for the Works, which would need appropriate management.

In addition to the choice of funding mechanism itself, there is the application of that mechanism across partners to recover costs of the project. In terms of socialising the costs NGN are supportive of either approach outlined below:

1) Having the mechanism applied to National Gas and for them to recover the costs through NTS charges on customer bills, or;
2) Socialising the costs across NGN's own network and customers.

However, given that the BLCH project will primarily contribute to regional emissions reductions and air quality improvements, NGN propose that approach 2) is more appropriate (refer to Sections 2 and 7 for further information).

At the end of the project delivery phase, a close out report will be produced to summarise the outcome of the Works against the objectives of the project. This will aid in dissemination of learnings and knowledge to industry and stakeholders.

5 Engineering justification paper

5.1 Summary table

An engineering justification summary of the Works is shown in Table 13.

Name of Project	Birkshall AGI relocation		
Scheme Reference	Northern Gas Networks		
Primary Investment Driver	Environmental		
Project Initiation Year	2024		
Project Close Out Year	2026		
Total Installed Cost Estimate (£)	£6,630,285.09 (current values) £5,204,773.79 (2018/2019 values)		
Cost Estimate Accuracy (%)	risk allowance included within cost build-up		
Project Spend to date (£)	£107,845		
Current Project Stage Gate	Sanction Bid Case approved		
Spend apportionment	GD1: 0%	GD2: 100%	GD3: 0%

Table 13 Engineering Justification Paper summary table

5.2 Project status and request summary

The Birkshall AGI relocation project outlined in this submission is at an early stage of development. A design study was commissioned by NGN to assess the options available in terms of relocating the existing AGI and re-routing existing pipework. This study resulted in the following:

1) Ratification of the necessity to relocate the AGI and associated pipework
2) Identification of existing assets to be decommissioned and / or removed
3) A strategy to ensure continuity of supply for gas customers
4) Identification of options for equipment layouts within the new AGI

A detailed cost model has been developed, as detailed in Section 4. The project has engagement from senior members of NGN staff and has passed through the necessary internal approval processes, such that NGN are able to submit a funding request to Ofgem via the NZASP re-opener to fund the delivery of the Works.

5.3 Problem / opportunity statement

As outlined in Section 7, the government has national targets for hydrogen production and has committed to legally binding net zero targets. The BLCH project gives a unique opportunity for NGN to enable and facilitate the reuse of former gas holder site as a green hydrogen production and refuelling facility, one of the first of its kind. The Works are critical to the enablement of the BLCH project, as outlined in Section 2 of this submission. If NGN does not undertake the Works, the viability of the BLCH project is threatened and may not receive the LCHA funding it has secured as outlined in Section 2.

The Preferred Option is robust and will ensure continuity of supply for gas customers, whilst fulfilling the requirements of the BLCH project. It is not expected that there are any circumstances under which the Preferred Option would need to change.

As outlined in Section 5.7, the key target is to fully complete the Works by Q1 2026 to ensure that the BLCH construction can proceed unimpeded and within planned timescales. To achieve this, NGN will need to place equipment orders by the end of September 2024 and tender the construction Works in October 2024, to enable the planned 6 month construction period to commence by March 2025[24].

5.3.1 Related projects

There are no other projects that are related nor relevant to the proposed Works. Learnings have been taken from other similar projects that NGN have recently delivered, which have been used to de-risk the Works proposed within this submission.

5.3.2 Project boundaries

The Works required as part of this project are contained within the Birkshall site and immediately adjacent roads.

5.4 Project definition

The primary purpose of the project is to rationalise and relocate NGN's gas assets on the Birkshall site, thereby enabling the planned BLCH facility to be constructed in line with relevant engineering and safety standards. In summary, the key steps to achieve this objective are:

1) Complete detailed design for the new AGI and associated pipework
2) Develop a plan for the demolition, decommissioning and removal of existing AGI and pipework assets
3) Tender works packages
4) Deliver the works packages
5) Improve resilience of the gas network via an upgraded AGI

The project must ensure minimal disruption to neighbouring sites and zero disruption in service to gas customers.

5.4.1 Project scope summary

The proposed Works are split into individual works packages, which cover three overarching scope areas:

1) Engineering design
2) Materials and equipment
3) Construction and installation

As outlined in the overall needs case (refer to Section 2), this project is a like-for-like replacement and relocation of an existing AGI. All headline engineering data will be as per the existing AGI. The individual works packages are listed in Section 4 and within the Appendix A4 – Project costs.

The new AGI will include a boiler house, which the existing AGI does not. The new boiler house will include gas boilers rated at 72 kW to ensure that PRS gas outlet temperatures are maintained above 1°C under all operating conditions.

[24] Where spend on long lead items may be required before an Ofgem determination on this application, this will be funded through NGN's 10% cost contribution

5.5 Options considered

5.5.1 Base Case

The Base Case is where NGN do not conduct the Works to the AGI and associated pipework at Birkshall, and BLCH project does not proceed as planned. In order for the BLCH project to proceed in the Base Case (*n.b.* referred to as the 'Do-minimum' Options in Section 3.1), significant adjustments to the planned BLCH facility would be required. There are two potential options:

1) Reduce the production and refuelling capacity of the BLCH facility
2) Relocate the BLCH facility

Accommodating the BLCH facility on the current space available at the Birkshall site would necessitate a c.25% reduction in the footprint of the BLCH facility. This could only be achieved by a reduction in the production capacity and output of the BLCH facility, which would have a significant negative effect on the overall business case for BLCH. An illustrative layout of the Birkshall site in the Base Case scenario is shown in Figure 5.

Figure 5 Base Case with overlay of BLCH site

NGN do not believe that the Base Case is a viable option, given the BLCH project would no longer be in line with its approved funding case from DESNZ. This viewpoint is based on the reasoning and arguments outlined on Sections 2.2.3 and 3.1.2, and in consideration of the UK Government's hydrogen targets as well as NGN's own strategic objectives. The Base Case option would require third parties (*e.g.* BLCH, DESNZ) to make significant alterations to an approved HAR1 project, which is outside of NGN's control. The project risk register, referred to in Appendix A2 – Commercial risk register, provides further clarity regarding the nature of these risks.

5.5.2 Leading Option

The Leading Option is described in detail in Section 3.1.3, refer to this Section for more information. For purposes of comparison with the Base Case and Alternative Options, the layout of the Leading Option is presented again in Figure 6. Additionally, a detailed engineering layout drawing of the proposed new AGI in the Leading Option is included within the Appendix A1 – Proposed AGI site layout.

Figure 6 Preferred Option with overlay of BLCH facility

5.5.3 Alternative Option 1

Alternative Option 1 is identical to the Leading Option in terms of the location of the new AGI and the re-routing of the MP and LP pipework. The only difference between Alternative Option 1 and the Leading Option is the re-routing of the 450NB 17 bar(g) HP pipeline, which currently runs [redacted] This HP pipeline is referred to as the [redacted] pipeline.

The main drivers behind exploring the diversion the HP pipeline are to mitigate risks associated with developing the hydrogen facility on either side of the existing HP pipeline corridor. This pipeline is operational and diverting it will remove an otherwise unusable strip of land from the middle of the proposed BLCH facility site.

The proposed new HP pipeline ties into the existing HP pipeline towards the centre of the existing Birkshall site. The new pipeline route [redacted] It then passes [redacted] Leading Option. This route is outlined in Figure 7.

The existing pipeline is a piggable line and cannot be shut down for the diversionary works. Therefore end-on tie-ins and 3D radii bends are required to permit the passage of a pipeline inspection gauge. Flowstopping arrangements incorporating temporary bypasses will be required to facilitate the end-on tie-ins.

Figure 7 Alternative Option 1 layout

5.5.4 Alternative Option 2

Alternative Option 2 is identical to the Leading Option in terms of the location of the new AGI and the routing of the HP and MP pipework. The only difference between Alternative Option 2 and the Leading Option is the re-routing of the 630mm PE LP pipeline, which in the Leading Option runs from the location of the new AGI along the

The main driver behind exploring the re-routing of the LP pipeline is to release additional land space which is currently used for the exclusion zone around the LP pipeline for the BLCH facility. This would enable the BLCH facility to use the small sliver of land perimeter of the Birkshall site.

If the outcome of the Options assessment is that Alternative Option 2 is the Preferred Option, then a more detailed analysis of the available space for an additional LP pipeline would be required. This may include potential re-routing of some of the existing pipelines or other services in

5.5.5 Options assessment

As discussed in Section 3.1.3, the Alternative Options are assessed on a qualitative basis across five key criteria relative to the Leading Option. The outcome of this assessment is laid out in Table 14 Assessment of the Alternative Options against the Leading Option

14.

Assessment criteria	Alternative Option 1	Alternative Option 2
Does the alternative option improve safety on the Birkshall site and the surrounding area?	**No** The HP pipeline still runs directly through the Birkshall site, but the proposed route would require re-design of the BLCH refuelling facility.	**No** Re-routing the LP pipeline provides a marginal improvement in safety on the Birkshall site (from removing the LP pipeline), but this is offset by the additional risk present on the surrounding land due to the additional buried LP pipeline.
Does the alternative option reduce operating costs and / or improve operability of the Birkshall site or wider network?	**No** Operating costs and complexity are likely to be higher due to the additional bends required in the HP pipeline, which will increase the costs and complexity of maintaining the HP pipeline.	**No** Operating costs and complexity are likely to be higher due to longer length of LP pipework and routing of pipework through third-party property
Will the construction of alternative option be less disruptive to local stakeholders and gas network users?	**No** Building the new HP pipeline on [redacted] will cause significant additional disruption for local stakeholders, particularly for the domestic properties and businesses located on the [redacted]	**No** Building the new LP pipeline on [redacted] Street will cause significant additional disruption for local stakeholders, with the potential for further disruption if the existing pipelines in [redacted] require diversion to provide space for the new LP pipeline
Does the alternative option provide any tangible benefits to BLCH?	**No** The proposed routing of the HP pipeline will require a complete re-design of the BLCH refuelling area, given that the HP pipeline will pass straight across the middle of the BLCH refuelling area. This will increase Capex.	**No** Whilst re-routing the LP pipeline will provide additional space for the BLCH hydrogen production area, the additional space is not required. This will increase Capex.
Does the alternative option provide any additional resilience to the network?	**No** There is negligible overall change to the length of the HP pipeline and no change to the network resilience.	**No** There is a slight increase in the length of the LP pipeline (c.10%) and no improvement to the network resilience

Table 14 Assessment of the Alternative Options against the Leading Option

Based on the outcome of the assessment, neither Alterative Option 1 nor Alternative Option 2 will be carried forward to the Cost Benefit Analysis. Relative to the Leading Option, neither of the Alternative Options provide any additional benefit associated with the key criteria laid out, however will increase Capex and are likely to bring additional challenges and risks. Therefore, the Leading Option will become the Preferred Option, as laid out in Section 3.2.

5.5.6 Options cost estimate and summary

A detailed breakdown of the costs for the Preferred Option, which is the only option viable that requires any capital expenditure from NGN (*n.b.* the Base Case options require significant changes or re-design to the proposed BLCH facility, and no changes to NGN's existing assets), is laid out in Section 4. As per the requirement of the NZASP re-opener[25] a summary table is included in Table 15.

Item	Cost (2018-2019)	% of Total Installed Cost
Engineering Design	£ 96,947.50	2%
Project management	£ 105,975.00	2%
Materials	£ 1,316,519.38	25%
Main Works Contractor	£ 1,970,892.03	38%
Specialist Services	£ 472,116.86	9%
Vendor Package costs	£ 74,575.00	1%
Direct Company Costs	£ 693,519.37	13%
Indirect Company Costs	£ 0	0%
Contingency	£ 474,228.66	9%
Total Installed Cost	£ 5,204,773.79	n/a
Cost Estimate Accuracy	± 10%	n/a

Table 15 Options cost estimate and summary

Given that the proposed Works are a like-for-like replacement of existing AGI with PRS equipment, there are negligible changes in operating costs expected. A small boiler house, not present in the current AGI set-up, is included in the proposed Works to prevent gas outlet temperature below 1°C. Whilst there will be operating costs associated with operating and maintaining these gas boilers, the costs are expected to be offset by a reduction in maintenance costs on rationalised pipework valves and associated equipment.

5.6 Business case outline and discussion

The proposed Works outlined in this submission are critical to enabling the BLCH project to proceed. As discussed in Section 2.2, if the proposed Works are not conducted, the BLCH project cannot proceed with its existing design capacities, and its LCHA could therefore be threatened. Therefore, the business case and justification for the proposed Works are directly linked to the business case and overall justification for the BLCH project. This is reflected in the description of the key business case drivers and business case summary in Sections 5.6.1 and 5.6.2, respectively.

5.6.1 Key business case drivers

The key business case drivers of the Works outlined are:

[25] Ofgem, "Net Zero Pre-construction Work and Small Net Zero Projects Re-opener Governance Document," 2023

1) To enable the potential carbon emissions savings associated with the future BLCH facility to be realised.
2) To play a role in enabling a regionally and nationally significant energy transition project to proceed
3) To improve reliability and operability of existing NGN pressure reduction assets

5.6.2 Business case summary

The new AGI and associated pipework will be commissioned by December 2025. It is vital that commissioning is completed by this date to ensure that the existing AGI and associated pipework can be decommissioned, removed and / or safely abandoned. This will enable the BLCH construction programme to proceed in line with the commissioning dates prescribed in the LCHA.

As shown in Table 16 Key business case parameters

16, and further documented in Section 6, the proposed Works deliver a positive NPV. This is primarily due to the significant carbon emission savings that will be delivered over the first 15 years of the operation of the BLCH site, which corresponds to the length of the subsidy period via the LCHA. Demand and supply sensitivities do not apply to this re-opener application given that the Works are a like-for-like replacement of existing pressure reduction equipment.

Parameter	Value
Project commissioning date	Dec 2025
Project cost	£ 5,204,774 (2018-2019)
Project relative NPV (2070)[26]	£ 139,506,579 (2018-2019)
Carbon emissions saving (15 year)	701,000 tCO_2e
Project operating lifespan	40+ years

Table 16 Key business case parameters

5.7 Preferred Option scope and project plan

The Preferred Option for the Works required on the Birkshall site to rationalise and relocate NGN's existing natural gas assets involves decommissioning and removal of some existing assets, and construction and installation of new assets. These Works are outlined in Section 3.2.

A summary project plan is provided in Section 5.7.4, and a detailed project plan is included within the Appendix A5 – Detailed project plan.

5.7.1 Preferred Option for this request

The Preferred Option is detailed in Section 3.2. The Preferred Option removes all NGN assets from the area designated for the BLCH facility. The proposed layout for the new AGI is included within the Appendix A1 – Proposed AGI site layout.

5.7.2 Project spend profile

The cost of relocating NGN's existing natural gas assets outlined within this reopener document is set out in section 4. The spend profile is detailed below in Table 17 Annualised cost summary

[26] Includes societal benefits derived from the estimated carbon emissions reduction that the BLCH project will generate, calculated according to the 'Carbon Price (base case)' values for the price of carbon contained within the RIIO-GD2 Cost Benefit Analysis template

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FY Period	Total Cost per year (2018-2019)	Totex funding (2018-2019)	NGN contribution (2018-2019)
2024/25	£ 1,822,325.59	£ 1,640,093.03	£ 182,232.56
2025/26	£ 3,382,448.20	£ 3,044,203.38	£ 338,244.82
2026/27	£ 0	£ 0	£ 0

Table 17 Annualised cost summary

5.7.3 Efficient cost

The individual works packages are costed by NGN's engineering and commercial teams using rate cards developed from framework agreements and experience gained from the delivery of similar projects. All costs have been thoroughly checked and scrutinised by the relevant departments within NGN and have been signed off by the appropriate individuals under the NGN's DoA protocols. Throughout the delivery of the project, individual works packages will be competitively tendered and / or procured through framework agreements which themselves have been competitively tendered. Therefore, on this basis, the rates used and overall project costs are considered to be efficient.

Details of costing are provided within the Appendix A4 – Project costs.

5.7.4 Project plan

An outline project plan showing high level activities is provided in Figure 8. The proposed project plan and timeline is typical for projects of this scope and scale. The plan draws on NGN's experience in delivering similar projects. The overall timeline and sequencing of works may flex depending on the progression of critical work items and packages.' For additional clarity on the project plan, refer to the detailed project plan included within the Appendix A5 – Detailed project plan". Details of the goals to be monitored through the Works and key critical milestones to be achieved are detailed in Table 18.

Cost Area	Deliverable Goal	Deliverable Date
Engineering Design	Completion of detailed design	Oct 2025
Materials and Equipment	Long lead items procurement	Oct 2024
	Manufacturing and delivery	Jun 2025
Construction and Installation	Main works contract award	Feb 2025
	Construction commencement	Mar 2025
	Main works completion	Oct 2025
	Commissioning of equipment	Dec 2025
	All site works complete and demobilisation	Jan 2026

Table 18 Key Deliverables (project plan)

Reports will be completed and provided to Ofgem to demonstrate progress/completion and spend updates, based on the following schedule:

1. March 2025 - Completion of design, procurement and main contract award; Progress on construction commencement
2. Oct 2025 - Completion of main works
3. March 2026 - Close-down (and final spend), including completion of all site works and commissioning of equipment

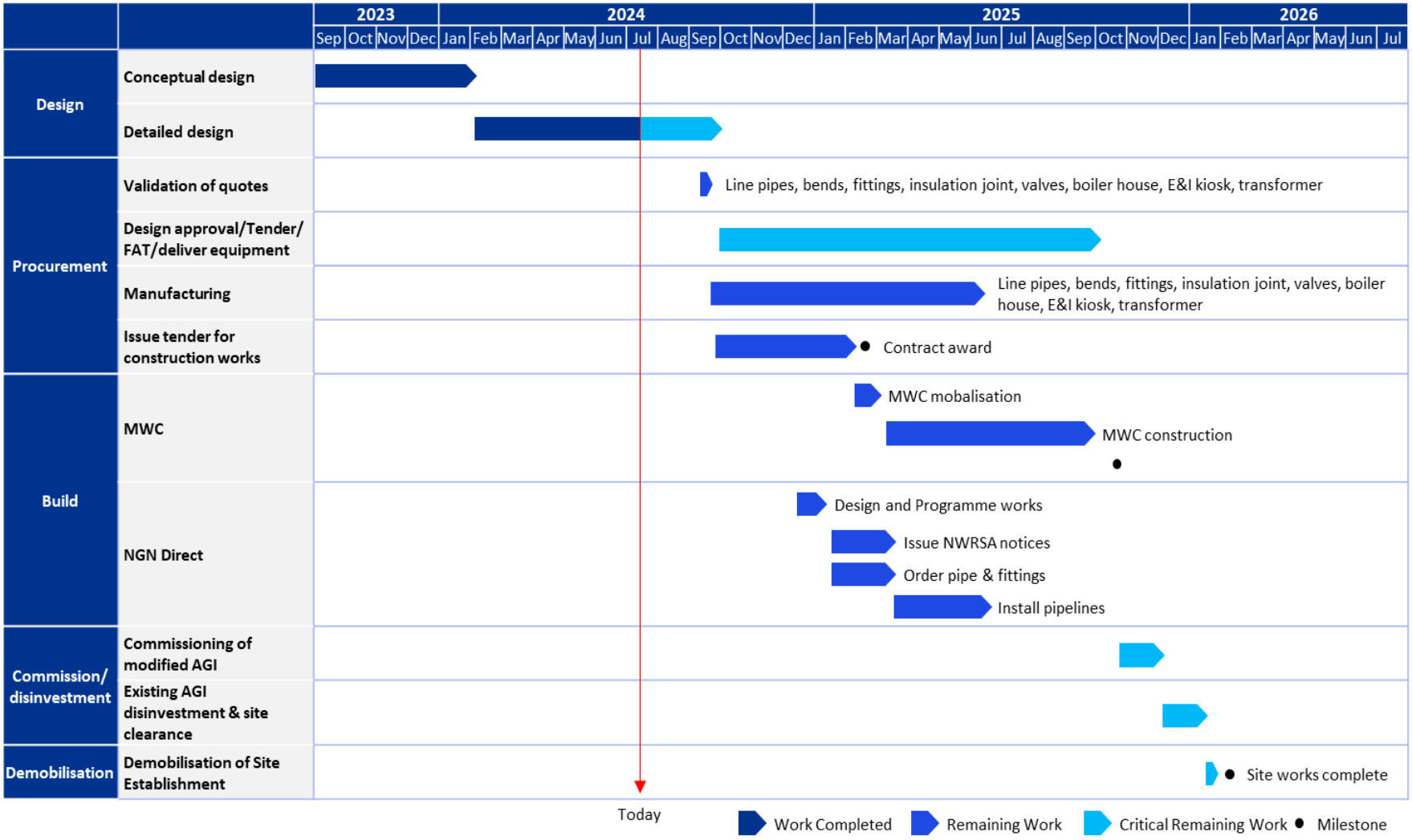

Figure 8 Summary project plan

5.8 Key business risks and opportunities

NGN have robust project governance, controls and reporting processes. These are documented in the businesses Integrated Management System (IMS) procedures, which covers all major projects such as those outlined in this submission. The IMS procedures cover the following key tasks and responsibilities:

1) Construction and Design Management (CDM) responsibilities
2) Management of works package contractors and sub-contractors
3) Programme management
4) Appropriate meetings, required attendees and cadence
5) Risk management processes
6) Performance improvement processes
7) Management of consents, approvals and notifications
8) Ofgem management and interface strategy
9) Communication and reporting procedures between internal and external stakeholders
10) Quality assurance

A project commercial risk register is included within the Appendix A2 – Commercial risk register. Additionally, a summary of the key CDM risks from the BLCH project, which relate specifically to the Works, is included within the Appendix A3 – BLCH CDM risk register.

6 Cost Benefit Analysis (CBA)

The approach to developing the CBA for the Works is relatively straightforward. As outlined in Section 5.5, two potential options are carried forward to the CBA (refer to Appendix A6 – Cost Benefit Analysis).

1) Base Case
2) Preferred Option

The CBA demonstrates that there are significant potential benefits from delivering the Works as outlined in the Preferred Option, compared to the Base Case. In the Base Case, the BLCH project is not built due to the constraints laid out in Section 2.2.

Works will deliver a significantly positive NPV, primarily due to the societal carbon emissions reduction benefit which enabling the BLCH project will deliver. A summary of the CBA is provided in Table 19. In the Base Case, the NPV is negative due to the ongoing maintenance costs, leakage and safety related costs.

	Base Case	Preferred Option	Preferred Option relative to Baseline
NPV (2030)	-£ 0.4m	£ 21.4m	£ 21.9
NPV (2035)	-£ 0.7m	£ 77.4m	£ 78.1
NPV (2040)	-£ 0.9m	£ 128.5m	£ 129.4
NPV (2050)	-£ 1.4m	£ 137.4m	£ 138.8
NPV (2060)	-£ 2.1m	£ 136.9m	£ 139.0
NPV (2070)	-£ 2.8m	£ 136.7m	£ 139.5

Table 19 Breakdown of CBA results

It is worth noting that the CBA assumes the BLCH facility will stop producing hydrogen after 15 years after Commercial Operations Date (COD). This may not be representative of how the BLCH will be operated in the 2040's, there may be a sufficiently viable business case to continue operating the BLCH facility without subsidy via the LCHA. If this is the case, the NPV in 2050, 2060 and 2070 could be significantly higher.

To ensure that these benefits are realised, it is critical that the Works are delivered in line with the project plan outlined in Section 5.7.4, to enable the BLCH construction programme to meet the commissioning deadlines of the LCHA (refer to Section 3.1.2.2)

6.1 Societal carbon emissions reduction benefit

The main driver behind the positive NPV for the Works is the societal reduction in carbon emissions which will be delivered by the BLCH facility[27]. By displacing the use of diesel fuel in road transport applications with hydrogen produced from renewable electricity, the BLCH facility is estimated to reduce carbon emissions by 701,000 tCO_2e[28] over the 15-year length of the LCHA subsidy scheme.

The reduction in carbon emissions and improvements in local air quality are quantified as per the 'Carbon Price (base case)' values for the price of carbon, which is contained within the RIIO-GD2 Cost Benefit Analysis template. This carbon price does not represent a direct financial benefit to NGN or its customers, or any other stakeholder of the Birkshall site.

[27] Without accounting for the societal carbon emission reduction benefits, the Works will have a negative NPV.

[28] This calculation is on an energy equivalency basis between diesel fuel and hydrogen produced from renewable electricity. The calculation does not account for the conversion efficiency of fuel into motive power within the propulsion system of vehicles. The BLCH facility is assumed to have hydrogen production output of 70,632t over the 15-year subsidy period

7 Policy context and justification

The BLCH project has been developed through exploration of and alignment with the wider UK policy landscape. Below summarises how the BLCH project and by extension the Works outlined in this re-opener submission:

a) are aligned with the UK hydrogen strategy and decarbonisation policy developments (refer to Section 7.1), and
b) will be aligned with the new UK Labour Government's future energy policy developments in net zero, energy security, and transport (refer to Section 7.2).

7.1 Strategic fit and alignment with the UK policy horizon

Since the target to achieve net zero greenhouse gas emissions by 2050 was set into UK legislation in 2019[29], the hydrogen strategy and decarbonisation policy landscape has continued to evolve as shown in Figure 9.

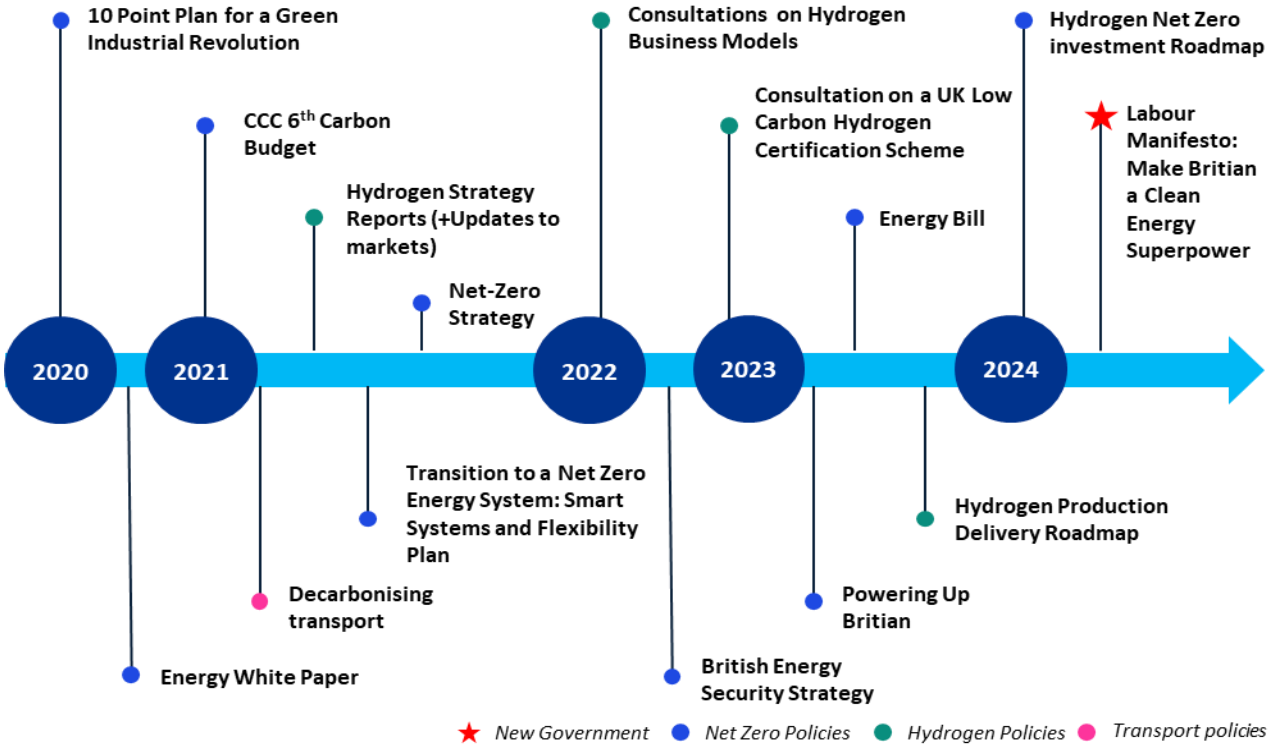

Figure 9 UK Hydrogen Strategy and Policy Landscape

The UK Government has remained steadfast in its commitment to developing a UK hydrogen economy with low-carbon hydrogen being cited in multiple papers as critical to the transition to net zero. Examples of key policies and commitments are outlined below:

- 10GW Hydrogen production capacity by 2030[30]
- Net zero electricity grid by 2030 (*under the new Labour Government)*[31]
- All new vehicles must be fully zero emission by 2040, including buses and heavy goods vehicles (HGV)[28]

[29] UK Government, "Climate Change Act 2008 (2050 Target Amendment) Order 2019," 2019
[30] UK Goverment, "British Energy Security Strategy," 2022
[31] UK Government, "Make Britian a clean energy superpower: Labour Manifesto," 2024

- Supporting infrastructure needed in the 2020s to support delivery of the 2030 10GW low carbon hydrogen production capacity target[32]
- 20 successful projects announced for the first hydrogen Electrolytic Allocation Around (HAR1) with 11 projects awarded LCHA contracts, including BLCH[33]

These targets are key steps to ensuring the development of a hydrogen economy, with BLCH positioned to play a key role in decarbonising our HGV transportation sector, delivering on low-carbon hydrogen commitments, and driving sustainable national growth. By harnessing the power of renewable electricity to generate green hydrogen, the project aligns with the government's ambitious target of producing 10GW of low-carbon hydrogen by 2030[34]. Moreover, the project's partnership with First Bus Group to fuel public transportation in the Bradford region underscores the versatility and practicality of hydrogen utilization across diverse applications.

7.2 New Labour Government policy objectives

The new Labour Government has reinforced the UK's ambition to transition away from fossil fuels and towards homegrown clean energy by 2030[26]. Ed Miliband, the newly appointed Secretary of State for Energy Security and Net Zero, has outlined his vision of *"creating jobs in Britain's industrial heartlands"* and ensuring a just transition for the oil and gas industries into a clean energy system[35]. The BLCH project supports his core mission by demonstrating the potential for GDN operators to collaborate with the broader energy sector to deliver critical net-zero infrastructure projects. This is exemplified by the redevelopment of land previously used within the gas industry, directly contributing to the UK's green transformation in the Yorkshire and Humber region, one of the UK's largest Industrial Cluster.

Labour pledged in their manifesto that to achieve its mission by 2030, they would:

- Invest in Carbon Capture and Storage (CCS), hydrogen, and long-duration energy storage to ensure that there is sufficient zero-emission back-up power and storage for extended periods without wind or sun.
- Double the government's target on green hydrogen to 10 GW of production, with use cases in flexible power generation, storage, industry and potentially transport[26].

The BLCH project is one of the first 11 HAR1 projects which gained LCHA contracts by the Government, it will serve as a blueprint for future large-scale hydrogen production plants, showcasing the technology's feasibility and scalability. By embracing green hydrogen production, the BLCH project promotes the attainment of net zero by supporting decarbonisation at pace. This positions the UK as a leading centre for green innovation, driving sustainable national growth and solidifying its commitment to a low-carbon future.

The project extends its impact beyond clean energy production. It plays a vital role in fostering green job growth within the Bradford area by providing opportunities for upskilling and reskilling. This aligns with the Government's broader strategy for regional development, investing in green infrastructure and creating high-quality jobs[36]. This will contribute to the economic regeneration of Bradford and surrounding areas, fostering a more prosperous and sustainable future for the region.

[32] UK Government, "Decarbonising Transport: A Better Greener Britian," 2021
[33] UK Government, "Powering Up Britian," 2023
[34] UK Government, "British Energy Security Strategy," 2022
[35] DESNZ, "Energy Secretary Ed Miliband sets out his priorities for the department," 2024
[36] UK Government, "The ten point plan for a green industrial revolution," 2020

Enabling the BLCH project to proceed by undertaking the Works outlined in this submission represents a low-regret opportunity for NGN to help achieve regional and national decarbonisation ambitions. It will help establish a blueprint for green hydrogen production and refuelling facilities across the UK, unlocking whole-system decarbonisation.

Table 20Table 20 Bradford Low Carbon Hydrogen alignment with policy objectives

highlights the UK Government policy landscape, with a demonstration of BLCH strategic fit and alignment with relevant policy objectives.

Government Policies	Policy objectives	BLCH alignment with policy
Decarbonising Transport: A Better Greener Britian *August, 2021*[37]	• All new vehicles must be fully zero-emission by 2040, including buses and heavy goods vehicles (HGV)	✓ Facilitates the supply of low-carbon hydrogen fuel to decarbonise buses and HGVs in Bradford
British Energy Security Strategy *April, 2022*[38]	• 10 GW of hydrogen production by 2030, with at least half of this total coming from Green Hydrogen • 1 GW of electrolytic hydrogen is in construction or operational by 2025	✓ Enables 24.5 MW of Green Hydrogen to be online by 2026, contributing to the UK's goal of achieving its 2030 targets
Powering Up Britian *April, 2023*[39]	• 20 projects announced for the first hydrogen electrolytic allocation round (HAR1)	✓ Selected as one of the 11 projects which have won LCHA contracts from the UK Government
Hydrogen Production Delivery Roadmap *December, 2023*[40]	• Allocated up to 875MW for electrolytic projects in HAR2 • Allocated up to 1.5GW across both HAR3 and HAR4 which are expected to launch in 2025 and 2026 respectively.	✓ Establishes a blueprint for producing green hydrogen at scale across the UK by developing capabilities and trialling nascent low-carbon technology
Labour Manifesto: Make Britian a Clean Energy Superhouse *July, 2024*[41]	• Invest in CCS, hydrogen, and long-duration energy storage • 10 GW of green hydrogen production by 2030	✓ Supports the new Government's commitments of enabling the rapid expansion and development of a green hydrogen economy

Table 20 Bradford Low Carbon Hydrogen alignment with policy objectives

[37] UK Government, "Decarbonising Transport: A Better Greener Britian," 2021
[38] UK Government, "British Energy Security Strategy," 2022
[39] UK Government, "Powering Up Britian," 2023
[40] UK Government, "Hydrogen Production Delivery Roadmap," 2023
[41] UK Government, "Make Britian a clean energy superpower: Labour Manifesto," 2024

8 Stakeholder engagement and whole system opportunities

NGN is aware that throughout the BLCH project's development, the project team has engaged extensively with the relevant stakeholders as part of the HAR1 application process as well as the planning process. These stakeholders include:

- ✓ DESNZ
- ✓ Wider government officials
- ✓ Local authorities
- ✓ Local community

A number of local consultations and one-to-one meetings were held with these key stakeholders to gather feedback on concerns, opportunities, and potential roadblocks associated with the project. The feedback received has been predominantly positive and supportive, enabling the project to secure planning permission, secure an LCHA contract from the UK Government, and progress to the next stage of development.

8.1 Justification for why limited stakeholder engagement is considered appropriate

Whilst the BLCH project team engaged with local authorities and the community during the HAR1 application and planning processes, this engagement did not specifically address the Works to NGN assets outlined in this submission. NGN has not conducted any stakeholder engagement to date regarding these Works, given the two key factors outlined below:

1) **No impact on gas consumers:** There will be no disruption to gas customers throughout the Works.
2) **Minimal disruption and impact to wider stakeholders:** The relocation of the assets will primarily occur within the NGN site. NGN will implement BAU engagement for any works in the public highways, including pre-notification letters to surrounding houses and businesses, engagement with the local highways authority and socialisation of information on the interactive roadworks website[42].

8.2 Approach for future stakeholder engagement

NGN's future stakeholder engagement plan for the Works outlined in this submission will focus on communication efforts to inform neighbouring sites that may be directly affected by the project works. Given that there will be negligible impact to wider stakeholders, no disruption to gas supplies, and the fact the Works are almost entirely contained within NGN land, NGN do not propose to conduct wider stakeholder engagement. Appropriate traffic management will be implemented during construction as per the project risk register, NGN will handle the traffic management and disruption in line with their standard operating procedures, identifying and liaising with impacted businesses as they would for any similar project.

[42] https://one.network/uk/bradford

9 Glossary of Terms

Term	Definition
AGI	Above Ground Installation
BLCH	Bradford Low Carbon Hydrogen
COMAH	Control of Major Accident Hazards
DESNZ	Department for Energy Security and Net Zero
DoA	Delegation of Authority
DSEAR	Dangerous Substances and Explosive Atmosphere Regulations 2002
GDN	Gas Distribution Network
HAR1	Hydrogen Allocation Round 1
HAC	Hazardous Area Classification
HAZID	Hazard Identification
HAZOP	Hazard Operability Study
HP	High Pressure
IMS	Integrated Management System
MP	Medium Pressure
LCHA	Low Carbon Hydrogen Agreement
LP	Low Pressure
NGN	Northern Gas Networks
OEM	Original Equipment Manufacturer
PS	Polyethylene
PRS	Pressure Reduction System
SSM	Sector Specific Methodology
TIM	Totex Incentive Mechanism
UM	Uncertainty Mechanism

10 Appendices

Appendix number	Appendix title	Description
A1	Proposed AGI site layout	*Proposed layout for the new Above Ground Installation*
A2	Commercial risk register	*Register of key commercial risks*
A3	BLCH CDM risk register	*Risk register of BLCH CDM risks related to the Works*
A4	Project costs	*Detailed project costs and justification of costs for key estimated cost items*
A5	Detailed project plan	*Detailed project plan for the Works*
A6	Cost Benefit Analysis	*Complete CBA template for the Works*