Gas Options Advice

December 2025

NESO
National Energy System Operator

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Foreword

Welcome to the Gas Options Advice (GOA) 2025 document. Published by the National Energy System Operator (NESO), this publication presents our assessment and recommendations for the proposed options to reinforce Great Britain's (GB) gas network – the National Transmission System (NTS).

GB's energy sector is undergoing a fundamental transformation. The pace of change continues to accelerate. As we progress towards a future powered by clean energy, the role of a resilient and secure gas network remains crucial.

Working in partnership with the government, the Office of Gas and Electricity Markets (Ofgem), industry and consumers, we take a long-term approach to strategically planning the future energy system network. We identify the whole energy system needs and ensure that the system can meet the future energy requirements of the whole of Great Britain.

The Department for Energy Security and Net Zero (DESNZ) defines the policy, regulatory, and market frameworks for GB's energy sector. To achieve the government's ambitions for a low-carbon, affordable, and secure energy system, DESNZ and Ofgem recognise the need for consolidated expert advice and coordinated planning.

As a result, NESO was established to be an independent and impartial public corporation, responsible for advising the government on the entire energy system. Our role involves strategic energy planning across electricity, gas, and new energy types such as hydrogen. We adopt a holistic approach to ensure the whole energy system is low carbon, low cost, resilient, and secure. As the whole energy system operator, NESO now serves as GB's gas network strategic planner, with specific obligations outlined in the Gas System Planner Licence[1].

The GOA reinforces our role as an independent advisor to the government, helping to shape the future gas system. The GOA will consider system needs against value for money, helping to safeguard the environment whilst ensuring system resilience and consumer benefits are realised.

Julian Leslie
Director of Strategic Energy Planning
& Chief Engineer

1 Gas System Planner: Licence Terms and Conditions

Executive Summary

In this GOA document, we, as the National Energy System Operator, are providing our first independent view of investment options to meet current and future requirements for capability on the NTS. This is one of our duties as the GB's gas strategic network planner, as set out in condition C8 of the Gas System Planner Licence.

The GOA reviews the proposed network reinforcement options in the Strategic Planning Options Proposal (SPOP)[2], submitted to NESO and Ofgem by GB's gas transmission owner, National Gas Transmission (NGT), and any options that we propose by evaluating the commercial value of new gas infrastructure. These options provide for the network needs identified in the Gas Network Capability Needs Report (GNCNR) that was published by NESO in December 2024. The purpose and sequence of the three documents – GNCNR, SPOP and GOA – form a two-yearly gas network planning cycle.

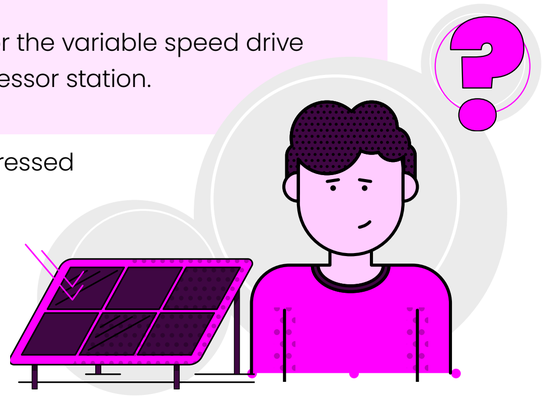
GNCNR 2024 highlighted a low likelihood of network constraints over the next 10-years, except for the South Wales region. In the GOA, we have assessed 23 options for South Wales (8 from NGT via SPOP and 15 from NESO), by considering combinations of up to ten individual components. The proposed options decrease network entry constraints in South Wales over the next 10 years therefore reducing a potential risk of curtailment undertaken through commercial action by NGT.

Our assessment approach has compared the net present value (NPV) of the options and assessed them through our social impacts and deliverability (SI&D) framework. This approach was consulted on in our GOA Methodology Consultation[3] in May 2025.

Our recommendation consists of the following components:

- Constructing 9km of 900mm pipeline between Wormington and Honeybourne AGI.
- Constructing 2km of 900mm pipeline between Churchover compressor tee and multi-junction.
- Pressure uprating[4] Feeder 28 to 102 barg from Felindre multi-junction to Three Cocks AGI and Felindre multi-junction to Cilfrew AGI, and associated works.
- Pipework modifications at Churchover compressor station to allow parallel running up to a maximum station flow of 75mcm/d.
- Procuring of a spare rebuild kit for the variable speed drive (VSD) unit at Wormington compressor station.

We recommend that Option D be progressed for further development and delivered by December 2028.



2 NGT's SPOP was shared with NESO and Ofgem in June 2026 as per their licence condition; it is not required to be shared publicly.
3 GOA Methodology - Consultation | National Energy System Operator
4 Pressure uprating: The increase of an existing NTS feeder's maximum operating pressure (MOP) to support an increase in flow conditions.

The recommendation is consistent with our advice to Ofgem on the RIIO-GT3 NGT Business Plan (2026-31), published in June 2025[5], which was used for Ofgem's final determination of the business plan, published in December 2025. We recommend approximately £50-100m[6] worth of investment in the NTS to increase capability in South Wales. We believe this option fulfils the purpose of the reinforcement need, whilst providing the best value for money to the consumer.

There are options in relation to South Wales, one of which appeared as a potential mitigation measure in relation to the Gas Supply Security Assessment (GSSA) which may be considered separately by Ofgem and DESNZ via a different investment process. For the GOA, the reinforcement proposal is assessed against the required entry capability need that was highlighted in the GNCNR.

Future iterations of the two-yearly planning cycle will include this investment from December 2028 onwards, or such other time as may be appropriate. An update on how the programme of works is progressing will also be included in other NESO activities such as the Centralised Strategic Network Plan (CSNP), the GSSA and any other related activities.

Recently, we have consulted on our CSNP methodology, which is used for our whole system strategic planning three-yearly cycle. The CSNP is proposed to include the gas strategic network planning and therefore, once approved by Ofgem, will replace both the GNCNR and the GOA.

5 NESO response to Ofgem Request for Advice: GT3 NGT Transmission Business Plan for 2026 to 2031

6 The recommended option has been assessed using NESO's own cost estimates. We understand that as port of the RIIO GT3 process, NGT have provided Ofgem with more detailed costs. The recommended option is not sensitive to the range of costs being considered.

Introduction to the National Transmission System (NTS)

The NTS consists of around 7,600km of pipeline, 21 compressor stations and more than 500 above-ground installations. NGT owns and operates the NTS, which transports gas from entry points which comprise of terminals, interconnectors and storage sites to exit points, which comprise of power stations, industrial sites, Gas Distribution Networks (GDNs), storage sites, and interconnectors.

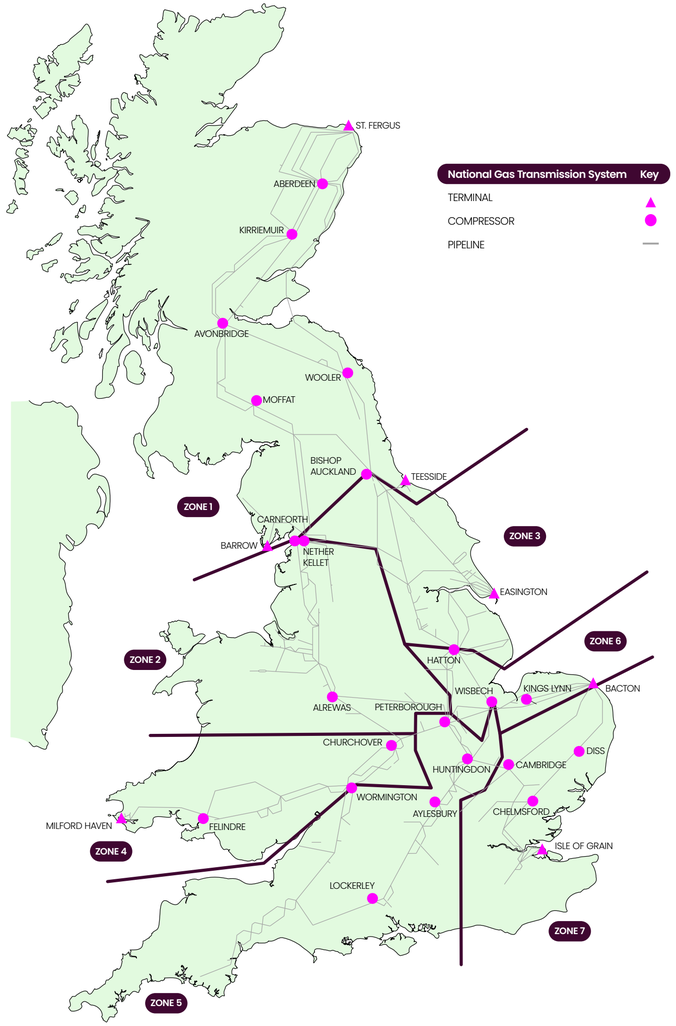
NGT has the responsibility for ensuring the safe and reliable transportation of gas from entry to exit points on the NTS.

Gas shippers buy the rights to flow gas onto, or offtake gas from the NTS. These are referred to as capacity rights[7]. Capacity can be classed as entry or exit capacity, and is either:

- firm capacity that is contractually guaranteed to be available
- interruptible (entry) and off-peak (exit) capacity that can be withdrawn by NGT if the NTS cannot provide it on the day

Although firm capacity is contractually guaranteed, there can be circumstances where the NTS cannot honour that commitment. When this happens, it is referred to as a capacity "constraint"[8]. NGT will take actions to alleviate the constraint otherwise it must buy back entry capacity from, or pay compensation to, shippers at any affected entry or exit point.

Figure 1: RIIO Zone map



7 Capacity | National Gas

8 Capacity constraint: The inability to flow gas onto, or offtake to take gas from the NTS.

Gas Network Planning

Our gas strategic network planning obligations are set out in condition C8 of the Gas System Planner Licence. These new obligations form part of the two-yearly gas network planning cycle, carried out in collaboration with NGT.

The cycle begins with NESO identifying, through the GNCNR, the market's potential capability needs and comparing them to physical capability. Based on these findings, NGT propose reinforcement options in the SPOP, which we have subsequently assessed in the GOA document.

The purpose of this two-yearly network cycle is to identify gas transmission network needs and drive the development and assessment of network reinforcement options.

Additionally, we have recently consulted on our CSNP methodology, which undertakes whole system strategic planning over a three-yearly planning cycle. We may therefore move away from a two-yearly network planning cycle in the future, subject to engagement with Ofgem.

The two-yearly cycle is illustrated and described in more detail on the right:

Figure 2: Gas network planning cycle

Gas Network Capability Needs Report (GNCNR)

In December 2024, we published the GNCNR, NESO's first gas publication based on these new licence conditions. It gave an independent view of GB's gas transmission system, the NTS, and its capability to meet current and future network requirements for capability on the NTS[9]. The GNCNR is not focussed on wider gas security of supply which, as noted below, is more thoroughly considered in NESO's GSSA[10].

The analysis carried out in the GNCNR showed that, except for South Wales entry, the NTS had sufficient capability and the probability of gas network constraints was projected to reduce over time.

Strategic Planning Options Proposal (SPOP)

The SPOP is NGT's response to the capability needs identified in the GNCNR. This is required as per special condition 9.10 of NGT's Gas Transporter License[11].

The purpose of the document is to identify the options that could meet the capability needs identified in the GNCNR.

Such options may involve:

- construction
- expansion
- reinforcement
- repurposing
- replacement or decommissioning
- the use of commercial options, where NGT deem these appropriate

NGT presented a range of options with a cost estimate, physical specifications, technical criteria, and estimated delivery timeline for each option. They also calculated the impact on the physical network capability that each option creates once implemented.

Where NGT's views differ from those expressed in the GNCNR, those differences and their implications have been documented.

NGT shared the SPOP with NESO and Ofgem in June 2025 and will continue to do so every subsequent two years.

9 Gas Network Capability Needs Report (GNCNR) | National Energy System Operator
10 Gas Supply Security Assessment | National Energy System Operator
11 Gas Transporter Licence | National Gas Transmission

Gas Options Advice (GOA)

This GOA is the final deliverable within the overall gas network planning cycle and represents the last stage of the process detailed under condition C8 of the Gas System Planner Licence. It is required to be published by 31 December 2025, and every two years thereafter.

The intent of the GOA document is to give an independent assessment of NGT's proposed reinforcement options for the NTS. It can also, where appropriate, present alternative options to Ofgem. The licence condition requires us to state a recommendation for which options should be progressed further. This information then supports Ofgem in decisions on funding and progression of asset interventions for the NTS.

Although we provide recommendations for the options to meet NTS requirements, Ofgem will ultimately decide on the investments to be funded.

GOA's purpose

The purpose of GOA is to set out, as far as is reasonably practicable:

- Our view of the drivers for change to the NTS, gas supply and demand requirements, deliverability, and entry and exit capacity obligations.
- Our view of the suitability of proposed investment options that meet any needs identified in the GNCNR.

The GOA provides analysis of each investment proposal based on the economic, environmental, social and deliverability factors, with more details found in the following chapter. Where NESO and NGT hold different views on the proposals put forward, such differences are identified in this document along with their implications.

Due to the sensitive nature of the commercial proposals, as specified in licence condition C8 section 16, we have taken due care to exclude any information where disclosure may affect the commercial interests of the owner of that information. Anything that is relevant will be shared with Ofgem to enable them to make the necessary decisions.

The GOA Methodology is an assessment framework that forms the backbone of this document. It has helped define how we assessed the investment proposals. By working closely with stakeholders via the consultation, we can ensure the gas system can be designed and built according to NTS requirements.

In May 2025, we launched a consultation on our methodology, inviting stakeholder feedback on our approach to assessing options from an economic, environmental, social and deliverability. Recommendations we received have shaped the final GOA Methodology, which was published in September 2025, followed by a public webinar in October 2025.

The final GOA Methodology and webinar recording are available on the NESO website[12].

We will continue to initiate and facilitate conversations on gas network planning. You can find more details about our engagement approach and timeline in the Stakeholder Engagement chapter.

12 Gas Options Advice (GOA) | National Energy System Operator

GNCNR and GOA in the energy transition

The government has an ambition for the country to be supplied with clean power by 2030 and to achieve net zero with in an affordable and secure energy system by 2050.

NESO is playing a fundamental role in delivering these targets[13]. For gas network planning, we provide evidence-based advice to the government and Ofgem via the GNCNR and GOA commensurate with our C8 licence condition.

The GNCNR and GOA will also interact with a range of NESO deliverables such as:

Spatial Strategic Energy Plan (SSEP): Future iterations of the GNCNR and GOA may consider more details from the SSEP pathway[14] alongside the Future Energy Scenarios (FES) to support NESO's whole system network planning

Centralised Strategic Network Plan (CSNP): Our approach to the GNCNR and GOA is expected to be included in our CSNP methodology, pursuant to our C12 licence consultation

GSSA (Gas Security of Supply Assessment): The GNCNR and GOA assess the network capability and evaluate the value of new gas infrastructure under normal operation. The GOA considers security of supply impacts which may also be considered in the GSSA which is produced pursuant to our C4 licence[15] condition

Future Energy Scenarios (FES): The GNCNR and GOA will utilise FES scenarios to assess the physical capability of the NTS over the next five years, ten years, and a view out to 2050

Other areas of work: We used our network analysis models and physical capability methodologies to support Clean Power 2030[13], Ofgem advisory requests (NGT GT3 Business Plan 2026-31), and future resilience and Critical National Infrastructure (CNI) projects

13 Clean Power 2030 | National Energy System Operator
14 Strategic Spatial Energy Planning (SSEP) | National Energy System Operator
15 Gas System Planner: Licence Conditions | National Energy System Operator

Stakeholder Engagement

Stakeholder engagement was carried out throughout the gas network strategic planning process. As we developed our GOA, we have engaged with stakeholders across three categories to best suit their anticipated needs as shown in Figure 3.

Our aim was to deliver meaningful and transparent engagement that instils confidence. We have considered all stakeholder input from our consultation, acting as an impartial voice for gas network strategic planning.

We identified a range of stakeholders that had varying levels of interest in this document. As we developed the methodology, we engaged with stakeholders via consultation, webinars and bilateral conversations.

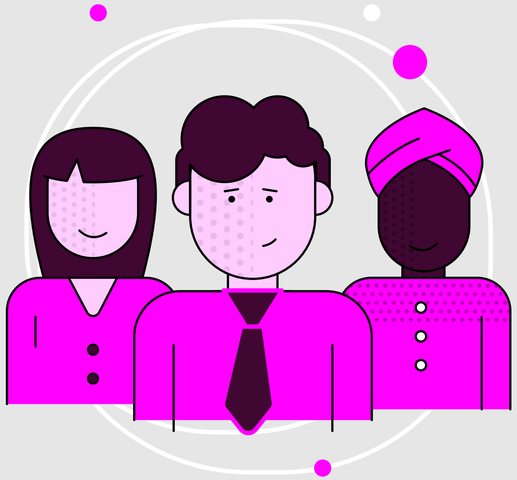
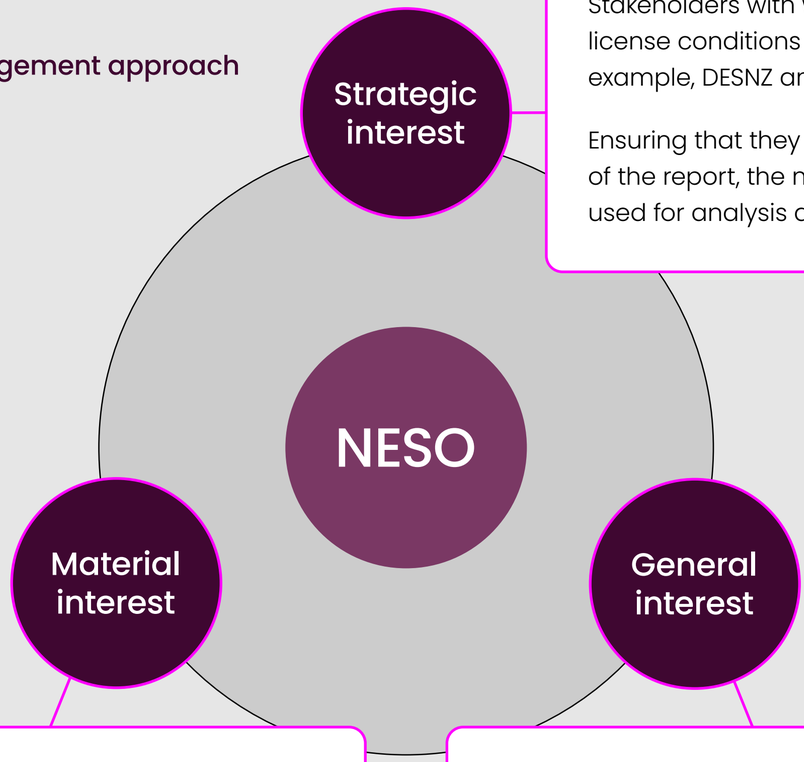


Figure 3: **Stakeholder engagement approach**



Stakeholders with whom we have specific license conditions or policy implications, for example, DESNZ and Ofgem.

Ensuring that they are aware of the direction of the report, the methodology that is being used for analysis and the various draft stage.

Industry participants that are likely to have material interest and involvement in the network planning process, for example, NGT and Gas Distribution Networks (GDNs).

Enabling these key stakeholders to understand how the work is being conducted and the important elements that the final report might include.

All other stakeholders that have expressed an interest in being kept informed about our analysis, for example, trade associations and academic bodies.

Keeping them updated about the contents due to be made public to ensure awareness of the analysis outcomes.

Key findings

01

Our recommendation in this document is consistent with both our advice to Ofgem on the RIIO-GT3 NGT business plan advisory request we published in June 2025, and with the Ofgem RIIO-3 final determination published December 2025.

02

We recommend approximately £50-100m[16] [17] of additional investment in the NTS to increase the network entry capability in South Wales. This option proves to offer the best value for money, amongst a range of proposals considered in the GOA assessment.

03

Options were identified as potential mitigation measures in relation to the GSSA[18] for South Wales, to provide additional security of supply benefits to the NTS (which may be considered separately by Ofgem and DESNZ). However, for the purpose of the GOA assessment these are not the preferred commercial solution to support entry capability requirements identified in the GNCNR 2024.

16 The recommended option has been assessed using NESO's own cost estimates. We understand that as port of the RIIO GT3 process NGT have provided Ofgem with more detailed costs. The recommended option is not sensitive to the range of costs we have seen.

17 The recommended option in GOA is consistent with Option 11 in Ofgem's RIIO-3 final determination.

18 Gas Supply Security Assessment | National Energy System Operator

Options Assessment

Introduction

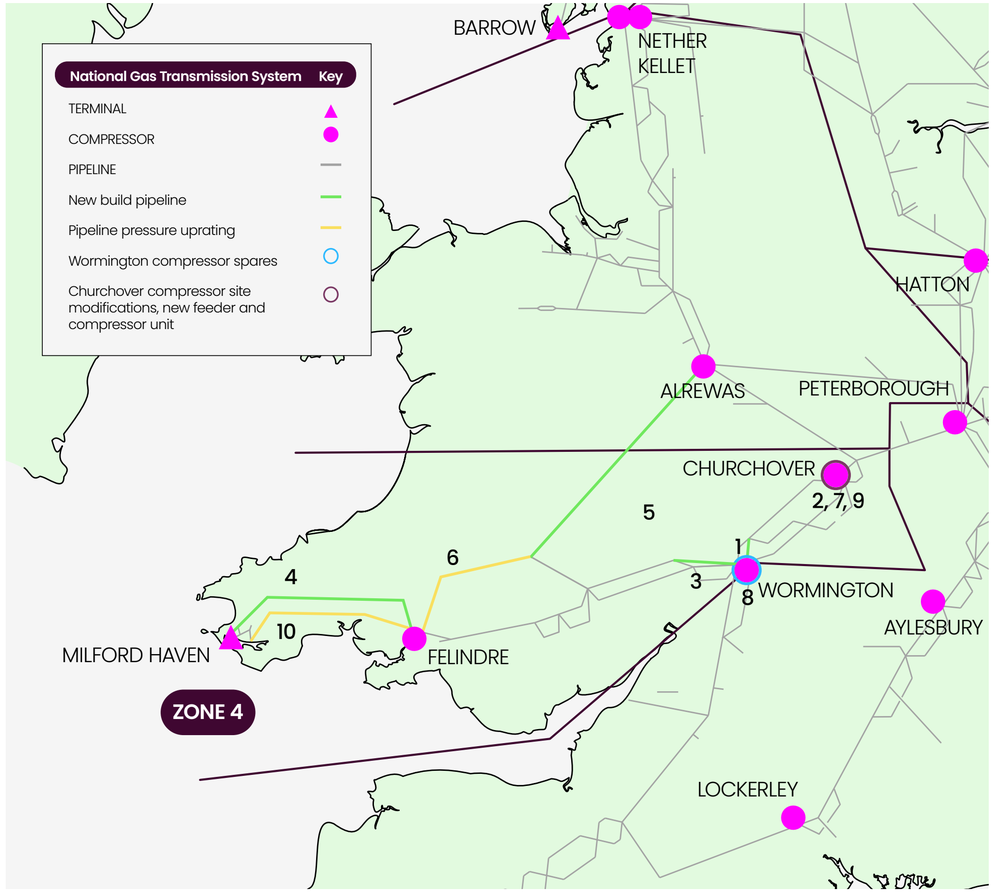
Our options assessment approach considers the identified investment options to ascertain which options NESO recommend for further development. Any recommendations are based on the value of the option in terms of providing for increased network capability under normal operating conditions. The options we assess are focussed on South Wales entry capacity, commensurate with the findings presented in the GNCNR. We have not assessed any options that mitigate wider security of supply mitigations as outlined in the GSSA[19].

Our analysis is based on economic, environmental, social and deliverability criteria (more details can be found in the GOA Methodology[20]). The recommendation and the rationale are presented at the end of the chapter.

As identified in the GNCNR 2024, without any increase in the entry capability of the NTS in the South Wales region, the number of constraint days is likely to increase in the future. This conclusion applies to all FES net zero pathways, Counterfactual and Falling Behind[21] [22].

A greater number of constraint days leads to an increase in consumer bills and imposes a higher risk to supplies. The increase in forecast constraints days in South Wales is due to the declining UK Continental Shelf (UKCS) supplies from the North Sea and increasing Liquefied Natural Gas (LNG) imports.

Figure 4: NTS map of South Wales investment reinforcement components



19 With the exception of the proposed duplication of Feeder 28 between Milford Haven and Felindre. Note, this means that we do not consider, within this document, any benefits of any proposed investment associated with increasing capability or flexibility in Southeast England, an option considered in GSSA.

20 Gas Options Advice (GOA) Methodology | National Energy System Operator

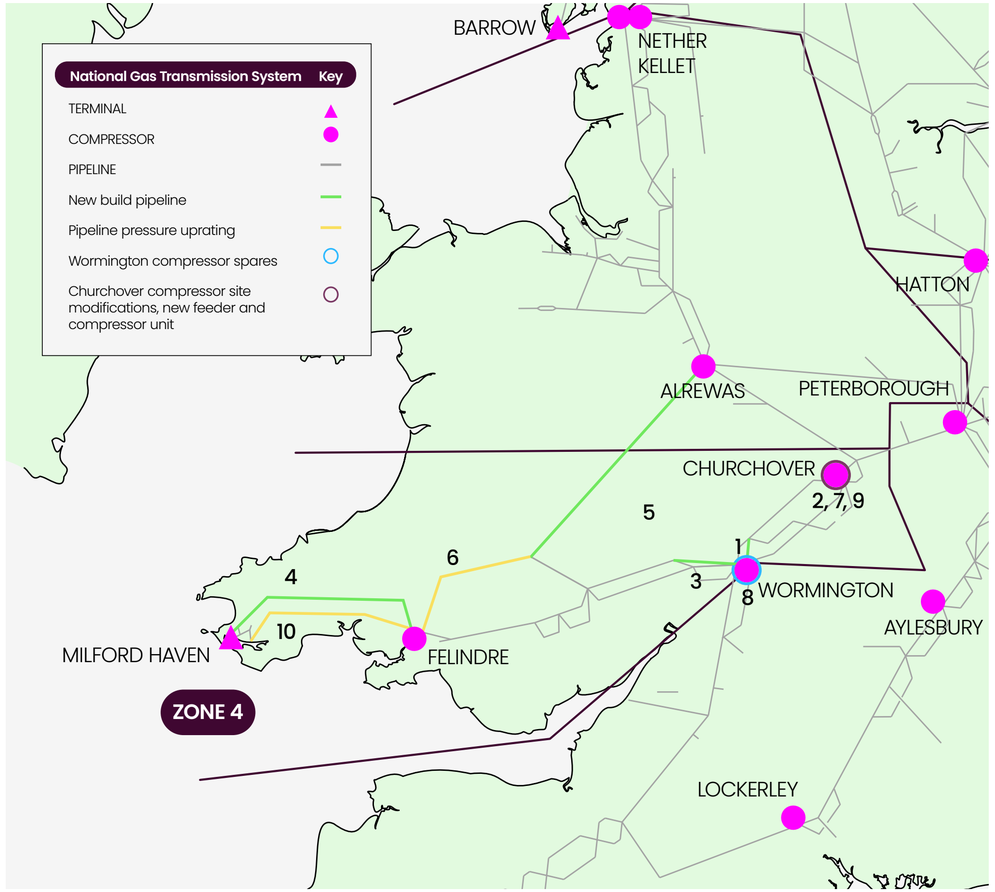
21 The GOA analyses supply and demand from FES 2024 and 2025 publications.

22 The GOA will be analysed against FES 2025 net zero pathways and "Falling Behind". GNCNR physical capability assessment was analysed against FES 2024 net zero pathways and "Counterfactual".

Investment components

1. Constructing 9km of 900mm pipeline (75 barg) between Wormington and Honeybourne AGI.
2. Constructing 2km of 900mm pipeline (70 barg) between Churchover compressor tee and multi-junction.
3. Constructing 26km of 1200mm pipeline (75 barg) between Tirley AGI and Wormington multi-junction.
4. Constructing 105km of 1200mm pipeline (94 barg) between Milford Haven ASEP and Felindre multi-junction.
5. Constructing 180km of 1200mm pipeline (94 barg) between Three Cocks AGI and Alrewas multi-junction.
6. Pressure uprating of Feeder 28 to 102 barg from Felindre multi-junction to Three Cocks AGI and from Felindre multi-junction to Cilfrew AGI, and associated works.
7. Pipework modifications at Churchover compressor station to allow parallel running up to a maximum station flow of 75mcm/d.
8. Procuring spare rebuild kit for VSD unit at Wormington compressor station.
9. Constructing a new 15MW unit at Churchover compressor station to increase station operations and availability.
10. Pressure uprating Feeder 28 to 102 barg from Milford Haven to Felindre.

Figure 4: NTS map of South Wales investment reinforcement components



Options overview

Prior to options assessment, network analysis is first carried out in order to understand how much additional entry capability a given option could provide across a range of national demand scenarios.

Figure 4, on the previous page, shows reinforcement options[23] that merit detailed network analysis. Options discounted before this stage are detailed in Annex B.

NESO view of strategic options

We analysed each component of an option to quantify the increase in entry capability it provides in the South Wales region. This helped ensure that our recommendation to Ofgem was the most cost-effective solution.

We identified that the NTS constraint in South Wales was primarily between the Wormington compressor station and the Churchover junction. Restrictions in this area make it more difficult for gas to flow out of the South Wales region (which impacts entry capability) and support the pressure requirements for the Gas Distribution Networks (GDNs).

Additionally, we analysed options for building new pipelines in South Wales and towards the Midlands as a means of addressing further restrictions identified in these areas. These options include duplicating pipelines and connecting Wales directly with other zones, where there is spare physical capability while assuming the current level of baseline obligation at Milford Haven terminal is not changed.

The options were assessed using analysis, NPV calculation and SI&D framework to understand the benefits of increasing entry capability against costs.

In Annex B, we explain how we derived the GOA options, which consist of a combination of investment components (represented in the key on Figure 4 on the previous page).

Investment components

The physical investment components assessed in GOA are categorised as follows:

Investment component	Component benefit
Pipeline uprating	Increase the existing maximum operating pressure of a pipeline
New build pipeline	Construct a new pipeline to increase gas flow capability
Compressor station pipework modifications	Modify a compressor station to allow an increase in station flow and operability
New compressor unit	Install a new compressor unit to allow a more effective operation of the station
VSD spare kit	Procure compressor unit spares to enhance unit availability

23 Reinforcement components 4, 6 and 10 are proposed for build in Wales, all other components are proposed for build in England.

Investment components

1. Constructing 9km of 900mm pipeline (75 barg) between Wormington and Honeybourne AGI.
2. Constructing 2km of 900mm pipeline (70 barg) between Churchover compressor tee and multi-junction.
3. Constructing 26km of 1200mm pipeline (75 barg) between Tirley AGI and Wormington multi-junction.
4. Constructing 105km of 1200mm pipeline (94 barg) between Milford Haven ASEP and Felindre multi-junction.
5. Constructing 180km of 1200mm pipeline (94 barg) between Three Cocks AGI and Alrewas multi-junction.
6. Pressure uprating of Feeder 28 to 102 barg from Felindre multi-junction to Three Cocks AGI and from Felindre multi-junction to Cilfrew AGI, and associated works.
7. Pipework modifications at Churchover compressor station to allow parallel running up to a maximum station flow of 75mcm/d.
8. Procuring spare rebuild kit for VSD unit at Wormington compressor station.
9. Constructing a new 15MW unit at Churchover compressor station to increase station operations and availability.
10. Pressure uprating Feeder 28 to 102 barg from Milford Haven to Felindre.

SPOP options

NGT presented eight physical investment options in the SPOP, summarised as Option A-H[24] in the table.

NESO options

Option I-W represent our proposed options. These options include single components and combinations of components that were considered to merit detailed assessment.

To formulate NESO options, we disaggregated SPOP options into individual components. We also identified an additional component (No. 10) – the pressure uprating of Feeder 28 from Milford Haven to Felindre.

We assessed these components in isolation and combinations, which provided fifteen options (Option I-W).

This modular approach allows us to quantify the value of adjusting the timing of installing specific components that make up a larger option.

GOA options summary

This table is a summary of all the physical intervention options assessed in GOA with our network modelling tools.

Prior to network analysis, we filtered out options that would have a negative NPV or which it would be unrealistic to implement. These options were not subject to detailed network analysis.

	GOA Option	Investment Component									
		1	2	3	4	5	6	7	8	9	10
SPOP A-H	A	X									
	B	X	X								
	C	X	X				X				
	D	X	X				X	X	X		
	E	X	X		X		X				
	F	X	X			X	X				
	G	X	X	X			X				
	H	X	X				X	X		X	
GOA I-W	I		X								
	J						X				
	K	X					X				
	L		X				X				
	M							X			
	N				X						
	O	X	X		X						
	P					X					
	Q	X	X			X					
	R			X							
	S	X	X	X							
	T							X		X	
	U	X	X		X		X	X			
	V	X	X	X			X	X			
	W	X	X				X	X			X

24 During the West Import Resilience project ('WIR', formerly Western Gas Network) NGT completed a range of stakeholder engagement: WIRP | National Gas

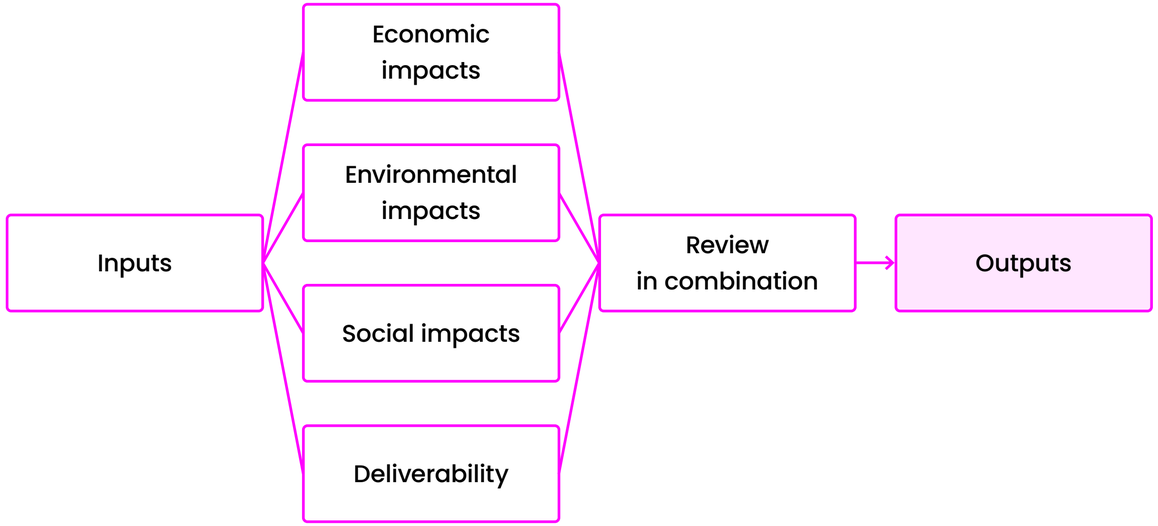
Investment components

1. Constructing 9km of 900mm pipeline (75 barg) between Wormington and Honeybourne AGI.
2. Constructing 2km of 900mm pipeline (70 barg) between Churchover compressor tee and multi-junction.
3. Constructing 26km of 1200mm pipeline (75 barg) between Tirley AGI and Wormington multi-junction.
4. Constructing 105km of 1200mm pipeline (94 barg) between Milford Haven ASEP and Felindre multi-junction.
5. Constructing 180km of 1200mm pipeline (94 barg) between Three Cocks AGI and Alrewas multi-junction.
6. Pressure uprating of Feeder 28 to 102 barg from Felindre multi-junction to Three Cocks AGI and from Felindre multi-junction to Cilfrew AGI, and associated works.
7. Pipework modifications at Churchover compressor station to allow parallel running up to a maximum station flow of 75mcm/d.
8. Procuring spare rebuild kit for VSD unit at Wormington compressor station.
9. Constructing a new 15MW unit at Churchover compressor station to increase station operations and availability.
10. Pressure uprating Feeder 28 to 102 barg from Milford Haven to Felindre.

	GOA Option	Investment Component									
		1	2	3	4	5	6	7	8	9	10
SPOP A-H	A	X									
	B	X	X								
	C	X	X				X				
	D	X	X				X	X	X		
	E	X	X		X		X				
	F	X	X			X	X				
	G	X	X	X			X				
	H	X	X				X	X		X	
GOA I-W	I		X								
	J						X				
	K	X					X				
	L		X				X				
	M							X			
	N				X						
	O	X	X		X						
	P					X					
	Q	X	X			X					
	R			X							
	S	X	X	X							
	T							X		X	
	U	X	X		X		X	X			
	V	X	X	X			X	X			
	W	X	X				X	X			X

Assessment Approach

We assessed each option against economic, environmental, social and deliverability criteria, using the assessment framework illustrated below (more details can be found in the GOA Methodology).



The economic assessment considers the economic benefit of reducing constraints on the network against the costs – primarily capex – of those reductions, which we contain in a NPV calculation. Further information on how constraint costs are calculated is presented in Annex A.

We used data from FES 2025 in the assessment, with the network analysis undertaken consistent with our approach to GNCNR and the Transmission Planning Code (TPC)[25] sections 7.2 and 7.3.

Assessment criteria

The GOA assessment includes the following stages:

- pre-filtering (option not progressed to detailed analysis)
- pre-filtering (options not progressed to NPV calculation)
- filtering based on NPV assessment
- filtering based on SI&D assessment

Below is a detailed description of each assessment stage.

Pre-filtering (option not progressed to detailed analysis)

We conducted the following qualitative assessment to determine whether an option should proceed to detailed network analysis:

- The proposed option fails to significantly reduce constraints in the area.
- It is unfeasible to implement the proposed option.
- The option was rejected in assessments for previous projects for reasons which we accept are still applicable.

A given option will be excluded at this stage, for if any of the above conditions apply.

25 Transmission Planning Code - 2023 | National Gas

Pre-filtering (option not progressed)

The second filter assessed whether a given option meets at least one of the conditions below:

- The option has been proposed by NGT.
- The option is expected to have a positive NPV across any of the FES net zero pathways and Falling Behind.

Options that meet neither of the conditions above will not be progressed to the NPV assessment.

Filtering based on the NPV output

We calculated the NPV value of each option for all three FES net zero pathways and Falling Behind[26]. The NPV value is calculated by monetising the investment and benefit the option provides[27]. An option will not proceed to SI&D assessment, if it has a negative NPV value in at least one of the FES net zero pathways or Falling Behind assessments.

Additionally, during the NPV assessment we used a range of different locational actions and buy backs ratio assumptions to analyse the GOA proposals. The distribution between locational action and buybacks is a key component for calculating constraint costs[28].

Filtering based on SI&D assessments

By weighing non-economic factors against the NPV, we fully consider the impact and value for consumers of a given option. This is to ensure the option we recommend is cost-effective, whilst minimising risk. We consider these factors by:

- Understanding the complexity of implementing a given option.
- Assessing the delivery risks around new and unproven technologies.
- Achieving a high-level understanding of the geographical and environmental[28] challenges of implementing a given option.
- Considering how the options will improve security of supply by reducing the potential for constraints.

We scored the above factors for each option against our SI&D framework, ranging from low, low-medium, medium-high to high.

Without a reasonable justification, any option that scores high risk under the SI&D framework will not be considered for recommendation[29].

Recommended option

We will recommend an investment option to Ofgem based on a balanced combination of the following:

1. NPV assessment conducted across the assumed asset lifetime.
2. SI&D assessment.

Assessment result

Pre-filtering (option not to progress to detailed analysis)

Options were discounted before network analysis for the following reasons[30]:

- Reinforcing routes to the south of Wormington or connecting to other parts of the NTS in the southeast, were discounted due to being unfeasible to implement.
- Connecting directly from Wales to more central or southwest sections of the NTS were discounted due to being unfeasible to implement.
- Pressure uprating options between Three Cocks and Churchover were discounted, due to being unfeasible to implement.
- Additional compression in Wales were discounted due to being unfeasible to implement.

26 Future Energy Scenarios (FES) | National Energy System Operator
27 Calculation of constraints is discussed in Annex A: Calculation of constraint costs.
28 The environmental impact of options is also captured in the NPV assessment discussed in our GOA Methodology and will be documented in the accompanying GOA workbook.
29 Except security of supply because it is assessed as a benefit.
30 Annex B: NESO's wider review of strategies for offsetting or mitigating entry constraint at Milford Haven terminal discusses this in further detail.

Pre-filtering (options not progressed to NPV calculation)

The following options were not progressed to the economic and environmental assessment stage:

GOA option(s)	Reason(s) for not progressing
I, J, L, M, N, R & T	Network analysis results showed a minimal reduction in potential constraints from 2030 onwards.
O	Option E provides significantly more network capability than this option with the pressure uprating of Feeder 28 from Felindre multi-junction to Three Cocks AGI and Cilfrew PRI.
Q	Option F provides significantly more network capability than this option with the pressure uprating of Feeder 28 from Felindre multi-junction to Three Cocks AGI and Cilfrew PRI.
S	Option G provides significantly more network capability than this option with the pressure uprating of Feeder 28 from Felindre multi-junction to Three Cocks AGI and Cilfrew PRI.

Options progressed to NPV assessment:

GOA Option	Investment Component									
	1	2	3	4	5	6	7	8	9	10
A	x									
B	x	x								
C	x	x				x				
D	x	x				x	x	x		
E	x	x		x		x				
F	x	x			x	x				
G	x	x	x			x				
H	x	x				x	x		x	
I		x								
K	x					x				
P					x					
U	x	x		x		x	x			
V	x	x	x			x	x			
W	x	x				x	x			x

Investment components

1. Constructing 9km of 900mm pipeline (75 barg) between Wormington and Honeybourne AGI.
2. Constructing 2km of 900mm pipeline (70 barg) between Churchover compressor tee and multi-junction.
3. Constructing 26km of 1200mm pipeline (75 barg) between Tirley AGI and Wormington multi-junction.
4. Constructing 105km of 1200mm pipeline (94 barg) between Milford Haven ASEP and Felindre multi-junction.
5. Constructing 180km of 1200mm pipeline (94 barg) between Three Cocks AGI and Alrewas multi-junction.
6. Pressure uprating of Feeder 28 to 102 barg from Felindre multi-junction to Three Cocks AGI and from Felindre multi-junction to Cilfrew AGI, and associated works.
7. Pipework modifications at Churchover compressor station to allow parallel running up to a maximum station flow of 75mcm/d.
8. Procuring spare rebuild kit for VSD unit at Wormington compressor station.
9. Constructing a new 15MW unit at Churchover compressor station to increase station operations and availability.
10. Pressure uprating Feeder 28 to 102 barg from Milford Haven to Felindre.

Net present value (NPV) assessment

Summary of the NPV assessment for the options are shown in the table below[31]

GOA Option	Holistic Transition NPV (£m)	Electric Engagement NPV (£m)	Hydrogen Evolution NPV (£m)	Falling Behind NPV (£m)	CapEx cost (£m)
A	550	711	1009	1224	44
B	564	730	1049	1275	48
C	569	740	1093	1357	54
D	602	790	1244	1586	54
E	-644	-482	-46	288	1242
F	-1276	-1043	-545	-213	2096
G	499	703	1129	1455	184
H	541	725	1162	1494	94
K	567	735	1083	1346	49
P	-1342	-1153	-594	-251	2042
U	-528	-322	114	445	1242
V	482	687	1126	1458	184
W	666	875	1296	1607	58

The following options were not included in the SI&D assessment due to having a negative NPV in at least one of the FES scenarios:

- Option E
- Option F
- Option P
- Option U

The new build 105km pipeline from Milford Haven to Felindre (Option E) was excluded due to the GOA NPV assessment scoring however it is still a potential mitigation for N-1 events as highlighted within GSSA.

Additional sensitivities were considered for NGT's SPOP delivery dates and for locational actions and buy backs ratios. These did not change the outcomes of our analysis and the discounting of options in the NPV assessment stage.

31 GOA option NPV calculations are available in the accompanying GOA workbook.

SI&D assessment

The SI&D assessment scores for the options are shown in the table below[32]

GOA Option	Complexity	Geographical Considerations	Technology	Network Security of Supply
A	Low	Low	Low	Low
B	Low	Low	Low	Low-Medium
C	Low	Low	Low	Low-Medium
D	Low	Low	Low	High
G	Low-Medium	Low-Medium	Low	Medium-High
H	Low-Medium	Low-Medium	Low	Medium-High
K	Low	Low	Low	Low-Medium
V	Low-Medium	Low-Medium	Low	High
W	High	Low-Medium	Low	High

The SI&D assessment excluded the following options:

- Option A
- Option B
- Option C
- Option G
- Option H
- Option K
- Option V
- Option W

The reasoning for each category and the discounting of these option are explained in Annex C: SI&D framework assessment. All categories are assessed against a scoring framework of:

- low
- low-medium
- medium-high
- high

Complexity, geographical considerations, and technology are evaluated based on risk, with a lower score indicating a more favourable outcome. Additionally, security of supply is assessed based on benefit, where a higher score represents a better result.

32 GOA options SI&D assessment reasonings are available in the accompanying GOA workbook.

Recommendation

Our preferred solution is Option D as this performs well across both the NPV and SI&D assessments. Option A is cheaper to implement than our recommendation but doesn't offer the same security of supply benefit reduction. Additionally, Option W scores better across the NPV assessment but the uncertainty around the complexity of the design and the CapEx cost adds uncertainty to the value of the option.

We recommend delivering the project by December 2028 . The proposed date aligns with when network constraints are expected to increase significantly in the South Wales region.

GOA Option	D
CapEx Cost (£m)[35]	54
Holistic Transition NPV (£m)	604
Electric Engagement NPV (£m)	790
Hydrogen Evolution NPV (£m)	1,244
Falling Behind NPV (£m)	1,586
Complexity	Low
Geographical Considerations	Low
Technology	Low
Network Security of Supply	High

Option D consists of the following investment components:

- Constructing 9km of 900mm pipeline (75 barg) between Wormington and Honeybourne AGI.
- Constructing 2km of 900mm pipeline (70 barg) between Churchover compressor tee and multi-junction.
- Pressure uprating Feeder 28 to 102 barg from Felindre multi-junction to Three Cocks AGI and from Felindre multi-junction to Cilfrew AGI, including associated works.
- Pipework modifications at Churchover compressor station to allow parallel running up to a maximum station flow of 75mcm/d.
- Procuring a spare rebuild kit for the VSD unit at Wormington compressor station.

In general, components within this option aim to enhance South Wales entry capability.

Our recommendation is consistent with our view in the Ofgem Request for Advice: GT3 National Gas Transmission Business Plan (2026-31)[36], and Ofgem RIIO-3 Final Determination[37].

Option Benefits

Once implemented, Option D will increase both the intact and high-resilience network capability from 2029. Most of the value of the capability increase will be seen during days of lower national demand, where Milford Haven terminal is set to deliver baseline flows.

Additionally, Option D has the potential to deliver gas flows that are above the current terminal baseline (on demands of 250mcm/d and above), supporting supply security. Recognising the role of gas in energy security is consistent with NESO's GSSA.

Option interactions with other NESO activities

Option D supports the ability to potentially flow gas above Milford Haven baseline capability. This can provide security of supply benefits, on occasions when one or more existing assets become unavailable. The option could reduce a possible deficit during a relevant security event by enabling higher flows at Milford Haven, potentially above the baseline capacity.

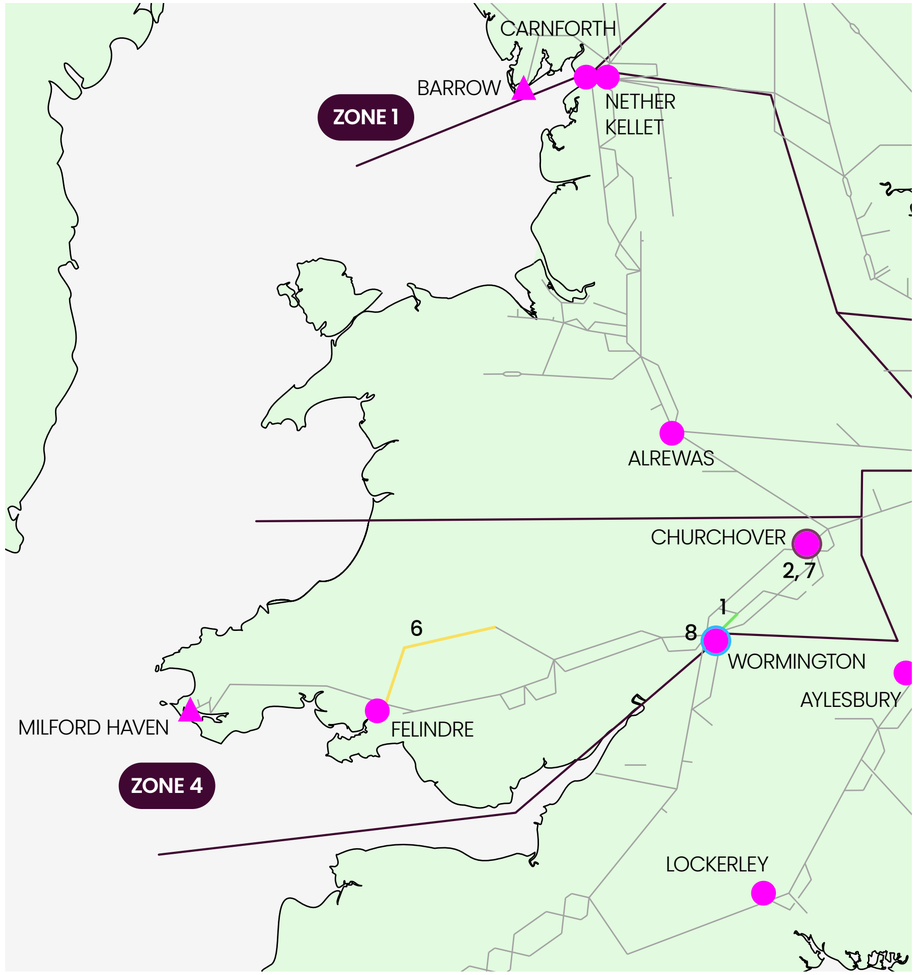
Additionally, one option proposed in SPOP involves duplicating Feeder 28 from Milford Haven to Felindre, thereby removing the high impact point of failure (HIPF)[38]. The GOA only assesses the options against the entry capability requirements identified in GNCNR. Whilst the duplication of Feeder 28 does not therefore appear to be economically attractive on the narrow basis of our NPV assessment, it may be attractive as a mitigation to wider security of supply concerns.

33 Option D NPV calculations are available in the accompanying GOA workbook and SI&D assessment reasonings are discussed in Annex C.
34 The recommended option deliverability is consistent with NGT's recommendations in SPOP.
35 This is NESO's independent estimate of CapEx. We note significant uncertainty in CapEx estimates but our recommendation is robust to examined sensitivities.
36 NESO response to Ofgem Request for Advice: GT3 NGT Transmission Business Plan for 2026 to 2031.
37 The recommended option in GOA is consistent with Option 11 in Ofgem's RIIO3 final determination.
38 HIPF: Refers to the section in the NTS where an asset failure occurs. HIPF stops gas flow, leading to a potential network constraint.

Zone map

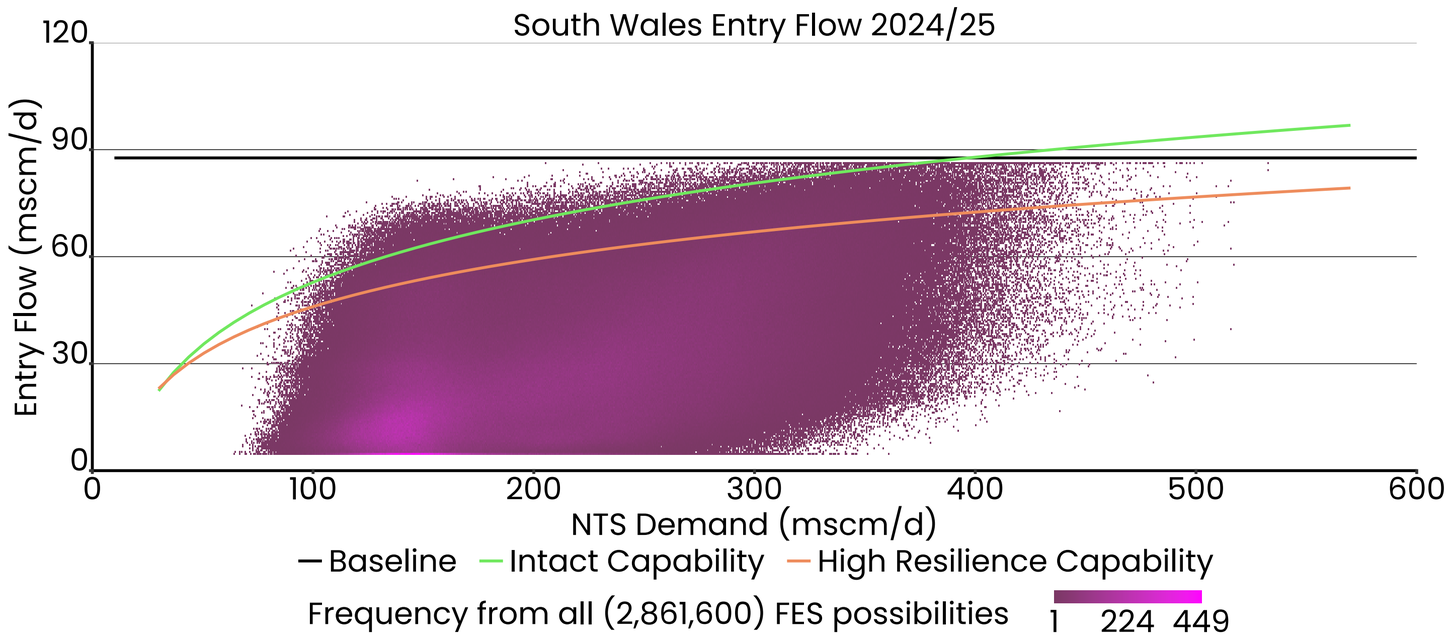
South Wales (Zone 4) map

National Gas Transmission System	Key
TERMINAL	▲
COMPRESSOR	●
PIPELINE	—
New build pipeline	—
Pipeline pressure uprating	—
Wormington compressor spares	○
Churchover compressor site modifications, new feeder and compressor unit	○



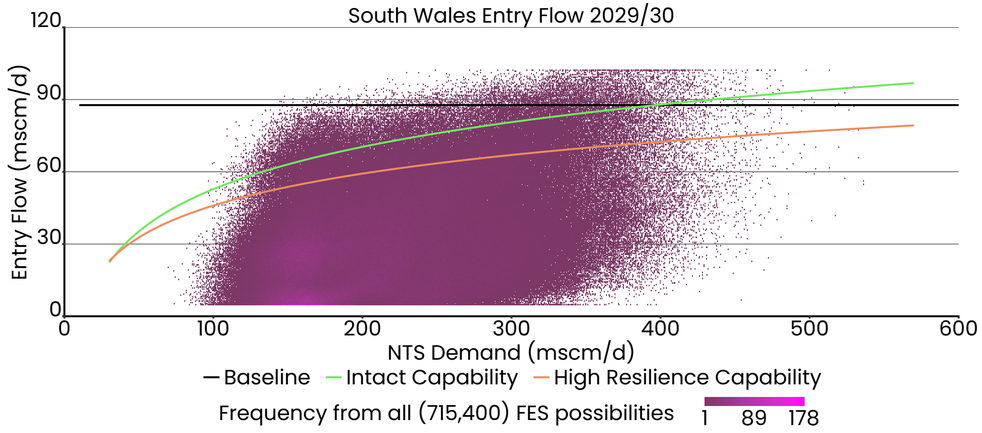
Base year flame chart

GNCNR - Net zero pathways and Counterfactual

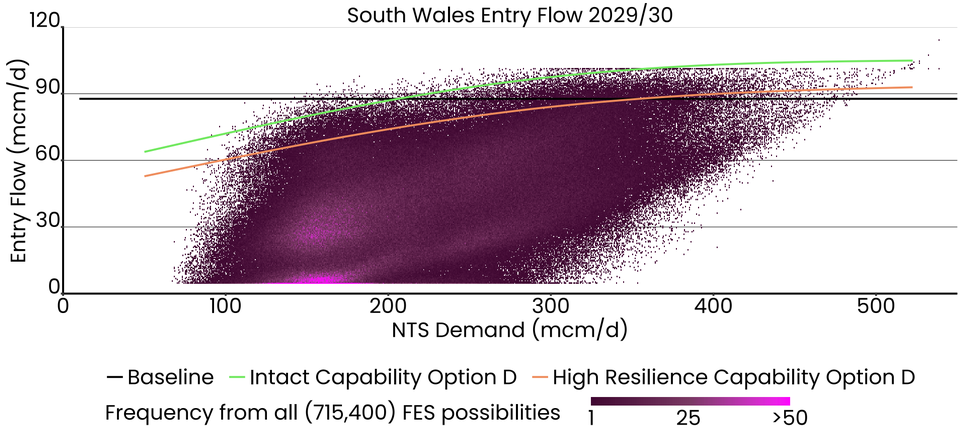


5 year out flame chart

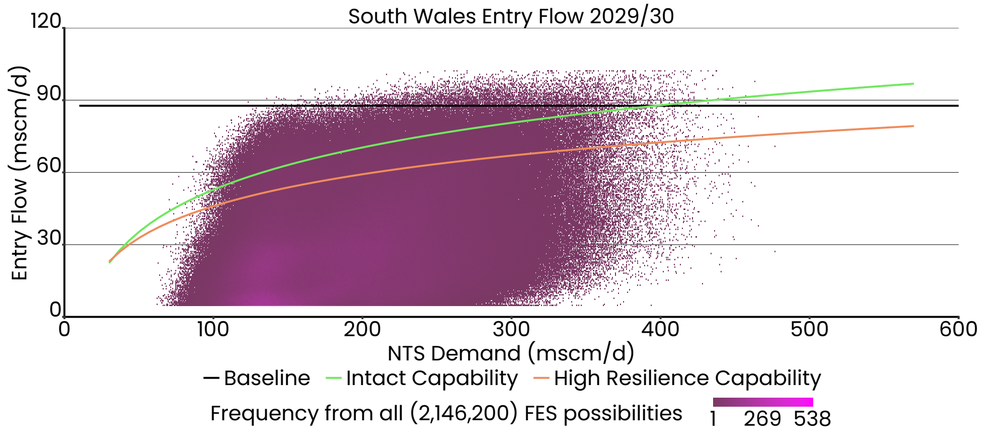
GNCNR – Counterfactual



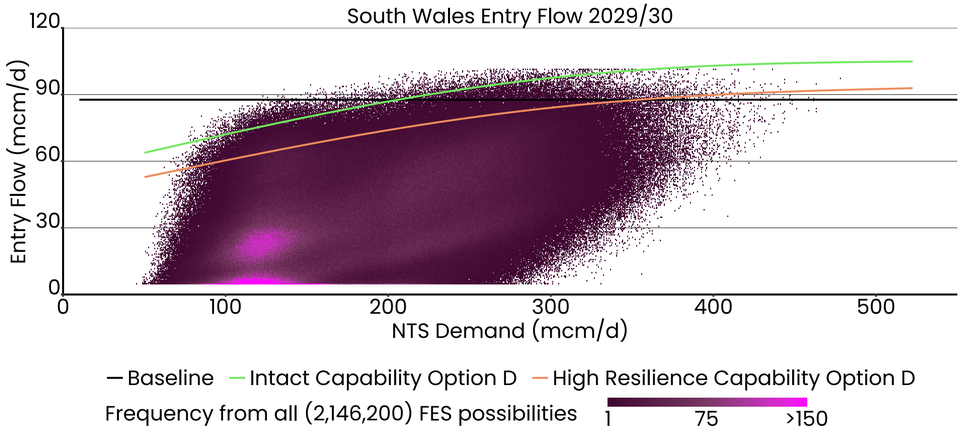
GOA – Falling Behind



GNCNR – Net zero pathways

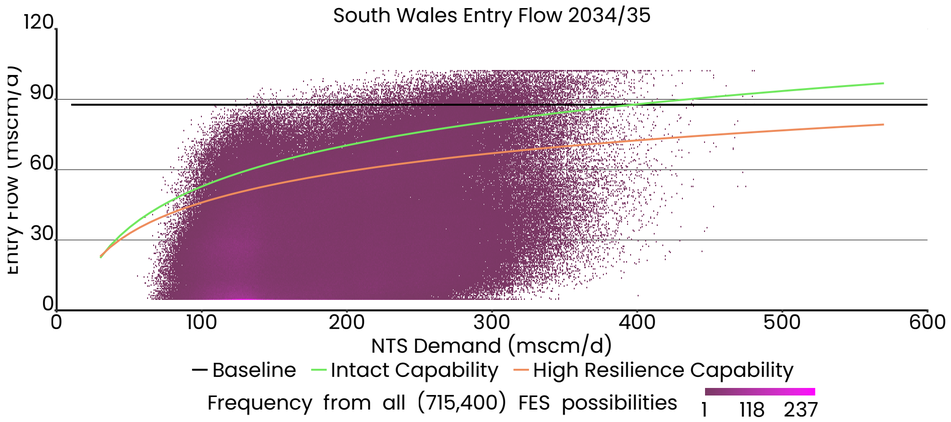


GOA – Net zero pathways

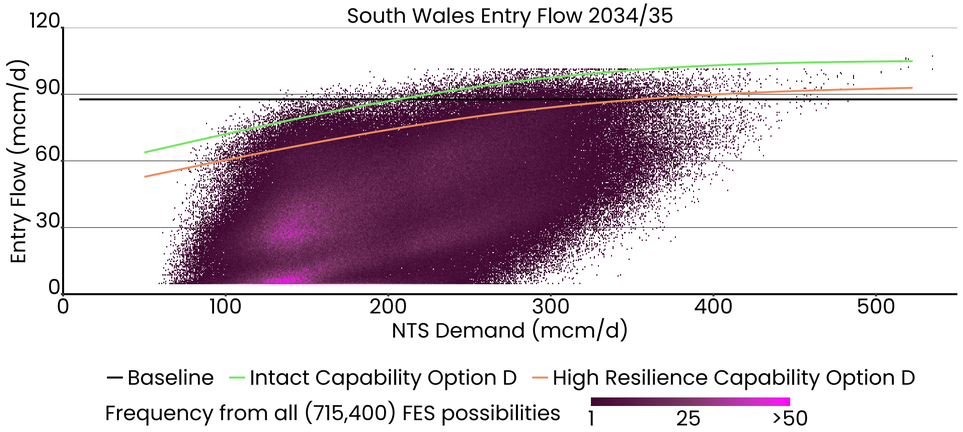


10 year out flame chart

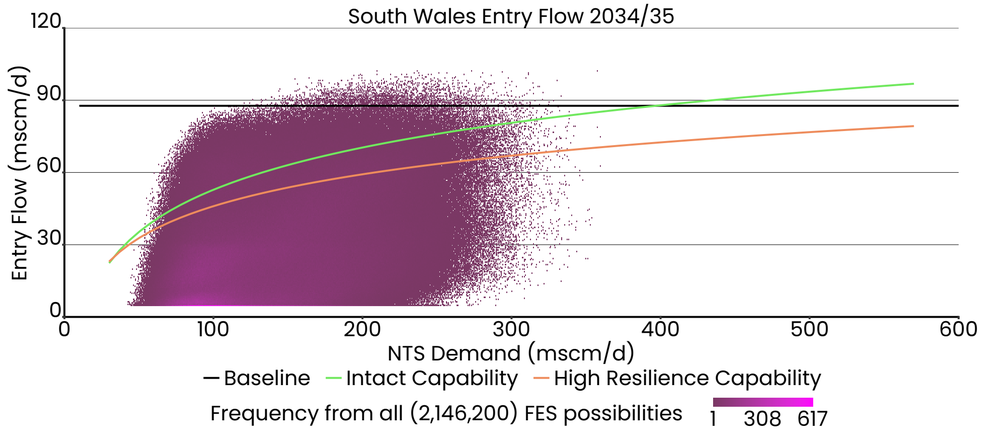
GNCNR – Counterfactual



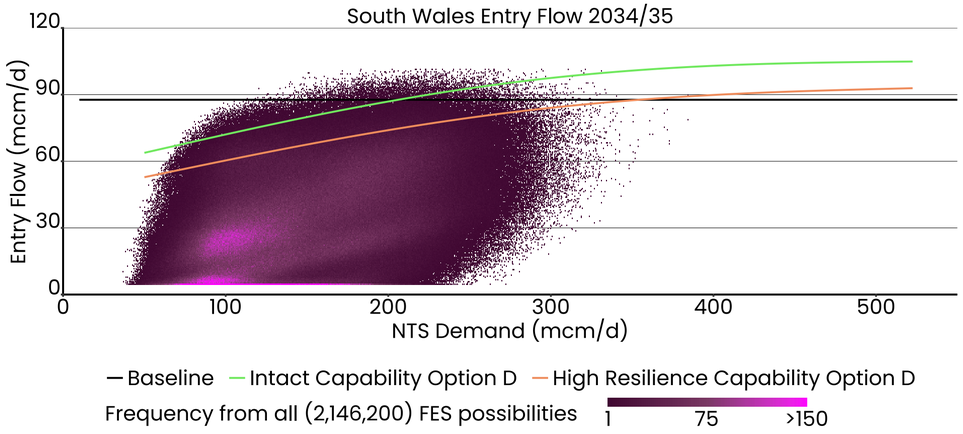
GOA – Falling Behind



GNCNR – Net zero pathways



GOA – Net zero pathways



Constraints

Constraints days - zone 4 entry (intact)						
	GNCNR			GOA		
	All scenarios	Net zero pathways	Counterfactual	All scenarios	Net zero pathways	Falling Behind
2024/25	2			2		
2029/30		12	13		1	1
2034/35		24	28		2	1

Constraints - zone 4 entry (high resilience)						
	GNCNR			GOA		
	All scenarios	Net zero pathways	Counterfactual	All scenarios	Net zero pathways	Falling Behind
2024/25	14			14		
2029/30		34	40		11	13
2034/35		45	62		18	16

National Transmission System (NTS) after 2035

Changing gas flows will require specific parts of the NTS to have a more crucial role in transportation. As flows from the UK Continental Shelf (UKCS) decline, the GB gas market will become increasingly dependent on imports. Gas from LNG terminals will become increasingly critical over the 2030 to 2050 period, to support a secure and reliable supply.

Figure 5 shows the difference in entry capability for South Wales between the existing network and following the implementation of Option D. It also shows the changing supply and demand forecasts of gas flows from 2028, (the date when Option D is due to be completed), as well as 2035, 2045 and 2050. While there is a reduction in potential constraints over the next 10 years, there is a growing uncertainty of risk in the longer term due to the divergence in FES pathways, and the potential usage of the NTS.

After 2035, we will see a changing requirement for the NTS: with gas demand reducing, we expect the network operation to be more varied with changing rates of supplies, directions of flows, and the operation of NTS assets. As the range of supply (entry flow) does not reduce, the potential range of gas flows gets larger.

As the NTS operation becomes increasingly varied, its operational efficiency is likely to decrease, and as the average age of the assets is greater, there is expected to be an increase in network maintenance activities and outage throughout the year.

GNCNR, GOA and CSNP-related activities will continue to assess capability requirements of the NTS, as well as the potential for decommissioning or for repurposing it to support a hydrogen transmission “backbone” across GB.

If NGT publishes investment proposals for new connections, repurposing or decommissioning NTS assets, we will consider their impact on both network capability, and on consumers. Should any such proposals be approved, we will incorporate the approved changes into our subsequent GNCNR and GOA assessment.

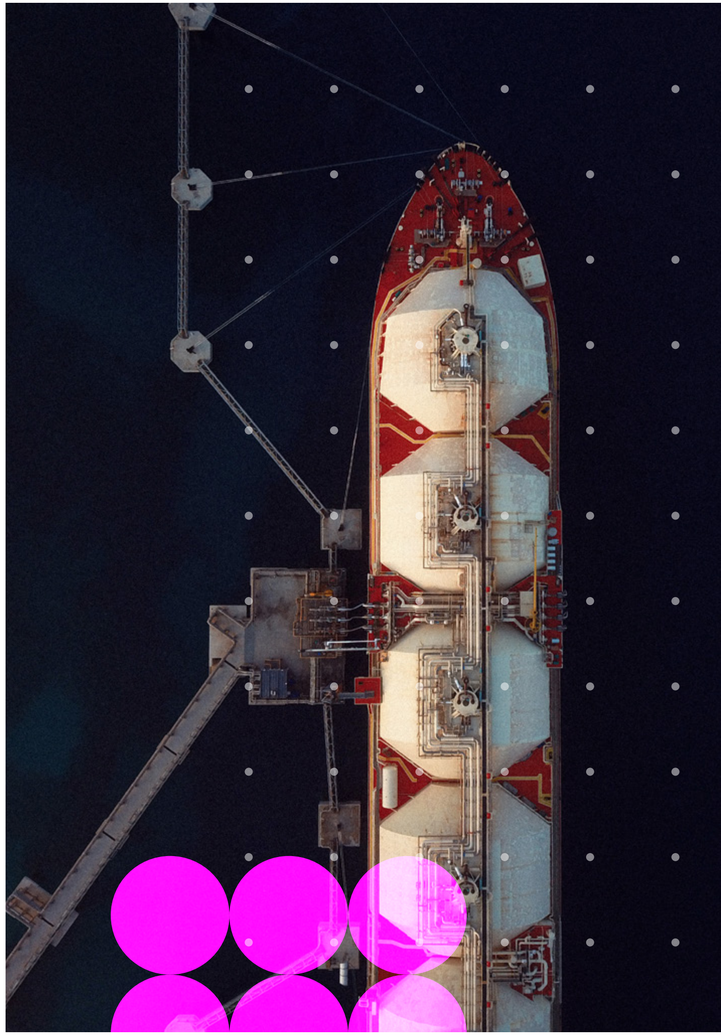
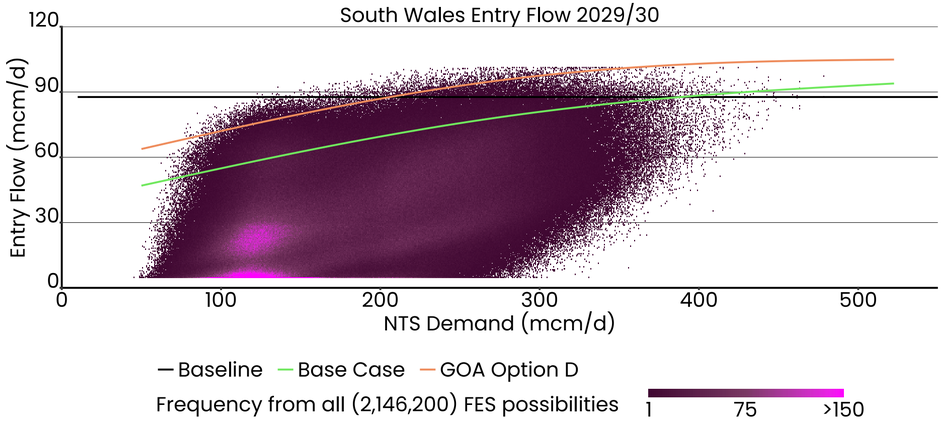
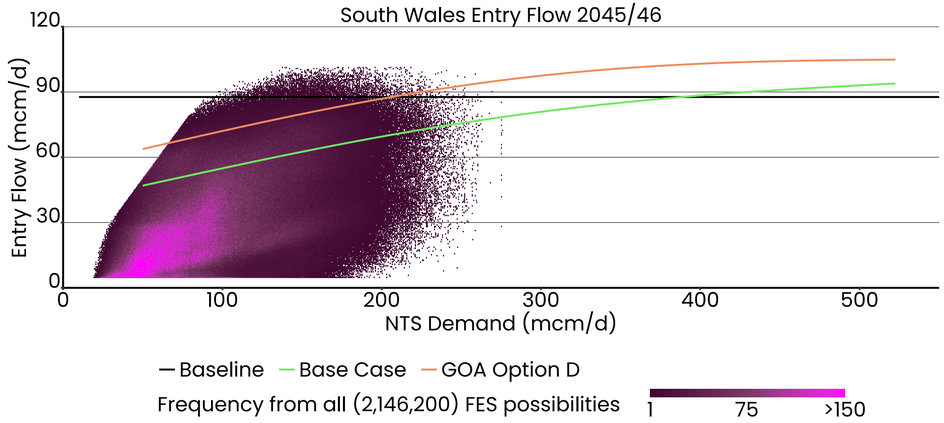
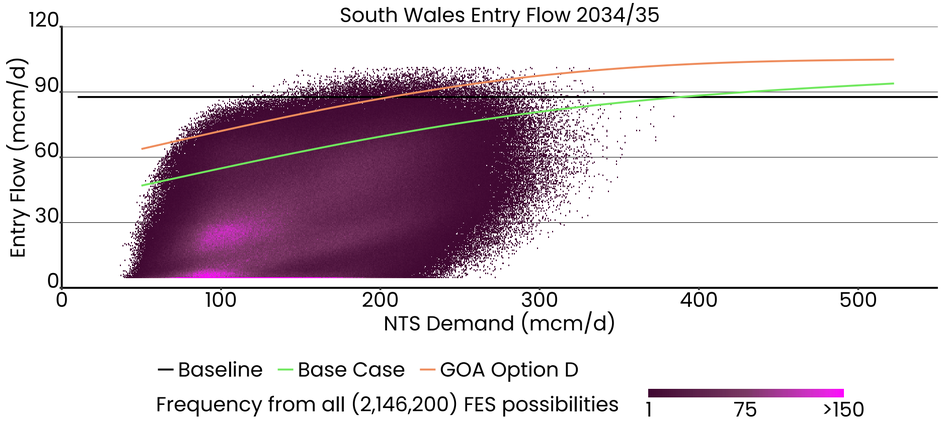
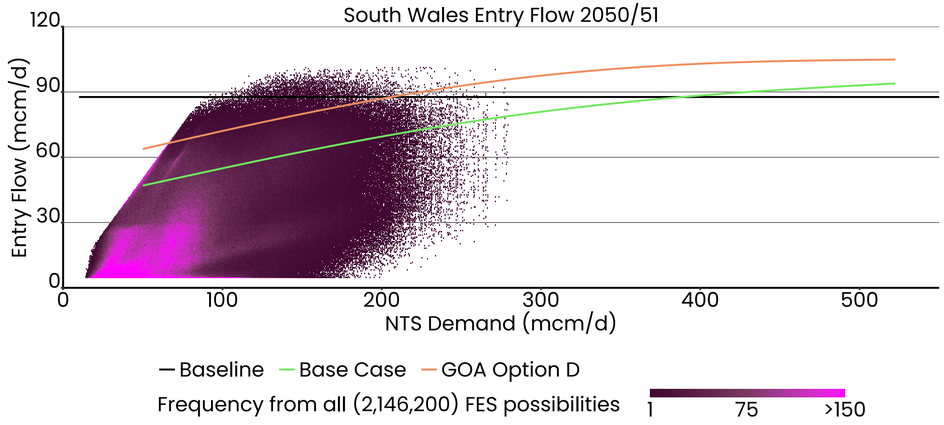


Figure 5: Flame charts 2030 (GOA recommendation vs GNCNR intact capability curve)









GOA Engagement Timeline

As illustrated below, we engaged with stakeholders via regular touchpoints throughout the GOA development.

GNCNR webinar
February 2025

GOA Methodology Consultation
6 May - June 2025

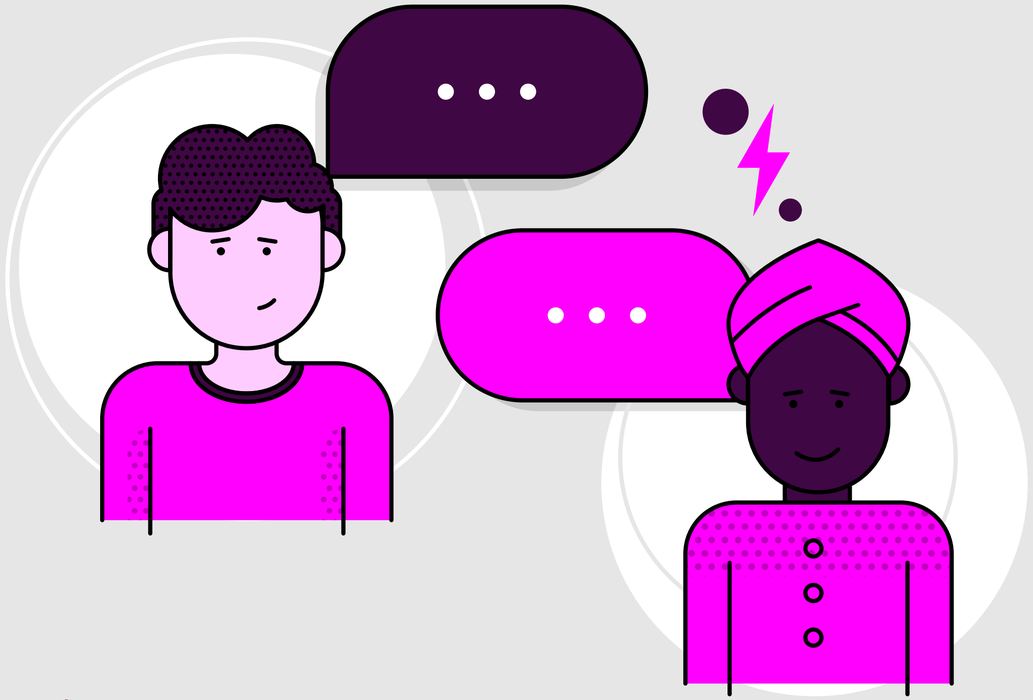
GOA Methodology publication
September 2025

GOA Methodology webinar
October 2025

GOA publication
December 2025

GOA post-publication engagement
Q1 2026

Continuing the Conversation



Thank you for reading, we hope you have found the Gas Options Advice insightful.

In terms of next steps, we welcome stakeholder engagement for our gas network planning process, using your comments and questions about GOA 2025 to inform our future analysis and insights.

With the publication of the GOA, Ofgem will be able to use the recommendations put forward to inform its decisions with regards to network reinforcement investments.

Ways to connect and stay in touch

We will be sending surveys, energy articles and engagement opportunities via our NESO newsletter. You can subscribe on the NESO website: neso.energy/news-and-events

You can also contact us directly via email and one of our team members will be in touch: gwend@neso.energy

Access our current and past documents, data, and media at: neso.energy/publications-library

For further information on NESO, please visit: neso.energy

Or, write to us at:

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FAQs

What is the NTS?

The NTS is a high-pressure gas transportation system, moving natural gas from entry to exit points. It is made up of approximately 7,660 km of pipeline, 21 compressor sites, 8 gas terminals, and over 500 above ground installations. It is owned and operated by NGT; NESO has gas network planning responsibilities for the NTS, as per the Gas System Planner Licence.

What are the entry points on the NTS?

Gas is delivered into the NTS via entry points where gas is added from:

- Supply terminals (sometimes comprising more than one sub-terminal)
- LNG terminals (where liquefied natural gas is returned to its gaseous state)
- Interconnectors
- Storage sites

What are exit points on the NTS?

Exit points are sites where gas leaves the NTS to meet the needs of end consumers. These include:

- Distribution network offtakes, for onward supply to domestic and business consumers
- Direct connections to large industrial users and power stations
- Sites where gas flows to locations outside of GB via interconnectors
- Sites where gas is put into storage

Why is Great Britain divided into seven zones for capability analysis?

The concept of “zones” has been introduced by NGT to breakdown the complex NTS into smaller and more manageable parts. Each of the seven zones (“RIIO Zones”) have distinctive gas flow regimes and requirements for which we can assess entry and/or exit capability.

The geographic descriptions, for instance “Southeast”, are provided as indicative explanations for each zone. For example, the South Wales zone, commonly known as South Wales, covers not only that area of GB, but also part of the Midlands.

What is a network asset?

A network asset is defined as any physical part of the gas transmission network, such as a compressor, pipeline, valve, or regulator.

What is a compressor?

A compressor is a piece of equipment used in the gas transmission network to move gas from entry to exit points by increasing the pressure of the gas within a specific part of the pipeline system. There are currently 24 compressor stations at different sites across GB.

What is mcm?

Million cubic metres (mcm), sometimes referred to as million standard cubic metres is a unit of measurement for effective gas volume. During our analysis, we use mcm as a measure of the volume of gas which is delivered into the gas network (supply) or taken off the gas network (demand).

What is a gas constraint?

A constraint is a scenario where the pressure or flow required to meet customer needs cannot be supplied by the physical capability of the network.

What is a constraint day?

A constraint day occurs when supply or demand exceeds the physical NTS capability.

What is Net Present Value (NPV)?

NPV is the economic evaluation of the present value of future costs and benefits of an investment relative to the base case.

What is network capability?

Network capability refers to the maximum flow of gas the network can safely transport to and from specific locations without exceeding safety limits or compromising equipment. This can be influenced by various factors, such as supply and demand fluctuations, the availability of network assets and so on.

What does intact capability mean?

For intact capability, all gas transmission compressors are assumed to be available and reliable.

What is high resilience?

High resilience is defined in terms of the combination of compressor units (within a zone or zones) that can be estimated to be available 99% of the time.

How do you model network capability?

We use network modelling software called SIMONE to simulate extensive scenarios across a range of supply and demand forecasts. It provides a complex mathematical model of the NTS which we use to assess current and future network planning requirements.

What is a flame chart?

Flame charts are visual representations of the capability needs within each NTS zone during a particular time. The probabilistic gas supply and demand points are represented in the flame chart and compared to capability lines to understand whether projected flows can be supported by the gas network.

Glossary

Acronym	Description
CapEx	Capital expenditure
CO_2	Carbon dioxide
CO_2e	CO_2 equivalent emissions
CSNP	Centralised Strategic Network Plan
DESNZ	Department of Energy Security and Net Zero
FES	Future Energy Scenarios
GB	Great Britain
GNCNR	Gas Network Capability Needs Report
GOA	Gas Options Advice
GSSA	Gas Security of Supply Assessment
HIPF	High impact point of failure
LNG	Liquified Natural Gas
NGT	National Gas Transmission
NPV	Net Present Value
NTS	National Transmission System
SEP	Strategic Energy Planning
SI&D	Social Impact & Deliverability
SPOP	Strategic Planning Options Proposal
SSEP	Strategic Spatial Energy Plan
VSD	Variable Speed Drive (Compressor Unit)

Legal Notice

As the designated independent system operator and planner, National Energy System Operator Limited (NESO) holds a gas system planner licence. Pursuant to its gas system planner licence, NESO has a long-term strategic planning and forecasting function relating to the gas transmission network.

For the purpose of this report, the terms "NESO", "we", "our", "us" etc. are used to refer to National Energy System Operator Limited (company number 11014226).

NESO has prepared this report pursuant to its statutory duties and its gas system planner licence in good faith, and has endeavoured to prepare this report in a manner which is, as far as reasonably possible, objective, using information collected and compiled from users of the gas supply system in Great Britain together with its own forecasts of the future development of this system.

While NESO has not sought to mislead any person as to the contents of this report and whilst such contents represent its best view as at the time of publication, readers of this document should not place any reliance on the contents of this report.

The contents of this report must be considered as illustrative only and no warranty can be or is made as to the accuracy and completeness of such contents, nor shall anything within this document constitute an offer capable of acceptance or form the basis of any contract.

Other than in the event of fraudulent misstatement or fraudulent misrepresentation, NESO does not accept any responsibility for any use which is made of the information contained within this report.

Annex A: Calculating Constraints and the Impact of Compressor Usage

How constraints and relative benefits are calculated

When the entry/exit flows are higher than the network capability for a given zone, constraints are likely to occur. In this scenario, without taking commercial action to adjust the flows apparent on the system, NGT cannot meet its contractual capacity obligations at those supply and demand points and would be need to buy-back the capacity right from the market.

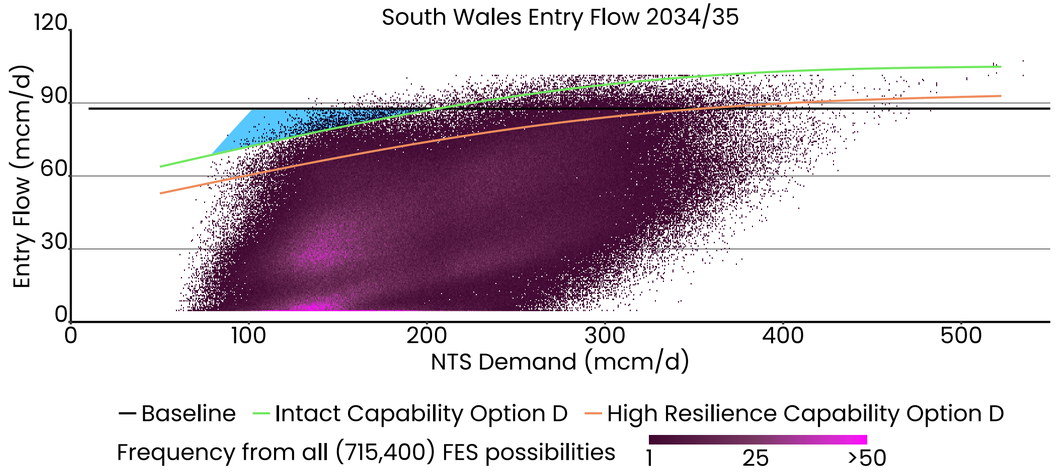
We use two sources of data to forecast the volume of future constraints in the network:

1. A mathematical equation defining the network capability for the relevant zone, across the range of annual national gas demand. This is plotted as a capability curve[39] and is defined for each option.
2. A forecast of the range and frequency of gas supplies and demands for GB. The forecast is produced for each year using the FES 2025 net zero and Falling Behind pathways.

For each option, every forecast flow point is compared with the corresponding national demand point on the capability curve and the capacity baseline for the entry/exit location. In this way, we can quantify gaps in network capability, defined as a constraint volume. Figure 6 illustrates South Wales region entry capability curves for Option D and the base case. The light blue area (top left) indicates the flows that would cause constraints that would require commercial actions (NGT are in effect not obligated to sell capacity above the baseline).

The constraint volumes are aggregated and scaled to derive annual constraint volumes for each year and under each FES net zero pathway and Falling Behind[40].

Figure 6: GOA - Falling Behind



39 GNCNR methodology | National Energy System Operator

40 The value that materialises each year might vary due to the specific weather or demand patterns. We are using a Monte Carlo approach to estimate how many constraint days and the constraint volume on average that might occur.

The next step is to monetise the constraint volumes by dividing the volumes into those resolved by:

- buyback actions
- locational trades

This split is done by applying a ratio which has been provided by NGT based on their system operator knowledge and experience.

For both types of constraint action, the principle is then to apply an assumed buy price (ABP) and/or assumed sell price (ASP) depending on the type of constraint action (entry/exit) that is required. These prices are based on the forecasted system average price (SAP)[41].

The ABP applies a premium to SAP to primarily take into account locational value but also reflects liquidity. Similarly, the ASP reflects a discount to SAP. The premium applied in the ASP for buy-back actions is higher than for locational trades, reflecting lower liquidity.

We have assumed 75% of volumes are managed through locational trades. This assumes gas is both bought and sold simultaneously. The remaining 25% of volumes are then assumed to be buy-backs, priced at the relevant ABP[42].

After applying the relevant prices, the annual volumes are offset and adjusted according to the specific construction or decommissioning timeframes of each option. This is to ensure that incremental changes to forecasted constraints versus the base case are calculated against the correct year. At this point, constraint costs are also added to compressor usage-based costs.

Finally, future-year constraints costs and compressor usage-based costs are adjusted to their present values by applying discounting rates[43]. For each option, the annual costs are compared with the base case to derive the benefit of the option[44].

41 The forecasted SAP is determined and published on the DESNZ website.
42 The percentage split of actions has been supplied to NESO by NGT.
43 Discounted rates are based on the weighted average cost of capital (WACC).
44 This benefit can be negative, where an option removes or reduces the effectiveness of assets from the network.

How we calculate compressor usage benefits

Options that increase network capability will often reduce the need for gas compression on the NTS. This is not always the case (they may show a negative benefit), but because compression usage is a function of forecast flows and network capability, it is assessed in a similar way to network constraints. We assess the following volumes for each option:

- carbon emissions
- nitrous oxide emissions
- compressor fuel usage

In all three cases, we use an additional set of network analysis to determine the conditions where compression is required to support entry and exit needs for a given region.

Such an analysis is conducted for every option assessed.

We then derive and compare compressor usage curves with the forecast flow data to provide the number of compressor station run hours per year for each FES pathway and Falling Behind. By factoring in technical detail provided by NGT around specific compressor unit preference and average compressor availability, we can forecast the running hours for each compressor unit in each region. We then use data from NGT to derive the relevant volumes per unit and apply the following to derive the costs of each factor (below). These values are added to the constraint costs and compared with the base case as described in the previous section.

Factor	Price Applied	Source	Link
Carbon emissions	Social cost of carbon	Treasury Green book	Valuation of greenhouse gas emissions: for policy appraisal and evaluation - GOV.UK
NOx emissions	Air Quality damage cost	DEFRA	Air quality appraisal: damage cost guidance - GOV.UK
Fuel	Forecast SAP prices	DESNZ	Annex M - Growth assumptions and prices

Annex B: NESO Wider Review of Strategies for Reducing Entry Constraints at Milford Haven Terminal

Contractual mitigations

We have engaged with NGT around potential solutions for contractual mitigations for entry constraints in South Wales. They confirmed there are no long-term solutions that are affordable and protect security of supply.

Physical network reinforcements

The NTS is a complex network and analysing the dynamics of flow, pressure and temperature requires hydraulic network analysis. Therefore it is expedient for network analysts to utilise their experience and understanding to review and suggest alternative network reinforcement options.

NESO has taken an independent view of the range of potential strategies for increasing entry capability at Milford Haven. Within this annex we outline various restrictions identified within South Wales and other impacted areas of the NTS, considering the possible mitigations for overcoming these.

Strategies and options are discounted at this stage only where there is a clear reasoning. For example, where a route is clearly less favourable than another for a similar capability benefit, or where there is prior evidence of an option being analysed as part of a previous project where new analysis will not change the result and findings.

Options submitted by NGT in the SPOP are encompassed within our review and are not subject to filtering. They are assessed within the GOA via network analysis to ensure their benefit is fully quantified for response to the SPOP submission.

Primary flow restriction in the South Wales

When modelling high LNG flow from Milford Haven, the primary restriction in transporting supply through South Wales and into other zones, occurs along the two 600mm feeders that carry the gas onwards from Wormington towards Churchover. This is the case across all levels of national demand. The restriction is observed as a large pressure drop, between Wormington and Churchover compressor station, resulting in low pressures at offtakes in the West Midlands area of the NTS. This leads to higher pressures upstream towards Wales and ultimately at Milford Haven.

This limitation of the network can be addressed through one of the following strategies:

- **Strategy one is duplicating** pipes between Wormington and Churchover, to directly alleviate the network pinch point.
- **Strategy two is offsetting** the resultant pressure drop by increasing the maximum discharge pressure at Wormington compressor station and uprating the MOP of the downstream pipework.
- **Strategy three is providing** new or additional capability for gas flows from Wormington to other parts of the network, including via new connections.

An additional strategy was considered, involving an increase in the compression capability at Churchover station. However, because a reduction of the maximum operating pressures (MOP) occurs at Churchover, experience shows that the benefit of increased compression has the impact of both reducing inlet pressures to an unacceptable level, while also reaching a ceiling on discharge pressure. This is without any notable increase in performance.

Due to this restriction upstream of the station, a very large uplift in pressure would be required for this to be effective, necessitating an uprating of downstream pipework beyond Churchover compressor station.

Options to increase capability at Churchover compressor station have been presented in the SPOP, but without uprating, they are only effective in addition to prior reinforcement being implemented.

Strategy assessment

Strategy one
This can be implemented by a new build 9km (900mm) pipeline between Wormington and Honeybourne, which duplicates the route of the existing 600mm pipeline. Additionally, this can be supplemented by a new build 2km (900mm) pipeline between Churchover tee and multi-junction which duplicates the route of two existing 600mm pipelines.

The proposed reinforcements have the effect of increasing capability in this section and increasing the operability of assets in the area, by ensuring a consistent capability between Wormington and Churchover (2 x 600mm, and 1 x 900mm pipes).

Strategy two
This involves uprating the MOP of the feeders from the outlet of Wormington compressor station, towards Churchover compressor station.

This strategy is challenging due to the physical limitations of the pipe design, maximum MOP increase of the asset, age of the pipework, and its current asset health. To counteract the pressure losses, we must also increase Wormington compressor station maximum discharge pressure capability and provide significantly more compression power to offset the downstream pressure drop.

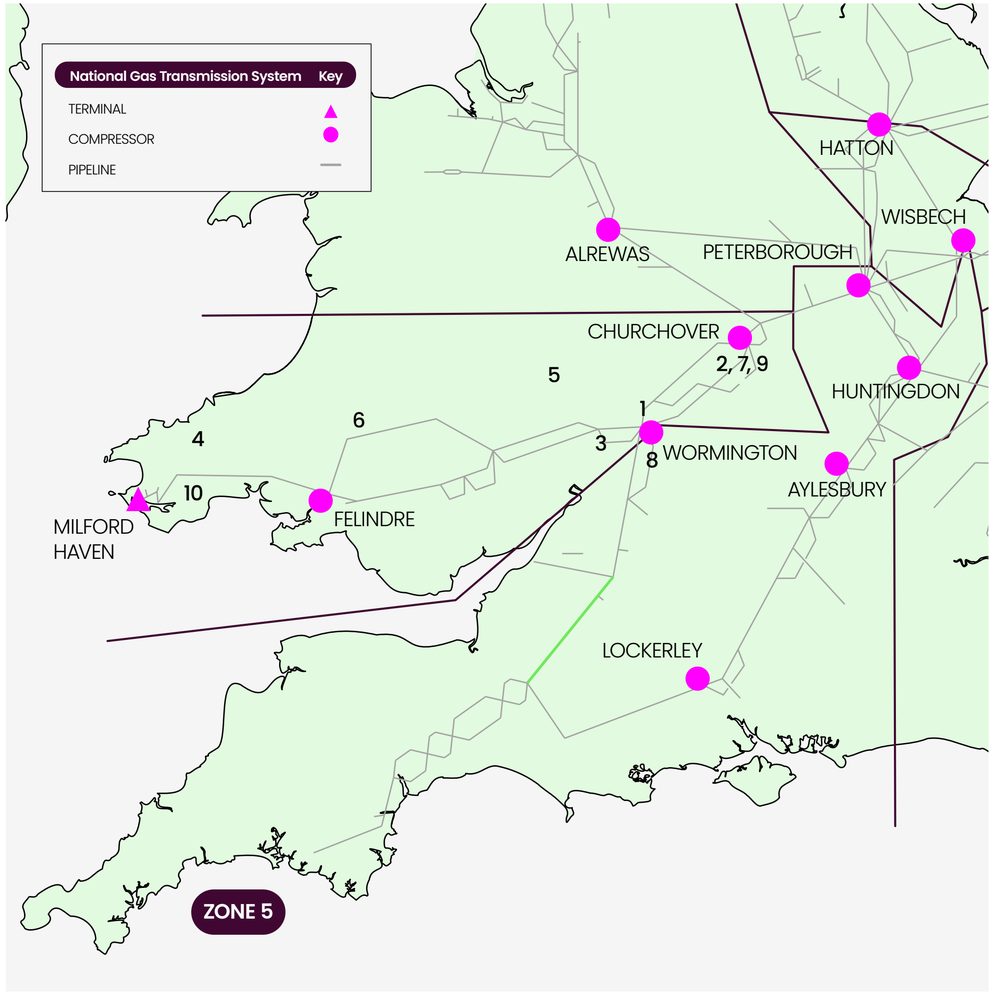
Strategy three
This could be achieved via a range of reinforcement options. The below consider the potential reinforcement options to the east of Wormington compressor station. These reinforcements would increase capability by re-routing gas away from the operational constraints.

Wormington compressor station towards the Southeast
A new pipeline connection from Wormington compressor station to Aylesbury multi-junction would allow flows to be transported towards the Southeast.

Wormington to the Southwest NTS zone
Duplication of Pucklechurch to Ilchester pipeline, (Figure 7) would allow the increase of gas to flow south from Wormington compressor station, therefore supporting Milford Haven terminal entry flows.

As demand in the southwest is relatively low, there is the requirement of additional new build NTS assets to support the increase of gas flow. This would require existing compressor stations to increase station directional flow configurations to transport gas to the southeast of the NTS.

Figure 7: Duplication of Pucklechurch to Ilchester Feeder



In principle, the above two options resolve the primary NTS operational constraints between Wormington and Churchover compressor stations. Therefore, they are comparable with Wormington to Honeybourne and Churchover new build asset options in terms of the network capability they provide. However, these options both involve new pipeline builds much longer that required to directly address the restriction, for example, via a 11km of new build.

A previous assessment of these options was completed for the Western Gas Network (WGN) project and concluded there was no additional benefit over the 11km build, so they can be discounted from further consideration. This is based on high cost, complexity and environmental impact.

Considering the primary restriction in combination with further restrictions West of Wormington

Whilst resolving the network restriction discussed in the previous section may bring substantial benefit, at high entry flows large pressure drops also appear across the whole region from Milford Haven to Wormington. To achieve further increases in capability, these restrictions must be addressed in combination downstream restriction of Wormington, otherwise they will be ineffective.

There are two strategies available:

Strategy one
Creating a new NTS route from upstream of Wormington into a part of the NTS which has spare capability for increased flows. This strategy avoids the restrictions between Wormington and Churchover.

Various solutions were considered for the WGN and are listed in NGT Strategic Options report[45], these options included routes crossing the Severn Estuary and offshore connections. We agree with NGT's view that these options are of little value because of their very high cost, complexity and social and environmental impact.

However, NGT retained an option from Strategic Options Report (SOR) which is now contained in SPOP to build a 180km new build pipeline from Three Cocks AGI (on the England Wales border) to Alrewas multi-junction in the Midlands. We have considered this option in our GOA analysis as it a solution that connects south Wales into a high connectivity part of the network without the inherent complexity of other comparable options.

Strategy two
Building NTS reinforcements to resolve restrictions upstream of Wormington, in addition to, prior resolution of constraints between Wormington to Churchover compressor stations.

Exploring this strategy, the next section details reinforcements upstream of Wormington compressor station, which are divided into the following categories:

- new build pipeline
- new compressor station
- feeder pressure uprating
- a combination of the above

New pipeline West of Wormington compressor station

Since a significant pressure drop arises immediately west of Wormington compressor station at high flows, it is reasonable to consider a pressure reduction installation (PRI), i.e., duplication of the pipeline, from Tirley to Wormington compressor station. NGT has also included this option. However, there are complexities in this section of the NTS caused by the proximity of the PRI with the Wormington compressor station which limit the effectiveness. We therefore also considered pipeline duplication from Milford Haven terminal, as currently a single pipe carries all the flow downstream to Felindre compressor station, creating substantial pressure drops. This reinforcement is also included in NGT SPOP submission.

45 West Import Resilience (formerly Western Gas Network) | National Gas

New compressor station

Additional compression could be used to counteract large pressure drops occurring between Milford Haven and Wormington compressor station. By resolving limitations downstream, this compression would be best located in the area that maximises its effectiveness.

We have explored whether a new compressor station along Feeder 28 may offer a benefit that is equivalent to that provided by the feeder duplication.

Adding a new compressor station between Milford Haven terminal and Felindre compressor station reduces the operational load of Felindre but does not significantly increase capability in the area relative to the investment cost. Factoring in the complexity, environmental and social implications for installing the new asset, there is insufficient justification to progress with the option in further detail.

New compression installed between Felindre and Tirley PRI runs into a different limitation. This is as any pressure uplift in this pipe at a suitable distance from Felindre compressor station is counteracted by the pressure reduction required at Tirley PRI to support lower downstream MOP of the NTS. It would only add significant value if combined by significant pressure uprating downstream, (including beyond Wormington).

NGT has not proposed an option in SPOP that includes the requirement of new compression in South Wales.

Feeder pressure uprating

NGT has proposed uprating of Feeder 28 from Felindre compressor station to Three Cocks AGI and Cilfrew PRI. We have also considered the potential to increase Milford Haven to Felindre compressor station up to 99 barg. This option is considered in combination with the uprating of Felindre compressor station to Three Cocks AGI and Cilfrew PRI that has been submitted in SPOP.

Conclusion

Having reviewed a comprehensive range of strategies, the reinforcement which NESO progressed to detailed analysis correspond to those proposed by NGT. This includes the addition of pressure uprating the pipeline Milford Haven to Felindre compressor station, (when implemented in combination with other downstream reinforcements).

Annex C: Social impact & deliverability (SI&D) assessment framework

The SI&D assessment framework of GOA options was completed against all that scored a positive NPV against all FES pathways or Falling Behind.

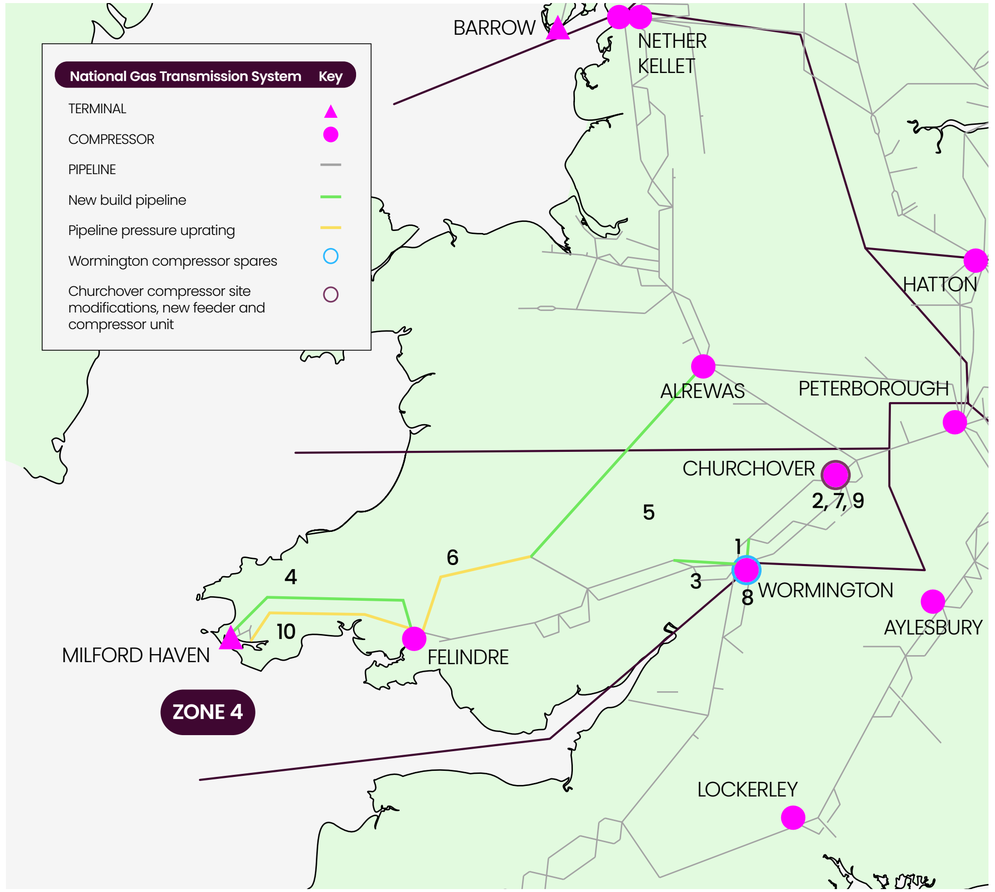
The assessment was against the following criteria:

- complexity
- geographical considerations
- technology
- network security of supply

The table summarises the options that were assessed against the SI&D framework and NTS map showing the investment components:

GOA Option	Investment Component									
	1	2	3	4	5	6	7	8	9	10
A	x									
B	x	x								
C	x	x				x				
D	x	x				x	x	x		
G	x	x	x			x				
H	x	x				x	x		x	
K	x					x				
V	x	x	x			x	x			
W	x	x				x	x			x

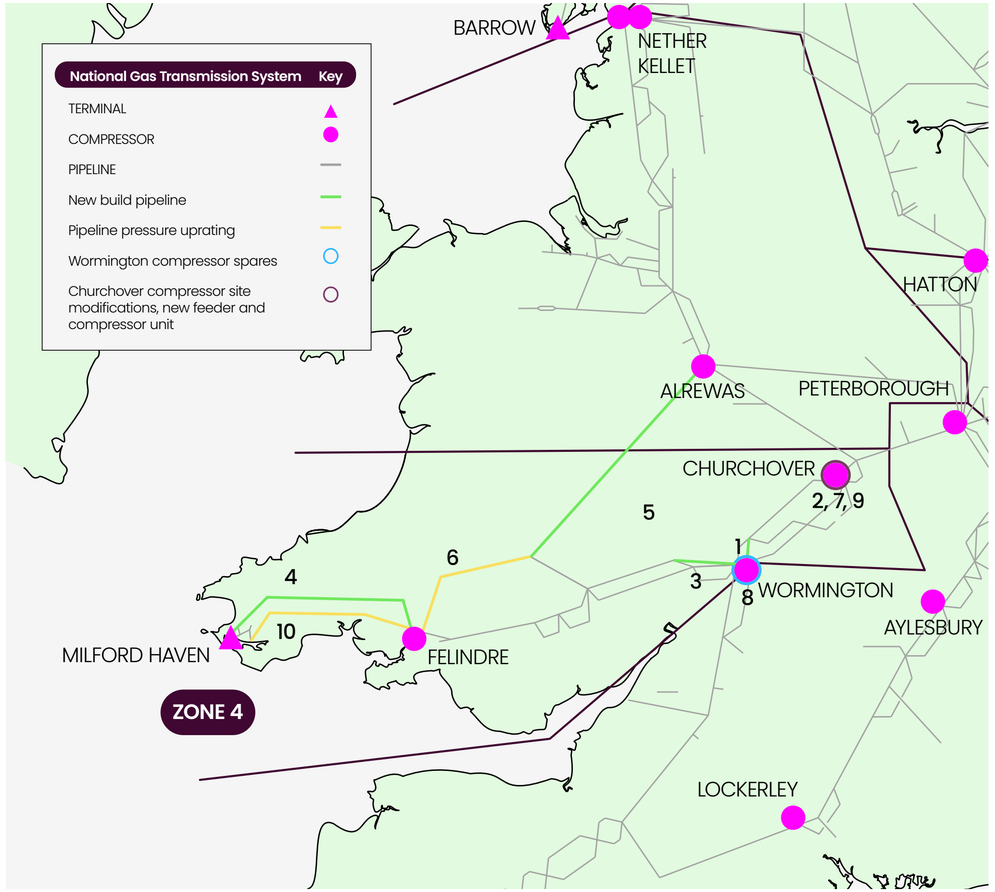
Figure 8: South Wales (Zone 4) map



Investment components

1. Constructing 9km of 900mm pipeline (75 barg) between Wormington and Honeybourne AGI.
2. Constructing 2km of 900mm pipeline (70 barg) between Churchover compressor tee and multi-junction.
3. Constructing 26km of 1200mm pipeline (75 barg) between Tirley AGI and Wormington multi-junction.
4. Constructing 105km of 1200mm pipeline (94 barg) between Milford Haven ASEP and Felindre multi-junction.
5. Constructing 180km of 1200mm pipeline (94 barg) between Three Cocks AGI and Alrewas multi-junction.
6. Pressure uprating Feeder 28 to 102 barg from Felindre multi-junction to Three Cocks AGI and from Felindre multi-junction to Cilfrew AGI, and associated works.
7. Pipework modifications at Churchover compressor station to allow parallel running up to a maximum station flow of 75mcm/d.
8. Procure Wormington compressor station (VSD) spare rebuild kit.
9. Constructing a new 15MW unit at Churchover compressor station to increase station operations and availability.
10. Pressure uprating Feeder 28 to 102 barg from Milford Haven to Felindre.

Figure 8: **South Wales (Zone 4) map**



Complexity

We have assessed the complexity, at a high level for each individual component, of all the options proposed by NGT in SPOP as well as the options we have proposed. These are reviewed below where the highest scoring component derives the overall score.

To describe complexity of the components we have adopted four categories:

- low
- low-medium
- medium-high
- high

We consider all investment elements be low or low-medium except for Option W. We consider this to be a rating of high because of the corresponding need to uprate the assets upstream of the Milford Haven entry point (i.e., Dragon and South Hook LNG terminals). We understand from conversations with NGT that the terminal operators are not considering such an investment.

We consider Options G, H and V to be low-medium impact ratings for the following reasons:

- 26km new build pipeline having a greater potential for re-routing in comparison to the 2km and 9km new build pipelines (Option G & V)
- New compressor unit at Churchover could require additional asset modifications and new builds in Churchover compressor station during Pre-FEED and FEED assessments (Option H).

Additionally, NGT in their SPOP submission to NESO and Ofgem completed an assessment of deliverability timelines of the proposals. We are assuming that these are achievable as they have been submitted in NGT RIIO-GT3 business plan.

Geographical considerations

We have assessed the geographical considerations of all options proposed by NGT in SPOP and any options we have proposed at a high level for each individual component. These are assessed on a whole project basis to evaluate the high-level impact on local areas, areas of outstanding natural beauty (AONB) and sites of special scientific interest (SSSI).

To describe geographical considerations of the components we have adopted four categories:

- low
- low-medium
- medium-high
- high

We consider all investment elements be low for geographical considerations except for Options G, H, V and W.

We consider the new build of 26km pipeline from Tirley AGI to Wormington, a new 15MW unit at Churchover compressor station and the potential Milford Haven terminal upgrades to have a low-medium impact on local area, AONB and SSSI. The reasoning for each component being low-medium impact are:

- 26km new build pipeline would have impact on local area causing potential disruptions during the build phase and may require re-routing due to the geographical location.
- 15MW new unit at Churchover is not specified if it a new gas or electrical turbine, both will have an impact on the local area during construction. If the new unit is a gas turbine, this will increase emissions in the local area.
- Milford Haven potential upgrades may require physical investment that would be determined during Pre-FEED and FEED stage.

Technology

All options considered use technologies that are already in use on the NTS and so we consider that all options are of low technological risk.

Security of supply

All options improve security of supply to some extent, because they all reduce the potential for constraints. Some options presented in SPOP, for example the Feeder 28 duplication between Milford Haven and Felindre, may provide wider system security benefits because they may mitigate wider gas system security of supply issues such as those presented in the GSSA.

In our GOA analysis, we focussed on the sufficiency and resilience of the NTS to support entry and exit capacity arrangements. To do so, we assessed the reduction in constraint days to give a measure for how much impact each option has on network security of supply. This is a narrower focus than the security of supply metrics considered in GSSA, which consider risks on the wider gas system including for example upstream supplies and imports.

We analysed the reduction over a 5 and 10-year period against a 'do nothing' option (Base Case). The scoring system for this is defined as:

- 95-100% reduction in potential constraint days (labelled as a high benefit)
- 85-94% reduction in constraint days (medium-high benefit)
- 75-84% reduction in constraints days medium-low benefit)
- Less than 75% reduction in constraints days (low benefit)

The table summarises the options reduction in constraints for the FES2025 net zero pathways and Falling Behind.

Option	Constraint days				Framework scoring (benefit)
	2029/30		2034/35		
	Net zero pathways	Falling Behind	Net zero pathways	Falling Behind	
Base Case	21	21	31	27	
A	5	5	9	7	Low
B	4	5	8	6	Low-Medium
C	3	3	6	4	Low-Medium
D	1	1	2	1	High
G	1	1	3	2	Medium-High
H	1	1	3	2	Medium-High
K	3	3	7	5	Low-Medium
V	1	1	2	1	High
W	1	1	2	1	High

Option A

Our assessment of Option A scored a low rating as the reduction of potential constraint days were reduced by 74%. While a new build 9km pipeline between Wormington and Honeybourne AGI reduces constraints, the addition of other investment components such as the 2km pipeline build, Feeder 28 MOP uprating and Churchover modification, reduces the potential of constraints further.

Option B

Our assessment of Option B scored a low-medium rating as the reduction of potential constraint days were reduced by 77%. While the new build of a 2km pipeline between Churchover compressor tee and multi-junction, and 9km pipeline between Wormington and Honeybourne AGI reduces constraints. The addition of other investment components such as Feeder 28 MOP uprating and Churchover modification reduces the potential of constraints further.

Option C

Our assessment of Option C scored a low-medium rating as the reduction of potential constraint days were reduced by 84%. While the new build of a 2km pipeline between Churchover compressor tee and multi-junction, 9km pipeline between Wormington and Honeybourne AGI, and uprating of Feeder 28 (Felindre to Three Cocks AGI) reduces constraints. The addition of investment component of Churchover modifications reduces the potential of constraints further.

Option D

Our assessment of Option D scored a high rating as the reduction of potential constraints days were reduced by 95%. The new build of a 2km pipeline from Churchover compressor tee to multi-junction, a 9km pipeline between Wormington and Honeybourne AGI, the uprating of Feeder 28 (Felindre to Three Cocks AGI) and Churchover modifications, provided a high level of constraint reduction across all options.

Option G

Our assessment of Option G scored a medium-high rating as the reduction of potential constraints days were reduced by 93%. The investment component of the new build 26km pipeline Tirley AGI to Alrewas multi-junction decreases constraints. This is because it is generally not as effective as combination of investment components of Option D.

Option H

Our assessment of Option H scored a medium-high rating as the reduction of potential constraint days were reduced by 93%. The investment component of the new build Churchover compressor 15MW unit is not as effective as Option D, this is due to the limitations of Churchover compressor station without doing the modifications proposed in Option D.

Option K

Our assessment of Option K scored a low-medium rating as the reduction of potential constraint days were reduced by 82%. The investment component of the 9km pipeline between Wormington and Honeybourne AGI, and uprating of Feeder 28 (Felindre to Three Cocks AGI). The additional components in Option D reduce these further.

Option V

Our assessment of Option V scored a high rating as the reduction of potential constraints days were reduced by 95%. However, we note that the addition of the new-build 26km pipeline Tirley AGI to Alrewas multi-junction, to the elements included in Option D, did not reduce the potential constraints any further that the reductions provided by Option D.

Option W

Our assessment of Option W scored a high rating as the reduction of potential constraints days were reduced by 95%. The addition of the Feeder 28 pressure uprating (Milford Haven to Felindre) decreased constraints compared to Option H.

Annex D: GOA Methodology Consultation – Stakeholder Feedback

In May 2025, NESO launched a public consultation for the GOA Methodology. The feedback we received was invaluable in helping us understand the perspectives of our stakeholders. These responses shaped the final GOA Methodology[46], which was published in September 2025.

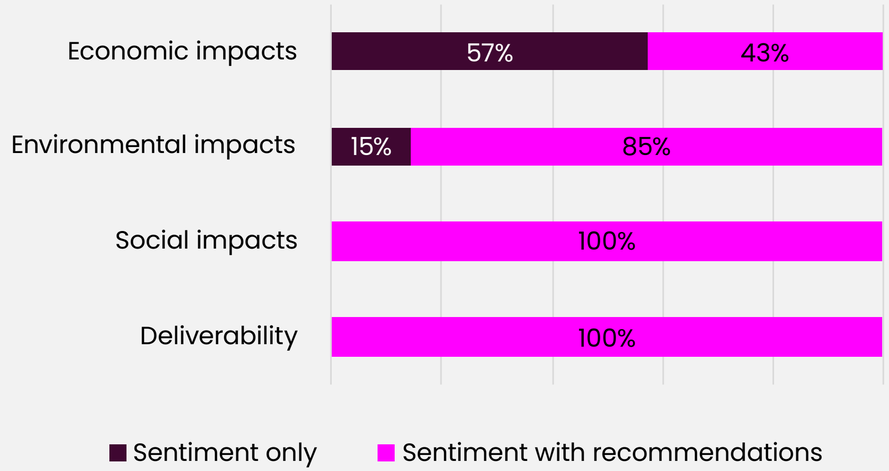
Annex C provides an overview of the consultation, summarises stakeholder feedback, and how it was incorporated into our final methodology.

Consultation overview

Our consultation participants provided a breadth of valuable feedback and insight about our draft methodology. Most responses provided recommendations alongside their general opinions on our assessment approach (Figure 9).

Since the consultation closed in June 2025, we assessed all the comments and, where appropriate, updated the methodology to make changes and clarifications. These are described in the following section.

Figure 9: Consultation overview



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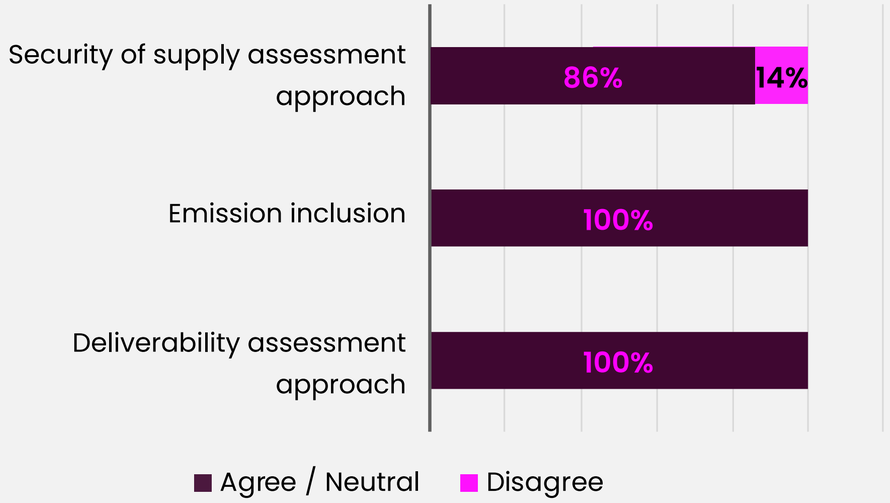
Key themes

Theme 1: There is general support for our approach to emission, security of supply and deliverability assessment

Stakeholders who responded have shown an overwhelming support for our proposal to include CO_2 equivalent emissions (CO_2e), fugitive methane emissions and NOx emissions in the environmental assessment. A majority agreed with our approach to considering the security of supply impact of a given option. Respondents were also accepting of a new framework to be used in assessing option deliverability, indicating the importance of considering both economic and non-economic factors.

Figure 10: **Response to GOA security of supply, deliverability and emission assessment approach**

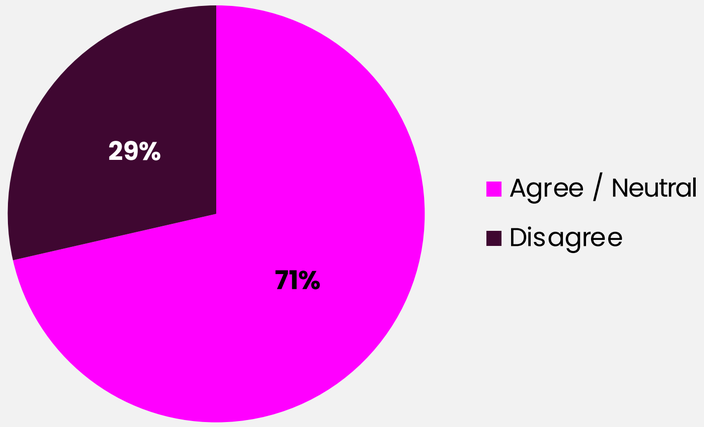


Theme 2: There are mixed views on our preferred assessment approach – NPV under the FES Holistic Transition pathway and Falling Behind

Most respondents were comfortable with our chosen approach: assessing NPV options under the FES Holistic Transition pathway and Falling Behind, with 29% providing additional comments in favour of alternative approaches. For example, participants cited the need to consider specific regional circumstances during the assessment, which the proposed approach did not reflect. Others preferred us to assess the option under Falling Behind only, to ensure security supply of the gas network.

After consideration, we decided to assess against all FES net zero pathways and Falling Behind. This allows NESO to have a greater understanding of the investment benefit. We will give a preference to the Falling Behind scenario as this is the scenario where gas demand is the largest out to 2050.

Figure 11: **Respondent view on the GOA overarching approach**



Theme 3: The inclusion of decommissioning costs in the assessment requires thoughtful consideration

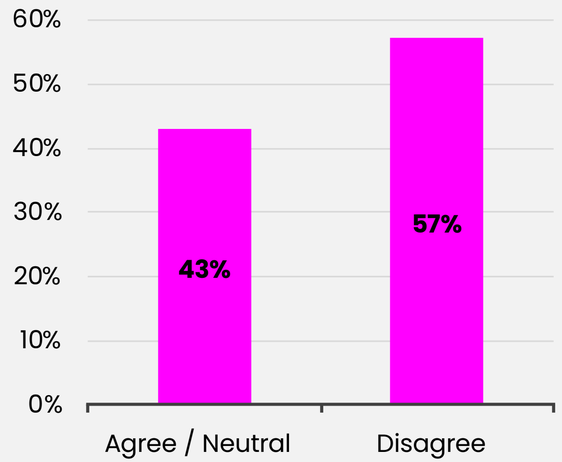
We have asked stakeholders for their opinions on whether we should include decommissioning costs in this year's assessments, with 43% agreeing with our suggestion.

Respondents agreed in principle that decommissioning costs are one of the areas that merit detailed analysis. However, the pace of the energy transition remains unknown, which was influenced by collective factors such as new technology adoption, policy position, and consumer choice.

After consideration, we have decided to keep decommissioning costs in the GOA economic assessment, as it forms part of the whole life asset cost. This is a requirement of the HM Treasury Green Book[47] assessment and part of the asset unit cost that was produced for us by the consultancy firm, Jacobs[48].

We acknowledge the uncertainty of the energy transition, and the future requirements of the gas NTS will be assessed in detail in future NESO gas network planning deliverables.

Figure 12: **Should we consider decommissioning costs in this year's assessments?**



Summary

We are grateful for the valuable feedback we have received and are committed to making the necessary adjustments to ensure the success of the development of the GOA.

Your continued input is crucial in helping us improve and refine these processes collaboratively.

You can find details of the next steps and opportunities to engage on our website: Gas Options Advice (GOA) | National Energy System Operator, or reach out to us via gwend@neso.energy

47 The Green Book and accompanying guidance | GOV.UK
48 Welcome to Jacobs | Jacobs

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