

Decision

Wormington Compressor Emissions – Final Preferred Option

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We are publishing our decision on the Wormington Compressor Emissions – Final Preferred Option. This decision has been informed by the responses we received following publication of our consultation on 5 December 2022. Alongside this document we are publishing the non-confidential responses we received in response to our consultation

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Executive summary

Wormington Compressor Emissions – Final Preferred Option

In August 2022, in compliance with Special Condition 3.11.7 of its licence National Gas Transmission submitted a Final Option Selection Report, which identified the Final Preferred Option for compliance with the Medium Combustion Plant Directive (the Directive) at the Wormington Compressor Station. The Directive requires that existing gas turbines, between 1MW and 50MW net thermal input, must not exceed an emissions limit of 150mg/m³ Nitrogen Oxide (NOx) by 1st January 2030. Neither of the two Avon gas turbine - driven compressors at Wormington are compliant with the Directive. Investment is therefore required to ensure that an appropriate level of network capability and resilience is in place from January 2030 onwards.

Network investment of this type is funded through our Gas Transmission Project Assessment Process. This process is set out in Special Condition 3.11(Compressor Emissions Re-opener and Price Control Deliverable). In the case of Wormington this involves submission of a Final Option Selection Report in August 2022 and a Re-opener application in November 2024. The Final Option Selection Report must contain a Final Preferred Option along with supporting evidence. The Authority can

- Approve the proposed Final Preferred Option
- Reject the proposed Final Preferred Option on the basis that the Authority considers no further work should go ahead at this time
- Reject the proposed Final Preferred Option and approve one of the other options in the Final Option Selection Report, or
- Reject the proposed Final Preferred Option and set out additional information that should be provided to identify the best option before a resubmission of the Final Option Selection Report.

The Re-opener application must be based on the option approved by the Authority.

Our Decision

In accordance with Special Condition 3.11.9, we propose to reject the option identified by National Gas Transmission as the Final Preferred Option (Option 10) and approve one of the other shortlisted options (Option 7) as the Final Preferred Option.

In reaching our decision we have assessed the evidence presented in the Final Option Selection Report submitted by National Gas Transmission. Our assessment was set out in our Final Preferred Option consultation published on 5 December 2022. We have also taken account of the consultation responses received in reaching our decision.

The Final Preferred Option requires the installation of a new gas turbine compressor unit, approximate size 15MW (unit size to be determined during tender event), commissioned before 1 January 2030. The new unit should be installed on a new plinth within the existing boundary of Wormington Compressor Station. In addition, one of the existing Avon units should be retained, under the 500-hour Emergency Use Derogation allowed for in the Directive, with significant asset health investment to improve unit availability. The other Avon should be decommissioned. There is no preference as to which of the existing Avons should be retained / decommissioned. The need for decommissioning should be reassessed following operational acceptance of both the new and derogated units. To ensure operation mapping alignment across all site compressors, this option will also consider the case for a VSD re-wheel during the next phase of the project.

Separately, should National Gas Transmission identify a cost effective solution, that will permit unrestricted operation of all units at Wormington Compressor Station. Then we would expect National Gas Transmission to implement that solution and seek funding as part of the next price control.

1. Introduction

Context and related publications

1.1. In August 2022, in accordance with Special Condition 3.11.7 National Gas Transmission submitted a Final Option Selection Report which identified the Final Preferred Option for compliance with the Directive at the Wormington Compressor Station. The Directive requires that existing gas turbines, between 1MW and 50MW net thermal input, must not exceed an emissions limit of 150mg/m³ Nitrogen Oxide (NO_x) by 1st January 2030. Neither of the two Avon gas turbine driven compressors at Wormington are compliant with the Directive. Investment is therefore required to ensure that an appropriate level of network capability and resilience is in place from January 2030 onwards.

1.2. Funding for network investments of this nature is secured through our Gas Transmission Project Assessment Process. This process is set out in Special Condition 3.11 (Compressor Emissions Re-opener and Price Control Deliverable). In the case of Wormington this involves submission of a Final Option Selection Report in August 2022 and a Re-opener application in November 2024. The Final Option Selection Report must contain a Final Preferred Option along with supporting evidence. The options available to the Authority are set out in the Executive Summary.

Our decision making process

1.3. We published our proposed Final Preferred Option for consultation on 5 December 2022. This document provides a summary of the responses received and our consideration of these responses. Following publication of this decision, National Gas Transmission will submit a Re-opener application with respect to Wormington Compressor Emissions in November 2024 in accordance with Special Condition 3.11.11.

General feedback

1.4. We believe that consultation is at the heart of good decision making. We are keen to receive your comments about this decision. We'd also like to get your answers to these questions:

1. Do you have any comments about the overall quality of this document?
2. Do you have any comments about its tone and content?
3. Was it easy to read and understand or could it have been better written?
4. Are its conclusions balanced?
5. Did it make reasoned recommendations?
6. Any further comments?

Please send any general feedback comments to stakeholders@ofgem.gov.uk

2. Background

Section summary

This section provides an overview of the RIIO-2 Re-opener mechanism and the Wormington Compressor Emissions Final Option Selection Report.

Overview of the RIIO-2 Re-Opener mechanism

2.1. The gas transmission network in Great Britain is planned, constructed, owned, and operated by National Gas Transmission. Economic regulation of the network follows the RIIO (Revenue = Incentives + Innovation + Outputs) price control framework. The current RIIO-T2 price control period will last five years from 1 April 2021 to 31 March 2026. Prior to commencement of the price control period, we set out in Final Determinations¹ our policy on the economic regulation of the network during the period. These policy decisions were given effect by new Special Conditions in Part C of National Gas Transmission's gas transporter licence, which came into force on 1 April 2021.

2.2. In our RIIO-T2 Final Determinations we accepted the 'needs case' for investment at several compressor stations, including the Wormington Compressor Station, to ensure compliance with the Directive. The Directive requires that existing gas turbines, between 1MW and 50MW net thermal input, must not exceed an emissions limit of 150mg/m³ Nitrogen Oxide (NOx) by 1st January 2030.

2.3. However, given the level of uncertainty at the time with respect to both the 'preferred option' and the level of funding required, we decided that these compressor emissions projects, should be funded through our Gas Transmission Project Assessment Process. This process is set out in Special Condition 3.11 (Compressor Emissions Re-opener and Price Control Deliverable).

2.4. At Final Determinations, we provided £14.83m (2018/19 prices) of baseline funding in the form of a Price Control Deliverable for the Wormington Compressor Emissions

¹ [Final Determinations - National Gas Transmission Annex revised \(10\).pdf](#)

project. The required deliverables were a Final Option Selection Report in August 2022 and a Re-opener application seeking a funding direction in November 2024. The baseline funding also allowed for long lead items to be purchased if this was necessary. The Final Option Selection Report must contain a Final Preferred Option along with supporting evidence necessary for the Authority to exercise one of the options set out in the Executive Summary. The subsequent Re-opener application must be based on the option approved by the Authority.

2.5. In August 2022, in accordance with Special Condition 3.11.7, National Gas Transmission submitted a Final Option Selection Report for investment at Wormington Compressor Station to ensure compliance with the Directive. Following consideration of the Final Option Selection Report, we published our proposed Final Preferred Option for consultation on 5 December 2022. The consultation period closed on 9 January 2023, by which time we had received six responses. In reaching our decision we have given due consideration to these responses.

Final Option Selection Report

2.6. Wormington Compressor Station comprises two Siemens Avon gas turbine compressors (Units A and B) and one Siemens electric-driven Variable Speed Drive (VSD) compressor (Unit C). The three units operate in two configurations. The first configuration involves single unit operation, where either a single Avon or the VSD alone is sufficient to provide the required capability. The second configuration involves parallel operation, when two units are required because, either flows exceed 50cm/day, when both the VSD and an Avon are required or, during a VSD outage, when both Avons are used as back-up. The VSD is the lead unit with the current most common mode of operation being the VSD unit operating on its own.

2.7. Neither of the Avon gas turbines (Units A and B) are compliant with the requirements of the Directive and so an appropriate solution needs to be operational before 1st January 2030

2.8. Wormington Compressor Station plays a critical role in ensuring that gas can enter the National Transmission System through the Liquified Natural Gas (LNG) import terminals at Milford Haven in South Wales. There is also a live "Planning and Advanced Reservation of Capacity Agreement" (PARCA) request to increase entry capacity by 17% at Milford Haven

entry point. We approved the related 'needs case' in December 2021². This identified the need for network reinforcement and the continued need for compression at Wormington.

2.9. Table 1 below summarises the ten shortlisted options considered in the Final Option Selection Report to facilitate compliance with the Directive. The high-level options considered included:

- Doing nothing to reduce site emissions (counterfactual), where the existing Avons (Units A and B) are placed on Emergency Use Derogation (EUD) i.e., limited to 500 run hours per year beyond 2030
- Modification, where the existing Avons (Units A and B) are retrofit with emissions abatement technology to enable compliance, Control System Restricted Performance (CSRP), Dry Low Emissions (DLE) and Selective Catalytic Reduction (SCR)
- Building new low-emission, high efficiency gas-turbine compressor units
- Delaying the investment decision, to account for uncertainties in the energy landscape

² [Western Gas Network Project FIOC Needs Case Decision | Ofgem](#)

Option Shortlist	Unit A	Unit B	Unit C	Unit D	Unit E
1 – Counterfactual	500Hr EUD	500Hr EUD	No Change	/	/
2 - 2 x CSRP	CSRP Retrofit	CSRP Retrofit	No Change	/	/
3 - 2 x SCR	SCR Retrofit	SCR Retrofit	VSD Re-Wheel	/	/
4 – 1533 DLE + 500 Hr	1533 DLE Retrofit	500Hr EUD	No Change	/	/
5 - 2 x 1533 DLE	1533 DLE Retrofit	1533 DLE Retrofit	No Change	/	/
6 - 2 x 1535 DLE	1535 DLE Retrofit	1535 DLE Retrofit	VSD Re-Wheel	/	/
7 - New GT + 500	500Hr EUD	Decom.	VSD Re-Wheel	New GT (Greenfield)	/
8 - New GT + CSRP	CSRP Retrofit	Decom.	VSD Re-Wheel	New GT (Greenfield)	/
9 - New GT + DLE	1533 DLE Retrofit	Decom.	VSD Re-Wheel	New GT (Greenfield)	/
10 - 2 x New GT	Decom.	Decom.	VSD Re-Wheel	New GT (Greenfield)	New GT (Greenfield)

Table 1 - Options build up summary

2.10. Table 2 below summarises the output from National Gas Transmission's Cost Benefit Analysis, used to compare the ten shortlisted options. A separate analysis was carried out for each of the four Future Energy Scenarios 2021 published by the Electricity System Operator³. Unlike a more typical Cost Benefit Analysis, the Net Present Value figures produced are all negative. This is because the capital investment being considered is to ensure compliance with an environmental regulation and does not generate positive cash flows or cost reductions. The objective is therefore to minimise compliance costs over the lifetime of the investment

³ [Future Energy Scenarios 2022 | National Gas ESO](#)

NPV £m (2018/19 prices)	Steady Progression	Consumer Transformation	Leading the Way	System Transformation
1 – Counterfactual	-4,231	-639	-499	-5,960
2 - 2 x CSRP	-1,402	-442	-357	-2,114
3 - 2 x SCR	-1,298	-438	-359	-1,902
4 – 1533 DLE + 500 Hr	-1,429	-458	-362	-2,127
5 - 2 x 1533 DLE	-1,512	-485	-385	-2,179
6 - 2 x 1535 DLE	-1,509	-494	-394	-2,163
7 - New GT + 500	-897	-311	-266	-1,429
8 - New GT + CSRP	-905	-324	-279	-1,399
9 - New GT + 1533 DLE	-944	-335	-288	-1,450
10 - 2 x New GT	-854	-329	-290	-1,320

Table 2 - Cost Benefit Analysis Outputs

2.11. In addition to capital investment and ongoing asset health costs, constraint management, compressor fuel and carbon emission costs were included in the Cost Benefit Analysis. The greatest variation in costs between options and between Future Energy Scenarios were observed in constraint management costs.

2.12. The Final Option Selection Report also included a Best Available Technique assessment summarised in Table 3 below.

BAT Assessment	VSD Unavailable	VSD Available
1 – Counterfactual	42%	46%
2 - 2 x CSRP	43%	47%
3 - 2 x SCR	58%	63%
4 – 1533 DLE + 500 Hr	40%	66%
5 - 2 x 1533 DLE	55%	66%
6 - 2 x 1535 DLE	59%	75%
7 - New GT + 500	44%	89%
8 - New GT + CSRP	51%	89%
9 - New GT + DLE	67%	89%
10 - 2 x New GT	79%	85%

Table3 BAT Assessment

2.13. The output from the Cost Benefit Analysis was subject to a sensitivity analysis and stress test, which demonstrated that the lead option (the option with the highest Net Present Value) was unchanged except in circumstances where constraint management

costs were reduced by 80%. A Real Option Analysis with the installation of a second new gas turbine delayed until 2035 demonstrated that there would be a minimal impact on the outputs from the Cost Benefit Analysis.

2.14. Based on this analysis National Gas Transmission's Final Option Selection Report identified Option 10 with two new gas turbines installed on a new plinth at the Wormington Compressor Station as its Final Preferred Option.

Our proposed Final Preferred Option

2.15. On 5 December 22 we published a consultation setting out our assessment of the evidence presented in the Final Option Selection Report. We proposed to reject the option identified by National Gas Transmission but instead proposed to approve Option 7 with one new gas turbine installed and the retention of an existing Avon operated under the Emergency Use Derogation as Ofgem's Final Preferred Option.

2.16. Separately we indicated that should Dry Low Emissions retrofit technology become available we would expect National Gas Transmission to carry out the retrofit of the derogated Avon and we would seek to identify an appropriate funding mechanism.

2.17. The consultation period closed on 9 January 2023, with six responses being received. These have been published alongside this decision.

3. Summary of responses and our view

Section summary

This section contains a summary of the responses we received and our views on the various issues raised.

Responses to specific questions

Question 4.1: Do respondents agree with our assessment that, assuming a 50:50 split between constraint management tools, capacity buy back and locational action, is not supported by the available evidence? What do respondents believe would be a more appropriate assumption?

3.1. One respondent (NGT) commented on this question. Disagreeing with our assessment and arguing that the 50:50 assumption was appropriate if not an underestimate of the likely role of capacity buy backs. While agreeing that historically locational balancing actions had been effective in managing network constraints, this was unlikely to be the case in the future, with constraints being both more severe and frequent. It was argued that entry at Milford Haven was unlikely to respond to the price signals provided by locational balancing actions, due to the high cost of delaying off-loading by LNG supply vessels. In support of this argument, the respondent cited a response to our consultation on the Western Gas Networks FIOC Needs Case, in which it was estimated that diverting a vessel would cost in the region of £2.3m to £3.9m.

3.2. This respondent noted that insufficient investment that failed to provide the required level of network capability and resilience, increased the likelihood of longer lasting and larger constraints. This would not be an appropriate outcome, given the increasing role of LNG in the energy mix.

Our View

3.3. As no quantitative analysis was offered in support of the arguments presented, we believe it is appropriate to give more weight to the historical data.

3.4. We note that, accepting the assumptions proposed by National Gas Transmission, System Transformation as the central case with a 50:50 split between constraint management tools, results in a negative Net Present Value of -£1,320m under Option 10, a figure that would seem to justify even more network investment to avoid constraints. Under these assumptions, the benefit of Option 10 over Option 7 is an increase in Net Present Value of £109m (7.6%), indicating that the variance in the absolute level of network constraints between the two options is small. We estimate that this variance is circa 11%⁴. We therefore believe that, given the uncertainty surrounding the assumed split between commercial tools and the impact this has on the level of constraint management costs, the focus should be on the percentage variance rather than absolute Net Present Value figures.

3.5. We encourage National Gas Transmission to develop a more robust approach to forecasting this key assumption underpinning the Cost Benefit Analysis.

Question 4.2: Do respondents agree with our assessment that the VSD available is the correct BAT assessment to use when comparing the shortlisted options?

3.6. One respondent (NGT) Commented on this question, clearly stating that both the VSD Available and VSD Unavailable BAT assessments had been considered as part of the option selection process. This respondent did not agree that VSD Available should be used as the primary scenario in decision making for back-up compression.

Our View

3.7. We acknowledge that both BAT assessments had been considered as part of the option selection process. The relative weight given to each of these assessments should reflect how the VSD operates and how reliable the machine is. In this instance, the VSD availability figure was estimated to be 87% and this figure has been used in the Final Option Selection Report and analysis submitted.

⁴ See discussion Impact on Wholesale Gas Prices

Question 4.3: Do respondents agree with our assessment of the evidence presented in the FOSR?

Future Energy Scenarios and Base Case Scenario

3.8. Three respondents (NGT, SGN and Cadent) provided comments on Future Energy Scenarios. All three noted that our assessment, that it was not *'appropriate to characterise System Transformation as the base case scenario'* and that *'no individual scenario is more probable than another'* appeared inconsistent with the approach taken in RIIO-ED2.

3.9. One respondent (Cadent) was of the view that such inconsistency when assessing investments is likely to hamper progress to net zero. They stated that our approach to Future Energy Scenarios was the key factor in our proposal to reject the Final Preferred Option favoured by National Gas Transmission. They also stated that we had proposed an option that potentially could not deliver sufficient resilience post 2040. This indicated a willingness to trade-off system resilience in favour of low regret investment for net zero.

3.10. Another respondent (NGT) expressed concerns about assumptions in the Future Energy Scenarios, which are a key input into the quantitative option selection analysis. These concerns related to both future demand for natural gas and more particularly the level of LNG imports.

3.11. This respondent argued that decreases in annual gas demand in both the Leading the Way and Customer Transformation scenarios are unrealistic considering current consumer behaviour and lack of incentives. For example, the installation of heat pumps is below the target level. Given this, the higher gas demand scenarios, Steady Progression and System Transformation, provide a more realistic outlook for demand.

3.12. This respondent added that anticipated LNG imports in Future Energy Scenarios do not reflect either the current reality or credible forecasts. The maximum import level in any Future Energy Scenario is 11bcm per year. However, credible market intelligence providers forecast annual LNG imports of double that level at 20 to 25bcm per year out to 2040, which is similar to the current level of 25bcm per year. This increase is due to the structural change in European gas market dynamics following the loss of Russian gas supply that has changed global gas trade flows. It was noted that the Future Energy Scenarios only consider domestic demand and do not take account of the National Transmission System being used to transit gas to European market, which has occurred during 2022.

3.13. This respondent believes that recent developments in gas markets have exacerbated the uncertainty around future supply and demand, underlining the key role of flexible LNG imports at entry points such as Milford Haven in assuring security of supply.

3.14. The third respondent (SGN) would welcome guidance on how Future Energy Scenarios would be used in future investment assessments. Suggesting that a weighted Net Present Value figure could be derived, based on the relative probability of each scenario. The formation of a working group to engage with stakeholders ahead of the next price control was recommended.

Our View

3.15. We do not accept that there is any inconsistency in our approach. System Transformation was used in RIIO-ED2 to anchor the calculation of the demand driver adjustment in the benchmark modelling. As noted in ED2 Final Determinations, it was chosen as a conservative option aligning with the lowest level of Low Carbon Technology (heat pumps / electric vehicles) uptake, while still being net zero compliant. The choice of the System Transformation scenario in the context of the ED2 Final Determinations does not represent Ofgem's view of expected Low Carbon Technology uptake, but instead acts to define the appropriate mix between ex ante and a suite of automatic uncertainty mechanism- funded expenditure. This will ensure RIIO-ED2 allowances flex in-period to align with actual Low Carbon Technology uptake and demand on the networks. RIIO-ED2 thus makes use of volume drivers and re-openers to fund demand-related expenditure, if Low Carbon Technology uptake turns out to be greater than the level that aligns with the System Transformation scenario.

3.16. We therefore reject any suggestion that in RIIO-ED2 we have rebased or selected System Transformation as the base case scenario, on which DNOs should base their plans.

3.17. Our approach to the appropriate use of Future Energy Scenarios in determining the Final Preferred Option is only one of several factors that have influenced our decision.

3.18. We note the concerns expressed with respect to the accuracy of Future Energy Scenarios. However, an assessment of the robustness of Future Energy Scenarios is outside the scope of this decision. We encourage National Gas Transmission to use the established annual Call for Evidence mechanism to present their arguments to assist National Grid Electricity System Operator in preparing subsequent Future Energy Scenarios. We note the evidence presented forecast a higher level of LNG imports out to 2040 than suggested by

any Future Energy Scenario. However, it would not be appropriate to give this single forecast the same weight as the current set of Future Energy Scenarios.

3.19. We do not accept the argument that Future Energy Scenarios do not take account of the National Transmission System being used to transit gas to European markets. Exports to both the island of Ireland and mainland Europe are specifically accounted for in Future Energy Scenarios. The version published in 2022 specifically state: 'We have also recently seen increases in imports of natural gas (more than what is required to meet British demand for imports) which transits through the National Transmission System for export into mainland Europe to support the re-stock of gas'.⁵

3.20. We recognise that current and future developments in energy markets may lead to Future Energy Scenarios including much higher LNG imports than they do at present. In these circumstances the question of whether it is cost effective to install a second new gas turbine at Wormington Compressor Station may need to be re-visited during a subsequent price control period. We note that the Real Options Analysis included in the Final Option Selection Report suggested that delaying the second new gas turbine until 2035 would have a minimal impact on the outcome of the Cost Benefit Analysis.

3.21. With respect to establishing a working group to discuss how Future Energy Scenarios would be used in investment assessment ahead of the next price control. Our Future Systems and Network Regulation review will include stakeholder engagement and consider the role of scenario planning.

Run Hours

3.22. One respondent (NGT) was of the view that, although run hours across each Future Energy Scenario were derived using capability and availability data as described by Ofgem, they should not be used to determine the Final Preferred Option. Future Energy Scenarios are averages over long periods and do not account for exceptional events such as, geopolitical events causing major disruption in European gas markets, or extended unplanned outages of the VSD. During 2022 for example run hours for all three units at Wormington Compressor Station exceeded 1,000 hours. Historical run hours do not reflect

⁵ page 121 <https://www.nationalgaseso.com/document/263951/download>),

how the National Transmission System is being utilised in response to the curtailment of gas supplies from Russia.

3.23. As an illustration, unit run hours were forecast under four potential scenarios. Table 4 below shows that the required run hours on the third unit exceeds 500 hours under normal operating circumstances (3rd unit not restricted to 500hrs Emergency Use Derogation).

Annual Flows	Availability	Forecast Run Hours 2022		
		VSD	New GT	3rd Unit
Current Year + PARCA	RAM Model	2,265	2,354	612
Current Year	VSD 7 mth outage	909	1,620	1,071
Current Year + PARCA	VSD 7 mth outage	1,322	2,354	1,556
Current Year + PARCA	RAM Model - 5%	2,152	2,237	843

Table4 Forecast Run Hours (network capability current + WGN upgrade)

Our View

3.24. The probability based modelling used in preparing the Final Option Selection Report should ensure that the impact of exceptional events is reflected in the analysis. For example, compressor availability figures reflect both the probability and duration of unplanned outages over an extended period of operation. By their very nature exceptional events are unpredictable and no modelling exercise can hope to capture this fully. In building a network, a balance must be struck between cost and the ability of the network to meet potential future events. The National Transmission System is designed to meet 1 in 20 peak day demand rather than for instance 1 in 35 peak day demand.

3.25. The predicted running hours for options in which one of the Avon units is retained under the Emergency Use Derogation indicate that for all Future Energy Scenarios prior to 2040 there is considerable headroom for the derogated unit to increase run hours and still be within the 500-hour limit⁶. Consequently, we do not believe that retaining an Avon under the derogation exposes consumers to an undue level of risk.

⁶ Table 7 [Consultation Wormington Compressor Station – Final Preferred Option 5 December 2022](#)

3.26. We note the evidence presented in Table 4 and recognise that these may be plausible scenarios reflecting exceptional events. However, we must give more weight to the systematic analysis presented in the Final Option Selection Report when determining the Final Preferred Option.

Resilience

3.27. One respondent (NGT) was of the view that our proposed Final Preferred Option in which the retained Avon is operated under the Emergency Use Derogation, with running hours restricted to 500 hours per year, underplayed the role of resilience at Wormington Compressor Station. These restricted run hours would be reserved for commercial entry constraint management, removing it from standard operation. Resulting in insufficient resilience for the other two units. An outage of the VSD in early 2022 resulted in both of the existing Avon units running for more than 500 hours during 2021/22 (Unit A 1,207hrs Unit B 837hrs).

3.28. Although planned asset health investment will increase the availability of the VSD to 86.6% this does not remove the need for planned outages or the possibility of unplanned outages due to failure. There are seven Siemens VSD units operating on the National Transmission System. Experience of major failures is that they result in extended outages as repair time, including mobilisation of spare parts, may last for months. Minor failures also require spares to be ordered. Spares could be held to improve availability but these need to be unit specific.

3.29. This respondent noted that 500 hours equated to 21 days of operation and that although the restriction was calculated as a rolling average over five years the maximum run hours in any year was 750 hours. Restricted hours would also negatively impact the availability of the unit as faults would only be detected when operating.

Our View

3.30. We recognise that an availability figure of 86.6% does not remove the potential for unplanned outages that take a considerable time to resolve. An availability figure reflects both the probability and duration of such outages over an extended period of operation. The use of availability data in the calculation of network constraints means that both planned and unplanned outages of extended duration are properly reflected over the assessment period. It is just that the impact is spread over the assessment period rather than occurring in discrete events. We expect that, in calculating the VSD availability figure,

National Gas Transmission will have appropriately reflected the impact of repair time on outage duration, and we do not challenge the use of the values or approach taken.

3.31. We recognise that the restriction on run hours required by the Emergency Use Derogation will reduce the operational flexibility of Wormington Compressor Station and, in exceptional circumstances, that this may result in network constraints that could have been resolved in the absence of the restriction. The Final Option Selection Report identified two technologies (Dry Low Emissions, Control System Restricted Performance) that could potentially offer a cost-effective alternative to derogation. We expect National Gas Transmission to pursue these and other cost-effective options that would allow all units at Wormington Compressor Station operate without any restriction on run hours. The objective should be to have a viable solution implemented during the next price control.

Impacts on Wholesale Gas Prices

3.32. One respondent (NGT) noted that, although the Cost Benefit Analysis considered constraint management costs, it did not consider the potential impact of constraints on wholesale gas prices. Based on market analysis it was estimated that, under current market conditions, a reduction in LNG supplies from Milford Haven of 10-15 mcm/day for a period of five days would result in a wholesale gas price impact of around £76m. This was set against the £40m cost of investing in a second new gas turbine.

Our View

3.33. We note that the market analysis is based on current market conditions, which might be regarded as exceptional. It would have been more appropriate to base the analysis on a period when market conditions were more typical. We recognise that similar results were observed when the analysis was repeated using forecast data for 2026. To assess whether the extra capital expenditure of £40m could be justified, based on impacts on wholesale gas prices, it would be necessary to understand the probability of such events occurring.

3.34. In any case, as demonstrated by constraint management costs, it is incorrect to assume that the installation of two new gas turbines will entirely remove the occurrence of constraints. For example, the Final Option Selection Report estimates that, for our proposed Final Preferred Option (Option 7), constraint management costs range from £235m - £2,955m depending on the Future Energy Scenario. Equivalent figures for the Final

Preferred Option favoured by National Gas Transmission (Option 10) are £214m - £2,636m⁷. The second new gas turbine therefore reduces constraint management costs by between 9% and 11%. There is no evidence that wholesale gas market impacts would follow a radically different pattern as they are also driven by network constraints reducing the supply of LNG to the market.

3.35. We accept the principle of including potential wholesale market impacts in the Cost Benefit Analysis. However, the analysis at present is insufficiently developed to be included in this assessment. We believe that the pattern of impacts between options and Future Energy Scenarios is likely to be similar to that exhibited by constraint management costs. Inclusion in the Cost Benefit Analysis is therefore unlikely to alter our assessment. We note that under the stress tests reported in the Final Option Selection Report the lead option from the Cost Benefit Analysis was only altered by an 80% decrease in constraint management costs.

Construction Outages

3.36. One respondent (NGT) was of the view that there would be fewer outages during construction and commissioning, when building two new units on a greenfield site rather than would be the case with options involving existing unit modification/retrofit. Although not a primary decision criterion, maximising availability at such a critical site that supports imports at Milford Haven should be considered a benefit to customers.

Our View

We continue to believe that the difference between options in this regard does not have a material impact on our assessment. No quantitative evidence has been presented in opposition to this view and the respondent agrees that this is not a primary decision criterion.

⁷ Table 2 [Consultation Wormington Compressor Station – Final Preferred Option 5 December 2022](#)

Question 5.1: Do respondents agree with our proposed Final Preferred Option?

3.37. None of the respondents agreed with our proposed Final Preferred Option. All those who expressed an opinion supported the Final Preferred Option identified by National Gas Transmission in the Final Option Selection Report. Respondents were of the view that, given the constrained nature of the network in South Wales, restricting the running hours of the second gas turbine to a maximum of 500 hours per annum under the Emergency Use Derogation represented an inappropriate reduction in network resilience. The reduction in network resilience could reduce security of supply and increase constraint management costs. Concern was also expressed about negative impacts on the expected increase in network capability and resilience required by the PARCA.

Our view

3.38. Having considered the responses received we continue to believe the Final Preferred Option proposed in our consultation document was correct. We recognise that the Emergency Use Derogation will reduce operational flexibility and in exceptional circumstances could result in additional network constraints. However, we believe that there are potentially viable cost-effective technologies which may become available in the next 5 years that would permit unrestricted operation. These should be pursued by National Gas Transmission for implementation during the next price control.

3.39. We recognise that current and future developments in energy markets may lead to Future Energy Scenarios including much higher LNG imports than they do at present. In these circumstances, installation of a second new gas turbine may become appropriate. We recognise that this may mean that some of the asset health investment envisaged in our Final Preferred Option might become stranded. We believe this is an appropriate level of risk. Not installing a second new gas turbine reduces capital expenditure by £44m, reducing this by the required asset health expenditure, the net reduction in installed costs will still be significant.

3.40. The increase in system entry capacity resulting from the PARCA was included in National Gas Transmission's network capability analysis and has therefore been appropriately reflected in the analysis and our decision.

Question 5.2: Do respondents agree with our proposals with respect to Avon Dry Low Emissions Retrofit technology?

3.41. One respondent (South Hook LNG) welcomed our proposal that, if it should become available, Dry Low Emissions technology should be retrofitted to the retained Avon operating under the Emergency Use Derogation. This would remove the restriction on running hours and so improve network resilience. This respondent was of the view that, although an Avon Dry Low Emissions retrofit would have lower availability than a new gas turbine, it is probably sufficient to provide the required resilience for a “backup” compressor. However, as the technology is not yet proven or commercially available, this respondent questioned whether an investment decision should be made based on potential future solutions.

3.42. Another respondent (NGT) was of the view that lower availability was not appropriate at a critical site such as Wormington Compressor Station. In addition, long term operation of an existing Avon increases risk due to age related fatigue, loss of engineering experience, dwindling support, lack of field service capability, minimal OEM support, low spares availability (often refurb only) and an inability to purchase OEM long term support packages. The reduction in site resilience would exacerbate constraint risks and negatively impact security of supply.

3.43. This respondent did not agree with our view that the availability penalty applied to a Dry Low Emissions retrofit would decrease over time.

Our View

3.44. The three units at Wormington Compressor Station operate in two configurations. The first configuration involves single unit operation, where either a single Avon or the VSD alone is sufficient to provide the required capability. The second configuration involves parallel operation, when two units are required because, either flows exceed 50cm/day, when both the VSD and an Avon are required or, during a VSD outage, when both Avons are used as back-up. The VSD is the lead unit with the most common mode of operation being the single unit configuration.

3.45. Table 5 below sets out the availability data taken from the site availability model submitted as part of the Final Option Selection Report. This shows that, for single unit operation, overall site availability is unaffected by retrofitting the derogated Avon with Dry Low Emissions technology, while for parallel operation the reduction is 1%. This small

reduction is a result of the assumed availability penalty of 5% applied to an Avon retrofitted with this new technology. We continue to believe that any penalty would reduce over time as operators and manufacturers gain experience. In any case the benefits to site resilience from removing the restriction on running hours outweighs the slight reduction in site availability.

3.46. This availability model also indicates that installing two new gas turbines (Option 10) will only deliver a small improvement in overall site availability when compared to our Final Preferred Option (Option 7). For single unit operation, the improvement is 0.2% and for parallel operation it is 2.2%. We believe the additional installed cost required to deliver this improvement in site availability is not justified by the evidence.

	Availability	
	1 from 3	2 from 3
7 - New GT + 500 hr Avon	99.7%	94.4%
8 - New GT + CSRP Avon	99.7%	94.4%
9 - New GT + DLE Avon	99.7%	93.4%
10 - 2 x New GT	99.9%	96.6%

Table5 Site Availability Model

3.47. Regarding issues relating to long-term operation of an Avon, we believe that the Avon market is sufficient large that suitable support will continue to be available into the future. Should the risks identified crystallise at some point in the future, then there will be sufficient time to take mitigating action.

3.48. For these reasons we continue to believe that, should the Dry Low Emissions technology become commercially available, it should be used to retrofit the derogated Avon.

Other issues raised by respondents

3.49. One respondent (South Hook LNG) noted that network capability is already below Milford Haven Obligated Baseline Entry Capacity for significant parts of the year. This respondent expressed a concern that National Gas Transmission, would seek to avoid constraint management costs by seeking reductions in the volume of entry capacity it is required to release at Milford Haven, as has occurred during summer 2022 and is proposed for summer 2023. Such proposals create significant uncertainty around deliverability onto the National Transmission System and increase the probability of unnecessary diversions of LNG cargos away from Great Britain. This respondent believed that at least two cargoes

were diverted over Summer 2022 due to this uncertainty. These outcomes highlight the need for additional network investment to achieve the required capability at Milford Haven.

Our View

3.50. Reductions in the volume of entry capacity National Gas Transmission is required to release during future periods at Milford Haven is outside the scope of this decision. Any proposals that we may receive will be considered in light of National Gas Transmission's licence conditions and / or the relevant objectives set out in the Unified Network Code.

4. Conclusion

Our decision

4.1. In reaching our decision, we have assessed the Final Option Selection Report submitted by National Gas Transmission. Our assessment was set out in our Final Preferred Option consultation, published on 5 December 2022. We have also taken account of the consultation responses received in reaching our decision.

4.2. In accordance with Special Condition 3.11.9, we have decided to reject the option identified by National Gas Transmission as the Final Preferred Option (Option 10) and approve one of the other shortlisted options (Option 7) as the Final Preferred Option.

4.3. The Final Preferred Option requires the installation of a new gas turbine compressor unit, approximate size 15MW (unit size to be determined during tender event), commissioned before 1 January 2030. The new unit should be installed on a new plinth within the existing boundary of Wormington Compressor Station. In addition, one of the existing Avon units should be retained, under the 500-hour Emergency Use Derogation allowed for in the Directive, with significant asset health investment to improve unit availability. The other Avon should be decommissioned. There is no preference as to which of the existing Avons should be retained / decommissioned. The need for decommissioning should be reassessed following operational acceptance of both the new and derogated units. To ensure operation mapping alignment across all site compressors, this option will also consider the case for a VSD re-wheel during the next phase of the project.

4.4. Separately, should National Gas Transmission identify a cost-effective solution, that will permit unrestricted operation of all units at Wormington Compressor Station. Then we would expect National Gas Transmission to implement that solution and seek funding as part of the next price control.