

Gas  
Transmission

GS(M)R Review

NTS Penetration Analysis

nationalgrid



# Introduction

Following a review of the UK gas quality specification contained within the Gas Safety (Management) Regulations 1996 (GS(M)R), the HSE is currently considering whether to recommend that the lower limit for Wobbe Index should be reduced from 47.2 MJ/m<sup>3</sup> to 46.5 MJ/m<sup>3</sup>

To prepare for implementation, NGG has engaged with all terminal operators to understand which of them would want to reduce their contractual lower Wobbe limit for entry into the NTS

For those operators that wish to change, information has been sought on estimated flow volumes and Wobbe Index of gas that may be delivered during the next 5 year period out to 2027

Network analysis has been undertaken against a number of different scenarios to model the penetration of low wobbe gas into the network

# NTS Entry Points in Scope

The following NTS Entry Points have indicated that they would like to be able to access a lower Wobbe Index limit:

- **Bacton Perenco**

- **Barrow**

- **Teesside Px**

- **St Fergus NSMP**

- **Grain LNG**

- **Somerset Farm Biomethane**

In scope of network penetration analysis

Out of scope of analysis due to low volumes &/or duration expected

# Terminal Information: Bacton Perenco

The Perenco terminal receives gas from 5 offshore pipelines, 4 of which are within the current GS(M)R specification

In steady state operation, gas deliveries from Perenco are within the current GS(M)R specification

Gas delivered from the Cygnus field ( $\sim 46.5 \text{ MJ/m}^3$ ) currently requires blending to meet the current  $47.2 \text{ MJ/m}^3$  lower wobble limit

A lower wobble limit would enable flows from the Cygnus field to be delivered if other supplies into the Perenco terminal were not available

Delivery volumes are forecast to peak in 2023 at  $\sim 17 \text{ mcmd}$  from all fields, with Cygnus contributing  $\sim 8 \text{ mcmd}$

Delivery volumes are forecast to steadily decline by 2027 to  $\sim 10 \text{ mcmd}$  from all fields with Cygnus contributing  $\sim 4 \text{ mcmd}$

# Terminal Information: Barrow

**In steady state operation currently, gas deliveries at Barrow are brought within current GS(M)R specification, requiring nitrogen removal onshore**

**Spirit Energy estimates that gas could flow from Barrow at a Wobbe Index of 46.5 MJ/m<sup>3</sup> over the period 2023-27 with a peak volume of 3.4 mcmd in 2023, falling to 1.6 mcmd by 2027**

- 3.4 mcmd has been used for the purposes of the penetration analysis in summer and winter scenarios

## **Forecast outages:**

- A short-term planned outage within winter and indicatively 7 days in summer when only South Morecambe would be flowing (max volume expected of 1.2 mcmd at a Wobbe Index of 46.8 MJ/m<sup>3</sup>)
- Network penetration of lower wobbe gas would be reduced at these times due to lower flows and a higher Wobbe Index

# Terminal Information: Teesside Px

The TGPP terminal at Teesside processes gas via two trains; Train 1 receives gas from the Breagh field which is low wobbe, Train 2 processes gas from the CATS pipeline which is within current GS(M)R Wobbe range

The two streams blend ahead of a common entry point to NTS and this arrangement is planned to continue if a lower Wobbe limit were to be implemented.

Steady state production gives a Wobbe Index within the current GS(M)R range.

A lower Wobbe limit would allow the terminal to continue to flow gas if Train 2 trips and could also provide flexibility for managing planned outages of higher Wobbe fields.

For gas years 2023-2027, Px estimates the following if Train 1 only was flowing:

Peak volume over the period: 1.92 mcmd

Estimated Wobbe Index: 47.12 MJ/m<sup>3</sup>

Px forecasts this requirement for one event each year lasting between 4-20 days between 2023 and 2027 based on planned outages, plus any unplanned outage days

# Terminal Information: St Fergus NSMP

**Steady state production delivers a Wobbe Index at NTS entry within the current GS(M)R specification**

**A lower Wobbe limit could be utilised to allow production from low wobbe fields to continue in the event of extended trips or planned outages of higher wobbe fields**

**For gas years 2023-27, NSMP estimates the following low wobbe gas deliveries in the event of outages of higher wobbe fields:**

**Volume: ~ 13 mcmd**

**Wobbe Index: in the range 46.91 – 47.19 MJ/m<sup>3</sup> (the lower value has been used in the analysis)**

**Over the period 2023-27, NSMP estimate a total of 90 days (~18 days per year) on which lower Wobbe gas may arrive at the terminal under these circumstances**

**Note: The above excludes the Vesterled supply which can range between 0-36 mcmd. If Vesterled was flowing then the estimated 13 mcmd would comingle with the higher Wobbe gas at St Fergus prior to NTS entry**

# NTS Entry Points that have expressed interest in a lower Wobbe Limit which are out of scope of this analysis

## Grain LNG

- As reported to the Workgroup in June 2022, any send-out of low Wobbe gas is expected to be for a short period infrequently, estimated at <10 minutes 4-5 times per year, at low flow-rates during start-up/shutdown processes
- This period would be long enough to receive a curtailment notice from National Grid if the lower Wobbe limit was breached but we would not expect the associated volumes to be sufficient to impact downstream offtakes

## Somerset Farm Biomethane

- This entry point currently delivers ~0.4 mcmd to the network
- It has no requirement at present to deliver gas below 47.2 MJ/m<sup>3</sup> to the NTS but may wish to in the future



# Approach to the analysis

**Future Energy Scenarios (FES) network for the 2025 gas year has been used**

**From this, the supply flows are altered for the terminals that wish to reduce their lower Wobbe limit based on the forecasted values supplied**

**Flows at another terminal are correspondingly altered, to balance the network**

- A balancing point is determined by it being the furthest away, by pipeline distance

**Simulation of the formulated scenarios is then completed using the Simone model at steady state, and 'solved', i.e. meeting the upper and lower pressure limits, and with network equipment within operating envelopes**

**Thereafter, the steady state model is converted into a dynamic model, to reflect within day supply and demand variations. The model is run for a typical high demand and low demand day**

**Minimum observed Wobbe Index values are then recorded at NTS offtake points and shown whether they are above or below 47.2 MJ/m<sup>3</sup>**

# Assumptions

**All terminals have a requirement to deliver low wobbe gas on the same day**

**Where terminal operators have provided a 5 year view of forecast volumes, the highest of those volumes has been used (which all occur in 2023) to generate a credible worst case**

**Wobbe Index values used in the analysis for these terminals are consistent with those provided by the relevant terminal operators**

**Zero Vesterled gas assumed to be entering at St Fergus NSMP in all scenarios**

**All other terminals' delivery volumes are as per FES 2025 (or as may be amended to balance the network) and at a Wobbe Index equal to:**

- Their historical average from 2021/22
- The current GS(M)R minimum of 47.2 MJ/m<sup>3</sup>

# Scenarios Modelled

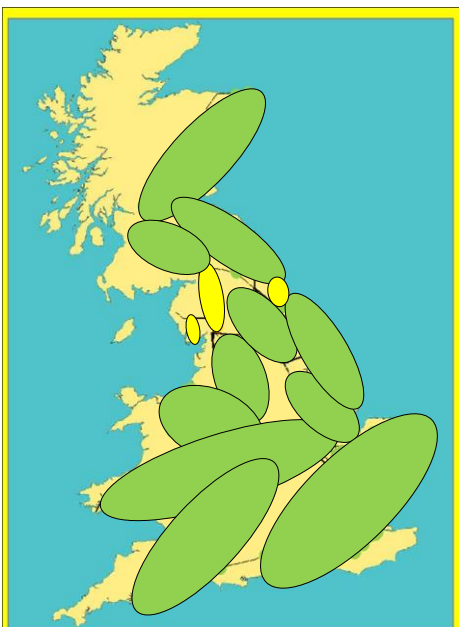
Scenario	Description
Scenario 1	<p>Bacton Perenco: Cygnus only flowing (8 mcmd) at a Wobbe Index of 46.5 MJ/m<sup>3</sup></p> <p>Barrow: All fields flowing (3.4 mcmd) at a Wobbe Index of 46.5 MJ/m<sup>3</sup></p> <p>Px Teesside: Flowing 1.92 mcmd at a Wobbe Index of 47.12 MJ/m<sup>3</sup></p> <p>St Fergus NSMP: Flowing 13 mcmd at a Wobbe Index of 46.91 MJ/m<sup>3</sup></p> <p>All other NTS entry points: Flowing forecast FES volumes in 2025 at average historical Wobbe Index</p>
Scenario 2	As scenario 1 but with all other NTS entry points flowing at a Wobbe Index of 47.2 MJ/m <sup>3</sup>
Scenario 3	As scenario 1 but with Bacton Shell and Bacton SEAL terminals at zero flow (Cygnus is the only UKCS gas being delivered at Bacton)
Scenario 4	As scenario 3 but with all other NTS entry points flowing at a Wobbe Index of 47.2 MJ/m <sup>3</sup>
Scenario 5	As scenario 3 but with Bacton interconnectors at zero flow
Scenario 6	As scenario 3 but with NSMP as the only supply at St Fergus

# Scenario 1

Barrow at 46.5 MJ/m<sup>3</sup>, Bacton Perenco - Cygnus only flowing at 46.5 MJ/m<sup>3</sup>, Teesside at 47.12 MJ/m<sup>3</sup>, and St Fergus NSMP at 46.9 MJ/m<sup>3</sup>, all other entry points flowing at their historical average Wobbe.

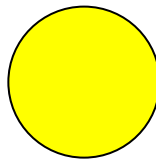
## Nodes below 47.2 MJ/m<sup>3</sup>

- Lupton (DN Offtake)
- ICI Avecia (Industrial)
- Keld (DN Offtake)
- Philips Tees (Industrial)
- Wetheral (DN Offtake)
- Melkinthorpe (DN Offtake)
- BOC Teesside (Industrial)
- BASF (Industrial)
- Barrow Black Start (Industrial)

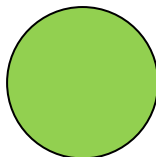


**HIGH DEMAND**  
(Typical Winter day)

46.5 – 47.2 MJ/m<sup>3</sup>

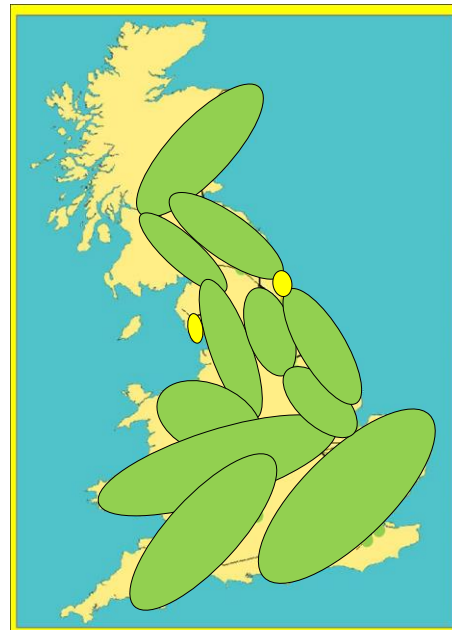


> 47.2 MJ/m<sup>3</sup>



## Nodes below 47.2 MJ/m<sup>3</sup>

- ICI Avecia (Industrial)
- Philips Tees (Industrial)
- BOC Teesside (Industrial)
- BASF (Industrial)
- Barrow Black Start (Industrial)



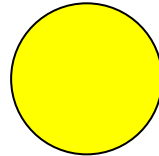
**LOW DEMAND**  
(Typical Summer day)

## Scenario 2

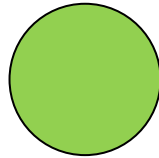
As scenario 1, except all other NTS entry points flowing at a Wobbe of 47.2 MJ/m<sup>3</sup> (GSMR minimum).



$46.5 < 47.2 \text{ MJ/m}^3$



$= 47.2 \text{ MJ/m}^3$



# Scenario 3

As scenario 1 except Shell and SEAL terminals at Bacton plus Perenco fields at zero flow (i.e. Cygnus is the only UKCS gas coming in at Bacton)

## Nodes below 47.2 MJ/m<sup>3</sup>

Lupton (DN Offtake)

ICI Avecia  
(Industrial)

Keld (DN Offtake)

Philips Tees  
(Industrial)

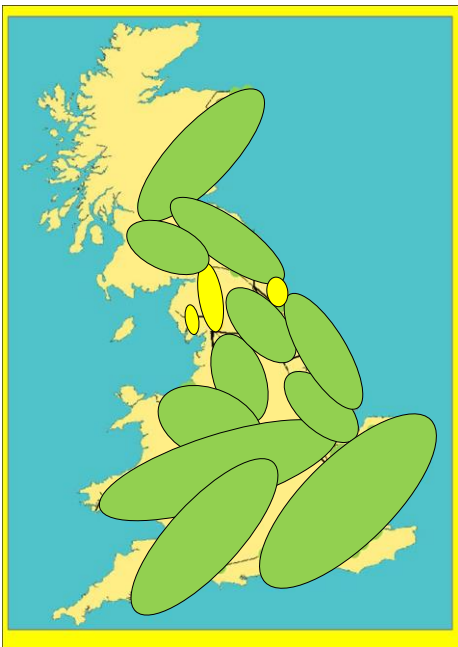
Wetheral (DN  
Offtake)

Melkinthorpe (DN  
Offtake)

BOC Teesside  
(Industrial)

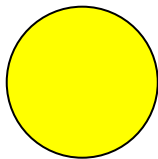
BASF (Industrial)

Barrow Black Start  
(Industrial)

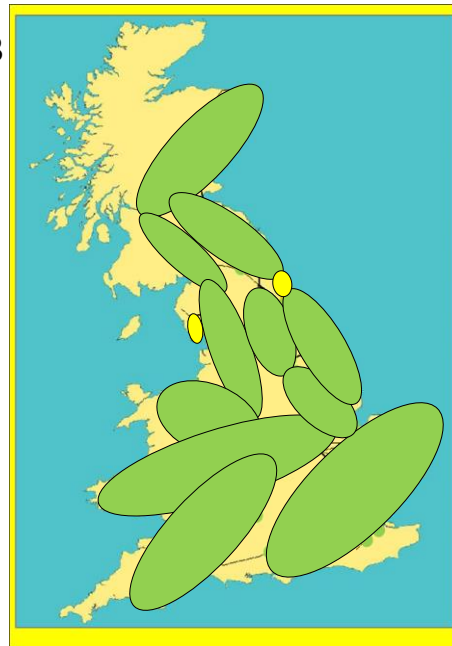
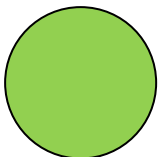


**HIGH DEMAND**  
(Typical Winter day)

46.5 – 47.2 MJ/m<sup>3</sup>



> 47.2 MJ/m<sup>3</sup>



**LOW DEMAND**  
(Typical Summer day)

## Nodes below 47.2 MJ/m<sup>3</sup>

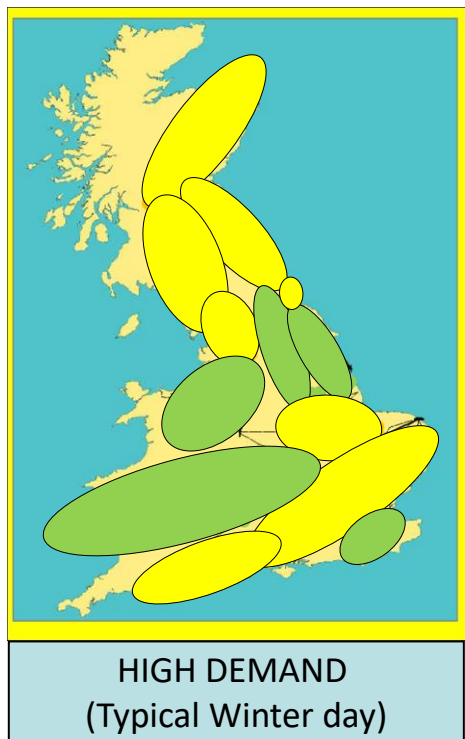
ICI Avecia (Industrial)  
Philips Tees  
(Industrial)

BOC Teesside  
(Industrial)

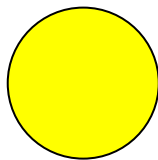
BASF (Industrial)  
Barrow Black Start  
(Industrial)

# Scenario 4

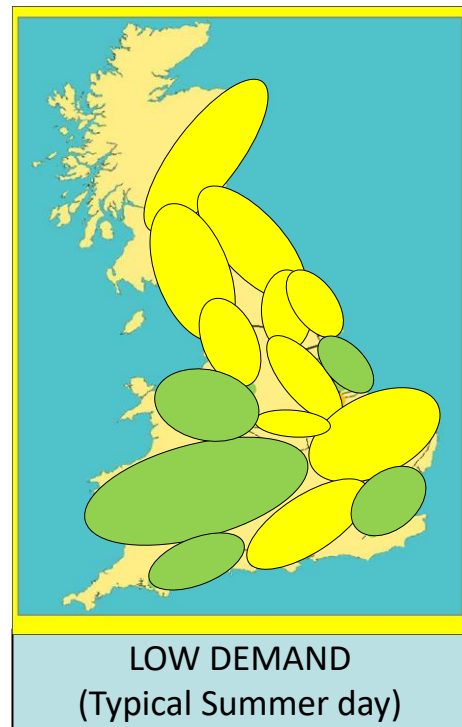
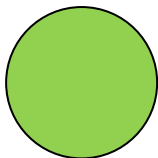
As scenario 3 but with all other NTS entry points flowing at a Wobbe Index of 47.2 MJ/m<sup>3</sup>



< 47.2 MJ/m<sup>3</sup>



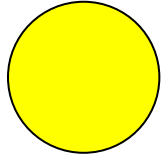
= 47.2 MJ/m<sup>3</sup>



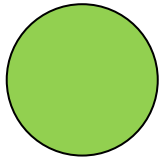
# Scenario 5

Summer day sensitivity: As scenario 3, **except Bacton Interconnectors at zero flow** (all gas from Cygnus is delivered to the NTS instead of being exported)

46.5 – 47.2 MJ/m<sup>3</sup>



> 47.2 MJ/m<sup>3</sup>



## Nodes below 47.2 MJ/m<sup>3</sup>

Brisley (DN Offtake)
Palm Paper (Industrial)
Kings Lynn (Power Station)
West Winch (DN Offtake)
Peterborough Eye (DN Offtake)
ICI Avecia (Industrial)
Philips Tees (Industrial)
BOC Teesside (Industrial)
BASF (Industrial)
Barrow Black Start (Industrial)

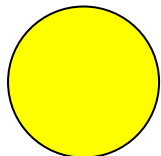


# Scenario 6

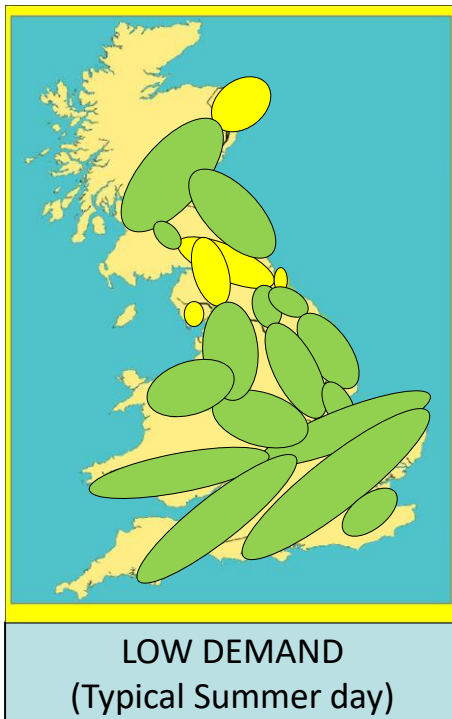
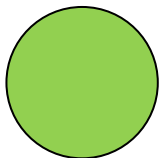
Summer day sensitivity:

As scenario 3 except **NSMP is the only supply at St Fergus.**

46.5 – 47.2 MJ/m<sup>3</sup>



> 47.2 MJ/m<sup>3</sup>



## Nodes below 47.2 MJ/m<sup>3</sup>

St Fergus (DN Offtake)
Peterhead (Power Station)
ICI Avecia (Industrial)
Keld (DN Offtake)
Aberdeen (DN Offtake)
Kinknockie (DN Offtake)
Lockerbie (DN Offtake)
Langholm (DN Offtake)
Philips Tees (Industrial)
Melkinthorpe (DN Offtake)
BOC Teesside (Industrial)
BASF (Industrial)
Towlaw (DN Offtake)
Burnhervie (DN Offtake)
Barrow Black Start (Industrial)

# Conclusions

**If the contractual lower wobble limits were reduced at these terminals, based on the terminal operators' forecasts, we do not currently expect any ASEP other than Barrow to deliver gas below the current GS(M)R lower limit of 47.2 MJ/m<sup>3</sup> in steady state operation**

**A reduction in the limit at Barrow is expected to result in offtakes in that area consuming lower Wobbe gas more regularly**

**Offtakes within the sphere of influence of Bacton, St Fergus and Teesside are expected to only be impacted when certain fields / adjacent terminals are on outage**

**We would expect any low wobble gas delivered at Bacton and St Fergus to be blended to be above 47.2 MJ/m<sup>3</sup> by other supplies at those locations on most days**