

Annex A12.02 Network Capability Report December 2019

As a part of the NGGT Business Plan Submission

Summary

In Ofgem's sector specific decision document on 24 May 2019, it stated that we should provide two reports on network capability as appendices to the business plan submission. These two reports were described as follows:

Initial Network Capability Report

- Setting out physical capability requirements of the NTS on 1 April 2021 based on user needs.

Network Capability Target Report

- Setting out user requirements for the network capability that we will deliver by the end of the RII0-2 price control period. It should also set out our longer-term forecast of levels of physical capability the NTS must provide to efficiently service user needs.

We have developed a set of metrics that allow us to meet the requirements of these two reports and, with agreement from Ofgem, have combined them into this single report – the Network Capability Report. These metrics are contained in Section 2 of this Annex.

Section 1 provides some introductory context and Section 3 provides some further supporting information and areas for further development.

A description of the stakeholder engagement we undertook in order to develop these metrics is in Annex 12.05 Network Capability Stakeholder Engagement Report.

Section 1 - Introduction

Scope

We have included the following aspects in this report:

- An outline of the approach we have taken to meeting Ofgem's requirements for an Initial Network Capability Report and a Network Capability Target Report in the new report titled "The Network Capability Report";
- A more detailed description of the rationale for the metrics, and how they meet the requirements set out by Ofgem;
- All the entry & exit metrics. These metrics are the initial and target levels of physical capability requested by Ofgem;
- Some supplementary information which may be helpful to give context on the assumptions behind the metrics/targets;
- A proposal for an enduring annual process, demonstrating that the metrics and the processes behind them have been embedded into our business planning processes and to give our stakeholders assurance that we will continue to be transparent in our investment decisions.

Overview

We have developed metrics that show the level of physical capability of the NTS at the start of RIIO-2, based on documented network analysis and stated assumptions, with the asset base that is proposed within our business plan. The metrics show how stakeholder requirements change over time and our proposal for an annual process sets out how we will deal with changing stakeholder needs during RIIO-2 and beyond.

Decommissioning assets may not have an immediate impact on the level of network capability that can be delivered. It would however reduce the resilience of the network and subsequent availability of that capability. Our business plan contains proposals to decommission assets during RIIO-2; however, there will be no material impact on the level of intact network capability delivered during RIIO-2 as a result of these proposals, i.e. the initial and target levels of network capability are the same.

The consequence of not replacing 20 compressors units impacted by environmental legislation and proposing the decommissioning of a further 7 redundant compressor units will result in a reduction in network capability during RIIO-3. We anticipate further decommissioning decisions will be taken during RIIO-3. This will be done whilst ensuring we meet customer and stakeholder requirements and any changes in Government policy such as the future of heat and the pathway to net zero. Therefore, at this stage we cannot be specific about which sites/units will be affected and when. These decisions will be made visible via the annual process that we are proposing to introduce during RIIO-1.

Metrics

The measures of network capability, and their assessment against stakeholder needs, have been developed since Ofgem set out their proposals in their sector specific consultation in December 2018. We have developed metrics based on 7 geographic zones.

The metrics included in this document represent the intact physical capability of the gas transmission network for five defined entry zones (there are no significant entry points in two additional zones) and seven defined exit zones, with the assets that are included in our business plan. They provide a framework to allow us to understand and communicate the implications of decisions in RIIO-2, RIIO-3 and beyond.

The level of physical capability has been calculated assuming all assets are 100% available; this is referred to as an “intact” network. Different combinations of compressors can be used to deliver the same level of physical capability.

Due to a combination of the need to undertake planned maintenance activities, and the fact that our assets have unplanned unavailability, the intact level of physical capability cannot be delivered 100% of the time. More information on this is provided in the “Supplementary information” - Section 3 of this annex.

We have recognised the importance of creating metrics that our stakeholders fully understand and can relate to. At their highest level, these metrics show the flows that the network can facilitate, at a range and pattern of national supply and demand combinations over a range of years from 2020 to 2050.

To deliver these metrics, we have built on data and processes that are already used by our teams and presented them in a way that is intended to show the capability of the whole network. They can also be used to show how network capability could change if assets were not available on a planned or unplanned basis.

Methodology

Given the highly integrated and interactive nature of the gas network and the inter-dependencies each entry and exit zone have on one another it is not possible to give a definitive, single number for the capability of the network or any point within it. The network capability at each entry and exit point will change depending on the local and national supply and demand balance and pattern, the starting linepack position and asset availability as well as customer behaviour on flow profiling and within day changes.

The methodologies we have set out give a good indication of network capability; the measures are repeatable, reliable and form the basis for internal and external discussion. The methodologies themselves are not included in this document but will be subject to a separate audit by Ofgem.

Our existing processes already deliver projects that have the lowest whole-life cost, are fit for purpose and meet stakeholder needs. These processes are described in our business plan and in the Gas Ten Year Statement.

Targets

When engaging with our stakeholders, we have used the term “metrics” to describe the lines on the chart that represent the network capability of the NTS. These metrics represent the range of capability of the NTS in the various zones at different levels and patterns of national demand. They are calculated using documented methodologies and assumptions and are based on the assets that we have included in our business plan.

Ofgem has asked us to propose network capability targets for our RIIO-2 plans. As such, the lines on the entry charts, and the dots on the exit charts, represent the target levels of network capability at the start and end of RIIO-2 and meet the Ofgem requirements for the Network Capability Report.

Caveats

There are some measures which, although we have assumptions associated with them and take them into account in our processes, we have been unable to develop meaningful output measures to the extent that we can share them in this business plan. These are:

- Measures of how we manage within day challenges, specifically dealing with changes to supply and demand profiles
 - Our network analysis uses assumptions about within day flow profiles; these are set out in the Transmission Planning Code. In solving the network analysis, we are therefore taking within day profiling into account. We are continuing to explore potential metrics that measure

how changes to within day behaviour link to the specific actions we undertake to continue to manage customer needs.

- Measures of how we use our assets to transfer the gas between the zones (Zonal Transfer)
 - Zonal Transfer capability is important because it is an essential part of the capability we use to operate the gas transmission network, but it is not necessarily directly linked to a specific requirement that our customers ask for. It is an indirect consequence of parties not flowing at 1/24th rates (i.e. if a party wishes to flow 24mcm during the 24 hour gas day, flowing a 1/24th rate would mean flowing 1 mcm per hour). Facilitating changes to customer flows as they optimise their commercial position in response to within day market and physical changes is a key benefit of an integrated gas transmission network.
 - Zonal Transfer involves actively moving gas between zones to mitigate planned and unplanned changes to supply and demand profiles and may involve actively depleting the amount of gas in one zone to manage a risk in another. As such we have been investigating how to measure and define the need for this, but we are not yet at a stage where we can bring forward proposals for metrics in this area.
 - Our current charts do not reflect Zonal Transfer capability and this means that some of the charts in this annex, seem to indicate capability in excess of stakeholder need. This applies in particular to the North East and North West zones. However, the pipes and compressors in those zones are used for the bulk transportation of from the zone in Scotland and into the South and as such, support Scottish entry and Southern exit capability.

Our processes and network analysis do however take account of these factors; more information can be found about this in the Transmission Planning Code.

Ongoing development

We aim to continue to work on these areas and will share any developments to test their value prior to including them in future reports. Our ability to develop a robust approach to the treatment of boundary transfer capability between zones and within day change, are areas we will seek to improve during RIIO-2. Our business plan includes baseline funding to deliver these improvements by enhancing the capability of our people, processes and IT systems.

Section 2 – Network Capability Targets

The Charts

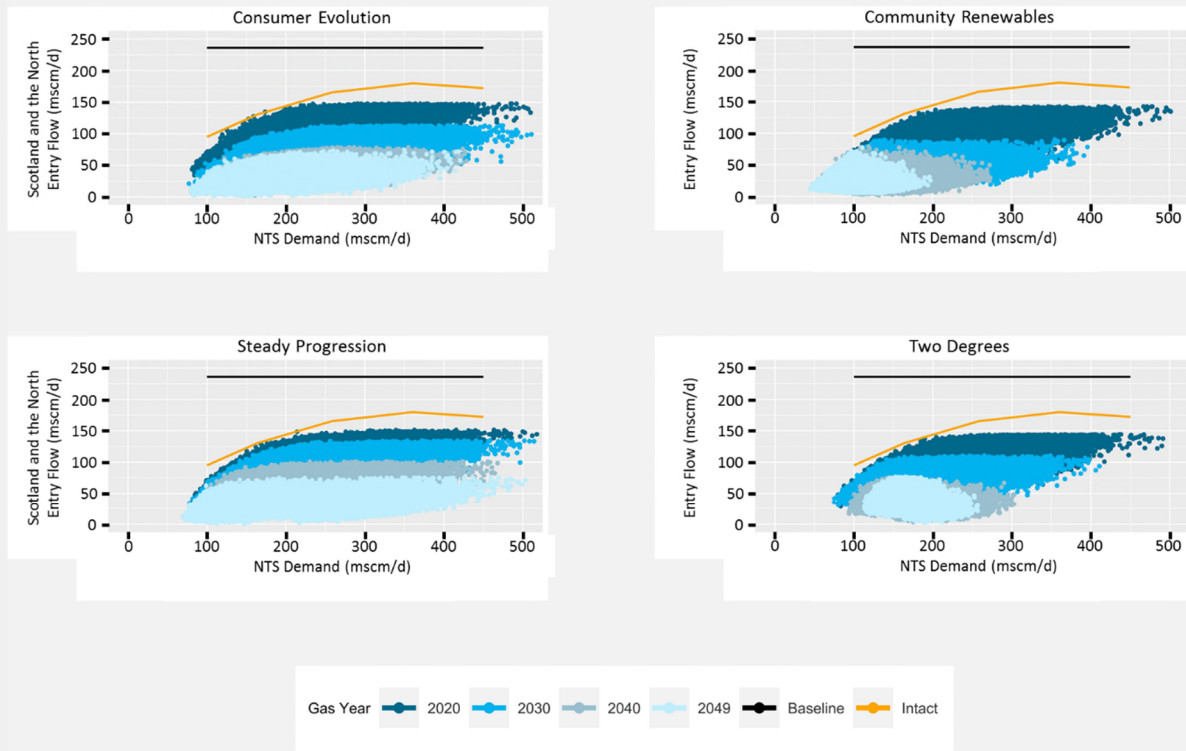
This section contains our entry and exit network capability targets. The orange lines on the entry charts and the red dots on the exit charts show the network capability of the NTS at the start and end of RIIO-2. The different shaded blue dots show the range combinations of supply and demands in different years. This information collectively meets the requirement to show how the capability of the network meets user's needs now and into the future.

We have included data from the four Future Energy Scenarios from 2018 on which the ENA common scenario was based, a requirement from the RIIO-2 Challenge Group. Showing the different combinations of supply and demand from the different scenarios allows us to focus on areas where they give a consistent message and therefore decisions can be made confidently, and where there is enough difference across the scenarios that decisions should be carefully risk assessed and/or deferred until there is additional clarity/evidence.

The network capability, Chapter 12 of our business plan, contains a description of the entry and exit metrics, and how they should be read. After each chart we have provided a short explanation on how these metrics relate to our business plan submission.

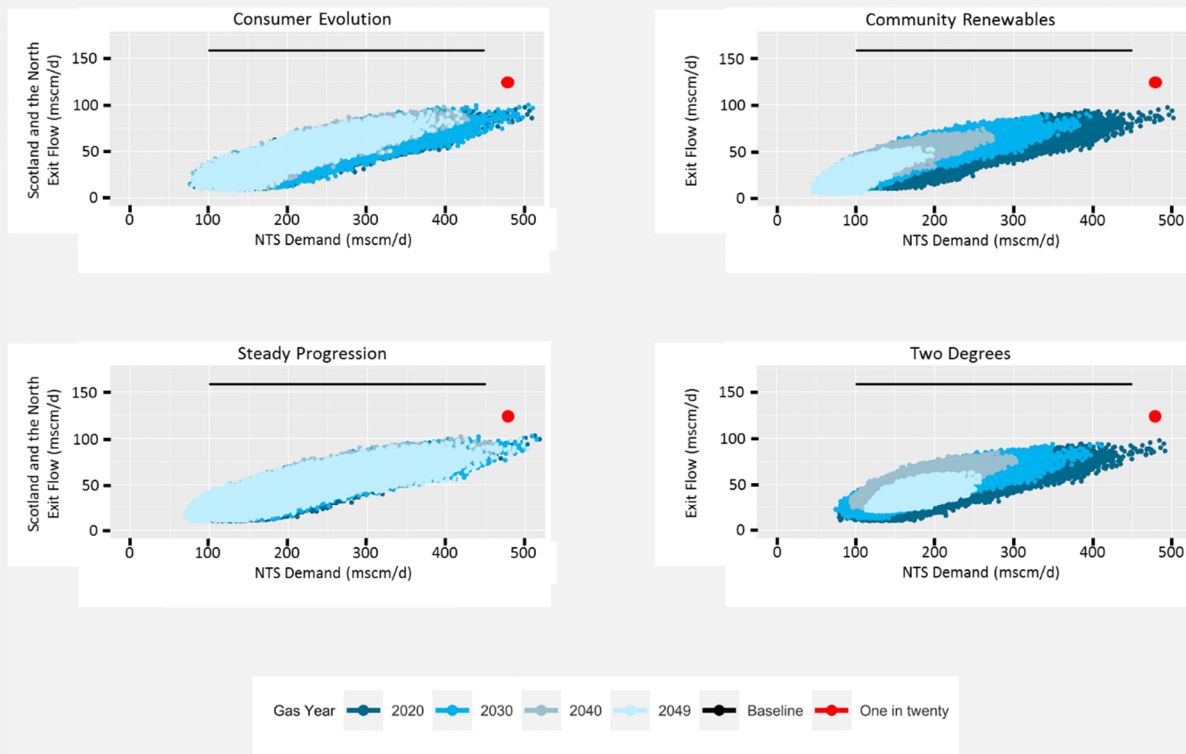
Scotland and the North

Entry Capability (St Fergus, Teesside and Barrow)



This chart shows that the level of physical capability of the intact network is broadly in line with stakeholder flows at lower demands and exceeds it at higher levels of demand. More detail on this can be found in Chapter 12 - Network Capability.

Scotland and the North Exit Capability

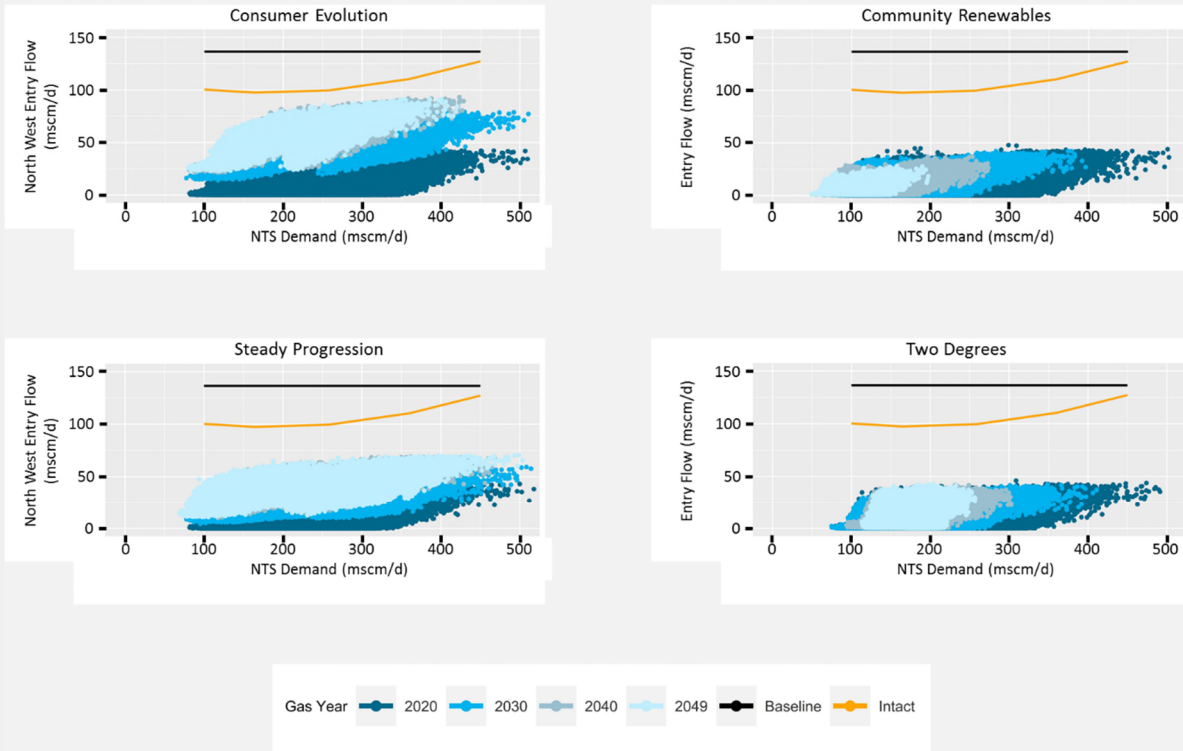


These charts demonstrate that with the assets required to meet entry requirements in Scotland and the North, we can also meet our 1 in 20 exit obligation in Scotland and the North.

To meet our exit obligations, we are dependent on St Fergus entry flows being high enough. If St Fergus flows decline, and subject to demand levels in Scotland, there is a point at which investment will be required in the NTS to re-configure certain existing compressors to push gas North and therefore ensure we can continue to meet our obligations.

North West

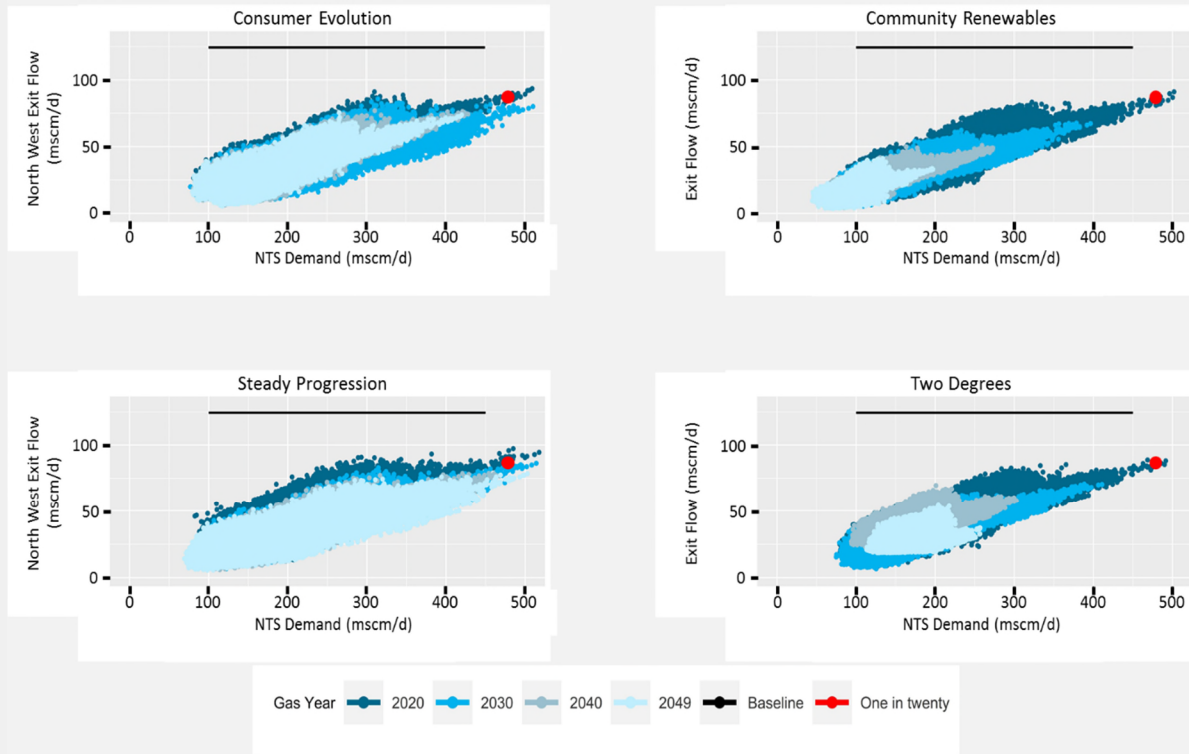
Entry Capability (including North West Storage sites)



This chart includes North West Storage entry sites, and in some future scenarios includes shale gas connections as well. The network capability of the assets in this zone is used to transport gas away from Scotland and further South into the NTS; as such, these charts cannot fully represent the capability used and valued by stakeholders or delivered by the NTS.

North West

Exit Capability (including North West Storage sites)

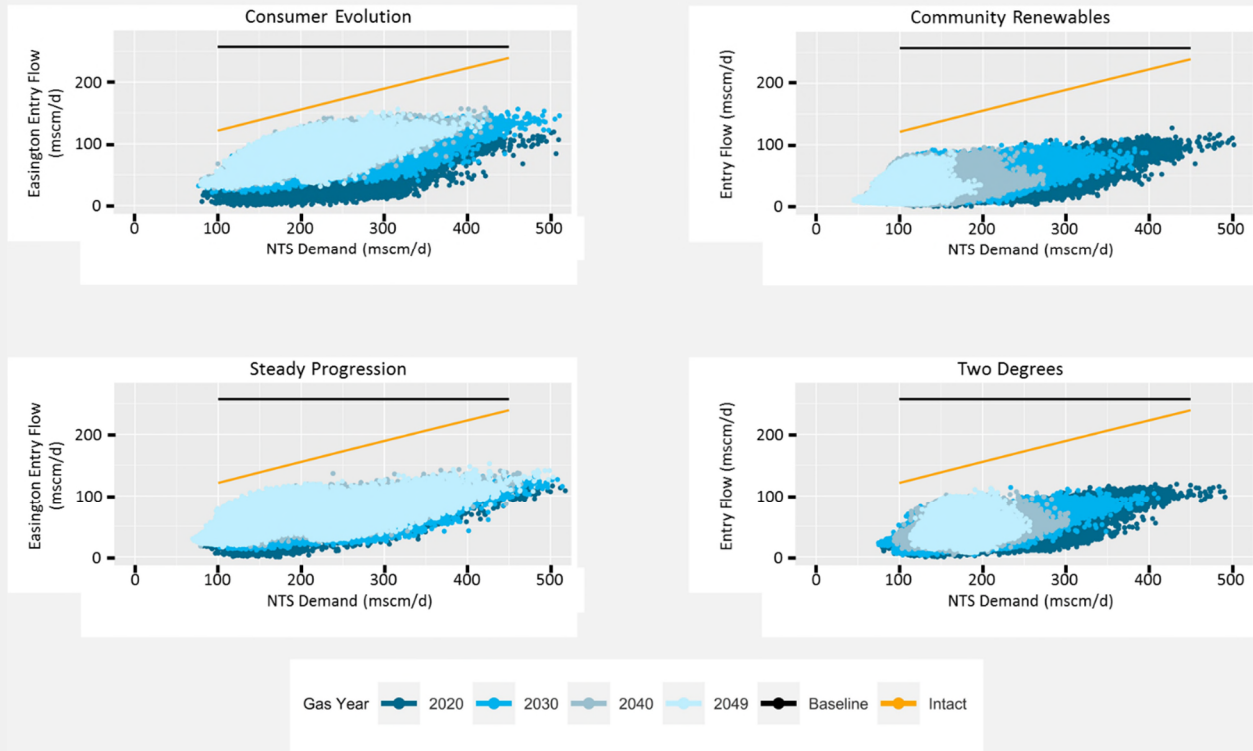


These charts demonstrate that with the assets required to meet entry requirements in the North West, we can also meet our 1 in 20 exit obligation in the North West.

In these diagrams, some exit flows are above the 1 in 20 capability level (red dot on the charts), an example explanation of this is provided in the South East section of this document.

North East

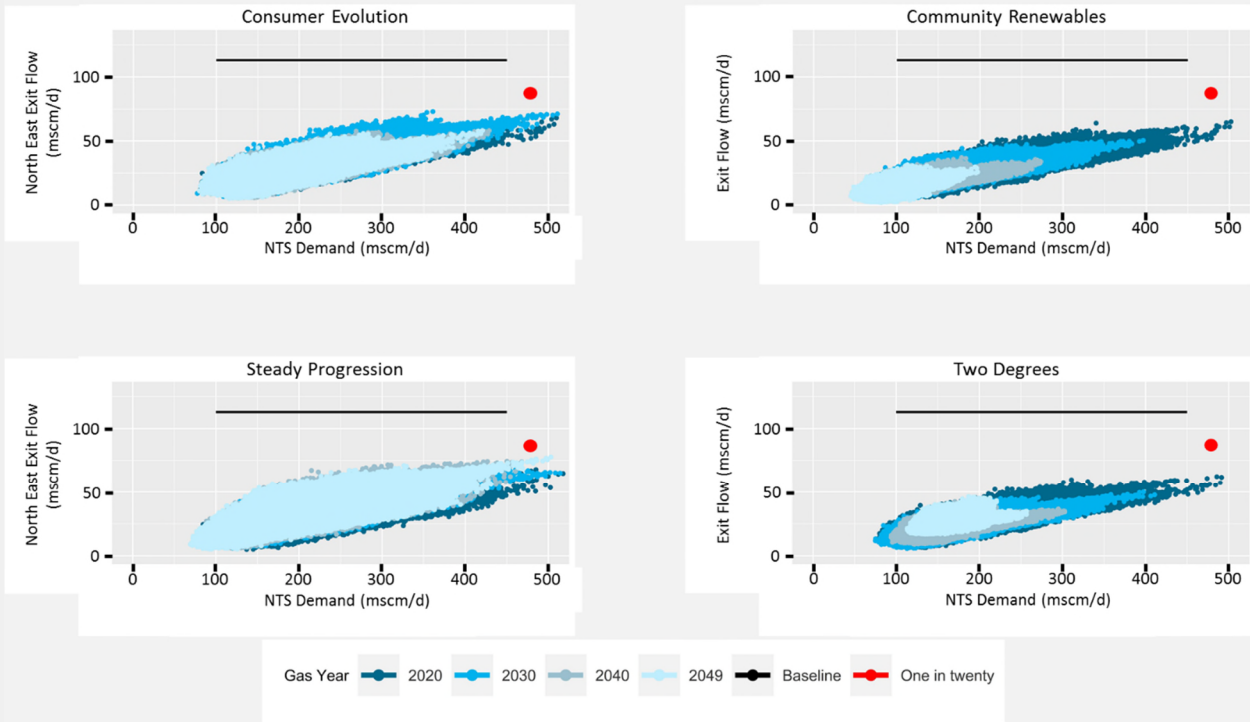
Entry Capability (including Easington, Theddlethorpe and North East Storage sites)



This chart shows that network capability exceeds forecast customer flows. This is mainly driven by the removal of the need to support storage injection caused by the recent closure of the Rough storage facility. However, the network capability of the assets in this zone is used to transport gas away from Scotland and further South into the NTS; as such, these charts do not fully represent the capability used and valued by stakeholders or delivered by the NTS.

North East

Exit Capability (including North East Storage sites)



These charts demonstrate that with the assets required to meet entry requirements in the North East, we can also meet our 1 in 20 exit obligation in the North East.

East Midlands

Zonal Treatment of Bacton

Bacton entry and Bacton exit are included in separate zones according to the movement of gas and the asset groups used to support these flows.

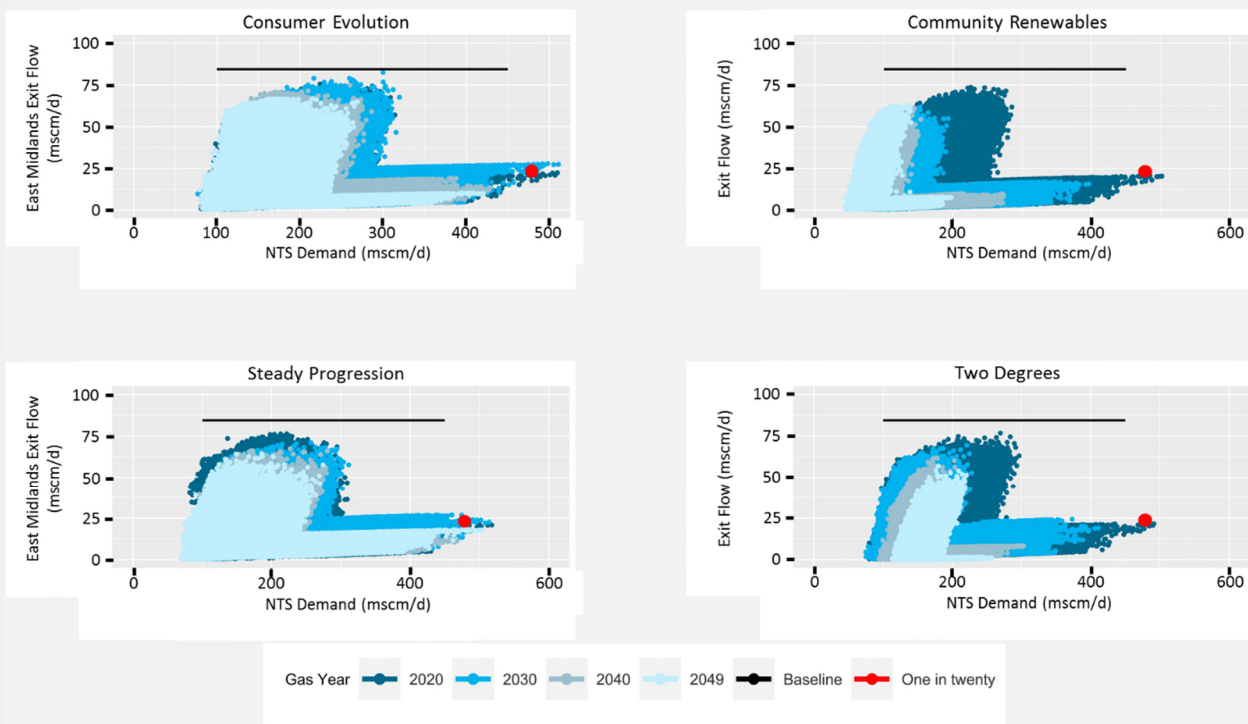
When Bacton is acting as a net exit point to Europe, this gas is supplied by moving gas from other terminals through the East Midlands and East via King's Lynn. **As such, Bacton as a net exit point is included in the East Midlands zone in our analysis.**

The South East section of this document explains why Bacton as a net entry point is included in the South East Zone.

Entry Capability

There are no entry facilities in the East Midlands zone and hence there is no entry chart.

Exit Capability (including Interconnector exports)



This zone includes interconnector exports to mainland Europe. These exports currently occur at times of low national demand (in the summer) and this accounts for the unusual shape of the stakeholder flow profiles.

For the purposes of assessing our ability to meet demand at winter peak, we assume minimum exports to mainland Europe and as such, this chart shows we can meet our 1 in 20 obligation.

We can configure the NTS differently in the summer in order to specifically deliver the export flows required by the interconnectors. This is not represented on this chart and we are considering how to demonstrate our export capability at times of low demand elsewhere on the NTS.

South East

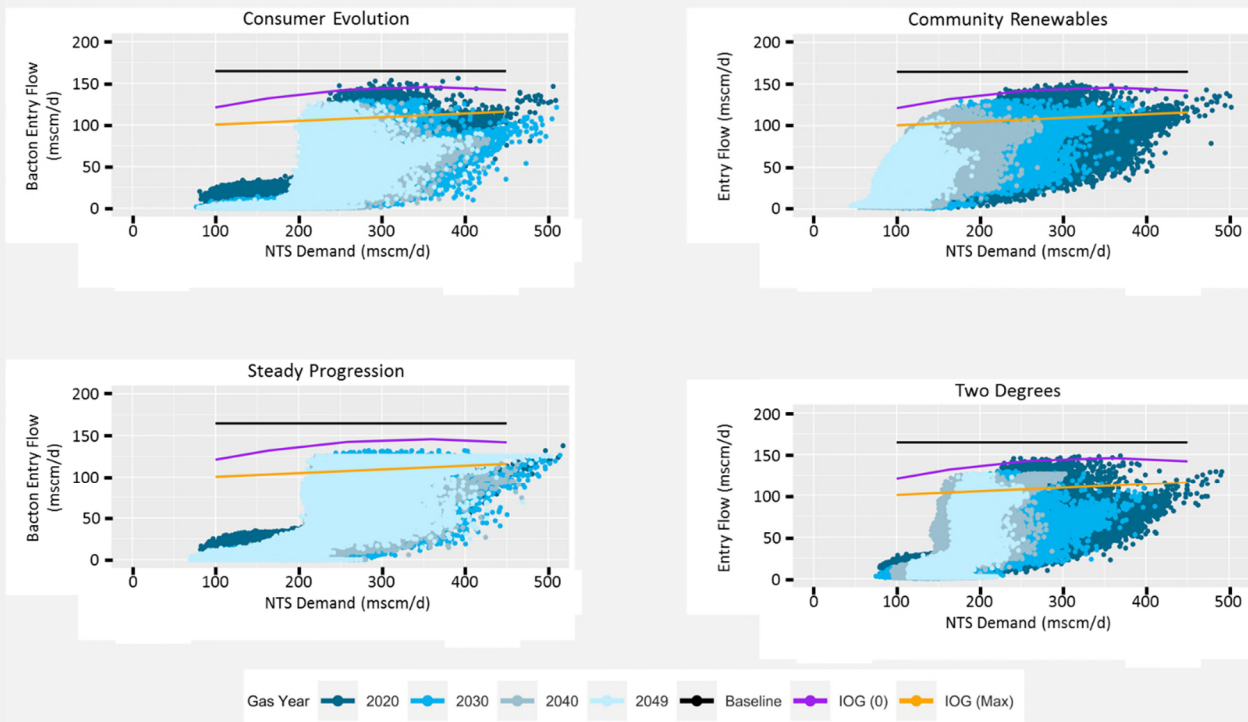
Zonal Treatment of Bacton

Bacton entry and Bacton exit are included in separate zones according to the movement of gas and the asset groups used to support these flows.

When Bacton is acting as a net entry point gas is primarily directed onto 2 pipelines that support South East demand. Any additional gas would move West, via King's Lynn, to Peterborough and support South West demand via the Southern feeder route. For this reason, **Bacton entry primarily supports South East demand and is included the South East zone alongside Isle of Grain when the terminal is net entry point.**

The East Midlands section of this document explains why Bacton as a net exit point is included in the East Midlands Zone.

Entry Capability (Bacton and Isle of Grain)

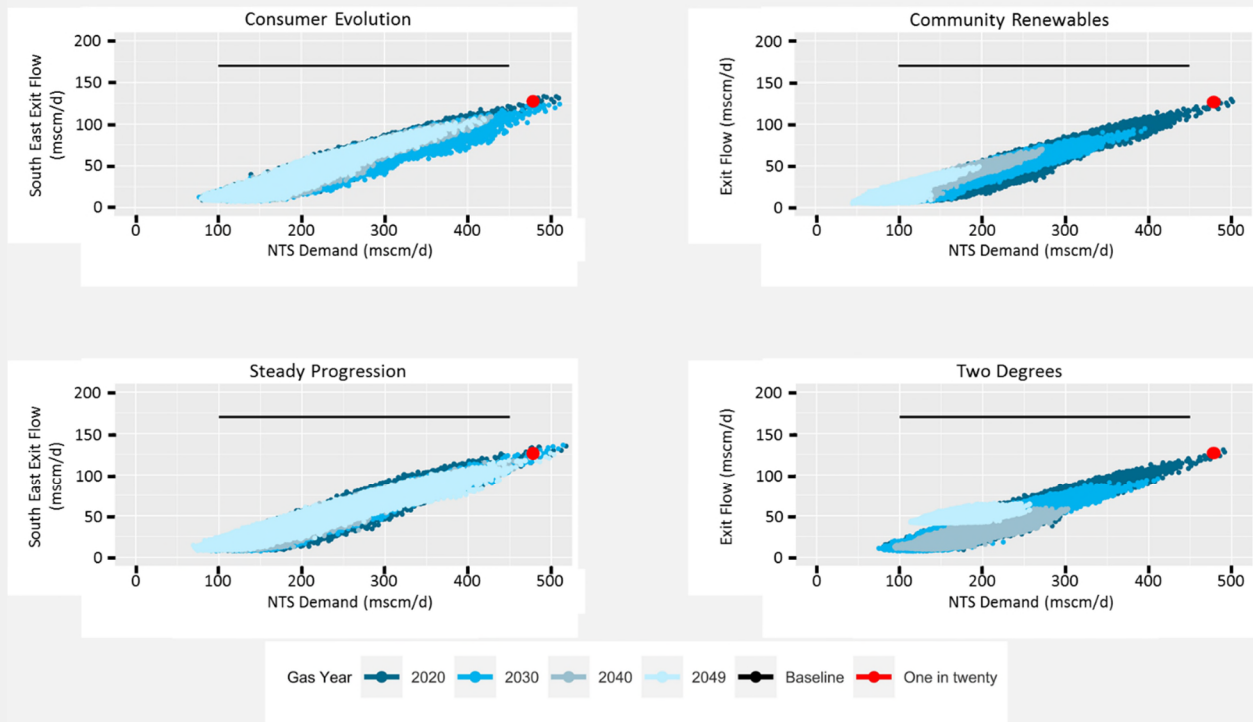


There are two entry sites in the South East, and they interact with each other. This chart shows the entry capability of Bacton in two situations; maximum flow from Isle of Grain (the orange line) and no flow from Isle of Grain (the purple line), and as such is intended to show the overarching entry capability in the South East of the NTS. We have never seen a situation with maximum entry flow at both entry points and as shown by the orange line, we have not invested to meet this situation. This leads to an inherent risk of constraints, and there have been occasions where we have scaled back interruptible capacity, and/or taken locational energy actions, in RIIO-1. We expect this risk to remain in RIIO-2.

The unusual shape of the stakeholder flows at low NTS demand represents the fact that interconnectors tend to export during summer, and this nets off any entry flows that may be seen.

The chart shows peak stakeholder flows reducing over time; this is explored further in the network capability chapter of our business plan.

South East Exit Capability



These charts show we can deliver our 1 in 20 obligations to meet peak exit flows in the South East.

Exit Flows above our 1 in 20 obligation

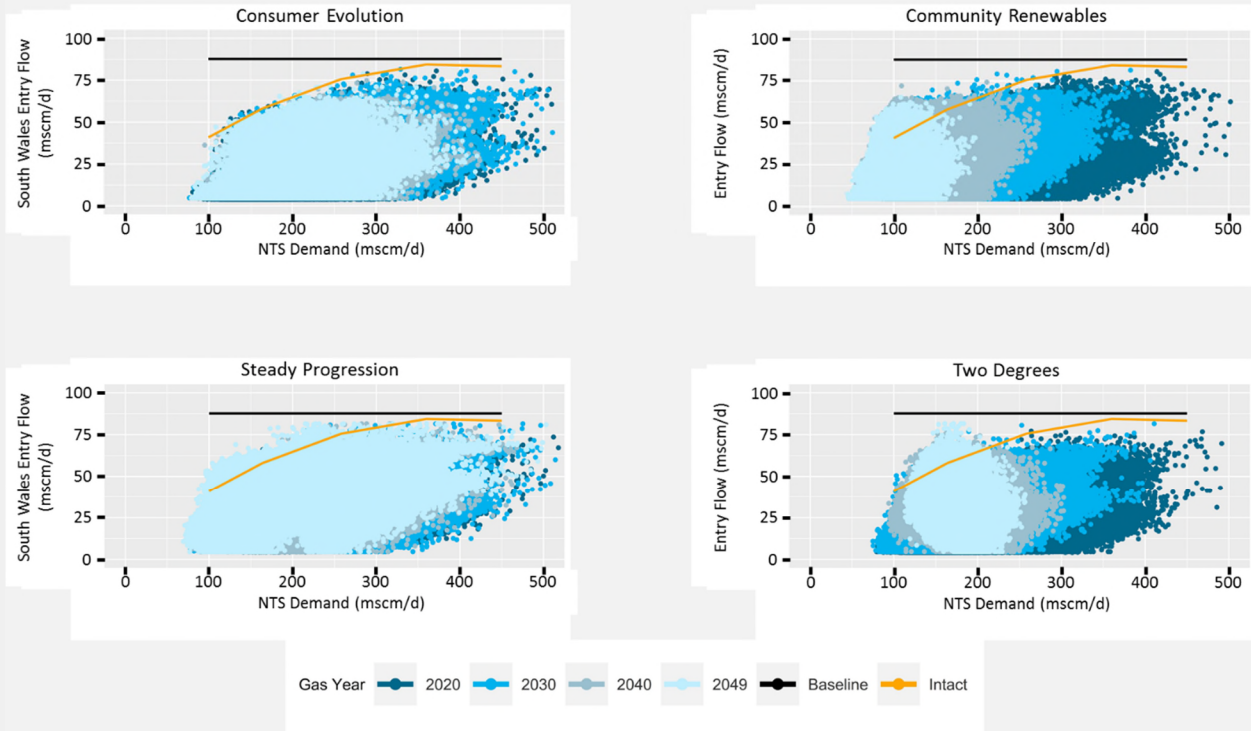
These charts include a few datapoints where the South East exit flow is above the 1 in 20 level (red dot on the charts). This arises as a result of some customers using non-firm capacity products which do not form part of our 1 in 20 obligation.

As an example, Grain power station has a firm capacity baseline of zero. However, when conditions permit we release non-firm capacity to Grain power station. This capacity is released on a risk assessed basis and when supply and demand conditions on the NTS enable it. This removes the need to invest to meet those needs under higher demand and unfavourable supply conditions.

At higher demand levels and low assumed entry flows at Isle of Grain (as used in our 1 in 20 capability assessments) we would not be able to safely accommodate exit flows at Grain power station. However, in the scenario of high demands, coincident with high Isle of Grain flows we may be able to accommodate exit flows at Grain power station that are above our 1 in 20 obligation. This example is based around a single power station, however similar circumstances apply to other customers without firm capacity rights and under favourable supply and demand patterns.

South Wales

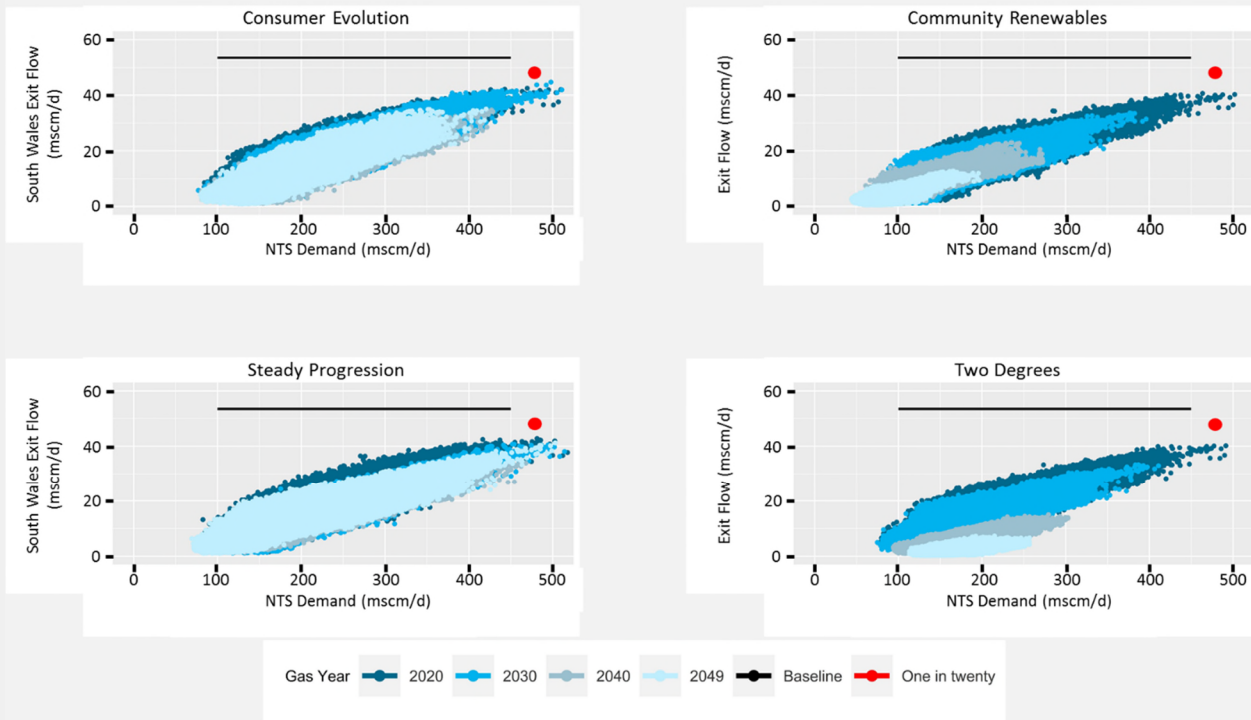
Entry Capability (Milford Haven)



These charts show that under all the FES scenarios there is a sustained need for capability that is close to, or above, the capability of an intact network. Even before considering the reductions in capability arising from planned or unplanned maintenance there is a risk of entry constraints at Milford Haven under certain supply/demand scenarios. Given the constraint risk and stakeholder feedback around the impacts of disruption, our strategy for this part of the network is to retain capability.

The capability of the NTS in South Wales is explored more fully in the main chapter and in the Wormington Engineering Justification Paper annex (A16.10) and the Compressor Supporting Information annex (A12.04 Section C).

South Wales Exit Capability



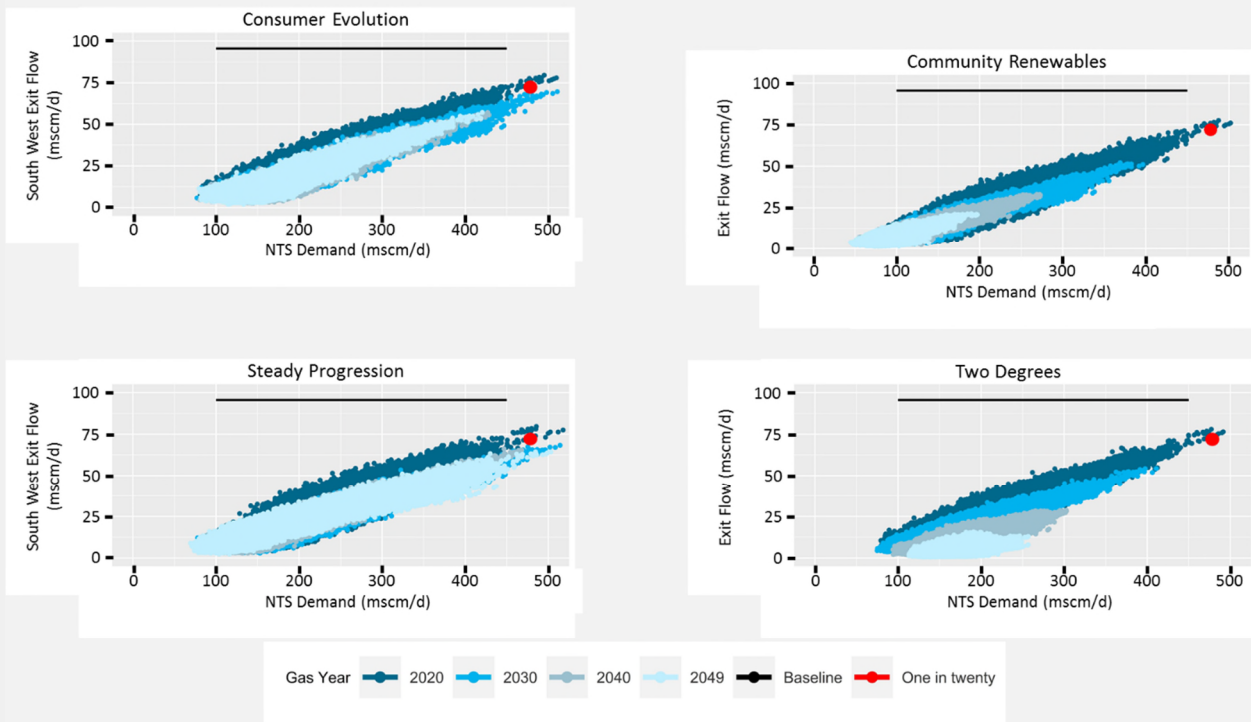
These charts demonstrate that with the assets required to meet entry requirements in South Wales, we can also meet our 1 in 20 exit obligation in the South Wales.

South West

Entry Capability

The network capability of the South West of the NTS is driven by the need to meet exit requirements and is shown in the charts below. There is one storage site in this part of the NTS; we can meet the entry capability of that storage site with the assets required for exit and therefore have not developed a specific entry metric for this zone.

Exit Capability



These charts show we can deliver our 1 in 20 obligations to meet peak exit flows in the South West.

In these diagrams, some exit flows are above the 1 in 20 capability level (red dot on the charts), an example explanation of this is provided in the South East section of this document.

Section 3 – Supplementary information and next steps

Supplementary information

During our engagement on the network capability metrics, we have shared and discussed the fact that we cannot deliver the level of capability indicated on the charts 100% of the time. This is due to the level of planned and unplanned maintenance on our physical assets, and the level of resilience in our compressor fleet.

The full level of capability across the NTS is not required by our stakeholders 100% of the time; there is diversity of both supply and demand profiles. We actively monitor and work with our stakeholders to understand the potential ranges and timings of different flow patterns. Using this information and intelligence, we can often schedule our planned work on assets, for maintenance or investment purposes, to coincide with the times we believe the need for these assets is lowest. If things change, we can manage and move these outages to be flexible to the needs of our customers to take gas on and off the system.

In order to represent this in a visual form, we start with assumed levels of availability of compressors by type and running hours (see table below). These assumptions are included in our investment processes; their derivation is described in Annex 16.05 the Compressor Emissions Compliance Statement.

Compressor availability by compressor type and running hours

Unit	500 hours	>500 hours
AVON 1533	85%	73%
LM2500 DLE	91%	79%
SOLAR TITAN	94%	86%
SIEMENS SGT400	94%	86%
15MW ELECTRIC	96%	91%
24MW ELECTRIC	96%	91%
35MW ELECTRIC	96%	91%
<i>*New Gas 15MW</i>	<i>97%</i>	<i>88%</i>
<i>*New Gas 'Large</i>	<i>93%</i>	<i>82%</i>

These levels of availability make assumptions about planned maintenance and unplanned unavailability, which can occur at any time such as a failure to start, a running trip or a fault found during routine inspections.

The level of capability shown in the network capability charts is delivered by combinations of compressors, as described in the Chapter 12 of our business plan.

We can create a weighting of the contribution that each compressor station, and the units within that station, makes to the intact capability for an entry point or zone. For example, a large compressor unit is likely to provide more to a region's capability than a small one, and one closer is typically more effective than one further away. The table below summarises the relative weighting of the key compressors that deliver the entry capability in South Wales.

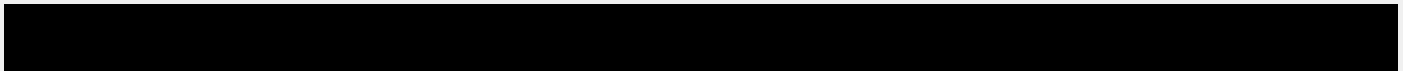
		Relative Station #	Relative Unit #	Wormington Override	Unit type	Availability
Felindre*	A	3	3	2	35MW ELECTRIC	91%
	B		1.5		SOLAR TITAN	86%
	C		1.5		SOLAR TITAN	86%
Wormington^	A	6	3		AVON 1533	73%
	B		3		AVON 1533	73%
	C		3		35MW ELECTRIC	91%
Churchover*	C	2	2	1	35MW ELECTRIC	91%
	D		2		SOLAR TITAN	86%
Alrewas	C	1	1		SOLAR TITAN	86%

*Felindre and Churchover are less effective when there is only one unit available at Wormington

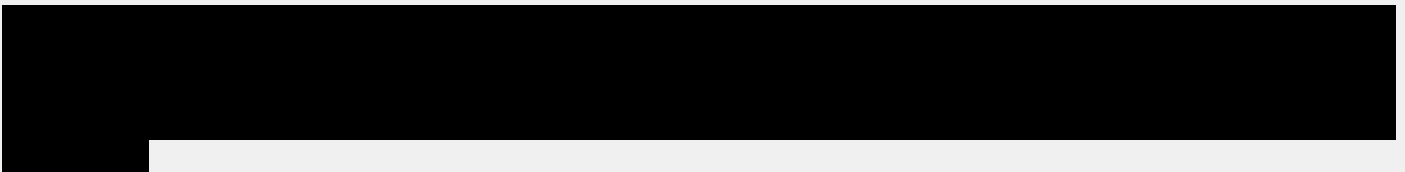
^ Wormington Unit C is not available for parallel running; this is explored further later in this section.

The maximum capability at any level of demand will be delivered by the same compressor combinations, as represented in the table above.

By running statistical analysis, we can combine the relative contributions of each unit along with their availability to determine an indicative number of days every year that different levels of availability will be delivered on average without proactive actions. [REDACTED]



In the course of our shorter term business as usual planning and operation, we are able to forecast profiles of stakeholder flow needs with a higher degree of confidence and use these forecasts to schedule planned work on our assets, to facilitate maintenance and investment, when the capability they provide is not required or by using backup units. This allows us to maximise the capability of the NTS when our stakeholders need it. A key example of this is our winter preparation, where we ensure that our assets and sites are as available and reliable as possible as we enter periods of high demand. We have a mobile field force who can respond rapidly to any asset trips or events that may reduce the capability of the system. We can keep teams on site during periods of high utilisation to enable us to keep assets in operation for the greatest proportion of the time they are needed. We can update the charts to show the impact of these types of action.





This representation of the availability of capability is an area we intend to develop further as these charts will help with showing the potential impact of future investment/non-investment decisions, on resilience of the network.

Market solutions

An important part of our role is to identify and develop potential market solutions which can be assessed against physical solutions, and to drive value for consumers in the balance between physical and commercial outcomes.

Stakeholders have asked how we will represent commercial or market solutions on the network capability metrics.

The physical capability of the NTS remains relatively static over the period covered by our RIIO-2 business plan. Contracts or market tools would essentially be for a turn up or turn down flow service, at either entry or exit points, with different lead times and durations depending on the problem to be solved. These contracts could be represented by a shift in the stakeholder flow combinations on the charts.

We do not intend to publish different sets of charts which include those shifts in stakeholder flow combinations. However, through the annual process, which we set out in the next section, we intend to report on any contracts that we have entered into and how they assist our ability to deliver the network capability our stakeholders require. For the avoidance of doubt, we have not currently entered into any

contracts related to the provision of network capability in the RIIO-2 period at the time of the business plan submission.

Annual Process

In the RIIO-2 period we will have a new licence obligation to produce an annual network capability report. To meet this licence obligation, we intend to run a transparent, annual stakeholder engagement process where we will update our metrics, and therefore the levels of network capability to be delivered in RIIO-2 and beyond, following the publication of FES. This new data, along with any changes to our asset base as a result of potential re-openers or unforeseen events, will allow us to propose refinements to any decisions for example, on when to disconnect or decommission certain compressors, or to justify the need to replace others.

This process will also allow us to show the progress and impact of the road to net zero, as that path becomes clearer.

It is possible that new metrics will be developed both to describe the full capability of the NTS in its current role to transport natural gas, and to show the potential opportunities to use the NTS for transportation of other gases such as hydrogen or carbon dioxide. We will be transparent about the underlying methodologies to develop these new metrics.

To the extent that, in the development of new methodologies, we identify operability challenges on the NTS, we would seek to define problem statements and work with our stakeholders to develop potential market or asset solutions.

Next Steps

Metric development

- The development of these metrics has been iterative with our stakeholders, and we continuing to develop our approach. Particular areas of work, include measures of boundary transfer capability and the challenges associated with managing within day changes to profiles.
- We do not have the capability within our processes, people or IT systems to progress these at the speed we believe is required. We are seeking funding via our RIIO-2 business plan submission to allow us to take advantage of technology and advances in data science in order to develop a fully comprehensive set of metrics that describe the capability of the NTS now and into the future, and to allow us to develop appropriate market solutions where possible.

Annual process development

- We intend to develop the detail and timing of the new annual process by the end of March 2020, and to achieve this we will be testing our thoughts with our stakeholders early in 2020.
- During 2020, there will be a new FES and Ofgem's draft and final determinations. We will review the network capability metrics as a result of these triggers, update them if required and may use these opportunities to test our internal processes for delivery of the new annual process.
- In line with our expected RIIO-2 licence obligation, we will complete the first cycle of our new annual process during financial year 2021. As a key input is FES, which is published in July, we do not expect that any updated network capability metrics will be published until September at the earliest. We must also be cognisant of timing and workload associated with other key publications such as GTYS and GFOP.