Gas System Operator

Operational Overview

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nationalgrid

The National Transmission System

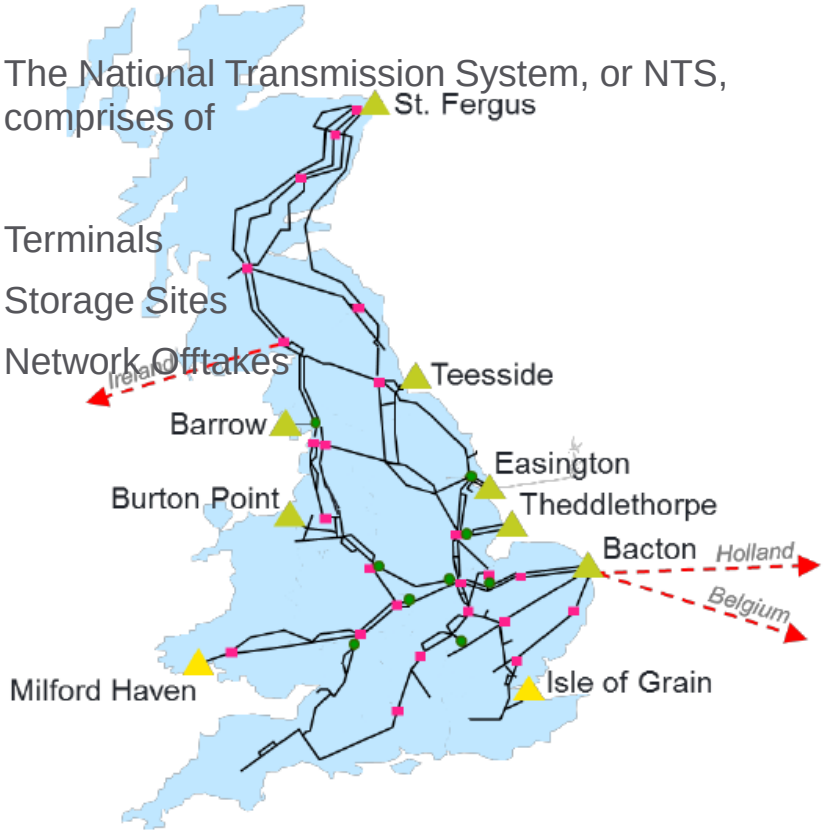
Our role	To connect millions of people to the energy they use safely, reliably and efficiently
We own & operate	7,660km of high pressure pipelines, 23 compressor stations and over 600 above ground installations
We transport	Over 3 times the energy provided by electricity (over 995TWhrs) each year

The National Transmission System, or NTS, comprises of

Terminals

Storage Sites

Network Offtakes



Energy

The NTS typically operates between pressures of **40 and 90 bar**, and typically stores up to **370 mcm** (3770 GWh) of gas in the pipework (linepack), equivalent to the demand that could be expected on a **cold winters day**.

Daily demand can vary from c150 mcm in the summer, to our record demand level of 465 mcm. On the average year up to **3 times more energy** is transported in the gas network than the electricity network

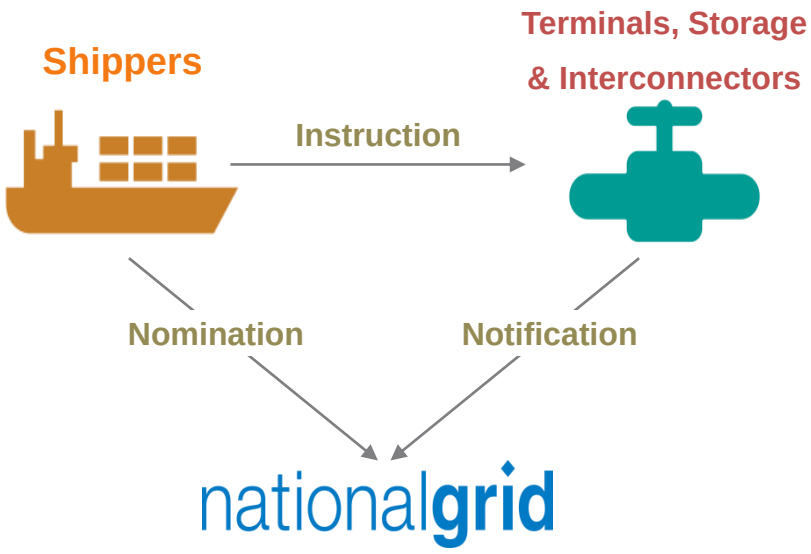
Compressors on the network are typically range from 7 MWh to 35 MWh, and when online together can require more than **30 GWh of fuel gas** in a day. This is equivalent to the yearly gas usage of **over 2000 homes**

NTS Management Principles

Our strategy is determined by the information supplied to us by our customers, as we aim to meet every assured pressure and ANOP throughout the gas day

Commercial **nominations** are received through Gemini which tell us the **amount of energy** that is expected to flow. Physical **notifications** tell us the **volume and location** of where the gas will flow.

As shippers revise their nominations, terminals, storage sites and interconnectors adjust their notifications



NTS Management Principles

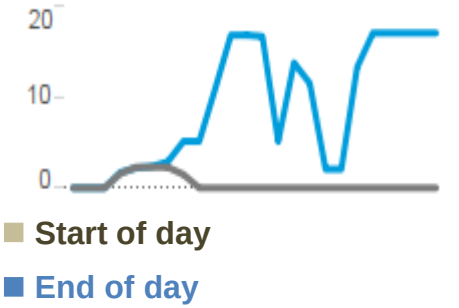
Our strategy and planning begins up to two weeks ahead as we receive clearer weather and demand forecasts and more intelligence on likely entry point flows. We manipulate stock on the network to maximise flexibility.

Within-day changes to flows necessities a less proactive and more reactive strategy

Around 1,600 Notifications received daily

Around 180 daily reconfigurations of the NTS

Revised Notifications can significantly change the profile of the gas flow that we have to manage:



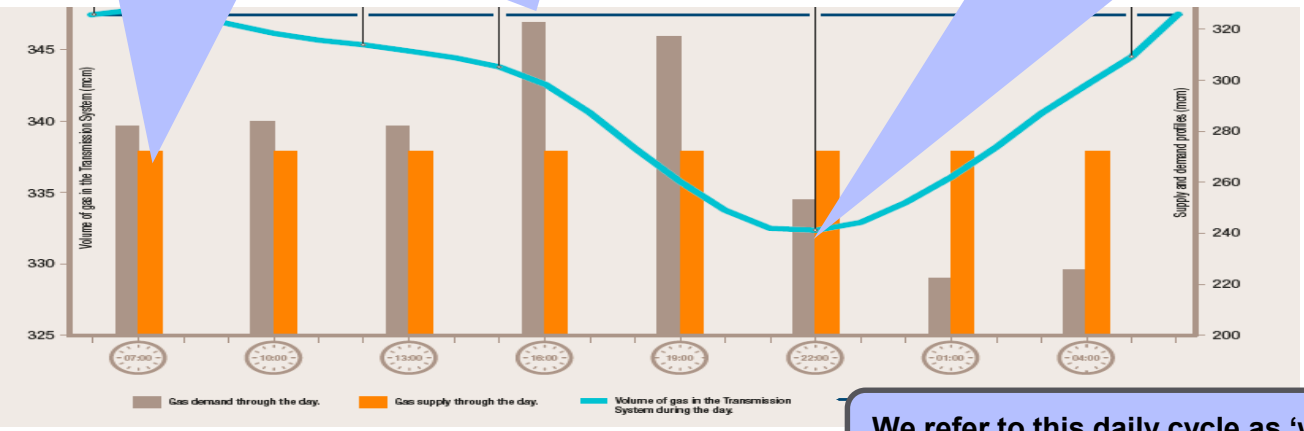
Pressure Management

Pressures on the network are, above all else a, product of the gas we have available in the pipes. This can vary significantly both day to day, and within day

Gas traditionally entered the network at a steady rate across the day (Orange bars)

Demand traditionally peaks during the day (grey bars)

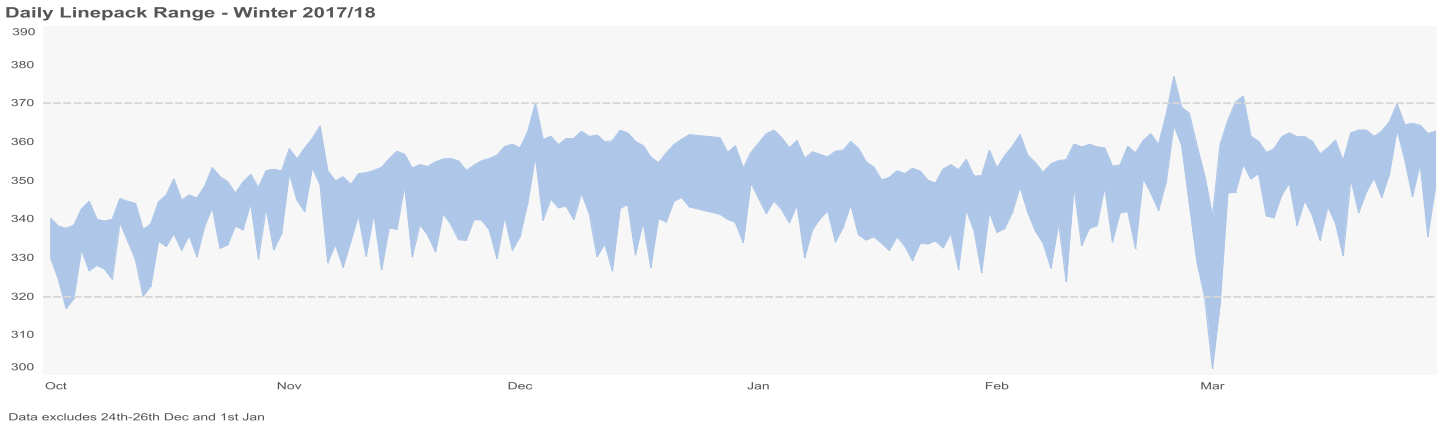
This means there is usually a dip in volume, and so pressure, during the afternoon (blue line)



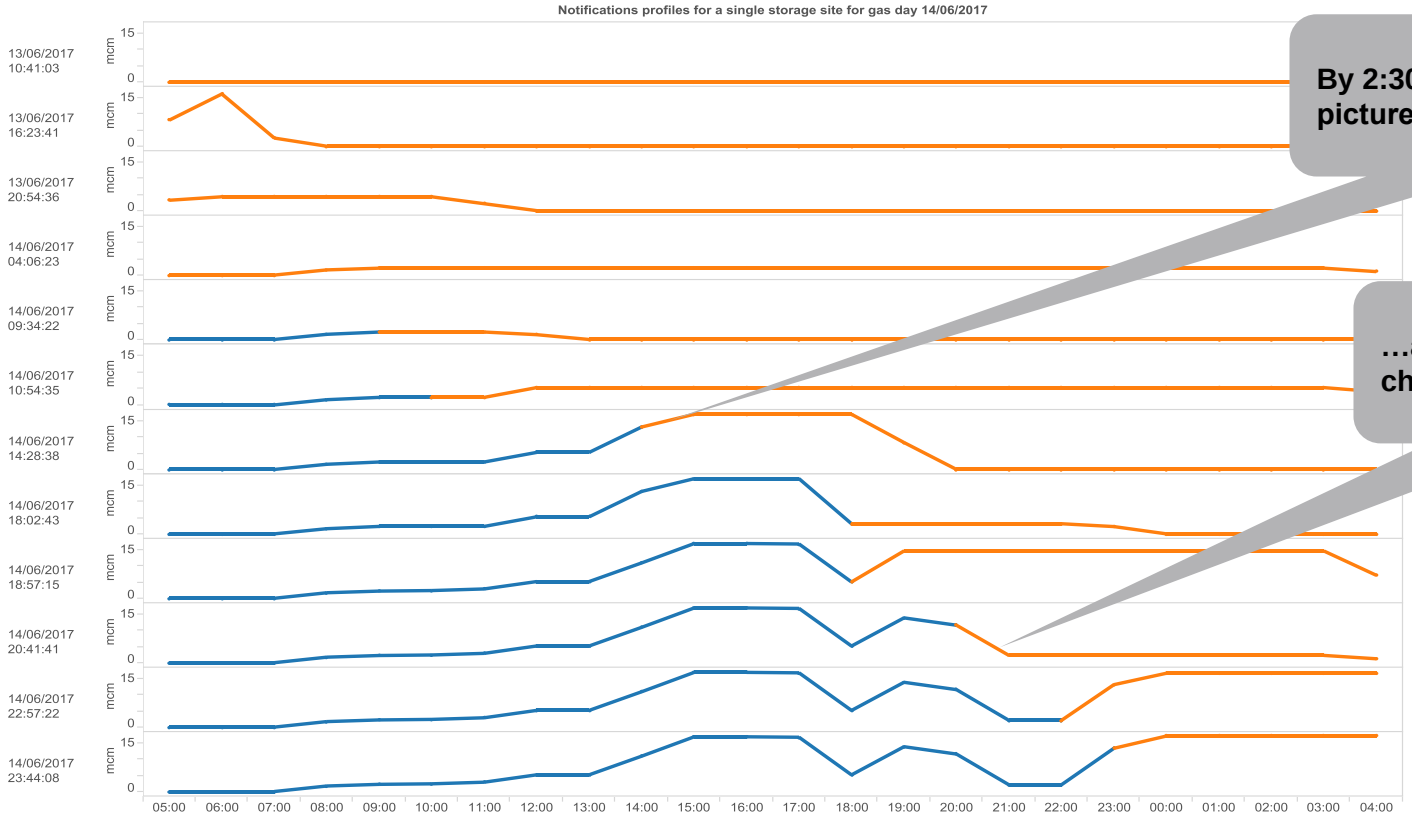
We refer to this daily cycle as 'within day linepack swing'

Pressure Management

As we see our customers requiring more flexibility we are seeing a move away from a traditional supply/demand profile. The result is a lower within-day stock position and typically lower pressures in certain areas of the network. Winter 17/18 regularly saw swings in excess of 30 mcm/d. Something unheard of 10 years ago



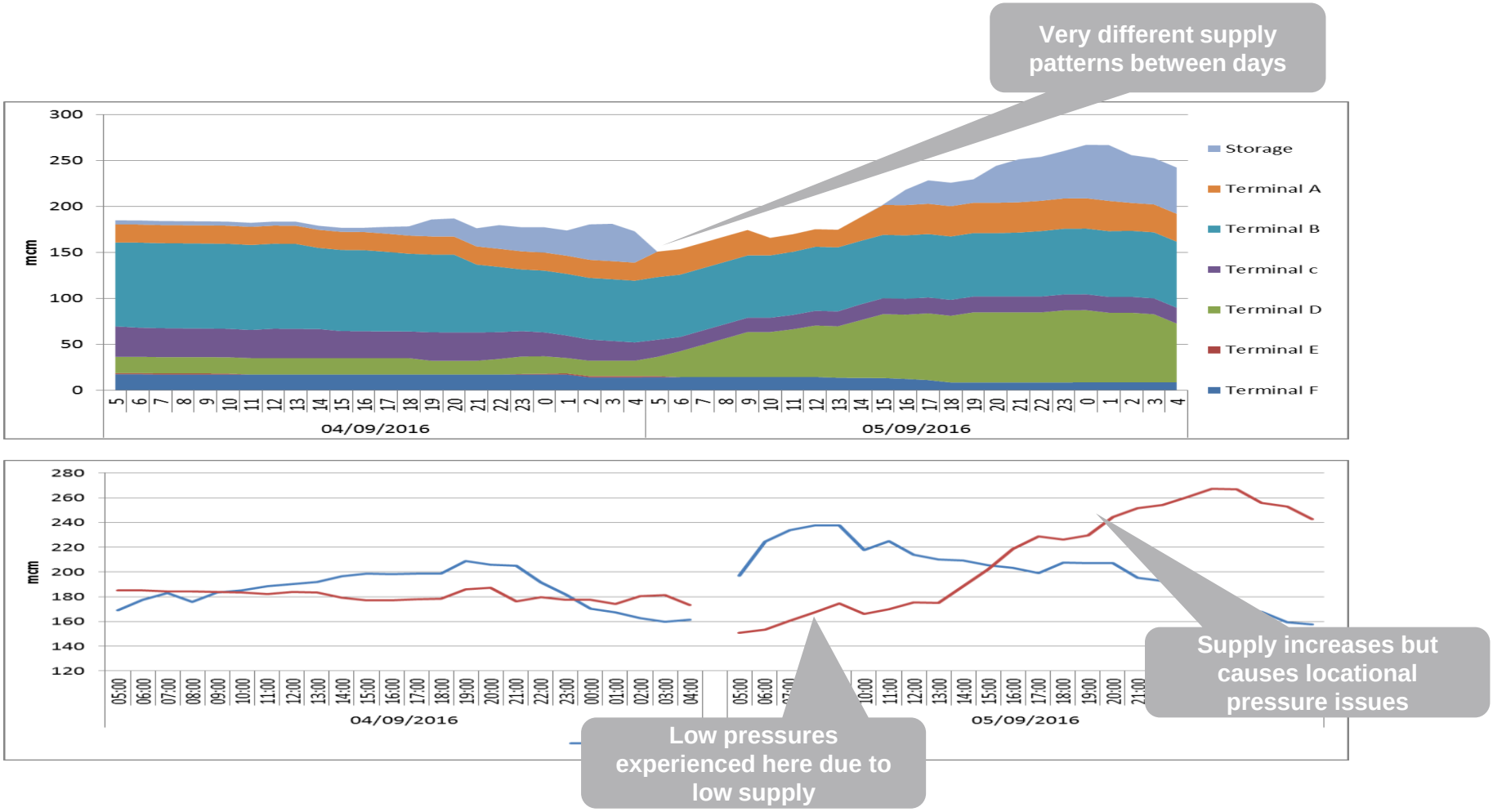
Customer Flexibility



By 2:30 on the day the picture has changed…

…and it continues to change throughout the day.

Large Changes in Supply Day to Day

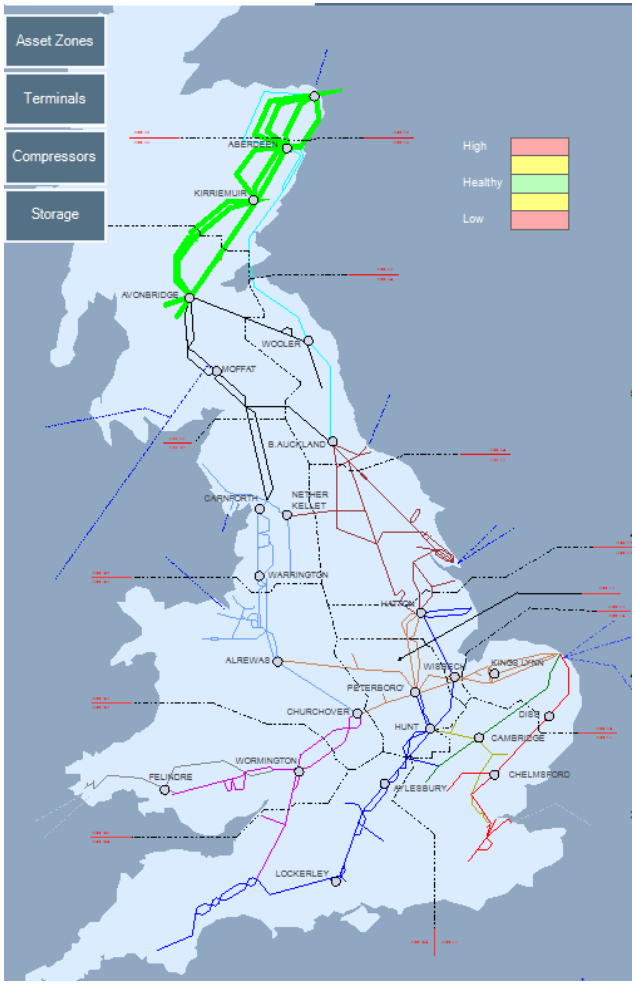


Linepack Management

Our National Linepack figure as quoted on MIPI is created from 12 zones, each containing a major pipework system.

The network can be configured to manage linepack (and therefore pressure) in specific zones via the use of valves and compressors.

As such, a drop in linepack nationally is not always observed locally and will be managed as strategy dictates



Pressure Loss in a Pipe

Whenever there is a flow through a pipe, there will be a loss in pressure from one end to the other. This is due to frictional losses which are proportional to flow velocity. The higher the velocity, the greater the loss

This effect has a large impact on how we manage pressure on the network. At the **extremities** of the network where **capacity is lower**, **pipes are typically smaller** and operate at **lower pressures**. All of these aspects result in a relatively **high gas flow velocity** and therefore pressure losses are exacerbated.

To maintain suitable extremity pressures it is often necessary to maintain higher pressures on the major transportation arteries. On days where we encounter large linepack swings we often need to sacrifice pressure in certain network locations in order to maintain **suitable extremity pressures**

Daily Challenges

05:00 - 08:00

Review latest notifications and maintenance

Set initial compression strategy and configuration

08:00 – 14:00

Mange maintenance activities

Manage linepack distributions for tea time peak

14:00 – 22:00

Manage commercial balance

Manage configuration and compressor strategy to maintain extremity pressures

22:00 – 05:00

Manage commercial balance

Manage entry pressures as system is restocked

Liaise with DNs for assured pressures

Develop strategy for next gas day

Transparency of Operation

We appreciate that the day to day configurations used by the Gas National Control Centre and resultant pressure changes are difficult to predict from an outside perspective.

To improve the transparency of our operation we have started to supply more information including our pressure forecasting service and our daily linepack information.

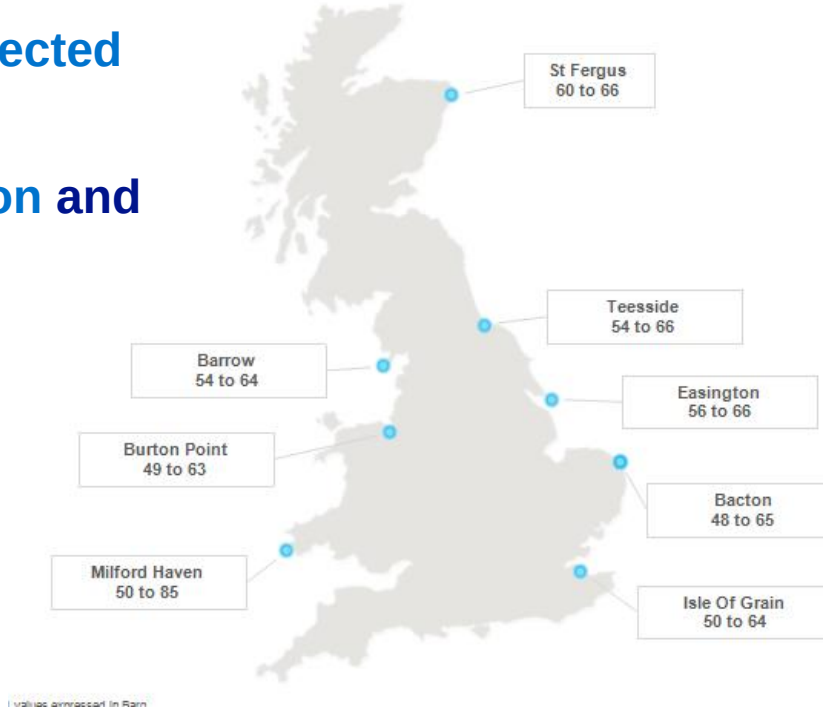
Both products are publicly available and available on our website

Pressure Forecasts

Provides a week ahead outlook on the expected pressures at System Entry Points

Created using the best available information and forecasts for supplies and demands

All data subject to change



Linepack Utilisation

The report is published three times daily and uses a combination of physical delivered and offtaken quantities combined with supply and demand notifications for the rest of the gas day

Each iteration will provide and the forecast minimum linepack and the time at which it is expected

Gas Day		Opening Linepack
24/10/2018		352.71
Run Time		
05:00	12:00	18:00
Calculated Linepack minimum (MCM)		
334.1	335.2	
23:00	22:00	