Shaping the Gas Transmission network of the future - Have your say

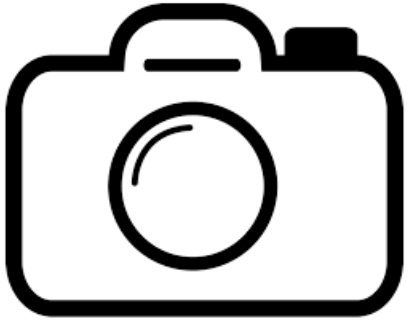
nationalgrid

Welcome

Jennifer Pemberton

Customer and Stakeholder Strategy Manager

Housekeeping



Agenda

Morning	▪ **Welcome and introduction** ▪ **How we've performed** ▪ **Roundtable discussions** ▪ **How we plan the network** ▪ **Future of Gas: Reflections to date**
Lunch and Networking – Opportunity to visit our stands	

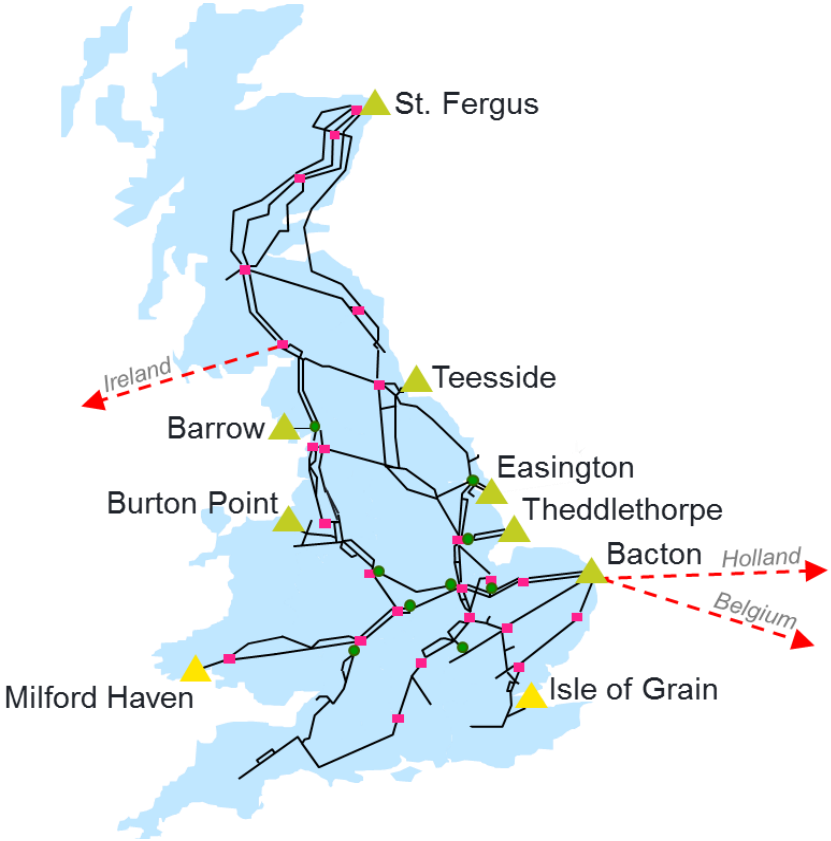
Afternoon	▪ **Working group sessions**
	  ▪ **Valuing Risk**
	  ▪ **Compressor Strategy**
	  ▪ **Innovation**

Introduction

Pauline Walsh

National Grid Gas Transmission – the network

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, 24 compressor stations and over 600 above ground installations
We transport	Over 3 times the energy provided by electricity (over 995TWhrs) each year



We live in uncertain times

- Decarbonisation
- New sources of gas
- Supply/ Demand patterns
- Brexit
- Gas/Elec interactions
- Renewables

Future of Gas

To **listen** to you and incorporate your views in our plans, to ensure we continue to provide the efficient services you require

Why we're here today

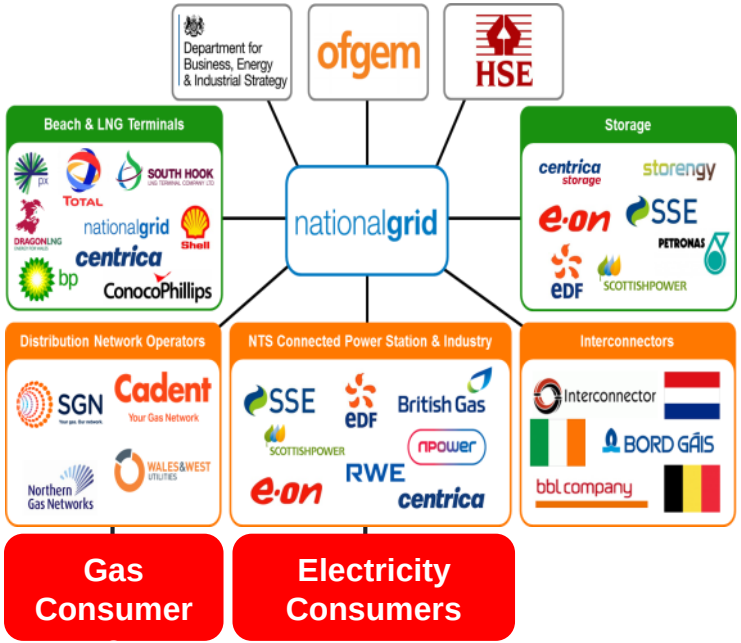
We know

Our customers and stakeholders rely on the service we provide

We haven't always spent enough time listening to your priorities

We're changing

To ensure your requirements are at the centre of our business plans



We are all customers of the NTS

You, me, our friends & family

- As Gas Transmission we are largely invisible to the gas consumer
- Yet there are 22 million domestic gas consumers and even more consumers reliant on electricity produced from gas
- Our charges currently make up £9/year of the average duel fuel energy bill

We would like your views on how we all ensure we successfully deliver for the end consumer

Please join the debate

We are at a time of significant change in the energy industry, and the vital role that gas plays will need to **evolve**

Today's workshop is focused on areas which you've already told us are important and which will directly **influence** our business plans

We are committed to **listening** to you, our customers and stakeholders, to develop the Gas Transmission Network you require for today and tomorrow

Take part

Have fun

Be honest and direct

How we've performed

Glenn Bryn-Jacobsen
Gas National Control Manager

Richard Phillips
Asset Strategy and Performance Manager

Our Performance

Regulatory Performance Measures 2016/17	
Safety	
	No-one was injured as a result of our activities and we met all of our safety targets
Reliability	
	In general we operated and maintained the NTS to deliver the reliability that gas consumers and our stakeholders expect. There were a few days in the year where we couldn't provide the capacity that some of our stakeholders required.
Environment	
	Our work to modify our assets to reduce our impact on the environment was delivered to target. Additional compressor operation to meet challenging network conditions meant that we exceeded our emissions targets
Customer / Stakeholder	
	We have been able to meet our customer connection requests and we have received good feedback from our customers and stakeholders

Meeting customer requirements

Responsibility

National Grid's responsibility as owner and operator of the National Transmission System is for safe, efficient and economic transport of gas to meet customer requirements.

Unconstrained

The ability for customers to put gas in to and take gas out, when they want and in the quantities they want.

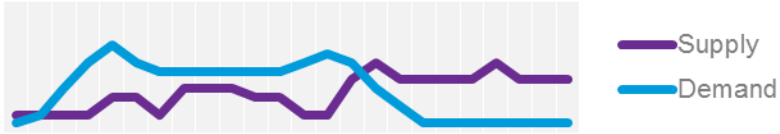
Challenges

Providing a level playing field and where possible an unconstrained service to our customers. Facilitating an efficient market, whilst maintaining gas quality and pressure requirements.

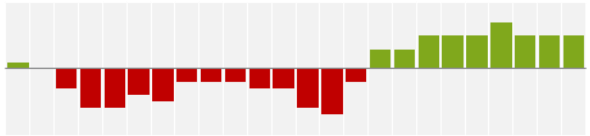
Operating a storage vessel…

The NTS transports gas from entry point (supply) to exit points (demand).

The daily profiles of supply and demand can differ significantly.



As a result of the imbalance between supply and demand, the volume of gas in the NTS varies during the day.

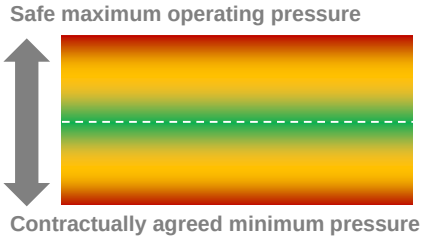


Typical daily balance

The volume of gas in the NTS at any one time is referred to as "Linepack".

System pressure is directly related to linepack.

The NTS is able to operate within a range of pressure limits.

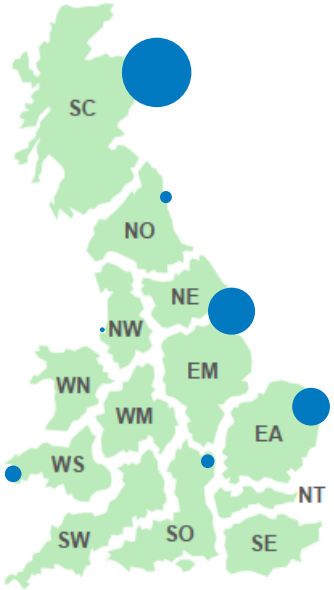


This allows for some flexibility to manage the daily imbalances and protect customers from short-term asset failures.

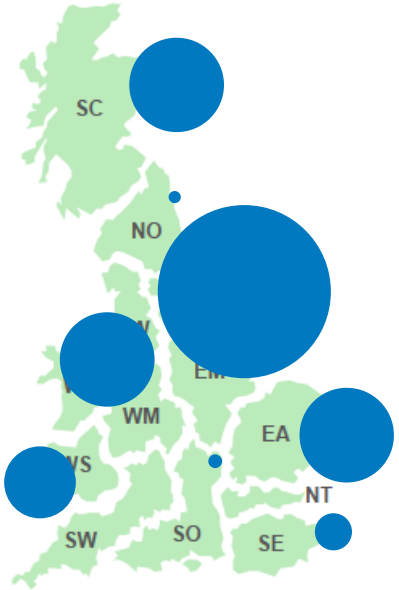
Note that the NTS was built to transport gas efficiently based on flat daily supply and demand profiles.

Varying end of day supply

This is where gas entered the NTS in 2016/17…



But based on capacity release obligation, supply could look very different…



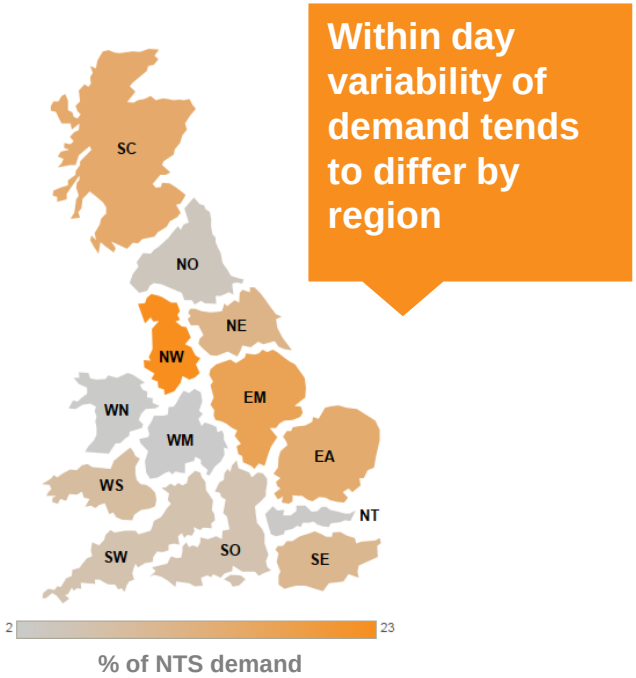
Supply profiles do change…

32% ↑

Increase in flows at St Fergus between 2015/16 and 2016/17

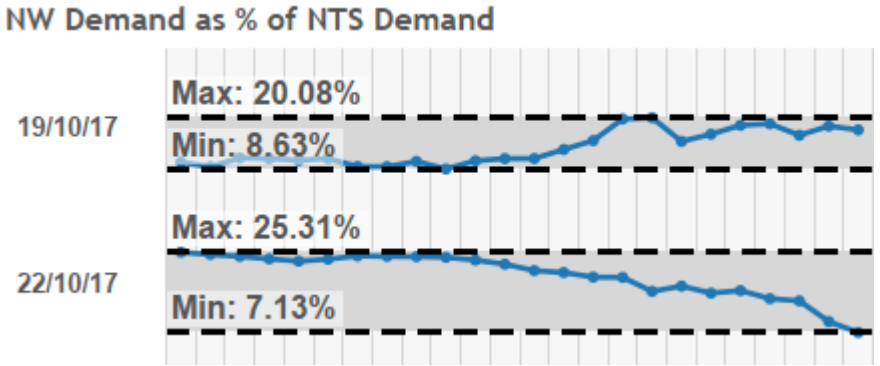
Varying within day supply & demand

Within the day demand and supply will vary regionally.



Whilst aggregate demand levels have been reducing over time, we are dealing with more volatile demand profiles within days.

For example, the North West can vary from less than 10% to more than 20%of NTS Demand and doesn't necessarily follow a predictable pattern from day to day.



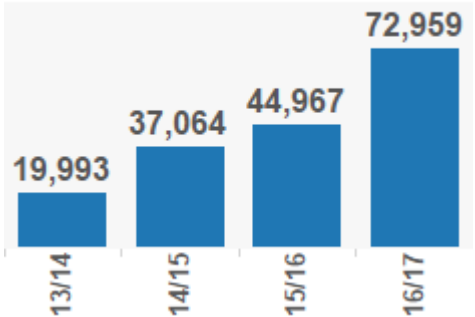
Moving gas around the NTS

We are reliant on using compression to move gas from the entry points to where it's needed.

62% Increase in compressor running hours in the last gas year.

- Balance
- Uncertainty
- Reliability

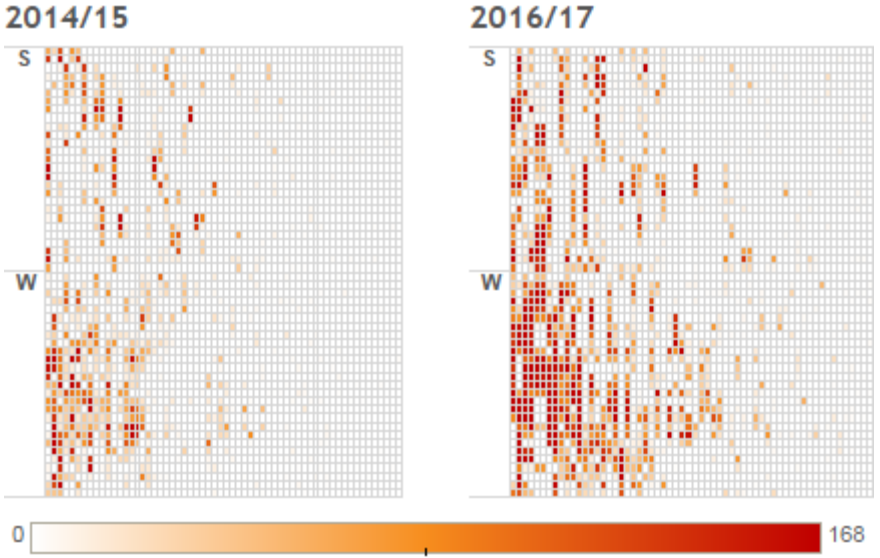
Compressor Running Hours



There is a negative environmental impact from running compressors

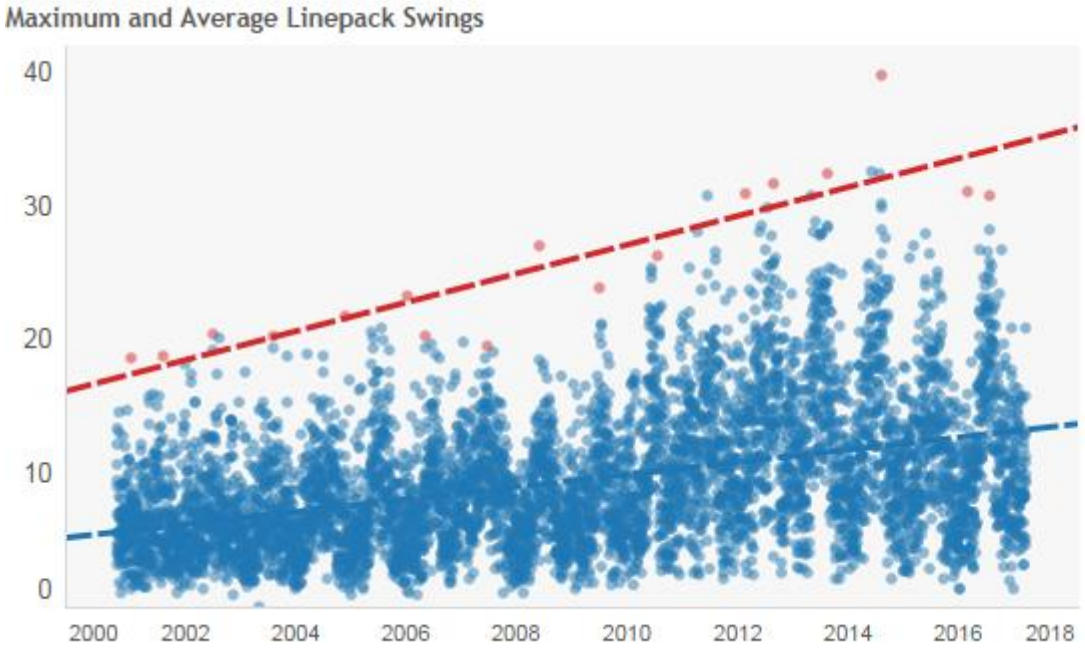
It is becoming increasingly challenging to plan and manage our outage requirements without causing customer disruption.

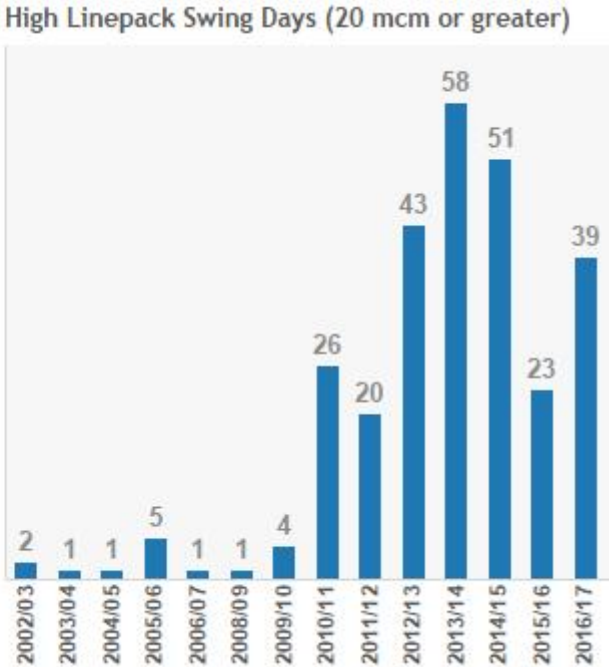
Compressor running hours by site and week



Reliance on linepack flexibility has increased

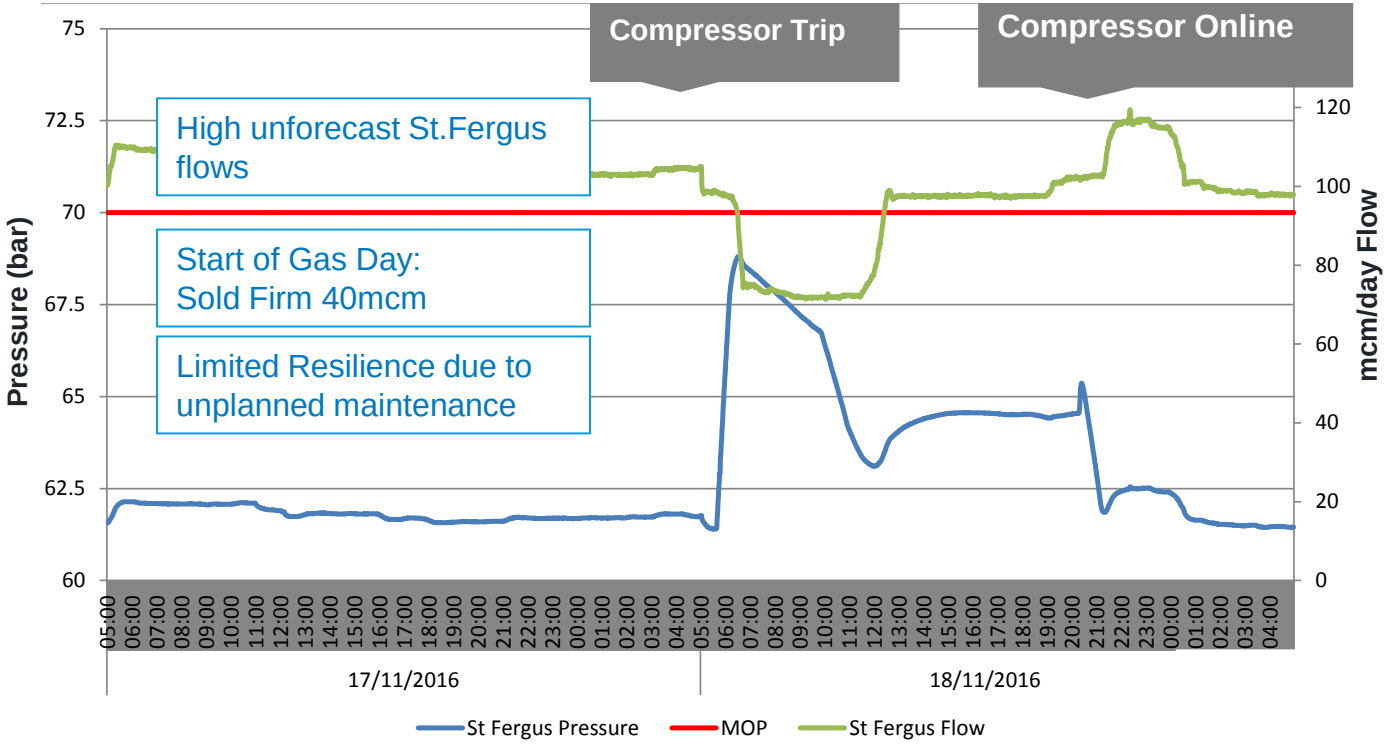
There are an increasing number of days where market operation is using up more of the available linepack flexibility, consequently the system is becoming less resilient to asset failures.





Example day – St.Fergus Terminal Restriction

What happened? 18th November – Managing overall supply uncertainty



What was the impact?

Safety notice to reduce flows at St. Fergus Issued

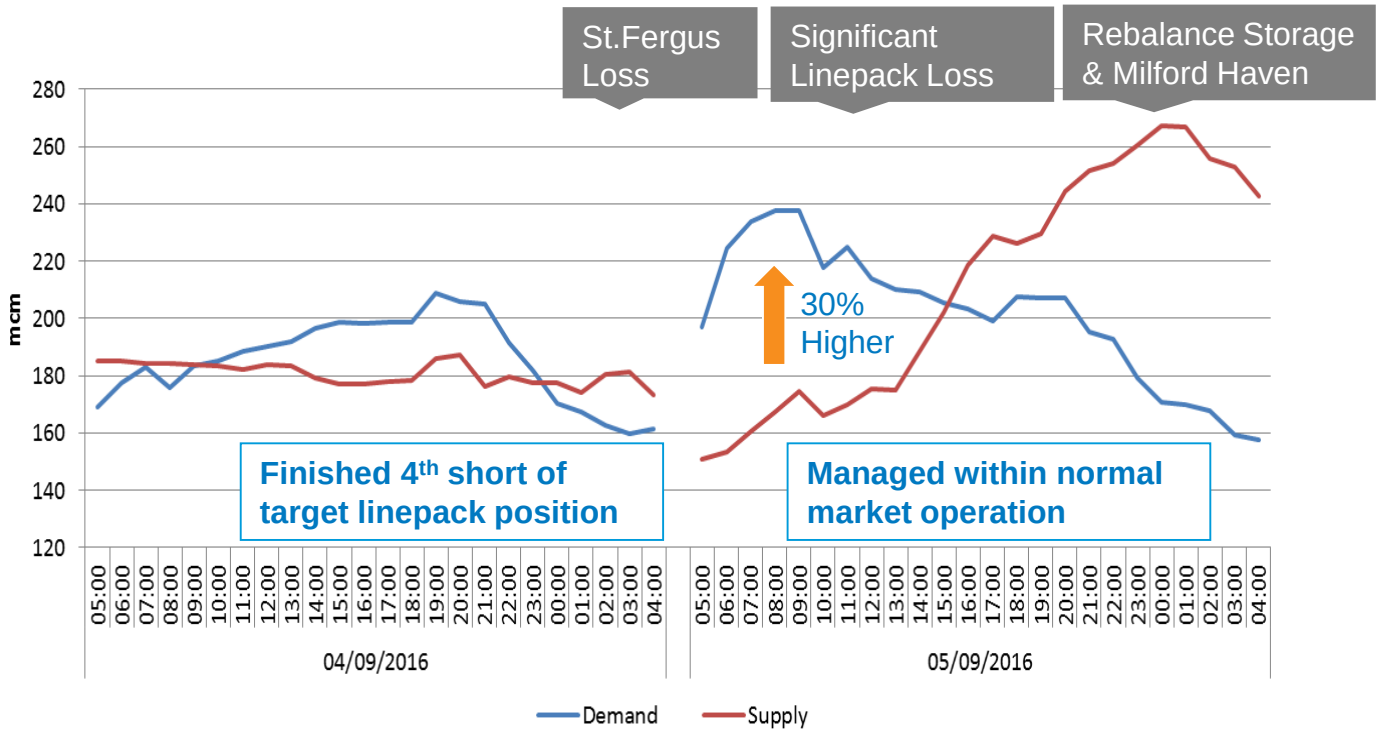
Terminal able to over deliver nomination

No Significant impact to commodity price

What could have been the Impact?

Example day - Milford Haven Terminal Restriction

What happened? 5th September 2016 : Managing within-day variation



What was the impact?

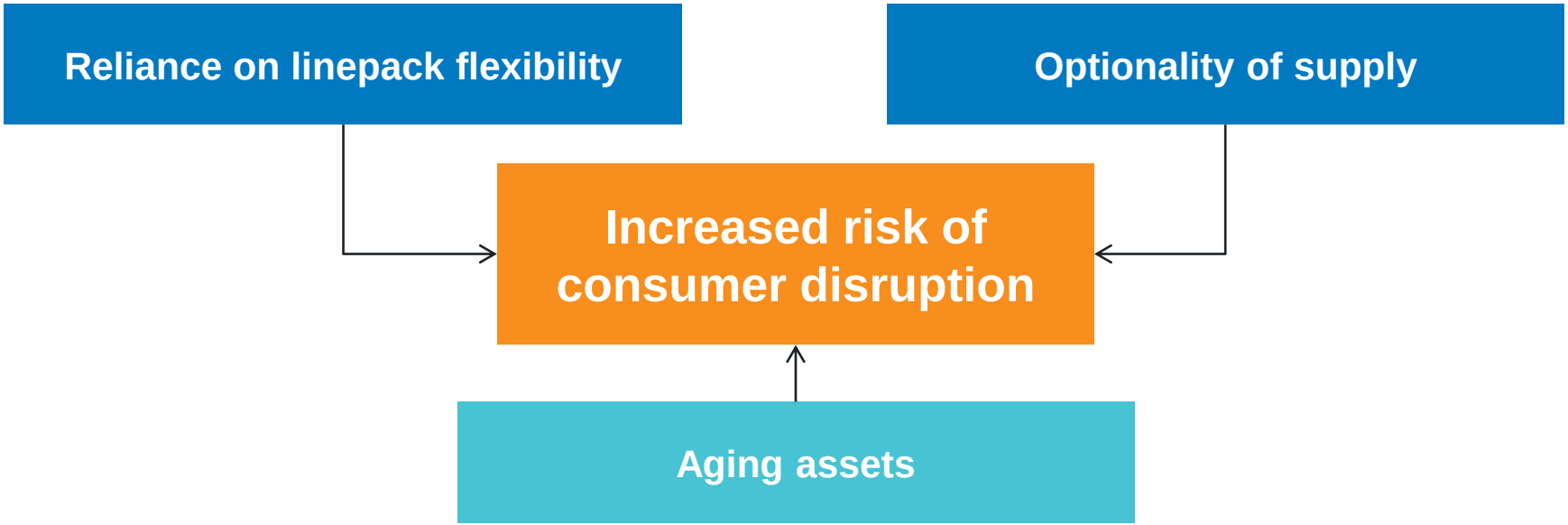
Early return to service of compressors : Limited commercial restriction at Milford

Small impact to on-the-day traded price

What was the value of managing within normal operation?

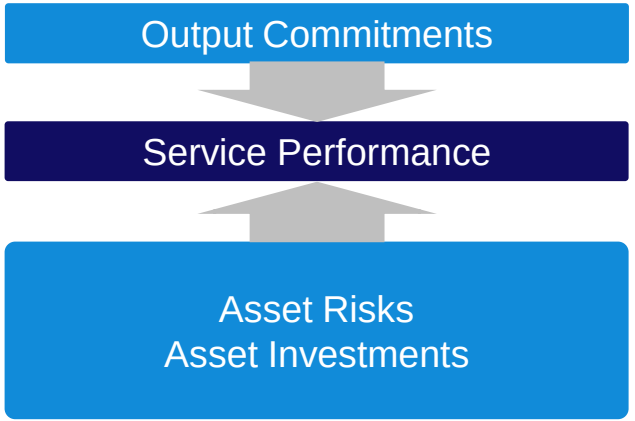
Increasing risk

Given the optionality of our entry points and reliance on using linepack flexibility to manage fluctuating profiles, we are increasingly susceptible to another coincidental event

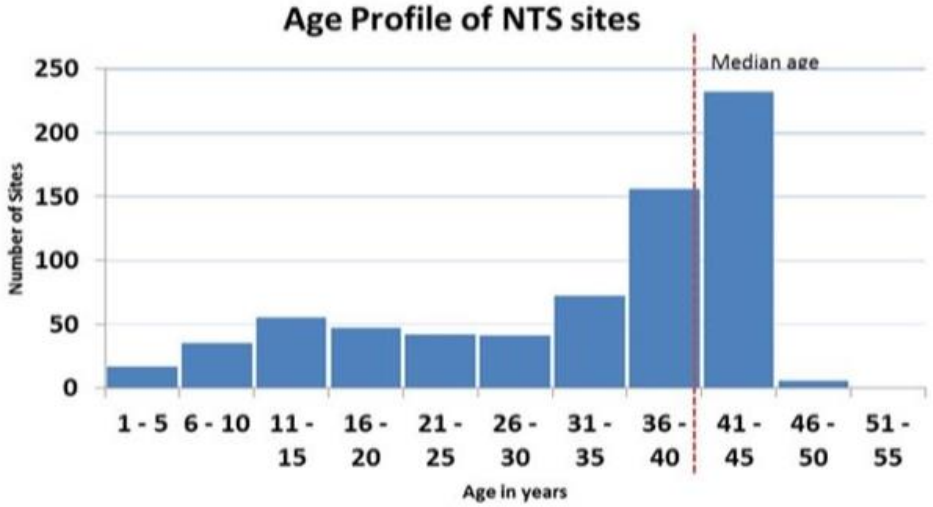


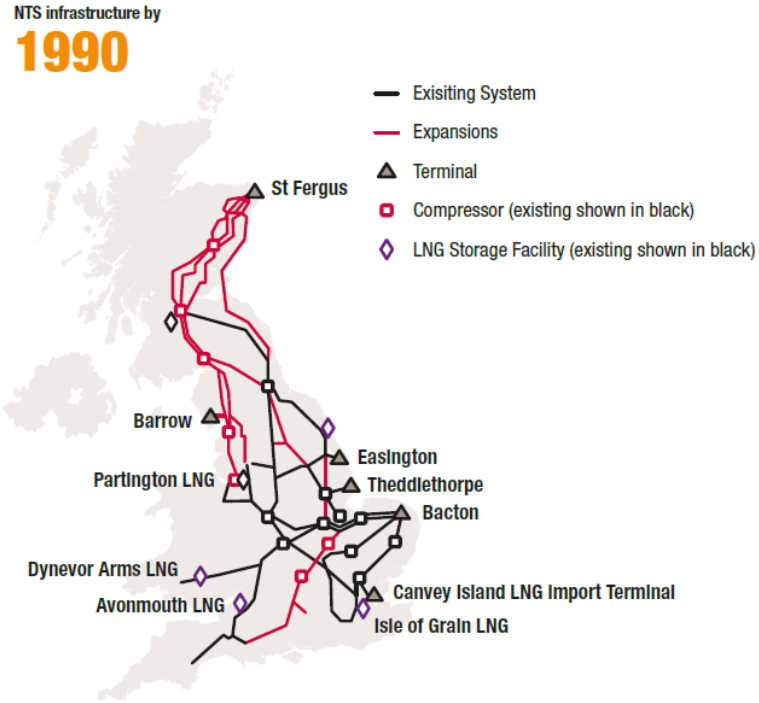
Asset performance delivers service performance

- Performance of our assets and the investments we make contribute to our ability to deliver our output commitments
- Under RIIO-T1 our output commitments cover Safety, Environmental, Reliability and Customer/Stakeholder



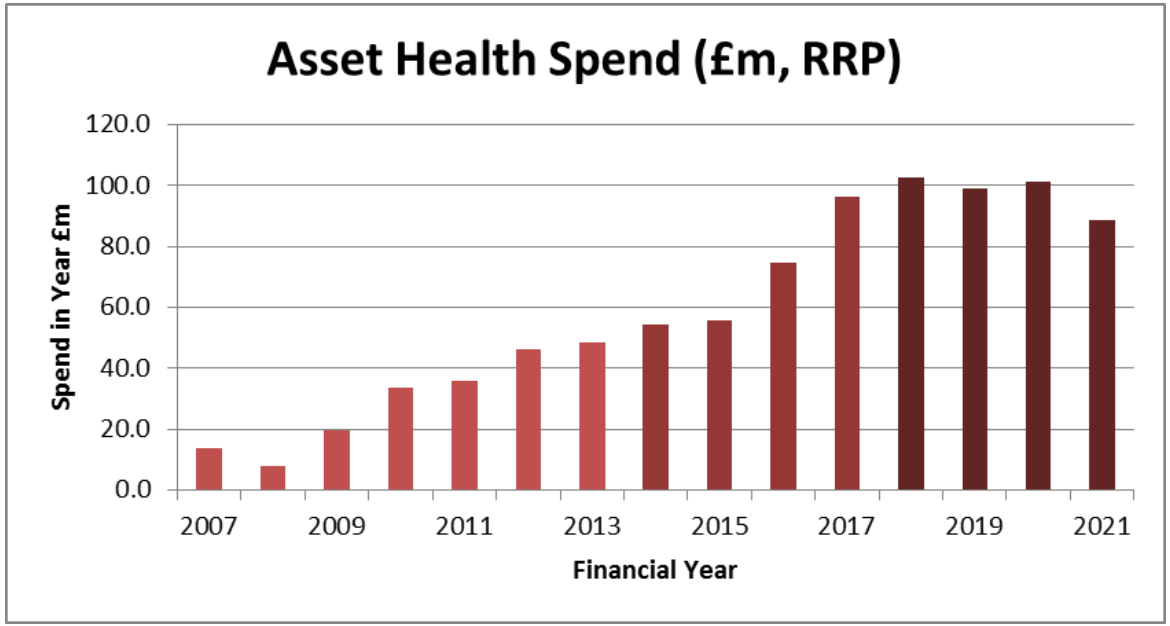
The asset base is aging and condition is declining





- Significant parts of the NTS constructed in 1970s and 1980s
- By end RIIO-T1, 70% of the network will be beyond original design life
- We are seeing increasing numbers of asset issues and failures

Increasing levels of asset investment



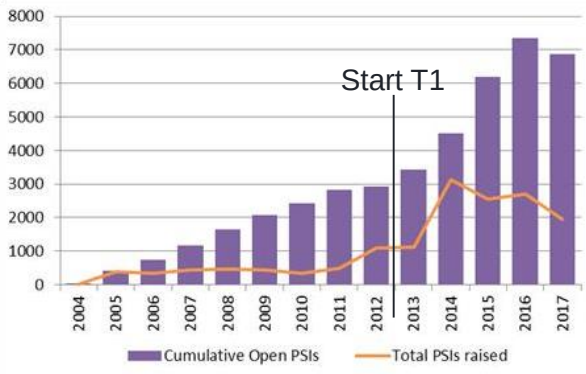
- We are investing more than ever before to keep the gas network running safely and reliably for our customers

Currently forecasting to spend over our Asset Health allowance in RIIO-T1

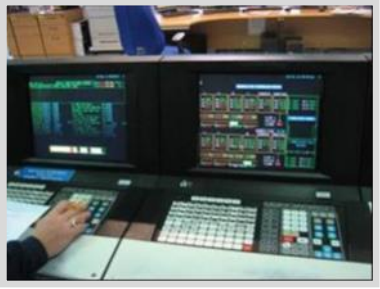
Asset Health spend is capital expenditure in our existing asset base, including asset replacement, refurbishment, overhaul and revalidation

Asset condition is worse than expected

As we have undertaken asset health works, we now have an improved understanding of asset condition



Number of asset issues has increased significantly since the start of RIIO-T1



Consequence of failure?

Failure to deliver output commitments:

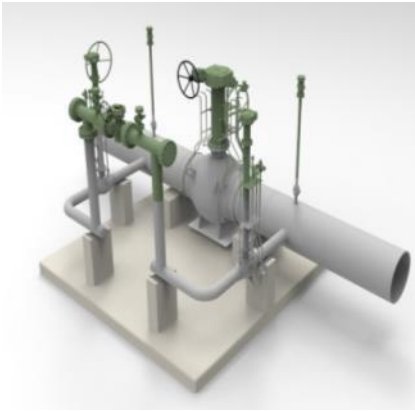
- **Safety**
- **Reliability**
- **Environmental**
- **Customer/Stakeholder**

Efficient delivery of works

- We use a “campaign” approach to deliver work efficiently and without impacting customers

One of four block valve replacements undertaken during an outage

Bundling work enables delivery efficiencies and minimises downtime on the network

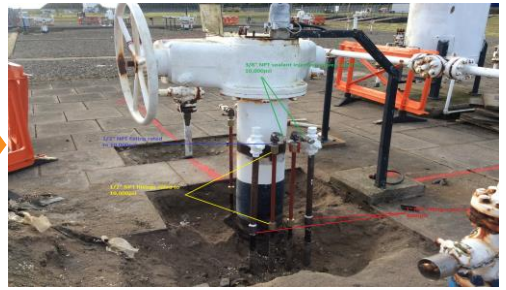


- New approach of modular block valve design with off-site build
- Above ground design **improves safety** with the removal of pit access
- 3D modelling used to reduce lifting risk by “rehearsing” complex lifts

Innovative solutions to asset issues

We continually review our work programmes to ensure that we are delivering work that benefits our customers and stakeholders

- Pit-wall transitions at St Fergus found to be in better condition than originally thought allowing deferral of this work type



- Repair of small bore vent and sealant pipework through shallow dig technique is quicker and more cost effective

Summary

- We have delivered on our outputs thus far and connected users have largely been able to take gas off and put gas on as required
- Our ability to deal challenging supply and demand scenarios is reducing as flexibility of the network is reducing with ageing assets and outages
- Larger pressure changes and volatility already experienced by connected system users
- We are investing more than ever before in asset health to manage risk and deliver a safe and reliable service for our customers
- We have developed innovative ways of ensuring that customers are not impacted by increasing asset health work and that cost impact is minimised

Market Attractiveness and Future Market Services

Hayley Burden
Market Change Development Manager
Phil Hobbins
Technical Code Development Manager

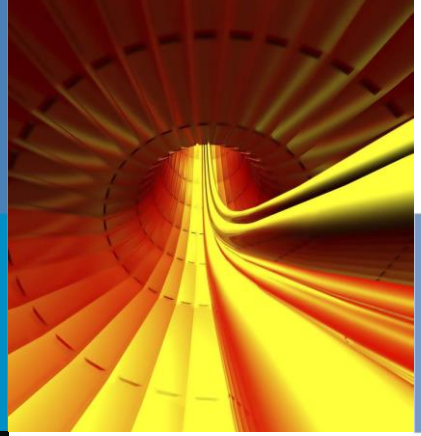
Market Attractiveness – why is it important?

- The market rules impact the attractiveness of the GB market to ‘land’ gas, and provide the framework for how our customers bring gas on and off the network
- Our Future of Gas (FOG) engagement has told us that retaining an attractive market, and ensuring ease of access to the network, will be important whatever pathway we take in the future
- We need to ensure our future market rules are agile and keep pace with the changing energy landscape
- **We would value your thoughts on what works well, what needs to change and what new arrangements might be required**

Future Market Services - why is it important?

- National Grid has a number of obligations to deliver services to the gas market
- We meet these obligations by delivering services both directly and indirectly e.g. via a third party service provider (Xoserve)
- We know it is important to our customers and stakeholders that these services are delivered in a way which they value, and are cost-efficient
- **We would value your thoughts on how the current services are delivered, and what changes and improvements you would like to see in the future**

Please come and speak to us during your breaks to share your views and thoughts on these topics



Break

Roundtable Discussions

Over the past 5 years, what have you **valued** and why, and what can we **improve** on and why?

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Current output measures are:

1. Delivering what I need
2. Broadly ok but need some changes to measures
3. Need a complete review of outputs and measures

How we plan the network

Rhys Ashman
Operational Capability Development Manager

What we'll cover

Why we plan for the future

How we plan for the future

The outputs that we produce

What we want from you!

- What do you think?
- What is important to you / what do you value?
- Should we be doing anything differently?
- What should we prioritise?
- Should we be producing different outputs?
- What would help you?

Why we plan for the future

Safe operation of the network

A reliable and available network for customers

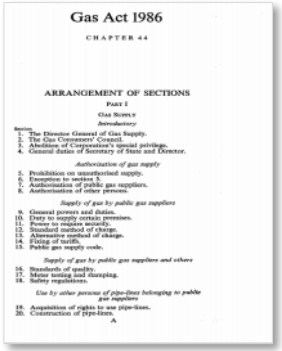
Minimise impact on environment

Economic and efficient operation

Economic and efficient investment decisions

Deliver value for investors

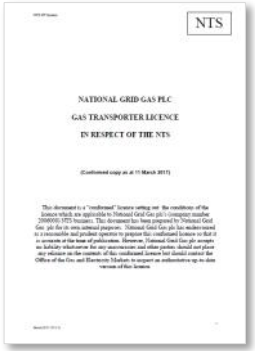
Why we plan for the future


Gas Act 1986

CHAPTER 44

ARRANGEMENT OF SECTIONS

The Law

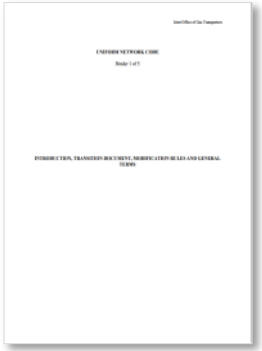

NTS

NATIONAL GRID GAS PLC

GAS TRANSPORTER LICENCE

IN RESPECT OF THE NTS

Our Licence


UNIFORM NETWORK CODE

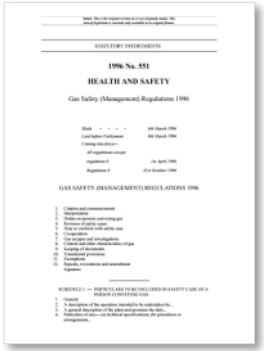
Network Code


STATUTORY INSTRUMENTS

1996 No. 825

HEALTH AND SAFETY

The Pipelines Safety Regulations 1996

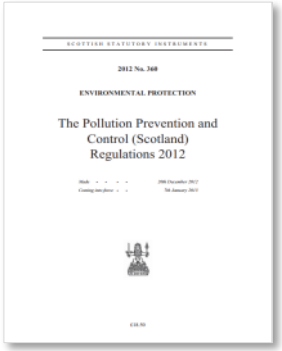

STATUTORY INSTRUMENTS

1996 No. 551

HEALTH AND SAFETY

Gas Safety (Management) Regulations 1996

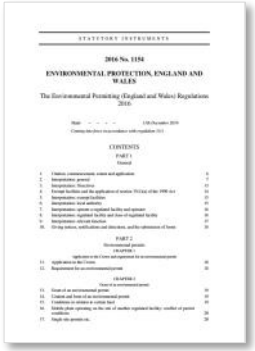
Safety


SCOTTISH STATUTORY INSTRUMENTS

2012 No. 360

ENVIRONMENTAL PROTECTION

The Pollution Prevention and Control (Scotland) Regulations 2012


STATUTORY INSTRUMENTS

2016 No. 1154

ENVIRONMENTAL PROTECTION, ENGLAND AND WALES

The Environmental Permitting (England and Wales) Regulations 2016

CONTENTS


DIRECTIVES


DIRECTIVE 2010/75/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL

of 24 November 2010

on industrial emissions (integrated pollution prevention and control)

(Recast)


REGULATION (EC) No 1907/2006 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL

of 18 December 2006

concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH), establishing a European Chemicals Agency, amending Directive 1999/45/EC and repealing Council Regulation (EEC) No 793/93 and Commission Regulation (EC) No 1488/94 as well as Council Directive 76/769/EEC and Commission Directives 91/155/EEC, 93/67/EEC, 93/105/EC and 2000/21/EC

Environmental

How we plan for the future

Supply and Demand Forecasts → **Network Capability Assessment** → **Assessing Options**

What do our customers want?

What will future supply and demand patterns look like?

What challenges do we anticipate?

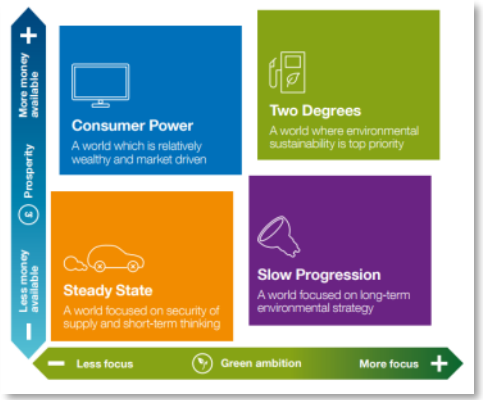
Can the network meet the needs of the future ?

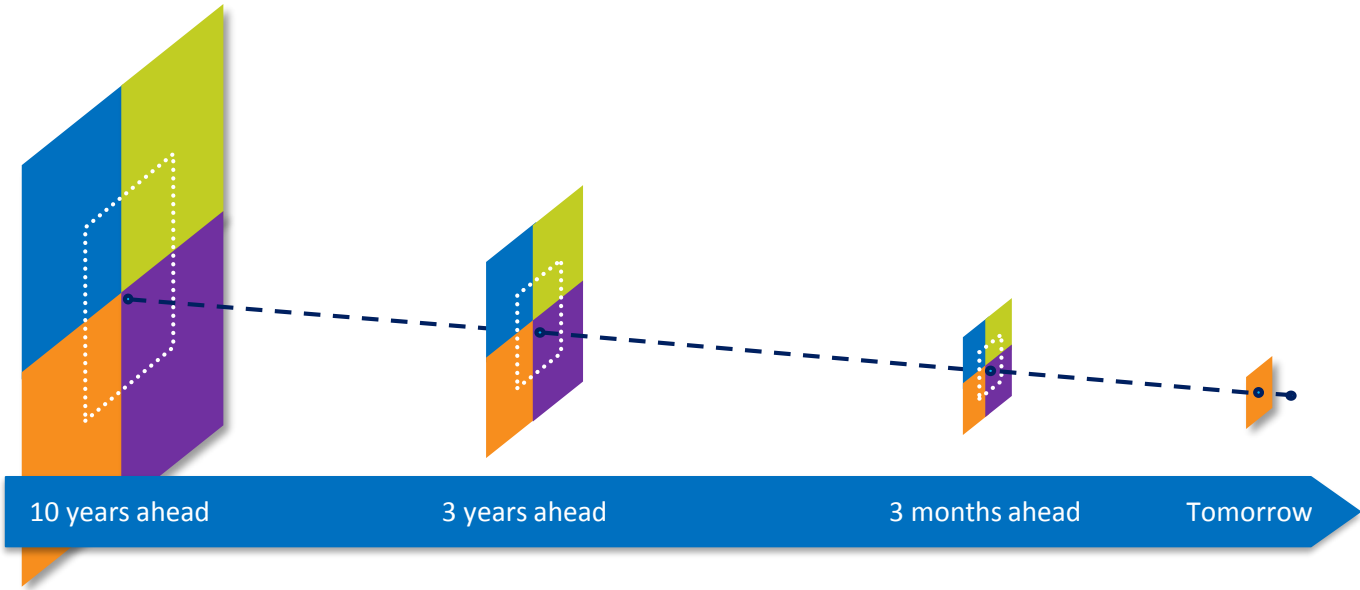
What are the options available to us?

Which is the best option?

How we plan for the future

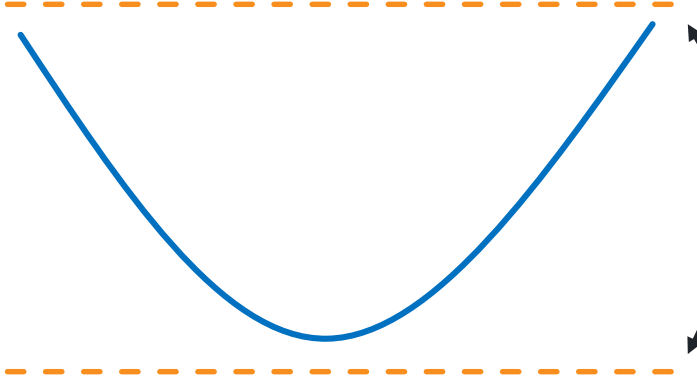
Supply and Demand Forecasts → **Network Capability Assessment** → **Assessing Options**





How we plan for the future

Supply and Demand Forecasts → Network Capability Assessment → Assessing Options



Maximum Operating Pressures

Safety Obligations

"Cover" providing time to respond to unforeseen events

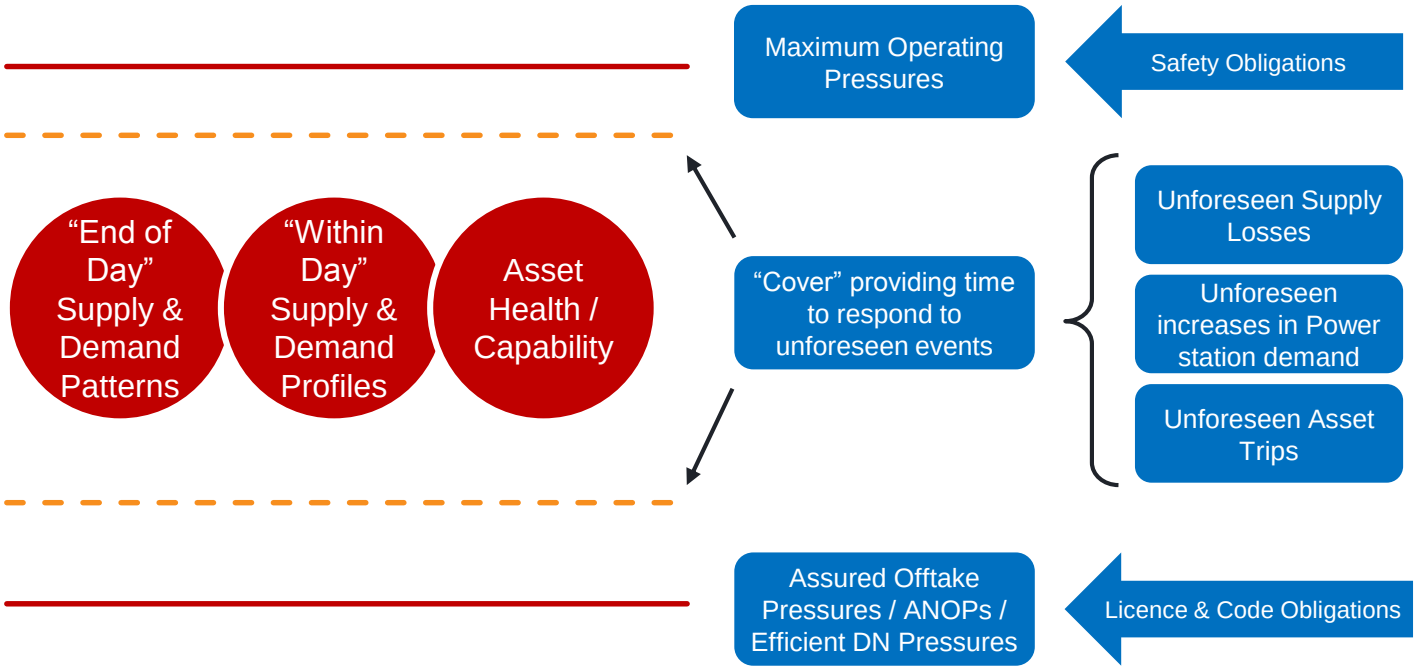
- Unforeseen Supply Losses
- Unforeseen increases in Power station demand
- Unforeseen Asset Trips

Assured Offtake Pressures / ANOPs / Efficient DN Pressures

Licence & Code Obligations

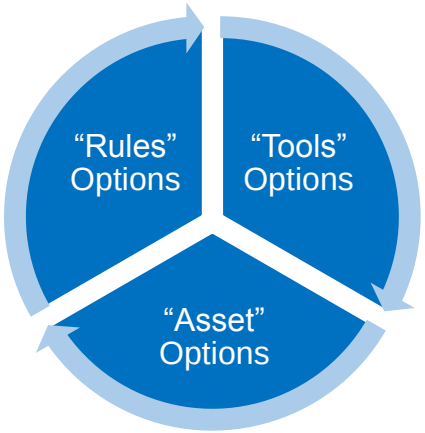
How we plan for the future

Supply and Demand Forecasts → Network Capability Assessment → Assessing Options



How we plan for the future

Supply and Demand Forecasts → Network Capability Assessment → Assessing Options

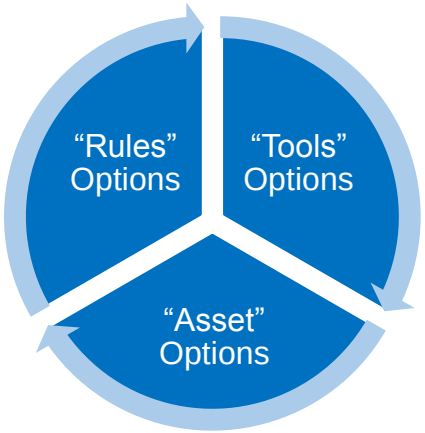


Cost Benefit Assessment

Cost of constraint mgmt. actions, if we do nothing	Cost of constraint mgmt. actions, with options included	Whole life cost of options
Network Operating Costs (with / without options)	Gas / Electricity / CO2 / SOx / NOx Prices	Probability of supply and demand patterns occurring

How we plan for the future

Supply and Demand Forecasts → Network Capability Assessment → Assessing Options



£

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Higher reliability

Future Proof

Higher cost

Higher resilience

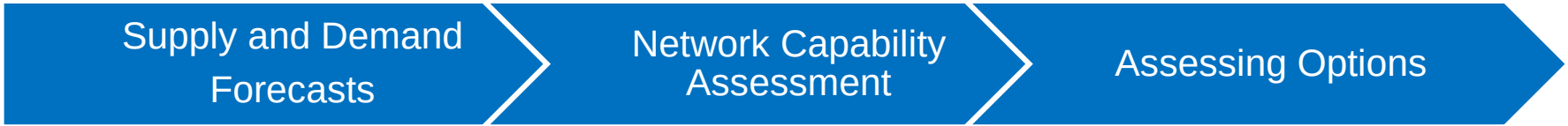
Lower reliability

Limited Future Options

Lower Cost

Lower resilience

Stakeholders have said…



- Need to narrow down the (FES) options
- A timeline of when things need to happen, or decisions need to be made, to eliminate or indicate possible scenarios would be helpful
- Make a case to more actively share information ….would ensure we make optimal decisions

- Is National Grid doing enough in the Innovation space?
- Reflect on gas quality specifications….make the NTS more accessible for supplies from other parts of the world
- Collaboration is absolutely key The regulator needs to enable / facilitate the collaboration

- Translate each scenario and investment into the impact on the consumer bill
- Need to understand impact through whole costs …. to change the network & costs to the consumer to convert to different technologies / appliances
- 10 year statement could include more on historical & future pressures in the network at a zonal level

How should we be communicating outputs?

Future of Gas

- reflections to date

Emily Leadbetter

Gas Market Strategy Manager

Future Of Gas Programme: Our objectives

Understand customer & stakeholder views to set out what the future holds for gas

Understand the potential future impacts on our network and the gas market

Develop policy recommendations to support government and regulators

Consider innovative solutions to future challenges

Our internal work: Future Energy Scenarios 2017
Testing the potential impacts on our network

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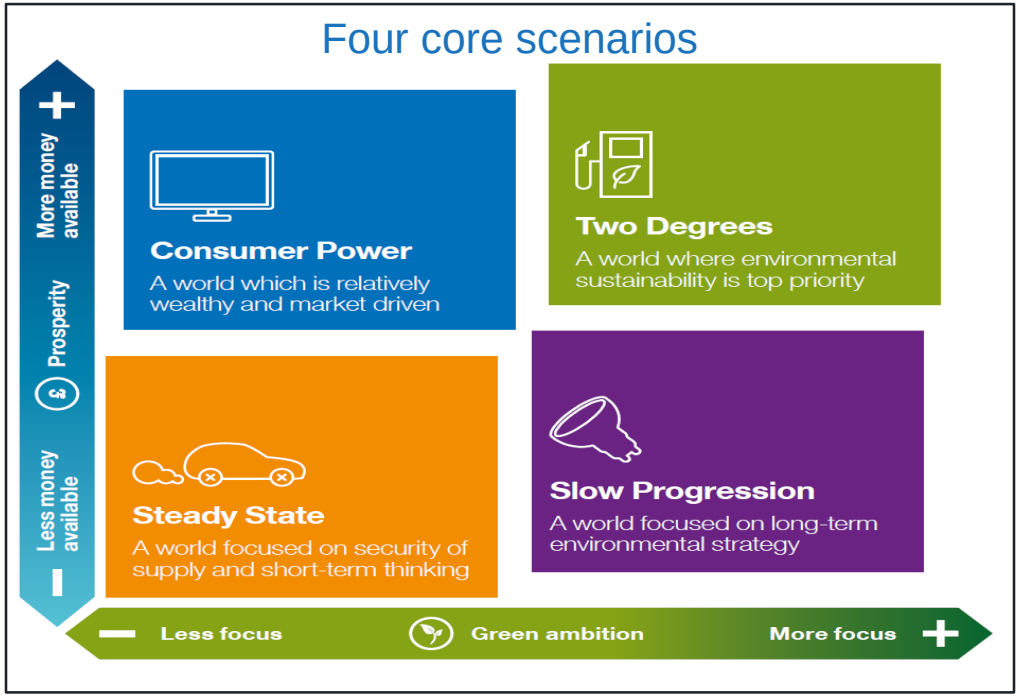
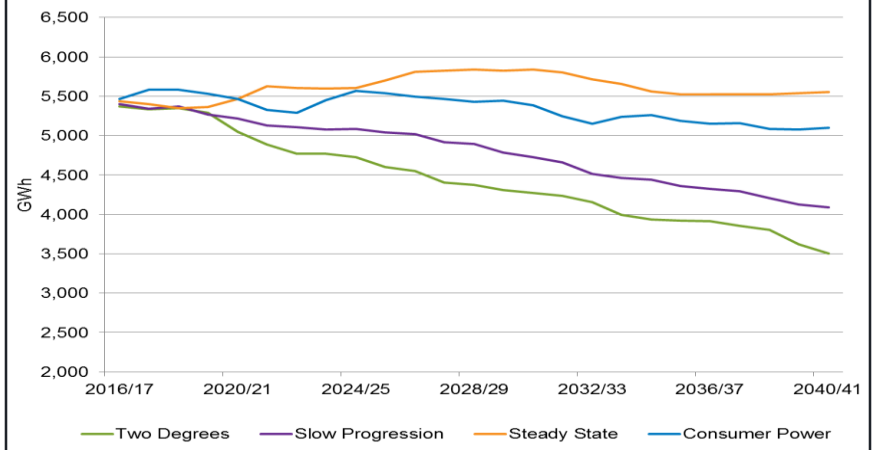
Four core scenarios



Future gas demand for a 1-in-20 peak day



In all scenarios and sensitivities there is an enduring need for gas

Source: National Grid Future Energy Scenarios 2017

Future Energy Scenarios 2017: Sensitivities

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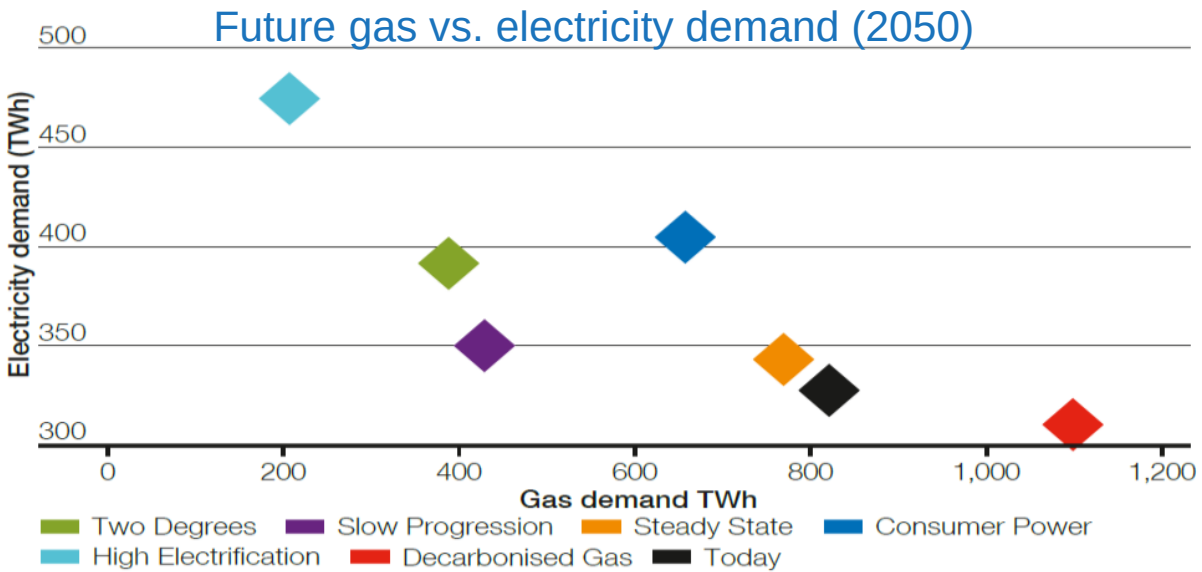
High Electrification

What would happen if society decided we should pursue a more electric future, with more renewable electricity, to help us reduce our dependency on fossil fuels?

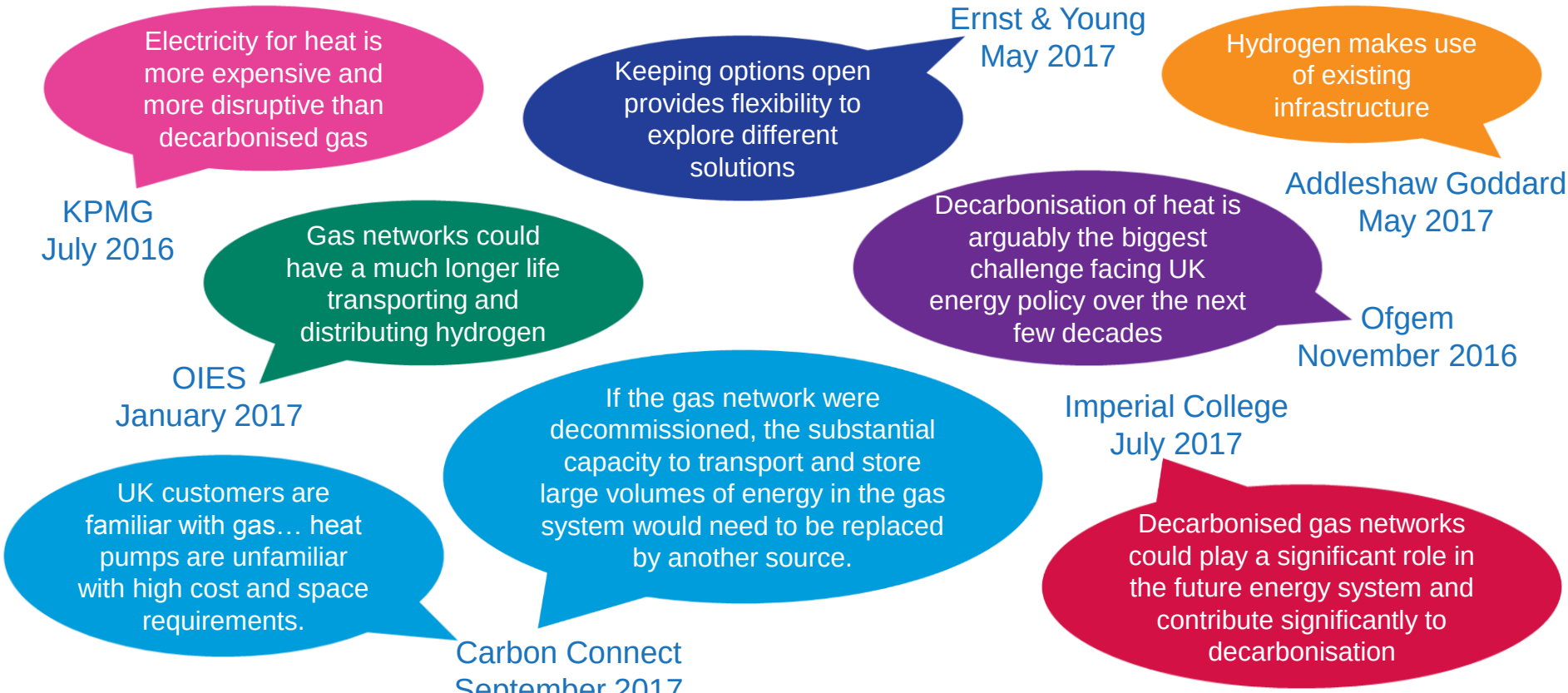
Decarbonised Gas

What would happen if heat was decarbonised through an alternative approach to heat pumps, which still enabled the 2050 carbon reduction target to be met?



Source: National Grid Future Energy Scenarios 2017

External work: Academic and industry reports



Our external learning:
Themes coming from customers and stakeholders

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There is **considerable uncertainty** on decarbonisation policy and approach

Making the **best use of existing assets** (rather than building new ones) will minimise the disruption caused.

Innovation will be essential to achieve decarbonisation – particularly in CCS

No one single technology or solution will achieve decarbonisation in an affordable way. The combination that will emerge remains uncertain.

We need to ensure that ongoing network and market framework development keep as many credible future scenarios **open for as long as possible**.

Gas will increasingly play a **key role across the whole energy system**: delivering flexible power generation to support low carbon generation and supplying energy for heat and transport

Optimising use of existing infrastructure and supply chains will likely be **more affordable than full electrification of heat** / transport.

So what does the future hold for gas? What we now believe…

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1. Gas has an important long term role but as the pathways are uncertain, now is not the time to shut down optionality
2. Gas supports the wider UK economy as it represents good value for consumers and supports industrial processes
3. We need to decarbonise heat but nothing substantial will change for heat in the short term
4. Decarbonising transport with gas is happening today so could be an early priority
5. Supply sources are going to change; we need to consider the market rules to ensure GB remains attractive
6. System operability is going to become more and more challenging, making gas and electricity interactions more important
7. Whilst energy storage is growing in importance, the gas system itself remains a critical store
8. Innovation in gas is imperative: Government, regulators and industry need to work together to investigate and facilitate different technologies, in particular CCS
9. Hydrogen will play a role in the energy future, but how big a role remains uncertain

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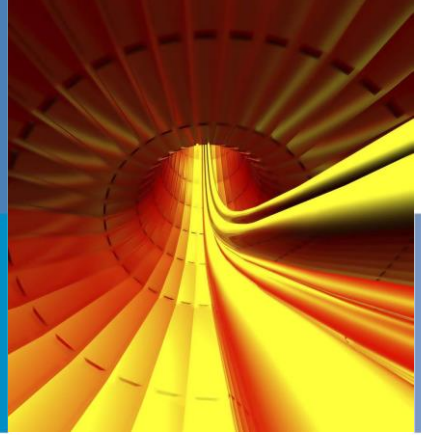
What's the best way to drive **innovation** across the industry?



Lunch

Working groups

- Compressor Strategy
- Innovation
- Valuing Risk

Questions

Bridget Hartley

Gas Transmission RIIO T2 and Investment Assurance Manager

Next steps

Thank you for attending

Shaping the Gas Transmission network of the future