

Industrial Emissions Directive Setting the Scene

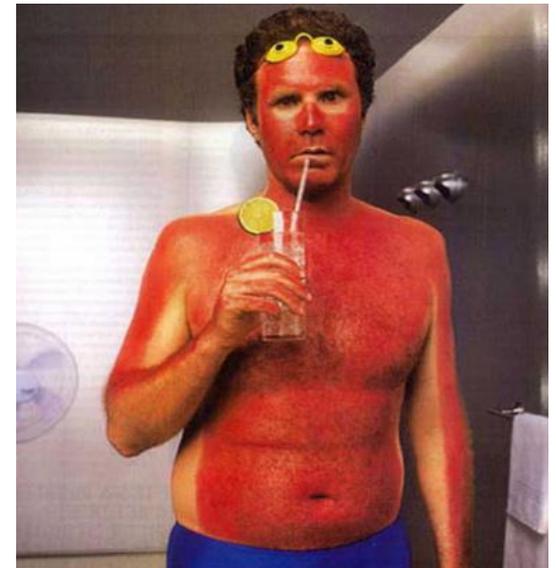


The Grand Connaught Rooms, London
16th July 2014

Safety Moment – Staying safe in the sun

What's the harm in a bit of sunburn?

- Overexposure to the sun and sunburn are the most significant risk factors for skin cancer
- Children and young adults at increased risk
- Effect typically not seen until at least your 40's



Safety Moment – Staying safe in the sun

■ Key advice is to:



spend time in the shade between 11am and 3pm



cover up with a t-shirt, hat and sunglasses



use SPF 15+ sunscreen with a high star rating – apply sunscreen generously and reapply often



young skin burns easily, so take extra care with children in the sun



report unusual moles or skin changes to your doctor

Introduction



Mike Calviou
Director - Transmission Network Service

Agenda

- Introduction
- Future Energy Scenarios

Coffee

- Understanding how National Grid makes investment decisions
- Understanding stakeholder priorities

Lunch

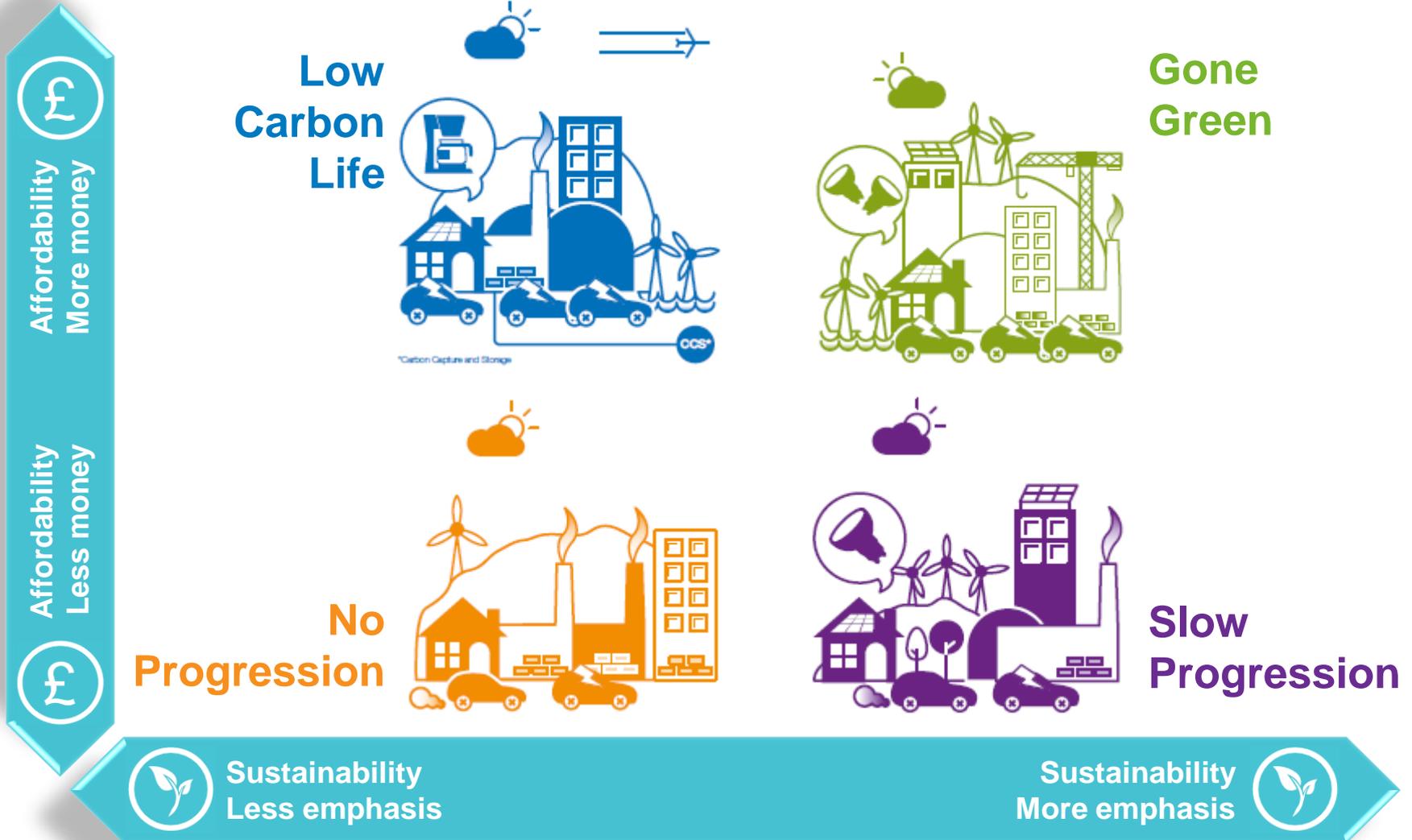
- Transmission Planning Code Review
- Sensitivities to scenarios
- Close

Future Energy Scenarios



Ben Graff
Transmission Strategy Manager

Our 2014 Future Energy Scenarios

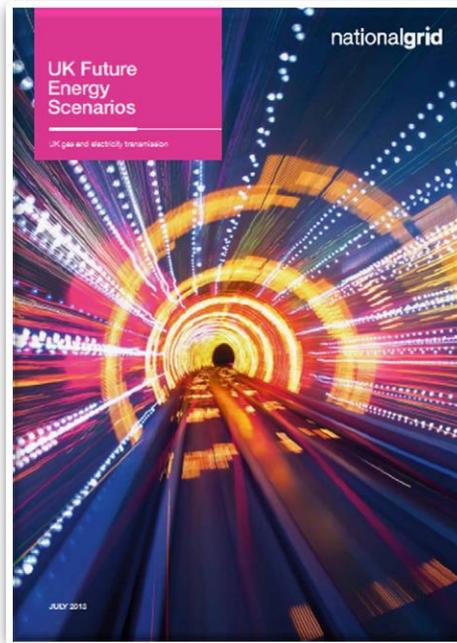


Our vision of the future affects & informs how important decisions are made...

Development of transmission systems



European developments



Supply & demand for the year ahead

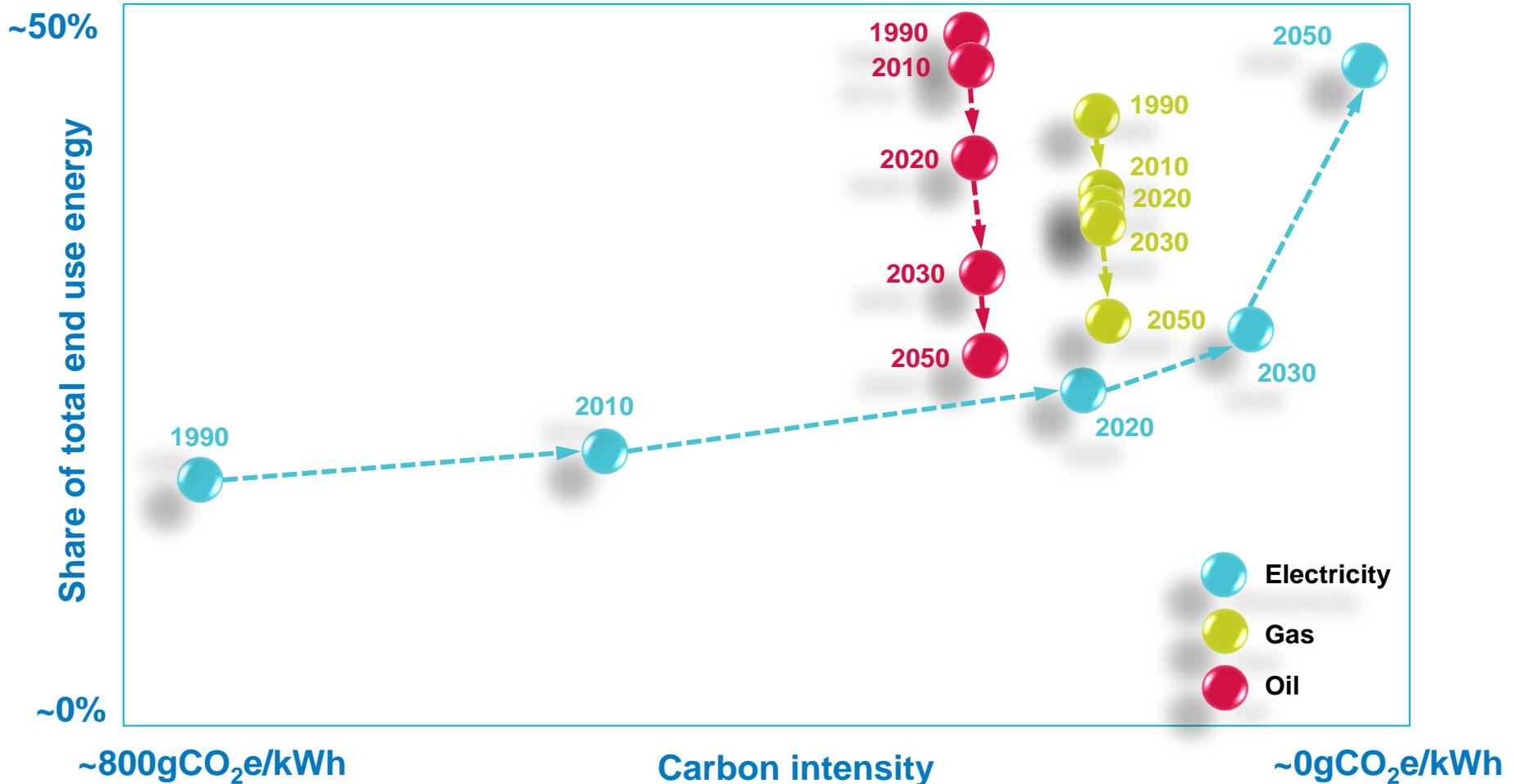


Security of supply & decarbonisation



Decarbonisation of energy a consistent theme...

A 'Low Carbon Life' pathway to 2050:



Some other common themes



Gas Demand – narrow range between the scenarios through to the end of the decade



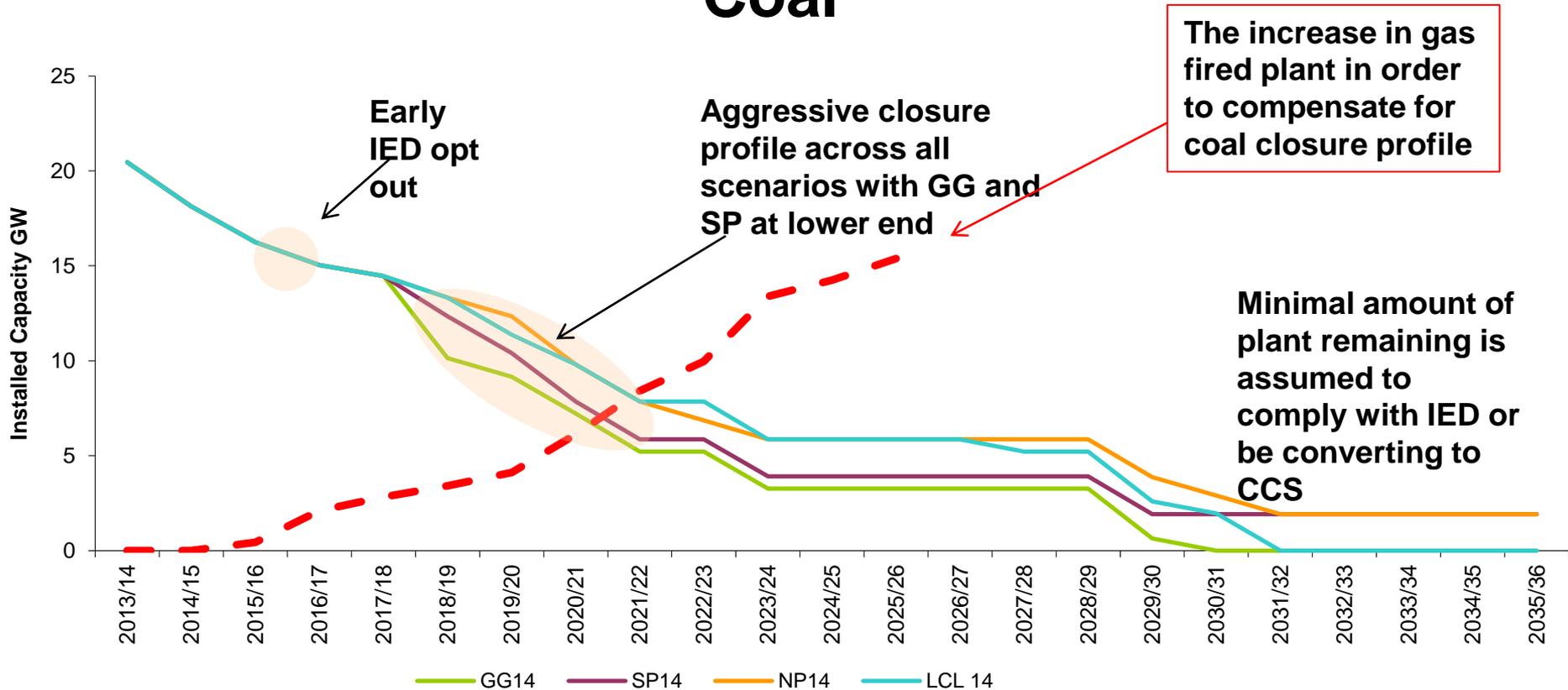
Brief UKCS renaissance in all scenarios



Norwegian gas makes up a significant part of the supply market

In all scenarios IED opt out plant run down by early 2020s

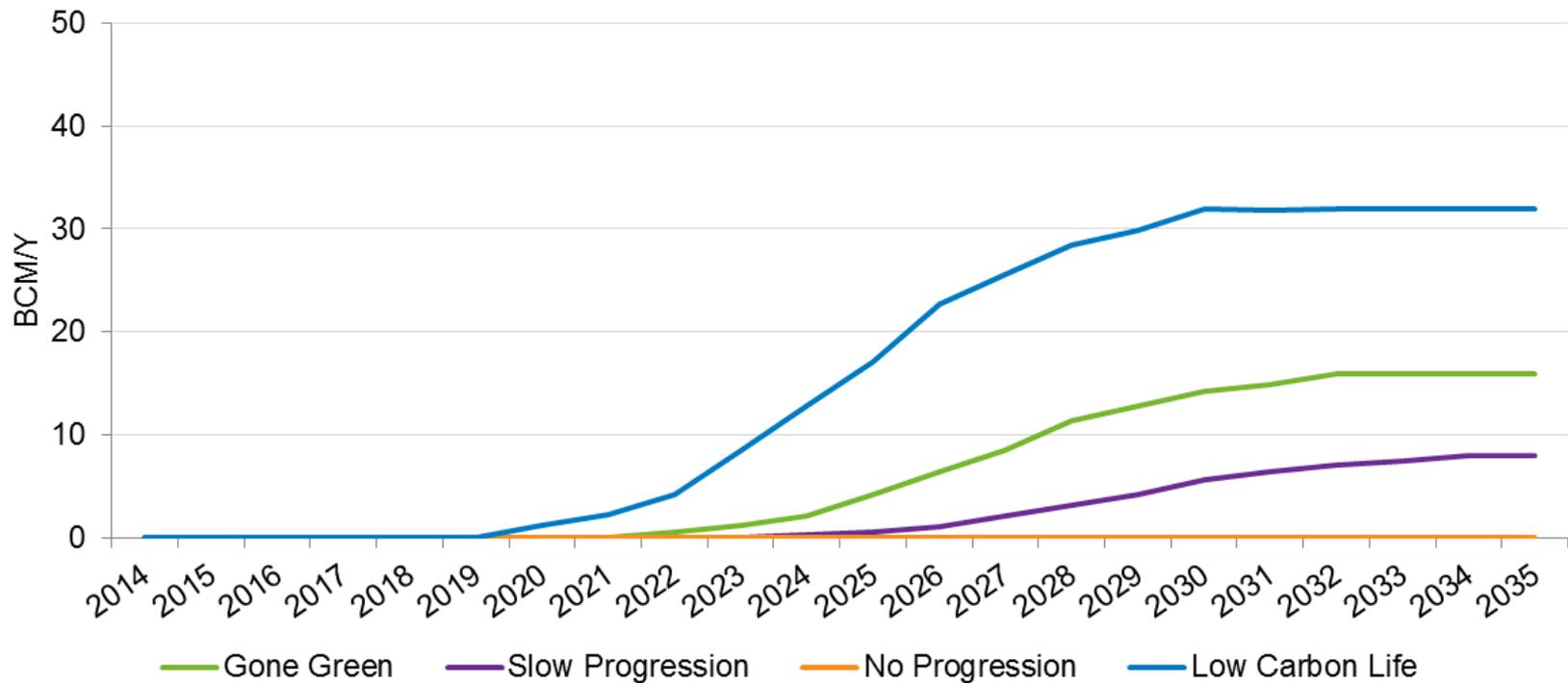
Coal



But many uncertainties; A large envelope^{nationalgrid} of parameters – Some to be explored later

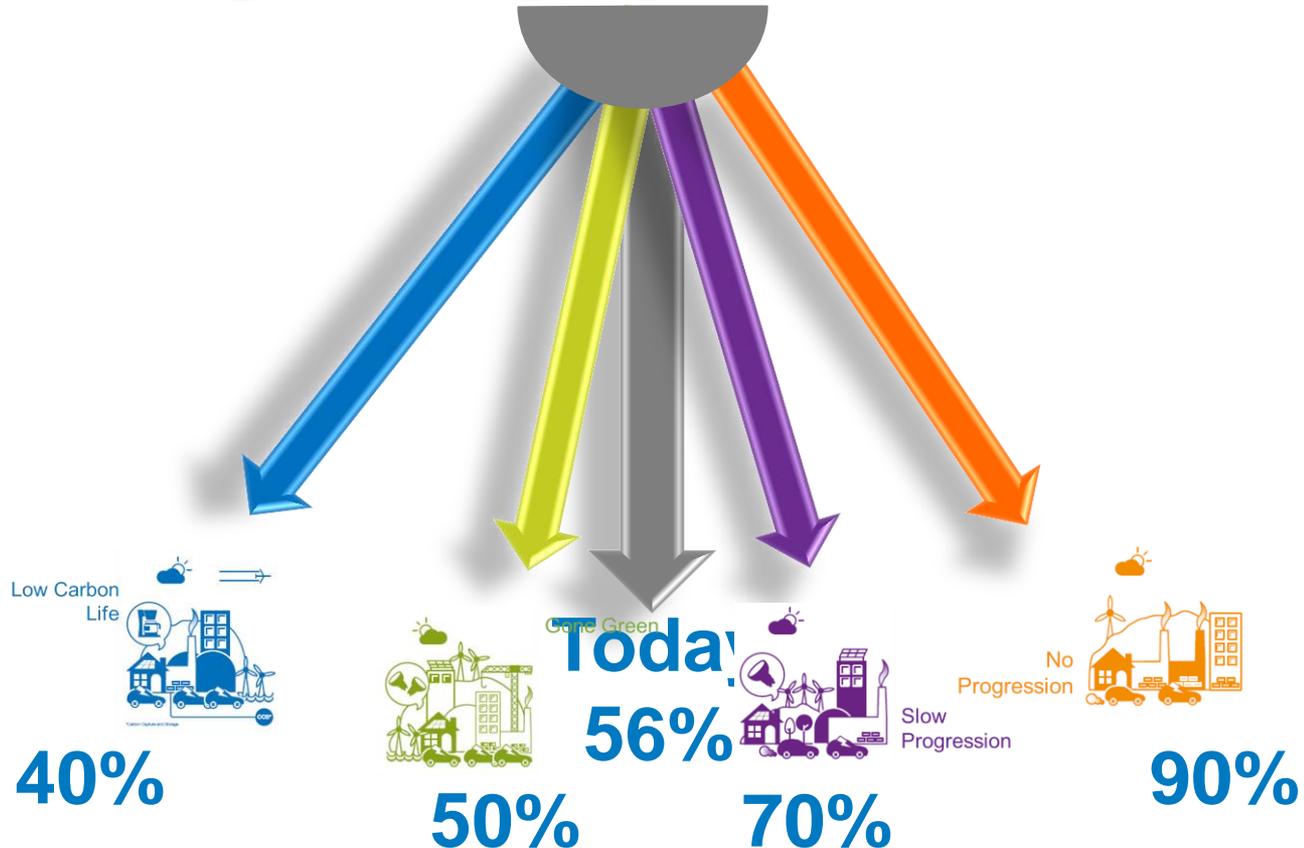


Many Uncertainties Shale - Hero or Zero?

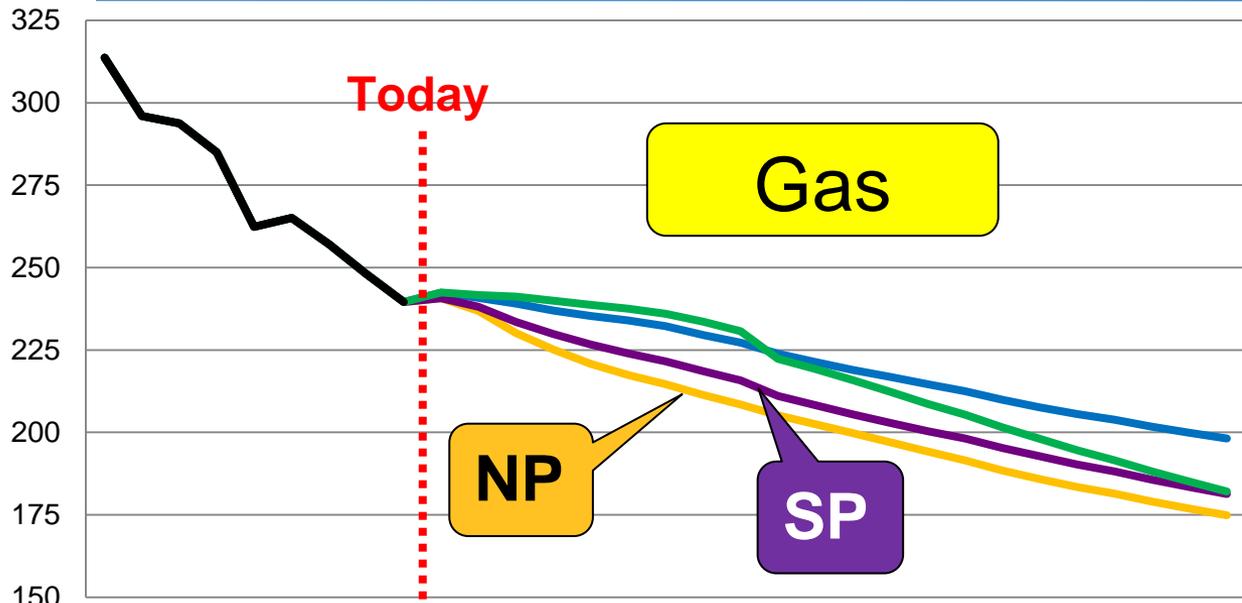


What will our 2035 import dependency be?

SWING-O-METER



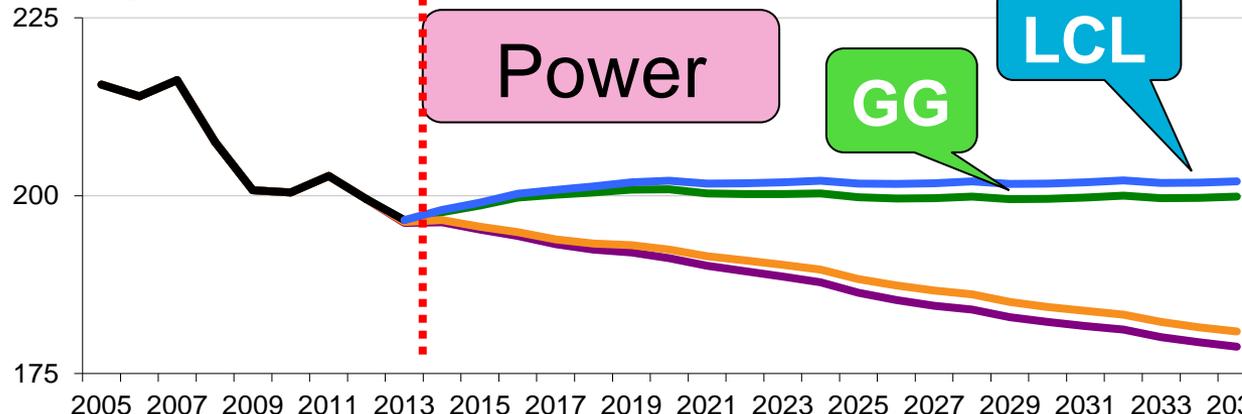
Potential Trends: Annual Demand – Industrial and Commercial



Decrease reliance on gas over past decade

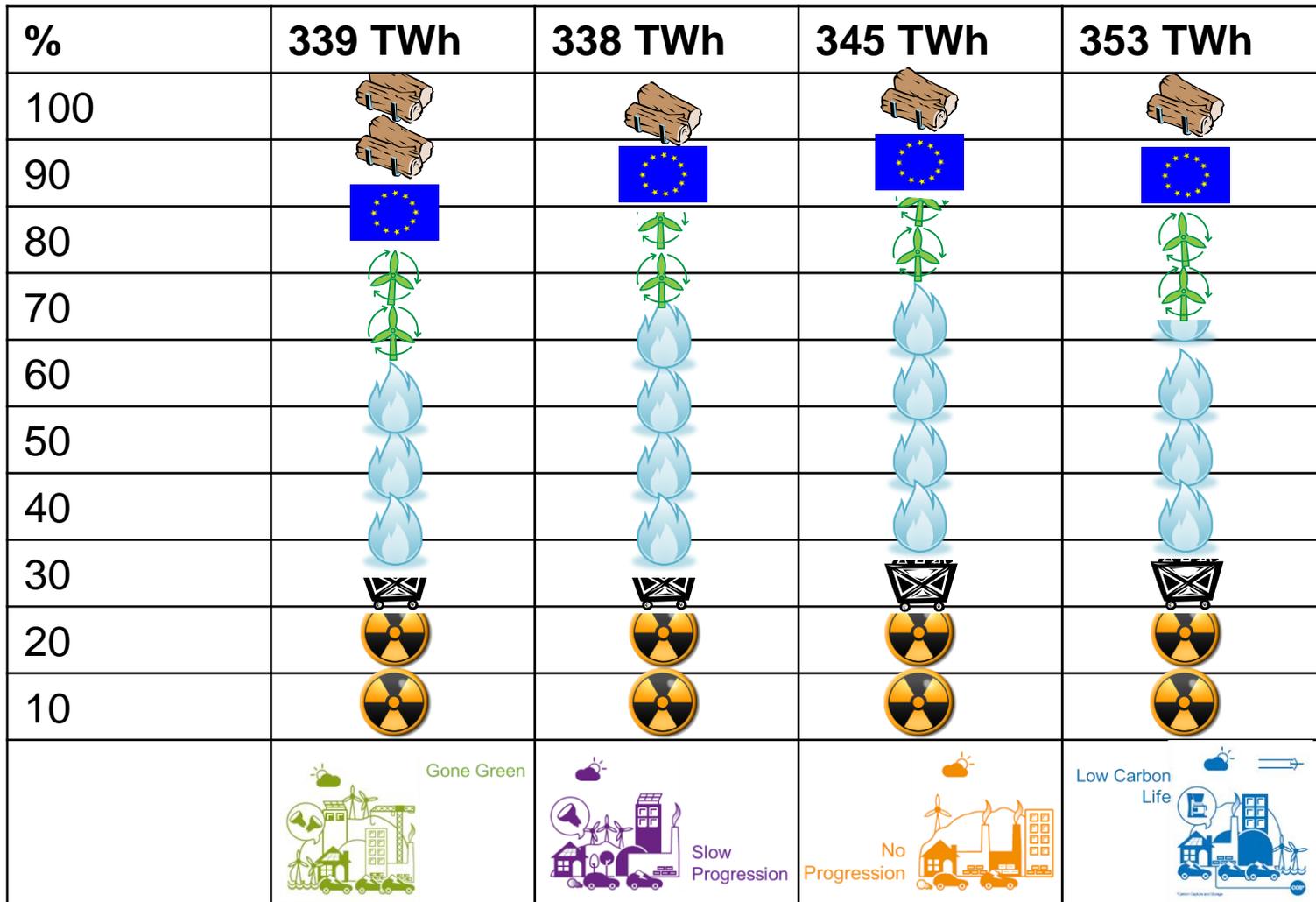
Shift away from energy intensive industries towards commercial sector

TWh/yr

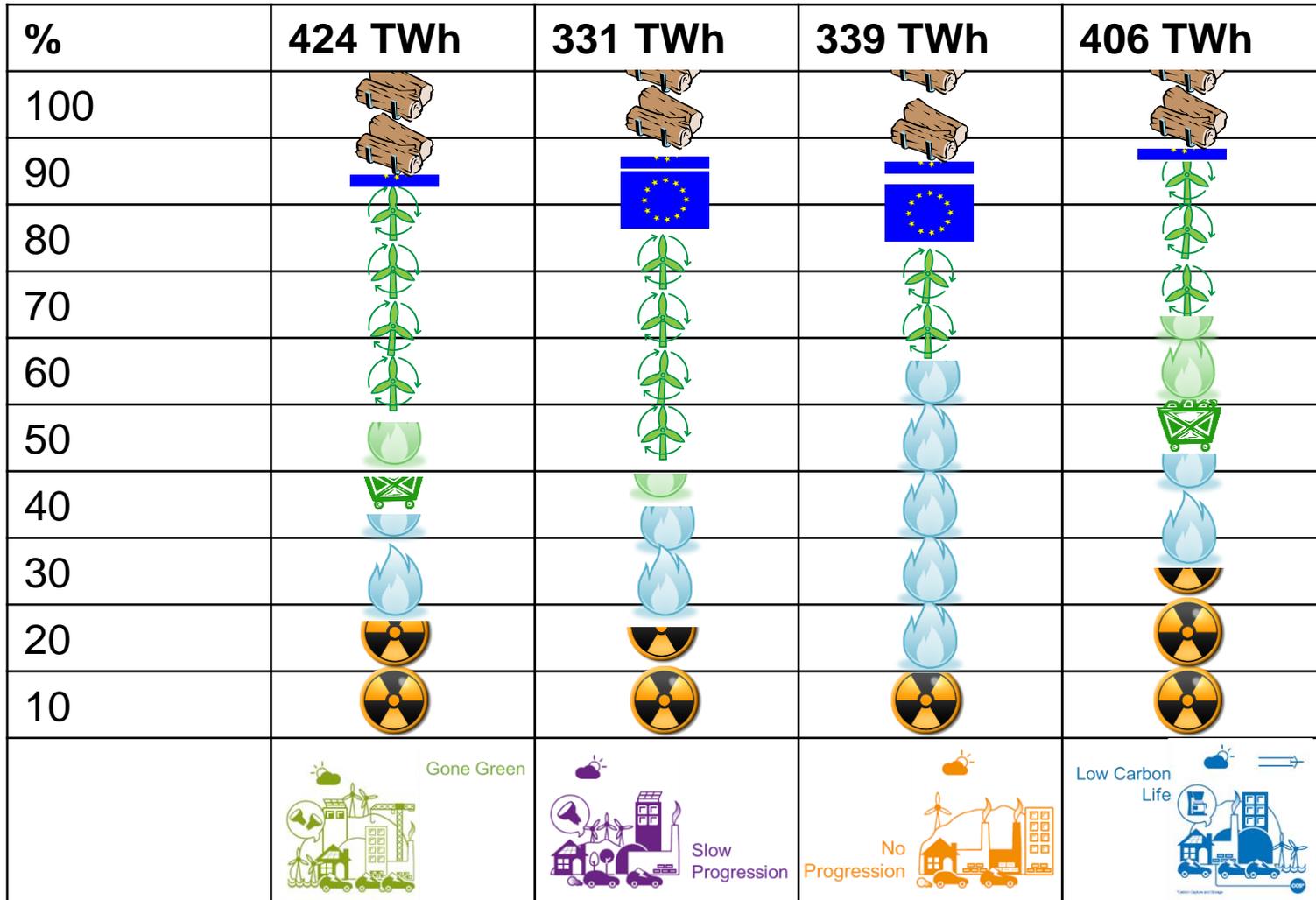


Higher economic growth in GG and LCL causes the commercial gas demand and power demand to increase

Potential Trends : 2020 Electricity Generation mix



Potential Trends: 2035 Electricity Generation mix

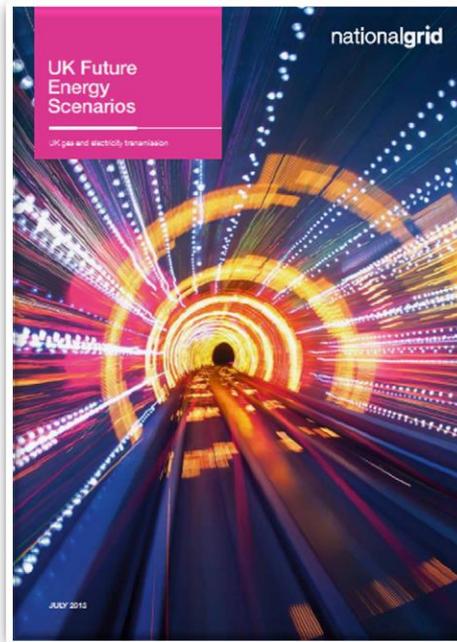


Our vision of the future affects & informs how important decisions are made...

Development of transmission systems



European developments



Supply & demand for the year ahead



Security of supply & decarbonisation



Learning from electricity experience...



Least Regret Decision Making

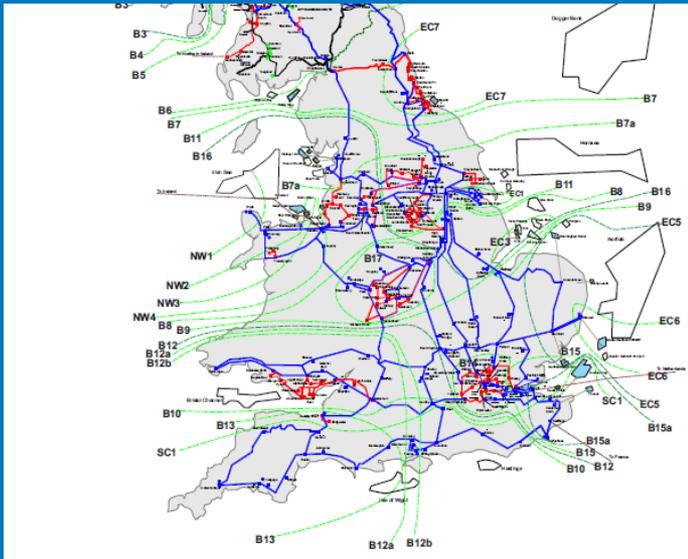
Building on RIIO experience to develop the NDP

What might a gas NDP look like?

Q&A



Network Development Policy



Stewart Whyte, Network Development Strategy Manager

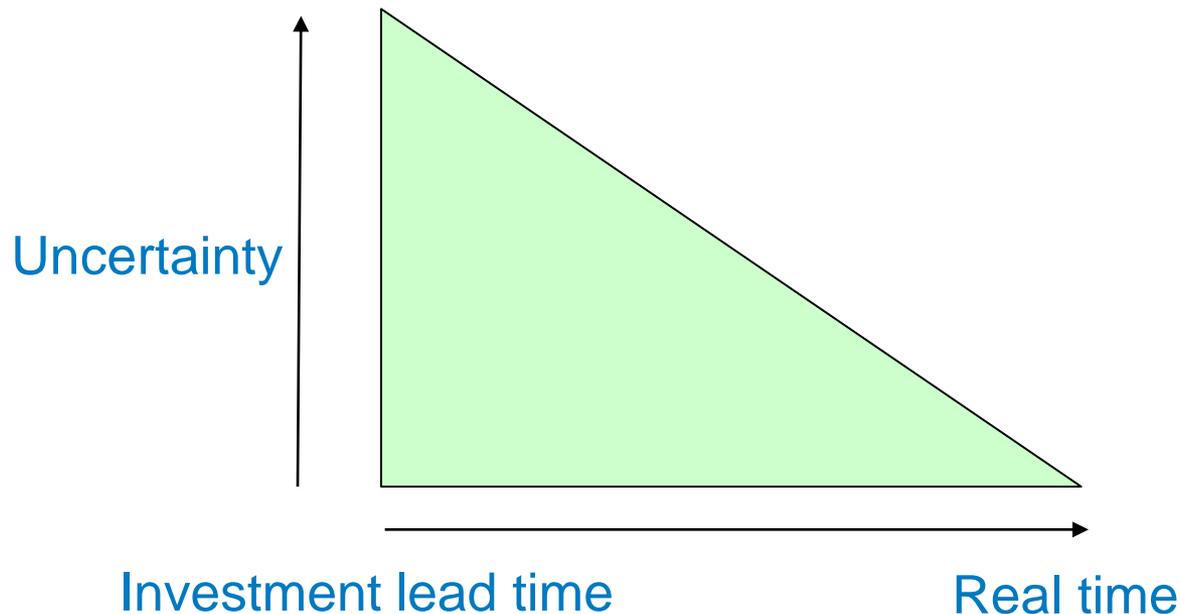
16th July

Agenda

- Overview
- Why the Network Development Policy?
- Introduction to the Network Development Policy Annual Process
- Scenario Planning
- Requirements and Capability of system
- Future Investment Decision Making Process

Background

- Future Energy Scenarios are key input to our network development decisions
- Scenarios show uncertainty



Background

- Various investment drivers
 - Changing generation or supply patterns
 - Changing demand patterns / increasing levels
 - Asset replacement
 - Design / security standards

Invest too early?

**Inefficient financing cost
Risk of stranding**

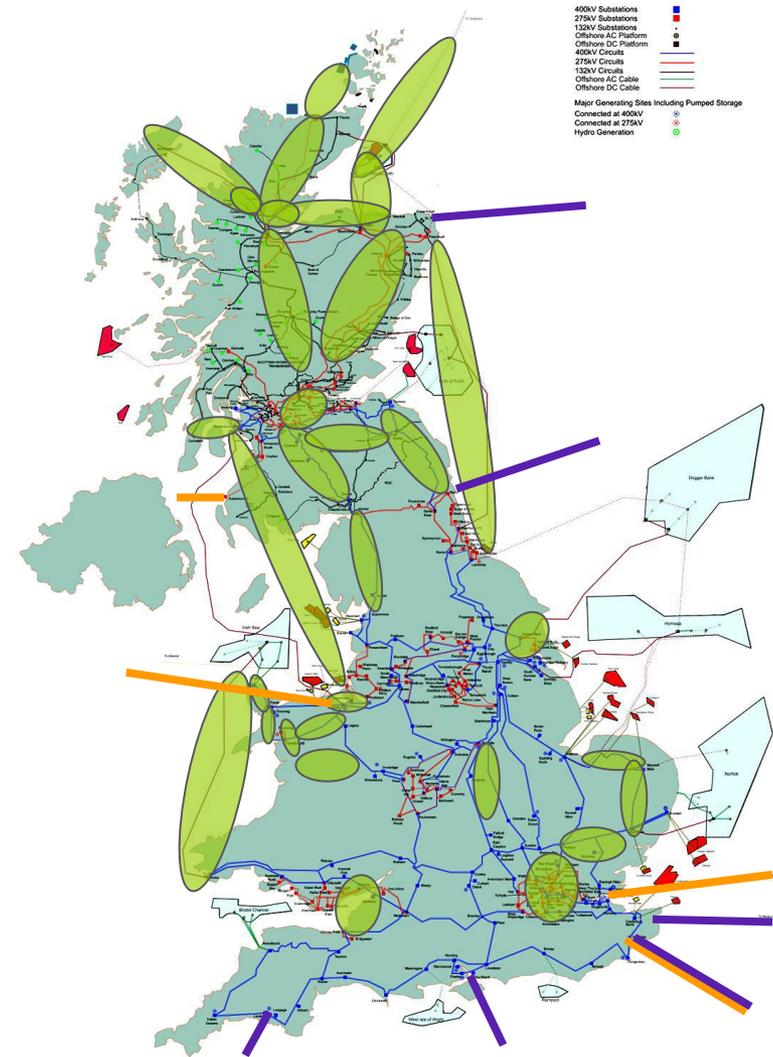
Invest too late?

Inefficient congestion cost

Where does NDP apply?

- Major System Boundaries
- Schemes with significant spend
- England & Wales only
 - NDP associated with NGET RIIO-T1 deal
- Published two annual NDP outputs thus far

Option	Decision	Scenario Completion Date	
		Slow Progression '13	Gone Green '13
Western HVDC Link	Progress Construction	2016	2016
Eastern HVDC Link 1	Continue Pre-Construction Scoping	N/A	2023
Series Compensation (North England)	Complete Construction	2014	2014
Norwich - Braford Reconductoring	Delay	2025	2022
Bramford - Twinstad New Overhead Lines	Delay	2025	2022
Wymondley New Quadrature Booster	Commence Pre-Construction	2018	2019
Hackney - Tottenham Waltham cross Uprate Line from 275kV to 400kV	Delay	2024	2022
Wylfa Pembroke HVDC Link	Delay	N/A	N/A
Wylfa - Pentir Second Transmission Route	Delay	2025	2023
Hinkley - Seabank New Circuit	Commence Pre-Construction	2020	2021



NDP – Providing a clearer path



Unsuitable

Proactive

Measurable

Uncertainty

Prudent

Efficient

Unclear

Smarter

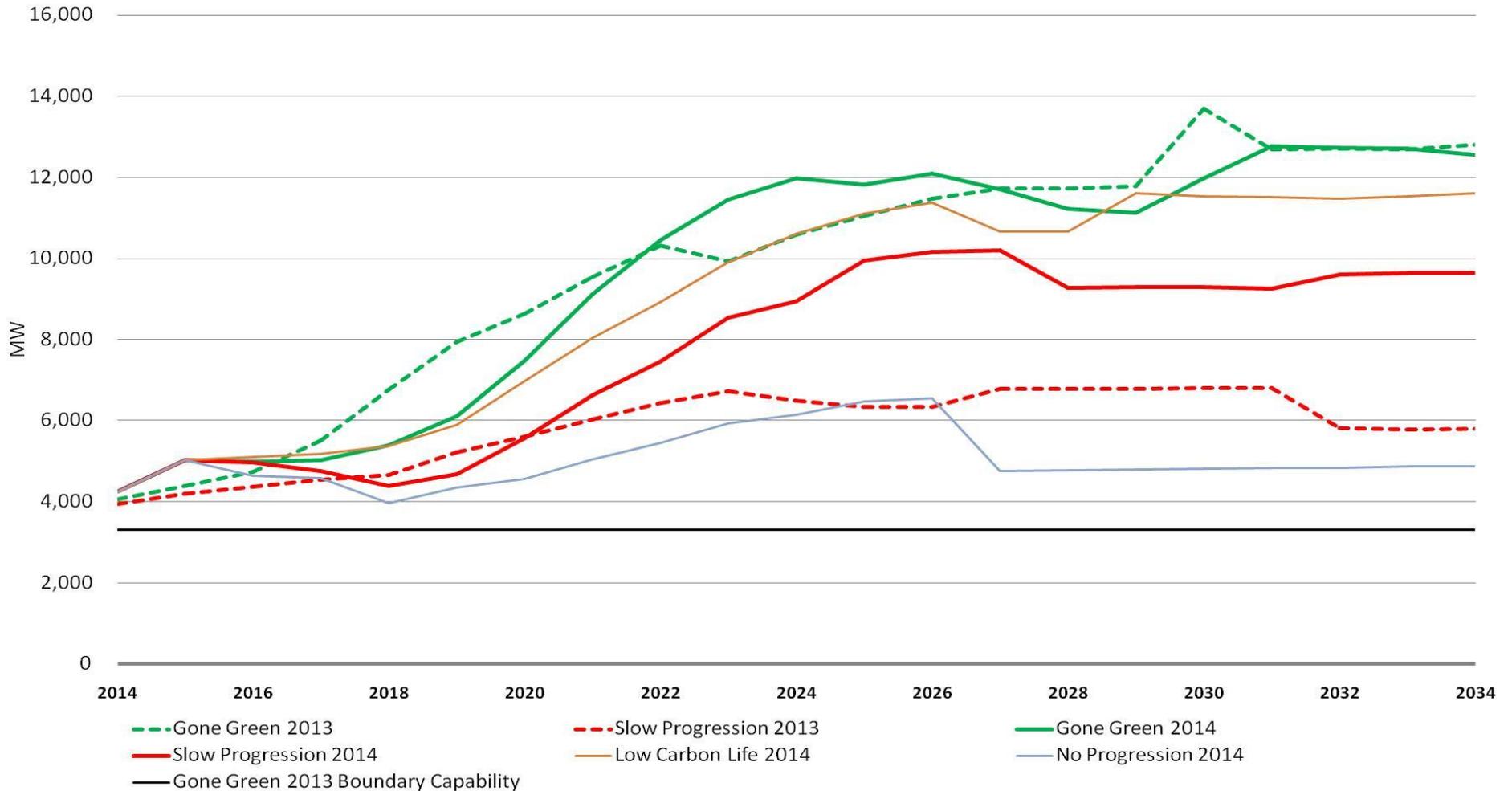
Controllable

Reactive

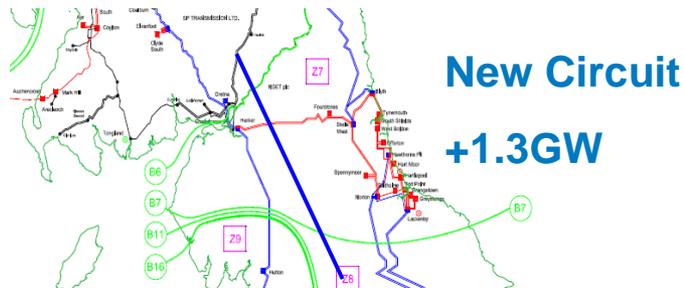
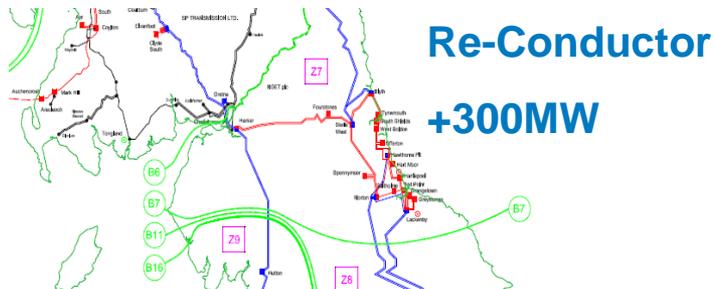
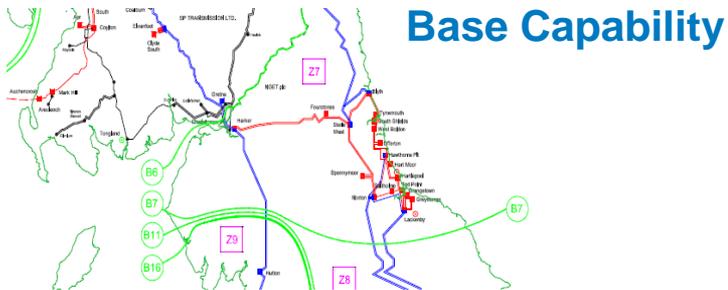
Calculated

Flexible

System Requirements based on Scenarios



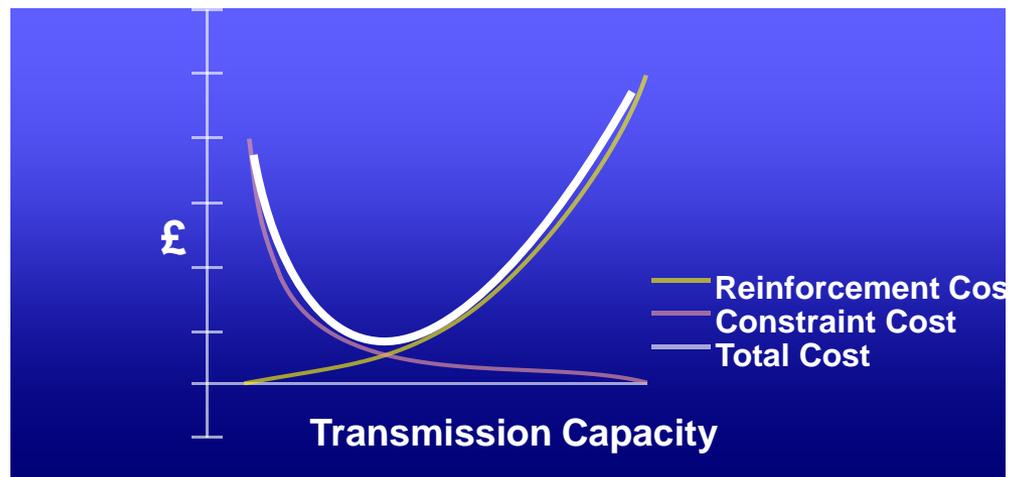
Boundary Capabilities and Reinforcements



- The amount of Power based on System Limits that can be transferred over a boundary
- Generally based on thermal, voltage and stability
- Boundaries have a known base capability
- Each reinforcement is analysed to show the benefit of its inclusion
- Benefit vs Cost analysed

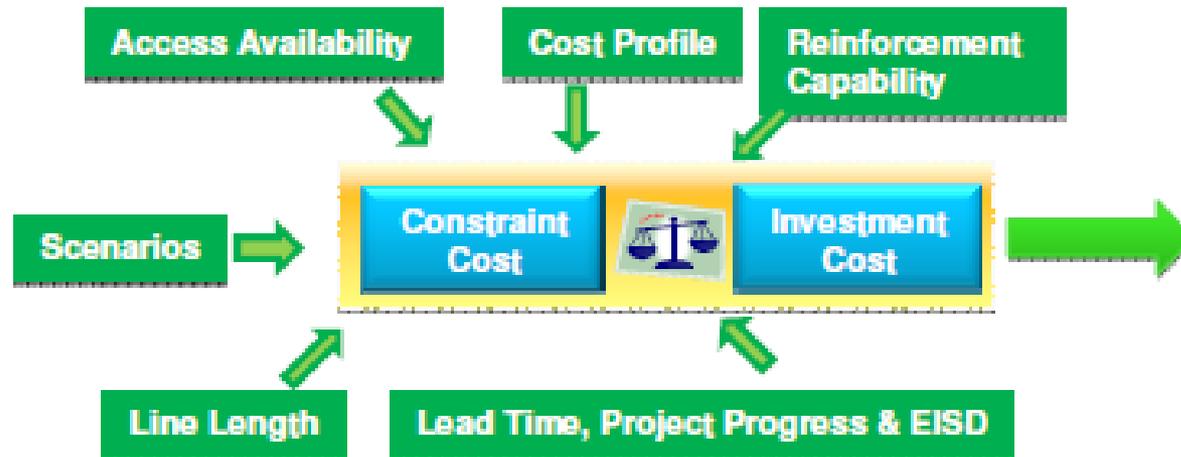
Analysing and Choosing the right reinforcement

- Determine optimum timing of reinforcements through Cost Benefit Analysis (CBA)
- Utilise Electricity Scenario Illustrator (ELSI) to analyse cost of investment vs constraints
- Provide robustness to optimum timing of reinforcements through “least regret analysis” as appropriate reflecting the value and proportionality of investment



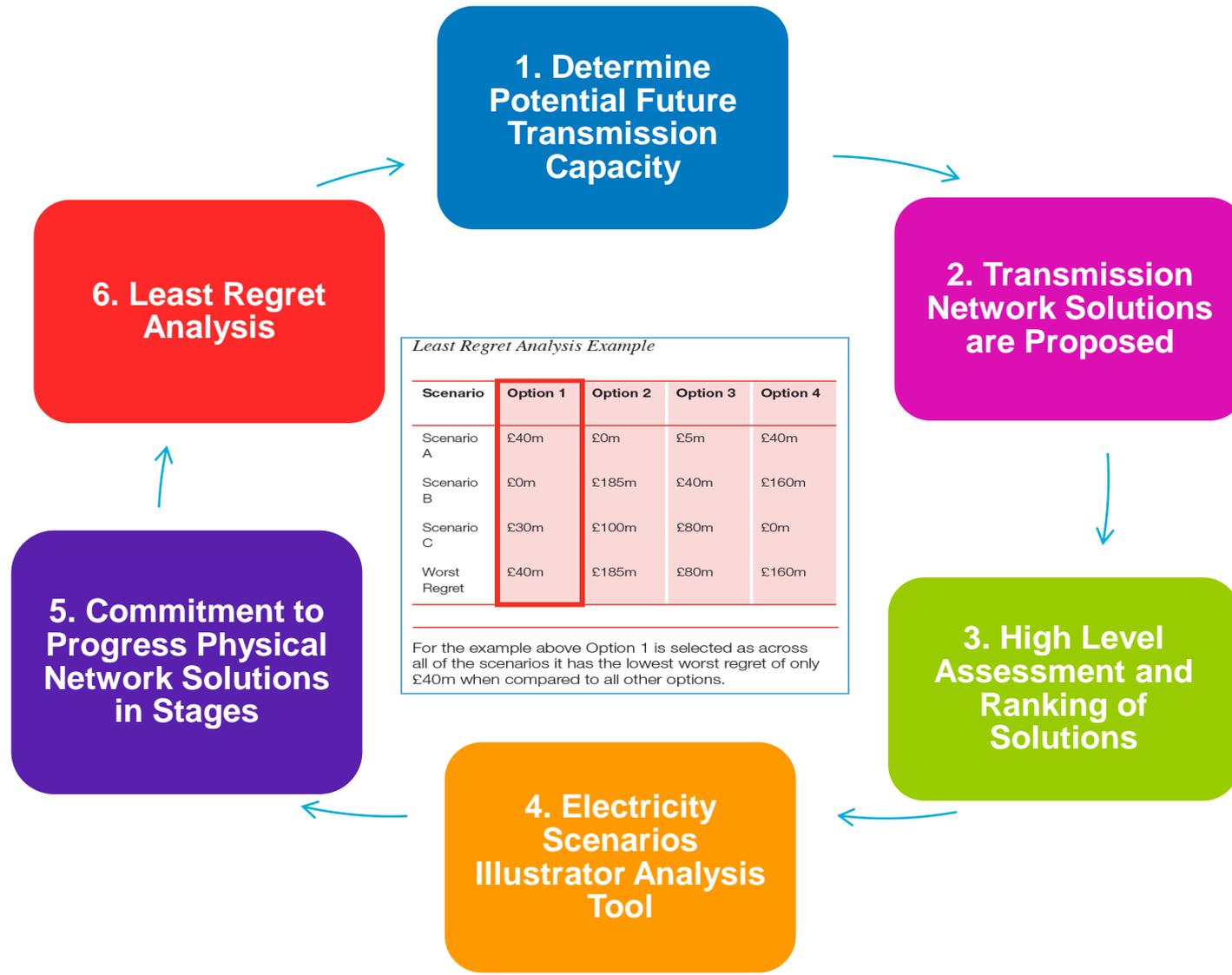
Analysing and Choosing the right reinforcement

Cost Benefit Analysis (CBA)



- Determine optimum timing of reinforcements through Cost Benefit Analysis (CBA)

Decision Making



Decision Making

- Least Regret Analysis
- The regret associated with each of the current –year options is calculated against each of the scenarios
- The regret against a particular scenario is defined as the difference in cost between the option and the best possible transmission strategy for that scenario

Current Year Options	Gone Green	Low Carbon Life	No Progression	Slow Progression	Worst Regret
Option 1	£17m	£0	£24m	£12m	£24m
Option 2	£29m	£197m	£0m	£15m	£197m
Option 3	£0m	£15m	£32m	£27m	£32m
Option 4	£17m	£182m	£17m	£0m	£182m

Network Development Policy

Group Exercise

Q.1 When does it appear we need a reinforcement on boundaries B6 and B7a

Q.2 Under what scenarios does Eastern Link give a +ve benefit?

Q.3 What is the optimal year for the Eastern Link reinforcement based on Gone Green only?

Q.4 What is the Least Regret investment decision?

Network Development Policy

Group Exercise Answers

A.1 B6 – 2018/19 and B7a 2021/22

A.2 Gone Green, Gone Green sensitivity and Accelerated Growth

A.3 2020 or 2021

A.4 Progress with both the Mersey Ring and Eastern Link

Network Development Policy

Questions Please?

Gas Transmission Network Strategy Stakeholder Scorecard

Eddie Blackburn

IED Stakeholder Event
16th July 2014

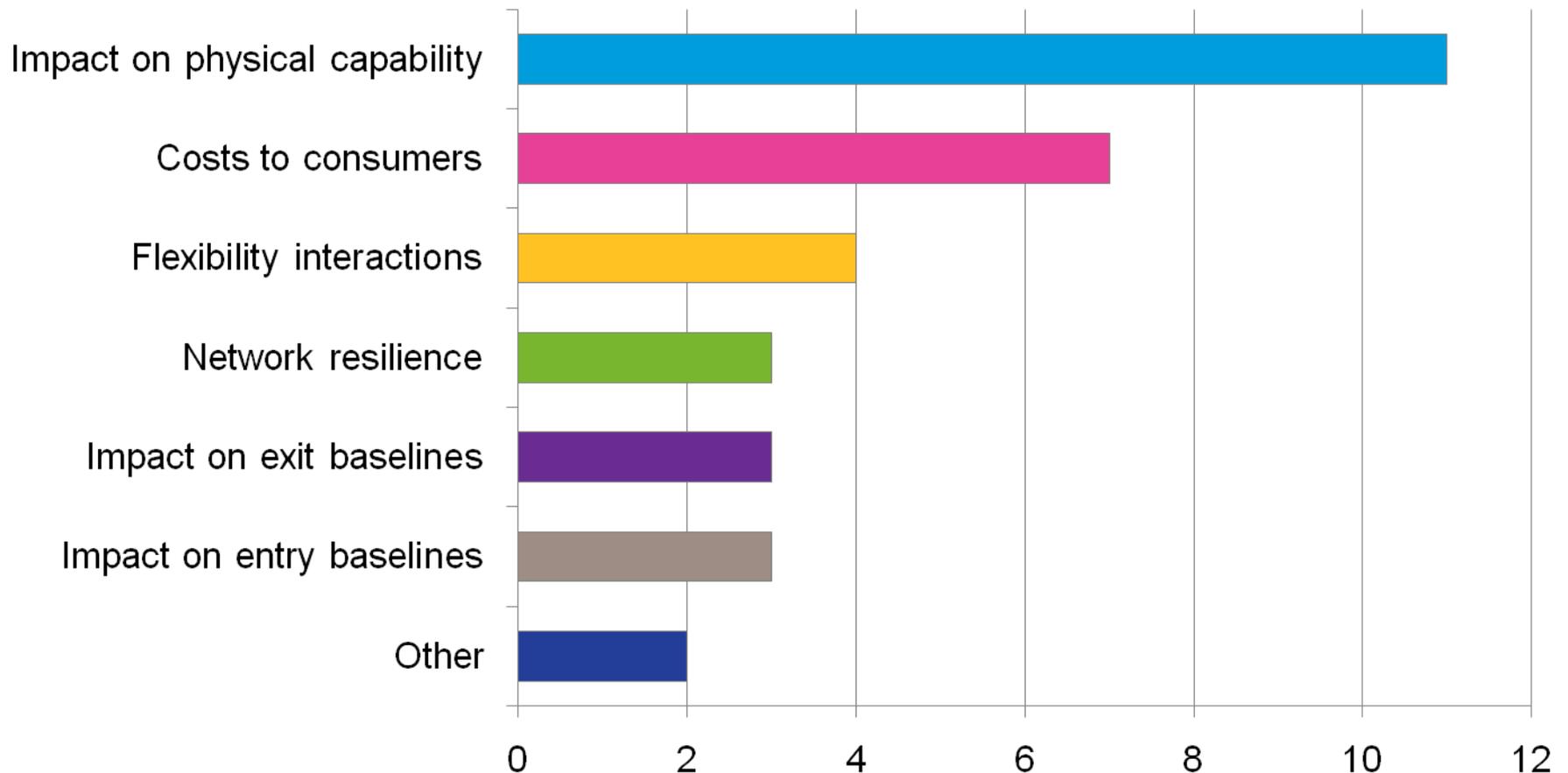
Gas Transmission

Network Strategy Scorecard

- Based on your initial feedback, we have developed a Network Strategy scorecard for you to provide feedback on and to give you an opportunity to provide your individual perspective on;
 - The importance of the criteria identified
 - Any additional criteria you might identify
 - The level of information you might require against each criteria
- Your feedback will inform;
 - Our future IED analysis and development of the compressor network strategy options
 - The information that we present to you in future IED communications and events and how that information is communicated against the criteria
- There are scorecards, along with definitions on each table
- Within your table you can discuss the criteria and record what is important to each of you for each of the scorecard categories for your location, area, or zone of interest (Please ask your table facilitators for any help)
- The scorecards will be collected at the end of the session

The Initial Feedback: IED Survey Results

Survey Question: “Based on the initial information provided on this topic, do you have any particular areas of concern / interest that you would like us to address”



Feedback Level

- We welcome your views at any level and/or location e.g.
 - National
 - Regional (geographic, group of system points etc)
 - DN / LDZ
 - Aggregated System Entry Point (ASEP)
 - Entry Point / Sub-terminal
 - Exit point / offtake

Gas Transmission Network Strategy Scorecard

Criteria	Importance* (from 1 to 10)	Please provide feedback as to why this criteria is important to you and what level of information you might require at future Gas Network Strategy events.	Which locations, areas or zones are important to you for this criteria?
Capability in addition to meeting FES supply and demand scenarios			
Entry Capacity Obligations			
Exit Capacity Obligations			
Current Utilisation (Capacity, Pressure and Flexibility)			
Future Flexibility (Profiling & Balancing behaviour)			
Resilience (& Maintenance outages)			
Impact on customer charges			
Other (please specify):			

Criteria

In developing our NTS compressor strategy, how important are.....	What is the underlying question?
Capability in addition to meeting FES Supply and demand scenarios	How important is it for us to consider further sensitivity analysis in addition to our FES scenarios?
Entry Capacity Obligations	How important is it for the obligated capacity levels to be maintained or do you think they should be reduced if they remain above our FES scenarios and we can avoid investment?
Exit Capacity Obligations	
Current (Capacity, Pressure & Utilisation Flexibility)	How important is it for us to continue to apply the current level of restrictions placed on capacity, flow changes and within day profiles?
Future (Profiling & Balancing Flexibility behaviour)	
Resilience (& Maintenance outages)	How important is it to you that we should carry on planning to the prevailing risk level?
Impact on customer charges	How important is it to you that we provide detailed estimates of future charge changes?
Other	Have we missed anything that is important to you?

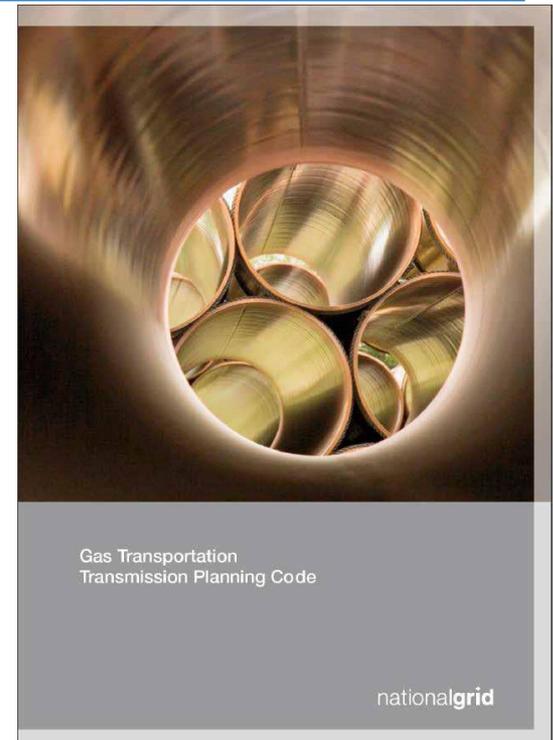
Transmission Planning Code (“TPC”)

Eddie Blackburn

IED Stakeholder Event
16th July 2014

TPC Review & Consultation

- At National Grid, we are continuing with our review of the Transmission Planning Code (“TPC”) based on gas industry developments and customer and stakeholder feedback.
- The TPC is intended to let you know how we plan the National Gas Transmission System and how the analysis to assess IED will be carried out.
- We are providing more detail on the “1-in-20” Security Standard and how we meet each element of it including
 - our requirement for and assessment of compressor standby to ensure the system is resilient to equipment failures and can still meet the “1-in-20”.
- We have published on our website pre-consultation drafts of the TPC.
- All of the documents can be found at <http://www2.nationalgrid.com/UK/Industry-information/Future-of-Energy/Gas-Ten-Year-Statement/Transmission-Planning-Code/>
- We have invited views on the pre-consultation drafts and intend to launch the formal Consultation by 18th July 2014.



TPC Review: Compressor Planning & Standby

- Compressor stations across the NTS are designed to meet the anticipated range of flow conditions. Some sites may be used for high demand conditions only, whereas other stations are equipped to allow a variety of different units to be used in parallel and/or in series configuration to achieve different pressure/flow characteristics.
- National Grid NTS will ensure that compressor configurations are used effectively within network analysis models, considering the range of configurations that may be used to accommodate flow patterns on the system to maximise the capability of the system, subject to other constraining factors such as emissions levels, discharge temperatures, efficient fuel usage and operation within compressor performance envelopes.
- Compressor failure (non-availability) is more likely to occur than a 1-in-20 demand day and hence within or prior to a 1-in-20 demand day a compressor may have failed, therefore we need compressor standby to comply with our obligation to develop the network to meet the “1-in-20” Security Standard. Standby is identified to ensure that the required transmission capability is maintained in the event of a credible loss of any single compressor unit or operationally linked units i.e. common mode of failure at a site.
- When assessing Standby requirements National Grid will consider:
 - Required Transmission Capability - which will be reviewed on an annual basis considering forecast supply and demand, capacity and other obligations
 - Forecast compressor run hours - taking into account a range of forecasted supply and demand levels taking
 - Economic and Efficient System Operation – consideration of the trade-off between standby and other commercial solutions e.g. CLNG, capacity buy-back, supply turn up
 - Maintenance – System access (outages) associated with maintenance requirements
 - Electricity and/or Gas Fuel Security – the failure of electricity supply for an electric drive may require gas compression standby.



Industrial Emissions Directive Scenario Testing

IED Stakeholder Event 16th July 2014
James Whiteford

IED Scenario Testing

- The aim of session is to test Scorecard criteria against some example scenarios
- We want to understand how you value the different trade offs available when we develop the options in response to IED
- These are example scenarios looking at issues in isolation for discussion purposes. The final options that are developed will bring all of the separate issues together across the network
- The examples presented are based on last years FES scenarios. The final options will be developed considering the four scenarios introduced in this year's FES process
- All analysis has been carried out according to the assumptions outlined in the Transmission Planning Code

IED Scenario Testing Session Outline

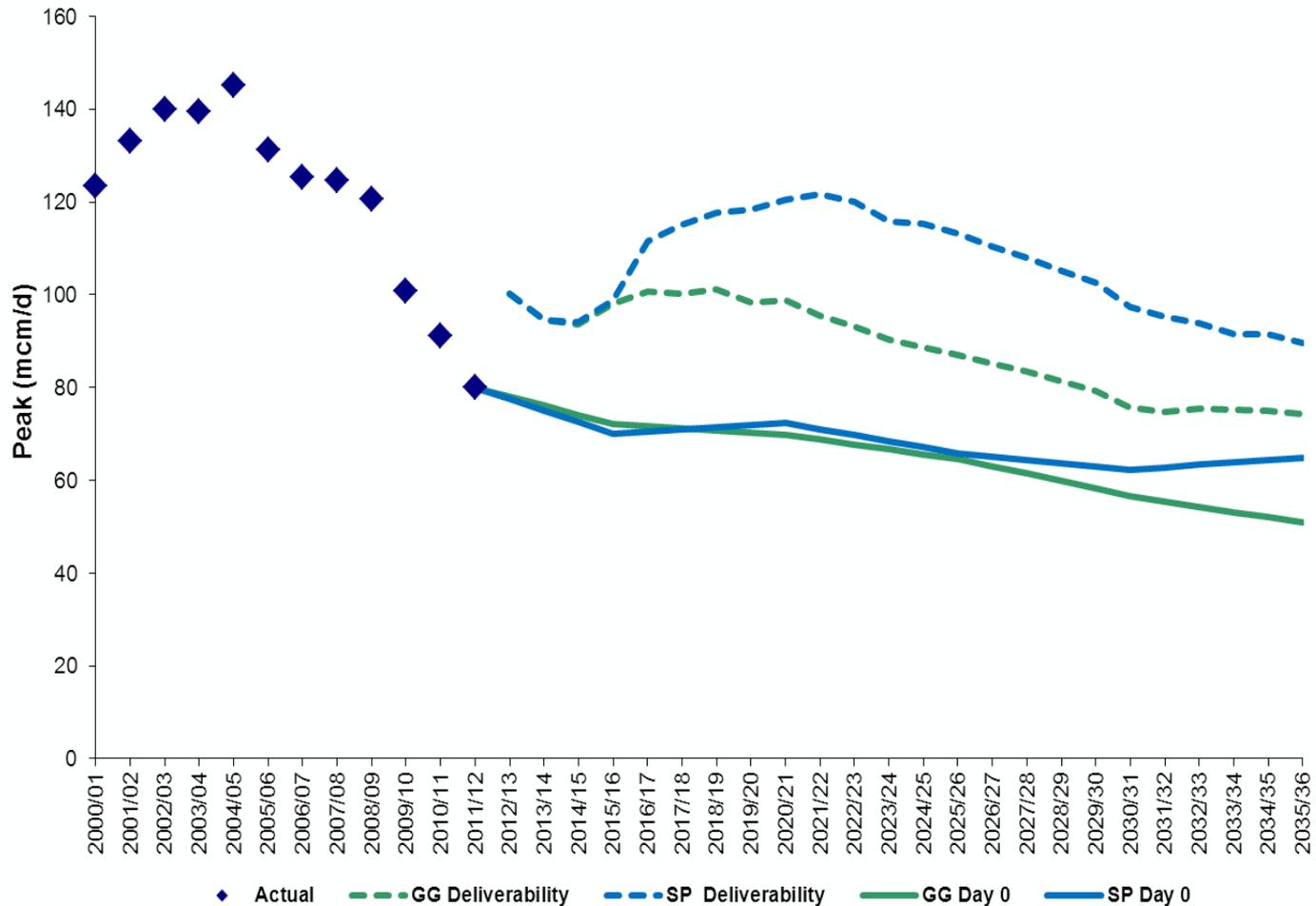
- Step through each scenario:

	Site (number of units)	Driver
	St Fergus (3)	St Fergus supplies – 1 sub-terminal
Scenario 1	Kirriemuir (1)	St Fergus supplies
	Moffat (2)	
	Carnforth / Nether Kellet (2)	Northern triangle and North-West Supplies
	Warrington (2)	
Scenario 2	Hatton (3)	East Cost / Easington Area Supplies
Scenario 3	Wisbech (2)	Theddlethorpe supplies and Southern demand
	Aylesbury (2)	Southern and South West Demand

- Opportunity to ask questions and edit Scorecard
- Round table discussion with facilitators and opportunity to respond to key questions

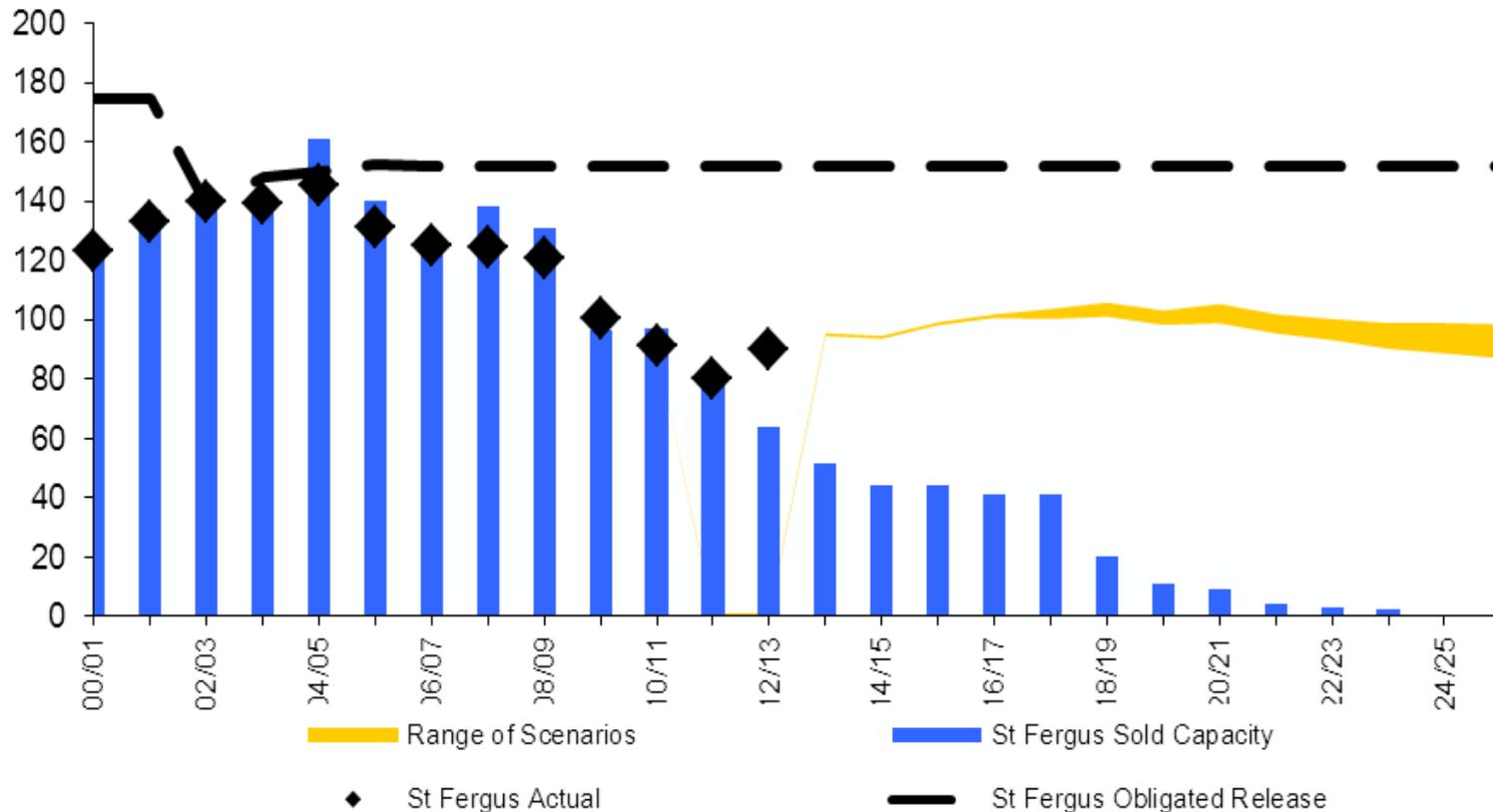
Scenario 1 – St Fergus Flows

■ Forecast flows from the St Fergus ASEP 2013



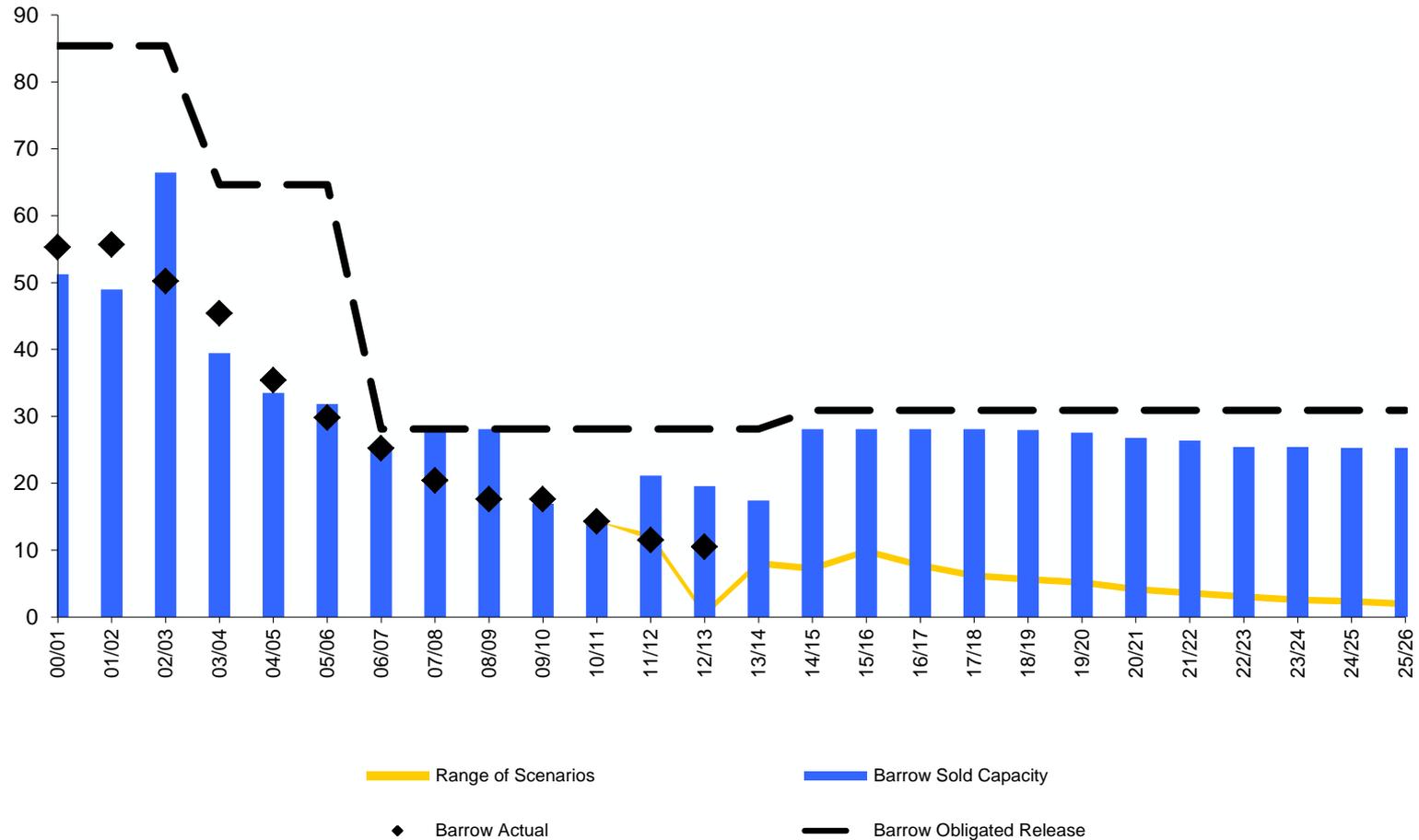
Scenario 1 – St Fergus Flows

■ Peak St. Fergus Capacity Chart

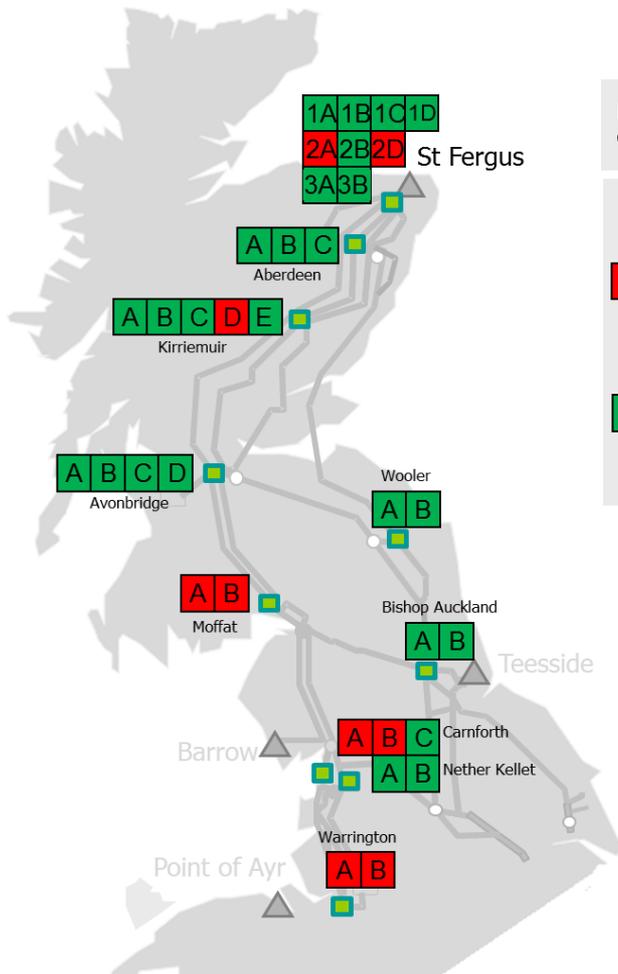


Scenario 1 – St Fergus Flows

■ Peak Barrow Capacity Chart



Scenario 1 – St Fergus Flows

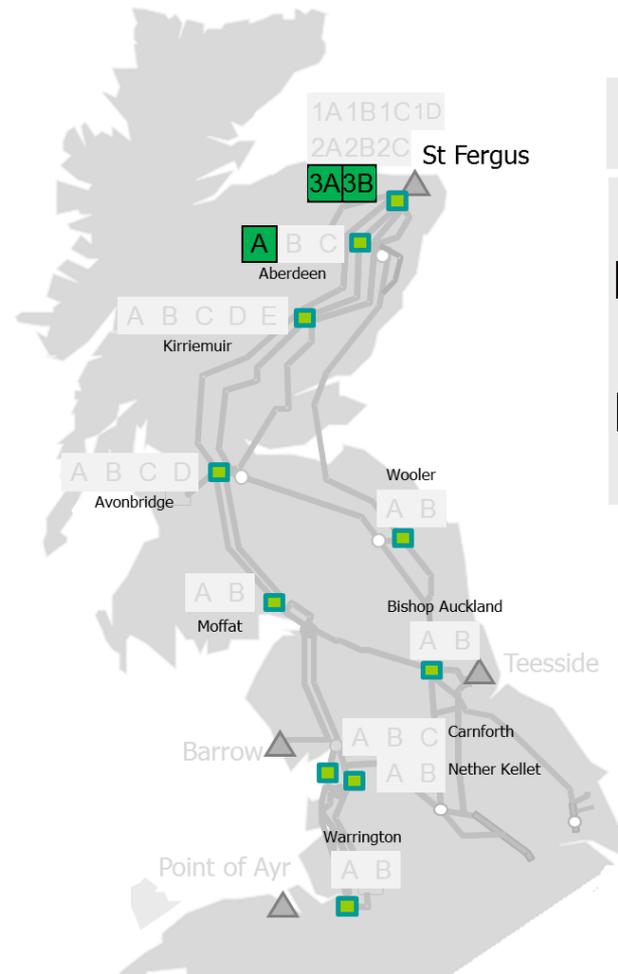


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Northern and Scottish
Compression map

Key

- IED (LCP) non-compliant unit
- IED (LCP) compliant unit



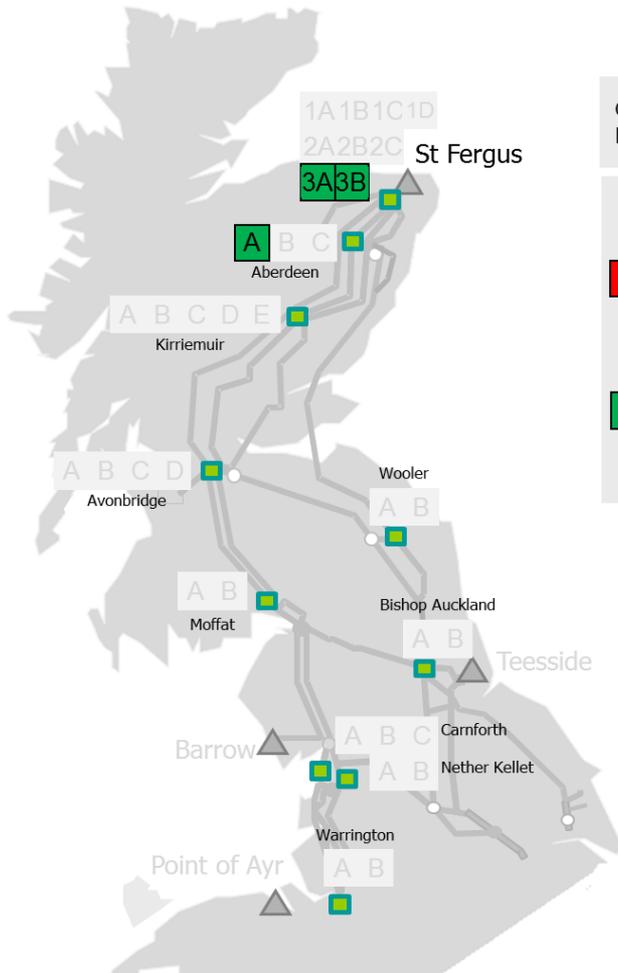
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Slow Progression Peak
Day Scenario

Key

- IED (LCP) non-compliant unit operating in the scenario
- IED (LCP) compliant unit operating in the scenario

Scenario 1 – St Fergus Flows

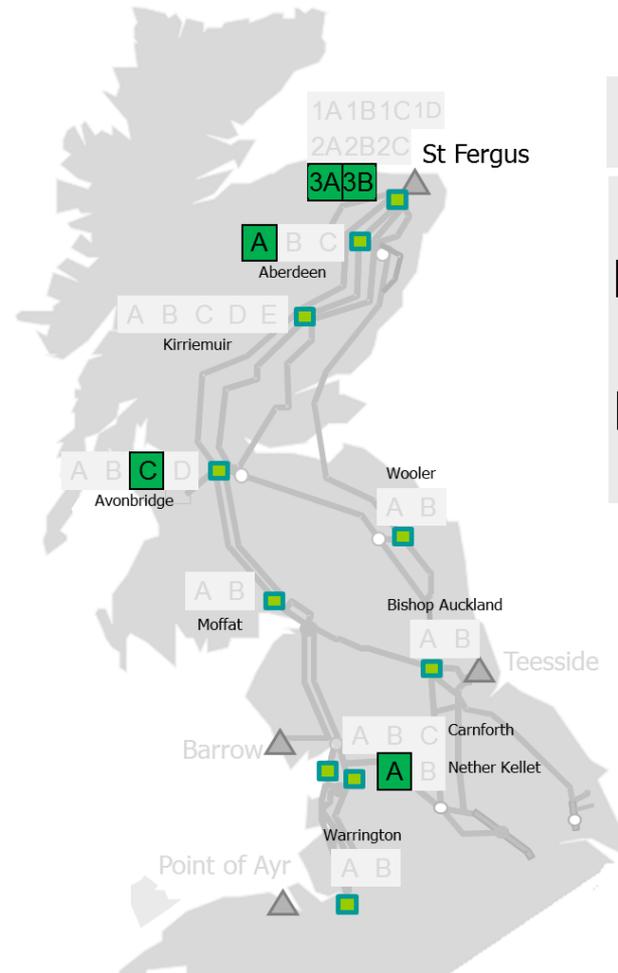


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Gone Green Peak Day Scenario

Key

- IED (LCP) non-compliant unit operating in the scenario
- IED (LCP) compliant unit operating in the scenario



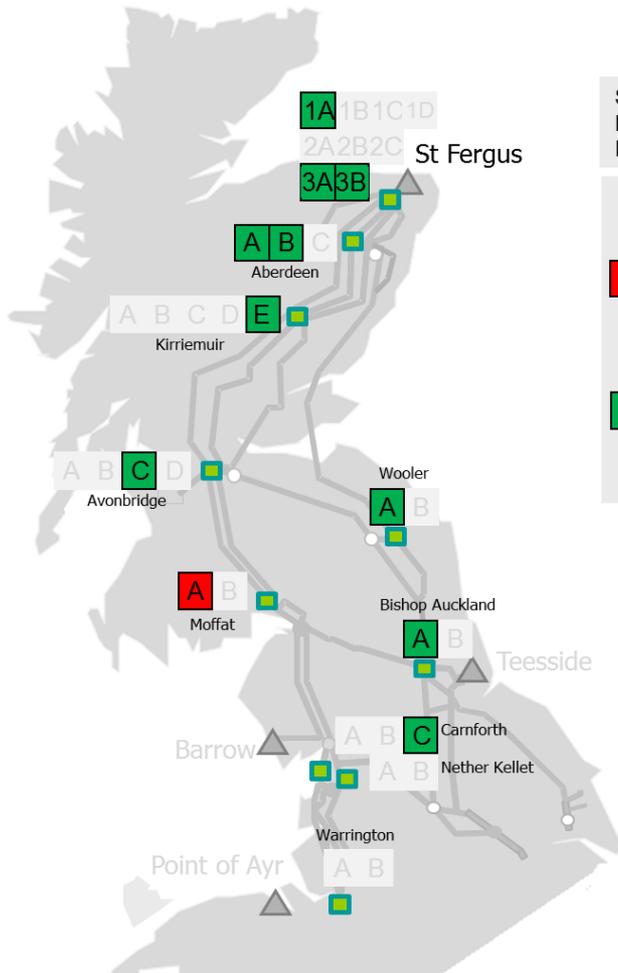
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Slow Progression – St. Fergus supplies maximised

Key

- IED (LCP) non-compliant unit operating in the scenario
- IED (LCP) compliant unit operating in the scenario

Scenario 1 – St Fergus Flows

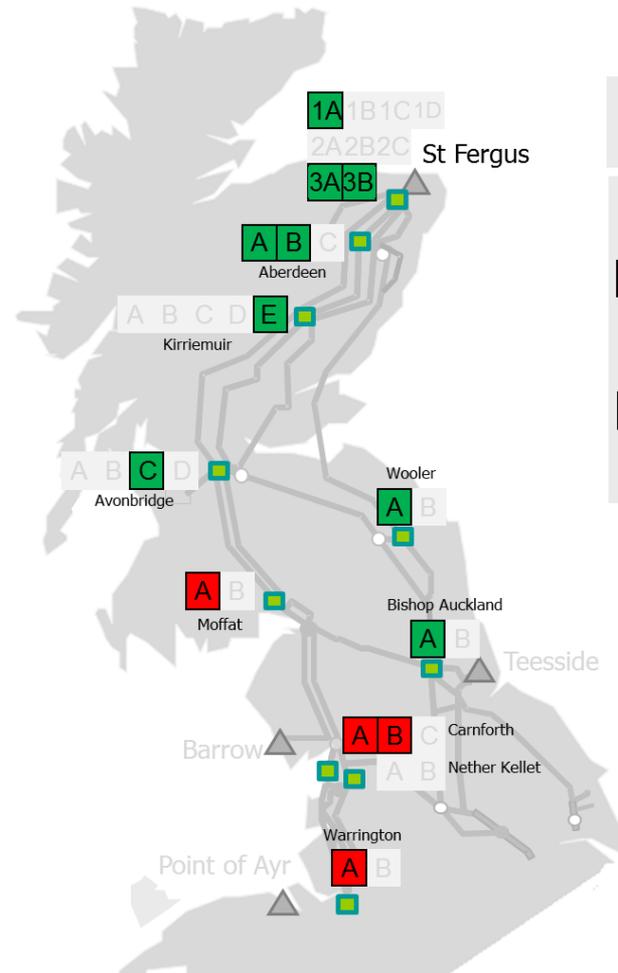


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Slow Progression – St. Fergus at obligated Release level

Key

- IED (LCP) non-compliant unit operating in the scenario
- IED (LCP) compliant unit operating in the scenario



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Slow Progression – St. Fergus plus Barrow at Obligated release level

Key

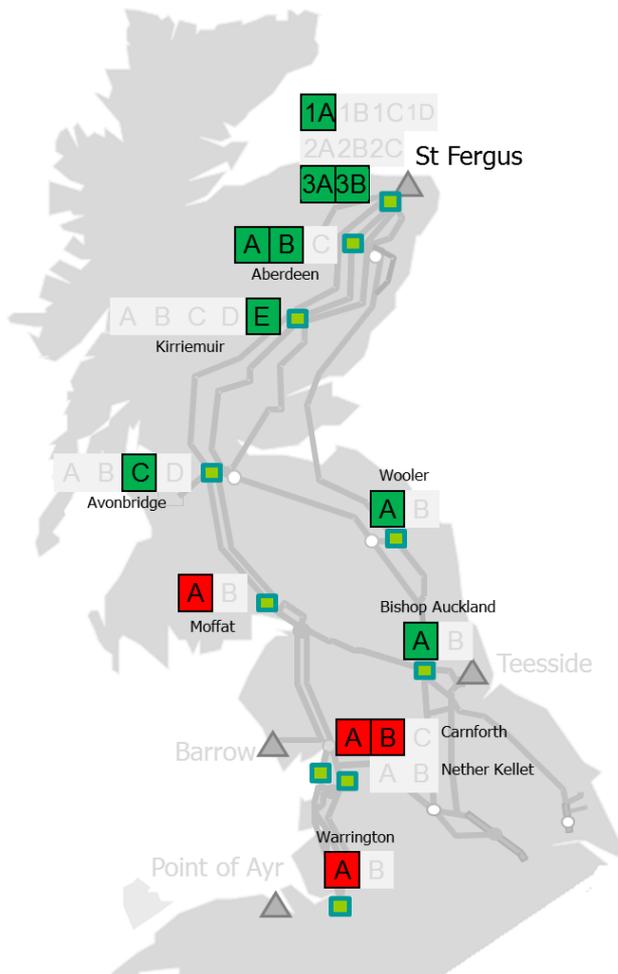
- IED (LCP) non-compliant unit operating in the scenario
- IED (LCP) compliant unit operating in the scenario

Scenario 1 – St Fergus Flows

By 2023 we will need to cease operating IED non-compliant units across the NTS.
What are the options?

Rules, Tools and Assets example options

- Invest for the FES Scenarios and reduce Entry obligated release levels
- Partial investment and partial reduction in obligated release levels to manage risk of sensitivities in addition to FES
- Replace non-compliant units like for like
- Manage with long term commercial contracts
- Manage through locational buy and sell actions on the day
- Other?

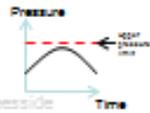


Scenario 2 - Flexibility

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Flexibility Scenario

Hatton compressor station is required to maintain pressures below safe operating limits at Easington supply terminal and also to support South West and South East pressures to ensure they are above safety and contractual limits



National Grid - Confidential

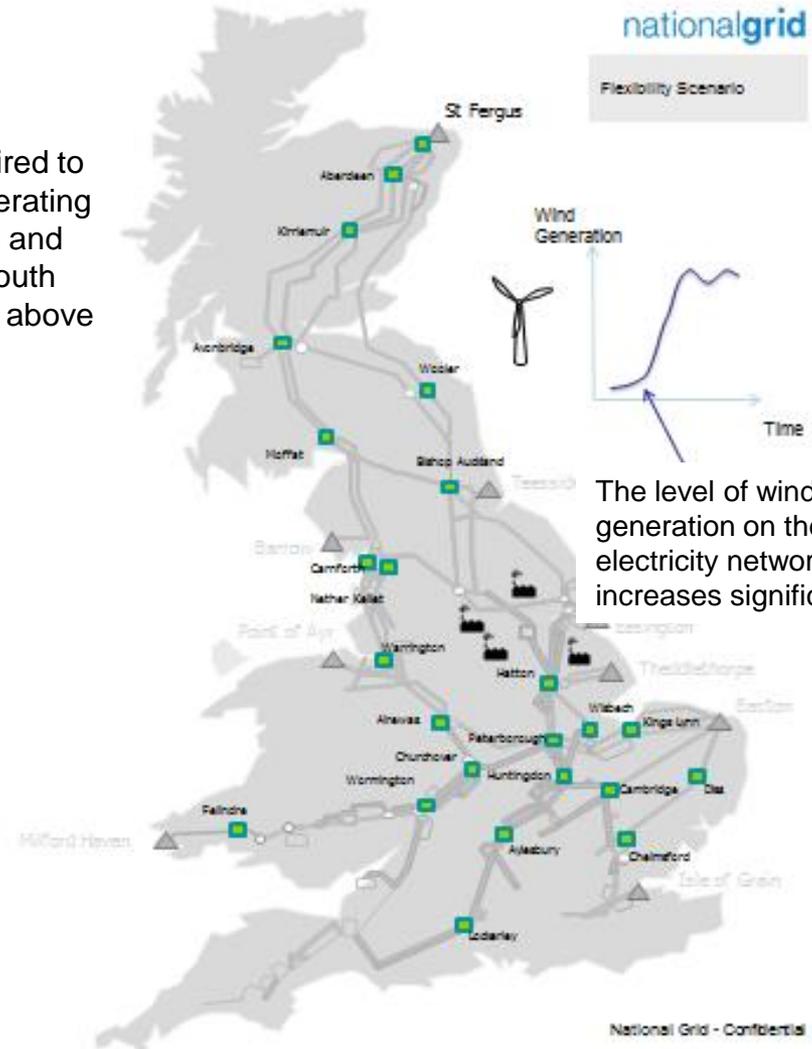
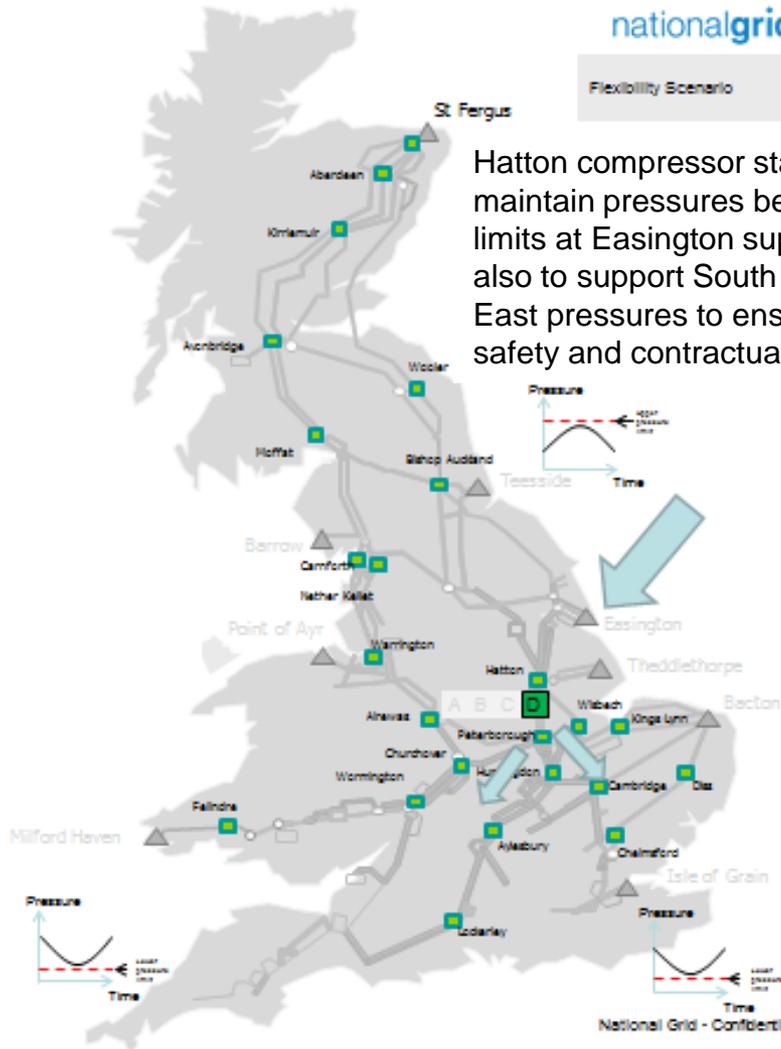
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Flexibility Scenario



The level of wind generation on the electricity network increases significantly

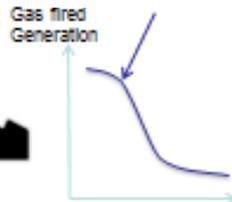
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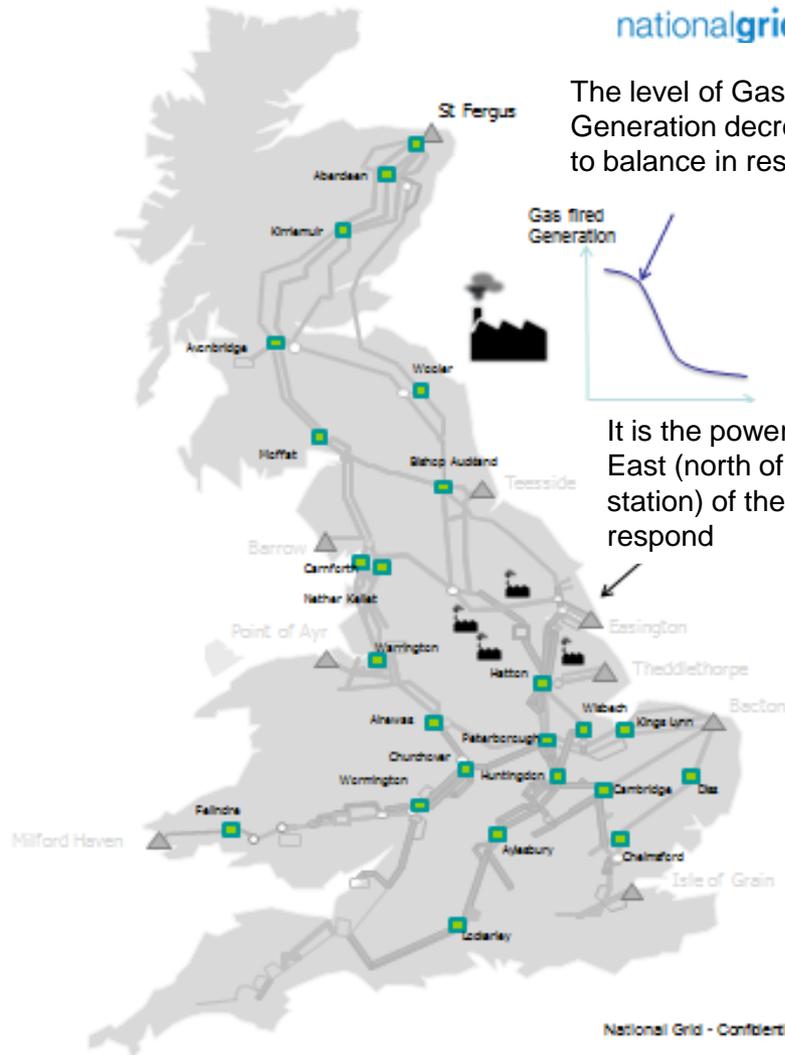
Scenario 2 - Flexibility

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The level of Gas fired Generation decreases rapidly to balance in response



It is the power stations in the North East (north of Hatton compressor station) of the gas network that respond

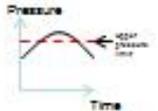


National Grid - Confidential

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Flexibility Scenario

There is a build up of "linepack" around the Easington terminal due this decrease in demand



If action was not taken, upper pressure limits at the terminal could be breached

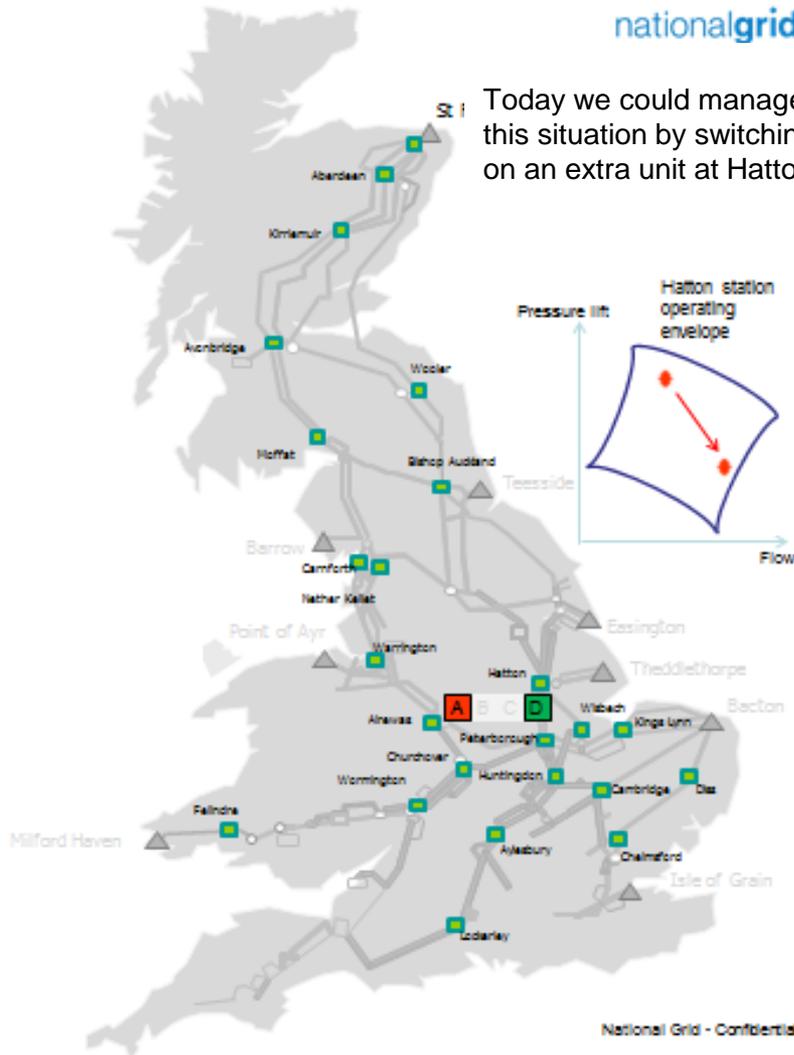


National Grid - Confidential

Scenario 2 - Flexibility

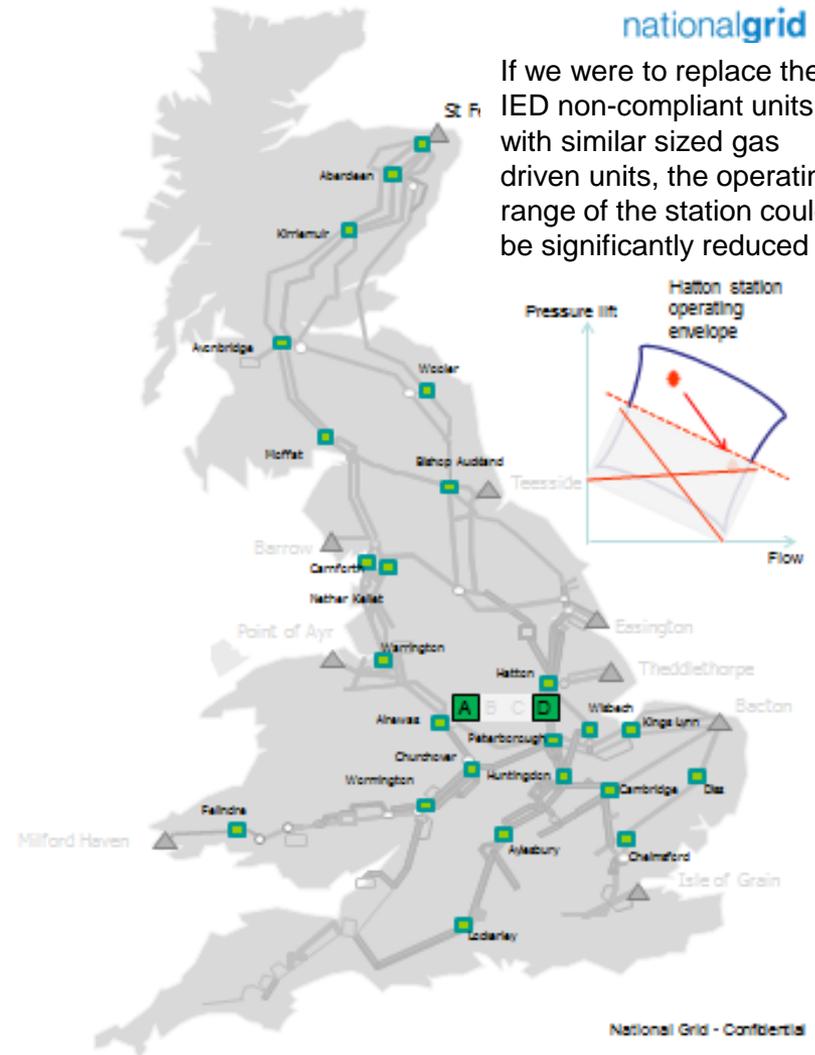
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Today we could manage this situation by switching on an extra unit at Hatton



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If we were to replace the IED non-compliant units with similar sized gas driven units, the operating range of the station could be significantly reduced



Scenario 2 - Flexibility



By 2023 we will need to cease operating the IED non-compliant units at Hatton. What are the options?

Rules, Tools and Assets example options

- Replace units with similar sized units and enforce ramp rates and notice periods
- Replace units with multiple smaller units to allow flexibility and broad operating range
- Manage with long term commercial contracts
- Manage through locational buy and sell actions on the day
- Other?

Scenario 3 – Resilience



Wisbech compressor was originally built to support southern pressures and maintain pressures below safe operating limits at Easington and Theddlethorpe supply terminals

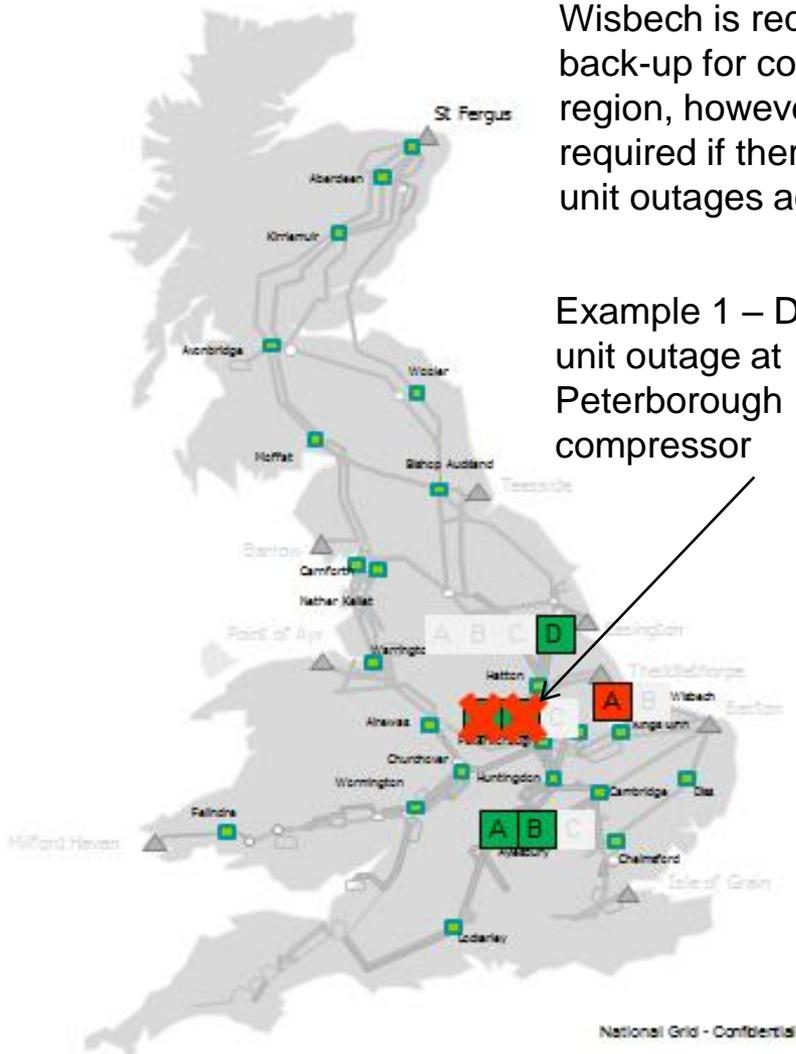
Scenario 3 – Resilience

- Standby is identified to ensure that the required transmission capability is maintained in the event of a credible loss of any single compressor unit or operationally linked units
- Compressor failure (non-availability) is more likely to occur than a 1-in-20 demand day
- Hence within or prior to a 1-in-20 demand day a compressor may have failed, therefore we need compressor standby to comply with our obligation to develop the network to meet the “1-in-20” Security Standard

Scenario 3 – Resilience

Wisbech is required to act as back-up for compression in the region, however it will only be required if there are multiple unit outages across sites

Example 1 – Double unit outage at Peterborough compressor



Example 2 – Double unit outage at Huntingdon compressor

