

The Changing UK Power Mix & The Future of Gas

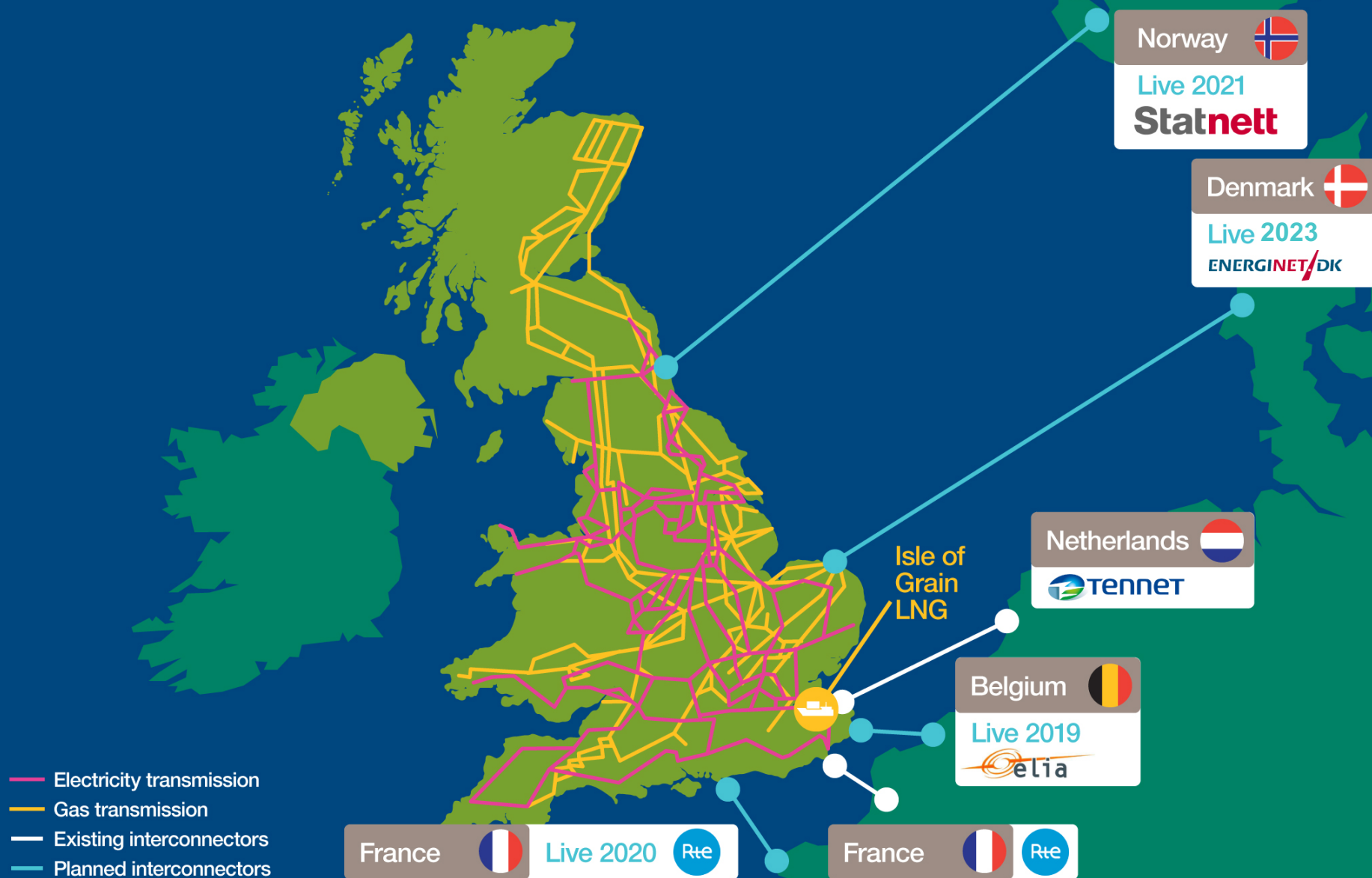
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20th April 2018

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National Grid - Our European Investments

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UK coal use and carbon emissions nationalgrid

– recent trends

Britain powered 24 hours without coal for first time in 135 years in 'watershed moment'

National Grid says it could happen more often in future

21st April 2017



National Grid Media
@Grid_Media

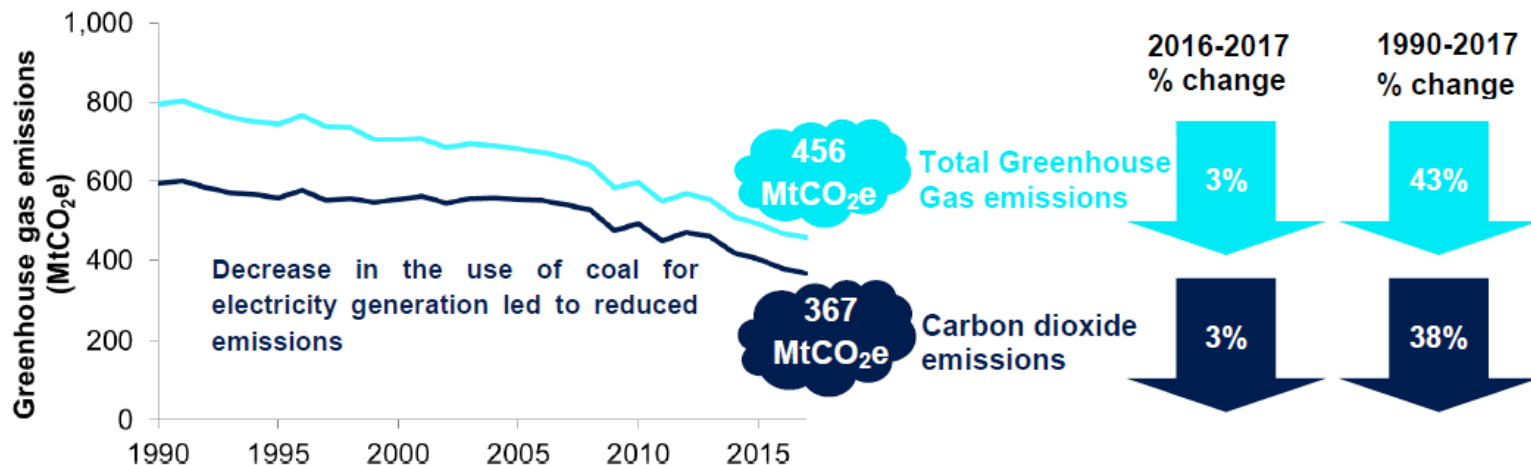
Following

For the first time since the 1880s the UK electricity network has clocked up over 72 hours without the need for coal generation. This new record comes days after the first ever 48 hour period of no coal on the network.

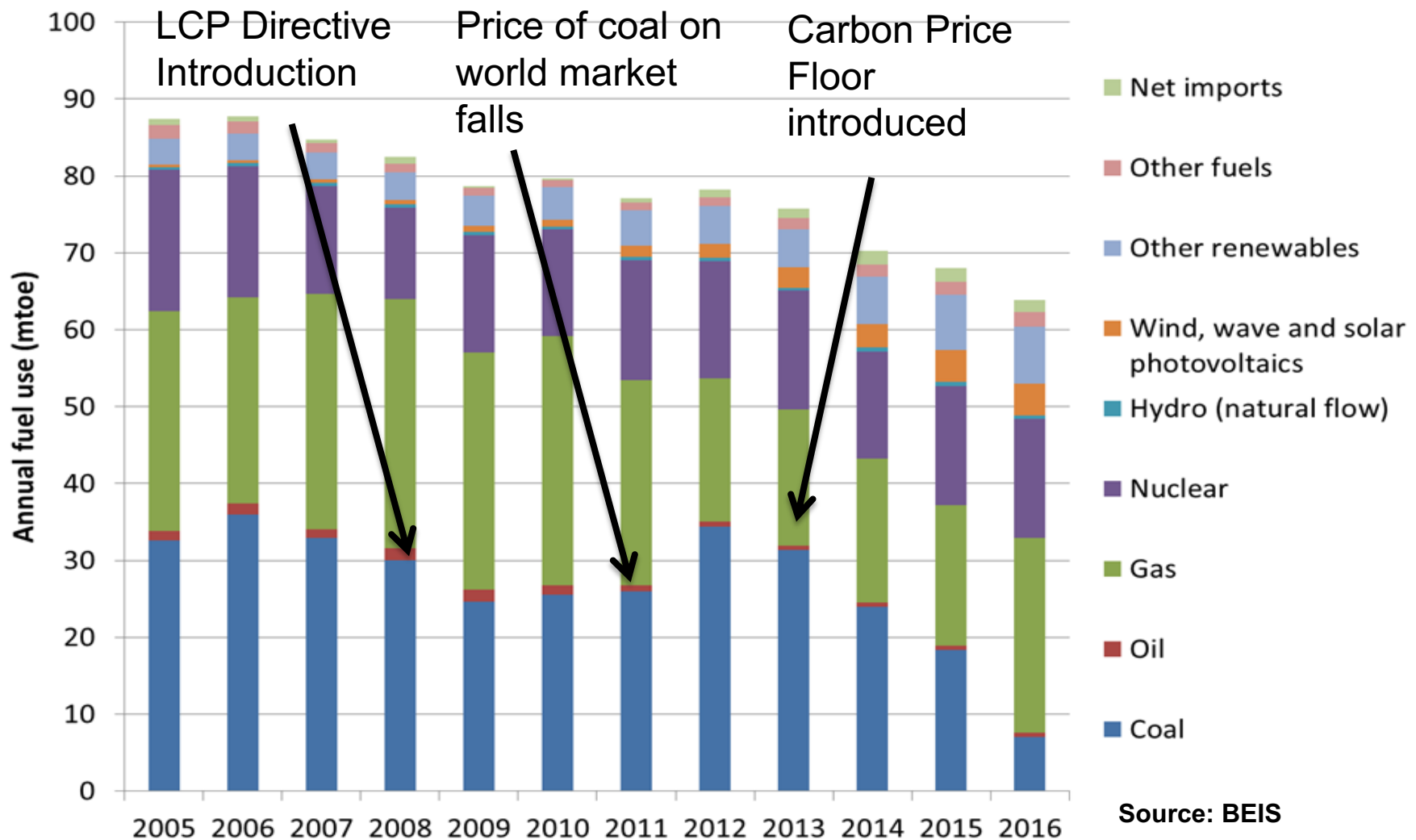
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24th April 2018

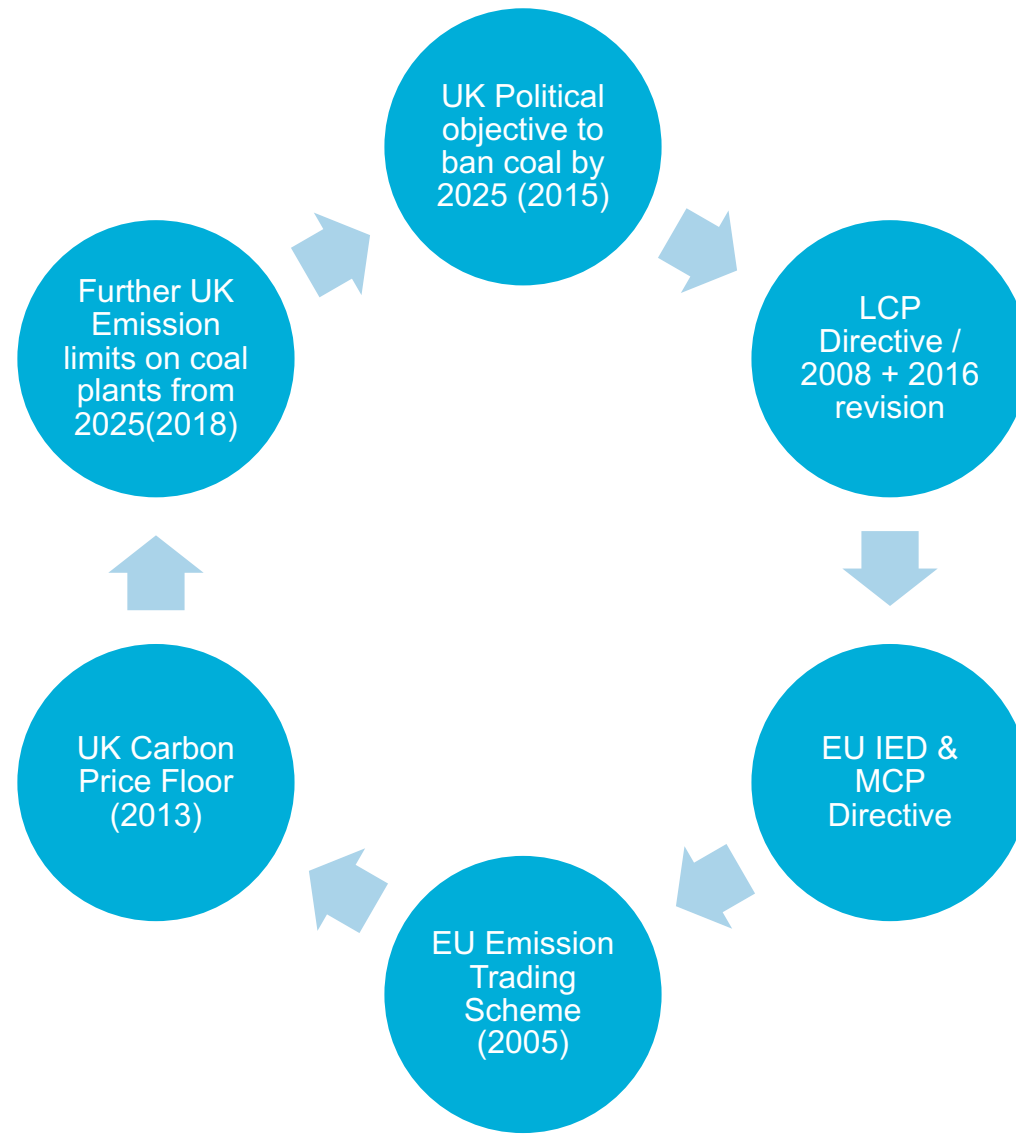
2017 UK greenhouse gas emissions provisionally estimated to decrease from 2016



Decrease of annual coal use & shift to gas



Energy policy drivers to reduce coal emissions



Gas plays a key role today...

- Gas demand in the UK increased by 12.5% in 2016
- In 2016 42% of electricity was generated from gas
- 8 out of 10 homes use gas for heating
- The demand for gas is not going down – around 60,000 new consumers connect each year
- Global gas demand is forecast to rise by 50% between now and 2040

GB Gas Transmission Element of Consumer Bills

£9 per year

Climate Change Act 2008

The act requires the UK to have reduced carbon emissions by at least 80% by 2050 from 1990 Levels, whilst maintaining security of supply and providing energy at lowest cost

884TWh

2016/17: Total gas demand

284TWh

2016/17: Total electricity demand

...but its future role is uncertain...



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

Three sensitivities were developed to test future requirements nationalgrid

Decarbonised Gas

- Focus on decarbonising the gas sector
- City heating provided by hydrogen
- Hydrogen created from natural gas
- Carbon capture and storage (CCUS) essential
- Hydrogen also used for transport and a large deployment of gas fired generation
- CCS supporting a high roll out of renewable capacity without nuclear generation

High Electrification

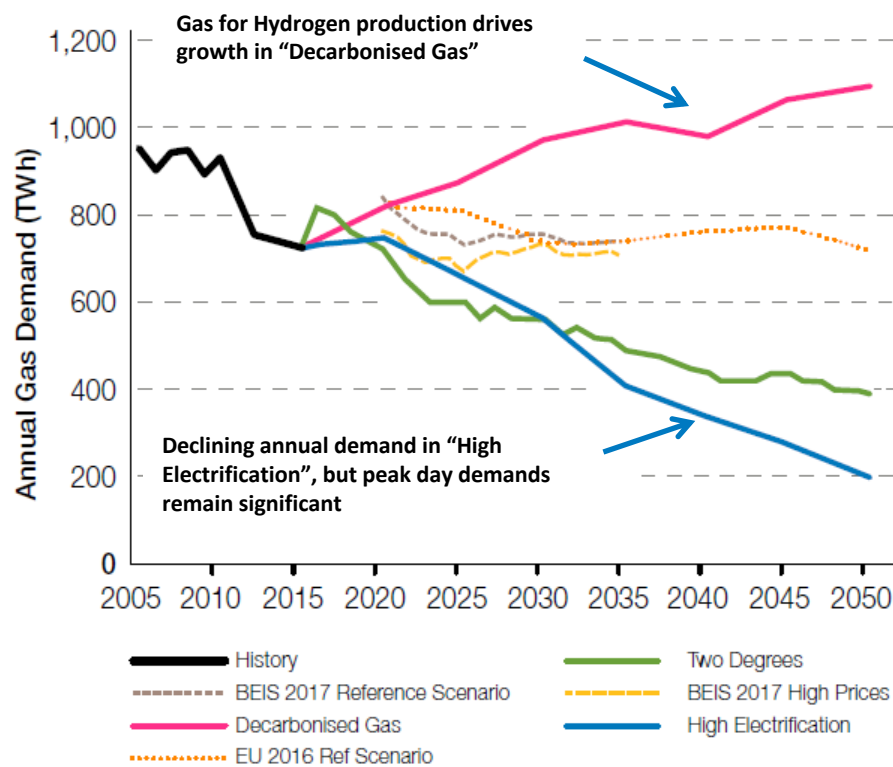
- Electrification of heat
- Decarbonisation of transport with electric vehicles and hydrogen
- Very high roll out of renewable generation
- Electricity provides majority of residential & commercial heat
- Peak heat demand supplemented by gas boilers
- Some industrial processes still require gas
- Considerable government support and intervention

Two Degrees

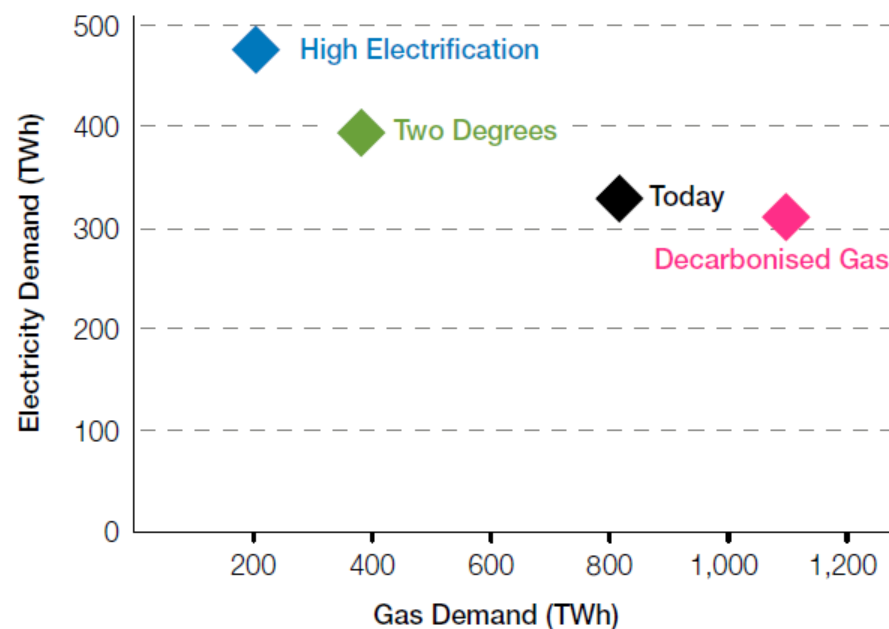
- Balanced approach
- CCUS enabled gas generation is deployed along with nuclear and renewable technologies
- Electrification of heat, supported by green gas
- Reduces the requirement of total electrification to hit 2050 target

In testing the extremes; gas was important in all sensitivities

Annual Gas Demand to 2050



Gas vs Electricity Demand



We have presented a series of key themes

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Decarbonisation of Heat

Demonstrates why gas is the ideal solution for decarbonising residential and commercial heat



Decarbonisation of Transport

Discusses why decarbonising transport through gas (and electricity) should be an early priority



Decarbonisation of Industry

Demonstrates why decarbonising the gas sector is the best option for much of GB industry



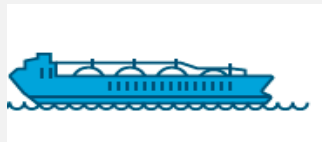
Whole Energy System

Establishes why the ability to work across all energy systems will become much more important



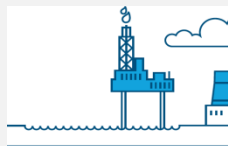
Future Networks & Markets

Discusses the products and services needed to facilitate the networks and markets of the future



Carbon Capture Usage & Storage

Maintains that CCUS plays a critical role if decarbonisation is to occur at the lowest possible cost



We have set out:

The challenge & potential solutions

What National Grid will do

No regrets actions
Signposts/triggered actions

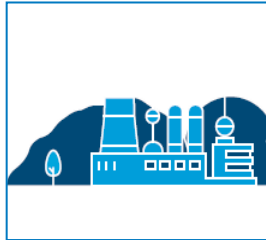
A potential timeline for policy decisions and actions

Our public policy recommendations

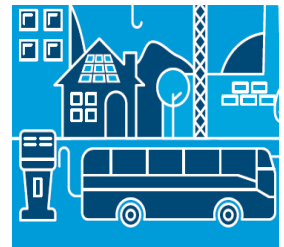
Recommended Policy Actions

Decarbonisation, Markets & Networks

The establishment of a heat oversight body and coordinated public engagement that considers the full range of impacts on end consumers



Fund research and testing focussed on scaling up green gases to ensure that decisions about heat are based on full consideration of the costs and practicalities of all available options;



Clarity about who should pay for decarbonised heat, the innovation required to get there, and for the likely increase in ongoing energy costs



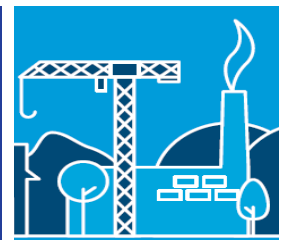
Transport policies should ensure that cleaner, less carbon intensive alternatives such as gas are favoured over diesel



cities should lead the way in developing the role of hydrogen in public transport, in particular buses, as a an early effective action to reduce NOx emissions;



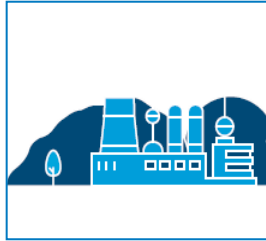
Decisions about the role of gas need to be made holistically alongside an understanding of the impact on industries and hence the wider economy



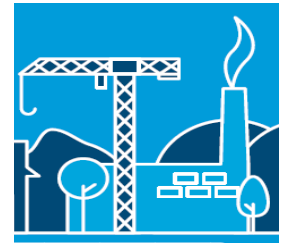
Recommended Policy Actions

Whole System / Sector Coupling

Policy considers the role of decarbonised gas as part of the whole energy system



Policy makers work with the energy industry to identify key areas where barriers to working more closely together can be removed



In the absence of policy clarity, we still take 'low-regret' steps to incrementally increase penetration of decarbonised gas



That TSO's are allowed to operate infrastructure which optimises gas and electricity infrastructure



The Future of Gas programme key messages

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We believe that the UK can lead the world in decarbonisation. Gas and Electricity need to be critical partners in a low carbon world. In order to do this we need to:

- **maintain a competitive GB gas market** which attracts gas from diverse, affordable sources as traditional UK sources decline
- **partner gas with renewable generation** to balance the electricity network
- make increasing **use of excess renewable generation**, when available, to produce hydrogen
- **continue to provide energy** across GB through cost-effective seasonal agility and supporting daily demand peaks at low cost
- continue to **provide UK industry** with an affordable source of heat and an important feedstock for manufacturing processes
- **invest in a more flexible GB gas grid**, which will be capable of flowing pure hydrogen, natural gas, and blends of gases in different areas
- **produce hydrogen at scale**, using natural gas **alongside CCUS** for the decarbonisation of heat, industry, power and transport
- **decarbonise heavy vehicles using a mix of biogases and natural gas** in the short term, making significant inroads into air quality improvements
- **develop world-leading carbon transportation and storage facilities**, leveraging more than 100 years of carbon storage capacity and a world-class oil and gas industry to help store it



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www.futureofgas.uk

Thank You

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BACKUP Slides

We engaged stakeholders extensively

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Circa 150 different organisations involved

What would you need to believe, for GB to go without gas?

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Gas for domestic heating

- Politicians are willing to drive change through a consistent, long term, national government policy drive to move all homes away from gas and towards an alternative that requires upfront investment and ongoing increased energy costs.
- There is public acceptance of the costs involved.
- There is a national roll out strategy for low carbon heat, converting 20,000 homes a week, 2025-2050
- There are no hybrid (gas/elec) heat pumps
- There is substantial investment in electricity generation (including removal of gas fired plant), transmission and distribution networks to support peak heat demand levels
- There is some form of seasonal, economically viable energy storage for the very worst winters (1 in 20)

Industrial Consumption

- Effective , economically viable, alternative established for high temperature processes
- Alternative to gas where used as a feedstock (e.g. fertiliser manufacture)

Electricity system balancing

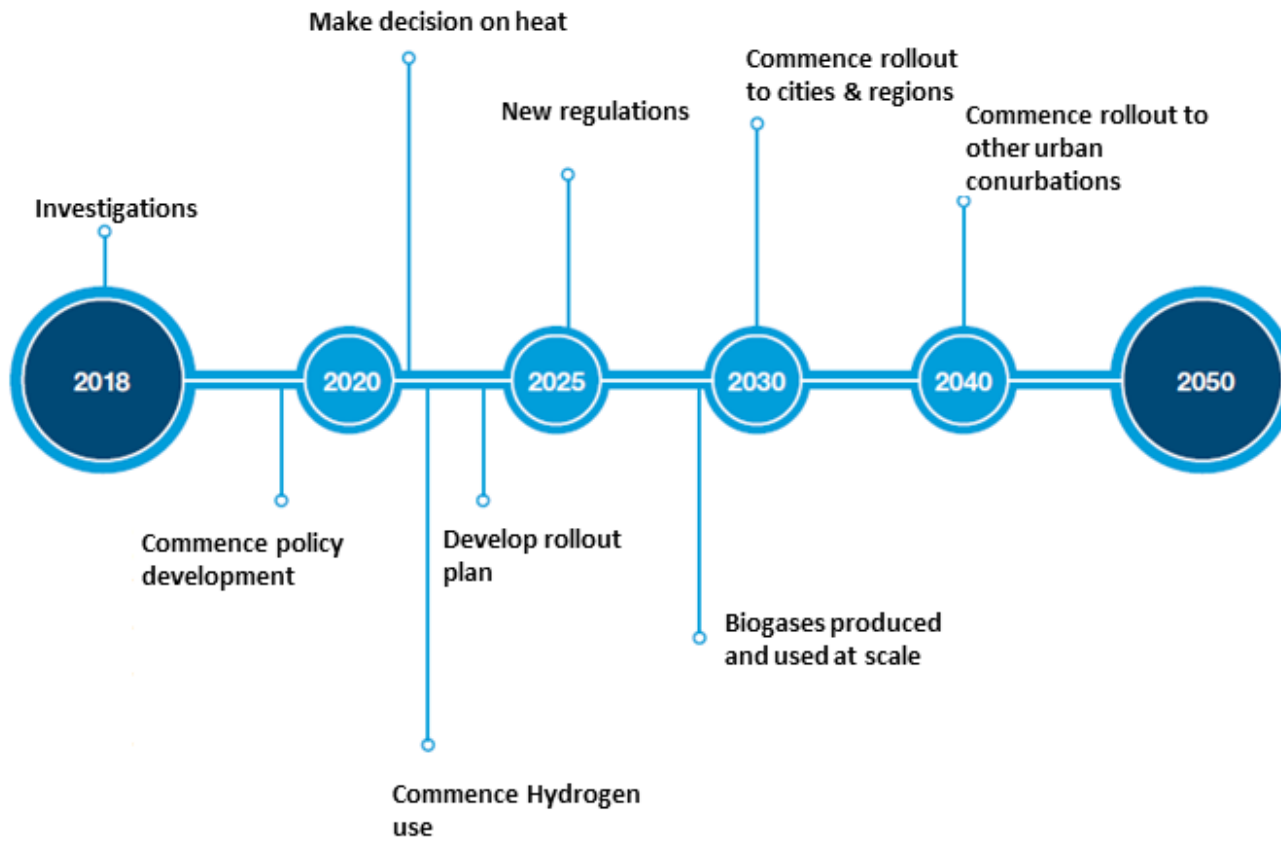
- Effective mechanism for balancing without the gas fired plants providing non-intermittent supply

Transport

- Electric heavy duty trucks are economic in the market and the rapid charging infrastructure is developed

Decarbonising heat

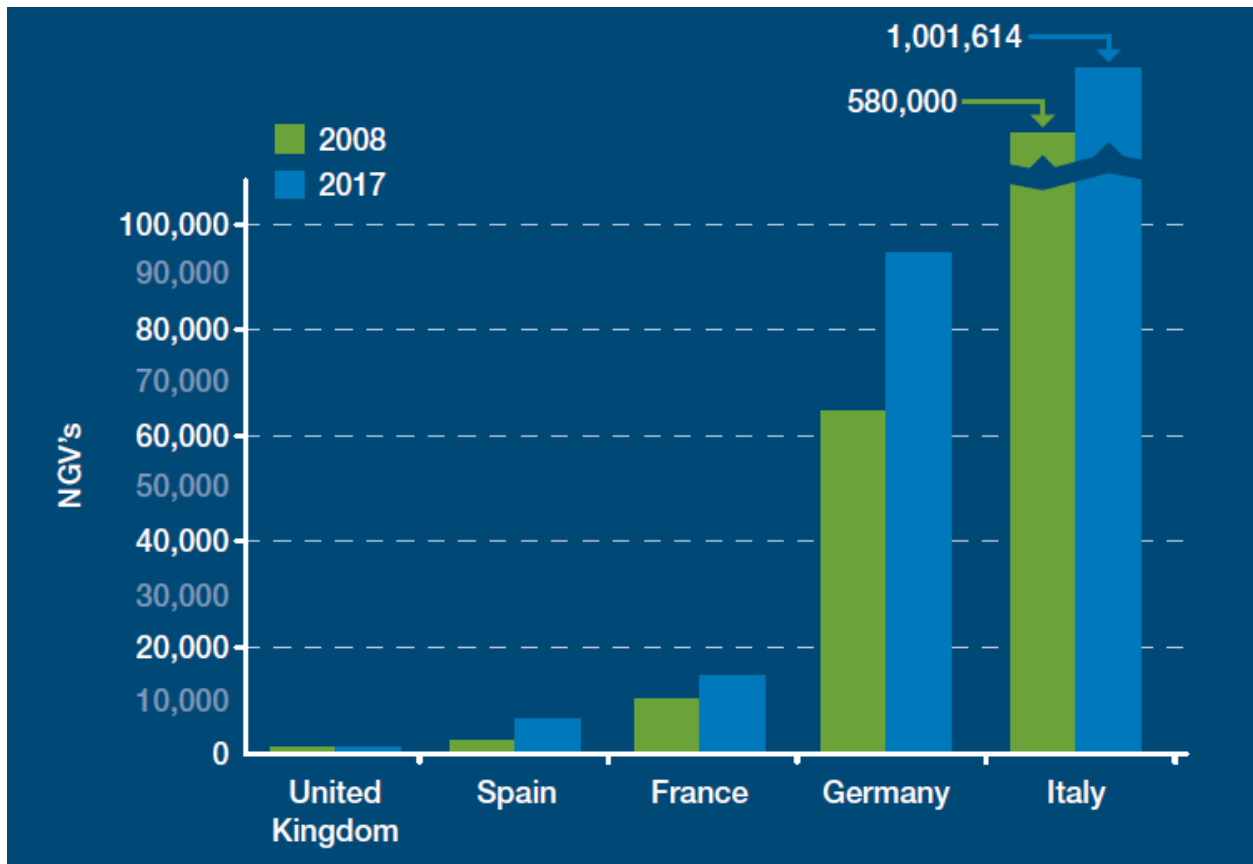
Potential 2050 timeline for heat



✓ Likely to see a combination emerge, but gas has distinct advantages in cost and level of disruption

Decarbonising transport

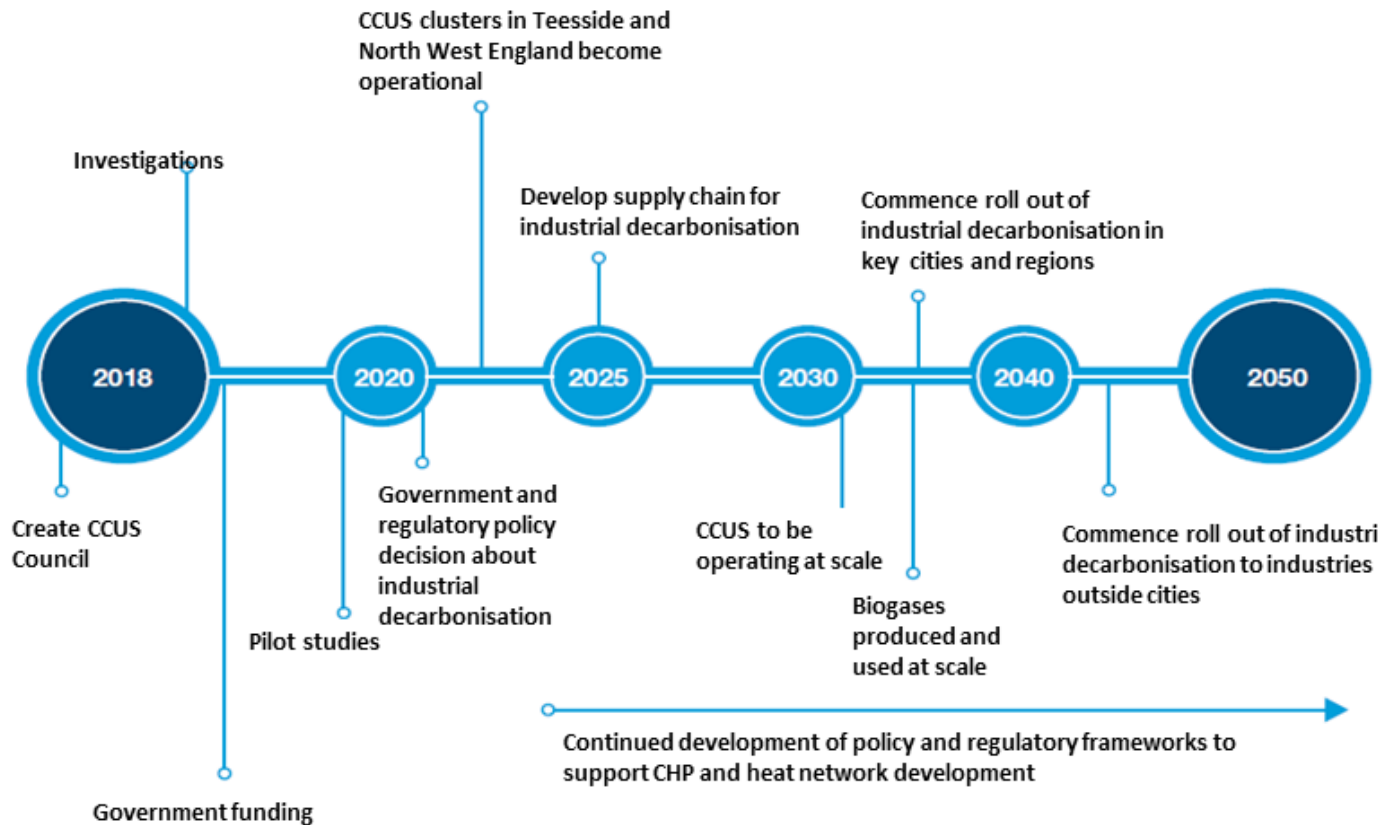
Natural Gas Vehicles in Selected EU Countries



✓ Again a combination, with electricity for cars and gas the preferred solution for heavy vehicles and maritime; Hydrogen coming later

Decarbonising industry

Potential 2050 timeline for industry



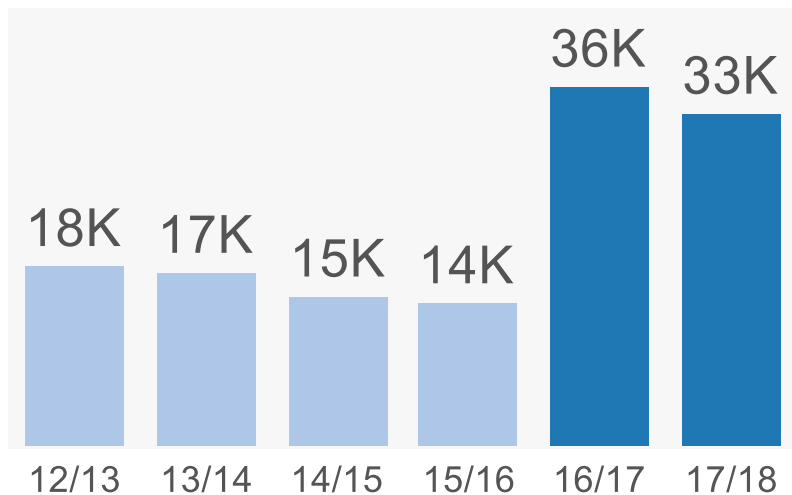
✓ *Electrification not an option for many who currently use gas for heat & feedstock. Biofuels, green gases and CHP to play a key role, alongside CCUS*

Whole Energy System



✓ Stakeholders are advocating the benefits of working across energy systems through a more integrated, flexible approach

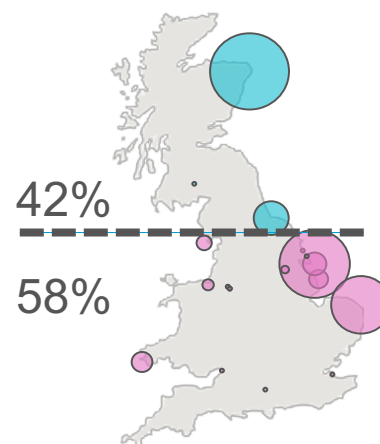
Future markets & networks



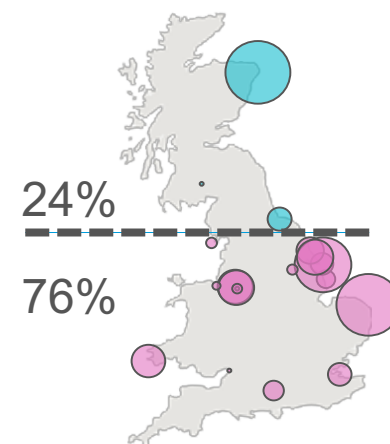
Compressor Running hours
(Gas YTD: Oct-Jan)

We are having to run
Twice as much Compression in the last 2 years
versus the previous 4 years

05/12/2017



12/12/2017



This winter we have seen
Changeable supply patterns
and the **Highest interconnector supplies since 2013**

✓ *We need to ensure that the GB market remains attractive and delivers products and services fit for the future; including innovative approaches*