The Changing UK Power Mix & The Future of Gas

Emmanuel Brutin, Head of European Affairs
20th April 2018
emmanuel.brutin@nationalgrid.com
National Grid - Our European Investments

- Norway
  - Live 2021
  - Statnett

- Denmark
  - Live 2023
  - ENERGINET/DK

- Netherlands

- Belgium
  - Live 2019
  - DeltaElfia

- France
  - Live 2020
  - RTE
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

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.

3:34 AM - 24 Apr 2018

24th April 2018

2017 UK greenhouse gas emissions provisionally estimated to decrease from 2016

Decrease in the use of coal for electricity generation led to reduced emissions

- Total Greenhouse Gas emissions: 456 MtCO₂e (3% decrease)
- Carbon dioxide emissions: 367 MtCO₂e (3% decrease)

1990-2017 % change: 43%

1990-2017 % change: 38%
Decrease of annual coal use & shift to gas

LCP Directive Introduction
Price of coal on world market falls
Carbon Price Floor introduced

Source: BEIS
UK Political objective to ban coal by 2025 (2015)

EU IED & MCP Directive

UK Carbon Price Floor (2013)

EU Emission Trading Scheme (2005)

Further UK Emission limits on coal plants from 2025 (2018)

LCP Directive / 2008 + 2016 revision
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

2016/17: Total gas demand

884TWh

2016/17: Total electricity demand

284TWh
...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

<table>
<thead>
<tr>
<th>Decarbonised Gas</th>
<th>High Electrification</th>
<th>Two Degrees</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Focus on decarbonising the gas sector</td>
<td>• Electrification of heat</td>
<td>• Balanced approach</td>
</tr>
<tr>
<td>• City heating provided by hydrogen</td>
<td>• Decarbonisation of transport with electric vehicles and hydrogen</td>
<td>• CCUS enabled gas generation is deployed along with nuclear and renewable technologies</td>
</tr>
<tr>
<td>• Hydrogen created from natural gas</td>
<td>• Very high roll out of renewable generation</td>
<td>• Electrification of heat, supported by green gas</td>
</tr>
<tr>
<td>• Carbon capture and storage (CCUS) essential</td>
<td>• Electricity provides majority of residential &amp; commercial heat</td>
<td>• Reduces the requirement of total electrification to hit 2050 target</td>
</tr>
<tr>
<td>• Hydrogen also used for transport and a large deployment of gas fired generation</td>
<td>• Peak heat demand supplemented by gas boilers</td>
<td></td>
</tr>
<tr>
<td>• CCS supporting a high roll out of renewable capacity without nuclear generation</td>
<td>• Some industrial processes still require gas</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Considerable government support and intervention</td>
<td></td>
</tr>
</tbody>
</table>
In testing the extremes; gas was important in all sensitivities.

**Annual Gas Demand to 2050**

- Gas for Hydrogen production drives growth in “Decarbonised Gas”
- Declining annual demand in “High Electrification”, but peak day demands remain significant

**Gas vs Electricity Demand**

- High Electrification
- Two Degrees
- Today
- Decarbonised Gas
We have presented a series of key themes

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.

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

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;

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;

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

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.

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

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

- That TSO’s are allowed to operate infrastructure which optimises gas and electricity infrastructure.
The Future of Gas programme key messages

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
www.futureofgas.uk
Thank You
We engaged stakeholders extensively

Circa 150 different organisations involved
What would you need to believe, for GB to go without gas?

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

Like to see a combination emerge, but gas has distinct advantages in cost and level of disruption.
Again a combination, with electricity for cars and gas the preferred solution for heavy vehicles and maritime; Hydrogen coming later.
Decarbonising 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
Stakeholders are advocating the benefits of working across energy systems through a more integrated, flexible approach.
Future markets & networks

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

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.