

## **Towards a 2050 Roadmap**

The UK Business Council for Sustainable Energy (UKBCSE) brings together the major players<sup>1</sup> in the energy sector to secure an effective and rapid transition to a low carbon economy that both tackles the challenge of climate change and maintains the UK's security of supply.

The Council and its members firmly support the trajectory that has been set for the UK through the Climate Change Act. Achieving the challenging statutory goal of an eighty percent reduction in greenhouse gas emissions by 2050 means the UK also needs to focus on the need for near-term policy to enable appropriate investment conditions for economically effective de-carbonisation of power in the UK by 2030, whilst maintaining security of supply.

This paper sets out a number of the key issues that need to be addressed in order to set the UK on this route, and is being made available as an informed contribution to policy development.

The paper is in three sections:

- 1. 2050 Challenge**
- 2. Investing for 2020 and 2030**
- 3. Near-term actions to set the UK on a cost-effective course for 2030**

### **Annex 1 – A 2050 Overview**

#### **2050 Challenge**

The Council has, with its members, now developed a broad overview of how it is envisaged that economic delivery of the 2050 target might occur whilst maintaining secure energy supplies. This draws on a number of sources (Annex 1).

In very broad terms, the energy companies consider that the basic cornerstones of 2050 are:

- Deep cost-effective energy savings in every sector;
- Substantial electricity de-carbonisation by 2030 (or soon after) in line with thinking by the Committee on Climate Change;
- A significant structural shift to electrification for short-range transport and for heat (together with some bio-gas for heat).

Concerted, overlapping actions are required across all of these areas.

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<sup>1</sup> Members of the Council include Centrica, EDF Energy, E.ON UK, National Grid, RWE npower, Scottish and Southern Energy and Scottish Power.

The challenge is not just to meet the 2050 target, but to do this in the most economic and affordable way, and to maintain security of energy supplies. Key sensitivities include assumptions on costs, technology risk and deployment, planning, and network-build (including for electricity and carbon, regulatory treatment, smarter networks, interconnection).

The ambition of the UK's 2050 greenhouse gas target is far-reaching. Energy policy frameworks therefore need to recognise the extent of these long-term risks and uncertainties by enabling an investment environment capable of creating and sustaining a range of technology options, both on the supply-side and on the demand-side.

At this early point, looking out to 2050, undue-prescription and / or closing-off future options could increase the risk and cost of failure.

**As of today, a key policy requirement for 2050 must be to create and maintain technology options and choice into the future, but also to take action now on deployable technologies.**

### **Investing for 2020 and 2030**

Energy sector investment is characterised by long-lived capital-intensive assets. Energy companies in the UK have therefore consistently sought long-term stable market frameworks attractive to investors, and also to deliver customer and policy requirements economically, free of unnecessary shocks.

A coherent policy framework to deliver progress by 2030 is therefore essential.

This means a firm route by 2030 to deliver the most economic power sector de-carbonisation, radical cost-effective energy saving, and to support the potentially significant electrification of transport and heat. Unprecedented levels of investment will be needed to achieve these goals. Estimated investment in electricity generation and transmission alone could approach £200 billion (subject to technology mix). Implications for energy prices are substantial and cost-effective investment choices should be neither delayed nor lost by investment uncertainty.

For the energy companies this means a particular need to:

- Identify critical actions now to ensure that by 2020 the UK is on course to deliver across all areas of the Low Carbon Transition Plan – and not just some;
- Place the UK on a firm path to economic and affordable power de-carbonisation by 2030, while ensuring energy security – through clarifying policies, actions, and expected timings for 2030 delivery.

### **Progress to 2020**

Policies and frameworks put in place via the Climate Change, Energy and Planning Acts 2008, and by the Low Carbon Transition Plan (July 2009) have already set the UK on an initial course for 2020 which aspires to deliver:

- 15% renewable energy, of which around 30% electricity;
- 1-2 nuclear plants commissioned; substantially more in development;
- 3-4 CCS demonstration plants and initial steps on carbon infrastructure;
- Smart meters fully deployed, and some progress on early smart grid development;
- Substantial cost-effective energy saving delivered in many buildings and homes;
- Product standards making significant impact on energy-use across all sectors;
- CHP, micro-generation and heat-pumps in suitable communities, buildings and homes;
- Strategic transmission - built and commissioned;
- Greater interconnection; development of a north European energy market;
- Planning regime – able to consent major new projects through the National Policy Statement and Infrastructure Planning Commission arrangements.

While some progress is being made, the UK is likely to fall short of achieving the full range of measures identified for 2020 in the Low Carbon Transition Plan without additional actions.

Two particular areas stand out.

First, concerted effort is needed to deliver demand-side investment and to achieve significant energy savings. The social costs of delivering the low carbon transition are extremely high and cost-effective energy saving right across the built environment and all economic sectors is essential for acceptability and affordability.

Second, large-scale high capital-cost low-carbon investment is needed for the UK to meet its targets in such a way that prices remain stable and affordable for the future. The scale of the investment challenge for nuclear and CCS is very considerable.

High wind volumes by 2020 potentially impact on development of other low carbon options. These impacts require a long-term policy view - such that investment in plant such as nuclear and CCS can happen alongside investment in wind. Failing this, there is a risk of medium-term costs for power sector de-carbonisation becoming unnecessarily high; of short-term investment in CCGT for supply-security reasons, leading to higher emissions, higher gas imports, and greater price volatility; of mass-electrification of transport and heat increasing in cost and being delayed. *In sum, failure to invest now in high capital-cost low-carbon plant is likely to make it harder in the long-run to de-carbonise at an acceptable overall cost.*

Energy companies therefore take the view that a near-term priority must be to:

- Ensure coherent policy frameworks to encourage high capital-cost low-carbon investment now;
- Achieve the 2020 targets in such a way that the UK is set successfully on a firm and economic road to power de-carbonisation in 2030 - while taking full account of security of supply and affordable delivery, including via cost-effective energy saving;
- Pave the way now for significant electrification of transport and potentially heat.

## **Near-term Actions to Set the UK on Course for 2030**

Companies have identified the following areas for near-term action to be on track towards cost-effective delivery of both 2020 and 2030.

- **A clear policy road-map needed to 2030 for delivering both power decarbonisation and the demand-side** – and which, amongst other things, needs to:
  - Demonstrate continuing importance to the UK of making significant investment now for a low-carbon energy economy;
  - Identify and facilitate least-cost routes to 2030 via coherent frameworks and incentives;
  - Underscore the attractions of the UK as a low-risk investment environment;
  - Ensure transparency and openness about the costs of transition to a low carbon energy economy;
  - Explain and communicate widely the associated costs and benefits of low-carbon;
  - Continue to engage with developments at an international and European level.
  
- **Energy Saving**
  - Early clarity on how after 2012 the UK proposes to deliver energy efficiency goals for 2020 so that retail and energy services businesses can develop against a clearer long-term policy framework;
  - Clarity beyond 2020 on comprehensive long-term demand-side measures, including for heat, that are able to deliver significant cost-effective carbon and energy savings, with suitable financing models.
  
- **Planning** – fully implement the Planning Reform Act 2008 and clarification on pre-application process and associated timescales.
  
- **Market Incentives** – A need to consider policy options to deliver investment in low carbon generation in the most cost-efficient way. From around 2017, substantial new capacity will be needed in the power sector. Appropriate incentives will be needed for sufficient high capital-cost low-carbon investment to come forward and be remunerated.

The industry has a strong and positive track record on investment, but, looking ahead to 2020 and beyond, welcomes a necessary evolution of the market. All of the companies acknowledge that the incentive arrangements currently in place appear insufficient to deliver capital-intensive low-carbon plant and the supporting infrastructure needed to successfully decarbonise the power sector on a least-cost basis by 2030. Current arrangements need some enhancement.

Investors need clarity and certainty about investment. This is especially so if the energy sector is to deliver 2020 targets, set the UK on a path to the 80% green house gas reduction for 2050, take a strong lead in creating low-carbon technology jobs and maintain security of supply.

- **Networks** - the desirability of a strategic overview for network development and the need to secure regulatory go-ahead for necessary strategic investment. Amendments to industry mechanisms to allow electricity connections and network reinforcement to be delivered in a timely way.
- **Smart Meters and Smarter Networks** - Coordinated delivery of smart meters to ensure a platform for energy savings / management. Clarify timescales for development of smart networks and smart demand. Appropriate regulatory arrangements to ensure smarter grids.
- **End-of-life arrangements** – long-term framework to encourage realistic approach to back-end costs (nuclear, CCS).
- **Gas** - improved understanding for the future about the role for gas and gas storage - including role of bio-gas and unconventional gas for power-generation, heat and transport.
- **Clarification of respective roles for Government, the regulator and the market** - An improved clarity and re-balancing of the respective roles for Government in terms of shaping long-term high-level policy frameworks, the regulator in overseeing economic implementation, and for the market with respect to delivery.

## Conclusion

In the near term, Government needs to ensure a coherent long-term policy framework for delivery of 2030 - with a clear focus on timely, cost-effective delivery and on supply security. Actions are needed now to ensure investment in high capital-cost low-carbon plant towards 2020 and to significantly boost action on energy efficiency.

Failure to take specific actions now to deliver 2020 may leave a higher-cost and less secure route to de-carbonisation of UK power supplies for the medium-term, with knock-on costs and delay in de-carbonising transport and heat.

The scale and innovation for investment in UK energy infrastructure, low-carbon energy supply and the energy demand-side - initially to 2030 and thereafter to 2050 – is unprecedented. Energy companies have a fundamental role to play and they remain keen to sustain and enhance their work with Government, and with the very many other companies, organisations and individuals, who will be needed to unlock the country's low-carbon potential and to set the UK on a road to deliver the binding 2050 target.

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*The views expressed in this paper cannot be taken to represent the views of all parts of all companies in the UKBCSE. However, they do reflect a general consensus.*

## Annex 1 – 2050 Overview

### 2050 Overview

DECC's work to create a 2050 Roadmap is a welcome step towards outlining longer-term technology scenarios and options for low-carbon investment to deliver the binding UK 2050 greenhouse gas target<sup>2</sup>.

The challenge is to meet renewable climate change targets in 2020 and the binding 2050 target in the most affordable manner whilst maintaining security of supply. To meet the 2050 target, in the very broadest terms, companies believe co-ordinated action is needed to achieve:

- Concerted and early action to reduce and re-shape energy consumption;
- A largely decarbonised electricity supply by 2030 – with an ideal opportunity in replacing ageing plant with a mix of lower carbon technologies (initially wind (or other renewables such as bio-mass) and in due course nuclear, CCS, wave, tidal);
- Decarbonising both transport and heat - potentially through a combination of electrification and bio-gas.

Concerted, overlapping actions are required across all of these areas.

Key sensitivities include cost-assumptions, as well as other major issues including: planning, regulatory treatment for network build, development of smarter networks and demand, and, greater interconnection.

This overview draws from a range of commentaries provided by the energy companies and the energy associations, as well as material from National Grid<sup>3</sup>. A broad picture emerges as follows.

#### 1. Reduce Energy Consumption

Reduce energy consumption through energy efficiency and saving measures across all sectors where cost-effective (electricity, heat and transport) – i.e. efficient appliances, insulation and smart technology to optimise efficient use and provide better information. Reducing energy consumption meets the three elements of energy policy (sustainability, affordability and security of supply) and is generally the most cost-effective.

**Necessary Policy Measures include:** legislation and standards (e.g. product policy, insulation); obligations and incentives to overcome initial up-front costs of investment; education to influence behaviour. Revenues need decoupling from consumption. Realistic zero carbon policy for new homes.

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<sup>2</sup> Reduce UK greenhouse gas emissions by 80% on 1990 levels by 2050

<sup>3</sup> National Grid 2050 Analysis and Scenario material.

**Key Assumptions / Sensitivities** - A 25% reduction in non-transport consumption / energy efficiency assumed by 2050 (against 2010 level, taking account of prospective population and household growth).

In parallel to addressing **consumption** we also need to decarbonise **production** across electricity, heat and transport.

## 2. Decarbonise Electricity by 2030 or shortly after with a Mix of Technologies

Electricity should be de-carbonised by 2030 or shortly after because:

- i. Significant electricity plant needs replacing in the next two decades due to age and legislation – offering an ideal opportunity to replace with decarbonised plant;
- ii. Much of the likely replacement technology is proven (wind, nuclear);
- iii. Need to connect Renewables to meet the 2020 targets. Beyond this, will need to consider economics of replanting;
- iv. Timing on decarbonising electricity significantly impacts the timing, scale and cost of electrification for transport and heat;
- v. Interconnection - there is a role for more interconnection with Europe to increase flexibility and to enhance security of supply resilience.

**Necessary Policy Measures include:** full implementation of the current planning reforms; regulatory change to encourage anticipatory network investment; smart grid deployment to operate the new generation and demand. Support for renewables and consideration of how to deliver investment in nuclear and CCS in the most cost-efficient manner within the context of the current and evolving framework. Consideration of back-up plant for intermittency and support for demand-side flexibility.

**Key Assumptions / Sensitivities** - A mix of nuclear, wind and CCS assumed, as well as more interconnection with Europe leading to substantial decarbonisation by 2030 (new fossil-plant fitted with CCS by 2025 if economic and technically proven).

## 3. Decarbonise Transport through Electrification of Domestic and Commercial Vehicles and CNG (Compressed Natural Gas) for Industrial Loads / Long-Haul

Transport currently accounts for around one-quarter of emissions. Given the limited opportunity to impact aviation emissions, the 2050 targets can only be met by a move away from petrol and diesel vehicles. Electrification of transport is a strong low carbon option, and timing of a mass roll out of electric cars should helpfully coincide with increasing electricity decarbonisation towards 2030. On this basis, mass vehicle electrification to take off in the middle 2020's when most non-CCS coal plant will be retired (from an emission point of view, electric cars powered by non-CCS coal-fired generation to be avoided - unless charged off-peak).

Increase in electricity demand in 2050 from electrification of transport is estimated at around 100 TWh pa<sup>4</sup> but this is assumed to contribute only marginally to peak demand.

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<sup>4</sup> National Grid 2050 analysis

Electrification of transport can be facilitated by earlier deployment of smart grids which will enable cars to be charged at home or elsewhere when electricity is cheap (away from peak) and will reduce the amount of potential network investment<sup>5</sup>.

Some targeted bio-fuel use may also play a role for HGVs and aviation.

**Necessary Policy Measures include** - R&D spend on electric batteries from both a cost and performance basis – to enable mass roll-out at an efficient cost from the mid-2020's. Deployment of smart grids will be crucial to operate additional demand from electrification of transport.

**Key Assumptions / Sensitivities** - Electrification of mass transport assumed. Pre-2020 much charging may take place at home and so initial investment in charging infrastructure may be modest. A key sensitivity is battery cost. If batteries were expensive, then an alternative to mass electrification of transport might be more Compressed Natural Gas (CNG). 2050 targets could be met by CNG, but would have a significant and expensive knock-on for both heat and electricity. First, more CNG for transport would mean less natural gas available for heat. In turn, this would mean increased electrification of heat, requiring more wind, and CCS being used at low load-factors (and therefore high-cost).

#### 4. Decarbonise Heat through Electrification plus some Bio-gas

The measures on reducing energy consumption, decarbonisation of electricity and the electrification of transport outlined above, will still fail to meet the 2050 targets if natural gas continues as the dominant home-heating fuel in GB. Steps towards decarbonising heat should therefore be:

- i. Electrification of heat (new homes in the first instance) using the most economic emerging technologies<sup>6</sup>;
- ii. Electric heat 'topped-up' at peak / high-cost periods by storage and / or natural gas:
  - Storage – development of cost-effective, practical storage solutions to avoid heat-pump use at peak and / or high-cost periods;
  - Natural gas – National Grid analysis has shown that it is economic to continue to use natural gas for top up heating. (Full electrification of heat could be very expensive if some generating plant needs to recover its fixed costs at peak over a small number of half hours).
- iii. Effective incentives will be needed for renewable heat and renewable community heating schemes. Biogas (bio-methane) for existing homes. Renewable gas through the existing network is an efficient way of decarbonising heat, but will require subsidies of the order of those for offshore wind.

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<sup>5</sup> For long-haul vehicles where electrification is impractical, then CNG-hybrids should be used to reduce emissions.

<sup>6</sup> National Grid analysis considers the impact of reducing the cost and / or increasing coefficients of heat pumps - and the impact on cost of meeting 2050 targets.

**Necessary Policy Measures include** - high-levels of thermal insulation fully delivered. In addition : Heat pump R&D – cost and efficiency of heat-pump technology has a material impact on likely costs of meeting 2050 targets; Storage - R&D and commercial deployment at scale; Smart grid deployment central in handling additional demand, including peak-demand, from electrified heat; appropriate and cost-effective subsidies to support biogas for heat-decarbonisation.

**Key Assumptions / Sensitivities** - Assumes electrification of heat, use of storage and / or natural gas for electric heat ‘top up’ at peak / high-cost periods, and some bio-gas. Two key sensitivities : full electrification of heat increases the overall cost of meeting the 2050 targets; impact of cost / coefficient of heat pumps on overall cost of meeting the 2050 target (i.e. high capital cost or low CoP for heat-pumps may significantly increase cost of meeting 2050 target).

## 5. International, EU and Domestic Dimension

A robust international agreement on emissions reduction, as well as continued development of emissions trading and technology transfer, both an international and at an EU level will be fundamental to global emission reductions overall. Levels of interconnection will also be material.

### Other Scenarios

A brief review of other 2050 scenarios<sup>7</sup>, including that of EURELECTRIC, also highlight the significance of energy saving and power decarbonisation as well as a major role for electricity in transport and heat. They also point to the importance of considering national policies within a wider EU and international context. All of the studies stress the very significant long-term uncertainty regarding technology potential and cost and show a variety of possible pathways to 2050 – all with attendant risk in delivery and cost. They also identified a number of common themes and questions in looking out to 2050, relevant to the Narrative set out above, including, for example, issues such as:

- **Carbon profile** – i.e. whether emissions will be reduced early or late; extent of delivery of emissions reduction at an international, European or national level;
- **Sectoral shifts** - extent and timing of sectoral shifts (transport, heat);
- **Degree of prescription** - relating to fuel / technology mix;
- **Network development** – extent of ‘guiding mind’ and timing of delivery;
- **Uncertainty on technology costs** - pointing to investment uncertainty into the longer-term.

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<sup>7</sup>Simon Skillings. Trilemma-UK