CBI, 'Decision Time' (2009)

1. Purpose of the activity

To identify the challenges to the UK energy system with the reduction in North Sea hydro-carbon production. Within this context, it is designed to ensure energy system remains sercure, is able to attain 2050 climate change targets and attract global capital required to replace an ageing electricity network.

The work modelled a business as usual (BAU) trajectory for energy companies with the present suite of policy incentives. This suggestes that electricty generation will be:

- Dominated by a mix of gas-fired sources and renewables which in turn will lead to the UK struggling to hit 2050 targets;
- Being `locked in' to upto 25GW of new gas-fired power stations; and
- Experience some of the highest elextricty and gas prices in Europe.

The project used a modelling scenario to explore the likley outcome for the UK energy system if the present policy framework was adjusted away from th tendency toward gas-fired plant. This `balanced pathway' results in:

- Large volumes of wind generation;
- A large nuclear programme;
- Some gas-fired for flexibility and a blend of other renewables; and
- CCS coal stations to make up the balance.

The scenario also results in 45% less emissions than BAU and a marginally cheaper capital outlay.

2. Model / scenario description

a) timespan and region	2030, UK energy system - principally electricity.
b) scenario type:	Forecasting; Quantitiave; Normative; Expert and Sector Specific.
c) what the approach has been designed to achieve.	To ensure energy system remains sercure, is able to attain 2050 climate change targets and attract global capital required to replace an ageing electricity network.
d) description of modelling method	McKinsey proprietary macro-economic model of pan European power system which is linear cost-optimisation, responding to endogenous policy measures. This matches hourly demand and supply by minimising the cost of electricty generation for a given portfolio of generation and interconnection capacity. The model covers 21 countries in Europe and 2,000 power plants. The scenario is principally focused on electricity generation with limited representation of transport (except where transport met through electricity).
e) references, links	'Climate Change: everyone's business' (2007) report and other material is available from http://climatechange.cbi.org.uk/reports/00051/; 'Decision time' is available from http://climatechange.cbi.org.uk/reports/00283/.

3. Key Assumptions

a) carbon & energy prices	In the balanced pathway future energy prices based on coal, gas, oil and carbon emissions based on publically available reports - real electricity prices stand at £124/MWh in 2020 and £134/MWh in 2030. These were fed into the McKinsey & Co European Power Model.
b) final energy demand	Electricity demand based on gross electricity generation requirements and peak power demands (inclusive of transmissions losses). Peak demand based on historical ratio of peak to average demand of (1.35) with adjustments for smart meters reducing peak demand by an incremental 1% over the reduction in average demand; and demand for electric vehicles has a flat load curve i.e. vehicles are charged uniformly throughout the day.
c) economic conditions	Natural growth curve driven by GDP growth rate (tracked by electricity generation requirement from historical data) with the impact of financial crisis, electric vehicles and energy efficiency factored in.
d) social conditions	Not specified.
e) learning rates	In the BAU the Industrial Emissions Directive forces the retirement of coal and gas plants which leaves too short time for low carbon technologies to deliver the required capacity.
f) technology costs	Offshore wind: Capex/KW: £2000, load factor: 35%, capacity credit: 18%, T&D capex £400/KW offshore, £100/KW onshore. Gas capex: £500/KW. Nuclear: Capex/KW: £2500, load factor: 90%, T&D capex, decommissioning costs.
g) policies	Maximise energy efficiency and flexible electricity demand through appliance efficiency standards and fiscal incentives resulting in a 20% drop in electricity demand. Accelerated smart meter roll out would enable demand peaks to be smoothed out. No green field sites for new nuclear power i.e. new nuclear plant to be built on existing nuclear sites.

4. Outputs

(a) final energy demand overall;	72 GW generation capacity with consumption at approximately 400 TWh. *Heat:* Not specified. *Transport:* Impact of electric vehicles increased electricity generation requirements by 4TWh in 2020 (at 5% penetration) and 23 TWh in 2030 (at 30% penetration) - based on 12,500 km per car per year at an energy requirement of 190 KWh/km. *Industry Process:* Not specified.

<table>
<tr><td>(b) how demands were met by fuel</td><td>Electricity generation demands in 2030 met by:
<table>
<tr><td>Wind capacity</td><td>25 GW</td></tr>
<tr><td>Nuclear</td><td>16 GW</td></tr>
<tr><td>Gas-fired</td><td>for flexibility 10 GW (of which 2GW of Industrial CHP which results in a gas demand of 93 bcm in 2020 and 80 bcm in 2030)</td></tr>
<tr><td colspan="2">Blend of other renewables</td></tr>
<tr><td>Biomass</td><td>3 GW</td></tr>
<tr><td>Biogas</td><td>1 GW</td></tr>
<tr><td>Tidal</td><td>1.5 GW</td></tr>
<tr><td>Distributed</td><td>1.5 GW</td></tr>
<tr><td>CCS coal stations</td><td>7 GW</td></tr>
</table>
Noting that the rebalance of approach to 2020 renewables target with contribution from renewables dropping from 32% to 25%; this will faciliate a more balanced and manageable system.

A reserve electricty generation margin of 20% over peak demand is maintained.</td></tr>
<tr><td>(c) power generation by technology</td><td>As per above, noting the need for regulatory and funding frameworks for CCS and the timelines for nuclear do not slip to enable long term investment in these low carbon technologies.</td></tr>
<tr><td>(d) role for bioenergy</td><td>Bio-gas production for 2009 based on time-series analysis of historical data and from public reports estimate availability of biogas for heating to be 4.5 bcm in 2030 and 5.5 bcm in 2030. The amount of biogas production in different years was netted out from total UK gas demand to get total UK natural gas demand.

Noting the fact that in order to find a cost effective way of meeting the EU renewable target there is a need to explore the scope for expanding the production of biogas for heat.</td></tr>
<tr><td>(e) role of enabling technologies</td><td>Accelerated smart meter roll out would enable demand peaks on electricity system to be smoothed out. Reduced required electricity generation by an incremental 3% under scenarios.

Accelerated grid investment to encourage assets to be used more efficiently, investment in grid connections and upgrades.</td></tr>
<tr><td>(f) decentralised energy/CHP</td><td>Minor role for decentralised energy (1.5 GW) and Industrial CHP (2 GW)</td></tr>
<tr><td>(g) costs of achieving goals</td><td>Investment costs will be around £121-167 bn over next 20 years; this is considered to be no higher than industry already anticipates and results in a lower carbon outcome.
<table>
<tr><td>Total Gas</td><td>£ 4-7 Bn</td></tr>
<tr><td>Network</td><td>£ 18-26 Bn</td></tr>
<tr><td>Coal CCS</td><td>£ 15-20</td></tr>
<tr><td>Other renewable</td><td>£ 11-15 Bn;</td></tr>
<tr><td>Wind</td><td>£ 33-43 Bn</td></tr>
<tr><td>Nuclear</td><td>£ 35-45 Bn</td></tr>
<tr><td>Gas</td><td>£ 4-9 Bn</td></tr>
<tr><td>Coal</td><td>£ 1-2 Bn</td></tr>
</table>
Prices would still rise in real terms by 30% under the `balanced</td></tr>
</table>

	pathway' driven by policy costs.

5. Key messages

- Current energy policy will push renewables (wind) beyond an efficienct level. Intermittency will become a pertinent problem that can currently only be effectively solved through large scale deployment of centralised gas fired generation. This will lock us in to a gas future in the medium term that will prevent us reaching longer term goals.
- There is a need to introduce the following policies to attain a more balance electricty generation system:
  - Maximise energy efficiency and flexible electricity demand;
  - Rebalance the contribution of renewable electricity to the UK's renewable target;
  - Push CCS and new nuclear;
  - Accelerate grid investment;
  - Explore need for new low carbon generation investment mechanism; and
  - Speeding up the planning process.

Electricity Generation:
Out to 2030 this will be resolved through centralised gas turbines unless a more diverse mix of low carbon generation is incentivised and the 2020 renewables target is relaxed. Smart metering and demand response will have a key role to play in a future system.

Transport:
Demand side impact of electric vehicles increased electricity generation requirements by 4TWh in 2020 (at 5% penetration) and 23 TWh in 2030 (at 30% penetration) meaning that 40% of cars sold between 2020 to 2030 are electric vehicles. Energy use by transport is outside scope of report but can be found in the CBI Transport Abatement Roadmap.

Energy Efficiency and Heat
Energy efficiency assumes stronger mandates and financial incentives for all levels of energy efficiency and reduce generation requirements by 20% compared to the natural growth curve.

Report touches on aspects of heat policy calling for an incentive for CHP and pressing ahead with the zero-carbon homes agenda, the insulation of existing housing stock to cut fossil fuel demand for heating, exploring the scope to increase biogas production and the feasibility, and the carbon benefits, of the electrification of domestic space heating as the grid becomes progressively decarbonised.

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