Centre for Alternative Technology, Zero Carbon Britain 2030 (2010)

1. Purpose of the activity

Set in the context of what the climate science says and what that means for the UK emissions in relation to the rest of the world. It sets a target of zero carbon emissions for the whole economy by 2030, updating a 2007 report which looked at achieving zero carbon emissions by 2027. The study is intended to illustrate the feasibility of achieving a radical shift to a low carbon economy in the UK with the aim of influencing policy makers. It identifies the issues that need to be considered for each sector, the policy framework to deliver it and the impact on the economy. The authors link the need to address energy security closely with climate change.

2. Model / scenario description

a) time span and region	2030, UK
b) scenario type	Backcasting, framed by an assessment of climate research to identify future carbon constraint and timetable. Whole economy scenarios. Qualitative narrative, using published data and research combined with some sector-specific modelling. Report explores a range of routes and options, presenting a single normative scenario. A participatory approach is taken to inform the development of the scenario. With groups brought together to consider each sector.
c) what the approach has been designed to achieve.	Objective to remove all fossil fuels and nuclear power from the economy and the energy system by 2030, mapping future demand and matching it with possible supply.
d) description of modelling method	Focus is on matching supply and demand. The potential to reduce emissions and energy demand is explored for each sector across the whole economy. Using a similar method the ability to meet this energy demand with zero carbon supply is then examined. Sankey diagram used to illustrate supply and demand. The technology mix is based on proposed projections for technology development. The resulting energy scenario was tested with the (Future Energy Assessment) FESA energy model over a designated time period in different weather and demand conditions. An expanded Contraction and Convergence approach is used to determine the UK's emissions leading to the zero emissions by 2030.
e) references, links	Report available from http://www.zerocarbonbritain.org/. Draws on UKERC 2009 scenarios, AEA, NERA Economic Consulting, DECC and National Grid (2009) plus wide range of other published data for specific technologies.

3. Key assumptions

Many of the assumptions are implicit in the reference material used. The scenario is generally descriptive and identifies the issues and relative impacts, with most detail provided on the supply and demand figures.

a) carbon & energy prices	Assumes that fossil fuel prices will rise as peak oil is reached, which will also affect the prices of other fuels. Draws on DECC figures for fuel and carbon prices. Renewables are preferred as they have no fuel cost which is seen as decreasing risk, and therefore offering more guaranteed returns. Offshore wind has comparable capital cost to coal with CCS, but without the fuel cost.
b) final energy demand	Review of energy demand based on range of published work. Some consideration is taken of emissions from imported goods and of embodied energy in delivering technologies.
c) economic conditions	Impact of recession considered; discussion about number of jobs that might be created; and discussion of equity impacts.
d) social conditions	Not detailed explicitly. Review of potential for voluntary behavioural change based on published work. Voluntary reduction in energy demand assumed to contribute to reduced energy use.
e) learning rates	Learning rates and technology costs are not explored explicitly, instead it adopts those used in the reference reports and data.
f) technology costs	Draws on existing work. Indicative costs are shown for some technologies to illustrate feasibility and discussion of issues relating to cost of carbon.
g) policies	Various options for pricing mechanisms discussed, including global and national mechanisms, as well as specific sector interventions and the need for market reform. Options are related to the scenario but are not built into its development. UK energy demand can be met without the use of fossil fuels or nuclear.

4. Outputs

(a) final energy demand overall	Across entire economy energy demand is reduced by 55% below 2008. (i) Heat: ~350TWh (ii) Transport : ~280TWh (63% below 2008 levels), mainly biofuel and H_2 some elec.tricity. Quotes reference to overall electricity demand increasing by 16% to supply transport demand. Aviation decreased to 33% of current (2008) demand. (iii) Industry: 221TWh, approx 2/3rd heat. Commercial/public – 143TWh, mix of heat and electricity.
(b) how demands were met by fuel	Electricity roughly double to 842TWh (inc. exports, which could amount to about 150TWh). Several gas power stations remain as back-up to renewables, fuelled by bio-gas. Heat pumps provide 148TWh of heat, 54% of domestic demand and 40% of non-domestic demand.

<table>
<tr><td>(c) power generation by technology</td><td>Approximate values for 2030:<table>
<tr><td>Wind</td><td>615 TWh (195GW installed capacity)</td></tr>
<tr><td>Solar thermal</td><td>24 TWh</td></tr>
<tr><td>Biomass</td><td>300 TWh</td></tr>
<tr><td>Marine</td><td>70 TWh</td></tr>
<tr><td>Hydro</td><td>7 TWh</td></tr>
<tr><td>Solar PV</td><td>4.4 TWh</td></tr>
<tr><td>Nuclear</td><td>7.5 TWh (ie Sizewell)</td></tr>
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<tr><td>(d) role for bioenergy</td><td>Bioenergy supplies ~300TWh, split roughly equally between biomass for heat and CHP; biogas to replace natural gas in OCGT to provide back up for renewables; and, biofuels for transport.

Its role is ultimately limited by availability.</td></tr>
<tr><td>(e) role of enabling technologies</td><td>Grid balanced by demand side management, the use of the EU grid and use of biogas (OCGT mainly with some CCGT).

Several measures including smart meters and domestic water tanks allow, overnight electric vehicle charging and heat storage to utilise off-peak wind generation.</td></tr>
<tr><td>(f) extent of decentralised energy production and role of CHP</td><td>Distributed generation is limited due to higher cost than centralised and also having a higher embodied energy. However, there is some niche usage to help manage the grid. It also benefits from having lower transmission losses.

CHP provides approx 45TWh total energy, but unclear how much is heat (19-35TWh) or electricity (31.4TWh), with additional heat from log stoves and wood boilers.</td></tr>
<tr><td>(g) costs of achieving goals</td><td>No overall costs given. Some indicative costs provided for specific technologies.</td></tr>
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5. Key messages

Removing fossil fuels from the economy by 2030, is achievable, but ambitious and will require reducing consumption through greater efficiency and technology improvements; reducing consumption and energy demand through behaviour change; adopting electricity as an energy carrier and utilising waste resources.

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