Response to ‘Planning for a Sustainable Future’ Gordon Taylor 2007-08-13

Planning – Energy – Climate - Sustainability

Energy is a unique aspect of sustainability, since it alone allows the winning of materials by extraction or recycling, the manufacture of hardware, and then its operation, to demand and supply heat, power and portable fuels for energy services. Also energy security and climate change are key objectives of the UK Government.

All infrastructure has energy implications – e.g. built environments, road, rail, ports, and airports for energy demand and oil and gas terminals and pipelines, power stations, and transmission lines for energy supply. Moreover, all infrastructure projects involve both one-time invested, embodied or ‘grey’ energy, as well as recurrent operating energy. Specifically, all involve large amounts of concrete and steel, which are energy and carbon dioxide intensive, and hard to recycle.

For example, all buildings – particularly greenfield - would have transport impacts. Likewise, additional road capacity usually results in more traffic (vehicle-km), and additional airport capacity - for which the business case assumes increased air traffic – generates more road traffic - witness the size of airport car parks. Moreover, there is no renewable liquid fuel available or in prospect in sufficient volume for fuelling aircraft. (Petroleum-based fuels have very high energy content per unit mass and volume. Anything with less would reduce the aircraft payload and range).

Indeed, while all are competing for a declining supply of oil, fuelling ships, trains, and road vehicles with biofuels and renewable electricity will present huge challenges. Hence the totals of air, sea, rail, and road traffic will all have to decline in volume, especially in the developed world, despite any gains in fuel efficiency.

The reserves of cheap fossil energy are limited, with Peak Oil, Gas and Coal all being reached imminently. Hence a significant proportion of this should be invested over the next few decades in infrastructure for a sustainable energy future. (See http://www.energypolicy.co.uk/sustainpres.htm). Even so, the sustainable levels of activity will be lower than hitherto.

In the White Paper, P 8, Para 1.1, the emphasis is on ‘clean and affordable energy’. However, it should be on ‘sustainable energy services’. This means mostly energy savings with some renewable energy. As a guide, the Swiss ‘2000 Watt’ (per capita) documents mention that the current value (for Switzerland) is about 6000 Watts per capita. They outline how some 4000 Watts per capita would come from energy savings (in all sectors), while - of the remaining 2000 Watts per capita – 1500 Watts per capita would come from renewable supply and only about 500 Watts per capita of fossil carbon or equivalent in greenhouse gas emissions. (See Jochem E. (ed), 2004, ‘Steps towards a sustainable development’. http://www.cepe.ethz.ch/publications/Jochem_WhiteBook_on_RD_energyefficient_technologies.pdf).

Energy and Carbon Impact Statement

Therefore all planning submissions should include an energy and carbon impact statement, analogous to or extending the environmental impact statement. The statement should include the embodied energy - even for imported components, since they would add to the planetary burden. In particular, since the subjects of such infrastructure proposals are inherently long-lived, the statement should show that the proposal would be consistent with the prevailing energy and carbon objectives over the full lifetime.

Moreover, any proposals for replacement or new energy infrastructure should include energy savings, since these are inherently sustainable. Such proposals should specify any existing capacity that is replaced or the integral components that help the attainment of the energy and carbon targets. (These should not be based on Clean Development Mechanism or Joint Implementation Offsets, since these are hard to verify, and may not be permitted under post-Kyoto treaties).

White Paper, P 12, Para 1.10. Therefore we require a statement of need on energy saving.

White Paper, P 20, Para 1.30, Box 1.3, ‘There should be a presumption in favour of development’. However, for energy services to be sustainable, the presumption for all infrastructure must be in favour of energy savings and renewables.

Timeframe

Consultation, P 7. ‘National Policy Statements should have a timeframe of 10-25 years’. This is quite insufficient, since we are now in the end-game for cheap fossil energy, climate change and sustainability. The national targets have been defined as 60% reduction of greenhouse gas emissions by 2050 and 80% reduction by 2100. (See ‘Energy – the Changing Climate’, RCEP, 2000, http://www.rcep.org.uk/newenergy.htm). Moreover, even greater reductions may yet be required. Yet the lifetimes of infrastructure projects are e.g. 40 years for power stations and 60-100 years for the built environment. Hence there is no time remaining for interim solutions. All infrastructure choices must contribute directly to the energy and greenhouse gas reduction targets.

Risks

There should be no continuation of exemptions from insurance of risks to the public – for example, under the Nuclear Installations Act 1965 and later. This would amount to an infinite subsidy, and hence distort the allocation of resources. Moreover, the consequences of any major radioactive releases would bear extremely heavily on both the current and future generations, and thus be unsustainable.
Nor should any such exemptions apply to Liquefied Natural Gas facilities – terminals, pipelines, and rail and road tankers. Explosions and conflagrations have already occurred by accident and could be caused by terrorists. Hence building such vulnerable facilities would be a ‘hostage to fortune’. In any case, as pointed out above, Peak Gas is imminent, so they would be unsustainable.

Micro-Generation

White Paper, P 28. Microgeneration is mentioned, with the implication that it makes sense. This may be true for the generation of heat by solar collectors or biomass boilers. However, for the generation of electricity by small wind turbines, all photovoltaic arrays and micro-chp, all the evidence – both in the UK and overseas - is to the contrary. This means that such installations should be discouraged – as counter-productive to the national energy and climate objectives.

Small Wind Turbines:

‘The Warwick Urban Wind Trial Project’, Interim Report, March 2007. The initial results for an Ampair 600 were 14 kWh in 694 hours, giving a capacity factor of 3.4 %.
(See http://www.warwickwindtrials.org.uk/resources/Warwick+Wind+Trials+Interim+Report+Final+2.pdf Page 11).

Assuming an initial cost of £ 3500, and no maintenance costs over a 20-year lifetime, this implies a ‘cost-of-electricity’ of about £ 1/kWh – i.e. about 100 p/kWh – about 10 times the current retail price.

‘Predicting the yield of small wind turbines in the roof-top urban environment’, Simon Watson et al., Loughborough University, presented at EWEC 2007. This found that the capacity factor for an Urban Wind Turbine would be between 1% and 5%.
(See http://www.ewec2007proceedings.info/allfiles/52_Ewec2007presentation.ppt Slide 13).
This comprehensive study thus confirms the findings of the limited field trial.
(The capacity factor for a large onshore wind turbine would be about 30%).

Small Photovoltaic Arrays:

The BRE Field Trial. This found that the average capacity factor was about 8.6% and the best about 10%. (See http://www.bre.co.uk/filelibrary/rpts/pvdt/PVDFT_Final_Techn_Report.pdf).
(The capacity factor for a large crystalline silicon PV array in the UK, with optimal fixed orientation and slope and no shading, would be about 13%).

Micro-chp Units

The electricity efficiency of the WhisperGen Stirling micro-chp unit has been measured and reported as around 7.8% (HHV). (See http://www.micropower.co.uk/publications/eonfieldtrial260606.pdf Page 11).

The efficiency of the Enatec Stirling engine unit was reported in April 2006 as 13.5% (LHV) - i.e. 12.2% HHV. (See http://www.dgs.de/uploads/media/06_Ger_Beckers_ENATEC.pdf Slide 12).

'MicroCHP - delivering a low carbon future: Report on the market for microCHP', prepared by the Domestic CHP Section of the SBGI, 8th September 2003. This noted that: 'as no current Stirling Engine-based design is capable of meeting the electrical efficiency requirements of 20%, they cannot receive Good Quality CHP accreditation under the current rules'.
(See http://www.sbgi.org.uk/index.php?fuseaction=sbgi.viewFile&id=8010979 Page 27).

Hence after taking account of the low electricity efficiency, the 'thermodynamic heating efficiency' of micro-chp units is no better than that of good condensing boilers. In addition, micro-chp units depend on natural gas, and so are unsustainable. (See http://www.energypolicy.co.uk/epolicy.htm).

Gordon Taylor, B.Sc., M.Sc., M.I.Mech.E.

G T Systems
19 The Vale, Stock, Ingatestone, Essex, CM4 9PW
Tel: 01277-840569
Email: gordon@energypolicy.co.uk
Web: http://www.energypolicy.co.uk