ELECTRICITY MARKET REFORM CONSULTATION

A submission by Calor Gas Ltd

Executive Summary

1. Infrastructure delivery and affordability are just as important as potential interruptions of supply by third parties to the security of supply to the householder. In relation to gas/LPG our sources of supply are diverse and broadly secure.

2. Infrastructure delivery from the renewables wind and biomass is questioned; even when installed, wind is intermittent and undependable, not least during the coldest weather.

3. Because of its intermittency wind has to be backed up by expensive fossil fuel plant on standby; wind does not reduce the need for fossil fuel plant, it embeds a future need for it. Wind's subsidy is on course to reach £5bn a year and it necessitates further "incentives" to generators to provide the back-up capacity.

4. Offshore wind is acknowledged as having "high and uncertain" capital costs, "high" technology risks and "high" operational and maintenance risks. Projections of its cost of generation show it as being £53-£106/MWh more expensive compared with other mainstays of generation. It is a bad value for money technology.

5. The commonly used figure of £200bn needed to maintain our electricity supplies predates DECC's realisation that under a pure electricity play our need for generation will double or even triple. No-one has yet costed the impact of that on fuel bills and future affordability.

6. Much of that extra capacity need appears to be driven by the cherry-picked technology represented by heat pumps, once again highly subsidised and requiring cripplingly expensive upgrades of the national grid, especially in rural areas.

7. Already official forecasts are that fuel poverty will rise by 50% to cover 6 million households and that fuel prices might rise by 60%. Policies that rely on high fuel bills and expensive subsidy are in effect stripping millions of Britons from security of supply.

8. An alternative "Green Gas" solution is available priced at £700bn less than the pure electricity play, and will save the average household £20,000.

9. Distributed generation promises much more efficient generation of heat for households during the 31 coldest days of the year which will otherwise be supplied by very expensive unabated centralised gas generation which will stand idle for the remaining 334 days of the year. Besides, rather than adding to fuel bills, fuel cell mCHP boilers will reduce household bills by 25%.

10. Since biomass is not zero carbon and may only reduce GHG emissions by 60% it should be set proportionate emissions performance targets. The emissions of black carbon (a powerful contributor to climate change) and particulates (significantly dangerous to human health) from biomass should be taken into account in setting policy.

Question 2: Do you agree with the Government's assessment of the future risks to the UK's security of electricity supplies?

Security of supply is not simply about ensuring the sourcing of the fuels necessary to keep the economy going and keep our homes lit, warm and functional. If the infrastructure necessary to deliver the quantum of generation we will need in future decades is lacking, or if power becomes so expensive to pay for that industry is exported abroad and our homes go unlit or unheated then that is a crisis of security of supply just as severe as interference with imports of fuels or power from abroad. To ensure security of supply we must give due consideration then to:

- Potential interruptions of supply from third parties
- Infrastructure delivery
- Affordability

We believe insufficient attention has been devoted to the two last factors.

Is Gas Under Threat from Third Parties?

Calor Gas is currently focused on distributing Liquefied Petroleum Gas (LPG) mainly to rural areas off the gas main. The UK is self-sufficient in LPG – indeed 45% of the UK's LPG production is exported. Europe is almost self-sufficient in LPG. Europe's security of supply is further safeguarded by:

- a wide range of sources, both inside and outside Europe;
- a flexible supply chain via water, rail and road with numerous routes and entry points into Europe.

In relation to natural gas, the recent report from Pöyry, "Gas: At the centre of a low carbon future" (September 2010) concluded: "Recent studies by, and supported by DECC, concluded that there are no major security of gas supply concerns as Britain increases its gas imports…We also survived the coldest winter in over 30 years in 2009/10 with plenty of gas available and no impact on the wholesale price".

Is There a Threat to Infrastructure Delivery?

Wind - Pöyry thinks so: "With large scale renewable build, new nuclear power stations and a major expansion in electric grid infrastructure (both offshore, mains transmission and within homes) required, there is an enormous challenge in putting together the resources, capabilities and skills required…Based upon various substantive analysis we have undertaken we believe there is a greater risk of the 'lights going out' through insufficient power generation and increased peak forecasts than any concerns over security and price from rising fuel imports".

Will 30% of electricity generation come from renewables by 2020 as is envisaged by the Revised NPS on Energy? At the end of 2009, 3% of our energy came from renewable resources (WA, 8.12.10). Is it really imaginable that we can increase that by a factor of ten within 9 years?

In a Lords Written Answer on 19th January 2011, Lord Marland envisaged a scenario of 4,000 offshore turbines by 2020. The Carbon Trust points out that the build rate of offshore wind turbines has been one every 11 days since 2003: 436 offshore wind turbines have been installed to date. To reach the 2020 target, therefore, would require the current installation rate to accelerate tenfold.

The Daily Telegraph reported on 11th January 2010 that out of a UK capacity of 5% wind was delivering 0.2% during the cold spell. The wind was not blowing when most needed. Andrew Horstead, a risk analyst for energy consultant Utilyx, commented: "This week's surge in demand for energy in response to the cold weather raises serious concerns about the UK's increased reliance on wind power…Failure to address these concerns could mean further rationing of energy in future years and could even lead to black-outs, so it is vital that the UK Government takes action now to avoid the lights going off," (ibid.) The poor performance of wind in January 2010 was echoed in the cold snap of December 2010: The Times (3rd January 2011) reported that since the beginning of December turbines had been operating at only 20% of their capacity – on 2nd January wind was contributing but 0.5% of the country's power.

The Renewable Energy Foundation reported on the wider European context on its website: "Load factor in other European countries at exactly this time was also low. The Irish wind fleet was recording a load factor of approximately 18% (261 MW/1,425 MW), Germany 3% (830MW/25,777 MW), and Denmark 4% (142 MW / 3,500 MW).

Such figures confirm theoretical arguments that regardless of the size of the wind fleet the United Kingdom will never be able to reduce its conventional generation fleet below peak load plus a margin of approximately 10%.

They also suggest that while widespread interconnection via the widely discussed European Supergrid, may assist in managing variability, its contribution will not on its own be sufficient to solve the problems, since wind output is approximately synchronised across very large geographical areas.

The now emerging fact that wind power can be highly variable year on year adds further layers of complication to this problem. Conventional generators will not only have uncertain income over shorter timescales, but will face significant year on year variations."

Biomass - As for the potential contribution from biomass, the Government acknowledged "constraints to the provision of such infrastructure" ("The UK Renewable Energy Strategy 2008) including "public hostility to combustion plant, particularly those burning waste" (ibid.) Prof. David MacKay, Special Adviser in DECC unrepentantly called for "industrialising really large tranches of the countryside"(11.09.2009 – Times Online) to supply biomass. The renewables strategy depends on doubling the land devoted to energy cropping in every year from 2010 to 2017. The expectations of biomass look as heroic as for wind: "To date there has been a failure to achieve significant planting of woody energy crops in the UK" ("Combating Climate Change, Forestry Commission", 25th November, 2009, para.14.2).

Missed targets - Reality may possibly be beginning to break out. Charles Hendry MP, Minister of State at DECC on 8th December 2010 admitted in a written answer: "As a result of the failure to make sufficient progress in past years, the UK will miss the 2010 renewable electricity target this year… meeting our 2020 target is challenging but achievable." Renewables, as heavily subsidised as they are, are failing to rise to the challenge.

The consultation describes very well the benefits that a market oriented system has brought. It proceeds to describe the gaming and inertia that is implicit where large subsidies are prevalent: "The UK electricity system is in the middle of a transformation to a low-carbon future. This creates significant uncertainty as the electricity price is increasingly influenced by Government intervention as opposed to market forces which investors are used to dealing with. This inherent policy uncertainty will have two impacts: firstly it will increase the value of a 'wait and see' approach resulting in delays in investments" (p.32). The greater the subsidies, the greater the temptation to play the game. This is another reason – in addition to considerations of affordability – why we favour low cost, low carbon, low subsidy solutions.

Does Affordability Threaten the Nation's Energy Supply?

Pöyry thinks that the sums involved for those building the necessary infrastructure are, "Stretching (in the order of £200bn by 2020 and 400bn by 2050) and there are questions over the ability of the market players to raise the necessary debt or equity funding."

The most commonly - if rather loosely - used figure is £200bn. We believe that that figure is consistent with OFGEM's Project Discovery projections and with the original Draft National Policy Statements for Energy and were based on what we would regard as an optimistic view that grid peak demand would remain flat at 60GW to 2020. But, in the Revised NPS the full implications of a pure electricity play including the electrification of transport and heat are glimpsed for the first time: "Generation capacity will need at least to **double** to meet this demand and, if a significant proportion of our electricity is supplied from intermittent sources, such as wind, solar, or tidal, then the total installed capacity might need to **triple**" (para.1.66). This is an astonishing admission, with no doubt a similarly astonishing, and not yet revealed, cost. We believe that the commonly quoted costs of investment needed of £200bn (restated in this consultation p.5 etc) to deliver necessary capacity relate to the original target, not to the doubling, or tripling of existing capacity. If energy companies do find the resources to invest in doubling to tripling the generation capacity ultimately they will be hoping that the consumer of their electricity will pay for the increased cost of their electricity. We should have transparency as to what that will mean for the consumer - "the small impacts on bills in the near term" and longer term falls in bills as optimistically described on p6 stretch credulity.

Our projected future dependence on wind power is making our power unnecessarily expensive. The UK Renewables Strategy 2008 says this about wind:

"3.9.4 Analysis of wind patterns suggests that, at high penetration levels in the UK, wind generation offers a capacity credit of about 10-20%. This is an indicator as to how much of the capacity can be statistically relied on to be available to meet peak demand and compares to about 86% for conventional generation. This means that controllable capacity (for example fossil fuel and other thermal or hydro power) still has to be available for back-up at times of high demand and low wind output, if security of supply is to be maintained. New conventional capacity will, therefore, still be needed to replace the conventional and nuclear plant which is expected to close over the next decade or so, even if large amounts of renewable capacity are deployed…

3.9.6 In the British market electricity generating capacity does not earn money simply for being available; it earns money only when it actually generates. This is consistent with striking the optimal balance between costs and benefits of spare capacity on the system. It also means that wholesale electricity prices are likely to rise to very high levels at times when high demand and low wind speeds coincide. This is necessary in order to cover the costs of plant which does not get to generate very often, and so ensure that generators are incentivised to provide back-up capacity.

3.9.7 It is nevertheless possible that uncertainty over returns on investment, because of the difficulty of knowing how often plant will get the opportunity to run, will discourage or delay investment in new conventional capacity – or speed up the closure of existing capacity – and hence increase the risk of occasional capacity shortfalls."

The Revised Draft NPS on Energy accepts this argument: "However, some renewable sources (such as wind, solar and tidal) are intermittent and not all renewable sources can easily be adjusted to meet demand. An increase in renewables will therefore require additional back-up capacity and mean that we will need more total electricity capacity than we have now" (Para.3.3.11).

Put more plainly, every 10 new units worth of wind power installation has to be backed up by what are likely to be 8 new units worth of fossil fuel generation, because fossil fuel can and will have to power up suddenly to meet the deficiencies of wind. Wind does not provide an escape route from fossil fuel but embeds the need for it. Nuclear runs at base load and cannot power up to cover the absence of wind.

The true picture is even bleaker than that. If fossil fuel plant has to be constructed and stand by waiting for wind to default then its power will have to be more expensive in order for the plant to "wash its face". So, the effect of having a large investment in wind is to drive up the price of power generally. Charles Hendry has admitted that no-one has worked out the costs: "The Department has not provided estimates of the cost of constructing fossil fuel power stations to compensate for intermittency in the period out to 2030" (WA 9th February 2011, col. 356W). The subsidy to wind is not cheap either – by 2020 the subsidy will have risen to £5bn in that one year alone (Written Answer, House of Lords, 19th January 2010).

Fells Associates Report (17th September 2008) points out that, "The National Audit Office identified wind power as one of the most expensive ways of reducing carbon emission, with recent reports claiming that abating one tonne of carbon costs between £280 and £510. This compares with £10 to £20 per tonne in the European Emission trading scheme (National Audit Office, "Department Of Trade and Industry: Renewable Energy", report by the Comptroller and Auditor General,Hc 210; Session 2004-2005, 11 February 2005)".

We mentioned HMG's target of 4,000 offshore wind turbines by 2020 above. A recent report for DECC by Mott MacDonald, "UK Electricity Generation Costs Update" (June 2010) estimated the levelised cost of offshore generation to be £157-186/MWh, roughly twice that for onshore wind (£94/MWh). Offshore wind was by far the most expensive technology that MacDonald compared with gas (£80/MWh), coal with CCS (£104.5/mWh), nuclear (£99/MWh) and onshore wind (£94/MWh). As the consultation makes plain offshore wind has "high and uncertain" capital costs, "high" technology risks and "high" operational and maintenance risks (p.29). Why are we subsidising such poor value for money in such a risky and intermittent technology?

Rising costs – rising bills

On 16th December 2009, an OFGEM presentation showed 4 million households in fuel poverty and forecast fuel poverty to rise to cover 6 million. OFGEM has predicted a rise of up to 60% for domestic fuel bills (Evidence to Energy and Climate Change Committee 2.12.09). The Renewable Energy Strategy admitted: "Poorer households are likely to spend a higher proportion of their income on energy and so increases in bills will impact more on them".

A report, "The Cumulative Impact of Climate Change Policies on UK Energy Intensive Industries" (7th July 2010) published by the Energy-Intensive Users Group (EIUG) and the TUC forecast increases in total energy bills for industry, taking electricity, gas and emissions reduction schemes together, as high as 141% by 2020. However, the picture is just as bleak for smaller and less energy hungry companies. In a Written Answer (18th November, 2010, col. 930W) Charles Hendry MP, Minister of State for Energy and Climate Change estimated that renewables policies would add £246,000 (25%) to the average medium sized annual non-domestic user's electricity bill in 2020. The danger is that we will export our heavier and not so "heavy" industries to countries with lower fuel costs.

Rising fuel poverty

Tom Lyon, an energy expert at uSwitch, claims that the necessary investment, "Comes with a hefty price tag and mounting concern over who should be footing the bill…The overall cost of the investment programme…equates to £769 per household. If consumers do end up footing the bill we could see the average annual household bill reach over £2,000, a huge 68% rise" (Daily Mail, 4th October 2010). An energy analyst at the M&C Energy Group, David Hunter, said in the same article: "Customers should expect a 60% hike in bills over the next decade or so".

In the current economic context, these very high rises in fuel costs are unlikely to be underwritten by social transfers. This must raise questions of the potential impact on fuel poverty and social cohesion.

Nearly a fifth of all households in England, over a quarter of those in Wales, nearly a third in Scotland and over a third in Northern Ireland are in fuel poverty. The figures have been going significantly in the wrong direction for years. It is not credible that the fuel poverty targets can be met in the statutory timeframe in any of the nations of the UK. Government seems in denial of the seriousness of the position.

On 10th February 2011 Philip Davies MP had the following question answered: *To ask the Secretary of State for Energy and Climate Change what estimate he has made of the change in the number of people who will be classified as fuel poor as a result of increase in energy prices arising from the Renewables Obligation in each of the next five years.*

Gregory Barker: *There have been no recent estimates made as to the effect on the increase in the level of energy generated from renewable sources will have on the number of people in fuel poverty* (Hansard col. 438W).

Some might comment that a policy that threatened to consign a large proportion of the population to fuel poverty is in effect stripping that group of consumers of security of supply, and that it would be a wise precaution to work out the effect of the renewable energy policy on future levels of fuel poverty. As Pöyry warns, "Many of the pathways rely heavily on improved energy efficiency so that consumers can pay a higher unit rate for energy in order to fund all this major investment referred to above. Unless changes in consumer behaviour deliver their side of the equation we will see a substantial rise in the numbers of consumers in fuel poverty."

The Role for Gas Generation

Historically, gas has a very creditable green record. Pöyry points to the benefits accruing from the first "dash for-gas": "The UK is on target to achieve its Kyoto commitments mainly because of the major expansion of gas-fired power generation in the 1990s. Its widespread use of gas in heating homes and businesses also gives it a lower carbon footprint than many other countries." The report proceeds to question why policymakers underplay the potential role for gas in the future: "Our view is that a deliberate policy to reduce gas' share of the energy mix represents a flawed pathway for society to progress towards decarbonisation. Policymakers should present an unbiased set of technologies to market investors including gas CCS, CHP, district heating and biomethane. By doing so, markets will be able to choose the mix of technologies and energy sources that best ameliorate the risks and uncertainties of meeting the long term carbon targets in the most secure and affordable way for consumers."

An Energy Networks Association's report concurred ("Gas Future Scenario Project", 9th November 2010) pointing out that an all electric "solution" to decarbonisation over the period 2010 to 2050 would cost £700bn more than a "Green Gas" solution – that is equivalent to £20,000 per household or £10,000 per person. The report proffered an alternative route: "Pathways with ongoing gas use could offer a cost-effective solution for a low-carbon transition relative to scenarios with higher levels of electrification". There is value in continuing to enjoying the sunk costs in the gas mains: "The costs of maintaining the existing gas transmission and distribution networks are relatively small in comparison to the other system costs associated with a low-carbon transition." This solution offered "consequential benefits for consumers, the economy, and the competitiveness of GB industry". The Green Gas/biomethane solution is not necessarily reliant on CCS, and the Committee has left this potential pathway out of their consideration. As Pöyry states, gas could not just be a transitional technology, it could be the "endgame": We have seen that a gas-based solution adds more flexibility to the power generation mix, requires less infrastructure expansion as we can rely on the existing network, improves conversion efficiencies using mature technologies (CHP, CCGTs and condensing boilers) and delays the need for major investment."

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A Role for Distributed Generation

Given that there is going to be a need for unabated gas generation as part of the price we pay for massive investment in wind, which does not blow all the time, is there a further way of mitigating our need to build gas on standby?

There is indeed, and it accords with Government policy:

"This Government wants to see distributed generation become the norm not the exception…That way we can literally bring power to the people, to communities, to local businesses," Greg Barker MP, Minister of State for Energy and Climate Change, 25th November, 2010.

An Alternative to Expensive Centralised Distribution for Peak Generation

Heat demand spiky

National Grid projections in "Meeting 2050 Climate Targets 2050" show that by 2050 they expect the 31 coldest days of the year to account for 20% of the UK's annual demand for heating (Figure 1). This actually reflects the current situation in 2010 and highlights the "peaky" nature of heat demand. It also sets Government a significant challenge as heat demand is difficult to shift – when it's cold it's cold – and climate change will lead to more extreme winters and even greater heat spikes. Only last December we at Calor Gas delivered 50% more gas than we do in an average year – we would have delivered even more if the roads had been clear! Therefore we believe 20% significantly underestimates the potential spike under changing climatic conditions.

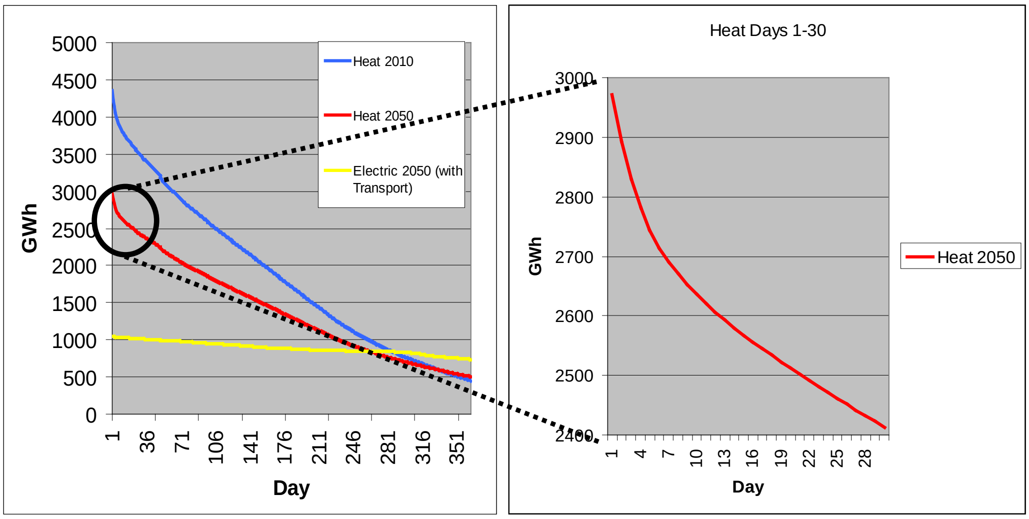


Fig. 1 - Heat curve flattens with improved insulation but still peaky compared with electric

This is in the context of the National Grid expecting far less heat to be supplied by natural gas, and proportionately far more by electricity (slide 9 from same report). This reflects the Government's energy policy: "Decarbonisation will require an increased use of electricity in domestic and industrial heating and transport, which…will outweigh increases in energy efficiency, potentially leading to a doubling of electricity demand by 2050" (Revised Draft Overarching NPS for Energy para. 3.3.29, DECC, October 2010).

This 20% has to stand idle for the rest of the year. It is intended that this peak demand for electricity will be met by unabated gas generation (CCS cannot be used on standby plant). Because a gas fired power station is a very big investment, and it has to stand idle for 334 days a year it would mean that the plant would need to sell its electricity at a very inflated price or it would have to be compensated in some other way. Either way this boils down to a very expensive way of generating electricity for the consumer and/or taxpayer. If, as certain climate change scientists believe, we are going to be facing more extreme winter variations in future, the demand for heat could be even more spiky, in which case the demand for standby generation would be even greater, and the costs consequently greater.

Direct gas heating – a long term renewable solution

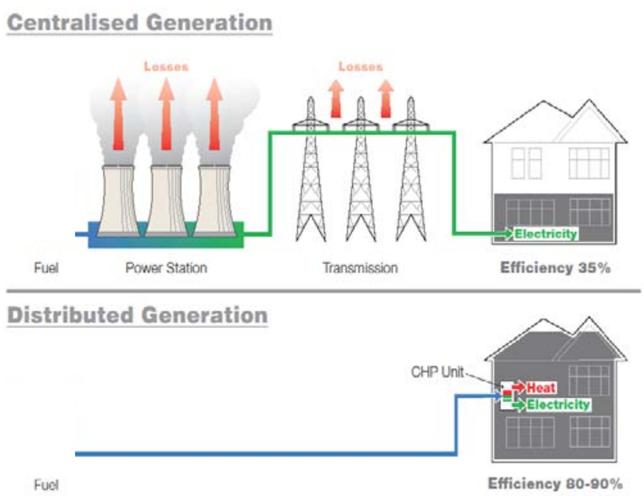
Might there be a cheaper, more efficient way of providing heat in the home for the 31 coldest days of the year?

The most modern CCGT gas fired generating plant does not yet achieve 60% efficiency in generating electricity. A further loss is occasioned through the transfer of the energy over the GB electricity transmission system and is typically of the order of 2% of the energy transferred across the network.

Heat does not have to come from expensive electricity, wastefully generated by unabated gas. It would make more economic and environmental sense to deploy whatever gas is used to provide heat directly in the home – through high efficiency gas condensing boilers.

Furthermore we can make gas work harder by deploying micro-generation for distributed rather than centralised generation. Micro-CHP (mCHP) involves the use of gas using a fuel cell boiler boasting 80-90% efficiency ratings to generate both heat and electricity. It is a technology that is available now. It is a low cost, low carbon solution delivering secure low carbon electricity. One possible component of the domestic heating scenarios contemplated in DECC's "Pathways Analysis" is mCHP – reaching up to 90% of the technology mix in one illustrated case, and with a maximum penetration of 36 million households by 2050. There are high efficiencies in generation and no losses in transmission.

Besides, projects are underway to decarbonise gas in the home (deploying biomethane or biopropane in urban and rural areas respectively) so this should not be seen as a transitional solution but a permanent solution.



A study by Delta Energy and Environment, "Micro-CHP Savings in the UK" (September 2010) confirmed the green benefit of the solution. It found that natural gas mCHP saves carbon until well after 2030 when compared to a decarbonising electricity grid and until 2030 on LPG. If anticipated improvements to mCHP technology materialise, and the natural gas network/LPG is decarbonised, this window extends further – towards 2040 and beyond. In addition, as a consequence of mCHP generating electricity, electricity from fossil plants is displaced – this will reduce the level of capital investment required in centralised generating plant due to the load-following ability of fuel cell mCHP technology.

Fuel cell mCHP units can reduce total household energy bills by 25% (a figure confirmed by Oxera) and provide cost-effective carbon emission reductions. Owners of compliant mCHP units can sell electricity back to the grid. So, mCHP will lower, not raise household energy bills – unlike most other strands of current energy policy. Indeed, because the potential energy cost savings are so significant, a mass move to mCHP could be an antidote to fuel poverty.

The Government should cost this Pathway and compare it with the cost of maintaining central unabated gas generation to cater for peak needs for but 31 days of the year.

Question 17: How should biomass be treated for the purpose of meeting the EPS? What additional considerations should the government take into account?

Biomass is not zero-carbon
HMG has lately recognised that biomass is far from zero carbon - "These sustainability criteria include a minimum greenhouse gas emissions saving of 60% compared to fossil fuel" (Written Answer, 20th January 2011). To the extent then that biomass is not zero carbon its emissions of carbon should be set an environment performance standard. There is even an argument to say that if 1 tonne of carbon is worth abating from a coal fired plant, the same 1 tonne of carbon is worth abating from a biomass plant.

Biomass emits black carbon – a major cause of climate change
We need to adopt a precautionary principle in relation to the emissions of black carbon (BC) from biomass. BC is part of the particulate emissions caused by combustion. When asked about the BC emissions from biomass the former Minster, Joan Ruddock MP admitted: "Specific estimates of black carbon emission have not been made in support of the development of the Renewable Energy Strategy" (Written Answer, 24.11.09, col. 81W). BC is the second largest contributor to global warming after CO_2. The UN's Economic Commission for Europe found that, "Urgent action to decrease (black carbon) concentrations in the atmosphere would provide opportunities, not only for significant air pollution benefits (e.g. health and crop-yield benefits), but also for rapid climate benefits, by helping to slow global warming and avoid crossing critical temperature and environmental thresholds," (UNECE's Executive Body for the Convention on long-range transboundary air pollution, meeting in Geneva, 15-18 December 2008: Item 13 of provisional agenda. Air pollution and climate change: developing a framework for integrated co-benefits strategies). "Available research suggests that adapting future regulation and policy with a view to limiting BC emissions could significantly slow global warming. It would also yield benefits in terms of human health, reducing the

social and economic burden associated with illness and reduced life expectancy as well as the associated costs" ("Black Carbon and Global Warming: Impacts of Common Fuels, Atlantic Consulting, 2009).

The possibility that biomass could potentially contribute to global warming by emissions of BC would be perverse indeed

Particulates from biomass will harm human health

We know from an AEA study ("Technical Guidance: Screening Assessment for Biomass Boilers" July 2008) that a typical domestic wood burning boiler of <50kWth would emit over 15kg of large particulates (PM_{10}) and over 15kg of small particulates ($PM_{2.5}$) per year per household. The paper states: "For modern appliances with well-designed combustion the particles emitted are all thought to be less than 2.5μ". This is no comfort. As "The Air Quality Strategy" (2007) states: "Recent reviews by WHO and Committee on the Medical Effects of Air Pollutants (COMEAP) have suggested exposure to a finer fraction of particles ($PM_{2.5}$, which typically make up around two thirds of PM_{10} emissions and concentrations) give a stronger association with the observed ill-health effects". These observed ill-effects include congestive heart failure, heart disease, cerebrovascular problems and asthmatic attacks.

On 26th March 2009, in a Written Answer (col. 695/6W) to Graham Stringer MP the last UK Government quantified the social (=health costs in terms of increased mortality) costs caused by emissions from biomass plants under various scenarios. For an uptake of 52TWh of biomass the social costs were estimated as £2,803,000,000 and for 38TWh (the Government target) the comparable costs were £557,000,000 – these figures were calculated on the basis of existing technology. Since the pollution is being directed to rural areas these health burdens will be largely borne by rural dwellers.

Andrew Tyrie MP asked a follow up question answered on 10th November (col.219W):

"Mr. Tyrie: *To ask the Secretary of State for Energy and Climate Change what recent assessment he has made of the effects of the use of biomass boilers installed to meet Renewable Energy Strategy targets on (a) air quality, (b) levels of particulate emissions and (c) levels of (i) morbidity and (ii) mortality.*

Jim Fitzpatrick: *(a) The Government have, in support of the development of the Renewable Energy Strategy (RES), carried out modelling of the effect of an increase in the use of biomass for heat and power on the emissions, ambient air concentrations and public health impacts of fine particles (PM2.5), coarser particles (PM10) and nitrogen dioxide. The key air quality results of this analysis are given in the Renewable Energy Strategy on page 121.*

(b) As part of the analysis the increases in the emissions of particulates were estimated over a number of different scenarios. For PM2.5 these were between 0.75 and 9.1 ktonnes from a baseline in 2007 of 82 ktonnes. For PM10, emissions were estimated as being between 1.3 and 9.5 ktonnes from a 2007 baseline of 135 ktonnes.

(c) (i) The impacts on morbidity resulting from the uptake of biomass as a renewable energy source were not assessed.
(ii) The mortality health impacts of these scenarios were estimated to be between 340,000 and 1,750,000 measured as the number of life years lost in 2020 from the impact on air quality of increased biomass combustion."

Presumably, then, the social costs of the increase in particulate emission would be higher than £557m because this costing does not include morbidity. This could be significant. The emission of particulates is estimated to advance 8,100 deaths a year (=mortality) in Great Britain and to cause an additional 10,500 respiratory admissions to hospital (=morbidity)("Quantification of the Effects of Air Pollution on Health in the United Kingdom", DoH, 1998).

The Revised NPS on Energy confirms that, "Biomass combustion could still have air quality impacts, which may have associated health impacts. The effects are likely to be greatest for sensitive individuals and those with pre-existing lung illnesses and are likely to last for the duration of the operational phase of the facility".

In relation to particulates, then, the biomass strategy is very costly in terms of damage to air quality and human health. The precautionary principle would argue for examining whether there may be other ways of meeting the carbon emission reduction targets other than with such a heavy reliance on biomass.

Question 28: Will the proposed package of options have wider impacts on the electricity system that have not been identified in this document, for example on electricity networks?

Pure play electricity – a costly gamble
The pure electricity play scenario that envisages doubling or tripling the current generative capacity does not only involve a big unknown extra bill beyond the £200bn envisaged for maintaining current capacity (Project Discovery) it means a great deal of disruption and attendant social costs that go with that.

Heat pumps – driving additional costs and uncertainty
Much of this extra bill appears to be driven by the cherry-picked technology of heat pumps. The strain that a large scale move to heat pumps on our generating capacity was analysed recently: "Air source heat pumps in particular have a peak electricity demand of up to 5 kW. This is because these types of heat pumps usually incorporate a resistive heating element to supplement heating requirement under peak load conditions. This could have a profound impact on the electrical capacity needed to meet peak power demands.

As an illustration, if 10 million homes replaced their gas boilers with air source heat pumps, each with a 5 kW peak load this would have the potential to create up to 50GW of additional electricity demand. Since heat pumps operate least efficiently and default to resistive heating when the outside temperature is cold and demands for heat also occur when it is cold, 'heat pump peaks' are likely in winter when peak electricity demand occurs. If heat pumps are also operated on a time of day cycle similar to today's central heating timers, the additional demand would coincide with current morning and evening demand increments. Peak demand in Britain is around 60GW (National Grid 2009), so, in the worse case, installing air source heat pumps in around half of all the UK's houses could almost double peak electricity demand," ("Building a Roadmap for Heat, Imperial College, London and University of Surrey, February 2010).

Furthermore, a recent report by NEA – "Air-Source Heat Pumps - Assessing the Implications for the Electrical Distribution System" pointed to the potential difficulties of grid load and problems of installation (including flicker, harmonic currents, thermal overload and voltage depression) when multiple units are installed in an area.

Heat pumps in the countryside

Heat-pumps represent a particular challenge in rural areas. Much of the electricity in rural Britain is single phase, limiting the power available for electric powered heating systems to approximately 3.5kW. In turn, this limits the applicability of ground source or air source heat pumps which suffer limited output on single phase electricity. While upgrading the power supply, substations and power lines in rural areas may bring benefits it will be hideously expensive, and probably visually intrusive. Besides, does the National Grid have the balance sheet to carry such a massive investment?