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SSE Response to DECC 2050 Pathways Analysis

Dear Sir/Madam

SSE welcomes the opportunity to respond to the DECC 2050 Pathway Analysis. SSE is very grateful to the 2050 team for travelling to Perth to discuss in detail the 2050 pathways work. As a result of the meeting SSE have plans to investigate a number of specific areas in much more detail and will hopefully have an active dialogue with DECC during this process. Please see the following pages for our initial comments and answers to specific questions. We consider this as an early response to the analysis, and see this as an ongoing piece of work.

We will be following up with more details in relation to specific areas including CCS gas and demand and are particularly keen to hear feedback from DECC on the biomass section in relation to domestic and non-domestic fuel use. We are also very keen to hear about the development of the model in the future,

Thanks again for your time and we look forward to working with you in the future,

Many thanks,

[redacted]

Policy Manager

2050 Pathways Analysis

1 Introduction

SSE welcomes the opportunity to respond to the call for evidence on the 2050 Pathways Analysis.

SSE is pleased that DECC has undertaken this analysis of longer term pathways which makes a valuable contribution to the debate and to the sum of knowledge. While the focus on shorter term actions for the delivery of the low carbon transition clearly needs to be retained, this longer term view can, *inter alia*:

- Help to better understand the interaction between different technologies and policy areas;
- Inform decisions on the targeting of research and development;
- Help contribute to long term certainty for investment if it is used to clearly signal the direction of travel; and
- Help to prevent "lock in" by identifying technologies or policies that might contribute to shorter term carbon budgets but hinder the achievement of deeper cuts in the longer term.

The high-level common themes, particularly the electrification of heat and transport and the need for a substantial increase in electricity supply coupled with a rapid decarbonisation, is very much in line with SSE's own assessment and long term strategy. The precise extent of electrification is still to be determined and will depend on the contributions of alternatives such as biogas, biomass and biofuels or district heating using surplus heat from power generation and industrial processes. Work on and support for these alternatives should continue in parallel.

2 Call for evidence questions

2.1 Scope of model:

(a) Are there any low carbon technologies or processes or major demand-side options which are not currently included within the scope of the model but that you consider should be in future?

SSE has not identified any other technologies although this is an area that needs to be kept under review.

We are concerned that the model is perhaps less ambitious in the levels of demand side (e.g. behavioural and lifestyle) changes than for the technological measures, where there is a clear methodology based on the limits of what is technically achievable. These demand side measures are potentially hugely important but have traditionally been the poor relation of the more technological solutions. The perception that more ambitious demand side scenarios might be more difficult to achieve (either politically or otherwise) should not prevent exploring the impacts of them.

2.2 Scope of sectors:

(a) Does the range of alternative levels of ambition presented for each sector cover the full range of credible futures? If not, what evidence suggests that the range of scenarios should be broader than those presented?

The maximum levels of ambition generally seem to be generally very high, which would suggest that the range of levels would cover the full range of credible futures.

However, the levels of onshore wind would appear to be too low under all scenarios given that the model is based on physical limits. It appears that assuming a maximum level (level 4) build rate in the UK that is approximately the same as the level that has been achieved in Germany over the past 10 years underestimates what can be done, especially given that the average size of turbine in Germany is considerably smaller than those that can be assumed to be deployed in the UK going forward. The location of wind turbine manufacturing facilities should not be considered a real constraint on deployment rates.

(b) Do the intermediate levels of ambition (levels 2 and 3) provided for each sector illustrate a useful set of choices, or should they be moved up or down?

More generally, it is not clear that the intermediate levels of ambition are equivalent for the different sectors (ie that level 2 for CCS represents an equivalent effort to, say, level 2 for nuclear).

It is also unclear whether each step is equivalent between any given levels in any given sector. As an example, it is possible to achieve the emissions target by adjusting pathway Alpha such that solar PV and solar thermal are reduced to level 1 but offshore wind is increased to level 3. This implies a reduction (compared to pathway Alpha as presented) of 70 GWp installed PV capacity, 1 m^2 per household of solar thermal systems, and an increase of 40 GW (from 60 GW to 100 GW) in installed offshore wind capacity. Is the effort required greater for the original or the modified Pathway Alpha?

It would be useful if the model allowed a continuous scale for the effort required, rather than the 4 discrete steps so that users could eliminate this potential problem.

The choices for PV seem to represent a very large jump between level 1 and level 2, going in one leap to estimates of the total technical potential. 70 GWp (level 2) is a huge amount of PV given that the total generating capacity of the UK is currently 87 GW.

(c) The 2050 Pathways Calculator currently describes alternative directions of travel rather than different levels for some sectors where changes reflect a choice rather than a scale. Is this a suitable approach and clear to users?

Yes; however this approach does exacerbate the problem of the discreteness of the model as noted above.

2.3 Input assumptions and methodologies:

(a) For each sector, are the input assumptions and the methodologies applied to those input assumptions reasonable?

Broadly yes.

The model assumes that any fossil fuels required by the scenarios are available. This ignores the issue of peak oil, which is almost certain to have an impact by 2050. Even if this does not mean that fossil fuels are physically unavailable, it could have significant impacts on their costs. Including costs more fully in the model would allow this to be tested further.

In addition, the fact that the emissions calculations are production rather than consumption based masks the fact that many fuels are likely to become more carbon intensive as increasingly unconventional sources are exploited.

SSE would also suggest that the load factor of offshore wind is probably understated - more recent offshore wind projects are delivering load factors in excess of 40%. DECC are using 40% for estimating the load factor of new offshore sites (those built since 2009). It is expected the load factor will increase going forward as availability rates increase and the higher wind regimes available further off-shore are developed.

As regards specific sectors:

(b) Are the bioenergy conversion routes used in the model accurate, or are there more efficient routes for converting raw biomass into fuels?

The bio-energy part of the model requires significantly more work including being broken down into a lot more detail in terms of each fuel source and each conversion route. SSE are currently working on this aspect of the model in more detail and will provide DECC with an update in the future.

(c) Can the model's assumptions on wave resource be improved, for example regarding the length of wave farms, their distance from shore, the efficiency of devices, constraints from other ocean users, and other assumptions?

The magnitude of the total wave resource incident on the west coast shores of the UK is in line with SSE's view; however SSE is not familiar with the estimation method proposed by David MacKay. With the total wave energy resource approximately equal to the UK's annual electricity demand (350 TWh), SSE considers wave power to have considerable potential to contribute to the UK's energy demands going forward. The extractable range of 50 TWh/yr up to 157 TWh/yr stated in the Pathways document is again in line with SSE's views, where the extent of the range is reflective of the key issues of technology development, consenting and grid infrastructure, which SSE consider to be the key risks for the sector going forward.

With respect to the 2050 wave power deployment levels (summarised below) SSE considers these to be reasonable for the scope and purpose of the Pathways analysis. In the near term SSE considers the 2020 target of 1.3 GW (wave & tidal capacity), as stated in the National Renewables Energy Action Plan (July 2010), to be the key target for the sector. If by meeting this target the sector proves the commercial viability of the technology, a level 4 deployment trajectory beyond 2020 is considered feasible.

Wave Power Deployment Levels out to 2050

Level 1	0 GW	0 TWh
Level 2	9 GW	19 TWh
Level 3	17 GW	38 TWh
Level 4	32 GW	71 TWh

(d) Can the model's assumptions on tidal stream resource be improved, for example regarding the method for assessing the resource at specific locations, and the scaling up of individual devices into an array?

The Pathways document recognises there are different methods for quantifying the theoretical tidal stream resource. Furthermore it highlights the key issue of understanding the impact of arrays on the resource and understanding the likely efficiency of any given array deployment. SSE agrees these are key issues for the tidal sector in addition to those of technology development (to a lesser degree than wave as we agree there is increasing convergence within the sector), consenting and grid infrastructure. To address the key resource and technology issues, SSE believe more full scale test deployments (devices and arrays) are required and will continue to recommend the sector is supported with these objectives in mind.

With respect to the 2050 tidal power deployment levels (summarised below) SSE considers these to be reasonable for the scope and purpose of the Pathways analysis. In the near term SSE considers the 2020 target of 1.3 GW (wave & tidal capacity), as stated in the National Renewables Energy Action Plan (July 2010), to be the key target for the sector. If by meeting this target the sector proves the commercial viability of the technology, a level 4 deployment trajectory beyond 2020 is considered feasible subject to there being an improved understanding on the resource potential.

Tidal Power Deployment Levels out to 2050

Level 1	0 GW	0 TWh
Level 2	2 GW	6 TWh
Level 3	9 GW	30 TWh
Level 4	21 GW	67 TWh

(e) Is there any evidence that would help build an understanding of the potential impact of long term spatial development on transport demand, and how could this be accounted for in the model?

No comment.

(f) Due to uncertainties in the evidence base on energy demand and associated emissions, the model currently sets out only one level of ambition for the future UK share of international shipping. Is there any evidence you could contribute to help build a greater understanding of the potential shipping trajectories?

SSE does not have any evidence on international shipping; however we welcome its inclusion and would make the following point.

It is important that all sectors pull their weight otherwise other sectors have to make additional efforts. As mentioned elsewhere, while these scenarios need to understand the limitations of certain sectors, they can also be used to determine the outcomes that must be met so that policies can be implemented that will meet those required outcomes. In this case, the scenarios could test pushing shipping harder in terms of emissions cuts to provide evidence for future policies or international negotiations that address emissions from shipping.

(g) Could the relative roles of coal and gas out to 2050 vary from the assumptions shown in this work, and if so, how?

Yes. The model uses a simplifying assumption that any unabated fossil fuel based thermal generation would be gas fired and that CCS is coal fired, although the report does recognise that CCS can apply to both fuels. SSE would urge that gas CCS remains part of the mix. It is difficult to predict the relative merits of CCS applied to gas compared coal out to 2050. This will largely depend on economics, which will be affected by numerous factors including:

- The costs of CCS technology itself for the different fuels and the overall efficiency of generation;
- The availability and price of fuel, which will in turn depend at least in part on the ability to exploit unconventional sources such as shale gas;
- The feasibility of retrofit versus new build and the economics of upgrade versus demolition and replacement;
- Constraints on transport and storage of CO_2, which could favour technologies with lower CO_2 capture per MWh generated;
- The energy and carbon input in extracting fuels.

The only way to deal with this uncertainty is to ensure a level playing field for all CCS technologies, starting with the CCS competition, and allow the market to develop the most appropriate solutions.

SSE has submitted a ‘market sounding’ response detailing our interest in building a gas CCS facility and believes that gas CCS is vital to the UK energy system for a number of reasons.

These include:

- Achieving climate change goals - increasing numbers of gas CCGTs are likely to be built over the coming decades and it is very important that CCS is available for these plants.
- Increasing security of supply - having both gas and coal available in the future will allow a more balanced generation portfolio increasing security. This is especially important with the future of gas and coal prices.
- Value to customers - a number of studies have shown that gas CCS is likely to be cheaper per MWh of low carbon electricity than coal CCS.
- CCS is very technology specific - coal CCS technology cannot be replicated for gas plant.
- Wider economic benefits - demonstrating CCS on gas would have a number of economic benefits for the UK.

The model also allows unabated coal and gas to be on the system past 2040 however this ignores interim carbon dioxide targets and as a result means that although 2050 targets could be met, interim targets will not be met. Although unabated gas may be required for cost effective balancing services, SSE feel that the model should take account of interim targets and so, unabated coal should not be included in the model past 2030.

2.4 Common implications and uncertainties:

(a) The introduction to the report sets out some of the implications and uncertainties common to the illustrative pathways. Does this list cover the key commonalities? If not, please identify other common implications and uncertainties and provide evidence as to why these are key conclusions from the analysis.

Yes.

2.5 Impact of pathways:

(a) What criteria should be taken into account in understanding the impact and relative attractiveness of pathways?

The most important criterion, after ensuring carbon targets are met, is the cost of the scenarios. Following this there are a huge number of criteria that could be taken into account, including:

- Security of supply;
- Dependence on foreign imports;
- Impacts on land use and other amenities;
- Ability of the UK to capitalise on sector growth and to export technologies or services;
- The extent of the requirement for demand side behavioural or lifestyle changes; and
- The embodied emissions (particularly important for imported fuels, eg biomass and nuclear).

2.6 Cost analysis:

(a) Can you suggest a methodology by which the wider cost implications of choosing one pathway over another could be accurately reflected, and any relevant findings from such an approach?

It is vitally important that costs are included in the model. While SSE understands the difficulties and uncertainties in projecting costs out to 2050, we believe that the methodology described for the large power generation sector should be extended to cover the other sectors as well. This would allow users to see the overall cost of a scenario as an output.

The uncertainty should be clearly stated, and addressed as far as possible through sensitivity analysis.

It is not uncommon to hear calls for subsidies or particular policy positions in support of particular technologies such as microgeneration justified by their technical potential, which may be large. However, this is only half the picture if the realistic potential is in fact severely limited by the high costs of those technologies. It is therefore critical to understand the costs in order to base any policy decisions on the scenarios.

2.7 Future improvements to model:

(a) Do you have any further suggestions for refining the 2050 Pathways Calculator?

Yes.

Firstly, SSE's analysis suggests that demand projections to 2050 are very sensitive to assumptions regarding GDP growth, population growth and social trends such as reducing household sizes.

The model should allow for easy adjustment of these assumptions, including variable rates of growth over time, so that sensitivity analysis can be carried out.

Secondly, the checks and balances should be added to the model to help understand the interactions between sectors. The report acknowledges that these are excluded, citing examples of allowing high levels of solar thermal and solar PV without checking the available roof space or high levels of district heating being allowed alongside low levels of thermal generation. Such restrictions are not particularly difficult to include in this type of model, and can have a significant impact of the potential scenarios that can meet the targets while satisfying all the additional criteria. One particular example of this is that the scenarios seem to depend on significant levels of district heating served by surplus heat from power stations. If thermal power stations are to be fitted with CCS technology this may introduce geographical constraints if there is a need for clusters that can share CO_2 transport infrastructure. This in turn might limit the extent to which power stations can be located to best serve heat demands.

SSE recognises that carbon accounting with respect to biomass is complicated, because carbon emissions associated with biomass production, processing and transport within the UK will be counted in other sectors in the 2050 pathways model and emissions abroad are not counted at all due to the production based methodology. However other policies including the RO and building regulations do apply emissions factors to biomass. This has the potential to cause confusion, which DECC may need to clarify. Also, the model may need to check that the demands on other sectors (such as land use and transport) as a result of increased biomass use within the model are consistent with the scenarios for those other sectors.

In relation to biomass, SSE feels that the maximum level of ambition may be too high. There are likely to be significant issues associated with biofuel availability as a result of changing biomass standards and these standards have not been included in the model. As well as the EU biomass standards which recommend that biomass saves at least 35% greenhouse gas emissions compared to fossil fuel mix (this is also increasing for new plant) the UK is pushing for this standard to be raised nationally to 60% for biomass to be included in the Renewables Obligation. This could therefore significantly affect biomass penetration in the UK and should be accounted for in the model.

(b) Could the 2050 Pathways Calculator be improved to reflect the fact that the level of ambition for some sectors will depend on local preferences? Could the Pathways Calculator be improved such that the inherent degree of individual and local choice in a chosen pathway were clear?

Local preferences should ultimately affect the total potential, which in particular will be limited by strong local opposition to a given technology. This might be made clearer by developing the model using local or regional elements to make up the national whole, but it is questionable whether this would add significant value.

It is worth understanding where certain technologies are mutually exclusive, and where a relatively small number of local decisions can influence the pathway from that point on. This is certainly the case for heat technologies. For example, if a community is going to be served by biogas using the gas distribution network or by a district heating network, then residents should be discouraged from installing renewable heat technologies in individual homes.

Local preferences can also, of course, be influenced by policy and other means. In this type of scenario modelling there is a balance to be struck between understanding how factors such as local preferences can limit the range of possible scenarios and understanding the extent to which the scenarios dictate that delivery of particular outcomes must be achieved.