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Dear Ian,

Project Discovery: Energy Market Scenarios Consultation

Thank you for providing Scottish and Southern Energy (SSE) with the opportunity to comment on the above consultation. We have detailed our responses to the consultation questions in an attached annex; however we would also like to take the opportunity to reiterate our high level views.

The energy sector is facing major challenges over the next decade or so, with the need to green the energy mix, maintain security of supply, while at the same time minimising the cost to customers. There are many institutions and companies, including SSE, already devoting significant time and effort to this task. Finding the solution can only be helped by in-depth analysis and planning, and we therefore welcome Ofgem's contribution to the debate.

At SSE, we are strongly committed to improving the way in which energy is produced and consumed. We are already the UK's largest non-nuclear generator and have a wide ranging commitment to addressing the long-term energy challenges facing the UK: to encourage lower carbon; and more secure supplies of electricity. By 2013 we intend to have doubled our renewable energy portfolio to 4,000MW, maintaining and extending our current lead as the largest renewable energy generator in the UK. We have also set a sector leading target of reducing the carbon intensity of our entire power generating portfolio by 50% by 2020.

Risk Ranking
We agree that maintaining gas supplies as the UK becomes more dependent on imports due to the decline of UK continental shelf gas is one of the most significant security of supply challenges. However, we believe that continued maintenance of electricity supplies also raises challenges, particularly in light of the many issues faced by the market such as the large levels of generation capacity that could be lost via IED closures; the uncertainty of whether Carbon Capture and Storage (CCS) can be proven to be technically and/or economically viable; and the system's requirement for flexible generation in a market where, due to regulatory uncertainty, it may not be economic.

Scenario Modelling

We agree with the key scenario drivers used i.e. the speed of global economic recovery, and the extent of globally co-ordinated environmental action. We also agree with the stress tests used, although we believe the following 2 stress tests should also be included in Ofgem's analysis:

1. Peak Oil
The International Energy Agency (IEA) have warned that, the recent rise in the price of oil "risks derailing the recovery" if it continues. In October 2008, the UK Industry Task Force on Peak Oil, of which SSE is a member, published a report, *The Oil Crunch*, which stated that a peak in cheap, easily available oil production is likely to be reached as early as 2013. Another report[1] published in October 2009 by the Government supported UK Energy Research Centre, following 'a review of over 500

[1] The Global Oil Depletion Report, October 08, 2009, UK Energy Research Centre

studies, analysis of industry databases and comparison of global supply forecasts', concluded that 'a peak in conventional oil production before 2030 appears likely, and there is a significant risk of a peak before 2020'. We therefore believe Ofgem should also model peak oil as a stress test.

2. Stress test interaction
The scenarios should be analysed with a combination of the stress test because their individual occurrence is likely to trigger another. For example, if wind levels were also low across Europe for an extended period, this would act to increase European wide demand for gas and increase the likelihood and severity of a gas shock, hence the two risks are not independent.

Project Discovery Phase 2: Policy Review

We believe the scenario results clearly demonstrate that the following areas should be addressed to ensure the maintenance of security of supplies.

1. Regulatory Stability and Transmission Investment
The single most important aspect that will allow the UK to meet its 2020 vision for the switch towards a low carbon economy and society is for the UK Government and Ofgem to provide a stable and attractive investment climate in the UK that will allow companies to finance their activities. Over the next decade, significant investment will be required not only in new renewable generation capacity, but also in the broad spectrum of established generation technologies to ensure that the UK continues to benefit from a balanced, flexible and efficient generation portfolio. Critical to this will be investment in new transmission infrastructure, both on and offshore. Delivery of this infrastructure will require a pro-investment regulatory and political climate.

2. Flexible Generation is Vital
A common theme across the four scenarios and stress tests is the necessity of flexible generation. As the penetration of wind increases, load factors for conventional plants will fall on average and become more uncertain. Given these lower running times, conventional plants will require higher prices to cover fixed costs and to earn an adequate return on investment. As Poyry state in their July 09 'Impact of Intermittency: How Wind Variability Could Change the Shape of the British and Irish Electricity Markets report' "…these spikes in price are necessary for the market to operate. Without them, generators that only run a few hours each year cannot make sufficient returns".

A stable market framework is fundamental to ensuring sufficient thermal plant investment is maintained as wind penetrations increase. In particular, it is important that wholesale price spikes which reflect supply and demand fundamentals during periods of low wind are not unduly restricted by regulation, since these will be crucial to allow thermal plants with low load factors to pay back their capital costs. Even the threat of potential restrictions on price spikes may be sufficient to deter investment.

If peaking plant is not unduly constrained (and a more accommodating transmission charging regime is put in place), the electricity market as currently arranged should be able to manage risks from high penetrations of renewables and deliver sufficient investment in flexible plant. However, we recognise that by 2020, if wind penetration has increased above 20% and demand-side flexibility has not improved significantly, there may be a greater risk of generation capacity inadequacy. Therefore, it is prudent that DECC, Ofgem, and National Grid continue to engage with industry to analyse potential interventions to reduce the risk of capacity shortages in the 2020 to 2030 period.

3. UK Lobbying Europe: IED and Interconnectors
IED
We believe that the assumptions used under the Green Transition, Dash for Energy and Slow Growth scenarios, for coal generation output, are very optimistic. We find the assumption of 19 units fitting Selective Catalytic Reduction (SCR) technology to be very unlikely to occur in reality given the current marginal economics of doing so. However, even under such optimistic assumptions, all four scenarios demonstrate the core role those stations encompassed by the IED will play in maintaining security of supply in future years.

In order to avoid a severe security of supply threat if generation build expectations are not realised i.e. CCS is unable to be demonstrated till a later stage than expected, or if existing generation is forced into closure earlier than expected i.e. it remains uneconomic to fit SCR, we believe it is vital the UK lobby the European Commission and Parliament to put in place derogations to IED for 2016 to 2023, 20,000 hours limited life derogation and a TNP.

Interconnectors
If the Green Transition or the Green Stimulus scenario were to become reality, one of the security of supply threats highlighted would be the reverse flow of interconnectors. We do not believe that there

is currently a clear interface between the different markets, and this acts to distort the interconnector flows within Europe. We believe the UK must continue to lobby the European Commission and Parliament to open up the European market arrangements, as this will act to alleviate the UK's security of supply concerns in regards to reverse flows on a 1 in 20 day.

4. Gas Storage - Long Range Storage
We agree that the UK's short range and medium range gas storage capacity level is sufficient to meet 1 in 20 peak day requirements. However, the biggest security of supply threat raised in the scenario modelling in the Dash for Energy and Slow Growth scenarios is a shortage of long range gas storage to meet a 1 in 20 severe winter. Although this risk is much reduced other scenarios, the implications of this should be fully explored.

5. Locational Signals
At present, the locational signal from TNUoS, potentially locational BSUoS and zonal losses is in danger of disrupting the build of new renewables and closing existing generation in the north of GB.

These zonal signals are also a particular issue for pumped storage plant. Pumped storage plant could play a significant role in maintaining reliability under high wind penetrations, however, the current transmission charging regime is a major deterrent to investment since: (i) pumped storage operates at low load factors and therefore must pay for large amounts of capacity which it does not use and cannot share, (ii) most suitable locations are in Scotland where transmission charges are disproportionately high; and (iii) it must pay these charges despite having a role in easing transmission constraints at times of oversupply (e.g. by pumping during periods of high wind output).

More generally, a transmission charging regime which allows efficient sharing of capacity will become increasingly desirable as renewables penetration increases. For these reasons the transmission charging regime is in serious need of review. This needs to be brought forward as part of Phase 2 of Ofgem's project on which policy measures are needed to meet policy targets.

6. Ensuring Demonstration of CCS is Accelerated
CCS could be a key technology for future security of supply, allowing dispatchable fossil-fuelled power stations to continue to be used in a carbon-constrained world. For this reason, the EU and UK demonstration programs need to be accelerated.

7. Need for a Robust Carbon Price
A strong and stable carbon price signal is key to promoting investment in electricity generation over the next decade and beyond. A robust EU ETS, with a tighter cap, is the key to delivering this.

8. Improving Smart Demand Capacity
Smart demand could play a major role in maintaining the reliability of the electricity system in the future, including by helping to reduce peak demand and to manage fluctuations in renewables output. There are at least three key areas for focus in realising the potential of smart demand: (i) developing appliances and infrastructure which allow automated demand response to remove the need for consumers to monitor and react to market conditions in real time; (ii) finding effective ways of co-ordinating the various parties involved in smart demand (i.e. customers, suppliers, network operators and generators) through efficient business models and contractual relationships between these parties; and (iii) providing funding for the development of smart networks (the Low Carbon Networks Fund is a very welcome development here). These need to form part of the Phase 2 policy considerations.

I hope that our comments are helpful. If you would like to discuss any of the points raised in more detail, please do not hesitate to get in contact.

Yours sincerely,

Robert Hackland
Regulation Manager

Annex 1: Consultation Questions

Chapter 2

1. **Please provide comments on our approach of using scenarios and stress tests to explore future uncertainty, and as a basis for evaluating policy alternatives.**

We support the general approach taken. However, we have some comments regarding the assumptions and stress tests used. Please refer to chapter 2 question 6, and chapter 4 question 2.

2. **Are there other techniques for analysing uncertainty that we should consider?**

We believe scenario modelling and stress testing to be the most appropriate methodology.

3. **Do you agree with how we measure the impacts of our scenarios and stress tests?**

See the comments above regarding the assumptions and stress tests used.

We also believe that it would have been beneficial to provide more in-depth information on the data behind the assumptions used for the scenarios and stress tests e.g. the hedging assumptions used, how the capital cost assumptions were established; assumptions used for the increase in demand created by heat pumps and electric vehicles; lead times of new generation build after price signals appear; and also details of the scenarios and stress tests which were modelled but excluded in the scenario selection process.

4. **Do you agree with our key scenario drivers and choice of scenarios?**

We agree with the key scenario drivers used i.e. the speed of global economic recovery, and the extent of globally co-ordinated environmental action.

5. **Do you believe our scenarios sufficiently cover the range of uncertainty facing the market, and hence cover the areas where future policy responses may be required?**

Regulatory Uncertainty
Uncertainty over future policies risks affecting investment in electricity generation. As recognised in the consultation paper, over the next decade, a large amount of investment needs to be made in electricity generation to meet energy security and climate change goals and it is crucial that uncertainty over future policies does not delay this. New policies need to be restricted to those that are both absolutely necessary and enduring.

Further to this, there are number of other significant barriers to investment in electricity generation, including:

- Planning constraints - especially for onshore wind and new transmission capacity;
- Carbon price - a strengthened EU ETS, with a tighter cap, is needed to deliver a strong and sufficiently robust carbon price to encourage investment; and
- Transmission charging - the current regime overly penalises plants in the North of Scotland.

6. **Do you have any specific comments on scenario assumptions, and their internal consistency?**

Security of Supply Risk Ranking
We agree that maintaining gas supplies as the UK becomes more dependent on imports due to the decline of UK continental shelf gas is one of the most significant security of supply challenges. However, we believe that continued maintenance of electricity supplies also raises challenges, particularly in light of the many issues faced by the market such as the large levels of generation capacity that could be lost via IED closures; the uncertainty of whether CCS can be proven to be technically and/or economically viable; and the system's requirement for flexible generation in a market where, due to regulatory uncertainty, it may not be economic.

Pumped Storage
We do not believe Ofgem should make the assumption that no new pumped storage generation will be built over the next 10-15 years. Such facilities are an effective way of ensuring peak demand is met and could play an increasingly important role in managing the large amounts of intermittent wind power expected on the GB electricity system.

SSE already owns and operates a 300MW pumped storage scheme at Foyers, on the south side of Loch Ness, which produces 300GWh of electricity in a typical year to help meet peak demand. We

have also submitted to Scottish Ministers an application for consent to develop a 60MW pumped storage scheme at our existing Sloy hydro electric power station at Loch Lomond, allowing it to produce an additional 100GWh of electricity in a typical year to help meet peak demand.

Further to this, we are considering two possible new large scale pumped storage hydro electric schemes in the Great Glen. We are to seek from the Scottish Government its formal opinion on the scope of the environmental impact statement that would accompany planning applications for the schemes, currently planned to be submitted during 2011. Subject to final agreements and design, it is envisaged the proposed schemes would have an installed capacity of between 300MW and 600MW each and be able to produce in excess of 1,000GWh of electricity in a typical year to help meet peak demand. In both cases, the upper reservoirs would be large, enabling electricity generation to continue for longer periods, without the need to pump water from the loch below, than is the case for other pumped storage schemes in Great Britain.

However, the viability of these and further new pumped storage schemes are undermined by the current transmission charging regime, in three key ways:

1. By charging based on capacity (rather than energy delivered), the TNUoS charging regime heavily penalises low load factor generation such as pumped storage;
2. Viable pumped storage locations are concentrated in the North of Scotland where the locational charges are extremely steep;
3. These charges are paid despite the fact that pumped storage can work to ease transmission constraints, by taking electricity off the system during periods of oversupply so that other renewable non flexible generation (such as wind) is not constrained off the grid.

At present the transmission charges represent up to 50% of the projects' lifetime costs, creating a major barrier to investment. Given the large benefits of pumped storage in ensuring security of supply and integrating variable renewables, there is a clear case for reform of the transmission charging regime to rectify the above disincentives.

Economics of Flexible Plant

As the penetration of wind increases, load factors for conventional plants will fall on average and become more uncertain. Given these lower running times, conventional plants will require higher prices to maintain revenue and to earn an adequate return on investment. As Poyry state in their July 09 'Impact of Intermittency: How Wind Variability Could Change the Shape of the British and Irish Electricity Markets report' "…these spikes in price are necessary for the market to operate. Without them, generators that only run a few hours each year cannot make sufficient returns".

A stable market framework is fundamental to ensuring sufficient thermal plant investment is maintained as wind penetrations increase. In particular, it is important that wholesale price spikes during periods of low wind are not restricted by regulation, since these will be crucial to allow thermal plants with low load factors to pay back their capital costs. Even the threat of potential restrictions on price spikes may be sufficient to deter investment.

Furthermore, as the penetration of variable renewables increases, there will be a larger proportion of installations (both renewable and conventional) which operate at low load factors. Many of these installations would ideally share capacity (e.g. when wind output is high, less conventional output will be needed). However, the current (per kW) charging regime does not allow for efficient sharing of capacity and is likely to lead to an over-dimensioned network with low load factor plants overly penalised. In this light, the transmission charging regime should be reviewed.

In addition, the vast majority of existing and new build CCGTs are designed to operate with a load factor in the range of 70 to 85%. If it is forecast that a high level of wind penetration on the system will force CCGTs to run at lower load factors, which could be as low as 20% (figure 3.10 p42) and consequently the operational lifetime of the station will be decreased, and the economic rent achieved from investment in new CCGT build will be far less attractive than that achieved in today's market.

With a guarantee of non-intervention on price spikes and a more accommodating transmission charging regime, the electricity market as currently arranged should be able to manage risks from high penetrations of renewables and deliver sufficient investment in flexible plant. However, SSE recognises that by 2020, if wind penetrations have increased above 20% and demand-side flexibility has not improved significantly, there may be a greater risk of generation capacity inadequacy. Therefore, it is prudent that DECC, Ofgem, and National Grid continue to engage with industry to analyse potential interventions to reduce the risk of capacity shortages in the 2020 to 2030 period.

Carbon Capture and Storage and Readiness (CCS/CCR)

We believe that the capital costs assumed by Ofgem for the build of CCS are very conservative. We estimate that the capital costs associated will be in the range of £3,000/kWe, rather than £2,200 kWe.

In September 2008, we responded to the DECC CCS consultation, stating that we supported the concept of CCR, but were concerned that it creates an illusion of progress in CCS developments, and deflects focus from the more important measures to take CCS forward. We advised that the Government should consider further the two most important actions to move CCS forward as being: funding mechanisms for a series of demonstration projects; and a commitment to carbon pricing via the EU ETS within an overall emissions cap as the driving mechanism long term for a lower carbon world. We still believe this to be the case. Indeed the lack of demonstrable progress towards commercial scale demonstration projects in the UK since the consultation last year has increased our concerns over the future of CCS.

We are also concerned that the level of detail required by the proposed CCR technical and economic assessments is impractical considering the immature status of the CCS industry. Instead, we believe that, under the current circumstances, the Government should create a more high level assessment that can be revisited, if required, at a later stage when the technology is more mature.

When considering the requirements for an economic assessment, SSE's concerns are even greater. It is widely recognised that CCS is not currently economically viable. The proposed requirement to demonstrate that the retrofitting of CCS will be economically viable in the future, is subject to a very high level of uncertainty, and therefore could be exposed to potential legal challenge. For these reasons we question the overall value of such an assessment.

Therefore, we believe it is very unlikely that the number of CCS station forecast under both the Green Transition and the Green stimulus scenarios will be achieved, unless current policy is altered to reflect the points raised above.

Coal Generation
We believe that the assumptions used under the Green Transition, Dash for Energy and Slow Growth scenarios for coal generation output are very optimistic. We believe the assumption of 19 units fitting SCR is very unlikely to occur in reality, given the current marginal economics of doing so.

Wind Output
We believe that the wind de-rating factor assumption of 15% used across the four scenarios is too high. Instead we would suggest that a load factor of 7% be used. This lower figure has been informed by the 95% exceedence curve of a portfolio of 42 existing wind farms.

Interconnection
We believe that the Moyle and the Britned interconnector linkages have not been included in the scenario modelling, but should have been to give an accurate picture of the market i.e. there should be a minimum capacity in 2015 of 3500MW in all scenarios.

Gas storage
We agree that the UK's short range and medium range gas storage capacity level is sufficient to meet 1 in 20 peak day requirements. However, the biggest security of supply threat raised in the scenario modelling in the Dash for Energy and Slow Growth scenarios is a shortage of long range gas storage to meet a 1 in 20 severe winter. Although this risk is much reduced other scenarios, the implications of this should be fully explored.

Electric Vehicle (EV)/Heat Pump Demand
We assume that EVs would be expected to add 0.8 TWh, 3 TWh and 5 TWh electrical demand in 2015, 2020 and 2025 respectively.

Based on the renewable heat scenarios published by DECC, we have calculated that heat pumps would increase electricity demand by approximately 8 TWh per annum in 2020. This would result in a combined demand increase from heat pumps and electric vehicles in 2020 of 11 TWh, compared to the 35.5 TWh in 2020 predicted in the Project Discovery report.

We believe Ofgem's assumption of a combined increased demand created by heat pumps and EVs of 2.2 TWh predicted for 2015 is plausible. However we believe the figures predicted for 2020 and 2025 to be extremely high. We would like to request that Ofgem publish separate figures for EVs and heat pumps, and provide further details to show how these figures were calculated.

We would also like to note that if heat pumps are to make a significant contribution to renewable heat targets, it is essential that policies are aligned to support this. In particular, SAP 2009 proposes to use a grid emissions factor of 0.591 $kgCO_2/kWh$. This is higher than the rolling average grid factor published by Defra and takes no account of the expected decarbonisation of the grid, which will be significant over the lifetime of a heat pump installed today or in the period to 2020.

When mapping the impact of new forms of transportation and their associated fuel demand increases, we believe that consideration should also be given to the expansion of Compressed Natural Gas (CNG) and Liquefied Natural Gas (LNG) vehicles.

Domestic Consumption
We believe the assumptions used for domestic energy consumption are incorrect. The domestic gas consumption assumption is too high, at 20,500 kWh/annum. We believe it should be 15,600kWh/annum. The domestic electricity consumption assumption is too low at 3,300kWh/annum. We believe it should be 4,200kWh/annum.

Customer Bills
We agree that consumer bills will rise in all scenarios. However, the model does not include the costs faced by customers for the Feed in Tariff scheme, which will add upward pressure on bills.

7. Do you agree with our methodology for modelling gas and electricity supply/demand balances?

Yes.

8. Do you agree that LNG is the likely medium-long term source of "swing gas" for the European market

Yes. Although we believe consideration must also be given to the differing gas qualities landed and the consequential impact on the Gas Safety Management regulations (GSMR), as the sources of LNG diversify e.g. North Africa, America, Asia, China, etc.

Chapter 3

1. Do you have any observations or comments on the scenario results?

We believe the scenario results accurately reflect the assumption input. However, we have concerns with assumptions and stress tests used. Please refer to chapter 2 question 6 and chapter 4 question 2.

2. Do you agree with our assessment of what the key messages of the scenario analysis are?

We broadly agree with the assessment of what the key messages of the scenario analysis are.

3. Are there other issues relating to secure and sustainable energy supplies that our scenarios are not showing?

Please refer to chapter 2 question 6 and chapter 4 question 2.

4. To what extent do you believe that innovations on the demand side could increase the scope for voluntary demand side response in the future?

In addition to the demand side response measures highlighted in the consultation paper, we believe that Ofgem should also take into consideration the development of smart grids. There are a number of ways in which smart grids can help decarbonise electricity whilst maintaining security of supply. In particular, smart grids should facilitate improved demand response, for example by allowing consumers to be exposed to real-time prices and automated response from appliances. Advantages of greater demand response include:

- Demand peak 'shaving' and consequent reduced generation capacity requirements;
- Efficient management of transmission capacity;
- Lower required thermal plant reserve with associated carbon reductions as less plant needs to be run at inefficient loads;
- Integration of intermittent renewables at a lower cost; and
- Heightened consumer awareness of consumption and costs, helping to drive uptake of energy efficiency measures and energy-efficient behaviour.

Chapter 4

1. Do you agree that our stress tests are representative of the types of risks facing the GB energy sector over the next decade?

We agree that the stress tests used are appropriate, but we believe there are other stress tests which should be conducted to present a true representation of the risks facing the GB energy sector. Please refer to chapter 4 question 2 for details.

2. Are there further stress tests that you think should be considered?

Yes. We believe the following 2 stress tests should be included in Ofgem's analysis:

1. Peak Oil
The International Energy Agency (IEA) have warned that, the recent rise in the price of oil "risks derailing the recovery" if it continues. In October 2008, the UK Industry Task Force on Peak Oil, of which SSE is a member, published a report, *The Oil Crunch*, which stated that a peak in cheap, easily available oil production is likely to be reached as early as 2013. Another report[2] published in October 2009 by the Government supported UK Energy Research Centre, following 'a review of over 500 studies, analysis of industry databases and comparison of global supply forecasts', concluded that 'a peak in conventional oil production before 2030 appears likely, and there is a significant risk of a peak before 2020'. We therefore believe Ofgem should also model peak oil as a stress test.

2. Scenario interaction
Scenarios should be analysed with a combination of the stress test because their individual occurrence is likely to trigger another. For example, if wind levels were also low across Europe for an extended period, this would act to increase European wide demand for gas and increase the likelihood and severity of a gas shock, hence the two risks are not independent.

3. Do you agree with the assumptions behind our stress tests?

We believe that it would have been beneficial to provide more in-depth information on the data behind the assumptions used for the stress tests.

4. Do you have any views on the probabilities of these stress tests occurring?

We believe that each of the stress tests have enough of a probability of occurring to justify their inclusion in the modelling, however we believe there are other stress tests with equal probability that should be modelled. Please refer to chapter 4 question 2.

5. Do you agree with how we have modelled demand curtailment in response to constrained supply?

Yes. However, we believe that it would have been beneficial to provide more in-depth information on the data behind the modelled demand curtailment.

6. Do you have any other comments on our stress tests?

We would be happy to discuss with Ofgem our suggestions for the additional scenario, the assumptions and the stress tests.

Additional Comments

Table 2.2 on page 18 of the consultation paper shows that further extensions are provided for nuclear under the Green Transition and Green Stimulus. However, we believe that Ofgem intended for these extensions to be applied under the Dash for Energy and Slow Growth scenarios, not the Green Transition or Green Stimulus.

The second row of the CCS Plant table on page 87, shows the assumed CCS build for 2009, however we believe it should illustrate the 2015 build.

The electricity demand curtailment assumptions table on page 99, state that the price per MWh of domestic electricity curtailment is £5,000; however we assume this is meant to read £50,000. We request confirmation from Ofgem that this is the case.

[2] The Global Oil Depletion Report, October 08, 2009, UK Energy Research Centre