Ian Marlee
Partner, Trading Arrangements
Ofgem
9 Millbank
London
SW1P 3GE

20 November 2009

Dear Ian,

Project Discovery – Energy Market Scenarios

EDF Energy is one of the UK's largest energy companies with activities throughout the energy chain. Our interests include nuclear, renewables, coal and gas-fired electricity generation, combined heat and power, electricity networks and energy supply to end users. We have over five million electricity and gas customer accounts in the UK, including both residential and business users.

EDF Energy welcomes the opportunity to respond to your consultation on Phase 1 of Project Discovery published on 9 October 2009.

The UK energy industry is facing very significant challenges in facilitating the achievement of the Government's climate change objectives. The scale of the potential investments required to significantly decarbonise the energy sector is unprecedented (between £128bn and £240bn by 2025 according to Ofgem) and the decisions and choices we make over the next decade or so will be with us until 2050 and beyond. In that context, it is essential that there is a clear, transparent and in-depth process for assessing whether the current market and regulatory arrangements are adequate to deliver sustainable, secure and affordable UK energy supplies into the future. Ofgem clearly has a key role to play in this, and Project Discovery is therefore both timely and welcome. We would however urge Ofgem to ensure that this project moves in parallel with, and complements, other work by DECC, the Committee on Climate Change, National Grid and the Energy Strategy Networks Group, which are all also looking at similar issues. There is significant overlap and interaction between these workstreams and it is imperative that it is all managed in a complementary and coherent manner.

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The key messages in our response on the scenario approach are as follows:

- Scenarios are the right approach for this sort of project, provided they cover a full and diverse range of the credible potential outcomes, an appropriate time period, and are subjected to appropriate stress testing;
- We believe the project's scenario work could be improved on all three accounts, namely:
    - The range of scenarios currently considered in Project Discovery is not in our view wide enough;
    - The time period over which the analysis is currently projected is insufficient - limiting the scenarios to 2025 is not appropriate given the investment timescales involved. All scenarios should therefore be extended out to 2030 at least; and
    - The stress testing could be enhanced.

Our main concern with the scenarios is the unrealistically low contribution from nuclear power in all scenarios. As the lowest cost large scale low carbon technology, nuclear power can significantly reduce the overall cost of decarbonising the energy sector. Indeed, independent analysis carried out by Poyry Energy Consulting for EDF Energy demonstrates clearly that placing more emphasis on nuclear power significantly reduces the overall cost of decarbonisation (please see confidential summary in Appendix attached). Such an outcome is clearly in the best interests of UK consumers and industry. We would be happy to discuss this analysis with you separately if that would be helpful.

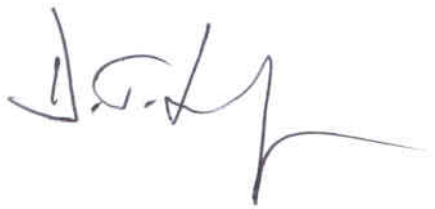
The amount of new nuclear used in all the scenarios is significantly below that which is possible and certainly well below the c15GW of projects identified in the Government's recent Nuclear National Policy Statement and also already announced by the three new nuclear consortia in the UK. As a minimum we therefore recommend that Ofgem test its scenarios with higher levels of nuclear power, thus enabling a clear comparison of this with other choices.

On next steps, having developed an agreed set of scenarios, we expect Phase 2 of this Project to then examine how best to ensure we have the right market and regulatory frameworks to ensure that the objectives of sustainable and secure supplies are delivered in the most cost efficient manner. Ofgem must be at the heart of this work.

EDF Energy's own analysis suggests that the current electricity market structure is unlikely to secure the investment required to decarbonise the electricity sector by 2030 in an efficient manner and at least cost to consumers. We look forward to continuing to work with you through Phase 2 of this project to ensure that this is achieved.

I attach our detailed response to the consultation questions in the attachment to this letter. If you have any queries on this response or would like to arrange a meeting to discuss our response further, please do not hesitate to contact me directly, or my colleague David Love on 01452 653325.

Yours sincerely,



Denis Linford
Corporate Policy and Regulation Director

Attachment

Project Discovery - Energy Market Scenarios

Consultation Questions:

Chapter 2

Ch 2 Question 1: Please provide comments on our approach of using scenarios and stress tests to explore future uncertainty, and as a basis for evaluating policy responses.

Scenario planning is best deployed in business environments that require a long term view of strategy and in circumstances where there are a limited number of factors influencing the success of the strategy and where there is a high level of uncertainty about such influences. The principal advantage in terms of energy policy is to design a set of incentives that deliver a particular objective - for example, low carbon generation, and identifying the barriers to meeting the targets is one of the key benefits of the application of scenario planning. The method can allow policy makers to challenge their own preconceptions and avoid simply projecting forward existing assumptions. Set against these benefits, the use of scenario planning can be a sensible approach.

However scenario planning will only be of any use if the underlying assumptions are effectively able to demonstrate the costs and risks of different pathways or options and it is important that policy lessons are carefully drawn from each scenario. EDF Energy does not believe that the scenarios considered in Project Discovery provide an effective platform to explore the extent of future uncertainty in outcomes for the diversity, security or affordability of future energy supplies.

One of the key parameters that will influence the successful application of scenarios is the time horizon over which the scenarios are developed. In our view this time horizon needs to be sufficiently long term in outlook to judge the effectiveness of decisions that need to be taken now to ensure that the investment path one is starting out on is genuinely capable of achieving the final objective. This is particularly pertinent in the context of achieving the UK's CO_2 reduction targets, as some of the choices available to meet the 2020 targets may at best unnecessarily increase the cost of achieving the longer term targets.

These issues are also pertinent to Ofgem's wider remit to ensure long term security of energy supply and particularly relevant in delivering what has been Ofgem's primary objective to date, to deliver competitive energy supplies to UK consumers. The importance of this increases significantly as we look ahead to 2020 and beyond, as the choices we make today can and will have a significant impact on the cost and

competitiveness of UK energy supplies. We discuss in subsequent sections of our response some of the scenario work that we have developed to inform our own strategic work and this work highlights differences in excess of £100 billion in cumulative investment between now and 2040 between different investment pathways.

EDF Energy therefore welcomes Ofgem's initial view on scenarios, but these scenarios need to be developed further to extend them to look beyond 2030, possibly to 2040, and to consider a wider range of input assumptions on the choices available in meeting future energy needs. In particular we are interested in the monitoring of key triggers that will initiate certain planned actions by both Government and regulators and understanding the cost impacts of different choices.

Ch 2 Question2: Are there other techniques for analysing uncertainty that we should consider?

There are other techniques, but we believe Ofgem's approach is appropriate.

Some of the academic options used more widely may not be appropriate, as they fail to recognise some important features of electricity generation:

- The long lead times required to build or replace capacity;
- The spontaneity and precision of matching demand and supply in real time and the limited ability to store electricity;
- The difficulty in achieving a large and reliable demand side response for sustained periods.

We believe that a long term scenario planning approach can be used to provide an effective understanding of the key risks that inform decision making in the energy sector. However, as noted in our response to Question 1 above, it is necessary that these scenarios are developed further to extend them to look beyond 2030, possibly to 2040, and to consider a wider range of input assumptions on the choices available in meeting future energy needs.

Ch2 Question 3: Do you agree with how we measure the impacts of our scenarios and stress test?

The assessment of the relative merits of the different scenarios should highlight the cost differences between them so informed choices can be made about both market design and the key necessary infrastructure investments. Ofgem has done this, but we would question some of the input assumptions, the breadth of the scenarios and the length of the assessment period (see below).

EDF Energy believes that the most important measures are the affordability and cost stability of energy supplies and the long term security of energy supplies. We believe

the purpose of the scenarios should be to inform the choice of the most desirable outcomes in the future, which can be used to develop energy policy in the UK that guides investors to making the most cost effective decisions and to bringing forward investment in affordable low carbon technologies. This will be essential to ensure that the UK maintains secure energy supplies that will mitigate the impacts of fuel poverty and protect the competitiveness of the UK economy.

Ch 2 Question 4: Do you agree with our key scenario drivers and choice of scenarios?

EDF Energy does not believe that the scenarios considered in Project Discovery currently provide an effective platform to explore the extent of future uncertainty in outcomes for the diversity, security or affordability of future energy supplies. Scenarios are a useful means of evaluating future uncertainty and risk to provide benchmarks to plan against. However, in order to achieve this effectively, the scenarios chosen must cover a diverse range of possible outcomes, and cover a sufficient time period. It is our opinion that the scenarios in Project Discovery do not currently achieve either of these.

The 2020 renewable energy target applies across all sectors of the UK economy and we should not assume that the electricity sector will or should be tasked with making a disproportionate contribution to this target, particularly when there are cheaper, more cost effective solutions in other sectors. Therefore by focusing on the delivery of renewables to meet a 2020 CO_2 reduction target, other low carbon technologies such as new build nuclear and carbon capture and storage are not given sufficient scope or prominence.

EDF Energy believes that the key period for the construction of the low carbon infrastructure necessary to meet the Committee on Climate Change ambitions is between 2010 and 2030. Our main concern is the extremely low prominence of the contribution expected from new nuclear power stations in Ofgem's scenarios. As the lowest cost large scale low carbon technology, nuclear power can significantly reduce the cost of decarbonisation of the energy sector. Indeed, independent scenario analysis carried out by Poyry Energy Consulting for EDF Energy clearly demonstrates that placing greater emphasis on nuclear power significantly reduces the cost of decarbonisation (please see confidential Appendix 1), an outcome that is clearly in the best interests of UK consumers and industry.

The scenarios are also at odds with the recent draft Nuclear National Policy Statement from Government and the publicly stated intentions of electricity generating companies who have announced programmes to build c15GW of new nuclear capacity by 2025. The challenge of delivering this investment in these timescales is significant and is, in our view, achievable. In analysing further scenarios, Ofgem should ensure that the challenges of future investment in all technologies are treated fairly and consistently in the development of the relevant input assumptions. So for example, if 25GW of wind

can be deliverable by 2020, we do not see why 15 GW of nuclear cannot be delivered by 2025.

We also note that the four Ofgem scenarios are reactive to world events, such as the global agreement on climate change, rather than being based on UK targets, such as the achievement of the 2030 low carbon ambitions. None of the scenarios meets the three government objectives for the industry: Low Carbon, Affordable and Secure. Since they are either inordinately expensive, or miss the carbon and renewables targets.

EDF Energy commissioned Poyry to develop scenarios that showed how the Electricity industry could be decarbonised over this period. We would like Ofgem to understand the implications of this study and would be happy to discuss this with you separately. The study builds on Poyry's modelling from its Implications of Intermittency[1] report from July 2009, and uses its own assumptions on costs. Each scenario takes, as its focus, a reasonable maximum build of one of the key low carbon technologies – Renewables, Nuclear and Fossil Fuel with CCS. The study targets 2030, but also looks to 2040 to understand the implications.

The key findings of the study were:

- 85% of electricity generated will be from a low carbon source to meet the 2030 ambition;
- While the current preference for new gas fired generation to replace ageing coal fired generation, is reducing emissions, it cannot achieve the 2030 ambition without further incentives;
- No single type of low-carbon generation can be constructed quickly enough, and all types are needed in what should be a balanced mix;
- The scale of the investment required is unprecedented, c£200bn by 2030 – however the choice of technology will have a major impact in minimising the overall costs;
- The existing market arrangements , including the disparate subsidies to various renewables technologies will not deliver the scale or direction of investment required.

We have included some more details of the results of this work in our confidential Appendix 1 and we urge Ofgem to review this analysis alongside its own scenarios in determining its views on the future development of the energy markets in the UK.

[1] Impact of Intermittency, Poyry, July 2009

Ch 2 Question 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?

We highlight in our response to Question 4 above the areas where we believe the scenarios do not yet adequately cover the range of possible solutions to meeting the UK's energy policy objectives. Additionally we believe there are other areas of uncertainty that market participants are facing that will require firm policy responses. This uncertainty needs to be assessed in the context of the electricity sector facing unprecedented levels of capital investment in new infrastructure (generating capacity and transmission and distribution networks). Late last month, (26/10/09) Citi Investment Research & Analysis, made the following remarks in its Valuation Sheet. "The €1,000,000,000,000 (trillion) Decade - Astronomical capex requirements — Utilities in the five largest EU countries face a capex bill of up to €800 billion in the next decade. Across the EU as a whole the figure could top €1 trillion. Annual expenditure in the big 5 could be running at €80 billion per annum – that's the cost of the London Olympics every 45 days." A similar comment on the €1 trillion investment need was made in a speech by the EU Energy Commissioner, Andris Piebalgs in late May.

Ofgem's own analysis has investment in the UK alone of between £127bn and £240bn by 2025. These levels are unprecedented and it is inevitable that the UK will have to compete internationally to attract such investment. EDF Energy believes that the UK is making good progress in understanding the scale of change required in moving to a genuine low carbon economy and the associated challenges. However, more needs to be done to convert this into reality.

We believe there are three major areas of uncertainty: carbon price; market design and profitability of peaking plant. We believe that the scenarios do not currently cover the potential outcomes required to meet this uncertainty, and so we have laid out our concerns more comprehensively below.

<u>Part A: Investment in low carbon base load generation</u>

There are a number of reasons why we believe that the current market structure will not deliver sufficient investment in low carbon base load generation. These are:

Reason 1: Inadequate long term carbon price signal

The primary scheme to promote carbon saving and associated infrastructure investments within electricity generation is the European Emissions Trading Scheme (ETS). While this scheme has had some success, we do not believe that the current scheme will successfully encourage the scale of long term investment required in the UK electricity generating sector to meet Government targets.

The ETS reflects the minimum cost of carbon reductions within the phase to meet the cap. This tends to reflect the short run marginal cost of any reduction. Thus, within the electricity industry, this is reflected in the balance between the dark and spark spreads (a proxy for gross margin based on the difference in price between wholesale coal and gas prices and the revenue from power prices). Thus its primary result is to encourage switching from coal fired to gas fired generation during the early stages of the scheme, rather than encouraging new investment. However fuel switching on its own will not deliver the deep cuts required to mitigate climate change. Relevant factors here include:

- New assets have very long lives and power stations that we build today will still be around in 2050 and beyond;
- If we believe the electricity sector needs to be substantially decarbonised by 2030, then any asset replacement must make the shift to low carbon technologies now;
- However the current ETS price does not support these investments and may not do so for the next 15 years or so, unless changes are made;
- If we slavishly follow the ETS price signal and replace assets now with carbon emitting plant, this will increase the risk that the long term CO_2 reduction targets will not be met (the 'carbon lock in' effect, because of potential difficulties in closing this plant and risking significant stranded investments); and
- If the speed at which low carbon plant is built is heavily influenced by the need to replace ageing assets, it cannot be appropriate to rely solely on the ETS to effect this change particularly as the current ETS price is not providing adequate long term signals.

It is also important to recognise that the prevailing energy policy landscape differs across member states in the EU and, while the ETS is supposed to help achieve the EU objectives for 2020, it cannot be expected to substitute for specific domestic energy policy and climate change mitigation objectives in individual member states. In these circumstances, where investment decisions are urgently needed before further changes can be made to the ETS, EDF Energy believes it is necessary for member states, and in this context the UK in particular, to create national mechanisms aimed at providing a clear long term carbon price signal that is consistent with their domestic energy policy.

There is significant evidence to substantiate these claims. One need only look at the current projects under construction or planned in the UK to see that the investment of choice is carbon intensive gas fired generation (of which there is currently 7 GW under construction, and more gas or coal fired generation to follow in the next 5-10 years). Committed investment in low carbon generation is limited to a small amount of renewable generation, which is delivered as a result of subsidies, rather than relying on a carbon price signal.

Reason 2: The market was designed for a different generation mix

Today's electricity market (BETTA) was designed to encourage efficient running of fossil fuelled power stations – technologies which have a moderate capital cost, and relatively high marginal costs of operation (principally the fuel cost).

BETTA includes forward markets and a balancing market. The forward markets cater for sales of power months and years in advance, while the balancing market operates close to real time, to enable the real time matching of supply and demand. Prices in the balancing market either reflect the marginal (operating) costs of the most expensive plant despatched to meet demand, or, if the system is constrained, they reflect 'willingness to pay'.

Forward prices do not experience the same level of volatility seen in the balancing market, but do reflect the general trend in prices. Investors in new low carbon technologies will make investment decisions based on a view of these forward prices.

Forward markets trade only up to 3 years in advance, therefore giving investors little foresight on which to base their decisions. However, this problem will be compounded as we move to a low carbon world, for two main reasons. Firstly, forward prices are likely to be significantly more volatile, owing to the addition of large quantities of wind power to the system. This creates significant challenges and risks for investors.

Secondly, the combination of the changing nature of the plant mix and Government and regulatory policy may lead to lower average base load prices that do not provide sufficient remuneration to new plant and will deter investment in new plant. The long term impact is detrimental to consumers, as this will lead to an erosion of capacity margins and higher and more volatile electricity prices caused by a reduced security of supply and a greater exposure to more volatile gas prices. The factors contributing to artificially low wholesale electricity prices are described below:

Our scenario analysis by Poyry shows that by 2030, 85% of generation may need to be from very low carbon sources. It is likely that a large proportion of this will be nuclear and renewables – technologies that both have high capital cost and low or very low marginal costs. Therefore if this plant becomes 'price setting' (i.e. at the margin for certain time periods) then electricity prices could be very low or even close to zero.

This effect is compounded by the subsidies received by renewables. If for example, wind was at the margin when there is potentially an excess of generation on the system (or behind constraints), power prices could be negative, as wind power would still have an incentive to generate at negative prices in order to secure the subsidy it receives through the Renewables Obligation, or for that matter, any other mechanism.

Fossil fuel plant with CCS does not have such low marginal costs, and has the potential to support power prices. However the early demonstration projects will be subsidised and, while the proposed support mechanism which is based on a contract for differences on carbon price could be an effective tool to underpin the carbon price risk for all low carbon technologies, it is likely to create significant distortions in the electricity market, if it is used as the sole means to deliver the substantial subsidy required for CCS, as it will lead to very low, or possibly even negative short run marginal costs of generation.

Demand side management (DSM) to reduce peaks in electricity demand is generally should be considered as a positive development. However, the downside to an increase in DSM would be a reduction in the number of high price periods that are needed to provide incentives for peaking plant or to balance out the low / negative price periods. Thus there would be a reduction in price signals for new peaking and baseload plant.

Finally, the increased level of intermittent wind output may require National Grid to hold greater capacity in reserve in order to protect security of supply. The downside of this course of action would be that a good proportion of the limited amount of high marginal cost plant that does exist would be 'paid for' outside of the wholesale market and may therefore not set the electricity price.

Part B: Investment in flexible peaking plant

Historically, the UK market has relied on older power stations approaching the end of their useful lives to provide flexible peaking capacity and this was supplemented during the 1990s by the existing oil plant which, faced with competition from new CCGT plant, became less economic to run at high load factors.

In the future it is likely that implementation of the IED will close power stations that are currently providing this capacity and from 2016 there will be no oil fired plant on the system and 9GW less coal fired plant than at present. CCGT plants will undoubtedly be required to contribute more flexibility to the system. However it is unproven whether they will be able to do this, as they are likely to run at lower load factors with significantly more starts during the year, which may well have an impact on reliability. It is also inevitable that all plant connected to the system will need to provide some degree of flexibility to help match supply to demand.

However one of the key differences in any 2020 scenario will be the increased penetration of wind generation. The increase in wind generation will increase the amount of standby plant required within the overall plant mix to respond to changing wind conditions, particularly in a 1 to 6 hour response time, i.e. be able to reach target loads in 1 hour and sustain the response for 6 hours. The running patterns for this

tranche of plant is by its very nature unpredictable and scenarios presented in the recent Poyry work also highlighted the possibility of significant year to year variations in the projected output from this plant. The lack of clarity on the precise role that smart demand can play in matching demand to supply creates further uncertainty for investors looking to invest in peaking plant.

EDF Energy does not believe that the existing market arrangements will provide a sufficiently robust market signal to bring forward the investment required in peaking plant for two reasons:

- It is unclear how much peaking or standby plant will be required.
- There is significant uncertainty on the day to day and year to year revenue streams that this plant may earn and this uncertainty may present an unacceptable risk for investors.

It will be important to ensure that any changes to the market arrangements to secure the reserve and short term operating margins do not undermine the revenue streams of other plant. It would be appropriate to examine the need for reform in this area, to reduce this risk, as part of a wider review of market arrangements.

Gas Market Reform

It has also been highlighted that the UK may need to invest heavily to ensure off-spec gas from the continent will not be curtailed due to its higher Wobbe Index (WI), by installing blending facilities at gas entry terminals. However we note that the regulatory framework and the access rules for such investment in gas blending plant is not defined, thereby creating risks for investors wanting to build and operate plant to alleviate these security of supply risks. Given the concerns raised above, it is apparent that regulatory policy and frameworks need to be developed to accommodate investment in gas blending equipment or rules to allow a greater range of gas quality into the UK. An Impact Assessment will also need to be done, similar to the DTI's 2004 report, to identify the impact of this new gas specification on the 20m households that currently use gas in their homes. We do not believe this is an issue just for 2020.

Ch 2 Question 6: Do you have any specific comments on scenario assumptions and their internal consistency?

Demand

In both the non-renewable scenarios, despite significant increases in consumer bills, demand continues to rise. While there is a significant inelasticity of demand, reducing the pay back period of Energy Efficiency measures over a long period is likely to lead to more installation of measures on an individual basis – rather than the scenarios which only envisage centrally led programmes.

New Nuclear

The proportion of power generated by nuclear power is significantly lower than expectations. The scenarios envisage only two new power stations are constructed by 2020. This contrasts with the announced plans of three consortia aiming to build circa 15GW of new nuclear plant by 2025.

The draft National Policy Statement for Nuclear released on 10 November 2009 details 10 sites that would be capable of having at least one operating nuclear reactor by 2025.

Malcolm Wicks in his August 2009 report on Energy security declared that a range of 35-40% of electricity would be a 'sensible aspiration beyond 2030'. Depending on load factor, this assumption would indicate 12 new power stations, together with Sizewell B, which will still be operating.

Existing Nuclear

The assumptions on nuclear life extensions suggest that extensions to the AGR fleet will be dependent on economic factors. However the Dash for Energy scenario, which has the highest wholesale energy price, does not envisage life extensions being achieved. It is important to recognise that while life extensions remain a possibility, any decision to extend the life of a power station will be based on site specific safety, technical and commercial considerations.

Carbon Capture and Storage

CCS as technology is yet to be proven at a large scale and we would suggest that it would be premature to assume a large scale deployment of CCS before 2025. Any attempt by Government to forcibly retrofit CCS on all fossil plant will place a significant cost burden on UK consumers and have serious implications for the competitiveness of UK energy supplies.

Ch2 Question 7: Do you agree with our methodology for modelling gas and electricity supply balances?

We agree that the methodology used for modelling Ofgem's energy scenarios is formally correct, but, as always, we are interested in the more detailed set of assumptions made during the development of the model as much as the "headlines" presented in the document. For example we are interested in the thinking behind the criteria used to assess which plants will close down or remain economic in its price scenarios. Furthermore the relationship between investment and prices creates feedback loops which may of course lead to multiple outcomes.

From the description of the stack models for generation capacity it does not appear that there is any way of analysing the impact of the rate of change of wind generation on

thermal plant. This will become more critical later in the time period and beyond the years being reviewed here, as more wind capacity comes on line. Furthermore, the noticeable absence of OCGT (fast response/peaking) plant from the generation mix suggests a lack of assessment of the impact of variable sources on the network. This suggests that CCGT plant is expected to serve this purpose, although in practice it would not be as responsive as OCGT plant.

It appears that investment is assumed to be in thermal CCGT plant at the expense of early investment in nuclear plant. We believe that this comes about as the time period for the study is too short. The full significance of long-term environmental issues and the future costs of emissions abatement that would be required for CCGT capacity are not considered in the modelling. EDF Energy notes that this consultation was announced prior to the publication of the Consultation on the draft National Policy Statements for Energy Infrastructure, which seeks to fast-track planning decisions on energy infrastructure, including new nuclear plant. In the light of this, we suggest that due consideration be given to any amendment or updating of the scenarios being modelled.

Given that the assumptions on gas supply appear to include considerable reliance on imports from Russia, Central Asia and North Africa, and also Global LNG it appears unreasonable not to include more early nuclear plant to mitigate increasing security of supply issues.

Ch 2 Question 8: Do you agree that LNG is the likely medium-long term source of "swing gas" for the European market?

We agree with Ofgem's assessment in the short term (up to 2015). Liquefaction to re-gasification ratio provides arbitrage opportunities between markets for example between Europe, America and UK. We have no reason to suspect this ratio will create problems. however in most cases, due to the doubling of global regasification, it should be assumed that LNG cargoes will flow to the highest bidder. It is worth highlighting that, high demand and prices in Asia, following either economic recovery or a loss of non CCGT capacity, will mean that the UK will have to heavily rely on imports from the continent, at a time when Europe may also need locally sourced gas, leading to higher premiums for this LNG in the UK and also increased security of supply risks. The time for LNG cargoes to be diverted to the UK needs to be considered, as they could take up to five days to land. Considering the increased level of continental gas supplies that are outside the UK safety specifications, as noted at a recent Ofgem seminar [2] , it may also create a security of supply issue, given the probability of high WI continental gas being curtailed from entering the UK. However the extent to which this security of

[2] Ofgem European Gas Quality workshop, 18th November 2009

supply risk could be alleviated will depend on the level of UK Gas storage, both on shore and at LNG terminals.

We note that global LNG liquefaction capacity combined is expected to rise from around 60 bcm in 2007 to close to 200 bcm in the period 2012- 2015 (IEA World Energy Outlook 2009). There seems to be a rapid period of investment between 2015- 2020 to reach 350- 700bcm stated on page 28 of Ofgem's document. However from 2015 onwards it seems likely that LNG would provide base load gas and that the swing gas has to be provided by local gas storage facilities, as this will be more economic.

Chapter 3

Ch 3 Question 1: Do you have any observations or comments on the scenario results?

Please see our detailed response to Question 1 in chapter 2. The scenarios are a useful means of evaluating future uncertainty and risk to provide benchmarks to plan against. However, in order to achieve this effectively, the scenarios chosen must cover a diverse range of possible outcomes, and cover a sufficient time period. It is our opinion that the scenarios in Project Discovery do not fully achieve this. EDF Energy has commissioned Poyry to develop long term scenarios to help inform our long term strategic work. A summary of the results of this work is attached in confidential Appendix 1 and we request Ofgem to review this analysis along side its own scenarios, in determining its views on the future development of the energy markets in the UK.

Ch 3 Question 2: Do you agree with our assessment of what the key messages of the scenario analysis are?

We agree with Ofgem that the assumptions of potential gas flows of LNG and through interconnectors are critical for the gas scenario analysis (page 23). We note however that in the dash for energy scenario Ofgem assumes increased investment in CCGT, but this is unlikely to happen if gas prices are high, as other technologies will provide more financially attractive investment opportunities.

We would also note the IEA's World Energy Outlook conclusion that **"**The world's remaining resources of natural gas are easily large enough to cover any conceivable rate of demand increase through to 2030 and well beyond, though the cost of developing new resources is set to rise over the long term." They claim that long-term global recoverable gas resource base is estimated at more than 850 tcm, of which 45% is unconventional gas (shale gas, tight gas and coal bed methane). Ofgem's scenario could well have considered the importance of the development of non conventional gas, particularly in the United States and Canada, which could have a material impact on LNG consumption.

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

Please refer to the detailed analysis of our long term scenarios that are presented in confidential Appendix 1, which contains pertinent messages on the need to provide affordable and secure energy supplies to the UK and help maintain the competitiveness of the UK economy.

It is important to recognise that while the recent economic recession may have reduced the extent of the capacity gap in the near and medium term, the need to deal with the carbon crunch and affordability of energy supplies remain as real and urgent issues. We believe that all low carbon technologies have an important role to play in this regard. However the specific contribution from each technology available to decarbonise electricity can have a significant impact on the affordability and competitiveness of UK energy supplies and it is important to debate the costs of the trade-offs in determining our future road map. We believe Ofgem has a critical role in informing this debate.

Ch 3 Question 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?

Optimising the generation profile (in terms both of marginal cost of production and carbon emissions) will continue to be essential if the UK is to continue to benefit from affordable, secure and low carbon electricity production. Conventionally this has involved moving electricity demand from peak periods to off peak periods. This reduces the total amount of generating capacity required to meet electricity demand, reduces the costs of electricity production and also helps minimise the total cost of transmission and distribution. However, as we look forward to a plant mix in 2020 and beyond which contains an increasing proportion of intermittent wind generation, it signals a much more sophisticated role for smart grids. The basic principle of trying to reduce peak demand will remain and, in addition to this, smart grids will have to achieve a closer alignment between electricity demand and wind patterns during every hour of every day of the year.

Achieving this objective will require innovation and investment in new power system technologies and information communication and management systems. It will also require the development of an appropriate market, commercial and regulatory framework and changes to consumer behaviour.

EDF Energy believes that smart grids, along with smart meters and their supporting communication infrastructure, could well play an important role in reducing the costs of decarbonising the electricity generation mix and maintaining security of supply. However, we need to explore a number of reasonably well established concepts that merit further consideration to understand their true potential. We believe this further

investigation will be critical in quantifying the contribution that each of them can make and in developing a coherent suite of solutions.

We believe that there is a need to recognise that the suite of smart grid solutions will involve some passive measures based on a system response and other interactive measures that will work by consumers responding to a price signal and which may require significant behavioural or lifestyle change. Apart from the behavioural aspects, EDF Energy believes that the following parameters should be included in any assessment of the available options:

- The enabling market framework required (to include aggregators and /or distribution companies);
- Quantifying the scale of demand response to an inconsistent and dynamic price (price elasticity of demand during different times of the day / week);
- Quantify the scale of involuntary response available;
- The duration of the voluntary or involuntary responses available.

Essentially, long term measures (such as dynamic time of use tariffs) could be used to shape demand, moving consumption out of peak periods. Fine tuning will be performed by shorter term measures such as frequency control demand management.

Smart demand is more likely to affect the timing of demand rather than total electricity consumption -for example, in respect of fridges, storage heaters or electric cars, which may be switched off for a time but are likely to lead to a subsequent increase in demand when reconnected.

Chapter 4

Ch 4 Question1: Do you agree that our stress tests are representative of the types of risks facing the GB energy sector over the next decade?

We wish to make the following points in response:

- Generally, yes – we agree that one of the main focuses of the stress testing should relate to the physical provision of gas to the wholesale market.
- Ofgem should give more consideration to possible combinations of different but linked stresses.
- Ofgem needs to clearly differentiate between market-related stresses and stresses that result from other events.
- The impact of stresses (both market-related and others) will depend on the extent to which the GB market is (both physically and in trading terms) linked to the wider EU market. This needs further consideration.
- The impacts of stresses will also depend on how much gas storage and distillate capacity there is in the UK. Ofgem's assumptions on this are unclear.

We generally agree that physical provision of gas to the UK is a key risk and that Ofgem's stress tests are reasonably representative of this at a global level. However, we believe a gas quality interruption risk to the UK supplies should be included, as this is potentially more likely than a pipeline failure at Bacton. For example, much of "new EU gas" will come from Russia, which can have a higher WI than is acceptable in the UK. This risk compounds the political risk of relying on Russian gas.

Further work also needs to be done on assessing the interaction of some of these risks with others. For example, the knock on effect of one gas stress factor on another should be considered. In order to explore "compounding risks". The re-direction of LNG supplies scenario should perhaps therefore be linked to pipeline import restrictions from continental Europe, due both to the increasing reliance on imports from declining UKCS production and to the tight UK Gas quality specification creating a potential "compound effect".

One of the key underlying assumptions in all this work is that 'markets [both within the UK and globally] continue to work efficiently'. Two of Ofgem's 5 stress tests are the result of markets apparently working properly (LNG re-direction and electricity interconnectors exporting). As such, they should be differentiated from other non-market risks when assessing the impact on the scenarios.

Two other factors will be key to assessing the impact of stresses and both need further consideration: the assumptions on gas storage are unclear; and the extent to which the GB market is further integrated with the EU wider market. On the latter it is surprising to note that Ofgem's input assumptions have only 2000MW of total electricity interconnection until 2015 and only 2500MW from 2015-2020. We note that current capacity is 2500MW and that the BritNed 1000MW link is due to commission in Q1 2011. There are also other potential links. We do not therefore understand Ofgem's apparent (implicit) assumption that there is no progress towards any further integration with the EU. We do not believe this is appropriate and at the very least Ofgem should review the robustness of the results of its stress testing in circumstances where there is much greater physical interconnection and market integration.

On wind availability, the summary of stress tests (Table 4.1 page 58) suggests that "No wind output" is a stress test. On the contrary, this is a widely recognised potential outcome which should really be part of 'business as usual' planning for both Ofgem and National Grid. We therefore do not agree that this should be included as a stress or shock per se. It will however have an impact on the amount of available reserve and should more appropriately be used as a sensitivity in combination with other stresses.

Ch 4 Question 2: Are there further stress tests that you think should be considered?

Yes, a stress test based on continental gas imports being interrupted as a result of off-spec gas should be included. We note that this is identified as an issue that was explored but not included. This is a major and credible risk, which was highlighted at Ofgem's recent gas quality workshop on 18 November 2009. It was identified that NW Europe will be supplied with more gas containing a higher WI that cannot be accommodated in the UK due to its tighter Gas Safety (management) (GS(m)R) Regulations, thereby creating a Security of Supply risk. It will also create a price shock risk, which, depending on when it happened, could have a long-lasting effect. For instance, a supply shock, combined with unseasonably high gas demand at the start of winter, will inevitably push up the forward price curve for the whole of that winter, as it did in the winter of 2005. In short, the higher the reliance on continental gas supplies the higher the risk of potential interruptions, unless large investments are made to blend the higher WI gas with lower WI gas at the beach.

The results of these further stress tests will also produce new peak price forecasts, which are needed for creating investment signals that are essential in ensuring new plant is brought forward ahead of time to deal with these risks. There was widespread recognition and agreement between Ofgem and the industry at the recent workshop on this issue, that the necessary large investments in gas blending facilities/processes are not being made, as there are no price signals at the moment. However this type of price analysis would potentially expose this risk and highlight the extent of these potential future price increases. We would urge Ofgem to explore this issue now, rather than later in the project, as a) they have already been discovered and b) it is not prudent to wait until the interconnector is interrupted, as price spikes could lead to an increase in the forward price curve, which is not in , consumers' interests. This effect will be exacerbated, if it happens at a time in future when we are even more heavily reliant on gas and when the global recession is over and demand for LNG supplies.has picked up in Asia

Another potential stress test not currently included is industrial (or other) direct or indirect action resulting in the shut down of certain powers stations. This could be by technology (eg. coal) or by company, and could be either directly, or through the supply chain. This is a credible risk that should be included.

Similarly, the unavailability of strategic parts of the gas or electricity transmission infrastructure should be included. This could be from direct or indirect action, physical failure or due to late commissioning of necessary upgrades.

Ch 4 Question 3: Do you agree with the assumptions behind our stress tests?

Other than the comments in response to Qns 1 & 2 above, we agree that the assumptions generally seem reasonable.

Ch 4 Question 4: Do you have any views on the probabilities of these stress tests occurring?

It was identified at the Gas Quality workshop on the 18th November that the probability of gas supply interruptions as described above, as a result of off-spec gas from the continent, was "a credible risk" – Belgium's TSO, Fluxy's, stated there had been 2 near misses already this year. This risk could be described as medium to high probability/ high impact, costing consumers millions of pounds in higher wholesale prices and claims.

As discussed above, little or no wind output in a cold winter is a likely occurrence, primarily due to the correlation between high pressure, low temperatures and little or no wind.

Given recent history, the probability of gas supply interruption due to political or other disputes in Eastern Europe is at least a moderate risk.

Ch 4 Question 5: Do you agree with how we have modelled demand curtailment in response to constrained supply?

Other than to agree that supply shortfalls will impact on consumer prices and the triggering of interruptible contracts, we have no further comments at this stage.

Ch 4 Question 6: Do you have any other comments on or stress tests?

We have no further comments on the Stress Tests themselves at this stage. However, we would like to comment here on some of Ofgem's key input assumptions, which will have an impact on both the scenario construction and the stress tests.

Interconnector capacity – the assumptions do not seem appropriate given that the 1000MW BritNed link is on track for commissioning in Q1 2011 and there are others planned too.

On nuclear capacity and output, we are concerned that Ofgem appears to have limited the contribution from both existing but particularly new nuclear stations. We see no justification for the arbitrary derating of new nuclear. Nor do we understand why Ofgem has limited the capacity of new nuclear to be built, given the recent NPS and commitments by the 3 new nuclear consortia.

On the increase in national demand from heat pumps and electric vehicles, we would question why there is no contribution from either in the Dash for Energy and Slow Growth scenarios.

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