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DECC,
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Consultation on Electricity Market Reform

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, 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 plans, with its partner Centrica, to build up to four nuclear reactors, with the first unit, at Hinkley Point, being commissioned by 2018. We are also actively developing our portfolio of renewable generation assets and completing construction of a 1300MW CCGT. Our final investment decisions for new nuclear generation are reliant on receiving the necessary consents and on a robust investment framework being in place.

We therefore welcome the Government's proposals for market reform, which we believe can with all due speed be developed into a robust market framework that is capable of delivering the low carbon investment the country requires. Our planned investment of around £20bn will create many thousands of jobs in the low carbon economy and make a significant contribution towards ensuring that the Government's objectives for provision of affordable, secure, low carbon energy supplies are met.

The UK needs to move faster to renew our infrastructure than other countries in Europe; there is a serious risk that a delay could expose UK consumers to volatile and probably higher energy prices. EDF Energy broadly agrees with Government's assessment of the various feed-in tariff (FIT) options, and supports the conclusion that FITs with Contracts for Difference (CfD) provide a sensible way forward to support investment in low carbon generation, but only in conjunction with Carbon Price Support and a credible mechanism that recognises the value of secure generating capacity. We believe it is important to recognise the difference between instruments, such as Carbon Price Support, used to correct the defects of the existing market arrangements, and additional measures such as CfDs that can mitigate risks for both customers and investors.

Instruments such as CfDs will need to be settled against a reference price in the wholesale market. ,This places a high premium on ensuring that market arrangements deliver wholesale prices that provide the right price signals for investment in low carbon electricity. We therefore place significant value on HM Treasury's proposal to provide carbon price support as a fundamental component of the reform package. We believe

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that this will play an important role in ensuring that future wholesale prices more accurately reflect the underlying cost of delivering low carbon electricity.

We believe CfDs can be designed to work for all low carbon technologies and agree that these contracts can offer better value to customers over the long term compared with premium FITs. The existing market arrangements have served UK consumers well till now and it is important that the detailed design and governance of the new arrangements preserves incentives for the efficient operation (investment, maintenance and despatch) of the electricity market. This will ensure that energy suppliers, and therefore ultimately consumers, do not have to pay more than is necessary, as the UK strives to achieve its energy policy objectives.

We support the introduction of a capacity mechanism, because we do not believe that the present market arrangements can be relied upon to give a sufficient signal for investment in reliable generation capacity or the provision of demand side response, particularly as increasing amounts of intermittent plant are added to the system. Provided care is taken to ensure that the market will provide an appropriate price signal to reward the availability of all plant and stimulate effective demand response, we can support the targeted mechanism suggested by the government. However, if this does not prove possible, we believe a capacity payment should be paid to all available plant.

We recognise that the introduction of an Emissions Performance Standard (EPS) is a part of the proposed reform package to which the Government is committed. We recognise that its role is to supporting the existing government policy of not permitting any new unabated coal-fired generation. However, in doing so the Government must be careful to avoid creating the perception that unlimited unabated gas fired plant is acceptable or desirable.

Much work will need to be done to develop the detail behind the electricity market reform proposals and to establish the necessary institutional arrangements to implement them. We are keen to work with the Government and other market participants to ensure that this is done quickly and thoroughly in a way that delivers a sustainable reform package that will give confidence to investors. We note the proposed legislative timetable and the recognition of the need for interim arrangements to ensure that these reforms do not create a hiatus in investment. The Energy White Paper should, therefore, confirm the clear requirement for interim arrangements to be introduced following its publication, alongside a statement of the proposed form of such interim arrangements. This will allow investors to continue to make progress in their investment plans for all low carbon technologies. Indeed, we believe that entry into these interim arrangements in advance of reform taking effect may be critical to ensuring that the aims of the reform are met.

Adequate market liquidity will be essential to the success of the reformed market arrangements and we believe that the new arrangements can be designed to deliver this. It will be important to ensure that any measures taken by Ofgem to enhance market liquidity in the near term are consistent with the longer term objective to provide a robust and accessible reference price for the new contract arrangements.

This consultation marks a significant milestone on our journey to delivering secure and affordable low carbon electricity. It is imperative that the Government moves quickly in establishing the new market arrangements, so that investors can move forward with their plans for low carbon investment and the need for any new unabated fossil fuel plant is minimised. These market arrangements will support the transition to a low carbon electricity system, and it is essential that they are delivered in a simple and pragmatic way to drive the next stage of decarbonisation, recognising that further technological and market solutions will develop over the next few decades.

Our detailed responses are set out in the attachment to this letter. [redacted]

[redacted]

[redacted]

Attachment

Electricity Market Reform consultation

EDF Energy's responses to your questions

1. Do you agree with the Government's assessment of the ability of the current market to support the investment in low-carbon generation needed to meet environmental targets?

EDF Energy agrees with the Government's assessment that the current electricity market arrangements will not be able to secure the investment required to decarbonise the electricity sector by the 2030s in an efficient manner while delivering secure energy supplies at least cost to consumers. The existing electricity market framework is being stretched in an attempt to deliver outcomes that were not envisaged when it was originally established. There are a number of reasons why the current market arrangements are unlikely to be fit for purpose over the next decade, including:

- the inability of the EU ETS to provide a strong, long-term carbon price signal for investment in low carbon generation;
- the significant increase in the proportion of the market that is sustained by subsidy and the consequential distortions in wholesale electricity prices which compromise the effective operation of the competitive market;
- the large increase in the proportion of high capital, low marginal cost plant required on the system to deliver the UK's decarbonisation objectives, and the need to deliver stable and adequate returns to investors in these plants; and
- the significant projected increase in the level of intermittent generation on the system, and the need to ensure that there is adequate capacity of short term response and standby plant to provide back up for variations in wind output.

If there are no other changes, the current arrangements will not deliver investment in low carbon generation but will instead lead to increasing dependence on imported gas for electricity generation and this may mean that the UK is not able to meet its energy supply and climate change objectives.

EDF Energy proposes, with its partner Centrica, to spend around £20bn on four new nuclear reactors over the next 15 years, creating thousands of jobs and providing enough low carbon electricity to meet 40% of the UK's domestic customer demand. This will add to our existing, diverse generation portfolio, which currently includes a mix of wind, coal, gas and nuclear. Our final investment decisions for new nuclear generation have yet to be taken, and are dependent on the Government implementing proposals to introduce carbon price support and reform of the wider electricity market. The Electricity Market Reform (EMR) project must therefore deliver a coherent and robust set of market

arrangements that allow market participants to invest with confidence in the generation capacity that is needed to deliver the UK's energy policy objectives.

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

EDF Energy broadly agrees with the Government's assessment and believes that delivering energy security and investment in low carbon generation capacity requires a coherent set of complementary measures. It is correct that the transition to a low carbon economy should incorporate a diverse energy mix as this will help reduce any security of supply concerns.

We believe that the existing market arrangements, where the market price is largely based on marginal energy costs, are insufficient to provide a credible market signal to bring forward adequate capacity to deal with the projected scale of intermittency that the UK system will have to deal with by the end of this decade. The current arrangements also do not provide sufficient reassurance to underpin investment in capital intensive low carbon plant. It is for this reason that we believe, as we will discuss in the course of our response, that some form of capacity payment will be required to maintain the levels of supply security that consumers are accustomed to.

EDF Energy does not believe that the current levels of market liquidity pose a risk to securing the investment required. The levels of liquidity in the market are sufficient to ensure that the market functions effectively. The key investment decisions that we plan to make by early next year concern assets that will not be operational until 2018 and which will have operational lives through to the latter half of the century. The decisions will be driven by a view of fundamentals and our assessment of the impact of EMR measures, rather than based on activity in the short term traded market.

From 2016 to 2023, there will be major changes in the generation mix. The impacts of the Low Combustion Plant Directive (LCPD) and Industrial Emissions Directive (IED), combined with the deteriorating economics of ageing and relatively inefficient plant, will result in the closure of all existing oil-fired plant in 2016, most existing coal plant by 2023 and some older gas-fired plant over the same period. Subject to the right economic incentives and market and regulatory framework, new plant will be built to replace these assets. However, in order to meet carbon reduction targets, this plant must be overwhelmingly low carbon, with some higher carbon plant required for peaking/balancing purposes.

After 2023, it is more difficult to predict the likely evolution of the generation sector but it is very likely that there will be a need for further substantial investment in low carbon generation assets. The urgent need for large-scale investment in new generation assets is supported by various assessments, including Ofgem's Project Discovery analysis[1]. This predicts that up to £200bn of investment in energy infrastructure will be required by 2020 and highlights the scale of the challenge ahead.

[1] Ofgem, Project Discovery Energy Market Scenarios, 9 October 2009

3. Do you agree with the Government's assessment of the pros and cons of each of the models of feed-in tariff (FIT)?

In general, we agree with the Government's assessment of the benefits and drawbacks of each of the feed-in tariff (FIT) models. In analysing the various options we have identified the following key objectives that the new mechanism should promote:

- to enable low carbon investors to manage the long-term price risk for their new plant while not creating new risks;
- to ensure that the solution works for all low carbon technologies and also works for customers and suppliers;
- to remove or minimize the potential for subsidies to distort the wholesale market price;
- to maintain efficient and effective signals that optimise despatch decisions; and
- to provide a solution that can be implemented without large scale disruption to the existing trading arrangements.

We believe that Government's preferred option of a FIT with a Contract for Difference (CfD) can be designed in a way that satisfies these objectives. We have provided more detail on our assessment of the three FIT options below.

Fixed FIT

This option reduces risk for generators to the greatest extent and therefore has the potential to achieve the largest reduction in cost of capital. By fixing the level of remuneration to low carbon generators in the long term, Fixed FITs also prevent over or under rewarding generators, thus protecting them from long-term electricity price risks and also protecting consumers from high market prices.

However, most importantly we also agree that the biggest drawback of Fixed FITs is that they significantly reduce the incentives that drive the efficient operation of the wholesale market by removing generators' exposure to the wholesale market price signals. Under a Fixed FIT there is also no market mechanism to manage the physical transfer of power from the generator to a supplier or customer.

We believe the retention of market signals is important because many studies show that, by 2030, there may be frequent occasions when the output of very low marginal cost plant (mainly wind and nuclear) will exceed demand. Some curtailment of this plant will be necessary - wind curtailment is already common in areas with high installed wind capacity such as the USA, Spain and Germany[2]. Our modelling shows that in a highly decarbonised generation mix we could have zero or negative marginal prices for up to 9% of the time.

[2] See for example Fink, S. and C. Mudd, K. Porter, B. Morgenstern, Wind Energy Curtailment Case Studies, NREL Subcontractor Report NREL/SR-550-46716 (2009).

Low carbon plant should not be immune to the market and maintaining the right market signals will ensure plant is despatched efficiently and also provide incentives for:

- efficient planning of maintenance outages;
- optimal investment in generation plant;
- flexible operation of plant where it is safe and economic to do so (e.g. reducing output rather than switching off) to avoid the risk that system balancing decisions are driven by the level of the FIT a plant receives rather than market decisions based on real costs that can most efficiently meet the requirement to balance the system;
- providing reliable and accurate forecasts for plant output; and
- optimal investment in demand side response, electricity storage and interconnection.

Premium FIT

EDF Energy broadly agrees with the Government's assessment of Premium FITs and believes these could be made to work in a way that encourages investment in low carbon generation capacity. However, under the Premium FIT model, generators retain full exposure to long term fossil fuel price movements, so there is least potential for a reduction in cost of capital. In essence, the level of the Premium FIT has to be high enough to ensure that investments would be viable under a low fossil fuel price scenario. This will mean that the cost to consumers may be excessive with high fossil fuel prices. The relevance of consumers paying low carbon generators to take fossil fuel price risks has been questioned by many, as have the risks to consumers of the consequences of high fossil fuel prices.

Premium FITs also do not avoid the risk that the plant that is required to be curtailed is the one getting the lowest FIT, rather than the plant that can most efficiently meet the requirement to balance the system. The structure of the Premium FIT will encourage generators to bid at negative prices up to the value of the premium within the tariff and will distort market price signals.

FIT with CfD

As noted above, we believe that the Government's preferred option of a FIT with a Contract for Difference (CfD) can be designed in a way that satisfies the objectives that we have outlined.

CfDs are also likely to be effective in encouraging new entrants and independent generators to invest in new generation assets as the mechanism is capable of providing a stable and reliable revenue stream.

Further advantages of CfDs include the following:

- CfDs for low carbon generation will shield consumers against high fossil fuel prices and limit the damaging impacts of fossil fuel price volatility.

- The CfDs could be designed to expose generators to market signals to maintain and to schedule their plant efficiently.
- These mechanisms sit comfortably with the existing market arrangements.
- They create a strong incentive to participate in forward trading of electricity as generators seek to hedge their physical output: generators will need to trade in the forward wholesale markets to hedge their exposure against movements in the reference price used to settle the CfD; and this would in turn help promote liquidity.

4. Do you agree with the Government's preferred policy of introducing a contract for difference based feed-in tariff (FIT with CfD)?

EDF Energy broadly agrees with the Government's assessment of the various FIT options, and supports the conclusion that a FIT with CfD provides a sensible way forward to support investment in low carbon generation, but only in conjunction with Carbon Price Support and a credible mechanism that recognises the value of secure generating capacity. We believe it is important to recognise the difference between instruments such as Carbon Price Support used to correct the defects of the existing market arrangements, and additional measures such as CfDs that can mitigate risks for both customers and investors.

Instruments such as CfDs will be settled against a reference price in the wholesale market and this places a high premium on ensuring that market arrangements deliver wholesale prices that more accurately reflect the underlying cost of delivering low carbon electricity. We therefore place significant value on HM Treasury's proposal to provide carbon price support as a fundamental component of the reform package, and we believe that this will play an important role in ensuring that future wholesale prices more accurately reflect the underlying cost of delivering low carbon electricity. We touch on various aspects of capacity mechanisms in our responses to Questions 11, 19, 20, 21 and 22, and focus on some of the key design issues for CfDs below.

There are many possible choices for the design of a CfD that would support investment in all low carbon generation. We set out below one model that we believe would work. We recognise that other choices are possible and we would welcome further opportunities to work with the Government and other stakeholders to develop the right CfD design. EDF Energy believes that the CfD would need to incorporate the following features:

- The CfD payment (strike price minus reference price) would be applied to the actual output of the plant (except possibly for CCS and biomass plant where a substantial difference may emerge between availability and output – see our answer to Question 15).
- The CfD would also be applied to any volume curtailed as a result of the System Operator's actions in the Balancing Mechanism (to ensure generators do not have an incentive to bid at prices below their true short term operational costs).

- The CfD would be 'two-way' – that is, the generator is paid the difference between strike price and index price if the strike price is above the index price, and the generator pays if the strike price is below the index price.
- All contracts offered to all technologies would be settled against a single reference price based on a year-ahead forward index.
- The reference price could be structured by taking the average of the daily prices at which the Summer year 'Y' and Winter year 'Y' forward power contracts traded during the period 1 April year Y-1 to 31 March year Y.
- All low carbon generation scheduled to be commissioned after the 31st March 2017 would be eligible to enter into a CfD with a 20-30 year duration following start of commercial operation.
- We recognise that some technology-specific features within the contracts may be unavoidable but the key terms of the contracts apart from price and volume would be standardized as far as this is practical.
- We envisage that a single strike price would be set for each technology by bilateral or industry negotiations.
- We would expect the strike price to be indexed to some measure of inflation to maintain a stable level of remuneration in real terms and to protect against cost inflation for operation and maintenance costs.
- For biomass and fossil fuel with Carbon Capture and Storage (CCS) plant, the strike price could be struck against the spread between power prices and longer term fuel price indices.
- The counterparty to the CfD will be an 'Agency' that is able to aggregate and reallocate the cash flows arising from all of the generators' CfDs by placing a £/MWh levy on all electricity suppliers.

We explain the reasons behind these recommendations in more detail in our answers to subsequent questions.

5. What do you see as the advantages and disadvantages of transferring different risks from the generator or the supplier to the Government? In particular, what are the implications of removing the (long-term) electricity price risk from generators under the CfD model?

Risk allocation

We believe all generators should retain the risks they are best placed to manage. This includes mainly the construction and operations risks (availability, operation and maintenance costs, interest rates and exchange rates), but also the ability to achieve the reference price (basis risk). Today, these risks are already borne by generators, and we see no reason that it should change. Developers/operators also take the risk on the choice of design for their plant.

The introduction of CfDs will, however, limit generators' exposure to those risks that could seriously impact the economics of projects during the term of the contract, and which are outside generators' control. The CfD design should also ensure that it does not create additional risk exposure for generators. We therefore expect that, under CfDs, generators will be protected from risks such as general inflation, change of law/regulation/taxation regime, force majeure events, long-term gas prices and credit risk of the Agency. By ensuring the correct allocation of risks, these proposals should deliver an optimal outcome for consumers.

It is important to bear in mind that while CfDs can successfully eliminate or mitigate certain risks, the primary purpose of the CfD is to allocate risks where they can be best managed or mitigated. Therefore moving a risk from one party to another will only be an advantage if it improves the management or mitigation of the risk. Correctly designed, CfDs for low carbon generation will support investment and also shield consumers against high fossil fuel prices. This will limit the damaging impacts of fossil fuel price volatility on generators and consumers alike.

Advantages

- Under the right CfD design, the generator has the opportunity to benefit from reduced exposure to long-term electricity price risk, driven primarily by movements in fossil fuel prices. This is particularly relevant for nuclear and renewables plant where the fossil fuel prices have a very limited impact on production costs.
- This increases investment certainty and would facilitate access to cheaper finance. This would enable investors to reflect the reduction in risk through reduced investment costs and would ultimately lead to lower costs for consumers.
- CfDs also provide protection to consumers from the volatility in fossil fuel prices and from high fossil price risks.

Concerns and mitigations

It is important to design the CfDs, and institutional arrangements for reallocating CfD cash flows, in such a way as to avoid imposing unmanageable risks on supply businesses.

We believe there is growing demand for longer-term contracts from large consumers as businesses attempt to remove uncertainty from their cost base. An inappropriately-designed CfD may increase this uncertainty and may lead to suppliers bearing additional risk (at a cost to the consumer) or consumers bearing additional risk (at the expense of predictability).

From a supplier's perspective, one of the key criteria for the new arrangements is the ability to provide predictable cash flows to enable suppliers to effectively set tariffs and have the confidence to confirm contractual arrangements with large consumers. The unpredictability in cash flows stems from two basic risks: the price and the volume.

The price risk can be partly mitigated by having a year-ahead reference price, which, alongside a stable strike price, ensures that the price can be fixed on an annual basis. However, suppliers retain an exposure to changes in the levy as a result of movements in

annual power prices. To some extent, they will have a partial or 'dirty hedge' against this from their own power purchase costs. However, they may find the development of a CfD market helpful to improve their management of these risks.

The volume risk is inherent to the difficulty of predicting exactly the output of a plant, which is exacerbated by the natural variability in the output of wind farms. While suppliers operating under the Renewables Obligation (RO) already have to predict output of wind with relatively sufficient certainty, the magnitude of this unpredictability will increase significantly with the amount of new wind generation capacity expected to come online in the next decade. The Agency will need to develop a payment structure that deals with this unpredictability.

This feature of uncertain cash flows, as a result of variations in output, would also be a potential problem under a Fixed FIT, Premium FIT or, indeed, if the existing RO continues to operate.

The institutional arrangements and detailed regulations that determine the accrual of liabilities on electricity suppliers and the associated payment schedules will be extremely important in mitigating these risks.

There is a common misperception that an increasing proportion of generation covered by CfDs could somehow impact the functioning of the underlying wholesale market. EDF Energy's internal analysis of a highly decarbonised mix shows that, in 2035, the proportion of volume covered by CfDs could be c.70%. However fossil plant would still be the 'price-setter' for c.70% of the time. This shows that the introduction of CfDs, if appropriately designed, should not fundamentally change the wholesale market behaviour. Moreover the capacity mechanism will need to ensure the underlying wholesale market price remains attractive enough to encourage investment in low load factor plant. We do not therefore foresee that the wholesale market price would be significantly affected by CfD strike prices, rather that price would remain set by fossil fuel plant for most of the time. However, it is important that arrangements ensure that CfD-supported plant remain exposed to market signals as far as possible.

6. What are the efficient operational decisions that the price signal incentivises? How important are these for the market to function properly? How would they be affected by the proposed policy?

The key operational decisions that are incentivised by price signals include:

- Whether a plant will generate or not:
    - Carbon price will influence the relative costs of generation plant of different carbon intensities which will drive scheduling and despatch decisions.
    - For low marginal cost plant, there is an incentive to generate unless power prices are close to zero or even negative.

- Whether a generation plant operator will invest capital or other resources in improving the efficiency, availability, reliability or flexibility of a plant or will improve techniques for forecasting plant output.
    - High fuel or carbon costs will incentivise a thermal generator to improve efficiency in terms of fuel consumption or carbon emissions.
    - Correct valuation of capacity will encourage generators to ensure that there is adequate capacity available to meet peak demands.
    - Imbalance pricing will incentivise generators to ensure the reliability of their plant and the accurate forecasting of output.
    - The pricing of ancillary services by the System Operator will incentivise generators to provide such services to assist in balancing the system.
- Demand side participation (through improved energy efficiency or by reducing or moving demand), storage and interconnection may also respond to similar price signals to generation.

It is important for the proper functioning of the market that these price signals operate effectively and that they are applied to all low carbon plant as well as fossil fuel plant.

If implemented correctly, the proposed policy changes would support the effective operation of these price signals. However, there are risks which must be taken into account in the design of the mechanisms, and some specific examples of this are discussed below.

Instruments such as CfDs will need to be settled against a reference price in the wholesale market and this places a high premium on ensuring that market arrangements deliver wholesale prices that more accurately reflect the underlying cost of delivering low carbon electricity. We therefore place significant value on HM Treasury's proposal to provide carbon price support as a fundamental component of the reform package, and we believe that this along with a capacity mechanism will play an important role in ensuring that future wholesale prices more accurately reflect the underlying cost of delivering low carbon electricity.

A robust wholesale market price which truly reflects the value of carbon abatement will provide an important signal for a wide range of investment and operational decisions for all generation plant

Carbon price signal
The carbon price signals will be instrumental in incentivising:

- the right investment in new capacity to deliver a low carbon capacity mix;
- investment in existing plant in the form of energy efficiency improvements and increased biomass co-firing;
- the potential life extension decisions for existing nuclear power stations;

- the right scheduling and despatch decisions to optimise the operation of the generation mix year by year, day by day, minute by minute to deliver energy to customers in a manner that will reduce carbon emissions in an economical way; and
- reduced reliance on high carbon electricity generation and the eventual closure of unabated fossil fuel generation.

Electricity Price Signal

A robust electricity price signal will also influence investment in, and the operation of, other technologies that can contribute to the objective of achieving security of supply. These include electricity storage, demand response and interconnectivity.

Electricity storage provides the opportunity to reduce the overall costs of electricity generation by storing energy during periods when wholesale prices are low and releasing the stored energy when electricity prices are higher. Storage typically operates over relatively short timescales e.g. a daily cycle. Therefore the main commercial driver for storage is the difference between low and high prices that are revealed by the market.

The roll out of smart meters will be an important enabler to providing a more dynamic relationship with energy consumers and demand side response is expected to play a greater role in managing electricity demand.

EDF Energy believes that the need for effective storage and demand response solutions provide further reasons for ensuring that the wholesale prices that emerge from the reformed market arrangements provide a true reflection of generation costs, which include any costs paid by the system operator to secure standby and reserve capacity as well as reflecting the costs required to keep the electricity system in balance. Such arrangements will allow the market to make optimum investment decisions in choosing between electricity storage options and building reserve capacity, as well as influencing the intra-day operational storage decisions.

Interconnection can be used to improve the efficiency of the system by balancing natural peaks and troughs in demand across national systems, including the impact of wind intermittency, and interconnection might also be used to import or export power if there are structural deficits or surpluses in the power sources. To date, the UK system has generally operated in a way that has ensured there is sufficient capacity to meet domestic demand and we believe that, with the right policy choices, this will continue into the future. Therefore, the main reason for investing in increasing the level of interconnection is likely to be the reliability and predictability of domestic generation sources, which will in turn depend on the choices we make regarding our future generation mix. Similar to storage, the important outcome for the electricity market reform project will be to ensure that the wholesale market reveals a price that is an accurate reflection of the underlying generation costs and this will ensure that market participants can see a reliable market signal to inform both investment and operational decisions.

Possible risks arising from EMR

Targeted Capacity Payments

DECC acknowledges that the policy proposals for targeted capacity payments have the potential to distort wholesale prices unless the mechanism is well designed. The distortion would manifest itself in depressed wholesale prices, with the additional costs of providing adequate capacity being recovered outside of the wholesale market. EDF Energy believes that the costs of the targeted capacity payments should contribute to the composition of the wholesale electricity price and that this would provide a more efficient outcome for consumers with lower overall costs. We would seek further reassurance that these distortions can be avoided

Structure of FIT/CfD Design

We have discussed the drawbacks of various FIT options more fully in our response to question 3. The biggest disadvantage of a Fixed FIT model is that it would remove generators' exposure to the wholesale market price signals and significantly reduce the incentives that would drive the efficient operation of the wholesale market. The key disadvantage with a Premium FIT model is that it would not avoid the risk that system balancing decisions are driven by the level of support a plant receives rather than pure market decisions based on real costs which can most efficiently meet the requirement to balance the system.

7. Do you agree with the Government's assessment of the impact of the different models of FITs on the cost of capital for low-carbon generators?

Redpoint has developed a helpful, if unorthodox, approach to estimating hurdle rates for projects facing different levels of technological and market risk. The derived hurdle rates are an important input to the modelling and evaluation of policy options through their role in determining the speed and scale of investment in new low-carbon generation.

The basis for the Redpoint methodology deviates from established theory in a number of areas, in particular the application of 'investment betas' within the cost of equity derivation and an assumed direct relationship between project earnings-at-risk and gearing. These shortcomings mean we consider the outcomes to be illustrative.

Despite some reservations about the methodology, our view is that the analysis produces broadly the right directional and relative outcomes for hurdle rates in response to different policy options. The identified weaknesses should be considered in view of the huge uncertainty surrounding costs of capital for projects in new and unproven technologies and the lack of available data upon which to base calculations. Furthermore the policy option recommendations in the consultation document do not appear to hinge on specific hurdle rate outcomes and are therefore not significantly undermined by questions over the estimation methodology. The principal arguments for and against particular options are for the most part justifiable qualitatively.

More detailed research into hurdle rates for projects in low-carbon technologies will be required as policy option designs are finalised. This research will need to be more robust and evidence-based in order to gain broad acceptance.

8. What impact do you think the different models of FITs will have on the availability of finance for low-carbon electricity generation investments from both new investors and the existing investor base?

At an industry level, Ofgem has estimated that £200bn of investment is needed over the next ten years in new generation, networks and metering[3]. Similarly, a recent report by Citigroup[4] argues that the UK utilities sector would need to spend €320bn by 2020, but that utilities will only be able to meet up to €181bn of capital expenditure – a shortfall of €139bn. This analysis would suggest that policy intervention of some form is therefore required, firstly, to ensure that existing investors stay in the UK, and are able to maximise the effectiveness of the capital available to them, and secondly to attract new sources of investment into the UK energy sector.

EDF Energy believes that the proposed market reform could have a very positive impact on this situation, by reducing uncertainty in investments for all low carbon technologies. In particular, the fixed FIT and CfD approaches, which offer investors greatest certainty about the returns they can expect, are likely to be the most successful.

It is worth noting that even with the proposed market reforms there is a practical limit on the finance that existing investors in the sector will be able to raise. For these reasons we believe it is right to be considering other sources of finance including the potential role that a Green Investment Bank (GIB) might have. We believe the Government should consider the possibilities that would allow the GIB to act as an 'equity co-investor' alongside utilities during the construction phase of major energy infrastructure projects.

9. What impact do you think the different models of FITs will have on different types of generators (e.g. vertically integrated utilities, existing independent gas, wind or biomass generators and new entrant generators)? How would the different models impact on contract negotiations/relationships with electricity suppliers?

EDF Energy believes that the impacts of the different models on a wide range of market participants will be largely determined by the detailed design of the instrument. In each model the detailed design could be adjusted to give a greater or lesser reassurance to a particular set of characteristics of generating technologies or type of market participant, and some of these design changes are likely to involve a trade off between the efficacy of the reform proposals and any concession to achieve any particular subordinate policy objective.

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[3] Ofgem, Project Discovery Energy Market Scenarios, 9 October 2009

[4] Citigroup, The €1 trillion EURO Decade – Revisited, 29th September 2010

We have discussed the relative merits of the different models in our response to question 3, and have provided some insights into the detailed design components that are required in our response to question 4. These are relevant in responding to this question and inform the answer which will depend on the extent to which the reform options can retain a credible and competitive wholesale market or rely on a much larger role for a system operator to manage the electricity system with considerable inefficiencies in despatch and operational decisions.

EDF Energy believes that the Government's preferred option of CfDs can be designed in a way that satisfies the objectives of market efficiency. This would include incentives:

- to participate in forward (or futures) trading of electricity as generators seek to hedge their output;
- to ensure generators do not have an incentive to bid at prices below their true short term operational costs and unnaturally contaminate the wholesale price; and
- to schedule plant efficiently as well as plant maintenance programmes.

A CfD design that is, as far as is practicable, common across all technologies and settled against a single reference price based on a year-ahead forward index with the CfD payment based on the actual output of the plant including any volume curtailed as a result of the System Operator's actions in the Balancing Mechanism would in our opinion provide a good base to start from.

Renewable Generators

It is important to ensure that the risk assessment of options focuses on those risks that are specifically linked to the choice of reform option and to separate these from generic existing or latent risks that will emerge regardless of the choice the market reform solution. We believe that renewable generators will benefit from a CfD based on output settled against a year-ahead reference price. This design actually works in a very similar way to the current RO mechanism with a Price Stabilisation Mechanism, as had been proposed in the consultation on Renewable Electricity Financial Incentives in 2009[5].

However, a further development in our proposal is that the CfD payment for all generators (strike price minus reference price) would be awarded to the actual output of the plant, and also to any volume that would be curtailed as a result of the System Operator's actions in the Balancing Mechanism to ensure generators do not have an incentive to bid at prices below their true short term operational costs.

The generator receives difference payments for all output produced with the £/MWh level of the payment fixed over a one year period (between the strike price and the year-ahead index). The generator is able to sell its physical output in whichever way it chooses – by trading on the prompt market or through an off-take contract with a supplier or aggregator. Because the generator's revenue is no longer dependent on realising the value of a Renewables Obligation Certificate (ROC) through a supplier, there may be more

[5] DECC, Consultation on Renewable Electricity Financial Incentives, 15 July 2009

freedom in the choice of contractual arrangements e.g. opportunities for wind generators to sell to a trader or aggregator.

In deciding the necessary strike price, the generator would take a view of the revenue that it would expect to realise from the market over the life of the project. The generator would have to consider any future changes in the generation mix, as well as the likely impact that this may have on the project's ability to secure the average price of electricity, given the non-firm nature of the output. This would include an assessment of the potential impacts of having high levels of wind penetration.

However, this analysis would not be any different to an assessment carried out by project developers under the existing support regime and this will inform the level of additional support that a project developer would seek to secure in the CfD.

In summary, the CfD model provides advantages over the RO from both the generators' and consumers' perspective:

- The yearly adjustment of the payment depending on the evolution of the index enables generators to avoid being under (or over) rewarded, and provides additional revenue certainty.
- Excluding Balancing Mechanism bid/offer volumes from the calculations helps provide the right economic incentives to despatch the plant efficiently (reducing the potential for the implicit support to contaminate the wholesale price) and does not reduce the level of support available under the CfD.
- The CfD reduces the reliance of wind generators on suppliers as a means to realise the value of a ROC.

Supplier Obligation

A commonly perceived idea is that the removal of the RO will remove the incentive for energy suppliers to contract with renewable generators. However, we are not aware of any evidence that there is any additional incentive or value for suppliers over and above the power value and the market price of a ROC. On that basis there is no compelling case for retaining a supplier obligation. We believe that decisions on the power purchase pricing are already taken on a merchant basis by suppliers. It is also important to keep in mind that the current RO does not create an obligation on suppliers to buy renewable energy, as they have the option of paying the buy-out fee.

Suppliers buy renewable power under the RO because they either have customers who want renewable energy; or more likely that there is an economic incentive for them to do so. Suppliers also have an incentive to invest in profitable renewable projects rather than let the money they pay into the RO pay for profitable projects developed by their competitors.

The situation under a CfD model will remain the same with suppliers buying renewable power because they either have customers who want renewable energy or there is an economic incentive for them to do so.

Nuclear generators

We believe new nuclear generators will also benefit from a CfD based on output and settled against a year-ahead reference price.

Similarly to other generators, nuclear generators would be receiving a payment fixed for one year (strike price – year-ahead index price) for every unit of output produced with the appropriate adjustment for any Balancing Mechanism activity. The relative stability and predictability of nuclear plants would enable operators to hedge their output efficiently at the long-term reference price, thus securing the strike price for their output. Investors would be protected against low gas and power prices, and customers would be protected against instances of high prices.

Nuclear generators would rightly retain volume risk. The structure of the reference price would also incentivise nuclear generators to plan their outages at times when prices are low.

Fossil fuel CCS and Biomass generators

For high and variable marginal cost plant such as fossil fuel with carbon capture and storage (CCS) and biomass plant, we see there are two broad radically different options for the CfD design:

1. The CfD can be struck against a measure of the power price, as it would be for all other technologies
    a. This helps standardise the CfD design to a maximum
    b. It protect consumers from rising fuel prices
    c. However, it exposes generators to significant risks of high fuel price, and, although this risk could theoretically be hedged through long-term fuel contracts, it poses a threat that developers will not invest as a result.

2. The CfD could also be struck against a measure of the spread between the power price and the fuel cost of the plant
    a. The main advantage of this solution is that generators are protected against long term fuel cost and power price risks, at the expense of customers.
    b. However, it poses the question of identifying a robust index for fuel cost, which can be particularly problematic for biomass as it does not currently exist. Any future index would possibly work on a similar basis to the coal API but may need some refinement.

EDF Energy has always supported the Government's objective to promote a balanced mix of technologies in the UK. For this reason, we would advocate option 2, with a CfD struck against the spread between a year-ahead power index and a year-ahead measure of the fuel cost, enabling the generator to hedge both positions and recoup the revenue it requires on top of its fuel costs.

The planned CCS demonstration projects are likely to be funded to compensate for technology development risks and deployment and that CCS is unlikely to be considered as a commercial option before 2025. By then we would expect to have a much better view on carbon prices with the proposed UK carbon price support around £50/tCO$_2$. It may be more appropriate to consult on how effective arrangements to support the commercial deployment of CCS can be incorporated into the trading arrangements at that time.

New entrant generators

We would tend to agree that new entrant generators would benefit from the introduction of CfDs by the removal of long term market risk which provides better access to finance. However, the key risk for smaller new entrants may lie in their ability and or desire to trade in the market. New entrant generators could mitigate these issues by assigning some, or all, of the contractual arrangements to energy aggregators.

10. How important do you think greater liquidity in the wholesale market is to the effective operation of the FIT with CfD model? What reference price or index should be used?

The effective operation of CfDs requires a liquid wholesale market to provide a robust reference price. Therefore, good and sufficient market liquidity will be essential to the success of the new market arrangements and it will be important to ensure that any measures taken to enhance market liquidity in the near term are aligned with ensuring that the right liquidity signals are brought into the market to provide a robust and accessible reference price for the new arrangements.

We see that there are five broad options for the reference price:

- half-hourly (spot) price
- short-term forward index (e.g. day-ahead)
- long-term forward index (e.g. year-ahead)
- an intermediate forward index (week ahead or month ahead)
- basket of forward index prices at different horizons

We believe the reference price should be based on a forward contract and there is a wide spectrum of possibilities; day ahead, week ahead, year ahead etc.

Having considered the various options, we strongly believe that a reference price based on a longer dated year-ahead forward index would work for all technologies and provide a similar level of protection to renewables that they enjoy under the RO. This would allow participants to pool all market liquidity to support one index, and ensure that is robust rather than have fragmented pools supporting different price indices. We provide some brief commentary on some of the available options below.

The natural inclination for intermittent or non-firm generation sources may be to favour the day-ahead contract (or half hourly price) because the limited ability in predicting specific output levels over longer time horizons. However, a short-term reference price (and certainly a half-hourly price), would not satisfy one of the stated objectives in the consultation document of the FIT with CfD model, which is "to maintain exposure to the short-term electricity price signal, incentivising efficient operational decisions by generators, which also contributes to security of supply" (p38). Indeed, a short term reference price would actually tend to insulate generators from short-term price signals as the CfD payment would compensate for any price movement.

On the other hand the natural tendency for conventional firm generation sources would probably favour longer-dated contracts as this provides opportunities and incentives to optimise power output and plan cost efficient maintenance regimes. A longer dated contract would also offer a better match to traditional hedging approaches.

Half-hourly spot price

The half-hourly spot price seems most attractive as a reference price for intermittent generation which would be able to realise the full reference price as its value would reflect actual output, without the consideration of any consequential actions required to balance the system. A half-hourly spot price would also free renewable generators from their requirement to liaise with a supplier in order to reach the market. However, it is the least effective index in terms of providing effective market signals for efficient despatch. Such a reference price would undermine the incentive to make plant available when prices are high, and would distort the short term market signals as any volatility in the within-day price would be compensated for by the CfD payment.

Furthermore, NETA does not provide a single cash out price that could be used as a half-hourly reference price. The alternative would be the APX half hourly index and we are unsure whether this has sufficient liquidity to provide a robust reference price. There would be a risk that on occasions such a price could either be distorted or even manipulated.

A short-term forward index (day ahead)

This could theoretically work but we do not believe a short-term forward index would provide a solution that works for all participants/technologies.

A day-ahead index would be much more volatile than other longer dated instruments and this would expect to create volatile cash flows from the CfDs. This approach could easily become unmanageable from a supplier's perspective if there were large volumes operating under a CfD creating significant working capital and cash flow management issues. As an energy supplier, we would strongly prefer a reference price that limited the price volatility element of the CfD payment to help manage the predictability and management of the resulting cash flows.

A short-term forward index will be correlated to the short term output of plants on the system. This has two disadvantages. Firstly, it weakens the impact of market signals to

encourage efficient scheduling and despatch of plant, and secondly it encourages all low carbon generators to hedge their output in the very short term which will undermine liquidity in forward markets.

A long-term forward index

A long-term forward index provides a number of advantages which apply to all technologies:

- It provides a CfD payment, the price of which is uncorrelated to short-term output variations, giving some volume risk protection.
- In turn, this enables to provide more predictability in CfD cash flows, enabling both the Agency and suppliers to better manage their exposure.
- This would provide much better visibility and signals to participate in forward electricity markets and enhance market liquidity.
- It will provide greater transparency on the value of firm secure generation and intermittent generation.
- As the price is set in advance, from a supplier's perspective, the cash flows are likely to be more predictable than under alternative indexation arrangements.

An intermediate index

A reference price based on a weekly or monthly forward price would be possible. However, we believe that these would neither deliver the benefits of a year-ahead forward index nor would they provide the protection that some intermittent generators expect from a short term reference price.

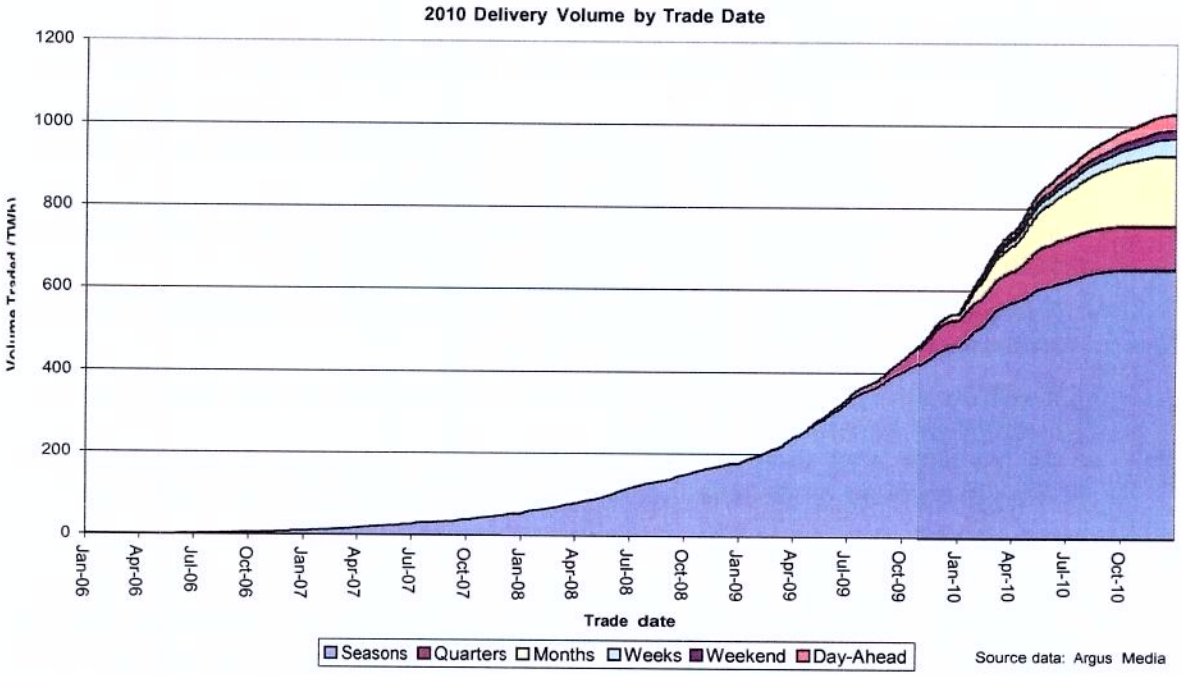
Market Liquidity

Further work will be required to consider the detailed implications of market reform on the level of liquidity and the liquidity needed to support the relevant price index or indices. In the context of Ofgem's review of market liquidity, we believe that there may be immediate steps that could be taken to address the specific needs of small suppliers and we will be writing to Ofgem on this topic shortly. However, beyond this development, Ofgem's liquidity review should be integrated into the development of EMR to ensure a consistent approach.

Considering existing market liquidity, we think that this supports the use of a long-term year ahead reference price based on Winter and Summer season contracts. However, as CfD FITs will not come into operation until the latter part of the decade and will lead to new market developments, we believe that it is necessary to look beyond existing market liquidity. We believe it is very likely that the development of a CfD mechanism will encourage the development of physical trades at an indexed price in parallel with CfD trading against the index. This is common in other commodity markets and potentially provides a good basis for enhancing market liquidity.

The chart below illustrates how trade volumes pertaining to delivery in the calendar year 2010 built up over time, by product. EDF Energy's analysis uses data provided by Argus

Media, and we are grateful to them for permitting us to include the chart in this document.



11. Should the FIT be paid on availability or output?

We believe that a CfD payment made on availability has many theoretical advantages over an output based CfD. In particular, it meets the need of low carbon generators to recover the costs of providing capacity and it also provides better market signals for the efficient operation of this capacity. However, we recognise the complexities associated with the definition and monitoring of availability, particularly with regard to wind generation. We also recognise that, although the principles of efficient market signals are very important, the practical difference between availability and output will remain relatively small for low marginal cost low carbon generators (such as wind and nuclear generators) until substantial progress has been made towards full decarbonisation. We therefore advocate a CfD model based on generation output on the basis that this will create a simple design that is relatively easy to implement.

However, for low carbon generators such as fossil plant with CCS which do not have a very low marginal cost, it is possible that there will be a much more significant difference between availability and output. For this reason, there may be a stronger case for considering an availability-based CfD for these plant to provide the right incentives while ensuring that these plant can earn an adequate return.

We provide below our assessment of pros and cons of either choice.

Availability based CfD – pros and cons

A CfD could have a fixed volume, not directly related to output, provided that the plant achieves a specified level of availability over a fairly long period. Assuming the generator sells its expected output forward at the reference price index, the difference between expected output and actual output is then exposed to the prompt market. This gives the right incentives for efficient despatch; there is no need to 'weight' the availability payments. This approach could work with either a long-dated or short-dated reference price.

Advantages

- The generator retains the incentive to respond to market signals and despatch as well as plan the maintenance of its plant efficiently.
- The volume risk taken on by the generator is mitigated partly as the payment is made on expected availability rather than actually output, which protects wind generators from low wind periods and all generators from outages.
- Defining availability over an average of several years (say, rolling three years average availability) would help increase this protection in the longer term.
- From the supplier's perspective, an availability CfD (particularly when combined with a long-term reference price) allows it to better predict the cash flows from the mechanism and the resulting costs to be passed through to consumers.

Disadvantages

- Defining, monitoring and verifying availability will be difficult, particularly for wind farms in low wind conditions and offshore wind farms that are difficult to access.

Output based CfD – pros and cons

This CfD covers every unit of power generated, including adjustments for Balancing Mechanism activity. The reference price could be a long-term index (e.g. year-ahead) or a short term index (e.g. day-ahead). This provides effective cover against price risk but does not mitigate against low utilisation risks in circumstances where too much capacity has been contracted.

Advantages

- Relatively simple concept, easy to implement; the key requirement is only to be able to measure output.
- Reduction of market risk as it gives certainty of revenues for all output.
- The risk of inefficient despatch decisions can be mitigated.

Disadvantages

- Suppliers (and consumers) could become subject to high variations and unpredictability of payments to generators, and are therefore less able to accurately fix long-term contracts.

12. Do you agree with the Government's assessment of the impact of an emission performance standard on the decarbonisation of the electricity sector and on security of supply risk?

EDF Energy agrees with the Government that an Emissions Performance Standard (EPS) will not in its own achieve decarbonisation of the electricity sector as this can only be achieved through a wider package of electricity market reform. It is essential that reform results in a strong carbon price and credible revenue for low carbon generation from the market that is protected from the distorting impacts of excessive subsidies for various technologies.

We support the principle of an EPS and believe that this could be a useful instrument in the future as either a form of regulatory backstop to ensure emissions from operational fossil plant are abated, or as part of the longer-term solution in removing residual emissions. However, although we welcome the Government's signal of its intent to phase out fossil-fuel generation, we believe that the immediate focus should remain on delivering new low carbon generation capacity by implementing the proposals for Carbon Price Support and electricity market reform.

We understand that the primary objective of the EPS is to prevent the construction and operation of new coal-fired power stations unless they are able to demonstrate sufficient CCS facilities. However, we are concerned that applying an EPS solely to new coal plant implies the acceptability of new unabated gas plant. Favouring one fossil fuel over another will not deliver the level of decarbonisation required to meet the UK's climate change objectives, and it will also pose a significant risk to the country's security of supply due to a lack of diversity. We believe that further investment in CCGTs, beyond the minimum that is required to bridge the gap to transition to low carbon technologies, will not be the right answer for the UK, because it will increase the risk that the long term reduction targets will not be met. It will lock in the higher carbon emissions from these new assets. As well as increasing the country's exposure to gas price risk, there would be little immediate contingency if CCS were delayed or found to be too expensive.

13. Which option do you consider most appropriate for the level of the EPS? What considerations should the Government take into account in designing derogations for projects forming part of the UK or EU demonstration programme?

EDF Energy believes that the choice of initial limit for the EPS should be based on the following factors:

- The contribution made to decarbonisation of the UK electricity generation sector;
- the impact on costs of power for consumers; and
- the impact on security of supply.

If generators are able to invest with confidence that they will be able to earn a reasonable return on their investment, then:

- A more demanding target (i.e. 450g/kWh) will drive faster decarbonisation; and
- there will be no difference in the impact on security of supply.

From a cost perspective, it is clear that initially, a 450g/kWh target will entail a higher cost than a 600g/kWh target because the additional capital and operating costs associated with CCS plants will outweigh the value of the saving on carbon emissions. However, over time, if CCS develops as a commercially viable solution, we can expect this cost differential to reduce and eventually reverse as:

- Capital and operating costs of CCS technology are driven down as the technology matures (moving from first-of-a-kind (FOAK) costs to n^{th}-of-a-kind (NOAK) costs); and
- the true value of carbon savings is better reflected through carbon pricing, secured by the application of Carbon Price Support.

The impact of the EPS will therefore be as a transitional safeguard against development of high carbon plant. EDF Energy believes that this safeguard will be more effective if it is targeted at the more ambitious level of 450g/kWh.

A further consideration is the potential cost of the future retrofitting of coal CCS plant if the rising carbon price support signals this to be viable (even for plant with grandfathered emissions limits). There is a risk that a less ambitious EPS emissions limit will lead developers to undersize their CCS capability (e.g. capture equipment, emissions transportation or storage which cannot be easily expanded), such that the future cost of retrofitting will be high. The mitigation of this risk further strengthens a case for a signal to invest in larger facilities at an earlier stage.

The UK/EU CCS demonstration projects will likely need some scope for flexibility of operation to mitigate initial operating and availability risk. The Government will need to consider the commercial viability of the projects to operate in line with emissions limits if they are constrained-off due to outages or the partial running of CCS equipment.

There is a high risk of the CCS demonstration equipment suffering a major unplanned outage. In this scenario, the operator would likely need to run unabated plant alone to maintain project cash flow. Operators would therefore need some form of derogation to their annual limit or the requirement for demonstration CCS units to run in parallel with unabated units in order to continue to prove the technology. The Government will also need to consider how, and over what period, these derogations for demonstration plant will be amended or removed.

14. Do you agree that the EPS should be aimed at new plant, and 'grandfathered' at the point of consent? How should the Government determine the economic life of a power station for the purposes of grandfathering?

EDF Energy agrees that the EPS should only be applied to new plant and 'grandfathered' at the point of consent as this will help provide investor certainty.