



Department of Energy and Climate Change  
3 Whitehall Place  
London  
SW1A 2AW

10<sup>th</sup> March 2011

Dear Sir/ Madam,

**Department of Energy and Climate Change: Electricity Market Reform Consultation**

InterGen is pleased to be afforded by the Department of Energy and Climate Change the opportunity to comment on its consultation on Electricity Market Reform ("EMR"). This proposed reform and the Ofgem liquidity review running in parallel is potentially monumental for InterGen and the wider energy industry in the UK. InterGen supports fully the Government's commitment to achieving its climate change, security of supply and affordability targets. InterGen's view is that this can be achieved only by encouraging a diverse generation mix operating within a truly competitive environment in order to protect the interests of consumers.

InterGen is the UK's largest and most successful new entrant independent generator, having invested £1.4 billion in the UK since 1995. InterGen owns and operates three highly efficient gas fired power stations in the UK totaling 2,490MW and actively trades in the prompt and forward wholesale power, gas and emissions markets. InterGen is currently pursuing a number of development opportunities in the UK including the construction of two further 900MW gas fired power stations, representing a further £1.2 billion of investment.

InterGen can only commit to continuing investment in the UK if the outcome of the EMR allows us to do so. As an independent generator, InterGen relies solely on project finance and the backing of overseas shareholders to develop generation projects in the UK. InterGen's existing gas assets will struggle to survive in a market focused on providing significant subsidies to renewable and nuclear technologies. Given these subsidies, InterGen believes that a capacity mechanism that rewards flexibility is essential to sustaining its existing fleet. Furthermore, even if capacity margins are tight, InterGen's planned UK projects will be unable to obtain finance (e.g. via the EC's proposed Project Bond or project financing) to support their construction unless a capacity mechanism for flexible generation is introduced.

InterGen believes the survival and continued growth of the independent generation sector, including gas fired generation, is fundamental to encouraging a diverse and competitive UK energy market. Independent generators and suppliers encourage competition and ultimately help to deliver value for money for consumers. InterGen urge DECC to consider carefully the role of the independent sector in its EMR design to ensure that existing independents can flourish and new entrants are encouraged into the market.

InterGen would be happy to discuss further any of the points raised in our response.

Yours sincerely,

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**DECC Electricity Market Reform Consultation Document**  
**Response by InterGen (UK) Ltd**

**Executive Summary**

InterGen believes that:

- Large-scale reform of the wholesale electricity market is required to support the Government in meeting its long-term three-fold objective of delivering a low-carbon future, maintaining security of supply and ensuring affordability for consumers.
- Market reform must lead with improvements in liquidity to ensure that the widest spectrum of investors and participants have access to the UK market. Wholesale market liquidity has declined in the UK during the last decade as larger companies have become increasingly vertically integrated to protect themselves from electricity market price volatility. A liquid market is a precursor to encouraging more independent companies and financial institutions into the market, providing much needed competition which benefits consumers.
- The threat to security of supply in the coming decade is significant. InterGen believes that gas-fired generation will play an increasingly important role by:
  - Continuing to contribute to carbon emissions reductions targets by replacing more carbon intensive fossil-fired generation such as coal; and
  - Providing clean, reliable and flexible generation capacity to support the increasing penetration of inflexible and intermittent low-carbon technologies in the UK, such as wind generation and new nuclear.
- The transition to a decarbonised energy sector will require a change in the current arrangements to allow for the continued economic operation of flexible generation capacity in order to alleviate security of supply concerns.

***Desirable outcomes of EMR:***

- To provide a complete and coherent package of measures which is robust and flexible enough to work in a wide range of demand and fuel-price scenarios, is cost-effective and is broadly supported by the industry and mainstream political parties. This offers the UK a stable and durable regulatory environment which is essential to secure long-term investor confidence.
- The Government's proposed package of carbon price support, FITs for low-carbon generation and a capacity mechanism, could form the basis of a stable environment in which its low-carbon objective can be delivered. Such a package must include long-term support for the flexible and efficient gas-fired generation required to meet peak demand and demand when intermittent renewables cannot generate.

- Long-term security of supply and the lowest costs for consumers can only be delivered if a truly competitive, liquid, rational and transparent wholesale market also exists. InterGen welcomes Ofgem's continued focus on wholesale electricity market liquidity and believes that action to improve liquidity is an essential precursor to EMR. InterGen believes that vertical integration is not compatible with a competitive and liquid market and that steps must be taken to require vertically integrated companies to trade progressively increasing percentages (ultimately 100%) of their generation via the wholesale market, coupled with progressively greater physical separation between the wholesale and retail supply businesses and separation of accounting and reporting. InterGen believes that a fully competitive and liquid electricity market will be achieved only once this process is complete.
- InterGen proposes that an annual statement to Parliament discloses which firms have benefited from each of the EMR elements. This report should contain information on carbon price support, FIT rates, capacity mechanism costs and nuclear waste liabilities. This will ensure that taxpayers have clarity on what technology types are being supported and the costs of that support.

#### ***Specific needs for the three key elements of the proposed reforms***

- Carbon price support requires careful implementation and long-term clarity to ensure that market participants can continue to manage carbon and electricity market price risk and that there are no unintended consequences from interactions with the EU Emissions Trading Scheme.
- The capacity mechanism should:
  - Address the issue of the intermittency of renewable generation by rewarding the provision of *flexible capacity*, rather than simply *capacity*;
  - Provide long-term support for all types of flexible plant, not just traditional 'peaking' plant. That support should apply equally to existing and new plant; and
  - Give clear long-term price signals in order to support the financing needed by independent generators to construct new flexible capacity (via the likes of the EC's proposed Project Bond or project financing).
- The FIT regime should:
  - Allow low-carbon generation to be financially supported in a transparent manner;
  - Ensure sufficient, though not excessive, returns are made (including the aggregate of power prices and FIT);
  - Ensure such generation retains significant exposure to short-term price signals in order to encourage efficient generator behaviour and hence provide value to consumers.

InterGen's responses to the EMR consultation questions are included below.

## **Current Market Arrangements**

### **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?**

InterGen believes that with appropriate banding of Renewable Obligation Certificates for each technology, the existing Renewables Obligation ("RO") can achieve significant growth in renewable generation. However, InterGen agrees that the RO does not support sufficient investment in other low-carbon generation (primarily nuclear) to meet the UK's ambitious environmental targets.

The UK's target for 15% of energy consumption to come from renewable sources by 2020 requires approximately 30% of electricity production from renewable sources. To meet the Government's target of an 80% reduction in carbon emissions (relative to 1990 levels) by 2050 in a cost-effective manner will require the electricity sector to be largely decarbonised during the 2030s. Despite the financial support given to renewable generation through the existing RO at its present banding levels, most analysts agree that the incentives for new offshore wind and nuclear generation are insufficient to ensure a rate of investment that will meet these targets, though this will to a certain extent be addressed through a market driven electricity price with a high Carbon Price Floor.

InterGen agrees with the Government's assessment that reform of the current market is needed in order to meet the ambitious environmental targets and ensure that the lights stay on throughout the coming decade. InterGen would urge, however, that the programme of reform must evolve with investment at the forefront of thinking at all times. An estimated £200 billion of investment in generation and transmission is required to meet the 2020 targets, and investors will not be comfortable backing projects in the UK until the future is more certain. A clear, simple message from Government on the direction the EMR will be taking in the upcoming White Paper is essential to support continued growth in the coming years.

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

InterGen shares the Government's concern that there is a high risk to security of supply under the current market arrangements owing to the likely lack of new flexible gas plant investment, coal generation investment (with CCS unproven on a large commercial scale), the current focus on renewable generation and new nuclear being at present uneconomical. An estimated 20GW of flexible fossil-fired plant will close by 2020 due to age and environmental regulations. As the penetration of subsidised intermittent renewable and inflexible nuclear generation increases, the load factors and revenues of existing flexible plant will decline which could accelerate plant closures. This is contrary to the requirement for an acceptable level of security of supply which drives the need for existing flexible low-carbon gas-fired plants to remain in operation and will require significant new flexible generation capacity to be developed and commissioned. Reform of the market arrangements is therefore required to remunerate flexible plant sufficiently and to ensure an acceptable level of security of supply is achieved in a cost-effective manner.

## Options for Decarbonisation

### Feed-in Tariffs

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

InterGen has summarised the main pros of each type of FIT (as described in the EMR consultation paper) in the table below.

	<b>All FITs</b>	<b>Fixed FIT</b>	<b>Premium FIT</b>	<b>FIT with CfD</b>
<b>Pros</b>	<p>Improved revenue certainty compared to the RO, resulting in a lower cost of capital for financing projects.</p> <p>Increased certainty of meeting renewable and decarbonisation objectives compared to RO.</p>	<p>Attractive to small independent generators (removes market price, offtake and balancing risk).</p> <p>No requirement for a route to market for generation.</p>	<p>Closest to existing RO and easiest to implement.</p>	<p>Generators incentivised to generate and sell power at times of high price, contributing to security of supply.</p> <p>Attractive to small independent generators (removes market price risk) and provides suitable investment signals.</p> <p>Least impact on consumer bills (according to modelling) as provides revenue certainty (lowering cost of finance) and avoids risk of excessive payments during times of high power prices.</p>
<b>Cons</b>	<p>Process for setting the price level has to be determined.</p>	<p>No incentive to generate at times of high prices, impacting security of supply and increasing balancing requirements from the rest of the system.</p> <p>Detrimental to wholesale power market liquidity.</p>	<p>Generator retains market price risk which may result in over- or under-rewarding.</p> <p>Lowest reduction in carbon emissions due to slower investment in low-carbon generation.</p> <p>Least confidence in meeting carbon reductions in low gas and carbon (and hence power) price scenario.</p> <p>Highest impact on consumer bills (according to modelling).</p>	<p>Most complex to implement.</p>

InterGen generally agrees with the above qualitative assessments. However, it believes that the Government's findings in relation to the impact on consumer bills (and / or tax payers) will depend on the reaction of sponsors and lenders of low-carbon projects, the level at which the FIT is set and the period over which the impact is assessed.

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

InterGen's view is that the RO, with appropriate banding, could achieve the renewables build targets. Sponsors and lenders are now very familiar with the RO scheme and it will take some time for the market and banks to understand and respond to any new arrangements. The recent removal of agreed subsidies for existing renewable projects in Spain has highlighted the regulatory risks faced by investors and therefore any change away from the RO will likely cause some hiatus in lending. However, if the system is simple and the returns stable and calculable, this should not act as a long-term barrier to investment.

InterGen believes that the decision between Premium FIT and FIT with CfD is finely balanced. Both require generators to find a route to market for their power and ensure they retain imbalance risk, which will prevent further deterioration of liquidity in the near-term wholesale market. Both place incentives on generators to act efficiently by making low-carbon plant available at times of higher electricity prices (i.e. times of high demand, high fossil-fuel prices or low output from intermittent generation).

On balance, InterGen agrees with the Government's preferred option of introducing a FIT with CfD. Although it is the most complex to implement, this option avoids under or over rewarding generators as wholesale electricity prices move and should prove attractive to smaller generators through removal of market price risk and hence lowering the cost of financing.

The expansion from renewables only for the RO to all forms of low-carbon generation in a FIT scheme, would, of course, include nuclear. InterGen has always supported new nuclear on a no-subsidy basis as a pathway to reducing carbon emissions in the longer term. Consequently, InterGen does not accept that the FIT scheme should provide a subsidy to nuclear, given it will benefit from the carbon floor price and a potential cap on waste management liabilities.

**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?**

Unless the Government removes some element of risk from investment in low-carbon generation it is unlikely to meet its environmental targets as such generation remains uneconomical without support. The main uncontrollable risk for investors is the uncertainty in the wholesale electricity price, driven largely by uncertainty in fossil fuel prices and the carbon price, which in turn is driven by uncertainty in the EU target reduction and the Government's proposals for a carbon price support mechanism. Whilst the FIT with CfD and Fixed FIT both remove the long-term electricity price risk, the Fixed FIT removes other risks (offtake and

balancing) which established generators are best placed to manage and removal of which could severely impact electricity market liquidity.

Premium FITs do not remove long-term electricity price risk and would therefore need to be set at a higher level to yield similar investment incentives to the FIT with CfD or Fixed FIT. Against this the FIT with CfD is more complex than the Premium FIT and would introduce basis risk between the reference electricity price for the CfD and the achieved electricity price, reducing the cost benefit of the FIT with CfD over the Premium FIT. On balance, InterGen believes that the CfD FIT is likely to give consumers slightly better value for money compared with the Premium FIT.

To the extent that risk is removed from renewable generators and renewable deployment is increased, this will cause reduction in the load factors of the flexible plants necessary to provide generation in low wind conditions. This will result in a commensurate reduction in flexible plant revenues and therefore a long-term support mechanism such as a capacity mechanism will be needed to ensure the continued economically viable operation of flexible generation. This is discussed further in our response to Question 19.

**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?**

If a low-carbon generator is correctly incentivised by price signals it will, where possible, divert generation into periods during the day with the highest electricity price and into days when the average price is higher than other days. Conversely, it will incentivise planned maintenance and storage of energy to occur during low price periods and days.

This can be achieved by calculating the difference payment in the manner described in the response to Question 10.

**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?**

As stated in Box 5 of the consultation paper, all 3 types of FIT improve the revenue certainty for low-carbon generators compared to the status quo and so will reduce the cost of capital for new investment in such capacity. As more risks are removed or reduced, so the cost of capital will be reduced. Accordingly the Fixed FIT should provide the lowest cost of capital, followed by the FIT with CfD and then the Premium FIT option.

**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?**

The impact of the different types of FIT on the availability of finance for low-carbon investment will depend on the level of the FIT, the duration for which the tariff is guaranteed and how these compare to levels and durations that are available in other countries. Obviously, the most risk averse FIT (Fixed) will give the greater access to capital for new and existing investors. However, it removes all reference to the wholesale



market price of electricity and hence will reduce efficiency and value for money to the consumer. Accordingly, the FIT with CfD, with its greater focus on near-term market exposure, produces the right balance between market efficiency and cost of capital.

**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?**

It is anticipated that the implementation of any FIT will have a greater relative attraction for smaller and independent generators than for larger, vertically-integrated companies, who are already incentivised to build renewable generation to internally satisfy their Renewables Obligation. A FIT with CfD would insulate generators from the long-term market price of power but retains the requirement for a route to market and so should prove attractive to established independent generators.

**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?**

InterGen is concerned that the introduction of a large volume of subsidised intermittent capacity will increase the uncertainty of flexible plant dispatch patterns. This could undermine attempts to improve longer-term market liquidity because uncertain output cannot be sold forward. InterGen believes that a truly competitive, transparent, robust and liquid wholesale electricity market is an essential precursor to electricity market reform.

For the FIT with CfD to be effective, a robust reference price that can be achieved by an active market participant is essential. It would be possible for the CfD payment level (in £/MWh) for each day to be calculated as the strike price less the average of the 48 half-hourly Market Index Prices (MIPs). This would retain the incentive on intermittent low-carbon generators to target their generation within the half-hourly periods of highest prices. However, it does not encourage them to transact in the long-term forward market.

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

Provided the FIT design incentivises the generator to divert generation to periods and days of higher prices, the best practicable solution would be for the FIT to be paid according to metered generation.

### Emissions Performance Standards

#### **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?**

InterGen does not consider the Emissions Performance Standard ("EPS") an essential part of EMR: rather it is a backstop against investors making the counter-intuitive decision to invest in high-carbon generation. The EU Emissions Trading Scheme ("EU ETS"), Large Combustion Plant Directive and Industrial Emissions Directive already incentivise emissions reductions from fossil-fired plants which will be driven down further by the introduction of a Carbon Price Floor. Furthermore the National Policy Statements already state that unabated coal plants will not be permitted as new coal plants are required to fit 300 MW with CCS.

An EPS is unlikely to noticeably increase the rate of decarbonisation of the electricity industry, except in circumstances where, despite the introduction of a Carbon Price Floor and existing environmental legislation, high-carbon generation remains economically attractive (perhaps due to exceptionally high gas prices and low coal prices, for example). In such an event, the Government may consider its affordability objective to be the more appropriate constraining factor. In the event that an EPS did cause a meaningful reduction in UK emissions, the EU ETS cap would simply allow a corresponding increase in emissions elsewhere.

CCS is currently an emerging technology and prematurely introducing an EPS may unintentionally restrict the development of the full range of technologies under the CCS Demonstration Programme. More widely, the presence of an EPS which may subsequently be tightened or retrospectively applied will make investors wary of investment in back-up fossil-fired generation in the UK. Both issues increase the risk to security of supply in the longer-term.

#### **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?**

If an EPS is to be introduced, it should be without exemptions and allow the full range of CCS technologies to be further developed. Accordingly the higher rate of 600gCO<sub>2</sub>/kWh would be appropriate.

#### **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?**

If it is implemented, the EPS should be limited to preventing the construction of new unabated coal plants and should be grandfathered at the time consent for the plant is given. CCS on gas plant would reduce their flexibility and such CCS technology is commercially unproven on a large scale. Consequently, new gas plants should remain unabated at least until such time as the technology has developed.

**15. Do you agree that the EPS should be extended to cover existing plant in the event they undergo significant life extensions or upgrades? How could the Government implement such an approach in practice?**

No. It would be extremely difficult to define what would constitute a significant life extension or upgrade and such extensions or upgrades may, perversely, prevent implementation of plant improvements that would reduce emissions levels if these were to result in the introduction of an EPS. This will deter investment in maintaining and improving the efficiency of existing plants, which is counterproductive in terms of value for money and security of supply.

**16. Do you agree with the proposed review of the EPS, incorporated into the progress reports required under the Energy Act 2010?**

The progress reports should be used to consider the progress of development of CCS technology and whether or not further environmental legislation is required to achieve the Government's objectives at the time.

**17. How should biomass be treated for the purposes of meeting the EPS? What additional considerations should the Government take into account?**

InterGen does not wish to comment on this question.

**18. Do you agree the principle of exceptions to the EPS in the event of long-term or short-term energy shortfalls?**

No. In such energy shortfall events, the wholesale price of electricity should be allowed to rise sufficiently to send price signals to investors that additional plant capacity is required. This is will not happen if market signals are dampened by the relaxation of environmental legislation.

#### **Options for Market Efficiency and Security of Supply**

Given the anticipated large increase in subsidised renewable and nuclear generation, a strong case can be made for introducing a capacity mechanism that supports flexible fossil-fired generation capacity. InterGen believes that the consultation paper discussion is too narrowly focused on a targeted capacity mechanism which rewards a selected volume of 'peaking' plant. In the responses that follow, we argue that:

- A capacity mechanism should recognise the need for, and reward the provision of, flexible capacity rather than simply capacity; and
- There is a need for long-term support for all types of flexible plant, not just traditional 'peaking' plant. That support should apply equally to existing and new plant.

InterGen believes that existing and new highly efficient gas fired generation capacity is an essential provider of the required flexible capacity.

InterGen has, along with a number of other independent generators, commissioned Oxera to review the potential requirement for some form of capacity mechanism in the UK market and suggest how that mechanism might be structured. The full Oxera report *GB Capacity Mechanism Design* ("The Oxera Report") will be submitted to DECC collectively by those independent generators. The report's Executive Summary, containing the key findings of their analysis, can be found in Appendix A of this response. InterGen has used the findings of the Oxera report to inform its responses to the following questions.

**19. Do you agree with our assessment of the pros and cons of introducing a capacity mechanism?**

***The future need for system capacity and flexibility***

An estimated 20GW of flexible fossil-fired plant will close by 2020 due to age and environmental regulations. As the penetration of subsidised intermittent renewable and inflexible nuclear generation increases, the remaining flexible fossil-fired plants plus a significant amount of new flexible generation capacity will be required to achieve an acceptable level of security of supply. The problem is not simply that sufficient capacity is required at the peak of Net Demand (meaning demand minus inflexible nuclear and intermittent wind generation), but that sufficient flexibility is available when Net Demand is changing rapidly (i.e. when demand swings are enhanced by opposing changes in wind output).

InterGen is concerned that the consultation paper focuses on a traditional capacity mechanism, ensuring only the ability to meet peak demand. It does not giving sufficient consideration to the requirement for generator **flexibility** to cater for variations in both demand and renewable generation output and InterGen urges DECC to give greater consideration to this issue.

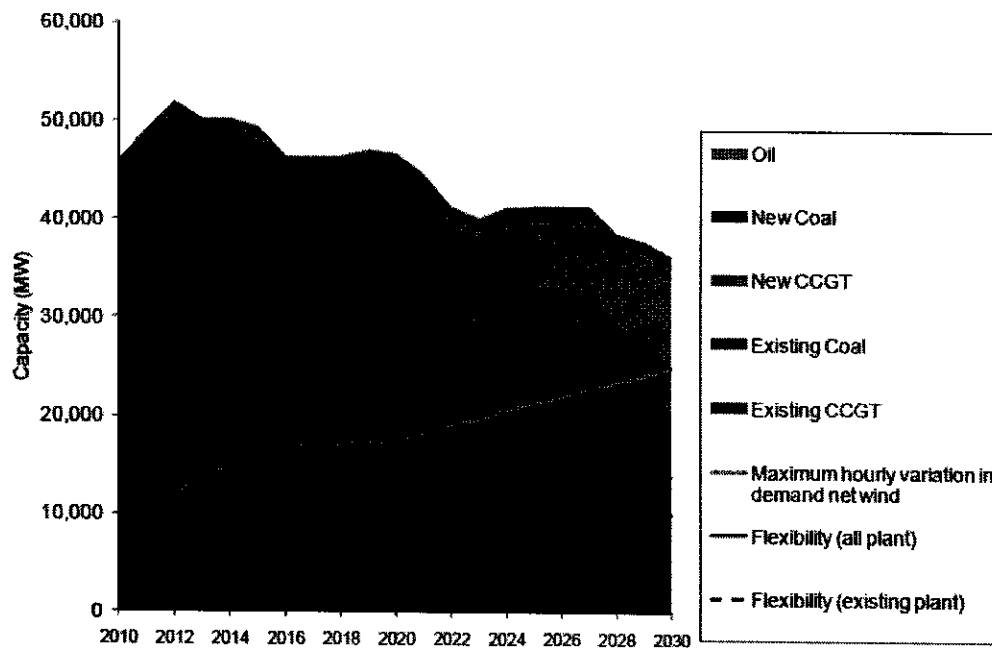
The Oxera Report examines the requirement for and provision of system flexibility<sup>1</sup>. Figure 1<sup>2</sup> demonstrates that as the provision of flexibility from existing plant decreases in time due to retirement of capacity (dotted black line), so the system requirements for flexibility increase as the volume of intermittent capacity increases (solid grey line). The graph indicates that system flexibility is expected to be relatively tight between 2015 and 2020, after which substantial new flexible capacity is required.

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<sup>1</sup> The Oxera Report: Chapter 2

<sup>2</sup> The Oxera Report: Figure 2.6

Figure 1: Supply of, and requirement for, hourly flexibility



Thus the system not only has to ensure it has sufficient *capacity* available to meet peak demand net of wind and nuclear output but also sufficient *flexibility* available to meet load changes. Ideally then, a capacity mechanism should recognise the need for, and reward the provision of, flexible capacity rather than simply capacity.

#### ***The economics of flexible fossil-fired generation capacity***

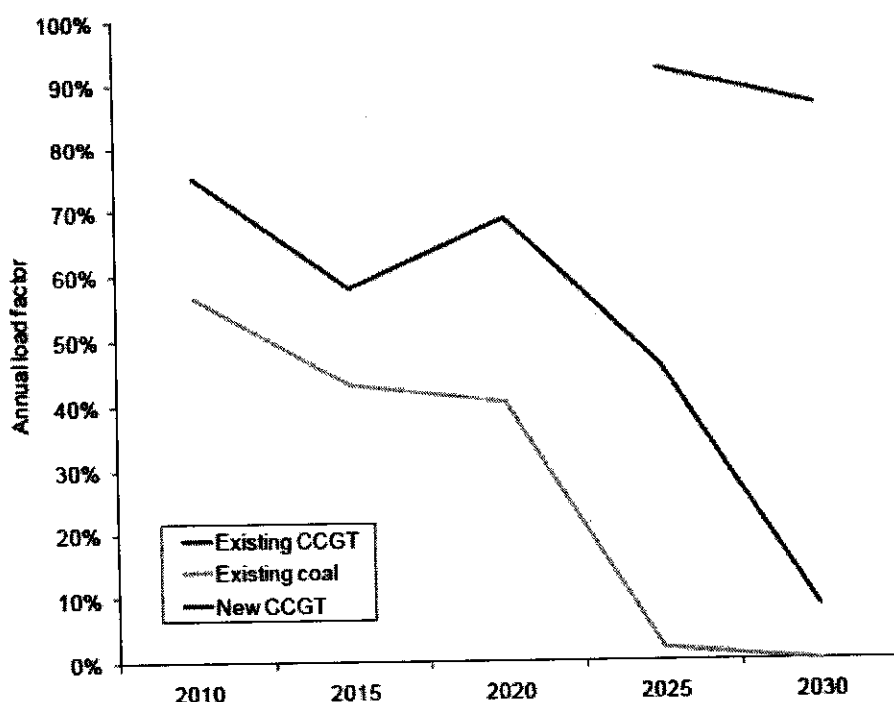
As the penetration of subsidised intermittent renewable and inflexible nuclear generation increases, so the role of existing and new flexible fossil-fired generation capacity will increasingly become one of covering that demand not met by low-carbon generation sources. Accordingly load-factors of flexible plant will decrease and it becomes increasingly difficult for that plant to hedge its exposure to volatile power prices.

The Oxera Report examines the issue of price capture in more detail<sup>3</sup>. As plant despatch patterns move away from the traditional and reasonably predictable relationship with the daily and seasonal demand profile, it becomes increasingly difficult for flexible plant to predict its future running regime with any degree of accuracy. It will therefore become increasingly difficult to hedge this output in the wholesale power market using existing tradable products. As a consequence it becomes necessary to hedge a greater proportion of generation in the near-term market (which is anticipated to become increasingly volatile, making capture of the reference power price difficult) with a corresponding decrease in the longer-term market liquidity. Furthermore, in the event that a targeted capacity mechanism were implemented, the relatively small volume that would be supported under such a scheme could have a disproportionate impact on reducing the peak power prices earned by plant outside of the mechanism (see response to Question 21).

<sup>3</sup> The Oxera Report: Chapter 3

The Oxera Report also examines the impact of decreasing load factors on existing flexible plant<sup>4</sup>. Figure 2<sup>5</sup> shows a rapidly decreasing load factor is expected for existing CCGT plants, from around 70% over the next decade to as little as 10% by the end of the next. As the cycling and part-loading requirements for this plant increase so the fixed cost base of this plant will increase. Forced and planned outage costs and frequencies will increase, as will operation and maintenance costs whilst average efficiency will decrease. This will yet further accelerate plant economic problems far ahead of the rate of decline of load factor and revenues.

Figure 2: Forecast annual plant load factors



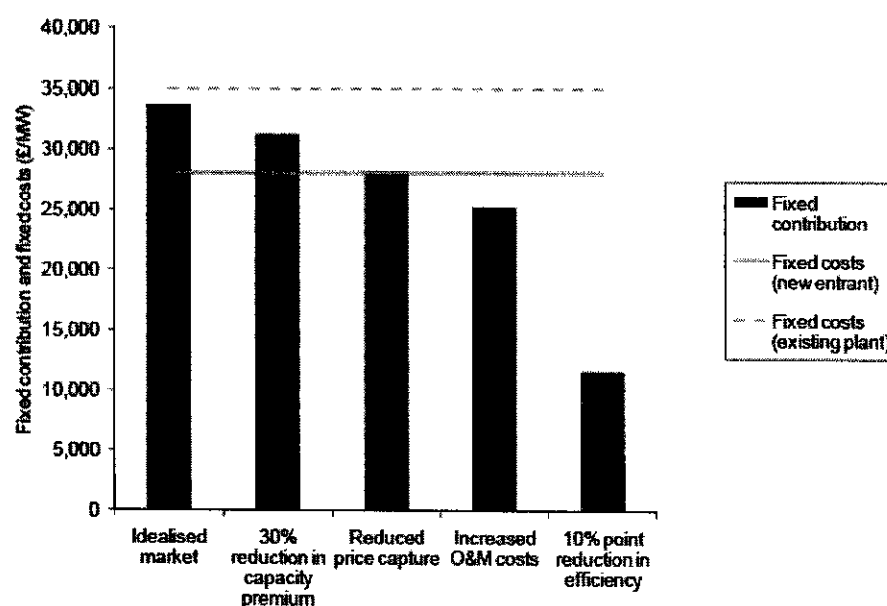
Putting these issues together the economic viability of existing CCGTs (and coal plant) looks increasingly unfavourable, as illustrated in Figure 3<sup>6</sup>. This shows that the combination of price capture difficulties, price distortions and increased operational costs may, by 2020, leave an existing CCGT (or coal plant) unable to cover its fixed costs by a considerable margin (right hand bar on graph) and with no prospects of a market recovery. Hence, without any further source of revenue, it would be decommissioned. However, as Figure 1 illustrates, that capacity is essential to meet security of supply and system flexibility requirements. Accordingly there is a need for long-term support for all types of flexible plant, not just traditional 'peaking' plant. That support should apply equally to existing and new plant.

<sup>4</sup> The Oxera Report: Chapter 4

<sup>5</sup> The Oxera Report: Figure 4.1

<sup>6</sup> The Oxera Report: Figure 4.9

Figure 3: Impact of market distortions on CCGT earnings (2020)



It is possible, although unlikely, that the Big 6 vertically integrated companies would build new generation without change to the wholesale market, relying on revenue from elsewhere in their value chain (InterGen believes that some of the companies look at the whole value chain, effectively subsidising generation investment through the value achieved from their retail operations). However, it has been widely reported that the Big 6 companies do not themselves have sufficient resources to construct all the new generation capacity required in the UK. Independent generators will also be required to construct some of this capacity and bring much needed competition to the electricity market, ensuring better value for consumers. Consequently, a stable and long term capacity mechanism is also needed to support new flexible plants and the financing of such (e.g. via the EC's proposed Project Bond or project financing). Without such a mechanism we believe that new flexible plant will not be built and there will be a significant security of supply problem – possibly by 2017.

**20. Do you agree with the Government's preferred policy of introducing a capacity mechanism in addition to the improvements to the current market?**

If the Government's only objectives were to reduce carbon and maintain security of supply at minimum cost, InterGen believes that rather than reforming the market simply remove all subsidies (principally the RO) and impose a progressively tighter carbon cap. The market would then provide the carbon reduction in the lowest cost manner, driving innovative methods of doing so. Market price spikes would provide the incentive to maintain and develop sufficient flexible generation, albeit on this aspect the cost would be high due to the volatility of the expected returns.

However:

1. The theoretical perfection of the carbon cap only / no-subsidy market would be rendered useless by the complete loss of investor confidence when the subsidies underpinning existing projects were removed; and
2. The government has additional objectives, for example technological and fuel / fuel supply geopolitical diversification, which the carbon cap would not address.

Therefore a capacity mechanism has to be introduced.

The consultation paper considers a number of additional changes to the current market, namely: calculation of imbalance (or cashout) prices, changes to the procurement of balancing services, management of intermittent renewables and improvement of market liquidity. These are considered in turn below.

#### ***Cashout prices***

InterGen believes that sharpening imbalance prices will send a positive signal to flexible generators through suppliers, as suppliers will be more strongly incentivised to contract for sufficient generation and flexible generators will be most able to respond quickly to increase or reduce load to avoid imbalance prices. However, flexible generators will be operating at lower load factors in the latter part of the decade and whilst flexible generation will be incentivised to respond quickly at times of system pressure to take advantage of potentially high imbalance prices, InterGen believes that overall this incentive will be ineffective in making flexible capacity economic. This is because sharp imbalance prices will also result in massive penalties for unavailability which will render investment (both by shareholders and debt funders) in flexible generation unattractive. Hence, while an attractive theoretical option, InterGen does not believe that sharpened incentives will attract necessary investment in flexible generation but will reduce investment attractiveness (as such a mechanism will not give the long term price signal visibility needed to attract bond holders or banks).

#### ***Management of intermittent renewables***

InterGen does not believe that intermittent renewable generators should face reduced imbalance risk as this would not be consistent with the objective of minimising the financing cost of renewables. This issue should instead be taken into account when setting the level of support in the FIT scheme.

#### ***Procurement of balancing services***

Given the proposed introduction of a capacity mechanism it would be appropriate to review the manner in which the System Operator procures balancing services ahead of Balancing Mechanism timescales to ensure that the schemes are complementary and do not over- or under-reward the provision of such services. This may require the merging of the STOR contract part of the SO procurement into the capacity mechanism arrangement. The remaining flexibility services contracted by the SO should not be modified as their timescales are shorter than the credible capacity mechanism time base.

#### ***Improvement of market liquidity***

New players will be encouraged to enter the market if the current low levels of liquidity are improved. Improved liquidity will make long-term price signals more robust and transparent which will assist smaller independent players who rely on project finance and investment from banks. InterGen is pleased that Ofgem has committed to continuing their work in this area to complement the EMR proposals.



Vertical Integration is incompatible with a competitive and liquid market. InterGen recognises the important role of the large balance sheets of the vertically integrated players in taking forward certain technologies – nuclear, offshore wind and wave. However, InterGen believes that to develop a competitive and liquid electricity market the activities of generation and supply need to be separated. InterGen's proposal is that Ofgem should introduce a self-supply licence condition requiring vertically integrated companies to trade progressively increasing percentages (ultimately 100%) of their generation via the wholesale market, coupled with progressively greater physical separation between the wholesale and retail supply businesses and separation of accounting and reporting. InterGen believes that a fully competitive and liquid electricity market will be achieved only once this process is complete.

**21. What do you think the impacts of introducing a targeted capacity mechanism will be on prices in the wholesale electricity market?**

The consultation document highlights the potential for market distortion arising from a targeted capacity mechanism. InterGen agrees that the two issues described: that peak prices may not adequately reward ineligible capacity (the “missing money” problem) and that the only capacity that will get built is that which is eligible for payments (the “slippery slope”), are both major concerns.

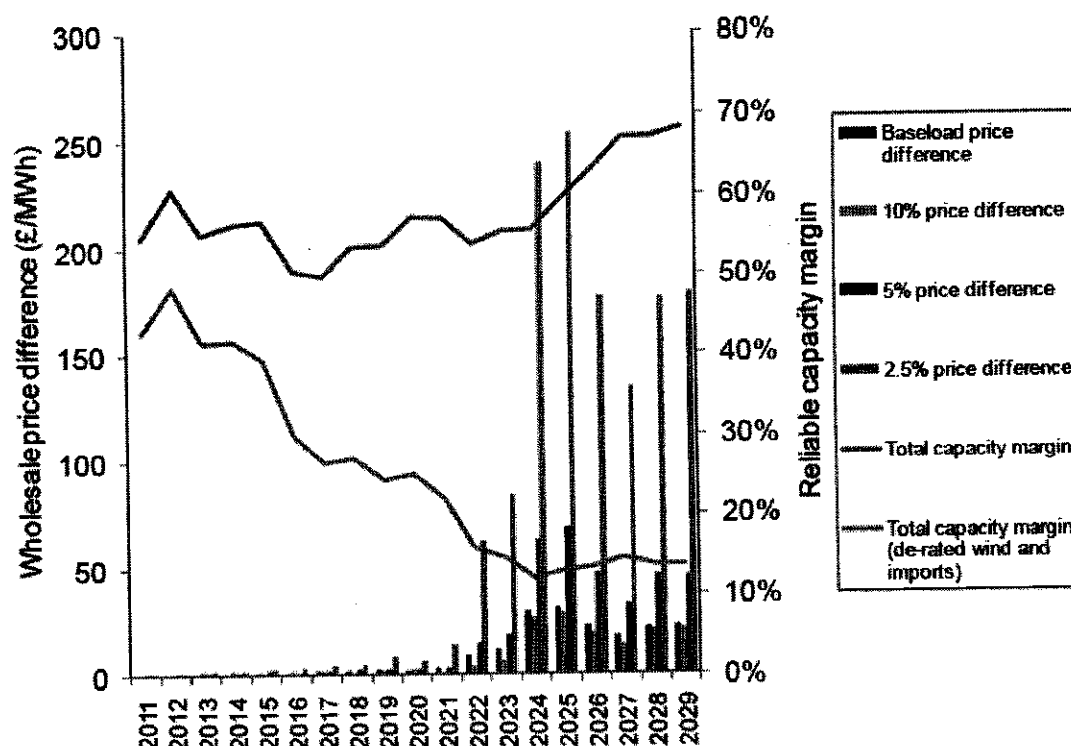
The Oxera Report illustrates the magnitude of the price distortion that may arise from an additional 5.4 GW of peak capacity, the minimum amount anticipated in the consultation paper to be supported by a targeted capacity mechanism<sup>7</sup>. Figure 4<sup>8</sup> shows the considerable reduction in peak prices (e.g. those that occur 2.5% of the time (brown bars)) that can be caused by this additional capacity as the system capacity margin tightens (green line). This reduction in peak prices, coupled with the anticipated reduced load factors of existing flexible generation, demonstrates the reduction in revenue that would be realised by the unsubsidised plant outside a targeted capacity mechanism, leading to that plant's early closure and exacerbating the requirement for additional supported capacity.

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<sup>7</sup> The Oxera Report: Chapter 3.4

<sup>8</sup> The Oxera Report: Figure 3.2

Figure 4: Price distortions from additional 5.4 GW of peaking capacity



Accordingly InterGen does not support the introduction of a targeted capacity mechanism aimed only at supporting a selected volume of peaking plant. A well designed market-wide capacity mechanism would be the most cost effective way to deliver and maintain the required level of flexible generation and hence minimise the cost to consumers. The design of such a scheme is outlined in the response to Question 22.

**22. Do you agree with Government's preference for the design of a capacity mechanism:**

- a central body holding the responsibility;
- volume based, not price based; and
- a targeted mechanism, rather than market-wide.

InterGen is concerned that the Government's stated preference for a targeted capacity mechanism is based on limited quantitative analysis, the results of which are particularly sensitive to the assumptions made on fuel costs and the value of lost load. Accordingly, more attention should be given to a qualitative assessment of the benefits of a targeted versus market-wide capacity mechanism based on flexible capacity. Furthermore, the proposed targeted mechanism is based on the Swedish Peak Load Reserves model which has received much criticism recently for its potential for price distortion.

The consultation paper states that any capacity mechanism should be assessed against 4 broad principles: cost-effectiveness, durability and flexibility, practicality and coherence. The Oxera Report provides a high-

level outline of how an alternative market-wide capacity mechanism based on flexibility requirements might be structured with these principles in mind<sup>9</sup>. In summary the proposed scheme would work as follows:

- An annual flexibility requirement (potentially covering more than one time-scale e.g. hourly and daily requirements) would be calculated based on wind capacity and expected variations in output, demand variations, and a security standard (e.g. a requirement to meet 3 standard deviations (or 99.7%) of expected hourly variations in demand-net-wind);
- A total annual revenue amount would be determined based on this annual flexibility requirement and the costs and revenues of the providers of flexibility;
- The annual revenue amount could be split between different time periods; a fixed element and an after-the-event element based on demand and wind outturn (so that revenues increase when flexibility requirements are highest across the year and across the day); and
- All flexible generation and demand participants available within a given period would be eligible to receive a share of the revenue available in that period based on their flexibility.

Such a scheme would have a number of benefits:

- It recognises the requirement for and rewards the provision of flexibility;
- It rewards flexibility at the time it is most needed, increases as the flexibility margin tightens and decreases as the margin grows;
- It does not discriminate between existing and new capacity;
- It can recognise flexibility offered by demand side response;
- A degree of stability can be introduced through the split of revenue between ex-ante and ex-post amounts;
- Short-term price signals are created by the ex-post calculation of flexibility revenues;
- Longer-term investment signals for new flexible capacity arise from the mechanistic determination of annual revenues based on wind penetration, demand growth and variability and system flexibility;
- The calculated size of the total annual revenue amount limits the scope for under- or over-rewarding ("double payments" or windfalls); and
- It is centrally administered, is non-discriminatory and does not present a significant barrier to new entry.

Whilst such a scheme requires considerable further development, particularly to balance the need to incentivise new generation while not over-rewarding existing, InterGen believes that this should be undertaken as part of a thorough and urgent appraisal of potential capacity mechanisms.

**23. What do you think the impact of introducing a capacity mechanism would be on incentives to invest in demand-side response, storage, interconnection and energy efficiency? Will the preferred package of options allow these technologies to play more of a role?**

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<sup>9</sup> The Oxera Report: Chapter 5

InterGen can only comment on this at the most general level. Introducing a capacity mechanism based on the level of flexibility for generators, storage and demand response would allow effective use of all resources to meet system flexibility requirements at minimum cost.

**24. Which of the two models of targeted capacity mechanism would you prefer to see implemented:**

- Last-resort dispatch; or
- Economic dispatch.

As outlined above, InterGen does not support the introduction of a targeted capacity mechanism. Were one to be implemented, that capacity which has been selected to be rewarded under the scheme should only be dispatched after all other possibilities have been exhausted to minimise the price distortion caused.

**25. Do you think there should be a locational element to capacity pricing?**

It is anticipated that the non-uniform distribution of intermittent and inflexible generation will give rise to regions in which there will be particular difficulty in balancing the system with flexible back-up generation and therefore it appropriate to recognise a locational element to the pricing of capacity.

**Analysis of Packages**

**26. Do you agree with the Government's preferred package of options (carbon price support, feed-in tariff (CfD or premium), emission performance standard, peak capacity tender)? Why?**

The Governments preferred package (Package 3 in chapter 5 of the consultation paper) comprises a carbon price support, a FIT with CfD scheme for low-carbon generation, an EPS and a targeted capacity mechanism.

InterGen supports the carbon price support and FIT with CfD scheme for low-carbon generation with the proviso that a fixed FIT scheme may be more appropriate for smaller generation projects. InterGen does not believe that the introduction of an EPS is an essential part of EMR. The capacity mechanism should be market-wide and should particularly recognise the value of plant flexibility. Finally the Government needs to ensure the existence of a competitive and liquid wholesale market in addition to the other contents of the package.

Subject to the comments above, InterGen believes the package of reforms, if broadly supported by all types of industry participants and mainstream political parties, could form the basis of a stable and robust regulatory environment in which its low-carbon objectives can be delivered.

**27. What are your views on the alternative package[s] that Government has described?**

For the reasons outline in the responses to Questions 3 to 9, InterGen believes Packages 1 (no FIT), 2 (Premium FIT) and 4 (Fixed FIT) are inferior to Package 3.

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

As stated in the response to Question 19, a rapidly decreasing load factor is expected for existing CCGT plants, from around 70% over the next decade to as little as 10% by the end of the next. This need to cycle and vary load frequently will increase the frequency of forced and planned outages, reducing the de-rated availability and flexibility offered by this plant below that which has been achieved historically.

The increasing penetration of wind generation also raises concerns about the grid stability. InterGen acknowledges that this has been identified as a major issue by the System Operator and that they are best placed to resolve this.

**29. How do you see the different elements of the preferred package interacting? Are these interactions different for other packages?**

As mentioned in its response to the Carbon Price Floor consultation (Questions 4.E1 to 4.E3), InterGen is concerned that carbon price support needs careful implementation and long-term clarity to ensure that market participants can continue to manage carbon and electricity market price risk simultaneously.

The key benefit of package 3 is that the FIT with CfD complements carbon price support.

InterGen proposes that an annual statement to Parliament discloses which firms have benefited from each of the EMR elements, by technology. This report should contain information on carbon price support, FIT rates, capacity mechanism costs and nuclear waste liabilities. This will ensure that taxpayers have clarity on what technology types are being supported and the costs of that support.

### **Implementation Issues**

**30. What do you think are the main implementation risks for the Government's preferred package? Are these risks different for the other packages being considered?**

The most significant risk in consulting on and implementing EMR is that of investment hiatus. To some extent this can be withstood for flexible generation while a capacity mechanism is designed and implemented because of the high post-recession capacity margin. However, the existence of the EMR consultation process has already stopped some banks from lending to renewable projects and it is likely that development and deployment will be slowed until such time as the low-carbon parts of the EMR have been designed and implemented.

It is appropriate for the implementation EMR to be delivered in two or three rounds. Support of the all-in carbon price, essential to improve the investment case for low-carbon generation, and steps to improve wholesale market liquidity can both be implemented in isolation and should be introduced quickly. The

remaining reforms are likely to take longer to design and implement and would best be implemented subsequently such that they have been thoroughly analysed and will be robust to a variety of scenarios at introduction.

The Government needs to ensure that in delivering EMR it not only supports investment in new generation, but also does not undermine the value of flexible and efficient assets currently operating or in construction. Conversely the EMR process should not create windfall profits for specific technologies of generation, beyond the explicit subsidies for low-carbon generation via the FIT scheme.

Many generation assets in the UK have associated long-term electricity off-take or tolling contracts which will require adaptation to account for the proposals under EMR, entailing high legal costs. The changes from the Pool to NETA cost InterGen approximately £1M in legal fees and the last NETA adapted contract was only signed in July 2007, six years after NETA was introduced.

Package 1, which does not incorporate a FIT regime in theory has a reduced implementation risk but has the risk that such a regime is subsequently required and has to be implemented separately incurring additional costs. The other 3 packages all present similar levels of implementation risk.

The impact of existing and future European energy legislation should not be underestimated and should be clarified before the Government decides on its preferred EMR package.

Lastly, the Government should be aware of the burden a regulatory change of this magnitude will place on smaller, independent market participants. An increase in administration and implementation costs will have a bigger impact on small players; who are also likely to have less resource available to participate fully in the development of the EMR proposals. InterGen urges DECC and The Treasury to continue to consult fully with all industry participants to ensure a smooth transition from the current arrangements.

**31. Do you have views on the role that auctions or tenders can play in setting the price for a feed-in tariff, compared to administratively determined support levels?**

- Can auctions or tenders deliver competitive market prices that appropriately reflect the risks and uncertainties of new or emerging technologies?
- Should auctions, tenders or the administrative approach to setting levels be technology neutral or technology specific?
- How should the different costs of each technology be reflected? Should there be a single contract for difference on the electricity price for all low-carbon and a series of technology different premiums on top?
- Are there other models government should consider?
- Should prices be set for individual projects or for technologies?
- Do you think there is sufficient competition amongst potential developers / sites to run effective auctions?
- Could an auction contribute to preventing the feed-in tariff policy from incentivising an unsustainable level of deployment of any one particular technology? Are there other ways to mitigate against this risk?

InterGen supports the principle of a competitive auction or tendering process for determining FIT prices but has no specific comments to make on how this should best be achieved.

**32. What changes do you think would be necessary to the institutional arrangements in the electricity sector to support these market reforms?**

The key changes to the institutional arrangements will be the requirement to establish responsibility for FIT price setting and development and running of the capacity mechanism scheme. This could either be through establishment of suitable structures within DECC and Ofgem or through extension of the role of the System Operator.

**33. Do you have view on how market distortion and any other unintended consequences of a FIT or a targeted capacity mechanism can be minimised?**

As per the response to Questions 19 and 22, InterGen believes it is important to put in place a market-wide capacity mechanism to avoid the distortions inherent in a targeted mechanism.

As stated in the response to Question 4, the FIT with CfD scheme is the most likely to avoid unintended consequences as it avoids under- or over-rewarding low-carbon generation and maintains incentives to operate efficiently to the extent possible.

**34. Do you agree with the Government's assessment of the risks of delays to planned investments while the preferred package is implemented?**

There is broad consensus, backed-up by the quantitative analysis undertaken by Redpoint, that the current market structure is not capable of delivering adequate investment in low-carbon generation capacity and sufficient security of supply in a cost effective manner over the long-term. As a result, there is already a widespread expectation throughout the electricity sector that large-scale reform of the market will be forthcoming and this has already created an investment hiatus. Accordingly it is important that, at the conclusion of the current EMR consultation, the government announces a complete and coherent package of measures which will deliver its objectives, are robust to a wide range of demand and fuel-price scenarios, are broadly supported by the industry and mainstream political parties and have a firm timetable for implementation. This will provide a stable and durable regulatory environment which is essential to restore and secure long-term investor confidence.

**35. Do you agree with the principles underpinning the transition of the Renewables Obligation into the new arrangements? Are there other strategies which you think could be used to avoid delays to planned investments?**

Yes, InterGen are supportive of the broad principles outlined on p122 of grandfathering existing support commitments, accelerating the next banding review, maintaining the ability for new projects to accredit under the RO until Mar 2017, reviewing the status of fuelled renewables and working with the devolved administrations to create a consistent UK-wide investment environment.

**36. We propose that accreditation under the RO would remain open until 31 March 2017. The Government's ambition is to introduce the new feed-in tariff for low carbon in 2013/14 (subject to Parliamentary time). Which of these options do you favour:**

- All new renewable electricity capacity accrediting before 1 April 2017 accredits under the RO;
- All new renewable electricity capacity accrediting after the introduction of the low-carbon support mechanism but before 1 April 2017 should have a choice between accrediting under the RO or the new mechanism.

Allowing generators a choice of whether to accredit under the RO or the new FIT mechanism would minimise the risk that investors delay development of new low-carbon generation capacity to ensure accreditation under the new scheme.

**37. Some technologies are not currently grandfathered under the RO. If the Government chooses not to grandfather some or all of these technologies, should we:**

- Carry out scheduled banding reviews (either separately or as part of the tariff setting for the new scheme)? How frequently should these be carried out?
- Carry out an "early review" if evidence is provided of significant change in costs or other criteria as in legislation?
- Should we move them out of the "vintaged" RO and into the new scheme, removing the potential need for scheduled banding reviews under the RO?

InterGen does not wish to comment on this question.

**38. Which option for calculating the Obligation post 2017 do you favour?**

- Continue using both target and headroom
- Use Calculation B (Headroom) only from 2017
- Fix the price of a ROC for existing and new generation

InterGen does not wish to comment on this question.



## **Executive summary**

This report, prepared for members of the Independent Generators Group (IGG), provides an analysis of DECC's preferred approach to the introduction of a capacity mechanism in the GB electricity market. It examines the appropriateness of narrowly targeting capacity payments to certain reserve capacity in order to meet a centrally determined target capacity margin.<sup>10</sup>

The report provides an initial assessment of the change in system conditions, and the accompanying risks that may be caused by increased wind generation alongside the expansion of nuclear and carbon capture and storage (CCS) projects in the GB electricity market.

In particular, analysis is presented to examine the extent to which system 'flexibility requirements' are likely to change over time. That is, the hourly and daily changes in demand net wind, as well as the economic incentives that may be present in order for existing and potential flexible capacity to be available to meet this requirement—a challenge that is distinct from the need to provide a capacity margin above system peak demand.<sup>11</sup>

The analysis provides a starting point with which to undertake an initial assessment of whether DECC's preferred targeted capacity mechanism (TCM) might alleviate or exacerbate these risks, and the scope for potential price distortions and the impact that this may have on investment incentives.

The report then sets out some initial considerations on an alternative mechanism that could be better equipped to address the flexibility challenge posed by the possibility of early retirement of existing flexible plant, and weakened investment incentives that may otherwise deter investment in sufficient new flexible capacity to deliver longer-term security of supply.

### **Flexibility requirements**

With regard to system flexibility requirements, the key findings of the analysis are that:

- changes in the generation mix could increase GB flexibility requirements, which are governed by short-term variations in demand net wind, and as such, are different to the traditional need to meet system peak demand;
- flexibility can be provided by flexible generation and demand-side response (DSR), with short-term responsiveness on the generation side governed by the difference in plant's maximum and stable export limits, with further constraints determined by plant ramp rates and whether the plant are already synchronised;
- a 'flexibility gap'—defined in this report as the situation in which short-term responsiveness from flexible capacity could be insufficient to meet hourly demand-net-wind variations—could emerge by around 2020, regardless of whether system capacity is sufficient to meet peak demand.

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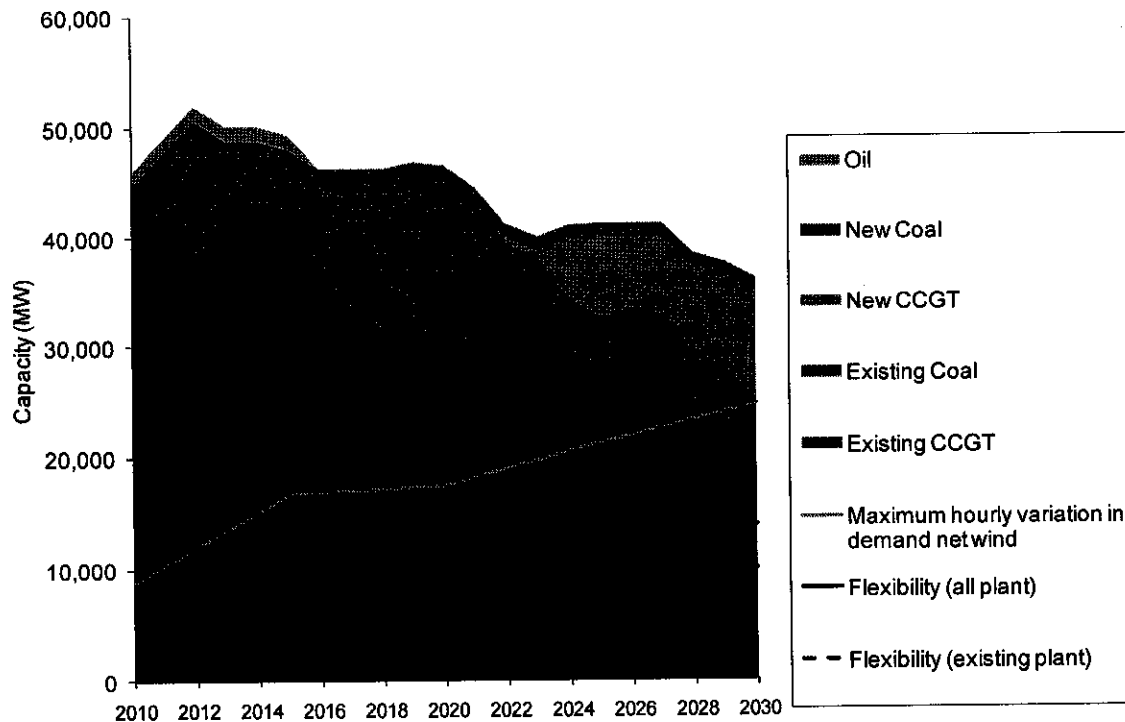
<sup>10</sup> Department of Energy and Climate Change (2010), 'Electricity Market Reform. Consultation Document', December.

<sup>11</sup> Flexibility requirements are likely to include the ability to meet hour-to-hour variations as well as increased variation in daily peaks and troughs of demand net wind. The analysis in this report focuses on the ability to respond to hourly variations.

Figure 1 below shows a projection of total de-rated capacity for flexible thermal plant, and the supply and demand of hourly flexibility (or responsiveness). The analysis is based on commodity price assumptions reflective of current forward prices, and investment in new CCGTs based on current price dynamics and revenue expectations that assume perfect foresight and efficient dispatch.

The figure highlights the increase in system flexibility requirements over time, and the decrease in the supply of flexibility (measured as the difference between plant's maximum and stable export limits) alongside the decrease in total flexible capacity.

**Figure 1 Supply and demand for hourly flexibility**



Note: Retirement profiles of existing plant and investment in new plant are based on efficient dispatch and existing price dynamics that reflect the historical relationship between price levels and capacity margins, and absent possible price distortions. Capacity is de-rated to reflect average availability. Capacity figures exclude nuclear and CCS, which are deemed to be inflexible (both due to technical restrictions and because they are likely to operate at high load factors and to have limited scope to provide additional output). It also excludes pumped storage, which cannot be drawn on frequently once depleted, and is often used to provide shorter-term (sub-hourly) response.  
Source: IEML, and Oxera analysis.

Increased wind penetration is also likely to exacerbate the total peak-to-trough changes in demand net wind over the duration of a typical day. The analysis in this report suggests that the maximum simulated daily range of demand-net-wind levels could increase by around 40% compared with 2009.

### Flexibility investment incentives

With regard to flexibility investment incentives, the key findings of the analysis are that:

- absent intervention, there might be insufficient incentive to invest in adequate flexibility. This is because thermal plant could be required to rely increasingly on short-term revenues that encompass increased risks that may not be hedged, and are subject to the threat of distortions from 'out-of-market' actions;

- specific risks include the ability to capture short-term price spikes caused by wind variations, and the increased risk to plant performance from more frequent output variations;
- these risks could be larger for non-integrated and non-portfolio players—uncertainty over future operating conditions could reduce the scope to contract forward and sell power sufficiently far in advance at attractive terms, as well as hedge price risk.<sup>12</sup>

DECC's preferred TCM does not attempt to mitigate these risks, and may exacerbate the risk of price distortions. Out-of-market actions (or even the potential for such actions) by the operator of capacity contracted under the proposed TCM, can directly affect price and volume expectations for balancing and ancillary services. In particular:

- they may reduce balancing volumes procured through the market, and hence expectations of balancing mechanism prices;
- there may also be a reduction in other reserve contracts and ancillary service requirements, leading to reduced price expectations for contracts outside the proposed mechanism.

The Electricity Market Reform (EMR) consultation recognises that potential distortions could arise through the effect of dispatch of the targeted capacity on peak prices, and that these distortions, along with the risk that an increasing proportion of capacity may need to be contracted under the proposed mechanism, 'could undermine the mechanism's ability to ensure secure supplies of energy'.<sup>13</sup>

DECC's proposed TCM is similar to the Swedish model, which makes use of peak load reserves. There is evidence from regulators and academic studies that potential price distortions remain a risk under this model and that peak load tendering should generally be avoided.<sup>14</sup>

### **An alternative flexibility mechanism**

A broader-based mechanism, designed to reward flexible capacity, could provide the necessary investment incentives and mitigate the increasing market risks faced by providers of flexibility. Basic, technology-neutral eligibility criteria could be defined, and plant receiving FITs could be deemed ineligible to avoid over-rewarding low-carbon capacity.

In the EMR consultation DECC states that it would assess the effectiveness of the market reform options along four broad principles:

- cost-effectiveness;
- durability and flexibility;
- practicality;
- coherence.

In this context, an appropriate flexibility mechanism might be expected to:

- mitigate the increased risks faced by flexible plant as wind penetration increases;

<sup>12</sup> Hart (1988) describes how the firm as an institution can be thought of as arising from the incompleteness of contracts and the need to allocate residual control rights. See Hart, O. (1988), 'Incomplete contracts and the theory of the firm', *Journal of Law, Economics and Organization*, 4(1), spring.

<sup>13</sup> Department of Energy and Climate Change (2010), op. cit., p. 94. The EMR consultation recognises that the potential effects on peak prices and the 'slippery slope' effect could undermine the performance of the proposed TCM.

<sup>14</sup> See, for example, Svenska Kraftnät (2002), 'Effektöversörjning på den öppna elmarknaden, Utredningsrapport', January 10th. Johansson, T. and Nilsson, M. (2010), 'Signs of stress II: The customer strikes back', April 9th. Nord Pool Spot (2010), 'Handling of the peak load reserves in the spot market', October 1st. Botterud, A. and Doorman, G. (2008), 'Generation Investment and Capacity Adequacy in Electricity Markets', International Association for Energy Economics. Energy Markets Inspectorate (2006), 'Price Formation and Competition in the Swedish Electricity Market', report 2006:13. NordREG (2009), 'Peak Load Arrangements, Assessment of Nordel Guidelines', report 2/2009. NordREG (2010), 'Assessment of Nordel's revised Guidelines for transitional peak load arrangements', March.

- minimise entry barriers that could accompany a non-market-based and discretionary mechanism such as the TCM;
- provide the greatest signals to invest as the flexibility requirements from intermittency increase;
- accommodate increased DSR, and spur innovation and increasing participation from the demand side.

Based on the initial considerations in this report, a fixed revenue mechanism might be able to strike an appropriate balance between creating the right investment signals for providers of flexibility while minimising complexity and the risk of gaming. Such a mechanism could be implemented as follows.

- An annual flexibility requirement (in GW) could be calculated based on wind penetration and expected variations in output, inflexible demand variations, and a security standard (eg, a requirement to meet three standard deviations (or 99.7%) or expected hourly variations in demand net wind).
- A total annual revenue amount could be determined based on system flexibility requirements and the costs of the marginal provider of flexibility.
- The revenue pot could be split between different time periods, based on a combination of anticipated flexibility requirements and ex post demand and wind outturn (so that greatest revenues are available when flexibility requirements are highest).
- All flexible generation and demand participants available within a given period could be eligible to receive a share of the revenue available in that period.

The advantages of such a mechanism are that:

- a degree of stability could be introduced into the flexibility payments through tailoring the revenue split between a fixed element and one related to ex post system conditions;
- the mechanistic calculation of annual revenues based on wind penetration, demand growth and known statistical distributions could help promote longer-term investment signals;
- short-term signals could be generated to create the incentive for flexible generation and demand to be available through the ex post revenue allocation.

The potential drawbacks of such an approach are the administrative costs of annual forecasting and operation of the scheme. This would be likely to be a feature of any broad-based mechanism, but could be smaller for mechanisms that are relatively less complex.

A useful area for further analysis would be to consider the timeframe over which flexibility requirements should be defined.

### **Next steps**

This report provides an initial analysis of the potential flexibility gap facing the GB electricity system, and the risks that are likely to be faced by owners of existing flexible capacity and developers of new plant. The provision of future flexibility has been assessed based on existing price dynamics.

Useful further work would be to refine the estimates of future GB flexibility requirements, based on a more detailed analysis of flexible plant operating capabilities, and the manner in which prices may respond to a potential flexibility shortfall and the implications of this for plant returns. This would also facilitate a full cost-benefit analysis of alternative flexibility mechanisms.