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Security of electricity supply: is a Capacity Market the answer?

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The Energy Bill

The Energy Bill, currently on its passage through Parliament following its inclusion in the Queen's Speech, proposes a number of important changes to the UK energy market. Although the Bill contains several elements, its focus, notwithstanding its title, is on electricity rather than on other parts of the energy market. Within this narrower purview, electricity market reform (EMR) takes centre stage. In its introduction to this part of the Bill the Department of Energy and Climate Change (DECC) explains that the reforms are being put in place to attract £110 billion of investment which it claims is needed to replace generating capacity and upgrade the grid. Two key elements of EMR are the introduction of a system of contracts to support new nuclear and other lower carbon generation (the so-called contracts for differences, CfDs) and the development of a 'Capacity Market'.² It is with this latter element, the Capacity Market, that this paper is concerned.

The present capacity situation

The decision to include the introduction of a Capacity Market in the Bill stems from concerns expressed by Ministers, Ofgem and other observers that there will be insufficient generating capacity to meet electricity demand later in this decade and that there is a need to take action to "keep the lights on", a phrase generally invoked to describe the nature of the problem. The reason given for this concern is that many believe generators will be unwilling to invest in new capacity in a market generally characterised by considerable uncertainty and, more specifically, that the owners of plant required to operate only occasionally, for example to back up intermittent forms of generation, will not be remunerated adequately under present arrangements. It is argued that such low load factor stations will close and that security of supply will be jeopardised.

The Energy Act 2011 introduced a requirement for Ofgem to provide the Secretary of State each year with an Electricity Capacity Assessment, to give guidance to market participants regarding the possible development of the supply/demand situation over the next four to five years. The first Assessment was published in October 2012³ and provides a helpful starting point for assessing the present capacity situation. In its analysis Ofgem

¹ Member, Council of Management, Regulatory Policy Institute.

² In fact, as discussed below, the ability to contract for capacity availability already exists. What DECC refers to as a capacity market is a very particular set of arrangements, to be imposed by regulation, which might better be described as a capacity 'mechanism'. However, to avoid potential confusion, the DECC terminology is retained whilst the particularity of the arrangements is signalled in what follows by capitalisation: hence Capacity Market, not capacity market.

³ Electricity Capacity Assessment, Ofgem report to Government (ref. 126/12), 5 October 2012.

contracted NGC to develop a capacity model which it used, under a range of scenarios, to evaluate the likelihood of demand not being met in the years up to 2016/17, the required time horizon for the 2012 Assessment, as laid down in the Act. Ofgem's analysis includes assessments of future plant capacity based on known and anticipated plant closures and new plant commissioning along with projections of future peak demand (the parameter used being average cold spell, ACS, demand). Ofgem made assumptions regarding the likely availabilities of generating plant (which vary by technology) and produced a probabilistic assessment of the likelihood of energy not being supplied and the quantity that might not be delivered.

Ofgem presents the results of its analysis in a number of different ways. For example, under its Base Case assumptions de-rated capacity margins (i.e. the margin of capacity over peak demand taking account of the expected availability of generating plant) fell from around 14% in 2012/13 to just over 4% in 2015/16, before increasing to around 5% in 2016/17. The expected electricity shortfall under the Base Case is around 3400 MWh (and less in 2016/17 as margins improve somewhat). Ofgem places this shortfall in context by contrasting the figure with the annual loss of supplies arising from transmission and distribution outages, which are typically more than three times the 3400 MWh figure. (Another way of looking at the figure is that it represents 0.001% of total electricity supplied, which, according to DECC statistics, amounted to some 353 TWh in 2012⁴.) Ofgem also explains that such shortfalls could be dealt with by National Grid through demand-side action, with little or no impact on customers (NGC has a range of mitigation options available to deal with supply/demand imbalances, occurrences which are by no means unusual during the operation of a large integrated electricity network). Ofgem also states that the loss of load expectation (LOLE) associated with the expected energy shortfall in 2015/16, the year of tightest margins in the period to 2017, is within the reliability criteria used by neighbouring European countries including France, Ireland and Belgium.

It is always possible to take issue with input assumptions used in analyses of this type. However, there are a number of areas in which Ofgem's analysis may have overstated systematically the likelihood and magnitude of power disruptions. For example, the modelling framework provides no direct feedback from electricity prices (which would be expected to be higher at times of system stress) to available capacity and demand. And Ofgem's treatment of peak demand not only makes very simplistic and limited assumptions with regard to the potential for conventional demand side response (such as larger customers reducing peak load in response to financial incentives in their supply contracts) but also fails to recognise the potential offered by smart metering, even over the relatively short time horizon of the Ofgem analysis, to reduce peak demand (and hence reduce significantly the probability and magnitude of any curtailment). We return to this issue later in this paper.

⁴ Department of Energy & Climate Change, Energy Trends section 5 (25 April 2013), Table 5.5.

An alternative analysis to Ofgem's is provided by DECC in its security of supply section of its November 2012 Annex C to its Electricity Market Reform Policy Overview paper⁵. DECC's Base Case shows de-rated capacity margins falling from around 20% in 2012 to 14% in 2015 and remaining in the range 13-16% to 2020. The margin does not fall below 5% until after 2023. Under DECC's Stress Test (which involves more challenging assumptions regarding electricity demand, interconnector imports and delays to the introduction of a carbon floor price) margins during the period 2016 to 2022 remain in the range 7-9%. DECC's analysis presents an even more benign picture of the capacity situation than does that of Ofgem.

That two organisations undertaking the same analysis at essentially the same time (October/November 2012) arrive at different results is not necessarily surprising; this type of analysis involves a broad range of assumptions on which different views may legitimately be taken. However, the fact that both sets of analysis appear to confirm that the expected energy unserved due to insufficient generating capacity is either very small (in Ofgem's view in the period to 2016/17 for which it carried out its analysis) or negligible (a conclusion that follows from DECC's analysis, at least up to 2022) appears to give confidence that the electricity market does not face a capacity crisis, at least in the short to medium term to the end of the decade.

What is surprising in the light of the Ofgem and DECC analyses is the fact that considerable concern is now being expressed by a wide range of commentators regarding security of electricity supply. It is possible that the origin of this concern lies, at least in part, in the way in which some of the analysis has been presented and the language used to describe the results.

For example, many observers, including Ofgem in some of its public presentations (but not in the Capacity Assessment itself), focus on the retirement of thermal generating plant whilst failing to mention the amount of new generating plant that has recently been commissioned. In his 19 February 2013 presentation "Will GB's lights stay on and will the gas keep flowing: a look at the next decade?" Alastair Buchanan, Ofgem's outgoing Chief Executive, presents a table detailing the coal and oil power stations that have opted out of the Large Combustion Plant Directive (LCPD). The total capacity amounts to 10,383 MW of which all but 1285 MW have now closed (this remaining capacity comprises the large Littlebrook oil fired station, which is little used, and the conversion of half of the Ironbridge station from coal to biomass). However, Ofgem's Chief Executive makes no mention of the 9,119 MW of new gas-fired generating plant (plus 1000 MW of interconnector capacity) that has been commissioned since the start of 2010. Renewable energy capacity has also increased significantly in recent years. The installed renewables capacity at the end of 2012 was 15,479 MW, an increase of 6,241 MW on the position two years earlier. More than half of this increase (3,493 MW) was attributable to the

⁵ Department of Energy & Climate Change, Annex C: Capacity Market Design and Implementation Update, November 2012, (Annex to EMR Policy Overview paper).

continuing growth in wind power but over 2,700 MW of the rise came from a range of other renewables technologies, notably photovoltaics and plant biomass.⁶

This omission of discussion of new capacity is problematic for two reasons. First, it makes no recognition of the fact that, in addition to a large increase in renewables capacity, six major new gas-fired stations have been developed recently, all of them over 800 MW capacity and including RWE Npower's 2180 MW Pembroke station, which began full commercial operation in September 2012⁷. By any measure these recent gas-fired power stations represent very significant investments in the UK generation market. Second, by emphasising plant closures whilst not mentioning new power station construction, a potentially misleading impression can be given as to the state of the electricity supply/demand balance, an impression that has been reinforced on numerous occasions in recent years by officials, Ministers and industry observers. The fact that the title of Ofgem's presentation questioned whether "lights [would] stay on" when the analysis itself did not justify such concerns may also have contributed to the perception

Ofgem's first Electricity Capacity Assessment of October 2012 presented a picture that could not reasonably be interpreted as giving rise to concern (in the longer-term, of course, there will always be the need for new capacity to be built). Nonetheless, the concerns that have existed for many years regarding possible supply shortfalls remain.⁸ If anything, Ofgem's Capacity Assessment appears, paradoxically, even to have heightened worries, possibly for the presentational reasons discussed above.

It is against this background that the Energy Bill presently under consideration by Parliament includes, as an important component of the reform of the electricity market, the introduction of a Capacity Market.

The proposed arrangements for a Capacity Market

Electricity Market Reform (EMR) is an important component of the Energy Bill. In its November 2012 publication "Electricity Market Reform: policy overview"⁹, DECC provides a detailed description both of the rationale for the reform and an explanation of how it is proposed to be implemented. Paragraph 23 says:

⁶ Department of Energy & Climate Change, Energy Trends section 6 (9 May 2013), Table 6.1.

⁷ According to RWE's web site, Pembroke is one of the largest and most efficient plants of its kind in Europe.

⁸ Such concerns were aired at the beginning of the liberalisation of the electricity market and introduction of the Pool in the late 1980s and again at the time of the next major change to the market with the introduction of NETA in 2001.

⁹ Department of Energy & Climate Change, Electricity Market Reform: policy overview, Cm 8498, November 2012.

"The key elements of EMR include:

A mechanism to support investment in low-carbon generation: the Feed-in Tariffs with Contracts for Difference (CfD);

A mechanism to support security of supply, if needed, in the form of a Capacity Market; and

The institutional arrangements to support these reforms."

I focus here on the Capacity Market. DECC's detailed proposals for this part of EMR are set out in Annex C to the policy overview in which an update (as of November 2012) is given regarding the design and implementation of the new market. In its preamble to a discussion for the need for a Capacity Market, DECC says: "Historically, our electricity market has delivered secure supplies, largely due to competitive markets underpinned by robust independent regulation." However, the paper then goes on to discuss the significant changes taking place in the electricity market (including the closure of generating plant, as discussed above) and the perceived problem of operators of generating plant being unwilling to offer flexible generating plant to the market because of what DECC refers to as the "missing money" problem. This is apparently caused, on the one hand, by the present settlement pricing (cash out) arrangements under which the scarcity price of electricity does not rise high enough and, on the other, by fears from "investors" that either the regulator or Government will act to cap prices at times when wholesale market prices rise to high levels.

Although DECC is supporting a number of initiatives that might lead to changes to the market, including Ofgem's work examining cash out arrangements and encouragement of a more responsive demand side, DECC has concluded that a Capacity Market offers the best solution given market conditions. DECC recognises, however, that GB and European markets will continue to evolve and that the Capacity Market that it proposes introducing may need to evolve to reflect changing market conditions. DECC plans to ensure that the Capacity Market governance arrangements enable its evolution over time.

It is against this background that: *"The Government is minded to run the first auction in 2014, for delivery of capacity in the the year beginning in the winter of 2018/19. A final decision will be taken subject to evidence of need. This will be informed by updated advice from Ofgem and National Grid which will consider economic growth, recent investment decisions, the role of interconnection and energy efficiency, as well as consideration of the outcome of the review of the 4th Carbon Budget."*

Annex C goes on to describe the market in high level terms:

"The Energy Bill includes the high level legislation to enable a Capacity Market that will work as follows:

a forecast of future peak demand will be made, four years ahead of the delivery year in which it is needed;

the net amount of capacity needed to ensure security of supply (which is likely to be informed by an enduring reliability standard) will be contracted through a competitive annual central auction run by the System Operator;

generation and non-generation approaches such as DSR [demand side response] will be able to participate in the capacity auction. All generation plants, including existing plants, will be eligible to participate in this auction, with some exceptions (e.g. low carbon plants receiving CfDs);

providers of capacity successful in the auction will enter into capacity agreements, committing to provide electricity or reduce demand for electricity when needed in the delivery year/s (in return for steady capacity payments) or face financial penalties; and

the costs of the capacity payments will be shared between electricity suppliers in the delivery year."

DECC then go on to discuss in further detail how the arrangements might work in practice by considering specific elements of the Capacity Market. The decision on how much capacity to contract will be taken by Ministers based, it is envisaged, on a demand curve, which will be published before the auction (the first will take place in July 2014). The eligibility for participation in the auction receives considerable attention from DECC. The Capacity Market is designed to be a market-wide capacity mechanism involving both new and existing plant of all types as well as the demand side of the market. However, DECC is presently minded to exclude plant benefitting from CfDs designed to support low carbon generation but has not yet come to a view on the participation of Renewable Obligation Capacity or Interconnector Capacity.

Demand side response (DSR) and storage (which might be expected to include existing pumped-storage power stations as well as possible new technologies such as batteries or flywheels) is also welcomed as a potential participant in the capacity auctions. However, DECC identifies a number of potential difficulties associated with both DSR and storage and is developing tailored arrangements for these particular technologies. Amongst these are included three preparatory auctions for delivery of DSR and storage in 2015-2017, assuming a capacity auction is implemented in 2014.

DECC also gives consideration to elements of the design of the capacity auction. The Government has chosen a four year lead time between the auction and the delivery year as a means of ensuring a contestable auction. It is recognised, however, that a shorter lead time would have the advantage of greater accuracy in terms of establishing the quantity of capacity to be auctioned.

As to the form of the auction, DECC has considered both pay-as-bid (every successful provider is paid the price it has bid) and pay-as-clear (every successful provider is paid the clearing price set by the most expensive successful provider that bid into the auction). Government's initial thinking is that a pay-as-clear auction may deliver the best long-term outcome for consumers by minimising opportunities for gaming and establishing a single fair price for capacity. In this context we note that this decision is not consistent with present arrangements for cash out, although if cash out arrangements were to change, this may no longer be the case.

DECC's present thinking on the duration of capacity agreements appears to be a hybrid approach. New plants (including those on which construction had already commenced by May 2012) will be able to choose the length of their capacity agreement (up to ten years). On the other hand, existing plants will be restricted to one year agreements. It is envisaged that secondary trading of capacity (which may or may not be facilitated by Government) would also be a feature of the Capacity Market potentially providing a framework for the management of some of the risks associated with the variable agreement lengths and the four year period between auction and delivery.

Considerable thought has been given by DECC to what capacity providers are required to do to meet the terms of their capacity agreement, and how they are penalised if they fail to do so. Government has chosen a delivered energy model under which capacity providers are obliged to deliver energy or reduce demand whenever needed to ensure security of supply, i.e. in real system stress situations. If they fail to comply, they face a financial penalty. The Government recognises that additional work is required in this area including on whether it is necessary for the System Operator to carry out availability checks and whether there should be any exceptions when penalties would not apply (such as when plant fails). Government also recognises that, because the electricity price is not capped under these arrangements (a generator would not be limited in the bid that he made to the Capacity Market) the potential exists "for some degree of overpayment to capacity providers".

Details are also provided in DECC's Annex C document on the payment model and regulatory framework for the Capacity Market and these provide the basis on which capacity providers receive payments in the delivery year. The framework includes provisions whereby any changes to Capacity Market rules contained in codes or licences would be controlled by a formal governance process. The Government is investigating ways of providing certainty on Capacity Market rules created in regulations. Presumably, this certainty will be balanced by the intentions expressed earlier in Annex C : "The

Capacity Market design may need to evolve over time to reflect changing market conditions. This will prevent the Capacity Market being locked into an inefficient or ineffective design as the energy market evolves and improvements in the design of the Capacity Market are identified."

Criticisms of the proposed Capacity Market

The proposed Capacity Market represents a very significant change to the present market arrangements for electricity in Britain. The arrangements are extremely complex and, although the documents from DECC describing both the policy overview for reform and the details of the Capacity Market itself are clearly presented, they reveal some of the extremely difficult trade-offs that have had to be made in putting the new framework in place. Perhaps inevitably, given what is being attempted, they have resulted in arrangements that involve considerable outside judgement and intervention and appear to take little or no account of the dramatic and innovative changes that are now underway in the market.

Nowhere is the highly centralised nature of the interventions contemplated more clearly demonstrated than in the way in which Government proposes to address the question of how much capacity should be contracted: "The decision on how much capacity to contract will be taken by Ministers." It is expected that this will be taken with reference to an enduring reliability standard and that one way of establishing this would be to publish a demand curve.

This appears to be a quite extraordinary step and one that turns the clock back a quarter of a century. The thought of a department of government calculating a demand curve and Ministers using this to specify how much capacity should be placed under contract for delivery in four years time not only places extraordinary pressure on Ministers to get such assessments right (however that might be judged) but also is likely to have a profound impact on the way in which the market operates both in the short term and further ahead.

For such a framework to be contemplated, particularly in the light of DECC's assessment that the Capacity Market is expected to lead to higher customer bills¹⁰, there must be a high level of confidence of the emergence of an imminent crisis. We believe this not to be the case and we now discuss three principal reasons why the proposed introduction of a Capacity Market is both unnecessary and potentially very damaging.

¹⁰ DECC estimates that the Capacity Market will increase bills by around £14 per annum for average domestic customers.

1. There is no impending capacity crisis.

Our detailed discussion presented above, in which we rely heavily on the recent analyses produced both by Ofgem and DECC, shows that the GB electricity market is not facing a capacity crisis. Considerable uncertainty exists both with regard to future levels of peak demand and the availability of generating capacity and the differences between the Ofgem and DECC analyses, as well as the various scenarios explored by both, help to illustrate this uncertainty. It is also self-evidently the case that the further one looks into the future, the greater the uncertainty and the greater the need for new generating capacity. Nonetheless, over the time horizon in which significant amounts of new capacity could be brought on stream if justified by market conditions, the Ofgem and DECC analyses show that no crisis exists.

2. Generator contracts are already a feature of the market.

Under the proposed Capacity Market generators will enter into capacity agreements (i.e. contracts) following successful participation in a capacity auction. However, generators already enter into contracts as market participants alongside suppliers, customers, wholesale market traders and NGC (the latter purchasing a broad range of services to help balance the system in its role as System Operator). For a supplier, the principal focus is to provide a high value service to its customers whether they be residential, commercial or industrial users of power. The customer contracts a supplier enters into (and for residential customers the familiar tariffs are simply a form of supply contract) will contain a range of terms from the simplest form of single-part tariff (a single price per unit of electricity used) to two-part or multi-part tariffs under which a different price obtains at different times of the day. Suppliers also offer more complex contracts, typically to larger customers, in which maximum levels of demand may be specified (including conditions under which supply may be curtailed) and other charges established for specialised services, such as reactive power (important for those customers who have a large amount of demand associated with electric motors). In offering this complex array of contracts and tariffs the goal of the supplier is to satisfy its customers' needs profitably.

In order for a supplier to remain competitive and manage risk effectively it also enters into contracts, principally with generators, but also, potentially, with other wholesale market participants to purchase power. These supplier/generator contracts may be of any form mutually beneficial to both parties. For example, parties may enter into simple contracts in which a fixed amount of electricity is offered, either for twenty-four hours a day or for limited periods. Shaped contracts in which the profile of electricity matches the estimated demand shape of the supplier's customers may also feature as might contracts which may be interrupted, perhaps with some specified notice period (important if suppliers have customers who are also willing to have some or part of their demand curtailed in return for a more favourable price). Suppliers may also find it helpful to enter into option contracts with generators which give them the right (in return for a fee) but not an obligation, to take power, including at times of systems stress. It is contracts of this type

that can help suppliers ensure that their customers have the security of supply for which they are paying and they can provide a revenue stream to generators to give an incentive to ensure that capacity is available. Another term to describe such an option contract is a "capacity contract". Such contracts are already a feature available under the present trading arrangements and do not need to be supplemented by the proposed Capacity Market contracts. Under present arrangements the suppliers are at the heart of the contract chain and their focus is their customers. It is to their suppliers that customers will turn if their needs are not met, not some generating company with whom the customer has no commercial link.

3. A demand-side revolution is coming.

Customers are already engaged in the electricity market as described above and customer switching between suppliers is now commonplace. Few would argue, however, that the market operates fully in the interests of the customer and complaints regarding both price and service are far in excess of what would be considered acceptable by the very best customer facing businesses. This is about to change.

The introduction of smart meters brings the possibility of the demand side of the market becoming fully engaged in a way that has the potential to revolutionise electricity supply in the UK. In his Ministerial statement of 10 May 2013 the Secretary of State for Energy and Climate Change announced the planned timetable for the roll-out of smart meters (both electricity and gas). Over the next two years more than 2 million meters will be installed with the "vast majority" of more than 50 million planned to be in place by 2019 (coincidentally, the date when the first Capacity Market agreements are expected to apply). All customers will, through new contracts with their suppliers be able to choose, amongst other things, whether to contribute further to peak demand or adjust some activities (such as re-scheduling the operation of washing machines and dishwashers overnight) to benefit from lower prices. Any supplier failing to offer this type of much more flexible and innovative contract is likely to come under considerable pressure from customers who choose to move to a supplier who better serves their needs. And the smart meters will facilitate the rapid and error-free switching that is still not routinely available under present arrangements.

At this stage it is impossible to know how suppliers, both existing and new entrants, will compete to offer new services and terms to their customers.¹¹ And we do not know the extent to which new technologies, including internet delivered services and the interface of smart appliances, will feature. But we can be confident that the changes will be significant. Indeed, if we did not anticipate that the customer benefits would be very large,

¹¹ For example, over time we would also expect suppliers to enter into new commercial arrangements with transmission and distribution network operators as all parties strive to offer better value deals to increasingly savvy and cost-conscious customers. A full discussion of the impact that such arrangements might have on the future investment needed in transmission and distribution is beyond the scope of this paper.

there would be no point in embarking on such an ambitious and costly project. It is reasonable to expect much more from smart meters than simply an end to estimated electricity bills.

The demand side changes expected to accompany the roll-out of smart meters have a major impact on the arguments supporting the introduction of a Capacity Market for two reasons. First, we might reasonably expect the shape of electricity demand, and in particular the ratio of peak demand to average demand, to change significantly as customers seek to lower their bills by reducing consumption at peak. This means that the type of capacity analysis carried out by Ofgem and DECC would need to be reassessed as the amount of peaking capacity required would fall as customers change their behaviour.

Second, it is important if we are to benefit fully from smart meters that nothing is done to stifle the demand-side innovation that we might reasonably expect to accompany this profound change. If a Capacity Market were to be introduced, we run the risk that suppliers would feel that they could abdicate responsibility for contracting effectively to meet their customers' needs. Suppliers might consider that security of supply had been taken out of their hands thus reducing the incentive to offer new tariffs and contracts designed to allow customers to feed back their own willingness to pay for power at different times of the day. Security of supply should not be set by a Minister specifying a quantity of capacity to be procured at auction against a demand curve established by DECC officials. It should be established through dialogue between suppliers and their customers facilitated, at least in part, by the technology offered by smart meters.

Concluding Remarks

In this paper I have discussed the present capacity situation and described the arrangements for a Capacity Market proposed by DECC and now forming an important part of the Energy Bill. I have raised criticisms of the Capacity Market on three principal grounds:

- need - Ofgem and DECC analyses demonstrate that we are not facing any capacity crisis through to the end of the decade;
- interaction with other market contracts - a wide range of supplier/generator contracts already feature in the market, including option contracts, which perform the same role as Capacity Market agreements;
- the changing face of demand - the introduction of a Capacity Market becomes redundant with the fuller participation of the demand side, which I expect to accompany the introduction of smart meters.

For these reasons I do not consider that the imposition on customers of additional costs associated with the introduction of a Capacity Market is justified. Not only do I believe that such a market is unnecessary, but its introduction could potentially be harmful both to the functioning of the wholesale contracts market and, perhaps even more importantly, to the competitive development of the demand side of the market.

Electricity market participants frequently appeal for clarity of rules and several generators have in recent months indicated that they will delay investment in the electricity market until the details of EMR are finalised.¹² One thing that the Government can now do is announce that a Capacity Market will not be introduced. At a stroke, an element of market uncertainty will have been removed and customers will not face another element of costs being added to their bills.

¹² The Financial Times picked up on this theme in an article published on 28 May 2013: *"In a letter to Energy Secretary Ed Davey, Angela Knight, head of Energy UK [a trade body representing a number of UK power companies], said a decision on a capacity mechanism was "urgently needed" to avoid further uncertainty and risk."*