Electricity Market(s) Reform
Consultation Response

This is a response to DECC's consultation by David Hirst. It has several key messages:

- Extensive and deep reform is vital and urgent, and needs to cover several of the "markets" for the commerce of electricity: the Balancing Mechanism (BM); wholesale trading; capacity building; retail trading; and the supporting transmission and distribution infrastructure services. Implementation will require long term, staged rollout and is challenging.
- Demand participation offers huge opportunities for low impact entrepreneurial innovation and new business at lower cost than currently projected.
- The measurement basis for current retail trading – the Smart Meter rollout – is deeply flawed, creates perverse incentives, and leads to opaque pricing and trading and compounds current and future system problems.
- Government sponsored support for low carbon generation capacity is necessary, but the mechanisms proposed are unsatisfactory, and make integration of renewable generation into the system harder.
- Buying capacity, although necessary, is fraught, primarily with "counterfactual" risks which need to be better understood.
- A shared infrastructure for distribution and transport needs explicit handling of costs that cannot be appropriately allocated to competing parties. Attempts to do so with today's settlement systems prevent innovation.

This document presents relevant concepts and arguments to provide a context for the responses to specific questions.

This version corrects minor typos and misprints in the version submitted on 10th March 2010.

David Hirst is now an independent inventor and consultant. He was Central Design Authority for NETA. He founded (but has now left) RLtec, which was intended to implement his inventions.

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1 Introduction

1. I entirely agree with the Government that the electricity sector faces a vital and urgent need for deep reform. Demand participation in appropriate markets is central to this and suggests that rapid reductions in carbon can be achieved quickly and at significantly lower cost than currently projected. This consultation response presents a direction for reforms that will take many years to be achieved, as well as suggesting changes to the current flawed proposals.

2. I am grateful to many for ideas and discussions. Although I am not an economist (and disagree with much of their thought), the British Institute of Energy Economists (BIEE) has been particularly helpful in stimulating thinking. The work is my own, and I take responsibility for it.

3. The work is released under the Creative Commons Attribution 2.0 UK: England & Wales License. Anybody may copy it, publish it and modify it, so long as I am attributed as the source. It is not confidential. I plan to extend it for other purposes.

2 Executive Summary

Market or Markets

4. The purpose of competitive markets is to facilitate efficient and equitable trade between generators and consumers of electricity. It is usefully considered as four closely interlinked broad markets: wholesale; retail; the transport infrastructure and market for capacity. Currently, the workings of the wholesale market are distorted both by the current Balancing Mechanism (BM), (which could usefully be abolished), and by the inadequacies of retail measurement (meters) which imbalance market power in favour of generators and against consumers. The key issue is whether links between the wholesale market and the market for new capacity can achieve political and social objectives. The answer is no. Section 3 Market, or Markets? further explores the shortcomings and some of the reasons for them.

5. Section 3.4 Capacity discusses some of the issues of buying capacity. Broadly, what is being bought is physical delivery in contingency situations. If the contingencies do not arise, nothing is delivered, so it cannot be metered. Rather, the seller has to establish the counterfactual case that they would have delivered had the contingency arisen. This tends to need expert independent opinion to verify. With many possible contingencies to cater for, and choices in how they are faced, the market is unavoidably complex, more like Lloyds than an exchange, and policy interventions need to be more sophisticated than currently proposed.

The Politics of Scarcity

6. Competitive commodity markets with adequate capacity lead to prices that reflect the marginal cost of the most expensive generation needed to satisfy the population that is willing to pay the discovered price. This optimises the well-being of the participants, and maximises the efficiency of the existing infrastructure. Overheads, such as capital costs, can only be recovered at times of scarcity, or if there are opportunities for discriminatory pricing. Neither seems appropriate, so some other mechanism to encourage investment is necessary. Indeed, incumbents will profit most if scarcity is the norm. Essentially, the capacity needed is driven by the level of scarcity that is acceptable. This is a purely political (and so government) matter, and markets, however, designed, can provide no more than useful input to investment decisions. Section 4 explores this further.

Demand Participation

7. Useful participation by consumers (and their devices) is today prevented by inadequate metering concepts (and thus inappropriate technology). This has several unhappy consequences:

   a) Consumers cannot usefully distinguish between low and high value uses of electricity, so the (dire) consequence of scarcity is blackouts. The perceived risk of blackout (indicated by plant margin) is inefficient.

   b) Settlement processes are monolithic, inflexible, and punish preferred behaviour, both of consumers and of retailers[1]

   c) Unbalanced market power, enhancing the dominance of generators over consumers (and retailers) and who, by their size, are naturally dominant.

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[1] The UK has adopted the term supplier for electricity retailers, to the confusion of everybody.

d) Inappropriate (and illiquid) wholesale markets, as the BM prevents useful tools for short and medium term price risk hedging.

8. Section 5 enlarges on these issues and proposes the adoption of "flowcost" meters, enabling the optimisation of flexible consumption in the face of uncertainties and failure events. Rapid rollout of frequency responsive fridges facilitates this.

Managing Extremes

9. Current and anticipated low carbon generation technologies make the existing issues worse. Generally, they are less flexible, so we have less control over when they generate. The variability[2] of wind, along with the larger scale of suggested nuclear plant, creates three extremes that have to be coped with: large scale sudden failures, leading to rapid changes in the short term market situation; shortages, when the wind does not blow; and plenty, when the wind enables very high output from wind farms. Section 6 explores this, and explains how their effect can be mitigated.

Electricity Capacity Authority

10. Meeting the extremes will require capacity, both of generation and demand, with characteristics appropriate to the need and how often it arises. Planning and maintaining appropriate and efficient capacity needs a combination of political, industrial technological (and economic) understanding and analysis. The institutional arrangements need to be responsive to events (which may well come as surprises, such as the current Middle East turmoil), and to trends (such as the need to reduce carbon and perhaps other critical resources). I cannot see (or conceive) market (or markets) designs, or enduring predefined market interventions that can achieve this. Therefore Section 7 proposes an Electricity Capacity Authority (ECA), with appropriate participatory and transparent governance, that is empowered to make interventions that ensure only acceptable scarcity, and to achieve other politically driven objectives (such as carbon reductions).

11. The possible interventions are wide. Many will take the form of long term contracts with players. They may include, for example, Feed In Tariffs, capital grants, payments for demand side measures (such as flowcost metering), energy efficiency grants, or contracts to maintain plant that would otherwise be decommissioned. (It may be that, during the rollout of demand side measures, it would be appropriate to preserve coal or gas plant for use during the few times each year when wind is seriously short). While the ECA may offer and evolve enduring fixed template contracts that are open to smaller players, large scale interventions would be individually negotiated, (and the contracts published[3]).

Revenue, costs and transparency

12. Transparency of costs, and cost allocations to revenue streams, present intractable issues for electricity, and current arrangements show major flaws. For example:

a) The regressive nature of the Renewables (and other) Obligations. These should be replaced by a fixed and visible levy

b) The meaninglessness of "long term marginal costs" in price assessment. A competitive market where demand varies quickly does not permit prices to exceed short term marginal costs, except at times of scarcity. Capital repayment needs to be recovered in other ways.

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[2] The industry jargon "intermittency" is inaccurate, misleading and confusing.

[3] Probably only after signature. Prior to approval the guidance should be "no surprises".

c) The invisibility (to consumers) of the relative cost of variable consumption (i.e. electricity units (kWh)), and fixed costs, such as the distribution network. Distribution costs should be unbundled, and fixed costs made explicit in retailers contracts.

d) The allocation of individual consumption to retailers costs for wholesale settlement cannot be precise, and so makes for uneasy competition. One good solution is local retailer monopoly. If this is unacceptable, then allocation by a neutral authority, recognition of benign actions taken by retailers (and their customers), with some subsidy to recognise the socialisation of costs would address the issue.

13. Given these issues, a per kWh levy as input funding to the ECA raises revenue in a transparent, simple and fair way. It also serves to provide an incentive to efficiency in end use electricity consumption, quite separate from the incentive to consume at times that enhance the efficiency of the system as a whole provided by variable kWh prices. The issues are discussed further in Section 8.

Consultation Question Responses

14. The final section (9 Responses to Selected Consultation questions) gives short answers to relevant question in the consultation, making references to the discussion in earlier sections. However, the consultation questions are too specific to proposals which are broadly misguided.

3 Market, or Markets?

15. The electricity sector is rich in confusions and contradictions: of language and of policy. Does electricity need one market (as the consultation title suggests) or many? Certainly the purpose is to facilitate efficient and equitable trade between generators and consumers of electricity, but quite different approaches are appropriate to different aspects of this end to end trade. It is useful to distinguish four markets:

a) Wholesale, where electricity is traded in bulk between generators and retailers. This needs to include the BM.

b) Retail, where consumers buy electricity.

c) Transport. The infrastructure for moving electricity around, which is a natural monopoly. It is useful to consider two subsectors, transmission, and distribution. This document, however, has concern only for distribution.

d) Capacity. Principally but not only concerned with generation capacity.

3.1 Wholesale Markets

16. In most commodity markets, such as oil, trading is between producers and retailers (or other intermediaries who need the production)[4]. Contracts are standardised for quality and delivery (or at least change of ownership) on specified dates and defined places, so what is traded is well understood by both parties. The physical volume traded is of consumption over a period, with storage buffering short term volume variation. The key output of the trading is a “spot price”, where producers can deliver and buyers can receive all they wish for at the discovered spot price. It is where supply meets demand.

17. If a published spot price is discovered by means that are considered fair, and not subject to manipulation by market power, then it (or some compound of several periods) can be used as an index by which derivative trading can be settled. So that, for example, a spot price at some future time is accepted as the arbiter of whether a futures contract is in the money or not. This gives parties ways to hedge their risk against changes in the future price. This may make it possible for producers to use such contracts to assure investors of longer term revenues, or consumers to plan production with greater cost certainty. Longer term assurance lowers the cost of investment.

18. Electricity has great difficulty in defining a spot price that is useful as a derivatives index. A/C electricity cannot be stored, so there is no buffer that participants can use to cover short term variations – discussed further in [1]. Yet the price of electricity varies significantly each day, and its value can change within minutes, even seconds (see section 6 Markets to meet Extremes.) Averages will not reflect the exposure of players with different mixes of generation, so risks are not consistent across traders, and liquidity is lost. Retailers have no present means to alter their short term consumption (see section 5 Flowcost metering and its benefits), so have no option but to accept prices offered by generators.

19. This is made worse by the nature of the BM, where the price reflects variation from anticipated volumes, not the overall supply: demand balance. Retailers are exposed to

[4] Also pure traders (technically speculators), who are willing to risk loss for the prospect of gain from price change. They may be willing to trade at times when physical counterparties are not, and so add liquidity to the market.

price risks they cannot control, and that can be extreme. Nor can they be hedged, as there is no acceptable index.

20. A better approach, outlined in 5 Flowcost metering and its benefits, is to enable retailers (through influencing their customers) to actively participate in a real time wholesale market where the spot price accurately reflects the spot balance of supply and demand. This enables removal of the current BM, and thus reduces the dominance exercised by generators over the market price[5].

3.2 Retail Markets

21. Retailers traditionally act as intermediaries between large numbers of customers and smaller numbers of larger scale wholesale players. As such they will normally behave so as to minimise the cost of adequate supply, and moderating the dominance that large players will tend to have over smaller ones.

22. Electricity retailers do not have the opportunity, basic to all other retail sectors, of managing the flow in their supply chains by price variation that influence their customer's consumption. To electricity retailers, their wholesale trading (often within their corporation) is dictated by their share of the market, the profiles of their customers, and the national demand forecasts prepared by national grid. They have no means of influencing their customers short term consumption, nor of its timing. So they are powerless payers in the short term wholesale markets, and particularly the BM.

23. Nor do retailers have any control over the most important service their customers are buying – reliable delivery of electricity – as this is most influenced by the performance of the local (monopoly) distribution network operator (DNO). Failures and quality issues require customers to call their DNO, with whom they have no (direct) commercial relationship.

24. Nor is it sensible for retailers to offer their customers incentives to consume at times when wholesale prices are low, or to avoid consumption when wholesale prices are high. It will make only adverse differences to the settlement costs they face. If such incentives require an appropriate meter, this introduces investment costs with no assurance that they will benefit from it.

25. Nor do retailers have any influence over the costs they face for the (monopoly) distribution services, and have to recover from their customers. These are set by Ofgem. They are better unbundled, and so made transparent to consumers.

26. Nor are there any regulations that influence how various overhead costs, such as the renewables obligation (RO), are to be recovered from customers.

27. In effect, the main service delivered by retailers is to insulate consumers from the unavoidable price volatility of the wholesale market. This discourages useful consumer (and consumer device) behaviour, enhances the dominance of generators, and provides opportunities for excess profits. All of which are very harmful to consumers.

28. In such circumstances, new entrants to the retail market face insuperable barriers, and only highly specialised ethically driven retailers have survived independent of the main generators.

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[5] Arguably, it is the dominance enabled by the BM that has forced the restructuring of the sector into a vertically integrated oligarchy, and the excess profits of these players.

29. This document suggests that a flowcost metering infrastructure (Section 5 Flowcost metering and its benefits) gives retailers the opportunity to profit from encouraging improved consumption behaviours; to play an enhanced role in the wholesale markets, making them more balanced and transparent, and to innovate in services useful to consumers.

30. This will be challenging for retailers. Instead of playing a passive, price taking role in wholesale markets, they will have to develop strategies and support systems to play a proper active role in the wholesale market, offering service to the System Operator in competition to generators, and enhancing the role of smaller scale distributed and backup generation capacity in the market extremes (see section 6 Markets to meet Extremes).

3.3 Transport

Natural Monopoly of Distribution

31. The cable network to transport electricity to consumers is universally regarded as a "natural monopoly". That is, there is no conceivable cost effective way for competing systems to be built. So the distribution network needs to be regulated to balance the monopoly power of the provider while ensuring there is sufficient reward for sunk investment.

Politics of Cost Allocation

32. Within a distribution network fair allocation of costs to different consumers and to different aspects of consumption is difficult. For example:

a) Rural locations clearly require a lot more infrastructure per consumer than is needed to serve dense urban housing. Larger houses with greater street frontage need more cable than smaller houses. Should the distribution charges reflect this, and, if so how?

b) Provision of a network to new properties clearly requires capital investment. Once that investment has been made, connection of additional properties has a lower increment of needed investment. So how much of the first investment should be allocated to the first property? How much of the capital should be recovered in a one-off capital charge and how much in on-going revenue charges.

c) Extension of the network will place additional demands on deeper parts of the network, which will need further investment. To what extent should this investment be funded as part of the network extension, and how much should be a general burden on the network budget?

d) Losses in the network depend in part on the loading of the network, so greater consumption increases the losses and so costs for all. How should the losses be paid for? In some countries, the network operator is obliged to buy the losses that arise on their network, and so have incentives to minimise the losses. Should those who consume more be charged more for their use of the network, and, if so, how?

33. While economic analysis of the costs, benefits and incentives of different answers to these questions may lead to insights, the issues are essentially political ones, what do people prefer, and it may be desirable for different communities, in different circumstances to choose different answers.

34. Consumer (and so demand side) engagement is likely to be greatest if they can participate in these choices, and that the consequences of the choices should be visible to them. So I suggest that the charges of DNOs should be unbundled from other retail

charges, and collected directly by the DNOs from their customers. In addition, there should be local political participation in the regulation of the DNOs.

Local Charges reflecting Local Wind

35. It may be that this would be an opportunity for local communities to benefit from wind farms in or near their locality. While the ideal is to have lower local per kWh charges when the local wind is blowing, it may be easier and quicker to reward the community with lower DNO charges.

Transmission as Monopoly

36. Higher in the bulk transport system – the transmission network – the case for monopoly provision arises because there is no effective way of controlling the electricity that flows over routes that might be competing. Within an A/C system any benefit from extra investment in a route falls to the system as a whole, and its contribution cannot be measured by the flow over the route. In addition, it is effective for central management of the redundancy essential to keep the system reliable. All parts are so tightly coupled that a single failure may have adverse impacts across the whole system.

37. Evolving technology, such as HVDC transmission, might change this, as it enables active control over flows, and so might make it feasible for a "merchant" HVDC link to trade in the markets and networks to which it is connected, and so profit from the investment in the link. To some extent we see this emerging in the regulation of interconnectors with other countries. However, it remains likely that well regulated monopoly planning will lead to the most efficient outcomes.

38. The efficiency opportunities are most apparent in the planning for transmission across and within the North Sea, both to bring wind generation ashore, and to provide interconnections with other jurisdictions. Competing systems to serve individual wind farms or individual interconnections will be less efficient (and less reliable) than a well-engineered integrated network, and the eventual benefit will be a system wide one.

39. This does involve some risk. Early investment may initially be more costly than minimum short term builds might need, and the payback may be delayed. In practice, this is a capacity decision, and best taken by the proposed Electricity Capacity Authority (see section 7 The Electricity Capacity Authority).

3.4 Capacity

What capacity is

40. Markets in capacity essentially concern provision of physical capacity in the event of possible contingencies. They are a form of insurance, and any markets trade the premiums. Since the contingencies to be covered are many and varied, capacity markets do not lend themselves to commodity style trading. It is more like Lloyds than the commodity exchanges.

41. It is not possible to meter capacity, as nothing physical is normally delivered. It is potential delivery, and thus counterfactual. Since it concerns physical things, they can break down, even without intention by the person selling the capacity. There can be a strong temptation to save costs by reducing the potential capacity. If the contingency does not arise one may well "get away with it". For some capacity, it may be a matter of opinion as to whether it was available. In some circumstances (as experienced by the NFFO) it is mere incompetence that prevents delivery, but gaming behaviour can lead to strange and usually unsatisfactory outcomes.

42. So buyers of capacity need to have its existence attested to by an independent and technically skilled party – an expert technical audit function. The buyers also need to be aware of both of what they need, and how it is delivered, so that the technical audit is reasonable. Currently, the System Operator[6] puts considerable effort into audit tasks. Indeed, the lack of a clear audit process can prevent useful capacity being deployed.

43. The behaviour when contingencies do arise can provide a good retrospective measure of whether the capacity was in place. However, many contingencies cannot sensibly be tested. So post contingency analysis is important for learning.

44. Although capacity markets are complex, and do not naturally lend themselves to standardised trading, a centralised buyer may be able to form standardised contracts for small scale even retail project participation. However, the bulk of capacity needs will be bespoke, and the result of bilateral negotiation.

UK Capacity Markets

45. The trading arrangements in the UK today were founded on the (now discredited) assumption that effective wholesale markets for electricity alone would provide effective signals to generators (and their investors) for them to build new and appropriate capacity in time to prevent scarcity. The capacity payments of the pool system adopted at privatization, which had paid generators for being available to participate in the short term wholesale markets, were to be abolished.

46. Abolition was not quite absolute, as the SO was able to contract for Reserve and has since entered into long term contracts for capacity like services, such as the capacity to start up again should a major system failure arise. However, these are a very small part of the capacity that is desirable for a stable electricity system. Continued, and continual capacity intervention is unavoidable, and is discussed in 7 The Electricity Capacity Authority.

[6] The National Grid Company has been awarded this role.

4 Capacity (and Scarcity) is a political issue

Marginal cost prices maximise utility

47. Spot markets in electricity are very good at optimising the utility of existing assets, maximising the well-being of all parties [2, 3]. Short term derivative markets (covering a few months or seasons) are also very helpful in planning major maintenance activities. With improvements suggested in this paper, high volumes of demand assets can also participate, to the potentially substantial profit of all parties.

48. Competitive spot markets will tend to result in prices at the marginal cost of the most expensive capacity needed to meet demand. If the production capacity normally used all have similar marginal costs, then their price will tend towards their marginal costs, and contribution to capital costs and profit are unattainable. The lowest marginal cost generators will profit most, and this has been a driver towards large scale generation.

49. At times of scarcity, however, the price will tend to rise, and it will become a "sellers' market". Even the most expensive generators will be able sell at prices above their marginal costs. At such times of scarcity, prices can rise most extraordinarily high. Perhaps 100s of times average prices. This has three consequences:

   a) It provides an opportunity for investor to recover the costs of "peaking" plant, that is idle for much of the time.

   b) The high price can trigger politically sensitivities. In many jurisdictions, the price is legislatively capped.

   c) The price may be far above the value many people would place on their use of electricity. Indeed, if I were knowingly exposed to £30 / kWh, I would usually be prepared to stop using my PC, TV and most lighting for a period[7]. Unfortunately, there is no way I (or my device) can see the price, and I am wholly shielded from the risk.

The capacity dilemma

50. This shows the core dilemma of buying capacity. You can pay for the peaking plant as a regular premium, or you can let an investor do so, in the expectation of peak prices occasionally. But what is to prevent the peaking plant capacity your premium has paid for still recovering the peak price when the scarcity opportunity presents itself? To whom does the profit belong? A capacity contract will have to define what is to happen.

51. If a consumer can reduce demand at times of such scarcity, this will itself reduce the high price and so benefit all consumers. It will, however, also deny the peaking plant the opportunity to profit.

52. If more (mid-priced) capacity is installed, this will reduce the periods of higher prices, and so also reduce the profit of all generators. A clear discouragement to investment.

53. If there is less mid-price capacity on the system, then scarcity becomes more frequent, prices rise, and generators profit. Market power in generation can be exercised by a player withdrawing mid-price plant. This raises prices which in turn can make other

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[7] Actually, I have left writing this document too late, and as the deadline approaches might even be prepared to pay even this much!

plant owned by the player more profitable. Whether plant is withdrawn for maintenance or as an exercise in market power is often a matter of opinion.

54. The ultimate outcome of generation scarcity is blackouts, which are invariably of high political significance. So the perceived risk of blackouts is often a driver for political involvement. Currently, a proxy for this risk is an assessment of the unused and notionally available plant at peak demand – the plant margin.

55. The plant margin represents wasted assets. A more efficient outcome would be to have all plant in use at peak demand times. But this presents very substantial risks of blackout. The acceptable level of plant margin is a matter of political opinion.

56. Without demand participation, it is also impossible to discover what the peak would be if consumers and their devices were exposed to the prices at peak. Informal analysis suggest that a few percent of peak demand is worth less than it costs. It is of the same order as the plant margin. But what is an acceptable level of peak prices? Thus demand participation shifts the issue, but acceptability of the peak price to which consumers are exposed clearly remains a political issue. Markets can give indicators, but not enough to drive capacity planning.

Discriminatory pricing

57. One response by capital intensive players faced with marginal cost pricing is to use discriminatory pricing. That is, to find some ways by which some consumers can be persuaded to pay more than the marginal cost. If such payment is in some sense voluntary, and related to willingness to pay, then there is no loss of social utility. A classic example of this is the airlines, who offer various ways and timings to pay. So, for example, those who plan travel well ahead can get better deals than those who turn up at the airport planning to travel. You become unlikely to sit next to somebody who paid the same as you.

58. In electricity, politically acceptable discriminatory pricing is hard to find. One successful approach is to offer “green” tariffs, for which people are prepared to pay more. Although potentially valid, it was unfortunately widely abused, and needed regulatory intervention. Currently, the main discrimination is against the poor, who tend not to have access to (say) direct debit discounts, and whose prepayment meters automatically disconnect service until payment is made.

59. Discrimination in timing of consumption is legitimate, if it is not exploitative – that is the utilities are trusted to set the variable prices fairly. One consequence of the current market structures is that few consumers would trust their utilities enough to find this acceptable.

60. It seems the alternative to discriminatory pricing is either scarcity or subsidy.

The low carbon imperative

61. Most of the low carbon generation technologies have high capital costs and low or negligible marginal costs. So the marginal cost pricing tendencies of competitive markets make justifying investment on the basis of selling to a commodity market even harder.

62. As there is no doubt that this is desirable capacity, political intervention has been essential and forthcoming. However, the RO and the proposed FITs have unfortunate impacts on the workings of an electricity market – as explored in section 6 Markets to meet Extremes.

63. Yet today’s need is for low carbon plant, which has high capital costs and negligible marginal cost. If market prices are dominated by marginal costs then investment is unattractive. Indeed, incumbents, and new entrants will only join if prices are very

high. This is politically (and socially) unattractive, so other mechanisms for encouraging investment are necessary. Ultimately, however, the scale (and technology) of the investment is a political decision, as markets cannot signal the level of scarcity that is acceptable.

5 Flowcost metering and its benefits

Metering shortcomings

64. Useful participation by consumers (and their devices) is today prevented by inadequate metering concepts (and thus inappropriate consuming technology). The unhappy consequence of this are scattered throughout this paper.

65. Most devices that have timing flexibility need to schedule their activities in advance if they are to minimise the cost. They have tasks that, once started, cannot sensibly or efficiently be stopped. For example, if a heating cycle is not finished, the water will cool again, and the initial heat input wasted [8]. Interrupting some tasks may damage the service offered, as, for example, some clothes will be harmed by a long soak. Some interruptions might put the proper working of the device at risk. For example, interrupting a freezer defrost cycle can leave the system clogged with ice.

66. So it is not safe, sensible or attractive to let any central utility system control the device. It has to control itself, but can usefully be influenced, both by price and by user policies and decisions.

67. Current meters, even when they have multiple tariff levels, are designed to change the tariff at fixed times each day or each week. This is useful for levelling load within a day, and has the virtue of being predictable – devices can be set to assume the times of tariff changes. However, renewable generation will increasingly be plentiful at times that can only be usefully predicted a day or so ahead. If, as is desirable, the tariff varies with the availability of wind, more flexible tariff setting is necessary.

Flowcost meters

68. The key features of a flowcost meter system are:

    a) The price signal defines expected prices over a period ahead, perhaps a week or more, so that all consuming devices can plan their consumption to minimise the price.

    b) The price signal may be changed at any time to reflect the current view of future expected prices. This means that as wind and demand forecasts become firmer, the price can be refined to tune demand to match the generation.

    c) The meter passes on the price signal to all "downstream" devices that wish for it. The meter DOES NOT attempt to control the devices. Devices using the signal for planning will need to replan whenever the price signal changes. Devices that have cost limits set can switch according to the limit.

    d) The meter knows the current price from the price signal, so can calculate and accumulate the cost of consumption. The bill calculation is performed within the meter.

    e) The price signal represents a future price curve, with prices changing continuously and gradually. This means that load will never change suddenly, as loads will be scheduled to start at a price levels that is unique to each device.

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[8] There may be prices that can make such interruptions worthwhile. To know whether this is so, the device will still need a view of expected future prices.

f) The price signal is broadcast, so that all consumers see any changes simultaneously. Many technology channel options are open, and all are cheap and have near universal coverage. This means that price curve changes can be implemented quickly, within minutes, and so enable usefully response to unexpected events, such as failure of a power station[9]

g) Although broadcast is reliable, the meter maintains a default future price curve for use if the communications channel fails.

h) A meter reading, which includes all necessary billing information, can be collected irregularly (as today's readings are), and so does not need new communications capability (although, if available, it can be used).

69. An optional feature, which has profound competitive impacts, would be for a meter to be able to see the price signals of several competing retailers. In principle, then, devices could choose to consume from the cheapest. If this were done, it would put very strong competitive pressure on retailers prices, and, consequently, on wholesale prices. In effect, it would force non scarcity prices to be based on marginal costs, making capacity subsidy even more vital. No doubt meters with this capacity would be a lot more expensive than single retailer meters!

70. Although not essential, it is highly desirable to rollout ResponsiveLoad (RL) controllers in all new fridges and freezers. These devices, my invention, but now belonging to RLtec, respond to changing system frequency by changing the timing of fridge motors. They do this in a subtle way that makes the response of a population of fridges to frequency variation highly and precisely predictable, and with a large enough population of fridges (perhaps in 10 – 12 years) power stations no longer need to be involved in the frequency regulation task. The fridges provide effective electricity storage with no losses in sufficient quantity to be able to cover the loss of a major power station for several minutes, and so give time for markets to respond to events.

Flowcost meter implications and benefits.

71. The key implication is that retailers could implement a way to change the short term consumption of their consumers by varying price. They will thus be able to respond to high wholesale prices by not buying, and this changes the whole dynamic of the BM. Indeed, with an adequate population of RL fridges BM can be abolished, as retailers and generators will have time to trade to keep the system balanced.

72. A further implication is that demand will be able to vary according to (uncontrolled) renewable generation. If the nation's laundry is washed when the wind is blowing, and not when it is not, demand can offer flexibility that can reduce (but not eliminate) the need for flexible generation.

73. Electrification of transport by battery cars can be achieved largely with renewable energy. It may be that battery cars, by not charging during longer periods of low wind, could avoid the need for any fossil fuel generation. If, as seems likely, charging can be achieved during off peak times, there will be a reduced need to strengthen the distribution or existing transmission network.

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[9] Any large power station failure has potential short term pricing impacts. Nuclear plant, once switched off, has to stay off for days, so also has longer term impacts where this is particularly useful. Coal and gas plant may come on-line again in minutes, and so may need no price change.

74. Flowcost meters can also be used to price the export of domestic and small scale generation. So the electricity exported from a domestic CHP or solar panel can be measured and priced. While it is appropriate to have a difference in price between consumption and generation, this can be set as a margin between the buy and sell prices of a retailer.

75. Flowcost meters need only be implemented selectively. That is, they can be installed in homes where they are likely to deliver benefit. For example, a retail package with a flowcost meter and a smart appliance or battery car would focus the investment in new metering where it has most value.

76. Retailers will need to develop strategies and support systems to integrate their wholesale trading with their price setting. They will need to build and maintain models to assess the volume changes arising from changes in price. To do this they will need a greatly increased understanding of the nature and flexibility of their customers load behaviour. Their systems will, eventually, need to be pretty sophisticated.

77. There are profound implications for the settlement system. It becomes harder to allocate gross consumption, measured within the distribution network, to individual domestic meters. This is discussed further in 8 Price Transparency and Funding

78. It becomes important to unbundle the cost of electricity, as measured by the flowcost meter, from the other costs, such as distribution. If prices are bundled together, or vary by volume, the savings are less clear to consumers. If prices vary by volume band, one can get the ridiculous possibility of a dishwasher load costing less at the end of the month than the beginning. The benefit of good behaviour becomes muddled. Again see 8 Price Transparency and Funding.

79. Flowcost will need understanding by consumers, who will see variable and changing costs. To overcome the distrust which many people hold for utilities, they will need to see real cost savings. This is best started with consumers who have most to gain from the dynamic prices, rather than by imposing blanket change.

80. The price curve needs to be able to go negative. That is, consumers may get paid for consuming, or have to pay for exports. See the discussion at 6.3 Plenty.

Comparison with smart meters

81. The current Smart Meter programme compares poorly with a flowcost meter programme.

a) Smart meters need a full two way communications system to every meter. This is very expensive, and tends to mean that Smart meters can only be offered within areas where the more central components of the communications infrastructure has been implemented. So Smart meter rollouts tend to expect all meters in an area to be rolled out, before implementing another area. There is no selectivity for early adopters where the benefits are greatest.

b) Smart meters collect data for each short settlement period (or more frequently) and pass this back to via a complex central system to a data centre. There the readings are calculated and processed into to a bill for the consumer, and to settlement data for wholesale settlement. This increases the volume of data to be processed by the retailer by a factor of some 15,000% (over 48 readings per day instead of one each month or quarter). Yet the value of the transactions is essentially unchanged. Flowcost meters need no additional data processing, although they do need greater sophistication.

c) Smart meters are not designed to offer future prices, or to have prices that are easily changed. Any change in the price, or price signal, needs to be communicated individually to every meter over the two way communications. Either this will become a significant bottleneck, or the capacity of the communications system will need to be enhanced.

82. The benefits arising from a flowcost meter infrastructure seem worth major pursuit by DECC and the Regulator.

6 Markets to meet Extremes

83. Current and anticipated low carbon generation technologies exacerbate the serious issues already facing the electricity markets. For example:

a) Nuclear power stations are inflexible. Modern ones may have technical capability to flex, but reductions in output are not reflected in reductions in costs[10], so they are commercially inflexible.

b) Proposed nuclear power stations are very big, some 50% bigger than any previous plant. Their failure, however rare, would put the entire system at risk unless there are response systems in place. While the nation's fridges (if fitted with ResponsiveLoad) can cover the loss of Sizewell for many minutes, they would not be able to cover the loss of an EPR. Currently, response systems are very carbon intensive. When nuclear plant shuts down, they stay shut for days, so there are implications for the short term markets.

c) Wind is uncontrolled, variable, and only predictable for a few days ahead. Wind farms sized for an average load are capable, in strong winds, of generating about three times that load, but may produce nothing. In some circumstances, such as the passing of a storm front, there may be rapid localised changes in output. Such rapid ramping can also arise from tidal generation.

84. The consequence of this is that the electricity system, and its markets, have to cope with three extreme circumstances:

a) Large scale sudden failures, leading to rapid changes in the short term market situation

b) Shortages, when the wind does not blow. In extreme cases calm may cover a very large area, and last for days.

c) Plenty, when the wind enables very high output from wind farms.

6.1 Large Scale Failures

Frequency Response

85. Most large scale failures involve major loss of generation. The immediate effect is for the system frequency, nominally 50Hz, to drop dramatically and quickly. A large proportion of the lost generation has to be put back on the system within 10 seconds (a Frequency Response service), or the system will automatically start disconnecting loads. If this is done well, the blackout can be limited, but it is hard to set things up so that the removed load balances the lost generation, and, in the worst case, a cascade of failure can arise. This has never happened in the UK.

86. Currently, most of the lost generation is replaced by rapid increase in the output of other generators on stream, triggered by the drop in frequency. Large coal fired power stations are particularly good at this, but the capacity held in reserve has consequences for carbon emissions. Gas fired power stations are also able to respond quickly, but do not have the reserves of steam that coal plant has. Again, there are emissions consequences from the capacity held in reserve. Nuclear plant can provide response, but there are commercial consequences of the reduced output

[10] Fuel change schedules are essentially unaffected by output.

87. There are currently no large scale renewables generation technologies in England or Wales that can provide the necessary response[11]. It is possible to feather down wind turbines, so that they can increase output when necessary, but this involves loss of zero carbon electricity. Biomass plant can act like coal, but is as yet rather small scale.

88. Currently both coal and gas fired plant may be scheduled so that it can provide response (or reserve, which comes on slightly more slowly). This is not necessarily the scheduling of a single plant solely for reserve, but the need for response may shift the balance between low or high carbon plant.

89. Some large scale failures involve loss of load, usually associated with a transmission or distribution failure that is not covered by redundancy. The immediate effect of this loss is to increase the system frequency, and some plant is designated to reduce output quickly when this happens. Reducing load quickly tends to be easier than increasing it but still has cost consequences.

90. As previously mentioned fitting new fridges with the RL controller allows them to modify their timing, and so reduce or increase overall load very quickly in response to frequency changes. It is disgraceful, and to me tragic, that RLtec, its investors, its managers, Ofgem, DECC and the SO have so far failed to start any serious roll out of this technology. Within the fridge/freezer fleet replacement time of about 12 years most of the need can be met, at reduced cost and with reduced emissions. The need for it is increasing, and it looks probable that, without it, high emissions plant will stay on stream far for longer than would otherwise be necessary. My estimate is that the CO2 emissions saving are of the order of 2 million tons of CO2 p.a.

Short term Market Response

91. Frequency response tends to be able to cope with a major failure for 20 minutes to half an hour. But during that time the system is at risk until the lost generation is replaced. A further failure will lead to blackout. The Balancing Mechanism exists largely to enable rapid replacement of this lost cover, and provide the SO with a way to buy it. If the failure is of nuclear the market impact shortage may last for days, but coal plant can take up to 24 hours to reach full production. Gas is quicker.

92. However, prices can be significantly elevated in this aftermath, making it the equivalent of a time of shortage.

93. If it were able to participate, large aggregations of small scale demand would be able to cover much of this shortage, probably at much lower cost, but certainly with lower emissions consequences. Retailers would be able to influence their consumers to reduce or postpone consumption.

6.2 Shortage

94. Various published analyses establish that, with a reasonable penetration of wind on the system, there will be periods of significant or extreme shortages, occasionally prolonged. It looks unlikely that this will be much alleviated even by a supergrid that could bring in electricity from distant wind farms. Interconnections with other sources, particularly the hydro of Norway, can help, but will be constrained by the capacity of the interconnector.

[11] Hydro electric is a good answer, if there are wet mountains, so in this respect Scotland is better placed than England. Pumped storage, which exists in Wales, is good for response, but its renewable status depends upon when it does its pumping!

95. This will be a time of extremely high prices, and there may be investors willing to hold capacity with the expectation of profiting at these times of very high prices. Is this a risk that politicians are willing to take? Of course, all holders of capacity at that time can expect to "make a killing", so it could well be perceived by consumers as "gouging" by their utilities. Is this a level of scarcity that is acceptable? It leaves me pretty shaky.

96. So there is no doubt that generation capacity is needed for these times of shortage, and the key issue is how to ensure that enough is available. But how much is enough? And what impact will it have on the electricity market when there is no shortage?

97. Until we have started to implement demand side participation, and discovered what it can offer, we can have no reliable idea of how much capacity is needed. What we do know is that most (or even all) of our need could be met by existing thermal plant. So one option is to purchase the on-going capacity of aging plant, so ensuring it will be available for these times of shortage. Indeed, if its lifetime is limited by its running time, it may be wise to encourage its move to standby as soon as possible.

98. This does raise the difficult issue of when the plant would be decommissioned if it were not acquired for standby purposes. This is a counterfactual assessment, and the answer can really only be discovered by detailed commercial and fairly technical negotiation between the current plant owners, and somebody willing to pay for its continued life, and constrain the profit opportunity that shortage might present.

99. This paper proposes that the Electricity Capacity Authority should exist for this purpose. It may find that it is appropriate to fund new capacity, but I believe we are a long way from that.

6.3 Plenty

100. The converse of the times of shortage are the times of plenty. If we have 30% of our average demand met by wind, there will be times when this is enough to meet all our demand, and then some. If we have a significant nuclear fleet the excess generation could become very substantial. How should the wholesale electricity market behave in this extreme?

Negative Prices

101. It will clearly be a time of very low prices, but how low? Nuclear plant may well wish for negative prices, so that generators other than themselves receive reward for shutting down. So the market price could go negative, and demand could be paid for consuming electricity.

102. This could be an extraordinary opportunity for energy intensive manufacturing, so long as the capital requirements were low enough for the plant to stay idle for much of the time. It is a rational response to a rational market.

FIT negative Prices

103. However, if plant is receiving a Feed In Tariff, or being paid under the Renewables Obligation, they will not wish to shut down until the prices are sufficiently negative to offset the gain from their tariff subsidy. This could be significant, so there could be occasions when the wholesale price is (say) -£30 per MWh. Since the whole market price can become offset by this amount, there will be longer periods, albeit still rare, when the price is less negative, but still implies payment for consumption.

104. I find it hard to accept that this is appropriate. I can see how it happens, and can see its rationale, but I would feel most uncomfortable trying to justify this to a confused consumer, particularly if they were still paying positive retail prices for electricity

that they knew to be negative in wholesale markets. It would be easier if they were offered cash for consuming.

105. It is for this reason that I find FITs inappropriate. Since the principle need is to subsidise the capital investment, can this be done without making the wholesale market look silly? This is the role of the Electricity Capacity Authority.

7 The Electricity Capacity Authority

106. The need for intervention in capacity has been argued elsewhere in the paper – see 3.4 Capacity and 4 Capacity (and Scarcity) is a political issue. However, the purchase of capacity is complex and difficult to do well. Most simple subsidy approaches, such as the RO or FITs (with or without premiums or CFDs) are useful only at the gross level. They cannot differentiate the different needs of different projects, and this makes for uneven rewards for investment. Low cost projects do very nicely, thank you, but more marginal project, despite being sound and useful, struggle. Nor can they take into account the different characteristics of capacity that may be needed. Some need to be able to respond fast, some can react more slowly. One type of capacity is needed for some contingencies, and different capacity for another contingency.

107. Sophistication and flexibility in the buying is called for, and this needs a rich range of expertise: political, as the matters are politically sensitive; commercial and business, as it will involve difficult and complex negotiations with sophisticated sellers; financial, as large sums of money (collected from consumers) will be handled; technical, as the specifications of the need, and particularly the attesting of its delivery, must reflect technical reality and good sense; legal, as the contract will be complicated; and finally managerial, as coordination and leadership will be vital.

108. This corporate role is incompatible with Ofgem, which is a regulator. It is incompatible with DECC, and the civil service culture. So it needs to be separate role taking time to form, and perhaps drawing on Ofgem and DECC for initial resources.

109. I suggest that the body be newly formed and called the Electricity Capacity Authority. It will have the obligation to ensure the worst level of scarcity is acceptable, and do so by transparent contracts with sector players, including generators, retailers and project developers. It will expect the short and medium term electricity markets to function to produce reliable price signals, and will use this, among other inputs to maintain strategic plans, in the national (and EU) interest, which articulate the various capacity needs to be fulfilled over coming decades.

110. The ECA will need funds, and my suggestion is that this is collected as a per kWh levy on all consumption. A possible name for it is a Feed Out Tariff. The levy will be significant, and will need to be balanced both by lower consumption tariffs (indeed, the occasional negative tariff), and clearly separated from distribution fees, which become a separate bill.

111. The ECA will (no doubt) be answerable to Ministers, and will have to negotiate with the Minister the how much levy they can raise. However, it should include significant independent and representative participation from all interested players, including customers, and the environment (perhaps in the form of the Climate Change Committee). Perhaps the BBC is a role model.

112. The ECA needs the authority to negotiate contracts with players. The contracts may, but need not, take the form of FITs of various sorts, but the choice will depend upon the need that it seeks to meet. It may also be in the form of fixed payments towards capital, perhaps conditional on various outputs or behaviours. It will have a duty to minimise the costs it faces in meeting its needs.

8 Price Transparency and Funding

113. Transparency of costs, and cost allocations to revenue streams, present intractable issues for electricity, and current arrangements show major flaws. For example:

a) Retailers have to raise the funds to fulfil their renewables (and other) obligations in their charges. They have to do this through competitive tariffs, yet there are no obligations for equitability and fairness (and no objective approach to allocation to different tariff components or different times). This disadvantages those with least market power, and advantages those with most. It is therefore socially regressive, benefitting industry, commerce and the better off at the expense of the poorest. This should be replaced by a fixed, per kWh levy, paid by all consumers to the ECA, and used to subsidise low carbon generation, and to ensure capacity that limits scarcity (and thus high prices)

b) In the face of highly variable demands and so prices (seasonally, weekly, hourly and even minute by minute) generators have no objective way of allocating overhead (and capital) costs to particular periods[2, 4]. At prices that cover only variable marginal cost, production is no worse than no production. So the "long term" marginal cost (as used by Ofgem) is undecidable, and so subjective – a matter of opinion. Generators have to gain their contribution to overheads at times of scarcity or through market power. Such (necessary[12]) gaming makes price setting more opaque. The increasingly capital intensive nature of generation makes this worse. Instead, contributions to fund capital for capacity should be paid by the RCA, working towards strategic national (and EU) objectives.

c) The invisibility (to consumers) of the relative cost of variable consumption (i.e. electricity units (kWh)), and fixed costs, such as the distribution network. These are (apparently compulsorily) bundled into a single set of charges, which are essentially unregulated (prices are supposedly set by competition). Yet the cost and regulatory basis for the two are quite different, one facing competitive trading, the other unavoidably being a capital intensive monopoly. While the issue is complex[13], current arrangements lead to avoidable confusion among consumers, and various unhappy outcomes. In urban areas it is also regressive, again benefiting the better off at the expense of the poor. At the very least, distribution should be unbundled, and separately billed, and local political involvement in the charges should be implemented.

d) The allocation of individual consumption to retailer's costs for wholesale settlement cannot be precise. The current approach is to allocate profiles to individual meters, and use assumptions associated with the profile to refine estimated allocations of wholesale costs as meter readings become available. This means that, if the consumption behind a meter is actively varied to minimise the wholesale cost, the retailer will not benefit from this. Instead, all retailers benefit, and, indeed the retailer of the "good behaviour" meter may face increased costs as they depart from the assumed profile. The

[12] Arguably, it was the failure to engage in such games that bankrupt British Energy

[13] There are other costs, such as taxes, and load related network losses, as well as allocation of deeper network investments.

currently proposed smart meter programme will alleviate this, but will not solve it, as the wholesale price can (and likely will) vary significantly within a settlement period. The impact is to distort competitive efforts towards the (zero sum and political game) of aiming to adjust profiles and profile allocations to their benefit, and punishes the sort of behaviour that is most desirable, and that an innovative retailer will wish to encourage. The problem would be resolved by having monopoly retailers within an area that can be metered at the wholesale level (so they unequivocally benefit from desirable changes in consumption profiles)[14]. Or by having an authority (which might be the ECA) that accepts and manages the unavoidable socialisation costs of a shared transport infrastructure.

[14] Municipal co-operatives wholesale buying for areas of exclusivity tend to have lower costs to consumers than competitive markets

9 Responses to Selected Consultation questions

9.1 Current Market Arrangements

Q1. 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?

114. The current market is unsuited to supporting low carbon investment, and needs reform and continued support.

Q2. Do you agree with the Government's assessment of the future risks to the UK's security of electricity supplies?

115. No, Given the opportunity from renewables, and the substantial opportunities for improved energy efficiency, there is no need to increase any dependence on imported fuels of any sort. Diversity is not desirable of itself. Reduction, even removal, of reliance on any hydrocarbon fuels is a key security objective. 3, 4, 6 & 8 above

116. Building new, long lived coal plant before CCS is established as workable and safe commits us to long term carbon emissions. If, as seems likely, carbon emissions reductions need to become even more stringent, it leaves a stranded asset, and so reduces supply security.

117. The assessed level of investment needed is unjustifiably large. Active participation by demand will give significantly options.

9.2 Feed-in Tariffs

Q3. Do you agree with the Government's assessment of the pros and cons of each of the models of feed-in tariff (FIT)?

118. No. All FITs introduce distortions in the electricity market price. What is needed is more sophisticated and flexible schemes of capital support for preferred capacity. Large projects should be supported on a project by project basis. It may be that a capacity authority will wish to introduce standardised contracts for smaller schemes. See in particular 3.4 Capacity.

Q4. Do you agree with the Government's preferred policy of introducing a contract for difference based feed-in tariff (FIT with CfD)?

119. No, although an Electricity Capacity Authority may find it useful for some projects.

Q5. 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?

120. Only governments can do anything about the long term price risk, and so should carry that risk. That implies active intervention in capacity building. It also places price risk on future consumers, and so political risk on future governments.

Q6. 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?

121. Short term prices should drive consumption decisions and schedules. For generators, short term prices drive scheduling and despatch decisions. For generators, medium term prices will drive maintenance decisions.

122. The absence of means for short term prices to influence consumption is a major market failure, distorting competition, and enabling oligopolistic pricing and excess profits.

Q7. 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?

123. The cost of capital depends mainly on the nature of the project and what can be delivered. Different projects will need different models. One size fits all is inappropriate, and encourages unconstructive gaming.

Q8. 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 existing the investor base?

124. It is not the model so much as the level of support that influences financing.

Q9. 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?

125. Not answered. It needs a strategic analysis of the sort the ECA would need to undertake.

Q10. 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?

126. Liquidity on the wholesale market depends on a sensible mechanism for discovering the spot price. The FIT will not make much difference. The market also needs to play a more central role between generators and retailers, and not just be a tool for vertically integrated players to fine tune their positions. The market will not be liquid if demand is unable to participate meaningfully.

Q11. Should the FIT be paid on availability or output?

127. This would be up to the ECA. Assessment of availability requires complex counterfactual analysis and audit. This may be appropriate. It is much easier to meter output, but this can be inappropriate.

9.3 Emissions Performance Standards

128. The EU ETS is the primary policy for discouraging operation of existing fossil fuelled plant and should remain so.

Q12. 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?

129. No, You have assessed the levels on "baseload" working. No new fossil fuelled plant should work as baseload, but only part time, when wind is inadequate. No new unabated coal plant should be built at all.

Q13. 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?

130. No answered.

Q14. 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?

131. Grandfathering is a form of future subsidy, and so this risks subsidising CO_2 emissions activity.

Q15. 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?

132. It may well be appropriate for the ECA to encourage existing fossil fuel plant to be maintained to cover short term generation shortages, and so subsidise it. This gives the ECA the opportunity to decide the extent to which additional abatement should be installed. Under these circumstances the plant will be expected to run for only a few hours each year, and investment in abatement may not be effective for the volumes abated.

Q16. Do you agree with the proposed review of the EPS, incorporated into the progress reports required under the Energy Act 2010

133. Not answered.

Q17. How should biomass be treated for the purposes of meeting the EPS? What additional considerations should the Government take into account?

134. Not answered. Biomass should be treated with great caution, as it may compete with food production.

Q18. Do you agree the principle of exceptions to the EPS in the event of long-term or short-term energy shortfalls

135. Old plant extended to enable cover for short term periods of scarcity need not face the constraints of plant intended to be "baseload". Long term shortages should not arise.

9.4 Options for Market Efficiency and Security of Supply

Q19. Do you agree with our assessment of the pros and cons of introducing a capacity mechanism?

136. Capacity should be most influenced by a long term strategic national (and EU) plan, explicit in its objectives and specific capacity needs. This needs active intervention by a powerful and participatory institution with broad expertise. There is little point in a capacity mechanism that tries to second guess what the various interventions will achieve, and fill in perceived gaps.

137. Even a well-designed competitive two sided electricity markets cannot give appropriate signals to investors, (see 4 Capacity (and Scarcity) is a political issue), and only at times of scarcity can electricity prices provide a reasonable return on capital intensive investment. Sufficient scarcity to provide a reasonable return will rarely be an optimum (or politically acceptable) outcome and will usually be inefficient for consumers.

Q20. Do you agree with the Government's preferred policy of introducing a capacity mechanism in addition to the improvements to the current market?

138. Yes, but it needs flexible authority to negotiate the conditions for all the subsidies to projects.

Q21. What do you think the impacts of introducing a targeted capacity mechanism will be on prices in the wholesale electricity market?

139. Well directed subsidy for appropriate capacity will facilitate the market in reaching marginal cost pricing, and thus optimising system operation.

Q22. Do you agree with Government's preference for a 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.*

140. Yes, and no. Yes, the ECA should be central, with authority to act in ways that it considers will best achieve politically set objectives. It should be free to act in ensuring desired capacity in any way it sees fit. It will undoubtedly wish to see a well-functioning electricity market, and so will seek to minimise its impact. No, it should not be constrained by limits that might weaken its position in negotiating for capacity.

Q23. 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?

141. A sensible ECA will undoubtedly wish to encourage appropriate demand side participation, appropriate storage capacity and import export capacity, and may well wish to make interventions so long as these contribute to the efficiency of the electricity system as a whole. Only if there are benefits to the electricity system would it be appropriate to intervene in energy efficiency measures.

142. The Feed Out Tariff and market prices should be structured to reflect the benefits energy efficiency measures could achieve.

Q24. Which of the two models of targeted capacity mechanism would you prefer to see implemented:

- *Last-resort dispatch; or*
- *Economic dispatch.*

143. This depends upon the objectives of the ECA in negotiating the capacity. Either might be appropriate.

Q25. Do you think there should be a locational element to capacity pricing?

144. Yes, There should be some mechanism so that areas near wind farms get lower cost electricity when the wind is blowing. This could be a component within the flowcost price curve.

Analysis of Packages

Q26. 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?

145. No, they are too rigid, capable of being gamed to the benefit of incumbents, and may not achieve the intended low carbon result. Better to let an Electricity Capacity Authority negotiate for each major project.

Q27. What are your views on the alternative package that Government has described?

146. None of the packages are appropriate. See the improved vision presented in the earlier sections.

Q28. 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?

147. They are most unlikely to improve things, but may well give additional opportunities for strategic gaming by utilities.

Q29. How do you see the different elements of the preferred package interacting? Are these interactions different for other packages?

148. Not answered.

Q30. 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?

149. The packages do not provide incentives for appropriate demand side participation. Without that generation investment will be excessive and wasteful and unnecessarily expensive.

Q31. 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?*

150. Auctions tend to restrict participation to incumbents and can go spectacularly wrong..

- *Should auctions, tenders or the administrative approach to setting levels be technology neutral or technology specific?*

151. Project specific. One size cannot fit all, and an intelligent buying authority can negotiate what is considers most beneficial and lowest cost, as appropriate.

- *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?*

152. The ECA will have well considered views on the benefits of different technologies, and should be permitted to let the subsidy reflect their assessment of its value.

- *Are there other models government should consider?*

153. Yes, the model of the Electricity Capacity Authority described in this document.

- *Should prices be set for individual projects or for technologies*

154. Subsidies should be agreed for individual projects

- *Do you think there is sufficient competition amongst potential developers / sites to run effective auctions?*

155. No.

- *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?*

156. This risk is best mitigated by participation of an Electricity Capacity Authority, able to flex intelligently in the light of circumstances and forecasts.

Q32. What changes do you think would be necessary to the institutional arrangements in the electricity sector to support these market reforms?

157. The formation of a broad, participatory Electricity Capacity Authority, with the funding to offer subsidies tuned to the needs identified in strategic plans. Regulation alone is not enough, and the market, however well designed, will cannot optimise the provision of capacity. That is a political matter. See 4 Capacity (and Scarcity) is a political issue

Q33. Do you have view on how market distortion and any other unintended consequences of a FIT or a targeted capacity mechanism can be minimised?

158. A FIT can cause hugely negative prices, and it is hard to see this being politically acceptable. See 6.3 Plenty

Q34. Do you agree with the Government's assessment of the risks of delays to planned investments while the preferred package is implemented?

159. Not answered

Q35. 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?

160. Not answered.

Q36. We propose that accreditation under the RO would remain open until 31 March 2017. The Government's ambition to introduce the new feed-in tariff for lowcarbon 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.*

161. Not answered.

Q37. 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?*

162. This should be within the authority of the ECA to decide.

Q38. 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*

163. Not answered.

Appendix A. References

[1] Hirst, D.R. *Demand Side - Teaching an Old Dog New Tricks*. in *Networks for Sustainable Power*. 2006. IEE London: IEE http://www.responsiveload.com/downloads/DemandSidedogHandoutPublish.pdf

[2] Vickrey, W. *Responsive Pricing of Public Utility Services*. in *Economics of Regulated Communications Industry in the Age of Innovation*. 1970. New England Telephone

[3] Vickrey, W., 1992 *Principles of Efficient Congestion Pricing*, Columbia University http://www.vtpi.org/vickrey.htm

[4] Vickrey, W.S., *Marginal and Average Cost Pricing*, in *The New Palgrave. A dictionary of Economics*. , J. Eatwell and e. al, Editors. 1987, Macmillan. p. 311-18.