THE ELECTRICITY STORAGE NETWORK

Consultation on possible models for a capacity mechanism

The Electricity Storage Network, E S N, welcomes the opportunity to respond to the consultations on the capacity mechanism as it relates to Great Britain.

The E S N is led by Anthony Price, a consultant with 20 years experience of developing and advising on energy storage, both in the UK and overseas. The E S N seeks to inform UK policy about the role that energy storage in a future UK low carbon grid and to develop the commercial and business framework for electricity storage. The E S N is a company limited by guarantee which is supported by and works with manufacturers, developers and users of grid connected electricity storage including those involved in the research into future energy storage technologies in both the UK and abroad.

The consultation for the EMR White paper presented a scenario for meeting the UK government's emission targets, both 2020 and beyond. Electricity market reform has been identified as a key part of the process for implementing sustainable generation, whilst maintaining energy security and minimizing the cost of electricity. The White Paper states the complexity of these interlinked problems and no one simple solution will meet the needs of each issue. The history of the electricity market has left many legacies which have distorted the market and which might be considered to worsen, and not improve, the overall position.

We note that the challenge is not just about energy, but is a concern to balance the power between supply and demand throughout the day, every day and every year. The process of system balancing is a task that is likely to become more onerous because of the combined efforts of increased variable generation as well as an increased electrical demand arising from a switch to newer technologies such as heat pumps, electric heating and electric vehicles. The problem is summarised by the need to ensure security of supply and we agree with the identification of the three primary challenges:

- Diversification of supply: to ensure that the nation is not over-reliant on one source or technology for its energy
- Operational security: to ensure that there is sufficient generating capacity and energy to meet electricity requirements on a moment by moment basis: with particular reference to ensuring adequate capacity to meet peaks at the highest periods of demand in each year

- Contingency adequacy: to ensure that there is sufficient capacity to meet a contingency event such as might be caused by a week or two week anti-cyclone limiting wind generation.

Operational security and contingency adequacy are both related to diversification of supply (and reduction in demand).

We were pleased that The White Paper recognises the role of storage and the further consultations explain the need to identify mechanisms which may reward storage enabling storage projects to be developed alongside other technologies and methods for system balancing. The increased levels of renewable generation are already having an impact on the system and this effect is expected to increase substantially in the years 2015 – 2020. There is a need for action now in order to ensure that the necessary steps are in place before this requirement becomes a reality.

Electricity storage may be delivered in a number of sizes, technologies and with different operating parameters and in different locations. Storage has now been recognised by a number of DNO's as being one of the methods to support increased renewable generations at the transition to the smart grid. However, the demonstrations under the LCNF are still at relatively small scale and will need to be magnified and replicated several times for sufficient balancing, both at a national (system) and local (distribution) level to be achieved. The commercial methods assumed at present for some of the LCNF demonstrations may not be relevant in a post EMR commercial environment.

In addition to the more specific comments on the consultation, the Electricity Storage Network would wish to make the following points as being central to the discussion:

A) There are now a substantial number of independent reports, both generated from the UK and overseas which state that electricity storage is part of the solution to future system balancing. Reports such as Energy Research Partnership's statement on the Future of Electricity Storage leave no doubt that this key technology is a vital part of our future electrical infrastructure.[1]

B) The issue that must be addressed by all those with a responsibility for system and capacity planning is to produce a realistic estimate of the potential volume and value of electricity storage. This estimate should be translated into targets for storage that need to be adopted as part of the future infrastructure plan.

C) The broad scope of electricity storage technologies needs to be encompassed within the targets. In the same way that generation plant comes in many sizes and types, but is treated equitably within the market, all types of storage should be provided with an opportunity for just and equitable treatment.

D) Many parts of the future electricity network will receive some form of market support in order to encourage development of more efficient technologies, and these mechanisms, whether through a renewable obligation certificate, low carbon fund grant, regulatory

[1] Energy Research Partnership, The future role for energy storage in the UK, June 2011

incentive, capacity mechanism or feed in tariff should also be clearly available to nurture the development of storage. So far, the deployment of storage in the UK has been at low levels in comparison to other countries.

E) The level of financial support needed to bring storage to the market is small in comparison to the funding provided to other low carbon technologies. Due recognition must be given to the size of individual projects and the need to move projects away from small bespoke installations towards high volume manufacture and deployment.

F) However it must be recognised that financial support is essential since energy storage is a nascent technology but has to compete head to head with traditional and highly mature forms of reserve for revenue, i.e. diesel generating sets or OCGT, and with no regulatory or market value for the additional benefits of storage – i.e. absorb wrong time energy. Storage therefore cannot compete for commercial investment and move to high volume deployment with associate cost-down benefits.

G) We should look at the examples of other countries which are investing in research, development and deployment of energy storage as a partial solution to the challenges of a low carbon future. For example, Germany has recently announced an extensive programme of up to €200 million[2] and in the United States, electricity energy storage has benefitted from grants of up to $185 million on deployment projects of total project cost of $770 million.[3] We recommend that funding arrangements for development and deployment of utility scale electricity storage projects should take account of the need for urgent investment in this area.

H) A robust analysis of the use of electricity storage on the network is urgently required. Recent system studies have not included storage as a realistic and available technology option, thus removing the vision for storage from the scenario. This needs to be reversed and storage should be included as a viable means of providing flexibility across the network.

We have comments on both the strategic reserve and the capacity mechanism, both from a general market perspective and from the point of view of creating an opportunity for storage to be used in the future. Whatever option is adopted, it must not close doors on the opportunity to use electricity storage in the future.

There are advantages and disadvantages to both systems, and both systems could be designed to favourably support the greater introduction of electricity storage (and indeed the other necessary low carbon technologies).

The Strategic Reserve could be designed with targeted tranches which are specific to the needs and capabilities of energy storage. If adopted, the Strategic Reserve would enable some storage to be installed and operated under more favourable commercial conditions. However storage plant is

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[2] http://www.bmwi.de/English/Navigation/Press/press-releases,did=391256.html

[3] http://www.sandia.gov/ess/docs/ARRA_StorDemos_4-22-11.pdf

generally designed to be used, and installing storage systems, to be kept in a permanent state of standby is not the most effective way of using such a flexible resource in the future. If storage is only deployed as part of the strategic reserve, the flexibility that could be offered to the system is much reduced as the storage operator does not have full access to all the viable income streams. The strategic reserve must also be specified so that reserve may be both upwards and downwards on the system.

The Capacity Market could also provide support for capacity to be provided by electricity storage. The option for the central purchasing agency to contract for capacity enables electricity storage to be deployed with some certainty of income. The deployment of electricity storage technology, which is appropriate to provide capacity to cover both short term and longer term deficits, would benefit from the certainty of income.

The design of the capacity mechanisms should also allow investors to make long term investments by providing a certainty of income, at least in the early stages of additional storage deployment. This would encourage investment, set business models and support further investment, sales and hence cost reduction. As much as this can encourage UK manufacturers, it will also bring additional economic and environmental benefits to the nation.

We see the following key applications for storage as the system level:

- Provision of flexibility to the system operator;
- Purchase of "wrong time" delivered renewable energy;
- Supply of energy at key times to the market:
- With an underlying impact being reduced emissions across the system.

System operations in the future at the national level will seek to introduce as much sustainable generation as possible, while at the distribution level, the need will be for as much active network management and flexibility as possible in order to reduce peaks to avoid unnecessary and expensive local network reinforcement. Such load flattening will feedback to smoother time of day pricing, so other signals will need to be adjusted to ensure maximum use is made of sustainable generation and minimum high carbon generation is used.

A capacity mechanism is one method that encourages and supports flexible resources such as energy storage, to be deployed. But although a capacity mechanism is a method to remunerate new forms of generation capacity (which is important to avoid future generation constraints), to be effective in supporting good quality storage, it is important that the designs of the capacity mechanism takes account of:

(i) both generation and demand, where the value of storage as a system resource exceeds the arithmetic sum of these two values;

(ii) the cost to deploy valuable but nascent technology against the costs of mature but high carbon emission technology.

DEPARTMENT OF ENERGY & CLIMATE CHANGE

Consultation on Possible Models for a Capacity Mechanism

Response form

Responses are welcome by email or post. You may find this document helpful for structuring your response, but can reply in a separate document if you prefer. If replying in a separate document please make clear which questions you are answering.

Respondent Details	
Name	[redacted]
Organisation	The Electricity Storage Network
Address	Dairy Farm, Pinkney
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Tick this box if you are requesting non-disclosure of your response. ☐

Department of Energy & Climate Change,
Electricity Market Design – Security of Supply
4th Floor, Area D
3 Whitehall Place,
London, SW1A 2AW

You can also submit this form by email to:

DECC.capacity.mechanism@decc.gsi.gov.uk

Consultation questions

Note: the references in square brackets refer to page and figure numbers in the consultation document where more information can be found, and the questions are set out in context. The consultation document is Annex C of the Electricity Market Reform White Paper, and is available here:
http://www.decc.gov.uk/en/content/cms/consultations/cap_mech/cap_mech.aspx

Targeted mechanism

Consultation question	[page 167]
1	**Does this table [see Figure C3] capture all of your major concerns with a targeted Capacity Mechanism? Do you think the mitigation approach described will be effective?**
Response	Environmental issues are not mentioned. The differences between short-duration and long-duration storage are not adequately described or explained Support for fixed costs may depress energy costs Focus is on conventional generation (gas based) and does not take other technologies (such as storage) into account. Does not offer support for storage over initially lower cost, but less environmentally sound technologies such as peaking diesels or OCGT. Strategic reserve plant is described as being supported by a capacity payment but the discussion document indicates that a variable payment is due.

Consultation question	[page 168]
2	**How long should the lead time for Strategic Reserve capacity procurement be and why?**
Response	The lead time for procurement of Strategic reserve should be broadly similar to procurement of a range of other technologies, reflecting lead times for project development, manufacture and deployment as well as the contract length to reflect investment. We would support a range of procurement timescales, with tranches of strategic reserve placed on long term contracts in order to secure the necessary investment and provide strategic options over the long term, and some reserve to be contracted on a short term, revolving basis to meet the needs of the market. Provision may also be given to the use of strategic reserve to retain plant for reserve service instead of retirement.

Consultation question	[page 168]
3	**Should the length and nature of contracts procured by the Strategic Reserve procurement function be constrained in any way?**
Response	There should be sufficient incentive for a range of alternatives to be provided by suppliers. Contracts should be classified by contract length, volume, technical capability and sustainability performance.

Consultation question	[page 169]
4	**Which criteria should providers of Strategic Reserve be required to meet?**
Response	The concept of the strategic reserve is to ensure that there is sufficient capacity to meet any requirement. The final tier of strategic reserve should therefore be of high reliability, however lower tranches of reserve may not be so rigorously determined. The purpose of the strategic reserve is likely to also be split into tranches: that reserve which is likely to be required for running on one or more days in the season when peak demand exceeds the normal unconstrained capacity on the system, and the long term strategic reserve which is providing the capacity to meet a one week anti-cyclonic dip in renewable production, which can only be met, at present, by using conventional generation.

Consultation question	[page 169]
5	**How can a Strategic Reserve be designed to encourage the cost-effective participation of DSR, storage and other forms of non-generation technologies and approaches?**
Response	First, the role of the strategic reserve has to be enumerated and understood by the participants. It is assumed that the reserve will comprise two large tranches: a) reserve which is likely to be required for running on one or more days in the season when peak demand exceeds the normal unconstrained capacity on the system, and (b) the long term strategic reserve which is providing the capacity to meet a one week anti-cyclonic dip in renewable production, which can only be met, at present, by using conventional generation. DSR, storage and other forms of non generation technologies are likely, at

	least in the short term, to only be suitable for the first large tranche (a). Within this tranche, we envisage a number of separate invitations to tender or participate, based on a range of operating characteristics. These sub classes of reserve should be of volume and contract duration and lead-time such that they offer an incentive for new technologies to participate. The NFFO process of the electricity privatisation allowed for calls to be made to support and validate various new technologies. Such calls may be tightly controlled, and by offering participation on a volume and time basis, do not lead to exhaustive long term subsidies, but encourage participation and competitiveness amongst suppliers and developers. Nevertheless, we expect that some energy storage technologies will able to offer longer periods of reserve and provision (and support) for these needs to be included in the design for the Strategic Reserve, if it is to be adopted. A significant disadvantage of relying on the Strategic Reserve as a means of market introduction for storage is that the basic modus operandi is to be held in reserve, and not for operation. This is counter to the expectation of most manufacturers and developers who would wish their products to be used on a regular basis in order to build up operating hours experience. Furthermore, for a storage plant to be included in a strategic reserve, may mean that it is excluded from other activities, thereby severely limiting its revenue earning capability.

Consultation question	[page 175]
6	**Government prefers the form of economic despatch described here. Which of the proposed despatch models do you prefer and why?**
Response	The models of economic dispatch and last resort dispatch are not clear, and appear to be un-necessarily complex. The objective is to use the strategic reserve as a means of contracting in advance for capacity. In this instance, the capacity should be paid for on an ongoing basis as an availability payment. The energy charge, or utilisation payment, is therefore only expected to cover the short run marginal operating cost of the plant when it is called. Almost by definition, the purpose of a strategic reserve is to be held in reserve as part of a strategy to provide capacity which the market would not otherwise to supply. Relating the dispatch of the strategic reserve to either the system marginal price and its relationship to VOLL would seem to be interference with the market. The sole criteria for dispatch of the strategic reserve is that there is no other capacity that is available at that point in time on the system.

Consultation question	[page 175]
7	**How would the Strategic Reserve methodology and despatch price best be kept independent from short-term pressures?**
Response	In part, see the answer above. The most important step is to remove the element of political control from the dispatch of strategic reserve. Irrespective of the spot electricity price, strategic reserve should not be dispatched unless there is no other capacity that is available to fulfil the requirement, that is the decision to call strategic reserve should be operational, rather than economic.

Consultation question	[page 175]
8	**Do you agree that a Strategic Reserve should be periodically reviewed? If so, who would be best placed to carry out the review and how often should it be reviewed?**
Response	Yes. A review must be carried out at regular and announced time intervals. Such reviews should not interfere with the procurement process, and reserve that is under contract, should remain under contract, even if the review indicates a surplus. Failure to do this will indicate market interference, leading to lack of confidence by suppliers and potential investors in the future. For this reason, procurement of strategic reserve should be an underestimate of the total requirement in order to keep the market short in anticipation that deployment of new plant is required. The review should be carried out by a body (such as OFGEM) that is not responsible for the procurement and contracting of reserve.

Consultation question	[page 176]
9	**Into which market should Strategic Reserve be sold and why?**
Response	We believe that the simplest market for Strategic Reserve is for an extension of the proven market for reserve products such as STOR, but taking into account the different operating requirements for tranches within the Strategic Reserve. The market arrangements are simple, rely on proven assessment techniques and the volumes and timescales procured are suitable for a range of technologies of widely different operating parameters. STOR already is used to procure DSR, diesel and GT generation as well as fast

	acting hydro and other conventional plant. If the Strategic Reserve model is adopted as a means of contracting for capacity, and it is has some level of design to support new technologies, we also expect some providers of new storage technology to participate in this area.

Consultation question	[page 178]
10	**Do you have any comments on the functional arrangements proposed for managing a Strategic Reserve?**
Response	We favour a simple arrangement for procurement and dispatch of the Strategic Reserve. Clear rules and procedures need to be in place, and these must be followed to avoid market distortion. The business model for expansion of the STOR market into a STOR plus Strategic Reserve market would make the NETSO a suitable manager for the Strategic Reserve, but caution is required if the NETSO's independence is not to be jeopardised. The dispatch of the Strategic Reserve may be on a national, or under certain circumstances, regional basis. We do not favour the establishment of another new governmental or quasi autonomous non-governmental body to be set up especially for this purpose.

Consultation question	[page 179]
11	**Given the design proposed here and your answers to the above questions, do you think a Strategic Reserve is a workable model of Capacity Mechanism for the GB market?**
Response	Overall, we believe that the strategic reserve is a workable model as it has the capability to provide an increase in capacity, and thus prevent the prophetic shortfall in generation. Correctly established, it provides reserve flexibly and under a competitive framework, whilst at the same time, allowing scope for new technologies to be demonstrated. Nevertheless, in terms of a means to achieve additional reliable capacity on the system, a market wide mechanism is preferred. Our concern is that Strategic Reserve may not provide a satisfactory means to introduce electricity storage to the market and may indeed reduce the options for using storage in the future.

Market-wide mechanism

Consultation question	[page 182]
12	**How and by whom should capacity in a GB market be bought and why?**
Response	A central buyer should add transparency, but leaves issues of credit risk and completion risk in the process. The new capacity market should not interfere with the existing market, but the interactions between the two mean that this will probably not be achieved. The central buyer would also be able to specify any special requirements, which otherwise would not be seen if the capacity was simply contracted between generators and supply companies. A central buyer reflects the need to accommodate new entrants and maintain an open market.

Consultation question	[page 183]
13	**What contract durations would you recommend for a Capacity Market?**
Response	Contract durations need to be of sufficient length to provide certainty of investment and consequential reduction in the cost of capital. However not all contracts should be of the same length, and we see various tranches across the bandwidth of contract lengths from less than one year to fifteen or twenty years.

Consultation question	[page 184]
14	**How long should the lead time for capacity procurement be? Should there be special arrangements for plant with long construction times?**
Response	Logically, the lead time for procurement should reflect the lead time for the construction of new generation plant. However this assumption is heavily skewed towards the solution of new gas plant as the sole means to provide capacity. However, many of the non traditional technologies, such as storage and DSR have much shorter construction and deployment times and this should be included in the options for procurement, and the advantages of rapid deployment brought into play.

Consultation question	[page 185]
15	**Should there be a secondary market for capacity? Should there be any restrictions on participants or products traded?**
Response	A secondary market would encourage storage and DSR to participate, preferably through a secondary tender process.

Consultation question	[page 186]
16	**What are the advantages and disadvantages of making a central, administrative determination of (i) the capacity that can be offered into the market by each generator; (ii) the criteria for being available; and (iii) the penalties for non-availability? In outline, how would you suggest making these determinations?**
Response	A centralised determination leads to a more uniform approach to the supply of capacity and assists potential providers who will build up levels of confidence in the system. However these determinations will be complex as a variety of technologies and methods will be proposed, and an equitable determination should reflect actual performance and not perceived performance. This is a particular problem for proposers of new technologies, such as storage, where there are a number of different categories each with their own operating characteristics.

Consultation question	[page 191]
17	**How should the reference market for reliability contracts be determined and what would be an appropriate reference market if it is set by the regulator? How could any adverse effects of choosing a particular option be mitigated?**
Response	In our view, reliability contracts add an extra layer of complexity onto an already complicated system. Reliability contracts will tend to favour existing participants and known technologies and we do not support this proposal at the present time.

Consultation question	[page 192]
18	**For a Reliability Market, how should the strike price be determined? If using an indexed strike price, which index should be used?**
Response	See question 17

Consultation question	[page 193]
19	**For a Reliability Market, what level of physical back up (if any) should be required for reliability contracts and how should it be monitored?**
Response	See question 17 in part. As our interest is to see a physical manifestation of capacity (including storage) we would suggest that a high level of physical back up is required and should be subject to an open monitoring process.

Consultation question	[page 194]
20	**Do you agree that a vertically integrated market potentially raises issues for the effectiveness of a Reliability Market? If so, how should these issues be addressed?**
Response	Any market is open to distortion and response to participants' behaviours. A fully functioning model to simulate cash flows and profits, from the investor / owner perspective is required, simulating trading and investor response in order to estimate behaviours and outcomes.

Consultation question	[page 195]
21	**What could we do to mitigate interactions between a Capacity Market (especially if a Reliability Market) and Feed-in Tariff with Contract for Difference without diluting the effectiveness of either?**
Response	The overlap between the two mechanisms may lead to some participants being paid twice, and clearly this is unacceptable as it will further distort the market. For this reason, the Reliability market is a sub optimal solution.

Consultation question	[page 196]
22	**How can a Capacity Market be designed to encourage the cost-effective participation of DSR, storage and other non-generation technologies and approaches?**
Response	Where markets have been open to DSR, DSR has blossomed. This has been shown recently by the increased number of DSR participants in the STOR market. Interconnectors cannot be relied on as firm reserve capacity as their use depends on price differential and transmission rights cannot be guaranteed. To date, storage has not yet undergone similar growth. Storage has a capability to provide two way response, however the contracts need to reflect not only the power rating of the technology but also its inherent energy storage capacity as well as the capability to offer two way power flows to benefit the system. The technology aspects are relatively simple, the commercial aspects are more complex. Electricity storage projects need market access which is dependent on the scale of the project and the relative scale of the transaction costs which are higher for smaller projects than for large participants, such as a CCGT. A central buyer reflects the need to accommodate new entrants and maintain an open market. Non generation participants are often not experts in energy trading, so simple market access is essential. It may be necessary to limit aggregation by large participants, while encouraging aggregation of smaller projects.

Consultation question	[page 199]
23	**Do you have any comments on the functional arrangements proposed for managing a Capacity Market?**
Response	The capacity market needs to be built, and it would be appropriate to assemble it in small contract volumes as confidence is gained.

Consultation question	[page 199]
24	**Do you think that a trigger should be set for the introduction of a Capacity Market? If so, how do you think the trigger should be established, and how should it be activated?**
Response	Investment in the power market is subject to perception of a number of factors, including fuel prices, carbon taxes, and market stability. While much development is considered to have long lead times, not all technologies are constrained in this way. The Capacity Market needs to be introduced in a constructive and incremental way, and an appropriate trigger mechanism offers the opportunity for different technologies to be brought in under each tranche. We would propose for example, that an early trigger is set for a tranche of capacity based on storage technologies to be released, prior to a tranche for carbon based generation.

Consultation question	[page 199]
25	**What is the most appropriate design of Capacity Market for GB and why?**
Response	We support the Capacity Market based on a central purchaser of capacity. The market should be introduced in tranches, and early tranches should critically support new technologies with high quality capacity rather than traditional carbon-based generation. High quality capacity should include flexible technologies such as electricity storage, other energy storage, and DSR. A stable position for the market should be adopted and high carbon capacity should only be triggered when all other available technologies have been exhausted. Generators and Energy customers will need to become re-acquainted with the concepts of paying for both energy and capacity as well as power related component for their transmission and distribution costs. The overall market design must be simple and clear to understand. It must be designed in such a way that **investors** have confidence in the system; it provides long term reassurance of income where necessary in order to reduce the costs of capital for developers.

Capacity mechanism Assessment

Consultation question	[page 210]
26	**What are your views on the costs and benefits of a Capacity Mechanism to industry and consumers?**
Response	The industry has faced several restructuring processes since privatisation, each at considerable initial cost and with increased complexity and ongoing charges. Market entry for new participants is close to being prohibitively expensive. Although the headline driver for market change in the past has been to reduce costs for the end consumer, it is now recognised that substantial changes to the market are needed in order to realign energy production and consumption in a sustainable and low carbon manner. The additional costs are high and the benefits of a low carbon industry will be long term in nature. The modelling assumptions on the cost of the market reform are based on characterisation of new plant build, which does not include a realistic proportion of electricity storage and we therefore recommend that the modelling to examine the NPV is repeated with a more likely adoption target for storage.

Consultation question	[page 211]
27	**Which Capacity Mechanism should the Government choose for the GB market and why?**
Response	We believe a capacity market, with a central buying agency is the better option.

Please select the category below which best describes who you are responding on behalf of.

- ☒ Business representative organisation/trade body
- ☐ Central Government
- ☐ Charity or social enterprise
- ☐ Individual
- ☐ Large business (over 250 staff)
- ☐ Legal representative
- ☐ Local Government
- ☐ Medium business (50 to 250 staff)
- ☐ Small business (10 to 49 staff)
- ☐ Micro business (up to 9 staff)
- ☐ Trade union or staff association
- ☐ Other (please describe):

Thank you for taking the time to let us have your views.

The Government does not intend to acknowledge receipt of individual responses unless you tick this box. ☒