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BEIS / Ofgem

12th January 2017

Dear Sir/Madam,

Smart Flexibility Call for Evidence

Thank you for the opportunity to respond to the Call for Evidence on Smart Flexible Energy.

We strongly believe domestic energy storage presents significant benefits for the UK in reducing electricity costs, reducing carbon emissions and in increasing energy security. While this market is still in its early stages, customers are very enthusiastic about the opportunity to install home energy storage and do not receive any subsidy for doing so. When they do buy home energy storage then significant benefits also accrue to other players in the supply chain in the form of reduced transmission, distribution and capacity costs (see Appendix A). Customers are not currently fairly rewarded fairly for these benefits. Markets should therefore be opened up, through the introduction of half hourly settlement and other market reform to allow customers to benefit fully from the flexibility that they are providing. It is also therefore very important that that new costs and new regulatory burdens are not placed on them.

Our answers to your specific questions are below.

Yours sincerely,

Joe Warren

Managing Director

Powervault Limited

1. Have we identified and correctly assessed the main policy and regulatory barriers to the development of storage? Are there any additional barriers faced by industry?

Please provide evidence to support your views.

Domestic energy storage faces many of the same kinds of barriers as larger scale energy storage. We note that BEIS and Ofgem have been very supportive in helping to remove certain of these barriers. However, some specific barriers to domestic scale flexibility, and some of its specific benefits do not feature in your call for evidence. Furthermore, the call for evidence suggests introduction of several new barriers to domestic flexibility.

For example:

- Existing over-regulation of domestic flexibility (including storage). For example, the application of G/59 and G/83 to behind the meter energy storage which does not export and is prima facie beneficial to the network. We appreciate the support that BEIS, Ofgem and the ENA have provided in resolving this issue which needs to be followed through if the benefits of domestic flexibility are to be maximised in future.
- Lack of smart metering and elective half hourly settlement for domestic customers leading to inability to recognise the benefits of storage in reducing investment and operating costs and CO2 emissions and increasing security of supply for the DNO, SO, transmission costs, and reducing capacity requirements.
- Not recognising the special benefits of locating flexibility (including domestic energy storage, not just electric vehicles) in people's homes and small businesses. In Appendix A we have provided some evidence from studies that suggest that domestic energy storage (and by extension other domestic flexibility) can alleviate low voltage network issues, including voltage increases resulting from distributed generation and increased demand from electric vehicles and heat. However, the value of these is often not mentioned in documents such as the call for evidence.
- Lack of medium term views on distribution and transmission network pricing regimes, evidenced through the call for evidence section on duos pricing and embedded benefits review. It would be useful if network charging could facilitate flexibility and be locked for 5-10 years to support investment decisions.
- Potential regulation of domestic flexibility from smart appliances proposed in the call for evidence. Consumer appliances are already heavily regulated through European directives and other laws and codes. The main barrier to smart appliances is not regulation but rather a lack of market access – for example the lack of smart metering and half hourly settlement. Inappropriate regulation could create a new barrier in the form of costs.

2. Have we identified and correctly assessed the issues regarding network connections for storage? Have we identified the correct areas where more progress is required?

Please provide evidence to support your views.

We appreciate the support that BEIS, Ofgem and the ENA have provided to prevent potential over-regulation, for example, the application of G/59 and G/83 to behind the meter storage which does not export and is prima facie beneficial to the network. If the benefits of domestic flexibility are to be maximised, then continued support is required to immediately remove any potential barriers to behind the meter flexibility that does not export (and the prevention of any new barriers to it) and in the medium term to remove any potential barriers to behind the meter domestic flexibility fully exporting.

4. Do you agree with our assessment that network operators could use storage to support their networks? Are there sufficient existing safeguards to enable the development of a competitive market for storage? Are there any circumstances in which network companies should own storage?

Please provide evidence to support your views.

The traditional regulatory regime for DNOs establishes a model where incentives drive them more firmly towards investment in assets such as transformers and cables and in using diesel generators to provide flexible network reinforcement. The perception seems to be that new technologies are uneconomic because DNO's cannot access all of the revenue and other value streams of these new technologies. Furthermore, where flexibility is required there may be a preference among DNO's for traditional technologies such as diesel generation. Given that revenue stacking is likely to be required to economically operate new technologies it would be better for DNOs to instead be incentivised to create markets for the value that they see in flexibility and to buy services from these markets rather than investing in and owning these assets. We understand that this is in line with much of the innovation and work already being done in BEIS, Ofgem and the DNO's.

5. Do you agree with our assessment of the regulatory approaches available to provide greater clarity for storage? Please provide evidence to support your views, including any alternative regulatory approaches that you believe we should consider, and your views on how the capacity of a storage installation should be assessed for planning purposes.

While a clear definition of energy storage may help, the definition alone is not sufficient to ensure a level playing field for storage. This is because the impact of this definition for storage depends on how that definition is used elsewhere in legislation and regulations. The focus should now shift to how best to use this new storage definition to unlock access to relevant markets (for domestic/small, medium and large scale storage. As with all new regulations, regulators and policy makers should state the objectives of any legislation or regulation introduced and review it periodically to see whether original objectives are not met. The storage definition (or rules that use it) can then be adjusted if the intended objectives are not being met.

10.Do you agree with our assessment of the risks to system stability if aggregators' systems are not robust and secure? Do you have views on the tools outlined to mitigate this risk?

Understandably, system stability is often cited as the first concern with any new technology. However, where there is no subsidy, new technologies are usually deployed at comparatively low penetration levels *compared to the size of the GB grid (average consumption 45 GW) and its operating parameters (single largest loss 1.2GW)* and hence at very low risk levels. To avoid creating barriers for nascent technologies, we should be careful not to jump to worse-case scenario planning before new technologies have established and reached a significant penetration level.

While the issue of synchronisation is important, there are a number of simple technical methods which could be used to mitigate the risk of synchronisation. For example, the DNO's and National Grid have been controlling gigawatts of storage heaters pseudo-synchronously for many decades without significant issues. Furthermore, most demand side response aggregation can already be controlled by National Grid with equivalent or better speed and granularity than existing generation. All of these systems were put in place without any legislation or regulation being required and with standards being agreed between suppliers and National Grid. It is also possible to implement appropriate security simply and cost effectively. Given the greater sophistication of today's technology simple and fit-for-purpose solutions should be easy to develop within industry and without any regulation being required, or at worst very light touch regulation.

Any policy or regulation should be proportionate to the level of risk, recognising that most technologies are likely to remain at low deployment levels *compared to the size of the grid and its operating parameters* and will develop naturally over a number of years and existing processes for developing suitable technical systems to manage risk have been successful for a number of decades.

11 What types of enablers do you think could make accessing flexibility, and seeing a benefit from offering it, easier in future?

For domestic flexibility including smart appliances, domestic DSR, domestic energy storage and EV's, the lack of half hourly settlement is creating a barrier to accessing differential DUoS pricing and DNO DSR and may also be a barrier in other value streams, for example transmission charging, the capacity mechanism and some National Grid ancillary services. The lack of medium to long term certainty over network charging is also a potential barrier which could be remedied by creating a longer term 5-10 year policy.

13 If you are a potential or existing provider of flexibility are there benefits of your technology which are not currently remunerated or are undervalued? What is preventing you from capturing the full value of these benefits?

For domestic flexibility including smart appliances, domestic DSR, domestic energy storage and EV's, the lack of half hourly settlement is creating a barrier to accessing differential DUoS pricing and DNO DSR and may also be a barrier in other value streams, for example transmission charging, the capacity mechanism and some National Grid ancillary services. The lack of medium to long term certainty over network charging is also a potential barrier which could be remedied by creating a 5-10 year policy.

14. Can you provide evidence to support changes to market and regulatory arrangements that would allow the efficient use of flexibility and what might be the Government's, Ofgem's, and System Operator's role in making these changes?

For domestic flexibility including smart appliances, domestic DSR, domestic energy storage and EV's, the lack of half hourly settlement is creating a barrier to accessing differential DUoS pricing and DNO DSR and may also be a barrier in other value streams, for example transmission charging, the capacity mechanism and some National Grid ancillary services. The lack of medium to long term certainty over network charging is also a potential barrier which could be remedied by creating a 5-10 year policy.

15.To what extent do you believe Government and Ofgem should play a role in promoting smart tariffs or enabling new business models in this area? Please provide a rationale for your answer, and, if you feel Government and Ofgem should play a role, examples of the sort of interventions which might be helpful.

For domestic flexibility including smart appliances, domestic DSR, domestic energy storage and EV's, the lack of half hourly settlement is creating a barrier to accessing differential DUoS pricing and DNO DSR and may also be a barrier in other value streams, for example transmission charging, the capacity mechanism and some National Grid ancillary services. The lack of medium to long term certainty over network charging is also a potential barrier which could be remedied by creating a 5-10 year policy.

16. If deemed appropriate, when would it be most sensible for Government/Ofgem to take any further action to drive the market (i.e. what are the relevant trigger points for determining whether to take action)? Please provide a rationale for your answer.

Government should commit to the target set last year of half hourly metering and smart tariffs being in place by the end of 2017 at the latest, together with the smart meter timetable to complete rollout by 2020.

17. What relevant evidence is there from other countries that we should take into account when considering how to encourage the development of smart tariffs?

International experience suggests that "net metering" tariffs can result in the removal or reduction of incentive for flexibility. Smart tariffs settled on half hourly price signals should be introduced instead.

19.Are distribution charges currently acting as a barrier to the development of a more flexible system? Please provide details, including experiences/case studies where relevant.

Any lack of certainty over distribution and transmission network charges is a barrier to a more flexible system. We believe that a full scale review of grid access charging is necessary, via an Ofgem-initiated Significant Code Review (SCR) that considers all the issues as a whole, rather than in isolation as in the current Embedded Benefits review.

20. What are the incremental changes that could be made to distribution charges to overcome any barriers you have identified, and to better enable flexibility?

We believe that a full scale review of grid access charging is necessary, via an Ofgem-initiated Significant Code Review (SCR) that considers all the issues as a whole, rather than in isolation as in the current Embedded Benefits review.

21. How problematic and urgent are any disparities between the treatment of different types of distribution connected users? An example could be that in the Common Distribution Charging Methodology generators are paid 'charges' which would suggest they add no network cost and only net demand.

We believe that a full scale review of grid access charging is necessary, via an Ofgem-initiated Significant Code Review (SCR) that considers all the issues as a whole, rather than in isolation as in the current Embedded Benefits review.

22.Do you anticipate that underlying network cost drivers are likely to substantively change as the use of the distribution network changes? If so, in what way and how should DUoS charges change as a result?

Underlying network cost drivers are unlikely to change so rapidly as to prevent the creation of a charging regime that is stable over periods of 5-10 years. Such stability is important to facilitate to introduction of new technologies including domestic energy storage. The benefit of facilitating introduction of new flexibility technologies is outweighed by inefficiency that fixing the regime for a longer period of time.

23.Network charges can send both short term signals to support efficient operation and flexibility needs in close to real time as well as longer term signals relating to new investments, and connections to, the distribution network. Can DUoS charges send both short term and long term signals at the same time effectively? Should they do so? And if so, how?

It would be useful if a network charging regime could be developed that would be remain stable over periods of 5-10 years because this stability would facilitate introduction of new flexibility technologies. This is really a topic for a comprehensive review but it ought to be possible to come up with a tariff or charging regime which rewards both systematic time of use benefit and also rewards providers of flexibility by paying for an option to shift the deployment of that energy. As with all incentives, long term stability for flexibility or optionality will encourage market development.

25.Can you provide evidence to show how existing Government policies can help or hinder the transition to a smart energy future?

In line with Government's position in the call for evidence we believe that smart meters combined with smart time of use tariffs for both consumption AND generation should be introduced before deemed export tariffs are removed. Full, half hourly settled generation and consumption tariffs could compensate customers fairly for their generation and provide incentives to store energy on-site where appropriate.

27. Do you have any evidence to support measures that would best incentivise renewable generation, but fully account for the costs and benefits of distributed generation on a smart system?

In line with Government's position in the call for evidence we believe that smart meters combined with smart time of use tariffs for both consumption AND generation should be introduced before deemed export tariffs are removed. Full, half hourly settled generation and consumption tariffs could compensate customers fairly for their generation and provide incentives to store energy on-site where appropriate.

28 Do you agree with the 4 principles for smart appliances set out above (interoperability, data privacy, grid security, energy consumption)?

While we agree that interoperability, privacy, grid security and energy consumption are important principles for smart appliances, disproportionate regulation could seek to address problems which are negligible or do not exist (and/or will not be substantive or exist for many years) while creating a barrier for innovation in the short to medium term. When it arises any regulation should be proportionate to the likely risk which in all categories (interoperability, data privacy, grid security, energy consumption) is very small at this stage in the market. Specifically:

Interoperability – regulation should instead focus on ensuring that smart meters and associated infrastructure operate on open standards. If the value of interoperating is great enough then appliance manufacturers will adopt these standards.

Data privacy – consumers are already protected by legislation. Consumers have a free choice to buy appliances (or not) in a competitive market (where there is already considerable regulation on data privacy). Since consumers are opting in, then it would be disproportionate to apply the same regulation which is applied to the mandatory smart meter roll out or situations where there is no choice but to purchase the product (for example in energy markets).

Grid security – this is obviously of paramount importance. However taking into account the relative size of smart appliance deployment in the coming years, *compared to the size and operating parameters of the grid,* this risk is extremely low in the short to medium term. It is important to keep any regulation strictly in proportion with risks and allow regulation to develop as the market evolves.

Energy consumption – economics of "smart" for all smart appliances depend on ensuring that they are as low cost and efficient as possible. Domestic energy storage is only viable if the cost of any energy consumption (resulting from the efficiency factor) is outweighed by the benefits.

29. What evidence do you have in favour of or against any of the options set out to incentivise/ensure that these principles are followed? Please select below which options you would like to submit evidence for, specify if these relate to a particular sector(s), and use the text box/attachments to provide your evidence.

□ Option A: Smart appliance labelling

□ Option B: Regulate smart appliances

□ Option C: Require appliances to be smart

□ Other/none of the above (please explain why)

The introduction of additional regulation suggested in this section of the call for evidence could create new barriers to entry, contrary to its objectives. Additional regulation brings costs which far outweigh any benefits, especially at this stage of market development. Any standards should emerge naturally at appropriate times as the market develops. Additional obligations should not be placed on new entrants in markets which are nascent and already difficult to enter.

For example, if it were a requirement under interoperability to add certain communications components, but there was no smart tariff benefit (yet) from doing so, this could make the economics of smart appliances worse not better. It would be more productive to mandate communications standards or open access to smart meters and to enable access to smart tariffs. There would then be a natural incentive to add appropriate components.

For this reason, perhaps labelling would be the most appropriate way forward.

30. Do you have any evidence to support actions focused on any particular category of appliance? Please select below which category or categories of appliances you would like to submit evidence for, and use the text box/attachments to provide your evidence:

□ Wet appliances (dishwashers, washing machines, washer-dryers, tumble dryers)

□ Cold appliances (refrigeration units, freezers)

□ Heating, ventilation and air conditioning

□ Battery storage systems

□ Others (please specify)

In all categories the main barrier to adoption of smart appliances is the lack of smart metering and half hourly settlement. The introduction of additional regulation suggested in this section of the call for evidence could create new barriers to entry, contrary to its objectives. Additional regulation brings costs which far outweigh any benefits, especially at this stage of market development. Any standards should emerge naturally at appropriate times as the market develops. Additional obligations should not be placed on new entrants in markets which are nascent and already difficult to enter.

31. Are there any other barriers or risks to the uptake of smart appliances in addition to those already identified?

The introduction of additional regulation suggested in this section of the call for evidence could create new barriers to entry, contrary to its objectives. Additional regulation brings costs which far outweigh any benefits, especially at this stage of market development. Any standards should emerge naturally at appropriate times as the market develops. Additional obligations should not be placed on new entrants in markets which are nascent and already difficult to enter.

34. What barriers are there for vehicle and electricity system participants (e.g. vehicle manufacturers, aggregators, energy suppliers, network and system operators) to develop consumer propositions for the:

- control or shift of electricity consumption during vehicle charging; or

- utilisation of an electric vehicle battery for putting electricity back into homes, businesses or the network?

For domestic flexibility including smart appliances, domestic energy storage and EV's, the lack of half hourly settlement is creating a barrier to accessing the value of flexibility of these devices.

39.When does engaging/informing domestic and smaller non-domestic consumers about the transition to a smarter energy system become a top priority and why (i.e. in terms of trigger points)?

Consumers are most likely to participate in flexibility schemes if it requires little or not effort from them and if they can realise the benefits of these schemes. Therefore removing barriers to smart appliances and opening up access to markets for flexibility is the most important thing that Government can do. For domestic flexibility including smart appliances, domestic energy storage and EV's, the lack of half hourly settlement is the main barrier to accessing the value of flexibility offered by these devices.

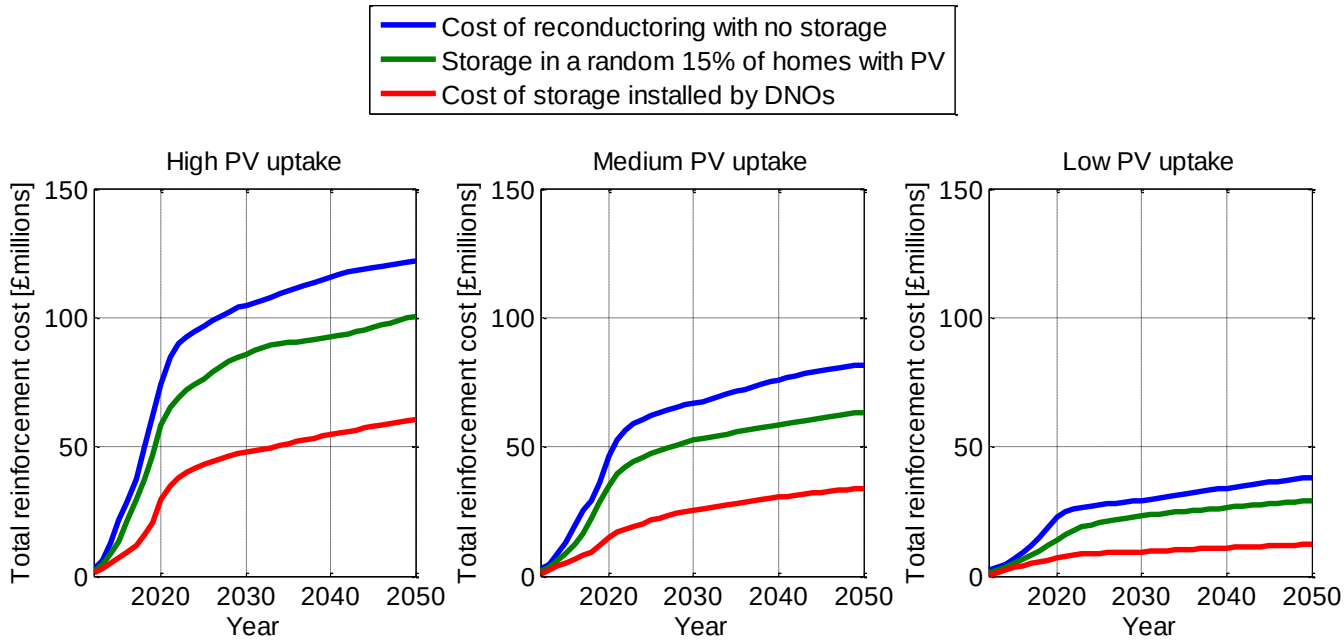
APPENDIX A : Domestic Storage Benefits

The UK is legally committed to meeting 15% of its energy demand from renewable sources by 2020[1] and the Paris COP21 talks have proposed to commit to ultimately reducing CO2 emissions to 0%. This is driving changes to the way homeowners generate and consume electricity which can create technical challenges for managing electricity networks. More than 850,000 customers have deployed small scale electrical generation (usually solar PV) systems to their houses resulting in higher voltage levels during the day. Customers are also moving to using electricity to power their cars and heat their houses which could lead to excessive consumption at peak times. The Electricity Networks Association and Imperial College estimated that these changes could cost **more than £10bn by 2030 with 90% of the cost resulting from low voltage network reinforcement[2].**

The National Infrastructure Commission and Lord Adonis recently estimated that **demand flexibility and electricity storage could save the UK £8bn a year**[3] and a Carbon Trust report (funded by SSE, Scottish Power, E-On and DECC) recently estimated that energy storage could save **£2.4 billion a year system wide by 2030; if regulatory hurdles are overcome this could rise to £7 billion a year**[4]. DECC have recently stated a policy of removing barriers from energy storage[5]

Recent research carried out by Dr Andrew Crossland and ENWL gives an example of these benefits to DNO's. Dr Crossland collaborated with ENWL and modelled the benefit to the DNO of installing domestic energy storage to reduce reinforcement costs. The results are shown below.

Cost reduction benefits of domestic energy storage, Crossland, ENWL (2015)



Crossland's project with ENWL concluded that:

- "Storage located at secondary transformers does not always prevent overvoltage in LV networks.
- DNOs should encourage homeowners to purchase storage in their homes as this reduces their reconductoring costs.
- Storage, if carefully located in LV networks, might provide cheaper ways of preventing overvoltage than traditional network reconductoring and should be considered by DNOs."

[1] http://ec.europa.eu/energy/renewables/index_en.htm
2 http://www.energynetworks.org/assets/files/electricity/futures/smart_meters/Smart_Metering_Benerfits_Summary_ENASEDGImperial_100409.pdf
3 https://www.gov.uk/government/news/a-smart-power-revolution-could-save-consumers-8-billion-a-year-adonis
4 https://www.carbontrust.com/resources/reports/technology/energy-storage-report/
5 https://www.gov.uk/government/publications/towards-a-smart-energy-system

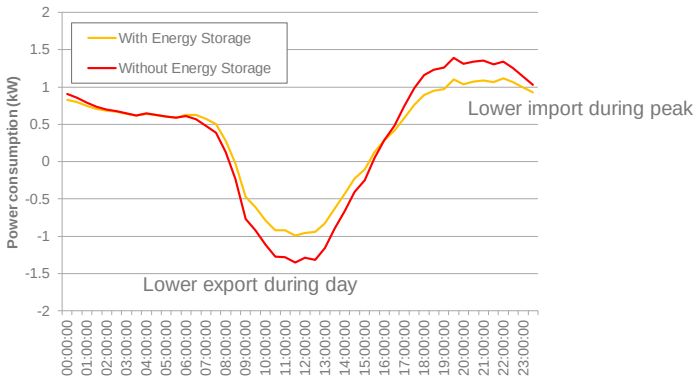
Domestic energy storage benefits in the distribution network

Domestic energy storage has the potential to help resolve problems introduced by embedded microgeneration and other new technologies including electric vehicles and ground source heat pumps. Benefits could result from both passive and active use of domestic energy storage.

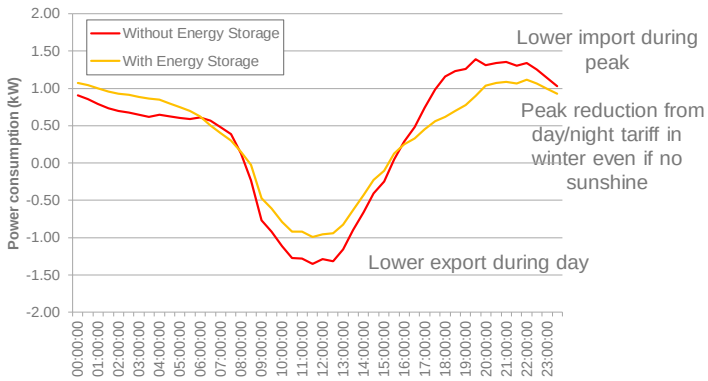
In its default operation mode, domestic energy storage reduces export to the network at times of solar PV generation and reduces import to the network as consumption increases. At first glance, this would be expected to alleviate the problems of voltage rise on the LV networks, reducing reinforcement costs, preventing voltage rises from causing solar PV systems to switch off (as they are required to do according to G83/2) and reducing the possibility that customers who wanted to connect embedded generation to the network would have to bear reinforcement costs. It is likely also to reduce the impact of peak consumption on the distribution network, resulting in a deferral of reinforcement costs. The benefits will not only accrue to electricity industry parties such as the DNO and TO/SO, but to the rest of "UK Plc." through reduction in the need for transmission capacity, and through the reduced need for generating plant at peak times.

Example benefits of domestic energy storage

Solar PV



Day/Night + Solar PV



Other benefits of domestic energy storage

The National Infrastructure Commission and Lord Adonis recently estimated that **demand flexibility and electricity storage could save the UK £8bn a year**[6]. Domestic energy storage can also provide benefits to other "UK Plc" stakeholders as follows:

1. Reduction in CO2 emissions: National Physical Laboratory assessed Powervault's prototype system and estimated that it could reduce CO2 emissions by maximising the use of lower carbon generation sources by 0.3 tonnesCO2/unit/yr. Combined with sales projections this suggests 1m tCO2/year by 2020.
2. Facilitating the connection of low carbon renewable generation and reducing the curtailment of renewable energy sources. Wind farms were paid £56m in 2014 to curtail 0.6 TWh of wind energy (Renewable Energy Foundation). Imperial College estimated that this could be 30 TWh by 2030 and that 3.5GW of storage could halve the curtailment of renewables to less than 15 TWh per year in 2030
3. Facilitating the introduction of electric vehicles and ground source heat pumps, indirectly reducing CO2 emissions.
4. Reducing transmission capacity costs
5. Reducing generation capacity costs in the capacity market which will cost of £1-£3bn/yr from 2020.
6. Reducing energy costs for customers by up to 20%.
7. Reducing the £1bn annual cost of balancing supply and demand of electricity (National Grid).

[6] https://www.gov.uk/government/news/a-smart-power-revolution-could-save-consumers-8-billion-a-year-adonis