SUBMISSION FROM THE ELECTRICITY STORAGE NETWORK

Security of Supply – Call for Evidence

1. The Electricity Storage Network is the UK's industry association for the promotion of electrical energy storage. Current members include electricity storage manufacturers and suppliers, developers of electricity storage projects, users, electricity network operators, consultants, academic institutions and research organisations.

2. The Electricity Storage Network works on behalf of its members to respond to and address issues affecting the development and utilisation of electricity storage within the UK power system. This includes special interest meetings, liaising with the media, responding to consultations, providing a unified point of contact for those interested in electricity storage and promoting the value of storage within the UK power system.

Background

3. Our evidence covers our main area of interest – electricity storage. This is relevant to the main points of the inquiry as it covers matters of supply and generation, demand, transmission, market changes and is a topic in its own right.

4. Electricity storage is a subset of the whole energy storage topic. Energy storage can cover a spectrum ranging from fuel stores (which are primary storage) through to devices such as batteries – rechargeable batteries (such as used in our phones and computers) are known as secondary batteries.

5. Electricity storage is concerned with electricity taken from the network, stored in a device and then discharged back to the network. The whole energy economy also depends on heat and gas networks, and there are interchanges between these networks and the electricity system. There is often a misunderstanding between the general term “energy” and the specific term “electricity.” In the context of storage, energy storage can be a general term representing systems that might store primary fuel, thermal energy (as heat) or electricity storage – which we define as being a system that takes electricity from the network to charge a device, and discharges electricity at a later point in time. All forms of energy storage have a place in the overall energy framework, and electricity storage is a key part of the power system.

6. As with generation, which can be at large scale or small scale, and encompass a range of technologies, storage can be at large scale through to small scale, not only in terms of power, but also in terms of its energy content. A chart showing the range of parameters is shown at figure 1.

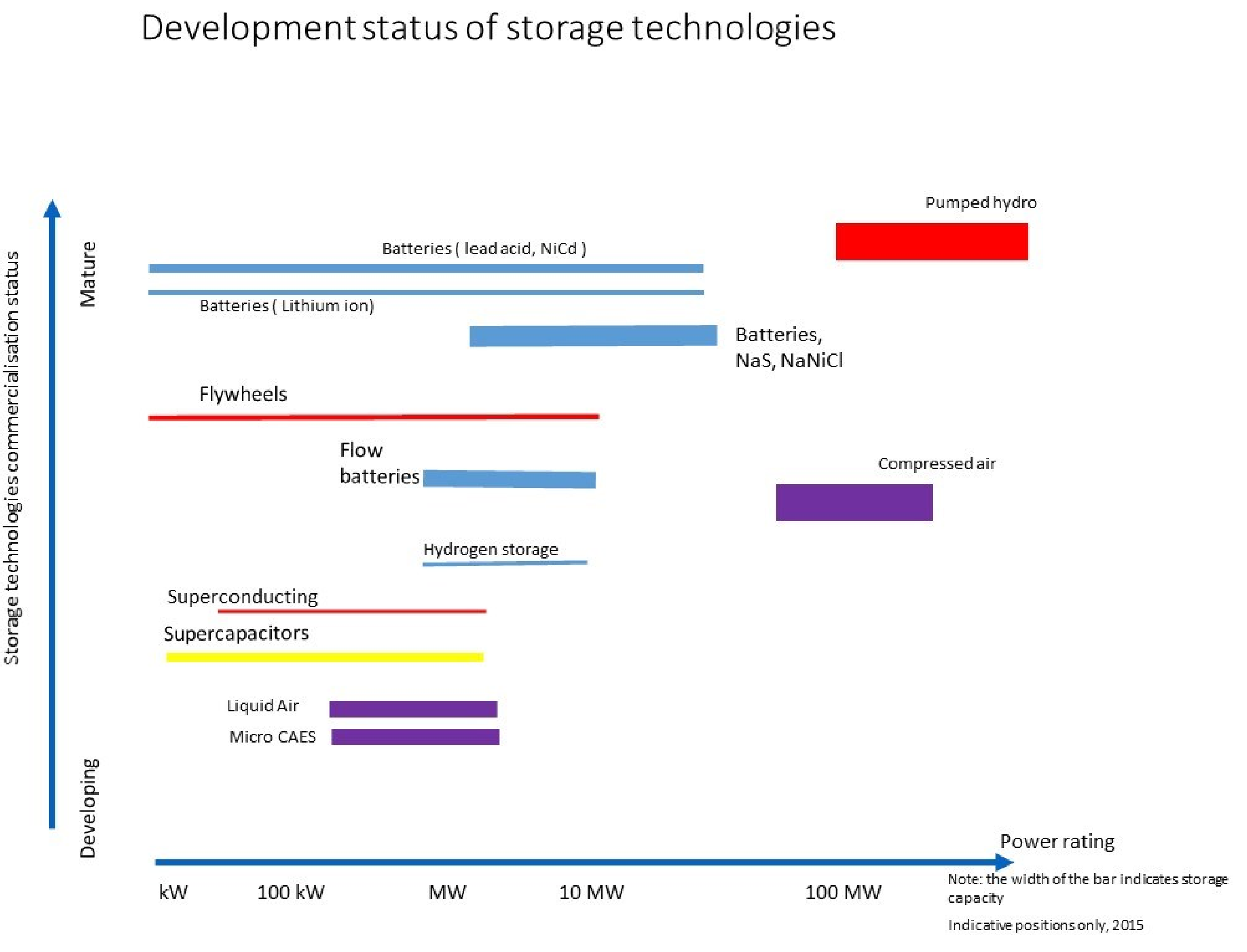

Figure 1. Parameters for storage

Source: *Swanbarton Limited 2015*

7. Figure 1 shows a selection of storage technologies. Those shown to the top of the chart are at a high state of commercialisation. Each technology is described in terms of the range of the relevant power rating that is most likely for the technology and has been demonstrated or deployed in an active installation.. For example pumped hydro is generally seen as a large scale technology with plant sizes in the hundreds of MW. The width of each technology bar indicates the typical energy content for a commercial installation. For example a lithium battery has a lower energy content for each nominal unit of power than a flow battery.

8. There are numerous storage technologies which are currently being deployed around the world and the lack of deployment of storage should not be attributed to under- development of the technology. A recent graphic in Figure 2 (2014) shows some of the nation's storage projects. A list of storage projects undertaken in the OFGEM LCNF programme may be downloaded from http://bit.ly/1Ej7jTM

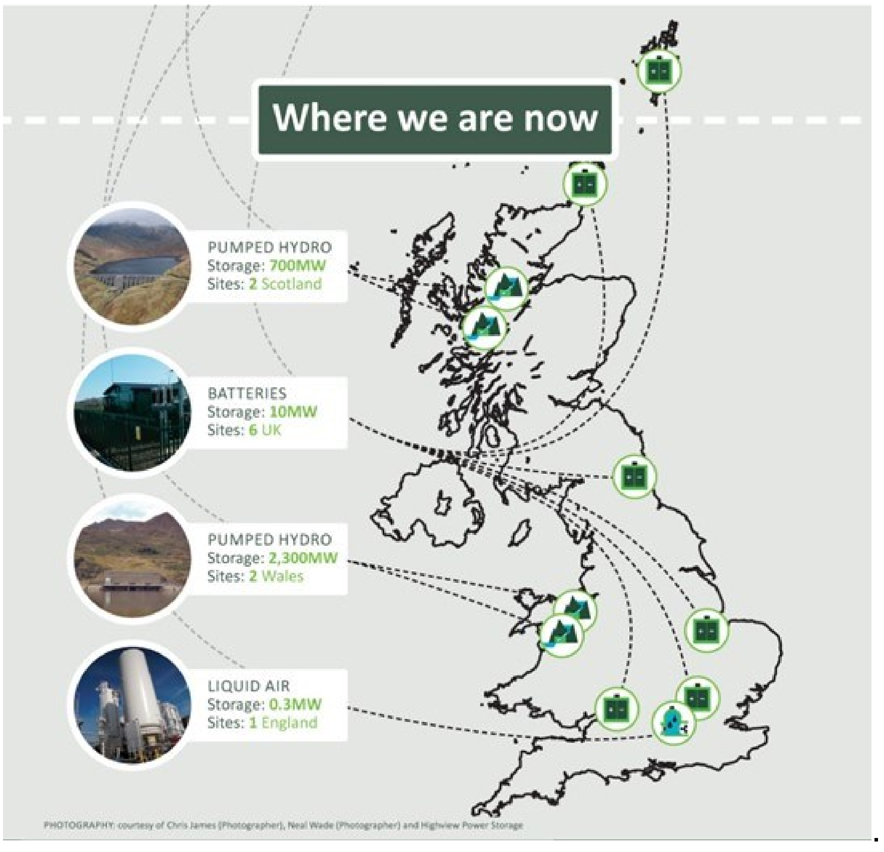

Figure 2: A graphic illustrating some of the current storage installations in the UK. This does not include several projects which are in the planning or construction stages.

Source: *Electricity Storage Network*

Role of electricity storage

9. We see three significant areas for the operation of storage:
   a) to provide ancillary services and reserves;
   b) to provide energy balancing;
   c) to support the challenge to rewire our transmission and distribution networks.

10. The application of electricity storage in these areas can contribute to the security of supply in a number of direct and indirect ways:
    a) Using electricity storage to provide ancillary services and reserves can save running costs over the use of conventional plant, reducing the need to import fossil fuel, or maintaining stocks of indigenous fuel. As the proposition of renewable energy increases, the need for ancillary services increases, and so there is benefit in making additional use of storage. There has been a rapid increase in the number of advanced energy storage projects of multi MW scale in the PJM market in North America. Here the operators of batteries and flywheels are paid for the enhanced performance of their fast acting plant. As a result, the total amount of frequency regulation procured is reduced, because the batteries and flywheels provide better system control than other types of plant. Other reserves are also suitable storage applications, such as black start, standby reserves, such as STOR.

b) Many renewable generation technologies are time variable, such as PV and wind. Storage can absorb surplus wrong time energy, and discharge it to maximise its value. This tends to increase the value of renewable energy when it is in surplus, and smooths the price at times of peak demand. This economic benefit should be available to all participants in the market.

c) Already, there is criticism of the low availability of connections for new renewable generation, there is concern about the impacts of renewable clusters, such as PV or local wind. These clusters can cause voltage rise, or local fluctuations which are difficult and costly to manage. In addition, the need to decarbonise other sectors such as heat and transport, will transfer significant demand from the gas and liquid fuel sectors to the electricity sector. We estimate that for GB this will increase peak demand from its current level of 60 GW, to 110 GW if electric transport is adopted and over 200 GW if all heating is provided by the electricity system. This electrical energy transformation will require substantial rewiring of the electricity industry. One way of avoiding this, or deferring this can be by the installation of storage.

11. These applications have been demonstrated in several projects. For example, one of the DECC innovation projects (the Evalu8) project uses battery storage to demonstrate the use of storage to power electric vehicle recharging points.

12. Another DECC project is showing how the lack of electrical connections for export of renewable energy can be overcome by the use of storage. On the island of Gigha, a MW size flow battery is to be used to absorb surplus wind energy, for storage for consumption on the island at later time. (This is also accelerating the development of this technology and bringing jobs and industry, including manufacturing and testing in Scotland.

13. In a similar way that distributed energy can be shown to improve security of supply by providing an option for local resilient networks, and to reduce transmission and distribution losses, distributed storage can also be shown to aid security of supply as has been demonstrated in several OFGEM LCNF projects.

14. Local energy systems, based on either true islands or electrical islands can be enabled to operate independently, either continuously, or in the event of a planned or unplanned outage, by using storage to provide modulation for either constant generation, or to provide shape to match the generation profile to the demand profile. Such systems, will reduce consumption of conventional fuel sources, increase the potential use of renewable generation.

15. Whatever scenario is modelled in order to decide whether more generation is required, it would be prudent to consider that a proportion of new plant build should be storage. Storage allows for flexibility and provides options for the future. As it is not dependent on any particular fuel source, the use of storage opens up future generation opportunities as opposed to closing options.

The future for storage

16. It is often stated that storage is currently too expensive and more R&D is required to lower costs and make storage viable. We suggest that the report for the Scottish Government prepared in October 2010 now needs to be revisited. [1] We would contend that this is not a true statement. Clearly, the pumped hydro in Scotland, built at high cost, has value, but we should look at the other extreme, with a number of companies, including several based in the UK, now actively deploying domestic storage. A number of projects, particularly with the DNO's show what can be achieved. SSE has deployed large scale batteries on Shetland, Orkney as well as in projects in their DNO area in Southern England. Current estimates for cost reductions in energy storage show significant potential for increased deployment.

17. We can see the impact of falling costs from an examination of the cost of lithium ion batteries, as shown in Figure 3:

Year	Lithium ion battery cost, ex manufacturer, for bulk purchases expressed in US $ / kWh
2012	$1200
2013	$1100
2014	$900
2015	$450,
2016	$350

Figure 3. Lithium ion battery costs shown in US $ / kWh. This is for the battery only and excludes the cost of control equipment, power conversion system, balance of plant installation and other works necessary to install a complete system.

Source: *Electricity Storage Network / S&C Electric Europe Limited.*

18. Storage is often compared to other actions such as flexible generation, interconnectors, and the demand side. All these four actions have their own merits, and disadvantages. A future power system will need elements of these four actions to be effective. Electricity storage is in a unique position, as it is able to both absorb energy, for example at times of oversupply on the network – which includes mitigating the effects of over frequency, as well as discharging to mitigate under frequency. This is important, especially when considering the growing proportion of time variable renewable generation with limited ability to control generation to maintain the system.

19. The main restriction on the deployment of storage is the financial impediment arising from the lack of clear future market signals for storage operators. Unlike other assets, such as solar or wind, there is no long term contract for storage that

[1] Energy Storage and Management Study ELL/000/077, October 2010.

would satisfy large numbers of investments, so storage is the preserve of specialist investors and developers, who understand the risks.

20. Current market conditions in the UK are holding back the widespread deployment of electricity storage technologies. In other country such as the U.S., the value of storage technologies are being realized and Government has set mandates and provided tax reliefs to encourage the levels of storage to grow. In Germany there is an incentive for distributed storage associated with PV generation to manage network and allow microgenerators to avoid buying electricity at peak demand (maximize self-consumption by shifting midday peak in generation to provide energy in the evening).

21. We see storage being deployed throughout the power system, at large scale, mid size and indeed at small scale. Each has a separate business case, but collectively they all bring value to the system. To explain, imagine if 1 million homes all had a 1 kW battery which was used to shave their peak demand between 6 pm and 7 pm each day. The grid would see an immediate drop in demand at 6 pm of 1 GW, but potentially an increase of 2 GW at 7 pm. However if that was controlled by the network operator and / or the supply company, those power swings could be put to good use, and deliver real value to the system. Predicting demand is a very difficult science, being able to use storage as an additional tool, along with demand side management and the use of interconnectors, gives increased security of supply to the system operator.