Energy Storage in the UK
An Overview

A Renewable Energy Association Publication

www.r-e-a.net

Published winter 2015/16

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Section 1 - Introduction

Recent years have seen a significant increase in renewable energy supplies amid ever growing demand for energy. At the same time, various factors are putting increasing pressure on the electricity grid network.

Energy storage (ES) technologies offer great potential for supporting renewable energy and the UK's energy system. The Department for Business, Innovation and Skills (BIS) has named storage as one of eight 'great technologies the UK can be world leaders in', but how can we reach this potential? Storage technologies are able to absorb and release energy when required and provide ancillary power services which help benefit the power system. The storage industry can therefore deliver tremendous benefits for system stability and security of supply as well as helping to decarbonise UK energy supplies. Storage technologies offer flexibility during times of fluctuating energy generation and demand, which make energy storage technologies an important part of a low carbon future network. In addition there are significant economic benefits - if 2GW of energy storage was deployed by 2020 the industry could create jobs for up to 10,000 people in the UK (Strbac, et al., 2012).

The REA sees energy storage as a key missing piece for the UK's energy policy. Storage can help deliver the low carbon energy the country needs and it is therefore vitally important that it is appropriately incentivised and supported. The REA has now launched the UK Energy Storage group to help the industry reach its potential.

Storage technologies can be deployed at different scales on a distributed and/or centralised basis. The development of energy storage technologies vary across the industry, while some are quite mature others are still in their development stages. There is significant investment in energy storage around the globe and we are now in something of a technology and deployment race. For the energy storage industry to develop and the UK to gain the huge benefits possible as a result then the Government, grid operators, industry and stakeholders need to work together to take action.

The aim of this report is to increase knowledge of the industry among various stakeholders. This report encompasses a summary of the current technologies; support available internationally for storage technologies; energy storage projects deployed at present in the UK; and the findings of a series of interviews with market leaders in energy storage in the UK, before offering some conclusions.

Benefits of Energy Storage

There are a number of benefits energy storage can offer in various forms and to various stakeholders, these include;

- Energy storage can enable the integration of more renewables (especially solar PV and wind) in the energy mix.
- Storage technologies could decrease the need to invest in new conventional generation capacity, resulting in financial savings and reduced emissions especially from electricity generation.
- Storage technologies improve our energy security by optimising the supply and demand, thus reducing the need to import electricity via interconnectors.
- They can also provide system stability during electricity outages by supplying energy at these times and reducing the financial costs of power outages.
- Utilisation of storage also means fewer and cheaper electricity transmission and distribution system upgrades are required.
- Energy can be stored when prices are low and used on site when they are high to save consumers and businesses money on their bills. Alternatively the stored energy can be sold.
- Large amounts of energy storage can significantly reduce energy loss during transmission and distribution. Electricity transmission losses typically run at just below 10% of the total energy first produced in the UK (this is formalised in the U by the application of a Transmission loss multiplier to CfD generation of 9%.
- Storage technologies can reduce the usage of fossil fuels, enabling a greener energy supply mix.

Section 2 – Summary of Energy Storage Technologies

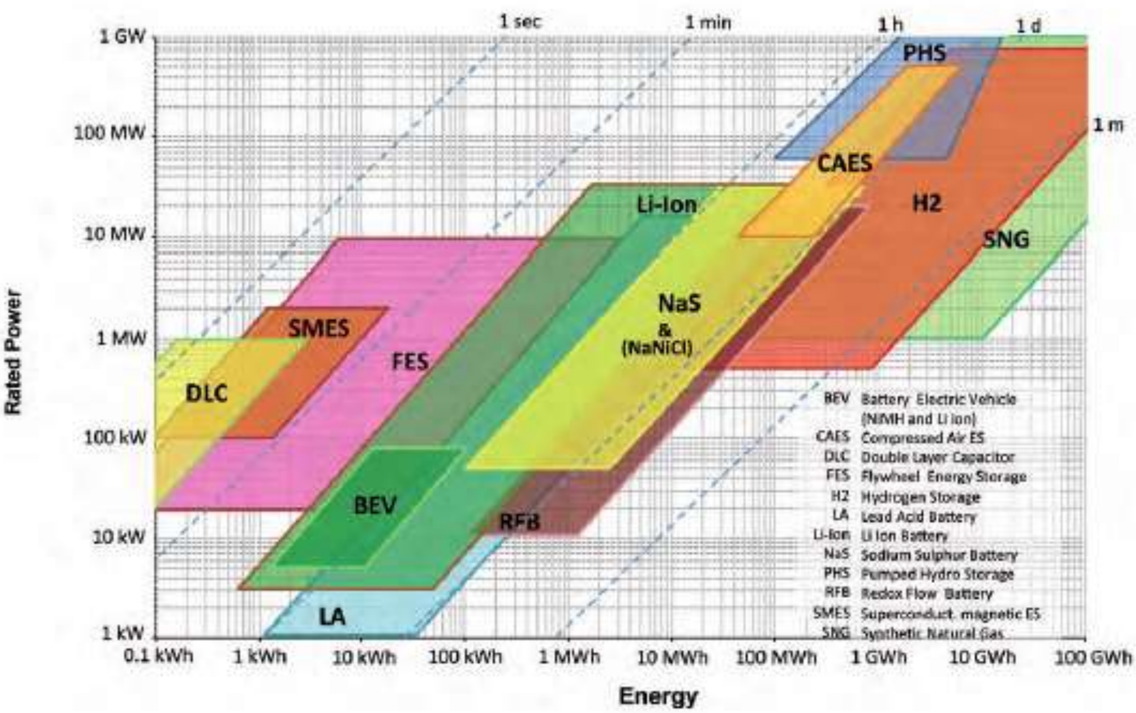

Figure 2-1 Overview of energy storage technologies power and energy storage durations (IEC, 2011)

Energy storage technologies are classified according to the form of energy they use. This section provides short overviews of each technology, using explanations from different sources presented in order to be comparable to each other, *(please note that new technologies are being developed however this report necessarily covers only those that are widely used, deployed or close to deployment).*

2.1 Mechanical

2.1.1 Pumped Hydro Storage (PHS)

Pumped hydro, one of the most mature energy storage technologies, stores energy by using electricity to pump water from a lower reservoir to an upper reservoir. It recovers energy by allowing the water to flow back through turbines to produce power. There is 129 GW of installed capacity worldwide which represents nearly 99% of installed electrical energy storage capacity (Dötsch, 2007). The technology is reliant on topographical features for its deployment but significant potential still exists in the UK.

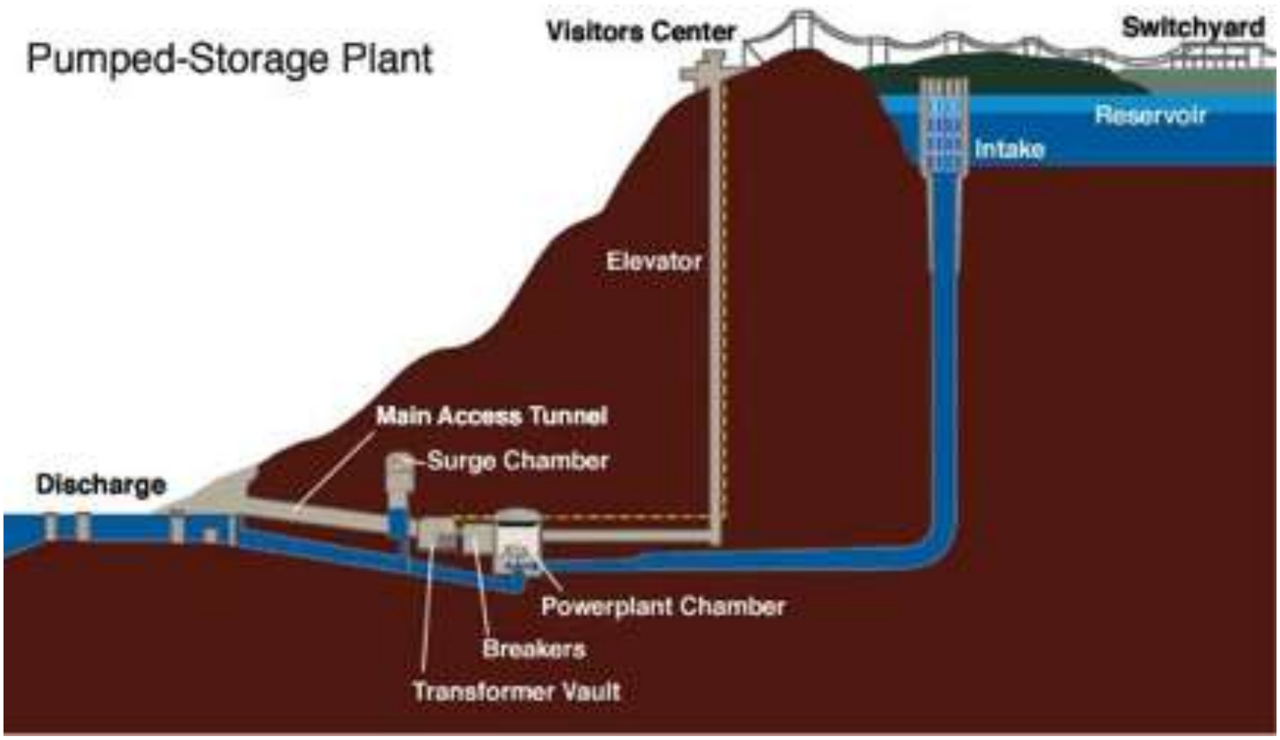

Figure 2-2 Illustration of a Hydroelectric Pumped-Storage System

2.1.2 Compressed Air Energy Storage (CAES)

Compressed air energy storage (CAES), stores energy either in an underground structure or an above-ground system, by running electric motors to compress air and then releasing it through a turbine to generate energy. It can help the grid by storing energy during low demand (off-peak) and then releasing it during high-energy demand (peak load) periods. CAES technology has large capacity but the main issues with it are relatively low round-trip efficiency and geographic location limitations. Although it consumes energy in the process overall it creates around three times the energy a similar sized conventional gas turbine would produce.

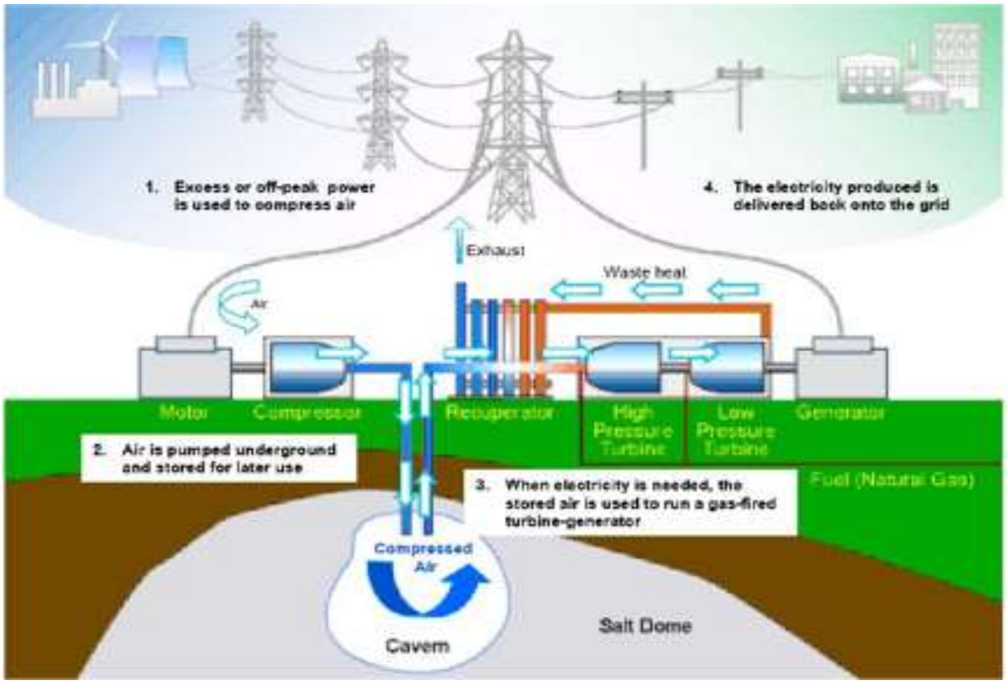

Figure 2-3 Underground CAES technology (Ridge Energy Storage & Grid Services L.P., 2015)

2.1.3 Flywheels

Flywheels are charged by accelerating the inertial masses also known as the rotors. The energy is stored as the rotational kinetic energy of the flywheel. To discharge the kinetic energy it is extracted by a generator, which decelerates the rotation. Flywheels have good cycle stability, a long life cycle, are low maintenance, high power density and use environmentally inert materials. At the same time, they currently have relatively low efficiency and high levels of self-discharge. Flywheels are commercially deployed and developments are underway to increase their use in vehicles and power plants (IEC, 2011).

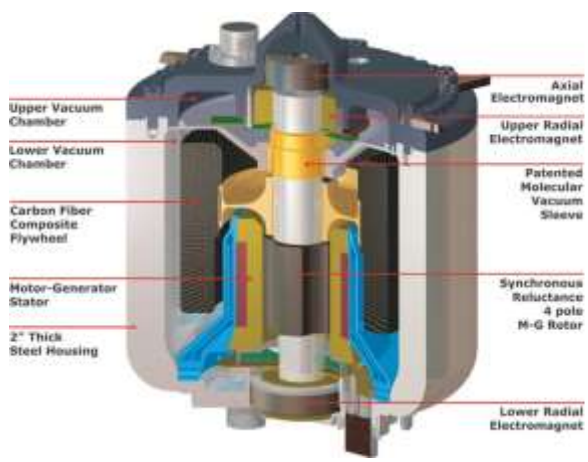

Figure 2-4 A model flywheel (Better World Solutions, 2015)

2.2 Electrochemical Energy (batteries)

2.2.1 Conventional Battery Technologies

Batteries offer an established form of energy storage both as a standalone option and some can be used after use in Electric Vehicles as a 'second life' storage option in domestic and commercial settings.

Lead Acid

The most mature of the battery technologies, used commercially since the 1890s. Lead acid batteries, despite their toxicity, are very popular due to low cost/performance ratio, short life cycle, simple charging technology and low maintenance requirements. Their main disadvantage is that as they discharge higher power their usable capacity decreases. Other disadvantages include a relatively low energy density.

Nickel-Cadmium (NiCd)

A mature technology, used since around 1915, nickel cadmium batteries have low round trip efficiency, high energy density and a long life cycle. They can perform well at low temperatures ranging from -20 °C to +40 °C. The batteries are highly toxic which is why they are used only for stationary purposes in Europe. There are about 27 MW of NiCd batteries installed globally.

Lithium-Ion

The most well-known and widely used in consumer electronics, lithium-ion batteries have high energy density, low standby losses and a tolerance to cycling. There are many different applications however the most popular at the moment is their application in electric vehicles. They are very flexible in their discharge time, which can be realised from seconds to weeks. Although prices are still considered to be relatively high, they have started to come down in price, and it is projected that this trend will continue in future years. A relatively new technology but likely to be widely deployed in the short term.

Figure 2-5 Artist's impression of a grid storage system to be tested at a wind farm in China (A123 Systems, 2015)

2.2.2 High Temperature Batteries

High temperature batteries are similar to conventional batteries but differ because their energy is based on reactions that only occur at elevated temperatures (ECOFYS, 2014). The most frequently used are sodium sulfur (NAS) and sodium nickel chloride (NaNiCl).

Sodium Sulfur (NAS)

Still in the early stages of currently grid Deployed at grid scale in Japan, NAS batteries are used for long durations of energy storage, they have high round trip efficiency, relatively high energy density but their costs continue to be high.

Sodium Nickel Chloride (NaNiCl)

The sodium nickel chloride battery is a high-temperature battery which has been commercially available since 1995. These batteries can stand limited overcharge and discharge. They have been used in electric vehicles (EVs) and new research is being done to further develop these batteries and use them in alternative settings following the end of their productive life in EVs.

2.2.3 Flow Batteries

The electrochemical reactions of flow batteries are similar to conventional and high temperature batteries, but their storing techniques differ. The electrolytes used are stored in external tanks and during charge and discharge they are pumped through electrochemical cells, which convert chemical energy into electricity. The most well-known types of flow batteries are **redox** and **hybrid.**

Redox Flow Battery (RFB)

Redox flow batteries are similar to conventional batteries except when the battery is discharged the fluids need to be newly-loaded. The electrolyte volume and power, which are related to the electrode area in the cells, determine the energy of the batteries. These batteries have a high level of discharge but low energy density although have reached commercialisation. They are suitable for mobile application in theory however until now their energy densities have been too low for this type of application. Two common redox flow battery chemistries are **zinc bromine** and **vanadium.**

Hybrid Flow Battery (HFB)

Hybrid flow batteries on the other hand use electro-active components deposited as a solid layer. (ECOFYS, 2014) The active masses are stored separately; one is stored internally in the electrochemical cell and the other externally in a tank. They are called hybrid because they bring properties from conventional secondary batteries and from redox batteries. A number of companies are working on commercializing Zn-Br hybrid flow batteries on utility-scale applications and in community energy storage systems (IEC, 2011).

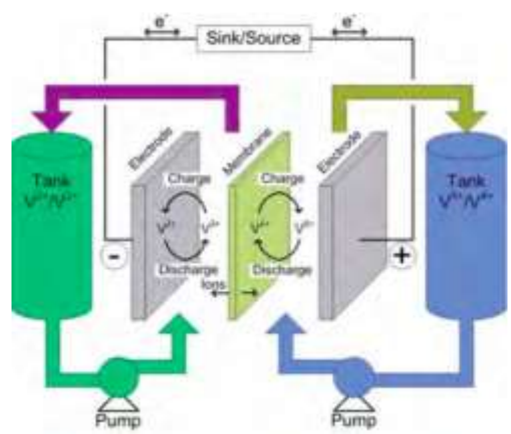

Figure 2-6 Vanadium Redox Flow Battery (Schwunk, 2011)

2.3 Chemical Energy Storage

Chemical energy storage technology, by using hydrogen and synthetic natural gas (SNG), relies on electric energy to generate fuel that may be burned in conventional power plants. By using water electrolysis the water is split into hydrogen and oxygen. The hydrogen can either be burned directly or it can be transformed to SNG. The efficiency of this technology is lower compared to PHS and Lithium-ion batteries. However, it remains an important technology because it allows large amounts of energy to be stored over longer periods of time.

2.3.1 Hydrogen (H_2)

There are different hydrogen storage techniques however the most popular is storing the gas under high temperatures used mainly for stationary applications. Smaller amounts can be stored above ground, in tanks or bottles, and large amounts stored underground mainly in piping systems. This technology is being examined closely for industrial applications and is not yet used commercially in a widespread way.

2.3.2 Synthetic Natural Gas (SNG)

Synthetic gas processes are referred to as “Power to Gas” technologies. After splitting water another step is added to the mix and with the help of an electrolyser the hydrogen and carbon dioxide react to generate methane. SNG can also be stored in over-ground pressure tanks, underground or can be directly injected into the gas grid. The most important advantage of synthetic methane is that it can be injected into the existing natural gas storage infrastructure without restrictions. However, on the other hand it has relatively low efficiency (ECOFYS, 2014).

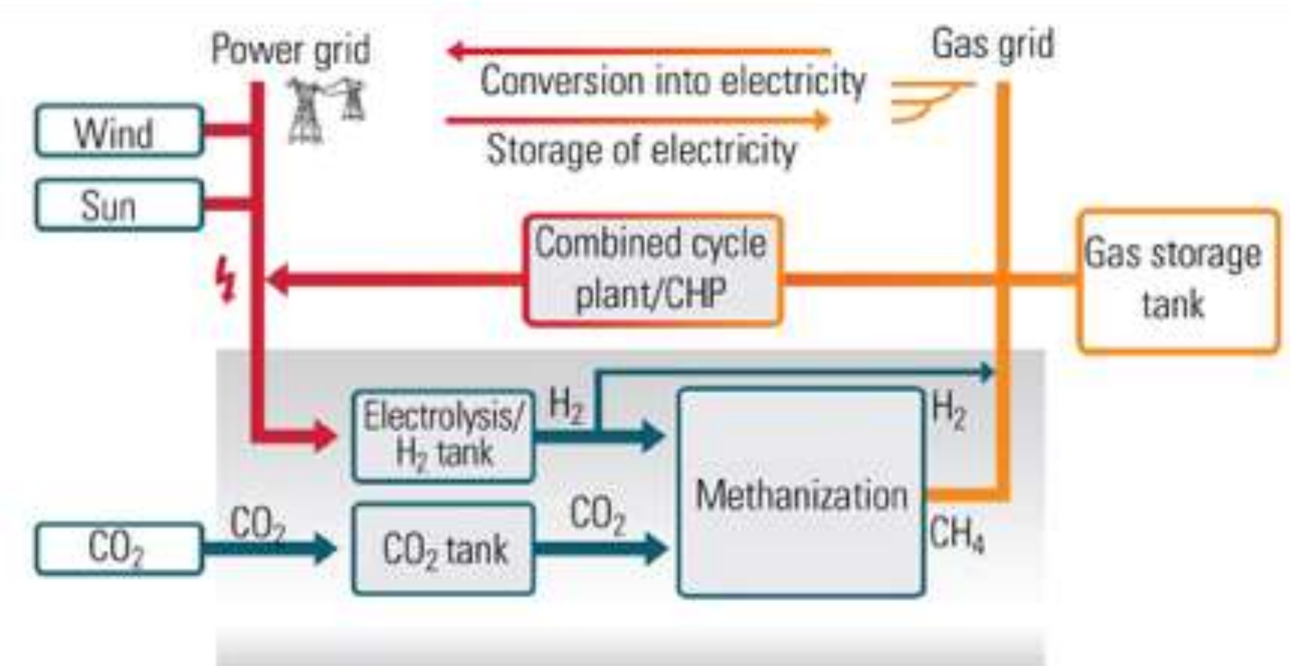

Figure 2-7 Schematic overview of chemical energy storage (power-to-gas) system

2.4 High Temperature Thermal Energy Storage

High temperature thermal energy storage has been used to store heat above 250°C from concentrating solar facilities for use after sunset (ECOFYS, 2014). Heat from solar mirrors is transferred to either molten salt solutions that are stored in insulated tanks or magnesium oxide bricks. During discharge stored heat is transferred to produce steam, which drives a turbine that feeds power to the electricity grid. Adding this technology to existing or future solar thermal power plants might present favourable economics. However for widespread deployment, control technology, containment mediums and material stability need to be improved and such plants do not exist in the UK at scale nor could be expected to in the future.

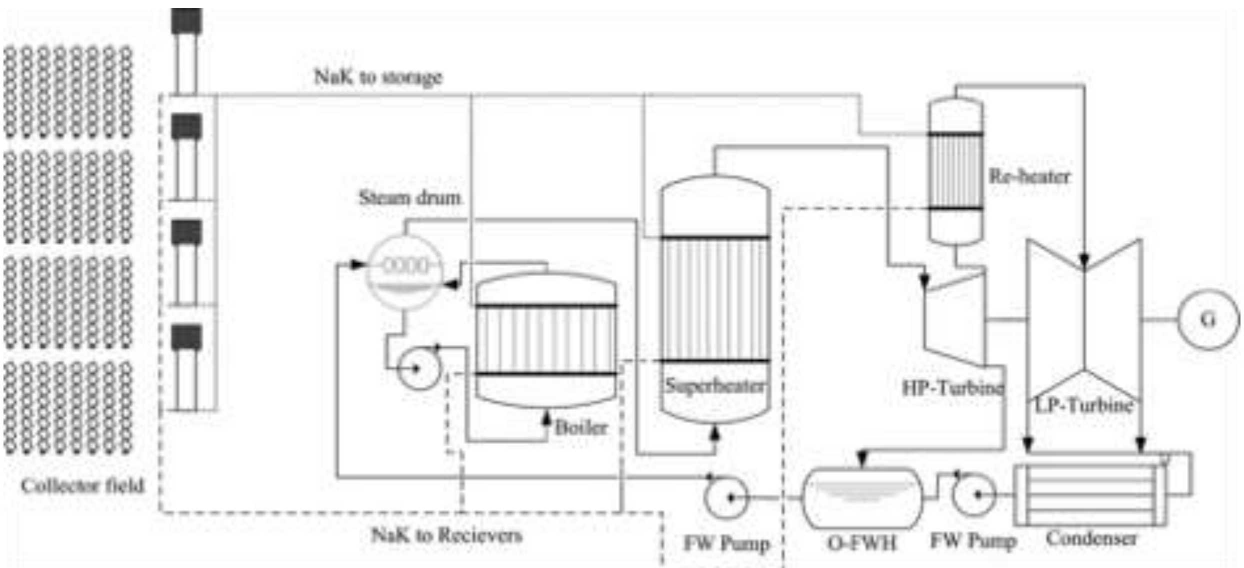

Figure 2-8 Power generating cycle of a high temperature thermal energy storage system (Kotzé, et al, 2013)

2.5 Electromagnetic

2.5.1 Capacitors

Capacitors, also known as double-layer or supercapacitors, are related to classical capacitors used in electronics and general batteries (IEC, 2011). Since the 1980s they have been used in a variety of consumer and power electronics. They have potential because they have extremely high capacitance value as well as the possibility of fast charge and discharge. They are very durable, reliable, need very little maintenance, have a long life cycle and can operate in different temperatures. However, they are interdependent on cells, are sensitive to cell voltage imbalances and maximum voltage thresholds, and may raise safety concerns.

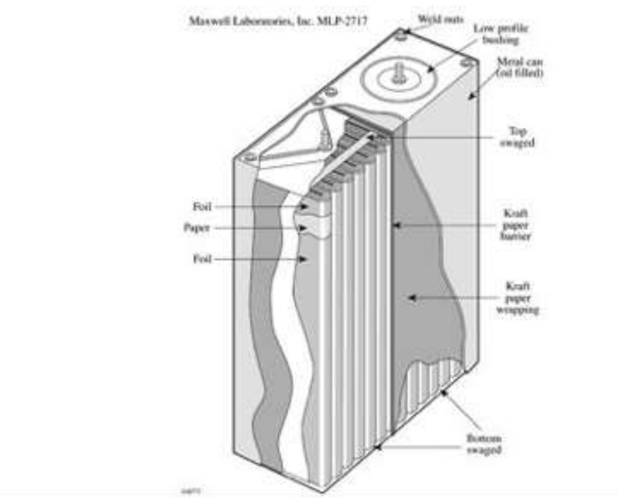

Figure 2-9 Cutaway view of a PCU energy storage capacitor (Rochester Laboratory for Laser Energetics, 2015)

2.5.2 Superconducting Magnetic Energy Storage (SMES)

This technology stores energy by using the flow of direct current through a cryogenically cooled superconducting coil to generate a magnetic field that stores energy (ECOFYS, 2014). Once the superconducting coil is charged and has reached a steady state the inductor where energy is stored does not dissipate, the current will not deteriorate and the magnetic energy can be stored almost indefinitely. The stored energy is released by discharging the coil. The technology is still in its development stage. SMES has a high life cycle and rapid response but on the other hand has a relatively low energy density, high cost and requires constant cryogenic refrigeration in order to maintain superconducting properties.

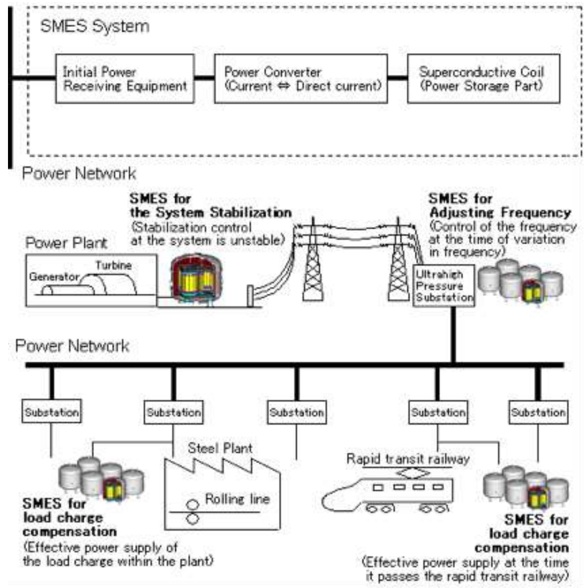

Figure 2-10 An example of the composition of a SMES for electric power generation (Chubu Electric Power Co Inc., 2007)

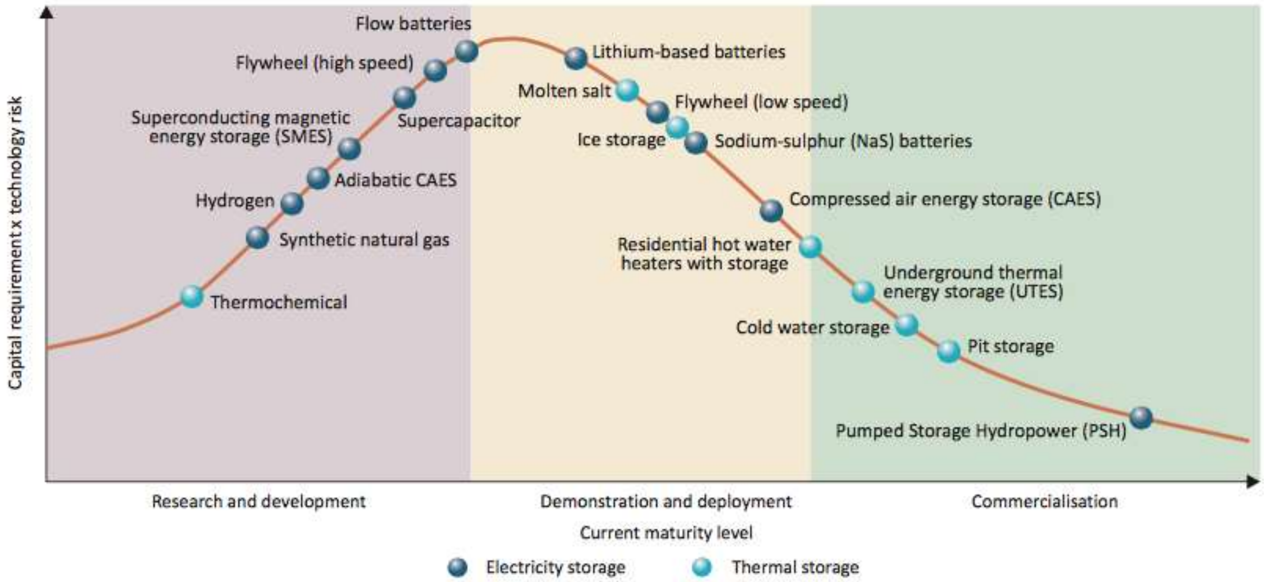

Figure 2-11 Approximate maturity of energy storage technologies (IEA, 2014)

Table 3-1 Cost and efficiency of storage technologies (ECOFYS, 2014) – *Costs in 2010 US dollars*

Technology	Maturity	Cost ($/kW)	Cost ($/kWh)	Efficiency	Cycle Limited	Response Time
Pumped Hydro	Mature	1,500-2,700	138-338	80–82%	No	Seconds to Minutes
Compressed Air (Underground)	Demo to Mature	960-1,250	60-150	60-70%	No	Seconds to Minutes
Compressed Air (Above-ground)	Demo to Deploy	1,950-2,150	390-430	60-70%	No	Seconds to Minutes
Flywheels	Deployed to Mature	1,950-2,200	390-430	85-87%	>100,000	Instantaneous
Lead Acid Batteries	Demo to Mature	950-5,800	350-3,800	75-90%	2,200->100,000	Milliseconds
Lithium-ion Batteries	Demo to Mature	1,085-4,100	900-6,200	87-94%	4,500->100,000	Milliseconds

Flow Batteries (Vanadium Redox)	Develop to Demo	3,000-3,700	620-830	65-75%	>10,000	Milliseconds
Flow Batteries (Zinc Bromide)	Demo to Deploy	1,450-2,420	290-1,350	60-65%	>10,000	Milliseconds
Sodium Sulfur (NAS)	Demo to Deploy	3,100-4,000	445-555	75%	4,500	Milliseconds
Power to Gas	Demo	1,370-2,740	NA	30-45%	No	10 Minutes
High Temperature Thermal Storage	Demo to Deploy	NA	NA	-30%	No	**Storing:** Seconds **Generating:** Minutes
Capacitor	Develop to Demo	-	-	90-94%	No	Milliseconds
SMES	Develop to Demo	-	-	95%	No	Instantaneous

Section 3 - Energy storage today

3.1 Energy storage policies internationally

Many countries and regions have recognised the potential of energy storage technologies and have developed policies to deploy energy storage at different scales.

Country or Region	Organisation and Overview
Canada	**Ontario Ministry of Energy** • In 2013, the government released a Long-Term Energy Plan, which included procurement target of 50MW for storage technologies. The LTEP has targets of 10,700MW of wind (11%), solar (3%) and bioenergy (3%) by 2021 (each source representing their percentage of total energy production).
China	**Central Government** • There have been funding for demonstration projects such as the Zhangbei project in Hebei, which has 36KWh lithium-ion battery capacity, in order to evaluate the value energy storage would have when providing electricity gird flexibility. • The National Energy Administration (NEA) is expected to release 13 energy policies in 2015, which include large capacity energy storage and EV charging infrastructure. • It is anticipated in 2015 that the National Reform and Development Commission will implement time-of-use pricing mechanisms.
European Union	**European Commission – Framework Research Programme** • The 'stoRE' project, co-funded by the Intelligent Energy Europe Programme of the EU, aims to create a framework that will allow energy storage infrastructure to be developed in support of higher penetration of variable renewable energy resources. Target countries to identify a series of improvements/application include, Austria, Denmark, Germany, Greece, Ireland and Spain.
Germany	**Federal Ministry of the Environment, Nature Conservation and Nuclear Safety** • Since May 2013, part of the support scheme for solar-plus-batter, the state-owned bank Kreditanstalt für Wiederaufbau (KfW) has granted low interest loans with an aggregate value of €163 million for 10,000 energy storage projects combined with PV installations with a power up to 30kW. • The Ministry also covers 30% of the storage system costs. Eligible PV systems should feed maximum 60% of installed capacity into the grid.
Japan	**Ministry of Economy, Trade and Industry** • Government support to demonstrate the ability to time-shift demand by 10% in

	conjunction with expanded use of renewable generation resources. Within the next seven years METI funding is aiming to decrease the total cost by providing funds up to 75% of the total storage system cost. • METI is planning to spend around 81 billion yen to resolve grid related issues and to increase renewable energy. Additionally, the Ministry is aiming to provide incentives for energy storage systems, which can be implemented onto solar power stations or substations. The budget is awaiting parliament approval. **Ministry of Environment** • Up to 50% subsidy for storage battery for renewable energy generation (<1MW) • Subsidy for renewable energy in local areas (Total 1bn JPY)
South Korea	**Ministry of Trade, Industry and Energy (MOTIE)** • Customised electric rates to stimulate the energy storage system and electric vehicle industries along with drawing investment in storage and the use of eco-friendly EVs by consumers (MOTIE, 2015). • The government plans to install 500kWH of energy storage systems. The Korea Electric Power Corporation also plans to install 1000kWh of storage (Agency for Growth Policy Analysis, 2014). • MOTIE also supports small and mid-sized companies with various incentives to install energy storage systems. **Central Government** • President Park has expressed support for innovative energy systems, which includes the usage of ES within Energy Management Systems and smart grids.
United States	**Storage Technology for Renewable and Green Energy Act of 2013 or the Storage 2013 Act** • Similar to the Storage Act of 2011 this act promotes deployment of energy storage technologies by recognising the benefits for renewables and consumers and benefits to the grid. The Act aims to level the playing field of energy tax incentives (U.S. Senate Committee, 2013). • The Act provides 20% investment tax credit of up to $40 million per project connected to the electric grid and distribution system. Additionally, the Act provides 30% investment tax credit of up to $1 million per project to businesses for on-site storage (ibid). • An important change from the Act of 2011 is that the minimum size of system eligibility had been lowered from 20kWh to 5kWh. This change helps promote deployment of systems from small businesses to the grid and it is expected to incentivise storage companies to create leasing models for residential users (ibid). • The Act also provides 30% tax credit for homeowners for on-site storage systems to store off-peak electricity from solar panels or from the grid for later use (ibid). **Federal Energy Regulatory Commission (Orders)** • **Order 755** increases the pay for “fast” responding sources like batteries or flywheels that are bidding into frequency regulation service markets. “Fast-ramping, more

accurate resources are now given greater compensation in the wholesale frequency regulation markets” (DOE, 2015). The FERC is ensuring that it’s providing just and reasonable and not unduly discriminatory or preferential rates of frequency regulation.

- **Order 784** expands Order 755 and focuses on third-party provision of ancillary services and accounting and financial reporting for new electric storage technologies (ibid). According to the Order public utilities must take into account the speed and accuracy of regulation resources, which opens the door for greater efficiency in transmission customers' purchase of regulation resources. Additionally, the order eases the barriers for third-party entry into ancillary service markets and by revising accounting and reporting requirement to improve market transparency.
- The incentives for systems that provide summer on-peak demand reduction are $2,600/kW for thermal storage and $2,100/kW for battery storage technologies (ibid). Proposed incentives are capped at 50% of installed project cost plus bonus incentives are available for large (>500kW) projects.

Master Limited Partnerships Parity Act

- A Master Limited Partnership (MLP) "is a business structure that is taxed as a partnership, but whose ownership interests are traded like corporate stock on a market” (Library of Congress, 2013). However, it has only applied for fossil fuel-based energy partnerships within the internal revenue code.
- The MLP Parity Act “Amends the Internal Revenue Code, with respect to the tax treatment of publicly traded partnerships as corporations, to expand the definition of "qualifying income" for such partnerships to include income and gains from renewable and alternative fuels (in addition to fossil fuels), including energy derived from thermal resources, waste, renewable fuels and chemicals, energy efficient buildings, gasification, and carbon capture in secure geological storage” (Lib. of Cong., 2013).
- The MLP Parity Act expands MLP eligibility to an array of renewable energy sources, including "electricity storage devices" (DOE, 2015). If the Act is enacted, it will allow for more equitable taxation methods across all energy sectors, and will allow for new ownership and taxation models for energy storage device partnerships (ibid).
- MLP Parity Act was introduced in 2012 and then in 2013 (with expanded qualifying resources) and still awaits approval.

Table 3-1 Examples of international government action to support energy storage

3.2 UK Energy Storage projects

There are currently 27 installed energy storage projects in the UK, with a total capacity of around 33GWh, as detailed in the table below.

Project Name	Location	Technology Category	Technology Type	Rated Power in kW	Status	Service 1	Service 2	Service 3	Service 4
ABB & UK Power Networks Energy Storage Installation	Hemsby Norfolk	Electro-chemical	Lithium-ion Battery	200	Operational	Voltage Support	Distribution upgrade due to wind	Renewable Energy Time Shift	Electric Supply Reserve Capacity - Spinning
AES Kilroot Station Battery Storage Array	Carrickfergus, Northern Ireland	Electro-chemical	Lithium-ion Battery	50000	Announced	Renewables Capacity Firming	Renewables Energy Time Shift		
Cruachan Power Station	Lochawe Dalmally	Pumped Hydro Storage	Open-loop Pumped Hydro Storage	440000	Operational	Electric Supply Reserve Capacity - Spinning	Electric Energy Time Shift	Electric Supply Capacity	Load Following (Tertiary Balancing)
Dinorwig Power Station	Dinorwig, Wales	Pumped Hydro Storage	Closed-loop Pumped Hydro Storage	1728000	Operational	Electric Supply Reserve Capacity - Spinning	Electric Supply Capacity	Electric Energy Time Shift	Frequency Regulation
EPSRC Grid Connected Energy Storage Research Demonstrator with WPD and Toshiba	Wolverhampton, West Midlands	Electro-chemical	Lithium Ion Titanate Battery	2000	Contracted	Frequency Regulation	Grid-Connected Commercial (Reliability & Quality)		
Ffestiniog Pumped Hydro Power Plant	Ffestiniog, Gwynedd	Pumped Hydro Storage	Closed-loop Pumped Hydro Storage	360000	Operational	Electric Energy Time Shift	Electric Supply Capacity		
Flat Holm Microgrid Project	Flat Holm Island, Wales	Electro-chemical	Lead-acid Battery	5	Operational	Electric Supply Capacity	Onsite Renewable Generation Shifting	Renewables Energy Time Shift	
Foula Community Electricity Scheme	Isle of Foula, Highland Scotland	Electro-chemical	Lead-acid Battery	16	Operational	Onsite Renewable Generation Shifting	Renewables Energy Time Shift		
Foyers Pumped Storage Power Station	Loch Ness, Highland	Pumped Hydro Storage	Open-loop Pumped Hydro Storage	300000	Operational	Electric Energy Time Shift	Electric Supply Capacity		
Gigha Wind Farm Battery Project	Gigha, Scotland	Electro-chemical	Vanadium Redox Flow Battery	100	Contracted	Renewables Energy Time Shift	Renewables Capacity Firming		
Highview Pilot Plant	Slough, Berkshire	Electro-mechanical	Modular Compressed	350	Operational	Renewables Energy Time	Electric Energy Time	Renewables Capacity	Electric Bill Managemen

			Air Storage			Shift	Shift	Firming	t
Horse Island Microgrid Project	Horse Island, Highland Scotland	Electro-chemical	Lead-acid Battery	12	Operational	Renewables Capacity Firming	Electric Supply Capacity	Onsite Renewable Generation Shifting	
Isentropic Demonstration Project	Toton, Nottinghamshire	Thermal Storage	Heat Thermal Storage	1400	Announced	Stationary Transmission/Distribution Upgrade Deferral	Renewables Energy Time Shift	Electric Energy Time Shift	Voltage Support
Isle of Eigg Electrification Project	Isle of Eigg, Highland Scotland	Electro-chemical	Lead-acid Battery	60	Operational	Onsite Renewable Generation Shifting	Electric Supply Capacity	Frequency Regulation	Voltage Support
Isle of Muck Microgrid System	Isle of Muck, Highland Scotland	Electro-chemical	Lead-acid Battery	45	Operational	Onsite Renewable Generation Shifting	Electric Supply Capacity		
Isle of Rum Microgrid System	Isle of Rum, Highland Scotland	Electro-chemical	Lead-acid Battery	45	Operational	Onsite Renewable Generation Shifting	Electric Supply Capacity	Renewables Energy Time Shift	
Northern Isles New Energy Solution	Lerwick, Shetlands	Electro-chemical		1000	Under Construction	Renewables Energy Time Shift			
Northern Powergrid CLNR EES1	Rise Carr, Darlington, North East	Electro-chemical	Lithium-ion Battery	2500	Operational	Voltage Support	Electric Energy Time Shift	Stationary Transmission/Distribution Upgrade Deferral	
Northern Powergrid CLNR EES3-2	Wooler, Northumberland	Electro-chemical	Lithium-ion Battery	50	Operational	Voltage Support	Electric Energy Time Shift	Stationary Transmission/Distribution Upgrade Deferral	
Northern Powergrid CLNR ESS2-1	Rise Carr, Darlington, North East	Electro-chemical	Lithium-ion Battery	100	Operational	Voltage Support	Electric Energy Time Shift	Stationary Transmission/Distribution Upgrade Deferral	
Northern Powergrid CLNR ESS2-2	Denwick, Northumberland	Electro-chemical	Lithium-ion Battery	100	Operational	Voltage Support	Electric Energy Time Shift	Stationary Transmission/Distribution Upgrade Deferral	
Northern Powergrid CLNR ESS3-1	Rise Carr, Darlington, North East	Electro-chemical	Lithium-ion Battery	50	Operational	Voltage Support	Electric Energy Time Shift	Stationary Transmission/Distribution Upgrade Deferral	
Northern Powergrid CLNR ESS3-3	Maltby, South Yorkshire	Electro-chemical	Lithium-ion Battery	50	Operational	Renewables Capacity Firming	Renewables Energy Time Shift	Stationary Transmission/Distribution Upgrade Deferral	Transmission upgrades due to solar
Orkney Storage Park Project	Kirkwall, Orkney	Electro-chemical	Lithium-ion Battery	2000	Operational	Transmission Congestion Relief			
Slough Zero-Carbon Homes Community	Slough, Berkshire	Electro-chemical	Lithium-ion Battery	75	Operational	Renewables Energy Time Shift	Renewables Capacity Firming		

Energy Storage									
Smarter Network Storage	Leighton Buzzard, Bedfordshire	Electro-chemical	Lithium-ion Battery	6000	Operational	Electric Energy Time Shift	Electric Supply Reserve Capacity - Non-Spinning	Frequency Regulation	Stationary Transmission/Distribution Upgrade Deferral
WPD Falcon Project, GE Durathon	Milton Keynes, Buckinghamshire	Electro-chemical	Sodium-nickel-chloride Battery	250	Operational	Stationary Transmission/Distribution Upgrade Deferral	Voltage Support	Transmission Congestion Relief	Electric Supply Reserve Capacity - Non-Spinning

Table 3-2 Overview of energy storage projects in the UK, April 2015 (Source: US Department of Energy, 2015)

3.3. DNO Low Carbon Network Fund projects

In the UK, Ofgem have funded a number of innovative projects aimed at the transition to a low carbon grid (the Low Carbon Network Fund). Many of these projects have included energy storage, as illustrated in the map below.

Figure 3-1 Energy storage projects funded by the LCNF programme (ESOF Group, 2014)

Section 4 – Industry Interviews

Barriers and next steps for Energy Storage

Government, Ofgem, DNOs, developers and stakeholders must act to accelerate the development and deployment of energy storage technologies.

A series of interviews were conducted with leading members of the storage market for this report, and the key findings are summarised below.

Strategic importance

The interviews stressed that the current rate at which storage technologies are developing poses a strategic opportunity. In order to meet our environmental targets more storage technologies need to be deployed and in order to achieve this goal storage needs to be acknowledged as an essential part of the energy mix and appropriate support provided. Recent ministerial statements have assisted in this regard.

Perception: Commercial vs R&D

"DECC is 10 years behind the storage market because it continues to look at the technologies in R&D terms." The UK could miss significant commercial opportunities, as overseas companies are moving fast and targeting consumers and businesses. If the UK does not want to fall behind (as happened with the wind industry) stakeholders must understand that storage is a rapidly maturing market. Thus, rather than looking at storage projects from an R&D perspective ES needs to be understood as an important commercial market already. Interviewees made clear the government should support targeted projects that offer promise, and focus on the funding problems in the market.

Distribution network rules

Energy storage can bring benefits to transmission and distribution networks, greatly reducing the need to invest in reinforcements for the grid. Policy needs to be changed to allow DNOs to install and operate ES systems as current licence conditions prevent this. There could be £2 billion worth of network savings by 2030 if appropriate levels of storage are installed (Strbac, 2012).

Securing financing

"Access to finance could be a major constraint on the storage market." There have been a number of Government R&D funding mechanisms, for example Network Innovation Allowance and Low Carbon Networks Fund (LCNF) as well as other R&D funding sources. However, there was consensus that the 'valley of death' is a major issue in the industry as firms face no financial support between the Government R&D funds and conventional debt finance entering the market. The fact that a significant number of interviewees are self-funded highlights the lack of available finance and is a major barrier to the sector's growth. Some have turned to crowd funding in order to gain funds. A common conclusion was that because there isn't enough visible support or funding from the government it makes it harder for investors to fund storage projects, which leads to a bottleneck in deployment. If there was

more support from government (other than R&D funding) it would stimulate more funding from private sector investors. This could be in the form of a high profile strategy or 'visible' commitment to storage.

Government financial support

There were mixed views on whether a Feed-in Tariff type of support was feasible.

Most respondents believed that financial mechanisms such as a Feed-in Tariff would benefit the sector, but are not the only option. Interviewees stressed that additional funding options would definitely fuel project development. For example, tax incentives could help deployment, especially for commercial projects. *"Investors need some form of signal from Government that it supports energy storage, for due diligence purposes." "The DECC Electricity Demand Reduction (EDR) pilot and Capacity Market are possible opportunities but in need of change to current formats."*

Another point made was that *"requesting a mechanism like the Feed-in-Tariff does not seem feasible at the moment. The best strategy would be for the government to identify and remove [policy] barriers."* Until there are appropriate rules and regulations for the energy storage industry, existing business models and regulations must be modified to create a more supportive environment for storage.

Manufacturing opportunity

A number of energy storage technologies are being manufactured in the UK, which indicates there is large potential for energy storage technologies to benefit the UK economically in line with Government industrial strategy. However, most of the interviewees stated that if the UK does not take action to grow the market then companies will have no other choice than to move production and deployment overseas. International competitors will be able develop faster than UK companies and eventually dominate the market, at the cost to the UK of the jobs and manufacturing opportunities.

A new definition & Standards

Government, developers, installers, consumers, businesses, investors and UK storage companies all lack information on the sector. The lack of information limits the ability of the storage industry to grow. One frequent comment was that an agreed 'definition' is essential for ES.

Educating the market is also essential to avoid 'cowboy' installers in the sector and because of the relative availability of battery units and installation equipment online. The need for new standards was summed up as follows: "*Establishing formal technical standards for installation and installers as well as potentially creating a certification scheme would prove beneficial."*

Section 5 - Conclusion

This report highlights that there are a range of technology options and that energy storage can deliver significant benefits to the UK in terms of energy security, the integration of renewables on the system, and growth of manufacturing and jobs. If we want to improve energy security and deploy more renewable energy, Government, finance providers and industry must recognise that storage technologies are an essential part of the energy mix and must become mainstream. As the price of energy storage continues to fall, the case for storage becomes even more compelling; however, an initial push is necessary to overcome the current barriers.

Storage can be deployed at all scales, from large-scale pumped hydro, to domestic 'behind the meter' batteries. For example, there are around 750,000 solar PV installations in the UK, and this is one significant early market for ES, especially in conjunction with used electric vehicle batteries. Based on typical daily household PV generation and electricity consumption profiles, storage can reduce household electricity bills and boost self-consumption of PV generation, also reducing system stress and carbon emissions. Installing large scale storage on the grid network would better enable the balancing of supply and demand and assist in providing technical services such as frequency response and voltage optimisation. Energy storage is not just electrically based, as it can be applied across heat and transport, for example using hydrogen and thermal stores.

The interviews with market participants clearly identified key barriers/areas for change. These include a need for:

- High-profile Government support to provide investor confidence
- Improved access to finance
- A shift in mindset from Government and more internal DECC resourcing
- Market education and information
- Developing the case for joint renewable energy / storage deployment
- An agreed 'definition' for energy storage
- The development of technical standards for installing and using energy storage technologies

The REA's UK Energy Storage group is dedicated to helping develop the market for energy storage in the UK and, enabled by its members, will be seeking to raise awareness and support and overcome the various barriers identified. The group has already started work developing technical standards and spreading awareness of the benefits of energy storage.

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Annex A

Table A-1 Detailed US storage policies as of May 2015 (Table reproduced from US DOE website: **http://www.energystorageexchange.org/policies**, with added content)

Policy Name	Policy Description	Applies from - to
California Assembly Bill 2514	**California Public Utilities Commission** Bill 2514 was adopted to determine appropriate utility procurement targets. Since 2013 it has required California's three largest utilities to invest in over 1.3 GW of new energy storage capacity by 2020 with biannual targets increasing every two years from 2016-2020. Additionally, Electric Service Providers and Community Choice Aggregator were directed to procure energy storage resources equivalent to 1% of their peak capacity by 2020. Additionally, the bill permits companies other than large utilities to sell ancillary services in the electricity market.	01.01.2011 -
Con Edison Load Reduction Incentives	**Con Edison / New York State Energy Research and Development Authority** Con Edison filed a proposal to provide 100MW of load reduction measures including energy storage, energy efficiency and demand response as part of their plan for the potential shut down of the Indian Point nuclear reactor. In doing so, NYSERDA and Con Edison provided the public with information for their program. Accordingly, the new incentive offerings for systems that provide summer on-peak demand reduction are $2600/kW for thermal storage and $2100/kW for battery storage systems. Furthermore, they have also mentioned that, for larger projects with a minimum capacity of 500kW, there would be additional incentives, which will be capped at 50% of the overall cost.	01.05.2014 - 01.06.2016
Energy Storage Technology Advancement Partnership	**Department of Energy** The Energy Storage Technology Advancement Partnership (ESTAP) is a federal-state funding and information-sharing project, aimed at accelerating the commercialization and deployment of electrical energy storage technologies in the U.S.	
FERC Order 719	**Federal Energy Regulatory Commission** Under this order, FERC regulations under the Federal Power Act were amended and each independent system operator and regional transmission organization was required to either demonstrate that their tariffs were already in compliance with all of the areas mentioned below or to make filings that propose adjustments to their tariffs for compliance with all of the areas mentioned below; 1.Demand response and market pricing during periods of operating reserve shortage 2.Long-term power contracting 3.Market-monitoring policies 4.The responsiveness of independent system operators and regional transmission	12.16.2008 -
Long-Term Procurement Planning: Rulemaking 12-03-014	**California Public Utilities Commission** This rulemaking "authorizes Southern California Edison (SCE) to procure between	13.02.2013 -

	1,400 and 1,800 MW of electrical capacity in the West Los Angeles sub-area of the Los Angeles (LA) base and local reliability area to meet long-term local capacity requirements (LCRs) by 2021. SCE is also authorized to procure between 215 and 290 MW of the Moorpark sub-area of the Big Creek/Ventura local reliability area" (SCE, 2013). This is the first state decision directing investor owned utilities to procure a certain amount of storage capacity (50 MW). It states that "energy storage resources should be considered along with preferred resources," (ibid) and that the two categories may be procured up to 800 MW of total capacity. "At least 50 MW [of capacity] must be procured from energy storage resources. At least 150 MW of capacity must be procured through preferred resources consistent with the Loading Order in the Energy Action Plan, or energy storage resources. SCE is also authorized to procure up to an additional 600 MW of capacity from preferred resources and/or energy storage resources" (ibid).	
Project Number 39917	**Public Utility Commission of Texas** With the ERCOT protocols, generators are compensated for energy on a nodal pricing model, meaning that the price of energy for a single location is subject to change depending on the grid traffic, whereas loads pay for energy on a zonal pricing model, meaning that the price of energy is the average of a number of nodes within a zone. As of now, there are eight zones in ERCOT. Even though energy storage facilities are treated as a load when it withdraws from the grid, the facility does not consume the energy but utilizes it for regeneration. Due to this reason, the Commission sought to couple the storage load at the nodal price. The difference between pricing mechanisms could have diminished the economic efficiencies when location and operation of storage technologies were considered.	12.11.2011 -
Smart Grid Demonstration Program	**Department of Energy** Smart Grid Demonstration Program (SGDP) projects are cooperative initiatives with the objective of demonstrating the advantages of the cost-efficient new technologies and analysing ways to integrating such tools and techniques on to those systems utilized today in order to improve them. The U.S. Department of Energy provides financial support of up to 50% of the SGDP projects' costs. Among the evaluated projects two were selected by the Department of Energy. The first one included regional smart grid demonstrations to observe grid viability and carry out cost benefit analysis. The second included energy storage technologies such as batteries, flywheels and compressed air energy storage systems for load shifting, ramping control, frequency regulation services, distributed applications, and the grid integration of renewable resources such as wind and solar power.	12.31.2007 -
Smart Grid Investment Grant Program	**Department of Energy** "The Smart Grid Investment Grant (SGIG) is a program with the purpose of hastening the modernization of the nation's electric transmission and distribution systems and promote investments in smart grid technologies in a multitude of areas including operational efficiency. The U.S. Department of Energy provides financial support of up to 50% of the SGIG projects' costs.	02.01.2010 -

Texas Senate Bill 943	**Texas Legislature** Under SB 943, which is concerned with the identification and classification of the utilization and regulation of electric energy storage facilities, active devices within the wholesale market must be registered as a Power Generation Company with the Public Utility Commission of Texas and must clarify that the energy storage is afforded all the same interconnection rights as other generation facilities, which are granted permission to interconnect, transmit and participate in the market. This particular bill does not identify the use of energy storage as a transmission asset.	09.01.2011 -
Self-Generation Incentive Programme	**California Public Utilities Commission** “The CPUC's Self-Generation Incentive Program (SGIP) provides incentives to support existing, new, and emerging distributed energy resources. The SGIP provides rebates for qualifying distributed energy systems installed on the customer's side of the utility meter” (CPUC, 2007). “Qualifying technologies include wind turbines, waste heat to power technologies, pressure reduction turbines, internal combustion engines, microturbines, gas turbines, fuel cells, and advanced energy storage systems” (ibid).	01.01.2010 - 01.01.2020

Annex B

Energy storage projects in the UK

Table B-1 Details of energy storage projects in the UK as of May 2015

Project Name	Description
ABB & UK Power Networks Energy Storage Installation	DynaPeaQ is an energy storage installation for UK Power Networks in Norfolk, England. The system is a combination of ABB's SVC Light technology system for reactive power compensation and a Lithium-ion battery storage system and is used to feed energy to the local grid form the local wind turbines. The system enables absorbing and injecting power into the transmission and distribution system. The capacity of the distribution grid is 11kV and the storage system can store 200kWh of energy. For more information: http://www.abb.com/industries/ap/db0003db004333/8c1f3603e2c36bebc1257892003252aa.aspx?country=GB
AES Kilroot Station Battery Storage Array	On April 1st 2014, AES Kilroot Power Limited announced plans to build a battery store system of 100MW capacity in Northern Ireland. It will support the efficiency usage of wind power and improve grid efficiency. The storage system will be integrated into existing AES infrastructure at the Kilroot power station and could be online in the early second quarter of 2015. For more information: http://www.aesenergystorage.com/2014/06/08/aes-files-100-megawatt-grid-storage-connection-northern-ireland/
Cruachan Power Station	Cruachan Power Station is a pumped-storage hydro-electric power station which has been operational since 1965 and is one of four pumped storage power schemes in the UK. It can produce electricity for the grid in two minutes or if the turbines are already are in "spinning reverse" it can generate energy in only 30 seconds. The system is buried in the mountain and has four motor-generators which have a total output of 440MW of electricity. For more information: http://www.spenergywholesale.com/pages/cruachan_power_station.asp
Dinorwig Power Station	Buried deep below the Elidir mountain Dinorwig power station has six 300MW generating units, which use reversible pump/turbines that can reach maximum generation in less than 16 seconds and can provide power up to six hours. The system was designed to assist the National Grid in event of a complete power failure. For more information: http://www.fhc.co.uk/dinorwig.htm
EPSRC Grid Connected Energy Storage Research Demonstrator with Western Power Distribution	Funded by the Engineering and Physical Sciences Research Council (EPSRC) aims to investigate the efficiency of energy storage connected to the electrical network and the supply of power and energy it feeds in to the grid at appropriate times. Supplied from the Toshiba Corporation a 2MW (1MWh) Lithium-Titanate battery based energy storage system would be installed in September 2014. Toshiba's SCiB system with 250kW of energy will further help investigate the use of repurposed second life EV batteries.

(WPD) and Toshiba	Although, Western Power Distribution (WPD) is currently providing the point of network connection and a short term lease at their 11kV Willenhall substation, UK regulations prohibit distribution network operators from generating electricity or trading in energy markets. So while the project will be owned and operated by EPSRC, both partners will closely monitor the "effects on the network of this influx of energy storage, paying particular attention to the power requirement, diversity of connection and power quality experienced, to draw together a standard arrangement and assessment method for connecting more units in the future." For more information: https://www.epsrc.ac.uk/files/research/capital-for-great-technologies-call-grid-scale-energy-storage-panel/
Ffestiniog Pumped Hydro Power Plant	Ffestiniog Power Station was the UK's first major pumped-storage power station, which was commissioned in 1963 and currently has four power generating units with a combined output of 360MW - enough to power North Wales for several hours. For more information: http://www.fhc.co.uk/ffestiniog.htm
Flat Holm Microgrid Project	This project was installed in the summer of 2006 by Wind & Sun Ltd and includes battery/inverter systems, a 6kW wind turbine and two PV solar arrays. The batteries have storage capacity of over 27kWh to 50% depth of discharge. For more information: http://www.windandsun.co.uk/case-studies/islands-mini-grids/flat-holm-project,-bristol-channel.aspx#.VVsYVs6dJFI
Foula Community Electricity Scheme	The island is not connected to the mainland electricity grid and in 1987 a community electricity scheme was constructed which included diesel generators, a wind turbine and a hydroelectricity scheme all comprising 3.3.kV of grid electricity. However, this generation was problematic due to the islands location and issues with delivering fuel to the island during adverse weather conditions. Thus, the island's electricity grid was redesigned to have better renewable generation and decrease dependence on diesel fuel by the collaboration of Econnect Ventures and Wind & Sun. In Phase I completed in 2008) 19kW of PV cells, 140kWh battery packs to store energy harvested from the PV cells, replacing the existing Hydro-Generator and installing a new Hydro-Generator and laying a pipeline between the two sites. In Phase II (completed in 2011) the old Wind Turbine was removed, three new 10kW Westwind wind turbines were installed, a control centre for the turbines was built and battery packs were installed to store additional energy generated from the PV system. For more information: http://www.fces.org.uk
Foyers Pumped Storage Power Station	Foyers is a pumped-storage power station which also has a small amount of conventional hydro-electric capacity. The scheme was redeveloped in 1969 to focus more on pumped-storage and during the redevelopment the original power station was replace with a 5MW turbine in order to supply pure hydro-electricity. A new power station was built to house two 150MW Francis generation-motor sets which became operational in 1975. The turbines can reach full power from a standstill in less than two minutes which make them highly responsive to demand. The scheme is run by Scottish & Southern Energy and has a total capacity of 305MW. For more information:

	http://www.scottish-places.info/features/featurefirst3852.html
Gigha Wind Farm Battery Project	In order to store energy generated by wind, tide and wave power plants, the DECC project will install 1.26MWh vanadium redox flow batteries specifically to store power from the wind turbines. The installation is due in Q1 2015. For more information: http://www.communityenergyscotland.org.uk/gigha-battery-project.asp
Highview Pilot Plant	The (350kW/2.5MWh) pilot plant was connected to the grid and subjected to a full testing regime, including performance testing for the US PJM electricity market. In practical terms, the plant has operating hours equivalent to more than three years of UK Short Term Operating Reserve service (Highview Power Storage, 2015). For more information: http://www.highview-power.com
Horse Island Microgrid Project	In 2009, a 2500Ah Rolls battery system and six 3kW wind turbines were installed to generate and store energy for the residents of Horse Island which also reduced their reliance on the diesel generators. For more information: http://www.windandsun.co.uk/case-studies/islands-mini-grids/horse-island.aspx#.VVskk86dJFI
Isentropic Demonstration Project	The project utilises pumped heat electricity storage which brings three essential features required from a storage technology; high efficiency, low capital cost and long life cycle. Each installation has a life cycle of 25 years with no limitation on the number of cycles or depth of discharge. The facility is capable of 1,900kW charging (input) power. For more information: http://www.isentropic.co.uk/Energy-Storage-Systems
Isle of Eigg Electrification Project	The island had a diversity of energy supply one 9.9kWp PV system, two 6kW and one 100kW hydro generation system and a 24kW wind farm which was supported by standby diesel generation and batteries. Econnect Ventures and Wind & Sun worked together to design battery inverters and PV systems, which make the Island's electricity system more sustainable in environmental and economic terms. The total energy storage of the system is approximately 212kWh to 50% depth of discharge (DOD). For more information: http://www.isleofeigg.net/eigg_electric.html
Isle of Muck Microgrid System	The island had been generating electricity with a power system comprising of two Vergnet 20kW wind turbines and a back-up diesel generator. Due to problems with the wind turbine batteries, inverter and chargers a new system was designed. The new system has six wind turbines with six inverters, PV modules with total of 33kWP with six inverters, nine SMA Sunny Island inverter/chargers, a multicluster box 12 and three battery banks with an approximate total 150kWh useable capacity to 50% DOD. For more information: http://www.windandsun.co.uk/case-studies/islands-mini-grids/isle-of-

	muck.aspx#.VVuUCc6dJFI
Isle of Rum Microgrid System	The Isle of Rum contracted Wind & Sun to develop a micro-grid system that would shift their hydro-generation resources to efficiently and effectively match peak loads. The issue the island was facing was that the load could peak to levels which exceeded the power output capacity of the generator causing power cuts on the island which required manual intervention ad inconvenient times. A Sunny Island system was installed, the 15kW existing hydro turbine was refurbished and a new 30kW hydro turbine was installed. The system has provided system balance, reduced diesel consumption, reduced maintenance and resulted in 24 hour power. For more information: http://www.windandsun.co.uk/case-studies/islands-mini-grids/isle-of-rum.aspx#.VVvFy86dJFI
Northern Isles New Energy Solution	This project (also known as NINES) aims to deliver a secure, affordable and reliable energy system in a more environmental manner to Shetland, which is not connected to the national electricity network. The installation will include the deployment of a lead acid battery with the capacity of storing 1MW of energy, which will be installed at Lerwick Power Station. For more information: http://www.ninessmartgrid.co.uk/our-project/
Northern Powergrid CLNR EES1 to EES3-3	Northern Powergrid's Customer-Led Network Revolution (CLNR) project aims to assess the potential for new network technology and flexible customer response, to facilitate faster and more economical take-up by customers of low-carbon technologies. Additionally, the project will help increase renewable energy generation as well as achieve low carbon targets by connecting these technologies to the distribution network. The project is partially funded by Ofgem Low Carbon Networks Fund. It project includes six NEC Energy Solutions GSS units which have been commissioned in 2013 and in three different areas. Deployment in both rural and urban areas provide a strategic angle to understand different grid settings and it is estimated that this project will become a representative sample of 80% of the entire UK power grid. For more information: http://www.networkrevolution.co.uk/wp-content/uploads/2014/12/Overview-of-Network-Flexibility-Trial-Design-for-CLNR.pdf
Orkney Storage Park Project	Scottish Hydro Electric Power Distribution (SHEPD) and Mitsubishi Heavy Industries Ltd have commissioned an energy storage system demonstration project using the distribution grid in the UK's Orkney Islands. The project aims at demonstrating power supply stabilisation in the region by introducing a container-housed large capacity energy storage system using lithium-ion rechargeable batteries, with a power output/input capability of 2MW. The storage system was handed over for operation in 2013. The funding for the project is being provided to SHEPD from OFGEM, under the Low Carbon Network Fund. For more information: https://www.ofgem.gov.uk/sites/default/files/docs/2013/09/sset1007_close_down_report_final.pdf
Slough Zero-	Three 25kWh lithium batteries were installed in the project, which aims to ensure that

Carbon Homes Community Energy Storage	the power generated from PV panels can flow into the grid with, appropriate the technology. The batteries are connected at a strategic point, which will help spread demand and generation loads during the day. The focus of this project is to understand the benefits storage technologies can provide to low voltage networks. Additionally, the project is the first to be funded by Ofgem's Low Carbon Network Fund (LCNF) that places batteries close to customers' homes, instead of the point of use or at a substation. For more information: http://www.sandc.com/news/index.php/2013/01/sc-and-scottish-and-southern-energy-power-distribution-announce-pilot-storage-project/
Smarter Network Storage	This project aims tackle the challenges associated with low-carbon transition and increase economic deployment of storage by carrying out a wide range of technical and commercial innovations. Storage technologies are demonstrated across different part of the electricity system, which are also go beyond the boundaries of the distribution network. By demonstrating this multi-purpose application of 6MW/10MWh of energy storage at Leighton Buzzard primary substation, the project will explore the capabilities and value in alternative revenue streams for storage, whilst deferring traditional network reinforcement. An important aim of the project is to provide the industry with a detailed assessment of a storage projects' business case and full economic data consequently increasing intermittent energy sources integration to the grid and low carbon generation. The project was awarded funding from Ofgem's LCNF scheme of £13.2 million in December 2012 and will last until December 2016. For more information: https://www.ukpowernetworks.co.uk/internet/en/community/smarter-network-storage/
WPD Falcon Project, GE Durathon	The Falcon (Flexible Approaches to Low Carbon Optimised Networks) aims to reduce carbon emission levels within the electricity network and to investigate the benefits alternative to network reinforcement and how to increase efficiency. The project consists of five 50kW of Sodium Nickel Chloride Durathon batteries, which were supplied from GE and another smart technique. "The purpose of installation is to investigate using energy storage to defer costly network reinforcement and evaluate using a number of smaller batteries distributed across a network, rather than a single unit at a single location" (DOE, 2015). For more information: http://www.westernpower.co.uk/About-us/News/Falcon-flies-the-flag-for-innovation.aspx

About the REA

The REA was established in 2001, as a not-for-profit trade body, representing British renewable energy producers and promoting the use of renewable energy in the UK.

The REA endeavours to achieve the right regulatory framework for renewables to deliver an increasing contribution to the UK's electricity, heat and transport needs. It is influential in helping shape UK energy policy and has a track record in delivering high quality events on a wide range of energy related topics. REA aims to help its members build commercially and environmentally sustainable businesses.

REA Expertise

Renewable energy is a major component of low carbon energy policy for the future and is now a significant global business.

Energy storage technologies offer huge potential for the UK's energy supply. The industry can deliver significant benefits for both system stability and security of supply as well as helping decarbonise UK energy supplies. By delivering these new efficient, flexible energy systems, energy storage powerfully enables the deployment of renewables such as solar and wind.

UK Energy Storage is the trade body for storage technologies of every type and scale in the UK, whatever the application. The body exists to further the aims of energy storage companies and establish a clear marketplace and policy framework.

REA - #UKenergystorage
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