Cynulliad Cenedlaethol Cymru Pwyllgor Amgylchedd a Chynaliadwyedd	National Assembly for Wales Environment and Sustainability Committee
Dyfodol Ynni Craffach i Gymru?	A Smarter Energy Future for Wales?
Ymateb gan Highview Power Storage (Saesneg yn unig)	Response from Highview Power Storage
SEFW 21	SEFW 21

Cynulliad Cenedlaethol Cymru National Assembly for Wales

National Assembly for Wales Consultation

A Smarter Energy Future for Wales?

A Highview Power Storage response

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Highview Power Storage (HPS) welcomes the opportunity to respond to this consultation. HPS is an award winning, UK based energy technology company focused on a cleaner, more efficient and secure energy future. HPS has developed a proprietary energy storage technology that uses surplus electricity, at times of low demand/low cost, to make liquid air, which can be stored and released later to generate electricity at times of high demand/high cost.

HPS technology uses proven components from the industrial gas and power generation sectors, is unconstrained geographically, uses no exotic/rare materials and produces no harmful emissions. It has the potential to provide a large scale, long duration solution to the challenges to the electricity supply chain associated with increased intermittent low carbon generation and low carbon technology.

The energy mix

How can we decarbonise our energy system at a sufficient pace to achieve the necessary reductions in emissions?

Answer:

What mixture of distributed generation resources best meets Wales' renewable energy needs in respect to the supply of a) electricity, b) gas, and c) heat?

Answer: No Comment

The grid

How does the grid distribution network in Wales enable or restrict the development of a new smarter energy system?

Answer: No Comment

What changes might be needed in terms of ownership, regulation, operation and investment?

Answer: Energy storage (ES) could make a significant contribution to electric power systems by providing benefits across the entire value chain. To date, the deployment of ES has been limited, in part, due to the current electricity market structure and regulation.

The main problems identified in projects such as the Smart Network Storage project ran by UK Power networks are the following:

1. Undetermined asset class for ES as such and unbundled electricity system limiting stakeholders, in particular distribution and transmission system operators, from appropriating ES benefits. Currently ES is classified as a generation asset limiting the ability of Distribution System Operators (DNO) and Transmission System Operators (TSO) to recover investments in this type of assets. This issue has been raised at European and International level and some progress has been made in the state of New York. Distribution Utilities will be allowed to own storage systems that are located on utility property and meet the following criteria - they must be integrated into the distribution system architecture and used to enhance overall grid reliability and integration of increased levels of distributed energy resources.

   The proposed change in regulation is the creation of a separate asset class for ES and associated rules for regulated and competitive operations.

2. The lack of ES deployment experience results in the absence of common standards and procedures for evaluating, connecting, operating and maintaining ES. This in turn results in barriers to the deployment of storage.

   Integrating the findings of energy storage demonstration projects in codes and standards and furthering the knowledge and experience on ES assets is a necessary step to streamline its deployment.

Additional barriers to the deployment of storage as presented in a paper published in 2014 by Anuta[1] et al. are the following:

1. Renewables integration policies. No benefit for controlled and dispatchable RES.
2. Transmission and distribution use charge, tax exclusions and renewable energy subsidies
3. Energy storage not being considered as a renewable energy source (RES) under RES targets

Storage

How can energy storage mechanisms be used to overcome barriers to increasing the use of renewable energy?

<u>Answer</u>: In general terms, the marginal costs associated with the integration of renewables into the energy portfolio of a power system increase with the share of renewables. The Potsdam-Institute for Climate Impact Research analysed the impact of wind integration on the levelised cost of energy (LCOE) of a power system as a function of the final share of wind in the energy portfolio. The study was based on the German power system where the penetration of renewables is among the highest in the world, but the study is applicable to other countries. As can be seen in **Error! Reference source not found.** below, the LCOE of wind remains constant at €60/MWh and is labelled as Generation costs whereas Integration costs increase proportionally with the share of wind. Integration costs are divided into Profile costs, Balancing costs and Grid costs and account for variability, uncertainty and location-specificity respectively. Profile costs are associated with over generation and the need to cycle base load power plants. Balancing costs are associated with the costs incurred by the Power System Operator to keep the balance between power supply and demand. Finally, Grid costs are associated with grid reinforcement costs. The dashed line and shaded area reflect short-term integration costs before the power system adapts to the deployment of higher shares of variable renewable energy sources.

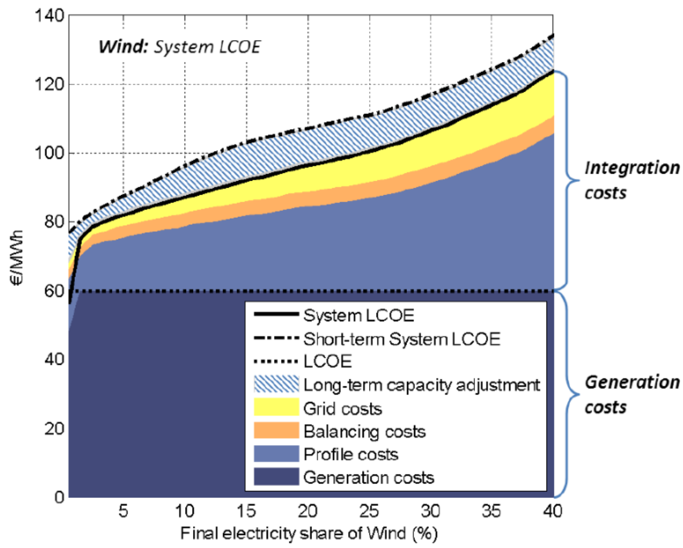

Figure 1. Source: Ueckerdt Falko , Hirth, Lion (2012): "System LCOE: What are the costs of variable renewables?" , Potsdam-Institute for Climate Impact Research.

Energy storage (ES) can be used to reduce Integration costs. In California, where the share of renewables is significant and Profile costs associated with the integration of solar PV are expected to be significant by 2020, the regulator has required investor owned utilities to procure 1.3 GW of ES for

[1] "An international review of the implications of regulatory and electricity market structures on the emergence of grid scale electricity storage"

different applications. These include network reinforcement deferral, which is seen as a cost effective alternative to traditional reinforcement. The procurement mandate requires that ES projects be evaluated based on a cost benefit analysis. This implies that the benefits that a storage system can generate are as important as its costs. *Table 1* presents the levelised cost of energy for a range of ES technologies for power and energy intensive applications as presented in a study[2] supported by the European Commission.

Overview of technology LCoEs for power- and energy-intensive applications

EUR/MWh

	Power-intensive application example (1 h of storage)				Energy-intensive application example (8 hrs of storage)				Long-term storage (2,000 hrs of storage)
	2013		2030		2013		2030		2030
	Low	High	Low	High	Low	High	Low	High	Low
Li-ion	138	573	38	106	181	754	76	218	1,000s
NaS	n/a	n/a	n/a	n/a	196	269	42	68	1,000s
Flow-V	155	238	57	97	148	239	50	96	1,000s
Lead	211	379	59	110	114	262	39	98	1,000s
CAES-A	27	n/a	19	n/a	49	n/a	37	n/a	1,000s
LAES-A	40	82	32	66	71	166	57	133	1,000s
PHES	18	28	18	28	24	42	24	42	>400
P2P H_2	Electrolyser and CCPP with salt cavern storage considered for P2P H_2 – suitable for longer-term storage								140

SOURCE: LCoE model; ISEA RWTH 2012: Technology overview on electricity storage; coalition input

Table 1

As can be seen, Pumped Hydro (PHES) and Compressed Air Energy Storage (CAES) exhibit the lowest LCOE but these are geographically constrained, which might limit their ability to appropriate the value they generate. By looking at the results of a study[3] undertaken by Imperial College, presented in *Figure 2*, it is clear that a significant proportion of the value created by storage is related to savings in Distribution CAPEX (i.e. grid reinforcement investment deferral), especially by 2020, so it's evident that location will play a key role in the financial viability of an ES project. On the other hand, the LCOE of batteries such as Lithium-ion (Li-ion) is significantly higher. This is due to the costs incurred every time batteries are replaced, which are a consequence of electrochemical degradation. This is affected by how often the battery is used and is worsened if the battery is fully discharged every time it is used.

[2] Commercialisation of Energy Storage in Europe. Available online at: http://www.fch.europa.eu/publications/commercialisation-energy-storage-europe

[3] Imperial College, 2012. "Strategic Assessment of the Role and Value of Energy Storage Systems in the UK Low Carbon Energy Future"

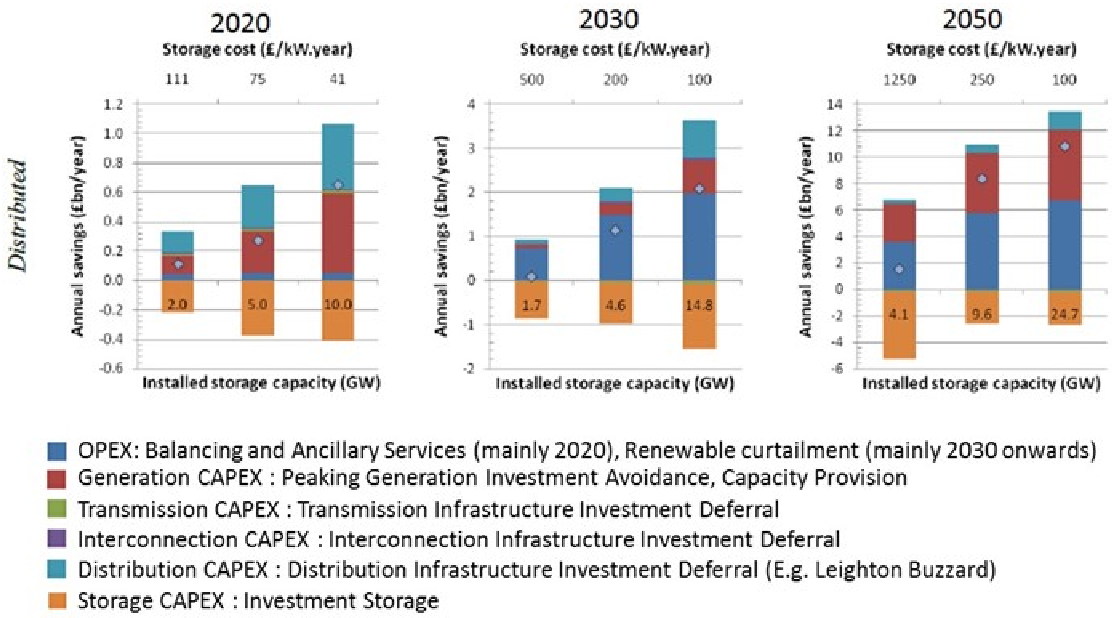

Figure 2

A Liquid Air Energy Storage (LAES) system can be located where required and because it doesn't use toxic materials, this can be achieved near demand centres where it can monetise the value it generates across different layers in the network.

Ownership

To investigate the desirability and feasibility of greater public and community ownership of generation, transmission and distribution infrastructure and the implications of such a change.

Answer: No Comment

Energy efficiency and demand reduction

How can the planning system and building regulations be used to improve the energy efficiency of houses (both new build and existing stock)?

Answer: No Comment

What would the environmental, social and economic impacts be if Wales set higher energy efficiency standards for new build housing? (e.g. Passivhaus or Energy Plus)

Answer: No Comment

Communities - making the case for change

How can communities, businesses and industry contribute to transforming the way that Wales thinks about energy?" Does the answer to this challenge lie in enabling communities to take greater responsibility for meeting their future energy needs?

Answer: No Comment