Energy Storage (2016)

NB: Please complete this form with support from Steering Group & Project Chair – the draft PID should be presented and discussed at the first Steering Group meeting, particularly the sections on Comms, Impact & Dissemination. Ensure Project PIDs are always saved on the ERP shared drive.

Overview

The number and variety of Energy Storage (ES) options[1], means the technology can encompass a range of meanings and applications. It is therefore important to define exactly what is meant by 'storage, and to understand the requirements for storage within a given context.

ERP's current work in this area (2016), will provide a non-exhaustive **'mix-and-match'** range of ES **use-cases** (see Aims & Objectives section) from across the energy system, to define the technology and showcase options for how it can be used.

However, given the volume of existing work with a focus on the *technical* range and capabilities of ES technologies, ERP's project will provide less of a focus in this area. Some "light-touch" technical information will be included as part of each use-case example, although major technological barriers (or enablers) will be noted when deemed significant.

The main focus of the work will therefore be to provide an ***overview of the current financial, legal, commercial, political and regulatory barriers*** within and across each situation assessed. This may also include a consideration of aspects such as the value of electricity; and competing or even 'displacement' technologies. The work will then move on to consider how these barriers may be addressed.

Having highlighted the issues at a use-case level, more generalised, high-level recommendations will subsequently be posed, to provide parties such as policy-makers, regulators, network operators, ES developers, customers and investors with clarity as to how the barriers for wide-scale ES deployment within the UK can be overcome.

ERP's work in 2011[2] highlighted that Energy Storage is not a panacea - there are other technologies competing within the same markets. But the technology can bring benefits to the energy system and these will be highlighted as part of this study. It is therefore key to ensure the right legal and regulatory conditions for ES to have an equal opportunity to succeed.

Context (background)

Energy Storage capabilities are already at the heart of our energy system, in the form of fossil fuels which currently provide large volumes of long duration storage over a period of months. Economic as well technical solutions are therefore already in existence. But changes to our current energy system (e.g. renewable technologies, electrification and transport) are creating a new challenge - to replace the current high value, low cost solutions that are already offered and provide storage that accounts for daily fluctuations, as well as variations over several weeks and months.

It has long been recognised that more modern Energy Storage technologies have a role to play in the future success and management of energy systems. This is particularly the case with pledges from a number of countries internationally (e.g. at the recent COP21 talks in Paris, December 2015) to limit the rise of global warming; resulting in commitments to further increase penetrations of renewables within the global energy mix.

Alongside this increase in renewables, Energy Storage is deemed a valuable and complementary solution for storing electricity that is generated variably and intermittently, dispatching it as needed to meet demand.

And the interest in ES is rising. Rapidly developing economies such as India (the world's third-largest GHG polluter) has proposed reducing its emissions from 2005 levels by 33% - 35% and specifically mentions energy storage as a goal in its INDC.[3]

However, the use of ES alongside renewables is not the only area where storage can add value. ES provides a complex field for analysis, with an array of possible technologies and applications, with many locational and temporal considerations. And these wide-ranging applications provide storage with the potential to compete in a variety of energy markets, plus markets for energy services. Heat and aforementioned Transport are other energy-intensive areas where the ability to store electrical or thermal energy could have great benefits.

UK Foreign Office Permanent Representative for Climate Change, Sir David King, recently highlighted ES as key for global decarbonisation, stating that he *"believes energy storage is the single most important area for investment in research and demonstration into the marketplace today"*.[4] Additionally, the recently initiated (UK-led) Mission Innovation (previously Global Apollo Programme),[5] considers storage as one of the three foundation elements common to all sources of energy.

In 2013, the UK Government additionally identified storage as one of the government's "eight great technologies",[6] anticipated to propel the UK to future growth in light of their potential to save money and reduce emissions.

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[1] As listed by the Energy Storage Association: http://energystorage.org/energy-storage/applications-energy-storage-technology
[2] http://erpuk.org/project/energy-storage-in-the-uk/
[3] INDIA'S INTENDED NATIONALLY DETERMINED CONTRIBUTION INDC. - http://energystoragereport.info/cop21-2015-paris-climate-conference-energy-storage/
[4] http://energystoragereport.info/cop21-2015-paris-climate-conference-energy-storage/#sthash.GJyet9qZ.dpuf
[5] http://cep.lse.ac.uk/pubs/download/special/Global_Apollo_Programme_Report.pdf
[6] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/249255/eight_great_technologies_overall_infographic.pdf

Yet despite actions such as these, according to some sources[7], the UK is behind other countries in its adoption of modern electricity storage, with manufacturers such as GE signing major Energy Storage deals outside the UK (for example in the US - case study California's Imperial Valley).[8]

Some excellent R&D / innovation and demonstration activities do however exist within the UK, and include a non-exhaustive list of examples here:

- DECC's Innovation Support Programme and projects undertaken by the Low Carbon Network Fund's (LCNF) e.g. UK Power Network's Smarter Network Storage project
- Highview Power Storage, who were awarded funding from DECC to build a 5MW Liquid Air (LAES) pre-commercial technology demonstrator
- Moixa Technology - an energy storage system for homes and offices, and EVEREST (Electric Vehicle Embedded Renewable Energy Storage and Transmission) – which demonstrates the viability of using energy storage to support electricity distribution networks, the integration of renewable generation and the rapid charging of electric cars; both DECC-funded.
- The Birmingham Centres for Energy Storage (BCES) established in 2013 with funding from Industry and EPSRC
- The Thames Valley Vision (SSE) and The Gigha Battery Project - Community Energy / Distribution / Low Voltage level Storage
- Isentropic's PHES & CAES Gas integrated Energy Storage Systems

with additional activities at an OEM / wider-industry level also.

But with a greater focus currently on R&D and less focus on providing the right legal conditions and regulatory incentives, wide-scale deployment is being hampered. According to National Grid's Future Energy Scenario, 2015 (in terms of Energy Storage grid application), one of the main challenges facing storage is *"the absence of a regulatory definition…Electricity storage is not recognised explicitly in EU legislation and is therefore treated as a subset of power generation. This legal uncertainty has implications for ownership and operation, and therefore business models for storage."*

The main challenges for Energy Storage are therefore predominantly:

- Markets & Regulation
- Politics[9]
- Legislation
- Economics & Financing
- Technology & Development

Aims & objectives (these are likely to be updated as the project progresses)

ERP's work on Energy Storage (2016) will provide a non-exhaustive overview of the current **financial, legal, political, commercial and regulatory** challenges for Energy Storage deployment to 2030 with a "light-touch" focus on the technical challenges.

Use-cases will provide a range of examples representing a whole energy system perspective and will be used to suggest ways in which challenges in these aforementioned areas may be overcome.

The aims of this work are therefore to:

1. Consider and highlight the financial, legal, political, commercial and regulatory challenges for Energy Storage deployment, by using **4-6 use-cases 'mix-and-matched'** from the options listed below. Use-cases will ideally be selected based on a consideration of what the UK's energy system needs are – e.g. by considering existing scenario / modelling works on storage, previous work by ERP and other relevant organisations.

NB use-cases are to be discussed and decided on at ES Steering Group meeting, end of Jan 2016, however **ERP member input is**

[7] http://www.electricitystorage.co.uk/policy-and-issues
[8] https://www.genewsroom.com/press-releases/ge-signs-its-largest-battery-energy-storage-deal-date-281520
[9] R&D will not be undertaken without a political commitment to a stable fiscal and support regime

sought and welcomed at or following the plenary meeting. Use-cases will be extracted from a mix of the following areas.

Owners/Users	Services / Applications	Technologies	Barriers
Householders (e.g. Behind Demand Meters)	Frequency Response (Balancing)	Hydrogen / Bio-SynGas	Politcal
Industrial	Reserve (Balancing)	Wind	Regulatory
Commercial	Inertia	PV (behind the meter)	Commercial
Service providers e.g. hospitals, hotels	Voltage Control	CHP	Financial
DNOs	Peak Shaving	Marine (offshore)Storage	Legal
National Grid (TSO/SO)	Demand Response	Thermal Storage (Heat)	Technical
Renewable Generators (e.g. Behind Generation Meters)	Black Start / Emergency Back-up	Electrical Storage	
Hydrogen Storage Developer	Electricity Balancing (incl. local level)	EVs	
	Peak Capacity (Storage Adequacy)		
	Time-shifting (Storage Adequacy)		
	Year-round (Storage Adequacy)		
	Heat Balancing		
	T&D Deferral		
	Gas Grid		
	Transport		
	Energy Arbitrage		

2. Following the analysis of these use-case areas, the project will highlight significant barriers and put forward recommendations for how energy storage technologies can be enabled and more widely deployed across the UK.

ERP contribution

ERP's role is to consider and propose a variety of solutions to help identify and remove artificial barriers to the successful deployment of Energy Storage across the UK. Given its range of members, many of whom have a keen interest in Energy Storage, the ERP is well placed to consider these issues and where possible, recommend and propose possible solutions.

It is the intention that this work (Energy Storage 2016) draws on a number of previous ERP reports that have highlighted the potential role for storage within their topic areas; with a view to investigating and further developing these. As noted below, previous work undertaken by the ERP of main relevance to this project work are: Hydrogen, Transport, Cities, Smart Energy, Managing Flexibility, Community Energy and ERP's previous work on Energy Storage (2011).

The 2011 work considered the opportunities for Energy Storage, as well as the nature and scale of some of the associated challenges. The 2016 work will provide a more up to date assessment of the challenges for Energy Storage using specific case studies, with a greater focus on the financial, legal, political, commercial and regulatory barriers for deployment, plus recommendations for how to overcome them.

Output and Key Deliverables

It is anticipated that the following documents will be produced following this project work:

1. A full report
2. An executive summary
3. A one-page 'elevator pitch'
4. A supporting powerpoint pack providing an overview of the project work/key messages

   Additionally, 1-2 workshops may be held (at the start and end of the project) to i) inform the project work and ii) help disseminate its findings (TBC by Steering Group, ERP Members and Head of Analysis Team).

Project Impact

*Consider as part of slide park at initial SG meeting / at start of project **and** once the project has been completed.*

Proposed project impact for ERP as a whole, potential impact for Members / member orgs and wider impacts (e.g. for energy system/gov/industry or particular organisations). Refer to impact-effort diagram in comms strategy.

Section to be completed at 1st official Steering Group meeting, end of Jan 2016.

Communications & Activities

Consider comms tools and methods with a focus on impact.

What comms support (in-house and external) will be required? Consider/map who you will need to engage with to produce the work.

Plan for promotion and dissemination of project work – this includes input or support from SG / Project Chair to create a recipient email list and consider any comms support required.

Refer to the stakeholder engagement strategy and subsequent tools as developed by ERP's Comms Team Resource.

Project & follow-up activities should be considered at the start of the project but will require updating as the project progresses. Consider, source and record impact and opportunities e.g. to present the work, speak at conferences, be involved in collaborations with others etc.

Section to be completed at 1st official Steering Group meeting, end of Jan 2016.

Approach & Schedule

In addition to desk-based synthesis and research, this work will be carried out by drawing on expertise from the Project Steering Group & Project Chair; interviews with colleagues from the wider ERP Membership; interviews with representatives from other (non-member) organisations of relevance; and from drawing on previous work undertaken by ERP in related reports on Hydrogen, Transport, Cities, Managing Flexibility, Community Energy, Energy Storage (2011) etc.

This (draft) PID will be presented to the January 2016 plenary to gain member approval for project initiation. Following initiation, the project will run between January & July 2016 when a 75-80% completed version of the report will be presented. The report will be finalised by September 2016.

Staffing, Steering Group and wider contributions

- **Steering Group Chair: Peter Bance, Origami**
- **Lead Analyst: Helen K Thomas**

Steering Group Members:

- Keith MacLean, ERP Co-chair
- Craig Edgar, Atkins
- John Tindal, SSE
- Stephen Marland, National Grid
- Sally Fenton, DECC
- Judith Ross, Ofgem
- Andrew Lever / David Sanders, Carbon Trust
- Martin Southall, GE
- David Butler, Scottish Enterprise
- Allen Creedy / Andrew Poole , FSB

Budget

£7k