



UNIVERSITY OF
BIRMINGHAM

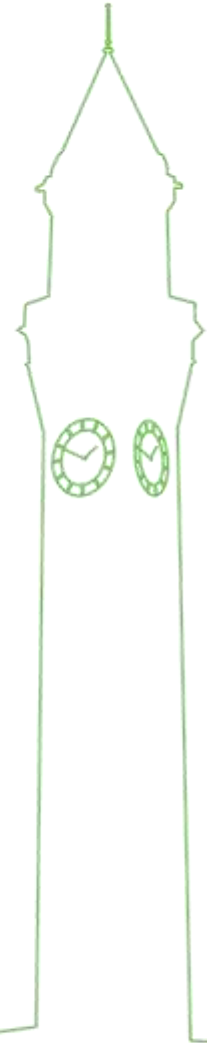
COLLEGE OF
ENGINEERING AND
PHYSICAL SCIENCES

Energy Storage roadmap etc

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<http://www.birmingham.ac.uk/energystorage>



Roadmap objectives

To develop the first integrated national roadmap for energy storage with the wider community

Set the UK agenda for energy storage research

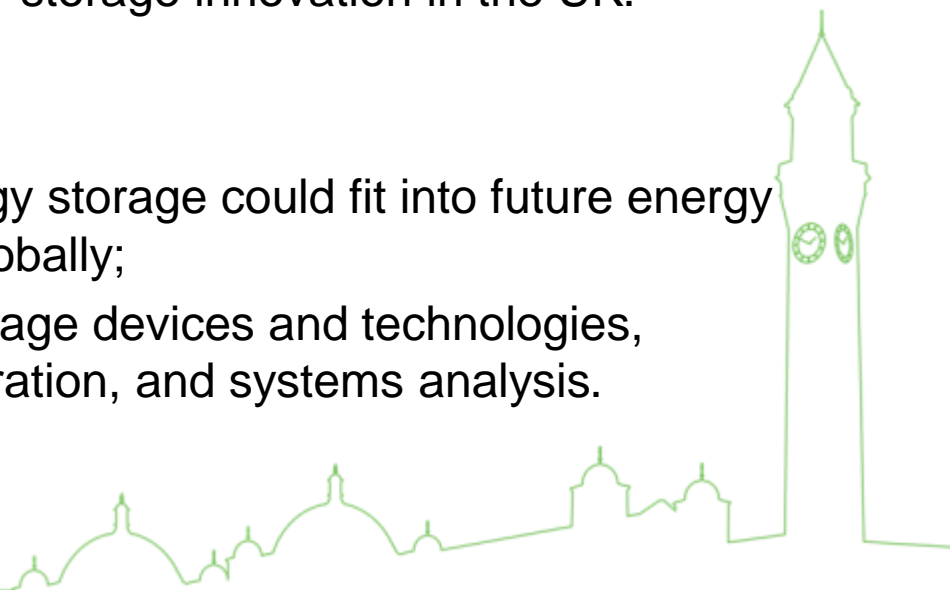
Aims

- Inform research agenda
- Develop a shared vision for energy storage innovation in the UK.

Scope

- A high-level roadmap of how energy storage could fit into future energy system pathways in the UK and globally;
- Research needs for materials, storage devices and technologies, manufacturing development, integration, and systems analysis.

Map, not a route...



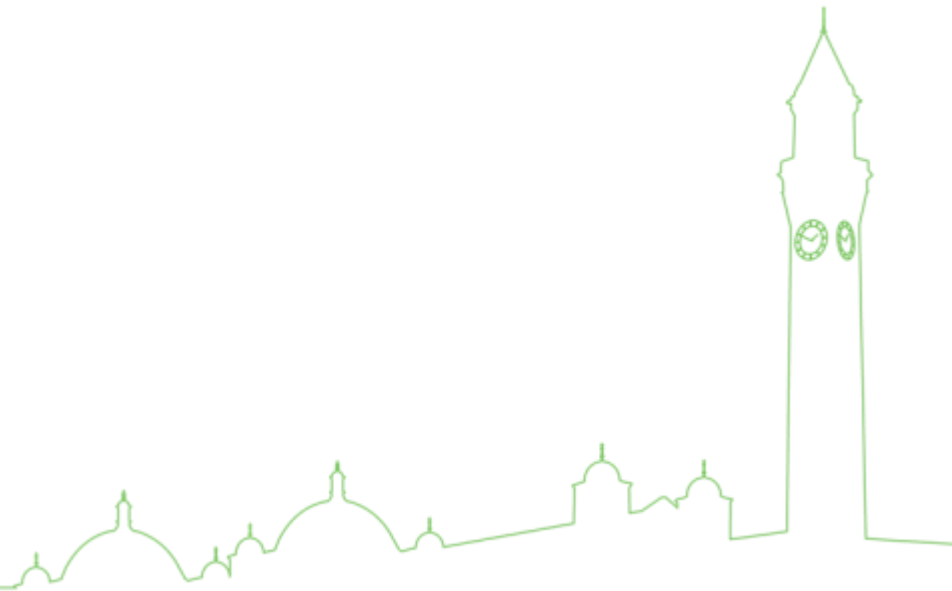
Process

- Science & technology trajectories: what could be delivered by when
- Energy system scenarios: understand the requirements for storage

Describe through a process of:

- Expert input – literature and interviews
- Participatory workshops
- Review
- Publication

Collaboration with key stakeholder

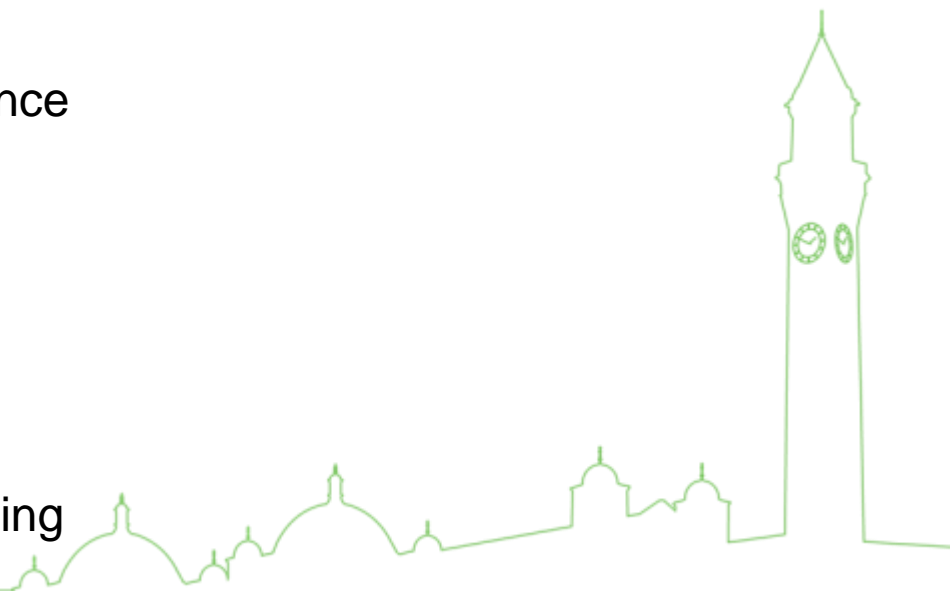


Roadmap layout

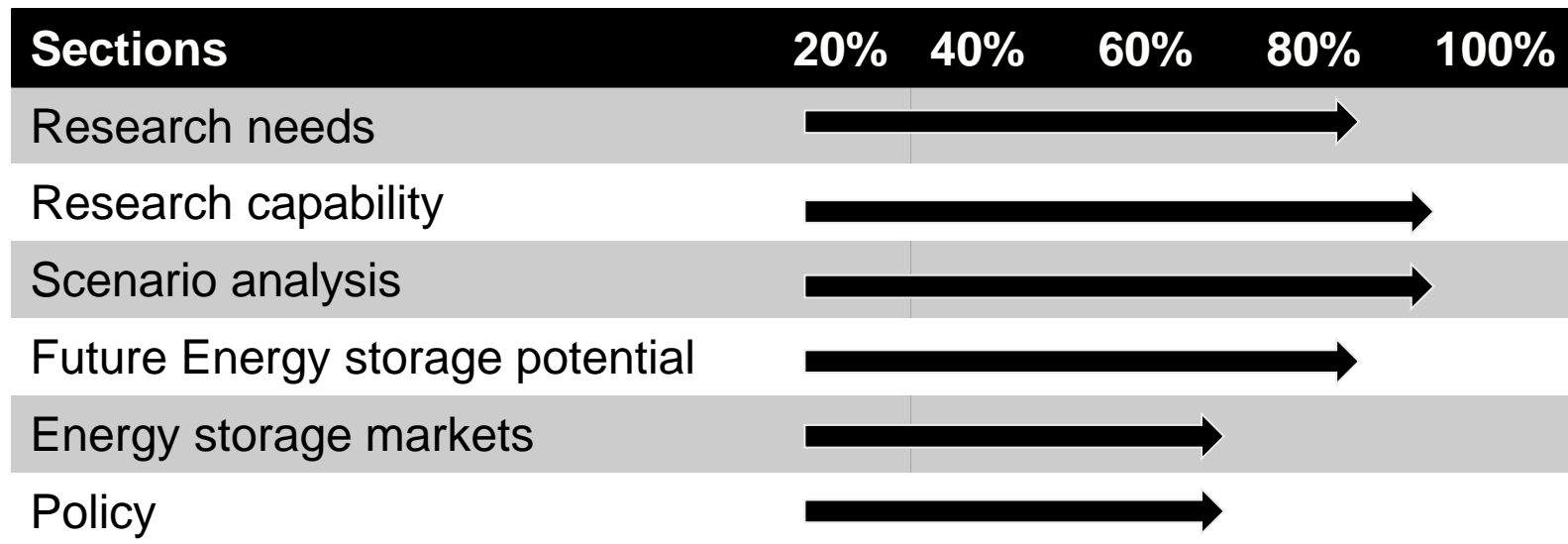
Draft manuscript in preparation (90 pages)

PDRA Sanghyun Hong

- Energy system scenarios
 - Role of storage in NG FES, CCC, UKERC
 - Review multi-criteria approach to assess applications
- Energy storage technologies
 - Trajectories of cost and performance
 - Research needs
- Applications vs technologies matrix
 - Markets and policy
- Innovation capability
 - UK focus, with global comparison
 - Research strengths, RD&D mapping



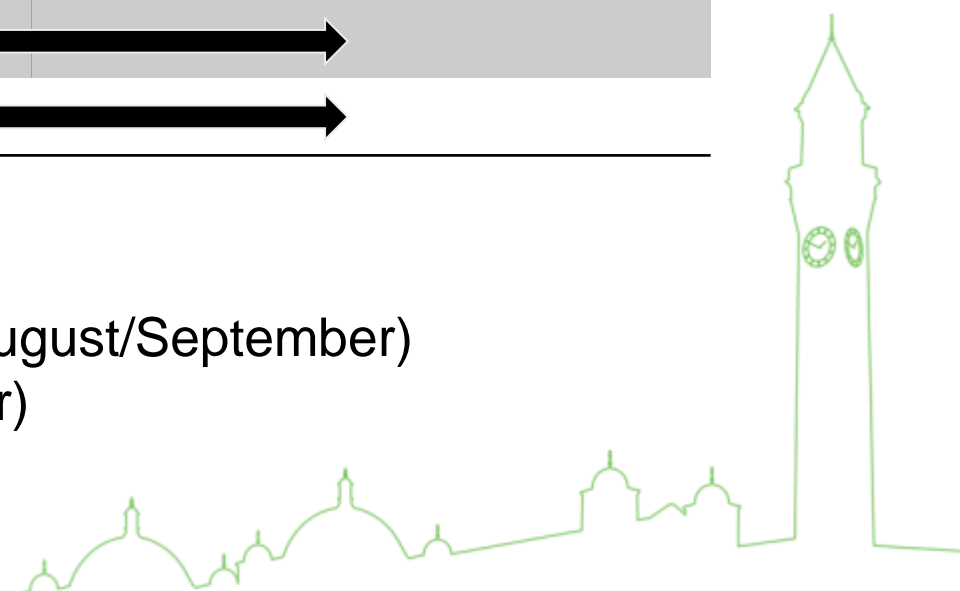
Roadmap progress



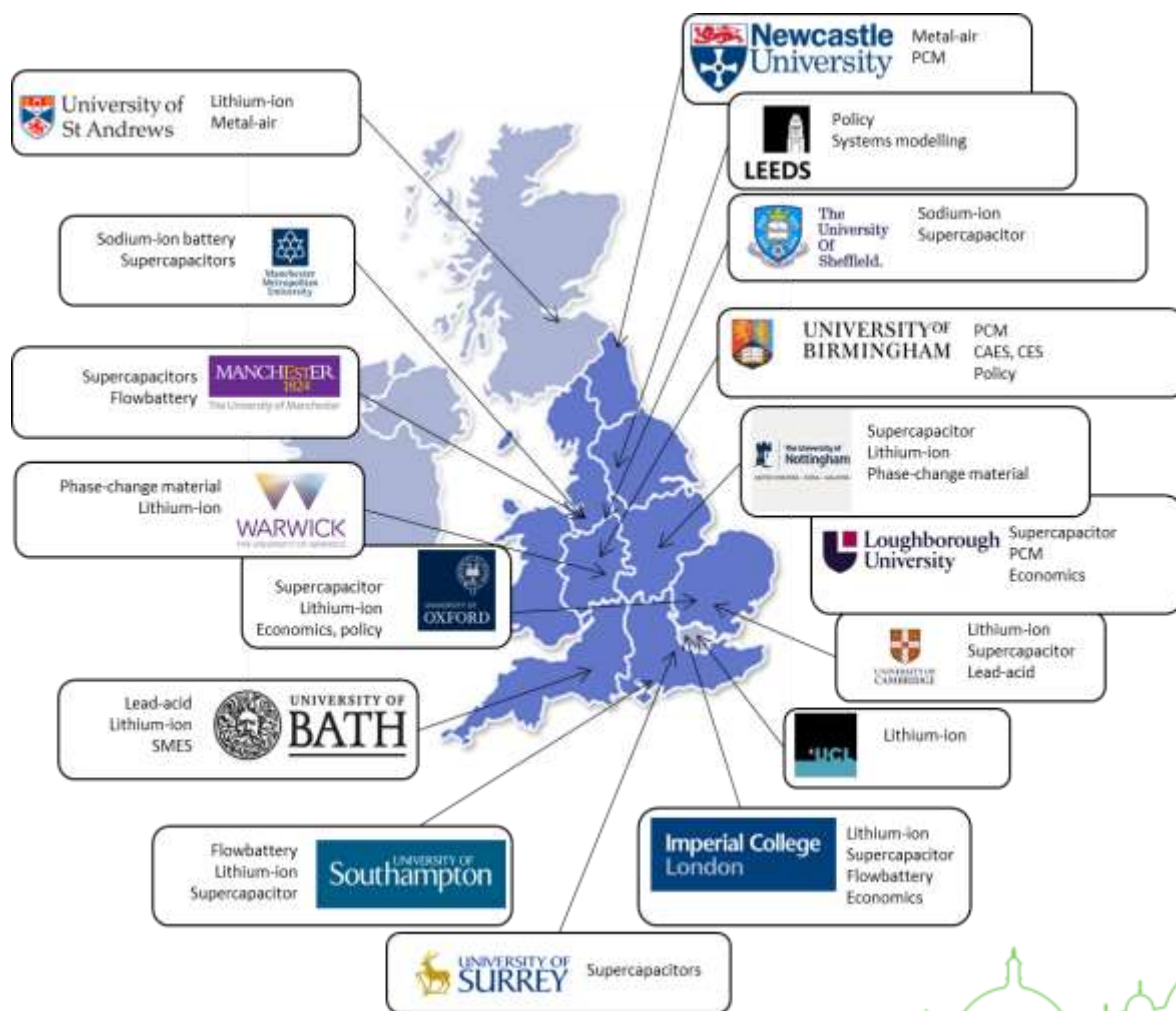
Main tasks to complete:

- Stakeholder interviews (July/August/September)
- Workshop (September/October)

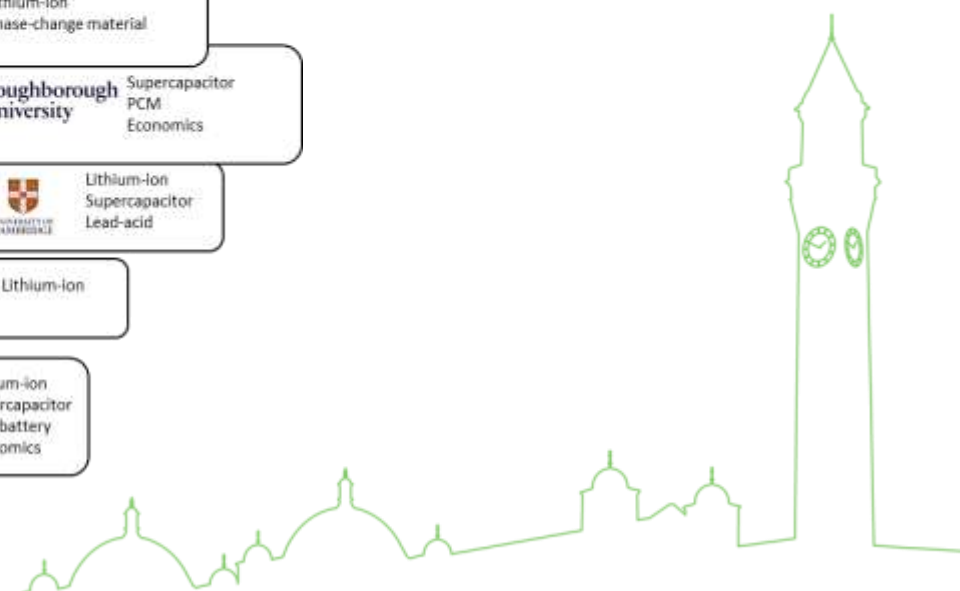
Launch at UKES 2016



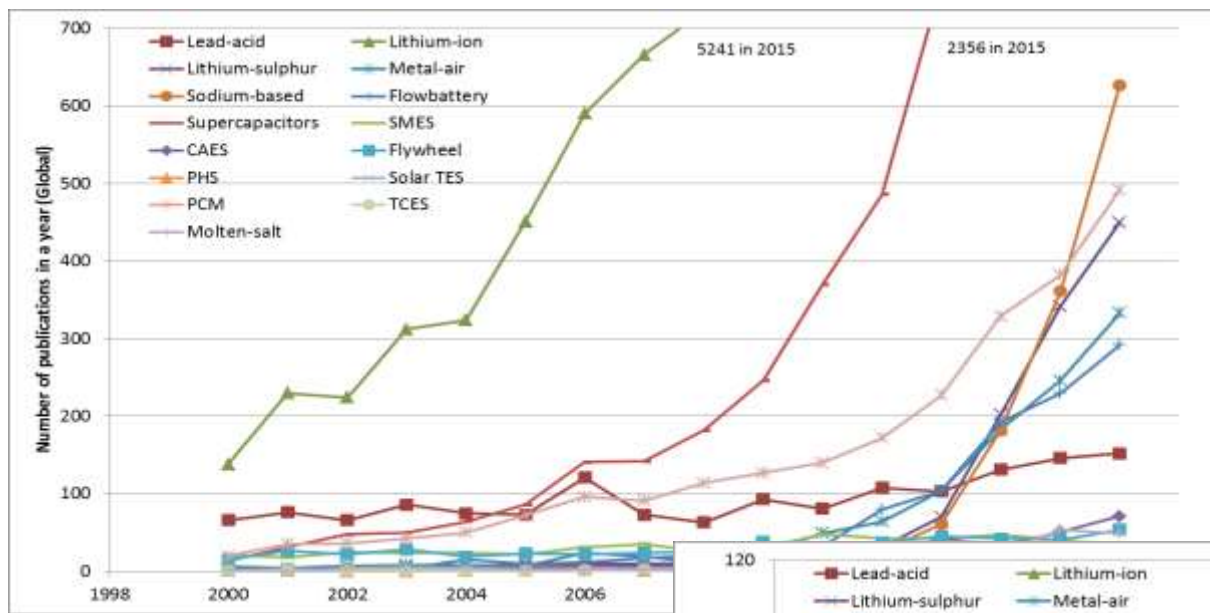
Research capability



Mapping based on funding and publication metrics.

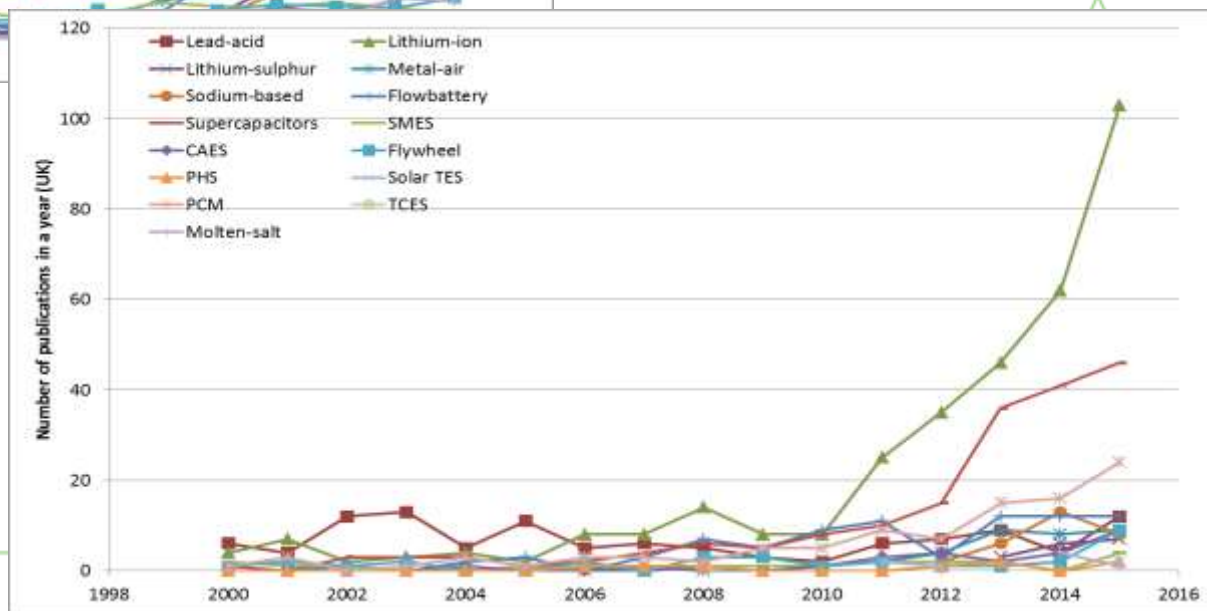


Publication trends



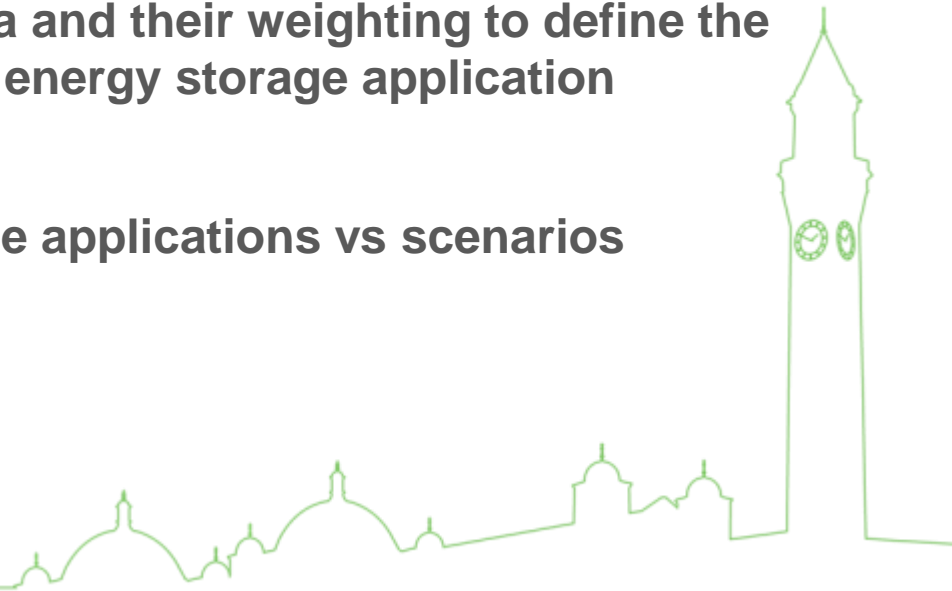
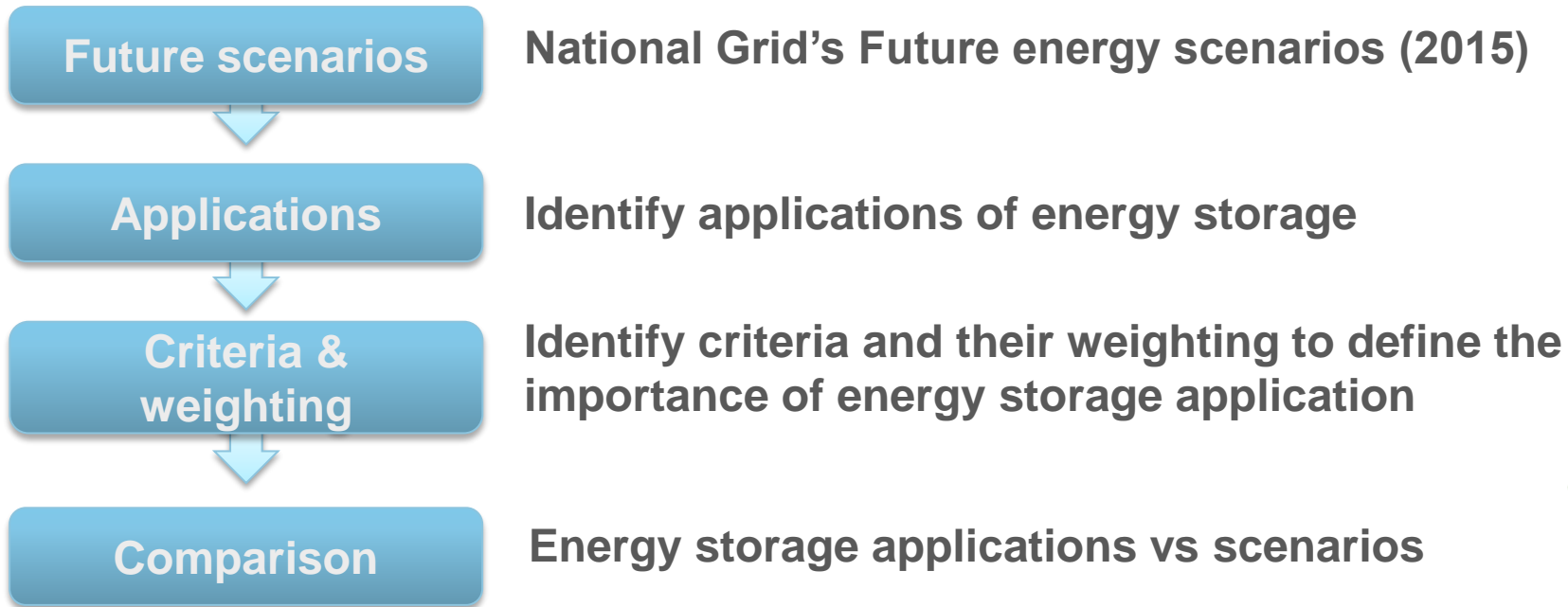
Global

Web of science database by 2015 (journal articles only)

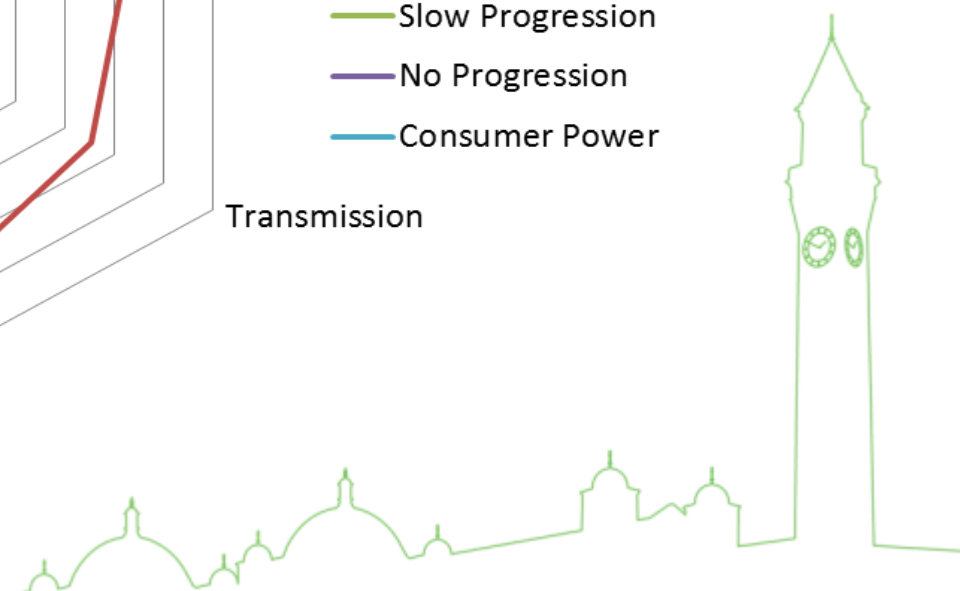
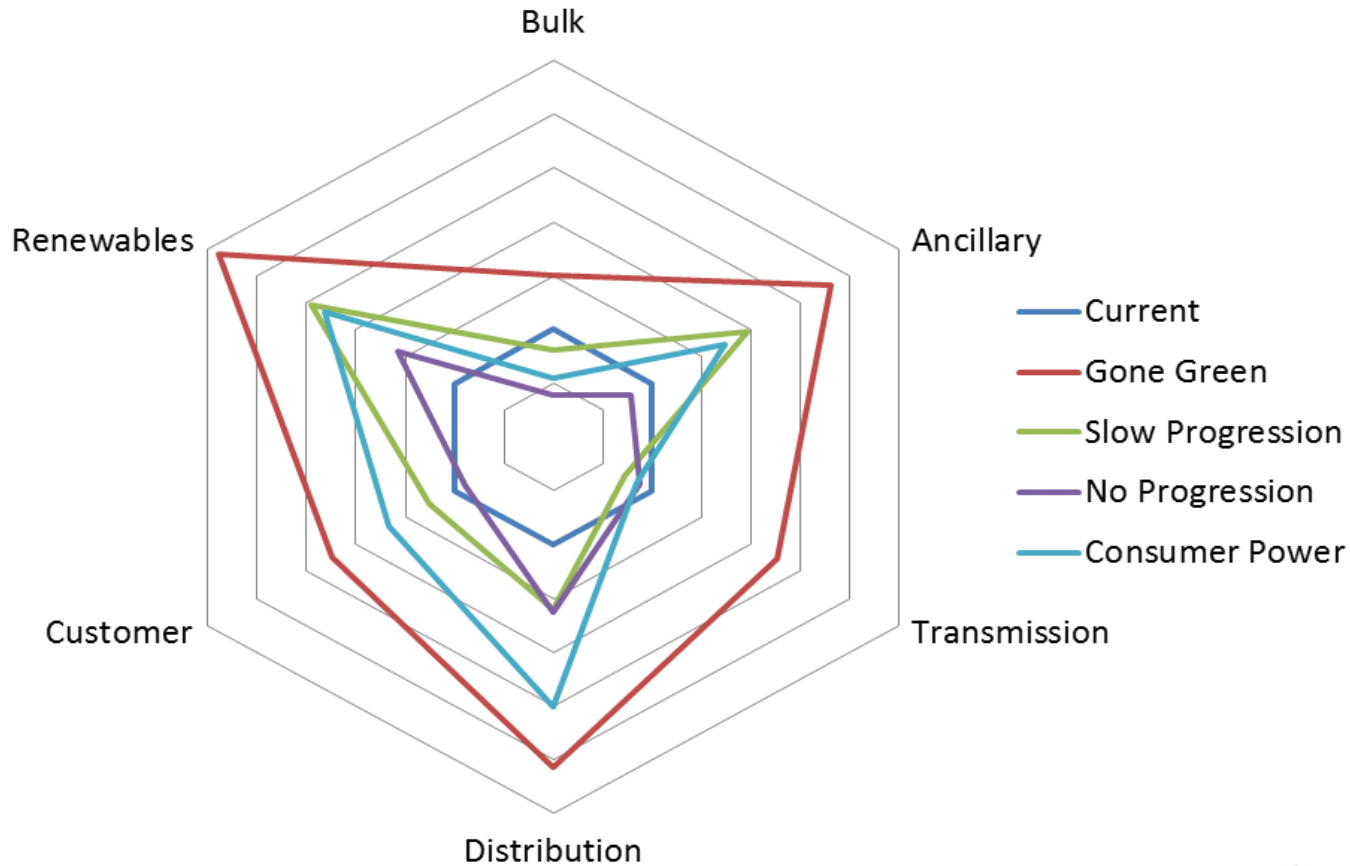


UK

Multi-criteria analysis process



Multi-criteria approach - example result



Assessing the innovation process for energy storage

- Flexible fund project, starting July 2015
- Co-I: Peter Taylor (Leeds); PDRA being recruited

Objective

Provide evidence-based recommendations to support innovation in energy storage

Approach

- Assess what current models of innovation can tell us given its unique characteristics and role, when compared to both supply and demand technologies.
- Examine Li-ion as a case study.
- Analyse recent innovation landscape for energy storage, in the UK, and in comparison to competitor countries (e.g. US, Japan, Korea, Germany).

Make recommendations that allow the UK to exploit its research investment and industrial base in energy storage, for consumer, transport and grid applications.



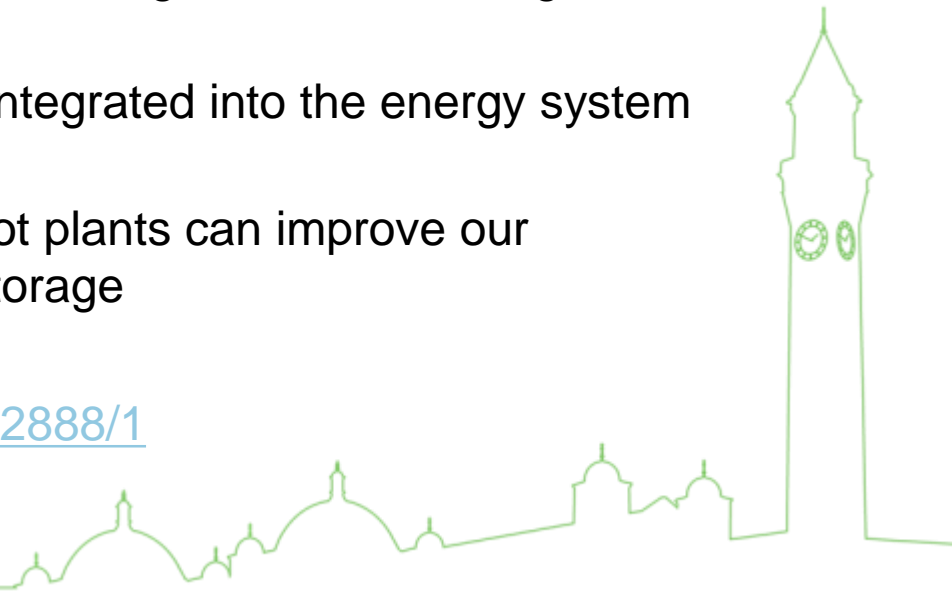
Multi-scale ANalysis for Facilities for Energy Storage (MANiFEST)

Builds on capital investment from 'Eight Great Technologies' call

Project to address key challenges, across length scales, from materials to devices, to systems, specifically:

- How the materials used in energy storage technologies, including batteries and thermal energy
- How processes are modelled in the technologies, and validating the models with experiments
- How energy storage devices can be integrated into the energy system most effectively
- How data from operational runs of pilot plants can improve our understanding of the role of energy storage

<http://gtr.rcuk.ac.uk/projects?ref=EP/N032888/1>



Manifest

Birmingham lead (PI: Radcliffe) with multiple UK universities; £5m/4 years, starting September 2016

Co-Directors:

- Brandon (Imperial),
- Ding (Birmingham),
- Eames (Loughborough),
- Forsyth (Manchester),
- Stone (Sheffield)

