EnergyREV

HERIOT WATT UNIVERSITY

What can past examples teach us about the rollout and scale-up of smart energy systems?

Dr Callum Rae
c.rae@hw.ac.uk

Co-authors:
Prof. M Mercedes Maroto-Valer
Dr Sandy Kerr

INDUSTRIAL STRATEGY

UK Research and Innovation

About EnergyREV

A consortium of over 50 researchers from 22 different UK universities, formed to help drive research and innovation in Smart Local Energy Systems.

Infrastructure

Adapting advances in AI, data analytics and controls to enhance smart local energy systems.

Business

Understanding current local energy business sector to accelerate innovation.

Institutions

Assessing policy, regulation and markets for local energy sector change.

Users

Reveal how user preferences and practices evolve over time in relation to local energy systems.

Developing a whole systems understanding

Capture and synthesise knowledge from all aspects of the value chain, utilising learnings.

Supporting Scale-up

Understanding potential constraints that can prevent scale up of local energy systems and solutions to overcome them.

What are the technical barriers to the upscaling of SLES?

Our 3 phase approach:

Review

- Identify technical barriers to scale-up, as reported in literature.
- Findings used to inform subsequent stakeholder engagement (case studies).
- "Upscaling Smart Local Energy Systems: a review of key barriers" *Renewable and Sustainable Energy Reviews (2020)*

Investigate

- Conduct 4 case studies of previous/existing UK-based SLES.
- Provide a more 'boots on the ground' understanding of barriers faced.
- Verify case study findings with wider local energy project stakeholder group.

Report

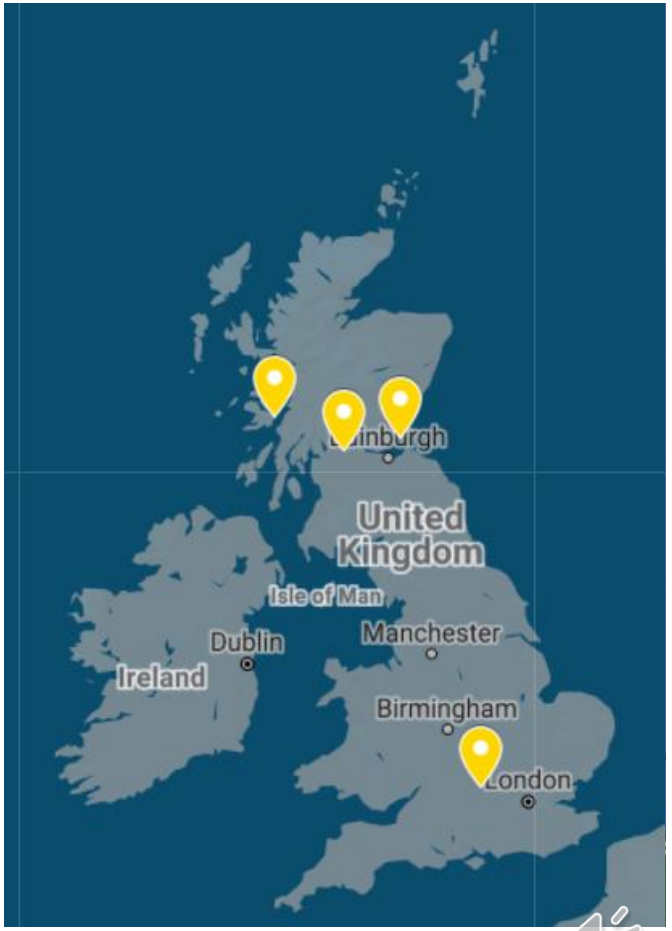
- Provide insight into the barriers faced by SLES, their contributing factors and resulting impacts on projects and upscaling.
- Provide recommendations for ways of mitigating or removing barriers in future.

Our case studies

Case studies were selected following an extensive review of UK local energy projects, with the aim of providing a representative view of SLES, whilst also maximising relevance to future projects.

Each case study combines a detailed desktop review with semi-structured interviews with selected key stakeholders, such as:

- *Project lead/management*
- *Industry partners (various)*
- *Local authority*
- *Intermediary support organisation*
- *Local representative / liaison*
- *Volunteer group*
- *Research (academic)*
- *Hardware providers*
- *Local stakeholder organisation*



Selected case studies

Fintry

Cluster of microgeneration and smart-grid projects in a small, rural village in central Scotland.

Project ERIC

Urban, neighbourhood-scale domestic PV-battery storage project in Rosehill, Oxford.

Mull ACCESS

Project demonstrating the use of smart control of domestic storage heaters to avoid local grid export constraint. On the Isle of Mull, Western Scotland.

Levenmouth

Cluster of Hydrogen-related projects supplying heat and power to an industrial estate and a hydrogen fuelled fleet of vehicles. Located in Fife, Scotland.

There is no common definition of upscaling in SLES

Project ERIC evidenced what could be seen as unconventional or indirect forms of upscaling:

- Batt-PV combination used again locally (albeit in different format).
- Project partners later worked together, securing funding for a feasibility study.
- Raised profile of – and provided momentum for – local sustainability group and other energy projects and initiatives, including drive to become a 'zero carbon estate'.

These outcomes are not formally captured by the project reporting process. But they all contributed to further related development, and should therefore be acknowledged as contributors to upscaling.

A broader, more nuanced understanding of upscaling would enable us to better understand what works and what doesn't, and could more usefully inform future policy/strategy.

Understanding technical barriers to upscaling

The following main findings emerged during the case studies:

1. Technical barriers are not distinct from non-technical ones.
2. Project barriers don't necessarily cause upscaling barriers.
3. The main technical challenge facing SLES is multi-vector integration and interoperability

Technical *vs* non-technical & project *vs* upscaling barriers

A case study example:

- **Communication** — *Failure to convey project aims, processes and intended outcomes to consumers*
- **Insufficient local recruitment** — *Attributed to lack of understanding and engagement*
- **INSUFFICIENT DENSITY OF IN-HOME METERING & COMMUNICATION HARDWARE, RESULTING IN VOIDS IN COVERAGE**
- **Programme** — *Resources dedicated to addressing issue*
- **Outputs** — *Inability to deliver intended outcomes during 2nd phase of funding*
- **Funding** — *Failure to secure final phase of project funding*

Multi-vector integration poses serious technical challenges

The inclusion of multiple vectors in increasingly complex and integrated systems represents a step change in SLES design and operation.

- This has implications on cost, time and skills requirements.
- The majority of case studies had aspirations to incorporate multiple vectors, most of which were unsuccessful. Until multi-vector integration can be demonstrated successfully, it is unrealistic to expect it to be scaled.
- Case study results also show that projects with the highest levels of pre-deployment simulation and testing experience the fewest unforeseen technical challenges.

Knowledge sharing & dissemination

Our research has found the quantity and quality of project reporting and knowledge sharing to be…. mixed

This has a series of negative effects on upscaling:

- Project learnings are not captured / made widely available.
- Project barriers become upscaling barriers.
- Responsibility for knowledge sharing and dissemination falls to intermediary / support organisations.
- Our ability to learn from our experiences is constrained.

A detailed, 'warts-and-all' approach to project reporting needs to be adopted, by funding bodies and project teams in particular.

How does upscaling occur?

Key enablers:

- Transferable knowledge, skills and experience.
- Committed (preferably influential) project partners.
- Identifiably scalable project elements or concepts.
- Knowledge of the successes (and limitations) of related previous / existing projects.
- Local momentum:
  - Established, trusted skills networks
  - Knowledge and awareness of funding opportunities
  - Successful track record lends credibility to subsequent projects/proposals
- Alignment of proposal with current policy drivers and funding priorities.

How is upscaling fostered?

	Ex-ante	*Ex-post*
Description	Scalability by design, where the demonstration / achievement of upscaling (usually through growth or replication) is a key performance metric, and prioritised from the outset.	A more organic form of scalability, where project focus is the delivery of successful local solutions & outcomes. Project success then serves as the basis for project elements to be grown or replicated elsewhere.
Advantages	• More quantifiable and controllable through the prioritisation of specific project elements to be scaled. • Minimises the risk of non-scalable projects. • Allows clear path for areas of policy/ industry/ academic… focus to be translated into real world.	• Prioritises local success, reducing the risk of project failure. • Increases rate of innovation by allowing successful elements and concepts to be identified and scaled rapidly and unsuccessful ones to be identified and abandoned, thereby reducing the risk of repeat funding.
Disadvantages	• Risks projects becoming too generic by neglecting site and project specific conditions, and neglecting the importance of local outcomes as a key success factor. • Can result in ineffective concepts receiving repeat funding.	• Lack of control (of policy makers, funders) over which project elements demonstrate scalability, and therefore higher risk. • Removing scalability as a key outcome also risks none being demonstrated. • Reliant on effective knowledge sharing and dissemination practices.
Examples	Most large scale pilot/demonstration projects.	Observable in locations with an established community energy track record e.g. Orkney, Fintry, Rosehill, Levenmouth etc.

(Draft) Recommendations

1. We need a broader, more holistic understanding of what upscaling is and how it is achieved.
2. Improved (standardised?) knowledge sharing and dissemination practices.
3. Provide the time and resource required by the increased complexity of multi-vector systems e.g. testing and simulation, project management / communication, stakeholder engagement...
4. Review of how upscaling of SLES is promoted i.e. *ex-ante* vs *ex-post*

EnergyREV

c.rae@hw.ac.uk

HERIOT WATT UNIVERSITY

www.energyrev.org.uk

@EnergyREV_UK

info@energyrev.org.uk

INDUSTRIAL STRATEGY

UK Research and Innovation