Practical learnings from deployed Smart Local Energy Systems:

technical barriers to scale-up

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EnergyREV

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- A broad ranging consortium consisting of over 60 researchers from 22 different UK institutions.
- Formed to help drive forward research and innovation in Smart Local Energy Systems (SLES).
- Working to deliver novel research in a range of themes:

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.

Research overview

What are the technical barriers to the upscaling of SLES?

Literature Review

- Identify technical barriers to scale-up, as reported in literature.
- Findings to inform subsequent stakeholder engagement (case studies).

Case Studies

- 6 UK-based existing Smart Local Energy Systems selected.
- Semi-structured interviews with selected stakeholders.
- Provide a more ‘boots on the ground’ understanding of barriers faced.

Report Findings

- Aim: to provide insight into the causes, severity and impact of technical barriers to upscaling, as well as how they can be mitigated or avoided.
- Insights to be shared with stakeholder network, industry and policy makers.
- To be integrated with other EnergyREV outputs and findings.

Literature review

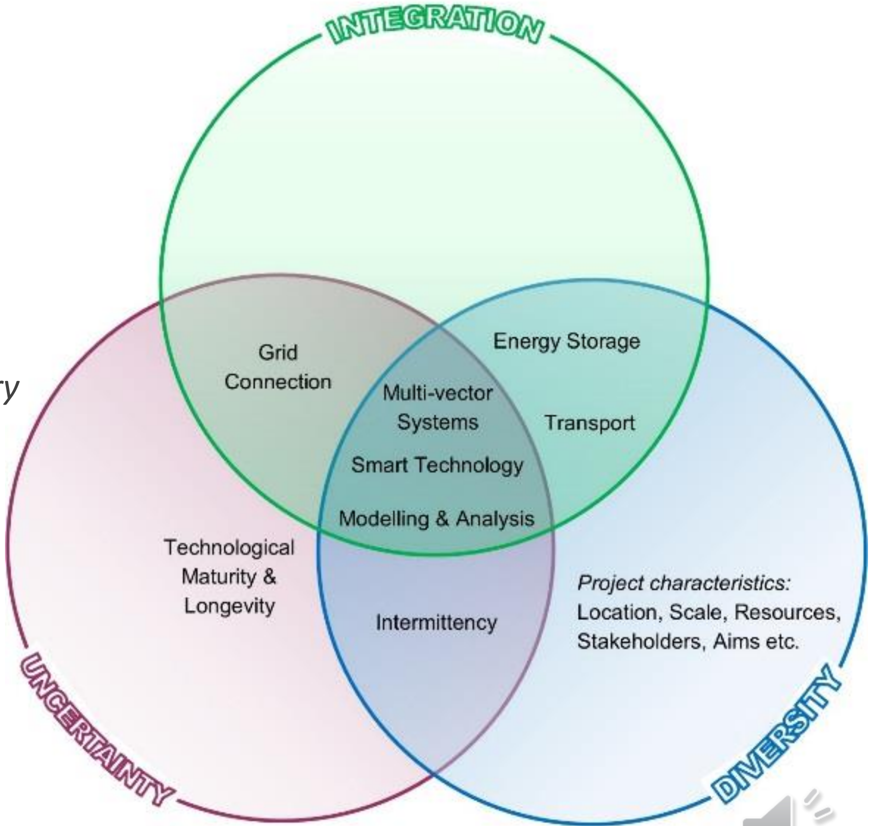
Aim: to identify and synthesise the technical barriers reported in literature.

- *132 academic and grey literature articles reviewed.*
- *Tends to be highly specialist in nature, with few high-level overviews*

Findings:

- *Main technical barriers are highly context-specific, and vary with size, scope, location, available resources, policy environment etc.*
- *Nevertheless, 8 main barrier areas emerged.*
- *These fall within 3 fundamental challenges of SLES design and operation: integration, diversity and uncertainty.*

Rae, C., Kerr, S., & Maroto-Valer, M. M. (2020).
"Upscaling smart local energy systems: A review of technical barriers"
Renewable and Sustainable Energy Reviews, *131*, 110020.



Rae, Kerr, Maroto-Valer (2020)

Case study selection and methodology

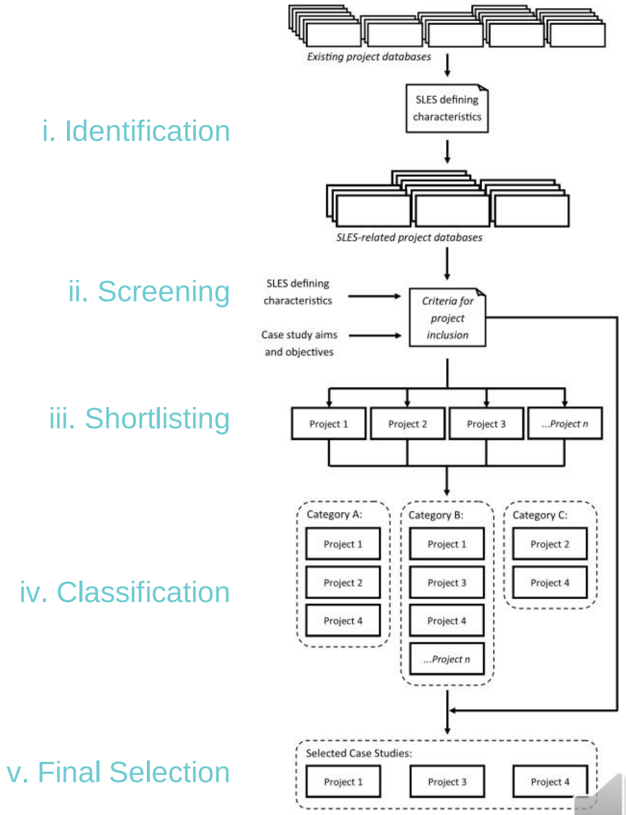
Aim: to select existing UK-based SLES which can best inform the scale-up of future SLES

Case study screening and selection objectives:

- *i. Identify existing UK examples using existing databases*
- *ii. Apply relevant screening criteria based on SLES characteristics and study aims*
- *iii. Create a shortlist of projects*
- *iv. Classify shortlisted projects based on key technical characteristics*
- *v. Arrive at a selection of projects which is as representative as possible of UK SLES*

Case study approach:

- *Further desktop analysis and review available data*
- *Identify key local-/project-specific stakeholders and organisations*
- *Conduct semi-structured online interviews*
- *Utilise snowball referral to build participant numbers*



An introduction to Fintry

- Rural location, approx. 30km North of Glasgow, Scotland.
- Approx. 700 population (300 households).

Fintry SLES: Key Projects

2007

Wind turbine ownership

Villagers take part in a pioneering agreement with the developers of a nearby wind farm, resulting in community ownership of a turbine. Fintry Development Trust is formed as a result.

2007-2010

Home insulation & microgeneration

Revenue from the wind turbine is used to fund a series of home insulation and micro-generation grants for villagers.

2015

District Heating Scheme

A biomass-fired district heating scheme is installed at a nearby holiday park, supplying heat to 26 chalet homes.

2014-2016

Smart Fintry

2 year project funded by Local Energy Scotland. Balancing local domestic consumption against local green generation.

Note: other projects include EV car club, Sports Club biomass installation, community orchard and others

Key Technical Challenge: Metering & Communications

Communication — *Failure to convey project aims, processes and intended outcomes to consumers*

→ Insufficient local recruitment — *Attributed to lack of understanding and engagement*

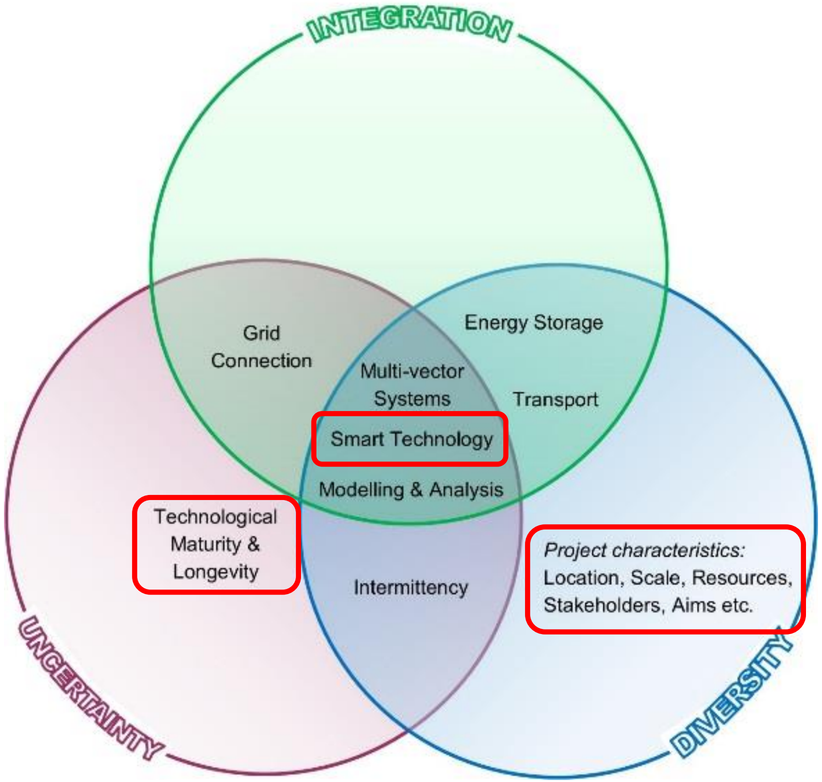
→ **INSUFFICIENT DENSITY OF IN-HOME METERING & COMMUNICATION HARDWARE, RESULTING IN VOIDS IN COVERAGE**

→ Programme — *Resources dedicated to addressing issues*

→ Outputs — *Inability to deliver intended outcomes during 2nd phase*

→ Funding — *Failure to secure 3rd phase of project funding*

Key Technical Challenge: Metering & Communications



Rae, Kerr, Maroto-Valer (2020)

Technical issue with non-technical origins and had significant impact on project success

- The issue was foreseen and avoidable, but had significant and wide-ranging negative impact, including on potential upscaling.
- Even though the issue was ultimately resolved, doing so diverted project resources.
- Project team exhibited differing levels of understanding and views on the cause and severity of the issue.
- **This reinforces the importance of not separating the technical from the non-technical**.

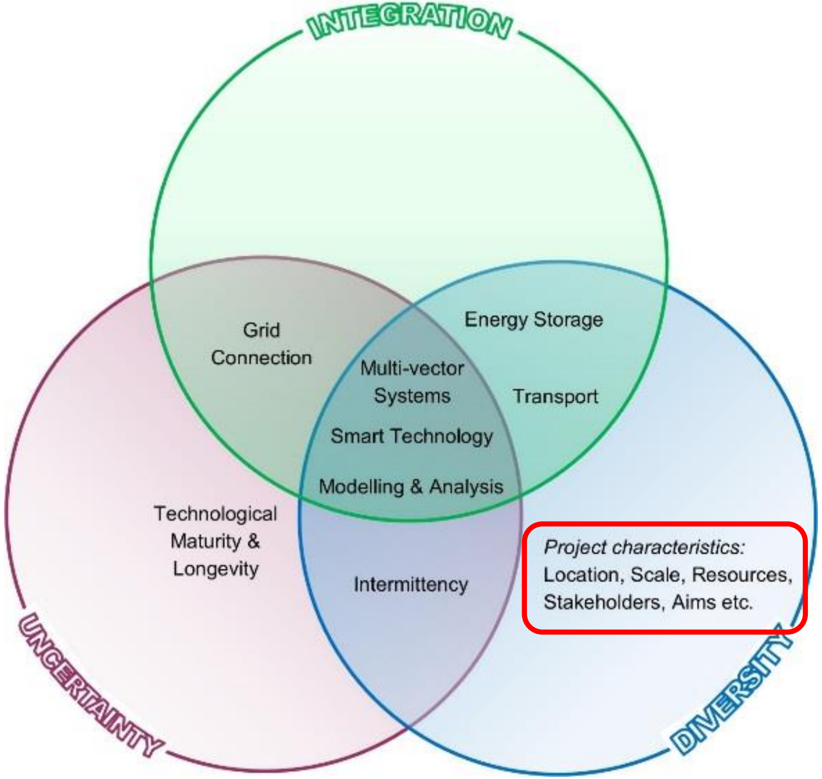
Replicable vs Local

“…I ran into a lot of resistance with the rest of the design team because I wouldn't let them do sort of local things. *Because* the whole idea was to keep it as generalised as possible….”

vs

“I was just really keen on making the model work, *and us being able to trade electricity locally and in real time, and for us to connect that with heating and transport so that we could decarbonise the whole community.”*

Replicable vs Local



Rae, Kerr, Maroto-Valer (2020)

Placing emphasis on high level replicability can risk compromising the ability to deliver bespoke/innovative projects successfully.

- Replicability (upscaling) is rightly prioritised as a funding condition, but can have the opposite effect if it detracts from ability to deliver a workable – and often bespoke/innovative - local solution.
- Is replicability best achieved by making it a requirement of demonstration projects, or by adapting bespoke local solutions?
- **Project failure is a major barrier to upscaling, with potentially viable solutions not being taken forward.**
- This will be examined further in upcoming case studies.

Loss of funding… and legacy

"…you get a really good project that gets up and running and then funding stops, so the project stops and everything, all the people, the expertise disperses."

"…there could have been a lot more legacy, and especially on the ground legacy, if it was able to continue and develop."

"…when we couldn't get the second phase funding, it really squashed the whole thing. It's sad really, because we were on the brink of doing something really, really significant."

Preliminary findings: summary

- Technical barriers can have a significant impact on the ultimate success of SLES projects.
- Technical barriers cannot be separated from non-technical factors.
  - *Non-technical factors can have technical effects, and vice-versa*
- Technical barriers are highly context specific.
  - *This creates barriers to upscaling and makes knowledge sharing difficult*
- Knowledge is being lost from unsuccessful or partially successful projects.
  - *This can contribute towards repeat funding of similar concepts/projects*
  - *Project failure is the greatest barrier to upscaling*
- Case study demonstrates the different ways in which upscaling can be promoted.
  - *Included as a funder requirement or based on adapting successful local projects?*

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Thank you

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