Assessing the Social values of using Smart Local Energy Systems (SLES)

EnergyREV Research Members:

Christina Francis, Research Associate, University of Edinburgh
Camilla Thomson, Chancellor's Fellow in Energy, University of Edinburgh

Overview

1. Introduction – Dr Camilla Thomson

    - EnergyREV Consortium
    - Multi-criteria assessment toolkit

2. Social Values - People and Living – Dr Christina Francis

Introduction

- Effective and sustainable transition of electricity, heat and transport.
- One possible solution: Smart Local Energy Systems (SLESs)
  - Prospering From the Energy Revolution challenge (PFER)

- Socio-technical, complex systems
- Need to understand:
  - What works
  - For whom
  - How

The EnergyREV consortium

Consortium of :

- *32 co-investigators*
- *22 Universities*

Exploring challenges around smart local energy systems from an interdisciplinary and whole-systems viewpoint.

Institutions
Policy, regulation, markets and governance issues around local energy systems

Business and finance
Local energy businesses practices and industry engagement

Data and AI
Expertise across wide ranging cyber-physical issues

End users and consumers
Social science understanding of end user research and engagement

Multi-vector "whole" systems
Electricity, heat and transport, and system integration

Energy and environment
Interactions between energy and environmental systems

Net Zero Target

The UK government introduced a statutory instrument in Parliament, to amend the 2008 Climate Change Act, committing to a net-zero 2050 emissions target


Low carbon electricity


Building and heating


Low carbon mobility


Carbon capture & storage


Biodegradable waste

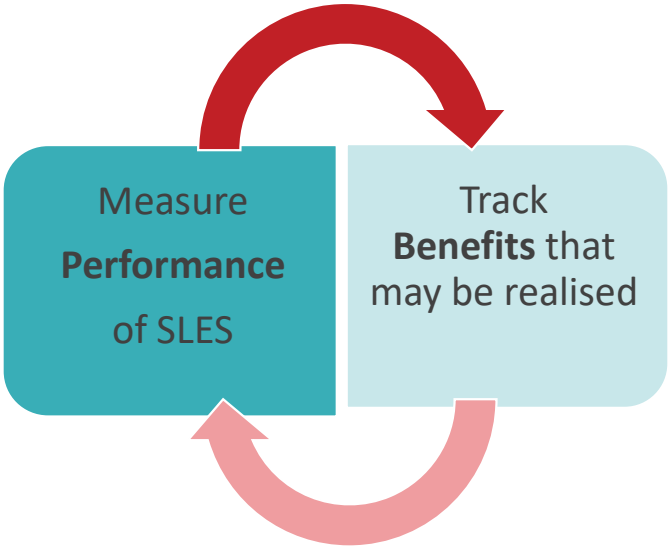

Fluorinated gasses


Afforestation


Emissions on farms

Source: "Net Zero: The UK's contribution to stopping global warming" Committee on Climate Change May 2019.

Multi-criteria assessment toolkit



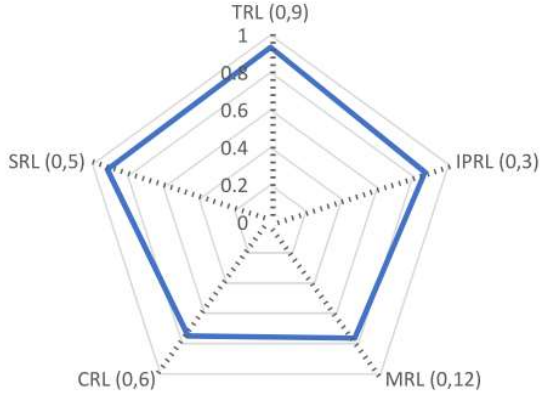
Develop a simplified, technology agnostic and multi-criteria assessment (MCA) framework to:

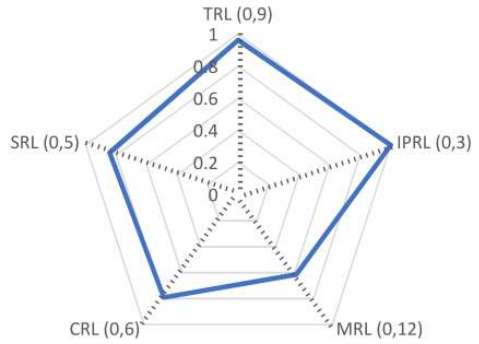
- Examine Smart Local Energy Systems (SLES) projects using a broad set of criteria
- Track **two** strands:
  - System performance
  - Benefits realisation

From this framework a standardised toolkit will be developed, and applied.

Tool Relevance

- An ***independent standardised assessment*** tool will help developers and SLES implementers ***benchmark*** progress against their own aspirations.
- Provide evidence to ***build investors' confidence***
- ***Route map*** and ***checklist*** for ***planning*** to support developers and implementers ***for SLES replication***
- Policy makers will be able to ***identify areas where policy change is needed*** to enable progress.

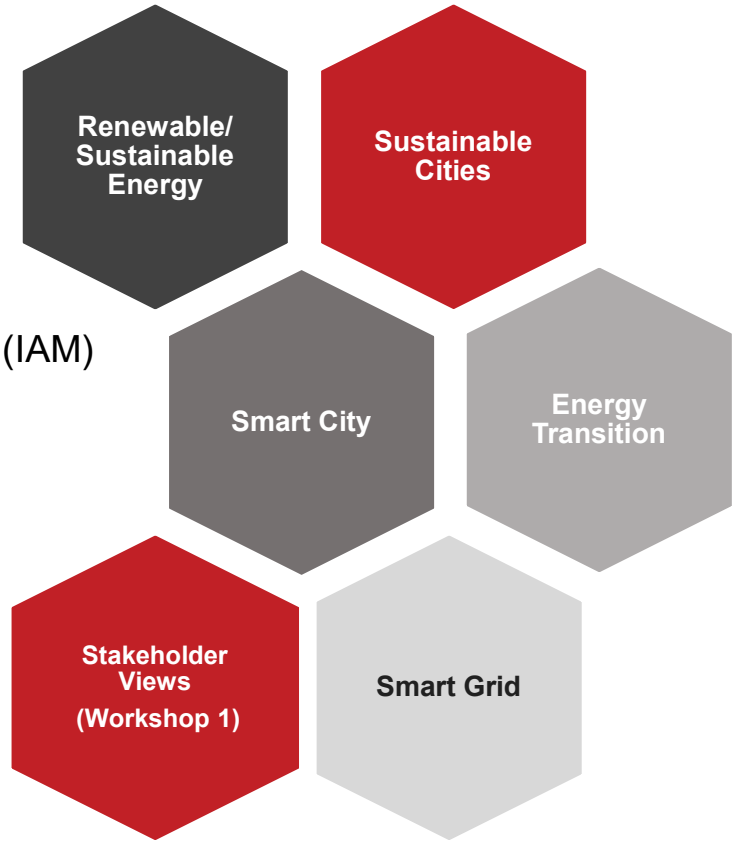




Existing Assessment Tools & Applications

Planning and forecasting, e.g:
- Techno-economic assessments
- Integrated Assessment Modelling (IAM)

Other, e.g:
- Smart city model



Maturity or readiness level, e.g:
- Technology readiness level (TRL)
- Innovation readiness

Sustainability transition, e.g:
- Multi-level perspective (MLP)

Connecting Low Carbon and Health

- Putting Health at the Centre
  - Little reference on how businesses can use smart low carbon energy and big data to aid planetary health informatics or other similar impacts which may lead to globally improved health and social wellbeing alongside reducing the environmental and pollution footprint of health care services such as the NHS.
- Road to Clean Air
  - Transition to electric vehicles - Available: https://www.lung.org/clean-air/electric-vehicle-report.
- Warm Homes Saves Lives
  - National Energy Action (NEA, 'Connecting Homes for Health – NEA') source: https://www.nea.org.uk/researchpolicy/connecting-homes-for-health/ (accessed May 03, 2021).
- Clean Indoor Cooking
  - May reduce pollution and associated respiratory diseases.

Low Carbon
Built Environment
Amgylchedd Adeiledig
Carbon Isel

The benefits and challenges of whole house energy systems retrofits

Dr Joanne Patterson, Professor,
Welsh School of Architecture, Cardiff University

- Over the past 12 years the Welsh School of Architecture at Cardiff University have applied a ‘whole building energy systems approach’ to new build and existing homes and buildings.
- This combines reduced energy demand, renewable energy supply and energy storage to attempt to reach energy positive buildings - to generate more energy over an annual period than is used by the building

Whole house energy systems retrofit – case study 1

End Terrace 1900s home

Very high energy bills with poor internal conditions – high humidity and low temperatures.

Retrofit – External Wall insulation, Internal Wall Insulation, LED lighting, loft insulation, PV panels on East and West roofs, battery storage, ventilation system and Transpired Solar Collector.

Whole house energy systems retrofit – case study 2 - benefits

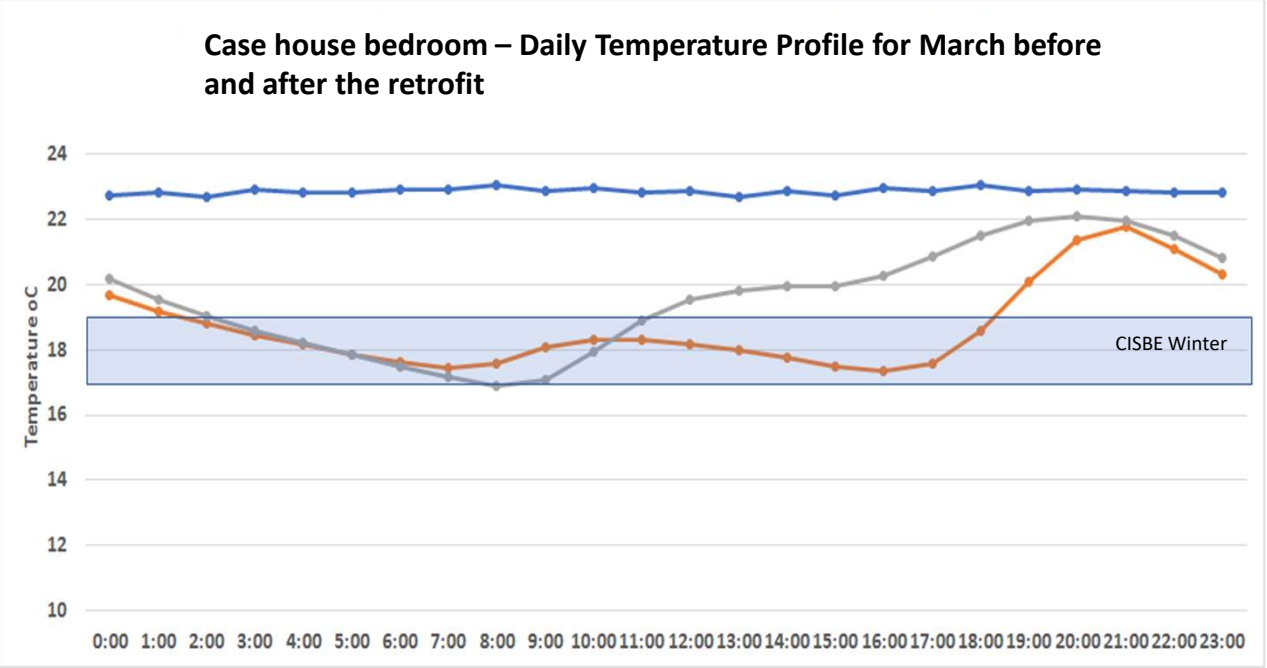
6 bungalow built in 1970s

Very cold internal temperatures and off grid. Very high energy bills.

Retrofit – External Wall insulation, loft insulation, LED lights, ground source heat pump, solar PV on 2 roof aspects, battery storage, ventilation.

EPC ratings have improved from G to A

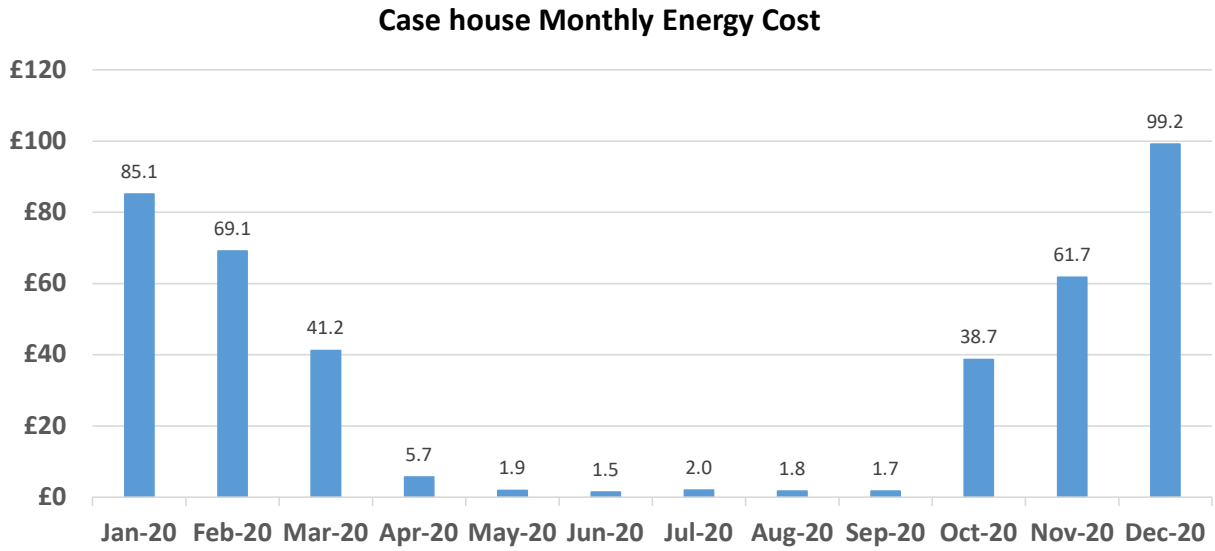
Temperatures have improved and are consistently comfortable throughout the year.



Whole house energy systems retrofit – case study 2

Energy costs have significantly reduced. Bills are <£2 for 5 months of the year.

Annual energy bill is around £410 compared to the pre retrofit cost of £1,500



Challenges and Benefits

Benefits

In ALL projects **energy bills have been significantly reduced** bringing **occupants out of fuel poverty.**

In ALL properties internal environmental conditions have been improved resulting in **healthier conditions**

Carbon **emissions have been reduced.**

The lifetime of the homes have been increased and they all provide a much **more attractive place to live.**

Challenges

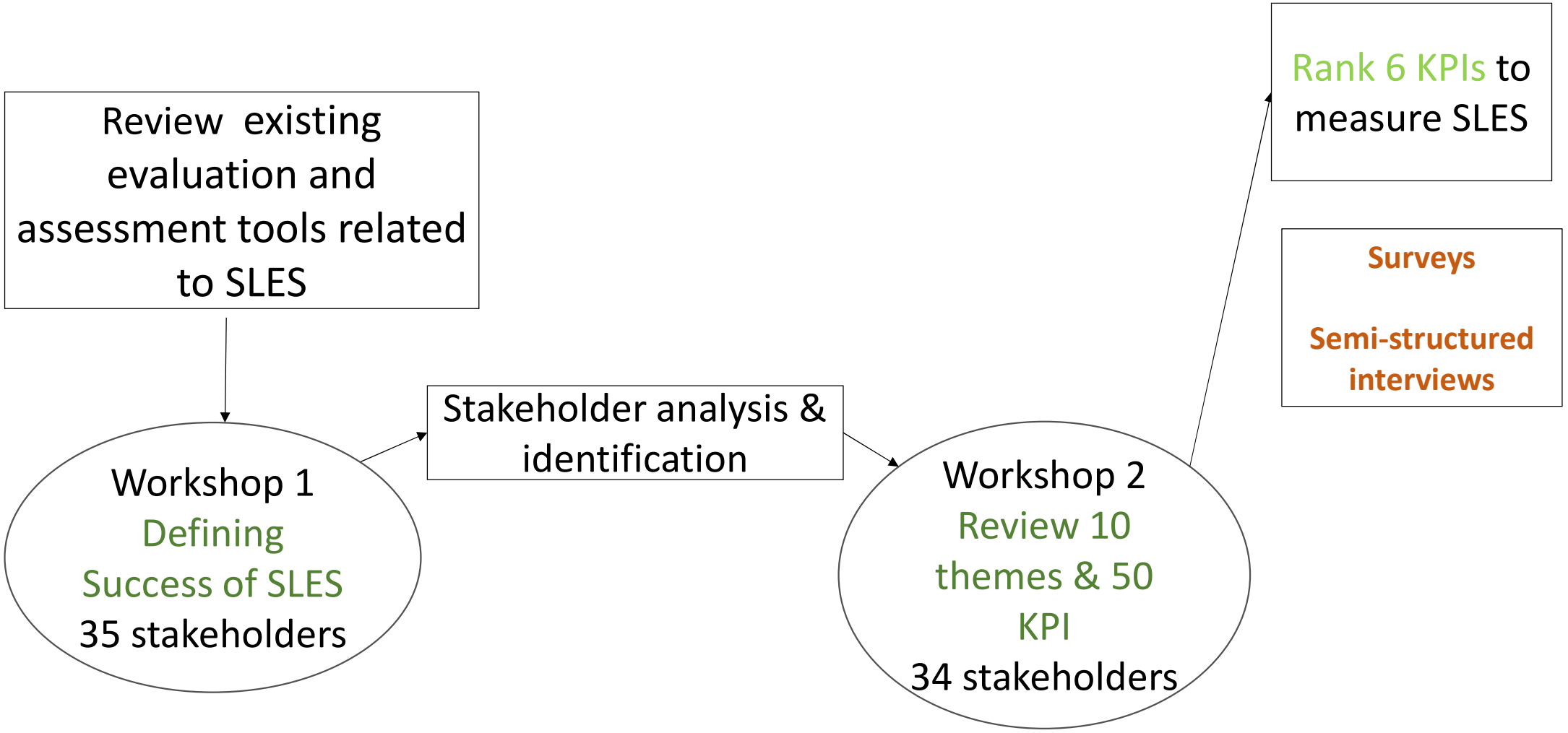
It is expensive to carry out a whole house retrofit but this is necessary if we are going to achieve net zero.

Need to ensure **projects are carefully planned,** designed, implemented and operated effectively.

Collaboration and Communication is critical at all levels.

There is a **skills gap** that has to be filled. Current construction sector has not moved forwards fast enough to enable the quality and level of retrofit required.

Process Overview



SLES themes and benefits aligned with UN SDGs

ww.sustainabledevelopment.un.org

Discrete Choice Experiments Survey Results

The main survey had six attributes, which correspond to the six KPIs:

- **Technical Performance,**
- **Data Management,**
- **Governance,**
- **People and Living,**
- **Business, and Economics, and**
- **Environment.**

Each attribute had **five** levels:

- *Poor,*
- *Fair,*
- *Good,*
- *Very good, and*
- *Excellent.*

with a few exceptions.

People & Living

The impact on end users, communities and social interaction. This may include education, engagement, acceptance, housing conditions, equity and culture.

People

- Education & Gender equality
- ICT Skills
- Engaging/participation
- Acceptance
- User friendliness/control
- Inclusion/ Empowerment
- Consumer protection/choice

Living

- Housing
- Equity
- Culture or behavior
- Livelihood
- Convenience

People & Living Sub-criteria	Trade-off name description	Sub-Criterion Weights (%)	% Participants Selected (n=51)
Fuel Poverty	Fuel poverty in the community served by the SLES	19.4	60.8
Reduction in Carbon	Consumer carbon emissions relative to existing	**16.5**	51.0
Cost of Energy	Cost of energy to consumers	**15.1**	60.8
Thermal Comfort	None	14.2	58.8
Community Engagement	None	12.6	68.6
Access to Services	Access provided to community services such as low-carbon transport or high-speed internet.	11.7	49.0
Job Opportunities	Jobs, training, upskilling and apprenticeship opportunities	12.7	47.1
Missing Elements			
Customer support - viable business model- customer relationships	Understanding that the SLES is a customer facing business. Commercial- Business model - customer focussed commercial business - *Asset roll out- monthly invoicing process, sales…knowledge and experience and measurement.		
Gender/ Inclusive	E.g. Energy user & bill controller are different		

People & Living

The impact on end users, communities and social interaction. This may include education, engagement, acceptance, housing conditions, equity and culture.

- Cost of Energy
- Thermal Comfort
- Access to Services
- Community Engagement
- Reduction in Carbon
- Health & Well-Being
- Gender/ Inclusive
- Fuel Poverty
- Job Opportunities
- Customer Service Support

Institute *for*
Energy Systems

THE UNIVERSITY *of* EDINBURGH
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