EnergyREV Insights & Impact

8th – 9th September 2022

sli.do/rev

Opening Plenary

Professor Stephen McArthur
Associate Principal and Executive Dean of Engineering,
University of Strathclyde
& Principal Investigator, EnergyREV

SLES and the Energy Crisis

Matt Hannon, University of Strathclyde (Chair)

Thomas Morstyn, University of Edinburgh

Rajat Gupta, Oxford Brookes University

Marko Aunedi, Imperial College London

Tim Chappelle, Energy Systems Catapult

Naomi Baker, Energy UK

Thomas Morstyn

University of Edinburgh

Smart Local Energy Systems, Market Design, and the Energy Crisis

Thomas Morstyn
University of Edinburgh
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EnergyREV WP3.2
Chaimaa Essayeh
Cameron Hepburn
Jeffrey Hardy
Jonathan Radcliffe
Iacopo Savelli

EnergyREV

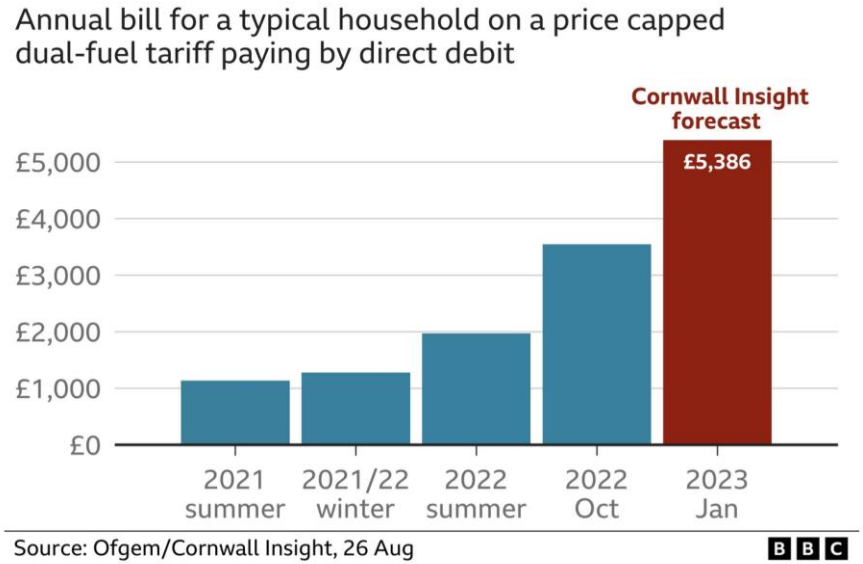
INDUSTRIAL STRATEGY | UK Research and Innovation

THE UNIVERSITY of EDINBURGH
School of Engineering

Energy Crisis

- Renewables supply 40% of demand
- Despite this gas prices dictate energy and balancing costs (up 48% year on year)
- Need action:

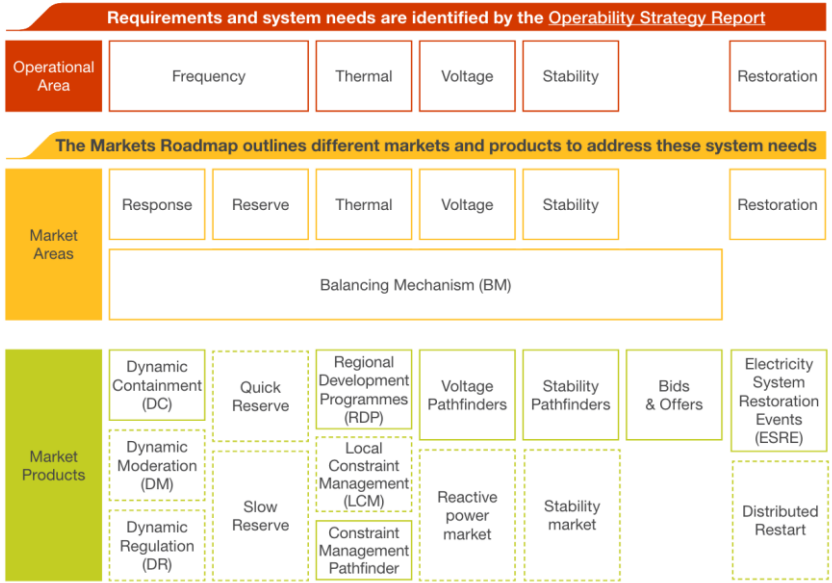
1. Short term: reduce gas usage & support vulnerable customers
2. Medium term: market reforms & technology change



Title slide image: Perth West (www.perthwest.com)

Electricity Market Design

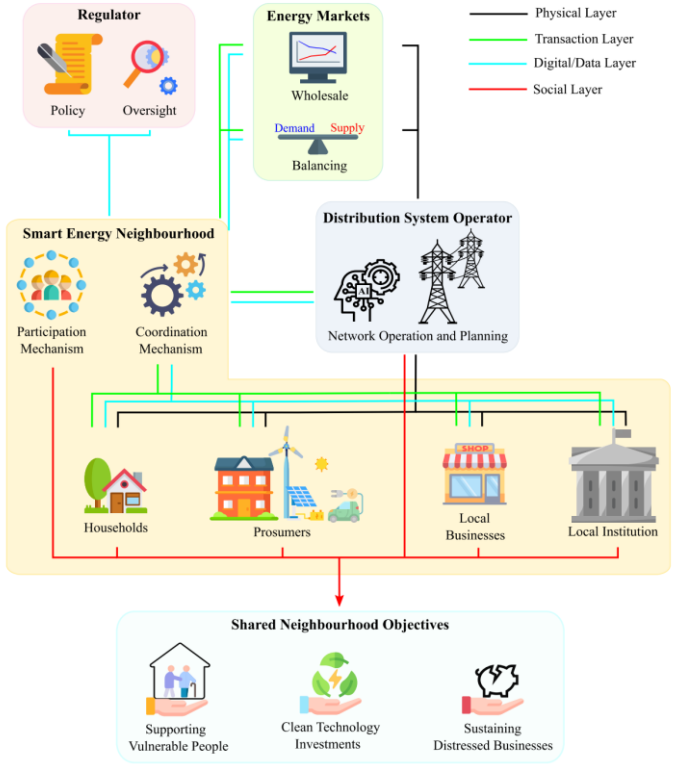
- Need for design due to inherently networked operation
- Design offers trade-offs (or win-wins) between policy objectives
- Energy trilemma is a starting point:
  - Clean, reliable, affordable energy
- Additional objectives for the energy crisis:
  - Minimum provision for wellbeing
  - Energy independence for security
  - Supporting inclusive growth



National Grid ESO, Markets Roadmap, 2022

Market Design for Smart Local Energy Systems

- Coordination mechanisms:
  - Coordinating local generation/flexibility
  - Integrating flexibility into network operation and planning
  - Integrating local generation/flexibility into upstream markets
- Cooperation mechanisms:
  - Support for vulnerable people and distressed businesses
  - Community investment models



Savelli, Morstyn, "Better Together: Harnessing Social Relationships in Smart Energy Communities", *ERSS*, 2022

Regional Case Study: Scottish Borders

Scottish Borders

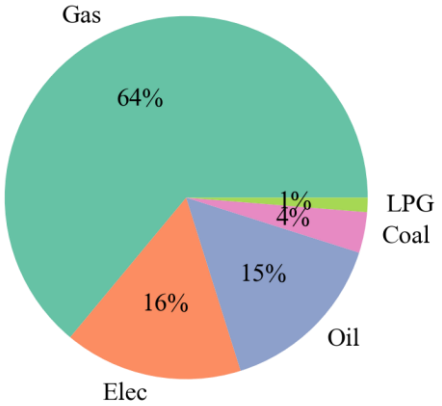
- Population: 115k
- Fuel poverty rate of 29.3%

Heat-pumps replacing non-gas heating:

- Reduce fuel poverty rate to 21.8%
- Flexibility market can reduce network costs associated with this by £4.1m (14%)

Flexibility market for EVs in 2030:

- Reduces network upgrade costs by £26m (13.7%)
- Increased hosting capacity for wind by 72 MW (22.6%) and solar by 84 MW (22%)

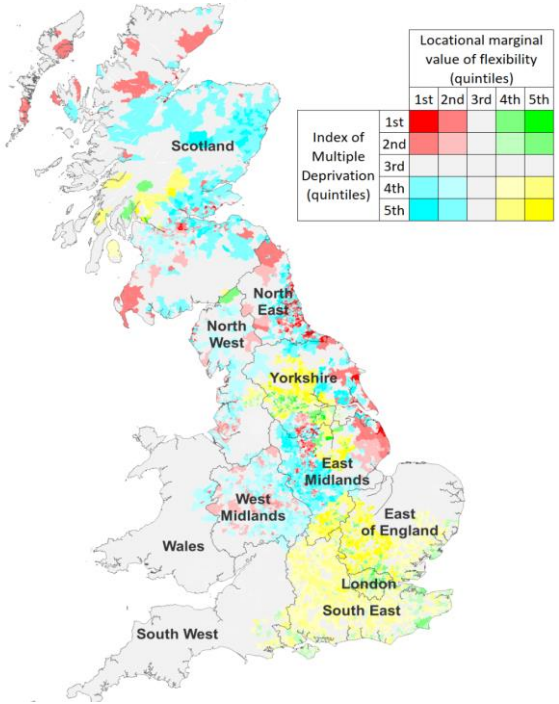


Heating technology mix in the Scottish Borders.

Zhou, Low, Lyden, Essayeh, Sun, Friedrich, Morstyn, "Assessment Of Options For A Smart, Resilient And Low-carbon Multi-vector Energy System In The Scottish Borders", 2022

Value of Energy Flexibility in Deprived Areas

- Looked at the locational value of flexibility across Great Britain
- Green Areas (e.g. London, Yorkshire):
  - High value of flexibility
  - High levels of deprivation
  - Strong potential for SLESs to create value and share benefits
- Red Areas (e.g. East Midlands, North East England):
  - Low value of flexibility
  - High levels of deprivation
  - SLESs may be less valuable, entrenching existing inequality



Relationship between multiple deprivation index and the value of flexibility in GB.

Savelli, Morstyn, 2022

Conclusions

- Winter crisis requires reducing gas usage and support for vulnerable customers
- Medium term opportunity for SLESs to reduce gas dependence, support vulnerable customers and foster clean growth
- Key market reform challenges:
    1. Properly valuing distributed flexibility
    2. Simplifying market integration for local flexibility
    3. Linking local and national operation and planning

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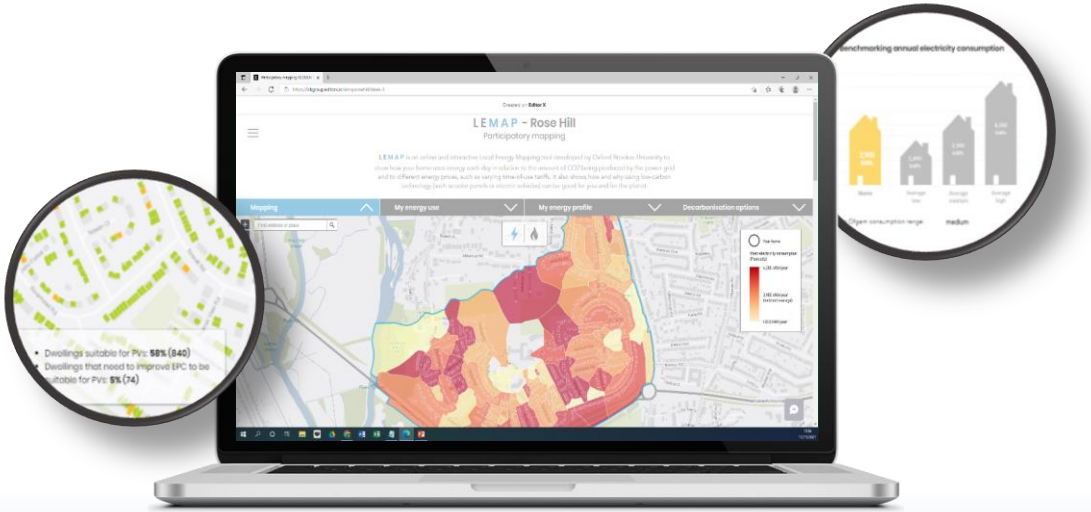
Rajat Gupta

Oxford Brookes University

How should we entice and/or engage users to become adopters of SLES?

EnergyREV Insights and Impact event

8-9 September 2022, London



Professor Rajat Gupta

Oxford Institute for Sustainable Development, Oxford Brookes University

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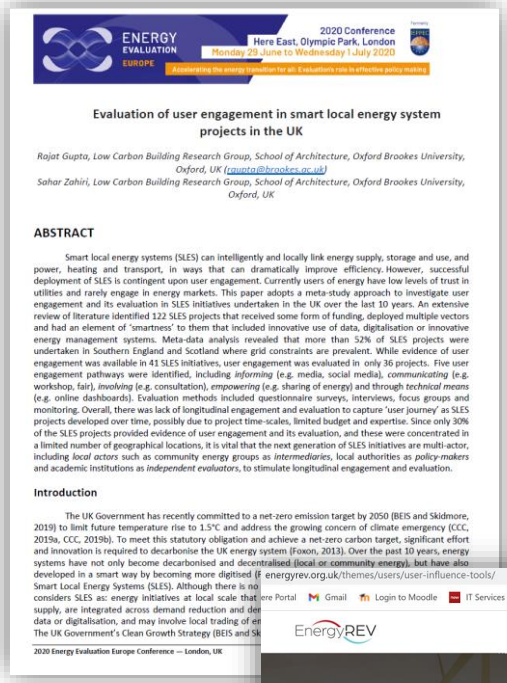
EnergyREV

Context

- User engagement is vital for the acceptance of such initiatives. However only 30% of smart local energy initiatives in the UK provided any evidence of user engagement.
- Geospatial energy mapping tools are emerging as essential tools for planning local energy initiatives given their ability to provide rapid and accurate spatial intelligence.
- Most of the current mapping tools are technical, and have low engagement levels with the target community.
- We need tools that are
  - more *socially interactive*, *inclusive* and *place-based*.
  - Offer visual engagement using mapping.
- Tools with two-way interaction could help to engage communities who can offer local interpretation of data underpinning these tools.



ENERGY EVALUATION EUROPE

2020 Conference
Here East, Olympic Park, London
Monday 29 June to Wednesday 1 July 2020

Evaluation of user engagement in smart local energy system projects in the UK

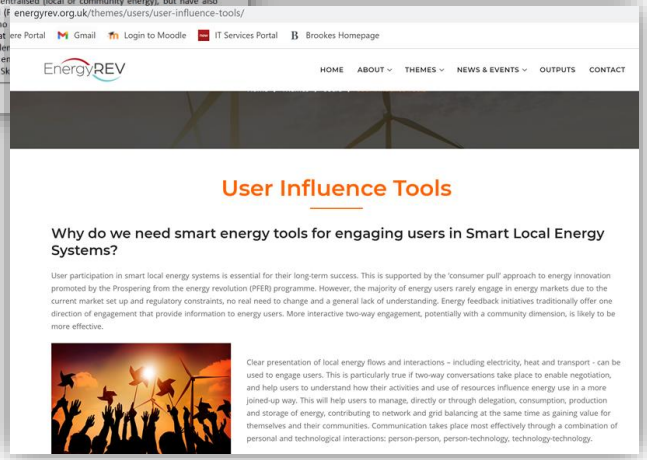
Rajat Gupta, Low Carbon Building Research Group, School of Architecture, Oxford Brookes University, Oxford, UK (rgupta@brookes.ac.uk)
Sahar Zahiri, Low Carbon Building Research Group, School of Architecture, Oxford Brookes University, Oxford, UK

ABSTRACT

Smart local energy systems (SLES) can intelligently and locally link energy supply, storage and use, and power, heating and transport, in ways that can dramatically improve efficiency. However, successful deployment of SLES is contingent upon user engagement. Currently users of energy have low levels of trust in utilities and rarely engage in energy markets. This paper adopts a meta-study approach to investigate user engagement and its evaluation in SLES initiatives undertaken in the UK over the last 10 years. An extensive review of literature identified 122 SLES projects that received some form of funding, deployed multiple vectors and had an element of 'smartness' to them that included innovative use of data, digitalisation or innovative energy management systems. Meta-data analysis revealed that more than 52% of SLES projects were undertaken in Southern England and Scotland where grid constraints are prevalent. While evidence of user engagement was available in 41 SLES initiatives, user engagement was evaluated in only 36 projects. Five user engagement pathways were identified, including *informing* (e.g. media, social media), *communicating* (e.g. workshop, fair), *involving* (e.g. consultation), *empowering* (e.g. sharing of energy) and through *technical means* (e.g. online dashboards). Evaluation methods included questionnaire surveys, interviews, focus groups and monitoring. Overall, there was lack of longitudinal engagement and evaluation to capture 'user journey' as SLES projects developed over time, possibly due to project time-scales, limited budget and expertise. Since only 30% of the SLES projects provided evidence of user engagement and its evaluation, and these were concentrated in a limited number of geographical locations, it is vital that the next generation of SLES initiatives are multi-actor, including *local actors* such as community energy groups as *intermediaries*, local authorities as *policy-makers* and academic institutions as *independent evaluators*, to stimulate longitudinal engagement and evaluation.

Introduction

The UK Government has recently committed to a net-zero emission target by 2050 (BEIS and Skidmore, 2019) to limit future temperature rise to 1.5°C and address the growing concern of climate emergency (CCC, 2019a, CCC, 2019b). To meet this statutory obligation and achieve a net-zero carbon target, significant effort and innovation is required to decarbonise the UK energy system (Foxon, 2013). Over the past 10 years, energy systems have not only become decarbonised and decentralised (local or community energy), but have also developed in a smart way by becoming more digitised (f
Smart Local Energy Systems (SLES). Although there is no
considers SLES as: energy initiatives at local scale that
supply, are integrated across demand reduction and der
data or digitalisation, and may involve local trading of e
The UK Government's Clean Growth Strategy (BEIS and Sk



energyrev.org.uk/themes/users/user-influence-tools/

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User Influence Tools

Why do we need smart energy tools for engaging users in Smart Local Energy Systems?

User participation in smart local energy systems is essential for their long-term success. This is supported by the 'consumer pull' approach to energy innovation promoted by the Prospering from the energy revolution (PFER) programme. However, the majority of energy users rarely engage in energy markets due to the current market set up and regulatory constraints, no real need to change and a general lack of understanding. Energy feedback initiatives traditionally offer one direction of engagement that provide information to energy users. More interactive two-way engagement, potentially with a community dimension, is likely to be more effective.

Clear presentation of local energy flows and interactions – including electricity, heat and transport - can be used to engage users. This is particularly true if two-way conversations take place to enable negotiation, and help users to understand how their activities and use of resources influence energy use in a more joined-up way. This will help users to manage, directly or through delegation, consumption, production and storage of energy, contributing to network and grid balancing at the same time as gaining value for themselves and their communities. Communication takes place most effectively through a combination of personal and technological interactions: person-person, person-technology, technology-technology.

Overview of LEMAP

- LEMAP is an online property-level spatial mapping tool for visualising local area energy flows for planning smart local energy initiatives to meet the net-zero targets.
- Developed as part of EnergyREV Plus project (User influence tools).
- Uses a range of datasets that are:
  - **Publicly** available
  - **Privately** available
  - **Crowd-sourced**
- LEMAP has been applied to local areas in Oxfordshire that are aiming to become smart energy neighbourhoods as part of Project LEO.
- One application is Rose Hill neighbourhood (1500 dwellings, secondary substation) in Oxford, as part of its aspiration to become a zero-carbon estate.

Proceedings of ECEEE 2021 Digital Summer Study

5-133-21 + Rajat Gupta

Spatio-temporal mapping of local areas for engaging communities in the planning of smart local energy initiatives

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Abstract

Community engagement in the planning and delivery of sma
term success. Spatial and temporal visualisation of local ene
more joined-up way. This paper describes the development a
energy mapping (LEMAP) tool for planning smart local energ
temporal tool has been designed for community groups and re
The LEMAP tool brings together public, private and crowd-
building attributes, socio-demographics, fuel poverty and elec
Postcode and dwelling level energy demand profiles are gene
tool has been organised around three technical and three enga
energy flows in relation to socio-economic characteristic
technologies (LCT) such as rooftop solar, heat pumps, EV ch
postcode level for different LCT scenarios. The engagement
residents to visualise their energy demand profiles, compare
changes with LCTs; 'Storymap' for creating blogs on local e
users of LEMAP and project stakeholders.
The LEMAP tool was applied to a socially-deprived but data-r
households. A social enterprise organisation in Oxfordshire w
management at neighbourhood level. Participatory mapping w
to provide local data through online surveys and highlight any
local data interpretation.

ECEEE report – Spatio Temporal Local Area Energy Mapping

June 2021

Reports > ECEEE report – Spatio Temporal Local Area Energy Mapping

Publication date:
14th June 2021

Authors:
Rajat Gupta, Pablo Jimenez-Moreno, Angelines Donastorg Sosa (Oxford Brookes University)

DOWNLOADS

Download the paper

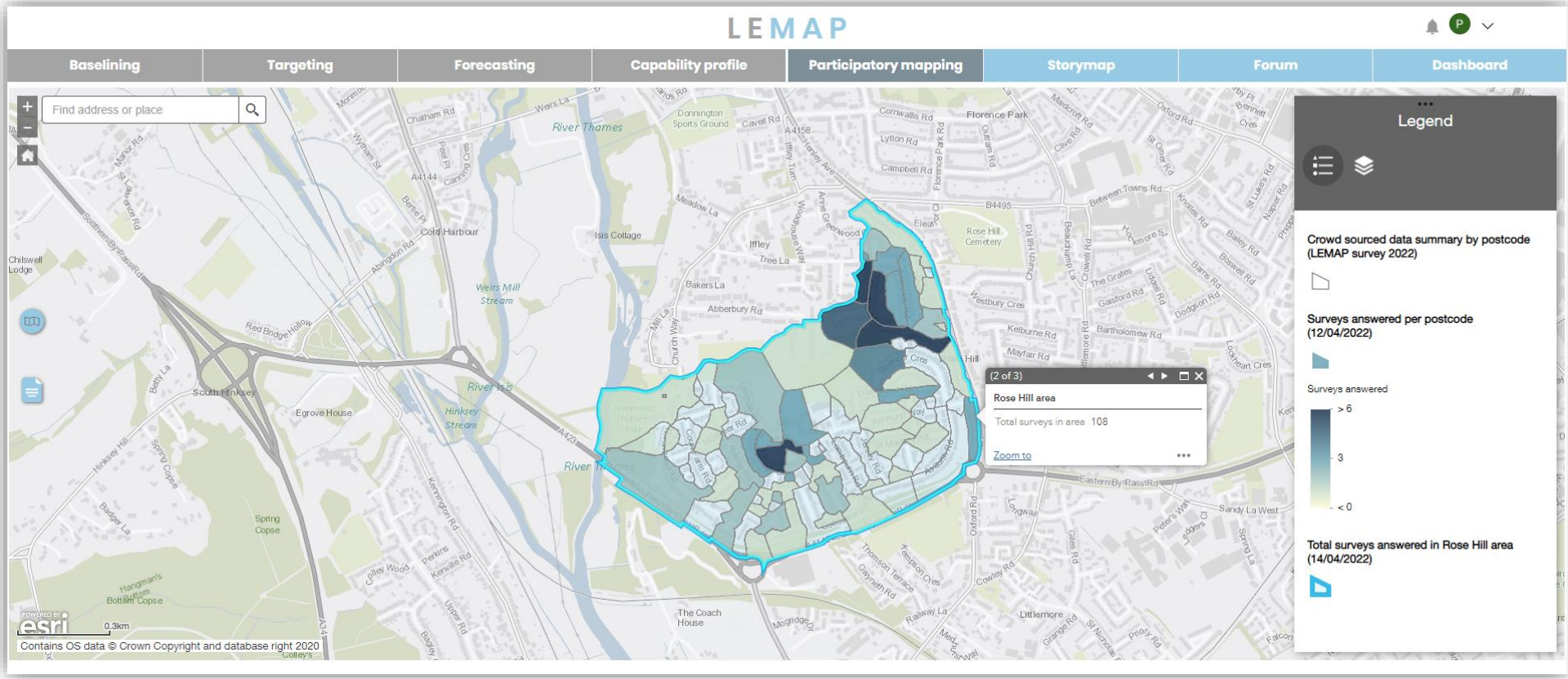
This paper was accepted and presented at the ECEEE conference in June 2021 – one of the leading conferences on energy efficiency.

Abstract

Community engagement in the planning and delivery of smart local energy initiatives is essential for their long- term success. Spatial and temporal visualisation of local energy flows can be used to engage communities in a more joined-up way. This paper describes the development and trial of an online and interactive smart local area energy mapping (LEMAP) tool for planning smart local energy neighbourhoods in Oxfordshire (UK). The spatial- temporal tool has been designed for community groups and residents.

The LEMAP tool brings together public, private and crowd-sourced data on energy demand, energy resources, building attributes, socio-demographics, fuel poverty and electricity networks within the ESRI ArcGIS platform. Postcode and dwelling level energy demand profiles are generated using the CREST energy demand model. The tool has been organised around three technical and three engagement elements that include 'baselining' local area energy flows in relation to socio-economic characteristics; 'targeting' suitable properties for low carbon technologies (LCT) such as rooftop solar, heat pumps, EV chargers; and 'forecasting' energy demand profiles at postcode level for different LCT scenarios. The engagement elements include: 'Participatory mapping' to allow residents to visualise their energy demand profiles, compare against the neighbourhood and see how the profile changes with LCTs; 'Storymap' for creating blogs on local energy flows; and 'Forum' to enable chats amongst users of LEMAP and project stakeholders.

LEMAP has been organised around four **technical** and four **engagement** elements:



LEMAP co-production journey

Version 1

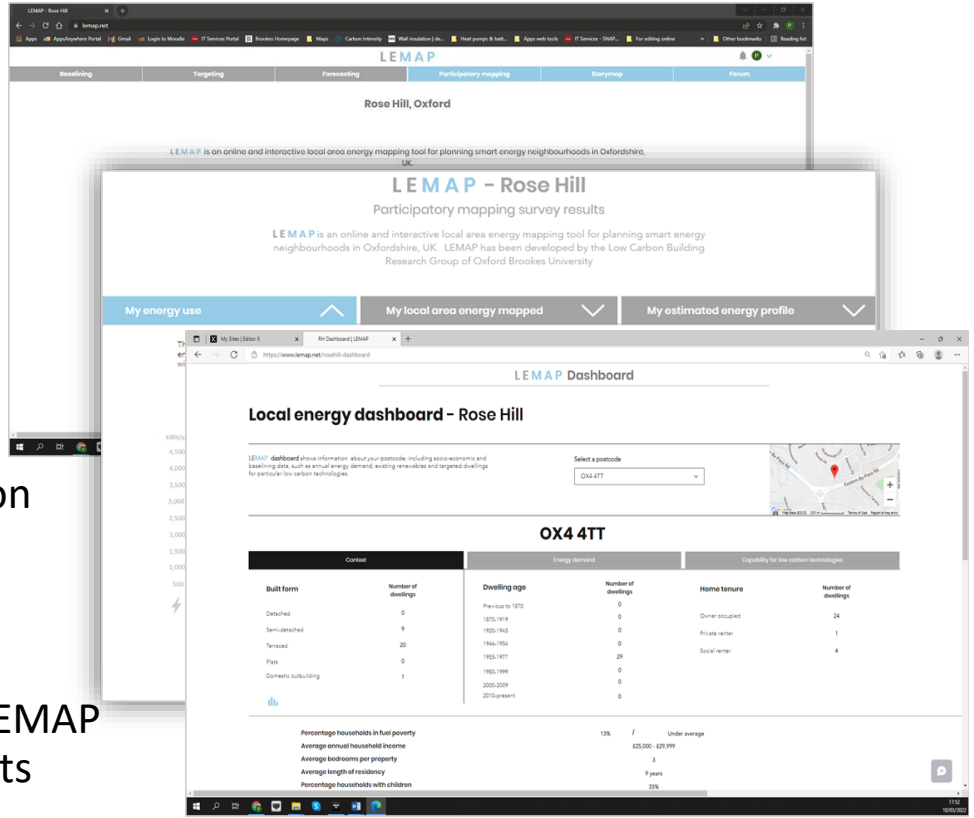
- January 2021
- User testing of technical elements

Version 2

- Autumn 2021
- Refinements based on user feedback
- Testing of engagement elements
- LEMAP Participatory Survey distribution

Version 3

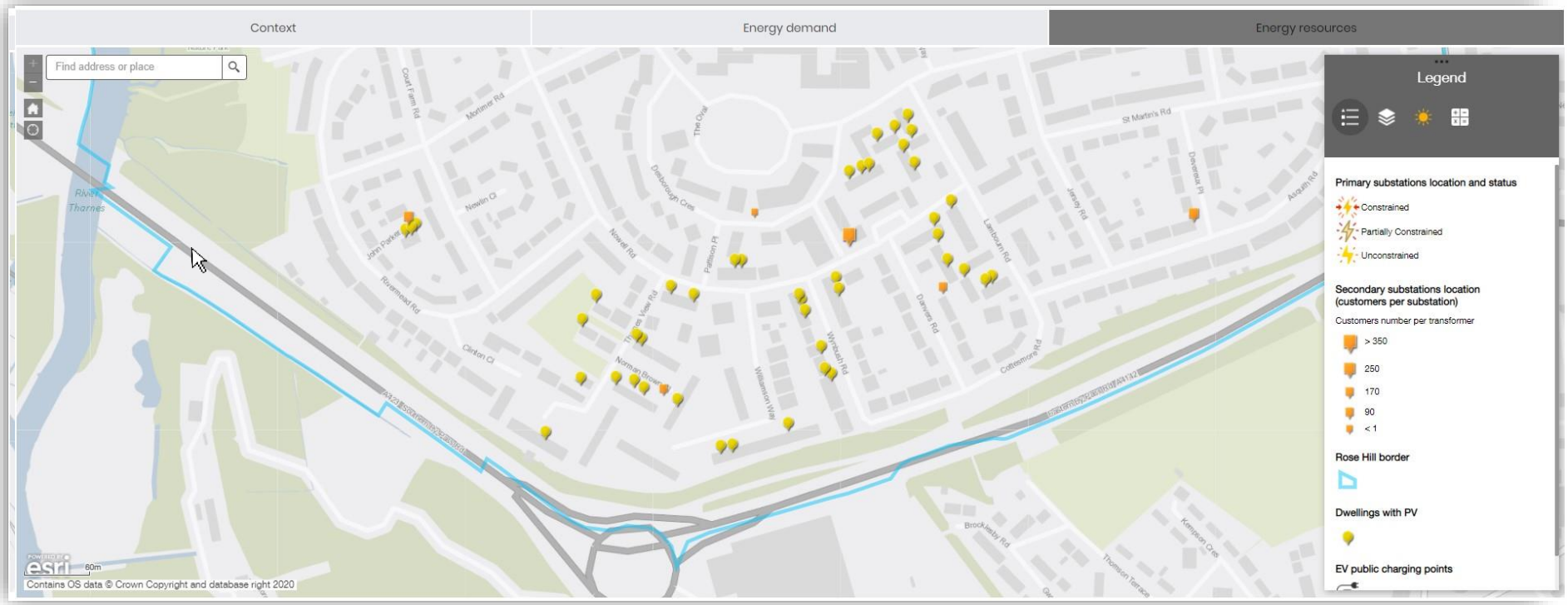
- May 2022
- Crowd-sourced data incorporated in LEMAP
- 4 technical and 4 engagement elements



Baselining

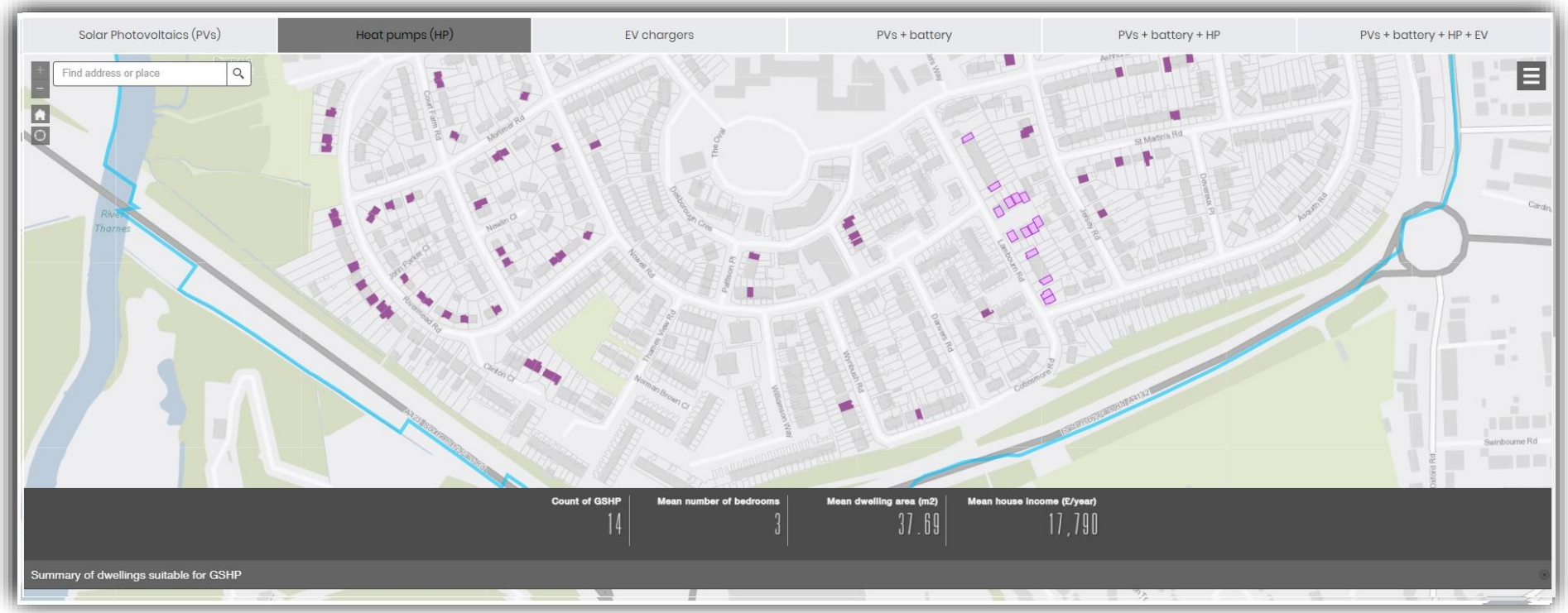
Energy demand map

Baselining



Energy resources map

Targeting


Solar Photovoltaics (PVs)
Heat pumps (HP)
EV chargers
PVs + battery
PVs + battery + HP
PVs + battery + HP + EV
Find address or place
Count of GSHP
14
Mean number of bedrooms
3
Mean dwelling area (m2)
37.69
Mean house income (£/year)
17,790
Summary of dwellings suitable for GSHP

Forecasting

Solar photovoltaics (PVs) | Heat pumps (HP) | EV chargers | PVs + battery | PVs + battery + HP | PVs + battery + HP + EV

Energy Profiles

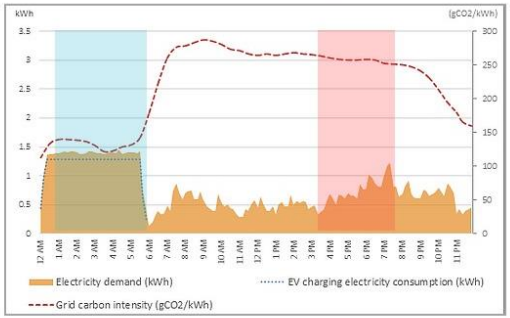
Select a postcode to visualise its energy profile: Type postcode

Time-of-use tariff: low tariff, high tariff

EV chargers

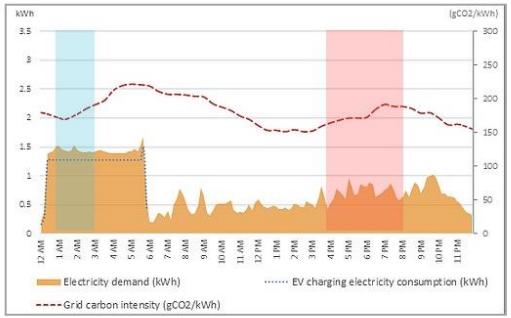
Postcode: OX4 4SN
Dwellings suitable: 19

Daily mean electricity profile **heating season**



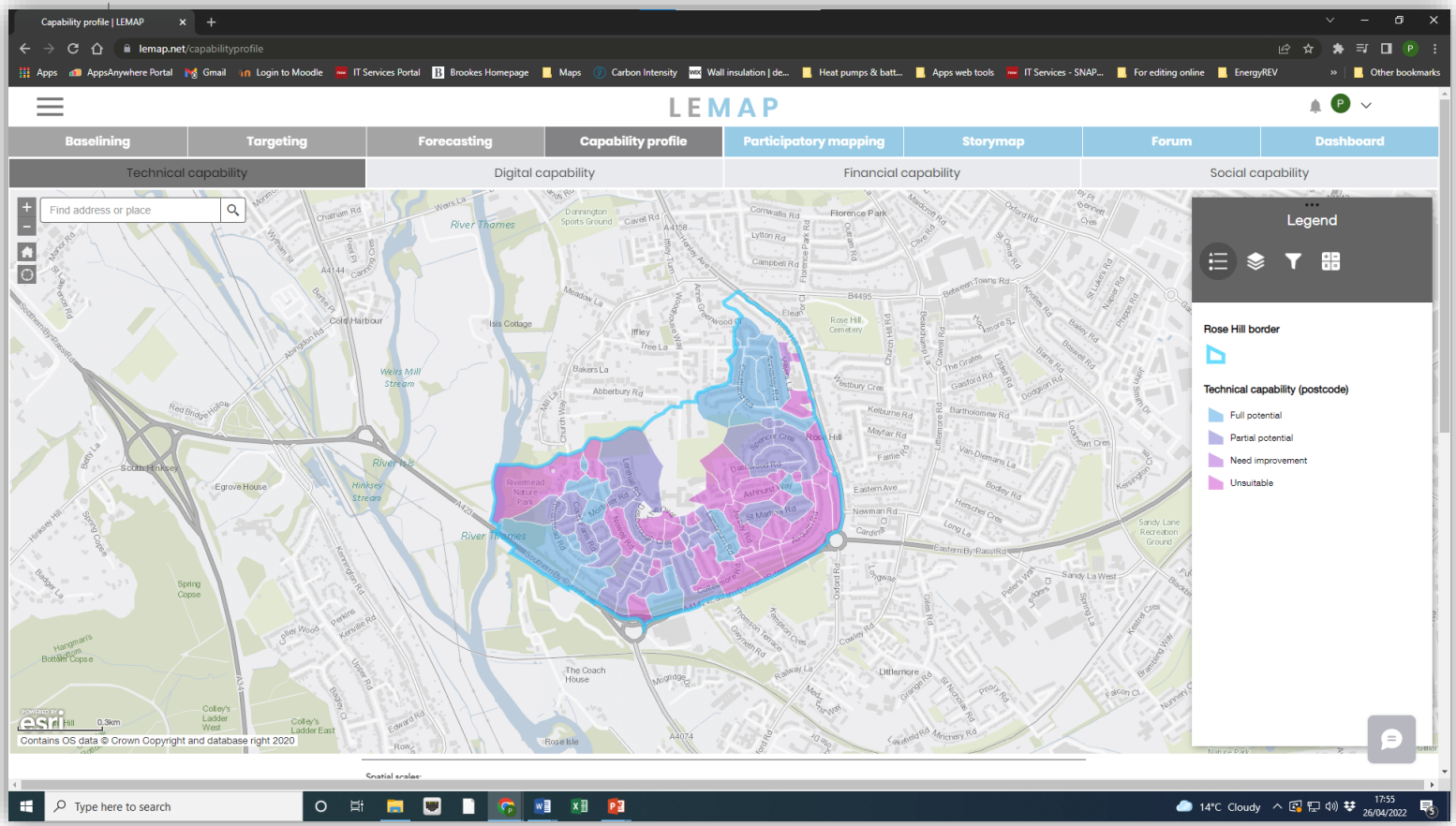
Total net electricity demand: 360.97 kWh/day
Mean net electricity demand: 18.78 kWh/day

Daily mean electricity profile non-**heating season**



Total net electricity demand: 360.26 kWh/day
Mean net electricity demand: 18.79 kWh/day

Capability profile



Participatory mapping

LEMAP Survey Archetype

survey123.arcgis.com/share/bed61dc4e18d4fcf92f59c7ca3469783

Guest

LEMAP

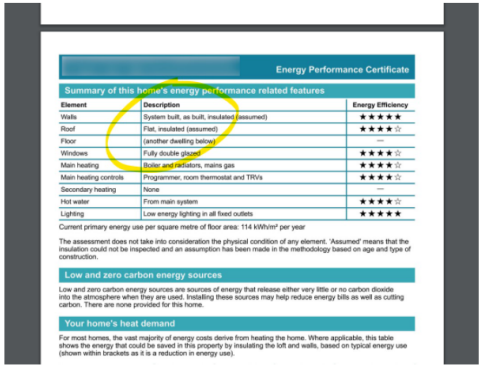
Section 1: Your home

Household characteristics

Does your home have any insulation on its walls?*

You can extract this information from your EPC performance report by clicking here (see image below)

Yes | No | Not sure



Energy Performance Certificate

Summary of this home's energy performance related features

Element	Description	Energy Efficiency
Walls	System built, as built, insulated (assumed)	★★★★★
Roof	Flat, insulated (assumed)	★★★★☆
Floor	(another dwelling below)	—
Windows	Fully double glazed	★★★★☆
Main heating	Boiler and radiators, mains gas	★★★★☆
Main heating controls	Programmer, room thermostat and TRVs	★★★★☆
Secondary heating	None	—
Hot water	From main system	★★★★☆
Lighting	Low energy lighting in all fixed outlets	★★★★★

Current primary energy use per square metre of floor area: 114 kWh/m² per year

The assessment does not take into consideration the physical condition of any element. 'Assumed' means that the insulation could not be inspected and an assumption has been made in the methodology based on age and type of construction.

Low and zero carbon energy sources

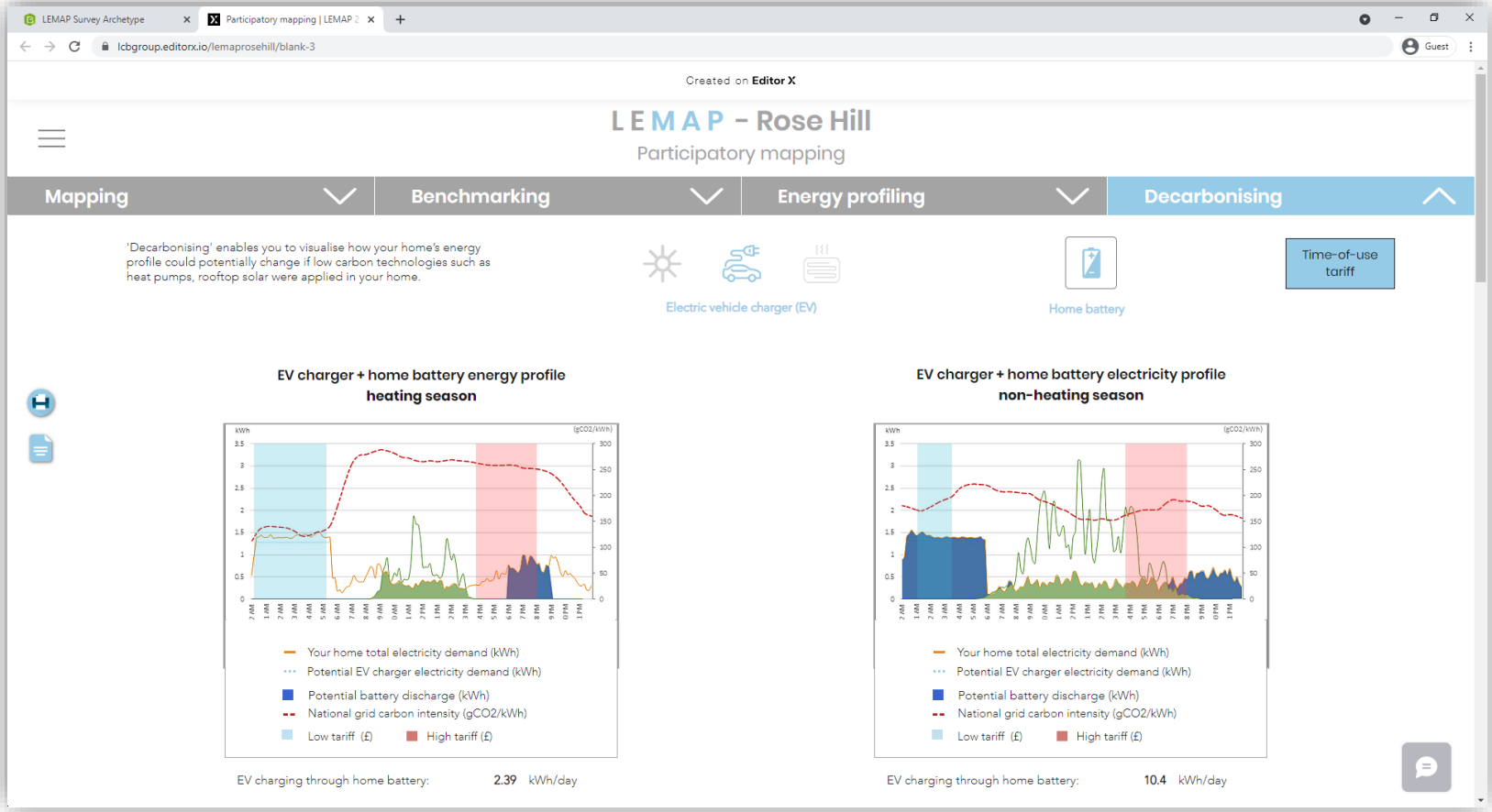
Low and zero carbon energy sources are sources of energy that release either very little or no carbon dioxide into the atmosphere when they are used. Installing these sources may help reduce energy bills as well as cutting carbon. There are none provided for this home.

Your home's heat demand

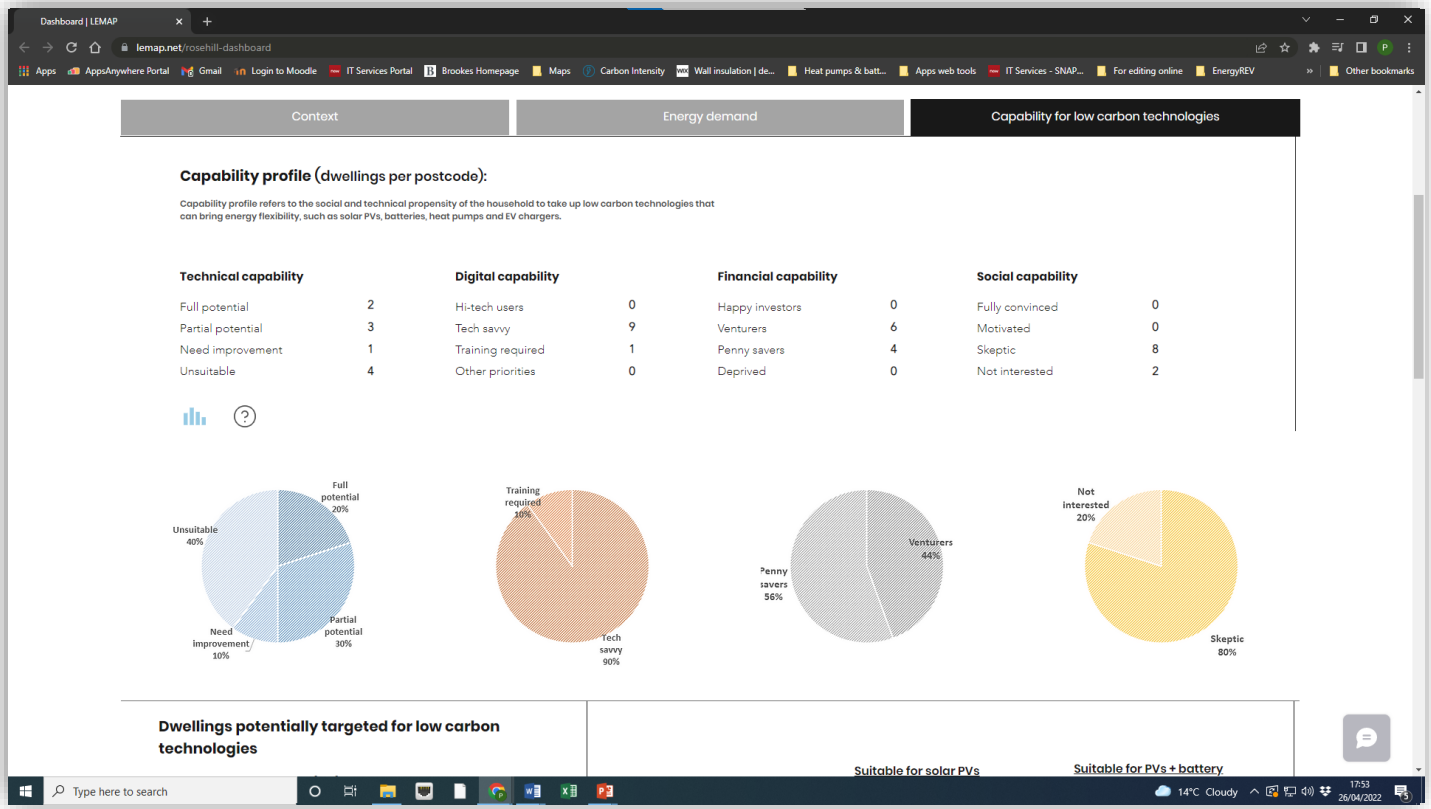
For most homes, the vast majority of energy costs derive from heating the home. Where applicable, this table shows the energy that could be saved in this property by insulating the loft and walls, based on typical energy use (shown within brackets as it is a reduction in energy use).

*This question is required to calculate your energy profile.

Participatory mapping



Dashboard


Dashboard | LEMAP
lemap.net/rosehill-dashboard
Context
Energy demand
Capability for low carbon technologies
Capability profile (dwellings per postcode):
Capability profile refers to the social and technical propensity of the household to take up low carbon technologies that can bring energy flexibility, such as solar PVs, batteries, heat pumps and EV chargers.
Technical capability
Full potential 2
Partial potential 3
Need improvement 1
Unsuitable 4
Digital capability
Hi-tech users 0
Tech savvy 9
Training required 1
Other priorities 0
Financial capability
Happy investors 0
Venturers 6
Penny savers 4
Deprived 0
Social capability
Fully convinced 0
Motivated 0
Skeptic 8
Not interested 2
Full potential 20%
Partial potential 30%
Need improvement 10%
Unsuitable 40%
Training required 10%
Tech savvy 90%
Venturers 44%
Penny savers 56%
Not interested 20%
Skeptic 80%
Dwellings potentially targeted for low carbon technologies
Suitable for solar PVs
Suitable for PVs + battery
Type here to search
14°C Cloudy
17:53
26/04/2022

Final thoughts

- LEMAP was produced in collaboration with a local community group (Rose Hill), community energy project developer (Low Carbon Hub) and local authority (Oxford City Council).
- LEMAP also helped in engaging with a DNO/DSO (SSEN) in overlaying network constrained areas with areas that have the potential for deploying distributed energy resources to support local grid balancing.
- The balance between technical and **engagement** aspects was found to be a novel feature
- Capability profile functionality can be used to show who is likely to adopt low carbon technologies and those who could be left behind.
- Crowd-sourcing of data was found to increase the accuracy of the tool with more local data and also help the local community group understand energy flows in their local areas to design appropriate offerings.

Thank you for your attention

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Marko Aunedi

Imperial College London

Imperial College London

8 September 2022

Benefits of flexibility of SLES in supporting national decarbonisation

Marko Aunedi
Imperial College London

Based on EnergyREV Briefing Paper:
"Benefits of flexibility of Smart Local Energy Systems in supporting national decarbonisation"

Objectives

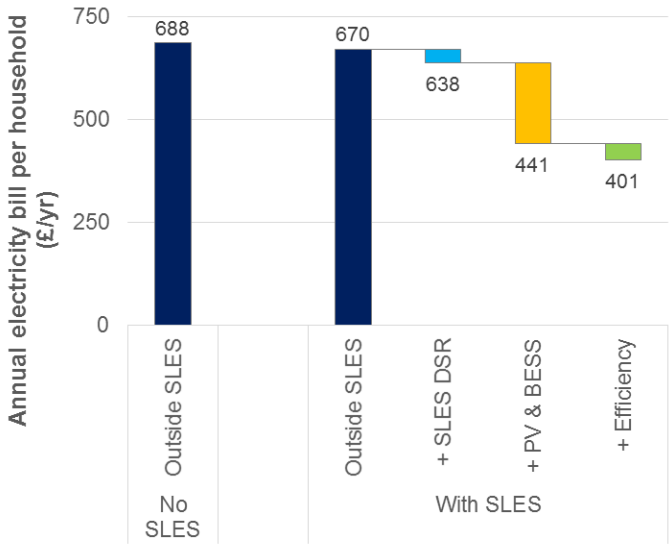
- Quantify **benefits of SLES in a net-zero electricity system** using a whole-system approach:
  - Quantify the impact of SLES on **customer bills**
  - Quantify the impact of SLES on the **whole electricity system**, including specific impacts on generation, networks and flexibility assets
  - Understand how the **system impact of SLES varies** with its uptake level, non-SLES flexibility and the variations in the portfolio of distributed energy assets

- SLES assumed to consist of portfolios of distributed energy assets:
  - Small-scale batteries
  - Demand-side response (DSR) assets in EV, heating, appliances and small commercial segments
  - Rooftop PV installations

Impact on customer bills

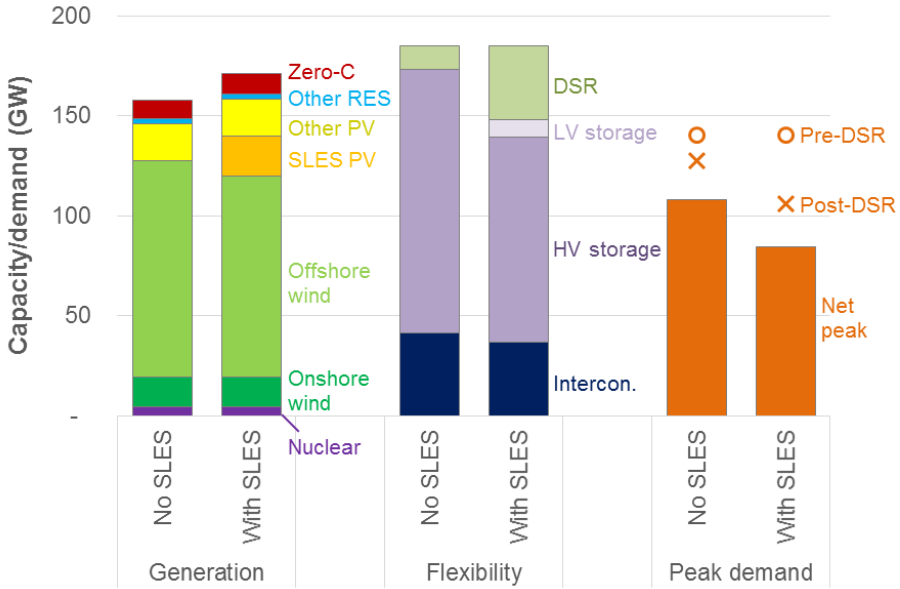
Customers within SLES schemes are likely to see a reduction in their electricity bills compared to non-SLES customers.

- Providing DSR services reduces the cost of electricity by 7-8%
- Implementing rooftop PV could bring further 30% reduction in bills
- Energy efficiency measures would bring another 5-7% reductions
- These are gross savings (i.e. not including cost of implementing DSR, rooftop PV, batteries and energy efficiency measures)



Impact of SLES on electricity system

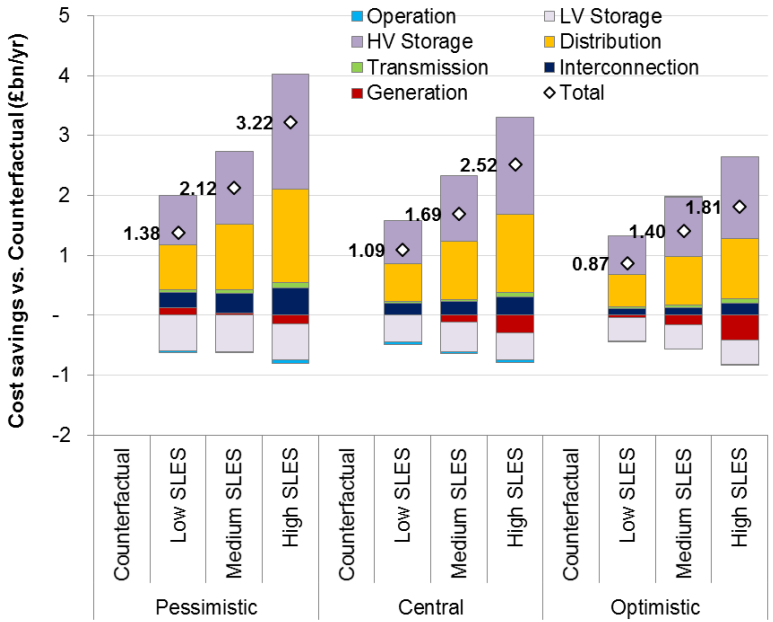
- **Impact on generation capacity:** rooftop PV in SLES displaces wind generation; SLES flexibility further reduces offshore wind capacity due to more efficient RES integration
- **Displacement of large-scale flexibility:** Extra flexibility unlocked by SLES through DSR and batteries, can displace large-scale flexibility assets such as grid-scale batteries
- **Reduction of net peak demand and network loading:** SLES flexibility will have a substantial effect on reducing the peak loading of the electricity grid, requiring less network capacity reinforcement



System cost savings from SLES

Deployment of SLES can deliver substantial savings in total system cost.

- In our Central case the total system cost savings from SLES were around £1.7bn/yr (4.2% of the total system cost)
- Cost savings materialise mostly through substituting grid-scale batteries with DSR and by avoiding distribution network reinforcement
- SLES benefits will depend on their deployment level but also on the volume of flexibility present in the counterfactual
- System benefits of SLES could increase further if they include energy efficiency or exclude rooftop PV



Tim Chapelle

Energy Systems Catapult

Naomi Baker

Energy UK

SLES and the Energy Crisis

Matt Hannon, University of Strathclyde (Chair)

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EnergyREV Insights & Impact

8th – 9th September 2022

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SLES, Skills, and Levelling-Up

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Skills and Training for Smart Local Energy: Systemic Perspective

Ruzanna Chitchyan

Researchers: C. Bird

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INDUSTRIAL STRATEGY | UK Research and Innovation

University of BRISTOL

EnergyREV

08-09-2022

Context of this work

Energy – the driver of all economic activity

UK Research and Innovation

Clean, Localised, Democratised Energy System

What skills do we need for clean energy transition?

How could these be delivered?

Data Collection Sources

Bristol

City-Scale
- Over 20 projects (broad tech)
- Running for 10 years
- 38 organisations

Socially-Focused
- Lead by Council or Non Profits

-> social learning and adoption e.g., community groups and council projects

ESO, REFLEX

Project-Scale
- 2 projects
- Running for 3 years
- 7 (ESO), 14 (Reflex) organisation

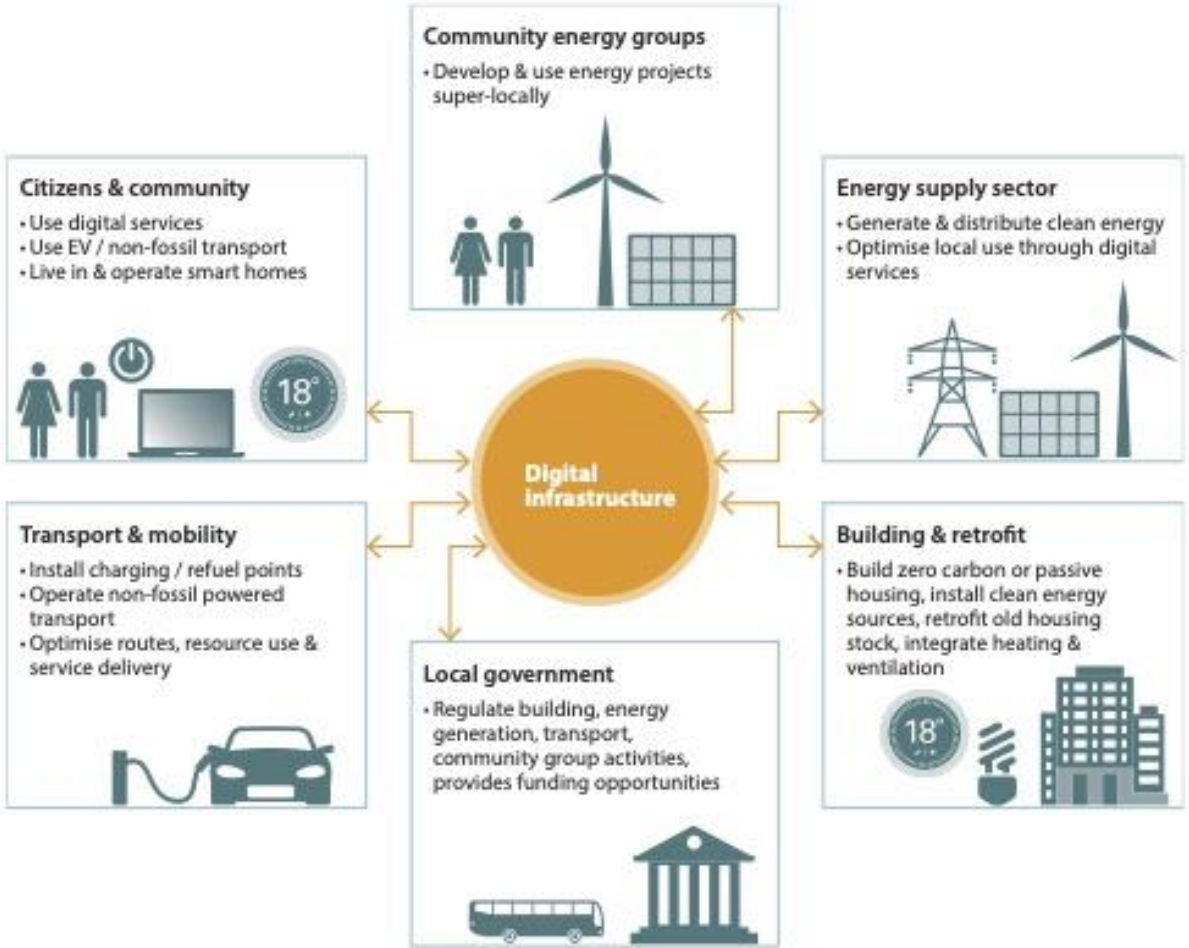
Business Focused
- Lead by For Profit Companies

-> scaling business, e.g., ESO:
- Invinity: 5 new projects
- Pivot: 40 projects over 10 years, 3 already ongoing …

Advisory Board, Focus Groups with Colleges

Skills for Transition in Smart Local Energy System of Systems

Net Zero – Transition of System of Systems



What Skills Are Needed within and Across Sectors

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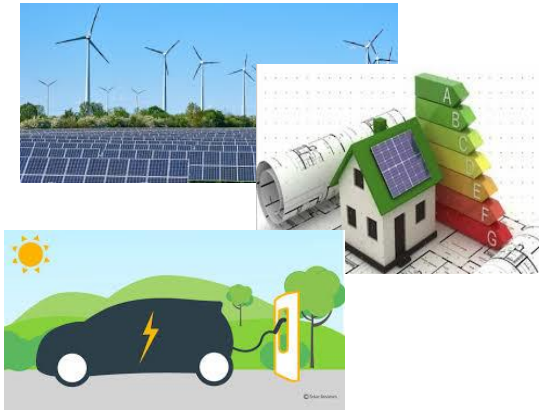
Skills Per Sub-System



Skills Across Sub-Systems

ICT

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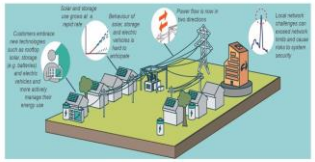


Figure 1. Australia's transforming electricity landscape

Policy & Regulation

People

Skills Per Subsystem: e.g. Energy Supply

Engineering Skills

Software Engineering skills
Databased Systems
Data Analysis and Machine Learning
Data Security
Power Systems Engineering
Systems Engineering …

Trades Skills

***Installation* skills**

- *Heat Pump Installation*
- *Smart Meter Installation*
- *Gas boiler decommissioning …*

Construction

- *Trenching for Heat Networks…*

Managerial Skills

Managing New Business Models
Large Scale Project Implementation Management:

- *Cross Institutional Management*
- *Setting Up Common Systems and Processes…*

Energy Skills

- *District heating*
- *Working with Community energy groups*
- *Sizing the heat pumps..*

Finance Skills

- *Develop New Business Models e.g., Based on Value of Data.*
- *Raising funds for the projects*
- *Financial modelling for the projects…*

Legal Skills

- *Contracts Preparation*
- *Handling Data* under Data Protection Regulation
- *Regulation of Heat…*

Policy Skills

- *Local Authorities SLES Delivery Skills*
- Setting *Policy on Subsidies for Renewables*
- *Local Authority for Future SLE Scenario Planning..*

Soft Skills

- *Collaboration across Teams within an Organisation*
- *Engaging Citizens* into the innovation
- Educating public on topics of SLE …

Whole SLES Skills

Managerial Skills
Building Partnerships/Core Trusted Team
Procurement (materials and services)
Cross-Institutional/Technology Project Management

Soft skills
Educating and Engaging General Public
Social inclusion, ensuring equitable outcomes

Energy Domain Skills			
Overview of Renewables/SLE Technology			
Designing renewables projects and understanding localisation	x		x
Integration of key sectors into SLE delivery	x	x	x

Skill	Bristol	ESO	ReFLEX
Engineering and design skills			
Data Analytics and Machine Learning	x	x	x
Algorithms Design and Monitoring	x	x	x
Data Management and security	x	x	x
Application Development/Programming	x	x	x
Systems Engineering and Integration	x	x	x
Connectivity, Networking and Telecoms	x	x	x
Research and Simulation Skills	x	x	x
Software Engineering	x	x	x
Electrical Engineering	x	x	x
Specialised infrastructure design and construction	x	x	x

What is Happening to Jobs and Training Needs?

Whole SLES Skills -> Skills Hybridisation in Occupations

UK Research and Innovation

Skill	Bristol	ESO	ReFLEX
Engineering and design skills			
Data Analytics and Machine Learning	x	x	x
Algorithms Design and		x	x
Data Management and		x	x
Application Developme		x	x
Systems Engineering and integration		x	x
Connectivity, Networking and Telecoms	x	x	x
Research and Simulation Skills	x	x	x
Software Engineering	x	x	x
Electrical Engineering	x	x	x
Specialised infrastructure design and construction	x	x	x

Managerial Skills			
Building Partnerships/Core Trusted Team			
Procurem			
Cross-Inst			nent

Soft			
Educating and Engaging General Public			
Social inclusion, ensuring equitable outcomes			

Energy Domain Skills			
Overview of Renewables/SLE Technology			
cts and understanding locallsation	x		x
o SLE delivery	x	x	x

Complexity-driven hybridisation

Data analytics/ Data science driven hybridisation (and Softwerisation)

Cross-domain hybridisation

Agile Accreditation Framework for hybridised skills

MSc in Data Science

Introduction to Artificial Intelligence
Introduction to Data Analytics
Advanced Data Analytics
Large-Scale Data Engineering
Technology and Innovation

MSc in Management Analytics

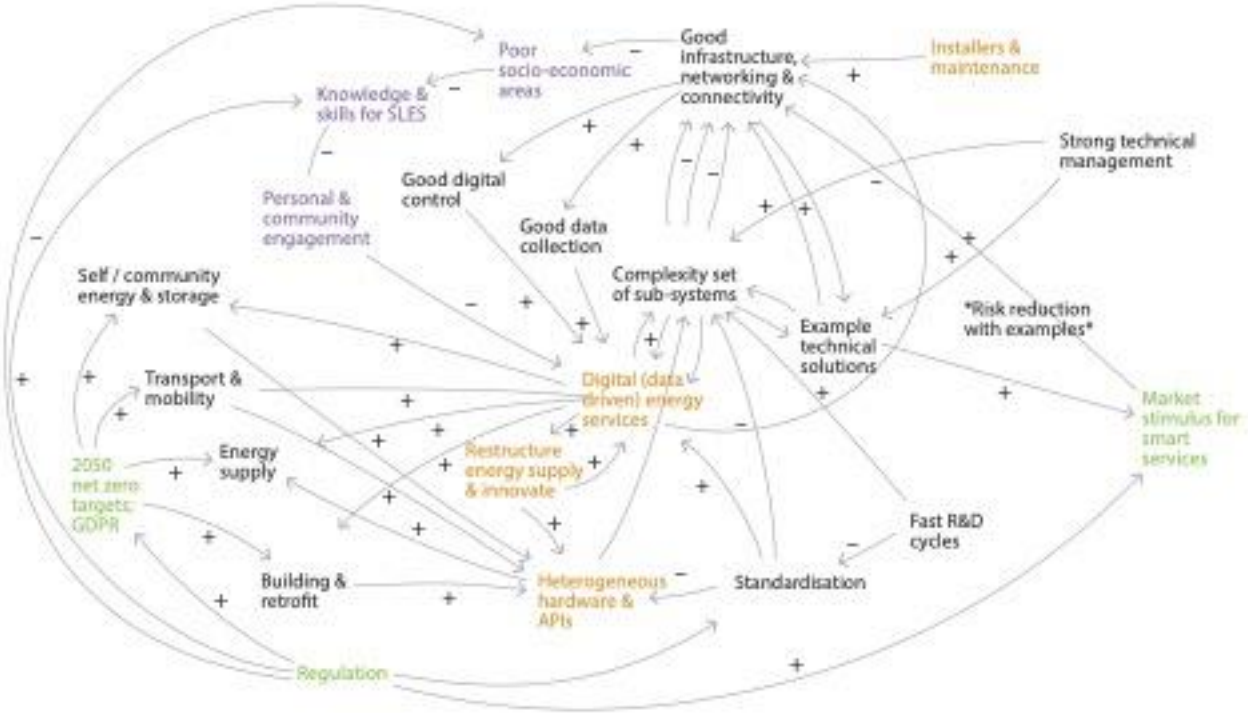
Management and Organisation
Accounting, Finance and Strategy
Introduction to Data Analytics
Advanced Data Analytics
Large-Scale Data Engineering
Level 4 unit in Media and Communications

MSc in Management

Management and Organisation
Accounting, Finance and Strategy
Operations and Marketing Management
Leadership, Strategy and Change
Research Methods
Professional and Personal Development

Summary: Observations on SLE SoS Transition

1. Software-based hybridization
2. Hardware-based integration
3. Policy-based drivers
4. People-focused needs



Summary: Observations on Jobs for Net Zero

More

Skilled

More

Digital

Less Disciplinary

Siloed

More

Collaborative

Delivered through an Agile Qualifications Framework

+

life-long-learning accreditation of newly acquired skills

Relevant References

- Smart Local Energy Systems: Training Needs and Provision
- Skills for Smart Local Energy Systems: Integrated case study report: https://www.energyrev.org.uk/media/1979/energyrev_integrated-case-studies_skills_2022205_final.pdf
- Bristol as a Smart Local Energy System of Systems: Skills Case Study: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3966236
- Transition to Smart Local Energy Systems: Energy Superhub Oxford Skills Case Study: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4066465
- Social and Economic Value in Emerging Decentralized Energy Business Models: A Critical Review: https://www.mdpi.com/1996-1073/14/23/7864
- Qualitative Study of Skills Needs for Community Energy Projects: https://www.researchgate.net/publication/349004227_Qualitative_Study_of_Skills_Needs_for_Community_Energy_Projects
- Exploring Future Skills Shortage in the Transition to Localised and Low-Carbon Energy Systems: https://research-information.bris.ac.uk/ws/portalfiles/portal/204091769/ICT4S19_SkillsShortateAssessment.pdf

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Tim Braunholtz-Speight

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EnergyREV

SLES, Skills and Levelling Up: business model challenges

Tim Braunholtz-Speight

September 2022

Outline

Research
led by Dr Maria Sharmina
with Dr Dimitrios Pappas

1. **Skills for SLES in general**
2. **Skills for SLES and consumers**

Interviews and online data collection with 29 local energy systems – mainly looking at existing business models

Workshops with developers and operators looking at business model innovations for overcoming SLES challenges

Skills for SLES

Skills needs are diverse

"We struggle to get competent and trained staff in the areas of data, telemetry, controls. The mechanicals – gas, electrics, plumbing - no problem. The small wires are the problem!" (system operator)

"Our skills development is currently more about finance and complex commercial models than about the technical aspects." (system operator)

- 'Traditional' energy engineering skills will remain important
- But 'new energy' skills – in heat pumps, electric heating systems, smart control systems – will be increasingly important
- Managing complex smart systems also presents commercial and financial challenges.

Skills for SLES and levelling up

We need smart energy maintenance engineers everywhere!

"Availability of local skilled maintenance workforce is a factor in the adoption of new technologies, for example, heat pumps." (system operator)

- Perhaps 2/3 of contractors are based locally to local energy systems
- However, many systems use national contractors for specialist 'new energy' work
- This limits local employment and skills development, and can present operational challenges in emergencies

Skills for SLES and consumers

from the literature

SLES need domestic consumers to adopt new tech and new tariffs

Mastering new technology

"people who are abused by technology … often do not know they are being abused"

(Vigurs et al 2022: 29)

Vulnerable customers

- Less able to represent their interests
- More likely to suffer detriment

(Ofgem quoted in Citizens Advice 2018)

Skills for SLES and consumers

from our research

Consumer understanding of technologies

"How customers operate their heat and cooling systems has a massive impact" (system operator)

"heat pumps are more complex than gas boilers, it's possible to make mistakes and use double the energy you should!" (system developer)

Heat pumps most frequently singled out as a challenge

But also smart controls and Passivhaus-style heating systems

Potential negative impacts on

- Comfort and health
- Affordability and fuel poverty levels
- Progress with transition - poor word-of-mouth reputation leading to low takeup of critical technologies

Skills for SLES and consumers

from our research

Consumer understanding of tariffs

"some effort is necessary to help people understand basic billing and tariffs" (system operator)

SLES typically use 'time of use' tariffs that charge a different price for energy at different times.

Understanding tariff structure is important for maximising customer cost savings.

Tariff structures may be

- Fixed time bands – same every day
- Variable e.g. in relation to when local renewable generation is available

Consumers can learn to use these – but will need support

Some existing local energy systems strive to make customer experience "seamless" and avoid new tariffs

Skills for SLES and consumers

Business models for consumer support

Resources
- Tech
- Finance
- People with skills

Activities
- Advice
- O&M
- Advocacy

Value

Revenue

Consumers
- Affordable energy
- Comfort/ health
- Security

Value

Revenue

Installers
- Trust
- Knowledge
- More customers

Value

Revenue

System operators
- Working system
- Social goals

Skills for SLES and consumers

Business models for consumer support

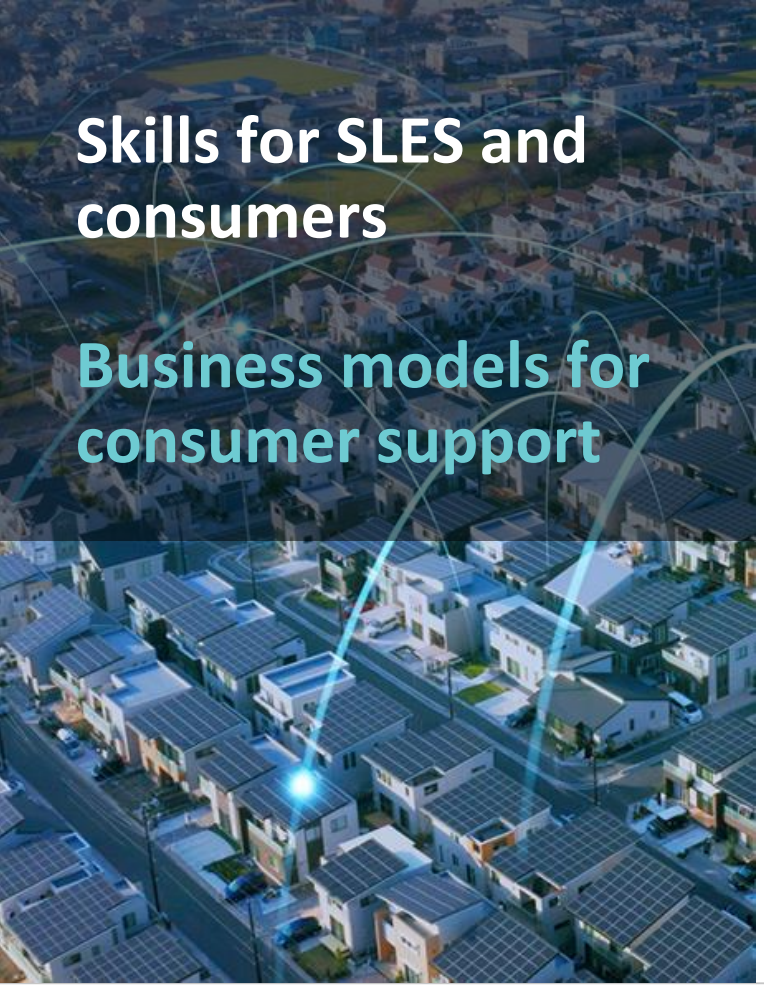
Resources – people with skills…

- people who can explain how the system works "in plain English" to the users
- available face-to-face all over the UK
- 600k heat pump installations p.a. (target) = **6k consumer support jobs** (1 per 100 installs)?

and tech resources - smart meters

- O&M can be made more efficient using remote monitoring of system performance*
- home visits will still be needed to investigate when monitoring suggests a problem

*see also Weigert et al 2022



Skills for SLES and consumers

Business models for consumer support

Activities

Advice

- pre-installation
- type of energy tech, sizing, tech choices

O&M

- ongoing post-installation – monitoring performance

Advocacy

- holding installers, energy companies to account if necessary

Skills for SLES and consumers

Business models for consumer support

Value

Consumers

- Affordable energy – avoiding high cost from poor tech choices or operation
- Comfort / health
- Security – support in the event of problems

Installers

- Data on system performance
- Trust leading to more business
- Reputational change – double glazing!

System operators

- System ‘works’
- Social goals – vulnerable customers supported to participate

And of course wider value to low carbon transition

Skills for SLES and consumers

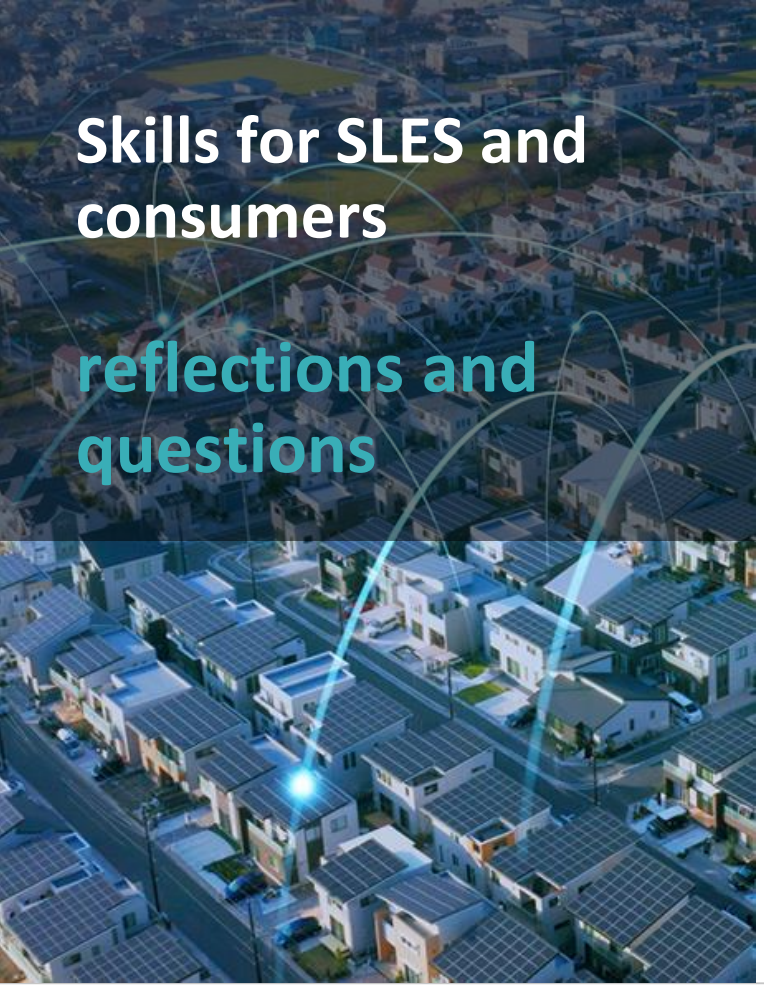
Business models for consumer support

Revenue

- subscriptions from consumers
- from installers linked to warranties – risk of capture?
- will these revenue models price out vulnerable consumers? – role for public funding / operator

Ownership

- social enterprise or not-for-profit – trust and value sharing?
- membership model for accountability?
- local authority role? – some local authorities looking at organising a consumer support service on similar lines



Skills for SLES and consumers

reflections and questions

Consumers' take-up and operation of new energy technologies will be critical to SLES business models.

Different consumers will have different capacity to use tech and get the best deals

Raises questions of

- 'non-energy' skills for the energy transition
- value generation and value sharing in SLES
- energy democracy, power and responsibility in the transition

…and more!

References

Report and briefing from the interviews

https://www.energyrev.org.uk/outputs/insights-and-tools/beyond-the-pilots-current-local-energy-systems-in-the-uk/

Citizens Advice (2018) *Vulnerable consumers and high energy prices.* London: The National Association of Citizens Advice Bureaux.

Vigurs, C., Maidment, C., Fell, M.J. and Shipworth, D. (2022) *Building and unlocking flexibility with smart local energy systems (SLES).* Energy Revolution Research Centre, Strathclyde, UK. University of Strathclyde Publishing.

Weigert, A., Hopf, K., Günther, S., and Staake, T. (2022) *Heat pump inspections result in large energy savings when a pre-selection of households is performed: A promising use case of smart meter data.* Energy Policy 169, October 2022.

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INDUSTRIAL STRATEGY

UK Research and Innovation

Cara Jenkinson

Ashden

Zero carbon towns and cities

EnergyREV
Insights and impact event 2022
8th September 2022

Ashden
Climate Solutions in Action

Ashden

Tried & tested solutions

Passivhaus Homes / Tools and support help builders, architects and clients create efficient housing

Guru Systems / Heat network software helps social housing tenants

e-cargobikes.com / Cleaner air and better working conditions

Upside Energy / Reducing energy stress for the grid

Q-Bot / Minimum fuss, maximum insulation

Chargemaster / Charge of the EV brigade

The National Energy Foundation and Energiesprong UK / High-impact retrofits

London Borough of Waltham Forest / Streets worth celebrating

Highview Power / Cheap and green energy storage

Energy Local / Making sustainable energy work locally

Switchee / Helping landlords cut costs and fight fuel poverty

Smarter Grid Solutions / Helping to balance the grid

Passivhaus Trust / Warmer homes and better air quality

Nottingham City Council / Robin Hood would approve...

The Active Well-Being Society (formerly Big Birmingham Bikes) / Improving the health of Britain's second biggest city

Greater London Authority / Experts in public sector sustainability

Low Carbon Hub / A catalyst for the big energy shift

Cosy Homes in Lancashire / Cosy as can be

Ashden

Tried & tested solutions

Sustainable Towns & Cities

A toolkit for city regions and local authorities

Climate action co-benefits:

Cutting carbon and improving people's lives

Authors: Emma Jones | Cara Jenkinson | Simon Brammer | Matthew Ahluwalia | Frieda Wignall | Kate Williamson

Toolkit chapters

1. CONTEXT
2. CITIZEN & COMMUNITY ENGAGEMENT
3. HEALTH
4. ECONOMIC OPPORTUNITY, GREEN JOBS AND SKILLS
5. RESILIENCE AND ADAPTATION
6. EQUITY AND SOCIAL COHESION
7. GLOSSARY

Ashden

Council action on green jobs

Road to zero carbon: council action on green jobs and skills

A report by Shared Intelligence
For Friends of the Earth and Ashden

Friends of the Earth

Ashden
Climate Solutions in Action

Supported by

ADEPT

SOS STUDENTS ORGANISING FOR SUSTAINABILITY UNITED KINGDOM

TEACH THE FUTURE

VOYAGE

Ashden

Council action on green jobs

Where local government can have impact: Our recommendations

Ashden

Challenges and opportunities

Challenges

- Lack of long-term government policy
- Big gap = skilled craft workers particularly for retrofit/construction
- Apprenticeship standards and other qualifications – slow to change
- Lack of trained instructors at FE colleges
- SMEs lack resource to get trained...
- Hard for SME's to take on apprentices

Opportunities

- Shared prosperity funding
- Government funding for retrofit
- Using social value properly in procurement
- Additional funding for colleges
- Employer partnerships to boost college capacity
- Regional skills academies
- Green skills bootcamps

Ashden

Best practice

highbury college Portsmouth | PART OF CITY OF PORTSMOUTH COLLEGE

Student Hub | Co

Courses | Student Life | Community | Apprenticeships

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New skills for a greener future - Aston Group teams up with Waltham Forest College to install their first Electric Vehicle (EV) Charger

01 August 2021

Share...

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Best practice from our Awards

B4Box

Low Carbon Academy

Ashden

Best practice

Ashden

Zero Carbon Towns and Cities

Thank you

Cara.Jenkinson@ashden.org

https://policy.friendsoftheearth.uk/download/road-zero-carbon-council-action-green-jobs-and-skills

Ashden

Charles Wood

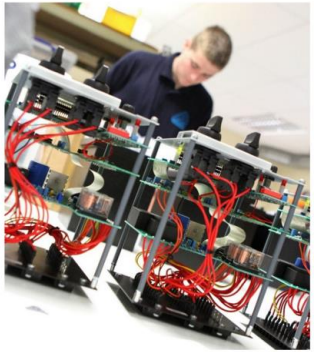
Energy UK

Jeremy Yapp

BEAMA

About BEAMA

BEAMA is the leading UK Trade Association for **manufacturers and providers of energy infrastructure** and systems.



Worth £13 billion

Employing 90,000

With exports worth £5 billion

Representing the supply chain of products and components for the UK energy system

https://www.beama.org.uk/industry-support/net-zero/growing-the-supply-chain-for-net-zero.html

Growing the supply chain for Net Zero

- Scale of infrastructure deployment to meet Carbon Budget 6 is unprecedented for electricity networks and end use technologies
- 85% of BEAMA members surveyed expect to scale up by 20%-100% (some answered 10x)
- Investment needs to come much earlier than previously anticipated: significantly earlier than 2035
- Demand on the supply chain will be global
- If we get the market conditions right, we can create new jobs in the UK
- No.1 barrier to inward investment & growth is availability of skills and people

Manufacturers agree they can make investment required to achieve this in UK

… but <u>not</u> under the current market conditions.

Backdrop

- Existing supply shortages
- Changing trading relationships
- Energy crisis
- Industrial decarbonization

BEAMA launches UK Electricity Products Supply Chain Council

- Crucial period of investment
- Mounting supply shortages and an energy crisis
- New council will report directly to BEIS and DIT
- Membership from across the energy supply chain
- To track and address current capacity challenges for supply of critical minerals and materials, future capacity building, inward investment, skills and jobs

Scale of electrification

Electricity demand could grow by 70% by 2050 – electrification of heat, transport, hydrogen production

Millions of heat pumps coupled with thermal storage by the early 2030s – 20 million heat pumps by 2050

300,000km of additional distribution cable installation and an increase of grid bulk substations by up to 50% by 2050

Connection upgrades required for many domestic properties

SLES, Skills, and Levelling-Up

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Local
Zero
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UK Research
and Innovation
EnergyREV

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The Future of SLES

Jeff Hardy, Imperial College London (Chair)

Stephen McArthur, University of Strathclyde

Janette Webb, University of Edinburgh

Joanne Wade, The ADE

Neil Kermode, EMEC

Ingrid Bennett, West Sussex County Council

Janette Webb

University of Edinburgh

Future of SLES

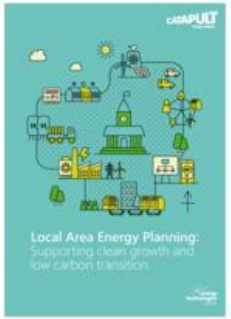
Janette Webb
University of Edinburgh

With Tim Braunholtz-Speight,
Maria Sharmina, Dimitrios Pappas
University of Manchester

London

September 2022

Proposition – Affordable, sustainable energy more achievable with integrated local systems



'To enable a *cost effective* low carbon transition, more *advanced* local area energy *planning* is needed to ensure the *right solutions* are implemented in the right place, at the right time'

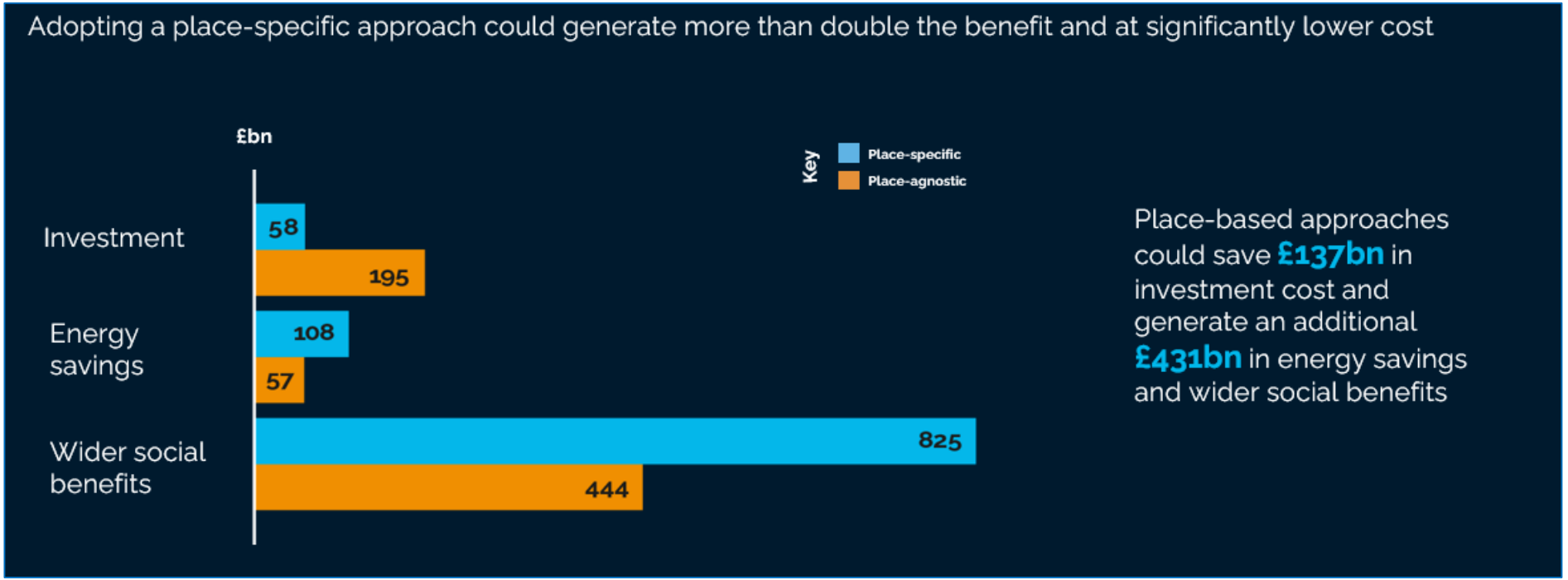
Whole system services from *local* systems

- Heat, power, transport, storage
- Facilitate transformation
- Manage costs

6Ds

- More **decentralised** technologies
- **Digital** infrastructure for systems' integration, efficiencies and **demand** flexibility
- **Diverse** businesses
- More participative **democratic** control

Socio-economic assessment: SLES = ‘more than energy’



Source: IUK with PWC, Otley Energy and University of Leeds, 2022 *Accelerating Net Zero Delivery: Unlocking the Benefits of Climate Action in UK City Regions*

Diversity of local energy

Technologies	Heat networks, microgrids, solar, wind, heat pumps, AD, biomass & gas boilers, EV chargers, BMS, fuel cells
Customers and scale	Less than 10 to over 5000; domestic, industrial and commercial
System operators	Energy businesses, LAs, farmers, industrial estates, housing providers, universities, community interest companies

https://www.energyrev.org.uk/outputs/insights-and-tools/beyond-the-pilots-current-local-energy-systems-in-the-uk/

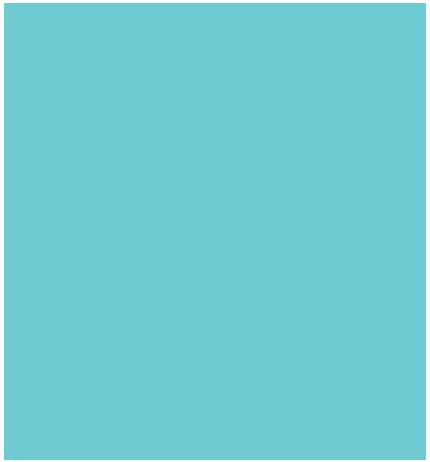
https://www.energyrev.org.uk/media/1457/energyrev_business_report_final_202010.pdf

Investment potential from technical support for Local Authorities

€23 million UK grants from EU ELENA Prog - invested in people, skills, expertise

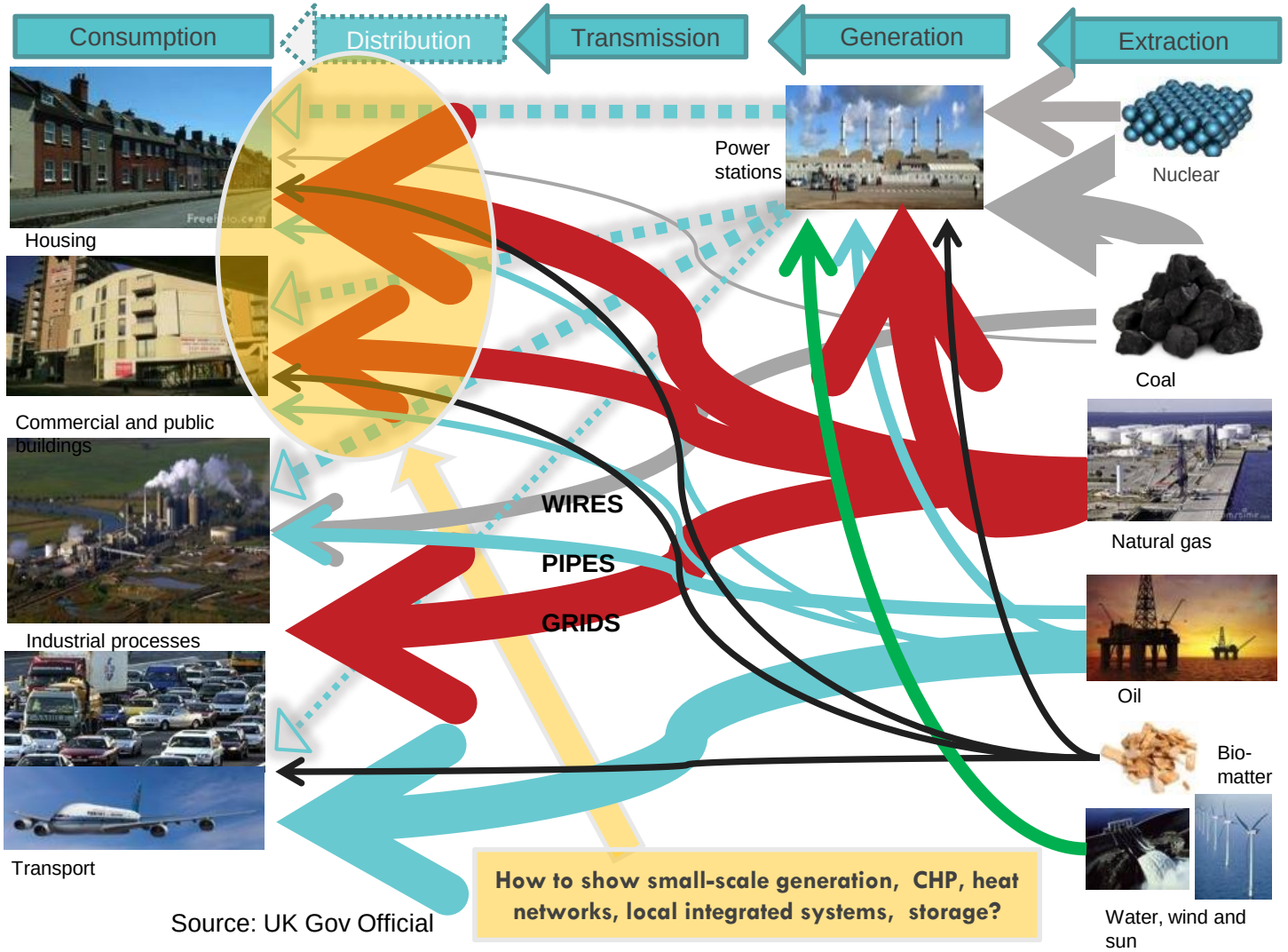
Every €1 led to about €37 investment

Delivering €859 million in low carbon investment at local scale



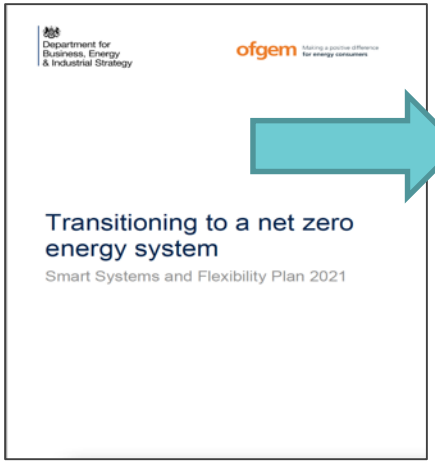
A very prudent investment

The Challenge?



Source: UK Gov Official

Where are we now? UK Government Mixed Messages



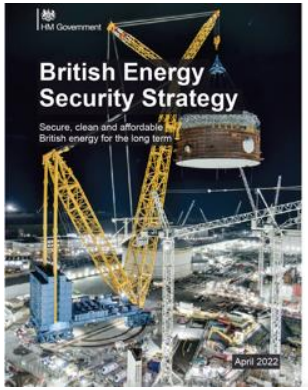
UK Net Zero Strategy
-
82% of UK emissions within scope of influence of local authorities

Enabling smart local energy solutions

Why this area is important

Decarbonisation of our buildings, transport systems and energy system will require lots of action at a regional and local level. Generation and storage are becoming increasingly decentralised, with solar and batteries being deployed in individual buildings and by local communities. Heat and transport decarbonisation, in particular, needs to be delivered in a way that meets local needs and with the involvement of local decision makers. Decarbonisation will require strong co-ordination across electricity, heat, hydrogen, transport and buildings. That means local actors can be strong drivers of change, enabling coordinated planning and engagement with markets, and supporting cleaner, cheaper and more efficient energy whilst providing a significant contribution towards local economic strategy.

Smart local energy systems are local-based initiatives which bring together a range of energy issues, typically including heat, power and transport, to reduce emissions in an integrated way, while also promoting local jobs and businesses. Local Authorities have a key role to delivering these systems by combining energy into their wider statutory work on housing, transport, waste and planning, making delivery more cost-effective and preparing for a net zero future. The



BUT BESS 2022 **NO** ref to Local Energy Systems

Where are we now? – Enterprise and Uncertainty

In principle commitment to integrated local energy for whole systems value BUT

In practice

- Project sponsors "awash with feasibility studies"
- GB centralised market – BESS 2022 continuity
- Gas grid?
- Local energy planning?
- Future Energy System scenarios – mainly electric future 'one consumer choice' at a time?

Multi-dimensional value of locally-integrated systems not yet translated into case for users

Will **heat** regulation, zoning and (in England) mandated DHN connection make a difference?

What Needs to Happen for SLES to Thrive?

Support customers in a shift to local energy services

Now - Lack of customer awareness, understanding and trust in local energy technologies, services and tariffs

- obstacle to SLES transition

Changes needed

Resources: local staff – jobs potential

Services: advice on options and continuing support

- micro-technologies to heat networks
- quality assurance
- consumer protection and advocacy

Ownership: independent organisations and trust

Energy service tariffs and payments

- warranties, subscriptions, guarantees

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INDUSTRIAL STRATEGY | UK Research and Innovation

What Needs to Happen for SLES to Thrive?

A policy mandate for net zero carbon localities

- Coordination across scales of government - reducing uncertainties and costs across sectors

Institutionalise local energy planning and implementation - statutory powers and resources to secure long term investment

- Combines ad hoc projects into local programmes
- Increases scale of investment through diversity and affordability of finance

Invest in local authority energy skills and expertise

- Funds for technical assistance and development capital
- Backed with regional and national coordination and support functions

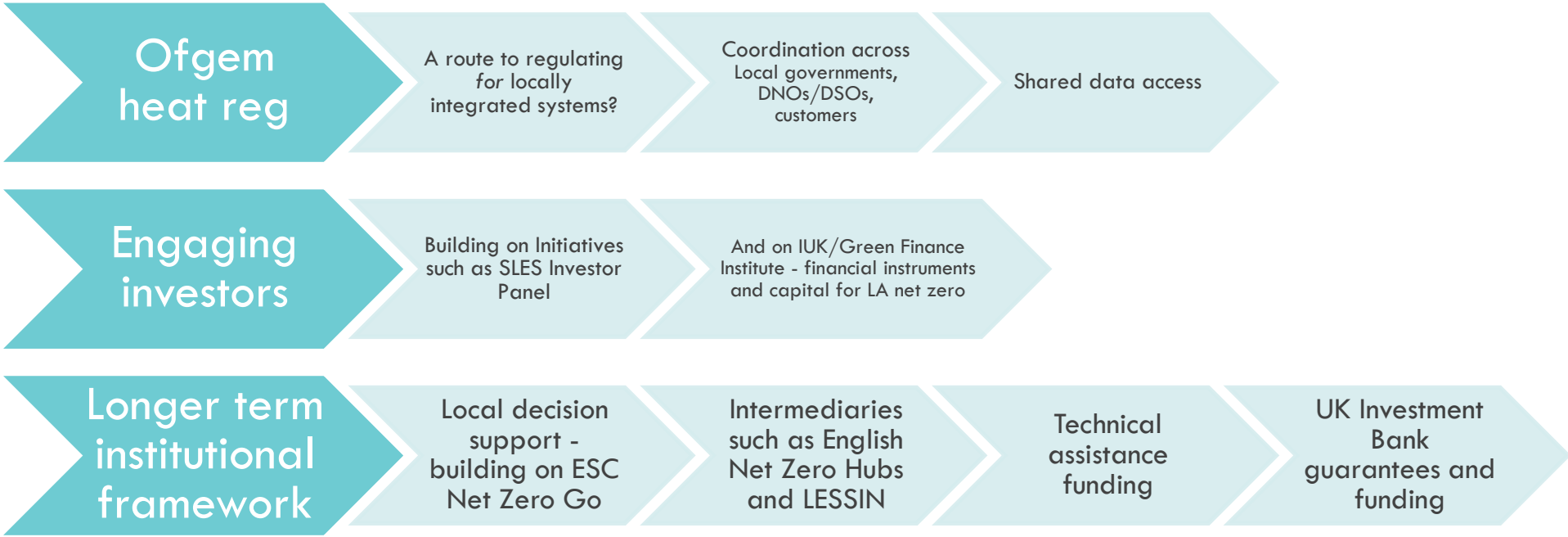
Recognising local expertise in low carbon heat, building retrofit and transport

- Hardest areas for central governments

Evaluate *all* local and regional public expenditure using net zero principles

- Metrics to normalise governance for net zero across local authority finance, development planning and services

Regulatory Framework for SLES to Thrive - the 'missing middle'



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Acknowledgements:

Fabian Fuentes Gonzalez, Mags Tingey and Katherine Sugar, University of Edinburgh

Matt Hannon, University of Strathclyde

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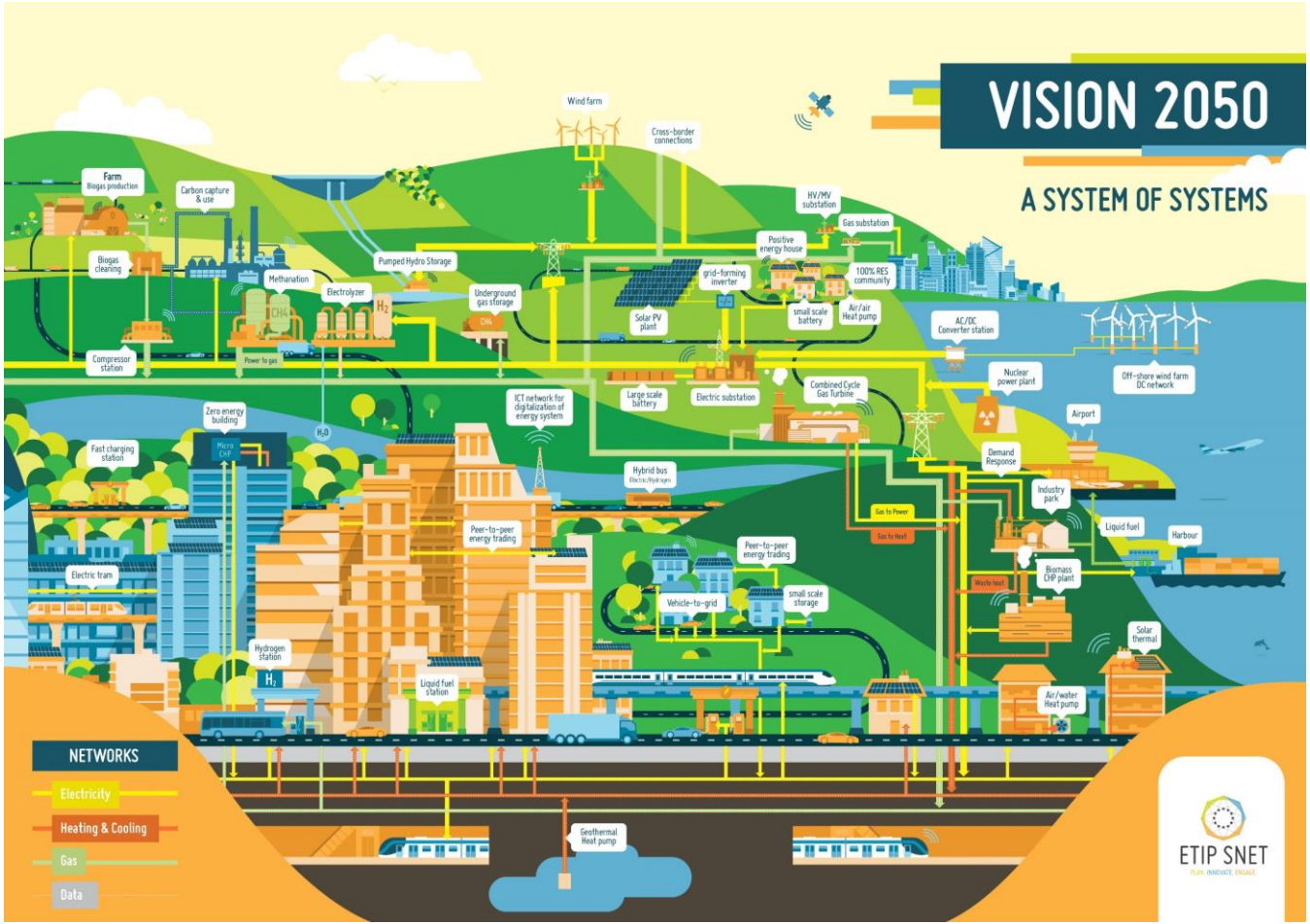
EnergyREV

Stephen McArthur

European Technology & Innovation Platforms (ETIP)

Smart Networks for Energy Transition (SNET)



Day 1 Comments…

- Matt Hannon:
  - "Dumb and inflexible" Energy System
  - Operate "smarter" and more flexibly – we can't do this
- Thomas Morstyn:
  - Local flexibility → "bespoke and difficult"
  - Comparison with smart grids: NOT *smart* **vs** *not smart,* but moving towards *"smarter"*
- Jeremy Yapp:
  - Smart "readiness"
- Local Zero:
  - Centralised vs. decentralised
  - Intelligent infrastructure

Scaling Up and Rolling Out →
Flexible, Scalable and Reusable Systems






Standards – Products – Services – Regulation - Skills

Joanne Wade

The ADE

Neil Kermode

EMEC

Ingrid Bennett

West Sussex County Council

The Future of SLES

Jeff Hardy, Imperial College London (Chair)

Stephen McArthur, University of Strathclyde

Janette Webb, University of Edinburgh

Joanne Wade, The ADE

Neil Kermode, EMEC

Ingrid Bennett, West Sussex County Council

Interactive Tools Session

Jo Patterson, Cardiff University

Interactive Tools Showcase

Friday 9th September 2022

CoPED – Catalogue of Projects on Energy Data

Alison Halford and Colin Stephens

CoPED

The Catalogue of Projects on Energy Data (CoPED)

A digital tool to support innovation and collaboration in the energy sector

https://coped.coventry.ac.uk

A data portal that captures energy projects metadata using a series of visualisation features to support innovation and aid the delivery of the UK Energy Digitalisation strategy.

Connecting energy actors within industry, policy, and research to promote, engage, and respond to the 'energy digitalisation' conversation.

- For the research community, visualisation tools provide options and perform queries that give more granular insights into proposed and existing projects that have been funded by research councils.
- Industry can access the visualisation and querying tools of the portal to identify potential and existing investable, scalable models for energy services/systems.
- Policymakers and local governmental departments can map the uptake and development of renewable technologies projects, providing an evidence base for strategic deployment.

GIS mapping of local energy businesses in the UK

Jan Webb

OPEN
An Open-Source Python Platform for Developing Smart Local Energy System Applications

Thomas Morstyn and Chaimaa Essayeh

Overview

- What

  ✓open source Python software platform

  ✓model, control and simulate distribution systems with embedded DERs

- Why

  ✓ Lack of adequate tools supporting SLES research and development

  ✓ Lack of extensibility and interoperability

  ✓ Lack of advanced modelling and control techniques

•Key Features:

✓Provide modularity, code-reuse and extensibility

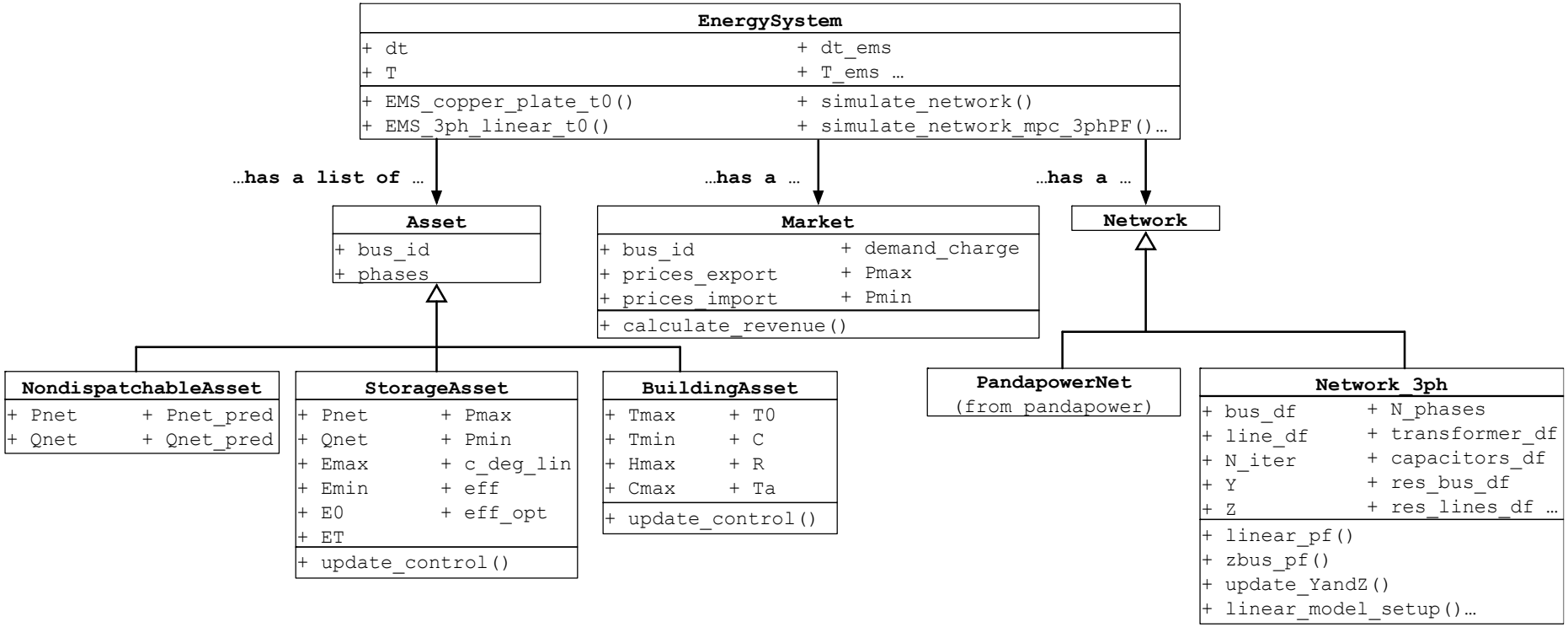
✓Allow for collaboration and replication between laboratories

✓Speed up the translation of new methods to industry application

- Object-oriented structure

  - ✓ Standardises interfaces between components (e.g. resources, networks & markets) and tools (modelling, control & simulation)
  - ✓ Users can expand OPEN's libraries of networks, market arrangements, datasets and energy resource models
  - ✓ Easy integration with third-party packages

Object-Oriented Structure



Future directions

- Broader market arrangements:
  - ✓Local Energy Markets
  - ✓Local Flexibility Markets
  - ✓Interaction between the different markets
- Larger Scale simulations:
  - ✓Implementation of high performance computing to support large-scale simulations

- Development of GUI:
  - ✓ User-friendly interface

Local Area Energy Mapping (LEMAP)

Rajat Gupta

Overview of LEMAP

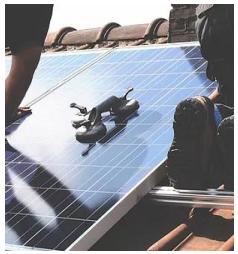
- LEMAP is an online property-level spatial mapping tool for visualising local area energy flows for planning smart local energy initiatives to meet the net-zero targets.
- Developed as part of EnergyREV Plus project (User influence tools).
- Uses a range of datasets that are:
  - **Publicly** available
  - **Privately** available
  - **Crowd-sourced**
- LEMAP has been applied to local areas in Oxfordshire that are aiming to become smart energy neighbourhoods as part of Project LEO.
- One application is Rose Hill neighbourhood (1500 dwellings, secondary substation) in Oxford, as part of its aspiration to become a zero-carbon estate.

LEMAP has been organised around four **technical** and four **engagement** elements:

Baselining

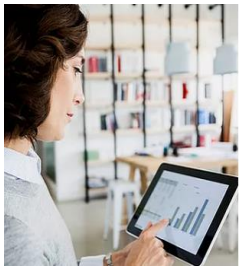
Local area energy flows in relation to socio-economic and dwelling characteristics.

Targeting



Identify which dwellings are suitable to deploy different low carbon technologies (LCTs).

Forecasting



Energy demand profiles at postcode level for LCT scenarios.

Capability profile

Shows which areas are likely to adopt LCTs based on their capability assessment.

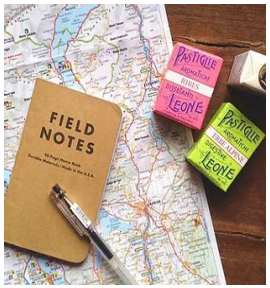
4 engagement elements
(for end-users)

LEMAP has been organised around four **technical** and four **engagement** elements:

Participatory mapping

Allows residents to visualise their energy profile, compare against the neighbourhood and see how the profile changes with deployment of LCTs.

Storymap



Summarises the local energy flows of the case study local area.

Dashboard

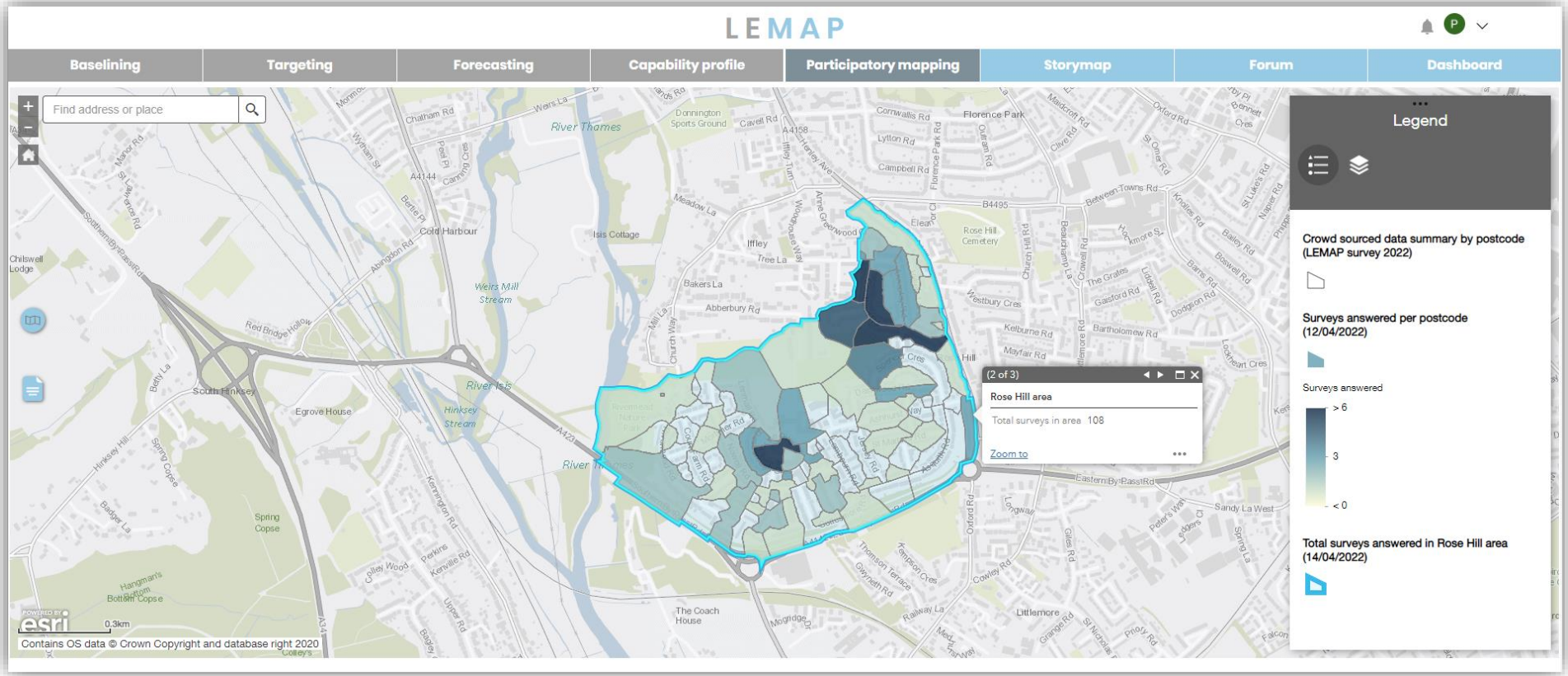
Shows local area energy information by postcode.

Forum

Encourage communication between users of LEMAP and project stakeholders.

4 technical elements (for project stakeholders)

LEMAP has been organised around four **technical** and four **engagement** elements:



Interactive Theory of Change

Mike Fell and David Shipworth

The Interactive EnergyREV Theory of Change

Showing necessary conditions for selected outcomes from smart local energy systems

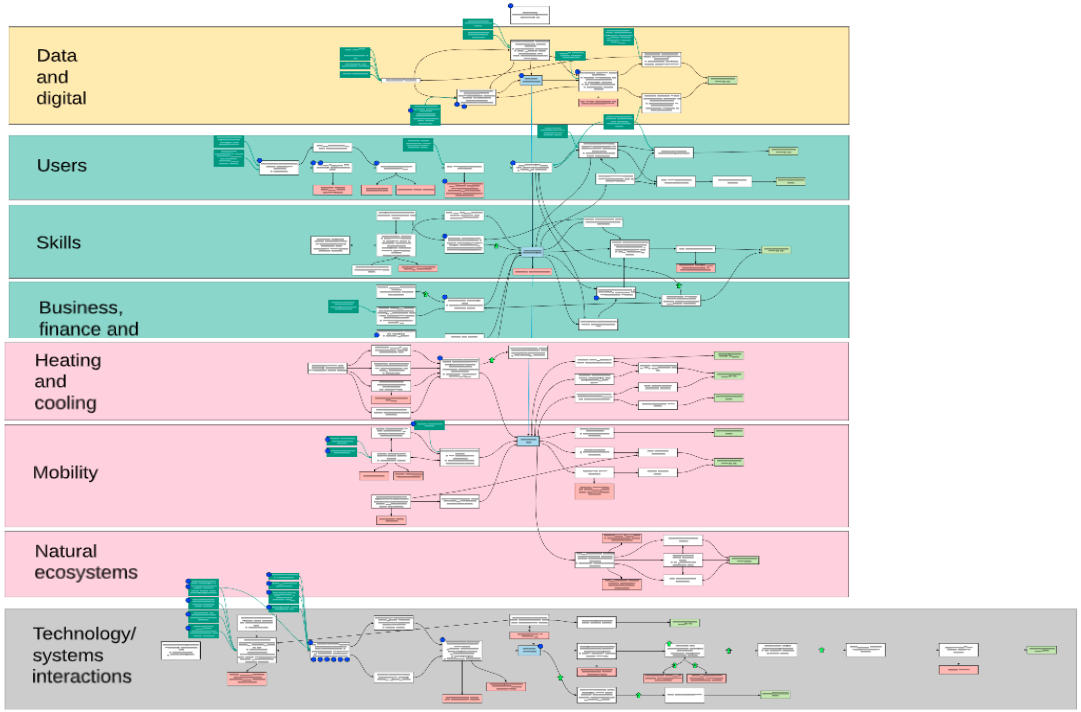
Click here to toggle between summary/ detailed version

Click here to toggle metrics

Click here to toggle policy/ governance layer

Click here to SHOW all evidence

Click here to HIDE all evidence



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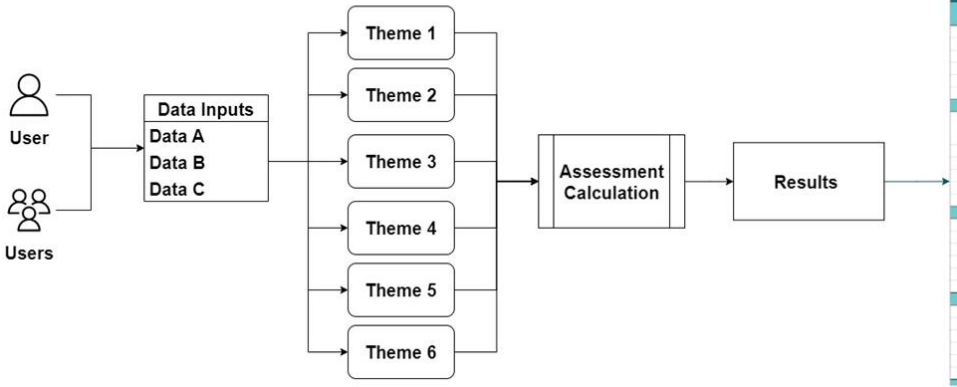
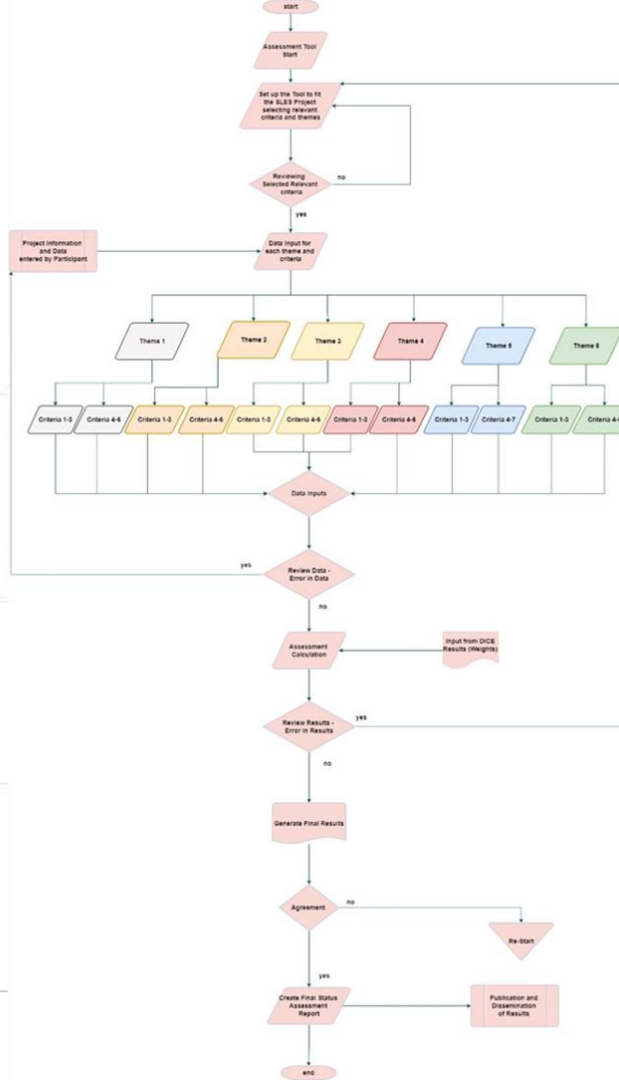
Smart Local Energy System Multi-Criteria Assessment Tool

Bjarnhedinn Gudlaugsson, Christina Francis, Camilla Thomson and David Ingram

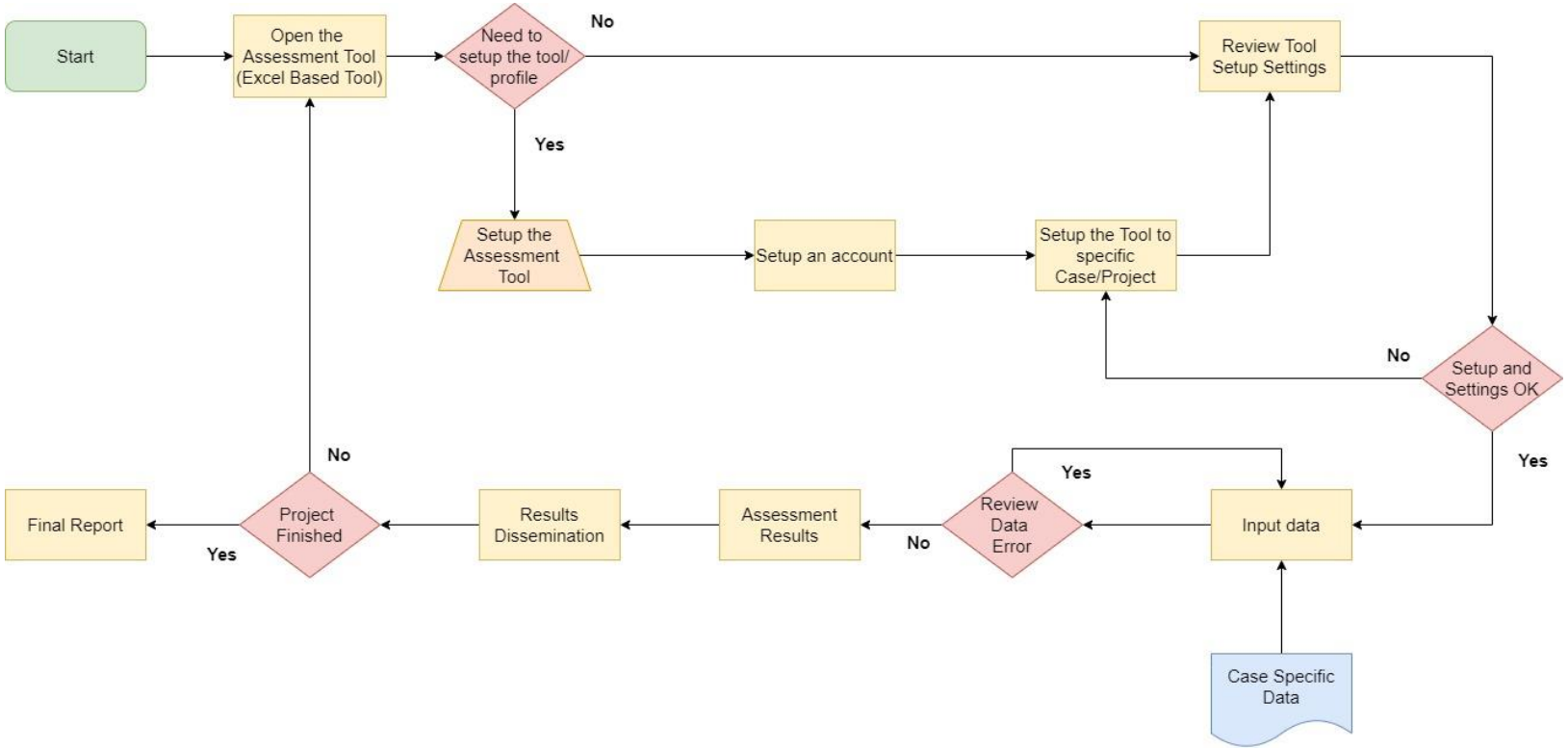
Application of the Tool



Objective Score	Current Score	Achieving Objective Difference (%)	
0.824	0.412	-0.412	-41%
0.975	0.78	-0.195	-20%
0.764	0.382	-0.382	-38%
0.756	0.378	-0.378	-38%
0.528	0.264	-0.264	-26%
0.44	0.264	-0.176	-18%
0.532	0.532	0	0%
0.372	0.186	-0.186	-19%
0.925	0.555	-0.37	-37%
0.52	0.26	-0.26	-26%
0.488	0.122	-0.366	-37%
0.444	0.333	-0.111	-11%
0.892	0.446	-0.446	-45%
0.856	0.642	-0.214	-21%
0.62	0.31	-0.31	-31%
0.592	0.296	-0.296	-30%
0.39	0.26	-0.13	-13%
0.39	0.13	-0.26	-26%
0.932	0.699	-0.233	-23%
0.985	0.394	-0.591	-59%
0.8	0.48	-0.32	-32%
0.76	0.304	-0.456	-46%
0.536	0.268	-0.268	-27%
0.496	0.248	-0.248	-25%



Flowchart –Users Flow



Expected Value Adding Factor(s) to projects

Project Stakeholders will be able to:

Identify the potential barriers concerning their project that are limiting and impacting the development of SLES.

To compare current status to past or future status to gain a better insight into the SLES-project progress.

Overall expect value-adding factors:

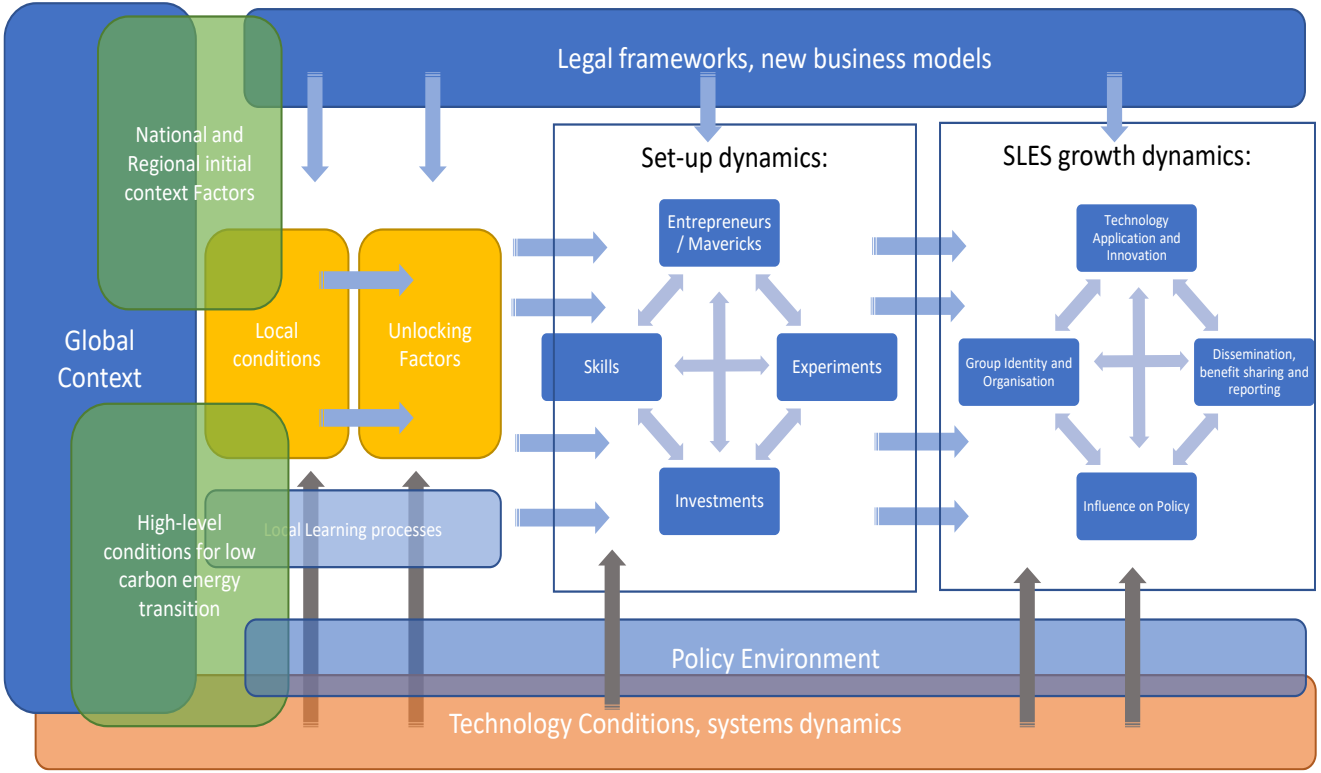
Improved decision-making and policy design to enable wider adoption of SLES.

Data and information generation that can be used to assess the SLES project in relation to the objective and aims of the project, e.g. the PFER programme.

SLES Pathway Tool

Damie Emmanuel-Yusuf and Walter Wehrmeyer

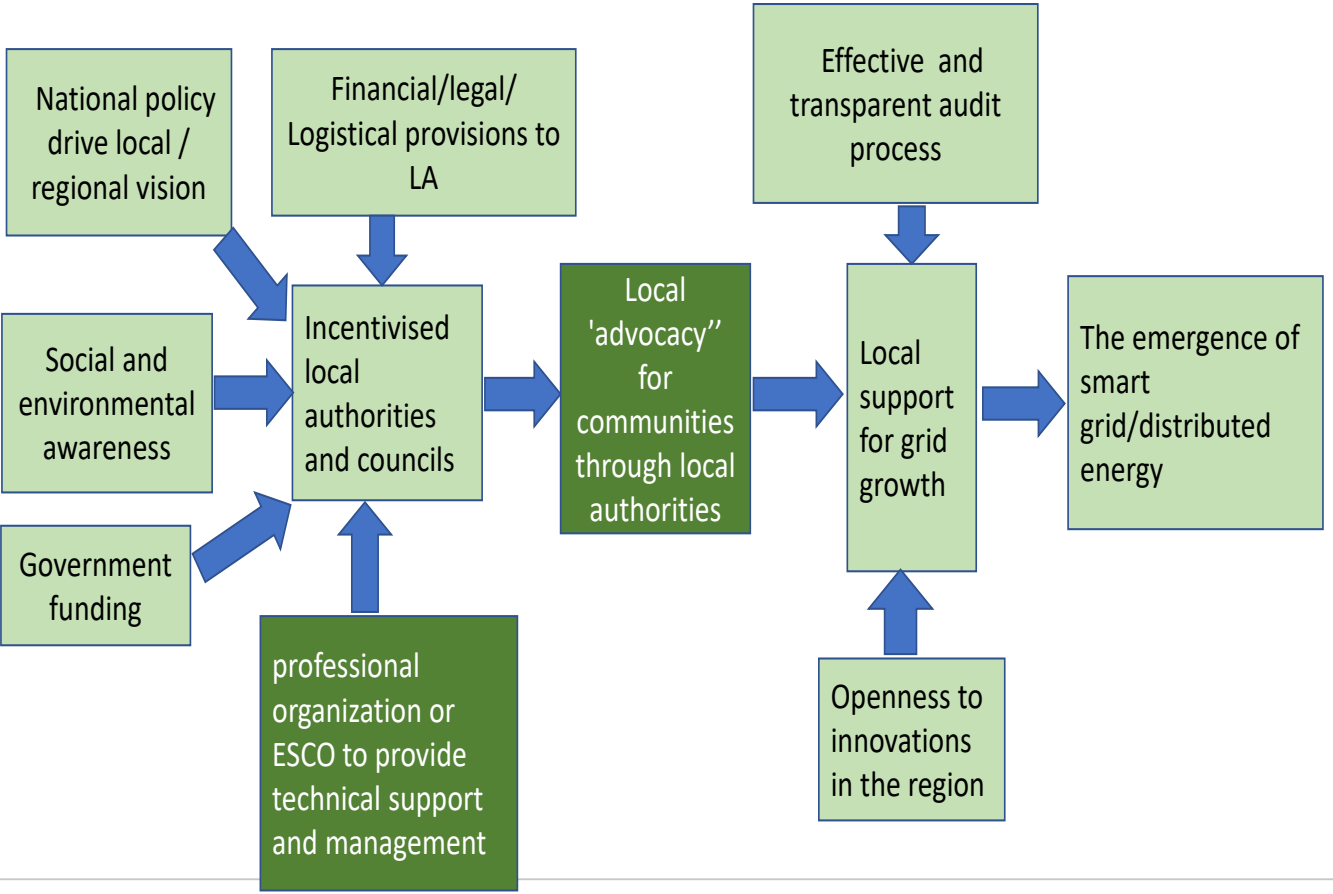
The Transition Map and Pathways



- 2 dominant SLES set up pathways: *'Local Authority'* and the *'Case study' pathways.*

- 2 dominant upscaling pathways: *'Economic Competitiveness' and 'Grid Technology' pathways.*

SLES Pathway tool (Local Authority Pathway)

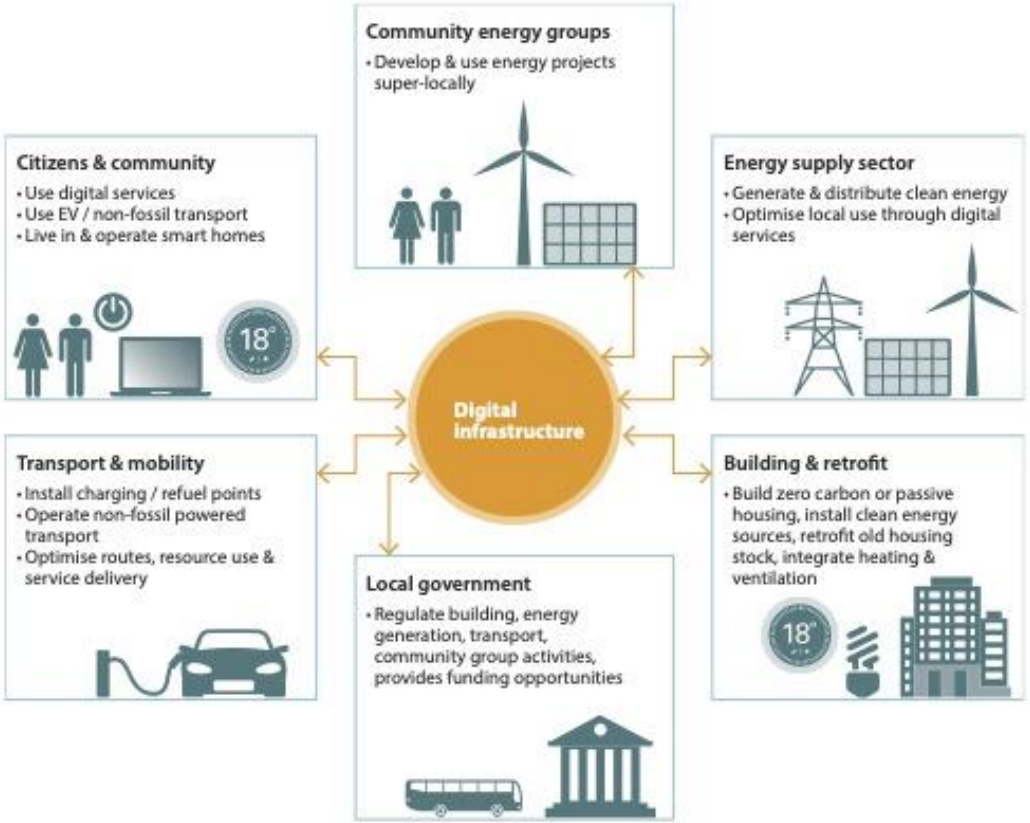


- Identifies underlying barriers and drivers of each step in the pathway.
- Highlights succinct actions to overcoming the barriers and facilitating the drivers based on key context factors.
- Evidence is gathered from various sources: EnergyREV research, SLES practitioner interviews, case studies and expert workshops.

Skills for Smart Local Energy: Obstacles and Drivers to Transition

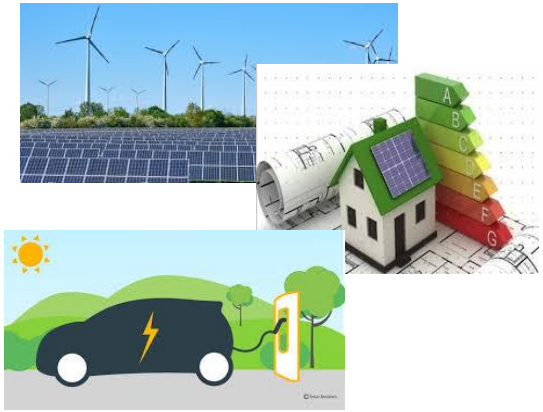
R. Chitchyan, C. Bird, R. Ferrero, Z. Fan

Net Zero Transition: System of Systems



What Skills Are Needed within and Across Sectors

Skills Per Sub-System



Skills Across Sub-Systems

ICT

Distribution

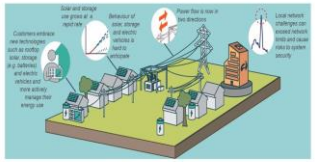
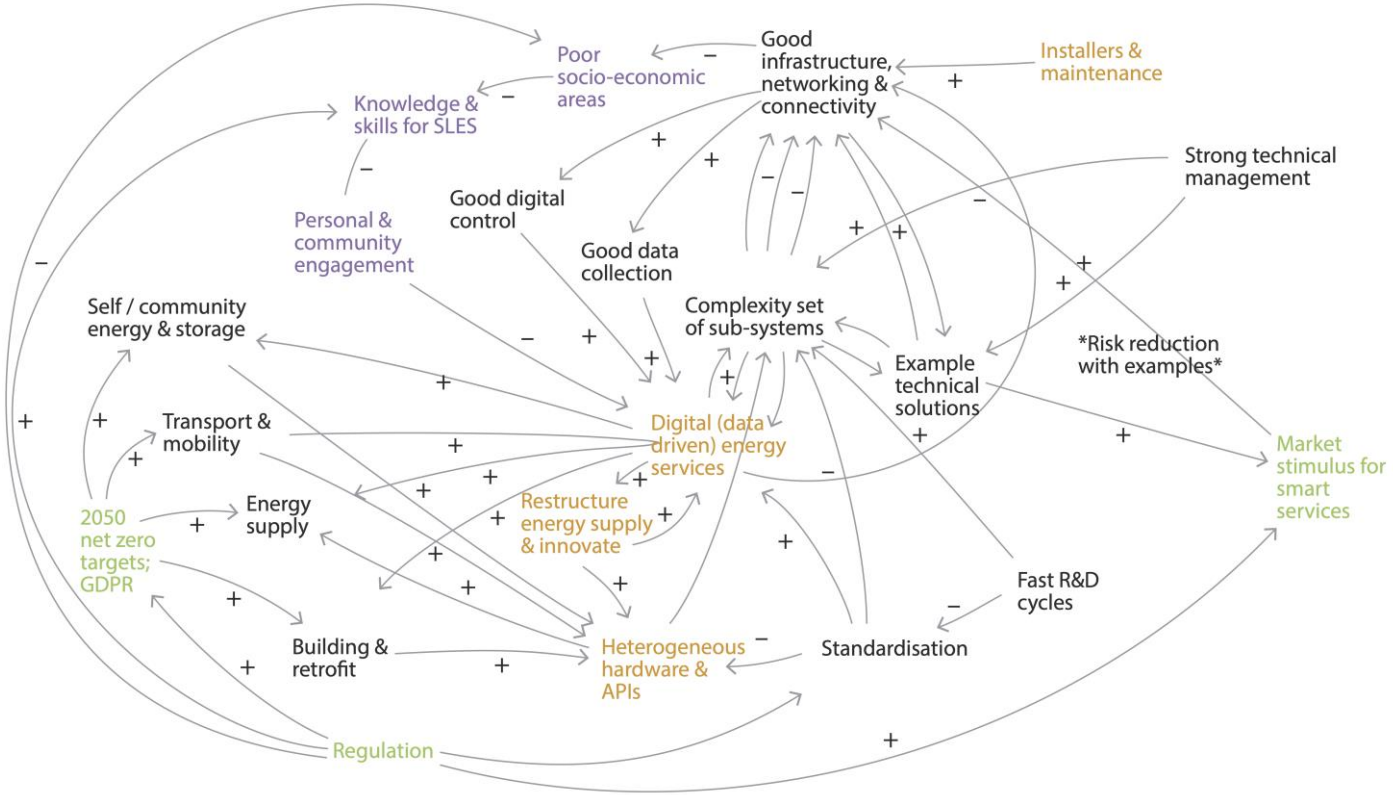


Figure 1. Australia's transforming electricity landscape

Policy & Regulation

People

Observations on SLE SoS Transition



EnergyREV Insights & Impact

8th – 9th September 2022

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Closing Plenary

Professor Stephen McArthur
Associate Principal and Executive Dean of Engineering,
University of Strathclyde
& Principal Investigator, EnergyREV

EnergyREV Insights & Impact

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