EnergyREV

Energy-Smart Places

Insights from the Research and the Challenges Ahead

14th – 15th March 2023

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Delivering Digitalisation to Unlock Energy-Smart Places

Stephen Haben, Energy Systems Catapult (chair)

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Delivering digitalisation to unlock energy smart places.

WP 1.1 Panel

15th March 2023

EnergyREV

INDUSTRIAL STRATEGY

UK Research and Innovation

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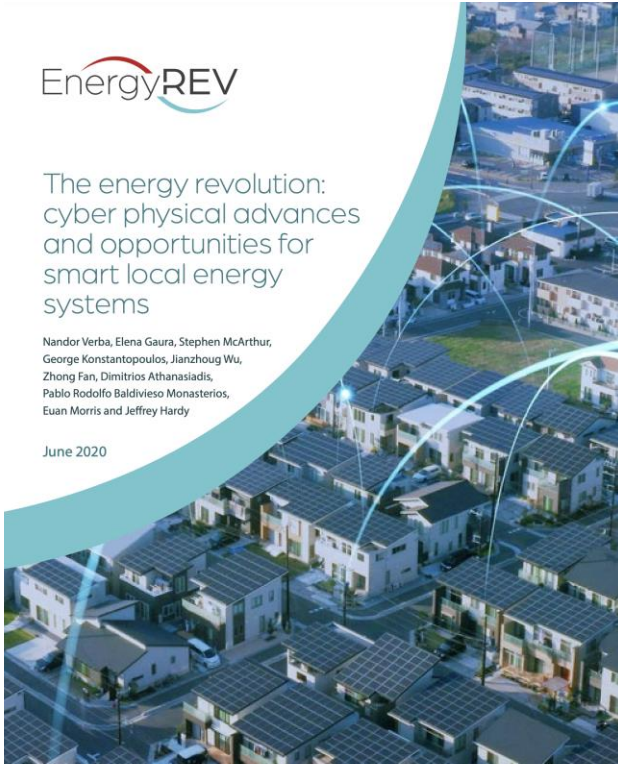
Insight 1: What distributed and flexible architecture elements are needed in a local energy system?



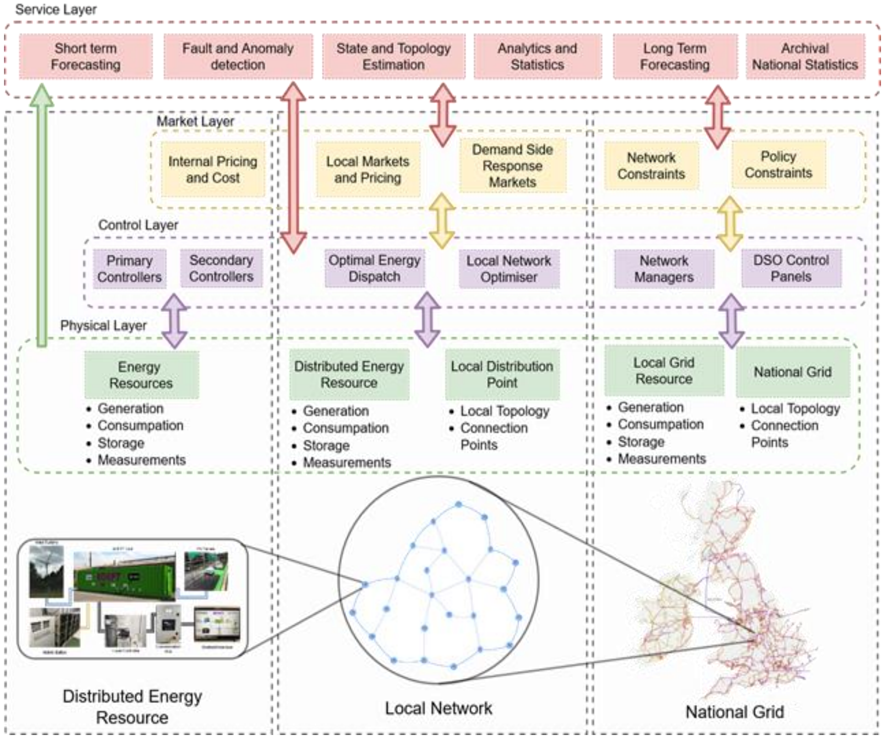
- All infrastructure and assets are fully described by data, resulting in a customisable energy system that can be tailored to consumer needs
- Predicts future behaviour, identifies faults and optimises other key performance metrics
- Energy markets and controllers are interoperable to meet local demand and encourage responsible innovation
- Monitoring and analytics work together to provide a detailed view of the system to optimise the operation and drive markets
- Uses data to unlock system and consumer benefits to offer flexibility, resilience and costs in the most efficient way.
- Allows for distributed and P2P energy markets that provide flexibility, demand-side response markets for individuals to choose how and which market to join

Insight 1: AI, Machine Learning and Energy Systems

Industry and Policy makers yet to maximise the benefits of AI, Machine learning and Cyber-physical system energy design

Why?

- **Processes**: Contractors and companies still dependent on proprietary and legacy protocols and systems
- **Cost:** AI-based decision-making and optimisation and Machine learning come at a high computational cost
- **Omissions in data**: Poor registration of energy assets means the UK Government Energy digital strategy estimates 10% of assets are not visible to the electricity system operator.



Insight 2: Energy data: gaps, challenges, actors and networks

INDUSTRIAL STRATEGY

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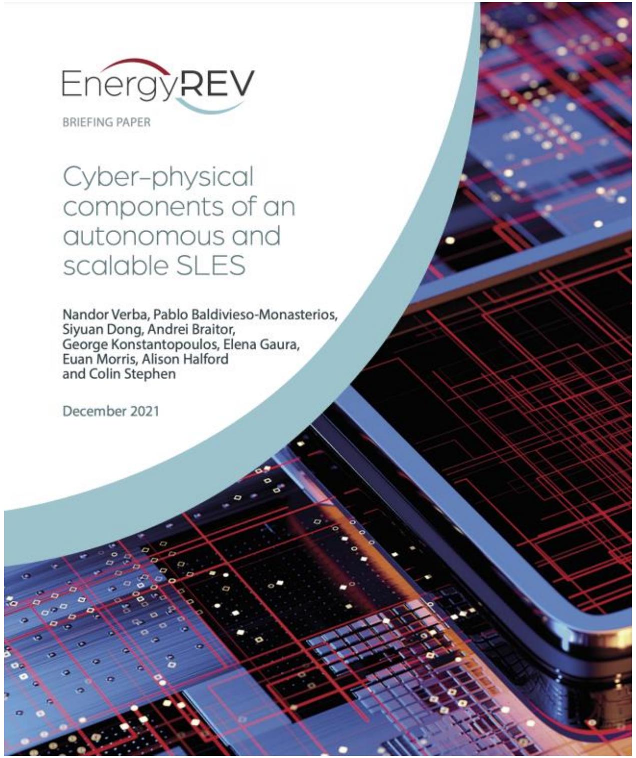
Data collected from 55 participants from 26 different institutions/organisations, academic and industry

Skills Gap: Difficult to find the right combination of digital scientists, energy specialists and engineering talent to deliver community-centred energy systems.

Data Access: The low visibility and accessibility of data reduces the ability of innovators, especially SMEs, to break into the energy sector in order to create new products and technologies.

Transparency: Lack of transparency of assets, their operation and how they interact with each other at local and national levels increase the risk to system stability.

Structural inequality in the allocation of resources: An inequality of influence/access/funding – i.e. large companies vs small start-ups. Companies that own or have access to Energy System Data are already commercially benefiting, creating a monopoly.



Concerns around societal safety, responsibility, privacy and liability

Regulations vs Ethics: While there is a recognition that regulation and policy around energy data have improved, there is a lack of organised space within the industry and within organisations specifically to discuss potential ethical issues.

Fragmentation: Rather than collaborative, data-driven solutions, a fragmented approach to data management results in developing standards and approaches that are not coordinated or interoperable.

Policy: lack of vision/ambition around funding, over/under-regulated that impacts on innovation.

Design: Design protocols around ethical considerations, practices, informed consent, and privacy are unevenly applied across the energy sector, impacting end-user trust.

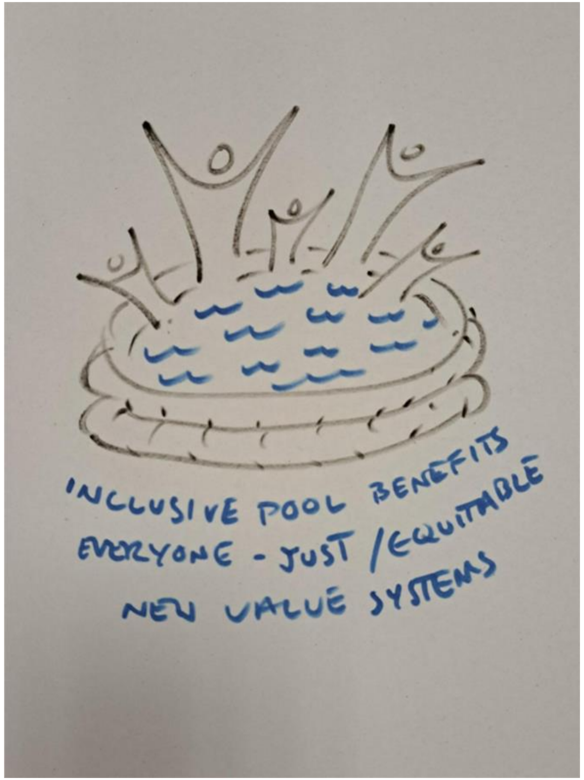
Data Sharing: Insights from Industry

'Feels as though the business mindset has gone from our people are our greatest strength to our data is our dragon's hoard of treasure. And even if we are not going to do anything with it, we don't want to let anyone else do it'.
(Data Manager).

' If digitalisation was working for us that's what it would be doing offering inclusive benefits.

We would be more connected and more supported, truly supported by the resources in a natural and good way'.

(Energy digital and data lead)



Insight 3: Architectures

Flexible, Scalable and Reusable Architectures

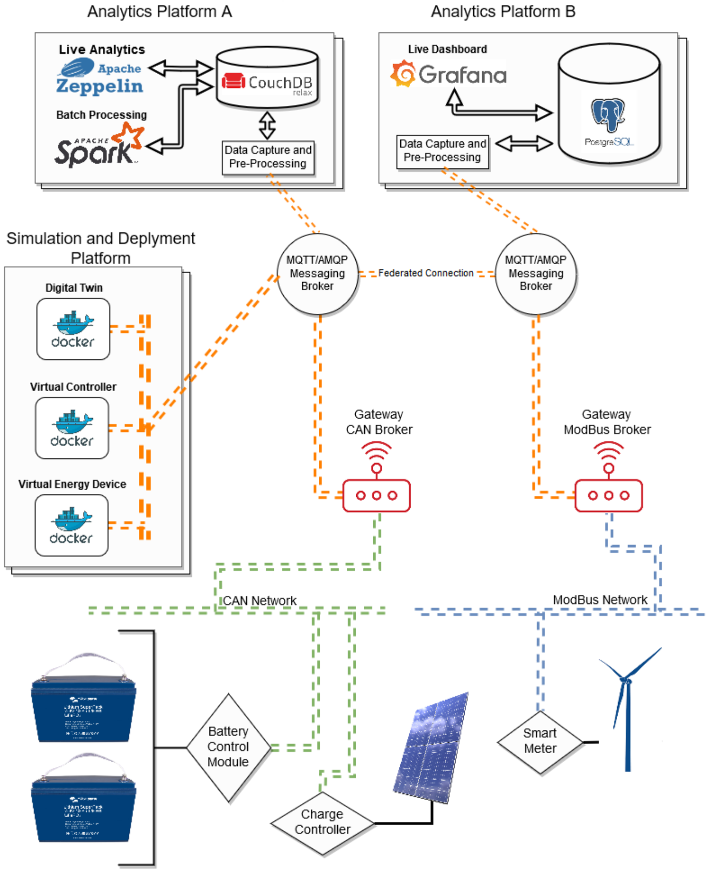
Flexibility - Throughout their lifecycle Smart Local Energy systems (SLES) will be subject to upgrades in:

- devices and protocols
- digital and physical extensions
- increase in the system size and the variety of energy vectors, sources and consumers

Scalability - Easier and cheaper upgrades and updates through:

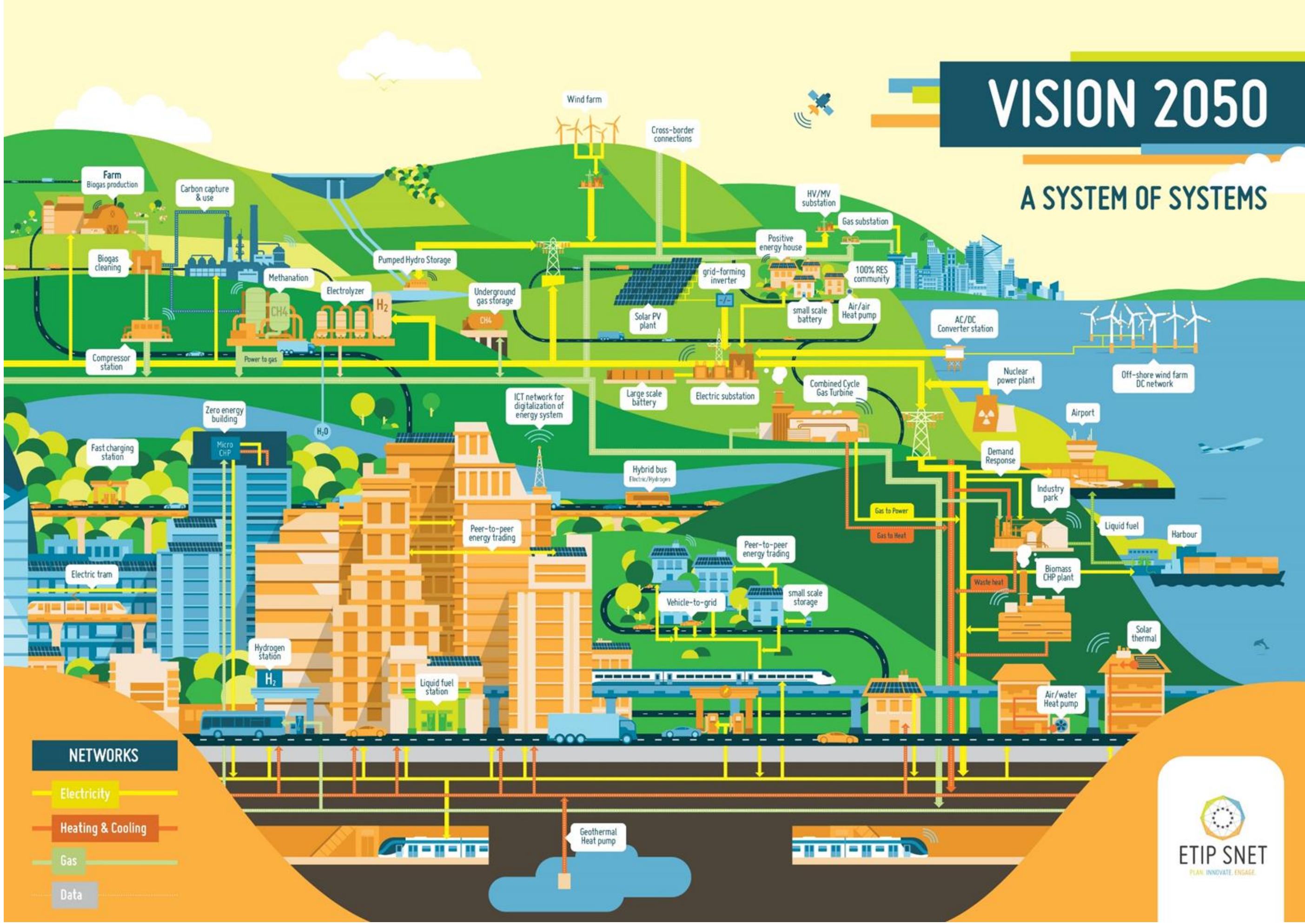
- more flexible data and information approaches
- easily adaptable control

Reusability - Easier translation to new use cases/locations



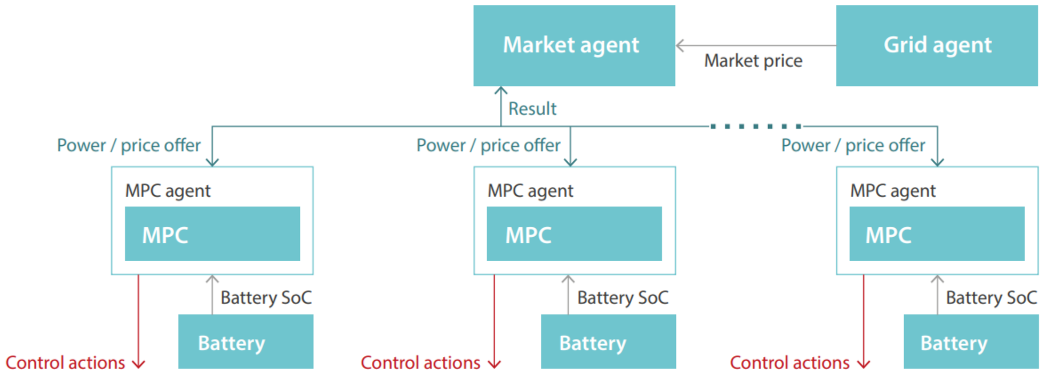
European Technology & Innovation Platforms (ETIP)

Smart Networks for Energy Transition (SNET)



Insight 4: Plug and Play

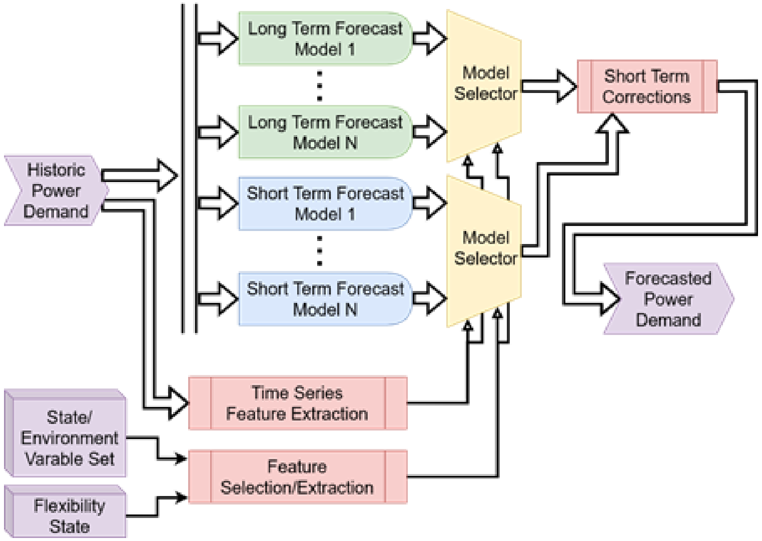
- Flexibility: additional functionalities were added to existing system
- Scalability: deployment and testing of multiple units was possible withou the whole system requiring reconfiguration
- Reusable "wrappers" allow for other controllers to take part in electricity trading
- The location of the units did not matter, so deployment would be possibl regardless of location



Plug and Play

Plug and Play Forecasting for Energy Systems

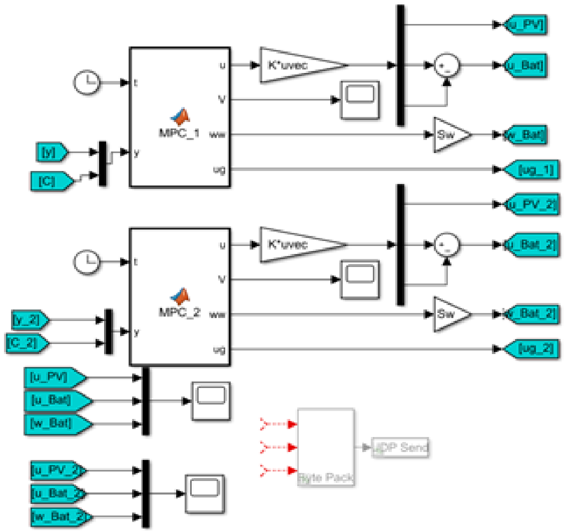
Multivariate forecasting enables flexibility and robustness while improving quality of service and reducing costs.



Plug and Play Trading and Control

Intelligent Agents can respond dynamically to environmental changes.

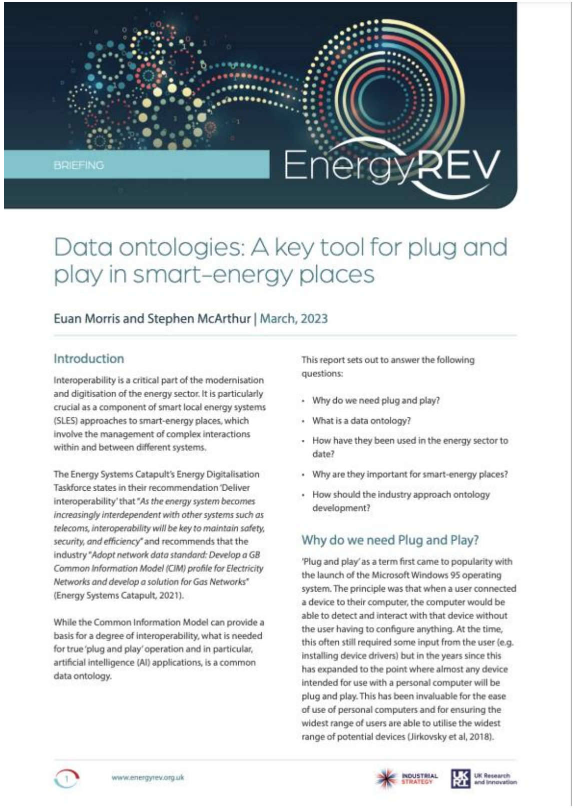
Distributed Controllers can improve **costs** and enable optimal energy dispatch.



Insight 5: Enabling Interoperability and Autonomy

- **Ontology:** “a formal, explicit specification of a shared conceptualisation” (Malik et al, 2015).
  - an abstract logic model created from the identified aspects of the domain being modelled
  - shared means the model captures agreed upon knowledge,
  - explicit means that the concepts and their relationships are defined
  - formal means machine-readable, or capable of being understood and processed by computers (Atkinson et al, 2006).

- The machine-language for exchange and co-ordination betrween data, software, digital and AI systems



BRIEFING

EnergyREV

Data ontologies: A key tool for plug and play in smart-energy places

Euan Morris and Stephen McArthur | March, 2023

Introduction

Interoperability is a critical part of the modernisation and digitisation of the energy sector. It is particularly crucial as a component of smart local energy systems (SLES) approaches to smart-energy places, which involve the management of complex interactions within and between different systems.

The Energy Systems Catapult's Energy Digitalisation Taskforce states in their recommendation 'Deliver interoperability' that "*As the energy system becomes increasingly interdependent with other systems such as telecoms, interoperability will be key to maintain safety, security, and efficiency*" and recommends that the industry "*Adopt network data standard: Develop a GB Common Information Model (CIM) profile for Electricity Networks and develop a solution for Gas Networks*" (Energy Systems Catapult, 2021).

While the Common Information Model can provide a basis for a degree of interoperability, what is needed for true 'plug and play' operation and in particular, artificial intelligence (AI) applications, is a common data ontology.

This report sets out to answer the following questions:

- Why do we need plug and play?
- What is a data ontology?
- How have they been used in the energy sector to date?
- Why are they important for smart-energy places?
- How should the industry approach ontology development?

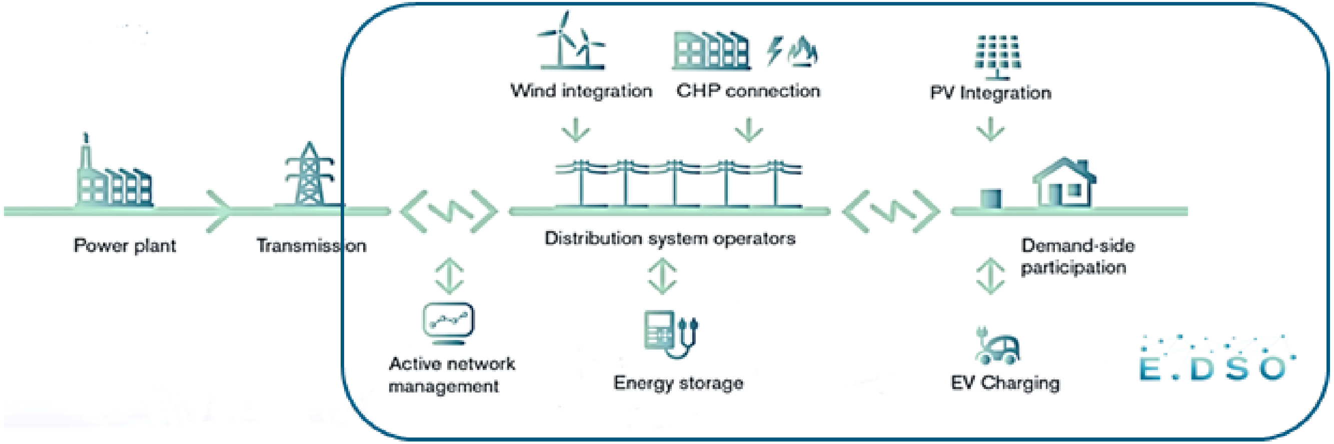
Why do we need Plug and Play?

'Plug and play' as a term first came to popularity with the launch of the Microsoft Windows 95 operating system. The principle was that when a user connected a device to their computer, the computer would be able to detect and interact with that device without the user having to configure anything. At the time, this often still required some input from the user (e.g. installing device drivers) but in the years since this has expanded to the point where almost any device intended for use with a personal computer will be plug and play. This has been invaluable for the ease of use of personal computers and for ensuring the widest range of users are able to utilise the widest range of potential devices (Jirkovsky et al, 2018).

1 www.energyrev.org.uk

Energy Smart Places & Operational Systems

- Real-time cyber-physical operation of energy system requires continual evolution
- Self-organisation and autonomy
  - Powered by data, AI, plug & play capabilities and ontologies
  - End use, intelligence, data and architectures need to converge
  - Systems thinking, not innovation alone



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Provocations

Provocation 1: Energy Data

Energy data will never be free and open, while big corporations harness their value for themselves and with little incentive to share data

Provocation 2: Architectures

Fix the architecture first – adding smart solution to a dumb infrastructure is a recipe for disaster.

Provocation 3: AI

AI use in Smart Local Energy Systems is limited because of insufficient skills to deal with an overly complex system that is difficult to maintain.

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The Role of Energy-Smart Places in the UK's Net Zero Future

David Shipworth, UCL (chair)

Thomas Morstyn, University of Edinburgh

Jess Britton, University of Edinburgh

Louise Alter, Equans

Stuart Fowler, National Grid ESO

Jeff Hardy, Imperial College London

Role of Energy Smart Places in Net-Zero: *Multi-Scale Market Design*

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THE UNIVERSITY of EDINBURGH School of Engineering

Net-Zero Power System Transition

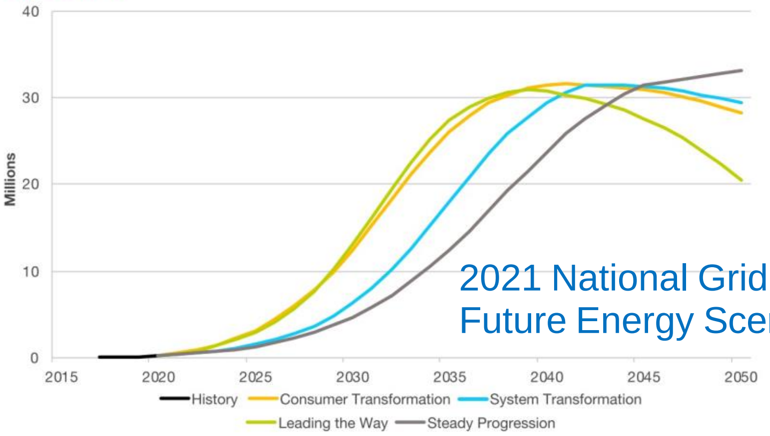
Major power system trends:

- Distributed renewable generation
- Electrification of transport & heating
- Consumer-level ICT infrastructure

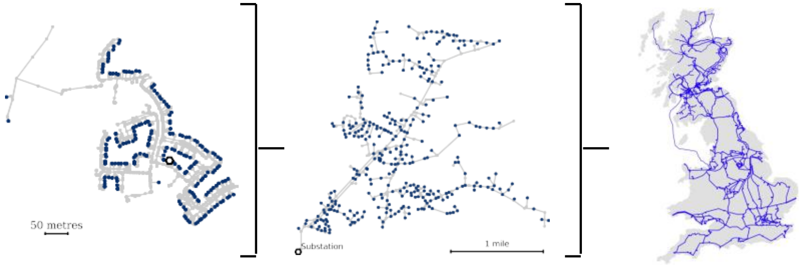
New challenges for planning & operation:

- Millions of market participants
- Embedded in distribution networks
- New sources of uncertainty

Figure CV.35: Number of BEV cars on the road



2021 National Grid ESO Future Energy Scenarios



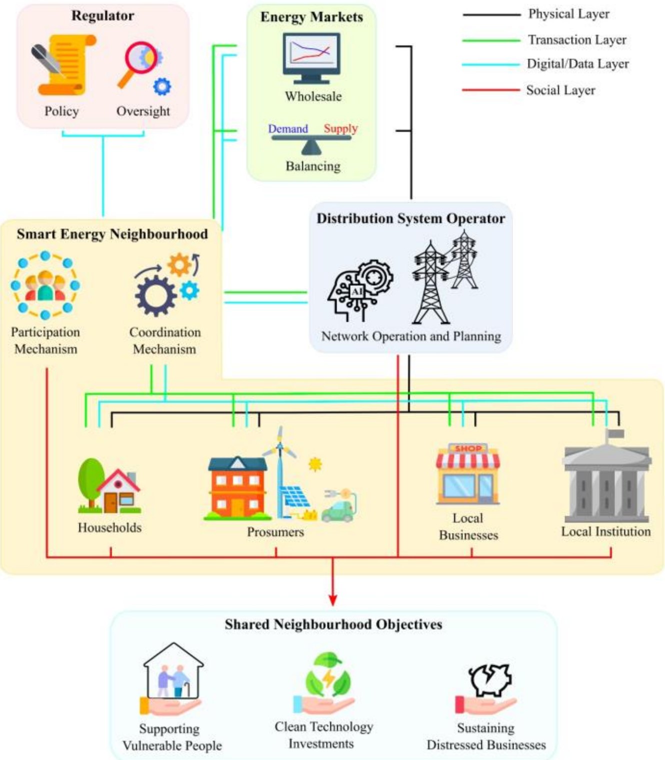
Residential Distribution

Primary Distribution

National Transmission

Smart Local Energy Systems

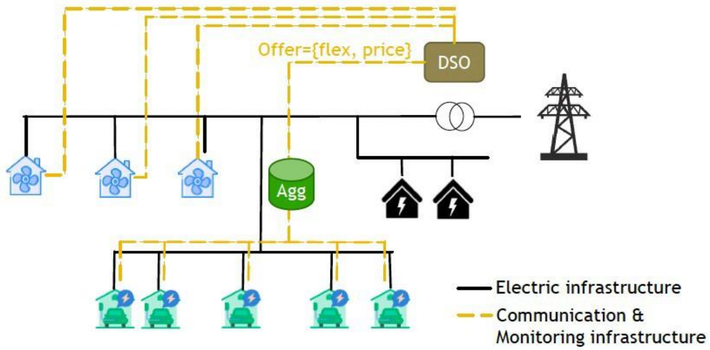
- Local communities share physical infrastructure and social relationships
- Can be augmented by *data* and *market* layers
- Opportunities for value to be created:
  - Data layer supporting coordinated energy system planning and operation
  - Market layer to align incentives between stakeholders
  - Social layer supporting cooperation around shared community objectives

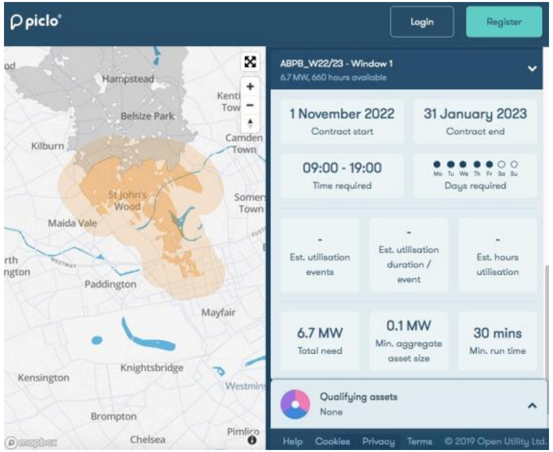


Savelli, Morstyn, "Better Together: Harnessing Social Relationships in Smart Energy Communities", *ERSS*, 2022

Emergence of Local Flexibility Markets

- An important step towards this is the emergence of local flexibility markets
- New opportunity to *incentivise* demand-side flexibility to enhance system operation
- Now being trialled by all DNOs
- Seeing significant growth: 3.7 GW tendered between 07/21 and 07/22
  (up 31% year on year)





Value of Local Flexibility Markets for the Scottish Borders

Scottish Borders:

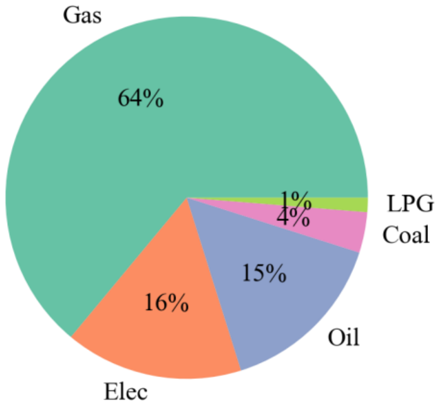
- Population: 115k
- Fuel poverty rate of 62% (2022 prices)

Heat-pumps replacing non-gas heating:

- Reduce fuel poverty rate to 53%

Value of local flexibility markets to 2030:

- Reduce heat-pump related network upgrade costs by £4.1m (14%)
- Reduces EV related network upgrade costs by £26m (13.7%)
- Increased hosting capacity for wind by 72 MW (22.6%) and solar by 84 MW (22%)



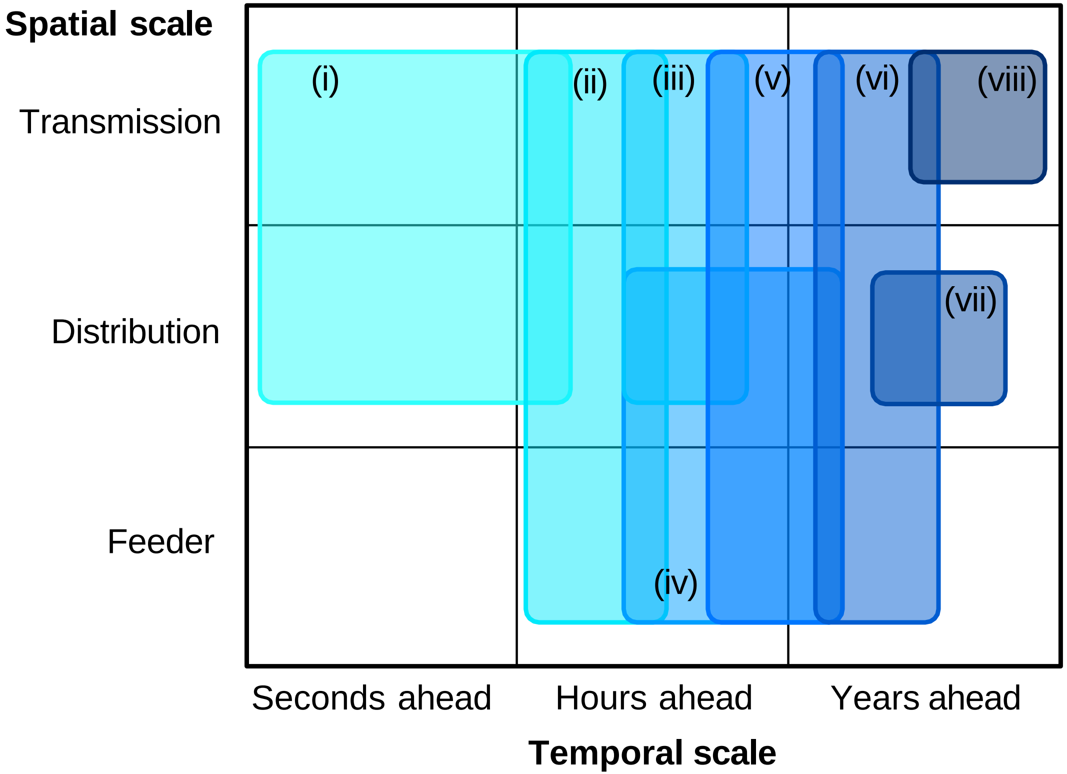
Heating technology mix in the Scottish Borders.

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", 2023

Potential Value of Local Markets Across Temporal and Spatial Scales

Categories of Value:

i. Increasing system reliability and preventing blackouts
ii. Reducing renewable curtailment
iii. Reducing losses
iv. Supporting local economies
v. Reducing energy poverty
vi. Incentivizing DER adoption
vii. Deferring distribution upgrades
viii. Deferring generation and transmission upgrades



Value of National-Scale EV Coordination

UK all new cars/vans fully zero emission from 2030

With 26m private electric vehicles:

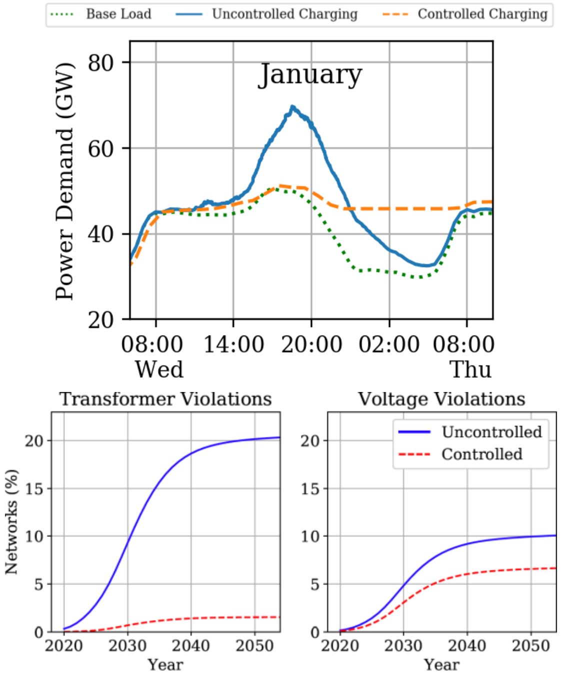
- Need 8 GW additional generation & transmission capacity
- Reinforcement for 28% of distribution feeders (approx. 300k)

With "smart charging":

- No increase in aggregate demand
- Reinforcement for only 10% of distribution feeders

Similar story for:

- Solar/wind + battery storage
- Electrification of heat



Crozier, Morstyn, McCulloch, "The opportunity for smart charging to mitigate the impact of electric vehicles on transmission and distribution systems" *Appl. Energy*, 2020

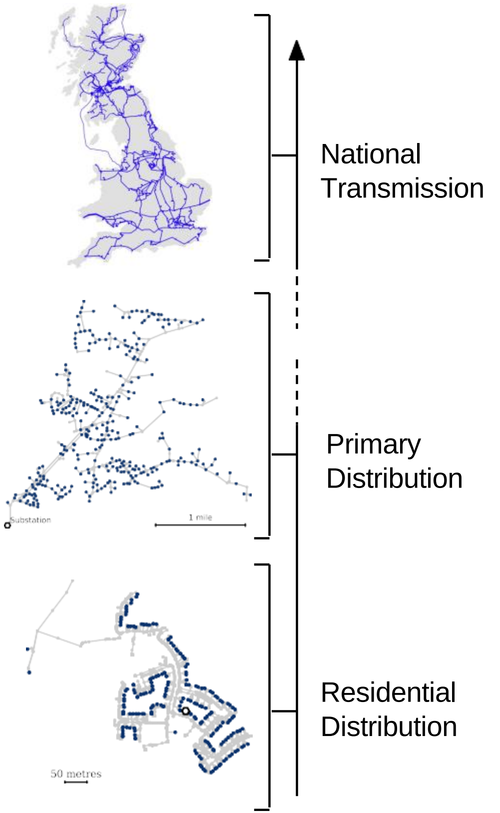
Challenges for Scaling Up Local Flexibility Markets

Scale-up: Increasing density of grid-edge devices

Scale-out: Deploying local markets across the system

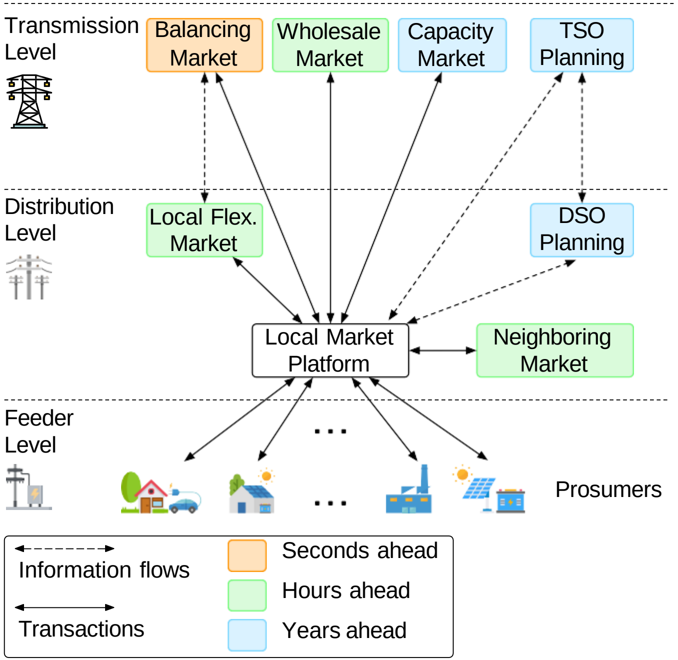
Challenges:

- Managing uncertainty without excessive conservatism (e.g. flexibility from EVs, heat-pumps)
- Managing constraints and flexibility services between transmission and distribution
- Risk of planning decisions undermining value



Multi-Scale Design Framework

- Our proposed approach is multiscale design with *multiresolution nesting*
- Ancillary service markets already have multiple temporal resolutions
- New design components:
  1) Uncertainty-aware markets
  2) Multi-scale flexibility aggregation
  3) Multi-market coordination mechanisms
  4) Tools for integrating local markets into network planning



T. Morstyn, I. Savelli, and C. Hepburn, "Multiscale design for system-wide peer-to-peer energy trading," *One Earth*, 2021

Uncertainty-Aware Local Flexibility Markets

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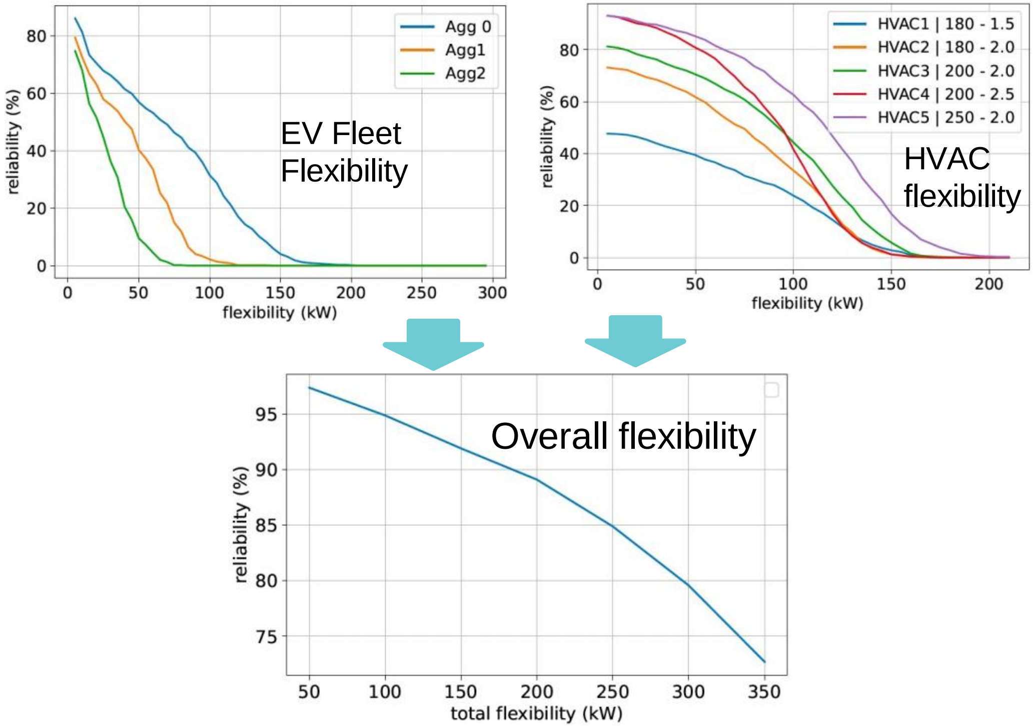
For a given flexibility product:

- Asset/aggregator optimisation to assess maximum flexibility
- Historical data used for scenario-based uncertainty quantification

DSO uses chance-constrained optimisation to select mix of offers:

- Flexibility uncertainty fit to a multivariate Gaussian distribution
- Convex (SOCP) optimisation formulation



Essayeh, Savelli, Morstyn "Optimal Selection of Contracts in Local Flexibility Markets under Stochastic Availability of Participants", 2022 (Submitted)

Multi-Scale Flexibility Aggregation

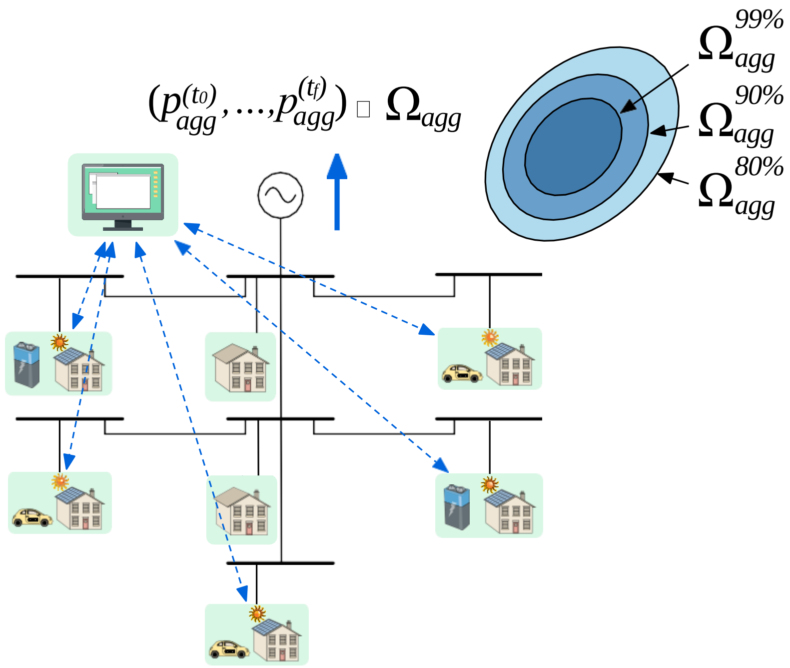
Aggregated distributed grid-edge devices can provide *upstream* flexibility

Available flexibility is *time-coupled* and *uncertain* due to:

- Weather-dependent renewables
- Behaviour-dependent flexible loads
- Network constraints

Historical feasible flexibility regions used to characterise jointly reliable probability distributions for *virtual battery* constraints

These can be easily integrated into scalable chance constrained dispatch



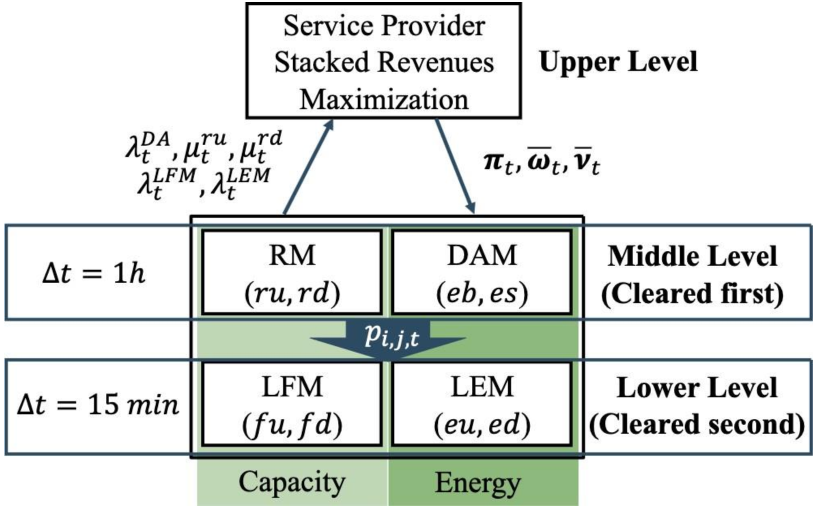
Zhou, Esayeh, Morstyn "Data-Driven Distributionally Robust Feasible Power Regions for Distributed Energy Resource Aggregation", 2022 (Submitted)

Multi-Market Coordination Mechanisms

Grid-edge devices can provide a range of local and national flexibility services

Multi-scale aggregation creates the opportunity for scalable multi-market bidding by aggregators:

- Tri-level optimisation integrates linked local and national market clearing into aggregator decision-making
- Opportunity to increase grid-edge device utilisation and displace generation



Paredes, Aguado, Esayeh, Xia , Savelli, Morstyn "Stacking Revenues from Flexible DERs in Multi-Scale Markets using Tri-Level Optimization", 2022 (Submitted)

Integrating Local Flexibility into Network Planning

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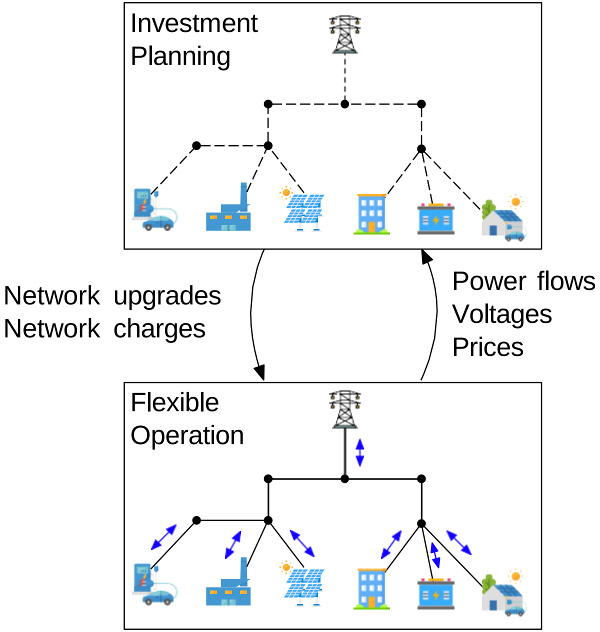
If network investment and local flexibility are considered separately:

- Over-investment in network infrastructure
- Under-utilisation of flexible resources
- Higher bills for consumers

Bilevel optimisation approach :

- System operator solves an 'upper level' investment problem accounting for 'lower level' operation
- Customers on traditional fixed retail pricing still benefit through lower network charges
- Currently extending from distribution to transmission level



I. Savelli, T. Morstyn, "Electricity prices and tariffs to keep everyone happy: a framework for fixed and nodal prices coexistence in distribution grids with optimal tariffs for investment cost recovery," *Omega*, 2021.

Conclusions

Multi-scale design and integration across spatial and temporal scales is increasingly valuable due to:

- Rapid adoption of distributed resources
- Availability of near real-time sensing & communications
- Need for reliable low-carbon flexibility (not just energy)

Challenges:

- Value of coordination is divided between stakeholders
- Data ownership, sharing and security
- Fairness in terms of the distribution of costs & benefits

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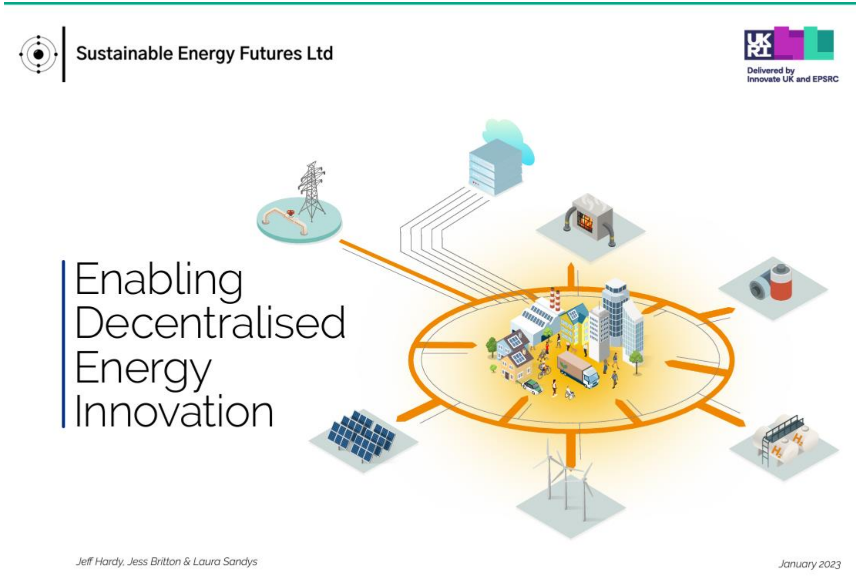
Energy smart places: barriers and enablers

Dr Jess Britton, University of Edinburgh

- IUK study on enabling DE (2023)
- UKERC research on policy and implementation of integrated local energy systems (ongoing)



UKERC
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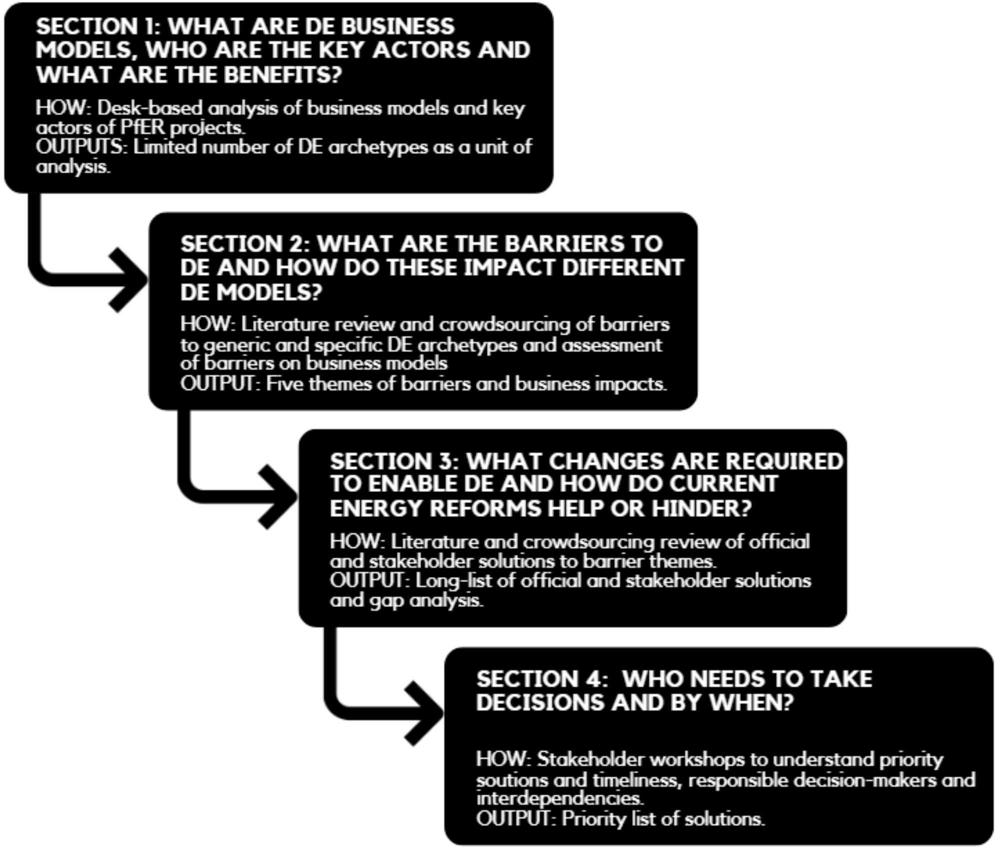
https://www.ukri.org/publications/enabling-decentralised-energy-innovation/
https://ukerc.ac.uk/research/local/
https://ukerc.ac.uk/publications/institutional-landscapes-for-local-energy-systems-mapping-england-scotland-and-wales/

IUK report: scope and approach



Barriers and impacts

Five barrier themes

1. Value of DE
2. Market rules
3. Limited innovation
4. Demand-side lacking
5. Overarching strategy

Green light

Soft stop

Hard stop

Barriers and impacts

Five barrier themes

1. Value of DE
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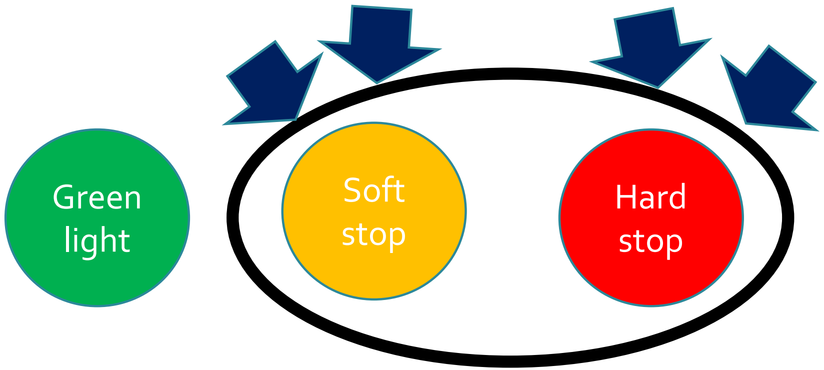


Changes to enable DE

A clear, holistic and inclusive vision for decarbonising the energy system

	REVIEW	STRATEGY	ENABLERS	REFORMS
Barrier 1 Realising value of DE	Review benefits and impacts of dynamic pricing on DSO operations Develop common methodologies for assessing local co-benefits	Clarity and responsibility and role of DNO/DSO in delivering decentralised energy FSO whole systems and local casting role		Implement REMA reforms and assess the impact on DE Demand-side reform in energy markets Clarify role, rights and access for energy communities
Barrier 2 Market rules and governance		CREATE AN OVERARCHING STRATEGY AND VISION FOR ENERGY SYSTEM DECARBONISATION	Deliver half-hourly settlement	Implement meter splitting Implement retail market reform
Barrier 3 Innovation support			Implement energy digitalisation taskforce recommentations	Create energy innovation zones
Barrier 4 Demand-side	Baselining and common methods for DSR/efficiency	Strategy for the future of the gas grid (including a hydrogen grid)		Establishment of a new body to manage infrastructure decommissioning
Barrier 5 Vision and scale	Review progress of the DSO transition Review of local markets (access, value streams, interactions)	Revise strategy and policy statement for Ofgem clarity on local and net zero	Require local or regional energy plans and integrate with network business planning	Implement heat network regulation and zoning Regulate waste heat (cross-regulation)

Key priorities

1. Vision for NZ energy
2. Whole system approach
3. Supplier hub reform
4. Flex-market standards
5. Roles and responsibilities
6. Definitions and agency

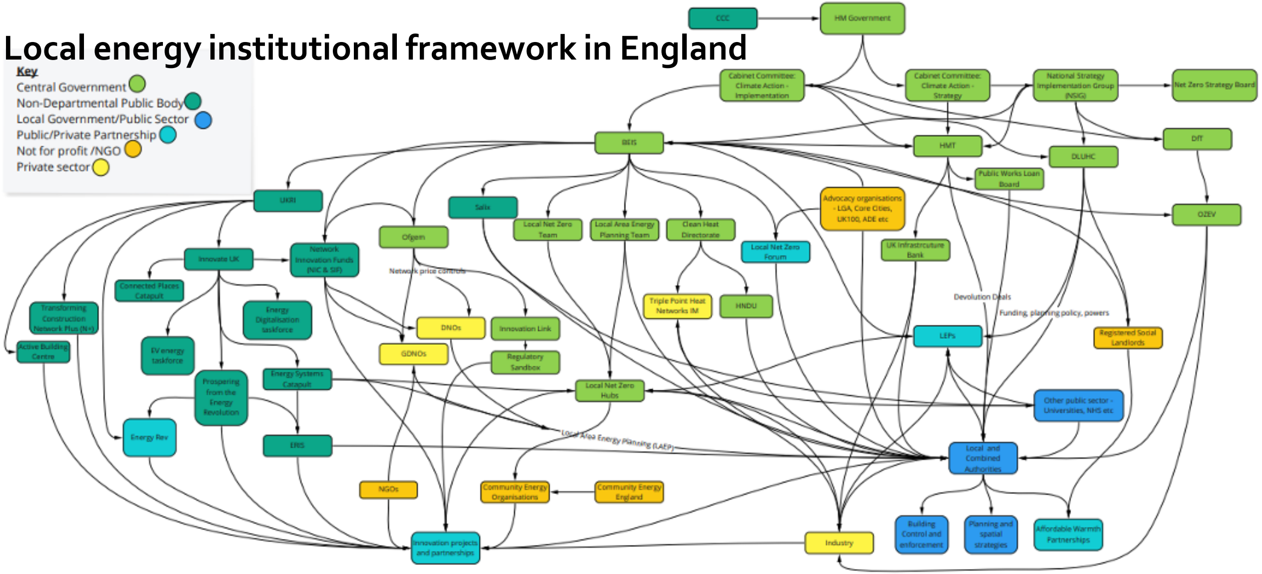
Cross cutting themes

Cross-cutting theme	Description
Centralised mindset	A linear, centralised logic pervades in the energy system. This logic permeates key decisions, such as the REMA programme and retail market reform, skewing them towards centralised and engineering solutions. The impact includes a lack of recognition of the benefits and role of distributed energy and a lack of valuation of demand-side solutions.
A lack of definition and agency of decentralised energy assets and actors	Decentralised energy assets, such as electric vehicles and behind-the-meter assets, such as batteries and heating systems, are not defined (in a legal or regulatory sense) in the same way as conventional assets, such as power stations.. The impact is that they can be invisible and undervalued in the energy system and not represented in discussions about rules changes.
Coordination, transparency, and clear roles	There is a lack of clarity on the role of decentralised energy and its customers and communities in the current and future energy systems. There is also a lack of attention on how the future energy system will be coordinated across scales, including between national, regional, local and individual asset scales. The impact is a lack of clear roles and responsibilities, for example, between DNOs and local actors on energy and spatial planning.
Risk-based approaches to managing change	The overly prescriptive nature of current licensing and innovation processes is a barrier to developing new, customer-centric business models. The impact is a regulatory regime which struggles to accommodate decentralised energy customer propositions.
Resilience	The definition and approaches to energy systems and climate resilience are not keeping pace with the energy system transition.
Recognising the diverse values of decentralised energy	The energy and wider system benefits of decentralised energy are not fully considered in energy systems decisions, particularly those by Ofgem and BEIS. The impact is that decentralised benefits are left off the table in decisions.

A shift towards multi-scalar coordination..?

- Local energy systems are diverse across technologies, scale, customers, delivery organisations (EnergyRev)
- Existing policy and deliver landscape is equally complex/chaotic
- But significant reforms in the offing…?
- Importance of a local energy planning and delivery mandate at the local level

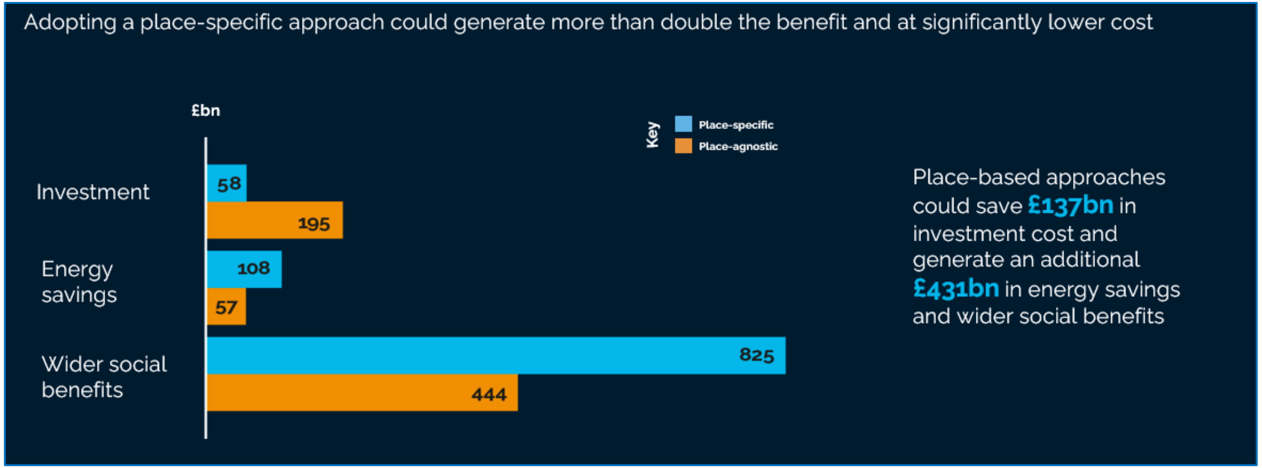
Local energy institutional framework in England



https://www.energyrev.org.uk/media/1457/energyrev_business_report_final_202010.pdf
https://ukerc.ac.uk/publications/institutional-landscapes-for-local-energy-systems-mapping-england-scotland-and-wales/

Beyond energy benefits…

getting the delivery of smart energy places right is likely to be central to ensuring a public mandate for rapid decarbonisation.



IUK with PWC, Otley Energy and University of Leeds, (2022) *Accelerating Net Zero Delivery: Unlocking the Benefits of Climate Action in UK City Regions*, https://www.ukri.org/wp-content/uploads/2022/03/IUK-090322-AcceleratingNetZeroDelivery-UnlockingBenefitsClimateActionUKCityRegions.pdf

Thank you!

- jess.britton@ed.ac.uk

- …with thanks and acknowledgements to Jeff Hardy, Laura Sandys, IUK, Jan Webb

The Role of Energy-Smart Places in the UK's Net Zero Future

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Jeff Hardy, Imperial College London

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Unleashing Smart-Energy Places Across the UK

Rebecca Ford, University of Strathclyde (chair)

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Energy Smart Places and People: Skills Development

Ruzanna Chitchyan

Researchers: C. Bird, T. Arueyingho

Co-Is: R. Ferrero, Z. Fan

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UK Research and Innovation

University of BRISTOL

EnergyREV

15-03-2023

Research Context

Bristol

City-Scale
- Over 20 projects
- 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

Where are the SLES skills?

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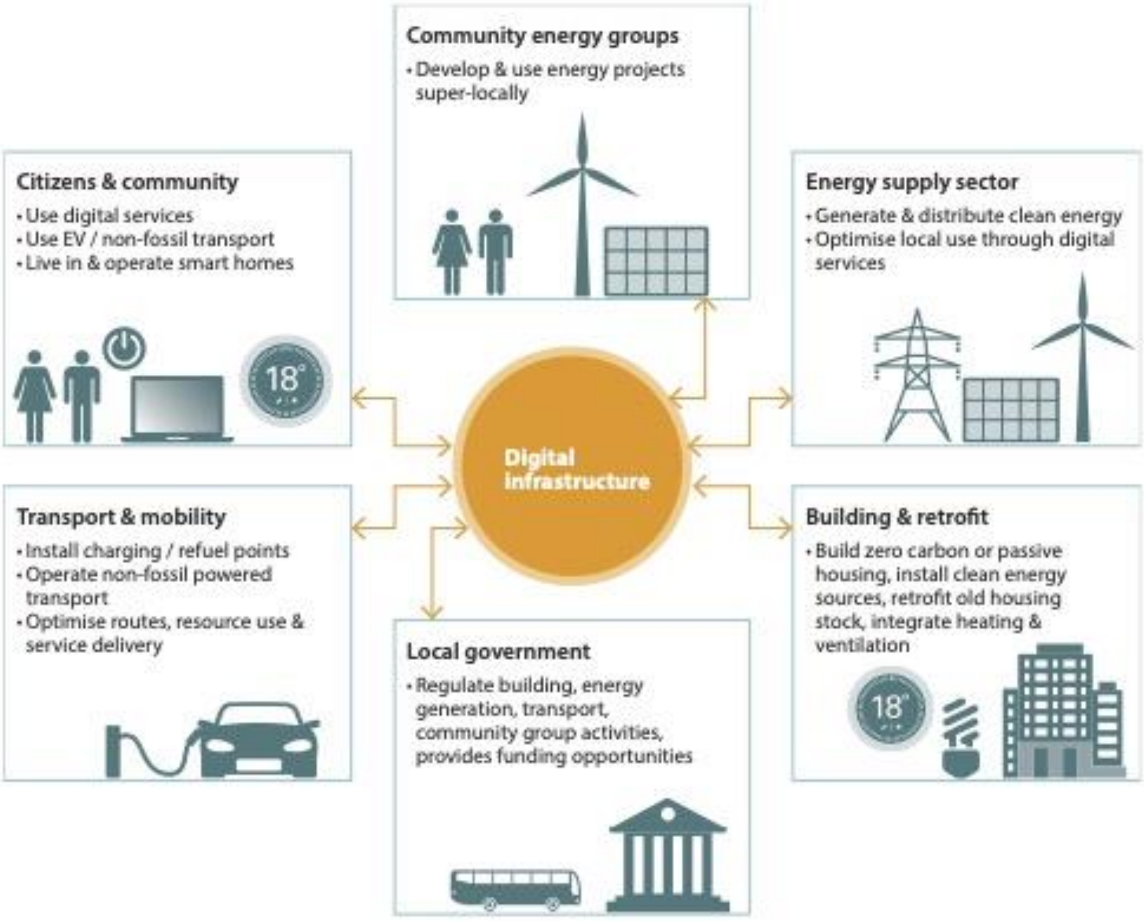
Place is a System of Systems

and

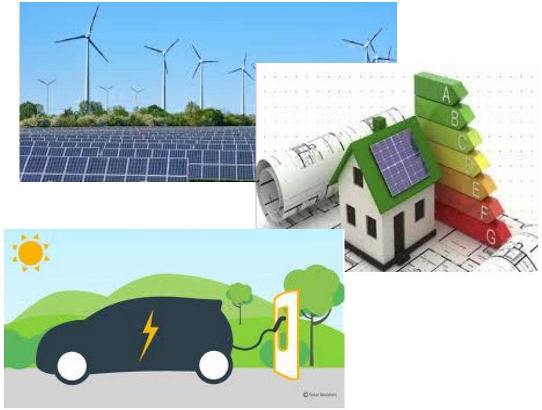
SLES runs through each sub-system



What are the SLES skills?

Example Subsystem: Energy Supply

Skills Per Sub-System



Engineering Skills
Software Engineering skills
Data Analysis and Machine Learning
Data Security
Systems Engineering …

Trades Skills
Installation **skills**
- *Heat Pump Installation*
- *Smart Meter Installation*
- *Gas boiler decommissioning …*

Construction
- *Trenching for Heat Networks…*

Managerial Skills
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*.
- *Financial modelling for the projects…*

Legal Skills
- *Contracts Preparation*
- *Regulation of Heat…*

Policy 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 …

Common Needs for all Sub-systems

All Sub-Systems

ICT

Distribution

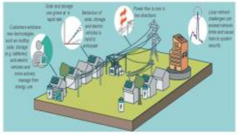


Figure 1. Australia's transforming electricity landscape

Policy & Regulation

People

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 Drives Careers in SLES?

Sector	SLES Career Progression Drivers
Community Energy	1. Consistent attendance of conferences and seminars and other com- munity events. 2. Volunteering at community activities
ICT	Continuous education in the form of postgraduate degrees e.g. in Business management and Computer science, or certifications such as ITIL Service Management foundation and Google Ads search
Transportation and Mobility	Continuous education and years of service.
Building and Retrofit	Continuous education (certifications and postgraduate degrees), years of service - learning from experience, and training events.
Local Authority	Predominantly continuous education in the form of obtaining post- graduate degrees and certifications. E.g., PRINCE2 Project management.
Energy Systems	Personal enthusiasm and drive. Certifications and years of service

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 [illegible]	[illegible]	x	x
Data Management and [illegible]	[illegible]	x	x
Application Developme[illegible]	[illegible]	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

Managerial Skills
Building Partnerships/Core Trusted Team
Procurem[illegible]
Cross-Insti[illegible] ...ent

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

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

Complexity-driven hybridisation

Data analytics/ Data science driven hybridisation (and Softwerisation)

Cross-domain hybridisation

What is Happening to Jobs and Training Needs?

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Agile Accreditation Framework for hybridised skills

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MSc in Data Science

APPROVED

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

MSc in Management Analytics

NOT APPROVED

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

APPROVED

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

Jobs for Net Zero

More

Skilled

More

Digital

Less Disciplinary

Siloed

More

Collaborative

Delivered through an Agile Qualifications Framework

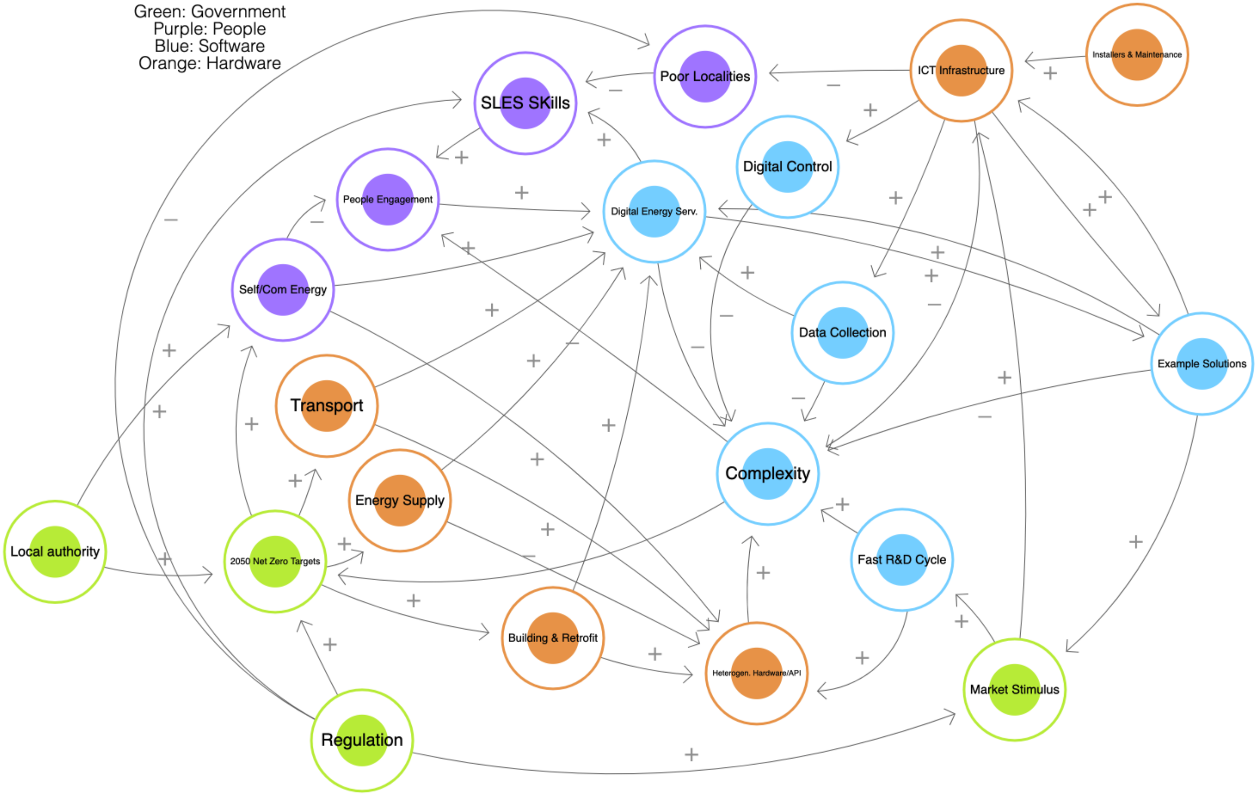
+

life-long-learning accreditation of newly acquired skills

What Do We See in Frontrunner Smart Places?

Summary: Observations on SLE SoS Transition

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



People-Driven Upskilling (Bristol, Orkney)

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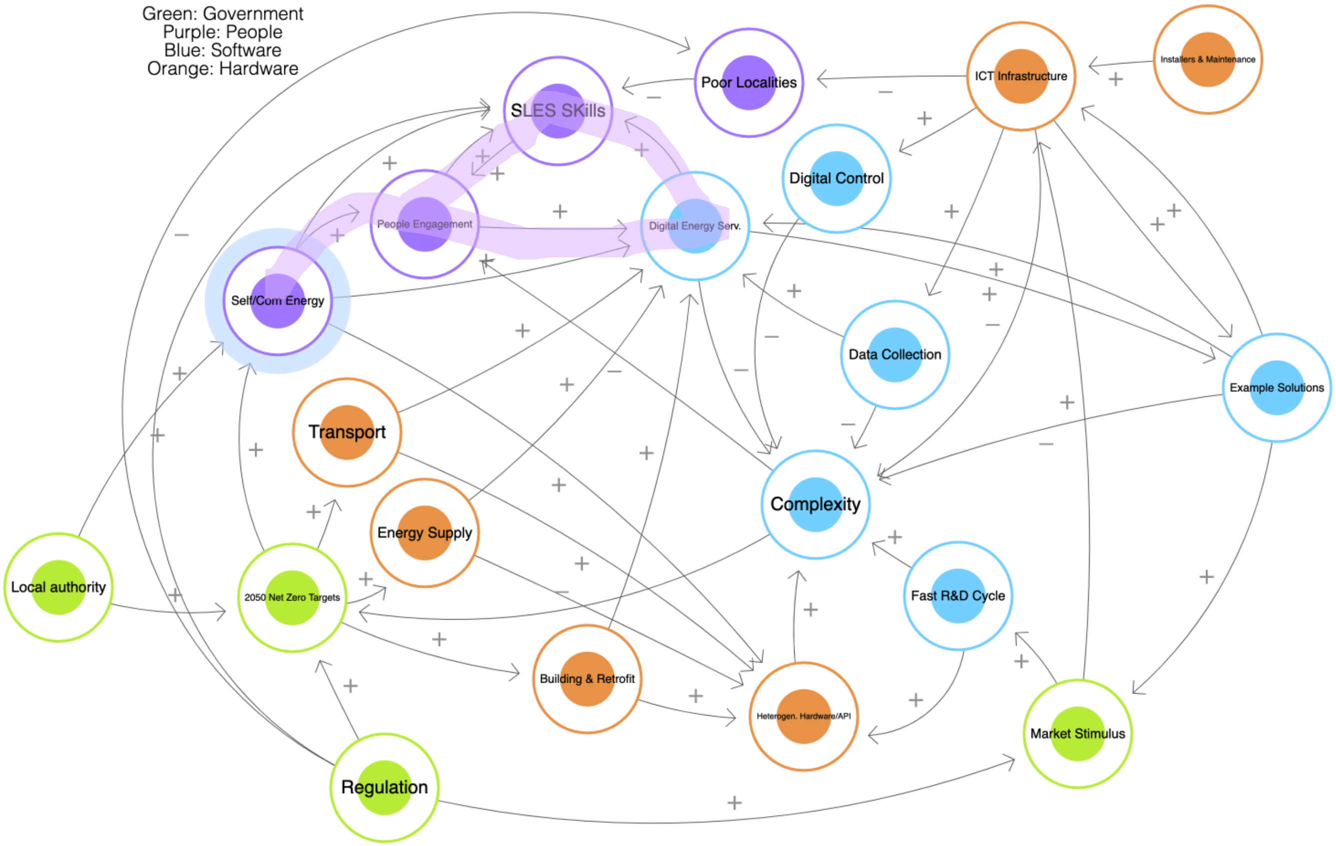

Local Authority-Driven Upskilling (Bristol, Orkney)

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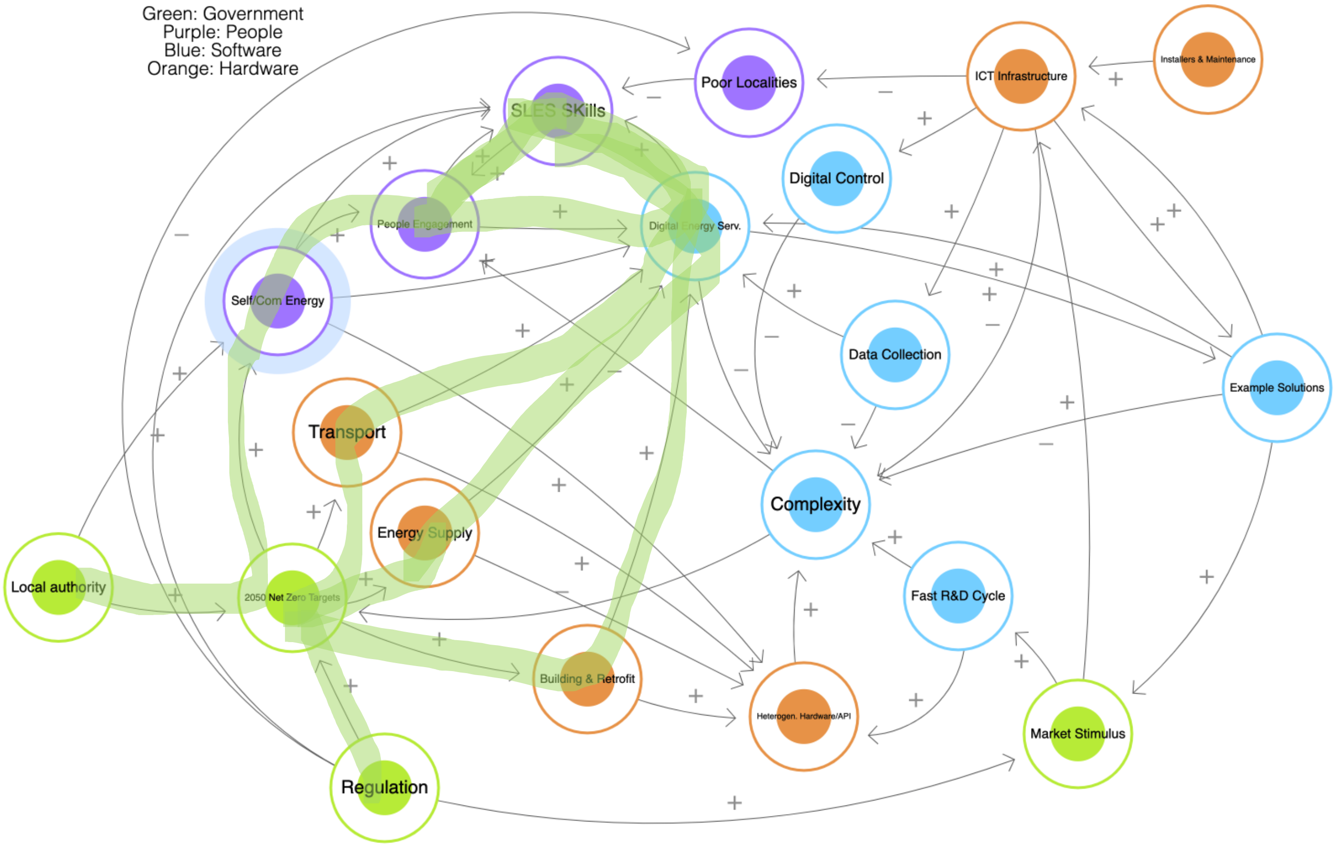
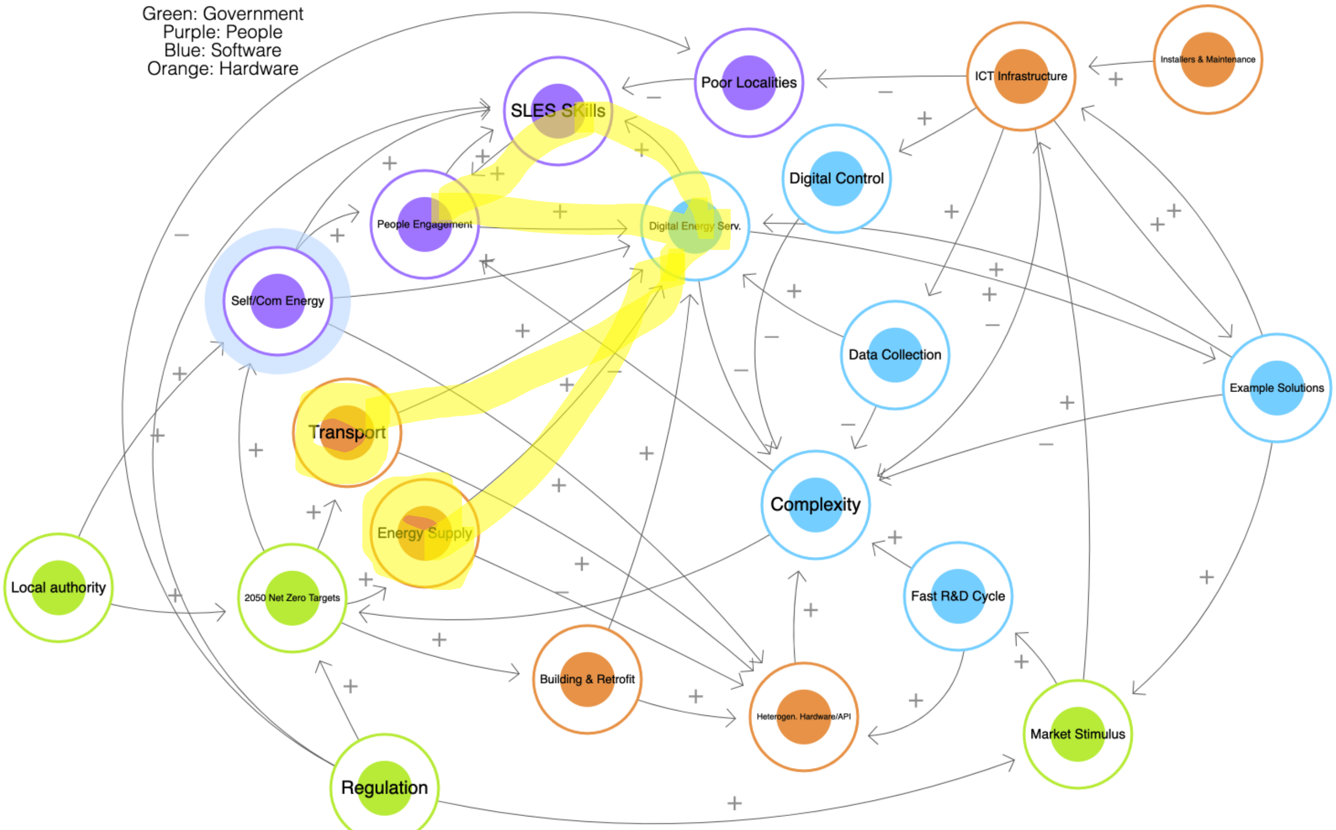


Business-Driven Upskilling (Oxford, Orkney)



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Unleashing Smart Energy Places and the role of engaged communities

Iain Soutar
University of Exeter

15 March 2022

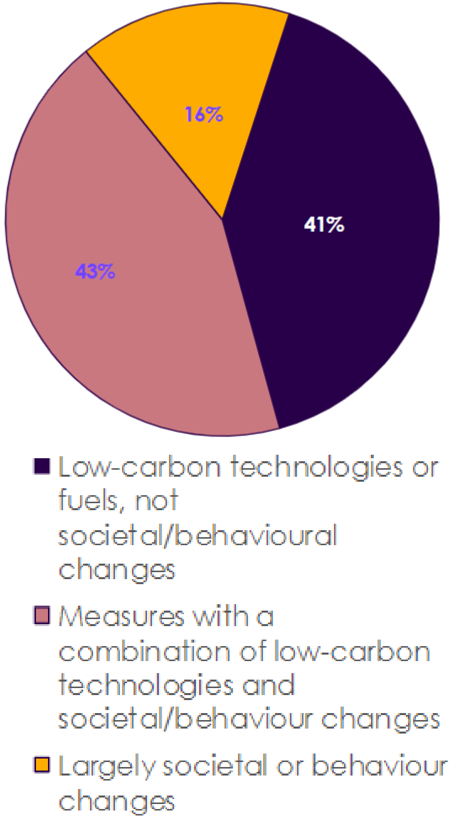
University of Exeter EnergyREV UK Research and Innovation

Societal engagement is a critical component of energy system change

- People and communities shape energy transitions by
  - Reducing / managing demand (or not)
  - Adopting new energy tech in homes (or not)
  - Supporting / accepting new energy tech in communities (or not)

- Most emissions reductions in UK so far have been achieved <u>without engaging the public</u>
  - Urgent need to better understand how to engage people, and how people can participate, in system change

Societal and behavioural changes in the CCC's Balanced Net Zero Pathway (2035)



CCC 2020

SLES projects: New challenges for engagement…

- What to engage people around?
  - New technologies, tariffs, value propositions, behaviours?
  - Single innovations or wider systems?
- With whom to engage?
  - First adopters or hard to reach?
- Who should be responsible for engagement?
  - Delegated or shared?
- What for?
  - To get projects done? Do projects better? Because it’s ‘right’?

SLES also create important opportunities for engagement

Provocation 1:
Project contexts constrain engagement

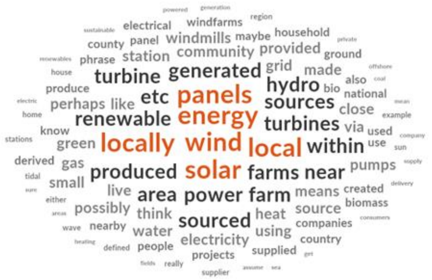
- Engagement within SLES projects can be (though not always)
  - Instrumental in nature, focused on ‘getting projects done’
  - Focused on single innovations rather than wider systems

- Mainstreaming SLES projects will mean:
  - Acknowledging the value of engagement
  - Bridging engagement in projects with engagement *beyond* projects
  - Getting better at learning

Provocation 2:
Engagement ≠ information provision

- ¼ of people in 2021 were unwilling/unable to attach any meaning to the concept of 'local energy systems'
- Also, diverse understandings of 'localness'
- An emphasis on renewable electricity, rather than smart/heat aspects

- Mainstreaming SLES will require:
  - Understanding diversity of expectations around local energy systems
  - Avoiding assumption that all people will value SLES outcomes equally



Provocation 3: Non-engagement is misguided

- Tendency (among some) to think about SLES as something to be designed *for* people, not *with* people

Smart systems might eventually allow *consumers* to disengage, but mainstreaming SLES will require trusted relationships with:

  - Technology adopters
  - System users, e.g. of local tariffs
  - Citizens, as local decision-makers
  - The ‘hard to reach’

Thank you

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Closing Plenary

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

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