EnergyREV

Unlocking the value of energy-smart places

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Introduction

The UK's energy system is changing, with greater variability in supply from increased renewable generation, and significant growth in demand from electrifying both heating and transport.

Work undertaken in the Prospering from the Energy Revolution (PfER) programme (Innovate UK, 2022a) has demonstrated that energy-smart places, implementing smart local energy systems (SLES), are a critical component for a cost-effective, equitable, and rapid transition to Net Zero, while offering the opportunity for creating and enabling new forms of value.

Additionally, there is an opportunity to ensure that the benefits of this decarbonisation are enjoyed by local communities. If delivered well, energy-smart places can help tackle existing injustices, creating a fairer energy system which delivers for everyone.

This document provides insights from the PfER programme on the new forms of value afforded by energy-smart places, including the value to local communities, and sets out the policy and regulatory shifts required to unlock this value.

Methodology

Insights and evidence were captured during two interactive workshops hosted by EnergyREV in November and December of 2022. The first workshop was attended by approximately 60 participants, and the second by approximately 40 participants, with representatives from the PfER demonstration and design projects, as well as stakeholders from across the sector, including from local and national governments, academia, and from both SMEs and larger businesses.

The value case for energy-smart places

Local joined-up thinking provides a lower-cost path to decarbonisation

Significant benefits can be achieved through coupling together different energy sectors including heating, cooling, and transport. Partners in the GreenSCIES project have demonstrated cost benefits from:

1. The integration of electricity and transport, with electric vehicles providing vehicle-to-grid flexibility
2. The integration of electricity and transport with heating, allowing for more efficient usage of solar PV generation by coupling it with heat pump operation and electric vehicle (EV) charging (Cenex, 2022).

Project ESO have also demonstrated the economic benefits from smart heat pumps, which couple the replacement of inefficient and expensive conventional heating systems with the provision of flexibility services to the grid (Energy Superhub Oxford, 2022).

Matching demand with generation locally benefits the whole system

Flexibility services and storage, which allow for demand to be varied to match supply, will be vital to manage UK energy system changes in an efficient and cost-effective manner (Vigurs et al, 2022).

Balancing the supply of electricity and demand at a local level increases efficiency and minimises grid losses at both the local and national level (Aunedi and Green, 2020). This approach is being trialled by ReFLEX Orkney, to explore how SLES can connect the technical operation of the existing network with new storage, flexibility, and electrification solutions (ReFLEX Orkney, 2020a). This approach can reduce the spending on grid reinforcement that would otherwise be required to meet projected generation and demand growth (Aunedi et al, 2022).

Local solutions can meet multiple national priorities

Local solutions can also support national agendas around maintaining grid stability, driving EV roll-out, and replacing inefficient and expensive domestic heating. Electricity System Operators (ESO) are trialling grid-scale batteries to support grid stability as combined-cycle gas turbines are displaced (Energy Superhub Oxford, 2020) , and have successfully demonstrated how the roll-out of ultra-rapid EV charging in a locality can accelerate the electrification of municipal vehicle fleets (Energy Superhub Oxford).

Delivering projects locally is vital to unlock the potential of decentralisation and democratisation, to take advantage of local resources and conditions, and to deliver value both to individual local communities and on aggregate to the nation (Innovate UK, 2022b).

A local focus allows for a 'user-centric' design to maximise local benefits

Zero Carbon Rugeley have successfully engaged with the Rugeley community, including local residents, businesses, and commuters to ensure the proposed SLES maximises local economic regeneration and social integration (Equans 2022).

ReFLEX are linking the local electricity, transport, and heat networks on Orkney into one integrated energy system which can be monitored and controlled. By engaging with local people through a membership model, domestic low-carbon technologies have been de-risked for customers. This reduces their heating and transport bills while contributing to the overall Net Zero ambitions of the island (ReFLEX Orkney 2022b).

Project LEO have shown how local area energy mapping can engage citizens in participating in their energy systems, including in socially-deprived areas where this has often proven to be more difficult (Gupta et al, 2021).

A local focus enables faster action

Project LEO's Smart and Fair Neighbourhoods trials have been successful in demonstrating that delivering reform of the energy system focusing at a local scale delivers change more quickly than a national focus. By providing local residents with data about their neighbourhoods, participation and engagement can be enhanced, and the deployment of local energy projects accelerated (Gupta et al, 2021).

A local approach can also engage local businesses and local authorities who are critical to a faster roll-out of new technologies (Morris et al, 2022). This is vital for building and strengthening local supply chains, and stimulating the growth of local economies (Arvanitopoulos and Agnolucci, 2020).

A local approach improves public health and quality of life

The creation of an SLES has the potential to improve public health and individuals' quality of life in general. If roll-out includes home insulation then consumers will have warmer homes, improving both overall comfort levels and health (Morris et al, 2022). Facilitating the electrification of transport through an SLES will reduce air pollution (Mehlig et al, 2021). This transformation of transport infrastructure can be coupled with the promotion of active travel and public transport, delivering further opportunities for health benefits (Innovate UK, 2022b), as seen in the Oxfordshire Low Carbon Neighbourhoods trials embedded within Project LEO (Low Carbon Hub, 2021).

Economic benefits for residents can be realised with a local focus

An SLES focused on the needs of the community it serves can facilitate the affordable decarbonisation of personal energy use, with a combination lower energy bills and potential revenue sharing models from the provision of flexibility services to the grid (as piloted by Project LEO and ReFLEX) or through investment in the energy system itself (for example through a Local Climate Bond initiative). This could help unlock wider social benefits from the increase in economic freedom.

A local approach brings economic benefit to local economies

Energy-smart places can bring significant benefits to the local economy where they are based. The creation and operation of an SLES can stimulate local supply chains, create secure local jobs and opportunities for up- or reskilling, and provide opportunities for local businesses to grow (Chitchyan and Bird, 2021). In addition, the local energy system can become a source of revenue that can be reinvested into the local community through the creation of trusts and community funds (UKRI, 2022).

Local solutions improve local infrastructure

An SLES, designed with not only the current needs of local consumers in mind, but with how these needs are likely to change, allows for the development of future-proofed infrastructure (Verba, 2020). As well as electricity infrastructure, energy-smart places can also improve transport infrastructure by supporting electrification. ReFLEX Orkney have demonstrated the potential for significantly accelerating the uptake of EVs through the creation of an SLES (ReFLEX, 2019).

Building stock itself can be improved, with an SLES approach providing opportunities for both retrofitting of existing buildings and the construction of more energy efficient buildings, the cost of which can be offset from the revenue generated by the energy system itself (Green et al, 2019). This can engage businesses with local communities and facilitate the sharing of benefits, as well as improving relationships between tenants and landlords, as demonstrated in the Manor Royal Business District, where the 'Re-Energise Manor Royal' project brought together different stakeholders to support the creation of a local energy community to decarbonise the estate (Manor Royal Business District, 2022).

A local focus can create a community

A place-based approach to decarbonisation can grow community spirit in an area, while also reducing its carbon emissions. Working with local people in the development of an energy system that serves their community means they become more engaged and proactive consumers of energy (Ambrose, 2020) as demonstrated in the Project LEO Smart and Fair Neighbourhoods trials (Low Carbon Hub, 2021).

Engaging from a local perspective can expand local knowledge

Engaging with local people during the creation of a smart-energy place can have significant impacts on energy literacy, improving peoples' understanding of the energy system itself, as well as their own energy usage (Soutar and Devine-Wright 2022). In particular it presents an opportunity to engage those who might be less-likely to have developed an understanding of the options available to them and the impact that their choices can make (Soutar et al, 2022). The Project LEO, ReFLex Orkney, and Milford Haven projects have all found success in engaging with consumers to increase their energy literacy.

Local approaches can target equality and empowerment for residents

Equality and the empowerment of marginalised and disadvantaged groups can be at the heart of SLES creation. It is often those who have the most to benefit from a just transition who do not engage with the current energy system; a place-based approach to reform can target these groups and the voices of those usually least-heard can be centred (Stewart, 2022). Examples of projects that have taken this approach are Swaffham Prior, Leeds District Heating, and Bristol City LEAP.

Recommendations

UK Government

1. The government must provide a clear direction for Net Zero ambitions that puts local delivery of energy-smart places at its heart. Shifting government priorities in recent years have meant continual changes in incentives and subsidies which have hampered growth across the sector. Further, existing Net Zero targets and plans do not contain sufficient detail, strategy or enablers for the local delivery required to meet those goals.
2. National policies need to better support local government to build capacity, resources, and skills to unlock their potential in delivering transformative energy-smart places. Local governments need sufficient resources to invest in training and in gaining experience of running projects in the energy-smart places space. Different areas have access to different local businesses, creating geographic disparities in the capability of different localities to utilise local skills. These disparities must be addressed.
3. There needs to be an increase in non-competitive funding, particularly for local authorities, which is adaptable to local needs and provides a guaranteed-term of investment to give local investors confidence.
4. Local government borrowing powers must be increased to allow for investment in smart-energy places with enhanced support from the UK infrastructure bank.
5. A skills strategy that includes flexible and modular training which allows for up- and re-skilling is vital, and would provide the confidence for individuals to invest in a longer-term plan to acquire the necessary skills. This plan must include creating a diverse and inclusive environment that encourages those from under-represented groups to view working in the energy sector as a viable possibility.

Ofgem

1. Both the energy planning and regulation systems need to change to enable smart-energy places. The planning system must be aligned to support all aspects of energy-smart places, e.g., by coordinating the location of heat sources and heat demands to facilitate heat networks. Regulation must become more agile and responsive to the rapidly evolving energy system needs and operating paradigms.
2. Market structures need to value flexibility services. They currently underestimate the costs for network balancing. They also treat energy storage – a key provider of flexibility – as generation, presenting a significant barrier to growth.
3. Distribution Network Operators (DNOs) must be encouraged by the regulator to embrace an SLES approach. This should consider the longer-term reduction in reinforcement costs compared to decarbonisation without SLES and the benefits that SLES can provide, such as the efficiency of balancing demand and supply locally, and the provision of flexibility services.
4. To unlock the potential of smart-energy places regulations must be updated to allow for peer-to-peer energy trading on the public network and for local generators to sell energy directly, as well as to create a market at distribution level including for flexibility services.

SLES Practitioners

1. The case for investment in SLES to deliver smart-energy places must be made clearer, with barriers to investment in local approaches removed:
    * Investment in smart-energy places must be de-risked for external investors, with a clear path to return on investments set-out
    * More attractive investment portfolios should be established to encourage investors to invest in local systems as well as new technologies
    * Relevant public and public-private grants should have funding criteria tailored toward local objectives and needs rather than a one-size-fits all national approach.

2. User engagement must be prioritised to design and develop fit-for-purpose SLES. User participation is a key component of SLES, but the degree to which different groups of people are interested can vary significantly, including between localities. While consumer experience of SLES technologies such as heat pumps is often positive, the spread of these technologies is limited. New approaches must engage people and develop affordable propositions that provide meaningful value, including business models that supply value downstream to customers.
3. SLES developments need to ensure they use approachable, relatable language around energy that is relevant to people's lives. Behaviour change should be made as simple as possible, with as much of the process of engaging with new technology made positive, and potentially, automated. Potential community participants should be able to understand the incentives for getting involved, and involvement should be possible to a degree which suits everybody.
4. There should be a focus on directly marketing towards specific underrepresented marginalised groups. Communities do not have equal access to energy resources, to the financial capital to invest in a local energy system, or to the education required to have enough understanding to engage properly. These inequalities exist across different regions and localities, but also exist within localities, particularly impacting marginalised groups and those with low socioeconomic status.

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About EnergyREV

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