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PROSPERING FROM THE ENERGY REVOLUTION

INSIGHT BRIEF 2

Smart local energy systems

Policy and regulation

Insights from UKRI-funded innovation projects

October 2022

“To reduce our reliance on expensive imports of gas and bring down customers’ energy bills, we need to accelerate our transition to net zero. This will require a transformation of our energy system, in particular at a local level.”

Ofgem review into local energy system operation, Call for Input, April 2022

This is the second of three insight briefs on findings from the UKRI-funded smart local energy system projects.

The reports cover:

1. Finance and investment
2. Policy and regulation
3. Skills and capabilities

All three will be available in the Prospering from the Energy Revolution section of the UKRI website.

Introduction

The Prospering from the Energy Revolution programme set out to demonstrate the viability, impact, and future prospects of smart local energy systems in the United Kingdom.

Such an integrated, place-based energy system brings together energy assets, demand and infrastructure at a local level and connects them in a smart way, creating new opportunities for investors, consumers, networks and the wider energy system[1].

Funded by UK Research and Innovation and delivered by Innovate UK, over £104m was awarded to the programme, with match-funding taking this up to £170m in total.

This funding supported three flagship demonstrator projects, 10 detailed designs[2], and a host of other concept, data and technology initiatives around the UK to understand the opportunity and value of integrated place-based energy systems in practice.

See the portfolio of projects

Introduction

Local approach, national value

To meet the targets set out in the Climate Change Committee's Sixth Carbon Budget[3], research from PwC[4] finds, place-based approaches to net zero could bring far more value for far lower cost than blanket, national-level policy.

Projects and wider research have demonstrated how an integrated, local energy approach can also provide serious and tangible value across multiple policy areas, for the energy system, policymakers, regions, citizens and communities[5].

Reflecting this and the decentralising, decarbonising nature of energy in the UK, the Department of Business, Energy and Industrial Strategy (BEIS) has recognised the need for a more local energy approach[6,7].

With Ofgem's recent Call for Input on Local Energy Institutions and Governance, and the Review of Electricity Market Arrangements under way, there is clear appetite and an important opportunity to consider how to unlock the value of integrated local solutions in our energy system going forward.

This report is based on the experience of organisations working on projects across UKRI's Prospering from the Energy Revolution programme, delivered by Innovate UK.

It sets out key learnings on value offered by integrated local energy approaches and the barriers and challenges they still face. It then recommends reforms to enable smarter, local energy systems to succeed as a key component of the UK's energy, net zero and economic ambitions.

KEY POINTS

1. **Integrated, local energy approaches can support critical UK policy priorities including reducing bills, net zero, security of supply, levelling up and economic growth.**
2. **Current policy and regulation restricts the value that projects so far have been able to realise.**
3. **Enabling integrated, local energy approaches requires clear local responsibility within a wider, whole systems framework.**
4. **More flexible regulation and innovation support can enable the wider value that place-based energy systems have to offer.**

What is a smart local energy system?

A smart local energy system brings together energy generation, storage, demand and infrastructure and **connects them in a smart way, at a local level such as a town, city or region**.

This allows for a more tailored, dynamic, local approach to the transition to low carbon energy, recognising that different places and communities have different needs and ambitions.

The different pieces of an integrated local energy system can vary, depending on local need and opportunity, building stock, network infrastructure and so on.

Typically, they will include some element of renewable generation and storage, transport and electric vehicles, and heat and energy efficiency. This could include solar panels, wind turbines, battery storage, heat pumps, electric vehicles and chargers, home insulation, energy trading, and other low carbon products and services.

These pieces are then brought together physically through cables and wires, and digitally through software, artificial intelligence and digital energy platforms.

Such systems can offer value financially, socially and economically to policymakers, investors, consumers, society, economy and the wider energy system.

In these systems, energy can be better optimised across local areas, reflect local and public need and stimulate regional economic growth. At the same time they can save significant amounts of network reinforcement and system costs – savings that could in turn be passed on to consumers.

Projects and research from the Prospering from the Energy Revolution programme have demonstrated how this value can be realised in practice.

Consumer bills

An integrated, place-based energy approach can reduce bills and improve fuel poverty outcomes. By adopting and integrating energy generation, storage, heat and energy efficiency at the local level, place-based energy systems can pass on savings to consumers.

Net zero

Projects and research have found that with a place-based approach to energy, net zero could be achieved more cost-effectively, with increased citizen support, and with better representation of local needs and benefit.

VALUE OF PLACE-BASED ENERGY SYSTEMS ACROSS KEY POLICY AREAS

Resilience and security

A more integrated, localised approach to energy has the potential to be less vulnerable to international price shocks or supply crises, since it relies less on centralised or international markets. This can better protect people, households and businesses in the longer term.

Economic development and "levelling-up"

Integrated local energy approaches can help regions and communities to level up. This can be through new job- and revenue-generating opportunities, and savings in the energy system which can benefit consumers and local economic development.

Achievements and value

An integrated, local energy approach can deliver value for key policy priorities

An integrated, place-based approach to energy has potential to support the transition to renewables, reduce energy demand and meet our climate change targets. It can also make the energy system more resilient to international shocks such as the current gas crisis[8].

Projects involved in the Prospering from the Energy Revolution programme have demonstrated that integrated local energy systems can also deliver value against a range of other key policy priorities[9].

Consumer bills

With the energy crisis in sharp focus, **an integrated local energy approach can provide significant savings on consumer bills compared to a one-size-fits-all national policy**.

Research from PwC estimates that by taking a place-based approach to the energy transition, £108bn of savings on consumer bills could be unlocked for investment of £58bn, compared to investment of £159bn for £59bn savings by adopting a purely national strategy[10].

Projects across the Prospering from the Energy Revolution portfolio have created consumer bill savings in practice.

Households involved in the **Energy Superhub Oxford** (Project ESO) have saved up to 50% on their bills as a result of participating in the programme, whilst domestic and commercial customers of **GIRONA**'s solar and storage microgrid have saved anywhere from 40-60%.

The Energy Superhub Oxford project has connected the world's largest hybrid battery storage system to the grid

Net zero

Integrated, place-based energy systems can support holistic emissions reductions by using low-carbon technologies and energy efficiency to reduce demand.

Place-based approaches can also encourage greater buy-in from citizens and communities on the net zero journey, supporting local areas to **develop net zero energy plans that suit their needs**.

In their citizens' jury, the **Greater Manchester Local Energy Market** (GMLEM) found that there was considerable public desire to pursue a place-based energy approach, with local needs and benefits at its core, over wider alternatives[11].

With over 80% of local authorities declaring a climate emergency, public appetite for local energy and net zero approaches has become substantial[12].

Economic development and "levelling-up"

The National Infrastructure Commission outlines that place-based energy approaches can support the UK Government's levelling-up agenda.

This is through the creation of skilled jobs in installing technologies and efficiency measures, as well as wider social and economic benefits such as reduced fuel poverty[13].

Through economic modelling, projects have demonstrated that this approach can provide substantial value to local areas and regions, supporting jobs and wider economic development.

The **West Midlands Regional Energy System Operator** (RESO) project team estimate that their integrated local energy approach could be worth £3.4m per year to residents in Coventry, or £721m to communities in the West Midlands area with a combined authority approach. 50-60 full-time equivalent jobs could be created in the development of an integrated local energy system alone.

The **Greater Manchester Local Energy Market** has similarly estimated that a local energy market could help to unlock £40m in energy system benefit.

Smart local energy systems can achieve a just transition faster and more cost-effectively, but current policy and regulatory barriers prevent the full actualisation of this approach.

SURVEY RESPONSE

Barriers and challenges

There are still considerable barriers to unlocking the full value of smart local energy approaches[14].

Across the partners and projects in the UKRI programme, barriers were identified around four key issues:

- Lack of clarity in direction and responsibility for smart local energy systems
- The lack of a joined-up, "whole systems" approach
- Current energy markets being designed for a centralised energy system
- The need for more supportive innovation and regulatory frameworks

Lack of clarity in direction and responsibility

The importance of "local" in the energy system has been emphasised by both UK Government and Ofgem. Yet the role of place-based approaches in the energy transition remains unclear.

This makes mobilising investment and skills challenging, limiting the viability of business models for integrated local energy approaches and the opportunity to realise wider value[15].

Without clarity and certainty, industry is unlikely to invest in the necessary skills to make integrated local energy systems a reality, while investment will prove trickier to mobilise without sight and certainty of future revenues.

Enabling smart local energy systems requires more integrated, whole systems thinking

Integrated place-based energy systems by nature sit across several policy areas including energy, housing, environment, heat, markets, business and economic development.

They also span many stakeholders and organisations including UK Government, local authorities, Ofgem, distribution network operators, community organisations, investors and developers.

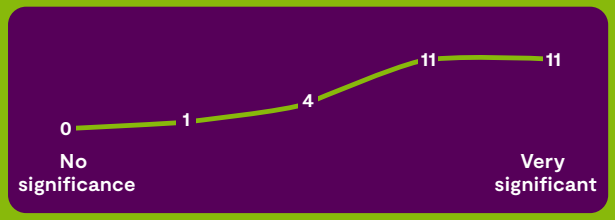
Relevant policy and ambition is not always aligned across these areas and organisations.

To unlock the value of place-based approaches to energy, there is a need to develop a more joined-up, whole systems approach in energy policy and regulation.

Ofgem and the UK Government have strongly outlined whole system ambitions in recent years[16], while some energy networks are developing coordinator roles to help support the collaborations needed. Building on this with more detailed action would be a very positive step.

SURVEY RESPONSES ACROSS PROJECTS

How significant are the policy and regulatory barriers to unlocking place-based energy approaches?



Survey of smart local energy system project participants, July 2022

Local authorities

Local authorities will have a key role to play in achieving net zero. They have a remit covering several net zero policy areas and a unique position in bringing the public along in the transition[17].

Local authorities also have a central role in the delivery of integrated local energy approaches, typically as the key organisational partner with responsibility over housing, transport, heat and energy efficiency and with capabilities for planning, managing stakeholders and raising finance.

One of the key issues noted by local authorities in the Prospering from the Energy Revolution Programme, however, has been the lack of clarity on the remit and resource they will have around energy specifically[18]. Several local authorities involved in the programme have shown an appetite to pursue place-based energy approaches and have called for greater powers in areas like energy planning and transport.

Research for bodies such as the Local Government Association notes that clearer direction would enable local authorities to deliver those powers consistently and in turn help them to mobilise investment in more ambitious projects[19].

Recognising this in its Net Zero Strategy (2021), the UK Government launched the Local Net Zero Forum to facilitate discussion between central and local government on key policy and delivery issues related to net zero, including on the roles and responsibilities of local government.

This is seen as a positive development and the forum is still in its early stages.

"Local authorities will be particularly important to ensuring a just transition to net zero, since no layer of government is closer to people or better able to tailor climate action to meet the needs of local communities."

UK GOVERNMENT HOUSING, COMMUNITIES AND LOCAL GOVERNMENT COMMITTEE, OCTOBER 2021

NET ZERO HUBS

BEIS funds five Local Net Zero Hubs across the five regions in the UK.

The Hubs promote best practice and support local authorities to develop net zero projects and attract commercial investment.

Current markets are designed for centralised delivery of energy

The UK energy system is designed mainly around larger-scale energy generation. Because of this, **smaller scale local energy assets face barriers to delivering their full value to the system**.

The demand-side (in particular energy efficiency) has also received limited attention in market reform discussions, making it challenging to include within smart local energy investment propositions.

According to the UKRI-funded projects, market barriers have been particularly significant in two key areas: local supply and flexibility.

Licensing has proved an issue for the Liverpool Multi-Vector Energy Exchange project.

Local supply

One of the key opportunities of place-based energy approaches is for citizens, communities, businesses and infrastructure to have their energy supplied by locally-situated and locally-governed generation or storage.

This can generate revenue for local energy systems and markets, creating additional value for local areas and economies.

However, **current regulations around licensing make it impractical to supply energy locally**, including stored energy.

The UK energy system still operates mainly under the **supplier hub model**, which requires all energy transactions to go through a licensed energy supplier.

Because becoming a licensed supplier is an expensive and complex process, at the moment local supply is mostly unfeasible. This restricts revenue-generating opportunities and business cases for integrated local energy systems.

The **Liverpool Multi-Vector Energy Exchange** (LMEX) project team note that this has been among their biggest challenges.

While discussions around local supply of energy have gained traction in recent years, such as with Ofgem's 2017 call for evidence on supply market arrangements[20] and the Local Electricity Bill (2022), code and regulation changes to enable this have yet to fully materialise.

Flexibility

As we begin to decarbonise things like heat and transport, more sources of clean energy supply and demand (such as heat pumps, battery storage and electric vehicles) are placed on the electricity network.

This requires flexibility to balance the network better, particularly at a local level; a role which integrated local energy systems are well placed to fulfil.

This can unlock new network capacity, help overcome network limits and restraint, and provide additional revenue for partners and cost savings for consumers.

At present, however, **local flexibility is undervalued within energy markets**, with little incentive for local balancing of generation and demand to alleviate network constraints.

This is recognised in BEIS and Ofgem's 2021 Smart Systems and Flexibility Plan.

Project LEO, **ReFLEX Orkney** and **GreenSCIES** have all noted this lack of value in practice, saying that the undervaluing of local flexibility adds complexity and risk to integrated local energy projects.

This can make it challenging to design robust business cases and pass on the full value of an integrated local energy system to consumers, investors or the wider energy system.

GMLEM identified how flexibility can help to shift demand and avoid or defer network reinforcement, but note that the mechanism for realising the benefit of this avoided cost has yet to be developed.

Projects need more sustainable innovation support within a more accessible regulatory model

Ofgem has recognised the need to facilitate local-level approaches to energy and local institutions.

The RIIO-ED2 draft determinations overview[21] states that innovation at the 'grid edge' is critical to our energy transition, and that recent developments offer an opportunity to support new place-based energy approaches.

However, current funding and support for innovation in the UK energy system can make it difficult for more innovative, integrated place-based approaches to move from short-term demonstrators to business-as-usual initiatives.

Funding for innovation projects is often relatively short-term and over-prescriptive, locking projects into early expectations and limiting their ability to implement new ideas and learnings as projects naturally develop.

Purpose and incentives do not always align across different funding initiatives, making the innovation landscape disjointed, while regulatory exemptions to allow trials of new models and systems are also short-term and inflexible.

This is a problem for smart local energy projects across the board, who **require more dynamic and sustainable support to demonstrate the viability of their business models and approaches**.

This is essential to supporting real-time innovation, inspiring investor confidence, and evidencing the value of local energy systems overall.

The UKRI-funded projects have also noted, with some frustration, that **a clearer pathway from innovation to regulatory change is needed**, with the process currently slow and difficult to influence.

Key learnings

The Prospering from the Energy Revolution programme has demonstrated the potential of a place-based approach to energy systems across a range of critical policy areas, and the barriers that still remain. The evidence from the programme is that progress in three key areas can help to fully unlock the wider value of smart local energy systems:

1 Reform markets and regulation to fully value "local"

The energy system remains centralised, designed around large energy-generating assets, with barriers for small-scale generation and integrated place-based approaches.

Evidence shows that if future regulation clarifies and fully recognises the value of "local" in the energy system, this could support new operational and business models and stimulate investment in smart local energy systems.

Reforming the current licensing regime to make local supply easier would be especially beneficial. Giving attention to the demand side in market reform discussions such as the Review of Electricity Market Arrangements, in particular energy efficiency, can also enable greater value.

2 Improve clarity on the role of local, place-based energy and net zero approaches

To mobilise skills, finance and investment to deliver low-carbon energy locally, evidence shows that there needs to be greater clarity on how local and central government – alongside network companies, citizens and other energy stakeholders – can break down silos and align ambitions across the whole system.

Providing detail on place-based approaches in future strategies to align incentives across smart local energy stakeholders, with particular emphasis on the role of local authorities as the key coordinating party, could help to facilitate stronger working relationships and unlock integrated local energy approaches more broadly.

3 Provide more sustainable innovation support within a more accessible regulatory framework

The current innovation landscape is valuable, but still governed by piecemeal, short-term support with limited scope for influencing regulatory change.

Longer-term trials and funding would allow projects to demonstrate their wider value, while a more joined-up, proactive approach to bring innovators and policy processes together could help inform more dynamic, inclusive and effective regulatory change.

Notes

1 Energy Systems Catapult, Smart Local Energy Systems, 2022

2 BEIS electricity networks strategic framework, August 2022

3 The Climate Change Committee, The Sixth Carbon Budget, December 2020

4 PWC, UKRI, Accelerating Net Zero Delivery, March 2022

5 Gooding, L., Ford, R. and Bray, R. (2021) 40 Benefits of Smart Local Energy Systems

6 BEIS, Ofgem, Electricity Networks Strategic Framework, August 2022

7 Ofgem, RIIO-ED2 Draft Determinations, June 2022

8 Energy Systems Catapult, Smart Local Energy Systems, 2022

9 UKRI, Smart Local Energy Systems, accessed May 2022

10 https://www.ukri.org/wp-content/uploads/2022/03/IUK-090322-AcceleratingNetZeroDelivery-UnlockingBenefitsClimateActionUKCityRegions.pdf

11 Carbon Co-op, The Greater Manchester Local Energy Market Citizens' Jury Report, 2022

12 Turning Point: Local Net Zero Delivery Progress, UK100, 2022

13 National Infrastructure Commission 2021

14 This will be further explored in forthcoming work on enabling decentralised energy innovation by Innovate UK and Sustainable Energy Futures.

15 For more on these topics see the other two Insight Briefs in this series

16 Ofgem Strategic Innovation Fund: whole systems integration – Discovery, 2021

17 Government response to Housing, Communities and Local Government Select Committee report of October 2021

18 Local Government Association/WPI Economics, Delivering Net Zero, 2021

19 Energy Systems Catapult, Enabling SLES Finance and Investment, 2021

20 Ofgem, Future of supply market arrangements – call for evidence, November 2017

21 Ofgem, RIIO-ED2 Draft Determinations, June 2022

The Milford Haven: Energy Kingdom project explored the use of hydrogen in a local integrated energy system

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Prospering from the Energy Revolution is a UKRI programme

This report was researched and produced by Regen for Innovate UK.

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For more information visit innovateuk.ukri.org

Innovate UK
Polaris House
North Star Avenue
Swindon SN2 1FL

Telephone: 01793 361000
Email: support@iuk.ukri.org
ukri.org/innovate-uk

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The islands of Orkney generate more wind energy than they need, yet rely on fossil fuels.
Pic Colin Keldie, courtesy Solo Energy