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PROSPERING FROM THE ENERGY REVOLUTION

INSIGHT BRIEF 1

Smart local energy systems Finance and investment

Insights from UKRI-funded innovation projects
October 2022



“The government and Ofgem recognise the need for a local area-level approach to deliver the best network for each local area, responding to their specific needs.”

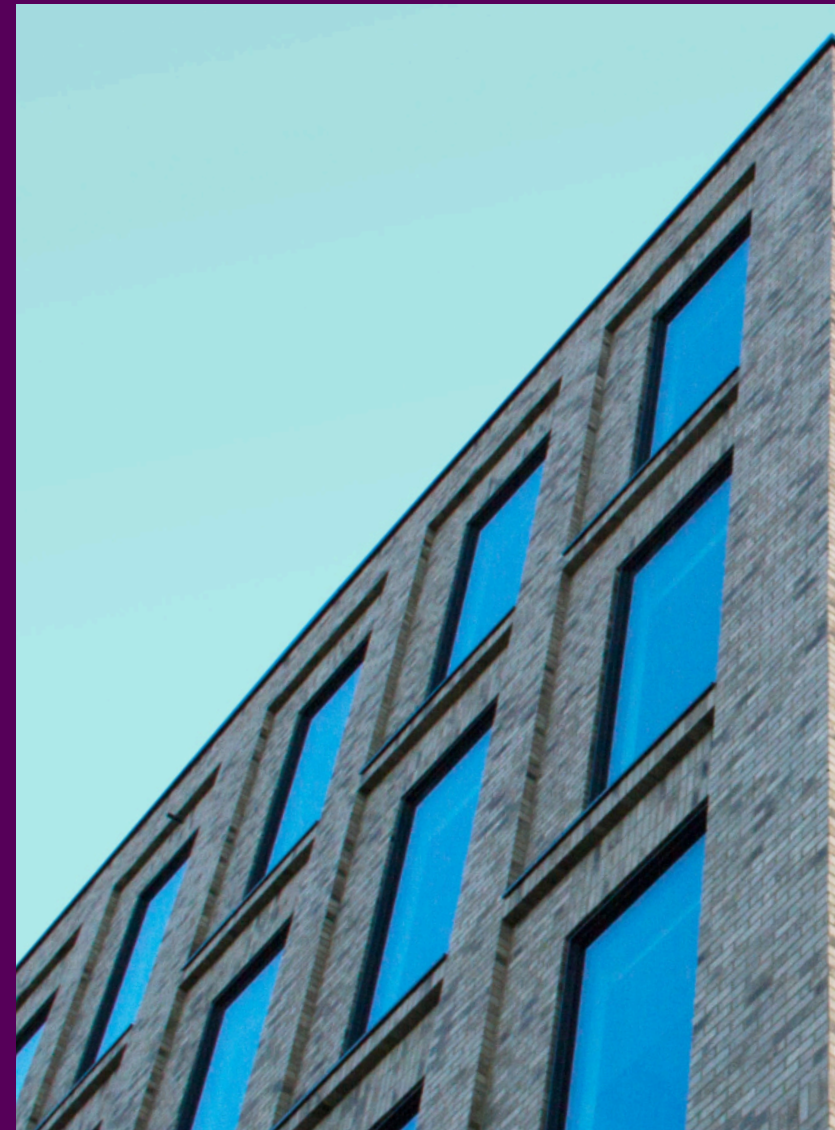
**BEIS & Ofgem, Electricity Networks Strategic Framework,
August 2022**

This is the first 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 regulatory barriers
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 system¹.

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 designs², and a host of other concept, data and technology initiatives to understand the opportunity and value of integrated place-based energy systems in practice.

More than 80 projects were funded across the United Kingdom in total. A further £733m in follow-on private, venture capital, equity, merger and grant funding has since been raised by partners in the project portfolio.

See the portfolio
of projects



Introduction

The importance of place

To meet the targets set out in the Climate Change Committee's Sixth Carbon Budget³, research from PwC⁴ finds that place-based approaches to climate change could bring far better financial and social returns for far lower cost than blanket, national-level policy alone.

On energy specifically, projects and research have demonstrated that smart local based energy systems could provide financial value to consumers, energy networks, investors, policymakers, local stakeholders, wider society and the energy system itself.

Project and research partners have modelled the many benefits that such integrated local energy systems have to offer⁵, and how to encourage the public and private investment needed to fully unlock them.

This report is based on the experiences of organisations working on projects across UKRI's Prospering from the Energy Revolution programme.

It outlines the main opportunities and barriers around finance and investment for smart local energy systems.

It also sets out the high-level changes needed to enable that investment and unlock the value this approach could bring to the wider energy system, economy and society.

KEY POINTS

- 1 Integrated local energy approaches can deliver significant financial value for households, networks, investors and society**
- 2 Integrating local energy systems can unlock wider value than blanket national strategies or individual technologies alone**
- 3 Clarity on direction-of-travel is critical to enabling this**
- 4 If policy better enabled 'local' this would support a simplified, de-risked integrated local energy proposition**

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.

Follow-on investment for programme partners

The Prospering from the Energy Revolution programme was funded with an investment of over £104m by UK Research and Innovation, delivered via Innovate UK. Match funding by the partners in the projects added more than £76m. Since then, over £733m of additional private, equity, merger, grant and venture capital funding has been successfully invested into these partner companies.

Project partner **Nuvve**, which was involved in **Local Energy Oxfordshire (Project LEO)**, combines solutions for supplying power from electric vehicles back to the grid with other services including equipment financing, vehicle-to-grid services, infrastructure and maintenance. Since the LEO project, Nuvve has received £44.9m in equity investment to further develop this work.

Moixa, which was involved in the **SmartHubs** project in West Sussex, secured £4.6m in investment to develop its GridShare smart energy management software. Using artificial intelligence and machine learning, GridShare connects storage devices such as batteries and optimises power flows across the grid to “help customers maximise the value of energy”⁶ Moixa has this year been acquired by Lunar Energy⁷.

From the **Energy Superhub Oxford project (ESO)**, battery storage developer **Invinity** has received £20.5m in equity investment that will be used to scale up production of its vanadium flow battery to meet commercial demand and help drive down unit costs.

FACTS AND FIGURES

> **£104m**
Programme funding from UKRI

> **£76m**
Match funding from participants

> **£733m**
Additional grants and investments secured by project participants

> **£913m**
Total committed grants and investment funding*

*Includes UKRI and other grants, project match funding, and additional investments of all types.

Opportunities and learnings

An integrated approach can unlock new value for consumers, policymakers and the energy system

Place-based energy approaches have considerable potential to provide value to the energy system, investors and consumers, while at once providing a more tailored approach to the energy transition and stimulating regional economic growth.

Individual parts of local energy systems⁸ can provide value on their own. Large-scale battery storage can create strong return for investors, while solar and storage can reduce energy bills individually for households and at a neighbourhood level.

While these component parts bring their own benefits, evidence from projects such as Zero Carbon Rugeley, Project LEO, Greater Manchester Local Energy Market and PIRI suggests that a holistic, integrated approach is the best way to generate the more significant social and economic value on offer – including network savings, revenue for local areas, regional economic growth, and better reductions in bills for consumers.

This is because integrated local energy systems can reduce the need for expensive reinforcement of the national energy network by connecting more infrastructure locally, and can optimise consumption,

generation and costs for people across the local system by joining infrastructure together in a smart way.

When assets and services are governed by local authorities and other local stakeholders, the value can in turn be better captured locally, supporting regional development, economic growth and levelling-up⁹.

If local energy components are connected in a smart and holistic way, those components can not only provide their individual benefits but also create the broader value of an integrated, optimised, tailored, local and dynamic energy system.

Table 1. Benefits and beneficiaries of an integrated, place-based energy approach.

Benefits of an integrated place-based approach	Beneficiaries
Tailored, local approach to the energy transition	Citizens, investors, UK Treasury, localities and regions, wider economy
Lower energy bills	Consumers, wider economy
Reduced network reinforcement costs	Networks, UK Treasury
Reduced fuel poverty	Consumers, social and health services, wider economy
Return on investment	Public and private investors, wider economy
Local and regional development	Local authorities, citizens, workers, wider economy

Opportunities and learnings

The value of an integrated local energy approach

While individual components of local energy systems can provide some benefit and return on investment, evidence shows that bringing together a full place-based approach can enable much wider financial, social, economic and technical value.

This value has been demonstrated in practice

Projects and wider research have shown how this value can be realised in practice for the energy system, for regions and communities, and for consumers in particular.

Net zero and the energy system

A place-based approach to the net zero energy transition is more cost effective than a place-agnostic (i.e. one-size-fits-all) strategy.

Research from PwC¹⁰ finds that a place-based approach would require just £58bn in investment to unlock energy savings for consumers worth £108bn, versus £195bn investment for £58bn in savings from a “place-agnostic” transition.

Insights from **EnergyREV**, the consortium of universities researching local energy system issues, likewise suggest that developing more integrated, place-based energy systems across the country could lead to system savings of up to **£3.2bn per year by 2040**¹¹ compared to a one-size-fits all approach.

This saving is realised mainly through unlocking flexibility via locally-connected electric vehicles and heating, rooftop solar power generation, distributed battery storage, and better thermal efficiency of buildings.

Project **REMeDY** in Southend estimates savings to the energy system of up to £1bn per year from deploying their integrated local heat approach¹² across the country. Similarly, based on its work, the **Greater Manchester Local Energy Market**¹³ (GMLEM) project estimates that using the energy network more efficiently could save over £40m per year in system benefit by 2038¹⁴.

Combining components into a fully integrated local system

- Substantial system benefit
- Significant customer savings from local assets and retrofit
- Reduced fuel poverty, less pressure on public health services
- Significantly reduced network costs
- Local and regional economic development
- Return on Investment (ROI)

Investing in some integrated components

- More system benefit
- Customer savings from local assets
- Some reduced network costs

Investing in individual components

- Return on investment
- Some system benefit
- Customer savings
- ROI

Regions and communities

The value of smart local energy systems has been modelled for specific cities, regions and communities.

The West Midlands **Regional Energy System Operator (RESO)**, a detailed design project in Coventry¹⁵, shows that an integrated local energy system could be worth £721m to the West Midlands area. This would be through maximising local generation and consumption; fuel price savings as the city accelerates its move to electric vehicles; and saving money that would otherwise need to be spent on reinforcing electricity networks.

The **Peterborough Integrated Renewables Infrastructure project (PIRI)** likewise shows that for every £1 spent, the local economy would receive £2.05 back with a total of £69.93m in economic value to local communities through bill savings, revenue generation and job creation¹⁶.

The RESO project estimated that an integrated local energy system could be worth £721m to the West Midlands area

Consumers

While only a few projects have been in full operation, that is with energy equipment installed and users connected, they have shown clear value for consumers. Against the backdrop of rising energy prices, this potential value is critical.

Project Girona – a smart microgrid of 60 domestic and commercial solar and storage assets in Coleraine, Northern Ireland – delivered £12,000 in savings to energy consumers¹⁷ between February and October 2021. Girona's smart grid allows users to save on their bills by **maximising local generation, storage and consumption**, with users so far saving on average 40-60% on energy bills per year. The project has also saved over 40 tonnes of CO₂ emissions to date.



In the **Energy Superhub Oxford project (ESO)**, ground-source heat pumps were installed in 60 social housing homes. In those homes, a majority of tenants have reported cost savings, typically of almost 50%¹⁸.

Barriers and challenges

While there is positive evidence of the value of integrated local energy approaches, and no shortage of private investment available for integrated local energy projects, **critical barriers remain to fully unlocking this going forward.**

The future of place-based energy approaches remains uncertain

UK Government, Ofgem and BEIS have all recognised the need to enable more local, place-based approaches to the energy system^{19,20}.

For this recognition, **there remains a lack of wider commitment, detail and certainty on the future role of 'local' within the energy transition.**

This lack of certainty means that the future of place-based approaches is unclear, making it difficult to mobilise finance and investment and develop new business models.

Key policy reviews are under way following the Net Zero Strategy, and could help provide greater confidence in place-based approaches.

In particular, BEIS's Review of Electricity Market Arrangements (REMA) is an opportunity to consider how the value of place-based approaches, for example in providing flexibility and reducing pressure on energy networks, could be recognised to unlock new revenue streams.

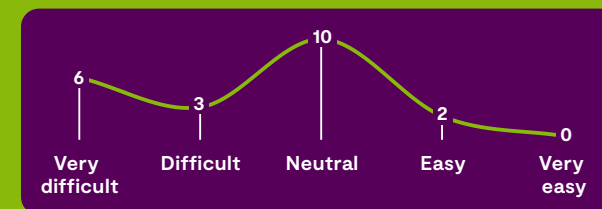
Without clarity providing confidence, smart local energy systems will remain a risky proposition to investors and mobilising the finance required to realise value at scale will prove difficult.

SURVEY RESPONSES FROM PROJECT PARTNERS

What are the key barriers?



How easy is it to finance an integrated local energy system?



Survey of smart local energy system project participants, July 2022

Current regulation does not value 'local'

While integrated local energy approaches can provide clear value and financial opportunity, **current markets and regulations limit the opportunity to realise their full revenue generating potential.**

These regulatory barriers in turn limit the value of the proposition to investors in particular²¹.

For instance, local flexibility could provide significant revenues for smart local energy systems and their investors. Yet local flexibility remains undervalued in current market arrangements (as Ofgem's 2021 Smart Systems and Flexibility Plan recognises), meaning that building business models which include this proposition is difficult.

Small-scale generators also have no guarantee such as that offered to larger assets under the Contracts for Difference²² scheme, and face considerable barriers to providing their energy locally to citizens and businesses.

The **ReFLEX** project in Orkney has noted frustrations with this lack of local value and prioritisation, while **Project LEO** partners cite that investors had been deterred by the current regulatory framework more broadly, making the commercial proposition of a fully integrated local energy system difficult to develop.

GreenSCIES in London also found that current network charging and market structures restrict the ability to unlock the full potential of an integrated place-based approach.

Removing these regulatory barriers²³ would provide greater opportunity for all partners to benefit while improving the case for fully integrated local energy investment compared to individual component parts²⁴.

CASE STUDY

Bristol City Leap

An early Prospering from the Energy Revolution design project, Bristol Energy Smart System Transformation (BESST) aimed to develop digitally integrated clusters of energy-smart businesses and homes, to support the delivery of innovative energy and transport services.

The project was integrated into the Bristol City Leap initiative that has secured a strategic investment partner in Ameresco Ltd to deliver a smart local energy system for Bristol, worth £424m in the first five years of the twenty-year project, including heat pumps, heat networks, solar PV and energy efficiency.

Learning: The council turned an integrated place-based approach into an investable proposition by conducting extensive feasibility work and packaging together its energy assets and demand, making it a clearer pitch to investors.



Integrated local energy is still a complex financial proposition

By nature, integrated local energy systems are diverse, drawing together offerings of generation, storage, local supply, trading, flexibility, digital platforms, heat, and energy efficiency.

Not all of these parts have equal financial returns, particularly energy efficiency which is recognised as notoriously difficult to fund²⁵. **RESO** and **Zero Carbon Rugeley** both find that energy efficiency measures impact the positive investment value of their local energy case²⁶.

As such, **bringing together fully integrated local energy systems in a way that is also attractive to project finance providers can be tricky.**

To overcome this, local authorities and stakeholders have been working to create streamlined, bundled and fully planned local energy offerings.

By bundling components together, projects can raise finance for full propositions, rather than investors

cherry-picking lowest risk options and leaving the wider value of an integrated approach (for investors themselves and more broadly) on the table.

Bristol City Leap has had some success here. Zero Carbon Rugeley has also made good headway, creating a platform to bring bundled propositions to market, although challenges still remain. The project has found that there is a need for greater subsidy at this stage to fully enable this.

Beyond this, there is a need to **de-risk integrated place-based projects, which are still new and mostly untested**. This will require a combination of clarity and incentive from central government to encourage investment in fully integrated systems, finance innovation communication of the benefits of integration for project financiers, and more practical de-risking mechanisms.

The Green Finance Institute outlines how the UK Infrastructure Bank can feasibly support de-risking integrated local energy offerings²⁷. 3Ci has also been working to build stronger relationships and

confidence between local stakeholders and the finance community, while showing how “blended finance” models can allow revenues from more profitable elements of local approaches to fund those with lower returns such as energy efficiency²⁸.

Local authorities often lack resource and expertise to make integrated place-based systems a reality

Local authorities have a critical role to play in enabling place-based energy systems and the UK’s wider net zero targets²⁹. They are typically expected to be the central convening partner, with access to finance, local knowledge and capability, public money and planning powers that are critical to design and delivery.

Many local authorities do not have enough resource to do this, and lack the in-house expertise to fully develop their own integrated local energy propositions.

The Energy Systems Catapult “Net Zero Go” tool³⁰ provides useful support for local authorities in planning and enabling local net zero approaches. Yet often local authorities still lack the resources to deliver the more robust **local area energy planning** capabilities needed to develop a fuller, investment-ready proposition.

There is a great need to develop the resource and skills within local authorities to create fundable propositions and link these with potential finance and investors³¹. The UK Infrastructure Bank’s local advisory service³², which is in development, could provide additional support here.

By bundling components together, projects can raise finance for full propositions, rather than investors cherry-picking lowest risk options

What next?

The Prospering from the Energy Revolution programme has demonstrated the potential of an integrated place-based approach to energy systems, and the barriers that still remain. The evidence from the programme is that action is needed in **four key areas** to attract investment into smart local energy propositions:

1 Clarity on the local role in delivering net zero

The programme's findings show that more clarity on the local approach to net zero, and the power local authorities will have to deliver on local energy ambitions, would help reduce risk and support investor confidence.

2 Appropriate recognition and reward for local generation and flexibility, to unlock vital revenue streams

The evidence points to a need for specific measures which can help unlock the revenue-generating potential of local generation and flexibility, and in turn attract investment.

Rapid implementation of the Smart Systems and Flexibility Plan would help to enable local flexibility.

Measures to better support local supply and provide revenue certainty for local generators would also open up new opportunities.

3 De-risking of finance to unlock wider value

Integrated local energy systems are complex, with different components carrying different risk and reward. Streamlining and de-risking projects is critical to securing finance and investment.

Potential models have been developed to bring "bundled" packages to market, but this will still require some de-risking to fully enable.

Projects identified that the UK Infrastructure Bank could play a role here, to help de-risk the propositions and unlock greater investment, while working more closely with investors and finance providers could also help to build confidence in the opportunity of the integrated place-based approach (see 3Ci)³³.

4 Supporting local authorities to develop robust feasibility and planning programmes

Putting together viable integrated, place-based energy projects relies on local authorities having the resource, finance, skills, and expertise to conduct local area energy planning and project feasibility work to draw in investment³⁴.

Supporting local authorities in developing these skills and delivering this function (with greater clarity on their role and power within the energy transition) would help to fully unlock the value of smart local energy systems.

Notes

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Funders and partners in the ReFLEX Orkney project



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