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# Prospering from the Energy Revolution

**Unlocking the potential of intelligent local energy  
systems for the UK**



# What is the Energy Revolution challenge?

The Energy Revolution challenge is part of the Industrial Strategy Challenge Fund. The challenge is designed to unlock the potential of local, intelligent energy systems. It aims to prove novel, investable and scalable local energy business models that can provide the cleaner, cheaper energy of the future – in ways that users want.

Through an investment of £102 million, the Energy Revolution challenge will realise commercial solutions that integrate multiple local energy flows using innovative technologies, with societal, market, and investment needs. The resulting solutions will create clean energy models that investors want to invest in, and energy users want to buy.

## **The challenge aims to do this by:**

- creating ground-breaking local energy system demonstrators
- developing a pipeline of ambitious, investable local energy designs
- funding critical innovations in the system
- bringing together new multidisciplinary research in local energy systems

The Energy Revolution challenge will support businesses and researchers in bringing clean, competitive energy systems of the future into reality. It will create high-value local jobs across the UK and international leadership in integrated energy provision.



A year into the Energy Revolution programme, it's a very exciting time. We've unveiled four game-changing local energy demonstrators, kicked off 11 concept designs of future energy systems, and funded a portfolio of early innovation projects - developing new storage, renewables and Artificial Intelligence products amongst others.

Here, we introduce some of the pioneering projects, research and integration activities that are helping to deliver our ambitious goals.

We're unlocking opportunities for businesses, investors and energy users alike from clean local energy systems. And we're making the UK a leading hub for smart energy systems - driving both inward investment and export growth.

**Rob Saunders, Challenge Director, Prospering from the Energy Revolution,  
UK Research and Innovation**



Total investment



£77m Future energy model proving

4 practical demonstrators

£48 million

up to 10 future designs

£29 million

£8m Innovation Accelerator

15-20 new products

£8 million

£17m Research, Expertise, Capability, Coordination

£17 million

Programme Integration

via ERIIS - Energy Revolution Integration Service and EnergyREV Research Consortium

Demonstrators

The Energy Revolution challenge has funded four game-changing local energy demonstrators. The demonstrators will be developed and built in the next three years to illustrate how integrated intelligent local systems can deliver power, heat and mobility to users in new and better ways.



The public grant, in excess of £50 million across the four projects, is stimulating activity worth at least £150 million in total. This activity shows that the appetite to both demonstrate and understand local energy systems is strong in the industrial and financial sectors, as well as in the local communities where they are being trialled. The following pages show details of the four demonstrators we are funding.



DEMO

## Local Energy Oxfordshire (LEO) | Working at a local level to reduce climate change

In Oxfordshire, one of the most wide-ranging and holistic smart grid trials ever conducted in the UK is underway. The £40 million Project LEO will explore how the growth in local renewables, including electric vehicles, battery storage, vehicle-to-grid technology and demand-side response can be supported by a local, flexible, and responsive electricity grid.

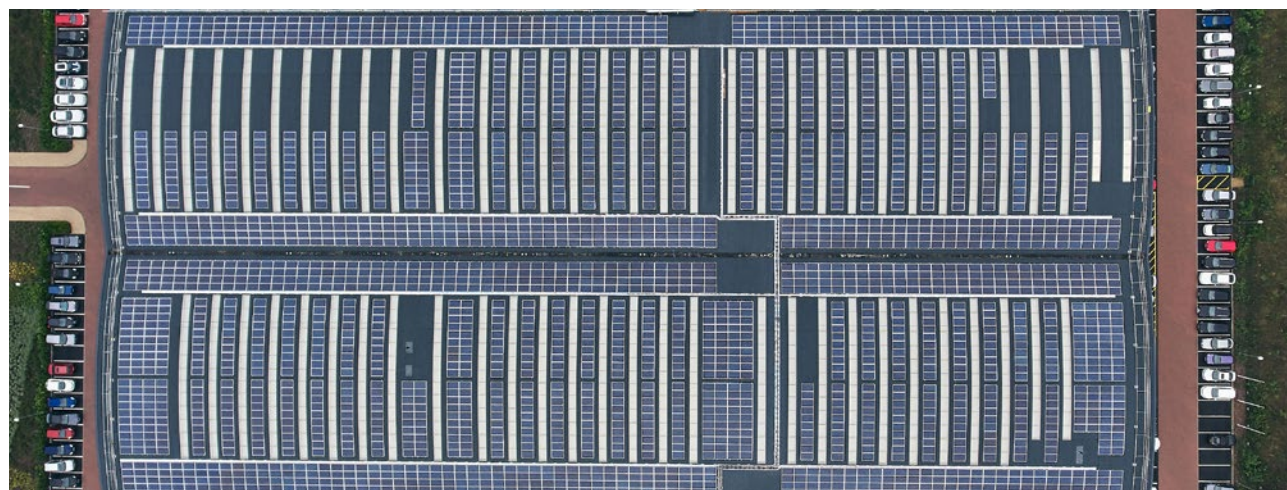
Project LEO will replicate and trial aspects of the system models already being explored by industry, government and the energy

regulator, via the Energy Networks Association Open Networks Project. It aims to ensure value for consumers, as well as opportunities for communities and market providers.

It will also balance local demand with local supply in a real-world environment, helping to test markets, inform investment models and ultimately assess the benefits of flexibility to the energy system.

We're delighted that the UK government has provided the final piece of funding for Project LEO. This will provide crucial research and learnings, accelerating the transition to new local energy systems and the move to a smart, flexible, low carbon future.

**Stewart Reid, SSEN's Head of Future Networks**



DEMO

## Project ReFLEX | Creating a smart energy island on Orkney

The Scottish island of Orkney generates more renewable energy than the island's population can use.

A £28.5 million project, ReFLEX (Responsive Flexibility) Orkney, is underway to help maximise the potential of the island's significant renewable generation capabilities and ensure higher quality and more affordable energy services.

Electricity, transport and heat, powered by local renewable energy generation, will be coupled with flexible energy demand to balance the intermittency of renewables provision.

The ReFLEX project will see a first-of-its-kind Virtual Energy System (VES) linking Orkney's local electricity, transport and heat networks into one overarching and controllable system.

The digital system will then control different energy-balancing technologies, including hydrogen fuel cells, electric vehicles charging through vehicle-to-grid chargers, and flexible heating systems.

The ReFLEX project aims to lower Orkney's carbon footprint by decreasing its reliance on imported carbon-intensive grid electricity from the UK mainland.

We're delighted that UKRI has funded this project. This new model will demonstrate how we can better interact with, own and manage our integrated energy systems locally, both at an individual and community level.

**Neil Kermode, Managing Director at EMEC**





DEMO

## SMARTHUBS | Shaping the way UK energy is generated, stored and supplied

The SMARTHUBS project in West Sussex will use an intelligent virtual power plant concept to help shape the way energy is generated, stored and supplied to homes and businesses in the UK.

The £42 million, three-year pilot project will design, implement and test a new smart local energy system. It will introduce new innovations around electricity, heat and energy for transport at scale.

The pioneering project will increase the amount of energy generated through solar photovoltaic systems, build more battery capacity to store the generated renewable energy, and invest in improvements to the local electricity grid.

It will also demonstrate how low-carbon heat can be generated and shared in an efficient and environmentally-friendly way, using solar photovoltaic systems and batteries to power domestic and commercial heat pumps.

By producing hydrogen gas to power vehicles and linking solar photovoltaic arrays and battery storage to an electric vehicle charging infrastructure, Project SMARTHUBS will also provide clean energy for transport.

The SMARTHUBS virtual power plant will integrate several platforms, dynamically monitoring and responding to energy demand and generation across West Sussex's council housing, private residential properties, commercial properties, and transport infrastructure.



We are delighted to be part of Project SMARTHUBS. The lessons we learn will help the government to plan ahead and adapt our national energy system to the fundamental changes taking place.

Steve Read, Director of Energy, Waste and Environment  
for West Sussex County Council



DEMO

# Energy Superhub Oxford |

## Helping cities cut carbon and improve air quality

The Energy Superhub Oxford (ESO) project is taking a different approach to unlocking new energy capacity. The project will model a way for cities around the world to both cut carbon and improve air quality, reducing emissions and improving public health by accelerating a switch to electric vehicles and decarbonising heating homes and buildings.

A world-first, Oxford's Energy Superhub will connect loads and grid-scale storage directly to the national high voltage network and see the deployment of mass energy storage to support the decarbonisation of energy, transport and heat across the city.

The Energy Superhub will trade flexibility

into the national grid via the largest (50MW / 55MWh) hybrid lithium-ion / vanadium flow battery installed to date, while a machine-learning optimisation and trading system will control the market interactions and work to make the best use of the assets.

The £41 million project will showcase cutting-edge technologies, including electric vehicle charging, to enable the ultra-fast charging of electric fleets, including taxis, trucks and buses.

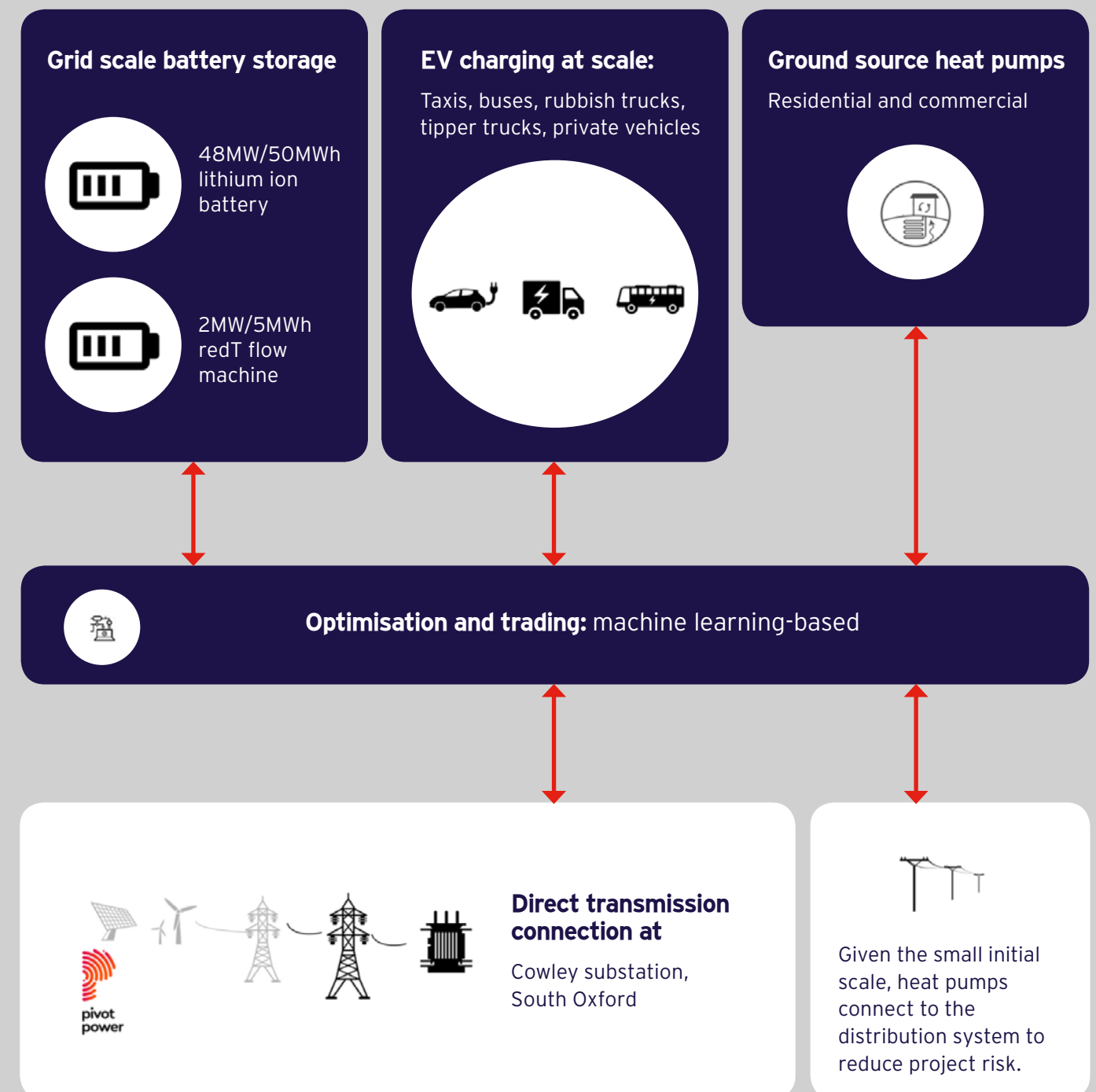
It will also introduce battery systems, low-carbon heating to homes and businesses, and smart management technologies via a shared ground loop system.

The City Council is working towards a Zero Carbon Oxford to tackle dangerous climate change in the time available to us to save the planet. Uniquely, this £41m once-in-a-generation down payment on Oxford will move the Council closer to achieving this vision.

**Councillor Tom Hayes, Executive Board Member for a Safer and Greener Environment**



## Energy Superhub Oxford optimises power direct from the transmission system





# Future Designs

We have launched 11 short concept designs of highly ambitious future energy systems, targeting areas across the country with rural, urban, domestic, industrial, commercial and mixed energy systems. A second call for detailed design projects will run from May to August 2019. Below is the case study of one of our funded Future Designs projects.

## **FUTURE DESIGNS** BankEnergi | Creating a local energy economy in London's South Bank

London consortium, BankEnergi, is developing a smarter, more sustainable, and more affordable model of local energy use. The consortium plans the development of a new infrastructure that will enable the trading of renewable energy at different times of day within the London area.

BankEnergi will use a range of existing renewable energy sources, like solar PV and ground source pumps and also plans to reuse heat from the tube network, installing large-scale battery storage, and fast electric vehicle charging.

BankEnergi plans to create a more efficient system and drive down costs for consumers, coupling time of day energy usage with the integration of heat, power and envisaged electric vehicle demand in the area.

Its peer-to-peer energy network will allow members to effectively trade energy with each other, creating a local economy and giving users the option to move away from the big energy suppliers.

This decentralisation of energy management could help reduce carbon and financial costs within the community.

BankEnergi will also look at ways to manage energy demand and storage to enable local trading in virtual power stations.

The BankEnergi project has received £136,107 from UK Research and Innovation's Prospering from the Energy Revolution challenge as part of the government's Industrial Strategy.

“What's innovative is that we're trading with each other to create a local economy. This allows us to keep the energy cost stable and to hedge against rising costs within the South Bank.”

**Project Lead, Rajvant Nijjhar**





# Innovation Accelerator fund

The Innovation Accelerator fund is a collaborative research and development programme.

**The programme is designed to:**

- commercialise smart local energy system products and services
- fill in the gaps in energy systems where technology components need specific development
- engage with the best international research and innovation opportunities

The first initiative finished in March 2019 and funded 18 quick start projects, which looked at components including, but not limited to:

- storage
- micropayments
- heat pumps
- solar



An international programme to promote UK expertise abroad is also underway and started with a business innovation mission to Boston in March 2019. Similar missions will continue over the next two years.

In late summer 2019, we are set to launch a collaborative research and development competition that will focus on specific components that are missing from other activities within the Prospering from the Energy Revolution Programme. The next page highlights a case study from one of our winners.

CR&D

## Multi-SAVES | Reducing customer energy costs and carbon emissions and increasing energy security

A feasibility study at the University of Oxford is researching the potential economic, social and environmental value of introducing a Virtual Private Wire Network (VPWN) to balance energy load across the university's buildings.

VPWN enables large organisations to balance energy supply and demand and increase energy security, while reducing customer energy costs and carbon emissions.

Oxford University's 400 buildings are spread across the city and are currently linked together on a micro-grid via a private wire network, reducing the ability to implement

estate-wide carbon reduction measures.

The Multi-SAVES project feeds into the Prospering from the Energy Revolution Challenge (PFER) demonstrator, Project LEO. It uses the MindSphere Internet of Things operating software from Siemens, a partner on the research project.

The Multi-SAVES project aims to manage the energy use of Oxford University's estate centrally and has identified that units such as the Bodleian Library Store have a large thermal mass that can be used to balance significant supply and demand loads.





# EnergyRev |

## The new consortium creating prosperous clean energy communities

A £9.8 million investment by UK Research and Innovation (UKRI) to create an Energy Revolution Research Consortium will coordinate and integrate existing UK world-class knowledge, research teams and facilities to provide advice, research and innovation.

The interdisciplinary consortium comprises over 20 universities, led by Professor Stephen McArthur at the University of Strathclyde.

Working with academia, industry, public bodies and communities, EnergyRev will deliver a suite of strategic research projects that address industrially-led challenges in the development of local, investable, consumer-centred energy approaches to create prosperous clean energy communities.

EnergyRev will work closely with the Energy Systems Catapult to provide analysis, evaluation and assessment of the demonstrators and designs funded under the government's Prospering from the Energy Revolution (PFER) programme.





# ERIS | Promoting sustainable new smart local energy markets

Developing robust, integrated business models is crucial to transforming the UK energy system to meet carbon reduction targets and achieve our clean growth ambitions.

Energy Systems Catapult is playing a central role within the Prospering from the Energy Revolution Challenge (PFER) through the Energy Revolution Integration Service (ERIS) and is helping selected projects to develop better business models by taking a systems-thinking approach.

ERIS exists to respond to the integration challenge and to break down the siloed thinking that stands in the way of sustainable new smart local energy markets.

Drawing upon the Catapult's portfolio of capabilities, assets, energy experts and

partners, ERIS is supporting PFER participants in understanding the maturity, risks, and benefits of their business models.

Through whole system guidance and support, ERIS is helping to identify what needs to change in participants' business models and/or the energy system to enable commercialisation. It is also evaluating how well these business models align to PFER objectives, such as reducing greenhouse gas emissions below the fifth carbon budget levels.

ERIS is building a community to combine forces around opportunities, challenges and synergies, and as the programme progresses, will capture lessons and insights, inviting key stakeholders who can influence change to engage.





