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CATAPULT Energy Systems

EMERGING BUSINESS MODELS FOR SMART LOCAL ENERGY SYSTEMS



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Energy Revolution Integration Service

This work was funded by UK Research and Innovation and Innovate UK
as part of the Prospering from the Energy Revolution programme.
For full details on Prospering from the Energy Revolution projects, click here.

About Energy Systems Catapult

Energy Systems Catapult was set up to accelerate the transformation of the UK's energy system and ensure UK businesses and consumers capture the opportunities of clean growth. The Catapult is an independent, not-for-profit centre of excellence that bridges the gap between industry, government, academia and research. We take a whole systems view of the energy sector, helping us to identify and address innovation priorities and market barriers, in order to decarbonise the energy system at the lowest cost.

About UKRI

Launched in April 2018, UKRI is a non-departmental public body sponsored by the Department for Business, Energy and Industrial Strategy (BEIS). Our organisation brings together the seven disciplinary research councils, Research England, which is responsible for supporting research and knowledge exchange at higher education institutions in England, and the UK's innovation agency, Innovate UK.

About Innovate UK

Innovate UK is the UK's national innovation agency. We support business-led innovation in all sectors, technologies and UK regions. We help businesses grow through the development and commercialisation of new products, processes and services, supported by an outstanding innovation ecosystem that is agile, inclusive and easy to navigate.

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WHAT ARE SMART LOCAL ENERGY SYSTEMS?

The case for smart local energy systems

Prospering from the Energy Revolution is a £102-million programme funded by the Industrial Strategy Clean Growth Fund and directed by UK Research and Innovation. The programme involves 25 different projects and 216 organisations aiming to trial and test innovative approaches to developing smart local energy systems (SLES).

Projects are looking to create investable business models, with success evaluated on whether they can:

- Leverage 10 times the investment
- Reduce greenhouse gas emissions to meet the 5th carbon budget
- Reduce end-consumer bills by up to 25%
- Create world-class consumer experiences
- Demonstrate national and international scale-up and replication

Energy Systems Catapult has been commissioned by the programme to analyse opportunities and barriers identified by the projects, and to help make SLES designs more investable, replicable and scalable. This insight paper is focused on emerging business models for SLES and how they can help deliver value to local communities.



WHAT DEFINES A

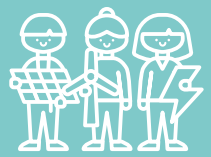
SMART LOCAL ENERGY SYSTEM?



What defines a

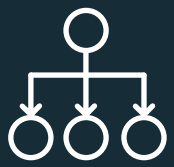
Smart local energy system?

Smart



- **By design**
  Using data for local area energy plans (LAEP) to identify opportunities for the energy system
- **By operation**
  Automated use of assets in the house and potentially automated trading of assets in energy markets
- **Learnt or autonomous**
  How the operation of the assets is delivered

Local



- **Defined by region or boundary**
  Often linked to a specific area with a supporting local authority
- **Better outcomes for the community**
  Aim to engage the local community in developing the SLES to meet the needs of the local area
- **Enabling Net Zero in line with local strategies**
  Working with LAs to identify measures that meet local Net Zero strategies

Energy system



- **Optimised and more efficient**
  By taking a local, more granular approach, the end result should create a more efficient energy system
- **Multi-vector approach**
  Taking power, heat and transport energy requirements into account and how they integrate
- **User-centred design**
  Ensuring the development of the energy system delivers desired outcomes for the consumer

Key considerations when designing a SLES

Smart local energy systems are a way of better connecting local energy users and assets. When thinking about the design of a SLES, there are three main factors to consider.



Components

A SLES is ultimately a **collection of projects, assets and users** in a local area. The key to SLES design is a) what are the most suitable projects and assets for the location and b) what is the most valuable way to connect them to serve users' needs?

A SLES could be designed from scratch (like a new-build development) or it could focus on how to connect existing assets and users in a more effective way.



Connectivity

There are different ways of connecting assets and users to deliver local value. That connection can be a tangible, **physical connection** (such as a heat network or a micro-grid) or it can be more **intangible connections** (like users on a digital platform) that still mean different projects or components have a shared purpose.



Meeting local needs

The key objective of a SLES is that it allows a local area to decarbonise in the most efficient and effective way.

This will be driven by local needs but there are three key areas of consideration:

- **Speed** – i.e. deliver Net Zero more quickly
- **Cost** – i.e. deliver Net Zero more cheaply
- **Value** – i.e. increased local benefits through delivery

What are the key components of a SLES?

Finance and investment
Different sources of finance and investment used to create and operate the SLES. *Examples: Private investment, public finance, grant funding and subsidies*

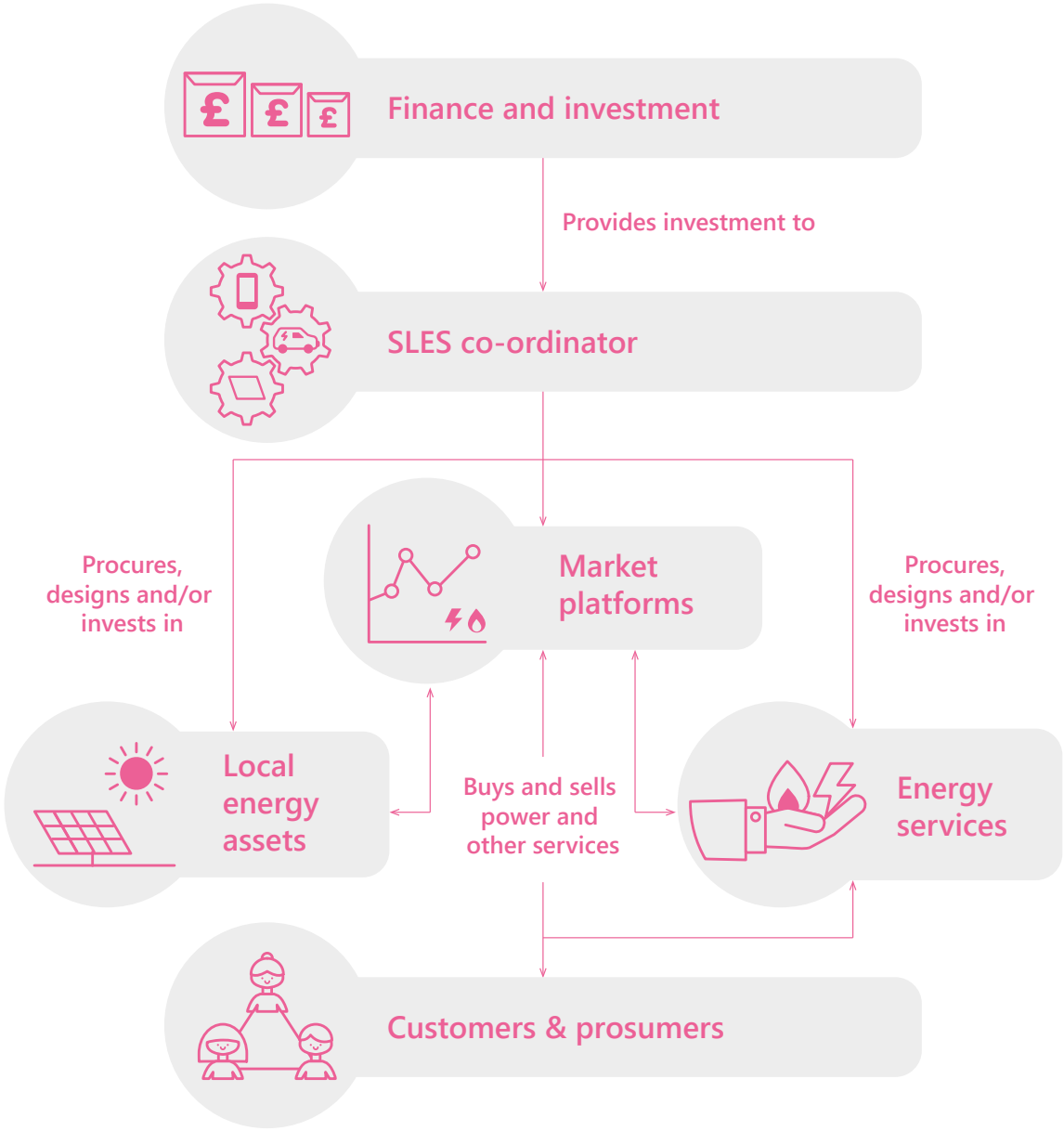
SLES co-ordinator
Organisation responsible for design and creation of smart local energy systems. *Examples: Project co-ordinator, local system operator, local energy market designer*

Market platforms
Digital and commercial platforms that allow different users in a SLES to interact. *Examples: Data-sharing platform, flexibility platform, peer-2-peer trading*

Local energy assets
Generation, energy assets and other energy infrastructure that enables a smart local energy system. *Examples: Grid-connected solar PV, EV charging infrastructure, heat networks*

Energy services
Sale of local energy and local energy services to customers, or delivery of energy services to networks. *Examples: Energy service companies (ESCo), heat contracts, aggregation and trading services*

Customers and prosumers
End users who buy energy and other services, or sell energy and services through their own energy assets. *Examples: Homes, small business, public sector estate, commercial & industrial, customers with solar and storage, EV users*



How can those components be connected?

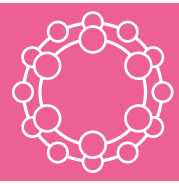
Digitally connected



Collecting data and insights for the local area that can be safely accessed by 3rd parties. Helps build and improve transparency and quality of services.

Examples: Asset register, data sharing, data marketplace, project marketplace

Virtually connected



Managing the smart local energy system virtually to improve balancing, flexibility and resilience. Involves better matching energy demand with local generation, especially during times of constraint for the network.

Examples: Local energy market, local flexibility market, virtual power plant

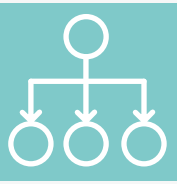
Commercially connected



Removing barriers and complexity so that users, generators and supply chain can more easily trade. Involves aggregating smaller scale customers or generators and helps them deliver more valuable services that otherwise would not be available to them.

Examples: Local energy service provider, local energy market, aggregators and trading services, joint ventures and SPVs, ESCo

Physically connected



Smart local energy that is physically connected and controlled. Physically linking energy assets together for greater value (e.g. storage with EV charging).

Examples: Anchor asset, EV charging fed by storage, heat network fed by solar

Meeting local needs and delivering local benefits

For a SLES business model to be viable, it must be delivering above and beyond an existing climate strategy. Taking a successful local approach means better value for end users (e.g. reduced bills or improved service), benefits for the wider community (e.g. improved health, wellbeing or jobs) and better value for the system (e.g. reduced constraints).



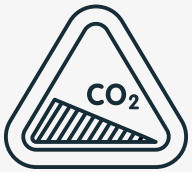
Financial

New opportunities to generate revenue, capture monetary value or reduce expenditure



Health & wellbeing

Actions that create more healthy buildings, spaces, services or environment



Net Zero

Actions that help reduce carbon emissions more quickly or more cost-effectively



Economic opportunity

Actions that provide jobs, training and enterprise opportunities that increase capability to deliver Net Zero and create growth in the local economy



System resilience

Actions that increase the ability of the local energy system to more effectively adapt to the Net Zero transition



Equity and social

Actions that create a fairer society and ensure the energy transition is just and equitable

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WHAT ROLE COULD LOCAL AUTHORITIES PLAY IN SMART LOCAL ENERGY SYSTEMS?

The drive for local energy and the need for action

So far, 245 local authorities have declared a climate emergency. They have done so in the belief that national energy policy will not address local needs and constraints at the same speed as local decision-makers.

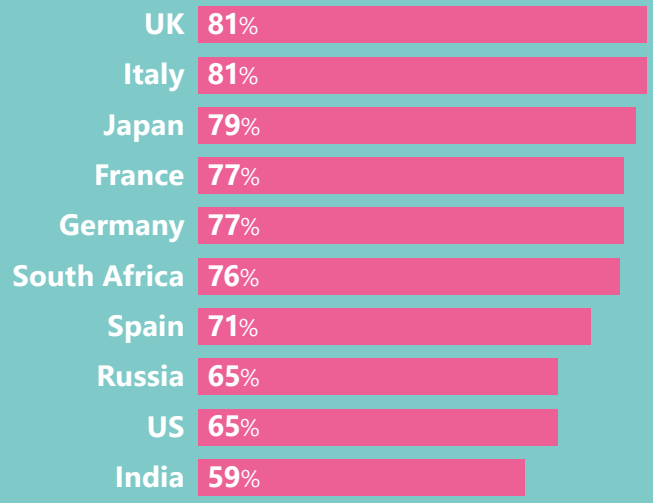
Communities are looking to their local authorities now to take action and deliver on their climate promises. This means that each local authority must take the lead and act in the areas in which they have influence. This includes:

- Decarbonising own building stock
- Designing local market conditions that reward low carbon choices
- Helping finance, own, operate renewable energy assets in a local area
- Working with and influencing partners to encourage stronger action



Where belief in the climate emergency is strongest

Share of the public who believe in the climate emergency in selected countries



n=1.2 million respondents in 50 countries (Oct 07 – Dec 04, 2020)
Source: United Nations Development Programme & Oxford University

The roles for local authorities and communities in SLES

Investor

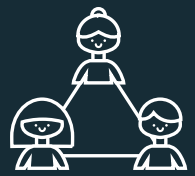


Asset investor
Investing in local energy assets like solar, storage or EV charging infrastructure

Energy services company (ESCo)
Invest in a service company that acts as the delivery mechanism for the energy services provided to customers

Market platforms
Play a central role in the design of local energy markets and local energy platforms, which allows the community to trade different energy services

Customer



Energy off-taker
A local authority who buys energy from the SLES for its own buildings or operations. This includes power, heat and transport.

Building
Public buildings or social housing that benefit from the installation of energy-efficiency improvements or low carbon technology

Land
Lease land to 3rd party to develop generation assets

Supporter



Community engagement
Support project engagement by providing local context and identifying key groups in the community

Local area energy planning
Providing data to either allow others to undertake LAEP or to undertake it themselves

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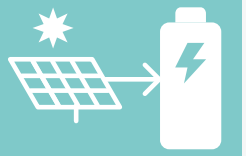
EMERGING TYPES OF SMART LOCAL ENERGY SYSTEMS

Categorisation of SLES business models identified

Emerging types of smart local energy systems

Click to visit page

1 Project Market-place



An organisation or digital platform that aggregates local energy projects up and links them to investors and delivery contractors

Projects: Rewire-NW (Warrington), Zero Carbon Rugeley, RESO (West Midlands)

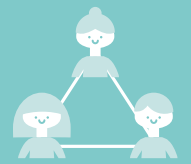
2 Local Flexibility Market



A single buyer creates a market and better business case for local, flexible energy assets

Projects: LEO (Oxford), LMEX (Liverpool)

3 Local energy market



Creates a market for local green energy from many local generators and many local buyers

Projects: GM-LEM (Manchester), MH:EK (Milford Haven)

4 Virtual Network Manager



Service provider helps virtually manage local constraints that allows faster roll - out of low carbon technology

Projects: ReFlex (Orkney), Girona (Coleraine)

5 Anchor Asset



Investment in assets and infrastructure that delivers low carbon services to locals

Projects: Superhub (Oxford), GreenSCIES (Islington), Remedy (Southend), PIRI (Peterborough)

What are the SLES business model archetypes and how can they be used?

The SLES business model archetypes look to draw out common approaches across the PfER programme, and their benefits and risks. Approaches are not mutually exclusive though, and in some cases projects will be testing multiple business models.

We hope local authorities and communities can use this as a guide to what the future of local energy systems might look like and are able to start to think about:

1. An overall vision for local decarbonisation that goes beyond technology and considers the whole system (e.g. finance, customers, data)
2. What role the local authority and community can play
3. The benefits and risks of different roles
4. Planning now so that resources, capability and partners are in place
5. Identifying key stakeholders in delivery and engaging with them early
6. Informing and widening the debate on market enablers required for local decarbonisation (e.g. policy and regulatory change)



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LOCAL PROJECTS MARKETPLACE

Archetype 1

1 Project Marketplace



An organisation or digital platform that takes the lead in finding local renewable energy projects and linking them to investors and the supply chain. This single port of call is beneficial for the local area because it means a more coordinated approach to delivery. It also increases economies of scale and reduces risk for investors and installers. It has the potential to evolve into other archetypes but in the early stages the focus is on delivery of new renewable capacity and energy efficiency, more than optimisation of the local system. Best for unconstrained areas looking to mobilise quickly.

Why is it better for Net Zero?
Increases visibility and credibility of renewable projects while decreasing costs and risks

What makes it a SLES?
A co-ordinator or marketplace that links projects with investors and supply chain

Main low carbon interventions
Solar, storage, retrofit



1

Project Marketplace

Benefits and considerations

Key benefits

Financial
- Increases private investment in local area
- More cost-effective delivery of projects
- Reduces energy bills

Economic
- Builds local skills and supply chain

Net Zero
- Accelerates roll-out of high-impact projects

Health & wellbeing
- Funded projects can be targeted at vulnerable/fuel poor

Considerations

Community interests
- Marketplace will improve investment and local supply chain. Although some projects may help increase community engagement in Net Zero, this is not a certainty.

System resilience
- Will not address any future network constraints or infrastructure upgrades that will be required in future.

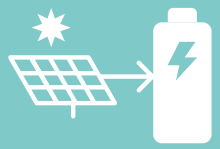
Market design
- Business case of projects in longer term, will need to address how value of using locally generated energy and providing local flexibility is increased

Financial/investor profile
- Finding the right type of investor. Need to appeal to a type of investor who is interested in long-term, slower returns.

1

Project Marketplace

Roles for local authority

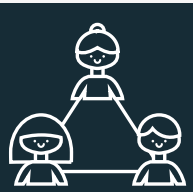


Investor roles



- **Local procurement framework** specific to the delivery of Net Zero projects
- **Invest in energy assets and infrastructure**
- **Local project co-ordinator** that helps create local projects, raise finance and contract supply chain to deliver
- **Local projects platform** software that aggregates local projects and matches it with finance and supply chain

Customer roles



- **Decarbonise buildings** – local authority estate could be put forward for heat network or solar projects without being the primary investor
- **Lease land** – licence or host land that could be used for grid-connected assets like solar and storage

Supporter roles



- **Local energy planning** – set priorities for the local area and assess potential for energy assets
- **Recruit local projects** – LA approved projects may be more likely to get investment
- **Support recruitment of investors and supply chain**

1

Local Projects Marketplace

Case study – Zero Carbon Rugeley

Overview of project

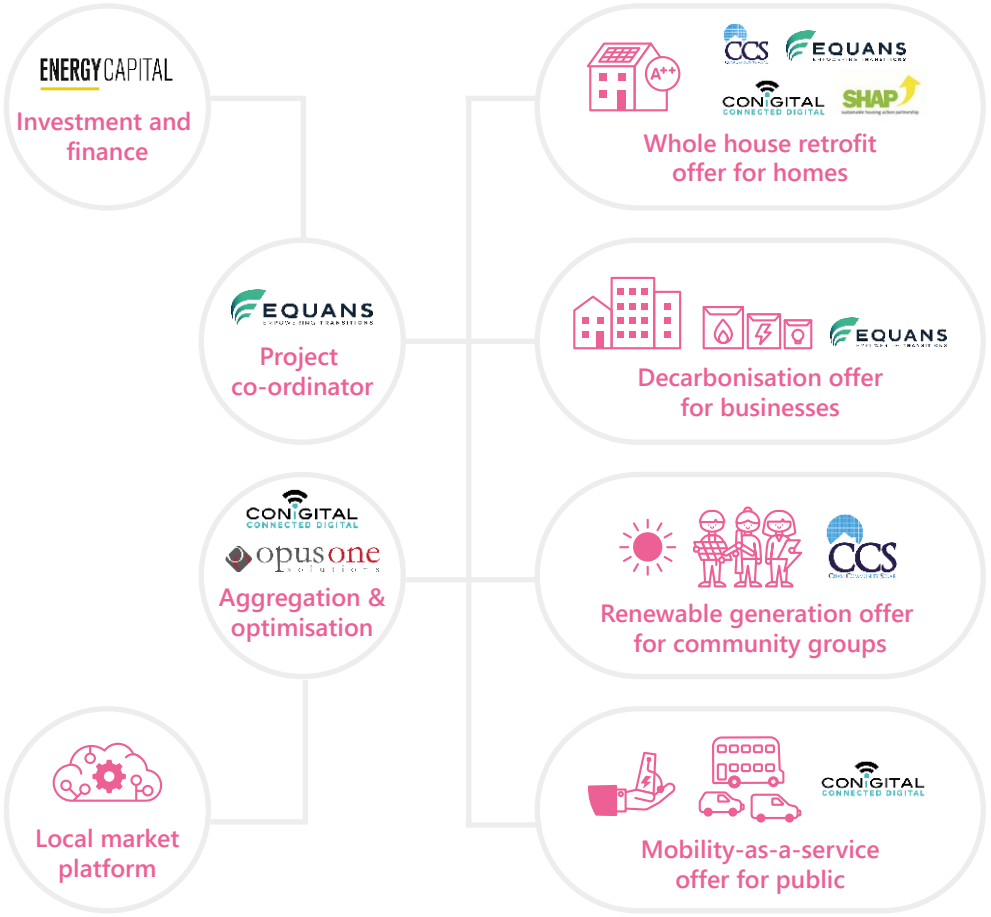
- Project led by Equans, as part of a redevelopment of the old Rugeley Power Station
- Project is looking to pull together investment, local stakeholders and service providers to enable town-wide decarbonisation
- New business models and service propositions being designed by consortium including Conigital, Equans, Chase Community Solar, SHAP, Cadent, Regen and Opus One
- Keele University and New Vic looking at how to embed community-led, user-centric design into the offer
- Opus One are main interface with distribution network operator (DNO) and provide local aggregation and trading platform

Scale of deployment

- Development of 3,200 new homes, and services on offer to existing 10,500 homes in Rugeley town
- Mobility trial is live and being led by Conigital/Connected Places Catapult (CPC)
- Expanding community energy offer (c. 100 homes with solar) with new rooftop solar installs and c. 75 batteries

Future ambitions

- Zero Carbon Rugeley consortium looking at nationwide roll-out for other communities



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LOCAL FLEXIBILITY MARKET

Archetype 2

2 Local Flexibility Market

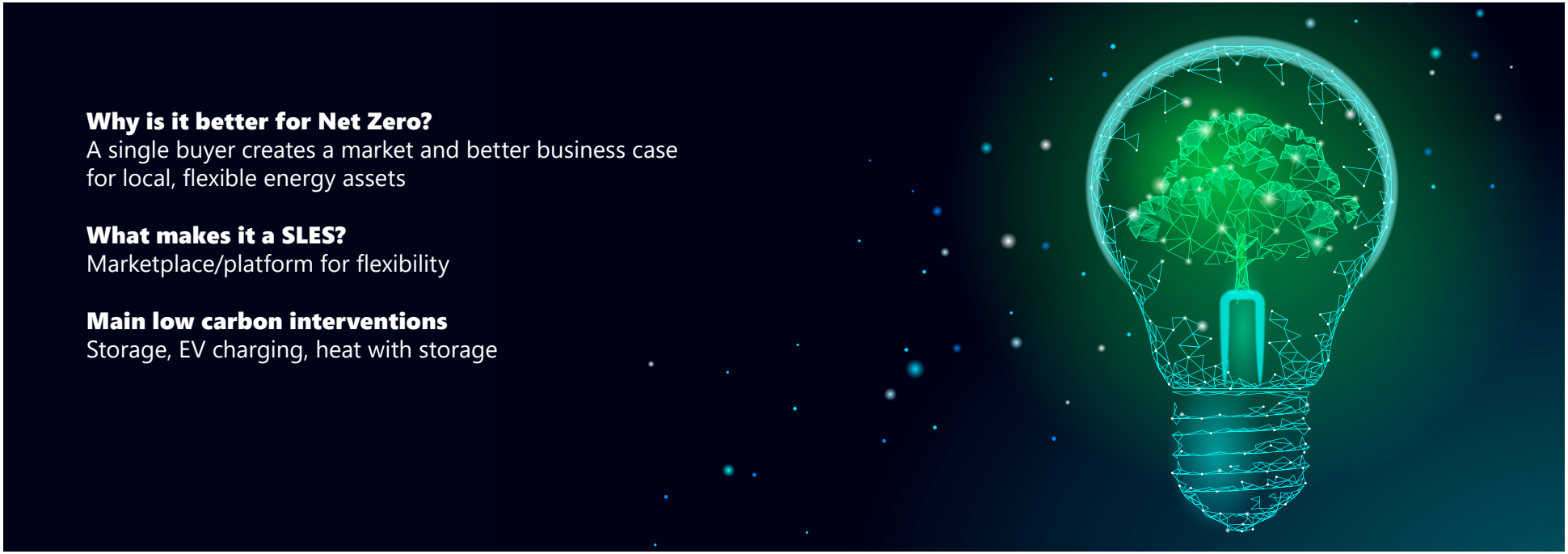


Local flexibility markets are driven by a single buyer at the top, creating incentives for more flexible use of the local power system. The buyer will be a system operator, like a DNO, or another organisation responsible for local system operation (e.g. RESO project). The market will send out price signals from the buyer to aggregators and energy asset owners in the area. It will enable local businesses and homes to provide flexibility by changing the amount of power they consume or generate at a given point in time. Unlike a local energy market, only flexibility and constraint management is being procured.

Why is it better for Net Zero?
A single buyer creates a market and better business case for local, flexible energy assets

What makes it a SLES?
Marketplace/platform for flexibility

Main low carbon interventions
Storage, EV charging, heat with storage



2

Local Flexibility Market

Roles for local authorities

Key benefits

Resilience
- Reduces impact of constraints
- Reduces need for network upgrades and reinforcement
- More diversity and flexibility in local network

Financial
- Lower energy bills for end users
- Improved business case for asset owners
- Reduces public money (including grants) required for Net Zero

Net Zero
- Accelerates roll-out of low carbon technology

Health & wellbeing
- Funded projects can be targeted at vulnerable/fuel poor

Considerations

Market design
- Need to create right price signal and incentives for local flexibility; the current market rules do not sufficiently reward this
- If moving to a local system operator, how will they integrate with wider system operation at a regional and national level?

Net Zero
- Favours flexibility first over the delivery of Net Zero

Scalability
- No consistent approach for buying local flexibility
- Harder for smaller scale assets to participate

Fair transition
- Extra support needed for vulnerable customers
- Flexibility markets alone will not address fuel poverty concerns

2

Local Flexibility Market

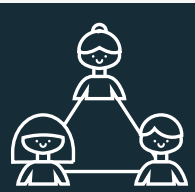
Roles for local authorities

Investor roles



- **Local system operator** – play a greater role in managing local networks and systems operation. Higher complexity and risk but much greater control in delivering climate strategy
- **Invest in energy assets** – Local flexibility market will improve the business case for energy assets that can provide local flexibility

Customer roles



- **Work with aggregators** – earn additional revenue from publicly owned energy assets. Also opportunities to utilise social housing
- **Trade flexibility** – work directly with flexibility platform and system operators for larger, publicly owned energy assets like solar and storage

Supporter roles



- **Local energy planning** – support local network operators to understand local constraints and value of flexibility
- **Work with local industry and businesses** – align development plan for local commerce and industry to energy plans

2

Local Flexibility Market

Case study – Local Energy Oxford (LEO)

Overview of project

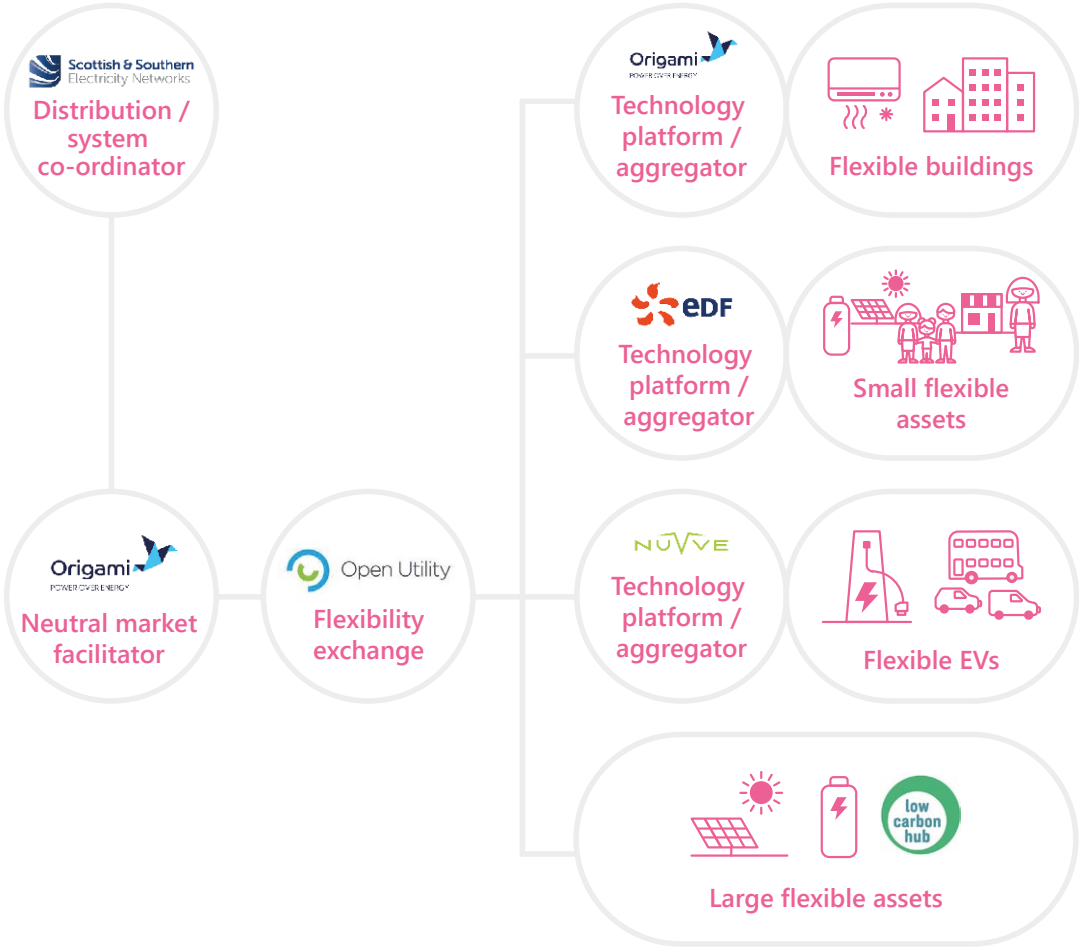
- Project led by SSEN and aims to trial their distribution system operators (DSO) model
- Origami act as main interface into the DSO, through their neutral market facilitator platform
- That allows multiple flexibility exchanges to exist, with the Piclo platform being trialled as part of LEO
- A mix of real time and longer-term flexibility that the DSO wants is posted on the exchange for different aggregators and asset owners to offer
- Three aggregators/service providers (EDF, Nuuve, Origami) will interface into the exchange
- Flex assets include local renewables (Low Carbon Hub), EVs, battery storage and demand side response
- Look to encourage further investment in the area by making the aggregator business model more viable

Scale of deployment

- This first trial will benefit up to 270,00 homes and 35,000 businesses, as well as 5 high-end science parks

Future ambitions

- Results of trial will play a large part in shaping the viability of different DSO transition paths
- Piclo are trialling with other networks in UK and internationally



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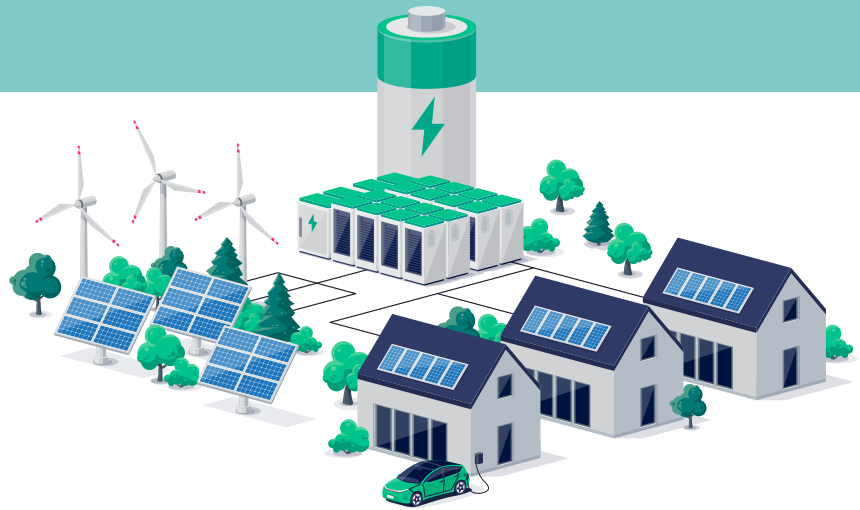
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LOCAL ENERGY MARKET

Archetype 3

3 Local Energy Market

A marketplace that matches many local energy users with many local energy assets like solar, storage and EV charging. Often referred to as a peer-2-peer energy market. Local users have the potential to buy directly from a local generator or buy other energy services available in the market. The market is facilitated by a software platform which could be run by a number of different parties in the local area. The key to its success is finding ways to increase value of energy that is being consumed in close proximity to where it has been generated.



Why is it better for Net Zero?
Creates a market for local green energy from many local generators and many local buyers

What makes it a SLES?
Marketplace/platform for buying and trading energy

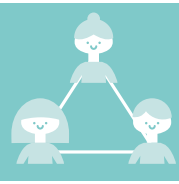
Main low carbon interventions
Solar, storage, EV charging, heating



3

Local Energy Market (LEM)

Benefits and considerations



Key benefits

Net Zero
- Accelerates reduction of local carbon emissions
- Increases local participation in Net Zero

Financial
- Lower energy bills for customers
- Improved business case for generators

Economic opportunity
- Increases local economic growth and employment

System resilience
- Increases flexibility in local network

Considerations

Policy & regulatory
- Complex to set up – new market rules required
- Relationship with system operators. Need to understand how DNO and National Grid will interact with the LEM.

Creating value
- It is not clear, yet, how additional value is generated in local energy markets vs national markets
- Market requires sufficient volume and liquidity to be viable

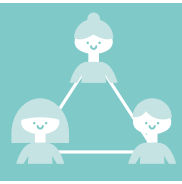
Digital and data
- Huge volume of user data needs to be stored and used. Need both technical capability and safety protocols in place.

Fair transition
- Extra support will be required to support vulnerable customers and address fuel poverty concerns

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Local Energy Market

Roles for local authorities

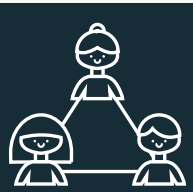


Investor roles



- **Own the local energy market** - set market signals to incentivise climate strategy. Generate income for council and potential replication in other LA's.
- **Invest in energy assets** like solar, storage and EV charging infrastructure. LEM will improve business case by increasing value of local power
- **Become an energy service provider** – create local energy tariff and sell through the market. Could include locally owned generation.

Customer roles



- **Buy from the local energy market** – local, renewable energy for public sector. Potentially at cheaper price through ToU and reduced use of system charges.
- **Sell to the local energy market** – existing community or publicly owned generation could sell to the LEM at increased price.
- **Leased buildings or land** to have energy assets installed that can sell into the LEM

Supporter roles



- **Recruit for the LEM** – inform public and encourage local participation in the LEM
- **Planning** – through planning can promote more use of land for more desirable social and environmental outcomes

3

Local Energy Market

Greater Manchester Local Energy Market

Overview of project

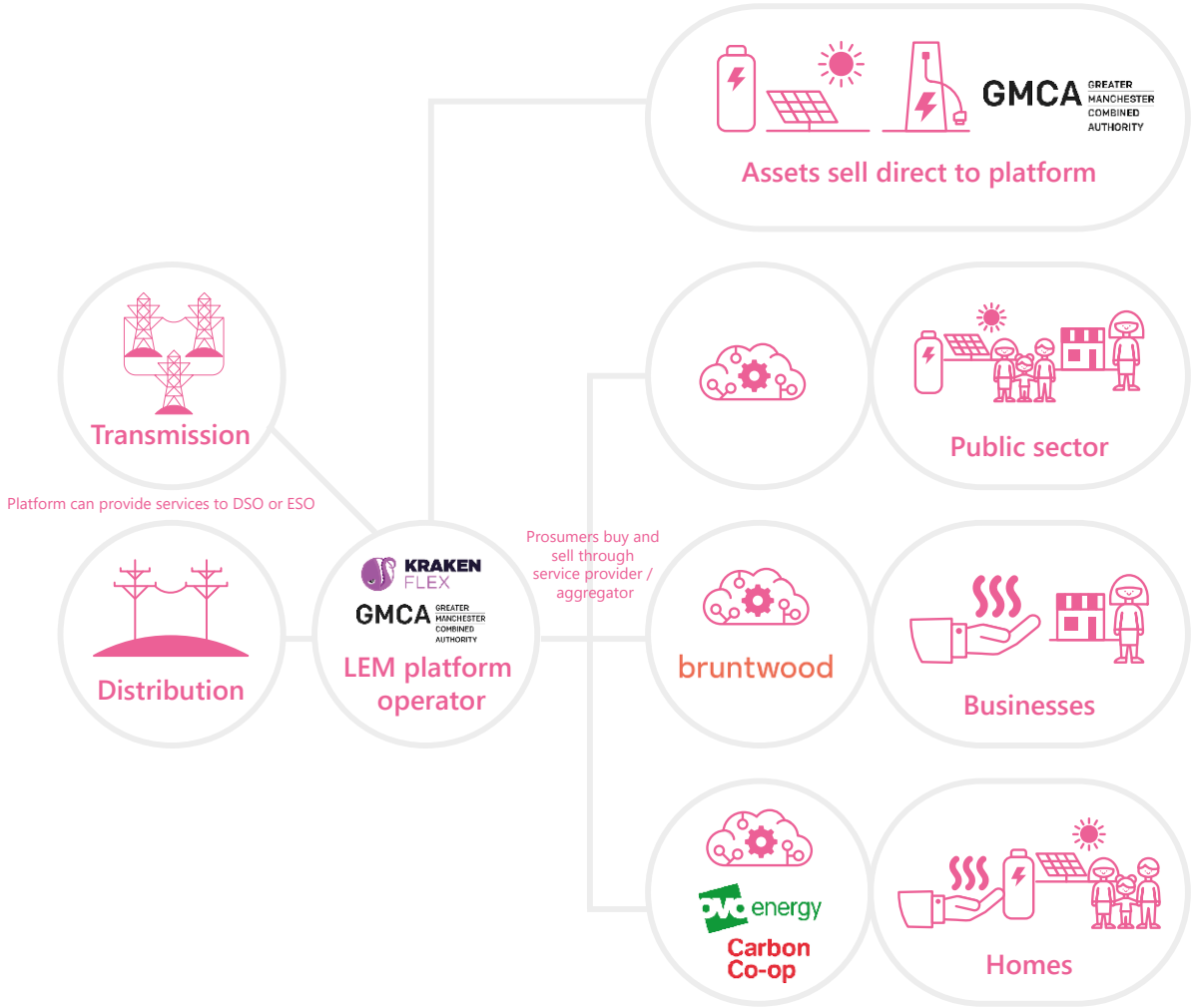
- Led by Greater Manchester Combined Authority (GMCA)
- Creation of a marketplace for the local exchange of energy and flexibility
- Being designed and developed by GMCA with support from Kraken Flex on the platform build
- Market looking to build new rules around selling; local flexibility and local capacity through the platform
- As consortium members, Bruntwood and Ovo developing innovative service propositions to support the marketplace
- Carbon co-op supporting community engagement with marketplace
- Market is being used to enable quicker and more cost effective roll-out of renewable capacity to meet GMCA's carbon targets

Scale of deployment

- 10 MW new renewable energy generation capacity – 22% of 2024 target for new capacity in GM
- Bruntwood and Ovo have trialled service offer with end users

Future ambitions

- Initial feasibility study completes in summer 2022
- Will be seeking further investment to expand trials of LEM market with generators and end users
- Manchester LEM is aiming to increase local energy generation by 80+ MW by 2024.



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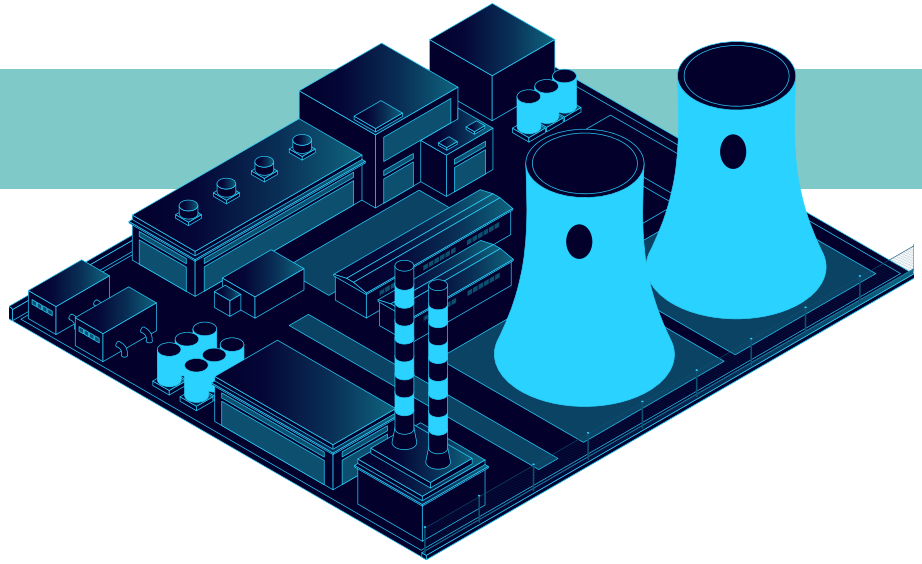
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VIRTUAL NETWORK MANAGER

Archetype 4

4 Virtual Network Manager



An organisation creating a virtual balancing system that optimises local generation and demand. Most commonly used in constrained areas where new grid connections are difficult or too expensive. Also seen in areas where curtailment is impacting generators. Energy assets are deployed behind the meter at low cost to the user. By aggregating assets to provide flexibility, any revenue generated or savings made are used to offset the technology costs. An energy service contract or licence arrangement would need to be in place with users.

Why is it better for Net Zero?
Service provider helps virtually manage local constraints, which allows faster roll-out of low carbon technology

What makes it a SLES?
Platform that virtually manages network at an agreed grid supply point

Main low carbon interventions
Solar, storage, EV charging and heat



4

Virtual Network Manager

Benefits and considerations



Key benefits



Financial

- Lower bills for end users
- Improved businesses case for local asset owners
- Reduces public spending required to meet Net Zero



Net Zero

- Accelerates roll-out of low carbon technology



System resilience

- Reduces need for network reinforcement
- More diversity and flexibility in network



Equity and Social

- Funded projects can be targeted at vulnerable/fuel poor



Economic

- Reducing constraints enables local economic growth

Considerations



Policy & regulatory

- Need to understand relationship with regional and national system operators
- Longer-term energy contracts required to roll out low carbon technology



Creating value

- Virtual network needs to be funded either through increased value for local authority or local network operator
- Revenue of virtual network is subject to merchant price risk



Community interests

- Making sure local interests are protected and virtual network is not just focused on revenue generation
- Handling data of participants on the virtual network ethically and safely

4

Virtual Network Manager

Roles for local authorities

Investor roles

- **Be a local energy service company** – joint venture with private investment to create a Local Energy Service Company
- **Invest in the virtual network manager** – working with partners to improve local balancing and constraints

Customer roles

- **Decarbonise buildings** – benefit from renewable assets installed for free on public buildings
- **Procure a local service provider** – bring in a private sector service provider to provide energy services to the local area

Supporter roles

- **Promote offer** – add credibility and trust to service provider looking to roll out energy assets in the local area
- **Co-ordinate local stakeholders** – bring together key stakeholders to ensure maximum benefit from the solution (e.g. networks, housing, business, community)
- **Planning and consent** – reduce legal or planning restrictions for licensing energy assets on buildings

4

Virtual Network Manager

Case study – ReFlex Orkney

Overview of project

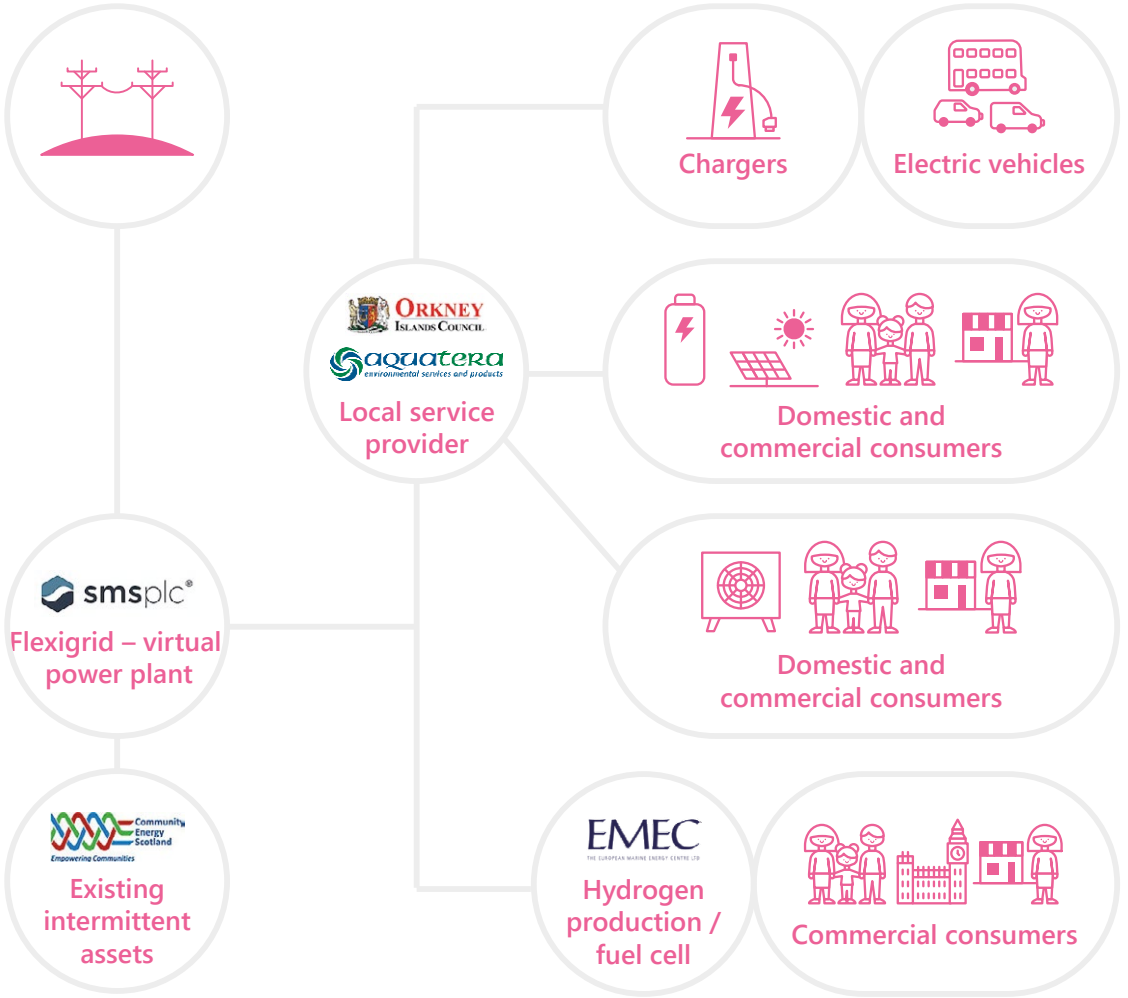
- ReFlex Orkney led by Aquatera, accelerating roll-out of low carbon heat and transport on the island and better utilising local renewables
- Aquatera set up a local energy service provider to own and operate EVs, EV charging and electric heating
- SMS developed Flexigrid, which helps match local demand when there is an increase in local generation
- Flexigrid generates value for flexible energy assets, through grid services, and reduces impacts of curtailment on local generation assets like wind
- Orkney Council and its residents get increased access to electric transport and share in value created by Flexigrid

Scale of deployment

- 200 new EVs, electric mini-buses and e-bikes
- 20 electric heating systems that can be managed flexibly
- Feasibility study looked at innovations like a local energy tariff, solar, storage and integration of EMEC hydrogen fuel cell but regulatory and market barriers have scaled back ambitions

Future ambitions

- Aquatera looking at replicability in similar locations.
- SMS have launched solar, storage and heating service to social housing called Solopower
- EMEC continuing with the development of industrial-scale hydrogen fuel cell



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ANCHOR ASSET

Archetype 5

5 Anchor Asset

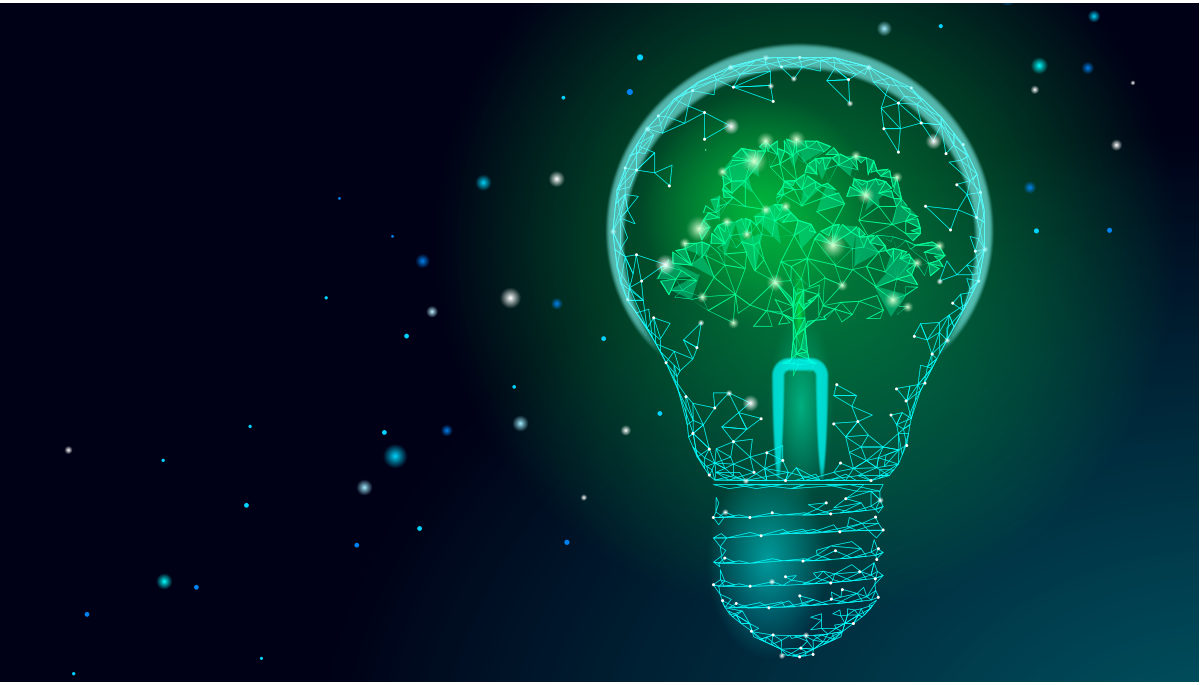


An anchor asset is a major local energy asset like heat networks, EV charging hub or storage. A SLES is then created by linking other energy assets to the main project, which will further reduce carbon emissions or reduce costs for end users. This can be gradually built on and expanded over time as demand in the local area increases. Examples include combination of storage and EV charging enabling the charging of public sector fleets, or solar and storage helping optimise a heat network to be lower carbon. The service becomes more cost-effective by utilising upstream trading and flexibility services. This is the most common type of SLES in the programme.

Why is it better for Net Zero?
Investment in assets and infrastructure that delivers low carbon services to locals

What makes it a SLES?
Physical connection of low carbon infrastructure (e.g. heat network with solar and storage)

Main low carbon interventions
Heat, EV charging, supported by other vectors (solar, storage, hydrogen)



5

Anchor Asset

Benefits and considerations



Key benefits

Net Zero
- Faster roll-out of low carbon technology
- Improves access to Net Zero for local area

Financial
- Revenue opportunities from investing in energy assets
- Reduces public money (including grants) required for Net Zero
- Lower bills for end users
- Price certainty/protects against future price rises

Health & wellbeing
- Reduces air pollution
- Better health outcomes and reduced illness

Economic
- Increases local employment and skills

Considerations

Finance and investment
- Large capital investment required

Creating value
- Reliant on wholesale trading or flexibility and those markets are subject to risk

Policy and regulatory
- The future of gas pricing
- Reliant on market rules outside of SLES remit
- Vertical integration – current Ofgem rules don't allow a power network provider to also sell energy services to end users.

Delivery complexity
- Long lead time on planning and delivery
- Complex to integrate different technology

5

Anchor Asset

Roles for local authorities

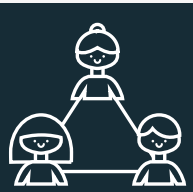


Investor roles



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- **Invest in the virtual network manager** – working with partners to improve local balancing and constraints

Customer roles



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Supporter roles



- **Promote offer** – add credibility and trust to service provider looking to roll out energy assets in the local area
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5

Anchor Asset

Case study – Energy Superhub Oxford

Overview of project

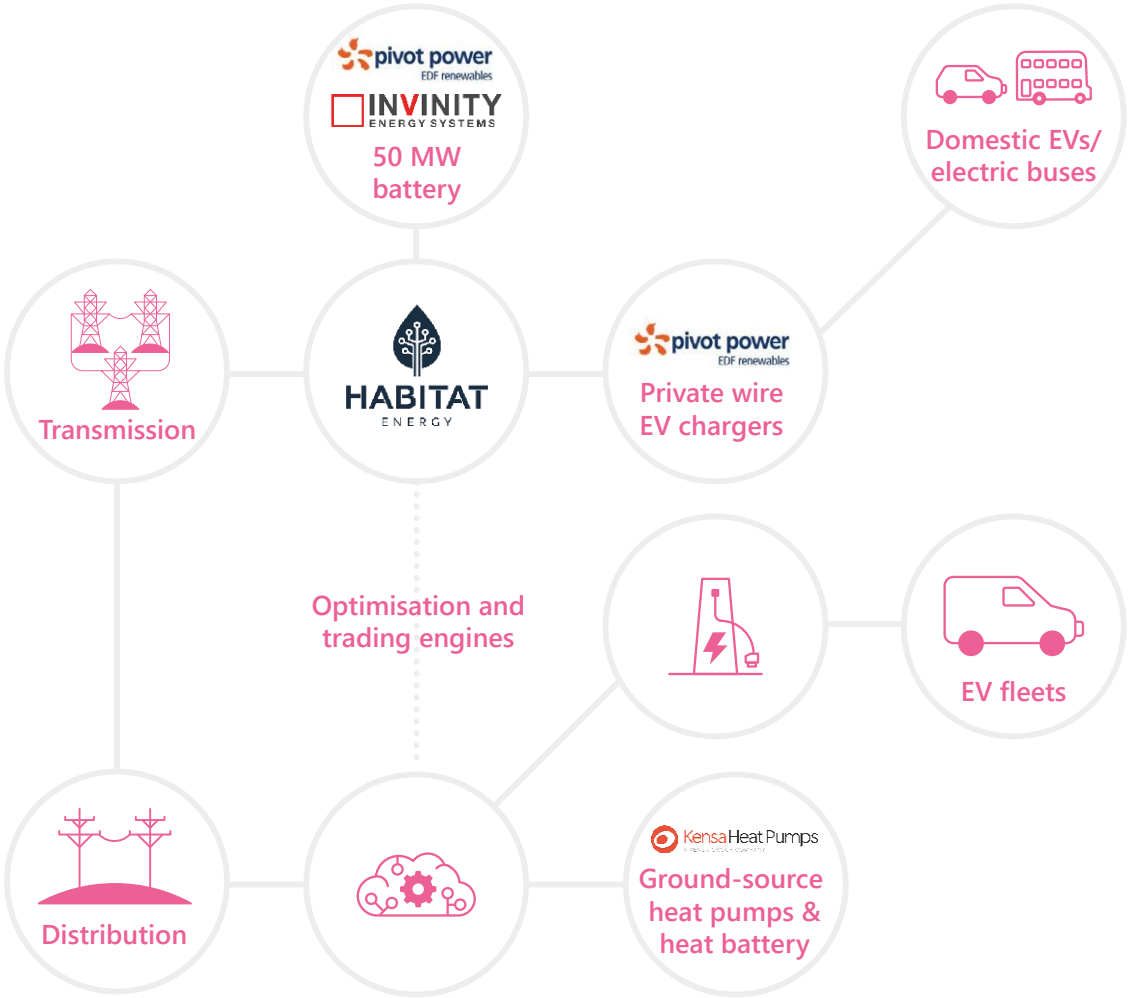
- Collaboration led by Pivot Power
- Allows delivery of new electric transport services (fleet, taxis, etc.), energy storage services for grid and heat service through local assets
- Transmission connected EV charging superhub is served by private wire, sharing a connection with a 50MW hybrid battery which provides services to National Grid
- Habitat Energy are providing aggregation, optimisation and trading software
- Kensa are trialling their shared ground loop heat pump and trialling flexibility services in social housing

Scale of deployment

- 40 public fleet vehicles
- 20 rapid chargers and 22 fast chargers at the Superhub
- 60 homes with ground source heat pump (GSHP) and 5 integrated with heat batteries

Future ambitions

- Pivot Power are investing heavily in this concept and aiming for 40+ sites around the country
- Oxford, 25% of council fleet electrified by 2023 and electrification of Oxford's bus fleets
- Kensa looking at full integration into SLES



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Energy Systems Catapult

WHERE NEXT FOR SMART LOCAL ENERGY SYSTEMS?

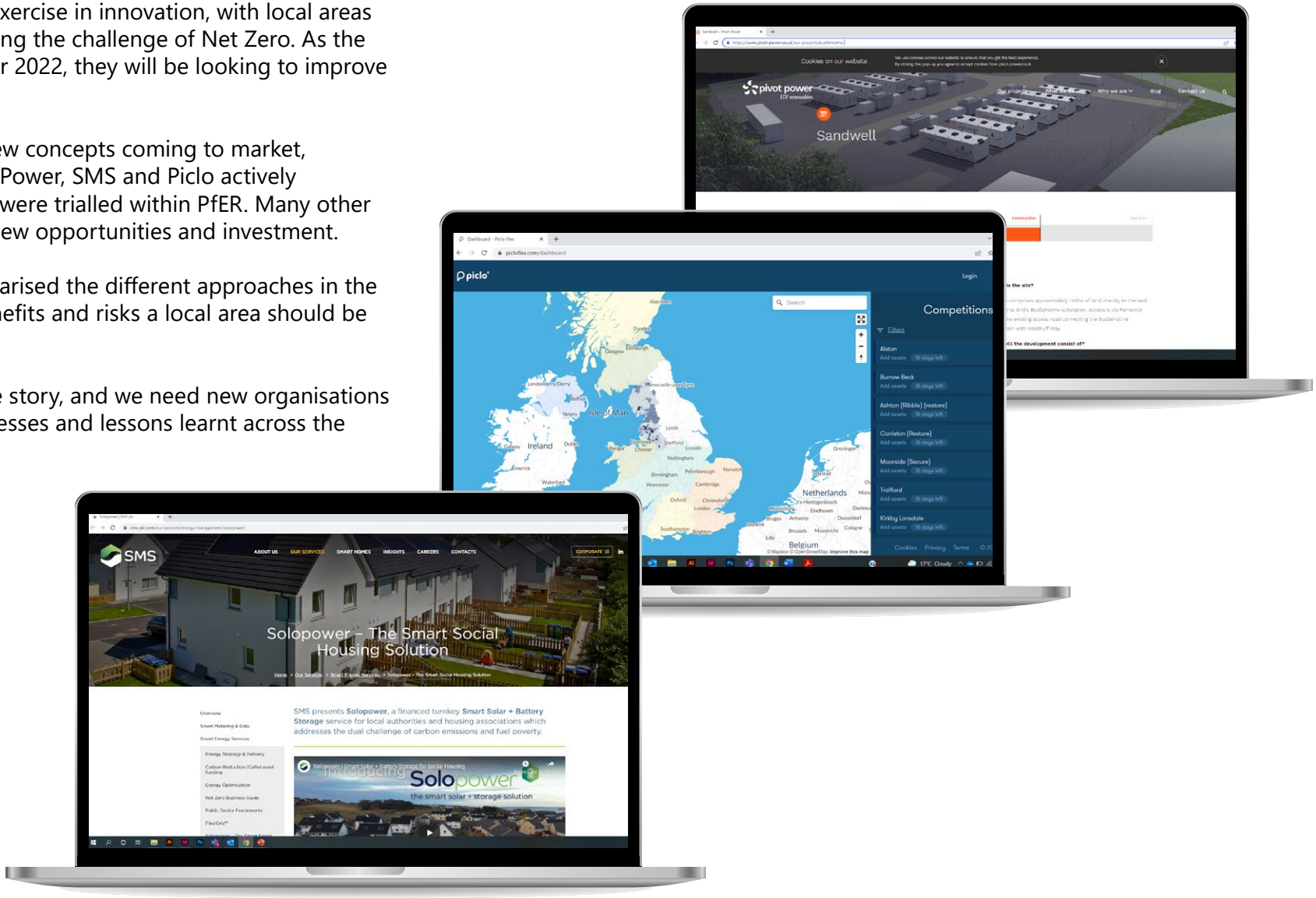
Where next for smart local energy systems?

The PFER programme is an exercise in innovation, with local areas exploring new ways of meeting the challenge of Net Zero. As the projects come to a close over 2022, they will be looking to improve and scale their ideas.

There are already signs of new concepts coming to market, with organisations like Pivot Power, SMS and Piclo actively marketing propositions that were trialled within PfER. Many other organisations are pursuing new opportunities and investment.

In this report we have summarised the different approaches in the market and the different benefits and risks a local area should be considering.

PfER is only beginning of the story, and we need new organisations to start building on the successes and lessons learnt across the programme.



Key lessons learnt across the programme

Laying the right foundations

1

Local energy planning is key

A SLES has most value when it is designed around local objectives, needs and constraints. A co-ordinated local energy plan will help achieve all of the above.

2

It's a collaboration.....

For a SLES to be most successful , it needs local authorities, networks, local business and community to all be involved. Projects that have struggled, haven't had early enough or regular engagement with key stakeholders.

3

..... and a journey

The most likely way a SLES will develop is by gradually integrating new concepts and projects. Start with manageable, investable projects that can be expanded over time.

4

Skills and capabilities

Investment in people, digital and supply chain is as important as investment in technology, for local authority looking to play a central role in decarbonisation strategy.

Getting the design and delivery right

1

Design should factor in local resources and constraints

Geography, land use and existing infrastructure will impact the business case for a SLES in an area. Value will be strongest where there are already energy issues being faced (e.g. curtailment, connection charges, fuel poverty).

2

User-centred design and meeting local needs

A SLES needs to deliver value over and above what the current energy market and energy system offers. Current business cases are too reliant on cost reductions (i.e. avoiding Use of System Charges) and not on creating new value. One area where local energy could be more valuable is where services can be tailored to specific local needs.

3

Test, learn and refine

When exploring new business models, local authorities need to adopt more innovative practices and have a willingness to change and adapt. Delivery should involve regular stages of designing, testing and refining the business model.

Key lessons learnt across the programme

Strategic decisions in the design of a SLES

1

Deliver in-house vs outsourcing

Need to make a decision on what role local authority wants to play over time. Delivering in house through asset investment or a local ESCo offers greatest financial rewards, but also significant risks. With procurement practices focused more on value and tighter contract management, it's possible to deliver well through partners.

2

Open markets vs a single contractor

Ideally want to create an open market for SLES to enable competition, innovation and better value for money. However, creating a network of multiple suppliers and buyers is more complex and may increase the cost to serve of a SLES. Where a SLES is single sourced, be wary of long-term lock that may impact your ability to integrate new projects.

3

Digital platforms and interoperability

Digital strategy is a key enabler to understanding local needs and integrating solutions in the future. Look at system architecture and existing platforms – many projects are using multiple layers of software to enable flexibility. Business model not sustainable as value of flexibility not worth the cost of each platform layer.

Market and regulatory barriers to address

1

Making local more valuable

In order for local energy / flexibility markets to work, there has to be more value in matching local generation to local demand. Locational marginal pricing creates a level playing field.

2

Active network management and local energy markets

The role of local energy markets and how that fits with the DSO and ESO transition is unclear and is impacting on investment. Need clearer future rules around balancing, capacity and flexibility at a local level.

3

Creating liquidity in markets

Some initial support may be needed for local energy markets and local flexibility platforms to ensure price stability. Until there is enough liquidity in the markets, local investors may be put off.

4

Policy costs and the impact on low carbon technology

The lack of policy costs on gas has big impacts. Many PfER projects have focused on solar + storage due to its more favourable business case but this does not tackle the greatest need within climate strategies.

5

Local exemptions for vertical integration

Some SLES projects have battled between trying to be an asset owner, system operator and service provider. This model is accepted in heat networks but not in the delivery of local power. Could exemptions be made when done in local interest?

How to get started?

SLES can't be developed overnight and emerging case studies highlight that smaller local energy projects delivered through innovative business models are key to development.

The first stage is **project identification**, achieved through spatial mapping to identify focus areas, project feasibility and assessment of network impacts

The second stage is to identify the most appropriate **operating model** by assessing the role a local authority wishes to play (investor, off-taker, facilitator) and the potential business models that can provide a route to financing them.

The third stage is to **bring together stakeholders to co-ordinate and deliver** energy projects. Depending on the scale of the project, this may include network operator, local business, community groups, investors, energy suppliers.

Project identification

- Spatial assessment
- Feasibility of technologies
- Impact on networks

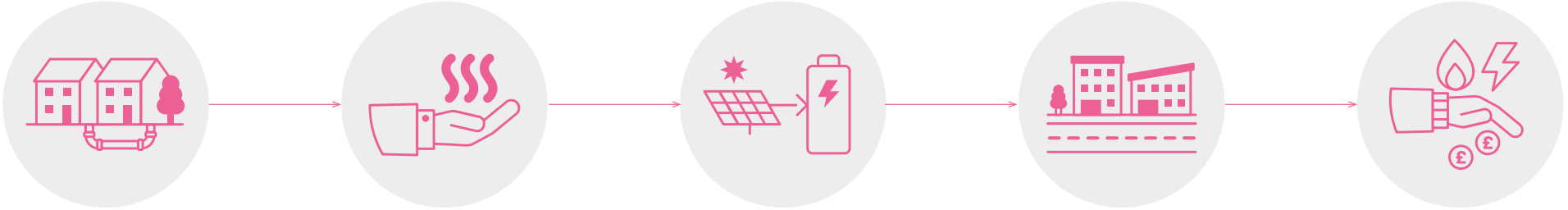
Operating model

- Sources of funding
- Due diligence of suitable business models
- Understand role of local authority

Coordinate delivery

- Bring together stakeholders
- Detailed design
- Set up contractual framework

Example steps to creating a SLES



Heat network delivered in a new build project powered by ground source heat pump

Local heat contract delivered through a ESCo

Integration of a local solar and storage project to increase renewable energy used and improve efficiency, increase revenue

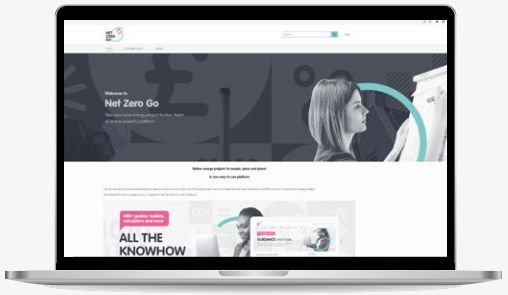
Expansion of heat network to include a set of existing homes and buildings close by

ESCo starts to sell power to local residents as well

Where to go for further information?

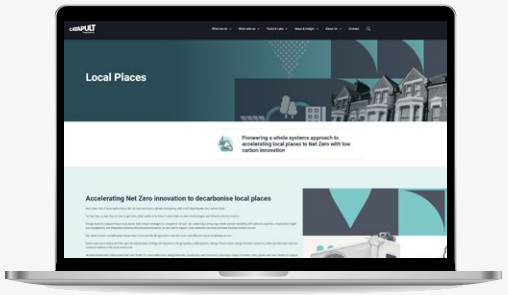
Net Zero Go has all the tools and features you need as a local authority to start your first energy project, build a successful business case, and deliver a portfolio of smart, successful local energy projects.

Get started with the Knowledge Library, or register for Net Zero Go's full suite of features.



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Energy Systems Catapult helps local places build robust strategies to navigate to Net Zero. We combine cutting edge whole systems modelling, with network expertise, stakeholder engagement and integrated planning and procurement advice.



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Energy Systems Catapult supports innovators in unleashing opportunities from the transition to a clean, intelligent energy system.

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