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Value Propositions in a Smart Local Energy System

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Executive summary

This report explores Value Propositions (VPs) for adoption of technologies and practices enabling participation in Smart Local Energy Systems (SLES). It is based on experience of Project LEO partners in developing and implementing SLES offers.¹ It describes sources of value and relationships between actors as they are seen by some of the main LEO stakeholders, as an introduction to the issues at this early stage in SLES development. The report addresses three main questions:

- Where does the capability to participate in SLES come from and how can it be developed?
- How can engagement between actors be fostered, building on social capital?
- What types of value proposition show promise for SLES at this stage of development, and why?

Capability (the capacity of a person, organisation or community to perform a task) is a term used throughout the report. The concept² is making a novel contribution to the debate on flexibility. Indicators of capability can be used to assess the suitability of VPs in different situations.

The research for this report has found that there has been some value created through a flex offer to all the LEO stakeholders studied. However, the offers are multidimensional and nuanced and so are the stakeholder responses.

Many decisions in households, small and medium enterprises (SMEs) and the public sector are values-led. We found that energy saving and revenue raising are not the only motivations to engage with flex markets, or even the primary motivations. However, financial considerations clearly remain important: at the least, even for households and organisations having non-financial motivations, the costs of providing flex should not be higher than the financial benefits. We also found that where financial benefits are a priority, the value of flexibility VPs to stakeholders is often not apparent.

We found that potential environmental and citizenship benefits should be prominent in a VP to stakeholders. However, emphasis on these sources of value will need to be tuned to groups beyond the early adopters that LEO is dealing with at present. VPs that reflect the needs, priorities and capabilities of later adopters will have to be developed if local energy approaches are to scale up.

We were able to identify some good matches between a LEO offer (e.g. operating a building or generation/storage asset to provide a network service or adoption of a smart heat pump) and the “jobs to be done” by SMEs, householders and organisations. However, there are still significant knowledge gaps that prevent stakeholders from making a connection between flex and their own priorities. Appropriate metering, good data visibility and the skills to interpret it will be important in establishing the knowledge to underpin Net Zero decision-making.

Principal findings are shown below, with reference to relevant sections of the report.

¹ <https://project-leo.co.uk/>

² Originating with the Bristol Centre for Sustainable Energy, now under development in collaboration with LEO partners.

Capability (section 3.1)

A capabilities framework can be applied at different scales – communities, organisations, individual actors or systems.

Community-scale capabilities can be identified and grouped using the same categories applied to individual householders and SMEs. Some community-level capabilities are linked to social capital – the value that is created when a community is well-networked with trusting relationships between community members, their organisations and external sources of skills, funding and other resources.

Capabilities, priorities and motivations are unevenly distributed

Technical factors, socio-economic characteristics and factors such as tenure and lifestage combine to create different responses to an innovative low carbon energy technology or flexibility offer. Therefore, engagement and VPs should be tailored to peoples' capabilities, recognising their likely pains and wished-for gains. When a VP offer is made, a "gain" or "pain reliever" could be in the form of offering the customer a new economic, social or technical capability.

The importance of trust

Mechanisms to build trust need to be woven through any design to build capability or develop value propositions. Examples include co-design of flexibility plans with a host community, emphasizing not-for-profit credentials of a project initiator, ensuring that technical feasibility work is seen to be undertaken by neutral third parties, using governance processes such as Memoranda of Understanding to clarify parties' responsibilities and roles, having a long-term presence in a community, and building energy literacy and other skills so that a community develops the capability to judge information about offers and to act effectively.

Some capabilities for low carbon technology adoption are more critical than others

A reasonably sound financial case for investment in SLES assets is needed for all potential customer categories, including 'early adopters' (with strong capabilities to take up a new technology or process), although financial benefits are thought somewhat less important to early adopters than to those who adopt later. We have also heard that financial capability goes beyond simple ability to take out a loan or pay upfront costs: householders and SMEs must also be in a position to judge the quality of an investment in terms of the cost:benefit ratio (including transaction costs).

Skills and knowledge to enable flexibility are complex, costly to acquire and in short supply

The capital cost of preparing a building to deliver flexibility can be very significant. Staff time to administer flex trades, staff training and other transaction costs (e.g. consultancy to calculate flex potential in a building) can also be considerable. A cost:benefit ratio may consequently be too skewed to enable flex market participation if the benefits are judged only in financial terms. Some LEO partners do not consider the Market Stimuli Packages adequate to cover the costs of capability-building, or to incentivise participation. Uncertainty about long-term prospects, in the absence of a strong market and policy signals, may also be a factor here.

Know your network!

Identifying and mapping capability, requires accessible and comprehensible network data showing constraints and opportunities. Data should be interpretable and usable by laypeople as well as experts.

Co-benefits and avoidable harms from getting buildings flex-ready

Getting buildings capable for flex will often entail improvements to control systems and the efficiency of the building, which can deliver numerous co-benefits (e.g. improved comfort) which can add to a value proposition and will be particularly important where there is no or little financial case for investing in flexibility.

Where flexibility is created from changes to building services, building occupants may need active engagement

Enabling flexibility in buildings, particularly through manipulation of temperature and humidity controls, will often require building management strategies to develop occupant capabilities so that building users can play their part. This can include setting expectations for appropriate clothing, thermostat control, opening and closing windows etc.

Engagement and communication (section 3.2)

Enabling informed decisions on flexibility provision must have a strong ethical dimension

Strong ethical standards to underpin development and implementation of Smart Local Energy Systems are critical to success. Without a strong ethical code to guide activity, trust in the Value Proposition and those delivering it will be undermined, damaging community support and buy-in for the SLES offer. So, whilst any case for flex participation should be framed to emphasize benefits, engagement should not be manipulative or encourage people to take decisions which are not in their best interests. Ethical standards should be built into governance processes for SLES.³

Hard-to-reach groups

We should not underestimate the challenge of engaging the “early and late majorities”⁴ of householders and SMEs. Engagement and value propositions need to address both attitudinal differences between early adopters and the early majority (e.g. in attitudes to risk and the need for “social proof” to legitimise adoption), and differences in capability across technical, economic and social dimensions. It is important to recognise that the difference between an early adopter and an early majority adopter may be related less to attitudinal motivation than to technical or economic capability, or to a life-changing event such as moving into a new home – and to engage with them accordingly

Communicating community benefits and requisite knowledge

Communicating wider social benefits of a SLES Value Proposition is greatly facilitated if households and businesses have some knowledge of the problems that flex technologies can help to resolve. LEO partners estimated that levels of understanding of the value of flex and of grid operation are

³ See <https://project-leo.co.uk/reports/focused-briefing/>

⁴ This refers to the classification of innovation adopters by Rogers, e.g. see https://www.valuebasedmanagement.net/methods_rogers_innovation_adoption_curve.html

low to non-existent across most of their grid edge audience and so the challenge of communicating these should not be underestimated. It is particularly important to be able to explain the benefits that participation in SLES can bring, and the likely costs. A suite of metaphors and analogies to explain grid operation to a lay audience was thought helpful; use cases and case studies can also help greatly with understanding how flexibility and SLES can work in real-life conditions.

When to present a value proposition

It can be helpful to make an offer of smart technology and flex tariffs at decisive points in a householder's life or in an organisation's development. In capability terms, this means when the householder or business has an opportunity to change their practice or equipment, such as when moving house. However not all life-changing moments are opportunities to shift to lower carbon practice. For example, acceptance of an innovative energy practice or technology is more likely when someone is not having to make a distress purchase (such as replacing a broken-down boiler), not preoccupied with other issues, and not facing a shift to a higher-priced energy vector. So that householders and businesses can integrate low carbon technology and flexibility into their planned works when the opportunity arises, they should be made aware of an offer's existence as early as possible.

Social capital and associated capabilities

The various forms of "social capital" ("bonding", "bridging" and "linking") create community-scale capabilities that can be harnessed to facilitate SLES. "Bonding" social capital creates strong attachment to place and the willingness to contribute to communal objectives. 'Bridging' social capital between formal and informal groups in a community can be particularly important in engaging with hard-to-reach people. "Linking" social capital allows external sources of expertise, funding and other resources to be brought in to help develop community projects. When developing plans for a community, it is helpful to identify and map such groupings and networks, and the communication channels between them.

Social learning

Social learning processes co-developed with key groups and individuals are a powerful means of spreading information and innovative practices through communities. An example would be setting up a show home where people can experience for themselves low carbon and flex technologies and can ask questions from peers who are involved in flex provision or can advocate for it.

Expertise in communities

Linking social capital refers to a community's ability to pull in external sources of funding and expertise and to work with external agencies to co-develop plans for the community. This invariably involves a few members of the community having the time, commitment, knowledge base and requisite skills (such as project management and finance skills) to engage with the external agency. As such, it is very helpful if there is some expertise embedded in the community, to make the most of external sources of expertise and guidance. Studies of successful community energy projects have repeatedly emphasized the importance of this "linking" social capital.

Social capital, equity and engagement

The challenges and resources required to develop bridging and bonding forms of social capital in a community are probably beyond all but the largest and most well-resourced projects⁵. More social capital for a certain amount of resource is probably achievable by working with “linking” social capital - e.g. through working with local groups, organisations, businesses and individuals to build up the skills, knowledge and confidence that facilitate linkage with external sources of funding, expertise and other resources. The value proposition development process developed by Low Carbon Hub (LCH), and the engagement functions of the LEMAP Local Area Energy Planning tool⁶, work in this way.

Working with social capital in disadvantaged communities

Some well-established low-income communities where people stay in the area for a long time have an abundance of social capital and useful capabilities related to deep knowledge of and attachment to their area. To guard against such communities being left behind, “transform” engagement work is likely to be needed to build skills and knowledge, along with “fit” strategies to work with the social capital and other capabilities that are already in place.

Creating stable and supportive decision-making spaces

A supportive policy and regulatory context is critical in communicating the sense that investment in smart technologies is futureproofing a home, business or organisation. Net Zero policy (enshrined in regulation) gives confidence that these changes are coming to all and that being a first mover will not lead to stranded assets and wasted resources. Net Zero policy adopted at national and local level has been particularly influential in local authority decision-making in respect of flexibility and smart energy initiatives.

Value propositions (Section 3.3)

Value propositions for flex will vary by audience and by technology

Value may be directly derived from flex provision, from enabling technologies or processes, and from aggregation. These sources of value will be more or less beneficial to different audiences and social groups. Therefore, an offer should be tailored. For example, innovation diffusion theory suggests that “early adopters” will be more likely to respond to perceived environmental benefits and to embrace innovative aspects of a technology. In contrast, the “early majority” will tend to respond more to perceived financial benefits and to “social proof” of the merits of flex technologies. Social proof messaging would be based on the idea that heat pumps work successfully in homes of “people like me” and that they are increasingly being adopted by the mainstream. However, we have also heard that even for early adopters, the financial benefits of heat pump adoption need to become more compelling before we can expect to see widespread take-up amongst this critical segment.

⁵ However, some examples do exist such as Stockholm Environment Institute’s work with the Joseph Rowntree Foundation’s housing estate, New Earswick. SEI and JRF’s report on this ground-breaking project is found [here](#).

⁶ See further detail of the LEMAP tool [here](#).

Using energy citizenship in value propositions for flexibility

Investment in flexibility can be used to demonstrate energy citizenship and prosocial values. This is likely to be of particular interest to businesses and institutions with strong corporate social responsibility policies and values. Demonstration of an organisation's "energy citizenship" can add value to its brand. Adopting flexibility practices as a demonstration of social values related to energy citizenship and prosocial behaviour is likely to be linked to awareness of the value and role of flex in the energy system. At present there is very low awareness of why flexibility is important in both domestic and non-domestic sectors; the presentation and targeting of VPs for flex should factor this into their design.

Incorporating benefits for local communities into the value proposition

The LEO project has identified multiple benefits for communities that can be incorporated into value propositions for flex and SLES. These include:

- Citizenship benefits. For example, by householders and SMEs operating their equipment flexibly they are being good citizens – enabling others to connect to the local network at lower cost (through avoiding the necessity for reinforcement).
- Resilience benefits. For example, by balancing local demand with local generation there is reduced exposure to outages created by problems higher up the system.
- Environmental benefits. For example, by collectively shifting demand to match generation of locally-installed solar (prompted by a Time of Use tariff) carbon emissions are reduced.
- Economic benefits. For example, by creating the opportunity for spare export and import capacity to be traded locally, local businesses and distributed generation can create additional revenue which increases the economic resilience of the community as a whole.

Transaction costs at different scales of organisation

Aggregate transaction costs of developing a specified quantity of flex capacity in multiple SMEs will be much greater than transaction cost incurred in developing the same quantity of flex potential in fewer, larger organisations.

Smart control in value propositions

Capabilities offered by smart automated control systems are critical to successful VPs for working with small flexibility sources at the grid edge. As well as driving down transaction cost, a VP can make the case that responsible and prosocial ownership and operation of low carbon technologies (such as solar panels and electric vehicles) necessitates smart control. The VP can also reframe concerns about automation and smartness leading to loss of control, and associated issues with trust and data protection, as an opportunity to take greater control, with the user setting the parameters governing equipment operation and thereby controlling energy costs and ensuring personal comfort.

Value propositions for heat pumps

A VP for adoption of heat pumps should not focus only on potential financial savings. Under current market conditions these are likely to be quite small. Instead, the VP should also emphasize the very significant carbon savings and the "good energy citizen" dimension, and give assurance that the technology is now proven and low risk. Further, that adopting the technology is only the first step: skilled commissioning and some form of ongoing support to get the best out of the technology

should also be offered. The VP should also be tuned to the needs and priorities of different socio-economic and demographic groups.

Value propositions for SMEs

A value proposition for SMEs to adopt new smart low carbon technologies, and/or retrofit smart controls, should show how adopting the technologies and operating the equipment flexibly aligns with fundamental business drivers such as cost savings and brand building to gain competitive advantage. A flex VP to SMEs could also incorporate the idea that responsible ownership of distributed energy resource (DER) technologies should include adopting control systems for flexible operation. This can be presented as future-proofing the business and allowing it to identify as a good energy citizen acting in a prosocial way in the community in which it is embedded.

1 Introduction

This report is about value propositions (VPs) in Smart Local Energy Systems. Value propositions are built around the offer of products and services from a supplier to a customer, noting that participants in the SLES can be both suppliers and customers. Products and services explored in Project LEO are a range of smart low carbon technologies (e.g. smart heat pumps, Vehicle to Grid chargepoints) and a range of services which help the local network operate more flexibly (e.g. services to manage peaks in electricity demand at the local level). The report describes sources of value and relationships between actors as they are seen by some of the main LEO stakeholders.

The report is informed by the quarterly cycle of stakeholder interviews and a number of LEO workshops, events and meetings. Learnings are contextualised with relevant research and with reference to other learnings generated by the project. Findings are summarised and are used to populate the LEO [central learnings log](#). The report is a working document, intended to be used internally to:

- facilitate transmission of LEO learnings and thinking across the project,
- shape future LEO activities,
- develop the LEO Theory of Change.

The report should also be published for external readers.

1.1 The ecosystem of actors in a Smart Local Energy System

Actors in a SLES can be thought of as linked together through the exchange of some form of value. Value comes in many forms. It could be a service allowing an actor to achieve its objectives (e.g. lower carbon emissions), supply of monitoring or control data, the opportunity to have equipment operated flexibly, supply network services or financial savings. Stakeholders in LEO have been grouped depending on their role in the project and the kinds of value they are able to supply and receive from other actors. This mapping of actor groups is shown in

Figure 1.

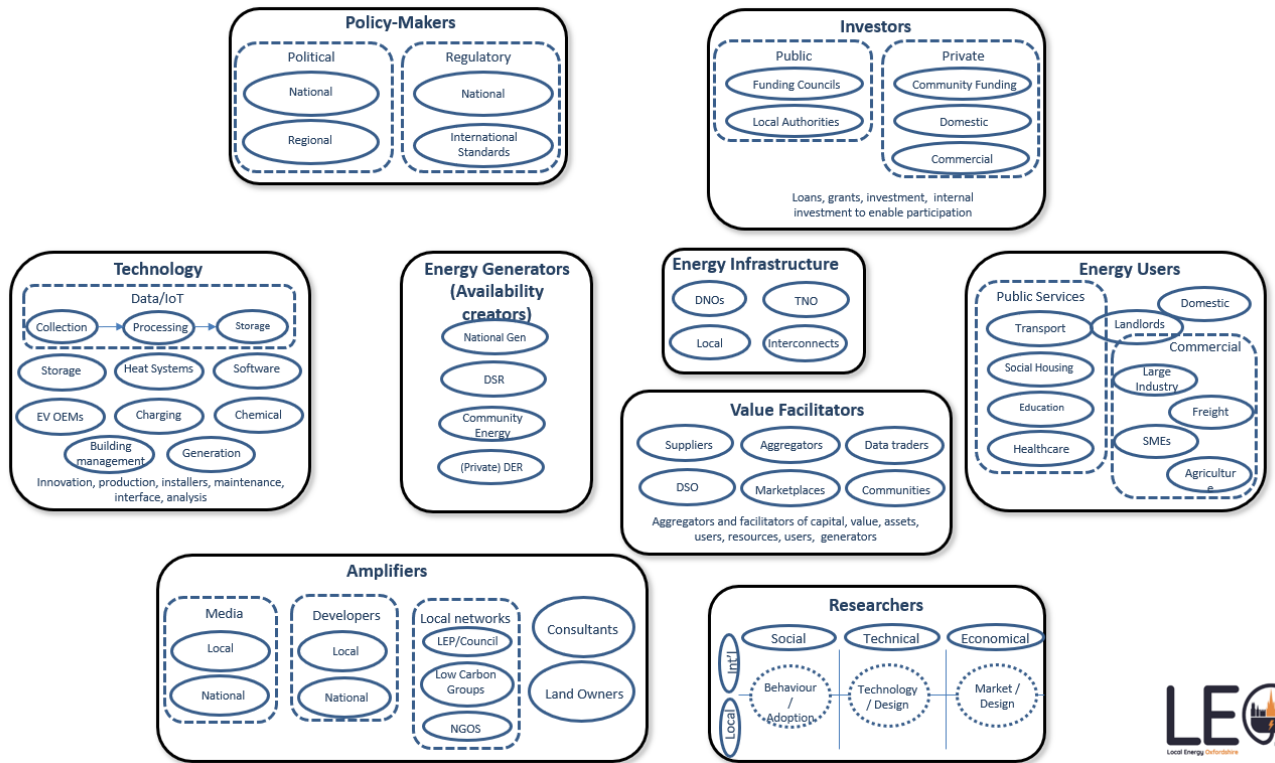


Figure 1: Stakeholder roles and value creation in the LEO ecosystem

The relationships between these actor groups in LEO and, implicitly, in a Smart Local Energy System have been further characterised using the value proposition template. The logic for this is that the relationship between one actor type and another is derived from an exchange of value in some form. This allowed a mapping of the actors in LEO to be developed - interacting with one another through the exchange of different forms of value in a system. An example of this map is shown in Figure 2.

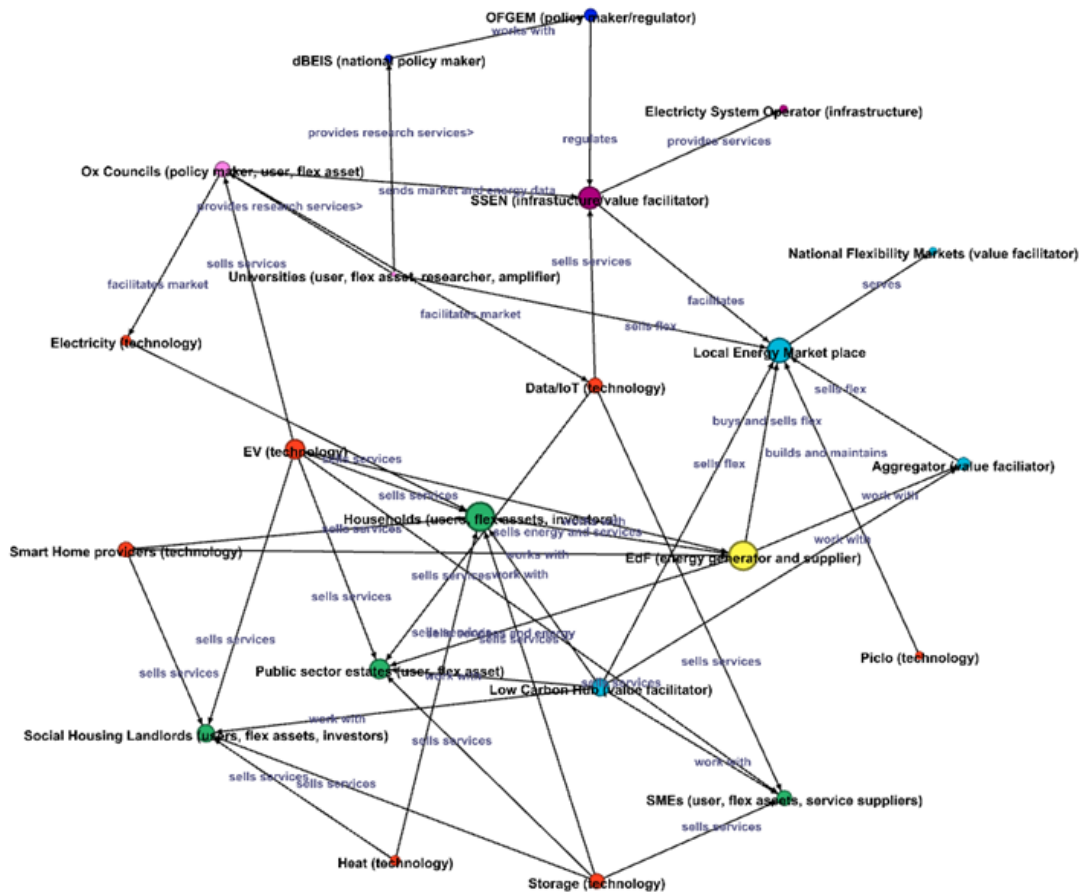


Figure 2: Example map of the LEO ecosystem (note, this map is presented to give a general sense of the network and the approach. A viewable pdf will be made available via weblink)

Different actors within this ecosystem are readily located by their relationships with other actors. The character of the relationship influences the activities of each actor and hence the direction of evolution of the entire system. The value proposition approach can characterise the detail of these relationships between actors acting as both suppliers and customers of value.

1.2 Aspects of the Value Proposition concept

A value proposition is a promise or statement of the value that a product or service that a supplier will bring to the customer or user. Value is experienced on both sides the arrangement. For example, the network operator can gain from a better-managed system, and from avoided investment in reinforcing it to cope with new electricity demands or distributed generation. The customer for the offer, the energy system user, can benefit from supplying the services needed to add flexibility to the system, by using traditional equipment in new ways and by adopting new devices – electric vehicles (EVs), heat pumps, smart washing machines, batteries, solar PV – that can be smartly controlled. In doing so, the customer acquires value that helps achieve the customer’s environmental, social and economic objectives (their “jobs to be done”). It is the value to customers that this report mostly considers.

The approach used for capturing dimensions of the value proposition is summarised in the Value Proposition template developed by Strategyser⁷:

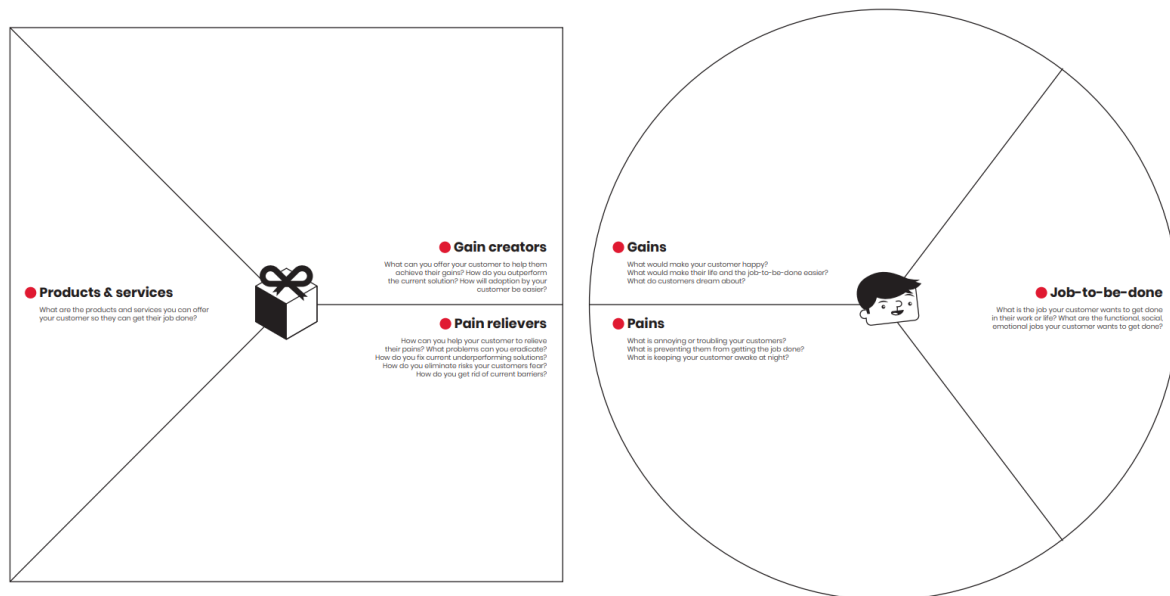


Figure 3: Value proposition template developed by Strategyser

In Strategyser terms, the value proposition can be thought of as the offer of a product or service to a customer which helps the customer achieve their “jobs to be done”. The value proposition offer must be built up around specific products and services.

The “jobs to be done” depend on the customer but, to take the example of a householder, could be thought of as having a comfortable, secure, low carbon and inexpensively powered home. The products and services in a transitioning energy system which get these jobs done are smart low carbon energy systems and flexible operation of existing technology.

In this respect, most of the value propositions in LEO can be thought of as an offer to allow participation in a Smart Local Energy System. Offers could include signing up with an aggregator, adopting a smartly controlled low carbon technology (e.g. a smart heat pump) or adopting a new energy practice (e.g. responding to a time of use tariff by load-shifting laundry, dishwashing or EV charging).

There are two dimensions to an offer:

1. The Gain creator – what is it about the product or service that delivers a gain in value to the customer?
2. The Pain reliever – what features of the product or service relieve the customer’s pains?

Correspondingly, there are two aspects of the customer’s profile that help “get the job done”:

1. Gains –things that make the customer’s life easier, more pleasurable and that help get the job done

⁷ Strategyser [website](#)

2. Pains – things that annoy or trouble the customer or prevent them from getting the job done.

A value proposition is successful when there is a match between the gain creator and the needed gains and/or between the pain reliever's capacity to relieve the customer's pain and the extent of that pain.

1.3 Capabilities in the Value Proposition

Capabilities refer to the personal, social, economic, regulatory, cultural and technical abilities to perform a task: the focus is on doing. They can be attributed at different levels of the energy system: a) at the individual actor level (e.g. household or business) b) at the community or neighbourhood level and c) at the system level⁸.

At the individual level, a person cannot make an omelette without the capability offered by eggs, butter, a pan, a heat source and some cooking know-how; a business or household cannot offer flexibility without electrical devices, appropriate controls, reliable arrangements with a trustworthy trading partner and some basic knowledge of how to become involved in flex provision.

“Capability” is a helpful complementary concept to “value proposition” because even if there is a good match between the “offer” and a customer's “jobs to be done”, the value proposition will not be acted upon unless both parties in the dyad have the requisite capabilities and the opportunity to act.

LEO partner, Low Carbon Hub are using capability thinking in a number of areas, including profiling the capabilities of assets and the organisation that owns them (e.g. solar farms, hydro-electric systems, batteries) to create value propositions for specific customers. For example, an organisation that would be interested in the VP of a solar farm with unused power export capacity in a peer-to-peer trade with another local generation asset wishing to exceed its agreed power export capacity limit for a specified period⁹. The capabilities of such a potential capacity purchaser can be identified to determine whether there is a viable value proposition between the flex provider (the solar farm) and a customer for that flex (e.g. a local hydro-electric plant). The Centre for Sustainable Energy has created The Smart and Fair? Offer Profiling Tool which provides a framework to systematically assess the capabilities and characteristics required for households to participate in one or multiple smart energy offers. LCH has started to adapt the offer profiling tool for use with SMEs.

The capability categories that LCH are using are:

1. Energy profile - generation, demand, storage and agreed power export and import capacity
2. Location – physical attributes of the site and its locality
3. Financial and legal – access to capital, contractual arrangements, tenure and income
4. Monitoring and data – connectivity, granularity, access, lag, controllability, technical know-how
5. Personal and social – Values, risk, resilience, motivations, trust levels of the organisation and key individuals

An example of the framework used to identify these capabilities (using a Mosaic whiteboard) is shown in [Figure 1](#). ‘RVS’ is a new solar farm with the potential to export more electricity in the

⁸ See: “A capability approach to smart local energy systems: aiming for ‘smart and fair’”. Banks and Darby 2021 [here](#).

⁹ See Project LEO glossary and short videos explaining the types of flexibility under investigation in LEO [here](#).

summer months than its current agreed Connection Agreement allows¹⁰. This is a pain for RVS as it means it is missing out on thousands of pounds of revenue from exports. So RVS is a customer for spare export capacity from another asset connected to the same part of the network. The partner with the spare capacity can relieve RVS' pain by trading its spare capacity in the summer months and so both parties benefit from the arrangement. But, to make a match between RVS and the partner, they will need to have technical, economic and even social capabilities that make them compatible.

<p>Energy Profile</p> <p>generation, demand, storage and capacity</p>	<p>RVS</p> <p>Solar generation: 19 Gwh a year</p> <p>Seasonal and day ahead Predictable generation</p> <p>Overized: Potential for over generation of up to 2 Gwh</p> <p>Potential for battery storage</p>	<p>Potential peer to peer partner</p> <p>Spare summer export capacity</p> <p>Flexible consumption profile - summer demand turn up in summer</p>
<p>Location</p> <p>physical attributes of immediate site and its locality</p>	<p>space for battery storage</p>	<p>SSEN region</p> <p>Within BSP? Primary? Secondary?</p>
<p>Finance & Legal</p> <p>Access to capital, contractual arrangements, tenure, income</p>	<p>Has a 2 yr PPA with a 24hr service break notice period</p> <p>PPA provider needs to be vetted by Loan Provider</p> <p>Some REGOs already committed elsewhere (approx 20%)</p> <p>Has a connection agreement</p>	<p>Not already tied into volume & shaping profiles in their energy contract</p> <p>Has a connection agreement</p>
<p>Monitoring and data</p> <p>Connectivity, granularity, access, lag, controllability, tech savvy</p>	<p>1 second response time (control & monitoring)</p> <p>Need to remotely access and control - tbc</p> <p>Implications for RVS Supplier and/ or MOP</p>	<p>Metering/data provision for verification</p> <p>Implications for P2P partner Supplier and/ or MOP</p> <p>Integrated metering and system controls (e.g. for demand turn up)</p> <p>Would need to be able to match an agreed response time</p>
<p>Personal and social</p> <p>Values, risk, resilience, motivations, trust levels of the organisation and key individuals</p>	<p>Social & Environmental drivers</p>	<p>Social capital</p> <p>Values LCH relationship</p> <p>Open to new technology - tech savvy</p> <p>Bandwidth to engage</p> <p>Values CSR potential</p> <p>Willingness to participate in contractual arrangement</p>

Figure 4: Matching capabilities between customer and the entity making the offer to activate the value proposition

¹⁰ RVS made an active decision to invest in AC capacity in excess of its grid connection to test the concept of trading. This is probably unique amongst solar farms which would normally be designed to match that limit.

LEO is using a capability framework across its evaluation work and have included capability in our discussions of value proposition in this report.

As mentioned, it may be useful to think of capability and value proposition as partner concepts. Specific capabilities from both parties in the VP dyad are required to enable a well-matched value proposition to proceed. A VP may be a perfect match between the customer and the offered product or service i.e. offering the customer the gains they desire and relieving their pains also. However, unless the customer possesses requisite capabilities they will be unable to take the offer until their capabilities are improved. Equally, if the customer cannot easily change their capabilities to accept the offer, the service provider must have the capability to change their offer before the value proposition can be accepted.

To take a further example of how the two frameworks can be used together in a LEO context, a University Estates dept wants to improve the resilience of its portfolio of buildings to electrical faults and supply issues whilst simultaneously reducing its carbon footprint and being a good energy citizen. Its pains are a less than optimally resilient fleet of buildings and its desired gains are meeting carbon targets. An aggregator is able to offer a control system linked to buildings' building management systems (BMS) that both reduces the university's emissions (a gain creator) and improves resilience - relieving pain. A perfect match. But the University cannot easily take the offer because it is lacking in certain technical and economic capabilities:

- Technically, the buildings do not have a high degree of thermal control. There is also a lack of knowledge of where potential flex opportunities lie and current metering and monitoring systems are inadequate.
- Economically, the costs of installing the new control systems are thought to outweigh energy savings thereby putting the project at the bottom of the list of investible projects which have quicker payback times.

However, the university *does* have strong environmental policies and therefore the capability to become more supportive of proposals for investing in greater flexibility in the future.

In sum, A VP will only be acceptable if it matches the capabilities of the people / organisations / communities to whom it is offered. If not, then either the capabilities will need to change, or the VP will have to be altered.

2 Methodology and use of the report

The report captures learnings from the quarterly interview cycle and from LEO workshops, events and meetings. They are set in the context of other project learnings and the research literature on capability, engagement and value. Findings are used to populate the LEO [central learnings log](#). The report is a working document, to be used internally to:

- facilitate transmission of LEO learnings and thinking across the project,
- shape future LEO activities,
- develop the Theory of Change.

The report may also be published for external readers. The report is based on interviews with:

- Three Low Carbon Hub (LCH) staff project managing the Oxfordshire Smart and Fair Neighbourhoods (Jan 2022);
- Three LEO internal partners in their roles as TRANSITION¹¹ trial participants (Nuvve, Oxford City Council, Oxfordshire County Council) (Feb 2022);
- Oxford University Estates Services team (March 2022);
- The business relationships manager at LCH (March 2022).

The interview material is supplemented with notes from attendance at:

- a two-part Commercial Ecosystem workshop (3rd and 10th March), facilitated by LCH;
- an EU-funded NEWCOMERS¹² workshop, “Keeping community energy alive in the creation of smart local energy systems” (11th March);
- SME engagement workshop facilitated by Oxford University (24th March).

The interviews were semi-structured, with the aim of gathering reflections on VPs for participation in LEO-related activity. Interviews with TRANSITION trial participants followed up issues flagged in a questionnaire that had captured technical, social and economic learnings from Trial Period 1.

¹¹ <https://ssen-transition.com/>

¹² <https://www.newcomersh2020.eu/>

3 Learnings

Learnings are grouped into three areas:

- Capability - insights into the skills, resources and other capabilities that facilitate participation. How capabilities should be handled in the Value Proposition.
- Engagement – to inform communication and engagement strategies and the presentation of the Value Proposition.
- Value proposition – components of the a proposition for actors offering a service or product and their customers.

3.1 Capability

3.1.1 Capabilities, priorities and motivations are unevenly distributed

Studies of adoption of innovative energy technologies and practices suggests an uneven distribution of capabilities, priorities and interests between and across communities targeted with the SFN offer which will affect engagement. Many capabilities of a community as a whole are linked to socio-economic and demographic profile of the neighbourhood. This creates challenges but also opportunities for facilitating SLES in a place. However, we find that inequities are inevitable because of the strong likelihood that actors and communities with fewer financial resources or less ability to take risk will have less capability to access benefits from SLES and may be ‘left behind’. For example, it is very likely that community level technical capabilities enabled by ownership of smart control systems for smart appliances and equipment will not be associated with low-income communities¹³. There is also an equity dimension in the distribution of forms of social capital. It has been shown that impoverished communities have lower levels of bonding social capital than higher income ones¹⁴ while skills and resources that could be shared across a community (e.g., knowledge of the planning system or financial expertise for linking to external resources) and which would provide the basis for greater self- governance and empowerment tend to be associated with communities with relatively high incomes and levels of education¹⁵.

Low-income communities have also been found to be relatively unengaged in local planning and policy processes¹⁶. But low income does not necessarily equal low social capital. Community transience seems more critical. For example, studies have found that levels of homeownership are positively correlated with presence of “bonding” social capital found in the community as is length of residency¹⁷. Long-established working-class communities in older housing estates, where extended families have lived for generations, may have lots of bonding social capital that can be worked with if new ideas, practices and technologies are to be widely adopted.

¹³ Carley, S and Konisky, D., (2020) The justice and equity implications of the clean energy transition,. *Nature Energy*, Vol 5, August 2020, 569–577

¹⁴ Larsen, L. Harlan, S.L, Bolin, B., et al. (2004) Bonding and Bridging: Understanding the Relationship between Social Capital and Civic Action. *Journal of Planning Education and Research*. 2004;24(1):64-77

¹⁵ S. Breukers, R.M. Mourik, L.F.M. van Summeren, G.P.J. Verbong, Institutional ‘lock-out’ towards local self-governance? *Environmental justice and sustainable transformations in Dutch social housing neighbourhoods*, *Energy Research & Social Science*, Volume 23, 2017, Pages 148-158. Available [here](#).

¹⁶ Pattie, C., Seyd, P. and Whiteley P. (2004) *Citizenship in Britain*. Cambridge University Press p.86.

¹⁷ Leviten-Reid, C. and Matthew, R. (2018) Housing Tenure and Neighbourhood Social Capital. *Housing, Theory and Society*, 35:3, 300-328

1. Socio-economic characteristics and other factors such as tenure and lifestage combine to create different responses to an innovative energy offer. This has profound implications for energy equity.

2. Requisite capabilities for acceptance of the smart energy offer should be identified and, where they are not present, alternative strategies developed that accommodate this. The value proposition can present creating or accommodating needed capabilities as “pain relievers” or “gains” to the customer.

3.1.2 The capabilities framework applies at community and individual actor scales

OU and LCH have identified that the term “capabilities” applies at community or neighbourhood scale as well as at the level of the individual, household, SME, or organisational actor. A distinction between actor and community scale capabilities is important for two main reasons:

- It suggests that interventions can be targeted at community scale social and material infrastructure.
- It foregrounds the social context (e.g. prevalent social norms) and shared material infrastructure in which individual actors make decisions (e.g. layout of streets, presence of local DER).

Examples of community-scale capabilities identified by LCH and in the evidence base can be grouped:



Some of these capabilities and socio-economic characteristics can be surveyed, quantified, derived from publicly available data and mapped. For example, researchers have produced a social fingerprinting tool that measures around 30 socio-economic and attitudinal variables of the neighbourhood as a whole using a survey. Analysis of this data allows a neighbourhood profile to be built up which then directly informs the design of interventions for e.g. promoting adoption of innovative low carbon energy systems such as smart heat pumps¹⁸.

3. Community scale capabilities are readily identified and can be grouped using the same categories applied to individual householders and SMEs (technical, economic, social etc). These capabilities and other socio-economic and attitudinal characteristics can be described, surveyed, quantified, mapped and then used in design of energy interventions.

¹⁸ Social fingerprints: Social characterisation of neighbourhoods as design frame for sustainable communities
Katelijne Bouw et al. eceee 2022

3.1.3 The importance of trust

Without trust in the offer (and those making the offer) is very unlikely that customers will pay attention or engage. And, where information is trusted, it is more likely to be acted upon. Consequently, innovative energy practices are much more likely spread through social networks that are built on trusted relationships between actors, groups and organisations.

Networks of trusted relationships within a community are described as imbuing the community with “social capital”. The term “capital” is used because there is a value deriving from trusted networks which enables beneficial ideas, practices and technologies to be spread, understood and taken up and these can even be given a financial value. For example, when social networks reduce marketing or promotion costs or other “transaction” costs.

LCH described how trust was developed between actors making and receiving a SFN offer in Deddington and Duns Tew in two main ways:

1. by ensuring that local people are aware of the LCH objectives (to serve communities) and recognise that they are not a commercial business:

I guess, we've got a basis of trust based on people knowing us, and the kind of thing we do, we're not a commercial operation that is seeking to sign people up for long contracts with punitive ... performance clauses or anything like that. So I think being a community organisation is a big part of that.

2. By practising “co-design” in project development. Local groups and households are in constant communication and work together with LCH on developing and implementing the project. LCH are very keen to emphasize that groups must not feel as though they are working for LCH and that decisions about project direction are “owned” by both parties:

We meet regularly, talk about the problems that we're experiencing. And it's very collaborative. You know, we are fronting the majority of the time and all of the cost. But we're not...driving it and acting like people are working for us... in terms of the attitude.

These ways of building trust must become integrated in project governance, for example, in establishing consultation processes for capturing community priorities and in ensuring project management has representation from the local community. Where local priorities overlap with LCH priorities, they can be energised and taken forward via processes such as all stakeholders signing up to a Memorandum of Understanding:

So from the outset, we had a workshop with the community groups from the two villages. And they talked about their priorities. And those priorities have become the spine of our MoU .. of what the project will deliver. And...we have had to look at the sweet spot in the overlap between everyone's priorities. So it's kind of a process of compromise and collaboration.

Having a long term “presence” in the community was also thought important for building trust and this was reportedly impacted by COVID restrictions. For example, COVID social distancing restrictions also resulted in cancellation of face-to-face meeting where more informal and trusted relationships between the local residents could begin to be built.

It was reported that reduced opportunities for building trust through face-to-face interaction particularly impacted the quality of engagement with the social housing residents at the Rose Hill block. It was decided to set up a “stall” outside the flats to create a “presence” for the project and facilitate face-to-face communication:

There is a certain amount of “becoming a familiar face” [in building trust]. So just having a stall. Stalls are not a particularly efficient way to get people to sign up - I think a lot of the shared ownership signed up anyway. And we didn't speak to many people when we're on the stall - but I think that [it was] valuable in terms of just being a presence.

4. It is critical to build trust in the offer otherwise the project will fail. Therefore, mechanisms to build trust must be woven through the project design. These include: co-design of project plans with the host community, emphasizing the not-for-profit credentials of the project initiator, ensuring the technical feasibility work is seen to be undertaken by an objective, neutral third party, using governance processes such as MoUs to clarify parties' responsibilities and roles, having a long term embedded presence in the community and building energy literacy and other skills so that the capability to judge the quality of information and the offer becomes embedded in the community.

3.1.4 Demographic differences in interest in Net Zero may extend to SMEs

LCH report that the group most interested in the smart heat pump offer were generally a slightly older demographic, white, middle class, engaged in their locality, and with an understanding of and concern for the climate emergency.

Demographic differences in interest in LCH's offer to SMEs amongst senior management were also observed. It was reported that those most likely to apply for funding for energy efficiency and low carbon measures are, “in their late 40s 50s and 60s.” It was thought this is likely to be linked to the maturity of the business:

In the early days of setting up a business, you really are just trying to survive and grow. Whereas ... established businesses who are financially comfortable can make these kind of value judgments. It's possible that people who are closer to retiring are more able to stick their neck out and say, “You know what? This is important. And we're just going to do it”.

LCH business relationships

It appears that older people in SMEs and organisations may be good targets for engagement because they are often in senior positions and can take the needed decisions; and because they could be less afraid to stick their neck out.

If approaching retirement, there is a legacy dimension to participation in a values-led innovative environmental project. People like to feel that they have left something of lasting value at their workplace (perhaps to be remembered by).

5. Capability and interest in embracing “Net Zero” lifestyle opportunities tends to be associated with some socio-economic and demographic groups more than others. Perhaps a “net zero” agenda could be reframed so that it has wider appeal¹⁹?

3.1.5 Critical capabilities

LCH noted that, depending on context and technology type, a critical capability required for technology adoption can be economic, technical or social, but that some level of financial capability will apply in nearly all situations.

Financial capability has various dimensions other than simply the raw ability to have enough credit or savings to pay for equipment. For example, the *quality* of the prospective investment is important. This is illustrated in Deddington and Duns Tew, where, despite a lot of initial interest in the heat pump offer, there have been no confirmed installs to date. This is surprising because these communities are seemingly ideally suited to be receptive to the offer – having the requisite social, technical and economic capabilities: LCH report that these communities are relatively affluent, knowledgeable about benefits and costs, motivated by the opportunity to make carbon savings, “*very very committed*” and are also attracted by the idea of participating in an innovation trial.

The stumbling block has appeared to be the cost, the cost: benefit ratio and the disruption of installation. Costs are just too high despite LCH covering some of the ancillary costs including all of the cost of initial survey work to check homes’ suitability for heat pumps and offering other additional benefits. So, whilst this group is thought financially capable of taking the offer, there appears to come a point in decision-making where the ratio of cost to perceived benefit is just too skewed for households to take the offer.

LCH report that the cost of a heat pump, both in terms of the initial capital outlay and the projected ROI, wasn't compelling enough for people despite the added benefits LCH were able to offer and the potential participants interest and appetite to be involved. This has meant that finding 15 households willing to pay the sums of money required has proved very challenging. LCH also find that potential participants have very many questions about the suitability of heat pumps for their property and the costs associated with running them which needed addressing before the flexibility element of the trial could be developed. This too has proved a barrier to recruitment. LCH conclude that take-up of the technology will only be facilitated where the grant for heat pumps better reflects the full cost of the install (including pipework replacement) and/or where the value of flexibility sales is significantly higher. Another mission-critical technical capability for smart local energy systems (SLES) is ownership or availability of access to the internet:

So who's excluded? and What do you need to tweak to make them included? For example, it might be that this is an area that's got no mobile phone coverage, and their mobile phone coverage is absolutely critical for participation in the flexibility service. So until that's sorted, forget it.

LCH SFN Manager

¹⁹ For example, Climate Outreach argue that if active responses to climate change are to break out of their ‘left wing ghetto’, climate change must be communicated in a way that resonates with the values of the centre-right. See their report on this topic [here](#).

This kind of technical capability (stable and fast internet access) is an example of a capability that is more tractable to create than, for example, building up “bridging” social capital which requires longer term programmes for building up locally embedded skills and knowledge.

6. A reasonably sound financial case for investment is needed for all segments including early adopters although it is thought somewhat less important to this group than those groups adopting later in the innovation diffusion curve.

7. Financial capability to adopt low carbon technology goes beyond simple ability to take a loan or pay for the system from savings. Householders and SMEs must also be in a position to favourably judge the quality of the investment in terms of the cost:benefit ratio. Costs include qualitative costs such as disruption and the transaction costs of managing the install process.

3.1.6 Skills and knowledge to enable flexibility are complex and in short supply

All the organisations interviewed emphasized that understanding the potential for flex is a highly complex and resource-intensive undertaking. Numerous knowledge barriers, gaps in understanding and resourcing issues were identified. For example, Oxford City Council described how they:

need to have staff available with the required capabilities to operate equipment and interact with market platforms for flexibility.

And that:

... Assets are hard to enable and the root cause is a lack of technical expertise and staff capacity / resource within the organisation, followed by a lack of funding (and business case) to procure [flexibility] assessments [from external experts]

Similarly, Oxon CC report:

Resourcing issues have held back further steps to bring in additional assets – the technical expertise sits elsewhere in the organisation.

And that:

... Identifying DERs [distributed energy resources] that can provide flex is not straightforward and requires resource for assessment or cost to bring outside expertise in to do this.

Initial assessment of flex potential is a critical first step to enable further engagement with the flex offer. For example, Oxford City Council (OCC) are clear that “no level of incentive” (such as offered by the Market Stimuli Packages (MSP)) “really works unless it helps to address and quantify and enable next steps”.

OCC further note that the MSP assumes a minor upgrade is required to enable flex, or that it is a small addition to support an investment tackling a larger upgrade. Experience suggests that getting buildings flex ready could be very expensive indeed - both in staff time and in capital expenditure.

OCC conclude that the MSPs as currently structured are unlikely to tackle the scale of getting assets flex-ready across the public sector and that participation in LEO markets with current payback and business cases is not a practical proposition. However, they think participation in peer-to-peer trades may still be possible: these do not require deep technical analysis or capital expenditure to equip buildings with the flex technologies required. If there is a lack of internal skills or resources to do initial flex capability assessment, external expertise will be needed, which can be costly.

8. The capital cost of preparing a building to deliver flexibility can be very significant. Additionally, staff costs and other transaction costs (e.g. training staff to work with flex market platforms, calculating flex potential in a building) can also be very significant. The cost:benefit ratio may consequently be too skewed to enable flex market participation if the benefits are judged only in financial terms. Some partners do not consider the Market Stimuli Packages as adequate to cover costs or incentivise participation.

3.1.7 Know your network!

Peer-to-peer trading involves organisations getting to know their network: who is connected to their part of the network, where constraints are forecast, and what the opportunities might be for P2P activities. One LEO partner described the usefulness for this kind of information when assembling a Local Area Energy Plan, if very large energy users are involved. This was in relation to a large business moving its operations elsewhere, which could open up some spare capacity which might be useful for the transition to electric heat and power.

Ofgem have made it clear that they expect DNOs to make this kind of data available and create the platforms where it can be shared and used in planning and in matching peers seeking to trade capacity or offset their generation and demand. These ICT architectures could facilitate collective action and underpin the development of social capital, building trusted relationships and decision-making capability.

9. Accessible and comprehensible network data showing constraints and opportunities is critical for Local Area Energy Planning, together with expert modelling of future scenarios. Data should be presented in formats and using tools that trusted local convenors, together with local authorities, can interpret and use to engage communities and other non-experts to facilitate co-design. That would ensure that local communities can actively participate in the local area planning process, given that will know what projects might be there and be able to validate data with their local knowledge.

3.1.8 Getting buildings flex-ready

Getting buildings flex ready can entail upgrading or recommissioning BMS systems so that the building operates efficiently. Oxon CC emphasized that it had taken a lot of work to get the Westgate library BMS controls upgraded to enable component parts of the heating and cooling systems to be individually controlled and monitored. Without this improved control plus the addition of a remote scheduling interface, it would not have been possible to have delivered flex services reliably. Additional monitoring ensured that temperatures within the building remained within a range that would not cause potential comfort issues for building occupants. Recommissioning BMS to give

additional control of building operation is an indirect benefit of enabling a building to deliver flexibility.

Getting homes flex-ready where the flexibility is provided by controlling electric space heating (heat pumps and storage heaters) will also generally entail ensuring that the building is reasonably well controlled and energy efficient. However, fabric efficiency measures can be extremely expensive:

We know that there's a real appetite for people to improve the energy efficiency of their homes, but external wall insulation costs £30,000 you know, that's 10% of the value of one of those homes [in the Rose Hill area] ...that is a huge capital outlay for people...

LCH

Where extensive insulation works are essential for the heat pump to be feasible the investment case for a (smart) heat pump does not always add up. Consequently, the VP for making buildings more thermally efficient so that heat pumps are viable should emphasise co-benefits e.g.:

3. improved comfort,
4. less vulnerability to energy price hikes,
5. lower carbon,
6. the building was in need of refurbishment in any case.

For non-domestic buildings we can also conclude that recommissioning buildings as part of flex-readiness could also form part of the VP: fixing problems and glitches in the heating systems so that the building is more controllable, energy efficient and operates as intended are clear co-benefits to the capability to provide flexibility in a local flex market.

10. Getting buildings flex ready will often entail improvements to control systems and the energy efficiency of the building. This delivers numerous co-benefits (e.g. improved comfort) which can add to value proposition and will be particularly important to emphasize where there is no compelling financial case for investment in flexibility.
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3.1.9 Enabling flexibility without compromising comfort or safety

Changes to the operation of HVAC systems to deliver flexibility can be complex for building managers to implement as they can affect occupant comfort and wellbeing. Ensuring there are no impacts on comfort (or that comfort is improved) often necessitates deep understanding of building services. For example, in the Westgate library building temperatures were monitored around the library prior to and during changes in chiller operation. The parameters of the flex to be offered were designed to fit within the comfortable temp range for users. The monitoring and analysis required to derive these comfort parameters required months of careful work.

Developing workable flex strategy based on changes to air temperature also requires good understanding of occupant behaviour and comfort seeking strategies. For example, dressing for the seasons with appropriate warm or cool clothing requires occupants to play their part in the management of the building. Gaining occupant consent and compliance with requests to dress for the seasons is itself an energy management skill. Oxford University Estates described how achieving

this form of flexible demand involving a measure of behavioural change required a combination of systems upgrades and occupant “education”:

It's kind of a bit of education, in terms of getting people not only heating up and actually to wear appropriate clothing for the seasons would help. It's a whole combination of things that come together, but as a driver for a consumption reduction - it all adds up. So if we reduce the building by one degree, for heating load AND acceptance - “you're only going to wear a light shirt or T shirt in the summer”, we can afford to let the building seasonally shift. And we now have controllers that are capable of doing that.

Oxford University Estates

University Estates also remarked that management of comfort involved interfacing with a whole realm of occupant expectations and the psychology of comfort:

It's managing people's perception, because we've had discussions with somebody who was cold in the winter at 23 degrees, and they were hot in the summer 23 degrees. It's just perception because the sun's on the window, they assume it's too hot. I don't know how we manage that. That's a case of, okay, just wear lighter clothes in the summer, and wear warmer clothes in the winter...

Oxford University Estates

Evidently, delivery of certain flex events which could impact occupant comfort also entails building managers using “people” skills to keep occupants comfortable and safe. Ideally, the systems can be designed so that occupants do not notice short term changes to settings – but this may entail them dressing appropriately, moving office furniture, refraining from making adjustments to thermostats, opening or closing windows etc.

<p>11. Enabling flexibility in buildings, particularly where this is achieved through manipulation of temperature and humidity controls, will often require developing building management strategies to ensure building occupants play their part. This can include setting expectations for appropriate clothing, thermostat control, opening and closing windows etc</p>

3.2 Engagement and communication

3.2.1 Enabling an informed decision has an ethical dimension

LCH are keen to emphasize that the offer to potential heat pump adopters should be delivered in an ethical fashion. This means that assessment of the feasibility of an installation should be delivered by an objective third party. This allows LCH to avoid being accused of manipulating the householder:

So our aim is to be smart and fair with every step we take. We don't want to do anything that in any way persuades people to make a decision they wouldn't have otherwise made. For example, enabling householders to have access to impartial third party advice about the suitability of a heat pump, rather than simply encouraging people to install one so they can take part in the trial.

This suggests there is a strong ethical dimension to building knowledge and awareness allowing informed decisions relating to low carbon technology adoption. It is important to LCH to avoid being considered manipulative, “*persuading people to make a decision that they wouldn't otherwise have made*”. But there is a fine line here. Clearly, the objective of the smart heat pump value proposition is to provide a persuasive case for adoption of the technology, setting out the benefits of the opportunity. But costs and risks must also be presented. So the value proposition should be persuasive, but only where acceptance of the offer is in the best interests of the customer.

The value proposition must therefore present information which enables households to make an informed decision based on their needs and priorities and not lead the household or organisation to an adoption decision which may ultimately not be in their best interests. Particular care should be taken with (smart) heat pumps as the financial case for investment may be marginal and significant benefits only realised when controls are correctly used and when required changes to heating practices are also adopted. Without intervention, these changes to heating practices may stretch the capabilities of some households²⁰ resulting in loss of comfort, underheating, high bills etc.

Where technology adoption had adverse outcomes, the bad news will rapidly spread through the community – particularly in well networked and risk averse communities. Bad news messages disseminated rapidly through a community could stop an install programme in its tracks. Therefore an ethical approach to design and delivery of the value proposition, where the cost and benefits are clearly presented and where households are not persuaded to take actions which are not in their best interests, is not just a “nice to have” and a moral imperative - by creating an offer which minimises the likelihood of bad news, an ethical approach to value proposition design is also critical to ensuring the technology has the best chance of being widely adopted throughout a community.

12. Developing and enacting projects using strict ethical standards is critical to success. Without a strong ethical code to guide project activity, trust in the project and those delivering it will be undermined and the project will not gain support or buy in. So, whilst the case for project participation should be persuasive and framed to emphasize benefits which will appeal to target groups, engagement should not be manipulative or encouraging people to take

²⁰ Low carbon system innovation through an energy justice lens: Exploring domestic heat pump adoption with direct load control in the United Kingdom. Philippa Calver, Sarah Mander, Dana Abi Ghanem, Energy Research & Social Science, Volume 83, 2022. Available [here](#).

decisions which are not in their best interests. Ethical standards should be built into the processes for governance of the project.

3.2.2 Hard-to-reach groups

We should not underestimate the challenge of engaging people in technology adoption and changes in practice. It has been found that many more categories of energy users than those with low incomes fall into a hard-to-reach and/or vulnerable category. It is estimated that up to three quarters of all residential and commercial energy users can be described as hard-to-reach. This includes renters, their landlords and small businesses (>97% of SMEs). In addition, there may be compounding vulnerabilities and disadvantages such as minority status, societal stigmatisation, geographic remoteness. This adds up to a vast and heterogenous energy user group that is largely disengaged, even for the most simple, cheap and health-improving energy measures²¹.

In this context, a complex offer of flexibility in smart low-carbon energy systems is some way down the list of priorities for all but innovators and early adopters.

13. We should not underestimate the challenge of engaging the early and late majorities of both householders and SMEs. This report and previous reports have identified that engagement and value propositions need to address both attitudinal differences between early adopters and the early majority (e.g. differences in attitude to risk and the need for “social proof” to legitimise adoption) and also the spectrum of differences in capability across technical, economic and social dimensions. And it is important to recognise that the difference between an early adopter and a early majority adopter may not be related to attitudes or motivation but linked instead to technical or economic capability or to the opportunity to adopt materialising from a life changing event – such as moving into a new home.

3.2.3 Communicating the community and environmental benefits of flexibility

By operating DER flexibly a range of benefits accrue both to asset owner and to the community at large:

- network services can be created, generating a small income to the individual;
- connection of other DERs (solar roofs, EV chargepoints etc) into the same part of the network are facilitated, benefitting the householder and others in the community²²;
- the community and the individual plays a part in delivering local and national Net Zero objectives;

However, it has been found that communicating how a smartened DER contributes to network flexibility and to achieving Net Zero goals is very difficult. This is because it entails some

²¹ Rotmann, S., Mundaca, L., Castaño-Rosa, R., O’Sullivan, K., Ambrose, A., Marchand, R., Chester, M., Karlin, B., Butler, D. and K. Ashby (2021). Hard-to-Reach Energy Users: A critical review of audience characteristics and target behaviours. User-Centred Energy Systems TCP - HTR Annex: Wellington. 255pp.

²² We have found that part of the flex system adoption value proposition could be that operating equipment flexibly facilitates others in the community to connect low carbon DER without incurring reinforcement costs levied by the DNO. So in theory, and depending on how DNOs charge for the reinforcement, it becomes cheaper for those wishing to connect new loads or generation on the LV network if existing load can be operated flexibly. But this requires end users to operate their equipment in response to signals from the DNO (perhaps via a local energy market).

understanding of how an electricity system works and the challenges it faces. This requires a level of technical knowledge which most people do not possess. At the householder level:

For that part of the value proposition, which is the social value that we can only all have pumps and EVS if we all play ball together and understand that they need to have some interoperability so that we don't melt the cables, it's really, really tricky. We've run webinars on this, and you do see blank faces, because it's quite a technical concept.

And amongst the SME community,

I could ask my team whether anyone ever talks about flexibility. I can almost guarantee that the answer is "no".

LCH Business relationships

Knowledge of flexibility and opportunities for trading were reportedly a challenge in the public sector also:

In a larger organisation where energy is not core business, it's challenging to get understanding across different teams of: a) what energy flexibility is and b) understanding of what we want to do in the LEO markets and c) then agreement to participate.

Oxford City Council

In this respect Oxford City Council respondents were keen to emphasize the importance of LEO in translating TRANSITION and flexibility terminology into plain English, using terms that local authorities are used to working with:

Plain language work undertaken in LEO is very helpful...Pitching the markets as a procurement mechanism (rather than an energy flexibility mechanism) was also a very good approach as its more easily understood internally.

Oxford City Council

These findings suggest that SLES initiatives need easily graspable analogies and metaphors for electricity grid management and operations, so that the importance of flexibility in energy transition can be understood and embraced. If households, bursars, estate management teams and CEOs do not have a basic grasp of the way the network operates, along with the issues relating to electrifying heat, transport and other services, then lack of awareness and knowledge are likely to undermine commitment to Net Zero decisions.

As all capability frameworks²³ suggest, behaviours stem from possession of the Means, Motive and Opportunity to act in particular ways. Lack of knowledge of the energy system is a component of Means – the means to act require a certain knowledge base. Also lack of knowledge degrades Motivation too: if it is not clear in a person's mind (or in the corporate mind) how the rationale for a certain course of action is aligned with values and attitudes (both personal and corporate) then motivation to undertake certain activities is reduced.

²³ E.g. [CSE's capability framework](#) informing this work or Susan Mitchie's [COM-B framework](#).

14. Recognising certain types of value in the value proposition such as community and wider social benefits is greatly facilitated if the customer has a certain level of the knowledge of the problem that flex technologies are helping to resolve. This entails a basic understanding of the way the grid operates. However, understanding of how flex facilitates DER is thought low to non-existent across most of the grid edge audience and so the challenge of communicating this understanding should not be underestimated. A suite of metaphors and analogies to explain grid operation to a lay audience was thought extremely helpful. LCH also advise emphasizing the benefits of flexibility rather than getting too bogged down in the “mechanics”.

3.2.4 When to present the value proposition: pros and cons of the trigger point

Received wisdom is that new practices and technologies are more likely to be adopted at key moments when decisions are being made: when a company moves its office, when a householder installs a new kitchen. However, this rule does not always hold. For example, in the case of distress purchases, it is probable that like for like replacement will usually be made - when a gas boiler breaks down the householder will seek to replace the boiler as quickly as possible with another gas boiler to get the heating service back online as quickly as possible.

In these circumstances, the introduction of novel technology involving unknown costs, benefits and risks and entailing changes to heating practices (such as a heat pump) may be less likely to be considered as an option. When faced with an immediate need for hot water and heating, householders may not have time to fully research a new heating solution, so default to a system they are already familiar with.

LCH note a similar potential situation with the Rose Hill residents whereby the offer to switch to a new tariff, coincided with the move into a new home. Although in principle the timing of the offer was such that it arrived during the small window of opportunity many homeowners have to change their tariff – prior to being locked into a contract – moving into a new home it is also a time when homeowners face a number of competing decisions and information, so sticking with a previous supplier may be the easiest option.

On the other hand, LCH report that heat pumps installed as part of the trigger of a previously planned refurbishment project were encouraged. This was for a number of reasons, including:

- Additional cost of changing pipework, improving insulation levels associated with successful heat pump installation are often not included in the householder’s payback calculations for the heat pump swap because this work was to be done in any case. Consequently, the Renewable Heat Incentive grant (around 5k) was considered a useful stimulus which did transform the business case for heat pump installation:

The feedback we've got, which is I would say anecdotal, rather than having seen all the numbers, is that people have been pleased with their decision financially. So the RHI seems to be a mechanism that works. But...that is for people who have also spent quite a lot of money on a refurbishment project. And they are not including those numbers in the payback analysis. That was work they were going to do anyway.

- In some cases, a heat pump install had been planned from the outset and so was not a distress purchase. This allowed time for the pros and cons of the technology to be assessed, for the finance to be arranged and for householders to do the internal mental processing to become comfortable with the adoption decision e.g. thinking about whether adopting a heat pump is a good fit with attitudes, values and personal identity.

In addition to capital costs, operating costs of the new heating system were also thought an important influence in adoption decision-making. Where a switch from gas or oil heating to electricity is desired, relative unit costs of these fuels were considered. Alternatively, where electricity prices are increasing but there is no technology switch, customers will be more responsive to offers which reduce unavoidable costs – e.g. through ToU tariffs. Unfortunately for the heat pump offer to the Deddington and Duns Tew communities, electricity prices were increasing relative to oil, further undermining the business case for a switch to heat pumps from oil boilers.

15. It can be helpful to make an offer of smart technology and flex tariffs at trigger points, but acceptance is much more likely when someone is not having to make a distress purchase, not pre-occupied with other issues, and not facing a shift to a higher-priced energy vector.

16. So that householders and businesses can integrate low carbon technology into their works that were to be undertaken in any case they should be made aware of the existence of the offer as early as possible.

3.2.5 Three forms of social capital and associated capabilities

LCH described how a blend of social capital and the presence of committed individuals is required to make low carbon projects happen:

... if you have a relatively small amount of social capital, but a couple of really determined others [i.e. individual community members] that really want to make something happen... [a project can be successful]. Or you can have loads of social capital, but no one with an interest [then a project can fail]. It's that combination.

Having a few “really determined others” that “want to make something happen” is reportedly a key success factor in local energy projects²⁴. This kind of social capital is sometimes called “linking” social capital as distinct from two other forms of social capital recognised in the literature:

- “bonding” social capital – a dense network of trusted social relationships – social glue.
- “bridging” social capital – the degree to which disparate groups within a community communicate and “get along” – social WD40.

A fuller description of the three types of social capital and the capabilities they enable is shown in Table 2.

²⁴ See Bridgeman, T., Lamley, A. and Goaman, D. 2019. Evidence assessment of local energy for BEIS. Centre for Sustainable Energy (CSE), Bristol, UK.

Table 2: Three forms of social capital

	Description	Capabilities deriving from social capital type
Bonding	Close ties between people in similar situations, such as family and close friends; the ‘glue’ that binds groups together. Typified by strong links, homogeneous actors, norms of trust, reciprocity and mutuality.	Helps explain community engagement and activism. Communities with lots of bonding social capital will have a strong sense of community identity. This encourages participation by community members in activities that achieve community-level objectives through the exercise of ‘soft sanctions’: blame for non-participation and creation of solidarity benefits from interacting with other community members ²⁵ . Lots of bonding social capital can foster reciprocity: “I am confident that what I put into this in time and resources will be reciprocated with benefits in kind from my community”.
Bridging	Looser ties between a wider mixture of people, such as loose friendships or work relationships. Also the connectedness of social groups within a community.	If bonding capital is the “glue” that binds groups together, bridging capital is considered a sort of “sociological WD40” that enables diverse groups to, “get along” allowing communities to create more outwardly-oriented networks ²⁶ - e.g., for closely-bonded groups to work with other groups within and beyond a community – building support, generating new ideas etc.
Linking	A special form of bridging social capital, referring to groups’ ability to access networks of power and resources beyond their immediate community.	Community projects are often driven by one individual or a small group who commit time and resources and are unified around an objective. They have the skills, confidence and knowledge to connect with external organisations (usually the local authority) that can facilitate planning and provide funding, expertise and other resources. Agencies seeking to catalyse energy projects within communities emphasise the importance of working with stable, valued and approachable individuals and organisations such as schools, local supermarkets, sports and social clubs. These groups and key individuals confer both linking and bridging social capital to the community.

Interpersonal communication is enabled when a community has a relatively dense network of social relationships, through a combination of “bonding” and “bridging” social capital. So some communities with higher levels of these types of social capital are more capable than others in hearing about energy innovations, spreading information about a new practice or technology through the community, and being able to coordinate their assets and resources to facilitate adoption of new practices²⁷. One study found that seeking information amongst personal contacts is associated with adoption of innovations such as household energy efficiency behaviours, increasing likelihood of adoption of new energy efficiency practices by up to four times. Also, that there are important differences between types of innovations and communities, requiring tailoring of messages²⁸.

²⁵ Holman, N and Rydin, Y (2012) What Can Social Capital Tell Us About Planning Under Localism? *Local Government Studies* 39 (1):1-18

²⁶ Putnam, R. (2001) Social capital: measurement and consequences, *ISUMA Canadian Journal of Policy Research* 2(1) pp. 41-51.

²⁷ Darley, J.M. and Beniger, J.R. (1981), Diffusion of Energy Conserving Innovations. *Journal of Social Issues*, 37: 150-171

²⁸ See McMichael and Shipworth, The value of social networks in the diffusion of energy-efficiency innovations in UK households, *Energy Policy*, Volume 53, 2013, Pages 159-168

Behaviour change is often thought of as enabled when households have the Means, Motive and the Opportunity. So, “linking” social capital is strongly associated with having Means - skills and knowledge in the community - and Motivations – determined individuals. But “Opportunity” is also needed, and LCH identify “*having the time*” to do things as critical:

We have loads of people interested in [projects] and no one with time... [we need that] somebody is interested in making it happen. And you've got the means to do it. And the time to do it.

This suggests that an important part of the value proposition could be in offering “pain relief” by making participation in SLES less onerous in terms of time commitments.

It was also noted that the quality of social capital needed to facilitate take up of a technology would vary by technology or practice type. And that some innovative energy measures would not need much bonding or bridging social capital whilst for others it would be essential. A contrast was made between uptake of a time of use tariff and a battery installed into a school:

I think that the importance of [social capital] really varies depending on what your local energy product or service is.... if your product's going to be about setting up a community battery, which only needs a private wire to one commercial investor, or one commercial off-taker of your power, ... having that one connection with the right person in that third party organisation is far more valuable, than knowing everyone when you bump into them in the community store.

LCH

17. There are different forms of social capital – bonding, bridging and linking. Each form can be harnessed in different ways to facilitate the adoption of an innovative energy technology or practice across a community. Technologies that installed at the grid edge amongst many members of the community particularly benefit from bonding and bridging social capital. Plenty of bridging social capital amongst the disparate formal and informal groups in the community will be particularly important in engaging with hard-to-reach groups.

18. Some technologies will not need much bonding or bridging social capital - particularly those where only a small number of community stakeholder are involved (such as installation of a solar roof or big battery at a school). However, all projects will require some “linking” social capital – i.e. a small group of embedded individuals with skills and capabilities that can work with external agencies.

Characteristics of bonding, bridging and linking social capital in the context of LEO activities are discussed further below.

3.2.6 Bonding social capital: working with internally well-networked groups

The presence of bonding social capital, i.e. a relatively dense network of trusted social relationships, has been found to be a factor in adoption rates of energy efficiency behaviours and innovations²⁹. Bonding social capital may facilitate take up of a flex or low carbon technology offer in at least three ways:

²⁹ See McMichael and Shipworth (2013). Op.Cit. available [here](#).

1. Through rapidly spreading information about the offer within a community and,
2. By creating a social norm for accepting the offer – i.e. by creating the thought that *“this is the kind of thing that people like us, living round here, do”* (author’s quote).
3. By creating a sense of shared purpose which can be harnessed to drive collective action toward net zero goals

A sense of shared purpose builds commitment and encourages people and organisations to participate in activities that would otherwise fall foul of the “collective action problem” – i.e. the situation in which individuals would be better off cooperating but fail to do so because of conflicting interests between individuals that discourage joint action. The collective action problem can be overcome if people feel they have a mutual interest in acting collectively and that there will be reciprocal benefits forthcoming. A clear set of mutual interests are negotiated and collectively agreed through dense social interaction through social networks in the community. A feeling that my activity for the social good will be reciprocated is encouraged when my relationships with others (neighbours, friends) and local groups is trusted and strong.

This suggests that if an external actor (such as LCH) can become accepted and trusted by a community with lots of bonding and bridging social capital then this can be a route to effective engagement. The presence of bonding, bridging and linking social capital can be harnessed to achieve positive outcomes for the community as a whole.

There is a caveat to the use of bonding social capital in social innovations, however. Social capital theory suggests that where a group has too much bonding social capital and not enough of the bridging or linking types (see below) it can become closed off to new ideas and practices. Those outside the group can become “othered”, with their priorities and agenda seen as conflicting or non-aligned - such a situation can breed distrust of the agency’s offer. In communities with lots of socially-bonded subgroups, new information and practices will only percolate through the community as a whole if the subgroups interact and communicate with one another – if they are developing bridging social capital, something that will enable diverse groups to get along with one another and allow communities to create more outwardly-oriented networks³⁰.

19. When developing project plans for a community it is helpful to identify and map the formal and informal groupings and networks in the community - and the communication channels between them. This will facilitate development of engagement strategy.

3.2.7 Bridging social capital: working between people and groups

As has been reported elsewhere³¹, LCH find that local groups are the entry point for introducing information about energy transition and the benefits of participating in local energy systems. These community groups do not have to be focussed on energy or even sustainability:

³⁰ Putnam, R. (2001) Social capital: measurement and consequences, ISUMA Canadian Journal of Policy Research 2(1) pp. 41-51.

³¹ See Bridgeman, T., Lamley, A. and Goaman, D. 2019. Evidence assessment of local energy for BEIS. Centre for Sustainable Energy (CSE), Bristol, UK

... they are groups who have a very holistic interest in the environment and are not necessarily technical people. They are mainly social groups, they have a number of activities they undertake, but they are like-minded people getting together more than they are established campaign groups... that's been our access point.

The community energy literature suggests that where communities are well networked internally with informal groups of householders (e.g. neighbours) and formal groups (such as identified above), and when these have trusting relationships and communication channels with one another, innovative energy practices spread more quickly and have a better chance of being adopted³². The practices spread through social learning and through norms developing in the community.

An interesting instance of bridging social capital was given by LCH in relation to the partnership of a nascent volunteer-run community electric car club, car hire company and a local sports centre coming together to deliver a community car club. The community would focus on recruiting members and developing the business model, the car hire company would provide the car, while the sports centre would host the electric charge points. This is a good example of an innovative collaboration between business, a community group and a social enterprise to help accelerate low carbon change, led from within the local community.

Social learning is facilitated when actors can meet face to face. However, the distancing imposed to tackle the COVID pandemic has damaged many of the learning opportunities that had been planned for the SFNs. Some activity has been hosted online (e.g. webinars to talk through the pros and cons of heat pumps), but the social engagement needed to develop trust, informality and opportunities to actually experience the technology in operation (e.g. feeling the warmth generated by a heat pump) are clearly not achievable online.

It was also thought that repressed desire for social interaction as a result of the pandemic now means opportunities to get involved locally (e.g. in a local energy group) are being seized upon:

I think maybe post-COVID, people have really missed connections, not just with family and friends, but with anyone...So this is a real ... kind of desire to reconnect at a community level.

LCH

Although COVID has curtailed face to face interaction it was also noted that the hunger for social interaction has spawned multiple WhatsApp groups. Now that these platforms are in place and are being used by large numbers of people this offers an opportunity as a communications and engagement channel. Also that social networks within communities can be replete with bridging social capital and offer powerful routes to engagement. Some Oxfordshire examples are given below:

³² One study found that seeking information amongst personal contacts is associated with adopting innovations such as household energy efficiency behaviours, increasing likelihood of adoption by up to four times, but that there are important differences between types of innovations and communities, requiring tailoring of messages. See McMichael and Shipworth, The value of social networks in the diffusion of energy-efficiency innovations in UK households, Energy Policy, Volume 53, 2013, Pages 159-168.

- Shop owners, businesses and traders operating in a retail area may form an association to represent their interests. For example, the Thames COP 26 initiative, with around 60 small businesses in the area making pledges to reduce their environmental impacts.
- Tenants and residents' associations such as that in the large housing estate of Rose Hill. These may contain smaller groups representing different parts of the estate.
- An area may also have a network of networks. For example, the "Rose Hill Network" represents a loose affiliation of all the different groups and clubs in the Rose Hill area of Oxford City. Most of these groups will *not* have a focus on energy and environmental issues but it was seen as important to work with this kind of network so that (innovative) energy and environmental practices and information could be transmitted beyond the usual suspects and into other areas of the community. The Rose Hill Network therefore embodies a form of "bridging" social capital

Similarly, LCH have attempted to introduce LEO in Deddington and Duns Tew via networks of local groups that are not directly concerned with energy issues:

In both of those communities there's an established network that runs a farmers' market, community orchard, working in local conservation areas, and is also interested in climate emergency stuff. So they are groups who have a very holistic interest in the environment, not necessarily people with a technical or energy systems expertise or focus.

Evidently, a flex VP should take advantage of these pre-existing networks, "so you don't necessarily have to reinvent the wheel" to build trust in the offer and those behind it.

20. We can conclude that a value proposition offer for flex should recognise the needs and capabilities of the various groups within a community and, if resources permit, be tailored accordingly.

21. Social learning "processes" co-developed with key groups and individuals could be a powerful means of spreading information and innovative practices through communities. An example of a social learning process would be setting up "show home" where community members can experience for themselves flex technologies and can ask questions from peers who have adopted the technology or can advocate for it. Where communities have low levels of "bridging" social capital there is some evidence of successful practices for developing it .

3.2.8 Linking social capital: expertise in communities

LCH have also found that where local groups do have members possessing sufficient technical and economic knowledge and other skills to understand the benefits and costs of the heat pump offer this can be a great help. These capabilities enable groups to become effective advocates for the technology with the skills and confidence to connect with external sources of expertise and funding that will allow local projects to be developed further. As discussed, when a community has these kinds of skills which facilitate outreach and connection with agencies, institutions and even other communities it is said to possess "linking" social capital.

Some of these skills will be quite generic (e.g. project management, fundraising). Others will be highly specific - related to the specific technology in question such as knowledge of the engineering challenges of a hydro station:

*....[for] Osney Lock Hydro ... it wasn't any random five people around the table. It was somebody who totally understood renewable governance and sources of funding, you had somebody who's an electrical engineer an architect, project management skill, fundraising skill. So it was a very particular set of skills, [which came together and made it happen, and] which are probably very different [set of skills needed] to say, build a solar PV or getting everyone to sign up to a solar tariff.
[LCH]*

It was also remarked that there was a need for different skillsets depending on the stage of the project:

- Start-up skills, associated with getting the project off the ground, such as fundraising and technical skill.
- Scaling skills, associated with creating wider take-up of an offer and galvanising support, e.g. marketing and project management.

The more networked a community is (i.e. the more bridging and bonding social capital) the easier it is to spread information about the innovation. Critically, this information must be trusted and therefore come from a trusted source for it to be acted upon. So the more that the information source is trusted and locally networked the greater the chances of success. Examples of linking social capital in LEO include:

- Osney Island SFN members, involved in management of Osney Lock Hydro with project management and energy expertise from their professional lives;
- Duns Tew and Deddington SFN members who run environmental consultancies and other environmentally-linked businesses;
- Shared-equity residents of the Rose Hill flats, with some social connections or connections via work colleagues to Project LEO;
- CEOs of local SMEs who have decided to steer their companies down more sustainable routes.

Small business owners and CEOs were thought particularly useful partners to link with because:

... if they really believe in this stuff, they don't even have to justify it to themselves as "this makes financial sense". They just decide, "Do you know what? - I'm going to do this" So unlike in a big corporation, where you put together the business case and you have to justify doing this as opposed to other big capital projects (which aren't necessarily connected to sustainability), it's just about how those key people in small businesses - what they believe - is important.

In the course of their work with Deddington and Duns Tew, LCH have also encountered a possibly unexpected "flip side" to targeted members of the community possessing technical skills and relevant knowledge and awareness: it also allows accurate assessment of disbenefits and costs:

They know their way around this kind of stuff. One of those people who runs a consultancy has just installed a new oil boiler, because it made more financial sense [for them] than installing a new heat pump. So, they can scrutinise numbers and know when something stacks up or not

Consequently, it was reported that some group members could not, in good faith, advocate for a technology that they themselves would not install because, for them, the economics suggest it is not always a good investment:

And heat pumps can be expensive. And, when your deep green community leaders aren't finding it an easy decision to decide to take, and struggle to see the economic case for making a transition from oil-based heating to heat pumps, because of the relative running costs in the current energy crisis, that dissemination of this being the right thing to do? It isn't going to happen.

This situation meant that LCH did not feel that it was appropriate to expect community group members to do, “a sales job” on behalf of LCH:

Going back to that point about our trials being smart and fair, it would not be fair for us to be recruiting people to do a sales job for us.

This situation raises the question of how energy projects should work with embedded community members in ways which are both effective and, critically, ethical.

22. Multiple studies of successful community energy projects have repeatedly emphasized the critical importance of so called “linking” social capital – i.e. the presence of a group of individuals or a group embedded within the community that have the skills, confidence and resources to engage with external sources of funding and expertise. Two main types of skills have been identified:

- Start-up skills, associated with getting the project off the ground, such as fundraising and technical skill.
- Scaling skills, associated with creating wider take-up of an offer and galvanising support, e.g. marketing and project management.

Having the time to work on the project was also identified as critical (a capability in itself). Project managers need to prepare value propositions that draw on the skills and insights of these embedded individuals.

3.2.9 Working with social capital to design successful interventions

So various dimensions of social capital can be important factors in the success of community energy schemes by bestowing certain capabilities for communities to participate in SLES and flex creation. This suggests that one route to creation of helpful capabilities might be via creation of the right forms of social capital. Alternatively, given finite resources, and recognising what is within and what is without one’s “gift”, an intervention should be designed around the social capital resources that are found. These two broad approaches are termed, “Fit” or “Transform” strategies:

- “Fit strategies” adapt the offer to work better with existing capabilities in a community. The offer and associated value proposition should be crafted to fit what is found, rather than communities changing their capabilities in order to adopt the new practice or technology.

- Conversely, “Transform strategies” are about changing the capabilities of households and communities in order to facilitate adoption of the technology. The onus for change is on the community, household or business.

In practice, it is likely that a blend of “fit” and “transform” strategies will be most effective in stimulating adoption of SLES technology and practices.

The literature on building social capital indicates that building social linkages between people is a prerequisite for creating a shared sense of what is normal, trusted and desirable. Also that opportunities for people to connect with one another are much more likely to be taken if they are fun and rewarded through recognition and social approval.

It is particularly important to create a sense of social inclusion where people can feel that their contribution is valued; also to develop a norm for prosocial behaviour. This will reduce the sense that others are free riding on an actively engaged group’s efforts, something that can undermine prosocial motivations and actions.

But some (community-level) capabilities cannot be changed. For example, the orientation of the roofs in a neighbourhood to facilitate solar PV installs cannot be physically changed and therefore a fit strategy will be required for some aspects of the offer. Equally, building requisite social capital in a community (such as building up skills and knowledge amongst community members) could be an intensive and extended process which is beyond the resources of the project.

I think the thing about the social capital is what's in our gift to change? Some things are much easier to change than others... how do you develop that social capital?

LCH

LCH and Oxford Brookes University have developed tools that build embedded knowledge, expertise and awareness of potential SLES benefits and thereby create linking social capital. The LEMAP tool is designed to be used by non-experts. It crowdsources technical information about the neighbourhood, generates interactive maps showing energy demand profiles and other technical data and also has platforms for communities to share information amongst themselves.

LCH’s “service offer template” is also designed to be used in workshop settings with local community members. The LCH tool assesses a community’s capabilities, records priorities and helps identify barriers and opportunities to low carbon living and participation in smart local energy systems.

Together these tools allow a community to assess its own technical, economic and social capital resources in order to make the most of its capability and to move forward in the Local Area Energy Planning process. They also play a key role in engaging communities and in facilitating co-creation of Value Propositions for SLES. Therefore these tools build local knowledge, awareness and skills and facilitate development of linking social capital.

23. The challenges and resources required to develop bonding and bridging social capital should not be underestimated and are probably beyond all but the largest and most well-resourced projects³³. More social capital “bang” for resource “buck” is probably achievable through working with an embedded group of individuals to build up their skills and resources so that they can manifest so called “linking” social capital. Tools such as the value proposition development process developed by LCH and the LEMAP Local Area Energy Planning tool work in this way.

3.2.10 Social capital, capability and equity

Difficulties in building social capital in disadvantaged communities tend to mean that interventions will be trialled in areas judged to be better-endowed both in social capital terms but also in terms of other helpful factors such as relatively high levels of average income and education which is associated with greater capability and propensity to take risks on new or innovative technologies and practices:

... if you're looking for early pioneers... I'd be going to places with high social capital, because you got the best chance of something thriving.

LCH

This raises equity issues: low-income areas often have lower levels of social capital. Thus, with limited budgets and time, projects are more likely to achieve higher adoption rates in non-low-income areas and there is a strong incentive to target projects into relatively affluent areas and to neglect the lower income areas which arguably have most to gain from a smarter local energy system.

Another factor to consider is that of risk. Unless very carefully managed, the potential risks and ‘costs’ of taking part in the trial of new technology may have a bigger negative impact for participants from more disadvantaged communities, so identifying potential risks and mitigation strategies need to be carefully considered in any trial, and even more so in those who may be less resilient.

The relationships between various forms of social capital and economic and social disadvantage are complex. But evidence has shown a number of trends. Impoverished communities will tend to have lower levels of bonding social capital than communities with greater levels of average income³⁴. But noting that an *impoverished* community is not the same thing as a low income one – there is no direct relationship between average income levels and presence of social capital. A low-income community can still have lots of social capital. However, the evidence suggests that below certain threshold income levels life becomes very difficult and social conditions change. This is discussed further below.

³³ However, some examples do exist such as Stockholm Environment Institute’s work with the Joseph Rowntree Foundation’s housing estate, New Earswick. SEI and JRF’s report on this ground-breaking project is found [here](#).

³⁴ Larsen, L. Harlan, S.L, Bolin, B., et al. (2004) Bonding and Bridging: Understanding the Relationship between Social Capital and Civic Action. *Journal of Planning Education and Research*. 2004;24(1):64-77

There is also evidence that skills and resources that could be shared across a community such as knowledge of the planning system or financial expertise are associated with communities with relatively high incomes and levels of education. Consequently, it has been found that lower income communities are much less likely to participate in planning processes and policy decision-making about their areas than higher income communities³⁵.

There are a number of explanations for this. For example, evidence suggests that living on a very low income focuses decisions on coping with current stressful circumstances, often at the expense of future goals. It is thought that poverty reduces a person's cognitive "bandwidth" reducing ability to think deliberately and systematically about e.g. the benefits of adopting an innovative energy practice³⁶. Further, people living in poverty are understandably less likely to be willing and able to take risks than those living in more settled and affluent circumstances³⁷ - because, if things go wrong, low-income households have no, or hugely diminished, ability to recover. Thus poverty detracts from a household's capability to take chances on a new technology or practice and to develop the skills and knowledge to value the benefits of a SLES participation or the capacity to adopt a potentially risky or innovative practice.

There are other factors which undermine social capital some of which are not directly related to poverty levels. For example, transience destroys social capital: levels of homeownership are correlated with bonding social capital, as is length of residency³⁸. And so low income does not always equate to low social capital. For example, long-established working-class communities in social housing estates, where extended families have lived for generations (and where many may have bought their own home) will tend to have lots of bonding social capital and deeply rooted sense of attachment to the local area. This could be leveraged by designers of an intervention – for example, by linking the value proposition to local priorities around creating greater local resilience and a sense of security, local employment opportunities, improving the local environment etc.

However, the literature also suggests that if there is too much bonding and not enough bridging social capital, it may be that new ideas tend to stay within tight social groups. And if there is too much bonding and not enough linking, a very insular community can develop where outsiders are distrusted, any deviation from existing ways of doing things is discouraged, and links to external agencies, sources of help and expertise are stymied.

24. Low-income areas often, but not always, have lower levels of social capital and embedded skills and resources that can be leveraged in technology diffusion projects. This raises energy equity issues where resources constraints dictate that innovative energy projects are more likely to succeed in higher income areas and are therefore targeted into those areas.

³⁵ Pattie, C., Seyd, P. and Whiteley P. (2004) *Citizenship in Britain*. Cambridge University Press p.86

³⁶ *The Psychological Lives of the Poor* (2016) Schilbach, F., Schofield, H., and Mullainathan, S. *American Economic Review: Papers & Proceedings* 2016, 106(5): 435–440. Available [here](#).

³⁷ JRF (2014) *Practical Action to Build Community Resilience: The Good Life Initiative in New Earswick* Stockholm Environment Institute for the Joseph Rowntree Foundation, York

³⁸ Leviten-Reid, C. and Matthew, R. (2018) *Housing Tenure and Neighbourhood Social Capital*. *Housing, Theory and Society*, 35:3, 300-328

25. Some well-established low-income communities with low levels of transience (i.e. people stay in the area for a long time) have an abundance of social capital and also useful capabilities related to deep knowledge and attachment to their area. Therefore, to guard against relatively disadvantaged communities being left behind, 'transform' work is needed to build skills and knowledge, along with 'fit' strategies to work with the social capital and other capabilities that are already in place.

3.2.11 Social capital and social learning

A number of issues were identified in relation to adoption of heat pumps which can potentially be addressed by facilitating "social learning" about the technology. These include issues related to the appearance of the heat pump (it's a fairly unattractive and large metal box housing a fan that must sit reasonably near the house), concerns around potential noise - and the widespread expectation that heat-emitters (radiators) served by the heat pump will feel hot to the touch in the same way that a radiator served by a gas boiler does.

It was further noted that a shift in heating practices is required to get the best out of a heat pump system (e.g. having the heating on for longer, no longer drying clothes on radiators):

It's well established that the change to a heat pump is a really fundamental lifestyle change in terms of not having a high temperature-emitter. And ... there's a well-established British sensibility around range cookers, and hot radiators and open fires and things like that. And the change to heat pumps is a really significant psychological shift.

LCH

Where an innovative technology may have quite disruptive impacts on heating services and lifestyle, first-hand testimony from an owner-operator can be extremely valuable, along with the opportunity to experience the technology in operation. These are social learning processes that have been incorporated into the Deddington and Duns Tew SFN:

The webinars we've done for this project went into a lot of detail with people who have had [heat pumps] talking about that kind of change, so that people were not blind to that. I think that's really important. And having people who have heat pumps talking about what the experience is like, and how they've adjusted ...generally positively, but flagging also that there is a significant change there... it's great to have people who have gone through the process, talking to people who haven't - that's been a key part of reassurance.

LCH

The same reasoning applies to adoption of new heating practices in the non-domestic sector - expectations should be managed and behaviour change may need to be guided. For example, effective heat pump deployment across the Oxford University Estate may entail running buildings at slightly lower temperatures and that building users dress for the seasons - an approach that embraces the principles of 'adaptive comfort'³⁹:

³⁹ Nicol, F. and Humphreys, M. (2002). Adaptive Thermal Comfort and Sustainable Thermal Standards for Buildings. *Energy and Buildings*. 34. 563-572.

We were turning temperatures down...So the background temperature is being defaulted to 20°C instead of 21°C... [this was during the winter]. Most people aren't noticing it. Most people are used to wearing jumpers at home. because they don't want to put their heating on as much if they're working from home. So coming into work in a jumper is not so bad. It's a bit of education, in terms of getting people to wear appropriate clothing for the seasons.

Oxford University Estates

26. Effective engagement with low carbon and innovative energy technologies and practices requires social learning. This means more than simply passing on information from expert sources to laypeople; new knowledge and processes have to be tested and validated in the real-life conditions of each community, with learning flowing in more than one direction⁴⁰.

3.2.12 Creating stable and supportive decision-making spaces

Political and regulatory uncertainty about the shape of future markets and systems could act as brake on investment and support for Net Zero. It was reported that the “double whammy” of Brexit and the pandemic, along with general market uncertainty, had reduced SME appetite to take out loans for investment in new equipment or low-carbon works; the priority was just to “keep businesses running”. In this respect, SMEs, organisations and possibly householders need reassurance that investments in low-carbon technologies and flexible operation will become worthwhile because the energy system is inexorably decarbonising. The Climate Change Act (2006) provides some form of assurance but, as we see at the time of writing, the policy environment can change rapidly.

Local authorities also need reassurance that the national policy and planning framework will support investment and planning that will contribute to Net Zero. Both the County and City Councils have found that framing LEO involvement in terms of a route to Net Zero was a way of engaging colleagues and securing support:

The national focus on Net Zero has a sway over Council. Working in a political environment has a large influence over the appetite for these types of projects. Providing flex is an additional part of people's day jobs. County Council have senior management and political support for LEO, which makes a huge difference.

Oxon CC

[There is] better engagement internally when flex is focused on Net Zero.

Oxford City Council

This suggests that a VP for investment in flexibility or participation in a SLES should emphasize that adoption of these technologies is “future proofing” the organisation because the policy and regulatory context for Net Zero transition is already being developed and smarter systems and flexibility is a key component of that⁴¹. For example, with reference to SMEs:

⁴⁰ Glad, W. (2012) Housing renovation and energy systems: the need for social learning, Building Research & Information, 40:3, 274-289.

⁴¹ See the UK government's Smart systems and Flexibility plan (2021) [here](#).

[There] are a significant number [of SMEs] looking at PV, EVs, and EV chargers. There is a real growth in those three areas. I think the other thing that you can potentially say to them is, it's important not just to think about the measures you're installing but the kind of controls, because you're future-proofing your new equipment. If you can put in controls on these systems, which would allow you to take part in the flexibility system, you are future proof...because we WILL need flexibility (speaker's emphasis).

LCH business relationships

The same future proofing argument was also thought influential for householders, along with motivation around being a good energy citizen and doing one's bit for society. It was noted that these types of argument are particularly important where the economic case for investing in flexibility and low carbon is marginal or non-existent. For example, with reference to LCH's work to stimulate adoption of heat pumps it was noted that:

The value proposition is about being part of this innovation trial, and being no worse off for participating in it, basically. So I think it's simply that you were going to do this anyway, we're going to give you all this extra stuff. And in the future, you may be able to access this market. But really, it's about being passionate about being involved in this trial, which could unlock the electrification of heating across wide areas of the UK, in particular, off-gas-grid communities.

27. A supportive and stable policy and regulatory context is critical in giving the sense that investment in smart technologies is futureproofing the home, business or organisation. Net Zero policy (enshrined in regulation) gives confidence that these changes are coming to all and that being a first mover will not lead to stranded assets and wasted resources. Net Zero policy adopted at National and Local level was particularly influential in local authority decision-making in respect of flexibility and smart energy initiatives.

3.3 Dimensions of the value proposition

3.3.1 Value propositions will vary by audience and by technology

Value propositions for flexible operation of equipment and for low carbon energy systems will vary by audience and by technology. Previous WP6 interviews told us that, in general, the motivations of "early adopters" of an innovative practice or technology are different from those of people who will adopt later (the "early majority" and the "late majority"), as the practice becomes more mainstream. Innovation theory suggests that, typically, early adopters will not be primarily motivated by financial incentives and will have different attitudes to risk from the mainstream.

This suggests a VP could be tailored to household segments and that a tailored offer or an offer that had messaging designed to appeal to multiple segments simultaneously would potentially speed up the diffusion process. For example, the offer could point out innovative features of a smart heat pump (scarcity value) but also emphasize that the technology is becoming increasingly widely adopted by similar householders (giving normative or "social proof" of the benefits of adoption – see below).

This is supported in the latest round of interviews, where early adopters of heat pumps were thought to be primarily motivated by environmental concerns - "deep greens" and were thus

differentiated from other segments who may adopt the technology after the early adopters. Other important motivations for the early adopters were thought to be:

- playing one's part in a national effort to electrify heating in off-gas-grid areas;
- "future-proofing" the home with smarter heating systems;
- the trial as an opportunity to be involved in something innovative;
- free expertise and advice bundled with the offer; and
- the suggestion that heat pump installation would have to be done anyway, and that the householder would have the opportunity, via the project, to bring forward the installation and combine it with any existing refurbishment plans:

We need to be aware that for participants in the trial, the value proposition included being part of this innovation trial. Often the proposition for participation was to focus on people who were already considering making a change, and adding the flexibility element to that. In terms of direct benefit, it has often been in terms of "you were going to do this anyway, we're going to give you all this extra stuff...and in the future, you may be able to access this market". But really, for many the motivation has been about being passionate about being involved in this trial, which could unlock the electrification of heating, you know, across wide areas of the UK, in particular, off-gas-grid communities.

LCH

It is notable that any financial benefits of the value proposition to early adopters are not highlighted here. This may be because financial benefits are small and contingent on other arrangements such as switching to a Time of Use tariff. But also, there is evidence that early adopters are less motivated by financial benefits and more interested in aligning their attitudes and behaviours around "intrinsic" values (such as concern for the environment).

Research building on Rogers' innovation theory⁴² suggests that messaging built around the idea of scarcity will be engaging for innovators and early adopters, whilst messaging using the psychology of "social proof" will be more effective for the early majority⁴³. This is because early adopters are thought to embrace new technologies or practices *because* they are not yet associated with the mainstream – i.e., that because a technology is somewhat difficult to attain (it is scarce) it is more desirable. On the other hand, the early majority are thought to find a technology or practice desirable if its adoption is somehow symbolic of social success or where there is a perceived social norm for adoption. i.e. if friends, family or neighbours are perceived as adopting.⁴⁴

In line with Rogers' theory, it was also thought that financial incentives would be more important to the "early majority" to adopt heat pump technology (rather than "early adopters"). Consequently, LCH noted that before heat pumps can become mainstream the "*grant situation needs to improve*". The grants accessed through the Renewable Heat Incentive (closed to new applications on 31st March 2022) were not thought a sufficient incentive (for the early majority in particular). This was because the RHI pays the additional cost of a renewable heating system above that of a standard gas- or oil- fired system over a seven-year period to the owner.

⁴² Rogers, E.M. (1976) New product adoption and diffusion. *Journal of Consumer Research* 2 (4), 290-301

⁴³ Maloney, C., 2011. The 16% Rule: The Secret to Accelerating Diffusion of Innovation. [Online] Available [here](#).

⁴⁴ A number of examples of the effects of norms on stimulating energy efficiency behaviours are summarised in RAND's 2012 evidence review for BEIS. This is found [here](#).

If the owner moves house, the payments are transferred to the new homeowner, and it was thought that this discourages heat pump purchases. A one off capital grant on purchasing the equipment was thought preferable and easier to understand⁴⁵ :

And probably for most people, a capital grant is more understandable than the RHI because the RHI assumes that you're committing to stay in your property for a really long time. That isn't the mindset of the majority, I would say. I think most people aren't looking outside of the five-year time frame.

LCH

This grant should also be “chunky” enough to stimulate interest in the heat pump offer – i.e. of sufficient size. The Boiler Upgrade Scheme, coming into effect in April 2022, does make a one-off payment of £5k to cover upfront costs for heat pump installation and it remains to be seen how far this will be enough to stimulate interest in the heat pump offer.

LCH also mentioned that the other financial aspect of the heat pump value proposition that would be of interest to the early majority (as well as other adopters) was innovative Time of Use tariffs such as offered by Octopus perhaps in conjunction with aggregation and trade of network services:

the other side would be that we find something that is really, really interesting in terms of the flex services and that might be partnering with an energy supplier such as Octopus, who does a really interesting time-of-use tariff, so some kind of aggregation and that kind of thing.

LCH

LCH noted that whilst aggregating smartened heat pump demand and sale of flexibility into a local energy market would be a big achievement for the project, it was probably more than could be achieved within LEO. The priority was to overcome technical and financial barriers to installation. Then, once some heat pumps had been installed, to understand impacts on the local network through substation monitoring.

28. The heat pump offer should be tailored to different audience segments. Early adopters will respond to the environmental benefits and embrace the innovative aspects of the technology. The early majority will tend to respond more to any financial benefits and to evidence of “social proof” of the merits of heat pumps – i.e. that they work successfully in homes of “people like me” and are becoming increasingly widespread.

29. Even for early adopters the financial benefits of heat pump adoption need to become more compelling before we can expect to see widespread take-up amongst this critical segment.

3.3.2 Using energy citizenship in the value proposition for flexibility

It was noted that SMEs are motivated by more than financial considerations when investing in efficiency and low carbon technologies. Many SMEs like to think of themselves as good citizens,

⁴⁵ Noting that the government’s Boiler Upgrade Scheme, coming into effect in April 2022, does make a one-off payment of £5k to cover upfront costs for heat pump installation.

helping local communities where they can, so the geographical dimension of SLES can be used in developing VPs.

SMEs can demonstrate their interest in being good citizens by flexing their energy demand, trading unused import or export capacity with others connected to the same part of the network, and thereby helping others in the area connect their DERs more easily and at lower cost. Also, by installing systems and practices allowing an SME to operate its equipment more flexibly, the network becomes cheaper to manage with less likelihood of expensive reinforcement costs being socialised to others connected to the same part of the network:

We need to...avoid putting more copper in the ground and learning to reduce infrastructure upgrades. Otherwise, there's going to be this massive cost needed to reinforce the network. And ... LEO is about avoiding that so that we can keep energy prices at a reasonable level for everybody.

LCH Business relationships

Oxford University also mentioned a strong “social conscience” as a motivator for how they manage energy. Given that flexibility only has value in local energy markets because it solves a geographical problem of network management at a particular location, the University’s wish to avoid “hogging” the city’s electricity supply, thereby acting in a socially responsible way, can be used in the value proposition for flex:

Rather than just everybody turning their boilers on the half past six in the morning, to warm the building up at nine o'clock ... is the value enough to stagger that to an earlier time? That's where we instigate a consciousness in the building managers or the building controllers, in terms of, you also have a social conscience here, because you must not keep hogging all the electricity of the city, where everybody's trying to achieve these same goals. And we do need to spread the power capacity until it's improved. So there's an element that has a social responsibility for universities as well.

Oxford University Estates

30. Investment in flexibility can be used to demonstrate energy citizenship and prosocial values. This is likely to be of particular interest to businesses and institutions with strong corporate social responsibility policies and values.

The “energy citizen” dimension was also thought to be a potential component of the heat pump VP for the domestic sector but, notably, it was thought that this aspect was not of widespread interest at this point in the development of the market. This could be because the “value” of energy citizenship is only achieved if the heat pump is operated in a particular way (e.g. optimised against a ToU tariff).

There may be a knowledge gap that needs to be filled before the connection between operating equipment flexibly and acting pro-socially or achieving environmental objectives is made. There is a challenge here because the causal chain linking particular heat pump practices with prosocial and environmental outcomes is complex to explain and to communicate. In addition, heat pump adoption simply confers *the opportunity* to operate the pump in a prosocial way. It also confers the

risk of creating problems on the network. Incorporating this complex bundle of problem and opportunity into a digestible value proposition is difficult.

We think that ... flex readiness will probably be where the market goes, but it definitely isn't where the market's at the moment. So, for that part of the value proposition, which is the social value that we can only all have [heat] pumps and EVs if we all play ball together and understand that they need to have some interoperability, so that we don't melt the cables.

LCH

The commercial ecosystem workshop had a further point about “energy citizenship” in relation to the energy transition: if we are to recognise that it is everyone’s “right” to be capable (or made capable) of connecting DER technologies at the low voltage level then, with the acceptance of that “right”, also comes a responsibility to manage one’s assets so that network problems do not result and that issues or costs are not created for others connected to the same part of the network. There is a parallel with car ownership, and the expectation (codified in law) that drivers will exercise their rights and drive their vehicle in a socially responsible way.

The workshop also recognised that in expecting householders to “live up” to their responsibilities a range of capabilities will be needed. Workshop participants also recognised that even “capable” energy users may still fail at times to act responsibly or act in bad faith, e.g. trying to “game” the system or capture free riders. It was thought that a legal framework that set out responsibilities contractually could be a partial solution.

31. Adoption of flexibility practices as a demonstration of social values related to energy citizenship and prosocial behaviour is likely to be linked to awareness of the value and role of flex in the energy system. At present there is very low awareness of why flexibility is important in both domestic and non-domestic sectors. The presentation and targeting of Value Propositions for flex should factor this into their design.

3.3.3 Benefits of flexibility to local communities

The commercial ecosystem workshop identified numerous benefits for the local community resulting from embedded flexibility and Smart Local Energy Systems. These can be grouped into categories:

Table 3: Potential community benefits from SLES

Technical	Economic	Social and cultural	Environmental
<ul style="list-style-type: none"> • Less disruption (digging up roads for reinforcement etc) • Benefits from assets that are difficult / impossible to install as an individual householder (e.g. flat owners and tenants benefitting from a solar roof on their block as in the Rose Hill Solar Saver trial) • More network capacity for new assets • Equity in ability to install – e.g. batteries / PV irrespective of location in area • System resilience • Demonstrating reliability of a renewables- based system 	<ul style="list-style-type: none"> • Reduced socialised cost of reinforcement • More local economic activity • Less reliance on centralised supply and exposure to hikes in gas/electricity prices • Post-subsidy community-scale renewable investment possible • More local use of local assets: new jobs and investment opportunities • Building business cases • Addressing fuel poverty • Lower network / balancing charges for all (where local flex also plays in national markets) especially at regional level. • Reduced connection costs 	<ul style="list-style-type: none"> • Improved skills / knowledge from learning-by-doing • Training and supply chain jobs • Engagement in energy transition can spill over into other constructive activity • Community cohesion: reason to come together • More local ownership / engagement/ sense of control • Empowering by learning • Addressing fuel poverty 	<ul style="list-style-type: none"> • Improving local environment • Health benefits from clean air • Supporting zero carbon – renewables and demand

These co-benefits can be offered in a Value Proposition as “gains” or “pain relievers”. However, there is no guarantee that they will be accepted as a *needed* gain or a *welcomed* pain reliever. The response to these community gains and pain relievers will depend on the priorities of the “customer”. Also, whether the customer is an individual householder or business in the area or whether it is a community group or local agency such as a local authority looking after the interests of the community as a whole.

32. The project has identified multiple direct benefits for communities and collectives. These can be incorporated into value propositions for flex and SLES. Offers will be more or less compelling depending on how prosocial the customer is.

3.3.4 Communicating the relationship between energy citizenship and flex is difficult

Conveying the energy citizen dimension to SLES and flexibility requires some explanation of how the grid operates and this has been found challenging to communicate:

I mean, getting the message across about what flex might mean, is really, really tricky. We've run webinars on this, and you do see blank faces, because it's, it's quite a technical concept. And people were just thinking, “Oh, well, I just hoping to be a bit more eco in my home. And you're suddenly trying to sort of explain how, you know, how the grid works”, which is not a simple thing.

LCH

Respondents in the commercial ecosystem workshop noted that part of a flex provider's role, acting as a good citizen, could be sharing an understanding of flexibility with other members of the community. This kind of dissemination has been anticipated by LEMAP's "Forum" function⁴⁶.

33. Activating energy citizenship elements of the VP is easier where householders and other system users have a basic grasp of how electricity networks operate.

3.3.5 The meanings of energy cost and savings and the link to energy literacy

Respondents reported that SMEs, large public sector organisations such as the university and local authorities and householders all had a complex and nuanced attitude to the financial benefits offered by flexibility. Any new revenue streams enabled through flexibility sales make the business case for investment in flex-enabling technologies easier, but this has to be balanced against transaction costs and other organisational priorities. However, rapidly increasing energy prices have brought the prospect of energy and cost savings into focus.

For Oxford University though, the primary driver of investment in better energy management and flexibility remains a more resilient fleet of buildings with lower carbon emissions – not financial savings as such. Resilience was prized for a number of reasons. For example, more resilient buildings were reportedly better able to cope with any unusually high demands from an energy-intensive experiment. They were also thought to be better at mitigating and recovering from faults, reducing the possibility of downtime that could seriously jeopardise University activities. So, as the University strives to maintain world class facilities for research and teaching, it is this dimension of resilience, i.e. the ability to mitigate and recover quickly from faults and outages that is a primary concern:

Because the University is 100% built on resilience, we must provide the world's leading research and education facilities ...So, therefore, resilience has to come at the top of the list. Second to that is energy consumption... or energy production... And that's increasingly for reducing the University's carbon emissions and moving away from savings as a prime driver....

Oxford University Estates

This is not to say that cost, savings and solid investment models are not important - it was reported that sensible financial metrics for prioritising investments in energy management are still central to decision-making. But these investment criteria should be understood in the context of getting the most bang per buck from a finite budget in the pursuit of greater resilience and control - doing more energy projects, and achieving the University's environmental objectives:

Okay, so resilience - energy consumption or energy production, really. And that's increasingly for reducing the University's carbon emissions and moving away from savings as a kind of prime driver....

Oxford University Estates

⁴⁶ LEMAP functionality is described in the eceee 2021 paper on the topic, "Spatio-temporal mapping of local areas for engaging communities in the planning of smart local energy initiatives" and is available on the Project LEO website [here](#).

Increased energy prices improve the investment case for energy efficiency and behind-the-meter renewable energy (solar roofs), reducing payback times and therefore increasing the likelihood that these interventions will be approved:

[Saving is] going back up the agenda now. So it improves my spend-to-save budget straightaway. Because if we do a seven-year payback project, but that's now three-and-a-half-year payback ...[it] increases the scope of work I can do.

Oxford University Estates

A nuanced attitude to energy savings amongst SMEs was also reported. For example, low levels of energy literacy were reported, linked in part to inadequate metering:

... there's a number of these organisations that aren't on half-hourly meters. And lots of organisations that don't actually know what pence per kWh they're paying for their energy.

Low levels of energy literacy around bills and energy costs mean that simple messaging about savings may be ineffective:

So, for instance, going in and saying, "we can save you N pence on your energy costs", it won't necessarily mean very much to them, because of their [limited] understanding businesses don't know what they are currently paying per kWh.

LCH business relationships

Frequent cold calling from energy brokers and suppliers offering savings from switching tariffs are thought to compound the communication issues deriving from low levels of energy literacy. This has reportedly resulted in some SMEs being unresponsive to conversations that begin by focussing on bill savings, as this was often taken as a "hook" into a change-of-tariff offer. Better engagement was reported when conversations began by framing better energy management in the context of achieving sustainability goals:

[SMEs] get constantly targeted by energy companies trying to sell them a cheaper rate of electricity or gas. We've done some cold calling work with a telesales company, to let people know about the fully-funded support we're offering. And what they've discovered is it's much better to start conversations about sustainability, than to talk about energy, because they immediately think you're trying to sell them a cheaper tariff.

LCH business relationships

34. Financial dimensions of the value proposition are always important but they may not be the most important consideration in adopting flex technology and approaches - particularly for values driven organisations with strong corporate social responsibility policy. Additionally, ensuring that investments in flexibility have a reasonably sound business case strengthens the organisation and allows more "investment for good" to take place.

3.3.6 Some investments in energy systems and practices are more attractive than others

LED lighting is a no regrets energy efficiency measure that guarantees short paybacks and therefore would satisfy most investment criteria. And yet it was reported that some SMEs still do not take this up; such decisions are not just about making financially-sound investments:

... it isn't all about finance... all these businesses would have installed LED lighting, and clearly they haven't. So it's got to be worth their while in terms of the disruption and the amount of time and ... headspace they need to commit to these upgrades. And that's where the [social] values come in.

LCH business relationships

It was further speculated that LED lighting, better control and other efficiency measures are not more widely adopted, despite sound economics, because they are not sufficiently “visible”, unlike solar panels and EV chargepoints:

If you look at our assessors' reports, quite often solar panels are one of the things that have a longer payback. But the businesses are choosing to do PV panels. And this is just my hunch, it's because when you drive into the car park, you can see them - you can't see their LED lighting, you cannot see their improved insulation, you can't see their heat pump. It isn't just green bling, they do genuinely want to make a difference. But it helps that it's SO visible [speaker's emphasis].

LCH business relationships

It was speculated that one reason why more visible measures were more likely to be adopted was because the visibility allowed an SME to demonstrate its green credentials to its staff, customers and other stakeholders. Acquiring the technology served a symbolic as well as practical purpose and could therefore be used in building an organisation's brand. Visible assets can serve a marketing purpose and have long term strategic value in attracting further business⁴⁷:

So there is a marketing side to it, which I suppose actually, in the long term is about securing more additional revenue and repeat business.

LCH business relationships

Control systems allowing demand side response for flexibility are invisible and some DERs (e.g. solar panels, EV chargepoints) are more visible than others (e.g. batteries, heat pumps). Therefore, VPs to SMEs to adopt SLES assets should emphasize that the technology should come as a package with the more visible and marketable components bundled with less visible flexible control systems and efficiency measures. The VP can then make the case that operating new generation and storage assets can only be done optimally and in a socially responsible manner if operated smartly.

35. Particularly in the SME community, investment in some types of low carbon energy system is more likely where it can be used to build the brand of the business - e.g. as a sustainable enterprise that takes its environmental and social responsibilities seriously. Technologies that are more “visible” such as solar panels and a fleet of electric vehicles lend themselves better to brand building opportunities than less visible or flashy technology such as most energy efficiency measures. Hence, installation of energy efficiency measures and flexible control

⁴⁷ The importance of a strategic benefit to investment decision-making has been well documented. Judgements of a long-term strategic benefit will sometimes outweigh short-term financial benefits. Energy efficiency decision-making in SMEs and organisations is reviewed in “What are the factors influencing energy behaviours and decision-making in the non-domestic sector? A Rapid Evidence Assessment”. CSE and ECI, University of Oxford 2012. Available [here](#).

systems will be facilitated if these measures are bundled with microgen technology, installation of EV chargepoints etc. The value proposition can make the case that responsible and prosocial ownership and operation of solar panels and electric vehicles necessitates smart control.

3.3.7 Transaction costs in different scales of organisation

In engagement terms, there are pros and cons to working with SMEs. On the one hand, decisions about the strategic direction of the organisation and its investment in technology and new practices are often in the hands of a single individual – i.e. the CEO. This means that decisions and actions can be taken very quickly. This stands in contrast to larger private sector organisations and the public sector where decisions are often taken by groups and in the context of a complex management hierarchy. This can mean that decisions and the resultant actions can take a long time to arrive:

... I think the good thing about working with SMEs is that the decision-making chain is short. It is often one person who is the managing director or the owner of the business. If they really believe in this stuff, they don't have to justify it to themselves as, "this makes financial sense". They just decide, "Do you know what? - I'm going to do this". In big corporations, the business case needs presenting to the senior management team and board and a justification is needed for undertaking an energy efficiency project as opposed to other big capital projects, which aren't necessarily connected to sustainability. It's just about what those key people in small businesses believe is important.

LCH business relations

The transaction costs of dealing with a single SME will be much lower than those incurred in dealing with a large organisation. However, in order to deliver a specified volume of flex, multiple SMEs will have to be engaged and their flexibilities aggregated. A single large organisation may be able to deliver all the flexibility that is required and so, despite incurring high transaction and capital costs to enable this, total transaction cost for a specified volume of flexibility may still be lower than that for dealing with multiple SMEs and their smaller assets.

36. Aggregate transaction costs of developing a specific quantity of flex capacity in multiple SMEs will be much greater than transaction cost incurred in developing the same quantity of flex potential in fewer larger organisations.

3.3.8 Smart control in value propositions

Smart (automated) control is key to VPs for small grid-edge assets to create flex services without incurring disproportionate transaction cost. For their heat pump offer, LCH intend to use the platform developed by Passiv UK⁴⁸. This offers a suite of control options, however, the primary way in which it will be deployed with smartened heat pumps is to allow users to schedule their heating needs using basic occupancy commands – “I’m in”, “I’m out”, “I’m asleep”, “I’m on holiday” etc. The control system’s algorithms will then control the system so that comfort requirements are always met whilst still allowing the heat pump to be turned up, down or off thereby allowing the heating system to become a DSR asset:

⁴⁸ [Passiv UK](#)

... the way that the Passiv UK system works is that people set themes so they can have, "I'm in, I'm out, I'm asleep, I'm on holiday" [as system settings]. So that within those quite simplistic and intuitive themes, they will set upper and lower limits, so that [users] can feel confident that their comfort requirements are mandatory, and trump anything that the project might want to do [i.e. control the asset to deliver a flex service].⁴⁹

The Passiv platform also allows heating demand to be aggregated so that flex services can be created and delivered by a remote operator. Scheduling the heating service to optimise benefits from ToU tariffs is also possible - *"there could be all kinds of opportunities"* - and the VP for smart heating control can be tailored to each property using the platform e.g. guaranteed comfort v. optimised flexibility v. cheapest operation or lowest carbon emissions.

37. Capabilities offered by smart automated control systems are critical to successful value propositions for working with small sources of flexibility at the grid edge.

3.3.9 Value propositions for heat pumps

The VP for the relatively affluent residents of the Deddington and Duns Tew SFN is a quality-assured smart heat pump from a trusted source. The need for the heat pump to be operated flexibly adds substantially to the complexity of the proposition, as will be the case with all the smart technologies offered through LEO. The rationale for smart operation requires some understanding of how an electricity system operates and the challenges of a Net Zero future. For some potential LEO participants, the level of complexity has been daunting (as noted in 3.2.3).

LCH emphasize that it is important that householders remain in control of their appliance: aggregator control over the heat pump is ramping up and down, rather than turning the heating on or off completely. Control arrangements give some headroom for flex within a dead-band or timescales that the customer is happy with and has pre-agreed to. In this way, a cluster of heat pumps can deliver the flex service collectively with minimal impact on householder:

... ramping up and ramping down is really key. There are ... control system providers who are effectively a fancy switch and will say "you can come on until four o'clock, and then you have to stop". Whereas, what we think is better for aggregating flex services across domestic properties is that you don't have a situation where someone feels like they're not allowed to have their heating on ... that feels a bit too powerful third-party control.

Other aspects of the value proposition include:

- The VP is also about creating the opportunity for an environmentally minded householder to take action on their carbon emissions. In this way the VP is removing the pain of the difficulty of acting effectively on carbon emissions.
- The VP is also about enabling the household to be part of an innovative project that is tackling a soon to be national problem. The householder is enabled to become a good

⁴⁹ Note that some households may be happy to have their comfort thresholds breached occasionally, if that means they can deliver more flexibility.

energy citizen and is future proofing their home ahead of a national transformation of the energy system that everyone, at some point, will have to participate in at some point.

- The VP is also about providing technical assurance that the system is correctly specified and installed in a suitable home with post install support to ensure householders get the best out of it.

38. A VP for adoption of heat pumps should not focus only on potential financial savings. Under current market conditions these are likely to be quite small. Instead, the VP should also emphasize the very significant carbon savings, the good energy citizen dimension and give assurance the technology is now proven and low risk. Further, that the adoption of the technology is only the first step: skilled commissioning and some form of ongoing support to get the best out the technology should also be offered. The VP should also be tuned to the needs and priorities of different socio-economic and demographic groups.

3.3.10 Using SME drivers in value propositions for flexibility and adoption of smart low carbon energy technologies

LCH do not offer flexibility services to SMEs at present and so the following discussion is not based on findings from their experience in making such an offer. LCH's offer to SMEs has several strands including conducting energy audits and offering low interest loans to fund low carbon measures. The values and priorities of SMEs that influence of adoption of these low carbon practices are thought relevant to the discussion of flexibility and participation in Smart local Energy Systems. These are discussed below.

LCH have discovered that it is much better to begin conversations with SMEs about energy use by talking about sustainability, innovation and topics other than bill or energy savings:

- SMEs are values-driven as well as profit-orientated, and want to be "good citizens". For example, the leisure centre working with a local low carbon community group to set up EV charge points. Being seen to take environmental impact seriously and to be part of an innovative project with national significance has marketing benefits for an SME.
- The volume of energy or bill savings achievable for most SMEs, particularly office-based organisations, is likely to be insignificant compared with the main costs (wages) and savings from operational changes (e.g. changing a supplier).
- There is also brand building value to be had by being part of an "innovative" and exciting project that is trying to tackle a big problem – starting in Oxfordshire at the moment but with national applicability.

... SMEs that want to be seen to be pioneers are often very values-led. So the approach to these SMEs might be "you could be part of an exciting project that is cutting edge, it's unique to Oxfordshire, and we're trying to solve a big problem that actually exists all over the UK. But we're learning by doing here in Oxfordshire". I think that would have quite an appeal to a lot of these organisations. The changes needed could be sold not in terms of how much it's going to save them, but more in terms of the societal benefit.

These priorities and motivations are not thought to be universal to SMEs but associated with a group of innovators and early adopters. LCH have identified a hunger for energy assessments amongst the SME community and noticed a change in the types of technology that SMEs are interested in

installing – there is less interest in efficiency measures and more in PV roofs, heat pumps and EV chargers:

... it's interesting just looking at the types of technologies that SMEs are coming to us for funding at the moment... I've seen a change in the five years I've run our programme...there are LOTS more businesses now putting PV panels on their roofs, and all of a sudden, lots more people thinking about heat pumps. And there are a significant number looking at EVs chargers...a real growth in those three areas.

The “job to be done” of an SME is to continue in business through gaining competitive advantage and customers for its services and products. The value proposition to SME’s can work with these fundamental business drivers. Adoption of DER technologies and their flexible operation to provide network services can feed into the branding of the organisation.

39. A Value Proposition for SMEs to adopt smart low carbon energy systems and or retrofit smart control to existing energy services should show how adoption of the technologies and the operation of equipment flexibility aligns with fundamental business drivers. For example, cost savings and brand building to gain competitive advantage.

40. A flex VP to SMEs could also incorporate the idea that responsible ownership of DER technologies should include adoption of control systems for flexible operation. This can be presented as future-proofing the business and allowing it to identify as a good energy citizen acting in a prosocial way in the community in which it is embedded.

3.4 Tailoring value propositions

We can condense the information captured here into a series of VPs linking service providers with customers. In a branching value chain as complex as a SLES we cannot capture all the possible relationships between supplier and customer (dyads), so only dyads that were identified as important in the interviews are analysed.

Value propositions need to be tailored to the user and the technology and practice that are involved. They were seen as applying at the level of individual actors (householder/ organisation) and also at community level: it was thought that individual actors would respond to offers that also benefitted their communities.

Moreover, VPs for SLES participation at grid edge must draw on aggregated value from the “community of geography” because usable, tradeable value is only realised when a necessary minimum of energy users in the same area of a distribution network coordinate their demand to provide flex services. Below are four specific value propositions.

Below we present 4 important value propositions in a Smart Local Energy System. Each captures the main points of the analysis above and presents the results in the fields found in the Strategysier template (i.e. as supplier gain offer and pain reliever and as the customer’s wanted gains and pains to be rid of in “getting the job done”. In addition to the VP components, we also suggest the capabilities required to both make the VP offer and to accept it, and also comment on how well an offer matches customer needs in each dyad.

3.4.1 Value proposition from an organisation capable of making buildings operate more flexibly to Oxford University (UoO) Estates Services

Equipping, commissioning and operating Oxford University buildings to provide flexibility					
Service provider		Customer		Outcome	
Trials: UoO Engineering Science and UoO Estates Services BAU: UoO University Estates Services? Third party contractor?		Oxford University Estates Services			
Service or offer		Job to be done		Capabilities required	Match?
Opportunity to participate in trials by flexing energy demand in response to auctions for flex services on SSEN's Neutral Market Facilitator (NMF)		Create and maintain world-class research and teaching facilities that are resilient to risk. Meet environmental objectives.			
Gain offer	Recommissioning control systems; training in operation of BMS systems and in use of trading platform.	Gain	Buildings that are more controllable, more energy efficient, that can talk to each other (trade capacity) and are resilient in the long term	<ul style="list-style-type: none"> • Technical buildings with high degree of thermal control; deep knowledge of buildings' performance and where potential flex opportunities lie. Much better monitoring systems. • Economic: Investments in flexibility need to fit in maintenance budgets; short payback in trials phase is not critical. In BAU, transaction costs should not dramatically outweigh revenues from flex market participation. • Social/policy Supportive management practices. Supportive estate management policies 	<p>Overall, the flex offer is a good match to Estates management priorities and capabilities. Financial savings are not critical. More important is the offer's ability to deliver strategic objectives: greater resilience, world-class facilities and environmental goals.</p> <p>As financial benefits are marginal, this is a good match to the offer.</p> <p>There is a need for tools and guidance to assess flexibility potential in each building</p>
Pain reliever	BAU: by enabling peer to peer trades of capacity potential, power supply contract breaches are avoided. By operating buildings more efficiently and flexibly, more DER can be connected without creating network problems	Pain	Buildings occasionally exceeding MIC or MEC. Does this ever happen? Meeting carbon targets.		

3.4.2 Value proposition from a not-for-profit community energy organisation to residents eligible for the Solar Saver scheme

Participating in Solar Saver					
Service provider		Customer		Outcome	
Trials: LCH, Younity BAU: LCH, various energy suppliers		Rose Hill residents			
Service		Job to be done		Capabilities required	Match?
Opportunity to sign up to a ToU - offer that offers cheaper electricity aligned to solar generation from rooftop-mounted PV.		Secure reasonably priced energy with environmental benefits			
Gain offer	ToU tariff for electricity supply which should deliver energy savings.	Gain	Low-cost electricity at certain times of day when the panels are generating	<ul style="list-style-type: none"> • Technical Possession of a smart meter. Apartment within a building with roof that can accommodate a solar array. • Economic Ability to sign up to electricity supply tariff that may not be the cheapest on the market • Social energy literacy to understand ToU tariff offers; residents motivated to purchase low carbon electricity; trust in offer; accepting a degree of risk in signing up to innovative offer 	A good match between the offer and the priorities and capacities of the shared equity group.
Pain reliever	Households have opportunity to purchase electricity linked via a time-of-use (ToU) tariff to local generation. The tariff offer is communicated via trusted sources – the City Council and a locally-embedded low carbon energy agency (LCH) that is constitutionally bound to act in the interests of the community. This eases the choice process. Solar panels installed on a communally occupied building.	Pain	Choosing between complex energy supply tariffs is difficult. As an individual household living in flat it is very difficult for me to “own” solar panels installed at my property.		The offer has not been taken up by the social housing tenants. Reasons for this are under investigation.

3.4.3 Value proposition to the residents of Deddington and Duns Tew

Installation of smart heat pumps in the villages of Deddington and Duns Tew					
Service provider		Customer		Outcome	
Trials: LCH BAU: LCH		Residents of Deddington and Duns Tew			
Service		Job to be done		Capabilities required	Match?
Quality-assured smart heat pump installation. Automated flex provision via an aggregator.		Heat the home using low carbon technology			
Gain offer	<p>Low carbon heating</p> <p>Allow heat pumps to be smartly controlled by a community aggregator</p> <p>Take part in an innovative project</p>	Gain	<p>Low carbon heating</p> <p>Act as a good energy citizen</p> <p>Future-proof the home</p> <p>Possibility of some additional revenue if aggregated flex sold</p>	<ul style="list-style-type: none"> • Technical: reasonably well-insulated and draught-proofed home. Broadband connection • Economic: available capital, or ability to obtain substantial loans • Social/policy: interest in innovative and low carbon technology. At ease with digital technologies. Willingness to adapt heating practices and accept some changes in appearance of the home. 	<p>A good match between gains and pains from the offer amongst the “deep greens” of these Oxfordshire villages.</p> <p>However, no installations to date due to the very high costs of the offer, showing the limits of this model.</p>
Pain reliever	Remove uncertainty around installing innovative heating technology by using Cosy Homes Oxfordshire ⁵⁰ for feasibility work.	Pain	Adopting innovative smart heat pump technology carries risk and is expensive.		

⁵⁰ a home eco-retrofit project launched in 2019 to help make homes across Oxfordshire more energy efficient while improving the comfort and health of residents. It is a partnership project delivered by the [Low Carbon Hub](#) and [RetrofitWorks](#).

3.4.4 Value proposition: smart low carbon energy systems and the opportunity to participate in SLES for SMEs

Offering the opportunity for SMEs to participate in smart local energy systems through adoption of smartly operated low carbon technology and retrofitting smart control to existing energy services allowing flexible operation					
Service provider BAU: potentially LCH or aggregator		Customer		Outcome	
Service		Job to be done		Capabilities required	
				Match?	
Installing low carbon energy systems that can be operated smartly. Commissioning SME building management systems to deliver flexibility. Guidance on participation in flex markets.		Operate a profitable business with well-managed facilities. Business to be a good citizen in community.			
Gain offer	<ul style="list-style-type: none"> Participation in flex markets Recommissioning building energy management systems Marketing opportunity to take part in innovative project and be a good citizen 	Gain	<ul style="list-style-type: none"> Better control of energy consumption leading to possible energy savings. Longer term strategic benefit through marketing and brand-building attributes of SLES innovation Good citizen status 	<ul style="list-style-type: none"> Technical Understanding flex potential and role of flex in facilitating DER connection. Most SMEs will not have this. Economic Sufficient staff resource to understand the benefits. Most SMEs will not have this. Social / policy SME values good citizen status and recognises longer-term brand building and strategic benefits. 	<ul style="list-style-type: none"> Good match between the offer and SME wish to be good citizens Poor match on understanding viability. SMEs need to be offered free or heavily subsidised assessments of their flex potential with recommendations for next steps. Poor match on SME awareness of benefits from flex market participation. Matching the flex offer with expressed wishes to adopt DER will become clearer if this knowledge gap can be bridged. Potential match between offer and SME aspirations if visible/brand-favourable DERs can be offered bundled with smart control systems.
Pain reliever	<ul style="list-style-type: none"> Potentially, though not yet available, assessment of flex potential in SME operations. This needs to be addressed. 	Pain	<ul style="list-style-type: none"> Insufficient staff resource or time to engage with SLES Differentiation in competitive markets 		

3.5 Conclusions on value proposition

The research for this report has found that there is value in a flex offer to all the LEO stakeholders studied. However, the offer is multidimensional and nuanced and so are the stakeholder responses. Consequently, each offering or service is different, designed for a different audience, tailored to be appropriate for their capabilities and designed to deliver benefits that they value which is communicated through the value proposition associated with that service.

We found that energy saving and revenue- raising dimensions of flex are not the only motivation to engage with flex markets, or even the primary motivation. In fact, many decisions in households, SMES and the public sector are values-led. However, financial considerations clearly remain important: at the least, providing flex should not be a significant drain on resources.

We found that potential environmental and citizenship benefits should be prominent in a VP to stakeholders. However, emphasis on these sources of value will need to be tuned/adapted to groups beyond the early adopters that LEO is dealing with at present. VPs that reflect the needs, priorities and capabilities of later adopters will have to be developed if local energy approaches are to scale up.

We were able to identify some good matches between a LEO flex offer and the “jobs to be done” by SMEs, householders and organisations. However, there are still significant knowledge gaps that prevent stakeholders from making a connection between flex and their own priorities. Appropriate metering, good data visibility and the skills to interpret it will be important in establishing the knowledge to underpin Net Zero decision-making. At present, the value in flexibility VPs to stakeholders is often not apparent.