A new local area energy mapping approach for capability assessment of households to adopt low carbon technologies

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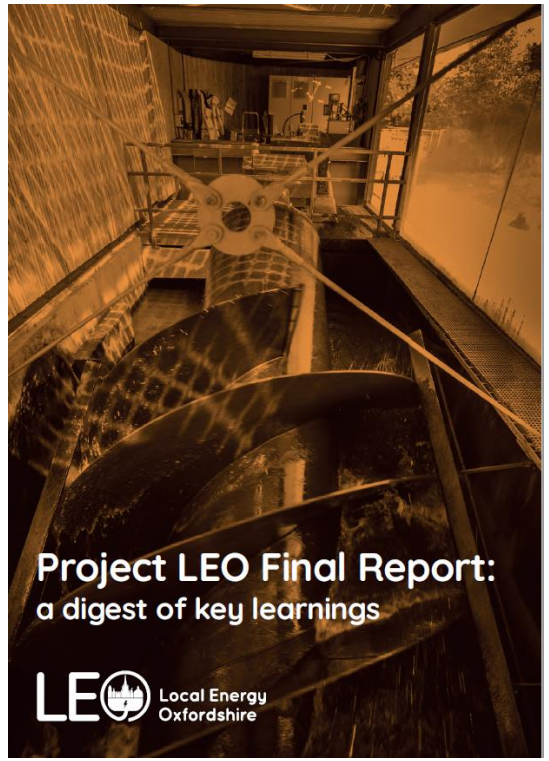
Study context

- Recent UK Government funded £102 million smart local energy system research and innovation programme has concluded that:
  - *Local area energy planning (LAEP) is vital for achieving net zero carbon emissions*

- For creating local area energy plans, spatially based data-driven approaches are required that can target appropriate areas for low carbon technologies (LCTs) and also engage with local community, planners and energy networks.



Local area energy planning

Local area energy planning (LAEP) is a data driven whole energy system, evidence-based spatial approach to:

- Provide spatial intelligence in a digital and geographically visual manner.
- Rapid analysis and visualisation of energy flows and related contextual data about the locality.
- Explore most effective route for local area to meet net zero targets.
- Geographically identify suitable and appropriate locations for LCTs.
- Provide high level understanding of energy network constraints, and investment needs of a local area.

Image: Catapult Energy Systems

Capability lens (assessment) approach

- Centre for Sustainable Energy's (CSE) developed the "capability lens" to holistically assess capability of areas so that no one is left behind in the energy transition.
- Purpose is to reveal the range of householders' capabilities and attributes required to participate in local smart energy initiatives.
- Considers the householder's **ability, suitability, and willingness** to participate in smart energy offers based a wide range of characteristics and capabilities of the household.
- Provides new insights into how development of a smarter energy system alters what is required of domestic consumers to participate fully in the new benefits it can offer.

Figure 1: The *Smart and Fair?* Capability Lens reveals an extensive range of consumer capabilities and attributes required to participate meaningfully in smart energy

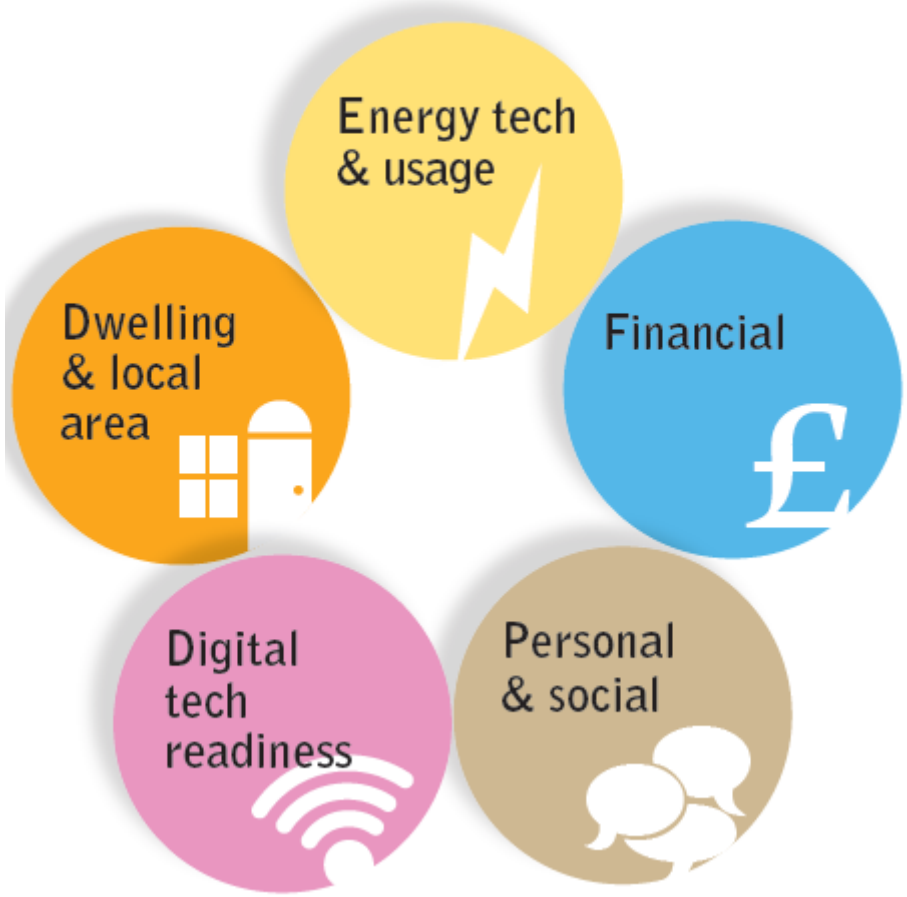
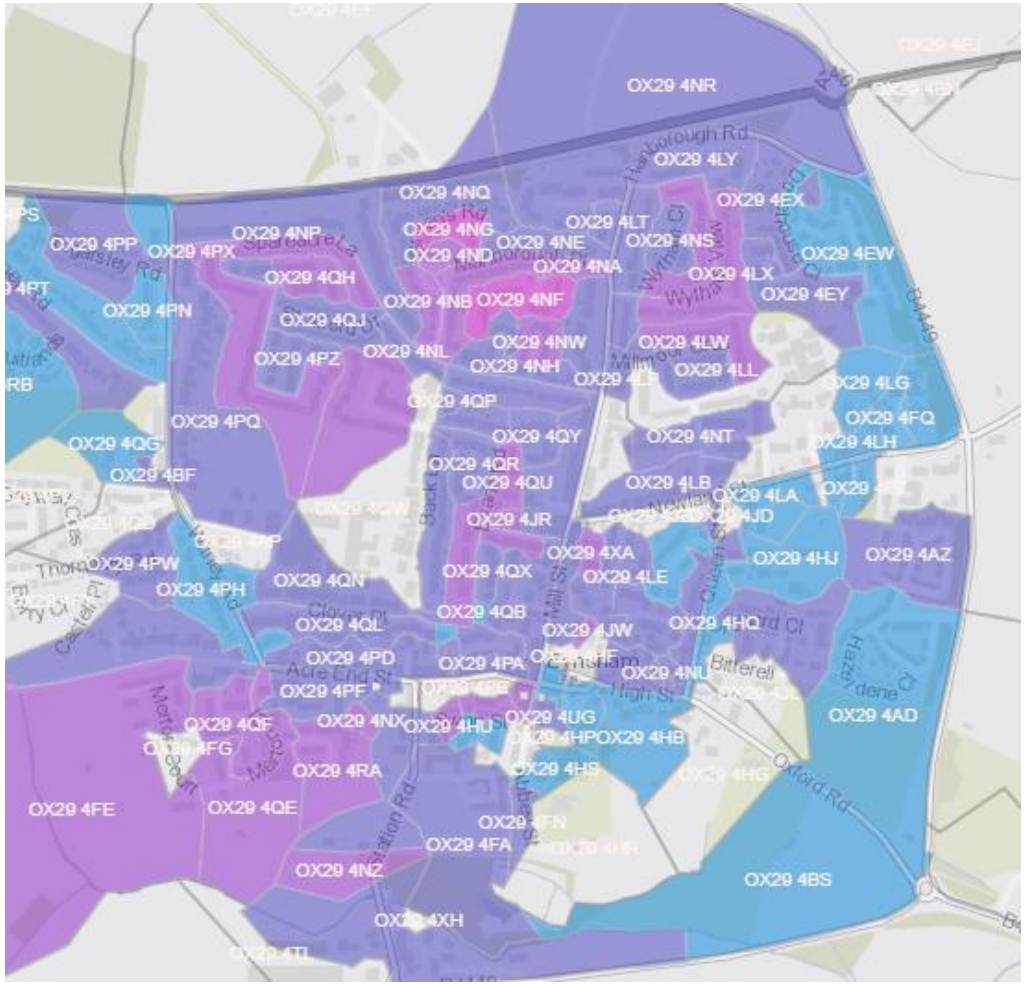


Image: Capability lens, CSE

Study aim and objectives

Application of a novel online and interactive local area energy mapping tool called LEMAP to a local area (Eynsham) in Oxfordshire (UK) to:

- Bring together spatial datasets on energy, buildings, socio-demographics, fuel poverty and the electricity networks.
- Investigate the technical suitability as well as digital, social and financial capabilities of households to take-up low carbon technologies for achieving local net zero.
- Identify those who may be left behind.



LEMAP: an online and interactive spatial-temporal tool

- Operating at neighbourhood, street, postcode and building scale
- Four key elements: *Baselining, Targeting, Forecasting and Capability profile* to show the social, digital and financial propensity of the household to take up LCTs.
- Combines public, private, and crowdsourced data.
- 69 datasets including:
  - EPC, UK buildings characteristics, Mosaic socio-economic data, Historic England's listed buildings, secondary substation locations and capacity.
- Mapped in the ESRI (Environmental Systems Research Institute) ArcGIS platform.

Baselining

This element presents local area energy flows in relation to socio-economic and dwelling characteristics

Targeting

This element identifies which dwellings are suitable to deploy different low carbon technologies (LCTs).

Forecasting

This element shows energy demand profiles at postcode level for LCT scenarios.

Capability profile

This element shows how likely are households to adopt different LCTs and those who can left behind based on their socioeconomic characteristics.

LEMAP: Targeting and capability assessment

Targeting: suitability assessment

Use datasets to evaluate homes most suitable for LCT, e.g.

- Roof type and slope orientation, and EPC rating for PV
- EPC rating, primary fuel source, garden size, dwelling size for ASHP/GSHP

Capability assessment

- Based on capability lens approach developed by Centre for Sustainable Energy
- Used Experian Mosaic dataset to identify **Technical, Digital, Financial, and Social** capability for each dwelling

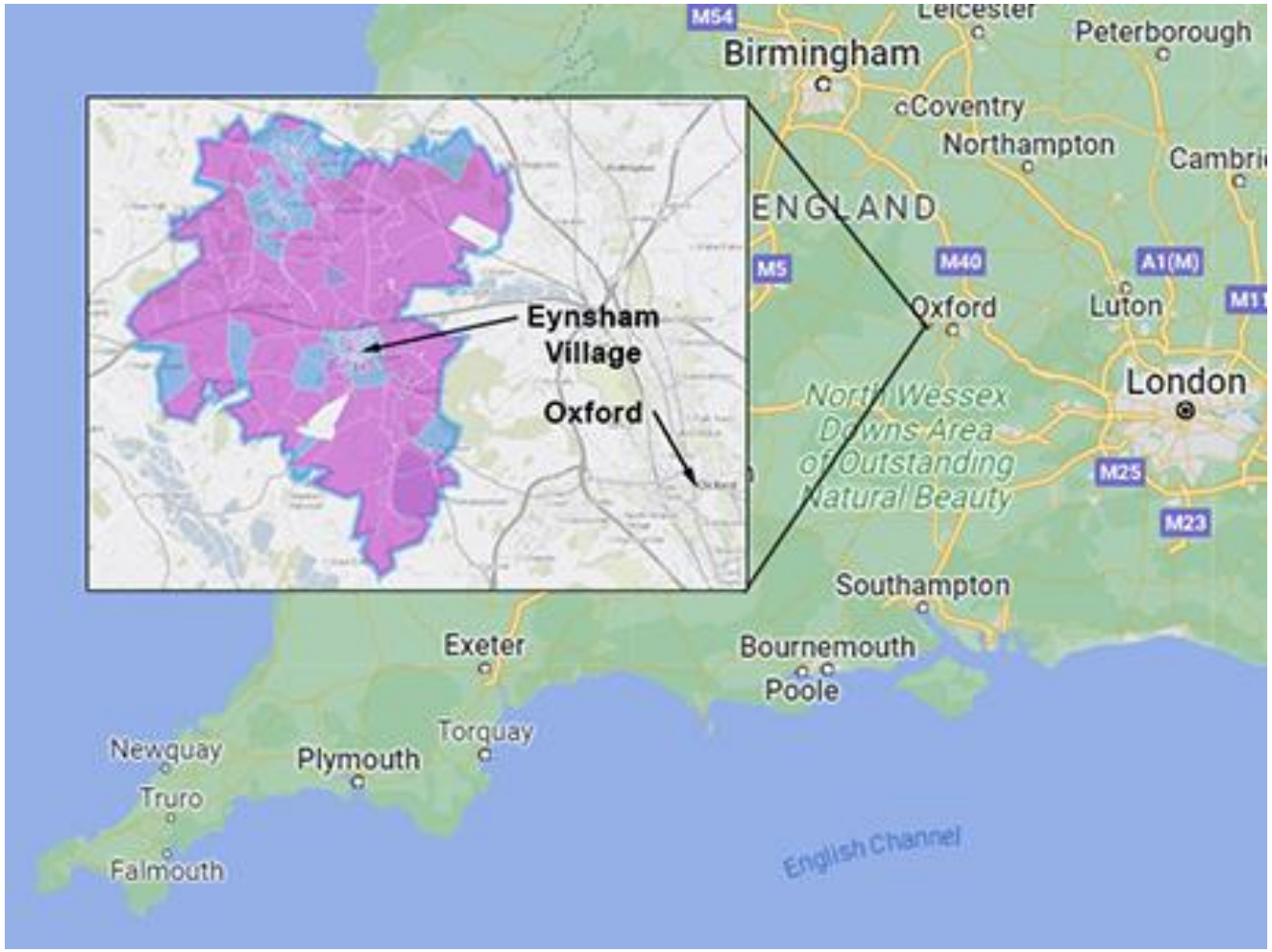
Table: Capability assessment levels

Technical	Digital	Financial	Social
Full potential	High tech user	Happy investor	Fully convinced
Partial potential	Tech. savvy	Venturers	Motivated
Need improvement	Training required	Penny savers	Skeptical
Unsuitable	Other priorities	Deprived	Not interested

Case study

Eynsham, West Oxfordshire

- 325 postcodes
- 3,600 dwellings
- 77% owner occupied
- 5-8% fuel poverty
- 37% semi-detached dwellings
- 32% detached
- 30% terraced
- 56% had wall insulation
- 73% had less than 220mm of roof insulation



Findings – LCT suitability assessment

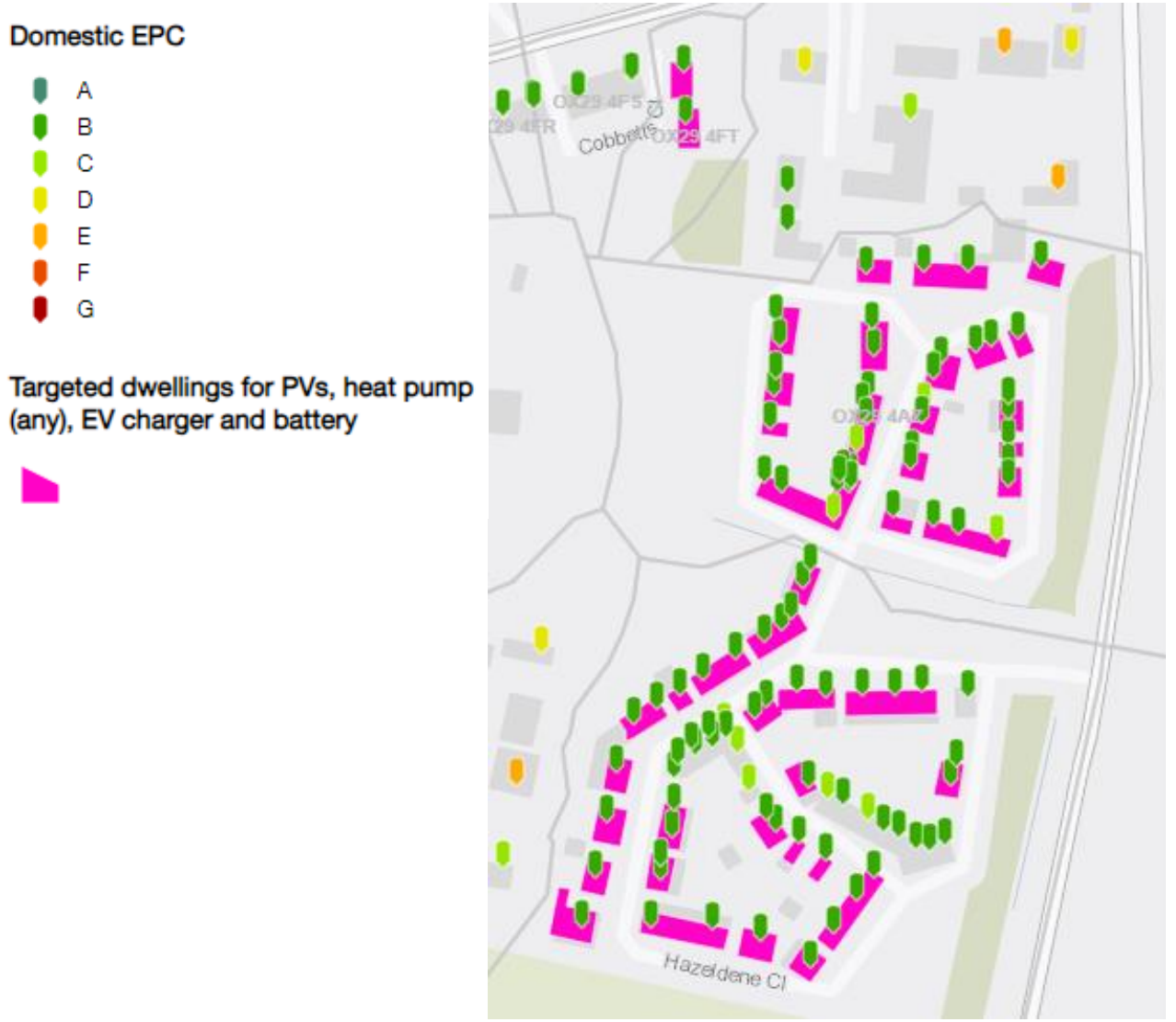
- 580 (16%) dwellings were considered suitable for **photovoltaics**
- Additional 3,100 (86%) dwellings could be suitable if EPC rating were improved

Findings – LCT suitability assessment

- 2,100 (58%) dwellings were identified as suitable for **GSHP**
- Alternatively, 2,165 (60%) dwellings were identified as suitable for **ASHP**

Findings – LCT suitability assessment

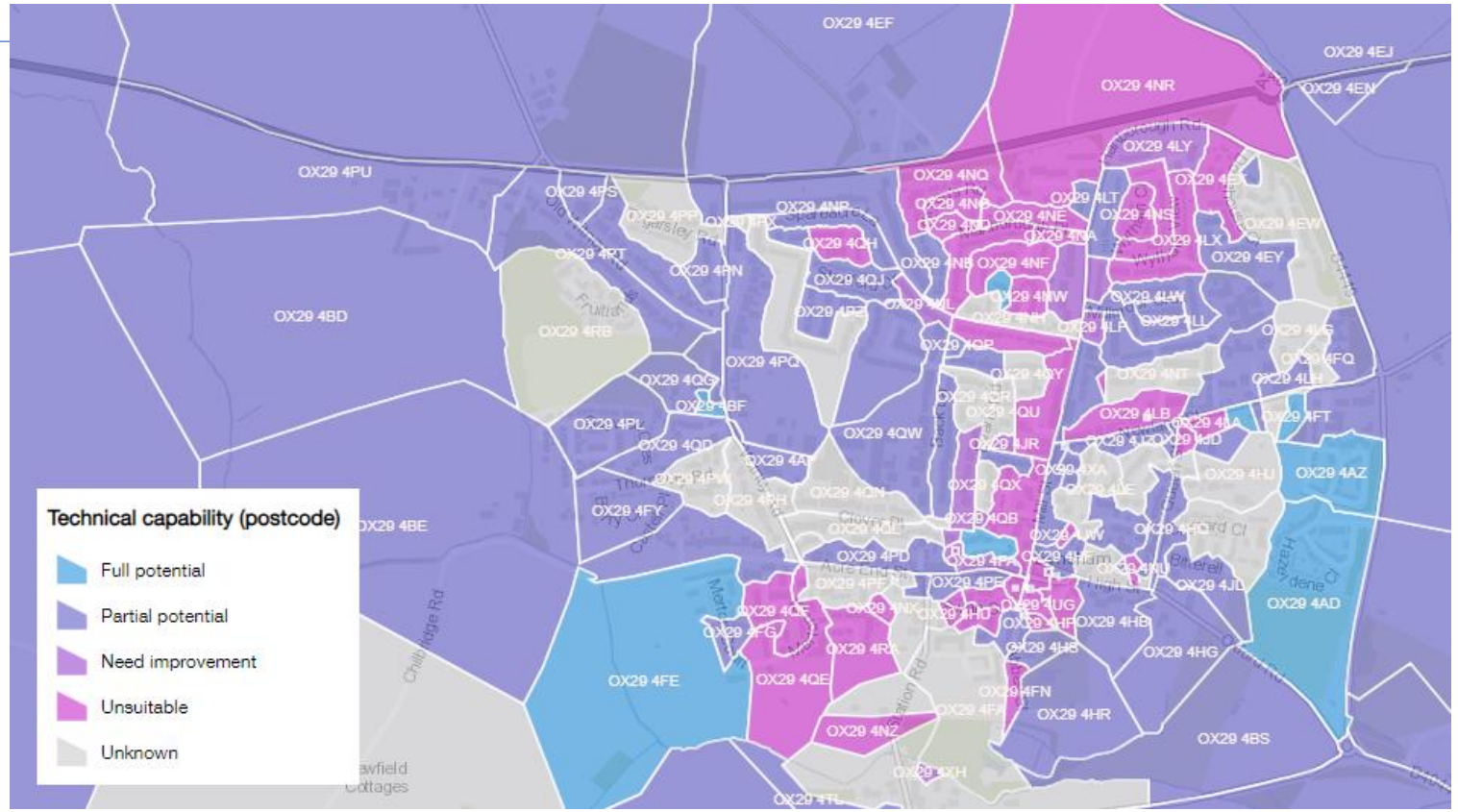
- 1,847 (51%) dwellings were identified as suitable for EV chargers
- 1,355 (37%) dwellings were identified as suitable for battery storage
- In total only 153 (5%) dwellings were identified as suitable for an all-inclusive LCT package of PV, HP, EV charging and home battery storage.



Findings – LCT suitability assessment

Technical capability

- Around 50% of dwellings are considered to have **full or partial technical capability.**
- The ‘need improvement’ and ‘unsuitable’ areas are **key areas on which to focus** greater fabric improvement.



Technical capability			
Full potential	Partial potential	Needs improvement	Unsuitable
4%	48%	7%	13%

Findings – LCT suitability assessment

Digital capability

- **Lowest capability values**
- householders likely require a higher level of help, education, and training to accept LCTs

Social capability

- 54% **fully convinced and motivated**
- a small percentage are considered skeptical or not interested.

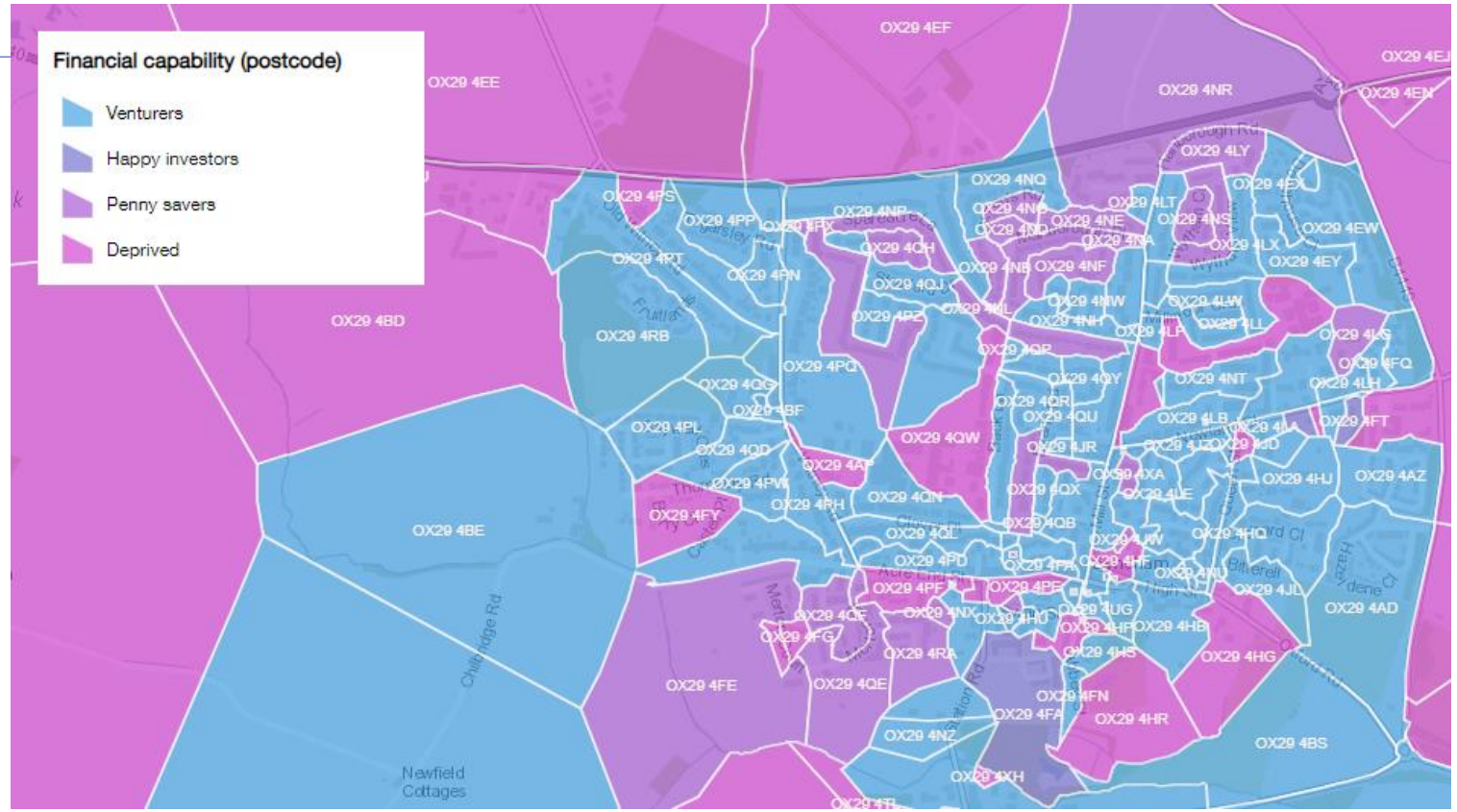
Digital capability			
High tech user	Tech. savvy	Training required	Other priorities
<1%	6%	46%	10%

Social capability			
Fully convinced	Motivated	Skeptical	Not interested
23%	31%	8%	<1%

Findings – LCT suitability assessment

Financial capability

- A borderline minority are financially capable, i.e., happy investors or venturers
- A significant number of households are considered ‘deprived’
- The villages have a higher concentration of Happy investors and Venturers,
- Deprived households are mostly concentrated outside of the village centre.



Financial capability			
Happy investor	Venturers	Penny savers	Deprived
7%	42%	12%	39%

Conclusions

- While technical capability in the case study area (Eynsham, Oxfordshire) was found to be moderate, digital capability was low, raising concerns about the roll out of smart energy technologies without adequate awareness raising, education and training.
- A significant proportion of households were considered ‘deprived’ with annual income of <£20,000, indicating the need for grants and subsidies.
- Social capability was relatively high with around 54% of households ‘fully convinced’ or ‘motivated’ to adopt LCTs.
- Such versatile data can help stakeholders such as community energy project developers and local authorities, plan for localised smart and fair energy initiatives in local areas.
- Capabilities can be improved by: reducing upfront costs (e.g., support, grants), providing appropriate training and support for technological solutions, providing examples of local benefits, and disseminating successes from installed technologies.
- Approaches such as LEMAP can enable creation of local area energy plans, target appropriate dwellings for LCTs and engage with local community and network operators.

Thank you for your attention!

LEMAP

Eynsham, Oxfordshire

LEMAP is an online and interactive local area energy mapping tool for planning smart energy neighbourhoods in Oxfordshire, UK.

The **technical** elements present detailed maps showing current and forecasted energy flows in the area. These elements are designed for social enterprises, local authorities and members of the Low Carbon HUB.

The **engagement** elements present interactive tools to understand your energy flows, including a home energy profile generator. These elements are designed for community groups and residents.

Baselining

This element presents local area energy flows in relation to socio-economic and dwelling characteristics

Targeting

This element identifies which dwellings are suitable to deploy different low carbon technologies (LCTs).

Participatory mapping

Residents can visualise their energy profile, compared against the neighbourhood and see how the profile changes with the deployment of low carbon technologies (LCTs).

Storymap

This element summarises the local energy flows of the case study local area.

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