# What is 'local' about Smart Local Energy Systems? Emerging stakeholder geographies of decentralised energy in the United Kingdom

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**Abstract**

As governments worldwide address the climate crisis, energy systems are becoming both decarbonised and decentralised. In this study, we aim to increase understanding of the spatial dimensions of new forms of decentralised energy systems that integrate electricity, storage, transportation, and heating. Drawing on workshops and secondary data from three, early-stage case studies funded under a UK government programme, we examine how stakeholders responsible for development construct the 'local' in Smart Local Energy System (SLES) demonstrators using three approaches to situate these initiatives: emplacement, place-framing, and place/boundary-making. Findings show how diverse locations, Oxford city, Oxfordshire, and the Orkney Islands, are argued to be 'suitable' places for decentralised energy through narratives that draw on distinctive infrastructural, social, ecological and political characteristics of each place. Although some community-centred benefits are recognized, projects were mostly framed around non-local goals of creating technological and business models for replication across the UK and worldwide. Lastly, our findings on place-making show pragmatism in flexing 'local' boundaries in order to align with project objectives. The application of our three approaches provide a useful framework to uncover 'local' complexities of decentralised energy, and emphasise intersections of space, place, and justice (including procedural, recognition and distributive aspects) that deserve further scrutiny.

**Keywords:** decentralisation; Smart Local Energy Systems; geography; emplacement; place framing; place/boundary-making

## 1. INTRODUCTION

Driven by the climate crisis, energy systems are rapidly changing. Governments and industry worldwide are investing in technologies that decarbonise electricity production, transportation, and heating. In part, these moves are often about the decentralisation of energy [1] whereby a relatively small number of large-scale power facilities are replaced with smaller-scale, renewable energy projects like wind farms and rooftop solar photovoltaics (PVs). While decentralisation has multiple contradictory meanings [i.e. too much "conceptual malleability"; see 2; p. 2], ~~at its core~~, it is about making sites of energy production, distribution, and storage more proximate to where energy is actually used. In doing so, these moves raise important questions about the geography of energy transitions, and in particular issues of place.

It is essential to conceive energy transitions [e.g. from wood/water to coal; 3] as fundamentally geographical processes [4] since they spatially reconfigure a range of social and economic activities [5,6]. Moves toward decarbonisation can take place across a variety of scales, from the global and national [7,8] to the city and neighbourhood [9], all of which propose different imaginaries of how decentralised energy systems 'should' or will be[1]. Decentralised projects form part of a soft energy path [10] and are frequently marketed as taking place at the 'local' scale [11]. This framing often brings with it at least five key expectations[2] surrounding: i) smaller project size [12], ii) social relations [e.g. high levels of trust; 13], iii) participation or ownership opportunities [14], iv) benefit sharing [15], and v) institutions of governance involving local organisations [1,16].

Shaped by these five ideas, what makes an energy project 'local' may also have a profound effect on broader successes, including energy justice at the host community scale [18][3], support, and project replication. In a study that examined the durability of decentralised urban energy initiatives in the UK, Rydin and Turcu [20] found that small, community or civil society-instigated projects were more likely to survive and thrive over time compared with those that were reliant on particular policy or investment opportunities. In writings on decentralisation [21] and community energy [6], the common assumption is that such projects are more 'successful' at the neighbourhood or host community-level because they allow for increased 'local' citizen participation/engagement, which can often lead to higher levels of support or acceptance [22]. However, bringing energy systems geographically closer to where people live will not necessarily lead to higher rates of public participation (i.e. 'energy citizenship' [23]). An example is the concept of decentralised disengagement [1], where the role of households is simply to host smart energy technologies that are initiated, owned, and operated by a third party. Especially in cases where project funding comes from central government, it may be that 'local' priorities are shaped or influenced by national or global interests [24,25]. Further, assumptions around 'local' support for low-carbon energy projects have been shown to setup inaccurate characterizations of those that oppose [26].

A fundamental aspect of decentralisation is that labelling an energy project as 'local' is not an objective exercise. We place the term 'local' in quotations because it has no set meaning [27]. Like the use of community in community energy, we understand its use as deeply socio-political [5] and meant to serve the aims of those in power. Moreover, what 'local' means may be strategically employed by those responsible for development within acts of place-making [28]. This necessitates a conceptualisation of localities not as 'containers' where social interactions occur, but as places associated with particular meanings and attachments, always viewed relationally and continually evolving in ways that are contested [29].

Conceptualising decentralised energy initiatives as acts of relational place-making has consequences for attaining energy justice [30] through low-carbon transitions. That is, part of a just transition [31], and one particularly relevant for this paper, depends on how energy projects are spatially represented to account for the views of 'local' host communities. References to place attachment, energy justice, and opposition to low-carbon transitions are most commonly seen in cases of large-scale and highly visible energy infrastructure like

[1] Bridge et al. [5] writes these moves toward a low-carbon carbon economy "will be a simultaneously creative and destructive process that significantly changes how different places are related to each other" (p. 339).
[2] We use the word expectations here to note that the reality of 'local' projects may not align with these characteristics.
[3] It is important to be clear about the concept of scale when speaking about the ideas of energy justice [18]. In this study, we focus in on an admittedly unclear 'local' scale – meaning those communities hosting SLES development (i.e. "the territory of…technological risk" as in [17; p. 619]; see also 19].

wind turbines, however there is some indication that similar trends might also be seen in smaller, often urban-based energy systems [32]. Research from Sovacool [33] noted that energy injustice could be found across scales and technologies including solar PV and nuclear energy, but also in more domestic applications such as smart meters and electric vehicles (EVs). In a similar review, Boudet [34] found that "seemingly benign" (p. 446) smaller-scale, technologies (i.e. smart meters, EVs, and solar PV) can face a range of public concerns and opposition driven around health, security, and privacy. Just as many once assumed wind and/or community energy schemes would be widely popular, there is a danger in assuming smart and 'local' energy projects will be supported by nearby residents [35,36].

It is within this context of energy system decentralisation that we investigate what is 'local' about Smart Local Energy Systems (SLES) – a recent initiative of the UK government. The question of what is 'local' in SLES is grounded in the social construction of place [37,38] which states geographic scales (i.e. national, regional, or local) are partially social constructs driven by capitalist economies and political structures. Thus we approach SLES with the assumption that the 'local' is the "outcome of both everyday life and macro-level social structures" [39; p. 221]. We also recognize that 'local' aspects of SLES are likely to be ambiguous and flexible, especially if the term is used to represent a divergent range of spaces from the neighbourhood to city to county or region. It may be that these spaces of energy networks are a nested assemblage whereby sites are co-constituted relationally with each other [28].

Shaped by this ontological grounding, we employ three analytical concepts: emplacement (i.e. how projects are considered to 'fit' into a particular place), framing (i.e. how projects are positioned around a set of objectives), and place-making (i.e. how physical and social boundaries are constructed). This approach, grounded in geographic thought and aided by the community and local energy literatures, can reveal spatial aspects of energy transitions, and the development of decentralised energy in particular. We do so through multi-method research which includes a qualitative analysis of project stakeholder[4] workshops and online secondary documents. As SLES and similar projects rollout across the world [40,41], our goal is to uncover how project stakeholders operationalize the 'local' [including the 'community'; see 19,42] in decentralised energy systems. This recognises that diverse stakeholders from public, private and community sectors, which are locally embedded in different ways, are also likely to view the geographies of SLES differently. In terms of what's at stake, we propose that how projects are spatially represented may change how nearby citizens associate with, participate in, and perceive these new energy systems, with significant downstream implications for justice and acceptability. This adopted stance is one based in the value of equity through procedural justice – that non-local or state interests should not predominate over more local or community interests [43].

## 2. LITERATURE REVIEW

### *2.1. Smart Local Energy Systems (SLES)*

A relatively new concept whose meaning is rapidly evolving [44,45], SLES combine advances in smart technology [i.e. digitalisation[5]; 46] with local energy generation and supply management [47]. SLES may be considered as an extension of smart grids, with key differences being that they are multi-vector (i.e. encompassing storage, transport, and heat)

[4] We define project stakeholders as the representatives from industry, local councils, universities, and community groups which together form each project's list of stakeholders.
[5] Together with decarbonisation and decentralisation, these ideas are often known as the 'Three Ds' of a modern low carbon transition. Others have added in democratisation as a 'Fourth D' [44].

with energy typically sourced from renewable or low-carbon sources [45]. In this way, SLES may provide value by finding ways to prioritise intermittent renewable electricity through integration with energy storage and otherwise emission-intensive transportation and heat elements. Ford and Hardy [48] state that the most important challenges of integrating renewables into local electricity systems are non-technical – including the fact that local actor participation may face resistance from power[ful] incumbents.

SLES is a term most prevalent in the UK. However it shares commonalities with a range of other ideas seen worldwide, including urban energy [20], smart energy systems [49], clean energy communities [41], distributed energy systems [50], multi[carrier] energy systems [51,52], renewable energy communities [40], and integrated community energy systems [ICEs; 47]. SLES reflect the UK government's move away from community energy and toward a 'local energy' approach, a move that is said to threaten "grassroots, citizen-led action" [11; p. 894]. SLES also differ from established community/'local' energy projects in the way and scale in which they use digitalisation (i.e. smart technology) to combine 'local' renewable energy, storage, transportation, heating, and in some cases hydrogen fuel production [45]. Looking at the broader decentralised energy literature, less attention has been paid to how the idea of 'local' is constructed and used by stakeholders to shape project development and outcomes. Despite insights from energy geography [5], it is the case that most decentralised energy studies either approach definitions of 'local' by assuming that its meaning is obvious and/or unproblematic, or fail to write about such lines of thinking altogether [20,41,49]. A rare exception is Koirala et al. [47], who acknowledge that ICEs will take place over diverse geographical contexts (e.g. urban and rural communities), require the reorganizing of spatial structures, and re-shape the way we think about energy system boundaries.

Meanwhile, limited social science research looking at SLES specifically [e.g. 44,45] has called for answers to fundamental spatial questions. Ford [53] asks: what makes the system local, who is (and should be) involved, and how are boundaries drawn? Similarly, Rae et al. [45] and Ford and Hardy [48] suggest that given our underdeveloped understanding of the 'local', there is a need for more research that is site and project specific. This paper aims to address these gaps.

### *2.2. The Geographies of Energy Transitions*

Understanding how decentralised energy systems (like SLES) are situated in particular localities requires the application of geographic thought. A key benefit of a geographic lens is that we can appreciate how activities are distributed across space – essential because the struggle over land and space (including questions of justice) is central to energy transitions [5, 54-56]. Here, and with the assumption that such moves have important implications toward justice and acceptance, we employ three analytical approaches to better understand the geographies of decentralised energy: i) emplacement, ii) place-framing, and iii) place/boundary-making. We use these three concepts to help us investigate the potentially slippery meaning of the 'local' in SLES. While not contending that these three are the only spatial concepts that should be brought to bear on this research objective (e.g. energy landscapes [57], spatial imaginaries [58], and boundary objects [59] could also play useful roles), it is our proposition that they are useful starting points to better understand how the 'local' in Smart Local Energy Systems is constructed, contested, and justified by project stakeholders. In doing so, we argue this approach offers a useful means to uncover important social science aspects of decentralised or integrated energy.

#### 2.2.1 Emplacement

Cowell [60] summarises low-carbon energy research that engages with spatial dimensions and found the most common approach treats energy transitions as processes that simply take place in (rather than as a result of) unique places in the world (e.g. cities like London or regions like the North of England). This is problematic as these places have significance for people, both as individuals and collectives, above and beyond particular decentralised energy initiatives or broader energy transitions. Therefore, how places relate to and are impacted by energy projects is an important topic of research.

Given a tendency in transitions research to treat the locations of energy projects as 'backdrops' [61,62], we draw on the idea of emplacement – what Cresswell [63] simply refers to as 'putting something into place'. Emplacement is a commonly employed geographical concept with some usage in energy transitions research [64-67]. The concept can help us to move beyond viewing the location of energy initiatives as mere 'sites' (i.e. environments with physical resources) [68] and toward 'places' with both physical and social-psychological qualities [69] including meanings about what makes a place distinctive, which can form the basis of place-branding [70]. Doing so allows one to move past seeing place as simply a 'container' within which technological change occurs [61,62], recognizing their ontological importance in explaining "how we organize and experience the larger world" [71; p. 935]. Building on these contributions, we look to examine the emplacement of SLES in terms of how stakeholders explain and justify the reasons for where decentralised energy developments are located (i.e. why projects are being developed in a particular 'local' area).

#### 2.2.2 Place-framing

As we look at the emplacement of SLES, it is also essential that we critically unpack the term 'local' [21]. Aligning with the social construction of place [37], 'local' is a socio-political construct that is used relationally with broader conceptions of scale – itself a constructivist framework rather than a kind of pre-established category [38]. Marston [39; p.220] summarizes that scale is not a "preordained hierarchical framework for ordering the world – local, regional, national and global". In this way, scaling can be a rhetorical practice. Decentralised energy projects like SLES are likely to be strategically framed by project partners around particular understandings of the term 'local' (and adjacent terms like community) in relation to what is considered regional, national or international in order to fit project stakeholder goals.

We hypothesized that SLES project stakeholders may frame the 'local' via acts of what Martin [72] calls place-framing. Place-framing can be seen when actors exercise their power [73] in presenting a vision (i.e. goals) of what a place is or can become in order to advance a particular set of objectives. Looking at decentralised energy through the lens of place-framing can help to better understand what claims are made about changes to places arising from energy initiatives, and which actors hold the power to do so [40,74]. The framing of the 'local' – particularly by 'outsiders' – may also have significant impacts in terms of the attachment that local residents have with that place [69,75]. When the 'local' framing aligns with residents' views, it may enhance sense of place. Yet when it fails to do so, it can threaten sense of place. Both outcomes could have significant consequences for the acceptability of decentralised energy projects like SLES, in a similar manner to large-scale energy infrastructures [76]. This may be especially likely when such projects fall into the 'local trap' [77], whereby positive expectations about projects, including participatory processes [11] are made based on its 'local' scale [19,78,79].

#### 2.2.3 Place-making as social and spatial boundary setting

In energy systems research, we can also look for acts of place-making, which attempt to establish the spaces where projects begin and end, with implications for who is involved, who makes decisions, and who benefits [80,81]. Place-making has intersections with boundary-making, an overlooked concept in both research and policy [80], where project stakeholders determine what is (and what is not) considered to be 'local' [82]. Doing so constitutes a strategic act done to both acknowledge benefits and harms and to fulfil the agendas of those 'drawing the lines' [83]. Place-making processes have been studied in community-based renewable energy contexts, where projects are said to evolve and be reconstructed through these means [68,84].

In a study of spatial dimensions of community benefits of a power line proposal [82], the act of boundary drawing was justified on the basis of impact and proximity, and was a dynamic and contested process whereby stakeholders' ideas of what the boundary should be changed in response to 'local' concerns. Similar ways that boundary-setting can be seen as a process of social construction and contestation was identified in a study of community wind energy projects [83]. These studies highlight how setting boundaries around the 'local' not only tells us about spatial or physical boundaries but social boundaries [85] – that is who is included, and who is excluded from being a part of the 'local' or 'impacted' community. If we value issues of justice and acceptance in communities living nearby or playing host to decentralised energy, it is vital to investigate how project stakeholders construct the boundaries of these initiatives, and then examine whether these align with what nearby residents perceive to be fair, in procedural, recognition, and distributive terms [86,87]. Thus in line with the work seen above, we look to scrutinize acts of place-making in SLES with the understanding that how these projects are placed in a locality may have significant 'downstream' effects. With a focus on those responsible for development, we see this as an important first step toward understanding the plurality of constructions of the 'local' in SLES, including potential contradictions between stakeholder and community perspectives. Learning more about 'local' residents' perceptions is essential to fully complete such analysis, though beyond the scope of the study presented here.

### 2.3 *Research Questions*

We propose that it is useful to trace how actors responsible for development construct, frame, and operationalize the 'local' in SLES using three inductive research questions:

1) How do project stakeholders rhetorically emplace SLES in localities?
2) How do project stakeholders frame SLES around 'local' and non-local goals?
3) How is place-making of the 'local' (in terms of spatial and social boundaries) constructed and practised by project stakeholders?

## 3. METHODOLOGY

### *3.1. Research Context*

Due to its value in the study of contemporary phenomena and the 'unclear boundaries of context' [88], we chose a multiple case study approach to address our research questions. Our study encompassed three SLES demonstrator projects: Local Energy Oxfordshire (LEO), Energy Superhub Oxford (ESO), and ReFLEX Orkney (ReFLEX). We chose these projects for three main reasons. First, due to their role as 'flagship' projects within the UK's move toward 'local' energy. Second, all three cases were (and remain) part of our larger program of research called EnergyREV. Third, the cases presented a potential for great empirical diversity with relation to place and scale due to the marked contrast between an archipelago of remote islands off the north of Scotland (ReFLEX), and inland English locations – both urban (ESO) and rural (LEO) – near one of the top global centres of intellectual capital and related commercial innovation. With project names also specifying place-names, we expected that concepts of emplacement, place-framing, and place-making would be useful to inform understandings of SLES (see Table 1 and Figure 1).

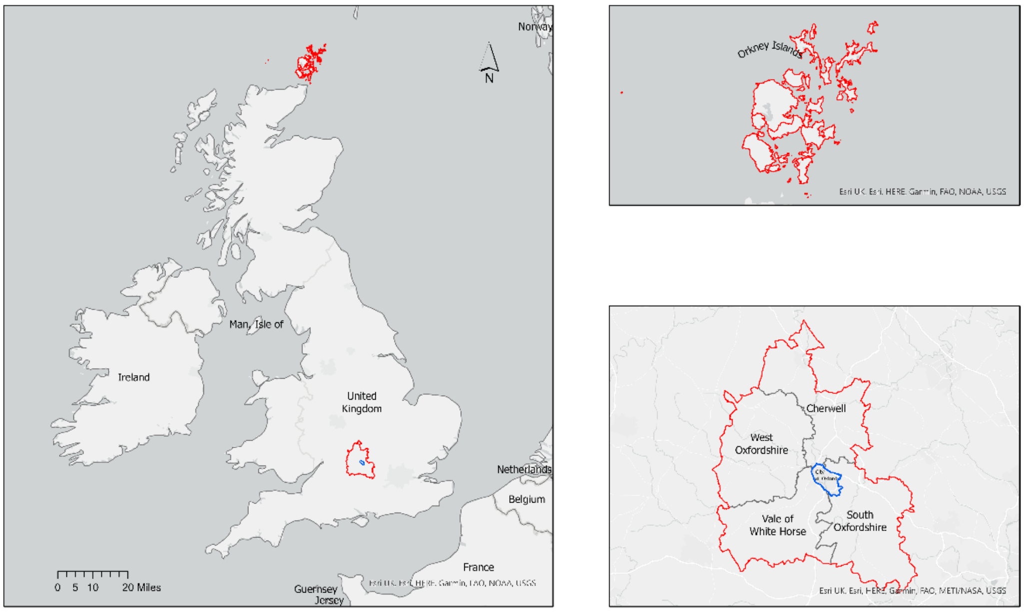
Each project integrates some combination of new renewable energy generation, battery storage, low-carbon heating, and EV charging stations (among other varied energy elements). Each project is led by a private company in partnership with stakeholders from different sectors, including more locally-grounded organisations from academia, city/county government, and civil-society/community groups. Data collection took place as each project was at a relatively early stage, 3-6 months after initiation.

***Table 1 – Case study host community details***

| | | | | |
|---|---|---|---|---|
| Oxford[1] (city; ESO) | 152,450 (est. 2019) | 46 | Parts are very densely developed though 52% of Oxford is 'open space'; 27% is within the Green Belt | Relatively high[2] median annual earnings of £31,200; Unemployment rate of 3%[3] (2017); 71% of jobs are in "knowledge-intensive industries" (2019) |
| Oxfordshire (city-region; LEO) | 691,700 (est. 2019)[4] | 2,605[5] | Predominately rural; 24 landscape types (e.g. rolling clayland, wooded estates); multiple Areas of Outstanding Beauty[5] | Relatively high[2] median annual earnings of £27,793; Unemployment rate of 4.5% (2017)[6] |
| Orkney (archipelago; ReFLEX) | 22,190 (est. 2018)[7] | 956[7] | Series of approximately 90 islands and skerries; separated from mainland Scotland by the Pentland Firth[8] | Relatively low[2] median annual earnings of £18,100 (2017)[9]; Unemployment rate of 1.3% (2019)[7] |

[1]Unless otherwise noted, Oxford information is taken from the City of Oxford (https://www.oxford.gov.uk/info/20122/statistics). [2] These are qualitative references in comparison to the UK median income in 2017 of £26,300 (https://assets.publishing.service.gov.uk/). [3]Information found at: https://www.oxford.gov.uk/downloads/file/3795/oxford_economic_profile_january_2018. [4]Information found at: https://insight.oxfordshire.gov.uk/cms/population. [5]Information found at: https://www.oxfordshiregrowthboard.org/wp-content/uploads/2018/04/OXIS_stage_one_document.pdf. [6] Information found at: https://www.oxfordshirelep.com/sites/default/files/uploads/Section%201%20Overview%20of%20the%20economy_0.pdf. [7]Information found at: https://www.hie.co.uk/media/6343/orkneypluskeypluss tatisticsplus2019.pdf. [8]Information found at: http://earthwise.bgs.ac.uk/index.php/Orkney_and_Shetland,_an_introduction. [9] Information found at: https://www.fifetoday.co.uk/news/fifers-earns-hundreds-pss-less-average-scottish-salary-987083.

***Figure 1 – Maps of case study communities (Oxford, Oxfordshire, Orkney)***




Each demonstrator is shaped by the UK's Industrial Strategy; "the long term plan to raise productivity and earning power in the UK" [89] and partly-funded through the Industrial Strategy Challenge Fund (ISCF)[6]. The Prospering From the Energy Revolution (PFER)

[6] The Industrial Strategy Challenge Fund is part of the UK government's Industrial Strategy [89].

programme provides more than £50 million of matched funding to SLES demonstrator projects. Outlined in 2018, the goal of PFER was to "bring together businesses…[to] develop and demonstrate new approaches to providing energy in ways that consumers want" [90][7]. As such, it represents a 'top-down' vision for decentralised energy that is driven by central government aspirations for systemic change, led by private companies [11] and an aspiration to replicate local innovations across the UK[8]. Having central government funding has been shown to result in the prioritization of 'non-local', national interests within urban transport transformations [24], though it is unclear if the same can be said for SLES projects that include local councils, academics, and community groups as stakeholders (see Table 2) as our cases do. Indeed the presence of both national and 'local' (i.e. councils, community groups) project stakeholders within each SLES case may lead to divergent and perhaps contradictory social constructions of place. While the PFER program sets out a vision for scaling-up and replication elsewhere, we aimed to investigate whether project stakeholders, notably local councils and community organisations, also attempted to add more 'local' priorities and concerns.

### *3.2. Dataset*

Given that multi-method datasets can introduce novelty and improve rigour [93], we used a qualitative dataset made up of project stakeholder workshops[9] (n=4; n= 21participants) and online secondary documents (n=93). Like the work of Süsser et al. [66], our multi-method qualitative dataset allowed for an in-depth understanding of socio-geographic context within local energy transitions [see also 94].

From December 2019 to February 2020, four in-person workshops took place across the three SLES projects: ESO, LEO, and ReFLEX. This method was chosen due to its value in effectively bringing together multiple stakeholder perspectives [95]. Each workshop lasted between 1 hour 45 minutes and 2 hours 30 minutes[10]. Workshop participants included actors responsible for the development and operation of each project, made up of representatives of industry, academia, research centres, local councils, and community organizations (see Table 2 below). Mediated through contact with each project's lead, people from all organizations were invited and overall, 15 of 22[11] organizations participated in a workshop. We had at least one person participate from each category (e.g. industry, academia, community group) within the LEO and ReFLEX workshops. In the ESO workshop we failed in recruiting the local council, but had representatives from all other categories. Due to the availability of participants in LEO, two separate workshops took place. To help maximize participation, we scheduled the first set of workshops to coincide with the time and place of project partner meetings.

At the time the workshops were conducted, stakeholders were presenting their projects in the public realm through online secondary publications. We added these to our workshop dataset as they provided us with useful sources about 'the local' in SLES while expanding the number and variety of stakeholder voices. Secondary documents included public-facing, project stakeholder-produced content provided through: i) each project's website and ii) web searches (see Table 2). Website documents included general information, newsletters, and links to media coverage. For the web searches (using Google.co.uk), we used search terms "Local Energy Oxfordshire", "Energy Superhub Oxford", and "Reflex Orkney". In each case,

[7] The ISCF and PFER funding was originally born out of the goals laid out in the Industrial Strategy. It identified four industries that were of "strategic value to our economy" [91; p.5]. At least three of these are related to Smart Local Energy Systems: artificial intelligence and big data, clean growth, and the future of mobility.
[8] For more detail about funding requirements and recommendations, see: https://www.gov.uk/government/news/design-and-trial-smart-energy-systems-apply-for-funding
[9] For more information about the workshops, see [92].
[10] The average length was approximately 2 hours 15 minutes.
[11] This value varied only slightly between projects. That is, we spoke with 6/9 (67%) in LEO, 4/6 (67%) in ESO, and 5/7 (71%) in ReFLEX. The number of workshop participants is larger than the numerators above because in all cases, we had multiple representatives from a single group.

we sorted by relevance and gathered documents associated with the top 20 web addresses. After excluding inaccessible content and duplicates, there were a total of 93 secondary documents (LEO n=31; ESO n=34; ReFLEX n=28). Secondary documents were either in text form or in the case of video or audio files, were transcribed into text. All documents were collected on April 9th 2020 – approximately one year after project funding was first announced.[12] We chose this early-stage period to represent the first third of each project's overall timeframe, which implies that the findings are representative of that period of project development. This time was full of project planning and just before the majority of assets were set to be installed. All data was placed into NVivo12 qualitative analysis software for analysis. Any stakeholder quoted through either dataset are given a pseudonym.

***Table 2 – SLES Project and dataset descriptions***

| | | | |
|---|---|---|---|
| **Local Energy Oxfordshire (LEO)**<br><br>"Project LEO is one of the most ambitious, wide-ranging, innovative, and holistic smart grid trials ever conducted in the UK." (https://project-leo.co.uk/) | Six participants (Workshop 1)<br>• Sean (Industry - Network Operator)<br>• Will (Industry - Network Operator)<br>• Thomas (Industry - Network Operator)<br>• Meghan (Community Organization)<br>• Susan (Academia)<br>• Peter (Academia)<br>Three participants (Workshop 2)<br>• Carol (Local Council)<br>• Katelyn (Local Council)<br>• Olivia (Local Council) | Google.co.uk<br>• 14 documents (n=7 project stakeholder updates/news, n=7 independent news)<br>Project website<br>• 17 documents | 33 (2 workshop transcripts and 31 secondary documents) |
| **Energy Superhub Oxford (ESO)**<br><br>"As a key part of Oxford City Council's response to the climate emergency, ESO will provide a model for cities around the world to cut carbon and improve air quality." (http://energysuperhuboxford.org/) | Five participants<br>• David (Industry)<br>• Mary (Academia)<br>• Lois (Industry)<br>• Anne (Industry)<br>• James (Industry) | Google.co.uk<br>• 16 documents (n=9 project stakeholder updates/news, n=6 independent news, n=1 video)<br>Project website<br>• 18 documents | 35 (1 workshop transcript and 34 secondary documents) |
| **ReFLEX Orkney (ReFLEX)**<br><br>"The idea is to integrate electricity, transport and heat networks in Orkney using advanced software to balance demand and supply." (http://reflexorkney.co.uk) | Seven participants<br>• Oliver (Industry Research Centre)<br>• Emma (National Community Energy Organization)<br>• Adam (Industry Research Centre)<br>• Lauren (Industry)<br>• Joseph (Local Council)<br>• Jacob (Local Council)<br>• Liam (Industry) | Google.co.uk<br>• 18 documents (n=5 project stakeholder updates/news, n=12 independent news, n=1 video)<br>Project website<br>• 10 documents (includes n=1 linked BBC Sounds program) | 29 (1 workshop transcript and 25 secondary documents) |
| **TOTAL PARTICPANTS /DOCUMENTS** | 21 (LEO=9, ESO=5, ReFLEX=7) | 93 (LEO=31, ESO=34, ReFLEX=28) | 97 |

[1]Excludes any workshop facilitators (i.e. members of [research program]). There were four such facilitators in the ESO workshop, five in the LEO workshops, and three in the ReFLEX workshop. [2] 'Network Operator' participants are actors responsible for developing and maintaining electricity distribution and transmission networks. 'Industry' participants are those from other businesses that are responsible for a particular project asset. Those from 'Academia' are researchers working at Universities in the UK. 'Industry Research Centre' participants are from a non-academic energy research station.

## *3.3. Data Analysis*

Given the nature of our research questions, critical thematic analysis (CTA) was chosen for this study. CTA is a method for connecting discourses to social practices set within unequal power relations [96]. Our approach aligns with Lawless and Chen [97] whose CTA approach looks at how "everyday discourses" can be enabled or constrained. We investigate such everyday discourses and how framings of the 'local' serve existing power structures associated with energy system change. Without a critical lens toward these discourses, they may become "taken-for-granted perspectives…reified as historical 'givens'" [98; p. 244].

[12] Over the course of this year, the projects progressed through planning and community, stakeholder, and team discussions. The spring of 2020 was a time when some physical components of projects were to be rolled-out. With the threat and response to the COVID-19 global pandemic, this timeline was delayed.

There was also pragmatic value in choosing to employ thematic analysis, as it is effective when working in team and applied settings [99] – both characteristics of [research project].

Analysis began by the lead author line-by-line reading each transcript and secondary document and coding for themes. These included user engagement, participation, energy justice, and ideas of place-making, locality and framing of the 'local' in SLES. After this first round of analysis, a summary of emerging findings was shared amongst the leading four co-authors, where reviews and comments were made. Following extensive team discussions, a coding template and summary of findings was shared with the third and fourth authors, who completed an interrater reliability exercise [100]. Here, each performed their own CTA of a sample (approximately 25%) of the workshop and secondary document dataset in an attempt to: i) uncover new or 'missed' themes and ii) confirm the presence/importance of existing themes. This kind of exercise is a form of triangulation whereby the lead author looked to colleagues for their interpretations of the same data [101].

## 4. RESULTS

Informed by the three spatial analytic approaches outlined above, we investigated how project stakeholders used the 'local' in three important ways: emplacement, place-framing and place/boundary making. We present our findings via direct quotes taken from the workshops and secondary documents in order to showcase the rich qualitative depth [102] provided through both datasets. Providing these quotes to the reader also enhances qualitative rigour by increasing the transparency and credibility of our study [101,103].

### *4.1. Emplacement of SLES in the 'local'*

In both LEO and ESO cases, Oxfordshire and Oxford were positioned by project stakeholders as progressive and 'sustainability-minded' places. We can see this through the words of David (ESO), who described why Oxford was chosen:

> **David (Industry):** Did you see the… Good Growth Report? Which has 50-odd cities or towns in it and Oxford is number one by a long way in terms of it's sustainable… not just business sustainable growth but as a place to live and all the benefits that you have… So [Oxford is] already in a good place… (ESO Workshop)

Oxford was positioned by project partners as the kind of place where innovative local energy projects could thrive, due to its supportive environment around decentralised and decarbonised initiatives. Within LEO, Oxfordshire was pronounced as an ideal location for SLES arising from multiple factors including capacity constraints on adding new renewable energy projects to the grid network. Alongside this consideration, a set of political and social characteristics were emphasised, primarily its set of progressive politics (i.e. among local councils). A common refrain seen across many news articles (via a press release) was that:

> Oxfordshire was chosen to host Project LEO because there are already significant constraints on the local electricity network, plus progressive attitudes among the local authorities and a thriving community energy scene. (SD)

This 'thriving community energy scene' referred to supportive community groups and sufficient numbers of individual citizens open to adopting a low-carbon, technological future. Meanwhile, the progressive attitudes said to characterise the 'local' areas where each SLES was emplaced were frequently connected with municipal environmental initiatives, especially those related to climate change. It was shared in a 2019 press release that Oxford City Council was a member of Low Carbon Oxford, "a network…that aims to reduce citywide emissions by 40% of 2005 levels by 2020". The urgency of the climate crisis was the most salient through the words of Trevor, a councillor in Oxford. Through a February 2020 release on the ESO website, he was quoted as saying:

> 2020 will be a crunch year for our climate and all our futures. We face a climate emergency that threatens all of our futures. For the sake of everyone in Oxford…we must clean up the lethal air we're all breathing (SD)

While the views of Trevor uniquely showed the sense of urgency required to address a warming planet in the 'local', there was recognition of the climate crisis across both Oxford and Oxfordshire councils. Just a year before (in 2019), both councils passed a climate change emergency declaration. According to Olivia, there was an immediate impact from this move:

> **Olivia (Local Council):** It has pushed environmental issues right up the agenda…I think it's given us quite a lot of optimism as well. People will come to me going, "Can LEO do this?". (LEO Workshop II)

It was therefore clear that project partners sought to embed their projects in a broader narrative of 'local' political and social responses to an environment and climate emergency. In doing so, stakeholders advanced a narrative that local decentralised energy developments would be well governed and accepted at the community level.

Emplacement of the ReFLEX project in the Orkney Islands was primarily associated with the experience and expertise that the 'local' community held in low-carbon energy development. From an online BBC program, Shannon and Holly describe how "the people involved in these projects" are driving the roll-out of SLES:

> **Shannon (Local Council**): We like to think of ourselves as the centre of innovation, and we're just so ingrained in our environment here, it has an effect on our day to day life that it just, we have the perfect set of conditions really to be testing out [SLES]. (SD)

> **Holly (National Community Energy Organization):** It's not just the natural resources, but the people involved in these projects; I've never met so many people in such a small area who are as creative. (SD)

Both comments show how the 'local' is positioned in relation to 'elsewhere' while Orkney is portrayed as a unique 'centre of innovation'. These statements take the geographically peripheral location of the islands, far from large cities and the UK capital, and 'turns it on its head'. Thus, we see an important rhetorical act to say why Orkney is the 'right place' for SLES.

Related to Orkney's experience, stakeholders also shared a distinct sense of injustice in the 'local'. That is, despite successful renewable energy projects, the islands were often still importing expensive and polluting fossil fuel-based electricity from the mainland UK:

> **John (Industry Research Centre):** Orkney's really been at the forefront of low-carbon technology for probably 20 years now….So [with ReFLEX] we're really trying to capitalize on all of that amazing generation…taking advantage of these natural resources. (SD)

> **Matthew (Industry):** We can have all the wind and solar farms we want but unless we have the means to store and balance renewables we will never fully wean ourselves off fossil-fuels…Orkney is a perfect location to demonstrate [SLES]. (SD)

Grounded in a discourse of the 'local' that is portrayed as resource-rich but 'benefit-light', we see how stakeholders position Orkney as a distinctive and deserving setting for SLES. The feelings shared by stakeholders revealed that it was about time Orkney developed a 'local' energy system that took advantage of qualities said to be unique to the place: natural (i.e. wind resource), social (i.e. citizen knowledge) and cultural (i.e. innovation-oriented). ReFLEX was therefore portrayed as an appropriate fit and one that could help in reversing a history of spatial energy injustice.

Across all three case studies, we see rhetorical attempts by project stakeholders to position their 'local' place as ideal contexts in which to undertake SLES [104]. Where local challenges are identified (e.g. network constraints in LEO, imports of electricity in ReFLEX), SLES are positioned as solutions to these problems. Both 'local' and non-'local' stakeholders affirmed the distinctive qualities of these locations that were said to make them superior to other places and suitable for innovative, low-carbon projects. These attempts to portray diverse marine, urban and rural contexts as an 'ideal place' or spatial imaginary [105] for SLES are consistent with a neoliberal approach to the identities of places articulated in economic geography literature, where localities compete with each other to brand themselves as places of innovation in order to attract investment in their locality, and not 'elsewhere' [106,107].

### *4.2. Place-framing the 'local' via project goals*

The most prevalent way that stakeholders framed a version of the 'local' was through the articulation of project goals. Attending to the voices of non-'local' industry stakeholders, there was great similarity across all three projects in that major goals were mostly centred around 'non-local' scales of reference. That is, projects were predominantly framed around the so-called 'bigger picture' of replication, and less so around the benefits of 'local' development in place. In line with the place-making literature [68], these moves show power and interests that lay outside 'local' places. For example, while some of ESO's goals focused on 'local' benefits (e.g. improving public health, addressing fuel poverty), stakeholders tended to focus on the idea of "broader [business] success":

> **David (Industry):** This is one of our first projects, I think all the success of this is all about creating that broader success and seeing the take-up that comes beyond that. Our objective is all about [electric vehicle] uptake so… making a visible splash of benefit, you know, that we can talk about beyond just the local environment. (ESO Workshop)

The ways that their work was framed as being about the broader success of SLES outside of the 'local' was evident both in workshops and secondary documents, where ESO was described as a model to showcase SLES development elsewhere. This spoke to Oxford as the container, equating 'local' with only the physical location. In this way, there were some similarities with the framing of LEO, which was primarily described as a test-project that would "produce a "blueprint for future local and low carbon market models" that could be scaled up across [the UK]" (SD). Discourse seen on the LEO website also constructs the impact of the project as reaching far beyond its locality to include our understanding of non-local opportunities:

> LEO will improve our understanding of how opportunities can be maximised and unlocked from the transition to a smarter, flexible electricity system and how households, businesses and communities can realise its benefits. (SD)

This phrasing suggests a focus on the UK energy system as a whole. Yet as hinted in the above, some of the stakeholders involved in LEO diverged from ESO in terms of the framing of Oxfordshire as a testbed for *community-driven* SLES – which has important connotations for locality in terms of social relations, trust, and citizen engagement. Indeed, in a publication from Oxford City Council, we see how this alternative imaginary of 'local' via community-based development, is a major goal of LEO:

> By creating opportunities for local communities to trade the energy they generate, use and store at a local level, project LEO will show the potential for individuals, businesses and communities to collaborate in the creation of an energy system that's good for people and the planet. (SD)

This rhetoric reveals both how the government funding programme seemed to shape stakeholders' discourse and how some stakeholders flexibly interpreted the funding framing in their vision of SLES. It also shows some diversity within project teams. Certain stakeholders of LEO that were based in Oxfordshire (i.e. academics, councillors and community group representatives) stressed that project objectives centred around more 'local' themes including citizen engagement, participation, and ownership. While keeping an eye to longer-term and non-local goals of SLES replication, including supra-national goals at the planetary spatial domain, these stakeholders made clear rhetorical connections both within *and* beyond the local – SLES as a 'good thing' across scales.

ReFLEX stakeholders also primarily stressed non-local goals in the figurative spatial construction of their SLES. Industry-based actors like Bradley tell of how ReFLEX is primarily driven by an opportunity to create a decentralised energy model for other places in the UK – and around the world:

> **Bradley (Industry):** It is a case of showing how this problem can be solved in a place like Orkney but be applied to anywhere in the UK or globally as the whole world begins to transition to renewable energy. (SD)

While emplaced in Orkney, the primary goals are spatially diffuse and longer-term, where stakeholders again use the 'local' as a container for replication. This sets up a potential tension where Orkney was framed as a unique place (see 4.1), yet capable of developing a model of SLES suitable everywhere. The framing of ReFLEX to emphasise non-local goals is similar to LEO and was especially common among industry stakeholders which suggests they are serving power outside of the 'local'. Yet for those stakeholders actually based in the islands, there were also plenty of mentions of 'local' goals. This included framing the project as a way to address 'local' fuel poverty, decarbonising Orkney, and taking advantage of local resources. As part of broader conversations about the spatial distribution of benefits, stakeholders described how they are aiming to tackle fuel poverty:

> **Lauren (Industry Research Centre):** It [will reduce] the energy bills, it reduces their fuel poverty levels, so yeah household profit increases. So I think profit does sit with the householder. (ReFLEX Workshop)

> **Robert (Industry Research Centre):** "We can tackle [local] fuel poverty, and we need to do it in a way that's fair across [Orkney], you see, it's not just a preoccupation for the middle class." (SD)

Centred around fuel poverty and injustice, place-framing via 'local' goals were perhaps most salient in the case of ReFLEX. This contrasts with ESO, a project that had relatively less attention paid to local outcomes, and LEO, where project stakeholders were at times focused on advancing place-based (community) participation and ownership.

In summary, across all three projects, it transpired that whilst project goals positioned them in particular locations, the 'local' context served as a means to an end. Benefits to the SLES locations were emphasised – notably by academic, council and community stakeholders - yet the primary goals were less place-focussed and more related to upscaling and systemic change. This can be seen as a direct consequence of the ways that the broader PFER government programme structured these demonstrator projects, steering their activities through a particular vision of decentralised energy that is tied to both the match-funding [89] and associated goals of replicability, innovation, and cost reduction across the UK and the world.

### 4.3. Place/boundary-making strategies of the 'local'

Despite explicit use of place names like Oxford and Oxfordshire by ESO and LEO, the 'local' was often portrayed as a flexible and ambiguous space shaped heavily by business interests, national priorities, and/or project practicalities. When asked to describe where LEO might be located, Sean states that this has yet to be defined:

> **Author:** Are there any particular places or areas…that you're really focused on? Or is [the SLES] quite dispersed?
>
> **Sean (Network Operator):** That's a lovely question. Can we come back in February and answer that?...there's no point in us defining [local] on the network, "we want go here" and "we want to go there"…and suddenly discover that two of the three of those areas there actually aren't any [project] assets …So we've got that Chicken and Eggs narrative – what I would describe as a Mexican standoff" (LEO Workshop I)

This approach to the 'local', guided by a search for assets, tells us that LEO's placement is ongoing and dynamic, shaped by techno-economic factors as much as anything else. 'Local' is operationalised as spatially granular (i.e. asset sites) yet flexible to meet new and changing circumstances. Later in the same workshop, Meghan, who works for a community energy organization, described how despite their preference for 'local' (Oxfordshire) investors in LEO's community-owned assets, they were open to having investment from anyone in the UK:

> **Author**: Is that Oxfordshire [where you are looking for investment]?
>
> **Meghan (Community Organization)**: It's primarily in Oxfordshire but we know we have investors who are interested in community energy from across the country.
>
> **Will (Network Operator)**: You're not going to turn down an investor. (LEO Workshop I)

This exchange indicates that while community-based stakeholders see value in 'local' investment, they are also flexible in 're-drawing the lines', if it helps pragmatically to fund SLES. Thus the LEO project reveals strategies that focus on sub-county granularity, county-wide action, and extra-county actions outside of the 'local'.

In ESO, stakeholders also described how they were using a strategic, flexible definition of 'local' in order to suit business-related aims. They directly spoke about the need to 'soften' the original idea of the project taking place only within Oxford:

> **Lois (Industry):** The houses that participate…that depends on take-up with the landlord, not geographic location… we're looking at Oxfordshire, not just Oxford, because we can't get enough housing. Well we can't get enough landlords to sign-up in Oxford city so we've had to extend it. (ESO Workshop)
>
> **David (Industry):** I think the way the UK [government] see this, they were thinking about this as the geographical boundary. But now we're definitely sort of softening and broadening that. It's not exactly clear what the boundary is. (ESO Workshop)

As found in previous research [83], these mentions of a flexible geographic scale suggest stakeholders are pragmatic about issues of boundaries. While place-focused to a degree, they seem more interested in finding suitable locations than keeping to a rigidly defined concept of 'local'. The challenge with this pragmatic approach to boundary setting, when it converges with use of named places (i.e. a city/county), is that it may lead to a loss of legitimacy for SLES if projects are perceived as not being credibly 'local', particularly regarding where benefits and risks are distributed, which could potentially lead to community disengagement or opposition.

ReFLEX was also situated as covering a broad and somewhat uncertain area. It was in line with LEO in the way project stakeholders spoke about the ‘local’ on a granular level – Orkney is not a single place, but a series of island communities. Though unlike the others, it seems in ReFLEX that spanning project assets across a wide area was part of the initial plan to help with ‘local’ social relations:

> **Emma (National Community Energy Organization):** Being on the mainland [of Orkney] quite often you say local, but you are not actively thinking about the isles, even though we do need to include the isles. In some ways [ReFLEX] is expanding what most people think as local. (ReFLEX Workshop)

This comment from Emma, who represents a national community energy organization, points to the fact that some project stakeholders were aware that an SLES centred mostly in – and to benefit – the mainland could prove divisive and unfair to those in smaller island communities. They did not want ReFLEX to cause such problems across the Orcadian periphery.

Lastly, we also observed stakeholders spatially constructing the ‘local’ through the way they characterised ‘local’ (non-stakeholder) actors involved in SLES. Especially among industry actors, the most commonly identified group were spatially-broad customers/consumers connected to the grid. This could be seen throughout the first LEO workshop, including when Sean outlined whom the SLES is built for:

> **Sean (Network Operator):** It’s not simply the customers that are actually directly operating and running the assets [e.g. EV chargers]…We’re operating the network as a whole for the benefit of all the customers. (LEO Workshop I)

Similar mentions of customers were made through all three datasets, which indicates that many project stakeholders were not, at this stage, focused on identifying communities of interest or groups that could play more participatory roles. Yet this trend really depended on which stakeholder was speaking. Those from community groups and councils tended to identify ‘local’ actors as residents and citizens. In doing so, people like Meghan (LEO) positioned their SLES as being shaped by neighbourhoods and interested local residents, including a “fired-up local community group”:

> **Meghan (Community Organization):** We’re an Oxfordshire-wide [project] and a lot of these [people] on Rose Hill, they’re an incredibly fired-up local community group…they’re keen to see this kind of thing happen locally. (LEO Workshop I)

This kind of citizen participation showcases a group that exists both as a community of locality and interest. Subsequent workshop discussions explored these issues and seemed to pique the interest of even industry stakeholders. ESO stakeholders were aware of the problems created when new energy systems are designed as an expensive luxury for those who are better off (e.g. early adopters of EVs). Here we see a questioning of the spatial areas (and people therein) that will take part in SLES. This idea of what we might call spatial inclusivity was also a point of debate among stakeholders within the ReFLEX workshop, who noted that inclusivity could be regarded as ‘fully-local’ if targeting all local communities, not just those earning over a certain threshold. This highlights stakeholder awareness of socio-economic and spatial inequities within ‘local’ places that host SLES projects. It seems that within stakeholder teams – and this may be contingent on the phase of projects we selected – there are some who question where to draw the lines, and whether ‘local’ is being used as a way to portray positive implications.

## 5. DISCUSSION

In this study, we sought to increase our understanding of how new decentralised energy projects are spatially represented. This is embedded within a socio-spatial approach to energy transitions in which shifts towards decentralised energy are commonly associated with 'local' expectations, but not necessarily realities, surrounding: i) smaller project size [12], ii) social relations [13], iii) participation or ownership opportunities [14], iv) benefit sharing [15], and v) institutions of governance [1,16].

Investigating three UK case studies of Smart Local Energy Systems, and drawing on the concepts of emplacement, place-framing, and place-making, we sought to reveal how the 'local' is being operationalised. Informed by literature on the social construction of place [37,38], we were interested in how constructions of the 'local' may differ between, but also within projects. That is, how the diversity of stakeholders may move to emplace, frame or place-make the 'local' in SLES in markedly different ways.

One of the study's key findings is that using place names (i.e. Oxford, Oxfordshire, Orkney) to label a project as 'local' only partially captures the emplacement of SLES [63,67]. Here, SLES were emplaced in unique 'local' communities [47] because of a variety of place-based characteristics, for example supportive political environments (ESO, LEO) and prior experiences of low-carbon energy (LEO, ReFLEX). Indeed, all SLES communities were marketed by their stakeholders as unique and even superior to others – both characteristics important in the context of competitive, neoliberal, and capitalistic environments [108].

This raises questions of equity and what kind of chance so-called 'average' or declining socio-economic communities have in taking part in changes to energy systems. While the cases indicate how SLES can be situated in highly diverse and to different degrees affluent and resource-rich marine, urban, and rural locations, SLES were also positioned by some stakeholders as a means to overcome significant local challenges (e.g. network constraints in LEO). This highlights ways that SLES could be positioned as offering potential solutions for less affluent or resource-rich communities, thus addressing important spatial justice aspects of energy transitions [109]. In this way, there may be great value to decentralised energy researchers in studying intersecting notions of place and justice in future research [110].

Related to our findings on place-framing [72], it was evident that especially industry stakeholder views were largely centred around a set of spatial goals that lay outside of the 'local'. These actors [75] exercised their power as decision-makers [73] to present a vision of what 'local' projects mean for other places throughout the UK and around the world. These emphasise 'big-picture' or geographically dispersed goals of project replication to a greater degree than those that may be more locally-concentrated. This framing positions the 'local' as more of a setting or container [62] for decentralised energy and may not be well-received by local residents, especially if they fall into the 'local trap' [77]. That is, if expectations around community-scale processes and benefits, including citizen engagement/participation [82], are not met. Some 'local' goals like addressing urban air pollution and fuel poverty were brought forward by community-based stakeholders, but we argue that they played a mostly secondary role in place-framing.

This concentration of project goals outside of the 'local' may not be entirely surprising given that the case studies were funded by central government as SLES demonstrators. These kinds of project characteristics have been shown to help amplify national or non-place based interests within the contexts of urban retrofitting [25] and urban transport networks in the UK [24]. Still, projects under a Smart Local Energy System program, with place-based names referring to Oxford(shire) and Orkney and involving 'local' stakeholders (i.e. councils, community groups) might portray an image of a locally-grounded project. While such expectations have been shown to be prevalent when using the label of community energy [19], we know much less about a possibly similar effect within 'local' energy [11], and therefore, this should be a priority for future research. We also recommend more research devoted to critically examining how national funding programs can more clearly promote both non-local replicability and locally inclusive energy projects.

Perhaps the strongest set of ‘local’ goals could be found in LEO and ReFLEX, which concentrated on community-driven development, and addressing twin issues of fuel poverty and ‘wasted’ (i.e. intermittent) renewable energy. However, even these problems were framed around a model for solving them far outside of the ‘local’. What may be concluded is that whilst replication elsewhere was a non-negotiable characteristic of all three SLES initiatives (driven by funding [90]), the two demonstrator cases which had community-sector partners highlighted ways that ‘top-down’ demonstrator programmes might still afford sufficient flexibility to embed a strong local emphasis, both in terms of community participation and beneficial outcomes. This aligns with past research on urban energy initiatives, which showed flexibility in how ‘local’ was interpreted [21] and a stronger commitment to ‘local’ outcomes in projects where community groups played a prominent instigating role [20].

We also found evidence of project stakeholder place/boundary-making [80-83] activities that revealed what places and people were considered to be ‘in’ or ‘out’ of these new decentralised energy systems. Mindful that the cases were at a relatively early stage, these decisions were often shaped by project-based and economic factors above anything we might refer to as ‘community-based’. For example, while LEO was projected as a county-level project, if not enough investment could be found in Oxfordshire, the team intended to look for shareholders from across the UK. In a similar way, part of the ESO project boundary was extended beyond Oxford city when insufficient landlords with suitable properties for heat pump installations could be found. While these kinds of approaches afford valuable flexibility to project teams, they may lead to challenges in the longer-term given research [81-83] has shown how important it is (i.e. in terms of local energy justice/acceptance) that benefits (financial and otherwise) are perceived to be fairly distributed amongst host communities.

What we call adaptive boundary-making involves viewing places as temporary containers [61] of SLES as well as conducting little engagement with broader ‘local’ publics regarding where (and why) boundaries should be established. When projects are named after real places – with associated meanings and emotional attachments – but boundaries do not accurately reflect these, the credibility, legitimacy, and acceptability of new systems may be undermined. Still, in other instances from ReFLEX in particular, we saw how the dynamic nature of project boundaries was actually designed in order to increase ‘local’ citizen participation while making the project economically viable.

The idea that decentralised energy systems should provide opportunities for participation among all people (i.e. regardless of wealth/status) was voiced by nearly all stakeholders in all three cases. That said, references to non-stakeholder ‘local’ actors as customers or consumers were most prevalent among non-local industry stakeholders in particular. Given that these kinds of new decentralised energy systems will require more active engagement from the public, imaginaries such as prosumer [i.e. producer and consumer; 111] and energy citizens [23] are arguably the more appropriate way to recognise the knowledge, capabilities and opportunities that could be afforded to individuals by decentralised energy initiatives.

We acknowledge several limitations of our study, with some providing opportunities for future research. First, the findings are contingent upon the stage in which data collection took place; workshops and secondary documents were both set within the first year of each project’s lifetime. Thus, what we find as ‘local’ about these SLES projects should be regarded as preliminary, and future research is required to trace the temporal dynamics of ‘local’ aspects of SLES over time. Such research should centre both on project partners and local actors, including residents. This may include questions of local concern regarding non-local organizations leading SLES. Only then will we be more confident in answering questions of what SLES looks like, and for whom, in practice. In the meantime, this research may offer critical feedback toward those involved with SLES and concerned about potential local resident perceptions and support for new systems.

Second, while all organisation types (i.e. industry, academia, councils, community groups) were represented in the LEO and ReFLEX workshops, the ESO workshop lacked a local government representative. However, we sought to address this this limitation by supplementing the workshops with secondary data from each case. Going forward, it may be that in order to gain insights from a greater variety of project stakeholders, interviews that are less time-intensive and more schedule-friendly may be more useful. That said, there was tremendous value in the workshop format. We reiterate the work of others [112,113], who have written about the value of participatory workshops including the ability to capture a complex set of often-divergent stakeholder views.

Third, given the fact that our case studies were somewhat unique in their status as PFER demonstrators, we suggest that future research should focus on SLES that are not funded through central government and/or without such directed calls for model-testing. This may include projects led by local government, community groups and others – both within the rapidly changing energy landscape of the UK and around the world. Attention to a diversity in project team structures as well as the varied social, economic, and political contexts where decentralised energy systems are emerging, should also be a priority.

Lastly, and as we pointed out earlier in this paper, there are a wide range of concepts including energy landscapes, spatial imaginaries and territoriality [5], which could be employed to better understand how spatial aspects of decentralised energy initiatives unfold across time and space. We see Star's [59] concept of boundary objects, which outlines the ways in which systems can be tested based on their ability to meet a community's needs and desires, to hold great potential in the study of SLES. The application of Cotton's [86] scalar parity may also be helpful, especially when research interests lie around how partnerships between 'local', regional, and national actors might achieve environmental or energy justice. Our selection, founded on a place-based approach [60], of the three analytical approaches employed in this study should not be seen as exhaustive or comprehensive, but a tentative first step in a research programme that redresses conventional approaches that view 'local' aspects of energy transitions as self-evident and unworthy of further scrutiny. While our set of spatial concepts allowed for a detailed temporal investigation of what is 'local' (e.g. emplacement centred within the application stage and place-framing/boundary making associated within design and rollout), it may be that other socio-spatial concepts may be more useful as SLES become fully operational.

## 6. CONCLUSION

In continued and urgent moves to address global climate change, it is important to remember that every solution – rooftop solar panels, EV chargers, and battery storage facilities – are always set in particular and unique places. An understanding of the 'local' should not be taken-for-granted, especially in countries like the UK who may be moving away from community and toward 'local' energy. We contend that this study has advanced our spatial understanding of these low-carbon moves toward decentralisation, and in particular new Smart Local Energy Systems. As SLES (and its synonyms) continue to rollout across the world, it is important that we investigate how these terms are being utilized by those responsible for development in host communities. We find that these project stakeholders often construct versions of 'the local' to align with both their perceptions of geohistorical context and project aims; many of which being non-local in nature. Perhaps our paper's most significant contribution is to set out three clear ways to understand how project stakeholders place – or do not place – decentralised energy systems in 'local' communities. Emplacement, place-framing and place/boundary making illustrate useful geographic ideas to help decentralised energy researchers better understand moves toward a smart and 'local' clean energy future brought forward by SLES.

Finally, in light of the COVID-19 global pandemic and more general calls for energy justice, there is a renewed urgency to 'build back better' in energy systems. That our data collection took place from late 2019 to early 2020 (just before COVID-19 became prevalent in the UK) meant we captured a unique snapshot in time, one that may be studied as a kind of 'control' if indeed significant changes are made in the way energy systems are designed. Looking to the future, research is needed to track how pandemic constraints have influenced the ongoing development of decentralised energy initiatives, such as SLES, including their spatial and participatory dimensions. This is important to address both climate change and the need for a just transition toward 'local' energy.

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