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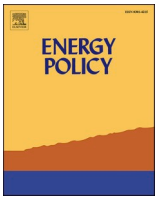

Constructing practices of engagement with users and communities: Comparing emergent state-led smart local energy systems

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ABSTRACT

Energy transitions require engagement with users, local communities and wider publics in order to be fair, acceptable and, ultimately, successful. Here we focus on the development of decentralised energy systems instigated by central government. Smart Local Energy Systems (SLES), involving low carbon generation, demand sources and smart technologies in a geographically-bounded location, are important but unexplored contexts for public engagement. Drawing on 23 interviews with partner organisations in 12 UK SLES projects, we investigate the targets, methods and rationales of engagement. Partners engage a range of user and community groups around multiple energy system components using a variety of methods, directly and via intermediary organisations. Project size is not a major influence on breadth and intensity of engagement. Project partners rationalise practices with reference to characterisations of users and engagement, and practices are conditioned by a range of factors (e.g. technological boundaries, place, partners involved, and the wider organisational context within which SLES projects take place). We highlight a need for future SLES policy to emphasise engagement as a key facet, institute systematic social learning between SLES projects, and consider how to engage publics beyond the boundaries of individual projects.

1. Introduction

The decarbonisation of energy systems is not just technical in nature, and the role of people and communities are increasingly recognised as central to energy system change (Sovacool, 2014; Bellamy et al., 2022; Creutzig et al., 2022). These roles are of relevance to a multitude of energy system challenges, including: the management of energy demand (Shove et al., 2012; Hargreaves and Middlemiss, 2020); the support/acceptance of new energy technologies (Walker, 1995; Boudet, 2019); and the adoption of energy technologies in homes (Gadenne et al., 2011; Mills and Schleich, 2012).

The need to engage with publics in changing energy systems has been highlighted as a key concern within both recent energy scholarship and energy policy. Three main rationales for engagement can be identified. First, the engagement of publics is often deemed an *instrumental* necessity in garnering acceptance of technological and infrastructural changes (Itten et al., 2020; Devine, 2011; Wesselink et al., 2011; Owens and Driffill, 2008). Second, including publics in decision making may be of *substantive* value, as incorporating a diversity of knowledges can help to improve the quality of decision-making (Wesselink et al., 2011; Demski et al., 2015; UK CA, 2020). Third, engagement may be driven by a moral obligation to allow those affected by decisions to influence them. *Normative* rationales may be of intrinsic importance, but are also significant in the context of 'just' transitions (Wesselink et al., 2011; Jenkins et al., 2016; Burke and Stephens, 2017).

While public engagement has been researched in relation to individual technologies such as wind (Elkjær et al., 2021), solar (Lazoroska et al., 2021; Parkins et al., 2018) and energy transitions more broadly (Bellamy et al., 2022; Willis et al., 2022; Butler and Demski, 2013; Walker and Cass, 2007), little is understood about engagement within programmes of Smart Local Energy System (SLES) projects, which focus on the *integration* of low carbon generation, transport, heating and

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'smart' (i.e. digital) technologies within geographically-defined 'local' communities (Ford et al., 2019; Rae et al., 2020; Walker et al., 2021). As place-based sustainability projects, there are parallels between SLES and other concepts of place based sustainability developments, most notably 'Integrated Community Energy Systems' (ICES) (Koirala et al., 2016) and smart cities (Albino et al., 2015),[1] although SLES projects do have a set of distinguishing features which, we argue, justifies an examination of engagement in that specific context.

First and foremost, while many decentralisation efforts (e.g. ICES, smart cities) typically exist as discrete developments, SLES projects are distinct in that they exist as part of a larger programme of decentralisation funded and administered by the central government. SLES projects need to be understood in terms of the policy contexts of state-led decentralised energy in which they exist, not least because these contexts might shape engagement activities in projects.

A second key aspect of SLES projects is the manner in which they are delivered and managed. SLES projects are characterised by an emphasis on the private sector in partnership with public and research organisations (Devine-Wright, 2019; Ford et al., 2021). In the UK, SLES projects can be understood in the context of the policy shift away from community energy and towards 'local energy', in which the role of private actors in energy decentralisation is emphasised over that of grassroots, community-led initiatives (Devine-Wright, 2019).[2] While there are similarities to smart cities in this regard (Grossi and Pianezzi, 2017), this distinguishes then from energy-specific developments such as community energy, which are typically (though not universally) led by voluntary organisations (Seyfang et al., 2013). Acknowledging a diversity of meanings and modes of decentralisation (Devine-Wright, 2019; Judson et al., 2020; Creamer et al., 2019), SLES developments present a novel opportunity to understand how engagement in decentralisation is shaped by the actors involved.

Third, SLES projects have a multiplicity of focal points for public engagement arising from the assembly of novel combinations of technological components within local energy systems. The breadth of SLES is such that focal points may span multiple technologies (e.g heat pumps, trading platforms), business models (e.g. tariffs, novel service models) and value creation opportunities (e.g. provision of energy services, enhancing flexibility) across multiple sectors (e.g. heat, mobility and power) (Rae et al., 2020; Ford et al., 2021). This emphasis on energy system integration is also common to ICES, which, Koirala (Koirala et al., 2016) argues, present opportunities for public engagement, although how engagement actually manifests in these contexts has not been critically examined.

Fourth, SLES, as is the case with other decentralisation developments, represent a reshaping of the geography of energy systems to make them more proximate to where people live and work (Watson and Devine-Wright, 2011; Balest et al., 2018) As projects within a wider programme of decentralisation (decribed in Section 4.1), the location of SLES projects across the UK did not emerge organically, but is in part determined by central government. Rather than creating 'fixed' geographies of energy systems defined (for example) by municipal boundaries, Walker et al. has shown how the 'local' in UK smart local energy systems is actively constructed by project partners (Walker et al., 2021), defining what places – and people – are inside or outside of the scope of SLES projects. SLES projects thus generate geographies of engagement that require exploration of the kinds previously undertaken in the context of community energy (Hoffman and High-Pippert, 2010; Bauwens and Devine-Wright, 2018) and smart cities (Söderström et al., 2014; Goodman et al., 2020).

Finally, how engagement in SLES projects is delivered is not only a matter for energy transitions. It speaks to wider urgencies in a context of Climate Emergency to engage local communities in conversations about public responses to a range of environmental challenges, including pollution, waste and biodiversity loss (Brondizio et al., 2019). It is in this broader context that SLES projects must be examined.

Together, the technical, geographical and organisational specificities of SLES projects provide important contexts for learning about how engagement is rationalised and practised by stakeholders within state-led multi-partner decentralised energy initiatives. If such projects should continue to play a role in energy system decarbonisation, a better understanding of public engagement within these projects is needed.

The paper proceeds with a review of the key literatures relating to engagement within managed energy transitions, and public engagement more broadly. We then develop the concepts of users and communities in relation to SLES. A discussion of methods is then followed by three results sections that speak to each of our research questions. Finally, we discuss the significance of our findings and highlight implications for research, practice and policy relating to public engagement in energy system change.

2. Conceptualising public engagement

2.1. Public engagement in (managed) energy transitions

Two interrelated theories of change – the Multi-Level Perspective (MLP) and Strategic Niche Management (SNM) - have been used as analytical frameworks for the study and management of energy transitions. The MLP positions sociotechnical transitions as the outcome of dynamic interactions between emerging 'niche' technologies, stable sociotechnical 'regimes' and the exogenous 'landscape' context (Geels and Schot, 2007; Geels et al., 2017). In turn, SNM uses core concepts from the MLP to focus on the management of transitions by way of the scaling up of niche experiments from local to global contexts (Kemp et al., 1998). These approaches have contributed multiple perspectives on publics and public engagement in energy transitions of relevance to our study.

The focus of both is on technological change and as such, the agency of publics tends to be limited to the expression of 'user preferences' for technologies, which together with other factors (e.g. creation of markets, policies and so on) creates stability in sociotechnical configurations (Markard et al., 2012; Geels, 2005). Early work incorporating the MLP framework has consequently been criticised for neglecting agency (Genus and Coles, 2008) and offering limited critical engagement around how sustainability transitions could and should unfold, especially within diverse geographies or places (Shove and Walker, 2007; Bridge et al., 2013; Calvert, 2016).

Similarly, in emphasising niche actors, SNM has been criticised for neglecting the role of others – including publics - in participating in local projects. While SNM's focus on transition by way of local experimentation is ostensibly significant given our focus on top-down, place-based, SLES projects, the role of local users are frequently neglected (Hoogma et al., 2002). Despite articulating social networks as a key factor shaping niche development (alongside the articulation of visions and expectations and the existence of learning processes) (Kemp et al., 1998; Verbong and Geels, 2007), SNM analyses have underemphasised the ways in which publics might be incorporated in and engaged through such social networks, with only a few notable exceptions (e.g. Rantala et al., 2020; Verbong et al., 2013).

More recently, Schot proposed a multifaceted characterisation of users in sociotechnical transitions (Schot et al., 2016), transcending narrow representations of users as 'consumers' to include roles in production, legitimation, intermediation and citizenship in relation to niche technologies. However, the focus here is on users in relation to single technologies, rather than technological assemblages, as is the case with

[1] Whilst typically focusing less on decarbonisation than broader notions of sustainability and other economic and social objectives, smart cities nonetheless offer a useful comparator against which to frame SLES projects.

[2] We note that the EU Renewable Energies Directive, conversely, seeks to strenghten local involvement and greater participation by citizens (EU Directive, 2018/2001/EU, 2018).

SLES. Moreover, while Schot does (briefly) suggest that diferent user groups will require tailored engagement approaches, the focus is on engagement by governments rather than by a wider set of stakeholders, such as private sector companies, as is the case with SLES.

Others have mobilised the MLP and SNM to frame community energy (Seyfang et al., 2014; Seyfang and Smith, 2007; Hargreaves et al., 2013) and the broader notion of local energy (Valta et al., 2022) as burgeoning sociotechnical niches in their own right. Such analyses move beyond narrow frames of 'people as users' to emphasise the importance of grassroots innovations, from providing information about energy issues, improving acceptability to renewable energy projects and increasing engagement in behaviour change initiatives through to carrying out energy audits and supporting local residents with the installation of insulation and efficient appliances (Seyfang et al., 2012, 2013, 2014; Braunholtz-Speight et al., 2018). While these studies consider modes and rationales for engagement, insights are limited to engagement by specific grassroots initiatives rather than by a wider set of stakeholders, or indeed in the context of the managed transitions SLES seek to facilitate.

In summary, the managed transitions literature has so far neglected the importance of publics and public engagement in energy transitions. The narrow analytical focus of SNM literature is such that transition studies typically offer only narrow perspectives on engagement, i.e. in relation to single technologies, or from the perspective of single organisations (e.g. community energy groups). While the transitions literature offer valuable insights about energy transitions, it is limited in helping us conceptualise how stakeholders engage with users and communities.

2.2. Conceptualising engagement in energy system change

Beyond energy transition literature, research on public engagement in energy system change is of direct relevance to our study, particularly research that investigates the rationales and methods underpinning engagement by organisations with publics. This section explores three key strands of research – analyses of diverse modes of engagement, the conceptualisation of people in energy systems, and the relationship between engagement and sociotechnical change – before discussing possible frameworks for concepualising engagement in SLES.

In focusing in on what engagement looks like in SLES projects, it is useful to first consider the range of *potential* modes and models of engagement. Literature on public participation with science and technology policy provides a useful foundation for understanding engagement in SLES. In an early typology, Rowe and Frewer define three key categories of engagement with publics: public communication, public consultation and public participation, distinguished by the nature and flow of information between 'sponsors' and participants, whether it is one-way (communication), two-way but controlled by sponsors (consultation) or two-way dialogue with equal status held by both sponsors and participants (participation) (Rowe and Frewer, 2005). Importantly, engagement by way of one mode or another requires attention to its effectiveness in transmitting information (Rowe and Frewer, 2000, 2005). In other words, engagement practices need to be understood in relation to rationales for engagement.

Using these core concepts, there have been multiple attempts to map energy engagement practices. These have focused variously on specific components of energy system change, including energy efficiency improvements (e.g. Morales-Guerrero and Karwat, 2020), specific renewable energy technologies such as onshore wind (e.g. Solman et al., 2021), and energy infrastructures (e.g. Devine, 2011). Other work has focused on diversity of engagement acoss entire energy systems (e.g. Chilvers et al., 2018; Pallett et al., 2019), or on smart cities in which aspects of sustainable energy transitions play out (e.g. Corsini et al., 2019). These studies provide important insights for engagement in specific contexts. However, we argue that the particular context of smart local energy systems - i.e. top-down, place-based, project-driven initiatives focused on local systems of multiple integrated technologies – present an important but underexamined set of circumstances to explore.

Publics are heterogeneous, comprising both individuals (e.g. citizens, consumers) and collectives (e.g. communities), and as such, public engagement needs to be understood in relation to target groups (Renn, 2006). How publics are distinguished and conceptualised by policymakers and practitioners has consequences for both understanding and enabling transition processes (Schot et al., 2016; Devine-Wright and Murphy, 2007; Lennon et al., 2020). Characterisations of people, and understandings of engagement activities, go hand in hand. For example, one dimensional energy 'consumers' characterisations can be expected to engender narrow modes of 'customer engagement', characterised for example by customer segmentation and marketing, whereas acknowledging a more diverse set of roles and responsibilities for people as 'citizens' opens up opportunities and challenges for engagement (Schot et al., 2016; Pallett et al., 2019).

Our focus here is on the organisations carrying out public engagement in SLES projects, and as such, research on the construction of the public as 'other' is especially instructive.[3] For example, Maranta et al. discuss the notion of 'imagined lay persons' as functional constructs manifested by the actions and products of 'experts' in relation to publics (Maranta et al., 2003). Applying the notion to engagement in energy system change, Barnett et al. (2012) show how the construction of publics by a specific set of energy 'experts' (renewable energy developers, manufacturers, consultants and marketing and public relations representatives) has been shown to shape preferences for engagement approaches (e.g. public meetings vs exhibitions). These concepts are particularly significant in the context of our current focus on the meanings and practices of engagement held by SLES project partners.

As outlined in the introduction, engaging publics in energy system change span instrumental, substantive and normative rationales (Itten et al., 2020; Devine, 2011; Wesselink et al., 2011; Owens and Driffill, 2008; Demski et al., 2015; UK CA, 2020; Jenkins et al., 2016; Burke and Stephens, 2017; Stirling, 2008), which can in turn be related to ideas about people, or rather, the roles played by people in accepting, informing and being impacted by energy system change. Such rationales find significance in the emergence of sociotechnical assemblages, whether relatively simple (e.g. a community wind turbine) or relatively complex (e.g. a SLES). As Sadowski et al. puts it, "every socio-technical system is embedded with, and seeks to enact, a vision of the world it plugs into (and produces), a model of the users it is built for (and constructs), a rationality based on the values/goals it prioritizes (and spreads)" (Sadowski and Levenda, 2020).

On one hand, specific sociotechnical assemblages such as community energy storage or community solar have been identified as affording specific opportunities for community participation such as around design and decision-making (Koirala et al., 2018; Michaud, 2020). More broadly, the discourse on energy democracy refers to the potential for increased participation, decision-making and ownership resulting from the shift to intermittent, distributed, and scalable nature of renewable energy technologies (Burke and Stephens, 2017; Szulecki and Overland, 2020). On the other hand, novel sociotechnical assemblages bring with them the potential for dilution of, or even the removal of possibilities for, engagement. Referring to the 'tyranny of participation', Kothari cautions that participation can be used rhetorically as a hegemonic device, stating that "programmes designed to bring the excluded in often reduce spaces for conflict and are relatively benign and liberal" (Kothari, 2001, p. 143). With particular relevance to the 'smart' aspect of SLES, Sadowski and Lavenda (Sadowski and Levenda, 2020) suggest that since data-driven, network connected and automated energy systems allow

[3] Whle we note that project partners comprise members of the public (local or otherwise) within them, we understand their agency to be mediated by the organisations within which they work.

consumer choice to be replaced by algorithms, there is the potential for 'smart energy' to be enacted by 'anti-politics', i.e. the active reduction and removal of human agency from energy systems (Sadowski and Levenda, 2020).

2.3. Distinguishing engagement from participation

In organising varieties of participation, two key pieces of literature are of particular significance to this study. The first is Sherry Arnstein's ladder of citizen participation, a well-known hierarchical framework originally developed to organise different forms of citizen engagement in urban development (Fig. 1) (Arnstein, 1969). This heuristic identifies three forms and eight levels of participation, varying in terms of the degree to which citizens exert power in affecting change. These range from 'Citizen Power' (encompassing 'Citizen Control, 'Delegated Power' and 'Partnership'), through to 'Tokenism' (which includes 'Placation', 'Consultation' and 'Informing'), to 'Non-participation' (e.g. 'Therapy' and 'Manipulation'). Key to Arnstein's ladder is the normative perspective that the highest rungs are preferred to lower rungs, i.e. that 'citizen power' is superior to 'delegated power', and so on.

Arnstein's ladder has found currency across a multitude of spheres, including the analsysis of participation in energy systems (Bidwell, 2016; Bull et al., 2015; Xavier et al., 2017; Jami and Walsh, 2014; Preston et al., 2020; MacArthur and others, 2016). However, as is the case with any popular framework, several criticisms have been made about how well the heuristic reflects the complexity of participation. This includes challenges about the appropriateness of a hierarchical, value-based model in organising a multiplicity of options of partipation (Carpentier, 2016), questions about the relative importance of experts and citizens in shaping systems (Hart, 2008; Tritter and McCallum, 2006) and related to this, the normative assumptions around citizen desires for control (Hurlbert and Gupta, 2015).

Reflecting on these critiques, Cardullo and Kitchin extend Arnstein's ladder to help analyse citizen participation in the context of the smart city (Fig. 1) (Cardullo and Kitchin, 2019). In particular, they propose a ninth rung, 'Choice', to capture neoliberalist ideas of people within smart cities as consumers. Cardullo and Kitchin also augment the original ladder with the inclusion of additional dimensions to illustrate how forms and levels of participation map across to roles, forms of involvement, political discourses and top-down/bottom up modalities.

While we acknowledge imperfections in the Arnstein and Cardullo and Kitchin frameworks, nevertheless we regard them as useful foundations for investigating engagement and participation in the context of SLES. Moreover, we distinguish *engagement by* citizens from *engagement with* citizens by other organisations. Without devaluing the importance of the agency of citizens, our specific focus is on exploring the ways through which organisations within SLES projects understand and enact engagement with publics as 'others', rather than, for example, how public participation in SLES is enabled or constrained more broadly. By focusing on public engagement by SLES project partners, we mobilise some key concepts from the literature on intermediaries. Kivimaa et al. define transition intermediaries as "entities that intermediate for a sector … or a region … to move towards new and more sustainable (or socially just) system configuration" (Kivimaa et al., 2019). In particular, SLES partnerships operate within the constraints of innovation policy towards the 'local embedding' of SLES technologies across local contexts (Barnes, 2019). As such, SLES projects can be conceptualised as brokering public engagement around SLES.

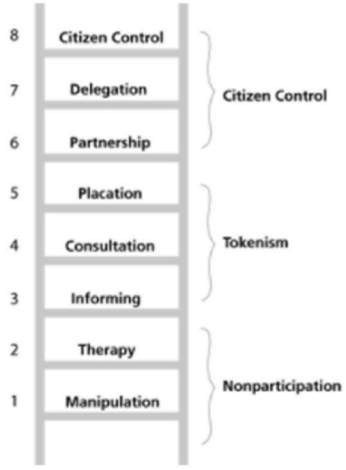
3. Distinguishing SLES users from SLES communities

Given the specificity of SLES as compared to other decarbonisation approaches, it is useful to reflect briefly on who 'the public' might be in the context of SLES and to distinguish SLES users and SLES communities.

3.1. SLES users

Taking the concept of 'users' first, we define SLES users here as "actors (e.g. households, businesses and public sector organisations) interacting with technologies to consume or otherwise procure energy services within the boundaries of SLES projects". This definition focuses on users as 'consumers', and thus on the provision of energy services by SLES projects to consumers (Belyakov et al., 1007). However, we note that the consumption of energy products and services in domestic settings in particular can be unconscious, embedded in daily practices and consumed to express status and identity as much as to stay warm, comfortable and mobile (Shove and Walker, 2014).

In the context of SLES, the diversity of actors who might be characterised as 'users' is noteworthy. While energy systems comprise multiple types of user (or 'end-user'), the term is frequently used with reference to *domestic* users, rather than users in business, industry and public sector settings (Ucci et al., 2014). Even within the subset of domestic users, users may vary in terms of interests, motivations and resources, presenting a variety of opportunities and challenges for



Form and Level of Participation		Role	Citizen Involvement	Political discourse/ framing	Modality	Dublin Examples
Citizen Power	Citizen Control	Leader, Member	Ideas, Vision, Leadership, Ownership, Create	Rights, Social/Political Citizenship, Commons	Inclusive, Bottom-up, Collective, Autonomy, Experimental	Code for Ireland, Tog
	Delegated Power	Decision-maker, Maker				Civic Hacking, Hackathons, Living Labs, Dublin Beta
	Partnership	Co-creator	Negotiate, Produce	Participation, Co-creation		
Tokenism	Placation	Proposer	Suggest		Top-down, Civic Paternalism, Stewardship, Bound-to-succeed	Fix-Your-Street, Smart Dublin Advisory Network
	Consultation	Participant, Tester, Player	Feedback	Civic Engagement		CIVIQ, Smart Stadium
	Information	Recipient	Browse, Consume, Act			Dublinked, Dublin Dashboard, RTPI
Consumerism	Choice	Resident, Consumer		Capitalism, Market		Smart building/ Smart district
						Smart meters, Mobile/locative media
Non-Participation	Therapy	Patient, Learner, User, Product, Data-point	Steered, Nudged, Controlled	Stewardship, Technocracy, Paternalism		Dublin Bikes, Smart Dublin
	Manipulation					Traffic control

Fig. 1. Two frameworks of participation: Arnstein's ladder and Cardullo & Kitchin's scaffold.

engagement (Ben and Steemers, 2018).

Second, the subset of domestic users can be expected to exhibit diversity in the ways that they relate to energy services and systems. For example, households comprise a range of building types, tenure types, occupancy, levels and patterns of energy demand, levels of disposable income, and connectivity to infrastructures and as such, domestic users will vary in terms of willingness and ability to engage with SLES components (Powells and Fell, 2019). Meanwhile, consumers are frequently segmented in terms of their attractiveness as potential customers by firms offering new energy products and services (Maiden et al., 2020; McCabe et al., 2018).

Third, SLES are explicitly about finding ways to integrate multiple technologies (including digital technologies), alongside business models and user practices (Ford et al., 2019). Any characterisation of SLES 'users' must therefore be capable of considering peoples' interactions with single technologies as well as combinations of technologies, novel as well as familiar technologies, as well as other non-material services such as energy tariffs or business models.

3.2. SLES communities

Moving on from users, we understand SLES 'communities' to include a broader network of locally-embedded individuals and groups with interest and/or influence in the move to smarter, more local energy systems. Compared to users, the role of SLES communities goes beyond direct engagement with energy services to potentially include participation in the design and development of SLES more broadly.

Our notion of SLES communities encompasses both communities of *place* and communities of *interest*. In terms of the former, SLES projects are, by design, geographically constrained; the SLES projects we examine here were required to be focused on a specific, named UK location "at least the size of a town" (UKRI, 2018a; UKRI, 2018b), resulting in local communities being elected to host SLES projects.

However, Walker et al. (2021) highlight how SLES project stakeholders actively engage in 'boundary-making' to construct the socio-spatial scope of projects, in doing so defining the communities with which processes and outcomes of SLES projects are focused. Importantly, they find this to be an ongoing and dynamic process, shifting to meet project objectives and address challenges as they emerge.

While it may be true that SLES projects are spatially demarcated, their role in the development of sustainable energy systems means that they are also of relevance to wider 'communities of interest' both within and beyond project boundaries. For example, some of the issues that SLES projects seek to tackle (e.g. climate change, sustainability, affordability, community) might be being addressed in parallel with community groups within and across communities of place. This includes but is not limited to those groups for whom sustainable energy features as a core theme, e.g. community energy groups.

Furthermore, SLES projects, individually and through a process of replication and 'scaling up', are expected to help address energy issues at a system level, including reducing emissions and other environmental impacts, providing cleaner, cheaper, more desirable energy services for users, and lead to more prosperous and resilient communities (UKRI, 2018a). In this sense, SLES projects are expected to be geographically contained while also reflecting on the relevance of their work for localities and communities *outside* of that container.

It is noted that the distinction between users and communities is not always clear. SLES might comprise communities of users, while users might also be engaged with SLES as members of a community. Further, a key facet of SLES projects is the development of SLES business models that are attractive to consumers, implying that local communities comprise actual users, but also potential users.

This research is guided by three research questions. First, what does user and community engagement look like from the perspective of SLES project partners, i.e. who are users considered to be, how do project partners engage them, and what is the focus of engagement? Second, what rationalities (e.g. instrumental, substantive, normative) underpin engagement practices within projects? And third, what factors shape practices of user/community engagement within and across projects? These research questions were designed to focus in on engagement by SLES project partners, but also to be broad enough to explore multiple facets of engagement.

4. Methodology

4.1. Research context

Our research focuses on 12 SLES projects carried out under a £102m[4] UK Government funded programme, Prospering from the Energy Revolution (PFER) (UKRI, 2022). As such, we take a comparative case study approach, examining engagement by multiple projects operating in a comparable set of circumstances. Such an approach is well-suited to examining effects beyond a single projects, and has been used in similar

Table 1
Summary of research participants and SLES projects.

Project type	PFER project	Role	Organisation type
SLES Demonstrator projects (Demo)	Energy Superhub Oxford (ESO)	Marketing and Communications	Industry
		Engagement	Industry
	Local Energy Oxfordshire (LEO)	Engagement	Industry
		Social impacts	Community organisation
	ReFLEX Orkney	Project management	Industry
		Engagement	Industry
		Communications	Industry
SLES Detailed Design projects (Design)	Milford Haven: Energy Kingdom (MHEK)	Project management	Industry
		Data analysis	Industry
	GIRONA: Coleraine, N. Ireland	Project management	Industry
		Project management	Industry
	Greater Manchester Local Energy Market (GMLEM)	Project Management	Commerce
		Platform design	Industry
	Green Smart Community Integrated Energy Systems (GreenSCIES): London	Engagement	Industry
	Liverpool Multi-vector Energy Exchange (LMEX)	User engagement	Academia
	Peterborough Integrated Renewables Infrastructure (PIRI)	Project management	Academia
		Engagement	Industry
		Engagement	Local Authority
	Project REMeDY: Southend	Engagement	Industry
	West Midlands Regional Energy System Operator (RESO)	Energy infrastructure	Local Authority
		Engagement	Local Authority
	Zero Carbon Rugeley (ZCR)	Project management	Industry
		Engagement	Academia

[4] This figure, and other references to project budgets, refer to government investment so excludes additional investment from industry partners.

Table 2
User and community actors engaged by PFER project partners.

		Users										
		Fleet drivers (D)	Housing developer (I)	Business landlord (I)	Drivers (D)	Fleet managers (I)	Local Authority (I)	Local residents (I)	Social housing landlord (I)	Social housing tenants (D)	Owner-occupiers (D)	Commercial users & industry (D)
Demo	ESO					●	●		●	●	●	
	LEO				●			●		●	●	●
	ReFLEX				●	●						●
Design	Girona								●	●	●	●
	GMLEM			●				●		●	●	●
	GreenSCIES						●		●			●
	LMEX										●	●
	MHEK	●			●	●						
	PIRI											●
	REMeDY		●	●					●		●	●
	RESO						●					●
	ZCR							●		●	●	
		1	1	2	3	3	3	3	4	5	7	9
		Total no. of user types										

Note. Cultural/heritage groups include theatre groups, local artists and heritage groups. Mobility groups include cycling clubs, car clubs and transport operators.

analyses elsewhere (e.g. Musall and Kuik, 2011; Oteman et al., 2014; Sovacool, 2014).

PFER was created in response to the identification of energy system decentralisation as a key 'challenge area' within the UK Government's 2017 Industrial Strategy (HM Government, 2017), with the core intention of accelerating innovation in smart local energy systems across the UK (UKRI, 2021). While PFER as a whole comprises six cohorts of SLES projects, we focused on the two largest (both in terms of value and scope) strands of PFER on the basis that they provide more scope for learning than the other smaller, shorter, technology specific projects.[5] The first comprises three large-scale (averaging £11.2m of government funding each), three-year duration 'Demonstrator projects', whose goal is to realise smart local energy systems in specific locations. Secondly, ten smaller-scale (averaging £2m of government funding each) 1 year duration 'Detailed Design' projects, in which the emphasis is on the design of SLES that can be replicated, in whole or in part, to other localities. With both strands, partnerships competitively bid for state funds to either demonstrate or design SLES.

Early documentation emphasised several key elements of the programme of particular relevance to understanding user and community engagement. From a 2018 UK Government press release (Innovate UK, 2018):

> "[PFER] will bring together businesses working with the best research and expertise. Together they will develop and demonstrate new approaches to provide cleaner, cheaper and more resilient energy. This includes providing energy in ways that **consumers** want by linking low-carbon power, heating and transport systems with energy storage and advanced IT to create intelligent, local energy systems and services." (emphasis added)

First, the private sector are viewed within PFER as key partners in the development of SLES, with an emphasis on developing collaborations between the business community, the public sector and research organisations (UKRI, 2018a; UKRI, 2018b). Second, the focus on *demonstrating* approaches to energy is indicative of the logic underpinning the programme – that the government can take forward learning about SLES – including learning about engagement – and apply that learning to scale up SLES. Finally, in suggesting that 'consumers' are the primary beneficiaries of SLES, the implicit focus of the PFER programme is that engagement could (and perhaps should) focus on identifying and satisfying the needs of consumers, rather than those of a wider set of publics.

In analysing SLES projects within the context of PFER then, the emphasis here is on engagement within the context of a managed decarbonisation innovation programme, carried out within local projects, through collaborative partnerships between businesses and other partners, and with an imaginary of publics as 'consumers' to the fore.

4.2. Interviews

We carried out semi-structured interviews with 23 stakeholders from twelve SLES projects (three Demonstrator projects and nine Detailed Design projects) between April and July 2, 021.[6] The semi-structured interview is a commonly-adopted technique within the energy social sciences for collecting data on the opinions, attitudes and understandings of people and groups across contexts (Sovacool et al., 2018) and is particularly appropriate given our interpretivist approach to studying the experiences, meanings and construction of engagement (Lin, 1998). The semi-structured nature of inquiry meant that insights around SLES engagement could emerge inductively rather than be constrained by hypothesis (McCracken, 1988).

Interviewees were identified on the basis of them having responsibility for user and community engagement within projects. For each project, we aimed to interview one person who held responsibility to oversee such engagement activity (often project leads) and one person who was directly responsible for engagement activity (see Table 1). Most participants represented industry organisations, with others from local authorities, academia, community organisations or industry (Table 1). Interviews were carried out remotely due to Covid restrictions, lasting 59 min on average, and most (Burke and Stephens, 2017) involved at least two of the author team. In total 22 h and 41 min of interviews were transcribed and placed in NVivo qualitative analysis software for analysis. Any quotations used here are attributed to projects, but individual participants have been given pseudonyms.

4.3. Data analysis

As our research questions focus on engagement through the eyes of project partners, we take an interpretivist approach to draw out to social construction of engagement within SLES projects. In doing so, we do not

[5] Alongside the Demonstration and Design projects are an additional four sets of projects focused in turn on SLES concepts, technology components, energy data, and 'fast start' initiator projects. Full details in (UKRI, 2022).

[6] All PFER Demnstrator and Design projects were represented in our dataset except from REWIRE-NW, who we were unable to interview.

Users	Communities										
Total no. of user groups	Architects (I)	Cultural/ heritage group (I)	Sustainability group (D)	Local development group (I)	Mobility groups (I)	Schools (D)	Wider community (D)	Local authority (I)	Community Energy group (I)	Community group (D)	Total no. of community groups
5		●			●	●	●	●	●	●	7
5							●	●	●	●	4
3					●			●	●	●	4
4				●			●	●	●	●	5
5			●				●	●	●	●	5
3	●		●	●			●	●	●	●	7
2									●	●	2
3					●	●	●	●		●	5
1						●	●	●	●	●	5
5						●	●	●	●	●	5
2					●		●	●	●	●	5
3		●		●	●		●	●	●	●	7
	1	2	2	3	5	4	10	11	11	12	
	Total no. of community types										

attempt to derive an objective picture of engagement practices, but to highlight those practices, meanings and rationales foregrounded by the project partners themselves.

First, content analysis is used to capture targets and modes of engagement across SLES projects (Weber, 1990). Reference to specific targets of engagement were initially coded deductively by distinguishing between SLES users and SLES communities, drawing on discussion of these themes in the literature, and discussed in Section 4. Inductive coding then helped to draw out reference to specific users and specific communities. Presence or absence of reference to targets and modes of engagement within projects were then recorded. Data was presented in tables and supplemented with selected quotes and subjected to interrogation and discussion across the authorial team.

Since interviews covered engagement in a broad sense, several ambiguities in the data were identified. For example, discussions around "engagement" covered engagement with users and communities, but also engagement with other stakeholders, including partners in other projects and policymakers. Since the focus here is on engagement by project partners with publics, references to engagement with wider stakeholders (e.g. other projects, policymakers, regulators etc.) were considered beyond the scope of the analysis.

Since interviews covered engagement within SLES projects in general terms, participants tended not to use the concepts of 'users' or 'community' consistently, meaning that coding for specific groups required some interpretation on the part of the authors. Where interviews referred to communities of users (e.g. engagement with the wider local community), but the impetus for engagement might be to identify potential users of SLES components, both codes were used in parallel.

Analysis of rationalities of, and factors underpinning engagement practices was guided by thematic analysis (Braun and Clarke, 2012) to draw out the most salient subjects and meanings of engagement, from the perspectives of project partners. This acknowledges the potential for normative reflections on engagement practices to be emphasised by project partners.

Given the subjectivities inherent in qualitative analysis, coding for rationalities and factors was carried out iteratively between the co-authors. An initial coding schema, identifying key themes, was developed by the lead author. This framework was discussed and reviewed among the research team to validate the inclusion of initial codes and identify additional codes. Since interviews had been conducted by multiple researchers, including all researchers in this phase of the analysis allowed us to cross-reference interpretations between interviews and projects and thus triangulating reflections (Baxter and Eyles, 1997).

5. Perspectives on user and community engagement

5.1. Who are the 'users' that SLES project stakeholders engage with?

Project partners discussed engaging with both users and community groups (Table 2). The number of actor types they spoke about engaging with as part of specific projects varied considerably, from five (LMEX) up to twelve (ESO, ZCR). The diversity of 'users' engaged with appears not to be determined by project size; ESO is a £11.3M SLES Demonstration project while ZCR is a £1.4M SLES Design project. However, interviews with partners in the latter revealed that engagement was not only considered central to the project, but also constituted a much larger proportion (around a third) of the project budget.

Project partners indicated that direct engagement with users was carried out with businesses, domestic and public sector users of SLES components. Project partners also engaged with users indirectly via landlords, local authorites and fleet managers, reveal how these actors are positioned as proxies or intemediaries of end users.

Similarly, project partners engaged directly with local communities, but often simultaneously targetted a variety of community groups as intermediaries (between projects and communities) for wider engagement. Carrying out engagement through such groups was cited as an important strategy for several project partners, allowing them to access parts of the community more readily than would otherwise be possible. In particular, interviewees cited ready-made networks, trust and expertise in engagement as key resources held by intermediaries. Importantly, these intermediaries included energy-focused groups (e.g. community energy groups), as well as others (e.g. cultural heritage groups), highlighting that it is the ability to use social capital that seems to be important, as well as expertise in engaging people with energy issues. Of course, this raises issues of community groups potentially being co-opted by industry to provide social capital to SLES (Lennon et al., 2019).

A minority of project partners – from both Demonstrator and Design project cohorts - referred to mapping exercises through which relevant users and communities could be identified. While this work typically focused on stakeholders, one Demonstration project reflected on mapping of physical and infrastructural aspects of the local energy system to

identify specific areas for intervention and engagement.[7]

Several project partners raised issues relating to the targeting or non-targeting of specific groups of people. First, several interviewees articulated the need for SLES to benefit everyone within a community, and to engage with as many people as possible. Related to this, engaging only those 'early adopters' who are most able/interested was raised as a challenge, with several participants giving examples of how they have engaged with less engaged users:

> *"We have asked [our community energy partner] not to interview [those who are already] interested … we want to reach out to the ones who aren't doing this, don't understand it, don't want to do it and find out why. What's the reason you've not thought about an electric car. Why do you never get public transport? Why do you get in the car to go around to the shop which is around the corner?"* (Colin, GMLEM)

For a minority, having learning at the core of the SLES projects appeared to shape engagement strategies. One participant for example suggested that targeted engagement was shaped by the need to generate learning in projects, rather than to achieve impact in more cost-effective ways:

> *"I don't, don't think that we've only gone for you know, completely sort of white affluent sort of areas. There are mixed areas, but I think if we purposefully gone and said, let's find the most deprived areas within … then I think we would have learned something different. These are trials. So obviously in the real world you would never go out and prioritize those easy areas first. You should actually be prioritizing … the harder to reach and more challenging [households]"* (Claire, LEO)

5.2. How do project partners engage with users and communities?

Project partners spoke about engaging with users and communities using a variety of practices (Table 3). Again, we see no significant difference between Demonstration and Design projects in terms of the number or diversity of practices articulated by partners. Engagement by Demonstration project partners does however appear to be more balanced between user-oriented practices and community-oriented practices, perhaps reflecting their focus on technology deployment. Design projects meanwhile appear to rely more on community-focused engagement practices, reflecting their emphasis on outlining new SLES configurations. That said, some Design project partners do engage with users beyond information-gathering surveys: Girona and MHEK, for example, are involved in trialling domestic batteries and hydrogen vehicles respectively.

The engagement practices/methods mentioned by project partners cross each of the categories cited by Rowe and Frewer (2005) including one-way communication approaches (e.g. websites, press releases) consultative approaches (e.g. exhibits, webinars and surveys) and more participative methods (e.g. workshops). All projects have some web presence, and most also maintain an active social media presence, used both for information sharing and as forums for discussion around key issues.

Some modes of engagement can be related to engagement audiences. For example, a representative from ZCR reported engaging with the wider community by way of a participative workshop run by a theatre group with whom they had collaborated. Elsewhere, GreenSCIES reported working with local artists to design and exhibit art as a communication medium. These examples also highlight the existence of innovative engagement practices that go beyond traditional modes of knowledge exchange.

We note that while the approaches captured here illustrate a diversity of practices used by project partners, individual practices may

Table 3
Methods of engagement employed by PFER project partners.

		User focus groups	User installs/ trials	User interviews	User surveys	No. of user focused practices	Community exhibit/event	Community surveys	Community webinar	Community workshops	Community social media	Community website/press	No. of community-focused practices
Demo	ESO		●	●	●	3						●	2
	LEO		●	●		2					●	●	5
	ReFLEX	●	●	●	●	4	●		●	●	●	●	5
Design	Girona		●		●	2		●	●		●	●	3
	GMLEM			●		1			●	●	●	●	4
	GreenSCIES					0	●			●	●	●	4
	LMEX				●	1		●	●	●		●	4
	MHEK		●	●	●	3	●			●	●	●	4
	PIRI					0				●	●	●	3
	REMeDY			●	●	2		●		●	●	●	4
	RESO				●	1			●			●	2
	ZCR					0				●	●	●	3
		1	5	6	7		3	4	5	9	10	12	
		Total no. of user-focused methods					Total no. of community-focused methods						

[7] For example, the LEMAP tool (https://project-leo.co.uk/case-studies/local-area-mapping-tool/), developed as part of the LEO project.

Table 4
Scaffold of SLES engagement.

Form and level of participation		Constructed role	Constructed involvement	Modality	Example of practice (user/community focus)	Indicative quote
Citizen power	Citizen control	Leader, member	Ideas. Vision, leadership,	Inclusive, Bottom-up, Collective, Autonomy,	None prevalent within the dataset	None available from the dataset
	Delegated power	Decision-maker, Maker	ownership, create	Experimental	None prevalent within the dataset	None available from the dataset
	Partnership	Co-creator, User designer	Negotiate, Produce, Co-design, co-creation		Beta testing (users) Participatory workshops (community)	*"We had four people driving it for about 20 min each and I think all but one mentioned the car's quite loud and quite noisy and obviously there's nothing we can do really quickly about that, but the engineers we fed that back to the engineering team and now for the next iterations of Rasa betas that they're making, they're working on improving the sound when it's accelerating*" (Susan, MHEK) *"… we have this belief that if you're going to design a [SLES], you should design it with the community rather than for the community … Drawing upon local expertise, local interests, and we're particularly interested in using a Smart Local Energy System as a way of innovative place shaping … It's kind of understanding how people will react to the premise of the [SLES] really and empowering the community to have a say in that in the development."* (Carl, ZCR)
Tokenism	Placation Consultation	Proposer Participant, Tester, Player	Suggest Feedback	Top-down, Civic paternalism, Stewardship, Bound to succeed	Participatory workshops (community)	"*I won't pretend it's full co-design … we can't deliver everything that everybody might want. But this is about co-creating the conditions for transforming the energy in the borough and everyone feeling like they've got some ownership in that if it's not literal, i.e. they've not invested in it, they've got ownership in terms of the fact that they had every possible opportunity to input into the process"* (Chloe, GreenSCIES)
	Information	Recipient	Browse, Consume, Act		Post-installation support (user) Information provision (community)	"*We have a tenant booklet that we give out which is super informative, in easy language and one of the things that our tradesmen and managers and site managers are good at is speaking in layman's terms. And they're really good at not judging because they've heard all of the questions before"* (Alison, ESO) *", we want to raise awareness across the board about, you know the energy challenge, the trilemma … the ability for the energy network to make such a contribution towards carbon zero for everyone"* (Claire, LEO)
Consumerism	Choice	Resident, Consumer, Prosumer			Marketing (user)	*"All [people] want to know about, as I would as the resident, is what does it mean for me. And you know, is it going to inconvenience me? Is it going to benefit me? So we need to be able to get that message across and sell that, and we're working on that at the moment"* (Ed, PIRI)
Non-participation	Therapy	Patient, Learner, User, Produce, Data-point			None prevalent within the dataset	None available from the dataset
	Manipulation		Steered, Nudged, Controlled		None prevalent within the dataset	
Non-engagement	Expert-led	Unwilling/Unable, Inconsequential	n/a	Technocratic, Anti-political	Non-engagement (user & community)	*"Sometimes the best kind of answer would be to allow people to be completely disengaged … can we as an industry, make it so that people need to engage less, but we still achieve the right outcome?"* (Sarah, GMLEM)

also vary in terms of the ways in which they enable or constrain engagement. For example, while the concept of 'workshops' suggests some degree of two-way dialogue or participation between instigators and users or communities, this may take the form of consultation/feedback gathering around a preconceived 'solution', or as forums for bottom-up discussions about energy system change.

6. Rationalities of SLES engagement

Table 4 presents a conceptual scaffolding of engagement as articulated by SLES project partners. This applies the framework developed by Cardullo and Kitchin (2019) to smart local enegy systems and to engagement from the perspective of SLES organisations.

The first four columns of the table (Form and level of participation, Imagined role, Imagined involvement and Modality) echo the structure in the original framework, although in columns two and three we emphasise the constructed natures of user/community roles and their involvement. To this we add two additional columns. Column 5 provides examples of engagement practices, highlighting where these refer to engagement with users or with communities. The final column provides indicative quotes from across the projects, where relevant.

6.1. Citizen power

Since our focus is on engagement in SLES by project partners within a state-led innovation programme - the top rows of Table 4 - in which citizens are in control of change, is not applicable here. However, we do find evidence of some more diluted forms of what Arnstein terms citizen power in the form of partnerships between project partners and users/communities. This framing of publics is that of technology co-creator/designer, emphasising the centrality of users and communities as key stakeholders in SLES projects. For example, the quotes from MHEK and ZCR in Table 4 respectively refer to the value of feedback from people test-driving a hydrogen vehicle, and informing the design of SLES more broadly. Framing publics in this way assumes that people have knowledge, skills, interests and agency of consequence to the success of SLES projects, with engagement approaches that draw out these interests and design energy technologies/systems around them. Given that these approaches are based on the premise that local energy systems should be designed for (and sometimes co-designed *with*) local people, these characterisations are most relevant to projects for whom technological characteristics of SLES are not predetermined. As well as giving users agency in designing SLES systems, user-centric design was positioned by ZCR as useful in helping to hone in on specific technologies around which they could engage.

6.2. Tokenism

A second framing of publics is that of recipients of information, or participants in consultation processes through which limited feedback is sought. Here, SLES projects appear to become more technocratic, rationalising some consultation with publics to 'take them on a journey', but limiting the boundaries of such consultations around preordained issues or technological options. For example, the GreenSCIES quote in Table 4 emphasises the value in helping people feel they have ownership in SLES – even if not in a literal sense.

Related to this is a second framing under Tokenism of people who lack knowledge about energy technologies (i.e. information-deficient lay people (e.g. see Owens & Driffil, 13)). This framing rationalises a need for more or better information provision about SLES projects and associated technologies, exemplified in ESO's reference to accessible information in Table 4. This idea of users presupposes that the problems and solutions of local energy systems defined by expert project stakeholders are objectively 'correct'. This problematizes members of the public as uninformed and potential barriers to change, and presents education and awareness-raising as critical modes of engagement.

6.3. Consumerism

In this context of SLES, consumerism focuses on users. This framing characterises individuals as consumers, with the household as the key site of agency. Such characterisations emphasise self-interest as a key trait of users, who are assumed to be apathetic with regard to system-wide or community benefits. This characterisation is frequently used to justify a customer-focused marketing approach through the products and services emerging out of SLES projects that can be tested and ultimately sold. Here, SLES represent packages of value propositions that need to be articulated in order to answer prospective users' questions relating to self interest, such as the so-called 'WIIFM' (what's in it for me) question.

6.4. Non-engagement

At the foot of Cardullo and Kitchin's original scaffolding we add a new row of particular relevance to SLES: Non-engagement. As the title suggests, this understands users and community members as unwilling or unable to add anything to SLES through their participation, rendering their views inconsequential. In turn, control is held entirely in the hands of project partners as SLES 'experts'. For GMLEM in Table 3, the suggestion is that such non-engagement may be a deliberate strategy to achieve the 'best' outcome, at least as at a system or industry level. We suggest that this represents a technocratic or even antipolitical modality (Sadowski and Levenda, 2020), in which users/communities should not, and need not, be disrupted by decarbonisation. Such views echoes research indicating limits in the appetite for participation in micro-generation adoption or in community energy initiatives (Sauter and Watson, 2007; Hoffman, 2005).

Also of relevance for this framing is one instance in which a local authority partner was used as a proxy for the public, meaning that some public interests are inferred rather than identified. An interview representing this project referred to the "stealthy" consideration of users.

7. Factors shaping user and community engagement across the SLES projects

Stemming from our analysis of engagement practices and rationales, we can identify a number of factors that appear to shape engagement across the SLES projects (Fig. 2). These factors span multiple levels of SLES governance, including both project-specific factors, and factors relating to the state funding programme (PFER) within which SLES

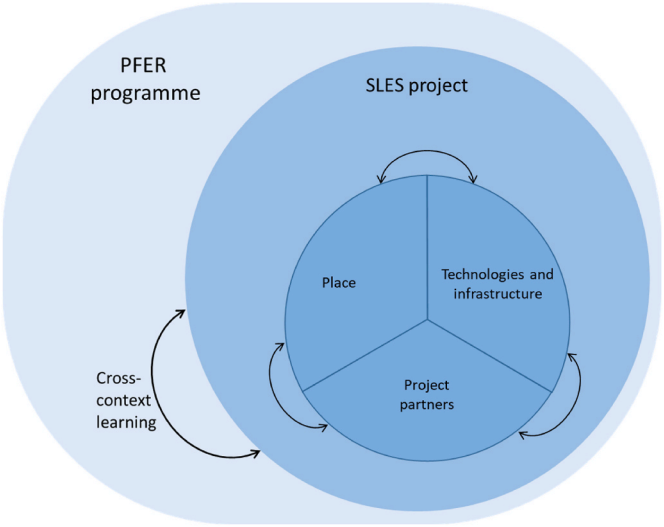


Fig. 2. Factors shaping user and community engagement in SLES projects.

projects are situated.[8]

7.1. SLES projects

Individual SLES projects provide nuclei around which three key components interconnect: specific technological assemblages concerning heat, mobility and elecricity; geographical contexts or places; and partnerships of disparate actors/stakeholders. In turn, SLES are funded by and under the administration of the state-led PFER programme, which in turn occurs within a broader social, political and cultural setting.

Working within project contexts was itself identified as engagement. Projects are geographically-specific and time and resource-limited, meaning that decisions have to be made about how much engagement is possible within project constraints, and how to approach engagement relative to other project objectives.

7.1.1. Place

For the majority of projects, place was identified as a key factor shaping engagement strategies and practices in a number of ways. At the most basic level, this factor is recognition that geographical contexts differ in fundamental ways and that these differences both enable and constrain what forms of SLES are considered feasible in a given place and time. The coincidence of technologies and infrastructures in specific localities shape what kinds of energy challenges (e.g. grid constraints – see ReFLEX) and opportunities (e.g. flexibility – see LEO) are tackled. Similarly, the socioeconomic and demographic characteristics of host communities might determine which target communities are identified (e.g. low income or more affluent households).

Several participants highlighted how the prospect of engaging local communities with SLES was not entirely new, but represented a new phase of local engagement with energy systems. In this way, certain localities are framed by SLES actors/stakeholders as 'energy places':

> "Because of the renewables pedigree within Orkney, and the fact that there has been … a lot of community engagement and promotion around all the renewable stuff that's happening here in Orkney over the last 10 or 20 years, the community are more aware … than other communities are of energy … and also when you live in Orkney, you can't get away from renewables … it's windy all the time" (Lucy, ReFLEX)

> "We are embracing this because people are open and see sustainable energy as a chance to do something … we have always been an energy place" (Carl, ZCR)

Such comments indicate the need for engagement to be sensitive to existing social networks and conversations around energy, but also to the ways in which they might contribute to, challenge or foster the ongoing process of 'place-making' (Pierce et al., 2011; Agnew, 2014).

7.1.2. Technologies and infrastructures

Challenges and opportunities relating to engagement appear to be inextricably linked to technological propositions - or lack thereof - within individual projects. While ostensibly attending to whole-system challenges, most SLES projects are focused on the integration of a small number of concrete technologies, i.e. on discrete sociotechnical assemblages, rather than on whole local energy systems in their entirety. As such, user and community engagement in projects typically focus on engagement with a small number of technologies or assemblages, rather than system issues as such.

For those projects centering on concrete technological offerings, the features of specific technologies span a range of 'affordances' in relation to engagement. Affordance relates to the ways in which technologies are perceived by humans and how the design of technologies can encourage of constrain specific actions (de Feijter and van Vliet, 2021; Norman, 1988). Some technologies (e.g. rooftop solar PV, smart meters), might be regarded by stakeholders as 'fit-and-forget' technologies, necessitating only shallow, short-term engagement with users (Sauter and Watson, 2007). Ground source heat pumps might imply more prolonged period of disruption to households by virtue of the need for drilling, installation and the behavioural shifts needed to use such technologies when complemented with 'smart heating' controls (see Project LEO) – and thus present a different set of challenges and opportunities for engagement. Other large-scale technologies meanwhile (e.g. community-scale batteries (see Project LEO) might require *user engagement* with a commercial actor, alongside *community engagement* with wider publics who are defined by proximity – i.e. those who live close to a given facility.

Engagement is also shaped by the absence (rather than presence) of specific technological propositions. The ZCR project Lead described the project as 'technology agnostic', underpinning a 'user-centric' approach in which engagement is used to identify SLES challenges/technologies on which to focus, rather than predetermining focal points within project partnerships.

7.1.3. Individuals, partners and partnerships

The interests, values and resources of partners within SLES projects are all important in determining the weight given to engagement, the engagement strategies adopted, and the engagement practices that actually take place. Who is involved in SLES projects thus shapes approaches to and outcomes in user and community engagement.

For most projects, engagement represents a discrete aspect of SLES; with ZCR as the only obvious exception, responsibility for engagement is assumed by a single partner, rather than shared across partners or integrated aross multiple work packages. This suggests a tendency to treat engagement activities as independent from technological activities, rather than as a cross-cutting theme.

Engagement is shaped by the organisational cultures and social networks (or lack thereof) of project partners as well as organisational dynamics within partnerships (Hoffman et al., 2013). Across the cohort of projects, stakeholders frequently identify local authorities as the most obvious delivery partner for engagement activities. Project partners, including councils themselves, present such actors as having an explicit focus on, and responsibility for, the interests and concerns of local citizens. This means that councils are positioned within SLES partnerships to balance other partners' commercial focus on customers. They are also seen as being able to provide trusted social networks through which projects can engage people:

> "the council is … unbiased. We are here for our residents … You know, we're not here to serve our stakeholders, we're not here to make money." (Hannah, RESO)

> "the Council obviously are closest to their constituents, what their needs are, what the challenges are" (Natalie, ESO)

However, several participants noted how local authorities are 'stretched' in terms of capacity and resources, making this tendency to rely on a single actor for engagement activities problematic. Moreover, a reliance upon local authorities (or indeed any single actor) to take responsibility for public engagement constitutes a 'governance trap' that ignores the structural and systemic aspects of the public engagement challenge (CCC, 2020; Newell et al., 2015).

There was also an indication that it is the individuals (rather than the partners) working on projects that are important in influencing engagement. The individual leading ZCR, for example, appeared to be instrumental in designing and supporting a project in which engagement was a central feature.

[8] We also note that engagement within PFER projects also has a temporal dimension, which is explored in depth in forthcoming research.

7.2. The programme context

The SLES projects covered in this research are part of the PFER programme, itself a mechanism of government policy aiming to accelerate innvation. Engagement plans and practices appear in part to be shaped by the PFER programme, and the cultures of innovation and engagement it represents. First, several interviewees reflected on an underemphasis on engagement within the programme's administration:

> "I don't think engagement in particular is the big focus, and I think the technology and the milestones is generally the focus" (Maria, REMeDY)

While engagement does feature to a degree in programme-level objectives, the sentiment here was that engagement was carried out in spite of – rather than because of – any particular emphasis on public engagement at the programme level.

Second, the PFER funding calls for Demonstration and Design cohorts required projects to focus specifically on the design and demonstration of SLES business models, to provide *"energy in ways that consumers want"* (Innovate UK, 2018), echoing a relatively narrow framing of people as consumers adopted across UK energy policy more generally (Parrish et al., 2021). While this is reflected in some of the rationalities expressed by project partners, the data presented in Table 4 suggests that project partners are evidently willing and able to go beyond narrow characterisations of people as consumers.

Finally, several partners suggested that although valuable lessons are being generated across the PFER cohort projects - about engagement as well as about how to develop SLES more generally – there could have been more structured opportunities for cross-project learning:

> "We can all read about each other's successes on the Internet, on blogs, on Twitter … everybody's great at saying how fantastic they are [but] we need to learn more from each other with what's gone wrong? What's failing? Where are their problems?" (Colin, GMLEM)

In sum, our interview data suggests that government policy, by way of the goals and focus of the PFER programme, set the tone for public engagement within SLES projects. The absence of any prescription about what engagement should look like created an environment in which partners elected (at one extreme) to creatively engage with people as co-creators of SLES, or (at the other extreme) to seek solutions that actively disengage with publics. Equally, we suggest that the PFER programme could have encouraged – or even mandated - specific framings, targets and methods of public engagement across SLES projects (Grossi and Pianezzi, 2017).

8. Conclusion and policy implications

This paper presents the first comprehensive analysis of how project partners construct public engagement in SLES. We show that project partners engage multiple users and community actors, both directly and indirectly through the use of intermediary organisations. For the most part, decisions about who to engage appears to emerge out of project-specific contexts, although some partners evidently engage in purposive mapping of relevant actors. A variety of user- and community-oriented methods are employed; of the three engagement categories identified by Rowe and Frewer's (Rowe and Frewer, 2000), 'communication' plays an important role across all projects, and while 'consultation' features in some, 'participation' is limited to a small number of projects.

Project partners rationalise engagement practices with reference to specific constructions of user roles and how they might be involved in SLES projects. We find most of the forms identified by Cardullo and Kitchin (2019) present in our analysis of SLES. More inclusive forms of participation (e.g. those characterised by bottom-up organisation of citizens) are however absent, a consequence of the use of intermediaries to drive engagement within SLES. We also identify an additional category of significance to SLES – that of non-engagement – articulated by a logic in which engagement with users or community groups should be actively avoided. Our findings echo those from research on smart cities, in which developments can similarly evolve as technocratic projects in isolation of wider communities, and with limited scope for citizen power (Grossi and Pianezzi, 2017; Cardullo and Kitchin, 2019; Granier and Kudo, 2016).

We find that engagement practices are conditioned by a range of factors including technological and infrastructural boundaries, place, the partners involved, and the wider innovation programme within which SLES projects take place. Project contexts are also significant, as engagement is influenced by the partners, technologies and geographies built into projects.

In relation to the existing literature examining engagement with, for example, specific technologies (e.g. 65,78), our analysis highlights a distinct set of opportunities and challenges for public engagement around SLES developments. First, the SLES projects examined here were directly selected and supported through a central government policy, which provided an opportunity for policymakers to shape engagement. Second, the conceptual breadth of what 'counts' as smart local energy systems (not least which technologies are pursued) gives way to a breadth of engagement logics, practices and rationales. Beyond SLES however, the findings presented here will resonate in instances where a) policies and programmes inform and shape the nature of decentralisation and thus the shape of engagement practices and b) where public engagement occurs within the context of discrete projects, in which partners work towards fixed objectives and with time and resource constraints that constrain engagement.

8.1. Future work

This research focuses on a relatively small number of projects and further analysis of patterns of engagement across future cohorts of SLES projects would be valuable. Public engagement in SLES is contingent upon – among other things – the technological focus of projects, and there are opportunities to examine future projects to systematically map engagement patterns to specific technologies, business models and value propositions, and assess the degree to which specific rationalities for engagement hold significance for specific project types or organisational types.

Work analysing engagement in SLES projects beyond the UK would also be valuable in helping us understand how social, cultural and political contexts condition engagement. There is also a need for longitudinal analysis of engagement to better understand how and why engagement practices and rationales might shift over time. Revisiting the SLES case projects analysed here is one such opportunity.

Our focus on engagement from the perspective of project partners tells only one half of the story, and research is needed to understand partners' engagement practices from the perspective of SLES users and SLES communities, as well as their appetite, agency and capacity for participation more broadly. Such work could also attend to the potential gaps between engagement rhetorics and praxis in projects, and how citizens' expectations around engagement are established and realised.

8.2. Policy implications

SLES projects can be understood as key elements of a place-based managed energy transition, in which project partners are granted considerable agency and capacity to design and deliver local energy transitions, and generate system-wide learning around decarbonisation and decentralisation. If SLES projects are to remain important in this wider context, policymakers will need to reflect on what the increasing importance of public engagement means for the design and implementation of future SLES policies and programmes.

First, there is a risk that future SLES projects miss opportunities for public engagement. SLES projects are by definition centres of

experimentation, and as such may be expected to vary in terms of how they approach energy challenges. However, normative and substantive rationales for engagement (Rowe and Frewer, 2005; Arnstein, 1969; Cardullo and Kitchin, 2019) suggest that public engagement could be regarded as a key objective in its own right within SLES projects. In this context, future SLES programmes could do much more to manage and prescribe engagement within and across SLES projects. Examples include: establishing engagement as a key project objective on a par with technological or economic objectives, going beyond 'customer' framings of SLES users to encompass citizens and communities, and ensuring that sufficient resources are built into project budgets for the design and implementation of two-way, participatory engagement practices.

In addition, to avoid a governance trap around responsibilities for engagement, programmes could require that engagement is embedded across rather than held within single work packages. Including specific actors (e.g. local authorities, community groups) as project partners with overall responsibility for engagement could make use of pre-existing social capital, but such steps could reinforce existing capacity challenges and appear as manipulation if sufficient resources are not mobilised for engagement delivery.

How projects respond to place-specific challenges around engagement is also important. Future SLES projects could be encouraged to acknowledge and respond to local and historical contexts and consider in SLES proposals how such contexts might inform, enable and challenge engagement in SLES projects. Stakeholder mapping can be useful to help identify key actors and guide modes of engagement, and could be used to help project partners build strong local networks and avoid reliance on unhelpful user and community stereotypes. This could ensure that occasional examples of good practice become routine in future programmes.

More clarity is needed around the relationship between SLES projects and the broader policy and societal contexts in which these projects sit. For example, the emphasis within some projects on 'non-engagement' needs to be understood within the context of broader debates on the inclusion or neglect of publics in wider system change. By taking a more pluralist approach to engagement and joining SLES up to wider environmental challenges and policy goals, programmes can more clearly articulate how user and community engagement in SLES projects can be coordinated with public engagement in climate change and net zero more broadly.

Finally, SLES projects represent important centres of innovation, and we argue that experimentation and learning in user and community engagement are important yet often overlooked aspects of wider SLES innovation. Whilst not ignoring tried and tested methods, future programmes could be designed in a way that encourages innovation in engagement practices within projects. More could be done to establish a culture, and provide a supportive infrastructure, in which social learning about what forms of engagement 'work' or doesn't work, in what contexts, can more easily be shared between projects.

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CRediT authorship contribution statement

Iain Soutar: Formal analysis, Methodology, Writing – original draft, Writing – review & editing. **Patrick Devine-Wright:** Supervision, Conceptualization, Funding acquisition, Methodology, Data curation, Formal analysis, Project administration, Writing – review & editing. **Melanie Rohse:** Formal analysis, Data curation, Supervision, Writing – review & editing. **Luke Gooding:** Formal analysis, Data curation. **Chad Walker:** Formal analysis, Data curation, Writing – review & editing. **Hannah Devine-Wright:** Formal analysis, Data curation, Writing – review & editing. **Imogen Kay:** Formal analysis, Data curation.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

The data that has been used is confidential.

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