BRIEFING

EnergyREV

Local conditions associated with local energy system projects

Theodoros Arvanitopoulos & Charlie Wilson | May 2021

Where might local energy system (LES) projects flourish?

The local energy landscape has shifted over the past decade towards more integrated or system-oriented projects. Compared to community energy projects with feed-in tariff backed renewable generation, local energy system (LES) type projects typically involve both demand and supply technologies, multiple energy vectors, a range of public and private actors, and different value streams including flexibility and balancing services. The Prospering from the Energy Revolution programme further emphasises smart local energy system (SLES) projects that include smart controls, smart networks, and digitally-enabled coordination of distributed storage and demand-side resources. SLES demonstrator and design projects are underway to explore what works in terms of business models, technological configurations, and institutional partnerships. But where might such projects occur? Which areas have the most favourable conditions for LES (or SLES) projects to flourish? We answered this question by looking at the local conditions associated with LES projects implemented over the past decade in Great Britain.

How did we analyse historical data on where LES projects have been implemented?

We used a dataset of 146 LES-type projects that began during the period 2010-2020. All these projects were at least partly supported by public funding programmes for being commercial demonstrators. All had at least some system characteristics.

First, we mapped where these projects had occurred and how this spatial distribution had changed over time. For this, we used the 380 local authorities in England, Scotland and Wales as our spatial unit of analysis. One out of five local authorities has at least one LES project. Figure 1 maps them out over two time periods: on the left, before 2016, and on the right, all projects to 2020. Second, we collected spatially-explicit data on a wide range of energy, social, economic, institutional and geographic conditions, all of which could potentially be related to LES projects. Third, we used econometric techniques to test which of these conditions has historically been associated with LES projects at the local authority level. We also tested for spatial clustering to see if LES projects have tended to clump together, evidencing local spillovers (transfer of benefits from one actor, sector, industry to another).

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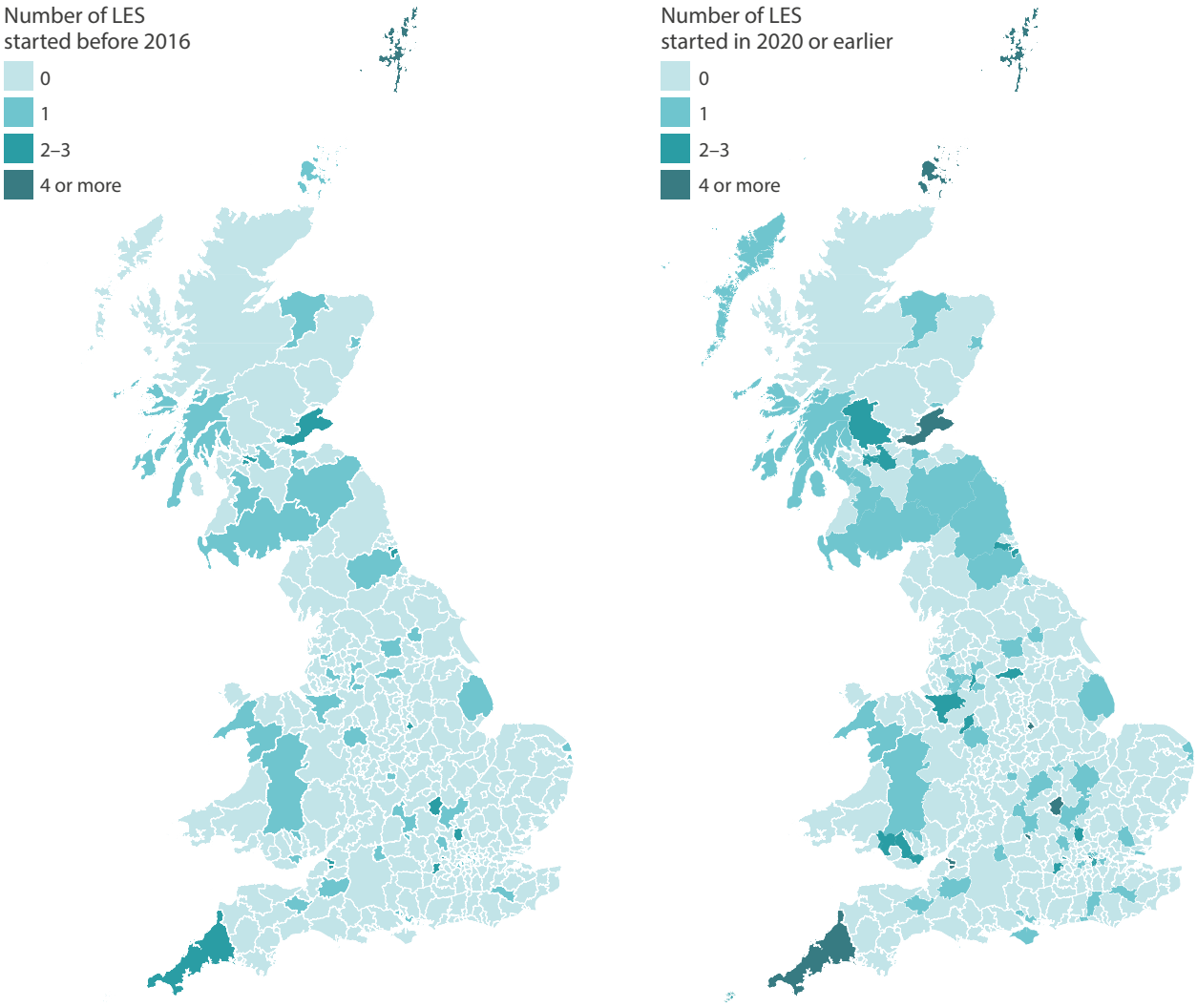

Figure 1: Spatial distribution of LES projects at the local authority level.
Notes: 14 local authorities have more than two LES projects: Nottingham, Bristol, Oxford, Newcastle under-under-Lyme, Glasgow, Milton Keynes, Cornwall, Scilly islands, Orkneys, Shetlands, St Albans, Westminster, Fife, Rhondda Cynon Taf. Out of these, Nottingham, Bristol, Cornwall, Oxford, Westminster, Fife, Orkneys and Shetlands have 4 or more LES projects.

Finally, we investigated the distinction between '**threshold conditions**' (0 and 1 LES) associated with local areas having one rather than no LES projects, and '**intensity conditions**' (1 to 7 LES) associated with local areas having many projects (see Table 1).

Which local conditions are associated with LES projects historically?

Our analysis revealed a variety of local conditions that are associated with LES projects. First, we found LES projects are associated with local areas that have **more** existing renewable power generation, less major power producers, and **less** access to gas grids. These are all indicators of potential electricity network balancing constraints for which LES projects may offer a solution.

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Second, we found LES projects are associated with local areas that have **more** EV charging infrastructure and are **more** likely to have energy and climate action plans. These are both measures of local strategic investment and planning around low-carbon goals that create enabling conditions for LES projects. Third, we found LES projects are associated with local areas that have **more** economic activity in information and communication technologies. This is an indicator of local knowledge and skills as enablers of LES project implementation. Fourth, we found LES projects are associated with local areas that have **less** efficient building stock, **less** targeted investments in fuel poor households, and **more** home energy audits in owner-occupied households. Improving the efficiency of the building stock can be an important element of LES projects as it both reduce demands on supply networks while reducing carbon emissions. But our analysis shows that LES projects historically have not been specifically associated with areas with high levels of activity to address fuel poverty.

The '**threshold conditions**' column in Table 1 identifies which of these local conditions help explain why some local authority areas pass the 'threshold' from zero to at least one LES project: EV charging, limited access to gas, older dwellings, and economic activity in the technology sector. Dwellings off the gas grid and older (more inefficient) dwellings create more demands on power networks to which LES is a possible response. Conversely tech sector activity and EV charging infrastructure (as an indicator of strategic investment) in local authority areas facilitate LES projects.

The '**intensity conditions**' column in Table 1 then explains which local conditions help explain why some local authority areas have several LES projects: renewable power generation, university towns, and home energy audits, but not fuel poverty investments. More intermittent renewables strengthens the need for local flexibility and balancing solutions. More energy efficiency activity among homeowners is consistent with demand-side energy improvements in LES. University towns have a similar function to tech sector activity. They create a skills base and knowledge capacity relevant to LES.

Repeated involvement of university and private sector partners in areas with multiple projects indicates accumulated local expertise. Overall, our analysis provides a rounded picture of the local conditions that both **enable** LES projects - like strategic planning and investment in decarbonisation - and local conditions that **create needs** for LES projects - like constraints on electricity network balancing, or an inefficient building stock.

What are the implications for national and local policy for supporting LES projects?

LES projects are an important part of the changing energy landscape on the pathway to net-zero emissions. By definition, LES projects are rooted in specific local contexts, so we are careful not to draw one-size-fits-all implications. However our analysis of historical evidence points to several general approaches for national and local policymakers to support future LES projects. First, locally available skills and knowledge resources matter. Policymakers can support knowledge exchange, capacity building, training and educational programmes, and local business activity in the energy and technology sectors. Second, strategic direction matters. Policymakers can support planning, roadmap development, infrastructure investment, and multi-actor collaborations in pursuit of local energy solutions. Third, living conditions matter. Policymakers can support widespread efficiency improvements to the building stock, particularly in older homes and homes off the gas grid, to alleviate peak demands and balancing constraints as locally-available renewable generation continues to expand. Finally, LES projects could enable levelling up of disadvantaged local areas. National policies targeting disadvantaged areas can support a more equitable distribution of LES projects by providing the appropriate financial and regulatory incentives to energy and technology businesses and enabling entrepreneurs.

Table 1: Our results: local threshold conditions and intensity conditions associated with LES projects historically

			Spatial variation in LES projects	
	Dependent variable		**Threshold conditions**	**Intensity conditions**
	LES projects per local authority (LA) in GB	Count	0–1	1–7
	Independent variables			
Energy	Renewable energy (RE) projects	Count		+
	Electric vehicle (EV) charging infrastructure	Count	+	+
	Off gas grid	%	+	
Local economy	Tech businesses	Count	+	
	University towns	%		+
Socio-economic	Average household income	£	–	–
Housing	New building stock	%	–	
	Efficiency improvement in fuel poor households	%		–
	Home energy audits	%		+
	Number of LAs with LES => 1		78	78
	Cumulative number of LES		78	139
	Number of LAs		380	78

Notes: Orange colours indicate statistical significance: dark = strong significance, light = weak. Signs indicate whether the association with LES projects is positive (+) or negative (-).

Authors

- Theodoros Arvanitopoulos | Tyndall Centre, UEA
- Charlie Wilson | Tyndall Centre, UEA

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About EnergyREV

EnergyREV was established in 2018 (December) under the UK's Industrial Strategy Challenge Fund Prospering from the Energy Revolution programme. It brings together a team of over 50 people across 22 UK universities to help drive forward research and innovation in Smart Local Energy Systems.

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@EnergyREV_UK info@energyrev.org.uk