

Describing a local energy business sector in the United Kingdom

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Highlights

- Describing or characterising the current state of UK local energy businesses is a first step towards assessing the sustainability benefits of decentralised, integrated energy systems, including their decarbonisation potential. It is key to understanding the current condition and shape of the sector, as well as supporting future innovations for a more decentralised, clean, affordable, resilient, and democratic UK energy system.
- A local energy sector characterisation needs to consider not only how 'local', but also how 'smart' such businesses are, with digitalisation a key factor.
- We have taken a first step with the development of a qualitative scale that covers 4 levels of localism and 5 levels of smartness.
- There are more local businesses than there are smart. In our sample of 699 businesses, 184 showed the highest level of localism. Only 21 have reached Level 2 of 5 when it comes to smartness.
- Private, public, and community-oriented sectors are integral to developing more local and smarter energy businesses.
- Transition is happening slowly towards a more local but also smarter energy business sector, with diverse energy businesses addressing decarbonisation, decentralisation, digitalisation, and democratisation.

Summary

More localised energy businesses are developing in the UK, albeit slowly. Insight into the sector and its future potential requires both a clearer picture of its current structure and composition, and some shared definition criteria. Estimating how 'local' and 'smart' businesses are now can help support sustainable growth of a more local, and even smarter energy sector.

To further characterise the sector, we devised a qualitative scale to map UK local energy businesses, from a database of 699 companies, according to estimates of their localism and smartness.

Local energy businesses comprise a mix of public, private, and third-sector actors. Revenue sources include, among others:

- sales of electricity and gas to the grid;
- (on-site) heat and power services;
- Feed-in-Tariffs;
- biofertiliser production and
- food and general waste management.

We found mixed levels of localism, with 184 showing the highest level of localism and 237 showing the lowest.

The situation was different when it came to smartness. Only 21 businesses showed Level 2 of smartness, the highest attained of 5 possible levels. But there are signs of innovation in the way businesses address decarbonisation, decentralisation, digitalisation, and democratisation.









These include businesses with a wider supply chain coverage, such as waste-to-energy projects, (on-site) heat and power services, or biodigestors which collect and treat their "raw material". Spin-off businesses, such as biodigestors which produce biofertilisers or a pumped storage plant that also runs as a tourist attraction are other examples.

Based on estimates of how 'local', and 'smart', these businesses are, we characterise a small, but diverse, sector. Many new entrants include farmers, universities, community groups, trusts and foundations, and municipalities. Based on their average assets, almost half of the companies included in our sample are small.

There is significant scope for developing the sector through pathways to more locally-embedded, smarter energy businesses capable of accelerating decarbonisation. These include:

- real-time management of energy use;
- customised engagement using machine learning;
- new ownership and decision-making structures and
- more innovative corporate structures and integrated energy services, combined with new financial instruments.

It would also be useful to further develop the criteria we have suggested for establishing the degrees and forms of localism and also smartness. Such criteria should help formulate more coordinated policies and measures to promote sustainable growth of the sector. One option is a sectoral survey building on our methodological approach, including more quantitative elements, such as an online or telephone survey to examine main business characteristics and aspects of localism and smartness in more detail, with effective participation of a representative sample of local energy businesses.







Why characterise a local energy business sector in the UK?

Decentralised energy integrated at the local scale is one option for responding to the environmental and climate crisis. Its potential to help decarbonise energy systems and reduce overall transition costs is catching the attention of policymakers, businesses, and researchers. Market liberalisation has, to some extent, facilitated the entry of some local actors and development of technologies, businesses, and institutions. Local energy businesses may offer a route to increased diversity and competitiveness.¹

There is currently no definitive characterisation of a UK local energy business sector. But creating such a characterisation is key to understanding its current condition and shape, as well as supporting future innovations for a more decentralised, clean, affordable, resilient, and democratic UK energy system.

Key factors: localism and smartness

Characterising a local energy business sector is not straightforward. The term 'local', in the context of energy systems, has various meanings. These can include:

- · community or local ownership stakes;
- geographical scope;
- · legal or regulatory guidelines;
- resource proximity and
- forms of service provision.

Similarly, digitalisation is expected to play a key role in decarbonising energy, with opportunities for more decentralised businesses. Any characterisation of the sector should consider how 'smart' local energy businesses are.

To characterise a UK local energy business sector, we use the following constituent elements of localism and smartness (Ford et al., 2019).



Localism

- Relationships with local stakeholders
- Local involvement in decision-making
- At least some local ownership of assets



Smartness

- Use of real-time information and communication technologies
- Automation of business operation and systems regulation
- Use of machine learning, artificial intelligence to inform decision-making and engage with people

Figure 1: Localism and smartness constituent elements

A qualitative scale

We developed a qualitative scale using these elements and used it to map UK local energy businesses, in a database of 699 companies, in order to further characterise the sector (Fuentes González et al., 2020).

The scale includes the following levels:

For Localism:

Level 0 – Stand-alone: No identifiable links or involvement with the community and/or other local stakeholders.

Level 1 – Participation: participation in specific initiatives with communities and/or stakeholders. This localism is defined as:

- participation in a project;
- decision-making or
- asset ownership.

1 The OFGEM's <u>State of the Market 2019</u> report reveals that in June 2019, the Herfindahl-Hirschman Index (HHI) was down to 1224 in gas and to 987 in electricity. A HHI-Index below 1000 suggests that a market is unconcentrated.









At this level, the above points are diffused, isolated, not clear, or not part of formal goals. Only one element (out of the three) is usually present.

Level 2 – Involvement: a degree of involvement with communities and/or stakeholders through participation in projects, decision-making or asset ownership. Two elements (out of the three) are present.

Level 3 – Engagement: deeper engagement with communities and/or stakeholders through participation in projects, decision-making and asset ownership. All three elements of localism are present.

For Smartness:

Level 0 – Minimum: The level of information and communication technologies is minimum or under development. Data are not gathered and used in real-time.

Level 1 – Baseline: The level of information and communication technologies allows the use of data in real or near real time for business decision-making.

Level 2 – Improved: In addition to basic information and communication technologies, the business can respond by automatically or semi-automatically optimising service provision.

Level 3 – Advanced: In addition to real time data, and automated adjustment of operations, the business is able to use data to engage users in decision-making, planning and/or governance.

Level 4 – Smart: The business is capable of collecting and using data in real time, automatically optimising services and engaging users, by having some degree of embedded machine learning or artificial intelligence.

CASE STUDY:

The electric mountain

First Hydro Company www.fhc.co.uk

A privately-owned large pumped storage initiative.

First Hydro Company places high priority on its role as a patron for a wide range of initiatives that benefit local communities, education, sport, the arts and the environment... It is (also) committed to a major renovation of the Electric Mountain Visitor Centre (EMVC) to create a modern, appealing visitor attraction with facilities better suited to the needs of users... First Hydro also assist many groups, clubs and staff through their Electric Mountain Visitor Centre by awarding sets of family tickets, in order to assist in the raising of funds for particular causes."

Assessed with **Level 2** of localism and **Level 2** of smartness.

An empirical snapshot of UK local energy businesses

To characterise the sector, we developed a database with details of 699 energy companies, including financial, legal, and commercial information collected from different sources.

Company ownership

As shown in Figure 2, most businesses included in our database are privately-owned commercial enterprises. A proportion are also third-sector organisations, universities, local authorities and community interest companies (CIC) – a type of limited company conceived to benefit communities.

Most of these companies have no, or just one, subsidiary, as shown in Figure 3. Energy services constitute the "core business" in more than 90% of companies. Circa 9% of this group have a dual classification, either core business/investment vehicle or core business/holding.















Figure 3: Companies' subsidiaries (N=699)

Some companies may be part of either a more complex corporate structure of related companies or joint ventures with other non-related companies with a shared interest in specific energy projects.

Company size

Based on <u>UK Companies House accounts guidance</u>, we assessed the size of each company, taking into account their average assets. Almost 80% have average assets of between £316,000 and £18 million. This means that 48% of businesses in our sample can be categorised as "small" and 29% as "medium". The remaining 14% consists of "large" companies, with average assets greater than £18 million, and "micro" entities, with average assets up to £316,000. This is detailed in Figure 4.

48%	29%	14%
Greater than £316,000 and up to £5.1 million	Greater than £5.1 and up to £18 million	Greater than £18 million
	Up to £316,000	9 %





Figure 5: Companies' number of revenue sources and Feed-In-Tariff disclosure (N=699)







Company revenue sources

Most of the businesses – 421 out of 699 – have one revenue source. Of these, 276 sell electricity to the grid² using renewable technologies such as solar PV, onshore wind, hydro and biogas. This is shown in Figure 5, above.

The remainder – 135 out of 421 businesses – are mainly geared to:

- gain on investments³ (67);
- heat and power services (27);
- power purchase agreements (PPA) (18);
- district heating (8);
- retail supply of electricity (6);
- retail supply of gas and electricity (4);
- benefits management (3);
- and enhanced frequency response services (2).

Some 27% – 188 out of 699 businesses – have two or more revenue sources. In addition to selling electricity to the grid, 154 of 188 of these businesses mainly derive revenues from the following:

- renewable obligation certificates (ROC);
- PPA;
- heat and power services;
- production of bio-fertiliser;
- gain on investments;
- food waste management and
- general waste management.

Around 13% (90 out of 699) declare receipt of Feedin-Tariffs (FiT); 49 of these have two revenue sources, while 31 have three. Primary additional revenue sources, apart from the FiT, are:

- the sale of gas or electricity to the grid;
- PPAs;
- gain on investments;
- production of biofertiliser;
- heat and power services and,
- renewable heat incentive benefit (RHI).

Energy sources

The prevailing energy sources/technologies across businesses are onshore wind and solar PV, which jointly contribute over 2,000 MW and 1,000 MW of installed capacity, respectively, to our sample. They are followed by projects that use biogas, hydro, and combined heat and power sources/technologies. Biogas and hydro individually involve circa 70 companies with an installed capacity below 500 MW. Combined heat and power sources/technologies involve around 50 businesses with a combined installed capacity over 500 MW.

Other groups can be clustered into those involved with energy sources/technologies in larger projects (pumped storage and offshore wind), and those which tend to offer a smaller installed capacity due to siting, technical limitations, fuel availability, etc.



Figure 6: Estimated installed capacity by source/ technology and related number of companies (N=606)

- 2 In the case of no explicit information about the energy company's revenue sources, it is assumed that, given the company's nature and purpose, its main revenue source is the production and sale of electricity to the grid (which may be either connected or not to the trunk transmission system).
- 3 This is not limited to investments in financial instruments, but includes investments in energy businesses as well.









Benefits

Providing benefits for the wider community or locality is one of the main aspects of local energy businesses. But finding information on direct benefits for communities was only possible for 37% of businesses included in our database. These mostly comprised community funds.

But, in essence, "localism" implies other concepts beyond community funds. For example, a local farmer involved in energy provision may not declare direct benefits for communities, even though she might provide local employment, income for surrounding farms that may supply feedstock for energy production, and carbon reduction.



Figure 7: Companies from whom information on (direct) benefits for communities was available (N=699)

CASE STUDY:

An Independent Hydropower Project Developer, Owner and Operator

Green Highland www.greenhighland.co.uk/our-story/

Group of hydro energy projects included in our database with an average installed capacity of 1 MW.

We have been developing run-of-river hydro schemes since 2007, identifying potential and implementing innovative development strategies in order to progress projects through every step of the development cycle. We work with landowners, government agencies, utility companies, communities, and multinational businesses to provide bespoke, turnkey solutions to deliver hydropower potential. We have extensive in-house capability covering planning, development, and funding, as well as civil, mechanical, and electrical engineering. We have grown to become the largest independent hydro developer in the UK."

Assessed with **Level 1** of localism and **Level 1** of smartness.

Where businesses locate on the scale

Based on our qualitative scale for smartness, we rated most businesses as **Level 1 – Baseline smartness** (678 businesses). Only 21 businesses have a rating **Level 2 – Improved**, mainly related to storage initiatives, enabling optimised service.

There is a more differentiated landscape for localism, as 223 businesses are rated **Level 1 – Participation**; 273 businesses **Level 2 – Involvement**; and 182 businesses **Level 3 – Engagement**. We represent the interactions between localism and smartness using a matrix:







Figure 8: Smart and local energy matrix

Local Energy Systems matrix categorisation

Localism (1) & Smartness (1): This group of privately owned businesses comprises:

- small/medium-scale projects owned by investment funds;
- energy businesses with limited evidence of direct benefits to communities, despite collaborations, relations with local authorities;
- energy projects which provide benefits through waste management and recycling, local employment, educational facilities or reduced tariffs.

They are likely to collect and use data in – or close to – real-time.

Localism (2) & Smartness (1): This group comprises companies providing monetary and/or non-monetary benefits to communities.

It includes:

 entities with third-sector organisations or local authorities involved in some decision-making or management aspects;

- small/medium "not-for-dividend" companies funded by eco-bonds; investment funds which invest in community-scale energy (sometimes involving benefits for communities);
- organisations working on local energy provision through partnerships with local authorities, property developers, residents or local companies (sometimes involving benefits for communities);
- local energy producers (e.g. farmers, landowners, other companies), some of whom provide benefits for communities.

Their level of smartness is limited. All these businesses are privately-owned.

Localism (3) & Smartness (1): This group comprises mainly trusts, foundations, or community groups. It also includes universities and local authorities, community interest companies, private cooperatives, and organisations that share ownership or benefits with community groups. Their level of smartness is limited.







CASE STUDY:

Proud to provide a service to the community that also assists in the reduction of fuel poverty and decarbonisation of Scotland

Shetland Heat Energy & Power Ltd www.sheap-ltd.co.uk

A trusted-owned waste-to-energy/storage initiative

We use hot water created from un-recyclable waste to heat approximately 1230 domestic properties and commercial and public buildings around Lerwick including schools, care homes, the leisure centre and the Gilbert Bain Hospital... In 2006 a hot water storage tank was installed to store excess heat during off-peak periods and provide heat during peak loads.

Assessed with **Level 3** of localism and **Level 2** of smartness.

Transition matrix categorisation

Localism (1) & Smartness (2): This group comprises small/medium-scale storage assets owned by investment funds. Businesses are smart enough to adjust operations to optimise service provision.

Localism (2) & Smartness (2): This group comprises privately-owned storage assets that provide monetary or non-monetary benefits for communities, or work with local authorities through partnerships. They are smart enough to adjust operations to optimise service provision.

Localism (3) & Smartness (2): This group comprises entities owned by trusts, foundations or community groups involved in storage initiatives. They are smart enough to adjust operations to optimise service provision.

Conclusions

A transition is happening

This characterisation indicates a UK local energy business sector consisting of diverse projects and organisations. It suggests "a forthcoming wave" of local, smarter UK energy businesses, encompassing a rich mix of organisations. New, less-experienced entrants are involved, such as universities, third-sector organisations, and local authorities, which address elements of digitalisation, consumer engagement, prosumerism, and supply chain innovation. More established private sector businesses are also playing a role, but even in the commercial sector, there are new actors, alongside large-scale utility companies.

Further research is needed to provide insights into the slow introduction of new actors and projects which could accelerate decentralisation where this provides local, environmental, economic, and welfare benefits.

Opportunities

The sector provides evidence of innovation, entrepreneurial activities, and value creation. Opportunities relate not only to new energy vectors such as bioenergy or waste-to-energy, which cover a wider section of the supply chain and have more than one revenue source, but also to local integration of heat, power, storage, and mobility services. Businesses in our database, for example, include:

- 3 aggregators;
- a carbon dioxide producer;
- a hydrogen storage operation;
- a microgrid operation;
- an electricity supply for EVs;
- a water supply and even
- a tourism service.









The main business is the more established solar PV and onshore wind, and most have not yet integrated digital or 'smart' systems. Concerning localism, there is potential for more innovative ties with stakeholders, the wider community or locality in addition to direct monetary benefits.

The state-of-art localism and smartness revealed in our matrix indicates that some businesses are closer to a local integrated/cross-vector systems model of the kind envisaged by the <u>PFER Challenge</u> <u>programme</u> than others. For example, projects using bioenergy sources, namely feedstock or waste, are more integrated across the supply chain, which implies the participation of farmers, transport providers, and "spin-off" products or services like carbon dioxide or biofertilisers, among others. There is considerable scope to make current local energy businesses into more integrated/cross-vector systems.

New forms of ownership

Public funding remains significant; businesses declaring FiT, and/or RHI income are mostly small or medium companies (86%), and almost half are non-private. But this is also changing. New forms of ownership and/or decision-making, involving localities or communities, as well as more innovative benefit schemes (beyond money) can strengthen localism. Effective real-time energy services management and adjustment, and real time engagement with customers, using artificial intelligence or machine learning, can improve smartness.

There are also more general measures that may facilitate an improvement in both localism and smartness, such as more innovative corporate structures or new financial instruments, capable of providing and channelling more resources. A sectoral survey of local energy businesses using the matrix and scale/ratings described above, for example, would be useful to add to the estimates revealed in this document. Such a sectoral activity would help strengthen the work revealed in this document, as well as involve local energy businesses in the consolidation of their sector and its definition and characteristics. The above may also lead to further collaborations across businesses, more focused and effective public policies on local (and smart) energy businesses, innovation at a sectoral level, etc.

CASE STUDY:

Appointed to deliver and operate a low carbon community energy scheme to new homes

H2010 ESCO LIMITED

www.vitalenergi.co.uk/casestudies/h2010leeds/#casestudy-overview

A combined heat and power scheme

One of the most remarkable achievements of the project was the efficiency that the Combined Heat and Power scheme evolved from concept to contract, with Vital Energi taking less than nine months to start on site. Vital Energi's contribution to creating a CHP energy source for the residents of H2010 will allow them to benefit from lower heating bills and have hot water and heating permanently available through an environmentally and economically viable solution.

Assessed with **Level 2** of localism and **Level 1** of smartness.









Policy recommendations

- 1. Further develop criteria for establishing a local energy business sector. Such criteria should help formulate more coordinated policies, and measures to promote sustainable growth of the sector.
 - Option: A sectoral survey building on our methodological approach, including more quantitative elements, such as an online or telephone survey to examine main business characteristics and aspects of localism and smartness in more detail, with effective participation of a representative sample of local energy businesses.
- 2. Establish policy support for investment in local energy businesses that provide innovative clean energy services.
 - Option: Specific tax exemptions or benefits for investors willing to devote money to local (and smart) energy projects that aim to benefit localities or communities via employment, community funds, local integrated/cross-vector energy services, decarbonisation of a specific area, etc.
- 3. Consider a unified financial, business disclosure regime to support transparency, informed policy and effective development of the sector.
- 4. Devise policy to support integrated smart, local systems with a local stake in clean energy.
 - **Option**: Map areas linked to potential integrated smart, local energy initiatives, which can be further developed in roadshows with investors, local authorities, community groups, financiers, etc.

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About EnergyREV

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