Digital Society

Digital energy services: climbing the Innovation Ladder

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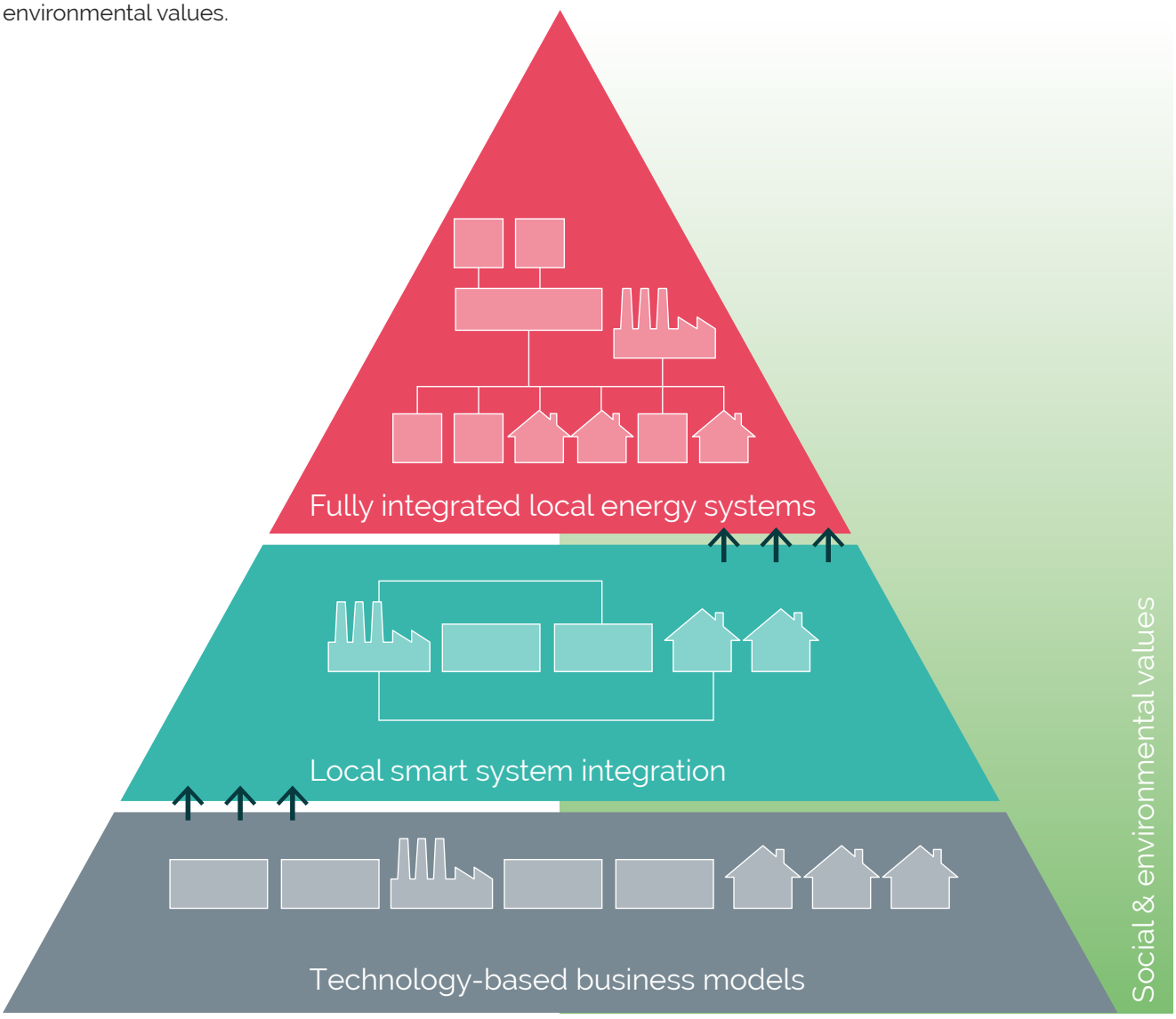
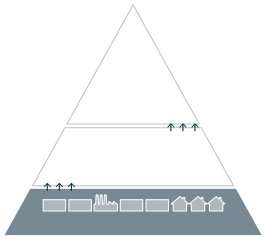
This brief is designed to aid development of innovative business models for energy services using digital technology.

The focus of the brief is on the delivery of energy services, such as heating and cooling. Energy services can provide benefits to the environment, society (social benefits), customers and the energy system as a whole. However, we find that more innovative energy services do not necessarily lead to better or more social and environmental values.



Ladder of Innovation

Digital energy services business models in the UK can be grouped into three broad categories of innovations, these build upon each other to create a Ladder of Innovation:

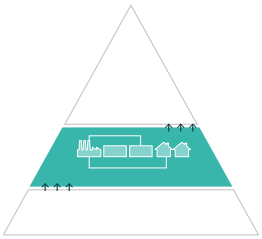


Technology-based

Business models at this level are usually built on use of a specific technology, such as solar PV, smart meters, storage etc. These business models are often tried and tested methods.

Technology-based business models are widely used by local energy groups, local authorities and businesses, and can be developed around individual buildings, such as social housing and schools.

Social (e.g. better access to energy and affordability) and environmental values are a driving force and are well embedded in the business models.

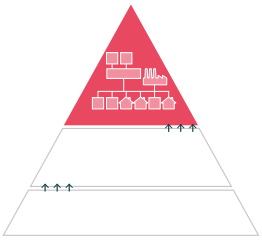


Local Smart System Integration

Business models at this level offer tailored innovations around connection, integration and aggregation through new digital platforms such as Smart City platforms, and customer-focused innovations, such as smart local generation tariffs.

This work is led by local authorities, energy NGOs and intermediaries such as Regen and Distribution Network Operators (DNOs).

Social and environmental issues are considered, but are on the periphery of the business model or limited to specific segments of the integrated whole. Providing evidence of the benefits to environmental values at this level of innovation becomes difficult.



Fully Integrated Local Energy System

This level features innovations built on large-scale social, economic and digital integration through new digital platforms and market mechanisms, such as flexibility auctions to deliver a more secure grid system and allow more direct interactions with the grid in real-time. Such business models can be local but involve horizontal and vertical integration with local energy systems and the national grid.

Innovations include exploring the role of energy aggregators in managing the energy consumption of specific groups of users, creating a system focused on local energy and economic needs, and investing in the built environment to create local value through retrofits or solar PV, for example.

Currently, social values focus on providing access to the energy market and built environment investment. Environmental values are well represented through investment in the built environment (which resemble individual technology-based business models), but less so with more system-focused innovations, e.g. market rules, flexibility services and aggregation.

Climbing the ladder

Generally, the higher up the business models are in the Innovation Ladder, the more value they create for the energy system but with fewer benefits for users. These differences are described as the value gap: this widens as the complexity of the business models increases. So far, digital energy services have not managed to scale-up the social and environmental benefits gained at the lowest rung of the Ladder to more complex business innovations. This points to a need for local authorities and other social institutions input on the users' perspectives, accessibility and affordability, and climate change. Innovative business models for digital energy services at all levels are needed to provide a balanced set of economic, social and environmental benefits to users and the energy system, and to build the necessary capacity for higher rung innovations.

Innovation in digital technology alone is not enough to step up to the next level. Climbing the ladder to Local Smart System Integration involves innovative partnerships, as well as aggregation and integration platforms. Stepping up to the next level requires building extensive linkages and partnerships with a broad range of energy customers, users and generators, and across different smart platforms.

Certain innovation models can help develop the technology experience and partnerships needed to step up to the next level. Business models that bring together different types of users and heat and electricity vectors, such as smart heat networks could be a good way for local energy actors to build expertise and move to the next level on the Innovation Ladder.

Smart heat business models

Smart heat ventures use technologies such as smart meters to provide heat to residential, public and industrial properties together. They are largely led by community energy organisations, local authorities or Energy Service Companies (ESCos). Such business models can increase the number of installations (e.g. ground source heat pumps and storage) and create demand for local smart heat tariffs, becoming a useful stepping stone on the innovation ladder. As these models become more established, they can create opportunities for more complex social and digital integration through local smart system integration business models – the next rung of the ladder.

Multi-vector business models

Increased interaction between energy vectors – electricity, heat and transport – helps to create new services to develop a more dynamic and flexible low carbon energy system.

Integration is built around the overarching business model, and includes building blocks to the Fully Integrated Local Energy System business model. This includes adopting a holistic, whole cost-of-living approach to energy use across services, as well as public-private partnerships at a local and regional level to enhance delivery capacity.

Currently, local authorities are best placed to bring the two elements together, as they have the power to broker partnerships and allocate roles and responsibilities.

C R E D S

Regulatory environment

- Innovation initiatives such as Ofgem's Regulatory Sandbox allow energy actors to test new business models in order to understand how the future of energy might change. However, this is only accessible to some actors and viable for certain technologies, with high transaction costs for others.
- Regulation barriers, not limited to energy (Ofgem), are equally important, including barriers around procurement, planning and taxation.
- Regulation can play a strong role in embedding social and environmental values in more complex types of digital services business models at the top of the innovation ladder. This suggests there are benefits from focusing on values in business models, as well as developing a flexible and responsive regulatory framework for innovation.

Our research

This brief builds on systematic mapping of innovative business models for digital services in the UK, including interviews and an innovation forum held in Brighton on 4 October 2019. The research was carried out between Oct 2018 and Oct 2019 by Dr Ralitsa Hiteva and Prof Tim Foxon at the Science Policy Research Unit at the University of Sussex, as part of the Centre for Research into Energy Demand Solutions (CREDS). For more details please see: www.creds.ac.uk/digital-society/

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About CREDS

The Centre for Research in Energy Demand Solutions (CREDS) was established as part of the UK Research and Innovation's Energy Programme in April 2018, with funding of £19.5M over five years. Its mission is to make the UK a leader in understanding the changes in energy demand needed for the transition to a secure and affordable, low carbon energy system.

UK Research and Innovation

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