

How does the structure of Distributed Ledger Technology-enabled retail markets impact on energy policy objectives?

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Introduction

Distributed Ledger Technologies (DLTs) are contributing to disruption of established retail markets across many sectors. Retail energy markets are beginning to see this disruption in Europe (motionwerk.com), the US (lo3energy.com) and Australia (powerledger.io) with DLTs creating new ways to buy and sell energy. The structure of such markets is a key determinant of ultimate social and energy system outcomes, such as mitigating fuel poverty or reducing local grid congestion. This prompts many considerations, for example, whether DLT enabled retail markets need to be local monopolies, whether/how they can exist alongside conventional energy retail markets, and how structure might be associated with nature and level of prosumer participation.

Method

The planned research will conduct the first systematic study of the relationship between DLT-enabled energy retail market structure and potential energy policy outcomes using the theory-driven systematic review framework (Pawson and Tilley, 1997). This approach to assessing evidence asks not simply ‘what works?’, but ‘what works for whom under what circumstances?’. It begins with construction of a ‘programme theory’, or a description of the set of causal links by which outcomes (in this case energy policy outcomes) are realised as a result of interventions (different DLT-enabled market structures). This is based on a combination of previous evidence, expert knowledge, and assumptions. A systematic review approach is then employed to identify all relevant evidence to each of the causal links describing the mechanisms by which outcomes are expected to come about.

A key strength of this theory-driven approach is its flexibility in incorporating different sources of evidence. It can certainly draw on existing findings from the growing number of trials of DLT-enabled energy markets – but these are still relatively scarce. However, by breaking down evidence needs into chains of causal links, evidence for each link can be sought individually – and for many of these evidence will exist from non-

DLT-enabled markets or trials. Where there is no existing evidence, where necessary, new empirical work can be conducted targeting certain links. In the context of this research this will include approaches such as expert elicitation (O’Hagan et al., 2006) and survey experiments (for example to gauge potential participation levels (Fell and Neves, in press)). Extensive engagement with the DLT community will be necessary.

The evidence review will permit comprehensive mapping of applications of DLT enabled new energy retail market structures (including peer-to-peer) using graphical probabilistic modelling methods (Jensen, 1996). These methods will also be used to map the transaction relationships between the actors in these new market structures, estimate the likely scale of consumer response, and to link the theoretical causal models implicit in them to their stated social values. It will compare these with current policy and regulatory objectives including: energy market participation; affordability; distributional impacts; climate change mitigation; air quality improvement; and fuel poverty alleviation.

Outcomes

The project will produce a set of models of existing and planned DLT-enabled new retail market structures, showing both the transactional relations between actors, and the theoretical (but evidence-based) causal models of their impacts. The models will allow policymakers and regulators to understand how such markets could work and the likely scale of consumer engagement. Options and recommendations will be presented for how DLT-enabled energy markets might be structured to maximize social and energy system value. The work will lay the foundation for the evaluation of regulator-sanctioned field trials.

References

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