Local Electricity Market Development for Distributed Wind Generation

Calum Edmunds, Simon Gill, Stuart Galloway

CDT Wind Energy Systems, Rm 3.36, Royal College Building
University of Strathclyde, 204 George Street, Glasgow, G1 1XW

calum.edmunds@strath.ac.uk

University of Strathclyde Engineering

Introduction

There is strong potential for the growth of local electricity markets (trading between local generators and consumers) with the increase in distributed generation and mass roll out of information communication technology (i.e. smart meters).

Large Generators — Wholesale Market — Suppliers — Retail Market — Local Market — Prosumer/distributed generator — Consumer

This PhD considers the potential for local electricity markets in Great Britain by looking at how electricity is currently traded and how local markets can be integrated to the current system.

Motivation/benefits

The benefits of local electricity trading rather than conventional approaches of trading through retail and wholesale electricity markets could include;
- Reduction in GB Feed-in Tariff (FiT) means opportunities for better returns for distributed renewable generators.
- Potential improved community benefit e.g. by offering cheaper tariffs to fuel poor from local generators.
- Avoiding Transmission Network Use of System (TNUoS) Charge and potentially reducing Distribution Use of System (DUoS) Charge.

State of the art – Pilot & commercial projects

There as been significant development of local energy markets in recent years. Some of the highlights are as follows;
- NOBEL[4] – Neighbourhood Oriented Brokerage Electricity and Monitoring System. Pilot study in Alginet, Spain in 2012 with 200 prosumers using intelligent agents to carry out trading automatically in brokerage agent front-end web based tool.
- SOLshare[5] - Peer-to-peer trading of solar power between homes with and without solar panels in rural areas in Bangladesh, India. Households connected by a low voltage DC grid with power flow monitored by bidirectional SOLshare meter connected to ICT which facilitates buying/selling of electricity.
- Vandebron[1] – Online peer-to-peer marketplace for renewable generators to sell to households and businesses. In February 2016 there were 50 energy providers supplying 30,000 households.
- OpenUtility Piclo[6] – successful pilot where consumers buy electricity direct from local generators. e.g 99% of Gorran wind Turbines' energy was sold within 33 miles. Now launched under Good Energy 'Selectricity'.

Current GB market entry

Small to medium renewable generators (< 50MW) wishing to sell electricity via the GB national grid currently have the following options;
- Power Purchase Agreements (PPAs) with Aggregators (e.g. Smartest energy) or Energy company (e.g. EDF for >250kW);
  - Suppliers of PPAs consolidate multiple generators and trade the generation from a portfolio of generators in the wholesale markets.
  - Offer fixed price contracts to protect generators from wholesale price variations and provide revenue certainty for investors.
  - Supplier contracts with Feed-in Tariff (FiT) < 5MW
    - Under the FiT generators are paid a generation rate which for small wind energy (< 50kW) is currently around 8p/kWh for new builds.

Local market structures

Local trading can be carried out via a 3rd party which will either facilitate peer-to-peer trades or carry out matching centrally;
- Decentralised peer-to-peer[3], e.g. AirBnB, Blockchain, Vandebron
  - Matching/Pricing set by individuals - increased consumer choice.
- Centralised assignment e.g. Uber, Selectricity
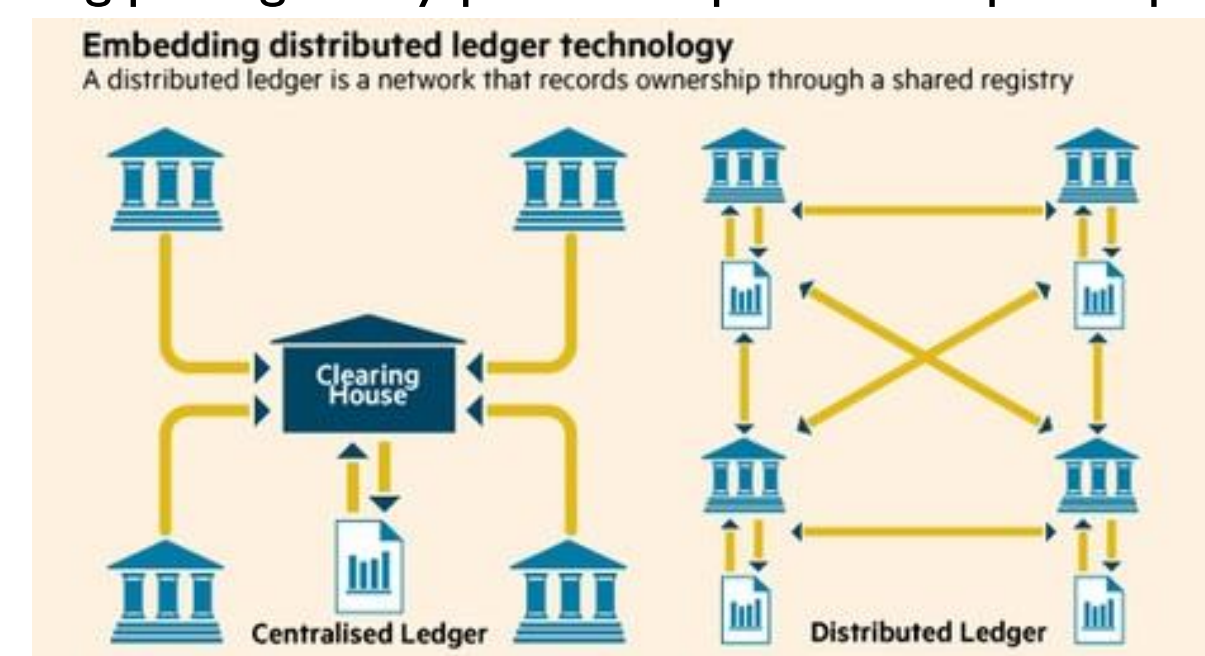 - Matching/pricing set by platform operator – optimal pairing.

Figure 1: Blockchain (Distributed Ledger) for peer-to-peer trading, Source: Financial Times

Barriers

There are many barriers to be overcome for local electricity trading of renewable generation to succeed including the following;
- Individual generators cannot guarantee supply in advance.
  - Without significant storage, supplier contracts are likely to still be required to provide balancing for local trades of intermittent renewables.
  - Risk for an individual intermittent generator may be too high without a portfolio of generators to guarantee supply.
- Smaller local generators may not be able to compete on price with larger suppliers who have economies of scale.
- Value of grid services includes reliability, power quality, choice, competition, risk management (hedging) and must be paid by all parties using the national grid.
- For many smaller domestic consumers the effort (and potential stress) of managing energy trades could outweigh the financial benefits.

Research areas

Possible research questions include;
- How do existing UK regulations aid or hamper development of local markets?
- Under what circumstances is it cost effective to promote local markets for distributed wind generation rather than carry out network upgrades?

References

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