Architectures for Community Energy Schemes: understanding the technical and commercial challenges of linking local demand and generation

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Outline

• Distributed Energy Scheme (DES) – technical and regulatory/commercial challenges

• DES architectures:
  ➢ Physical Private Wire
  ➢ Virtual Private Wire
  ➢ Demand Aggregator
  ➢ Local Energy Market

• Conclusions
Accelerating Renewable Connections (ARC)

- Objective
  - Accelerate connections of renewable generation to the distribution network
- Funding Mechanism
  - LCNI Tier 2
- Value
  - £8.4 million over 4 years (2013 – 2016)
- Trial Area
  - East Lothian and Scottish Borders
- Project Partners – www.arc-project.com
Distributed Energy Scheme (DES)

How should these five actors interact under ARC?
Technical challenges

How should these five actors interact under ARC?

- Within ANM?
- Private Wire or Virtual Private Wire?
- Single large demand, or many small demands?
- New or existing electrical demand?
- Demand flexibility ‘owned’ by specific generator?
- Is flexibility in demand needed?
Private agreement outside supply arrangements?

Local Supply company?

Licence-exempt, licence-lite (or fully licenced)?

Sleevings agreements?

Relative quantity and time-structure of curtailment?

Benchmarking?

How should these five actors interact under ARC?
Physical Private Wire

Suitable for private network systems.
A single network connection for combined NFG and flexible demand system.

- ANM monitors single connection point.
- Private network responsibility of private owners.
- Local controller implements ANM set point through demand flexibility or generation curtailment.
- Private commercial arrangements between NFG and flexible demand.
### Virtual Private Wire

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<th>Virtual Private Wire</th>
<th>Flexible Demand and NFG have separate connections and power flows between them across the distribution network. Flexible demand and NFG contribute to the same constraint.</th>
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- ANM sends single control signal to local controller for VPW network.
- Control achieved as in behind-the-meter system.
- ANM monitors flexible demand connection and calculates combined contribution to constraint.
- Rebate payments or a community supply company.
• ANM monitors aggregated demand via aggregator.
• ANM defines set-points for demand groups and communicates to aggregator.
• ANM instructs demand ahead of real time (dependent on demand response time).
• ANM continues to curtail NFG.

Demand Aggregator

Flexible demand spread across the distribution network. Demand not associated with a particular NFG.
An ‘aggregator’ controls multiple demand units in groups.
Local Energy Market

All NFG and flexible demand units take part via bids and offers. Market cleared for each period, results passed to ANM scheme for implementation.

One potential market:
- Initial dispatch of NFG via LIFO and notification of expected curtailment.
- Curtailed NFGs offer, and flexible demand (via aggregators) bid.
- Market cleared for additional generation.
- Market operator informs ANM schemes of additional generation and demand.
Conclusions

• Regulation of the distribution and supply of electricity are a significant barrier to the development of small schemes.

• The type of demand coupled to DG significantly affects the design of any scheme.
References

• Gill, S., Plecas, M., Kockar, I., Coupling Demand and Distributed Generation to Accelerate Renewable Connections: Options for the Accelerating Renewable Connections project, 2014. Available at: http://strathprints.strath.ac.uk/50135/