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INNOVATIONS IN INVERTER-BASED MICROGRIDS | Paper 1280

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Microgrids can support the transition to a low carbon energy system reliant on intermittent renewable generation. They balance local generation and demand in real time, operating in both grid-parallel and island mode to provide a resilient supply during grid outages. However, they are often more expensive to build than conventional distribution systems.

This is being addressed through innovation in technology and commercial models that can reduce CapEx, improve economics, and support the wider energy system.

Technical Innovation

- **Optimisation and control:** AI optimises design and operation of microgrids.
- **Multi-vector microgrids**: add heat and hydrogen for arbitrage and long-term storage value.
- **Modular microgrids**: standard modules significantly simplify design and construction.
- **DC microgrids**: lower hardware cost and improved efficiency when supply and demand are primarily DC.
- **Integrating BtM assets**: see case study (below).

Commercial innovation

- **Microgrid as a Service (MaaS):** can overcome higher CapEx by providing funding repaid through operational savings.
- **Connection constraints**: lower capacity requirements enable (housing) developments to take place where there would otherwise have been significant delays.
- **Transactive Energy (TE)**: economic signals to optimise operation and enable business models in which prosumers can optimise their investments.

Case study: Resilient Customer Response – Northern Powergrid

How it works

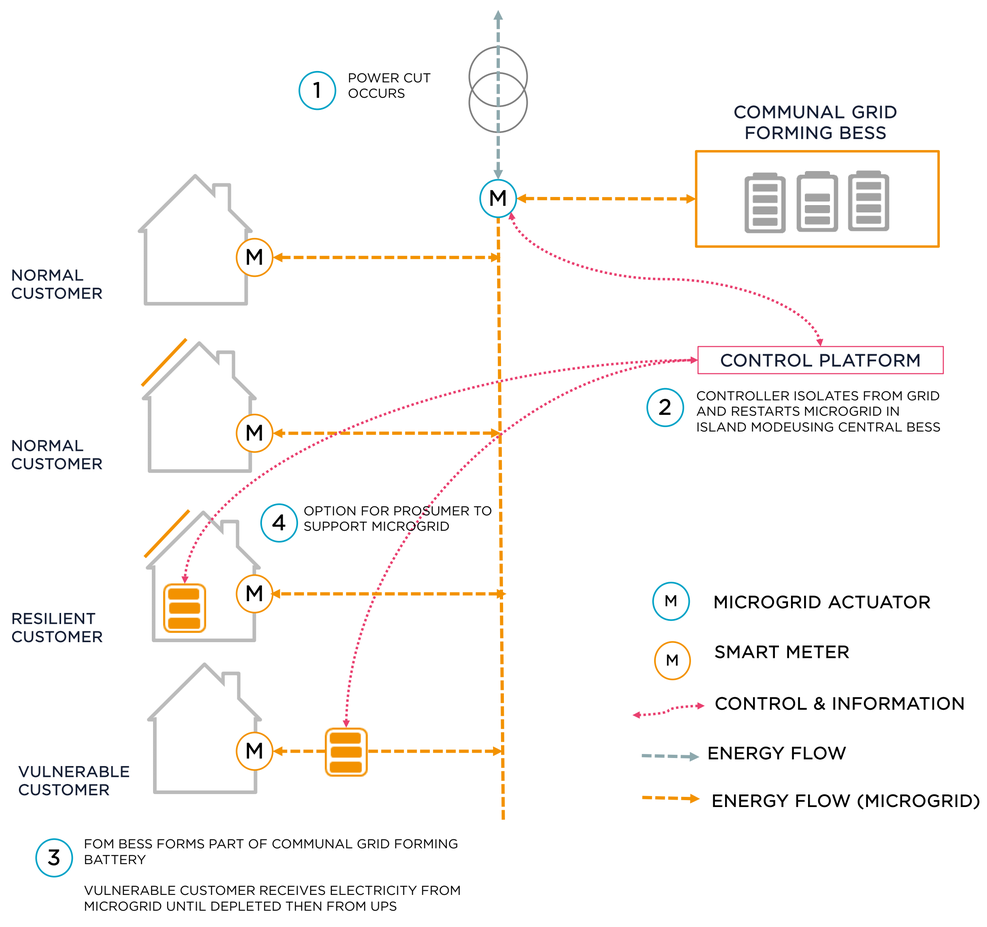
In the event of grid outage, the microgrid transitions to island mode using central BESS. It then uses Behind the Meter (BtM) PV + residential batteries to re-energise and extend microgrid duration.

Use of existing BtM assets enhances resilience and reduces effective microgrid CapEx.

Value creation

Consumer value: valuations range **from £7.87/kWh** (1-hour outage once every 3 years**) to £38.46/kWh** (48-hour outage fifteen times every 3 years), both unplanned.

DNO value: under favourable assumptions for worst-served customers, potential value per substation **can exceed £1m over a 25-year term**.



Takeaways

- Microgrids may have higher CapEx, but deliver lifetime value (price certainty, resilience, system value).
- Scaling depends on better technical design (eg. BtM integration, multi-vector, modularity) and stronger commercial models (eg. MaaS, TE).