MICROGRIDS, LEGACY GRIDS AND THE FARADAY GRID

Our electricity system reset, rebalanced...reimagined.

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The Traditional Value Proposition


- **EFFICIENCY** - Lower energy intensity and distribution system loss
- **RELIABILITY** - Near 100 percent uptime for critical loads
- **SECURITY** - Enable cyber security and physical security
- **QUALITY** - Stable power to meet exacting consumer energy requirements
- **SUSTAINABILITY** - Expand generation to renewables and cleaner fuel sources
The value proposition that microgrids offer has increased substantially with the growth of Distributed Energy Resources (DER) as the driving force.

Microgrid enabling technology (MET) market to reach $112 billion by 2026 driven by desire to aggregate DERs.\(^2\)

The relative case for microgrids has been strengthened due to the poor performance of network scale grids:

- Spiralling end user costs for electricity
- Unpredictability and control of electricity of cost
- Lack of security and increased threat to cyber attack
- Network reliability has declined, resilience threatened by:
  - Extreme weather, earthquakes, wildfires
- Provision of undesirable fossil fuel electricity

Microgrids are seen as a portal for defecting from the traditional power grid.

*The 3,200 U.S. utilities are facing what former NRG Energy Inc. CEO David Crane labels a “mortal threat” to the industry*\(^3\)

\(^2\) Navigant Research (2018) Microgrid Enabling Technologies Market Overview

Microgrids and Legacy Grid: Threat or Opportunity?

The threat (and opportunity) to microgrid growth is the indisputable need to sustain the legacy grid.

The Chair of PG&E says microgrids should have “to pay through some sort of charge”.

Sustaining a profitable and efficient grid network is beneficial to society and to microgrid developers and operators.

- Economic value of microgrids are maximised through interoperability and gains from trade.
- Microgrids need to be imagined as nodes in a wider system.

The UK Regulator Ofgem is reviewing charging arrangements so that network companies can equitably recover costs.

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5. Ofgem (2017) Targeted Charging Review
The great challenge is to integrate microgrids efficiently using a common protocol

- Historically microgrids had been constructed with a single stakeholder in mind (military, universities, industrials)
  - with the rise of DERs and community microgrids the focus must change
- Efforts across the United States are focussed on microgrid services tariff structures to encourage the development and use of resilient microgrids
- However the interoperability of distributed microgrids and utility grids remains illusive and costly. Current initiatives include:
  - ComEd’s pioneering Bronzeville (Illinois) microgrid integration project cost >$25m for what is essentially a study of microgrid integration
  - New York’s Reforming the Energy Vision is handing out $50m in prize money for microgrid feasibility and design studies

Microgrid integration question has barely been asked let alone answered

GTM Research says:

[As for the larger issues of how to share infrastructure, energy and real-world responsibility between microgrids and utilities], “We haven’t seen a lot of these questions being asked before…”

Power flow device advancements can facilitate interoperability
High-fidelity modelling and simulation to illustrate impact on the New York state energy grid

- Power quality enhancement worth $750 per household over the next five years
  - $12.4 billion per annum (value of removing all power quality problems in New York)

- Renewable Energy Hosting Capacity increased by 30% - 9.27 TWh

- Removing 3 million tons of CO2 (583,000 cars off the road every year)

- Reduced network losses of 517.3 GWh → around 30% New York Coal generation

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9. Assumes hosting capacity ~23%.
10. Based on Marginal Emission Factor of 0.316 kg CO2eq/kWh