The Invisible Hand of the Local Energy Market: Free-Market Energy Trading in Real Time

A report on the EMBLEM and LEMDEX trials

Simon Le Blond

Swanbarton
SMART ENERGY STORAGE

Local Peer to Peer (P2P) energy trading

Traditional energy market	P2P energy market
Monopoly • Trade with single supplier • Hard to change suppliers	Free market • Genuine choice of supplier/purchaser
Fixed prices • High price for consumers • Low price for producers	Variable prices • Lower price of energy for consumers • Higher price of energy for producers
No price incentive	Generates a price signal

EMBLEM Project - Iona

Swanbarton
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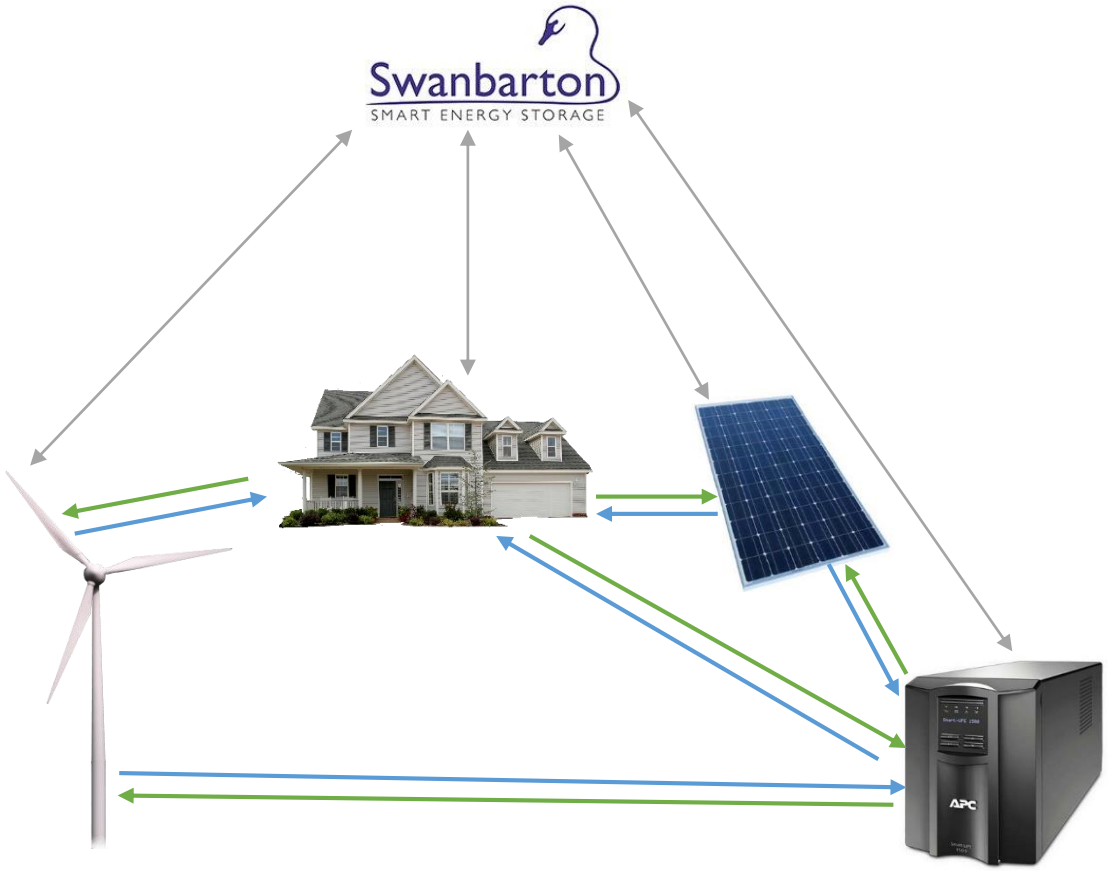
- Swanbarton
  - Trading platform
- Scene connect
  - Metering hardware
  - Participant engagement (including mobile app)

The trial

- 3 months – Sep-Nov 2018
- 26 participants:
  - 19 consumers
  - 5 PV prosumers
  - 1 wind turbine
  - 1 trading battery
- Continuing…..



What makes EMBLEM different?

Previous LEM trials

- Arrange energy trades based on traditional half hour, or longer, trading periods
- Centralised price setting

EMBLEM

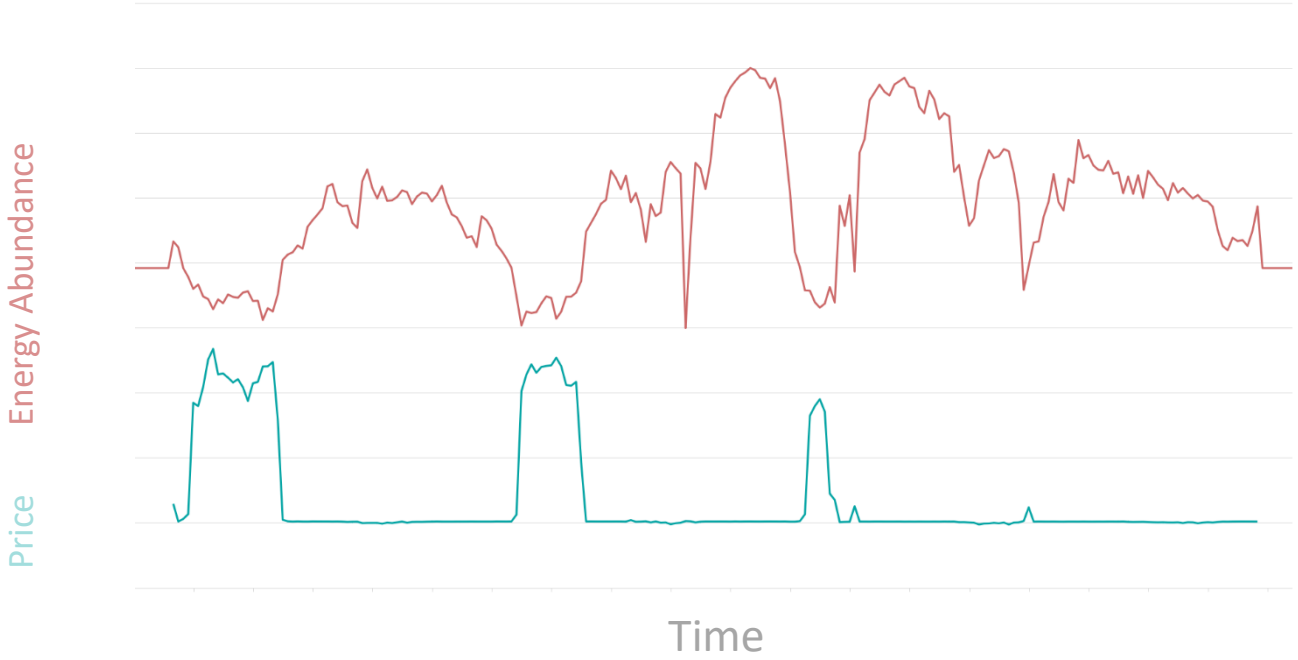
- One minute trading periods
- No centralised price setting

EMBLEM stats

- In 3 months:
  - 1.7 million trades
  - 26.8 MWh traded
  - Wind turbine revenue up 14%
  - PV revenue up 60%
  - Energy bills down 61%
    - £400 off average annual bill
  - Average participant total benefit – £440 / year

  - Long term price signal for renewable investment = emissions saving local energy vs grid mix

Price signal

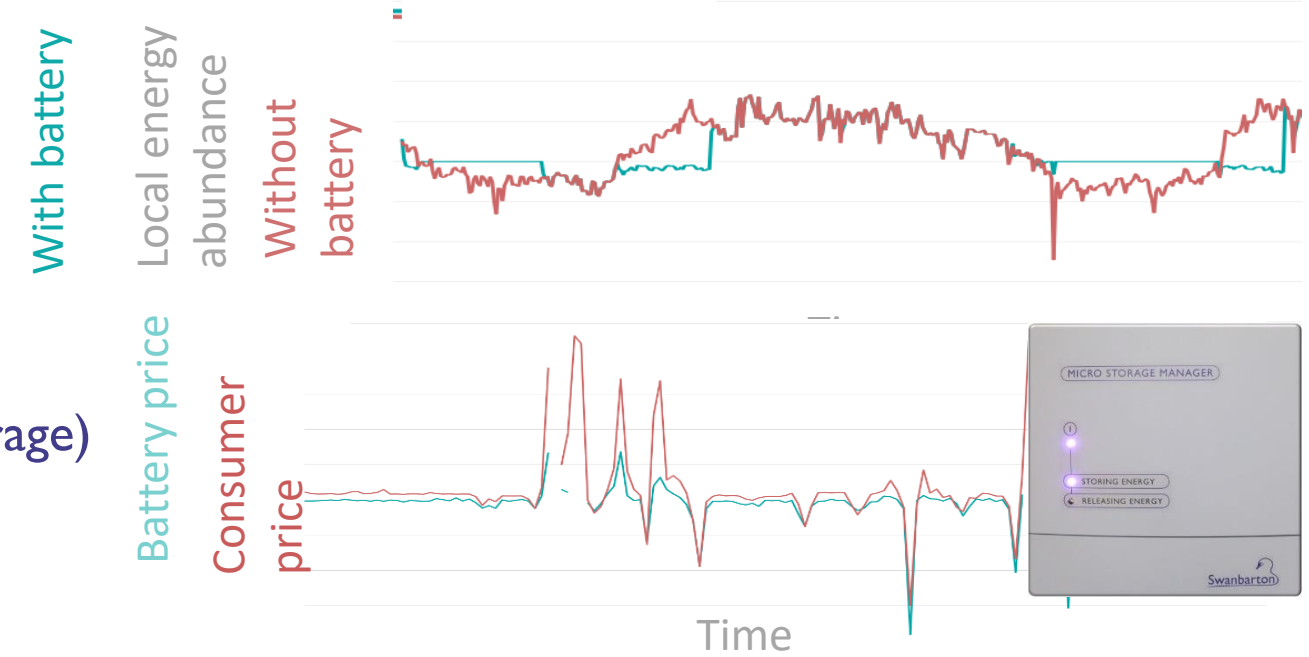


- Price ranges between grid supplier buy & sell prices
  - 15.5p/kWh buy (Northern Scotland average) and 3.86p/kWh PV sell and 4.9p/kWh wind sell (2019 FITs)
- Market energy *Abundance* is supply less demand
- Price varies inversely with energy abundance
- Price varies inversely with sign of derivative of abundance

Network balancing with storage

A) Simulated large battery

- 100 kW / 250 kWh
- Flattens out local energy abundance – balancing grid



B) Real UPS battery, buyer only (no export)

- Bought 91% of energy locally (compared to 79% average)
- Paid 7% less for energy

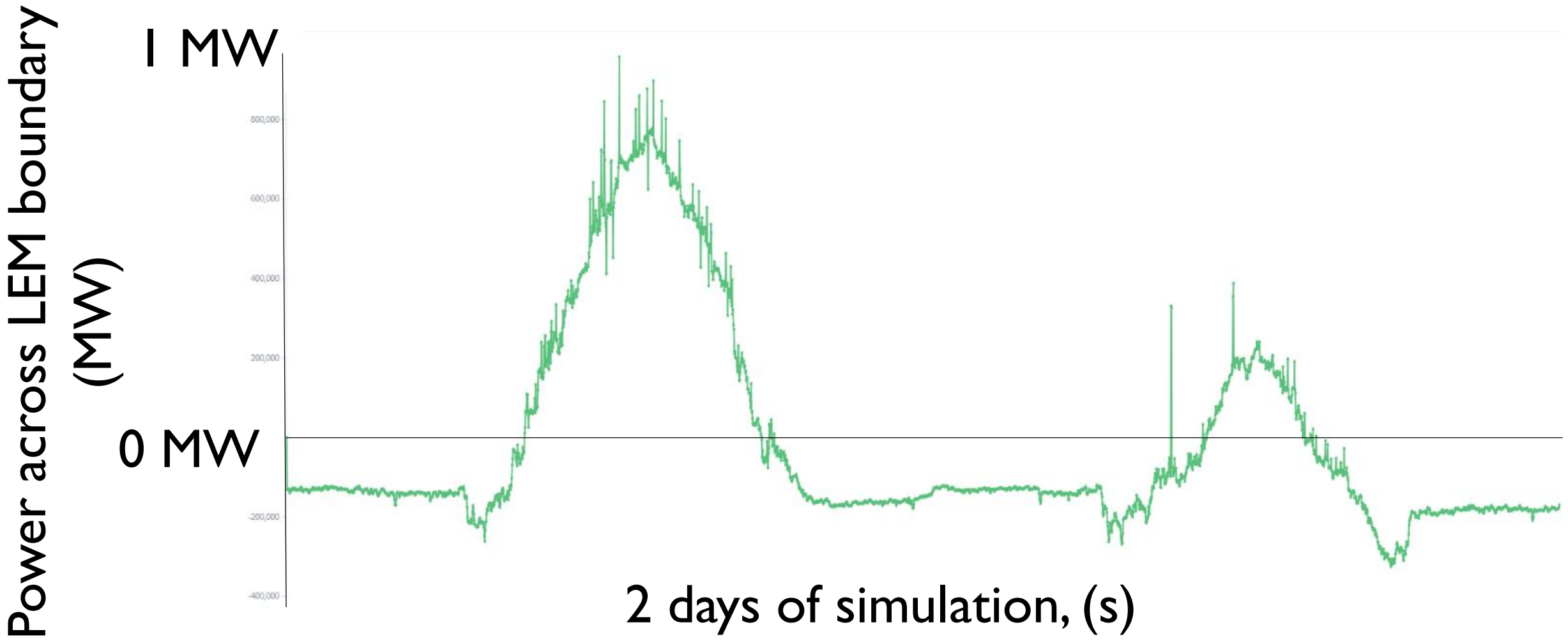
C) Simulated domestic battery 5 x 5 kW / 13.5 kWh

- Stores PV for self-consumption & then trades independently
- Average benefit of LEM + Battery = £1248/year
- Doubles wind turbine revenue uplift
- Balances grid
  - Supplies 64% of local generation shortfall
  - Absorbs 24% of local generation surplus

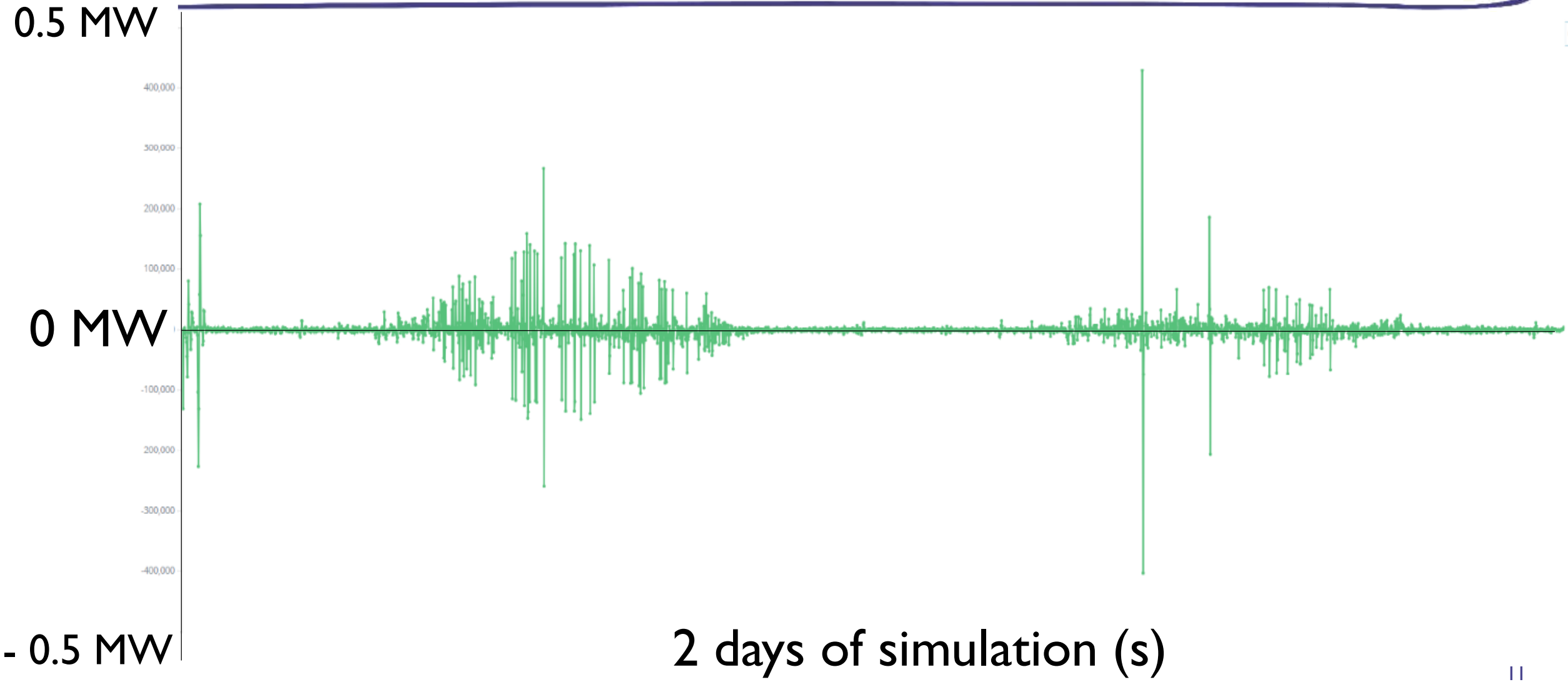
LEMDEx project - Devon

- Innovate PFER project with Devon County Council
- Jan-June 2019
- Extensively studied regulatory, commercial and technical steps for adoption of LEMs
- Used extensive real metering data from Devon CC site and assets
- Simulated PV heavy LEM between commercial customers in Exeter
  - 900kWp consumption
  - 2MWp generation (all PV)
- Optimal storage LEM are determined with the variations in abundance in time – mostly determined by local generation, and lesser extent demand
- For the LEMDEx market, long duration storage with 5 MWh (1 MW) duration was the sweet spot

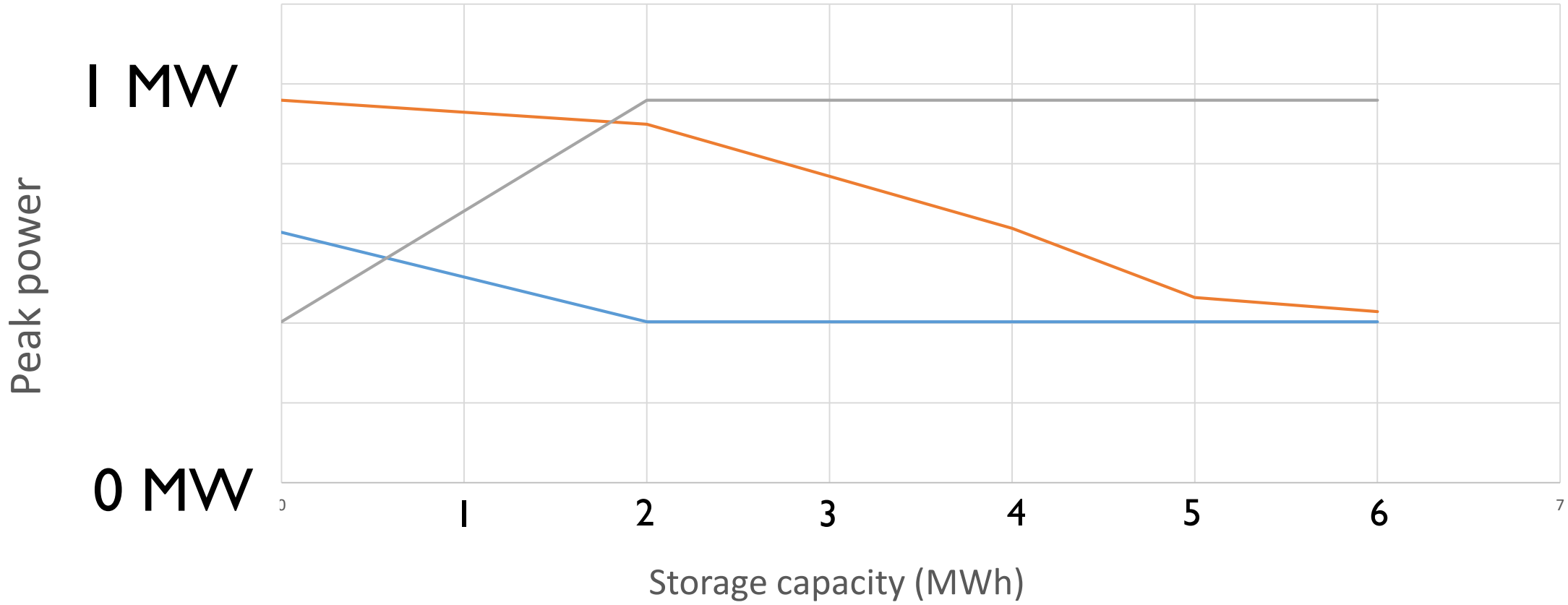
LEMDEx boundary power flows no storage



Boundary power flows with 1MW/6MWh battery



Peak power vs. storage capacity



Swanbarton Limited.

- Storage specialist SME, active in industry since 2004
- History of successful collaboration with academia undertaking Commercial R&D to bring products to market:
  - Patented Real-Time Trading Platform
    - Real-time free market local energy trading system
  - Patented Energy Asset Control Service
    - Dispatches energy micro-assets to provide ancillary services to the grid
  - Multi Storage Manager
    - Optimises deployment of storage
    - Used with Yuasa's innovative dual chemistry 'Gemini' battery and others