

Multimodal electricity storage

Oliver Shotton, Clive Tomlinson
Swanbarton Limited, Wiltshire, UK
email: oliver@swanbarton.com

Recent UK projects have highlighted the potential for using electricity storage, particularly battery systems, to meet the challenges of increasing consumption, costly network reinforcement and variable generation from renewables. Most batteries are operated in a single mode, either providing local power during a network failure, or responding to a command issued by a central network balancing controller or responding to local frequency sensor signal. The commercial return for single-mode operations is weak.

Swanbarton, with grant support from Innovate UK, has participated in several UK trials of the commercial value of deploying batteries through multimodal operations. We've presented some of them here.

For more detail, see: *Local energy markets to sustain distribution network storage*, Clive Tomlinson, *Proceedings of the Institution of Civil Engineers - Energy* 2015 168:2, 96-106

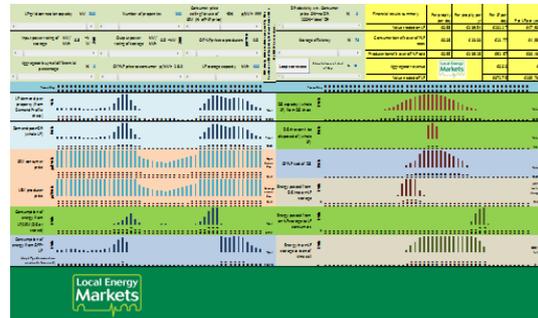
GB patent GB1308582.4 and international equivalents:
A microgrid control apparatus, method and system for controlling energy flow within a microgrid

Project LEMMA

What if householders could buy and sell electricity freely to each other?

- Whenever they want
- As much as they want
- Whatever prices they agree

What if an energy store could help a householder to exploit such a free local energy market?



We explored a detailed microeconomic model and showed how in such a local market, energy storage becomes a more reliable alternative to human Demand Response and a significant revenue earner.

Project EXSTORM

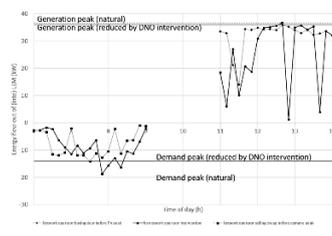
What heuristics would you need to control an energy store in a free trading local market? What market mechanisms would yield the most fluid price response to energy abundance?



How would energy storage, controlled simply by commercial imperatives, affect peak network power flows?

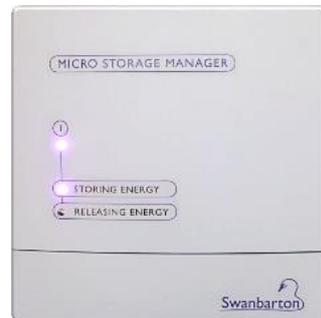
We demonstrated the dynamic behavior of free local markets operating in real time, and proved that

energy stores can be effective and well-rewarded participants.



Project SENSE

With UK aggregator Kiwi Power, we built and demonstrated our first Micro Storage Manager product.



It exploits multimodal storage control:

- Price arbitrage
- Trading negotiation
- Dispatch services
- Frequency response

The Micro Storage Manager was successfully deployed into a number of UK sited, managing 26 kWh Li-Ion batteries for over 6 months.