Transactive Energy Pilot

LoT-NET Workshop

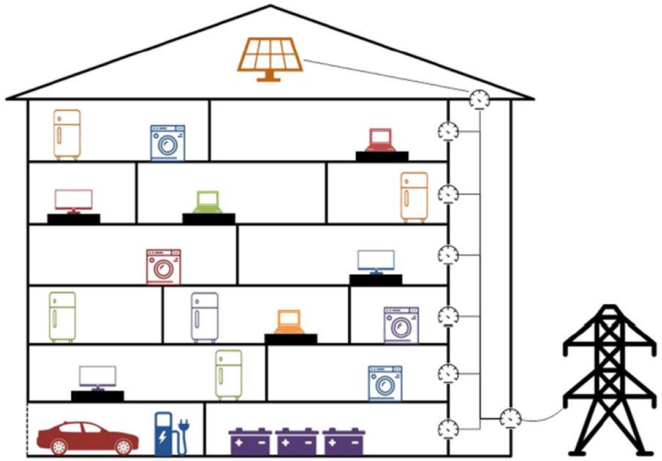
Chris Conlan – December 2019

WARWICK
THE UNIVERSITY OF WARWICK

Introduction

- About me
  - PhD Student at Warwick Institute for Science of Cities (WISC)
  - Data scientist
- What is Transactive Energy?
  - Automated P2P energy trading platform
  - Inter-vectoral
  - Technology based on IoT, AI and Blockchain
  - Part of a cyber-physical systems prevalent in smart cities

More on Transactive Energy

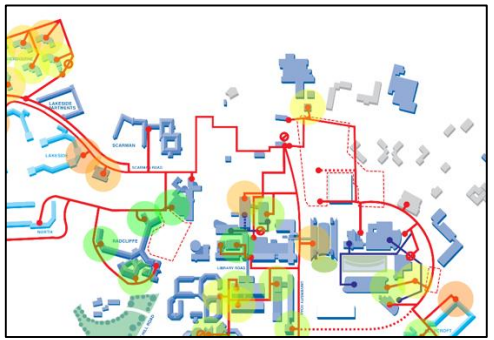


Ref - Mattila, J., Seppälä, T., Naucler, C., Stahl, R., Tikkanen, M., Bådenlid, A. and Seppälä, J., 2016. Industrial blockchain platforms: An exercise in use case development in the energy industry (No. 43). The Research Institute of the Finnish Economy.

- Device level control
- Operated by multi-agent system
- Benefits
  - Greater integration of renewables
  - Distributed control
  - Resilience
  - Community empowerment

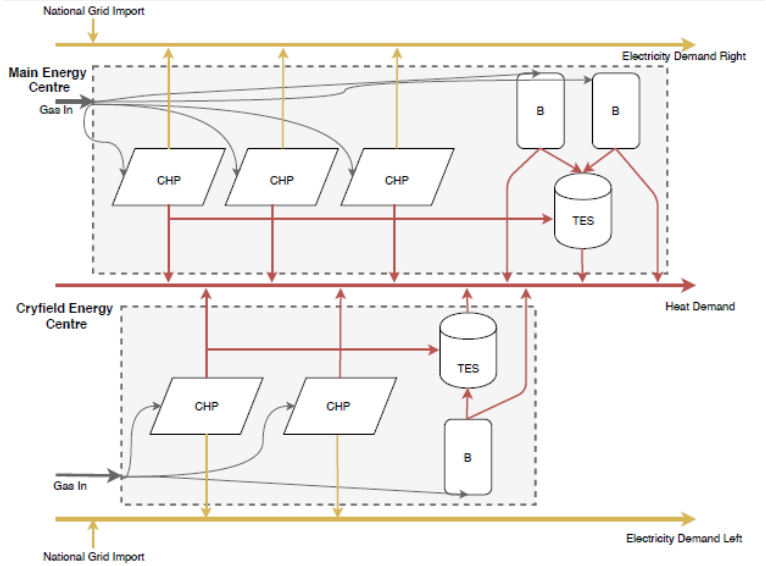
Transactive Energy - Campus

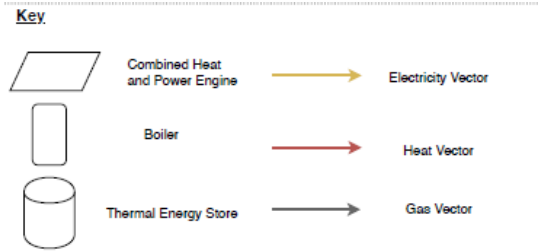
- Collaboration with Estates and Fetch.ai
- Initial scope – Energy Centres
- Next – **more diverse set of assets**
- Such as…
  - Leverage heat latency in buildings
  - Storage / EV Charging
  - Renewables



Schematic of microgrid

Energy Centre Schematic





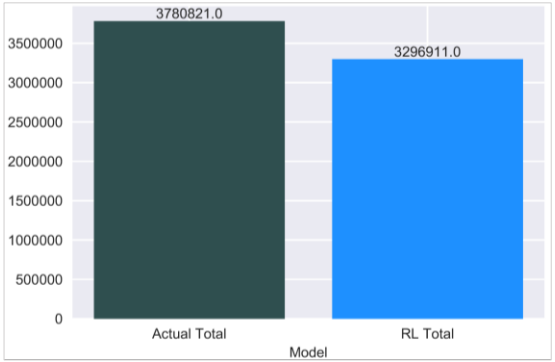
Energy Centres - Existing Control Model

- Rules based Energy Management software
  - Domain knowledge
  - Forecasting key to decision making
- Makes decision at a fine temporal scale, but…
- Does this model optimise cross-vectoral energy management?

Machine Learning Approach

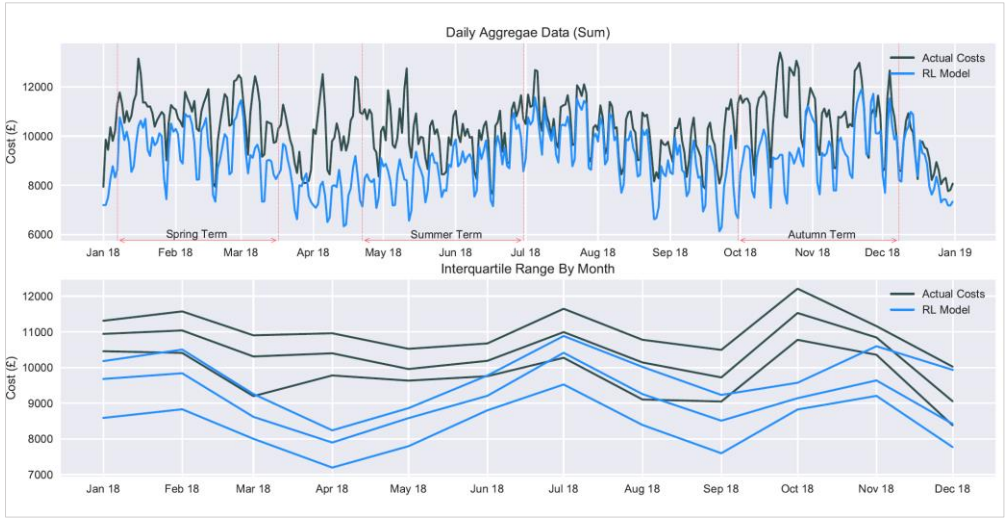
- Data driven
- Multi-agent system (AI)
- Optimisation problem – minimise cost
- Train using 2 years of data from energy centre
- Hourly control actions seeks the optimal mix of asset utilisation to meet energy demand

Results – Total Cost



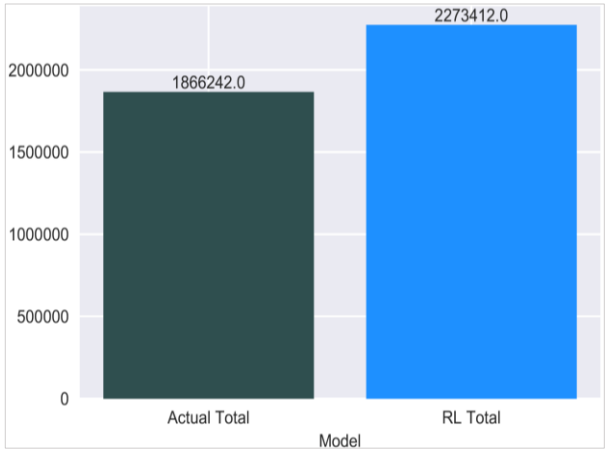
Total Energy Centre Costs 2018 (£)

- Reduce costs by 12.8% in 2018

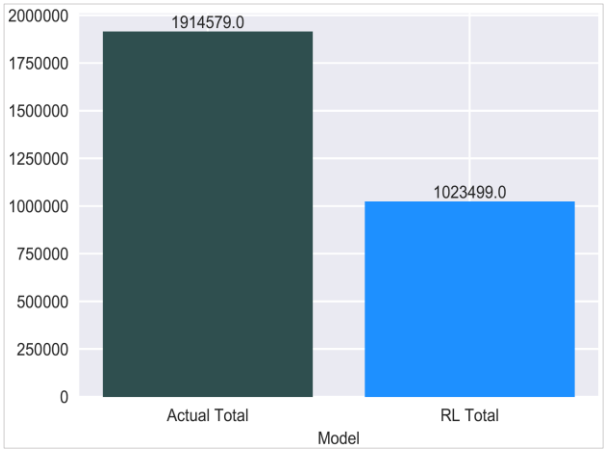


Energy Centres Costs in 2018 (£) over time

Results – Cost of Gas vs Electricity



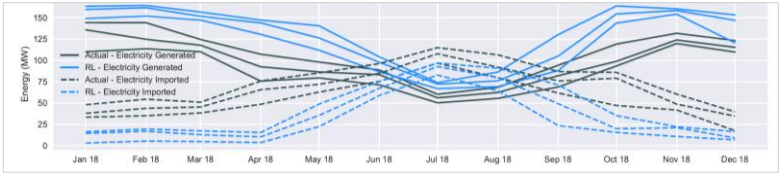
Total cost of gas (£) 2018



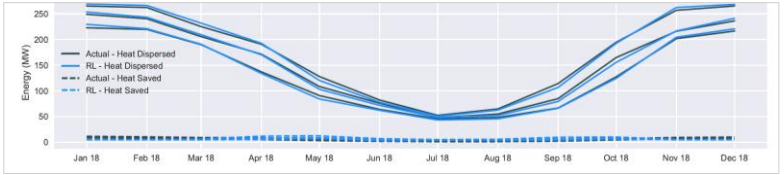
Total cost of imported electricity (£) 2018

- Gas costs increase 21.8%
- Electricity imports decrease 46.5%

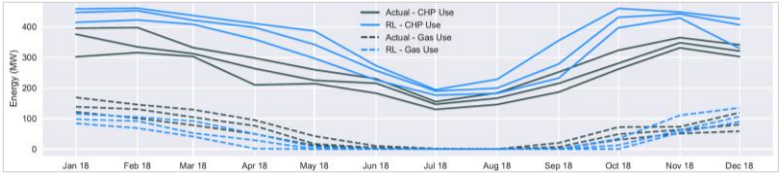
Results – Asset Utilisation



Electricity Generated vs Electricity Imported



Heat dispersed vs Heat Saved



CHP Use vs GB Use

- More intensive and dynamic use of CHPs
- GBs used less extensively
- Better at cross-vectoral optimisation

Actionability

- Working with estates to understand actionability of results
- Findings can work both ways
  - Can help make argument for how to better run energy centres
  - Support investment decisions
- Starting to investigate feasibility of real-world deployment
  - Controls to replicate
  - Establish responsibilities

Next Steps….

- Phase 1 - Energy Centre Pilot
  - Parallel run
  - Live deployment
  - Additional data feeds
- Phase 2 - Wider TE Pilot
  - **Include a more diverse set of assets**