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

- 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
Energy Centre Schematic

Key:
- Combined Heat and Power Engine
- Boiler
- Thermal Energy Store
- Electricity Vector
- Heat Vector
- Gas Vector
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-vectorial 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

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

Total cost of gas (£) 2018

Total cost of imported electricity (£) 2018
Results – Asset Utilisation

Electricity Generated vs Electricity Imported

Heat dispersed vs Heat Saved

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