Operations intelligence for decarbonisation

Contact

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Research projects

1. Transfer learning for pump controls in the water distribution network

Pumping presents a major challenge of decarbonisation as well as a substantial running cost in the water industry, where the current practice fails to efficiently schedule pump operations. The interplay between water hydraulics, consumer demand, electricity grid, among other factors, makes a complex real-time control problem. Though the advances in smart control technologies such as reinforcement learning and model-based predictive control (MPC), the solutions are often water network specific and require substantial domain knowledge and effort to be replicated. This project will develop a transfer learning approach to operate pumps at reduced running cost and carbon emission, focusing on the transferability of the solution.

2. Multi-objective optimisation of smart local energy systems

This project concerns smart local energy systems (SLES), which integrate renewables, storage, among other energy assets (e.g. heat pump) to meet power, heat and mobility demand at local communities. The optimal design of SLES, e.g. determining the size of heat pump and battery, is considered key to energy project roll-out at scale. However, many (often conflicting) considerations including CAPEX, OPEX, GHG emission and peak load were not systematically studied, nor did their impact on each other. This makes the energy system design suboptimal (sometimes yielding misleading conclusions). To address this problem, this project will develop a whole system approach exploiting recent advances from multi-objective optimisation to holistically balance between a wide spectrum of SLES design objectives.

3. Robust AI system for heat decarbonisation

Supplying heat in buildings alone accounts for over 20% of the total emissions in the UK, which presents a crucial challenge to the net zero target. This project will first investigate and model different decentralised solutions (as opposed to heat networks) for heat decarbonisation in the building stock through the use of low carbon technologies (e.g. heat pump, hydrogen, biofuel). The research will then focus on developing a robust AI system to recommend the best decarbonisation solutions based on building archetypes, household characteristics, occupant preferences, among other considerations.

Applicant skills/background

Successful applicants should be highly motivated and have a background in one or more areas of AI, machine learning, control engineering and electrical engineering. Good programming skills in Python, Java, R or Matlab are essential.