

Fully-funded 4-year PhD Project at Loughborough University – Empirical modelling of domestic energy demand, storage and production

Project Title	Empirical modelling of domestic energy demand, storage and production
Supervisor(s)	Dr Stephen Watson
Context (what is the wider social, political and technical context that leads to this work, why is it important)	<p>With an increase in intermittent renewable electricity generation (including domestic PV), and the electrification of heating and transport, the challenge of ensuring a reliable and affordable energy system is much greater. Understanding the scale of the problem and possible solutions requires modelling of domestic energy demand and production, at high temporal resolution, including the possibilities of energy storage and load-shifting. Existing energy demand models are typically deterministic, being based either on the physics of heat transfer, or simple empirical formulae. Existing stochastic models, such as the CREST model, are based on questionable assumptions about the relationship between time-use diaries and energy demands. Increased availability of monitored domestic energy demand data opens up new possibilities for energy demand modelling, which will take into account the variation in energy demand due to occupant practices. Such energy demand models would be of benefit to distribution network operators, housing developers and policymakers.</p>
Project Description	Develop stochastic domestic energy demand model, based on monitored data.
Aims and Objectives	<ul style="list-style-type: none"> Understand requirements of domestic energy demand models, from the perspective of housing developers, distribution network operators, building services engineers, academic research etc.

	<ul style="list-style-type: none"> • Give an overview of existing approaches • Develop domestic energy demand mode based on monitored data • Compare to existing approaches
Methods: (Measurements, data sources, methods of analysis, etc)	<p>Modelling based on monitored data. Sources of monitored data may include smart meter data (e.g. from SERL), connected boiler data (from a boiler manufacturer), field trial data from trials conducted at Loughborough university, heat pump field trial data from BEIS.</p>
Expected Outcomes	<p>Model of domestic energy demand which is useful to DNOs, housing developers and policymakers.</p>
Skills and Interest Required of Student	<p>Ability in handling data/programming Interest in domestic energy demand and monitored data</p>