Fully-funded 4-year PhD Project at Loughborough University – Suitability of existing UK dwelling stock for heat pumps

Project Title	Suitability of existing UK dwelling stock for heat pumps
Supervisor(s)	Dr Stephen Watson
Context (what is the wider social, political and technical context that leads to this work, why is it important)	Heat pumps are commonly proposed as an alternative to gas boilers, in order to meet net-zero emissions targets. Almost all future domestic heating decarbonisation scenarios include a significant role for heat pumps. However, there are concerns that the existing housing stock is not suitable for heat pumps, for example the heat losses are too high, the emitters are not sized for low-temperature operation, and the occupants are unaccustomed to the lower temperature heating provided by heat pumps. Rectifying these issues would add substantially to the cost of installing a heat pump, for example by replacing all emitters and making major improvements to fabric efficiency. Because of this, understanding the proportion of homes which are already suitable for a heat pump, and the extent of renovations needed in homes which are not currently suitable, is of immediate interest to UK government policy. It may be that significant numbers of homes are already "heat pump ready", but we do not know this with any certainty. Clarifying the proportion of homes suitable for heat pumps and any dwelling improvements that are necessary will help to guide UK domestic heating decarbonisation policy.
Project Description	Based on monitored heat pump and boiler data, and data on the UK housing stock, identify homes which are suitable for heat pumps. For homes that are not currently suitable for heat pumps, identify the changes which would be necessary to make these homes suitable for heat pumps.

Aims and Objectives	• Estimate proportion of current dwelling stock which are already suitable for heat pumps, without any modification. • Estimate changes in emitters, dwelling heat loss or occupant heating practices which would be needed to install heat pumps in homes which are not currently suitable
Methods: **(Measurements, data sources, methods of analysis, etc)**	Analysis of monitored datasets. Of particular interest is monitored data from a large sample of combi boilers, which gives space heating and DHW demand at 10-second intervals. This dataset provides a unique insight into current heating patterns and temperatures. Other datasets of potential interest include SERL smart meter data and emitter temperatures previously monitored at Loughborough. If desired, the student could also carry out some building energy modelling e.g. in Energy Plus.
Multidisciplinary Aspects (what different skills and knowledge will this project develop)	• Data analysis skills • Working with government and industry
BUDGET, STAKE HOLDER AND OTHER SUPPORT (Any financial or in-kind industry support offered, costs of T&S and materials if substantial):	The work is of considerable interest to BEIS, who may be able to offer some financial support. Dr. George Bennett (from BEIS) may be available as an additional external supervisor. It is hoped that monitored boiler data from a manufacturer will also be available.
Skills and Interest Required of Student	• Handling data • Understanding of building physics and heating systems • Possibly building energy modelling