MSc project : Domestic energy decarbonization and energy equality

· Evaluation of infrared heating for domestic heating in the UK (working with an UK company)

This project will investigate infrared heating for UK domestic heat decarbonisation. The project will start with a literature review of infrared heating: theory, system design and applications. Then the student will build a model of infrared heating and integrate the model into the domestic heating analysis framework. By running simulations across different scenarios, the project aims to understand the performance and cost variation between locations and household types in the UK.

· Policies and data for mitigating energy poverty and surviving from the crisis of living

This project will focus on collecting, processing, and analysing policies and data for addressing energy poverty and energy crisis in the UK and Europe. The project will have a literature review of policies and data for showing the landscape of past, current, and future polices and status of energy poverty in different regions. The finding will reflect what has done and learnt in tackling energy poverty. With all these data and understanding, some simulations and analysis will be done to estimate the impact of current and potential future energy policies.

· Analysis of impacts of domestic energy transitions on energy poverty (all pathways)

The project will start with a literature review of domestic energy transitions and energy poverty. Then, the project will use the developed HeatMyhome tool or similar models to simulate different decarbonisation pathways/options and evaluate how energy spending will vary compared to conventional fossil-fuel-based solutions.

· Analysis of the use of energy storage for domestic energy decarbonisation (new services)

The project will start with a literature review of electrical tariff structures and other demand side services for customers. Then this project will focus on the structure of tariffs and new demand-flexibility services and evaluate how these new products will affect the cost-effectiveness of energy storage for end-uses.

MSc project: Low-carbon energy solutions for sustainability Project stage

· Modelling of solar powered cold rooms for food preservation (Working with a company)

This project will focus on refrigeration system modelling of fridges and freezers. Literature review of refrigeration/cooling requirements for storing food (vegetables, fruits, seafood, and other meats) during post-harvest. Working with the partner, the student will get data of food types, storage temperature and duration, cold room sizes, and other parameters needed. Then, build models of refrigeration systems and models of heat gains/losses of the cold room. Run simulations and analyse results for understanding variations of refrigeration systems for varied food storage.

· Modelling of storage-integrated solar systems for food storage (battery vs. cold/ice storage, working with a company)

This project will focus on energy storage modelling, particularly batteries and cold storage for shifting solar energy for food preservation. The project will start with a literature review of different types of

batteries and cold storage for collecting technical and economic data of batteries (different chemistries) and cold storage (sensible and phase change materials). Batteries and cold storage models will be built and integrated into a solar PV system modelling framework. A heat (i.e., cold energy) demand model will also need to be built to estimate the varying energy demand. Cost models of energy storage and other components need to be built for conducting further economic analysis. The overall outcome is to analyse the trade-off between electrical energy storage and cold energy storage for solar powered cold rooms.

· Modelling of solar powered phase change materials for cold storage (working with a company)

In this project, PCMs will be modelled and studied to understand how PCMs can improve the solar-powered cold room for food storage. The project will start with a literature review on PCMs for cold storage, covering a temperature range from -20 to 10 °C. The review aims to get all technical and economic data of potential PCMs, as well as manufacture scalability, technology readiness level and current supply chains, which will be used in further simulations and analysis.

· Modelling of solar powered desalination systems

This project will focus on solar desalination systems. The project will start with a literature review on solar desalination systems and build models for localised thermal distillation technologies which include both single-stage and multi-stage systems.

Available python tools:

· PVlib, solar PV system modelling,

https://pvlib-python.readthedocs.io/en/stable/user_guide/index.html

· CoolProp, thermal property modelling of refrigerants, http://www.coolprop.org/

· HeatMyHome, https://heatmyhome.netlify.app/