



School of Computing, Engineering, and the Built Environment Edinburgh Napier University

PHD STUDENT PROJECT

Application instructions:

Detailed instructions are available at :

<https://www.napier.ac.uk/research-and-innovation/doctoral-college/how-to-apply>

Prospective candidates are encouraged to contact the Director of Studies (see details below) to discuss the project and their suitability for it.

Project details

Supervisory Team:

- DIRECTOR OF STUDY: Dr Stathis Tingas (Email: e.tingas@napier.ac.uk)
- 2ND SUPERVISOR: Dr Neil Urquhart

Subject Group: Engineering & Mathematics

Research Areas: Automotive Engineering, Electrical Engineering, Energy Technologies, Mechanical Engineering, Systems Engineering, Data Science, Machine Learning

Project Title: Modelling and optimisation of infrastructure for the decarbonisation of transport in rural areas

Project description:

The decarbonisation of the transport sector (primarily through electrification) has become one of the priorities of most advanced economies nowadays, including the UK, in the fight against climate change. This transformation is usually supported by national legislation that aims to facilitate the transition to more environmentally friendly technologies. For instance, the UK has recently mandated the ban on all new petrol and diesel car sales by 2030.

In 2021, 18.6% of the new car registrations in the UK were plug-in EVs (BEVs and PHEVs), a significant increase from 2020. Yet, in 2022, the share of new plug-in sales has been 20.6%, a negligible increase compared to the previous year. Hydrogen fuel cell electric vehicles (FCEVs) are perceived as an alternative to BEVs and PHEVs, albeit their retail prices are still inaccessible to most buyers. Yet,

it is expected that FCEVs will be an important part of the decarbonisation process and will eventually take a considerable part of the market share.

A necessary condition for the effective adoption of BEVs, PHEVs and FCEVs is the availability and accessibility to the required infrastructure, i.e., charging/refuelling stations. The available technologies for such stations currently can vary a lot hence the decision on the appropriate type is not straightforward. In addition to that, the exact location for the installation of a charging point is usually the result of an optimisation process where parameters such as the potential available users, safety, accessibility, land use, visibility, surrounding street network, traffic flow and many others are factored.

Optimisation approaches have been studied extensively in urban setups, however, there is limited understanding on the required approaches and appropriate technologies (e.g., types of charging stations, charging vs H2 refuelling stations, etc) to be used in rural setups, where the demands and the available solutions will be widely different. This becomes of paramount importance for countries like Scotland that are predominantly rural.

The objective of this work will be to develop appropriate models for establishing networks of charging and/or refuelling stations appropriate for rural areas, using evolutionary and machine learning algorithms. These models will need consider among others, the requirements of the distribution network (centralised vs decentralised), the possible revenue, the available public transport, the convenience of the users, the renewable energy sources, the local geography and others.

Candidate characteristics

Education:

A first degree (a minimum 2:1) in Mechanical Engineering, Electrical Engineering, Civil Engineering

Subject knowledge:

Renewable energy, Electromobility

Essential attributes:

- Experience of fundamental modelling of complex systems
- Competent in programming
- Knowledge of features and requirements of basic charging infrastructure for electric vehicles of all types
- Good written and oral communication skills
- Strong motivation, with evidence of independent research skills relevant to the project
- Good time management

Desirable attributes:

- Knowledge of/Experience in computing technologies such as: multi-agent systems, machine learning, AI.
- Experience in undertaking independent research with publications
- A completed or near completion MSc in a relevant subject area