Department	School of Computing
Supervisors	Jubaer Ahmed, Savvas Papadopoulos, Fadi Kahwash
Project Title	**Control of Utility-Scale renewable energy power plants for compensating variable generation and providing Ancillary Services to the grid**

PROJECT DESCRIPTION

To achieve the zero-carbon goal, renewable energy sources are penetrating their ways into the power system grid. Such penetrations are getting higher and in the future renewable energy sources will be the backbone of power generation in most countries. Thus, it is expected that renewable energy sources will not only be providing clean power but also be contributing to ancillary service to maintain the power balance and the stability of the grid. One of the main challenges with the integration and operation of power systems with increasing levels of renewable energy generation is the variable and uncertain nature of atmospheric conditions i.e. wind speeds and solar irradiance. Such variable nature of power generation from renewable energy sources makes it difficult to be a reliable candidate for ancillary services. To enable renewable energy sources to provide ancillary services, optimized control algorithms are required to monitor and regulate the power generation, power flow and economic operation of the plant. This project aims to design a real-time control algorithm to regulate power flow from large-scale renewable energy power plants and create the opportunity to provide ancillary services depending on the Grid demand. The developed algorithm needs to be verified using Hardware in loop grid prototypes.

Academic qualifications

A first degree (at least a 2.1) ideally in Masters degree, in a discipline relevant to the area of study, (ideally in Power System Engineering/Power Electronics) with a good fundamental knowledge of Power Electronics System Modelling and Design.

English language requirement

IELTS score must be at least 6.5 (with not less than 6.0 in each of the four components). Other, equivalent qualifications will be accepted. Full details of the University's policy are available online.

Essential attributes:

- Experience of fundamental Power System Simulation, Converter/Inverter design, Power Electronics Circuit Design
- Competent in Matlab/Simulink Modelling and RTI of Hardware in Loop implementation
- Knowledge of renewable energy sources working principle, optimization algorithm design & swarm intelligence
- Good written and oral communication skills
- Strong motivation, with evidence of independent research skills relevant to the project
- Good time management

Desirable attributes:

Track record of publishing in good quality Journals and Conferences.

Indicative Bibliography	1. James R. Nelson and Nathan G. Johnson. Model predictive control of microgrids for real-time ancillary service market participation Applied Energy, 269:114963, 2020. 2. B. Bohnet, S. Kochanneck, I. Mauser, S. Hubschneider, M. Braun, H. Schmeck, and T. Leibfried. Hybrid energy storage system control for the provision of ancillary services. In International ETG Congress 2017, pages 1–6. VDE, 2017. 3. Asmae Berrada and Khalid Loudiyi. Operation, sizing, and economic evaluation of storage for solar and wind power plants. Renewable and sustainable energy Reviews, 59:1117–1129, 2016. 4. Francesco Conte, Fabio D'Agostino, Paola Pongiglione, Matteo Saviozzi, and Federico Silvestro. Mixed-integer algorithm for optimal dispatch of integrated pv-storage systems. IEEE Transactions on Industry Applications, 55(1):238–247, 2018.
Enquiries	For informal enquiries about this PhD project, please contact j.ahmed@napier.ac.uk
Web page	https://www.napier.ac.uk/research-and-innovation/research-degrees/application-process