

Project Title: 'A Feasibility study into Mini grids for Renewable Energy Applications'
Principle Investigator: Prof D Morton (University of Bolton)
Project duration: 01/09/08 – 01/09/09
Grant Value: £71,940

The proliferation of renewable energy systems, e.g. wind turbines, solar cells, heat pumps and fuel cells present significant opportunity for solving the UK's energy problems but also present significant risks in terms of power system security. This is because integrating renewable energy systems into some parts of the electrical network may generate unacceptable voltage variations due to fluctuations in the levels of energy generated. Upgrading the power transmission line to mitigate this problem is often uneconomic and can reduce efficiency. A viable solution to this problem is to create a mini-grid system which distributes the energy generated to the surrounding area. These systems are particularly common in rural parts of developing countries where grid systems are weak or non-existent, in these situations back up is often provided by a small diesel generator. Creating a mini-grid is significantly cheaper than expanding or upgrading the network however little work has been done to look at the feasibility of using these on a wider scale, or interconnecting them, in the UK. This project focused on the feasibility of using mini-grids in the North West by considering issues such as system security, intelligent control, load and weather forecasting and the use of IT for control and system management.

The main objective of this project was to develop strategies for the interconnection of mini grids, these are systems which use some form of renewable energy generation alongside a generator. This involved the development of an appropriate control methodology and strategy for mini-grids. The development of an appropriate control strategy is crucial because the levels of energy being generated by the renewable energy source need to be monitored against the demand, and predicted demand, so that if demand isn't going to be met a backup generator is turned on. The research also demonstrated the feasibility of using mini-grids and in particular the control strategies which enable inverters to be used to regulate load flow and control voltage and frequency. Regulating the load flow and control voltage and frequency helps to increase the efficiency and stability of the grid.

The research carried out on this project could have benefits for developers of renewable energy systems, utility companies, Distribution Network Operators and energy consumers as a result of reduced transmission and distribution costs which maybe reflected in the prices they pay. It could also help facilitate an increase in the use of renewable energy systems in the UK, particularly in remote rural areas. This project has helped further strengthen the link between between Prof. Morton and his partners at the University of South Westphalia.