

Abstract

As the energy sector shifts towards a greater use of renewable energies, it is important that these provide a constant, reliable source of energy, which in turn helps to maintain a constant voltage on the grid. One solution is through the use of a battery energy store. The net power of a battery (connected to a non-renewable resource) and a fluctuating renewable energy can be smoothed to provide a more constant source of energy via the careful choice of strategy by which to charge and discharge the battery. A smoothing algorithm can also be applied to smooth the difference between renewable supply and demand; this helps to reduce the need for fluctuations in other forms of energy supply which, in turn, reduces costs to the consumer.

Dr Lisa Flatley has written an algorithm to determine optimal strategies of an electricity store minimising a discrete total variation analogue, requiring only short-term renewable energy predictions. This algorithm is being extended to consider more parameters of the energy store, such as maximum rates of charging and discharging.

In this project, we develop a MATLAB script for these algorithms. We apply them to a battery energy store at Warwick University to determine an optimal strategy which smooths the university's photovoltaic energy. We analyse this optimal strategy to determine whether the rate constraints are binding, find more information about how far into the future energy predictions are required, and discuss the effects of acquiring more batteries.