Optimising Charging of Electric Vehicles through the use of Genetic Algorithms

Author: Tom Curran

Supervisor: Dr. Edgar Galván-López, Co-Supervisor: Prof. Stephen Barrett

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The charging of electric vehicles (EVs) places a strain on the transformers in the electric grid in order for it to be able to supply enough power to meet demand. This is set to become more and more of a burden on the grid as EVs become more popular among the general public. The use of demand-side management (DSM) and smart grids have been investigated as a solution to this problem, and the problem of reducing load at peak times in general, by automatically shifting the use of some household appliances to times where there is a reduced load.

This dissertation aims to reduce these issues in a number of ways through the use of genetic algorithms (GAs) alongside the DSM approach. The proposed approach is to implement a GA which uses several `fitness functions' in order to target multiple separate objectives; fitness functions can be seen as black boxes which we can use to indicate how good/bad a potential solution is. The objectives include a lower overall transformer load, a lower peak-to-average ratio, a final state of charge (SoC) close to the normal approach, and a lower cost of electricity to consumers. The execution of this GA will create schedules that the EVs can follow throughout each day in order to charge whilst achieving these goals; in order to evaluate this implementation, we will simulate the electric grid using GridLAB-D across a 28-day period (for each approach) in which the EVs arrive home in the evening with a generated SoC, and must charge to the target SoC by the time of their departure in the morning.