Advanced Analysis of Building Energy Performance using Computational Intelligence Approaches

Energy efficiency is a key component of the UK Government's new climate change strategy with almost 50% of current CO_2 emissions resulting from energy use in buildings. Central to this approach is the ability to monitor and control energy consumption accurately.

Building performance is often measured through the metered energy use of the whole building, and/or through the more detailed monitoring of the individually controlled processes by the building management systems (BMS). Automatic meter reading (AMR) systems which can provide accurate consumption data, typically at half-hour intervals, have existed for several decades. Many initiatives are in place to install such meters in large numbers of industrial and domestic sites. This has resulted in an increase in their uptake and their associated services and the emergence of the smart metering paradigm.

Unfortunately, it is not clear how this data is actually going to be used. The advanced metering pilot run by the Carbon Trust has produced a breakdown of recommendations derived from introducing advanced metering into SMEs. It found that, without additional advice, only a small fraction of the potential savings can actually be achieved.

Computational Intelligence (CI) techniques are perfectly suited to the analysis of metering data. These algorithms allow for scalability and robustness and can be easily distributed over several processors.

In this EPSRC funded Midlands Energy Consortium project we are investigating the potential for using CI methods in the automatic analysis of metered building energy data. We examine how these methods can be used to provide maximum benefit to a large range of energy users. We will concentrate on identifying CI techniques that can be applied to wide ranges of sites, are largely automated, and require minimal training, system setup or manual data entry.

We will establish potential techniques, benefits, and requirements, as well as the extent to which building specific knowledge is required in the analysis together with the impact of time-varying boundary conditions (the weather and occupant driven heat loads). While this project concentrates on energy consumption by buildings in commercial and industrial sites, the research will also provide valuable insights for energy consumption of domestic buildings, industrial processes, and any other metered utility consumption.