

Energy & Climate Change: the Contribution of Complexity Science

24th March, 2009

Discussion Group on Renewables

Attendees:

Colin Axon (Oxford),
Godfrey Boyle (Open),
David Elliott (Open),
Russ Layberry (Oxford),
Ivana Kochar (Strathclyde).

The discussion was more about induced behaviour in the electricity distribution (not transmission) networks resulting from attaching “active” devices. By active devices we meant mostly “third generation” smart meters, responsive load such “smart fridges”, small to medium-scale generators (roof-mounted photovoltaics, community scale wind turbines, combined heat and power units, etc), and electric vehicles.

Our discussion was split by use of tools – network analysis and agent-based modeling (ABM) – because most of the challenges we thought of would best be tackled with one or the other technique. We considered that the starting point for analysing the behaviour of embedded generation devices was through network analysis, with responsive loads being added later as a further interesting complication. ABM is very good at examining collective behaviours and so dynamic tariffs, storage devices, electric vehicles, markets and trading, and responsive load could be considered in such a scheme.

Operating across the regimes of both techniques is scale. The scale issues we identified were how behaviours in micro-grids may affect the super-grid (and vice-versa), and how to consider moves from a centralised generation system to a decentralised one.

The other issue was heat. This may be looked at through CHP i.e. a heat led device which may feed power to the distribution grid, or as a “displacement activity” i.e. using solar thermal water heating to cut the need for other energy sources.

Colin Axon,
8/4/09