

CLNR Trials Interim Load and Generation Profiles

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The Customer-Led Network Revolution project is studying the electricity consumption and generation patterns of a large number of domestic and business customers in the UK. By the end of 2012 a large quantity of metering data had been collected from trial participants; subsequently this data was used to derive electrical load and generation profiles for the monitored groups. These profiles show typical daily use patterns for different types of domestic and business customers, low-carbon technologies, and distributed generation sites.

The CLNR project is undertaking a series of trials to monitor electricity use in domestic, small commercial (SME), and larger commercial and industrial environments. Load and generation profiles, which show the diurnal and seasonal patterns of electricity consumption and generation, are being studied by the project to understand how electricity is consumed and produced in the present day, and how this is likely to change in the future. The emergence of low-carbon technologies (LCTs) — solar photovoltaics (PV), electric vehicles (EVs), heat pumps (HPs) and micro-combined heat and power (μ CHP) units — has created new load and generation sources that are of concern to distribution network operators (DNOs), and these new technologies

are also being studied in CLNR trials. Profiles characterise the average behaviour of electricity customers or producers, and they are used by industry planning standards during the design of electrical networks. CLNR trial results and analysis will be used to inform updates to these planning standards.

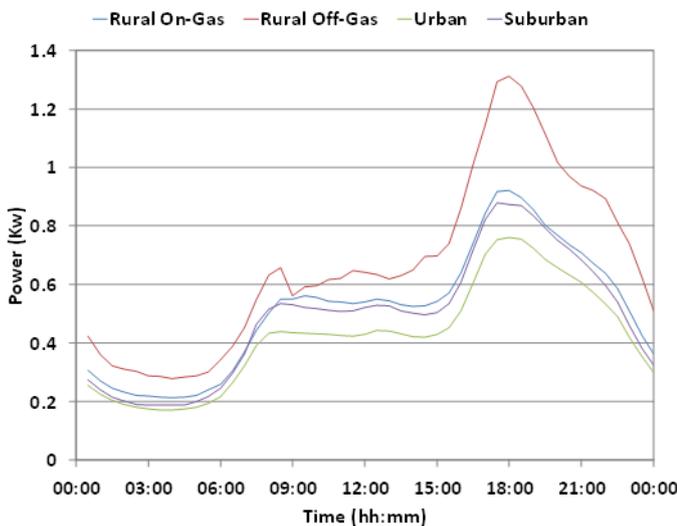
During 2011 and 2012 a large number of electricity customers in the residential, SME and industrial and commercial (I&C) sectors were enrolled into the monitoring trials; these trials are on-going, but a preliminary study [1] describes the data collected up to the end of October 2012 and presents some initial findings. The table

<i>Customer Type</i>	<i>Monitoring Type</i>	<i>Number Studied</i>
General Domestic Load	30-minute kWh	5554
General SME Load	30-minute kWh	1795
Domestic Heat Pumps	10-minute W	Up to 23
Domestic PV	10-minute W	88
Domestic EVs	10-minute W	2
Distributed Generation	30-minute MW	160

shows the numbers of customers available for study at this interim stage. A number of load and generation profiles have been produced for these groups of cus-

tomers; the profile data, in an accessible spreadsheet format, can be downloaded from the project website [2].

The largest study group is comprised of regular electricity customers, both domestic and small business; this group acting as a control for the other trials. Customers in this group do not possess any low-carbon technology and are on a flat tariff. Demand data is collected through a smart electricity meter. The group is stratified to ensure that the factors governing electricity consumption in the general population are adequately represented across the sample. Analysis shows that modern domestic load patterns are comparable to those from 1980 [3], but with a reduced morning peak. Demand differences between weekend and weekdays



are also evident. The figure above shows differences in daily demand for four groups of residential customers for December 2011; similar differences are also

observed between a variety of small business types.

The set of low-carbon technology customers (PV, EVs, heat pumps and μ CHP) forms a second study group. PV generation is seen to be quite uniform across the study group, on average producing around 35% - 40% of the rated output at mid-day. Heat pumps exhibit significant peaking demand that coincides with other network peaks (e.g. at teatime, and during night-time Economy 7 peak), which will be of concern to DNOs. Although only two EV customers were monitored it was evident that charging loads are high and that charging patterns are likely to be highly dependent on the combination of owner, vehicle and charging equipment.

The final group — distributed generators — is a mix of dedicated generation sites, and enterprises which generate electricity on-site for local use and sell any surplus to the grid. Boiler houses and community heating schemes feature alongside wind farms, hydro-power and large-scale landfill gas sites. Examination of their generation profiles shows that wind, landfill and cogeneration all produce “typical” outputs over the course of a day and the concept of a typical profile for these groups appears plausible.

- [1] *Initial Load and Generation Profiles from CLNR Monitoring Trials* (from CLNR website)
- [2] Learning Outcome 1 Interim Results: CLNR Dataset (<http://www.networkrevolution.co.uk>)
- [3] ACE Report No. 49 (1981)