

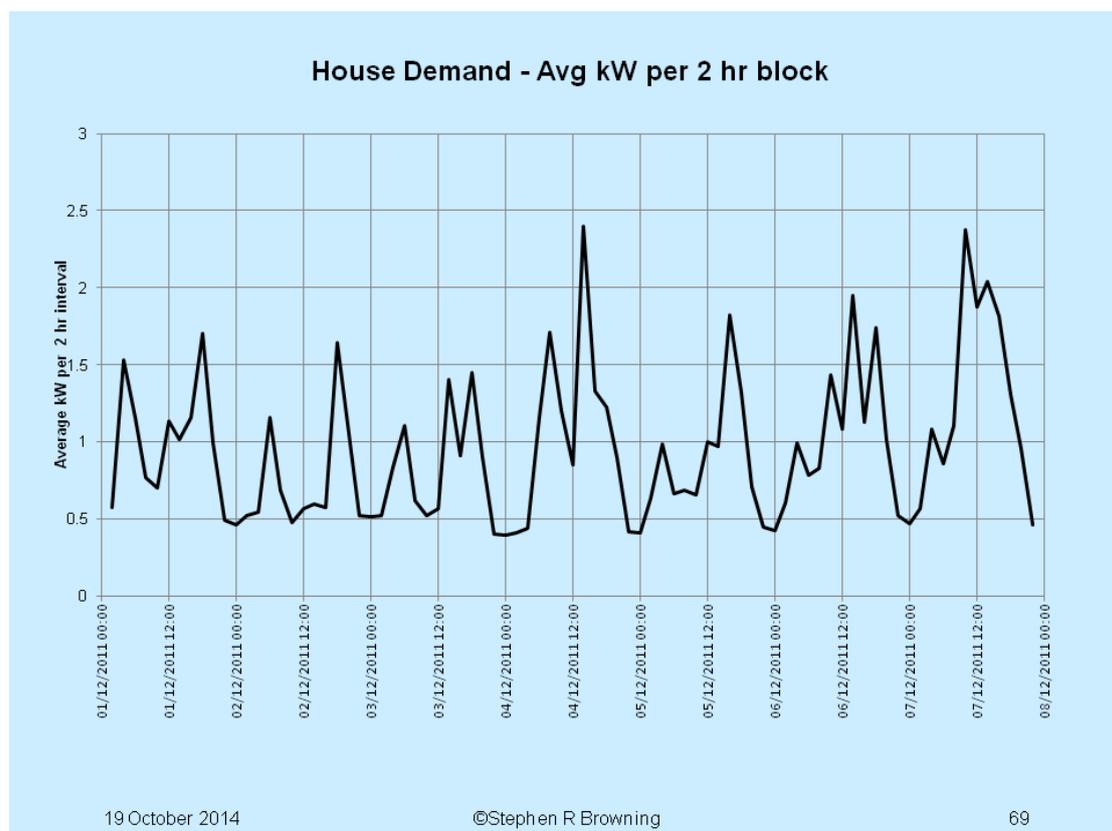
Future Power Systems 8 - The 'Active' customer

Distributed resources need careful handling for Distributed Network Security and to ensure that fossil fuel burn is reduced most efficiently. Clever management of 'Distributed Electricity Resources' (DER) is the key. The new Active Network now carries sometimes unpredictable generation and some controllable demand. There is also the possibility that storage could be applied to facilitate flow management on the distribution system and avoid fluctuations and also reduce the system import at times of high demand when the most inefficient fossil fired plant has to start up and run.

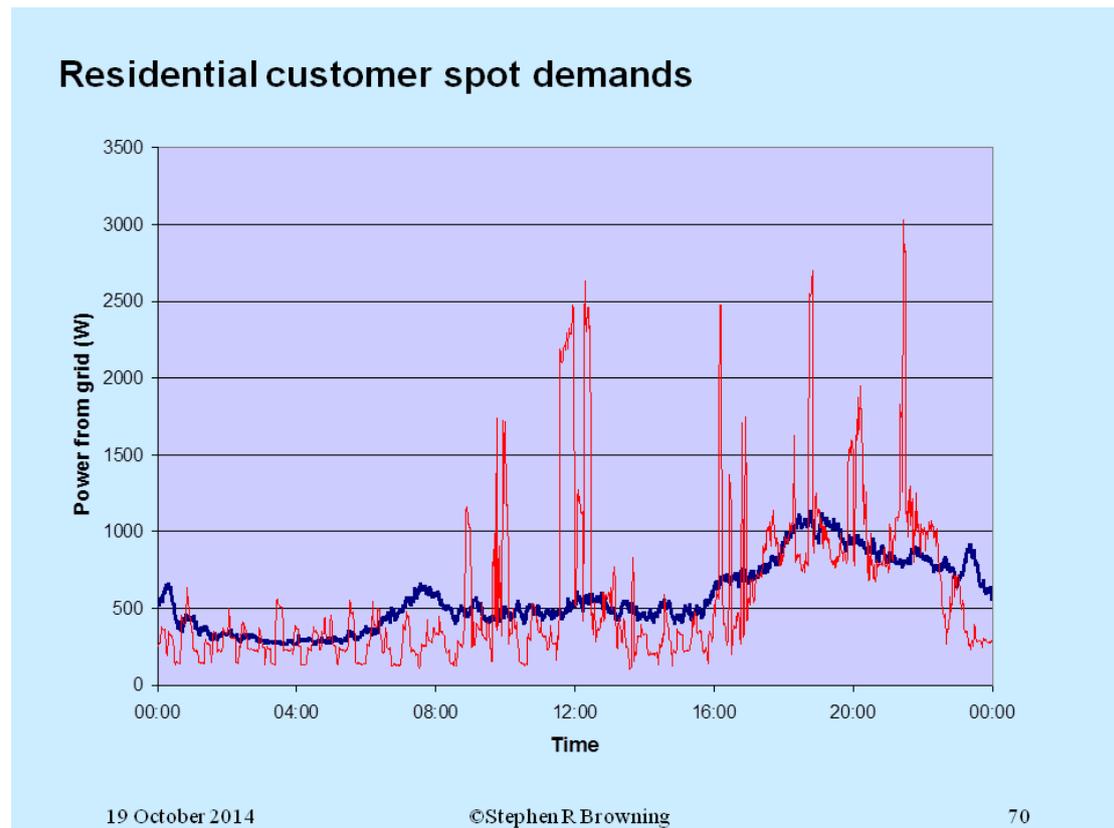
We need to persuade customers that the 'Fit and Forget' approach to distributed generation isn't going to achieve the best results. At the same time we must remember that the customer's main activity is getting on with life (domestic), carrying out business (commercial) and manufacturing (industrial). They do not want to dedicate time or expensive resources to good power profile management; the process has to be automatic.

Let us look at the Customer Demand and Distributed Generation profiles in more detail.

First, here is 7 days of 2 hour average demand for a busy house.



The spot demand is even more erratic.



The domestic customer has a basic refrigeration demand, a smooth lighting and entertainment load which peaks morning and evening then a large but highly erratic heating appliance demand (e.g cooking, hair dryers) which puts large spikes onto the profile. A large laundry equipment heating load will appear when the machines are operated. Note that domestic distribution connections are rated at least 12kW. Although this historically would be to accommodate some direct heating load, coincident heavy cooking demand with other demands peaking still needs to be catered for. In addition, Eco house designs can include instantaneous electric water heating. This will cause new demand spikes at time of general peak demand as against tanked hot water storage systems using gas or off peak electricity as the energy source.

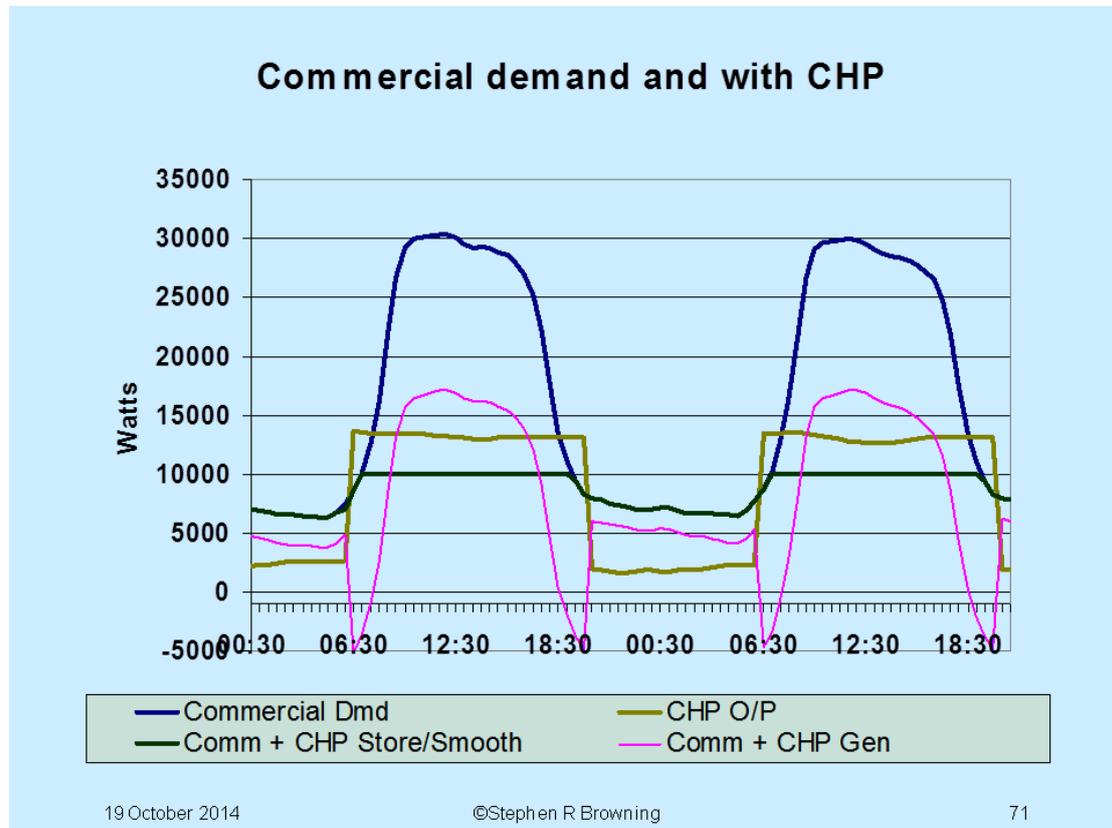
If the domestic customer adds some renewable generation, we would expect to see an 'erratic' generation pattern overlay for Wind (turbulence effect at low levels) and a more consistent generation pattern for PV, depending on cloud movements across the sun. This would probably lead to overall daytime export and morning/evening import. CHP systems would generate in blocks dependent on the outside temperature; however such technology is not appropriate for high efficiency houses with a low thermal and cooling demands are supplied by heat recovery, heat pumps and solar thermal panels, plus heat stores. Overall there is a considerable level of

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'unpredictability' at individual domestic premises level, both generation and demand, which limits the potential benefit of control.

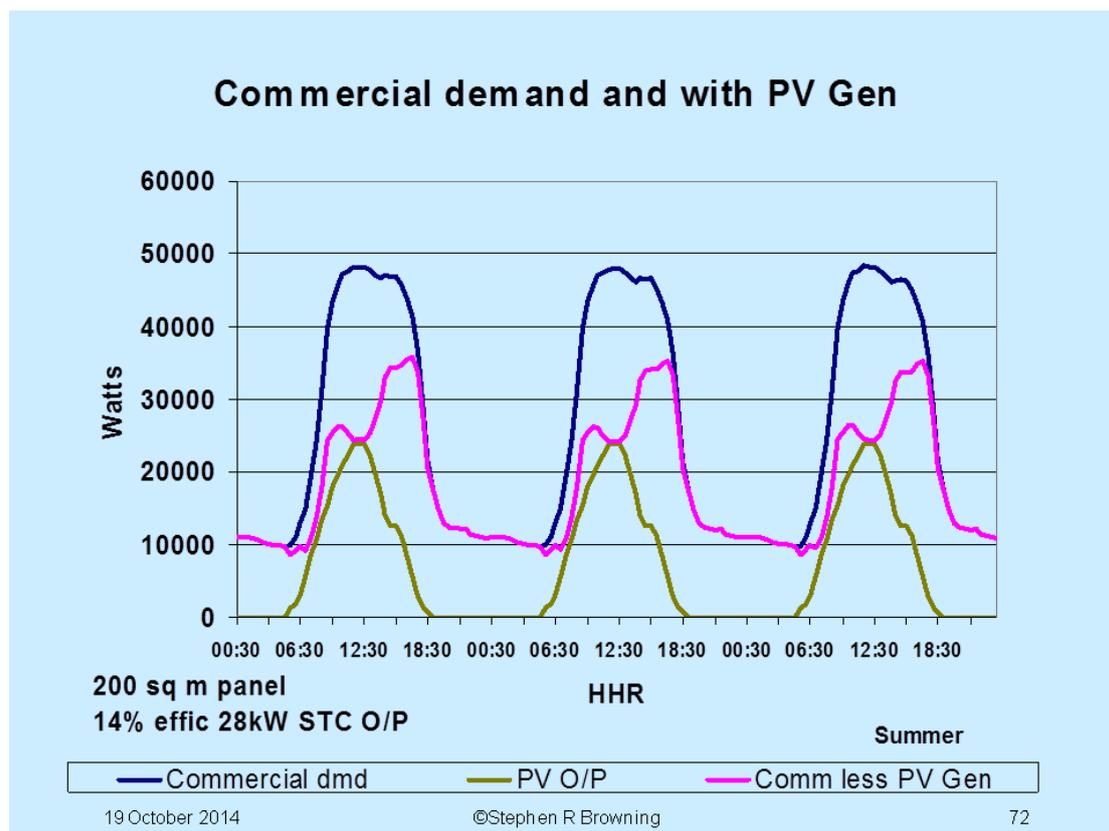
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Moving up to commercial level, assuming some heating load will be met by larger scale CCHP (20kWe) and with a day-night temperature variation on the building, we could get the following profile shape in Winter.



The demand is less erratic for a large commercial building but shows a large day-night variation. The CHP would however cut in before and cut out after main occupancy times. On a premises basis predictability is better than domestic. Generation varies with temperature while demand shows a higher 'basic' level plus some light and temperature based variations. Again generation and demand need to be monitored separately to ensure records of each are accurate and some level of control could be applied.

For a commercial building with a large PV array we might get this profile in summer



The residual site import is reduced in the morning but comes back up in the afternoon before work finishes.

At industrial level, large CHP is geared to providing heat and electricity for major processes. The generation will normally operate when the process demand is applied. The sizing of such CHP will normally be limited so as not to exceed the heat or electrical demands to avoid unprofitable export under simple tariffs or production of unnecessary heat. The operation of the plant and the demand should be predictable against manufacturing process operation timetables.

The more predictable and controllable Generation and Demand is, the more scope there is for control to assist with system management by operating outside normal premises requirement. At individual domestic level where there seems limited scope for control, some 'non time critical' demand (e.g. Laundry) can be usefully set to operate at appropriate times (low National Demand). Commercial and Industrial locations may be more suited to premises level control.