Future Power Systems 18 – DER Participation in Market Timescales.

When it comes to incorporating Distributed Energy Resource (DER) activity, the supplier will need to construct half hour energy blocks with prices, representing the aggregated 'offers' from or contracts with his customers to vary premises export and import. These can then be compared with the sale and purchase half hourly energy blocks and prices being tendered in the Market by other parties. Any trading with DER is simply between the supplier and his customers, to modify the supplier's account demands and thus his purchasing requirements within the market. The trades do not enter the industry settlement process and customer actions will be reconciled dependent on the framework for participation.

All the major decisions which affect genset running profiles, principally commitment, are made in market timescales. However, the market framework is trading of energy by account by half hour. This is not precise enough to facilitate efficient merit order operation of main plant by minimizing on load and start up fossil fuel burn against more accurate forecasts of total system and group demands. Thus the market price messages may not promote the best use of DER to avoid unnecessary running of marginal plant.

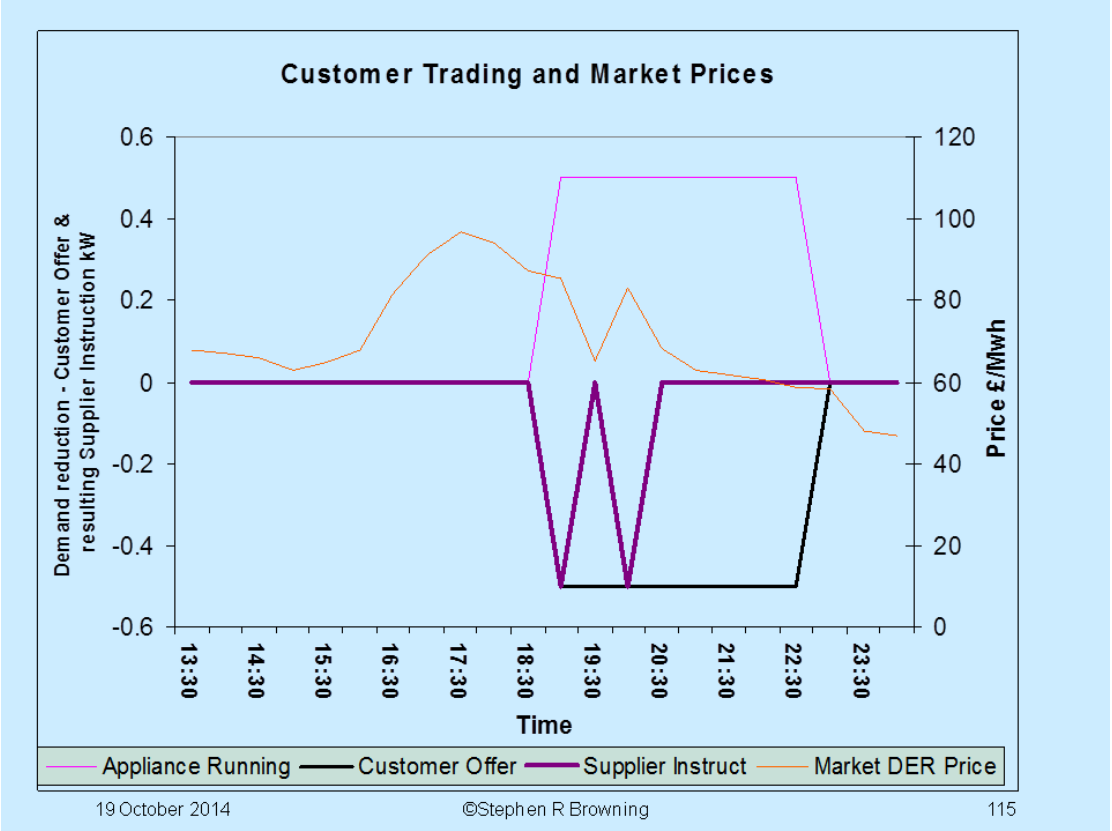
Trading Approach

The trading approach, comprising individual offers from the customer to increase or decrease import/export in market timescales, is difficult to handle for small premises. First his system has to know that a 'tradeable' demand, by definition non time-critical such as laundry, needs to run. His system next needs to schedule a running time period for the appliances, work out the half hourly energy demand and then calculate the worth of canceling the run. A single offer to represent the cancellation of the appliance run (reduction in demand) could be constructed, but putting an alternative bid to reschedule its operation cannot be time specific. All the customer really wants is to find the cheapest contiguous period to operate the appliance.

From the aggregation perspective a large number of differently priced offers and bids, all covering different periods and each rather small, would be presented by such a mechanism. These will need to be aggregated by half hour and price band for the supplier to use. It is probable that the resulting trades from the supplier by half hour, when disseminated, would only request demand reduction for part the offer period for an individual customer site. This would indicate the appliance should be switched off and on over an elongated running period; not a practical option with laundry equipment.

In this example the customer has planned to run laundry equipment (average demand 0.5kW), in two operations over 4 hours, from 1900 to 2300. He has offered to cancel the demand for an energy benefit of 5p/kWh (£50/MWh). The supplier will only accept this offer for the first and third half hours of the trade. Note that the

customer benefit will be the saving at his normal tariff rate (say 5p/kwh) plus a payment from the supplier up to the offer price (2p/kwh).



What we also have to remember is that the market prices are energy only while the customer tariff consists of energy + system use charges. These elements need to be kept segregated for the customer-supplier interface to correctly identify the benefits.

However, the opposite practice has sometimes been the case in the unbundled supply environment with standing charge elements to cover use of system being converted and added to the energy prices for simplicity. Thus in the above example the Market energy price has been increased to reflect the DER price at the premises.

It could be considered that industrial premises with large scheduled process demands could construct offers and bids to 'shift' the process demand period. However, it is again likely that the aggregation/instruction/dissemination chain would again result in an impractical request for non-contiguous operation of the process plant.

The other problem with this method is proving that the customer site has delivered the instructed 'trade'. In general customer demands are estimated as block aggregates. Unless the specific pre-trade demands for individual customer sites are

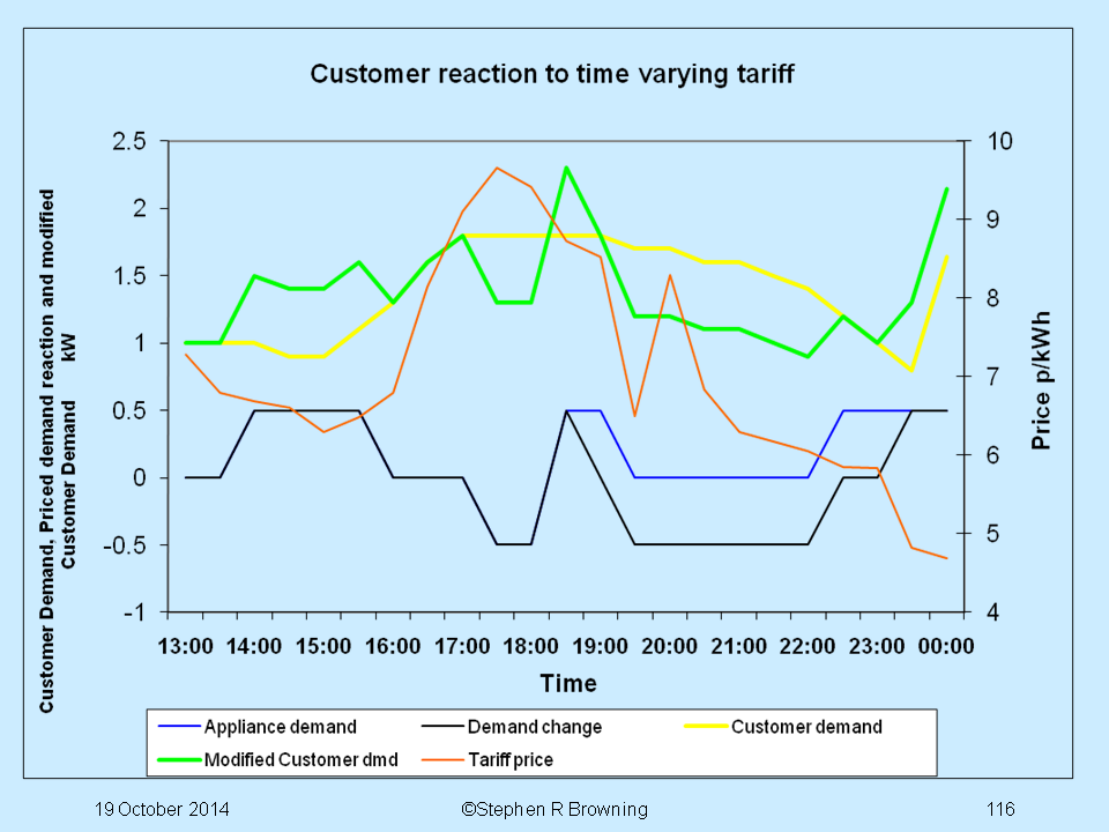
submitted, they cannot then be compared with the final metering. This process is needed to determine the demand reduction which is to be credited at the specific trade price less customer normal tariff rate, as against the reduced metered demand charged at the customer's normal tariff rate

Tariff Mechanisms

The most practical methods for dynamic DER management involve the supplier signaling half hourly prices in advance. Premises control systems can evaluate the tariff signals and determine when non time critical demand should run. Such systems should also warn the users of any critical high price periods so that 'accidental' unnecessary demand can be turned off.

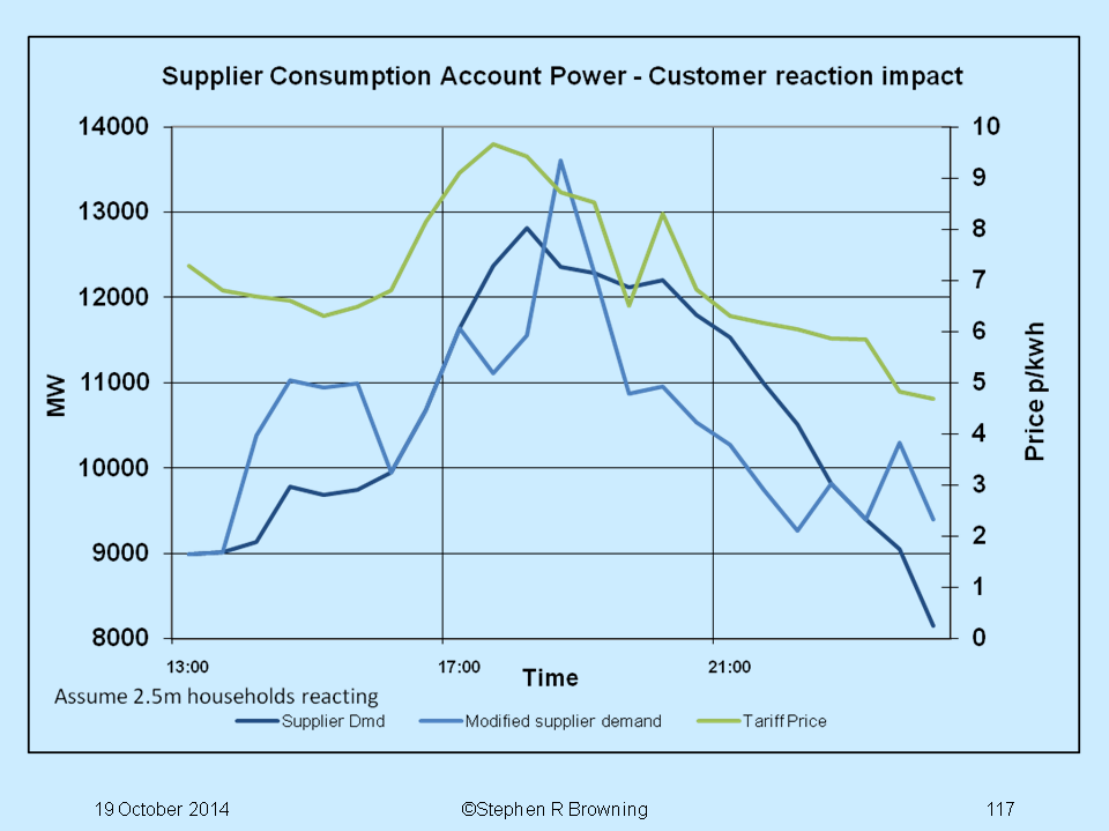
Proving 'delivery' of customer Import-Export changes is of course not necessary with this method as the tariff simply applies to all Import or Export energy.

Once again the market energy prices must be converted to the DER premises level by adding use of system elements.



In this case, the premises system has split the two laundry cycles over two periods, one in the afternoon and then a shorter and later run in the evening. It has also influenced the customer to reduce other demand around the peak time (say delay dinner) which is then recovered immediately afterwards.

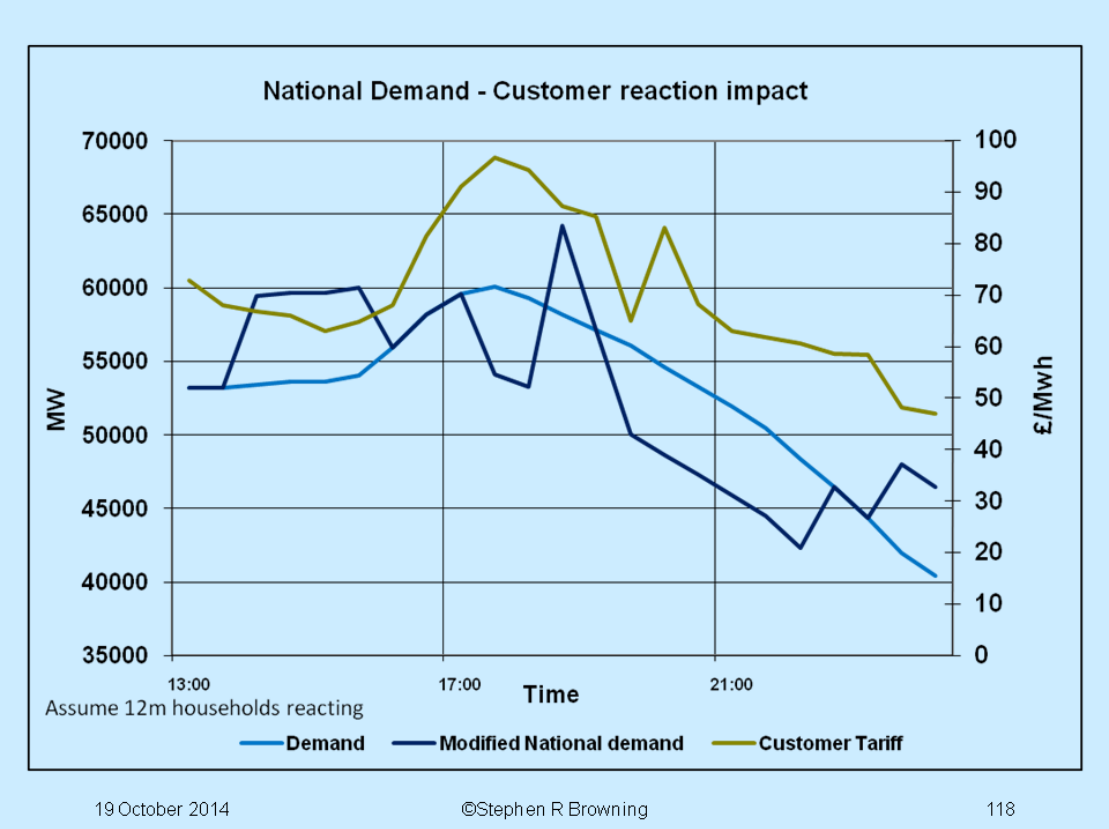
If say, this reaction was reflected over 2.5m households of a supplier with 5m households, the impact on the supplier's energy would be as follows….



This shows that prices based on the raw market profile should not be used as dynamic tariff prices because they only reflect the marginal market position and the resultant customer reaction can be excessive. The consequential bi-lateral trading energy trading to cover such demand reaction would drive market prices in various directions to compensate.

The supplier will need to evaluate and forecast the likely impact of pricing in terms of the change to his half hourly account energy demands. Feedback from the premises control systems could also be employed for the purpose of analyzing demand-price reaction. The resulting price profile issued would then be somewhere between the supplier's marginal energy purchase rate and the customer energy tariff rate, with appropriate correction for use of system charges on the latter.

If the above action was reflected nationally, with say half of all households reacting in the same way, the result would look as follows.



As noted earlier, the issue of accurate demand recording is important to settlement and forecasting. Priced DER management obviously has a serious impact on demand history and conventional demand forecasting methods.

So, in summary, dynamic price setting should be carefully managed with regard to customer reaction. Staggered price changes can also be utilized with different groups of customers having different price profiles to avoid co-incident over-reaction.

Control Mechanisms

Simple control signals can also be sent in advance to cause supplies to be reduced or to increase over a particular period, at a predetermined price or to avoid capacity charges. Such mechanisms for demand management have been used over many years to give large businesses advanced warnings of a peak occurring which will determine their chargeable maximum demand (use of system). Radio teleswitching has also been used to alter the operating time period for off-peak storage heating, on a day to day basis. This smoothes the effect of the heating load switching on and off, against the different demand patterns encountered over the winter period and between weekdays and weekends.

Suppliers can also enter into other pre-arranged contracts with their customers, which reward the latter for changes to their Import-Export profile in response to signals sent in advance. As with the trading option above, this method has the issue of 'proving' delivery. The changed energy is credited at the special contract rate while the residual Import or Export is still charged or credited and the normal tariff rate for the premises.

Automatic mechanisms

These are not really applicable in market timescales, as they rely on independent action at the premises in response to abnormal conditions on the electrical supply (frequency, voltage, stability). These events can only be detected in real time; thus the management of automatic action falls within the operators' domain.

Feedback to the Operators

Any market timescale changes to DER import/export need to be communicated back to the system and distribution operators, so that they can compensate their forecasts of generation, demand and system state within the matching and security processes.