Appendix G

Chapter Specific Terminology – Demand

This appendix is designed to be an overview of the terminology used within Chapter 2 (Electricity Demand) of the 2011 NETS SYS. It is strongly recommended that users of the NETS SYS who may be unfamiliar with industry terminology relating to Electricity Demand read this appendix before studying the chapter itself.

Self-Generation | Customer Demand Data | Average Cold Spell (ACS) Correction | ACS Peak Demand

Self-Generation

Customers who load manage in response to high electricity prices and/or triad demand charges can either reduce their production or, if available, fall back on their own generation in order to maintain output. In these circumstances, the form of self-generation used would normally be of a standby nature since other main forms of own generation such as combined heat and power (CHP) would be likely to be already in operation.

As part of its Climate Change Programme to reduce carbon dioxide emissions in 2010 by 20 per cent of their 1990 level, a target of 10GW of electrical CHP capacity was set for 2010 (see Chapter 4 ("Embedded and Renewable Generation"). Increases in the capacity, and hence use, of CHP and other forms of self-generation, particularly that which is not of a standby type, would be expected to result in commensurate falls in the level of demand met from the transmission system, although this does not necessarily mean a reduction in the system's use. (For example, the location of new self-generation in some areas could result in increased system power flows as a consequence of the displacement of local demand previously met by local generation, leading to the surplus local generation being transported elsewhere by the transmission system).

Customer Demand Data

Every 'User' who takes, or expects to take, demand directly from the transmission system via a Grid Supply Point (GSP) is required by the Grid Code to provide NGET with demand forecasts with respect to that GSP. These forecasts are required to be submitted by Week 24 (i.e. mid-June) of each year, although updates can be provided after this date.

'Users' who take demand directly from the transmission system are, in the main, the distribution network operators. In addition, some industrial sites are directly connected to the transmission system and most Large Power Stations' own demand is also met from it via their station transformers. The Week 24 forecasts are used for, amongst other things, studying power flows on the transmission system. Accordingly the Week 24 submissions, which are given in respect of each of the seven succeeding financial years, include:

the demand the network operator expects to take from each GSP at the time of the expected system demand peak (the date and time being advised in advance by NGET) - primarily for use in infrastructure planning; and

the maximum demand the network operator expects to take from each GSP at any time - primarily for use in GSP planning.

In both cases (i) and (ii) above, network operators are required to make allowance for demand met by Medium and Small Power Stations embedded within their networks and for imports across embedded External Interconnections.

When planning the development of the transmission system, account is taken of all Large Power Stations, whether embedded in a distribution network or directly connected to the transmission system.

For power flow studies and other system analyses, total transmission system demand is derived from the Week 24 submissions as follows. Peak demand forecasts at the time of system peak provided by each customer are aggregated and projected transmission losses are added. A correction factor is then applied to the resultant total demand stream which scales the total for the initial year to the provisional (or final, if known) ACS corrected peak demand outturn. Subsequent years are then scaled by the same factor, thus retaining customers' projected annual growth rates. This scaling process was originally formulated with the approval of distribution network operators.

For Grid Supply Point (GSP) planning, demand at each individual GSP's peak is used, together with appropriate allowances for embedded Large Power Stations, in accordance with the Licence Standard. For planning the development of the infrastructure of the main interconnected transmission system, as opposed to specific GSPs, the unrestricted ACS Peak Demand forecast is used. Using unrestricted demand for infrastructure planning recognises that demand control cannot be relied upon in the planning time phase. Nevertheless, in the event of a sufficiently high level of certainty being attached to the implementation of demand control we would take demand management into account within our infrastructure planning.

Average Cold Spell (ACS) Correction

Actual outturn peak demands can vary considerably from one year to another depending on the weather and other factors such as economic activity and consumer behaviour. ACS demand correction enables more meaningful comparisons to be made between outturn demands and allows forecasts to be made on a weather base that also conforms to security standard planning requirements.

National peak demand forecasts given in this Statement are based on average cold spell (ACS) weather conditions. These are the combination of weather elements (i.e. temperature, illumination and wind) that give rise to a level of peak demand within a financial year that has a 50 per cent chance of being exceeded as a result of weather variations alone.

Prior to the introduction of the British Electricity Trading and Transmission Arrangements (BETTA) in 2005, ACS outturn peak demands (and forecasts) were based on 'unrestricted' demands. These were derived by adding the load management enacted at peak and notified by suppliers under the Grid Code onto winter weekday outturn peak demands. With BETTA covering the whole Transmission System, in addition to extending the demand forecasts to incorporate Scotland, the ACS correction methodology was also updated.

One particular change to the methodology was made in order to address the significant fall-off experienced in the amounts of demand control being notified under the Grid Code. The latter made it increasingly difficult to derive realistic historical 'unrestricted' demands, i.e. actual metered ('restricted') demands plus notified demand control, on which to base the ACS correction, which is now calculated from historical 'restricted' instead of 'unrestricted' demands. (For the avoidance of doubt, 'restricted' demand is the level of demand after taking into account demand control, i.e. it represents the actual metered outturn, whereas 'unrestricted' demand makes no allowance for the impact of any demand control).

Although the ACS correction procedure now produces historical 'restricted' demands, infrastructure planning for the transmission system continues to be based on ACS 'unrestricted' demands. This prudent approach is made on the basis that load management cannot be fully relied upon to be enacted at peak times. ACS 'unrestricted' demands are therefore still required and these are obtained by adding estimates of load management obtained from analysis of winter weekday evening peak demands onto the ACS 'restricted' peak demands. The resulting ACS 'unrestricted' demands outturns provide the platform for producing 'unrestricted' demand forecasts.

As a cautionary note, other related documents may publish 'restricted' rather than 'unrestricted' demands, a case in point being National Grid's 'Winter Outlook Report'. Care should therefore be exercised when making comparisons between demand forecasts on different bases.

The specific methodology for identifying ACS demand comprises two main parts. Firstly, a mathematical model estimates demand/weather coefficients from historical 'metered' demands (i.e. actual outturn peak demands). The modelling uses recent winters' demands rather than a longer historical period to ensure that the latest demand behaviour is captured as well as to include as much weather variation in the modelling data as possible. Weather and demand data over the GMT period (i.e. late-October to late-March) for weekday peak half hours is modelled to give:

Winter Weekday Darkness Peak Demand is equal to the sum of:-

- A Constant;
- Weather Dependant Demand;
- Demand Management;
- Seasonal Trends (Day, Week, Year); and
- Error Terms.

The weather dependent demand at the darkness peak is a function of:-

- Effective Temperature at 17:00 GMT;
- Effective Temperature squared at 17:00 GMT;
- Effective Illumination at 17:00 GMT; and
- Cooling Power at 17:00 GMT.

The effective temperature (TE) is an average of the current and previous day's temperature at the time of the winter darkness peak. Cooling power (CP) is an empirical combination of temperature and wind speed, similar to wind chill. Effective illumination (EI) is a function of solar radiation, taking in to account the number and type of cloud layers, visibility and the amount and type of precipitation (although at the time of the darkness peak in mid-winter EI is zero).

In the second part of the ACS correction methodology, the coefficients are used to carry out a simulation analysis of Winter Weekday Darkness Peak Demand (WWDPD) for the last winter. Simulations of the Weather Dependant Demand & Day of the week are fed into the WWDPD model for each Electricity Supply Industry (ESI) week (where weather dependent demand is described above and estimated from TE, EI & CP actuals which are aggregated from regional weather stations collected for the last thirty years).

The peak of the simulated Winter Weekday Darkness Peak Demands for each of 10,000 winter simulations are ordered and the median demand (50^{th} percentile) is identified as the ACS demand (i.e. the level of peak demand that has a 50 per cent chance of being exceeded as a result of weather variation).

ACS Peak Demand

The definition of the term 'ACS Peak Demand' given below has been written for the purpose of this Statement. The meaning of the term may differ in some respects in other documentation,

The estimated unrestricted winter peak demand (MW and Mvar) on the National Electricity Transmission System for the Average Cold Spell (ACS) condition. This includes both transmission and distribution losses and represents the demand to be met by Large Power Stations (directly connected or embedded), Medium and Small Power Stations, which are directly connected to the National Electricity Transmission System, and by electricity imported into the National Electricity Transmission System from External Systems across External Interconnections.

Figure 2.6 provides a generalised illustration of the definition and also aids comparison with other demand terms in current usage.

The figure shows the different categories of demand directly connected to the transmission system together with the demands supplied from the distribution networks, which are in turn directly connected to the transmission system at Grid Supply Points (GSPs). Transmission and distribution losses are also included.

In Figure 2.6, the area within the red border encapsulates those components of demand making up ACS Peak Demand, with the generation used to meet ACS Peak Demand bordered in blue. This generation comprises; directly connected power stations, whether Large, Medium or Small; embedded Large Power Stations; and imports from External Systems across directly connected Interconnections. Until the winter of 2001/02, exports to France across the Interconnection were exceptional. Since then exports have become more common, although not at times of system peak.

In providing demand forecasts for their Grid Supply Points, the distribution network operators net off their own allowances for the output of embedded Medium and Small Power Stations, Customer Generation and also for the imports across embedded External Interconnections. Customer Generating Plant operates to supply all or part of its own electricity requirements and exports any surplus onto the local distribution network. Embedded generation is the subject of Chapter 4 (”Embedded and Renewable Generation”).

The SYS definition of “ACS Peak Demand” is demand including exports to external systems and pumped storage pumping demand, but excluding station transformer demand.

Please note that the SYS definition of “ACS Peak Demand” is not in line with the Grid Code definition of "National Electricity Transmission System Demand", which includes exports to external systems, pumped storage pumping demand and station transformer demand. Also, this is not the same as the Grid Code definition of "National Demand", which specifically excludes those three demand categories.