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Chapter 2

Electricity Demand

Introduction

This chapter presents forecasts of electricity demand to be met from the National Electricity Transmission System (NETS). The main forecasts are based on NGET's own forecasts, which are used in conjunction with the generation and transmission backgrounds described in Chapter 3 and Chapter 6 respectively, to form the basis of the studies presented in this Statement.

Alternative 'High' and 'Low' scenario forecasts are also included as supplementary information and reflect our views on possible outcomes based on specific assumptions.

Information submitted by Customers (transmission system 'Users') who take, or propose to take, electricity from the high voltage system is also presented. The 'User'-based forecasts, includes details of individual Grid Supply Point demands.

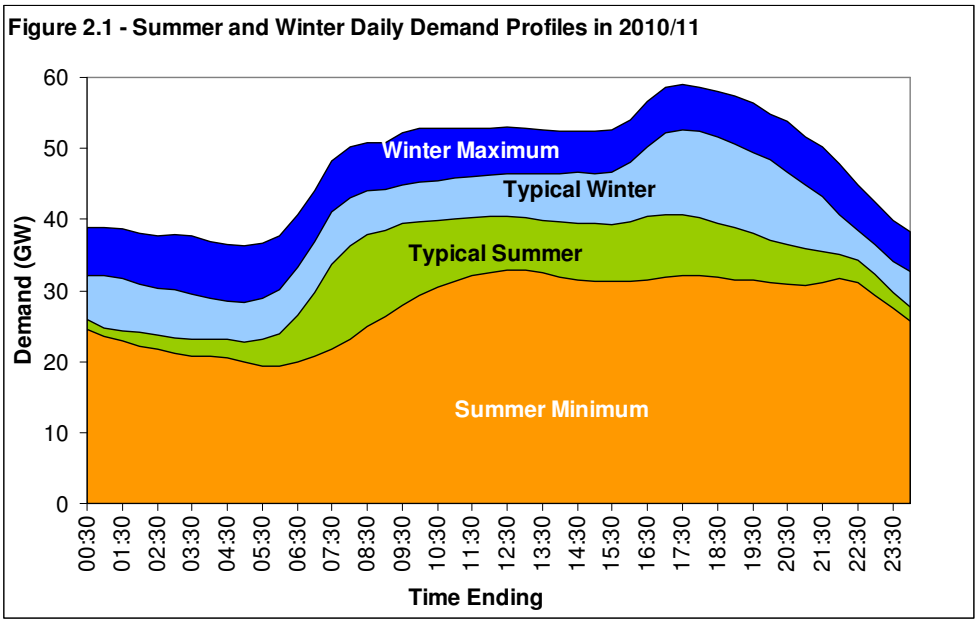
Other demand information such as winter and summer demand profiles, load duration curves, weekly maximum and minimum demands, and annual requirements for NGET's base, high and low cases are also presented in this Chapter to provide an overview of NETS electricity demands other than at the time of system peak.

Finally readers are advised that if they are not familiar with demand terminology that they read Appendix G before studying this chapter. Appendix G explains the terminology used in this chapter.

Demand Outturn 2010/11

Figure 2.1 presents daily demand profiles for the days of maximum (07/12/10) and minimum (18/07/10) demand on the Transmission System in 2010/11 and for days of typical winter (17/11/10) and summer (10/06/10) weekday demand. Please note that these demands are shown exclusive of station transformer, pumping demand and interconnector exports.

Figure 2.1 - Summer and Winter Daily Demand Profiles in 2010/11



Key points of interest are:

(i) Maximum & Typical Winter Profiles (Weekday)

00:00h - 03:00h: Operation of time-switched and radio tele-switched storage heating & water heating equipment.

06:30h - 09:00h: Build-up to start of working day.

09:00h - 16:00h: Plateau reflecting the working day (primarily commercial & industrial demand).

16:30h - 17:30h: Rise to peak due to lighting load and increased domestic demand outweighing fall-off in commercial and industrial demand.

(ii) Typical Summer Profile (Weekday)

As (i) above without effects of storage heating demand and with the later onset of evening lighting load.

(iii) Minimum Summer Profile (Sunday)

As (ii) above with increased lunchtime cooking demand.

Whilst Figure 2.1 shows how demand varies through the day in summer and winter, Figure 2.2 plots weekly maximum and minimum demands in 2010/11 to indicate how demand varies over the year. Please note that week 1 shown below on Figure 2.2 refers to the first week in April 2010.

Figure 2.2 - Weekly Maximum and Minimum Demands in 2010/11

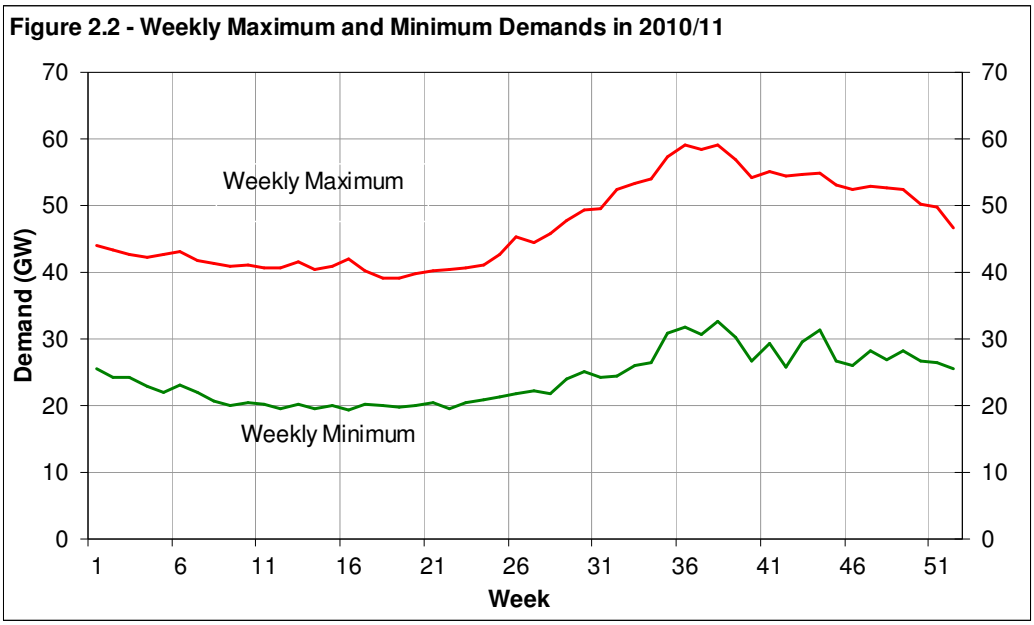
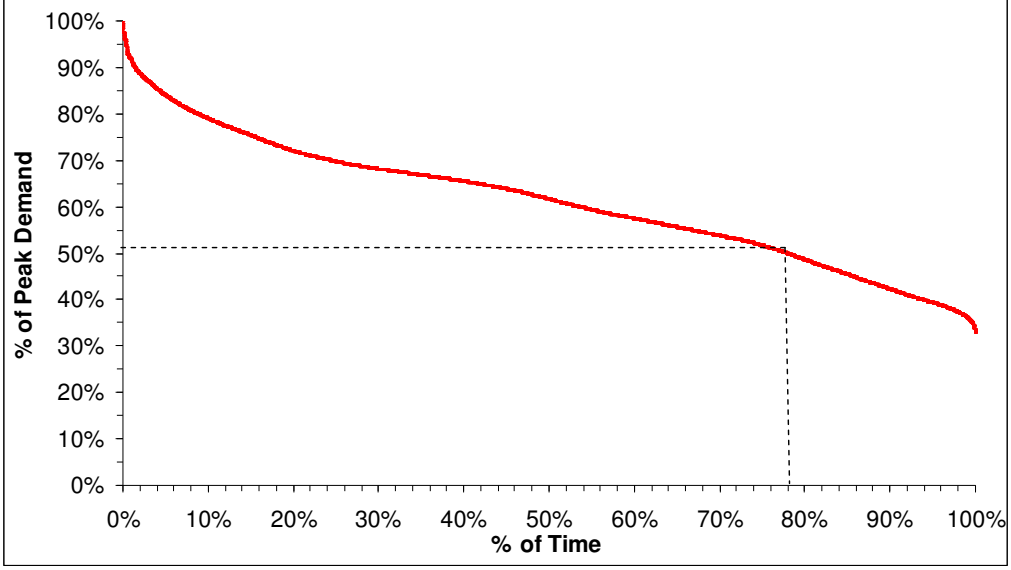


Figure 2.3 shows the annual load duration curve for 2010/11. Based on demand data for every half hour of the year, it shows the percentage of time in the year against the proportion of the year's peak. For example, demand exceeded 50% of the annual peak for 78% of the time.

Figure 2.3 - Annual Load Duration Curve for 2010/11



ACS Peak Demand

ACS Peak Demand refers to the time of the simultaneous peak demand on NETS and accordingly takes account of any diversity between the individual peak demands on each of the systems of the three Onshore Transmission Licensees (i.e. NGET, SPT and SHETL).

For this Statement, ACS Peak Demand is defined as unrestricted peak demand including losses, excluding station demand and exports. No pumping demand at pumped storage stations is assumed to occur at peak times. Infrastructure planning for the transmission system continues to be based on ACS 'unrestricted' demands – a prudent approach to transmission planning made on the basis that demand control cannot be fully relied upon to be enacted at peak times.

Please note that other related documents may refer to 'restricted' demands rather than 'unrestricted' demands, e.g. National Grid's 'Winter Outlook Report'. Naturally, therefore, care should be exercised when making comparisons between demand forecasts on different bases.

As outlined earlier in this chapter, NGET's own forecasts are used in conjunction with generation and transmission backgrounds to form the basis of the studies presented in this Statement.

NGET's ACS peak demand forecast is derived from detailed analysis on the annual energy consumption. A historic relationship between annual energy consumption and system peak demand is used to form the basis for the future relationship between the annual and peak demands.

Annual energy consumption is derived from a number of key drivers:

- Historic annual energy consumption
- Economic growth (including fuel price)
- Growth in household numbers
- Growth in industrial and commercial sectors
- Embedded generation development
- Energy efficiency measures

- New emerging technology such as heat pumps and electric vehicles

Historical annual energy consumption forms the basis of our forecasts, with each of the other factors adding or reducing energy usage to it. Growth in the economy, household numbers, industrial and commercial sectors would tend to increase energy consumption (with a shrink in these factors having a reverse impact); whilst an increase in embedded generation (CHPs, wind, biomass and other renewable generation) and greater energy efficiency measures will reduce demand. Smart metering is anticipated to have a greater impact on system peak demand than on annual energy consumption, with the distribution of the demand load throughout the day anticipated to change. The introduction of heat pumps and electric vehicles will also contribute to the change in energy consumption.

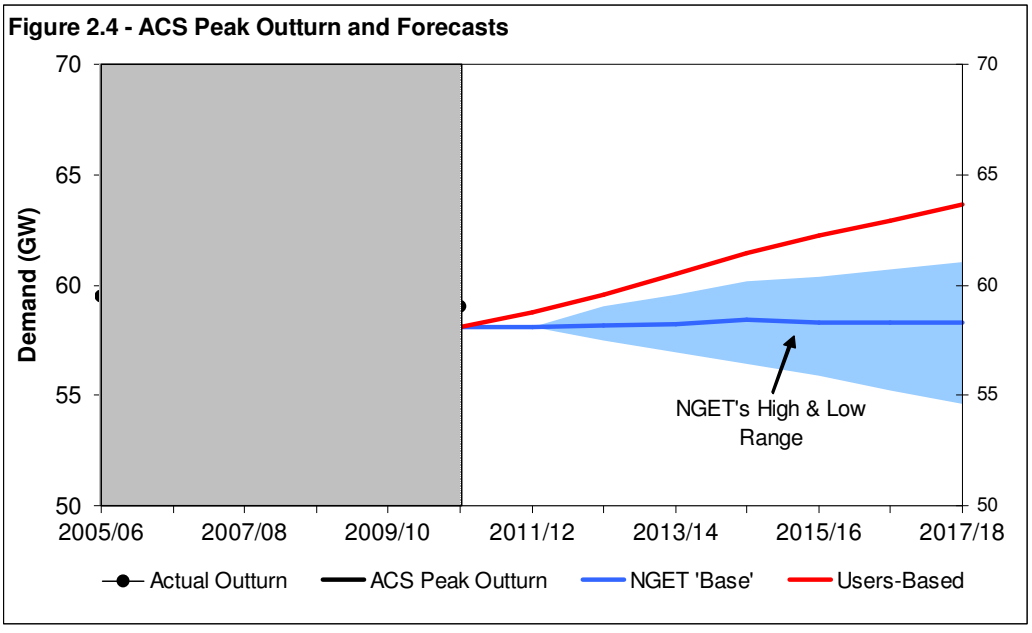
Details of NGET's peak demand and electricity requirements outturn and projections, and the main economic assumptions underlying them are given in Tables 2.1 – 2.5. (Please note that the central economic forecasts on which they are based have been provided by Experian Business Strategies).

For more information on ACS and Users-based demands, please see Appendix G.

ACS Peak Demand Outturn and Forecasts

Figure 2.4 shows recent actual and ACS peak demands along with the latest NGET 'Base' forecasts of ACS peak demand on the Transmission System. Correcting historical peak demands to ACS conditions enables underlying peak demand patterns and trends to be more readily observed. NGET's high and low cases, together with Users'-based forecasts are also shown in the chart.

Figure 2.4 - ACS Peak Outturn and Forecasts



NGET's 'Base' Forecast

In the 'Base' forecasts, peak demand is projected to increase by 0.3% over the study period. There are factors that drive this demand to increase whilst other factors drive the demand to decrease, giving a relative flat forecast over all.

The economic background is an important element of NGET's demand forecasts. The UK economy emerged weakly from an 18-month recession in the fourth quarter of 2009. GDP contracted by 4.9% over 2009. The economic recovery gained pace in early 2010, but reversed with a contraction in GDP in the final quarter of the year, partially attributed to poor weather. GDP grew by 1.3% over 2010. Economic recovery is expected to be moderate, with fiscal austerity acting as a drag on the positive impact of stronger exports. GDP is expected to grow by 1.7% in 2011, returning consistently to the historical trend rate of around 2.5% pa after 2016. Under these assumptions, annual GDP growth averages 2.0% over the period 2010 to 2016 inclusive.

Increasing end-user energy consumption driven by economic growth is forecast to be offset by forecast growth in embedded generation, thus reducing the growth in transmission electricity demand. Although the development of embedded generation, in particular CHP generation, has been weakened by the economic downturn, we forecast that total embedded generation will grow at about 2 – 3.5 % p.a. from current capacity of 8.8GW to 10.6GW by end of the study period Nearly half of this would come from embedded CHP, approximately a quarter coming from embedded wind (full capacity) and the remaining embedded generation from biomass plants, solar PV, etc. In addition, some solar thermal heating at homes could reduce direct electric water heating.

Another factor that could reduce energy consumption is energy efficiency measures. Our forecast assumes an increase in the level of energy efficiency over the period, with the change from incandescent light bulbs to CFLs (compact fluorescent light bulbs), more efficient household appliances and insulation (loft, cavity wall and solid wall) all having an effect on domestic demand. Energy savings from CRC Energy Efficiency Scheme for non-domestic customers were also incorporated into our forecasts.

The UK government has a policy to roll-out smart metering to all residential gas and electricity customers by the end of 2020. This policy would influence the demand daily profile, encouraging the charging of electric vehicles overnight, reducing the level of demand at peak and resulting in general behavioural changes affecting overall energy consumption. It is assumed that 20% of domestic consumers would take up the time of use tariff, reducing energy consumption over the year by around 3% for these customers.

During this study period, the combined savings from energy efficiency measures and time of use tariffs/smart metering reduces energy consumption by 0.5 – 3% per annum.

This forecast also assumes the deployment of heat pumps and locally-connected electric heating and an increase in the ownership of electric vehicles. Although these new technologies have minimal effect on peak demand and annual energy during this study period, both are expected to play a significant role beyond 2020.

For the duration of this forecast, it is assumed that there will be no exports to Continental Europe at the time of the system peak. Exports of 400 – 500MW at peak are expected from the SPT system to Northern Ireland via the Moyle interconnector and across the planned 500MW interconnector between North Wales and the Irish Republic. This change in forecast is due to the new exemption of TNUoS demand and generation charges on interconnectors. Under the second and third package EU legislation, an interconnector is defined as a transmission line (thus the flows are considered as neither generation nor demand). Please note that exports are not included in the definition of "ACS peak demand" and are consequently treated as negative generation.

NGET's High Growth Scenario

In this scenario, peak demand increases by 5% over the study period compared with an increase 0.3% in the base case, and similar increase on annual energy.

This scenario (see Table 2.5) is based on the possibility that the economic recovery will gain strength due to strong exports and investment activity, enabling the private sector to outweigh the impact of fiscal tightening. Under this scenario, annual GDP growth averages 2.7% over the period 2010 to 2016 inclusive.

Other factors considered in this scenario are lower energy efficiency savings, lower demand reduction from the effects of smart metering/time of use tariffs and less embedded generation. Increase in demands from electric vehicles and demands from heat pumps were also considered, though these have minimal effect on peak and annual energy over the study period.

Total embedded generation will grow at a slightly slower pace of about 1.5 – 3% per annum, giving a total capacity of 9.8 GW at the end of the study period. Please note that these are full capacities and may be lower at the time of system peak.

NGET's Low Growth Scenario

In this scenario, peak demand decreases by 6% over the study period compared with an increase of 0.3% in the base case and a decrease of 7.5% on annual energy over the study period.

This scenario (see Table 2.5) is based on the possibility that the recovery falters due to fading consumer confidence and rising unemployment as the fiscal squeeze takes hold, the impact being magnified by downward pressures on UK exports as recovery in the eurozone loses momentum. Under this scenario, annual GDP growth averages 1.4% over the period 2010 to 2016 inclusive.

Other factors considered in this scenario are greater energy efficiency savings, more demand reduction from the effects of smart metering/time of use tariffs, and a faster growth of embedded generation. Increase in demands from electric vehicles and demands from heat pumps were also considered, though these have minimal effect on peak and annual energy over the study period.

Total embedded generation will grow at a faster pace of 3 – 6% p.a., giving a total capacity of 12.1 GW at the end of the study period. Please note that these are full capacities and may be lower at the time of system peak.

'Users' Based Forecasts

As explained earlier in this chapter, the main forecasts are based on NGET's own forecasts rather than based on Users' forecasts. NGET's 'base' demand forecasts form part of the SYS background upon which most of the studies presented in this Statement are based. For comparison, 'User'-based peak demand forecasts are presented in this Statement. These are obtained from the aggregation of 'User' submissions (see Table 2.3).

In submitting their forecasts, 'Users' are not required to provide information on their background assumptions but possible reasons for the transmission system demand differences include alternative views on factors such as economic prospects and the growth of demand met by embedded generation. Furthermore, the User-based forecasts were submitted last June based on demand seen in 2009/10. NGET forecasts benefit from being based on provisional demand outturn seen in 2010/11.

Local peak demand is used for Grid Supply Point planning while the demand at the time of the system peak is used for infrastructure planning purposes. Transmission losses are added to User's demand submissions. The aggregation of these demands is then scaled to the provisional or, if known, final ACS corrected outturn for the winter. The resulting adjustment factor is applied to subsequent years, thus retaining customers' forecast aggregate annual growth rates.

Demand on the Grid Supply Points (GSPs)

Grid Supply Points (GSPs) are the points of connection between the transmission system and the distribution networks and/or Large Power Stations. The times of individual GSP peak demands can vary from GSP to GSP and as such may not coincide with the time (or date) of the system peak. In Appendix E, tables E.1.0 to E.1.7 list the 'User'-based forecasts of maximum demand for each GSP, firstly in respect of the time of the GSP peak and secondly in respect of the projected time of the system peak. These demands are measured at the GSP and accordingly include distribution losses but do not include transmission losses.

The final column in Table E.1.1 gives Direct Current Load Flow (DCLF) Node information. This has been included to enable Users to identify the HV DCLF transport model node at which LV demand is mapped for the purpose of calculating Transmission Network Use of System (TNUoS) tariffs (please refer to Chapter 6 under "Use of System Tariff Zones") and producing the Condition 5 information paper which forecasts the future path of the locational element of the TNUoS tariffs. The additional column is included for information purposes, but it should be noted that the peak figures included in the table will not necessarily exactly match those demand figures contained in the DCLF transport model as adjustments to the data are made to allow for station demand and generation is treated as negative demand. Also in Appendix E, table E.2.0 provides GSP information at the projected time of the minimum system demand.

For grid supply point planning, demand at each GSP's peak is used and is scaled to GB demand, together with appropriate allowances for embedded Large Power Stations, in accordance with the Licence Standard. An allowance for generation by Medium and Small Power Stations and imports across embedded External Interconnections is already made in the customers' demand projections. For completeness, the tables in Appendix E also list Large Power Stations connected to GSPs or embedded in the distribution networks behind GSPs, together with demand power factors.

Figure 2.5 - ACS Peak GB Demand

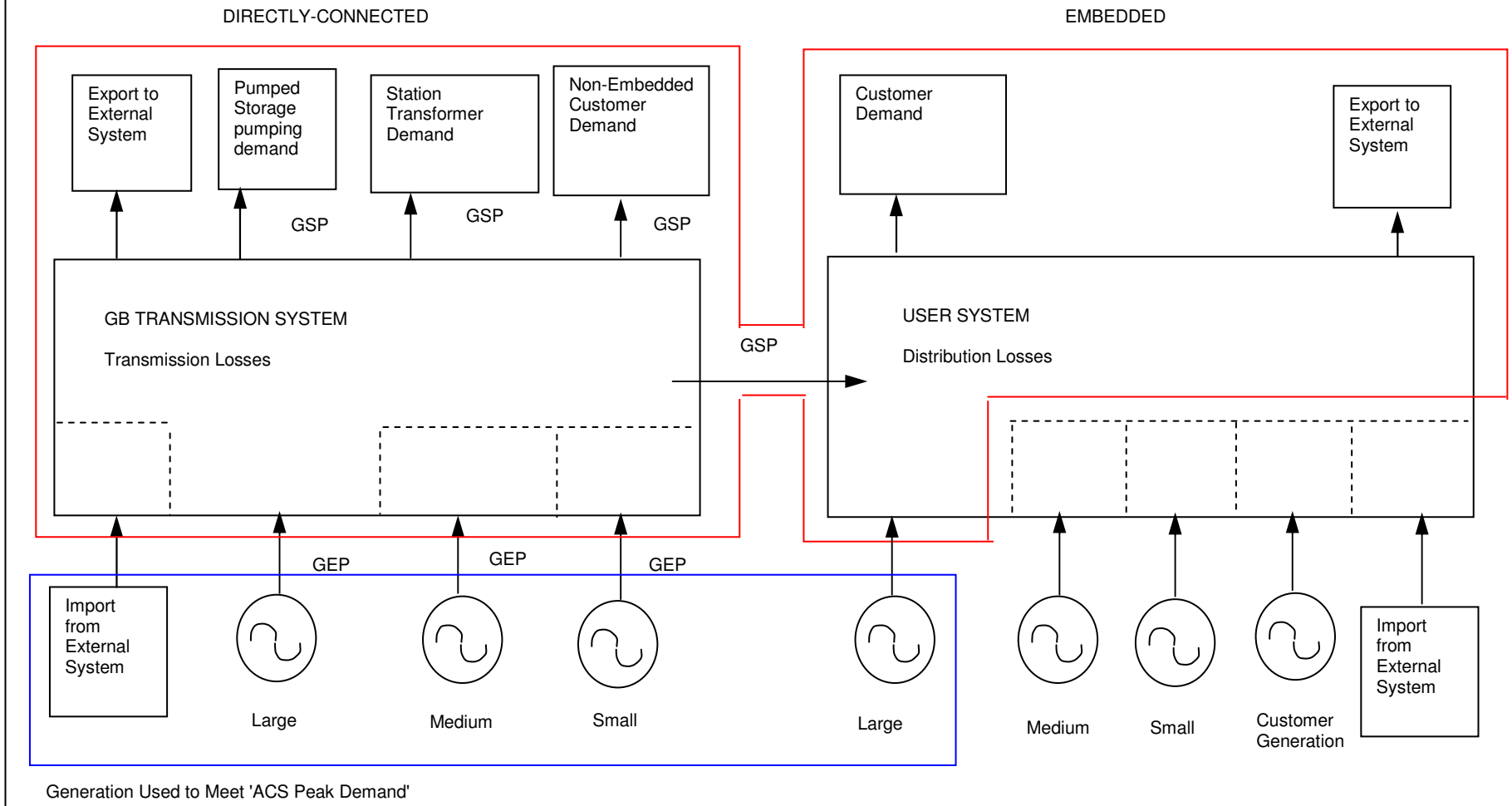


Table 2.1 - NGET's 'Base' ACS Peak Demand Forecasts (GW)									
Forecast	**Description**	**2010/11**	**2011/12**	**2012/13**	**2013/14**	**2014/15**	**2015/16**	**2016/17**	**2017/18**
1	ACS Peak incl Station Demand and Exports to External Systems	59.1	59.2	59.7	59.9	60.0	59.7	59.7	59.7
2	Station Demand	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
3	ACS Peak excl Station Demand and Exports to External Systems (for plant margin evaluation)	58.5	58.6	59.1	59.3	59.4	59.1	59.1	59.1
4	Export to N Ireland via Moyle Interconnector	0.4	0.5	0.5	0.5	0.5	0.4	0.4	0.4
5	Export to Republic of Ireland via "East/West" Interconnector	N/A	N/A	0.5	0.5	0.5	0.4	0.4	0.4
6	Export to France via IFA	0	0	0	0	0	0	0	0
7	Export to The Netherlands via Britned Interconnector	N/A	0	0	0	0	0	0	0
8	ACS Peak excl Station Demand and Exports to External Systems (for ranking order & SQSS studies, where exports to External Systems are treated as negative generation)	58.1	58.1	58.1	58.3	58.4	58.3	58.3	58.3

Table 2.2 - Peak Demands and Annual Electricity Requirements: Historical Outturns				
Year	**Actual Peak Demand (GW)**	**ACS Corrected Peak Demand (GW)**	**Actual Electricity Requirements (TWh)**	**Weather Adjusted Electricity Requirements (TWh)**
2005/06	59.5	61.4	349.0	347.6
2006/07	57.5	60.9	339.8	343.0
2007/08	60.0	60.7	339.9	342.5
2008/09	58.6	58.4	333.3	329.3
2009/10	58.5	57.5	320.7	318.1
2010/11	59.1	58.1	319.2	314.7

Table 2.3 - NGET's ACS Peak Demand Forecasts & Users' Peak Demand Forecast				
Year	**ACS Peak Demand (GW) Low Scenario**	**ACS Peak Demand (GW) Base Forecast**	**ACS Peak Demand (GW) High Scenario**	**Users' Peak Demand Forecast**
2010/11	58.1	58.1	58.1	58.1
2011/12	58.1	58.1	58.1	58.7
2012/13	57.5	58.1	59.0	59.6
2013/14	57.0	58.3	59.6	60.5
2014/15	56.4	58.4	60.2	61.5
2015/16	55.9	58.3	60.3	62.3
2016/17	55.2	58.3	60.7	62.9
2017/18	54.6	58.3	61.0	63.6

Table 2.4 - NGET's Annual Electricity Requirement Base Forecast and Scenarios			
Year	**Annual Electricity Requirements (TWh) Low Scenario**	**Annual Electricity Requirements (TWh) Base Forecast**	**Annual Electricity Requirements (TWh) High Scenario**
2010/11	314.7	314.7	314.7
2011/12	312.0	314.4	316.9
2012/13	309.3	314.8	319.2
2013/14	305.7	315.1	321.9
2014/15	302.2	315.9	325.3
2015/16	298.7	315.2	326.3
2016/17	294.2	314.7	327.8
2017/18	290.9	314.5	329.9

Table 2.5 - NGET's Base Forecast and Scenarios Economic Assumptions				
Forecasts 2009/10 - 2016/17 (% p.a.)	**GDP**	**Household Disposable Income**	**Manufacturing Output**	**Non-Manufacturing Output**
Low Growth Scenario	1.4%	-0.4%	1.0%	1.4%
NGET 'Base' Forecast	2.0%	1.1%	2.2%	2.0%
High Growth Scenario	2.7%	2.6%	3.4%	2.6%