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# Chapter 9

# Opportunities

## Introduction

This chapter provides a commentary on those parts of the National Electricity Transmission System (NETS) most suited to new connections and to the transport of further quantities of electricity. The information presented draws on that contained in the previous chapters, in particular Chapter 8 (Transmission System Capability).

Readers are reminded that anyone considering a development at a specific site and requiring additional technical information relating to that site may contact us for assistance as explained in "Further Information" in Chapter 1.

Notwithstanding the opportunities set out in this chapter, the three Transmission Licensees will continue to comply with Transmission Licence obligations and make offers to any User or potential new User wishing to use the NETS in respect of new generation and/or demand. The timescales, required by each Transmission Licensee to complete any necessary transmission work, associated with a new development, is, amongst other things, a function of the size and location of the development. In some instances no infrastructure reinforcement work at all will be required and no delay will be incurred. That is, if the required transmission reinforcement is localised and not environmentally contentious, the necessary work can normally be completed in similar timescales to that of the customer's project. However, where the development requires extensive and/or contentious transmission work (with the associated need for Planning Consent and possible Public Inquiries), it may not always be possible for the relevant Transmission Licensee to fully meet the customer's wishes with respect to timescales. Nevertheless, all three Transmission Licensees will always endeavour to meet their customer's requirements.

This chapter also contains a section on Ancillary Services. Amongst other things this section presents information on possible future opportunities for Users to provide Ancillary Services under contract to ourselves.

## Use of External Interconnections

### Introduction

The section on "Interconnections with External Systems" in Chapter 3 explained that our transmission system is directly interconnected with those of France, Northern Ireland and the Netherlands by early 2011. By the end of 2012 there will be a further interconnection with Southern Ireland. Parties that have acquired rights to use these External Interconnections are, subject to the relevant market arrangements and agreements, able to trade between the electricity market in Great Britain and those of the External Systems.

### France Link

Under NETA, new arrangements for obtaining access to the link were introduced and these continue under BETTA. The arrangements allow for capacity to be allocated in either direction via a system of auctions. These are jointly administered by National Grid and the French Transmission System Operator (RTE). Details of the access arrangements including the auction process can be found on the RTE and National Grid Website, namely: http://www.nationalgrid.com/uk

### Northern Ireland Link

This link is owned by Moyle Interconnector Limited and operated by System Operator Northern Ireland (SONI), who also administer the sale of capacity on the interconnector on behalf of Moyle. The relevant Website address is: http://www.soni.ltd.uk

### Netherlands Link

A DC link for interconnection with the Netherlands electricity system was commissioned in early 2011. The link has a capacity of 1000MW, capable of bi-directional flow, and will be connected at Grain 400kV substation.

### Eire Link

Eirgrid is developing an 500MW HVDC interconnecter to join Eire to the NGET network at Deeside. The interconnector is proposed for connection in 2012 and is currently under construction.

## New Demand

The majority of single new demands are less than 50MW in size (e.g. a large new car production plant). However, the demand from a new steelworks could be in the region of 150MW. In any event, a step-change of say 150MW of demand is usually too small a value to affect any single zone significantly. In general terms, there is likely to be sufficient additional capability over a whole zone of the supergrid to be able to accommodate any single new demand of this size without requiring major reinforcement into the whole zone. Reinforcements at and into a particular Grid Supply Point may be required for a new demand, and in some cases additional reactive compensation may also be required, and a prospective new entrant should contact us for a detailed discussion of an individual site.

An exception might be the introduction of such a step-change of load at certain points within or around some southern areas. For example, the London area has a large demand; approaching one tenth of the system peak demand. The London boundary is close to its thermal limit although planned work, some in Table B.7c and some in Table 8.2, will ensure continued compliance. A large step-change in demand might, dependent on exact location, require major reinforcement.

It should also be remembered that, whilst a 150MW demand increase may not have an appreciable effect upon the particular zone in which it is located, it could have a more global effect on the overall system. For instance additional demand in the south could, under certain circumstances, advance the need for major inter zonal transmission reinforcement between the north and the south. Each case needs to be considered on its own merits.

## New Generation

### Overview

In general terms, the disposition of demand and generation across the NETS is such that much of the generation capacity is located in or towards the northern and midland parts of England based on location of fuel, while much of the demand is located in the southern parts of the system. In consequence, the resultant power flows are broadly from the northern parts to the southern parts of the system, particularly at times of the system peak demand.

The disposition of the reported increase in generating capacity from 2010/11 to 2017/18 is described in ”Generation Disposition” in Chapter 3. In particular, Appendix F Table F.9 details the capacity changes on a zonal basis.

It should be remembered that the figures shown in tables such as Table F.9 reflect the current contracted position and take no account of future uncertainty. As mentioned previously, it is reasonable to suppose that further new applications for power station connections will be received and, at the same time, some existing contracts may be modified or terminated and some existing power stations will close.

It should also be noted that capacities in Table 3.11 and other tables in Chapter 3 do not include the embedded Medium and Small generation and embedded External Interconnections with External Systems. The capacity of such embedded generation sources is the subject of Chapter 4 (Embedded and Renewable Generation).

A key message arising from the analyses of boundary power transfers is that, with the increase in new generation planned over the next seven years, the resultant power flows through the Scottish and English grid systems to the Midlands would require significant reinforcement. The future is uncertain and it may be that not all projects may proceed to completion. With the implementation of Connect and Manage, new generation connection offers may be made ahead of this reinforcement. In addition some existing fossil fuel stations may close due to technical or commercial reasons, or due to environmental legislation, e.g. following the introduction of the Large Combustion Plant Directive in 2008 and the IED directive in 2016.

## Completion of the Transmission Access Review

On 27 July 2010, DECC published the government response to their technical consultation on the model for improving grid access, explaining that the Government had decided to implement an enduring Connect and Manage (C&M) approach to transmission access. This new approach became live on 11 August 2010, and from this date the necessary industry code and licence modifications became effective.

The full response can be found at:

http://www.decc.gov.uk/en/content/cms/consultations/improving_grid/improving_grid.aspx

The new arrangements continue the principle introduced under Interim Connect and Manage (ICM), namely generation projects are allowed to connect to the transmission system in advance of the completion of the wider transmission reinforcement works. The works that are required to be completed prior to a generator connecting are classed as 'Enabling Works' as defined in the government response and also set out within the new section 13 of the Connection and Use of System Code (CUSC).

To help interested parties understand how the new C&M regime will work in practice, we have prepared a "Connect and Manage Guidance" document which can be found on the National Grid website at:

http://www.nationalgrid.com/uk/Electricity/GettingConnected/PoliciesAndGuidance/

## Other Regime Developments

Other significant development work that may impact on connections are Ofgem's Project TransmiT (a review of Transmission charging and associated connection arrangements) and CUSC Modification Proposal 192 on the development of enduring user commitment. Further information on these two developments can be found in Chapter 10 of this document.

## Generation Opportunities

This section provides an indication of the likely connection dates that we would currently expect to offer to connection applications in various geographical locations around the country. These dates have been based around those that have been offered to projects that have recently been transitioned to the new Connect and Manage arrangements.

The information on connection dates is provided in the two figures 9.1 and 9.2. Figure 9.1 provides a high level overview of the likely connection dates around the country, whilst Figure 9.2 highlights areas where local difficulties tend to extend lead times.

Please note that these are indicative only and are subject to confirmation on an individual case by case basis. We welcome the opportunity to discuss your aspirations for grid connections

ahead of any formal application. To discuss an individual project please contact your Customer Agreement Manager or our Customer Services team. The contact details for the Electricity Customer Connections manager are julian.leslie@uk.ngrid.com or 01926 653350.

In the interim, we provide future updates to likely connection dates through our quarterly publication of the Transmission Network Quarterly Connections Updates (TNQCU), copies of which can be found at:

www.nationalgrid.com/uk/Electricity/GettingConnected/gb_agreements/

**Figure 9.1 – Illustrative Connection Timescales**

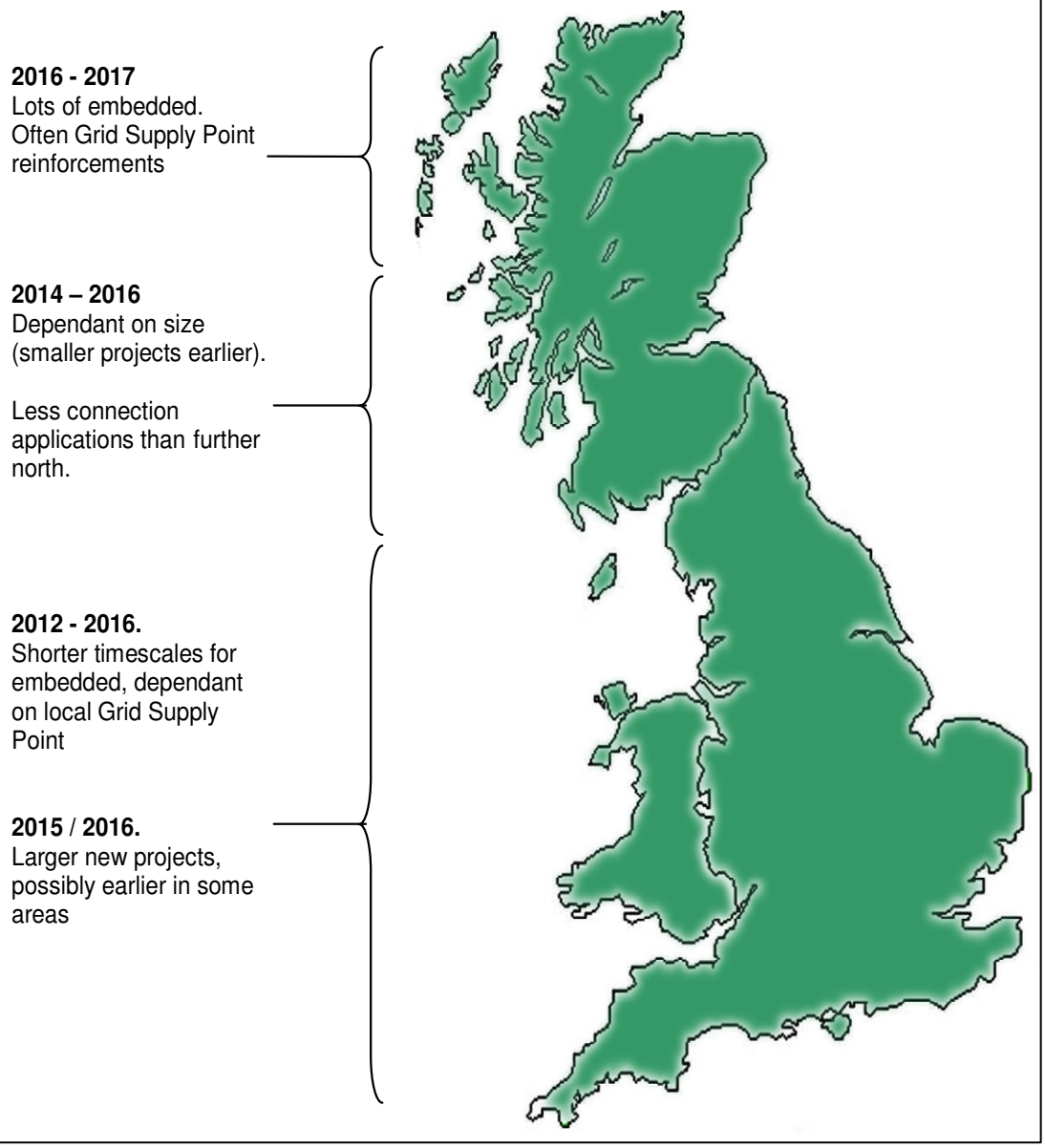
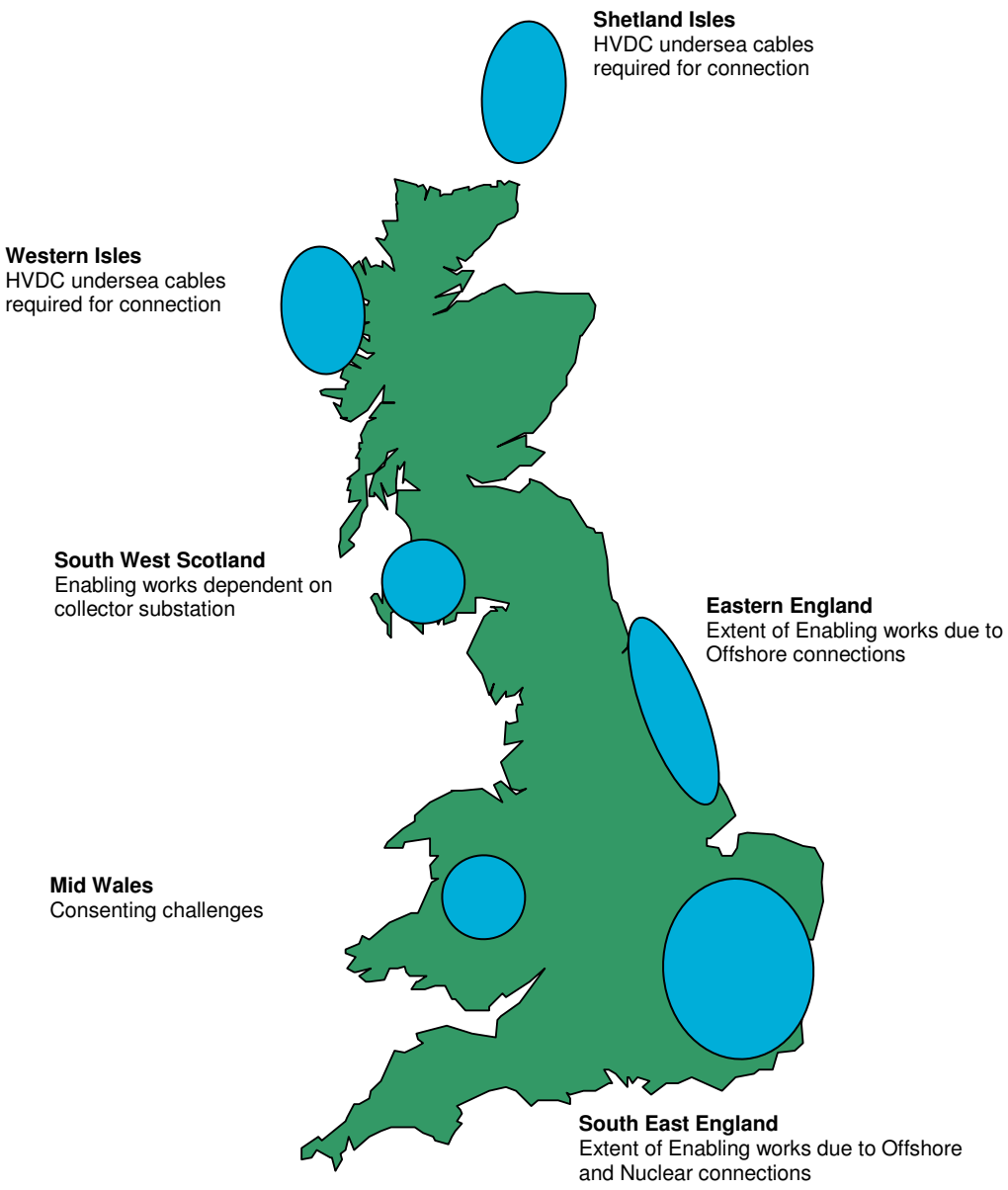


**Figure 9.2 – Illustrative Connection Timescales – Areas of local difficulty**




## Strategic Investment

The information contained in this year's SYS reflects the report delivered by the Energy Networks Strategy Group (ENSG) – Our Electricity Network – A Vision for 2020. The work carried out for ENSG identifies a set of transmission reinforcements that would facilitate the connection of renewable generation to help meet the Government's 2020 climate change targets. These works are now progressing ahead of full user commitment, as the date for construction becomes closer, the user commitment is increasing and hence these works identified will be completed (subject to achieving consents) in time to facilitate the connection of new contracted generation.

## Demand TNUoS Tariff Zones

The demand TNUoS tariff zones correspond to the original Regional Electricity Company (REC) franchise areas in England and Wales, and the geographical areas of the two Scottish electricity companies.

A demand customer's zone is effectively determined by the Grid Supply Point (GSP) Group to which the customer is deemed to be connected. In the case of a directly-connected power station, the generation tariff zone applicable relates to the geographical location of the transmission substation (connection site) to which the station is connected. In the case of an embedded power station, the generation tariff zone applicable relates to the transmission substation to which that station is deemed connected.

Table 9.1 shows the tariffs applicable from 1st April 2011.

**Table 9.1 - Demand TNUoS Tariffs applicable from 1st April 2011**

| Zone No. | Zone Name. | HH Zonal Tariff (£/kW) | NHH Zonal Tariff (p/kWh) |
|---|---|---|---|
| 1 | Northern Scotland | 6.535401 | 0.886871 |
| 2 | Southern Scotland | 11.730556 | 1.666105 |
| 3 | Northern | 15.684824 | 2.170176 |
| 4 | North West | 19.449161 | 2.736856 |
| 5 | Yorkshire | 19.582975 | 2.704505 |
| 6 | N Wales & Mersey | 20.204644 | 2.952899 |
| 7 | East Midlands | 22.205396 | 3.095769 |
| 8 | Midlands | 23.811436 | 3.387267 |
| 9 | Eastern | 22.671734 | 3.127405 |
| 10 | South Wales | 22.846195 | 3.097454 |
| 11 | South East | 26.737000 | 3.736654 |
| 12 | London | 27.943266 | 3.779345 |
| 13 | Southern | 27.567648 | 3.910939 |
| 14 | South Western | 28.408897 | 3.887151 |

For further information on charging please see the “Use of System Tariff Zones” section in Chapter 6 and also the “Transmission Pricing” section in Chapter 10, both of which contain useful links to the National Grid charging website.

# Ancillary Services

## Overview

To operate the system on a real time basis National Grid as NETSO requires access to a range of services. These services are used to balance supply and demand in an economic manner, and to maintain quality and security of supply in accordance with the NETS SQSS. To this end National Grid procures a number of ancillary services from a variety of different providers including generation, demand side and interconnector participants.

The various categories of ancillary services for which National Grid contract are set out in the table below:

| Ancillary Services | | |
|---|---|---|
| **Part I - System (Mandatory)** | **Part II – System (Necessary)** | **Commercial** |
| ■ Reactive<br>■ Frequency response | ■ Black Start<br>■ Fast Start<br>■ System to Generator Operational Tripping Scheme | ■ Enhanced reactive<br>■ Firm frequency response<br>■ Reserve –<br>  ■ Short Term Operating reserve;<br>  ■ Fast Reserve;<br>  ■ Balancing Mechanism Start Up (Warming)<br>■ System to System Services including Emergency Instruction<br>■ Maximum generation<br>■ Commercial Intertrip/ Energy Management Systems<br>■ Constraint management |

More information on each of the above can be found on the National Grid website at:
http://www.nationalgrid.com/uk/Electricity/Balancing/services/

Although the above services are provided by a party once connected to the relevant distribution or transmission system, discussion with National Grid as to what services could potentially be provided can commence prior to connection (see Contact Us section below). This is particularly pertinent for a service such as Black Start where it may be more cost efficient to install necessary additional equipment required to provide a service during the construction of a site rather than to retrofit.

## Future Balancing Services Requirements and Opportunities

Operating the Electricity transmission network in 2020

In June 2009, National Grid published an initial consultation on a range of issues and associated challenges to operating the electricity networks in 2020, a number of which arise as a result of a significant change in the GB generation mix. This consultation also coincided with publication of two documents detailing National Grid's subsequent future requirement for both reserve and frequency response services in order to manage these developments (http://www.nationalgrid.com/uk/Electricity/Balancing/services/FutureRequirements/).

A further consultation is to be published in summer 2011 which looks to refine the 'operating in 2020' document and provide further analysis and views on these issues. This updated 2020 document will be published on the National Grid website in the following location, where the original consultation and responses can also be found:

http://www.nationalgrid.com/uk/Electricity/Operating+in+2020/

Demand side and Aggregation

Services can generally be provided to National Grid in one of two ways, either an increase in generation or a reduction in electricity demand by parties connected to the NETS or relevant Distribution Network. Historically, balancing services have typically been provided by generation participants but National Grid has been actively promoting demand side participation in balancing services over recent years and has been successful in the integration of demand side service provision in services such as Short-Term Operating Reserve (STOR) and Frequency Response. More information regarding demand side participation in balancing services can be found at: http://www.nationalgrid.com/uk/Electricity/Balancing/demandside/.

In addition to demand side, National Grid has also encouraged smaller generation volumes into balancing services markets via an aggregation model. This allows a number of smaller loads (which alone may be too small to participate in balancing services where typically the minimum requirement is 3MW) to be aggregated from a number of sites. This model works particularly well in the STOR service where a number of aggregating companies actively participate. A list of such companies, along with contact details, can be found on the National Grid website at: http://www.nationalgrid.com/uk/Electricity/Balancing/demandside/aggregators/

Connect and Manage

Following the implementation of an enduring Connect and Manage (C&M) approach to transmission access on 11 August 2010, generation projects are allowed to connect to the transmission system in advance of the completion of the wider transmission reinforcement works. Connection of generators ahead of the completion of these wider works means that parts of the transmission system will not be compliant with the NETS SQSS until these works are completed.

This, in turn, means that National Grid as system operator will be required to manage this non compliance as there are likely to be more bottlenecks in the system and therefore an increase in constraints. A range of constraint management tools are available for this purpose, including fast de-load, commercial intertrips and Energy Management Systems, some of which may be required prior to connection in accordance with the relevant bilateral connection agreement.

National Grid will be seeking to initiate discussion regarding constraint management agreements prior to connection with providers where this is applicable.

National Grid would welcome discussion of the above balancing services opportunities with either new or existing providers. Should you wish to discuss any of the balancing services then please call Nigel Fox (Contracts and Settlements Manager) on 01926 656823 or your relevant balancing services account manager.

## Zonal Power Losses

It was explained in "Zonal Power Losses" in Chapter 7 that the effectiveness, in system terms of any new generating station is related, in part, to the effect it has on system losses. Clearly, if a new power station were to be located in the north, and this were to displace the operation of southern generation, then the north to south power flows would increase, transmission losses would increase and some of the output of the new station would, in effect, be 'lost' to the system. However, if the new power station were to be located in the south and this displaced northern generation, the converse would be true. That is, north to south power flows would decrease, system losses would decrease and the relative net effect would be as if a larger station had been installed.

Table 7.5 illustrates the effectiveness, in terms of optimising (i.e. minimising) overall transmission system losses, of locating additional generation in each of the 17 SYS Study Zones in turn. That table presents the 17 zones in order of effectiveness and thereby provides a useful and reasonably robust indicator of relative merits. The resultant order is consistent with the relative order of generation opportunities, discussed in the previous section, and the relative order of generation TNUoS charges across the system.

For comparison, the main tables from Schedule 1 of our 2011/12 'Statement of Use of System Charges', are available on the "Charging" web pages on the National Grid website:

http://www.nationalgrid.com/uk/Electricity/Charges/chargingstatementsapproval/

However, please note that, whilst similar, the 17 SYS Study Zones used for the purpose of displaying zonal power losses differ from the 20 generation and 14 demand TNUoS tariff zones.

Generators are also subject to local circuit and substation tariffs. Details of these can be found at:

http://www.nationalgrid.com/uk/Electricity/Charges/usefulinfo/

## Zonal Commentary

This section complements the previous sections of this chapter by providing additional information on opportunities for new generation capacity presented on the basis of individual zones or groups of zones. The following zonal commentary considers the opportunities for new generation on the probabilistic background as well as the SYS background.

The section "Boundary Commentary" in Chapter 8 describes the wide range of probabilistic transfers across the 17 SYS boundaries over the next seven-year period. The reader is guided to the description of the probabilistic transfers for each boundary shown in Figure 8.B1, Figure 8.B2, Figure 8.B3, Figure 8.B4, Figure 8.B5, Figure 8.B6, Figure 8.B7, Figure 8.B8, Figure 8.B9, Figure 8.B10, Figure 8.B11, Figure 8.B12, Figure 8.B13, Figure 8.B14, Figure 8.B15, Figure 8.B16 and Figure 8.B17 within this section. The adoption of a probabilistic view of future boundary transfer levels recognises the fact that there is uncertainty in the future generation and demand background. Clearly, this has an impact on the likely opportunities for the connection of new generation onto the transmission network. The commentary below seeks to address the opportunities for new generation given this level of uncertainty.

Clearly, generation and demand backgrounds, which increase North to South transfers, tend to precipitate the need for major inter-zonal transmission reinforcement and thereby reduce northern opportunities. Such backgrounds would include further northern planting and/or the export of power to France at times of peak. Conversely, backgrounds which reduce north to south transfers tend to increase northern opportunities and/or relax the need for major inter-zonal transmission reinforcement. Such backgrounds would include new generation in the South.

In considering the following zonal commentary it is useful to cross reference Table 7.1, which presents the studied generation, demand and transfer for each zone and the boundary commentary section "Boundary Commentary" in Chapter 8. Please note, however, that Table 7.1 is on the basis of the 'SYS background' and that the generation capacities given are the 'studied' or contributory capacities (based on Table F.4) rather than installed capacities.

For ease of reference, each zonal commentary includes the relevant extract of Table 7.1, repeated in Table 9.Z1 to Table 9.Z17 for each of the SYS Study Zones. Please refer to Table F.4 for the effect of generation capacity changes in terms of other plant displaced from being contributory under the SYS background. For further information, Table F.8 in Appendix F gives details of each new generation project together with its SYS Study Zone.

## Zone 1: North West (SHETL)

**Table 9.Z1 - SYS Study Zone Z1, North West (SHETL)**

| Quantity (MW) | 2011/12 | 2012/13 | 2013/14 | 2014/15 | 2015/16 | 2016/17 | 2017/18 |
|---|---|---|---|---|---|---|---|
| Effective Generation | 915 | 992 | 1100 | 1675 | 1655 | 1646 | 1638 |
| Demand | 511 | 515 | 520 | 509 | 507 | 506 | 506 |
| Planned Transfer | 404 | 477 | 580 | 1166 | 1148 | 1140 | 1132 |

The SHETL North West zone encompasses the area to the north and west of Fort Augustus, Beauly (near Inverness) and Keith. This area includes a significant amount of existing hydro generation, new renewable generation and the Foyers pumped storage scheme. Demand in this zone is significantly lower than the installed generation; consequently this zone is normally an exporting zone.

Generation in this zone is increasing at a significant rate due to the high volume of new renewable generation seeking connection in the area. Consequently, opportunities for connection of new generation are very low in this zone.

## Zone 2: North (SHETL)

**Table 9.Z2 - SYS Study Zone Z2, North (SHETL)**

| Quantity (MW) | 2011/12 | 2012/13 | 2013/14 | 2014/15 | 2015/16 | 2016/17 | 2017/18 |
|---|---|---|---|---|---|---|---|
| Effective Generation | 990 | 985 | 1019 | 1286 | 1440 | 1643 | 1775 |
| Demand | 609 | 611 | 616 | 618 | 610 | 609 | 609 |
| Planned Transfer | 381 | 374 | 403 | 668 | 830 | 1034 | 1166 |

The SHETL North zone comprises the area to the north of Errochty and Tealing, and to the east of a line drawn between Keith and Errochty. This area includes the thermal power station at Peterhead and some new renewable generation. Demand in this zone is significantly lower than the installed generation; consequently this zone is normally an exporting zone.

Generation in this zone is increasing gradually due to the connection of new renewable generation in the area. Consequently, opportunities for connection of new generation are very low in this zone.

## Zone 3: Sloy (SHETL)

| Table 9.Z3 - SYS Study Zone Z3, Sloy (SHETL) | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Quantity (MW)** | **2011/12** | **2012/13** | **2013/14** | **2014/15** | **2015/16** | **2016/17** | **2017/18** |
| Effective Generation | 273 | 299 | 333 | 325 | 322 | 316 | 177 |
| Demand | 65 | 66 | 67 | 66 | 68 | 70 | 67 |
| Planned Transfer | 208 | 233 | 266 | 259 | 254 | 246 | 110 |

The Sloy zone in the south west of the SHETL system encompasses the flows to the north and south of the Sloy busbar. In comparison to the 132kV infrastructure in the area, this boundary includes a significant amount of existing hydro generation and new renewable generation in Kintyre and Argyll. Demand in the area is centred around Oban and Mull, Lochgilphead and Islay and Campbeltown and Arran. The power flows are normally into this zone from Killin in the north and out of the zone to the south towards Windyhill (near Glasgow).

New renewable generation in Kintyre and Argyll is increasing over time and reinforcement is needed to accommodate the required capability. Consequently, opportunities for connection of new generation are very low in this zone.

## Zone 4: South (SHETL)

| Table 9.Z4 - SYS Study Zone Z4, South (SHETL) | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Quantity (MW)** | **2011/12** | **2012/13** | **2013/14** | **2014/15** | **2015/16** | **2016/17** | **2017/18** |
| Effective Generation | 456 | 453 | 449 | 474 | 1071 | 1050 | 975 |
| Demand | 517 | 520 | 527 | 540 | 541 | 548 | 545 |
| Planned Transfer | -61 | -67 | -78 | -66 | 530 | 502 | 430 |

Zone 4 comprises the southern part of the SHETL system excluding the Sloy zone. In view of the system limitations to the south of this zone, opportunities for connection of new generation are very low in this zone.

## Zone 5: North (SPT)

| Table 9.Z5 - SYS Study Zone Z5, North (SPT) | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Quantity (MW)** | **2011/12** | **2012/13** | **2013/14** | **2014/15** | **2015/16** | **2016/17** | **2017/18** |
| Effective Generation | 2158 | 2164 | 1914 | 1950 | 1915 | 2110 | 2289 |
| Demand | 1193 | 1183 | 1170 | 1170 | 1175 | 1167 | 1169 |
| Planned Transfer | 965 | 981 | 744 | 780 | 740 | 944 | 1120 |

In view of the system limitations within and to the south of this zone, opportunities for connection of new generation are very low.

## Zone 6: South (SPT)

| Table 9.Z6 - SYS Study Zone Z6, South (SPT) | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Quantity (MW)** | **2011/12** | **2012/13** | **2013/14** | **2014/15** | **2015/16** | **2016/17** | **2017/18** |
| Effective Generation | 3942 | 4283 | 4417 | 4611 | 4167 | 4114 | 5173 |
| Demand | 3130 | 3133 | 3136 | 3141 | 3135 | 3133 | 3131 |
| Planned Transfer | 812 | 1150 | 1281 | 1470 | 1032 | 981 | 2042 |

Boundary 6 is the primary importing border from Scotland to England in the UK, which relates zone areas 6 and 7. Zone 6 includes significant capacity of generating plant which includes new onshore wind farms. Opportunities for connecting new generation in this zone are considered to be very low, due to the limiting factors found south of the border. However there might be a slight possibility beyond 2016 due to the new HVDC cables being installed and the closure of Cockenzie coal fired power station.

## Zone 7: North & North-East England

| Table 9.Z7 - SYS Study Zone Z7, North & North East England (NGET) | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Quantity (MW)** | **2011/12** | **2012/13** | **2013/14** | **2014/15** | **2015/16** | **2016/17** | **2017/18** |
| Effective Generation | 2970 | 2961 | 2976 | 3181 | 3446 | 2993 | 2484 |
| Demand | 2861 | 2964 | 3067 | 3078 | 3091 | 3196 | 3303 |
| Planned Transfer | 109 | -3 | -91 | 103 | 355 | -204 | -819 |

Zone 7 is the upper north of England and lies beneath the SPT network and carries the bulk flow from Scotland to England especially in later years as a number of CCGT units fall out of merit. The net transfer varies from an exporting zone to an importing zone by a few hundred Megawatts in 2016/17 to approximately 800 MW in 2017/18. The network in this region is a mixture of 275kV and 400 kV circuits with many generators connected. As transfers from Scotland increase, and new generation connects to this zone; a need for further reinforcement in the area is essential to meet future demand in England & Wales and to achieve renewable targets. Given the high through flows through this zone and the limited transmission capability, there is little opportunity for further connections without major works.

## Zone 8: Yorkshire

| Table 9.Z8 - SYS Study Zone Z8, Yorkshire (NGET) | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Quantity (MW)** | **2011/12** | **2012/13** | **2013/14** | **2014/15** | **2015/16** | **2016/17** | **2017/18** |
| Effective Generation | 10137 | 9732 | 9405 | 9008 | 8768 | 8395 | 7880 |
| Demand | 5291 | 5283 | 5276 | 5200 | 5127 | 5111 | 5094 |
| Planned Transfer | 4846 | 4449 | 4130 | 3808 | 3641 | 3284 | 2786 |

This zone encompasses a diverse range of generation sources from conventional coal plants to offshore wind in later years throughout the SYS period. It can be seen from Table 9.Z8 that the net export decreases throughout the seven year period, as many large coal fired units either fall out of merit or close due to the LCPD. There are numerous new generation connections to this region, however additional new connections may be possible in later years.

## Zone 9: North West England & North Wales

| Table 9.Z9 - SYS Study Zone Z9, North West England & North Wales (NGET) | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Quantity (MW)** | **2011/12** | **2012/13** | **2013/14** | **2014/15** | **2015/16** | **2016/17** | **2017/18** |
| Effective Generation | 7357 | 7480 | 7660 | 7269 | 7004 | 7319 | 7518 |
| Demand | 7257 | 7070 | 6882 | 6918 | 6956 | 7288 | 7625 |
| Planned Transfer | 100 | 409 | 778 | 351 | 48 | 31 | -107 |

Zone 9 is located in the North West of England and North Wales which covers Cheshire, greater Manchester and Cumbria. It is characterised with high generation and demand levels which tend to compliment each other, leading to a very low net transfer from this zone. The transmission network region is a mixture of 275kV and 400kV and aids in transferring the bulk power from the upper north zone. Some potential exists in the North Wales region for new connections; however larger projects would require further reinforcements. As the bulk of the transfer travels South West to meet some of the localised demand in London, under a fault or outage condition some of the 400kV circuits within zone 9 can be overloaded substantially due to a concentrated import from Scotland.

## Zone 10: Trent

| Table 9.Z10 - SYS Study Zone Z10, Trent (NGET) | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Quantity (MW)** | **2011/12** | **2012/13** | **2013/14** | **2014/15** | **2015/16** | **2016/17** | **2017/18** |
| Effective Generation | 6542 | 6628 | 6765 | 6781 | 6920 | 6182 | 5334 |
| Demand | 957 | 966 | 974 | 986 | 999 | 914 | 828 |
| Planned Transfer | 5585 | 5662 | 5790 | 5795 | 5921 | 5268 | 4506 |

Zone 10 is located North East of the Midlands and includes Trent and the upper Wash region. This zone has a high generation concentration with low demand, giving an excess in transfer from the net generation. The zone compromises mainly of 400kV circuits which take the bulk of the power, and has considerably high fault levels due to the high concentration of generation. Due to the high flows, the transmission capacity is at its maximum and additional reinforcements or uprating of existing lines are necessary for any future generation connections.

## Zone 11: Midlands

| Table 9.Z11 - SYS Study Zone Z11, Midlands (NGET) | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Quantity (MW)** | **2011/12** | **2012/13** | **2013/14** | **2014/15** | **2015/16** | **2016/17** | **2017/18** |
| Effective Generation | 3486 | 3241 | 3023 | 3092 | 3217 | 2814 | 2359 |
| Demand | 7441 | 7330 | 7217 | 7227 | 7240 | 7282 | 7325 |
| Planned Transfer | -3955 | -4089 | -4195 | -4135 | -4023 | -4469 | -4966 |

The West Midlands is classified as zone 11, with a high demand and some generation. The West Midlands is an importing boundary and relies heavily on the transfer from the North West over numerous 400kV circuits which is then stepped down to 275kV to feed the localised demand. It is anticipated that a number of coal fired plants within the West Midlands will close due to the LCPD proposals, but will be replaced with efficient CCGT plants allowing the planned transfer to remain fairly constant throughout the majority of the SYS period. It can be noted that the planned transfer increases by approximately 20% from 2011/12 to 2017/18 which is predominately due to a net reduction in generation despite new generation commissioning.

## Zone 12: Anglia & Bucks

| Table 9.Z12 - SYS Study Zone Z12, Anglia & Bucks (NGET) | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Quantity (MW)** | **2011/12** | **2012/13** | **2013/14** | **2014/15** | **2015/16** | **2016/17** | **2017/18** |
| Effective Generation | 3773 | 3863 | 3983 | 4648 | 5405 | 6106 | 6715 |
| Demand | 4744 | 4820 | 4897 | 4959 | 5023 | 5075 | 5127 |
| Planned Transfer | -970 | -957 | -914 | -311 | 382 | 1031 | 1589 |

This zone is classified as East Anglia and Bucks which compromises of the southern Wash region, Grendon, Buckinghamshire and Norfolk. Table 9.Z12 shows that the zone is changed from an importing boundary in 2011/12 to an exporting boundary in 2017/18 which is mostly attributed to numerous offshore windfarms being connected beyond 2015/16. This in turn reduced the North to South power flows as the zonal demand remains fairly constant throughout the years. If further generation is to be added to this zone, a number of reinforcements need to be implemented, as the zone changes from an importing to an exporting zone.

## Zone 13: South Wales & Central England

| Table 9.Z13 - SYS Study Zone Z13, South Wales & Central England (NGET) | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Quantity (MW)** | **2011/12** | **2012/13** | **2013/14** | **2014/15** | **2015/16** | **2016/17** | **2017/18** |
| Effective Generation | 5833 | 6095 | 6404 | 5516 | 4717 | 4926 | 5057 |
| Demand | 5221 | 5216 | 5211 | 5206 | 5203 | 5144 | 5083 |
| Planned Transfer | 611 | 879 | 1193 | 310 | -486 | -217 | -25 |

Zone 13 is the South Wales and Central England zone which consists of Bristol, Gloucestershire and Wiltshire and possesses a larger portion of the MITS which connects the north of England and Wales to the south. In the early years the zone exports power to the East aiding in supporting the load in London, but then begins to import power in the later years, as numerous coal fired power stations fall out of merit. The thermal capability of the transmission network in this region is more than sufficient to import or export power, but restrictions occur in this zone as round 3 windfarms connect.

## Zone 14: London

| Table 9.Z14 - SYS Study Zone Z14, London (NGET) | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Quantity (MW)** | **2011/12** | **2012/13** | **2013/14** | **2014/15** | **2015/16** | **2016/17** | **2017/18** |
| Effective Generation | 1750 | 1724 | 1712 | 1861 | 2044 | 2035 | 1992 |
| Demand | 9504 | 9791 | 10078 | 10234 | 10395 | 10301 | 10205 |
| Planned Transfer | -7755 | -8067 | -8366 | -8373 | -8351 | -8267 | -8214 |

Inner and outer London is encompassed in zone 14, and is characterised with high demand and low generation; thus making it reliant on surrounding zones to transfer power into London. The majority of the London transmission network is at 275kV with the main London feeders being at 400kV allowing the connection of generation within London at suitable key locations across the zone. However if generation is to be connected in a concentrated region, major reinforcement upgrades would be required to export the power to the rest of the zone. Under either option, generation opportunity in London is considered high, in order to reduce its reliance on importing power from other zones.

## Zone 15: Thames Estuary

| Table 9.Z15 - SYS Study Zone Z15, Thames Estuary (NGET) | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Quantity (MW)** | **2011/12** | **2012/13** | **2013/14** | **2014/15** | **2015/16** | **2016/17** | **2017/18** |
| Effective Generation | 5214 | 5285 | 5395 | 5189 | 5073 | 5073 | 4990 |
| Demand | 2150 | 2155 | 2161 | 2193 | 2226 | 2273 | 2322 |
| Planned Transfer | 3065 | 3130 | 3235 | 2997 | 2848 | 2800 | 2669 |

The Thames Estuary zone consists of a mixture of generation including nuclear and CCGT plants, as well as some offshore wind farms. The generation exceeds the demand giving a surplus in generation and a high planned transfer which slightly drops in later years, as older conventional plants close. Two interconnectors exist within this zone; one being the French link and the other being the BritNed link. From Sellindge there is an existing HVDC which interconnects the NGET network to the French RTE network, while the Britned HVDC link (based in the Isle of Grain) interconnects to the Dutch TenneT network. The interconnectors may have a large effect on transfers and flows by importing and exporting power in and out of the NGET network.

## Zone 16: Central South Coast

| Table 9.Z16 - SYS Study Zone Z16, Central South Coast (NGET) | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Quantity (MW)** | **2011/12** | **2012/13** | **2013/14** | **2014/15** | **2015/16** | **2016/17** | **2017/18** |
| Effective Generation | 1259 | 1072 | 893 | 876 | 873 | 869 | 851 |
| Demand | 4433 | 4443 | 4452 | 4458 | 4466 | 4353 | 4237 |
| Planned Transfer | -3174 | -3371 | -3558 | -3583 | -3593 | -3483 | -3386 |

Zone 16 is the Central South Coast zone which covers a large portion of the south of England. The transmission network in this region consists of five 400kV circuits which interconnects the South Coast with London, Thames Estuary, South Wales and the South West of England. Little change occurs in generation within this zone, except for a CCGT unit falling out of merit. The opportunity for new generation development can be regarded as medium.

## Zone 17: South West England

| Table 9.Z17 - SYS Study Zone Z17, South West England (NGET) | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Quantity (MW)** | **2011/12** | **2012/13** | **2013/14** | **2014/15** | **2015/16** | **2016/17** | **2017/18** |
| Effective Generation | 1786 | 1760 | 1748 | 1713 | 1708 | 2382 | 3024 |
| Demand | 2950 | 2944 | 2937 | 2944 | 2951 | 3002 | 3053 |
| Planned Transfer | -1164 | -1184 | -1190 | -1231 | -1243 | -620 | -29 |

Zone 17 is the South West of England and separates its zone from the rest of the UK via the B13 boundary. The zone is reliant on importing power from the South West and Central South Coast over two 400kV double circuits. Only two large power stations exist within this zone Hinkley point B nuclear and Langage CCGT, which supplies approximately two thirds of the demand throughout the early years. The zonal generation and demand becomes fairly balanced in 2017/18 as Hinkley Point C nuclear connects and supplies an additional 1,670 MW of generation to the zone. The potential for generation connection is low for the zone.