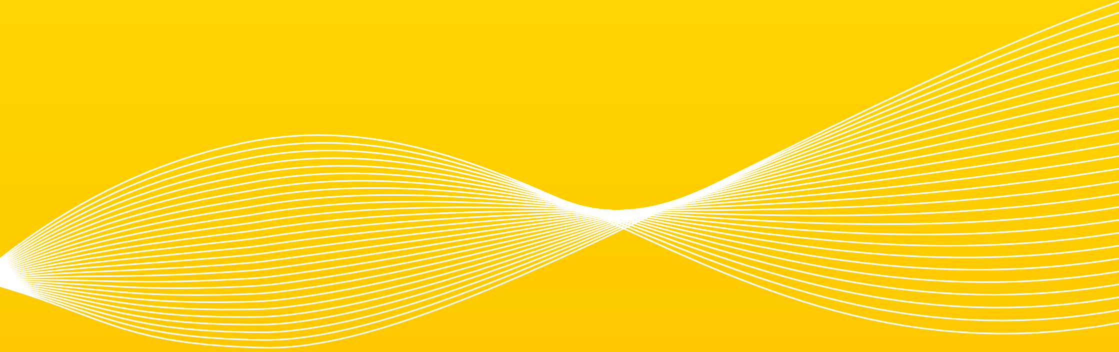
ETYS Appendix H

Further information in inputs and methodologies



H.1 Applying the *FES* in system planning

The *FES* data is applied to network simulation models of the NETS so that we can analyse their impact on the network and assess the network's performance.

Application of demand data

The *FES* demand backgrounds provide us with national demand broken down into regions. This is further split down to individual supply points so the flow of power from supply to demand can be monitored. Embedded generation is taken into account in the demand applied to the models so that both transmission and embedded connected generation is considered consistently.

Application of generation data

The NETS Security and Quality of Supply Standard (SQSS)[1] outlines the two criteria (security and economy) that form the system capability planning requirements. These criteria define two different generation and demand backgrounds against which to monitor flow of power from supply to demand. More detail about this monitoring is provided in Chapter 3 of the main *ETYS* document. Here we focus on how the generation data is applied to meet national ACS peak demand.

Security criterion

The security criterion assumes that intermittent generation and interconnectors are unavailable and power must come from generation plant with reliable energy supply. This scenario is to assess whether the NETS is sufficient to supply demand at times when intermittent low-carbon generation and interconnectors are unavailable.

To set up the security generation scenario, we start by checking if we need to trim the total generation connected to the NETS to below 120% of the total ACS demand. The 120% is the amount we've determined appropriate to ensure adequate generation margin. We trim the total generation capacity to 120% by applying a ranking order to help identify the generation units that are most likely to operate and meet 100% ACS peak demand and those which are most likely to provide 20% reserve.

We apply the ranking order considering both future and existing generation.

For existing generation, we apply appropriate ranks, by looking at how the unit operated during the previous two winter periods (beginning of December to the end of January). The method described for ordering plant in terms of operational history is supported by our experiential judgement and market intelligence. For example, a plant may have achieved a low ranking based on the previous winter's operational data but it could be that this was down to a unique set of circumstances that are unlikely to be repeated in the future (for example, a plant that has been mothballed but market intelligence suggests it may return in the future). So plant rankings may be revised, to make them more realistic.

For future plant, we apply appropriate ranks, by considering the fuel type of the unit. We assume that low-carbon plant is more likely to operate as baseload, and that new thermal plant is likely to be more efficient than existing thermal generation so we give it a higher ranking.

The ranking order we use to determine the operation of future plant is shown in Table H1.1.

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[1] https://www.nationalgrideso.com/codes/security-and-quality-supply-standards

Table H1.1
Ranking order

Rank	Fuel type
1	Hydro tranche 1
2	Nuclear (new)
3	Hydro tranche 2
4	Hydro tranche 3
5	Nuclear (existing)
6	CCS
7	Biomass
8	Gas thermal (new)
9	CCGT, OCGT and CHP (new)
10	Storage
11	Thermal and Hydro tranche 4

Economy criterion

The economy criterion assumes a credible dispatch with a significant output from intermittent generation such as wind farms and support from interconnectors. This tests the NETS has suitable capacity without unduly restricting generation output.

To set up the dispatch scenario which represents the economy criterion, we use three categories for generation units: non-contributory, directly scaled and variably scaled. Non-contributory plants, like OCGTs, are not included in the dispatched generation background. Directly scaled plants, like wind and nuclear, are included in the dispatch scenario using the scaled dispatch factors as specified by the SQSS (and shown in table H1.2 below). Finally we use variably scaled plants to maintain the balance of demand and generation.

Table H1.2
List of directly scaled plants and the associated scaling factors

Fuel type	Scaling factor
Interconnectors importing to GB	100%
Nuclear	85%
Coal-fired stations fitted with CCS	85%
Gas-fired stations fitted with CCS	85%
Wind	70%
Tidal/wave	70%
Pumped storage	50%

These two criteria allow us to assess the capability requirement of the NETS in order to maintain both security of supply and facilitate the economic and efficient operation of the generation market.

Chapter 3 in the main ETYS document explains how we use these two criteria to determine network capability and regional requirements.

H.2 Interconnector Information

With new interconnectors to neighbouring countries being built, they are forming an increasing part of the GB energy portfolio. With the ability to both bring power into Britain and export it out they can have a large influence on power flows across the NETS. Therefore they an important part of future network planning.

Current and planned interconnection

You can find the most up-to-date details of transmission contracted interconnectors from the Interconnector Register page: **https://www.nationalgrideso.com/connections/registers-reports-and-guidance**

Further projects have applied for Projects of Common Interest (PCI) status under the EU's Trans-European Networks (Energy) (TEN-E) regulations: **https://ec.europa.eu/energy/en/topics/infrastructure/projects-common-interest**

Other projects are already in other public domains, such as in the *Ten-Year Network Development Plan (TYNDP)*: **https://tyndp.entsoe.eu/tyndp2018/projects/projects**

Similar to our approach to the transmission generation backgrounds, assumptions have been made regarding the connection of interconnectors in the *FES*. Again, like the generators, a full range of factors, including planning consent, contractual connect dates, environment legislation and up-to-date market intelligence have been used to for the assumptions.

H.3 Constraint Forecast-Error Concept

In Chapter 3 of the main *ETYS* document we present the probabilistic thermal analysis case study. We suggested a probabilistic boundary capability number based on Constraint Forecast-Error concept for the South Coast boundary SC3.

The constraint forecast error [MWhr/season] for the winter is shown in figure H3.1. It is based on overestimated constraint volume [MWhr/season] and underestimated constraint volume [MWhr/season] concepts. The former is the sum of lost opportunity volumes of energy transfer [MWhr/season] and the latter is the sum of risk volumes of energy transfer at each boundary capability set-point. Opportunity volume is the MW transfer capability lost per hour as a result of underestimating the boundary capability. On the other hand, risk volume is the MW transfer at risk per hour caused by overestimating the boundary capability. The point where the constraint forecast error crosses zero is the identified boundary capability number.

Figure H3.1
SC3 Probabilistic Transfer Capability Calculation (Winter)