NETWORK MAPPING STATEMENT FOR THE DETERMINATION OF TRANSMISSION LOSS FACTORS

Summary

This Network Mapping Statement (NMS) has been established by BSCCo, with support from the Transmission Company, on behalf of the BSC Panel and in accordance with the Balancing and Settlement Code (BSC), Section T Annex T-2 paragraphs 4.3 and 4.4.

Contents

1. Scope

The NMS contains the following:

(a) for each Volume Allocation Unit (VAU) (other than a GSP Group, Supplier BM Unit, Interconnector BM Unit, or BM Unit embedded in a Distribution System), the Node or Nodes which represent or best represent that Volume Allocation Unit or the Boundary Points at which that Volume Allocation Unit is connected to the Transmission System (it being recognised that one Node may represent several such points);

(b) for each Node, the Zone in which the Node lies;

(c) for each BM Unit, the Zone in which the BM Unit lies;

(d) for each HVDC Boundary, the Node which represents or best represents the HVDC Boundary. Note that for 2016/17, the Transmission Company has confirmed that there are no HVDC Boundaries registered.

The NMS is used for the following purposes:

- The VAU to Node mappings are used to convert Metered Volume data for Volume Allocation Units into power flows by Node (section 4). These power flows by Node, along with associated Network Data provided by the Transmission Company, and the Distribution System Operator, are used to derive Nodal Transmission Loss Factors (TLFs) through use of the Load Flow Model (LFM), as as defined in the LFM Specification (reference 1);
- Once the Load Flow Model has been run, Node to Zone mappings are used to derive Zonal TLFs from Nodal TLFs (section 5); and
- Zone to Balancing Mechanism (BM) Unit mappings are used to allocate a TLF to every BM Unit (section 6).

1.1 Summary

This NMS contains the following sections;

- Section 2 provides the background to TLF Zones and BM Units;
- Section 3 details information about Nodes;
- Section 4 details the assumptions behind the VAU to Node mapping;
- Section 5 details the assumptions for the Node to Zone mappings;
- Section 6 details the assumptions of the BM Unit to Zone mappings.

1.2 Definitions and Terms

Boundary Point	means a point a which any Plant or Apparatus not forming part of the Total System is connected to the Total System.

BSC Year	each successive period of 12 months beginning on 1st April in each year.
HVDC	High Voltage Direct Current
HVDC Boundary Data	means the Transmission Company's estimate (based on metering or other available data) of the flow of Active Energy to or from each HVDC Boundary.
Node	Means a node on the AC Transmission System a node is a point on the electrical network at which: (i) a power flow on to or off the network can occur, or (ii) two or more circuits (forming part of the network) meet. A Node refers to nodes on the AC Transmission System.
Reference Year	12 month period ending 31st August in the preceding BSC Year.
running arrangements	standard substation configuration for intact network conditions as modelled in the Electricity Ten Year Statement.
Systems Connection Point	Means a point of connection (whether consisting of one or more circuits) between two or more Systems excluding a point of connection between Distribution Systems in the same GSP Group.
Transmission Loss Factor	is the factor applied to a BM Unit's Metered Volume in a Settlement Period in order to adjust for Transmission Losses.
Transmission Loss Factor Agent	the BSC Agent responsible for producing Zonal Transmission Loss Factors and BM Unit specific Transmission Loss Factors.

Transmission Network Data	means the following data relating to the Transmission System: (i) the identity of each pair of adjacent Nodes; (ii) for each such pair of Nodes, values of resistance and reactance between the Nodes; Transmission Network data shall be established on the assumption of an 'intact network', that is disregarding any planned or other outage of any part of the AC Transmission System.
Zone	Means geographic area: (i) in which the following lie: (1) a GSP Group (there being no more than one GSP Group in any one Zone); (2) any part of an Offshore Transmission System which connects directly to that GSP Group; and/or (3) any part of an Offshore Transmission System which connects to the onshore AC Transmission System at a point within the geographic area of that GSP Group;

Other abbreviations and terms take the meanings defined in BSC Section X.

1.3 Related Documents

The table below contains the list of related documents.

Reference 1	Load Flow Model Specification for the Calculation of Nodal Transmission Loss Factors
Reference 2	Reference Network Mapping Statement 2016-17 (Excel Spreadsheet)
Reference 3	List of Nodes provided by the Transmission Company (Excel Spreadsheet)

2. Background

2.1 Zones

The definition of a Zone is shown in the Definitions and Terms in Section 1.4 above. Each Zone is based on a GSP Group. A Zone to GSP Group Mapping can be found in Table 1 "GSP Group and Zone".

Table 1: GSP Group and Zone

Transmission Loss Factor Zones	GSP Group Description	GSP Group Id
1	Eastern	_A
2	East Midlands	_B
3	London	_C
4	Merseyside and North Wales	_D
5	Midlands	_E
6	Northern	_F
7	North Western	_G
8	Southern	_H
9	South Eastern	_J
10	South Wales	_K
11	South Western	_L
12	Yorkshire	_M
13	South of Scotland	_N
14	North of Scotland	_P

2.2 BM Units

The NMS contains the list of BM Units from the Central Registration Service (CRS) for the Reference Year 2016/17 (i.e. any BM Unit registered on any date between 01/09/16 and 31/08/17). Each BM Unit is assigned a unique BM Unit Identifier by the CRS, and this is dependent on the type of BM Unit, as stated in Table 2 below.

Table 2 – Description of BM Unit Types

BM Unit ID	Type of BM Unit
T_	Directly Connected to the Transmission System
M_	Directly Connected to the Transmission System (effectively the same as T_)
E_	Embedded in Distribution System
I_	Interconnector BM Unit

2__	Supplier BM Unit (both Base and Additional)
C__	Additional BM Unit for CFD Assets

3. Nodes

The Transmission Company (TC) has provided a list of Nodes to BSCCo that have been, or are, in operation for the Reference Year, in accordance with BSC Section T, Annex T-2, para 4.2. The list of Nodes reflects the GB transmission network, i.e. 400kV, 275kV, plus 132kV in Scotland. The list of Nodes covers any network updates up until the end of the Reference Year, and any Nodes that have been or are to be decommissioned in the Reference Year, and is considered to be authoritative and transparent. A number of Nodes are not included in the list of Nodes as they are only connected to small sites of demand, and for the NMS the corresponding adjacent Node is used.

A number of additional nodes have been included to connect BM Units that are expected to commission before the end of the relevant BSC Year 2018/19.

It should be noted that in a number of instances, the list of Nodes suggests two or more Nodes at a substation because the substation is run on a 'split' basis for operational reasons. For the purposes of the NMS, where a number of Nodes are on the same busbar, or busbar section, and have been identified by the TC as such, then they are considered to a "shared" node. Where there is a "shared" node, then the apportionment of that load/generation against each VAU is shown in the NMS.

In all instances, the Nodes in the NMS are consistent with the Network Data supplied by the TC for the calculation of TLFs. However, there are a number of Nodes included in the Network Data that are not described in this NMS since they have no power flow either onto or off the Transmission System and will not contribute to the TLF calculations. Hence no mapping for these Nodes is required.

3.1 Nomenclature of Nodes

The first four letters of the Node name refers to the substation in which to Node resides. The fifth character is a number used to signify the voltage at the Node.

The sixth character, which is either a number, special character or letter, signifies if the substation has a single Node entry or multiple entries. Generally a number or special character represents a substation or part of a substation. Where a site has more than one such node then the site is operated as electrically separate sections ('split'). Generally a letter represents a Node that cannot be merged with other nodes. For instance, this could be a 'T' point where three circuits join and there is no switchgear to change the electrical configuration.

4. Volume Allocation Unit to Node Mapping

The VAUs that have been mapped, in accordance with Section T, Annex T-2, paragraph 4.3 are:

- Grid Supply Points (GSP);
- directly connected BM Units, not including Interconnector BM Units, BM Units embedded in a Distribution System, Supplier BM Units, and Additional BM Units for CFD Assets;
- Interconnectors; and

- HVDC Boundary to Node[1]

The BSC requires that the above types of VAUs are mapped onto Nodes. For GSPs and directly connected BM Units this is on a many-to-many basis, for example, one or more directly connected BM Units may map onto a single Node, or one or more Nodes may be mapped to a single directly connected BM Unit. The mapping is always based on the Boundary Point location or Systems Connection Point, as the case may be. To establish the nodal power flow for the purposes of the Load Flow Model, all Metered Volume data associated with the VAUs allocated to a specific Node should be summed.

In the GSP to Node, and BM Unit to Node, sections of the NMS, there are several instances where the load, or the generation BM Unit, influence multiple Nodes, so these GSPs/BM Units have been split between the relevant "shared" Nodes. The "% of Metered Volume" column in the NMS shows the apportionment of that load /generation. For the "shared" Nodes, the "% Metered Volume" is split accordingly – please note that slight rounding may have occurred to ensure the apportionment equals 100%.

The following sections 4.1 to 4.3 outline the assumptions for the VAU to Node mapping carried out.

4.1 Directly Connected BM Units

Directly connected BM Units have BM Units Ids in the form of T_ or M_. The rules governing what should constitute a BM Unit (clause K3 of the BSC) do imply that a BM Unit may connect to the Total System via more than one Boundary Point. The following additional assumptions have been made for directly connected BM Units:

- all directly connected Network Rail BM Units connect to single phase transformers fed from parent substations. Such single phase connection arrangements cannot be easily modelled and all such BM Units have been mapped to the corresponding 400kV Node representing the parent substation;
- where a site containing a number of BM Units is connected to a number of distinct Nodes (for example, a power station connected to two Nodes at identical voltages) the mapping has been based on the normal running arrangements of that site and substations;

4.2 Grid Supply Points

The NMS contains the list of GSPs from the CRS for the Reference Year 2016/17. For the purposes of the NMS, a GSP is attached to either a single Node, or to multiple Nodes, and there may be more than one GSP attached to a Node. The following additional assumptions have been made for GSPs:

Embedded Transmission Systems

Where an Offshore Transmission System is connected to a Distribution System (an "Embedded Transmission System"), the calculation of Transmission Loss Factors (TLFs) cannot take into account the Distribution System that connects it to the remainder of the Transmission System (because losses on the Distribution System are included in Line Loss Factors, not TLFs). To address this, the Transmission Loss Factor Agent (TLFA) is required to 'join up' the two pieces of the Transmission System prior to performing the calculation, by merging:

[1] Although there is a requirement to map an HVDC Boundary to a Node, for 2016-17 there are no HVDC Boundaries to be mapped

- The Node representing the point at which the Offshore Transmission System joins the Distribution System (the "Offshore Transmission Connection Point"); and

- The Node on the onshore Transmission System to which the majority of the power from the Offshore Transmission System flows (according to the Distribution Network Data provided by the relevant Distributor).

Because these two Nodes are being merged in the calculation, the Offshore Transmission Connection Point could be mapped to either one of them in the NMS. The approach we have taken is to map the Offshore Transmission Connection Point to the onshore Transmission Node.

For example, Thanet offshore wind farm connects to the UKPN network at the Richborough GSP ('RICH1'), which is associated with Node THAW10 on the Thanet network. Distribution Network Data provided by UKPN shows that the majority of power then flows across the Distribution System to the Canterbury 132kV Node (CANT10). Therefore Nodes 'THAW10' and 'CANT10' will be merged for purposes of the modelling. GSP 'RICH1' could therefore be mapped to either, but our approach is to show it as mapped to the onshore Node 'CANT10'.

4.3 Interconnectors

The NMS contains the list of Interconnectors from the CRS for the Reference Year 2016/17. For the purposes of this NMS, an Interconnector maps onto Nodes on a one-to-many basis.

4.3.1 French Interconnector

The French Interconnector is attached to one 400kV Node at Sellindge and the Boundary Point for the French Interconnector is at this Node (SELL41).

4.3.2 Britned Interconnector

The Britned Interconnector is attached to one 400kV Node at Grain and the Boundary Point for the Britned Interconnector is at this Node (GRAI41).

4.3.3 East West Interconnector

The East West (Eirgrid) Interconnector is attached to one 400kV Node at Connah's Quay and the Boundary Point for the East West interconnector is at this Node (CONQ41).

4.3.4 Moyle Interconnector

The Moyle Interconnector (Auchencrosh) is attached to one 275kV Node at Auchencrosh and the Boundary Point for the Moyle Interconnector is at this Node (AUCH2-).

4.4 HVDC Boundary

The Transmission Company has confirmed that for 2016/17 there are no HVDC Boundaries, so no mapping has been applied in this NMS.

5. Node to Zone Mapping

In accordance with Section T, Annex T-2, paragraph 4.3, the BSC requires that a Node which represents or best represents a VAU, should be allocated to a Zone on a many to one basis (i.e. one or more Nodes may map onto a single Zone). Each Zone is based on a GSP Group. A Zone to GSP Group Mapping can be found in Table 1 "GSP Group to Zone". For the purposes of the NMS, all Nodes

have been mapped to the Zone that maintains consistency with the GSP Group to which the GSP or directly connected BM Unit is allocated.

6. BM Unit to Zone Mapping

In accordance with Section T, Annex T-2, paragraph 4.3, the BSC requires that all BM Units are mapped to Zones on a many-to-one basis, in other words, BM Units must lie in one Zone only

An Embedded BM Unit, Supplier BM Unit, or an Additional BM Unit for CFD Assets, is located in a single Zone, based on the GSP Group to which it is assigned.

Directly connected BM Units are mapped to the Zone in which the Node they are mapped to lies.

Interconnector BM Units are mapped to the Zone dependent on which Interconnector they are related to, for instance, Moyle Interconnector BM Units are allocated to Zone 13, and French Interconnector BM Units are allocated to Zone 9.

Appendix 1: Transmission System Diagram

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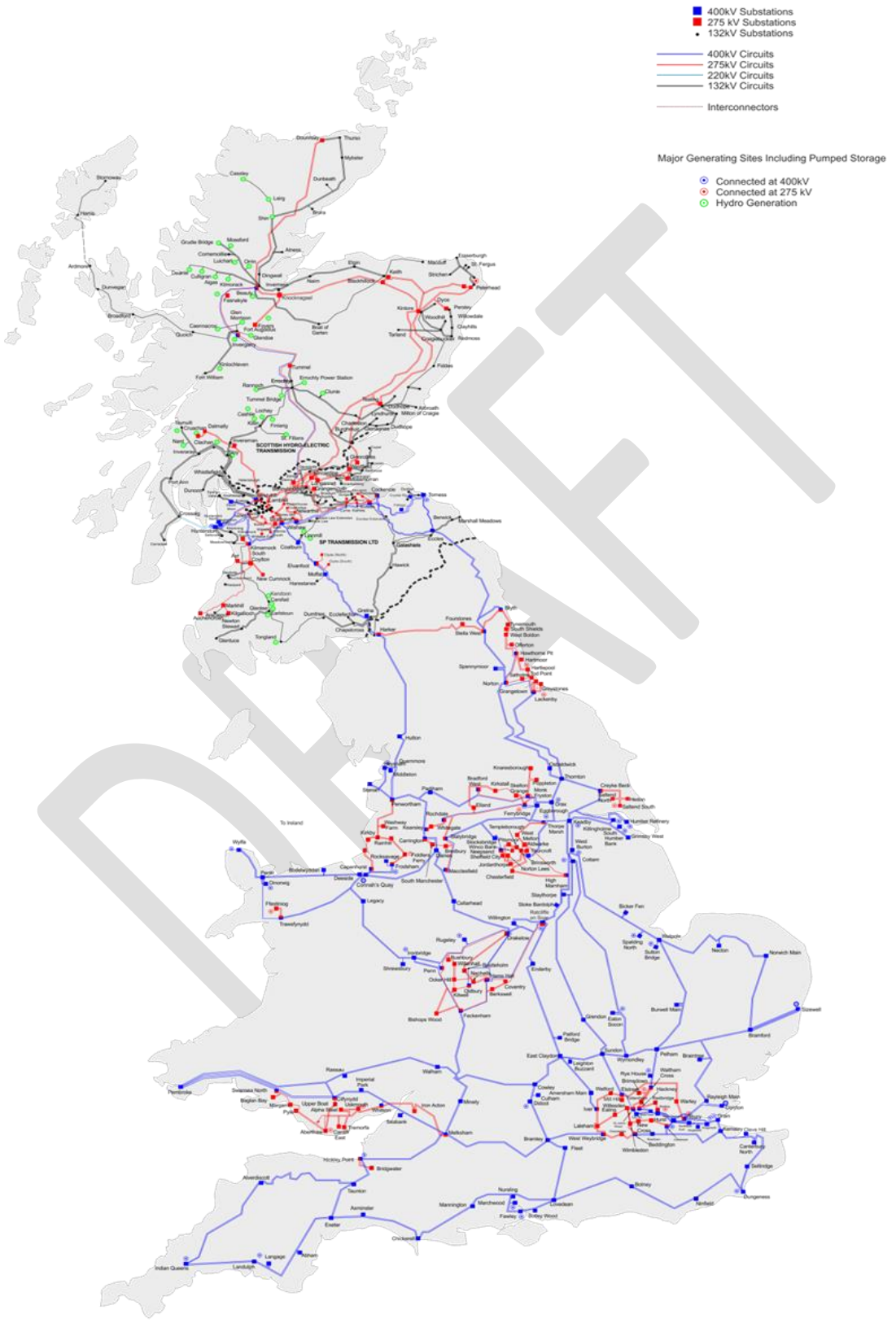
Figure A2: GB Existing Transmission System



Document Control

Version	Date	Author	Reviewer	Reason for review
0.1	06/07/2017	ALT	JOL	Draft Version
0.2	20/07/2017	ALT	NG	Reviewed by NG
0.3	27/07/2017	ALT	JOL	Updated Section 4.2 re OFTO Networks
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