P350 'Introduction of a seasonal Zonal Transmission Losses scheme'

Contents

About This Document

This document provides the requirements for the load flow modelling exercise for P350 'Introduction of a seasonal Zonal Transmission Losses scheme' to be carried out by the agreed Service Provider on behalf of the P350 Workgroup.

To support the assessment of P350, ELEXON is seeking to procure a modelling service to consider the magnitude of Transmission Loss Factor values under the first year of the proposed scheme and the sensitivity of these values under two specific scenarios. This document specifies the requirements for the load flow modelling service required. The modelling objectives, input data requirements, anticipated modelling process and required outputs are set out in this document.

Actual metered data, and network configuration information will be provided to enable the Service Provider to run the specified modelling scenarios. The modelling work will require grouping and post-processing of data from the system load flow model in a form specified by the P350 Workgroup.

There are two parts to this document:

- This is the main document. It provides background to P350 and specifies the requirements for the load flow modelling service required, including the modelling objectives, input data requirements, anticipated modelling process and required outputs.
- Attachment A contains the approved legal text for the P229 Proposed Modification.

Phase

- Initial Written Assessment
- Definition Procedure
- Assessment Procedure
- Report Phase
- Implementation

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1 Background

What are transmission losses?

When electricity is transmitted over the Transmission System some energy is 'lost'. This lost energy is commonly referred to as 'transmission losses'. Transmission losses are comprised of two main elements:

- **Fixed losses** are losses which do not vary significantly with power flow. These arise in transformers (from magnetising the iron core) and overhead lines (dependent on voltage levels, length of line and climatic conditions).
- **Variable losses** arise due to the heat caused by the flow of current through transformers and lines. Variable losses increase with current flow (and associated power flow) and the length of the line through which the current flows.

'Total transmission losses' refers to the sum of fixed and variable losses. The total losses are the total energy lost from the Transmission System at any given time, which equates to the difference between total metered generation and total metered demand.

How are transmission losses allocated?

A Transmission Loss Multiplier (TLM_{ij}) is a factor used to scale each Balancing Mechanism (BM) Unit's Metered Volumes in Settlement. A Transmission Loss Multiplier is generated for each individual non-Interconnector BM Unit[1] in each individual Settlement Period based on two further values, a Transmission Loss Factor (TLF_{ij}) and a Transmission Losses Adjustment ($TLMO_j$). The calculation for this is as follows:

$$TLM_{ij} = 1 + TLF_{ij} + TLMO_j$$

The Transmission Loss Factor is applied to BM Units on an individual basis. This is used to apply a differential allocation of some or all transmission losses, meaning each individual BM Unit could have its own specific Transmission Loss Factor applied to it. This parameter is currently set to zero for all BM Units and so has no effect in practice.

The Transmission Losses Adjustment is used to uniformly adjust all generation and demand to apportion transmission losses (excluding any already allocated through the Transmission Loss Factor mechanism) between BM Units. This ensures an exact allocation of the actual level of total losses in a given Settlement Period. Two separate Transmission Losses Adjustment values are calculated for each Settlement Period, one to be applied to BM Units in delivering Trading Units ($TLMO^+_j$) and one to be applied to BM Units in offtaking Trading Units ($TLMO^-_j$). The Transmission Losses Adjustment calculation includes a constant factor α (alpha), which determines the proportion of the total transmission losses to be uniformly allocated across all BM Units in delivering Trading Units. The remaining proportion is uniformly allocated across BM Units in offtaking Trading Units. This constant is currently set at 0.45, meaning:

- 45% of total losses are allocated across all BM Units in delivering Trading Units; and
- 55% of total losses are allocated across all BM Units in offtaking Trading Units.

Further information

The calculations for the allocation of transmission losses can be found in BSC Section T 'Settlement and Trading Charges'.

Further information is also available on the Losses page of our website.

[1] The Transmission Loss Multiplier for all Interconnector BM Units is set to 1 in all Settlement Periods. This change was introduced by Approved Modification P278 'Treatment of Transmission Losses for Interconnector Users' to comply with European legislation.

Since the Transmission Loss Factor for all BM Units is currently zero, each BM Unit's Transmission Loss Multiplier is determined solely by the Transmission Losses Adjustment values. This means two Transmission Loss Multipliers are applied in each Settlement Period, one to all BM Units in delivering Trading Units (which scales volumes down in magnitude) and one to all BM Units in offtaking Trading Units (which scales volumes up in magnitude). The appropriate multiplier is then applied to each BM Unit's Metered Volumes, depending on the direction of its Trading Unit in that Settlement Period. Each Party's overall allocation of transmission losses is therefore dependent on the Metered Volumes across all of its BM Units.

The current arrangements result in all fixed and variable transmission losses being allocated to Parties on a uniform, non-locational basis in proportion to each Party's Metered Volumes. This allocation of transmission losses does not take account of the extent to which individual Parties contribute to such losses.

What previous Modifications have been raised?

Several Balancing and Settlement Code (BSC) Modifications have been raised in the past to examine the allocation of transmission losses.

In 2002 and 2003, Modifications P75 'Introduction of Zonal Transmission Losses', P82 'Introduction of Zonal Transmission Losses on an Average Basis', P105 'Introduction of Zonal Transmission Losses on a Marginal Basis without Phased Implementation' and P109 'A Hedging Scheme for Changes to TLF in Section T of the Code' were progressed to put forward various options. In 2003, the Authority elected to approve P82. However, this decision was overturned in 2004 following a judicial review and P82 was not implemented.

In 2005 and 2006, four further Modifications were progressed: P198 'Introduction of a Zonal Transmission Losses scheme' (based on P82), P200 'Introduction of a Zonal Transmission Losses scheme with Transitional Scheme', P203 'Introduction of a seasonal Zonal Transmission Losses scheme' and P204 'Scaled Zonal Transmission Losses'. Following a Regulatory Impact Assessment, the Authority issued a statement noting it was minded to approve P203. However, in 2008 the Authority timed out on making a decision following a further judicial review.

In 2008, P229 'Introduction of a seasonal Zonal Transmission Losses scheme' was raised based on the P203 solution. The P229 Workgroup developed an Alternative Modification based on P204. The Authority subsequently rejected P229 in 2011.

What has the CMA concluded?

The Competition and Markets Authority (CMA) initiated a review of the energy markets in 2014 at the request of Ofgem. It final report was published in June 2016.

One of the areas the CMA considered was the absence of locational pricing for transmission losses. The CMA's conclusion was that this gives rise to an adverse effect on competition. The CMA's remedy requires a solution that is identical in its technical aspects to the P229 Proposed Modification, including notably the use of semi-marginal (rather than full marginal) Transmission Loss Factors[2]. To mandate this, the CMA will impose an order through secondary legislation on National Grid as the System Operator and make

[2] The P229 solution proposed a 'semi marginal' scheme in that it would only allocate variable losses locationally, and would therefore retain the existing uniform allocation of fixed losses.

amendments to National Grid's Transmission Licence conditions. This includes an obligation on National Grid to raise a BSC Modification in line with the P229 Proposed Modification. National Grid has therefore raised P350 accordingly.

What is the proposed solution?

P350 'Introduction of a seasonal Zonal Transmission Losses scheme' was raised by National Grid on 4 July 2016. To implement the CMA's remedy, it proposes to progress the P229 Proposed Modification as put forward in the P229 Final Modification Report.

Under this solution, 14 Transmission Loss Factor Zones would be created based on the existing 14 Grid Supply Point (GSP) Groups. A Network Mapping Statement will be established to document the allocation of BM Units to Zones. One Transmission Loss Factor value will be calculated per zone per BSC Season. These values would be published three months prior to the start of each BSC Year, and would be based on historical data from a preceding 12 month period (the Reference Year). The Transmission Loss Factor for a given Zone would be applied to all non-Interconnector BM Units allocated to that Zone for all Settlement Periods in the relevant BSC Season. A new BSC Agent, the Transmission Loss Factor Agent (TLFA), would be created to perform these calculations, and the calculation would be documented in a Load Flow Model Specification document.

Transmission Loss Factor values would only be used to allocate variable losses. A scaling factor of 0.5 would be applied to the marginal Transmission Loss Factor values, which would have the effect of ensuring that the volume of losses allocated through the Transmission Loss Factor mechanism is approximately equal to the total volume of variable losses. Fixed losses would continue to be allocated via the Transmission Losses Adjustment values, and the calculation and application of these values, including the value of α, would remain unchanged from currently.

P350 recognises that, since the progression of P229, P278 'Treatment of Transmission Losses for Interconnector Users' has exempted Interconnector BM Units from the allocation of transmission losses. Interconnector BM Units will therefore continue to be allocated a Transmission Loss Multiplier of 1 in all Settlement Periods under P350.

2 Modelling Tasks

P350 methodology

The P350 methodology is based on the final P229 Proposed Modification as set out in the final P229 legal text in Attachment A. This P229 methodology can be summarised as follows:

1. An electrical model of the Transmission System (a 'Load Flow Model') would be built, containing Nodes to represent points where transmission circuits meet or where energy flows on or off the Transmission System. Each Node on the Transmission System would be identified by the Transmission Company, and would be allocated to a specific Zone on the transmission network on the basis of a 'Network Mapping Statement' maintained by the BSC Company (BSCCo). The Zones would be set by the Panel, based on the geographic areas covered by GSP Groups. Since there are currently 14 GSP Groups, there would therefore be 14 Zones.

2. Transmission Loss Factors would be calculated on an ex-ante basis (i.e. calculated before the relevant year) for each BSC Year[3], using Metered Volumes and Network Data for Sample Settlement Periods from a preceding 12 month period (the 'Reference Year'). The required Metered Volumes and Network Data would be provided by the Central Data Collection Agent (CDCA) and the Transmission Company respectively.

3. Prior to the start of each BSC Year, the Load Flow Model would be run by the TLFA to calculate how an incremental increase in power at each individual Node would affect the total variable losses from the Transmission System. The output of the Load Flow Model would be a **Nodal Transmission Loss Factor** value for each Node in each of the Sample Settlement Periods.

    - Positive values would be produced for Nodes where an incremental increase in generation (or reduction in demand) had the effect of decreasing variable losses.

    - Negative values would be produced for Nodes where an incremental increase in generation (or reduction in demand) had the effect of increasing variable losses.

    For example, if an injection of an extra 1kWh of energy at a Node increased variable losses by 0.02kWh, the Transmission Loss Factor for that Node in that Settlement Period would be -0.02. The TLFA would average the raw Nodal Transmission Loss Factors across all the Nodes in each Zone by 'volume-weighted' averaging, to give 14 **Zonal Transmission Loss Factor** values for each Sample Settlement Period (one per Zone).

    The TLFA would then convert these Zonal Transmission Loss Factor values to **Seasonal Zonal Transmission Loss Factor** values by 'time-weighted' averaging, calculating a Seasonal Zonal Transmission Loss Factor value for each Zone for each BSC Season:

    - **BSC Spring**: 1 March – 31 May inclusive;

    - **BSC Summer**: 1 June – 31 August inclusive;

[3] The BSC Year runs from 1 April to 31 March.

- **BSC Autumn**: 1 September – 30 November inclusive; and
- **BSC Winter**: 1 December – 28/29 February (as applicable) inclusive.

4. The TLFA would adjust the Seasonal Zonal Transmission Loss Factor values by a scaling factor of 0.5 so the volume of energy allocated via the Transmission Loss Factor values is comparable to the volume of variable losses calculated by the Load Flow Model. These **Adjusted Seasonal Zonal Transmission Loss Factor** values would be made publicly available by BSCCo no less than three months prior to their use in the Transmission Loss Multiplier calculation for the applicable BSC Season.

5. Each BM Unit would be allocated to a specific Zone by BSCCo on the basis of the Network Mapping Statement, with any question or dispute over zonal allocation to be resolved by the Panel. The TLFA would determine the Transmission Loss Factor value to be applied to each BM Unit in the Transmission Loss Multiplier calculation for the applicable BSC Season, which would be the Adjusted Seasonal Zonal Transmission Loss Factor value for the relevant Zone.

   All BM Units within a Zone would therefore receive the same single Transmission Loss Factor value for every Settlement Period in the BSC Season. A positive Transmission Loss Factor would increase the Transmission Loss Multiplier value used to scale a BM Unit's Metered Volume (a benefit to generators and disadvantage to Suppliers), and a negative Transmission Loss Factor would decrease the Transmission Loss Multiplier value (a benefit to Suppliers and disadvantage to generators).

6. The BM Unit specific Transmission Loss Factor values calculated by the TLFA would be registered in BSC Systems by the Central Registration Agent (CRA), and would be used by the Balancing Mechanism Reporting Agent (BMRA) and the Settlement Administration Agent (SAA) within the Balancing Mechanism Reporting Service (BMRS) and Settlement calculations respectively.

7. The remaining 'fixed' element of transmission losses would continue to be allocated to Parties on a non-locational basis through the Transmission Losses Adjustment, and the overall 45:55 allocation of total transmission losses to generation and demand would be retained.

8. There would be no phased implementation or 'hedging' of exposure to the new Zonal Transmission Loss Factor values, which would therefore take full effect from the first Settlement Period on the P350 Implementation Date.

9. The applicable onshore Zones would be the geographical area defined by a GSP Group. For offshore nodes connected to the Transmission System (including both direct current (DC) and alternating current (AC) offshore networks and offshore networks connected to Distribution Systems) the relevant onshore GSP Group in which the network is connected would be used as the basis for the applicable Zone subject to Panel determination using specific criteria.

Overview of tasks

The Service Provider shall undertake the tasks detailed later on in this section. Further information on the Load Flow Model Objectives and Process can be found in Section 3.

Input data

The model operated by the Service Provider must possess the capability to model a set of specified scenarios, detailed below, using input data provided by ELEXON.

The Service Provider will offer a model that captures 'delivery' and 'offtake' (injections onto and withdrawals from the network) for a large number of 'Nodes' (points on the network) and Settlement Periods, scattered throughout a year. ELEXON expects the model to contain at least 2,000 Nodes and to be capable of estimating Transmission Loss Factors for at least 623 representative Settlement Periods over a year (623 is the number of Settlement Periods chosen for the previous load flow modelling exercises that were undertaken for zonal transmission losses).

ELEXON will provide the following input data, based on the last complete set of BSC Seasons, for the period **1 June 2015** to **31 May 2016**:

- Load Periods and Sample Settlement Periods;
- Generation and Demand Metered Volumes expressed in MWh for each Settlement Period under consideration (for GSPs, directly connected BM Units and Interconnectors);
- Mapping information relating BM Units, GSPs and Interconnectors to Nodes on the transmission network;
- Mapping information relating Nodes to Zones;
- Distribution Network Data, identifying which Node(s) on the onshore Transmission System receive power flows from each Offshore Transmission Connection Point[4]; and
- Network Configuration Data for the 'Intact Network', which is the complete Transmission System, assuming all lines are in operation and that no circuits are de-energised or disconnected.

It should also be noted that the data to be supplied to the Service Provider is sufficient to run a DC load flow model. The scope of the analysis to be performed does not require the operation of an AC load flow model.

Service Provider data requirements

The Service Provider should set out what additional data will be required to provide the modelling service specified in this document and to calculate the resulting Transmission Loss Factor values using the rules set out under P350. The Service Provider should also specify the proposed source of any data to be used that ELEXON cannot provide, including any assumptions.

[4] An Offshore Transmission Connection Point is a point of connection between an offshore Transmission System and an onshore Distribution System.

Required outputs

The Service Provider will generate the outputs specified under each task described below. The outputs from the modelling process shall be presented in a standard format (to be agreed with ELEXON). The outputs shall comprise:

- data in raw format in a standard electronic format (e.g. as comma separated value (.csv) files);
- summary tables where appropriate in a standard format to aid comparison between outputs and scenarios;
- graphical representations of data; and
- a formal report outlining the modelling approach and results.

The model shall produce outputs based on the approach for calculating losses identified under each task as set out below.

Service Provider documentation

In order that any assumptions, limitations, issues and risks associated with the use of the model and its output can be assessed, appropriate documentation should be provided and agreed with ELEXON prior to commencement of the modelling tasks. Where certain parameters are required for an individual modelling task (e.g. for a specified Node or generator) the Service Provider shall agree these parameters with ELEXON prior to the commencement of that modelling task.

Timetable

P350 Load Flow Modelling Exercise Timetable	
Event	Date
Load flow modelling exercise commences – input data received by Service Provider	08 Aug 16
Service Provider provides Transmission Loss Factor values to ELEXON	To be agreed
ELEXON provides corresponding Transmission Losses Adjustment and Transmission Loss Multiplier values to Service Provider	To be agreed
Service Provider provides all required outputs from the load flow modelling exercise to ELEXON	10 Oct 16
Service Provider presents the results to the P350 Workgroup	18 Oct 16

Task 1: Baseline Transmission Loss Factor values

Rationale for the task

This task will produce a set of baseline Adjusted Seasonal Zonal Transmission Loss Factor values. It will illustrate the likely patterns of loss allocation under P350, to provide Parties with an indication of the likely impacts of P350 on them in its first year. It will also provide a baseline against which further sensitivity scenarios can be considered.

Summary of the task

This task will calculate Adjusted Seasonal Zonal Transmission Loss Factor values for the set of Sample Settlement Periods using the P229 Proposed Modification methodology (as defined above).

ELEXON will use these values to calculate corresponding Transmission Losses Adjustment and Transmission Loss Multiplier values for each actual Settlement Period in the period 1 June 2015 to 31 May 2016.

Task 1 will calculate Adjusted Seasonal Zonal Transmission Loss Factors using the original P229 methodology, which involves including Interconnector power flows in the calculation of Nodal Transmission Loss Factor values and Interconnector Nodes in the calculation of Zonal Transmission Loss Factor values. Under this approach, Interconnector power flows will continue to be included in all stages of calculating Adjusted Seasonal Zonal Transmission Loss Factors.

However, because of the approval of P278, the Transmission Loss Multiplier received by Interconnector BM Units in Settlement would continue to be 1 in every Settlement Period regardless of any Transmission Loss Factor value or Transmission Losses Adjustment value.

Input data

The following data will be provided for the 623 Sample Settlement Periods:

- Half Hourly Metered Volumes for each directly connected BM Unit, GSP and Interconnector for the period 1 June 2015 to 31 May 2016;
- Network Data for the 'intact Network', with one Network for all Settlement Periods considered; and
- Weighting factor for each Settlement Period (for the purpose of determining seasonal average values).

Required outputs

The Service Provider will generate Transmission Loss Factors for Task 1. The following data shall be provided:

- Adjusted Seasonal Zonal Transmission Loss Factor values for each Zone for each BSC Season over the period 1 June 2015 to 31 May 2016.
- Corresponding raw output data as specified in Section 3.

ELEXON will use these values to determine corresponding Transmission Losses Adjustment and Transmission Loss Multiplier values for all Settlement Periods across the same period.

Task 2: Baseline Transmission Loss Factor values with Interconnector flows excluded from the Zonal average

Rationale for the task

Interconnector BM Units are exempt from the allocation of transmission losses following European legislation treating them as part of the Transmission System (as implemented in the BSC through P278). As this rule change occurred after P229, the P350 Workgroup needs to decide how best to account for this in the final P350 methodology.

So that the Workgroup can consider the sensitivity of the Adjusted Seasonal Zonal Transmission Loss Factor values in this area, Task 2 will recalculate the baseline values from Task 1 based on a scenario in which Interconnector power flows are excluded from the zonal averaging.

Summary of the task

This task will calculate Adjusted Seasonal Zonal Transmission Loss Factor values as per Task 1 but with the following amendment:

- Interconnector power flows will be excluded from the calculation of the Zonal Transmission Loss Factor values. Interconnector power flows will be used to calculate Nodal Transmission Loss Factor values, but the Nodal Transmission Loss Factor values and the Nodal power flow values for Interconnector Nodes shall be excluded from the calculation of Zonal Transmission Loss Factor values.

For Task 2, ELEXON will also recalculate the Transmission Losses Adjustment and Transmission Loss Multiplier values from Task 1 to reflect these different Adjusted Seasonal Zonal Transmission Loss Factor values.

Input data

The input data for Task 2 will be identical to Task 1, with the Service Provider creating the required scenario by excluding Interconnector Nodes and Interconnector power flows from the calculation of Zonal Transmission Loss Factor values.

Required outputs

The Service Provider will generate Transmission Loss Factors for Task 2. The following data shall be provided:

- Adjusted Seasonal Zonal Transmission Loss Factor values for each Zone for each BSC Season over the period 1 June 2015 to 31 May 2016.
- Corresponding raw output data as specified in Section 3.

ELEXON will use these values to determine corresponding Transmission Losses Adjustment and Transmission Loss Multiplier values for all Settlement Periods across the same period.

GB Interconnectors

There are currently four external Interconnectors connecting the Great Britain (GB) Transmission System to other countries' Transmission Systems:

- **IFA** has a 2,000MW capacity, links GB with France, and connects at Sellinge in Kent.
- **Moyle** has a 500MW capacity, links GB with Northern Ireland, and connects at Auchencrosh in South Ayrshire.
- **BritNed** has a 1,000MW capacity, links GB with Holland, and connects at the Isle of Grain in Kent.
- **East-West** has a 500MW capacity, links GB with Ireland, and connects at Deeside in north Wales.

Further information can be found on the Interconnectors page of our website.

Task 3: Inclusion of the HVDC Western Link

Rationale for the task

The High Voltage Direct Current (HVDC) Western Link is expected to become operational in 2017. Task 3 will recalculate the baseline values from Task 1 based on a scenario in which the HVDC Western Link is operational, and will consider the sensitivity of the resulting values to different approaches to including this in the model. Since no HVDC links have been in operation historically, such circuits will not be included in the input data provided for Tasks 1 and 2. The P229 methodology did not cater for HVDC transmission circuits as, at the time it was progressed, the introduction of such circuits was still many years in the future. Task 3 will therefore support the P350 Workgroup's consideration of how the final P350 methodology should account for HVDC transmission circuits.

HVDC Western Link

The HVDC Western Link is an offshore HVDC circuit linking Hunterston in North Ayrshire to Deeside in Flintshire. It is intended to reduce transmission constraints that sometimes limit the power flow from Scotland to England.

Further information can be found on the Western Link Project website.

Summary of the task

This task will calculate Adjusted Seasonal Zonal Transmission Loss Factor values as per Task 1 but with the following amendment:

- The HVDC Western Link will be included in the model.

There are two options for including the HVDC Western Link that will need to be assessed as part of this task, and separate sets of Adjusted Seasonal Zonal Transmission Loss Factors will need to be provided for each option:

- **Option A**: The HVDC Western Link will be modelled as a point of generation at one of the corresponding Nodes and as a point of demand at the other Node.
- **Option B**: The HVDC Western Link will be modelled as an AC connection between the two relevant Nodes in a manner that is consistent with the legal text for the P229 Proposed Modification (see Attachment A).

The reason for including Option B is that the P229 Proposed Modification legal text set out various assumptions and approximations that must be made in the load flow model. Because the CMA's remedy requires P350 to be 'identical in its technical aspects' to P229, the Workgroup may not have the flexibility to amend these to account for the different characteristics of HVDC circuits. In this case, it would need to find a method for including HVDC circuits in the model that is consistent with these P229 assumptions and approximations.

The P350 Workgroup therefore requires the Service Provider to detail:

- how its approach to Option A differs from the P229 legal text; and
- how its approach to Option B is consistent with the P229 legal text.

The P350 Workgroup also requires the Service Provider to explain clearly the factors behind the differences in results for Options A and B.

For Task 3, ELEXON will also recalculate the Transmission Losses Adjustment and Transmission Loss Multiplier values from Task 1 to reflect these different Adjusted Seasonal Zonal Transmission Loss Factor values.

Input data

The input data for Task 3 will be identical to Task 1. The Service Provider should therefore highlight as soon as possible if it requires any additional input data to complete this task.

Required outputs

The Service Provider will generate separate Transmission Loss Factors for both options under Task 3. The following data shall be provided:

- Adjusted Seasonal Zonal Transmission Loss Factor values for each Zone for each BSC Season over the period 1 June 2015 to 31 May 2016.
- Corresponding raw output data as specified in Section 3.

ELEXON will use these values to determine corresponding Transmission Losses Adjustment and Transmission Loss Values for all Settlement Periods across the same period.

3 Modelling Objectives and Process

Overall objectives

Objective A: Calculation of Transmission Loss Factors

The Service Provider will generate Transmission Loss Factor values (factors representing the change in transmission losses arising from marginal changes in demand or generation at Nodes on the Transmission System). Transmission Loss Factor values will need to be generated for the specified tasks listed in Section 2.

Using the Transmission Loss Factor values calculated by the Service Provider, Transmission Losses Adjustment and Transmission Loss Multiplier values will be calculated by ELEXON.

Objective B: Estimation of sensitivity of Transmission Loss Factors to specified scenarios

The Service Provider will establish the sensitivity of Transmission Loss Factor values to the treatment of Interconnector power flows and HVDC circuits as detailed in Tasks 2 and 3.

Objective C: Credible and accurate model

To ensure that the Transmission Loss Factor values generated by the model are as accurate as possible, the model should accurately represent the physical characteristics of the Transmission System. In addition, the input data should reflect the conditions prevailing on that network at the time in question.

To ensure that the Transmission Loss Factor values generated are credible, all assumptions used in the modelling should be credible, accurate and clearly described.

Objective D: Transparent model

To ensure maximum transparency of the modelling undertaken, the operation of the model and all input data must be objectively derived from public sources (or provided by ELEXON) and all assumptions must be clearly stated. Output data should be in a readily usable format. Finally, the model should be flexible and capable of producing a quick turnaround for results.

Modelling process

As indicated in previous sections of this document, a model is required for calculating marginal loss factors for the Transmission System. The precise methodology to be used for calculating these loss factors is not specified and the Service Provider is invited to propose an approach and ELEXON will review this approach. However, the subsections below outline the high-level requirements of the two key stages in the process: power flow modelling; and data analysis and presentation.

Power flow modelling

The first stage in the modelling process requires the calculation of Transmission Loss Factor values at each Node on the system. When proposing and justifying an approach to

the calculation of Nodal Transmission Loss Factor values, the following items must be considered.

Load flow model

All modelling should be performed using a DC Load Flow model. It should be noted that, although accuracy is important, a transparent model is also required. It is important that the judgements or assumptions on input data made by the modeller are kept to a minimum. Where these judgements are required, the sensitivity of results to the assumptions should be indicated.

Methodology for calculating Nodal Transmission Loss Factors

There are a number of methods for calculating Transmission Loss Factor values at an individual Node. The Service Provider will specify in detail the approach it recommends.

Developing alternative scenarios

The majority of the modelling required from the Service Provider requires the use of actual historic data. However, Task 3 requires the Service Provider to examine the sensitivity of Transmission Loss Factor values to different approaches for including HVDC transmission circuits in the load flow model. The Service Provider will indicate whether it has the capability to aid in the development of this scenario or whether it will require ELEXON, National Grid and/or the P350 Workgroup to provide any necessary data.

Data analysis and presentation

The second stage in the modelling process requires the manipulation of marginal Nodal Transmission Loss Factor values to create the actual data required. The manipulations required are set out below.

Grouping Nodes into Zones

The modelling process requires grouping individual Nodes into Zones to calculate Zonal Transmission Loss Factor values. Mapping information relating Nodes to Zones will be provided by ELEXON. A demand weighted Transmission Loss Factor value for each Zone is required.

Scaling Zonal Transmission Loss Factors

The proposal for introducing zonal losses requires the use of scaled Zonal Transmission Loss Factor values. The model should be capable of applying a specified scaling factor of 0.5 to the fully marginal Zonal Transmission Loss Factor values. For example, a Transmission Loss Factor value of -5% should be scaled to give a Transmission Loss Factor value of -2.5%.

Creating average Transmission Loss Factors

The proposal for introducing zonal losses requires the calculation of a Seasonal Transmission Loss Factor value by time-weighted averaging of a number of historic Sample Settlement Periods. The model should be capable of producing these time-weighted average Transmission Loss Factor values for each Zone. The weighting of each Sample Settlement Period will be provided as an input.

Calculation of Transmission Loss Multipliers

Once the Zonal Transmission Loss Factor values have been calculated they will be converted into Transmission Loss Multiplier values. This processing will be performed by ELEXON.

Data processing and presentation

It is recognised that this modelling exercise will produce large amounts of data. It is therefore important that the data presentation is considered carefully. The Service Provider will be required to perform statistical analysis and present results in a manner that supports easy consideration of the results. The Service Provider will attend a meeting of the P350 Workgroup to present the modelling results (when requested by ELEXON). A written report detailing the modelling performed and highlighting the conclusions which can be drawn from the results will be required.

As a supplement to the Service Provider's final report, ELEXON shall publish on its website all of the Transmission Loss Factor, Transmission Losses Adjustment and Transmission Loss Multiplier values calculated as part of this exercise in, as a minimum, comma separated value (.csv) file format. ELEXON shall also publish all other raw input and output data as stipulated in the P229 Proposed Modification legal text in Attachment A, listed in the table below. The Service Provider shall therefore be required to provide any such raw output data as produced by it during this exercise.

Raw Input and Output Data to be Published	
Data item	Definition
Distribution Network Data	Reports containing the Distribution Network Data for each Distribution System determined by the relevant Distribution System Operator.
Transmission Network Data	A report containing the Transmission Network Data determined by the Transmission Company.
Metered Volumes	A report containing the Metered Volume data provided by BSCCo.
Nodal Transmission Loss Factor values	For each Node, a report providing Nodal Transmission Loss Factor values as determined by the Service Provider.
Nodal power flows	A report providing Nodal power flows as determined by the Service Provider.
Load Flow Model power flows	A report containing the power flows which the Load Flow Model Specification provides for and upon which the Load Flow Model is established.

Appendix 1: Glossary & References

Acronyms

Acronyms used in this document are listed in the table below.

Acronym	
Acronym	Definition
AC	alternating current
BM	Balancing Mechanism
BMRA	Balancing Mechanism Reporting Agent *(BSC Agent)*
BMRS	Balancing Mechanism Reporting Service
BSC	Balancing and Settlement Code *(industry Code)*
BSCCo	Balancing and Settlement Code Company *(Code Administrator; ELEXON)*
CDCA	Central Data Collection Agent *(BSC Agent)*
CMA	Competition and Markets Authority
CRA	Central Registration Agent *(BSC Agent)*
DC	direct current
GB	Great Britain
GSP	Grid Supply Point
HVDC	High Voltage Direct Current
SAA	Settlement Administration Agent *(BSC Agent)*
TLFA	Transmission Loss Factor Agent *(new BSC Agent)*

External links

A summary of all hyperlinks used in this document are listed in the table below.

All external documents and URL links listed are correct as of the date of this document.

External Links		
Page(s)	Description	URL
1, 4	P350 page on the ELEXON website	https://www.elexon.co.uk/mod-proposal/p350/
2	BSC Sections page on the ELEXON website	https://www.elexon.co.uk/bsc-related-documents/balancing-settlement-code/bsc-sections/
2	Losses page on the ELEXON website	https://www.elexon.co.uk/reference/technical-operations/losses/
2, 4	P278 page on the ELEXON website	https://www.elexon.co.uk/mod-proposal/p278-treatment-of-transmission-losses-for-interconnector-users/

External Links		
Page(s)	Description	URL
3	P75 page on the ELEXON website	https://www.elexon.co.uk/mod-proposal/p075-introduction-of-zonal-transmission-losses/
3	P82 page on the ELEXON website	https://www.elexon.co.uk/mod-proposal/p082-introduction-of-zonal-transmission-losses-on-an-average-basis/
3	P105 page on the ELEXON website	https://www.elexon.co.uk/mod-proposal/p105-introduction-of-zonal-transmission-losses-on-a-marginal-basis-without-phased-implementation/
3	P109 page on the ELEXON website	https://www.elexon.co.uk/mod-proposal/p109-a-hedging-scheme-for-changes-to-tlf-in-section-t-of-the-code/
3	P198 page on the ELEXON website	https://www.elexon.co.uk/mod-proposal/p198-introduction-of-a-zonal-transmission-losses-scheme/
3	P200 page on the ELEXON website	https://www.elexon.co.uk/mod-proposal/p200-introduction-of-a-zonal-transmission-losses-scheme-with-transitional-scheme/
3	P203 page on the ELEXON website	https://www.elexon.co.uk/mod-proposal/p203-introduction-of-a-seasonal-zonal-transmission-losses-scheme/
3	P204 page on the ELEXON website	https://www.elexon.co.uk/mod-proposal/p204-scaled-zonal-transmission-losses/
3, 4	P229 page on the ELEXON website	https://www.elexon.co.uk/mod-proposal/p229-introduction-of-a-seasonal-zonal-transmission-losses-scheme/
3	The CMA's Energy Market Investigation page on the GOV.UK website	https://www.gov.uk/cma-cases/energy-market-investigation
10	Interconnectors page on the ELEXON website	https://www.elexon.co.uk/reference/interconnectors/
11	Western Link Project website	http://www.westernhvdclink.co.uk/