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LOAD FLOW MODELLING FOR MODIFICATION PROPOSALS P75 AND P82

Modelling of Transmission Losses to Support Modification Proposals P75 and P82

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0.2 second draft produced by ELEXON, incorporating the TLFMG Modelling Sub-group's comments

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0.4 fourth draft produced by ELEXON, incorporating refinements to input data section made by TLFMG Modelling Sub-group

1.0 final version produced by ELEXON, incorporating further comments of the full TLFMG

d Intellectual Property Rights and Copyright

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1 INTRODUCTION

1.1 Background

Currently transmission losses in the England and Wales electricity market are allocated between users on a uniform system wide basis with a 45:55 split between generation and demand. This is set out in the Balancing and Settlement Code (BSC), the document that contains the rules and governance arrangements for energy imbalance settlement, which all licensed electricity generators and suppliers must sign. Ultimately all energy, including transmission losses, is accounted for through the BSC central settlement processes which are managed by ELEXON.

Two modification proposals have been submitted under the change management procedures of the BSC to introduce the allocation of transmission losses on a zonal basis (i.e. Modification Proposal P75 'Introduction of Zonal Transmission Losses' and Modification Proposal P82 'Introduction of Zonal Transmission Losses on an Average Basis')[1]. A Transmission Loss Factor Modification Group (TLFMG) has been established under the BSC Modification Procedures to assess these two proposals[2]. The TLFMG is working to a challenging timetable, and detailed system load flow modelling is required at an early stage in this assessment process[3].

1.2 Modification Proposals P75 and P82

Modification Proposal P75 ('P75') advocates derivation of marginal zonal losses for each half-hour settlement period on an ex post basis. Modification Proposal P82 ('P82') recommends using annual average loss factors to recover the heating losses on a zonal basis and the fixed losses on a uniform basis. A summary of the key features of each proposal is summarised in the table below:

Feature	Modification Proposal P75	Modification Proposal P82
Transmission Loss Factor Methodology (TLFM)	'Marginal'	'Scaled Marginal' (i.e. scaling factor of approximately 0.5)
Transmission Loss Factor (TLF) Calculation	Half hourly ex-post	Annual ex-ante
Validity of TLFs	One Settlement Period	One Year (April to March)
Zonal Groupings	Generation –TNUoS zones Demand – GSP Groups	Generation – GSP Groups Demand – GSP Groups
Type of Flow to be Modelled (i.e. AC or DC)	Not specified	Not specified
Network Configuration Data	Historic or 'real time'	Historic
Methodology for Converting Metered Volumes into Nodal Metered Volumes	None specified	None specified
'Averaging' Process for Converting Nodal TLFs into Zonal TLFs	'Demand-weighted' averaging	'Demand-weighted' averaging
'Averaging' Process for Converting Half-hourly TLFs into Annual TLFs	Not applicable	Time-weighted averaging

The proposers of both P75 and P82 believe that their proposals will better target the cost of losses at those BSC Parties that are 'responsible' for such losses. They suggest that this will both reduce the overall cost of losses in the short-term and lead to more efficient siting of generation and demand in the long-term. They further assert this will reduce the overall costs of transporting electricity and enhance competition in generation and supply of electricity.

[1] Copies of Modification Proposal P75 and Modification Proposal P82 can be found in Annexes 1 and 2 respectively.
[2] The Terms of Reference of the TLFMG can be found on ELEXON website (www.elexon.co.uk).
[3] A copy of the 'Assessment Procedure' timetable is attached as Annex 3.

1.3 Assessment Procedure

The BSC Panel, the body that oversees the management, development and implementation of the BSC, has submitted both proposals to the 'Assessment Procedure'. The purpose of this procedure is the evaluation of the two proposals.

The BSC Panel has charged the TLFMG with undertaking the Assessment Procedure. This involves appraising and developing the proposals in close consultation with the industry and other interested stakeholders, and, finally, making recommendations to the BSC Panel to reject or approve them by 14 November 2002. This requires the TLFMG to carry out both technical and economic evaluations of the proposals and to establish whether the proposals (or any 'Alternative Modifications' that may be developed during the process) better facilitate achievement of the 'Applicable BSC Objectives'. The Applicable BSC Objectives are the criteria against which all BSC modification proposals are judged[4]. Essentially, they deal with the promotion of competition in the generation and supply of electricity and efficiency in the operation of both the transmission system and in the administration of the BSC.

To support assessment of P75 and P82, ELEXON, on behalf of the TLFMG, is seeking to procure a modelling service to model, amongst other things, the magnitude and variability of TLFs under each of the proposed schemes. The modelling objectives, input data requirements, the anticipated modelling process and the outputs required from this exercise are set out in sections 2, 3, 4 and 5 of this document. It is anticipated that actual metered data, and 'representative' network configuration information will be provided to enable the modeller to run various modelling scenarios and estimate various sensitivities.

The work will require grouping and post processing of data from the system load flow model in a form specified by the TLFMG. For example, information to enable geographical zones to be mapped to nodes will be provided for this purpose. The post processing of data will also require the processing and presentation of data in terms of Transmission Loss Factors (TLFs) and Transmission Loss Multipliers (TLMs) which are defined in section T2 of the BSC (a copy of the BSC can be found on the ELEXON website at www.elexon.co.uk).

Given the short timescales available for modelling, it is anticipated that it will be necessary to make use of a largely 'off-the-shelf' electricity load flow model.

1.4 Purpose of Document

This document is a requirement specification for the load flow modelling service being sought as part of the Assessment Procedure for P75 and P82. The following sections set out the objectives of the modelling, the input data that will be provided by ELEXON, modelling process to be followed and output required from the service provider.

This requirement specification will be issued in conjunction with the 'Invitation to Tender' as part of the tender process that ELEXON intends to pursue to secure the modelling service described above.

1.5 Glossary of Terms

The following key terms have been used throughout the report:

<u>Balancing Mechanism Unit (BM Unit)</u> BM Units are an accounting unit for energy flows in the Settlement process. A BM Unit is the smallest possible aggregation of plant and/or apparatus used for the determination of imports from and exports onto the system.

[4] A copy of the Applicable BSC Objectives is attached as Annex 4 for reference

Examples of BM Units include generating units, directly connected demand sites and demand (both half-hourly and non half-hourly) located within a GSP Group, supplied by a single supplier.

Trading Unit

A Trading Unit is a group of Balancing Mechanism Units (BM Units) that are close to each other on the transmission system. Because of this proximity, they are afforded “net” treatment, meaning that the overall commercial effect is the same as if demand occurring within the group were satisfied directly by generation within the group (or vice versa), with only the net of the two being traded over the system.

Transmission Loss Factor (TLF)

Transmission Loss Factors are factors allocated to BM units in the Settlement process to reflect the transmission losses incurred by the activities of the BM Unit in question. (NB: The role of TLFs in the allocation of losses for the purpose of Settlement is detailed in Section T2 of the Balancing and Settlement Code, which is reproduced in Annex 6 of this document.)

Transmission Loss Adjustment (TLMO$^+$ & TLMO$^-$)

Transmission Loss Adjustments are factors used in the Settlement Process to ensure to ensure that each side of the market picks up the correct volume. (NB: The derivation of TLMOs is detailed in Section T2 of the Balancing and Settlement Code, which is reproduced in Annex 6 of this document.)

Transmission Loss Multiplier (TLM)

Transmission Loss Multipliers are multipliers, applied to BM Unit metered volumes, to modify energy flows to take into account transmission losses. (NB: The derivation of TLMs is detailed in Section T2 of the Balancing and Settlement Code, which is reproduced in Annex 6 of this document.)

2 MODELLING OBECTIVES

2.1 Overall Objectives

This section sets out the high-level objectives of the modelling service being sought, a set of detailed objectives are contained in Annex 5. These objectives will need to be applied to a range of generation and demand scenarios that will replicate typical conditions of the transmission system during different seasons, days and settlement periods. The inputs, processing and outputs that are required to facilitate achievement of these objectives are described in sections 3, 4 and 5, respectively.

The service provider must meet all four of the objectives listed below.

2.2 Objective A - Credible & Accurate Model

To ensure that the output generated by the model is as accurate as possible, the model should accurately represent the physical characteristics of the England and Wales transmission network. In addition, the input data should reflect, as far as is reasonably possible, the conditions prevailing on that network at the time in question.

To ensure that the output generated is credible, all assumptions used in the modelling should be credible, accurate and clearly described.

2.3 Objective B - Calculation of TLFs & TLMs

The service provider will generate Transmission Loss Factors (TLFs); factors representing the change in transmission losses arising from marginal changes in demand or generation at nodes on the transmission network, and Transmission Loss Multipliers (TLMs); variables that adjust actual metered data to reflect overall systems losses. TLFs and TLMs will need to be generated for each of the proposals (P75 and P82) and under each of the scenarios specified in section 3.3.

The TLFMG will require this objective to be met in order to assess the impact of the proposals on TLFs and TLMs.

2.4 Objective C – Estimation of Predictability & Stability of TLFs/TLMs

The service provider will establish the sensitivity of TLFs and TLMs to changes in demand and generation by both time and location. In addition, the variability of both TLFs and TLMs will need to be estimated for several time frames. The changes to be modelled will be specified under the scenarios to be provided to the service provider.

2.5 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) an all assumptions must be clearly stated. In addition, the model should use any data provided by the TLFMG and be capable of review by the TLFMG. Output data should be in a readily usable format. Finally, the model should be flexible and capable of quick turn around.

3 INPUT DATA

3.1 Model Data Handling Capabilities

The model operated by the service provider must possess the capability to model a set of scenarios, specified below, using historical data for 2001/2002 using input data provided by ELEXON.

The service provider will have to offer a model that captures 'Delivery' (i.e. injections onto the network) and 'Off-take' (i.e. withdrawals from the network) for a large number of 'nodes' (i.e. points on the network) and Settlement Periods, scattered throughout a year. The service provider should specify how many nodes and Settlement Periods would be included in the model. For guidance, ELEXON expects the model to contain at least 100 nodes and to be capable of estimating TLFs for at least 800 representative Settlement Periods over a year – although the base case will contain only 6 representative Settlement Periods.

3.2 Input Data Provided

ELEXON will provide the following input data, for financial year 2001/2 for the base case and the set of scenarios:

- **Generation (BM Unit metered volumes, expressed in MWh, for each Settlement Period under consideration)**
- **Demand (Grid Supply Point metered volumes, expressed in MWh, for each Settlement Period under consideration)**
- **Trading Unit registration list**
- **Mapping information relating BM Units to nodes on the transmission network**
- **Mapping information relating nodes to TNUoS zones and GSP Groups**
- **Network Configuration Data in NGC's 'OPFLOW' format for the following three interpretations of the England and Wales transmission network:**
    (a) 'Intact Network': the complete England & Wales transmission network, assuming no circuits de-energised or disconnected (i.e. all lines in operation)

    (b) 'Representative Network': an approximation of the typical configuration of the England & Wales transmission network, assuming some circuits being de-energised or disconnected an approximation of the typical transmission network, in existence across financial year 2001/2. Such an approximation will be based on the intact network with scaled impedance to reflect overall circuit availability.

    (c) 'Indicative Network': an approximation of the transmission network in existence at a specific point in time (i.e. Settlement Period specific). Such an approximation will be based on subtraction of known outages at that time from the intact network.

The service provider should note that, due to the combination of actual metered data with various approximations of the network at the corresponding times, manipulation of the data sets will be required. The scaling of demand to match generation and losses on the system, given a particular network configuration, will be necessary.

In addition, it should also be noted that the data to be supplied to the service provider is sufficient to run a DC load flow model. However, ELEXON will not be able to provide the data necessary to run an AC load flow model (e.g. a comprehensive reactive power data set with aggregation rules).

3.3 Input Data sets & 'Scenarios'

ELEXON will provide the following data sets, combining various sets of metered volumes and with network configurations, to the service provider:

3.3.1 Data Set 1

The following data will be provided for the 6 'base-case' Settlement Periods (i.e. winter peak, summer weekday trough, weekday daytime, weekday night, weekend daytime and weekend night):

- Demand (actual)
- Generation (actual)
- Network '(indicative' i.e. different for each of the six Settlement Periods)

It should noted that the data for the 'indicative' network will be provided, where necessary, in the form of split nodes. The service provider may aggregate the nodes in an appropriate manner, as he or she sees fit.

3.3.2 Data Set 2

The following data will be provided for the 6 'base-case' Settlement Periods (i.e. winter peak, summer weekday trough, weekday daytime, weekday night, weekend daytime and weekend night):

- Demand (actual)
- Generation (actual)
- Network ('intact' i.e. the same for each of the six Settlement Periods)

3.3.3 Data Set 3

The following data will be provided for the 6 'base-case' Settlement Periods (i.e. winter peak, summer weekday trough, weekday daytime, weekday night, weekend daytime and weekend night):

- Demand (actual)
- Generation (actual)
- Network ('representative' i.e. the same for each of the six Settlement Periods)

3.3.4 Data Set 4

To simulate a constraint on the system the following data will be provided:

- Data for one Settlement Period from the base case where the line limit, on a specified line, has been dropped to the actual flow on it to simulate a constraint (i.e. a schedule, with a merit order, will then need to be run by the service provider to produce constrained TLFs)

3.3.5 Data Set 5

To simulate a reverse flow on the French interconnector the following data will be provided for the purpose of comparison:

- Data for a Settlement Period in which the French interconnector is importing (i.e. a position of net import)
- Data for a Settlement Period, with similar demand conditions to the above period, in which the French interconnector is exporting (i.e. a position of net import)

3.3.6 Data Sets 6 & 7

To simulate breakdown/closure of plant the following data will be provided:

- Data Set 1 (described above) with a generator removed from the North (i.e. 1000MW removed from a specified node and the shortfall in generation smeared uniformly across all other generators)
- Data Set 1 (described above) with a generator removed from the South (i.e. 1000MW removed from a specified node and the shortfall in generation smeared uniformly across all other generators)

The node from which the generation is to be removed in each instance is to be agreed between ELEXON and the service provider.

3.3.7 Data Set 8

To assess the sensitivity of TLFs/TLMs to the re-location of generation and demand the following data will be provided:

- Data Set 1 (described above) with a generator removed from the North and replaced by an identical generator in the South (i.e. remove 1000MW from a specified node in the North and added to a specified node in the South)

The nodes from which the generation is to be removed and added are to be agreed between ELEXON and the service provider. It should be noted that, whilst the scenario implied by data set 8 specifies the re-location of generation, given that demand can be considered as negative demand, the scenario also covers the relocation of demand.

3.3.8 Data Set 9

To assess the sensitivity of TLFs/TLMs to increased intermittent generation (i.e. offshore wind farms), the following data will be provided:

- Data for the winter peak Settlement Period from Data Set 1 (described above) with 500MW of generation removed from the node at which of Dinorwig injects onto the system and added to a node in coastal Cumbria
- Data for the winter peak Settlement Period from Data Set 1 (described above) with 500MW of generation removed from the node at which of Dinorwig injects onto the system and added to a node in coastal Norfolk

- Data for the winter peak Settlement Period from Data Set 1 (described above) with 500MW of generation removed from the node at which of Dinorwig injects onto the system and added to a node in coastal Cornwall
- Data for the winter peak Settlement Period from Data Set 1 (described above) with 500MW of generation removed from the node at which of Dinorwig injects onto the system and added to a node in the Thames Estuary area
- Data for the winter peak Settlement Period from Data Set 1 (described above) with 500MW of generation removed from the node at which of Dinorwig injects onto the system and added to a node in coastal Teeside

3.3.9 Data Set 10

In addition to the above data sets, which are variations on the ‘base-case’, the following data will also be provided to enable modelling of the annual ex-ante TLFs proposed under P82:

- Demand (actual) data for the following Settlement Periods: an overnight winter period from the same day as the winter peak, a daytime summer period from the same day as the summer weekday trough and the 48 periods from one of the weekday’s specified in the ‘base case’
- Generation (actual) data for the following Settlement Periods: an overnight winter period from the same day as the winter peak, a daytime summer period from the same day as the summer weekday trough and the 48 periods from one of the weekday’s specified in the ‘base case’
- Network (indicative) data for the following Settlement Periods: an overnight winter period from the same day as the winter peak, a daytime summer period from the same day as the summer weekday trough and the 48 periods from one of the weekday’s specified in the ‘base case’

3.4 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 calculate the resulting TLFs using the two sets of rules set out in Modification Proposals P75 and P82. The service provider should also specify the proposed source of any data to be used that ELEXON will not or cannot provide, including any assumptions.

4 MODELLING PROCESS

As indicated in previous sections of this document, a model is required for calculating marginal loss factors for the England and Wales transmission system. The precise methodology to be used for calculating these loss factors is not specified and candidates are invited to propose an approach. However, the subsections below outline the high-level requirements of the two key stages in the process - power flow modelling and data analysis/presentation.

4.1 Power Flow Modelling

The first stage in the modelling process requires the calculation of TLFs at each node on the system. When proposing and justifying an approach to the calculation of nodal TLFs, the following items must be considered.

4.1.1 Load Flow Model

The choice between an 'AC' and a 'DC' load flow model is not prescribed. However, as noted in the previous section, ELEXON will not be able to provide the data necessary to run an AC load flow model (e.g. a comprehensive reactive power data set with aggregation rules) to the service provider.

Candidates should indicate whether they are capable of calculating TLFs using both of these approaches, discuss the relative merits and data requirements of both models and indicate the model they would prefer to adopt for this exercise. When proposing an approach, candidates should bear in mind the modelling objectives and available input data as outlined in previous sections of this document. It should be noted that although accuracy is of course 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.

4.1.2 Methodology for Calculating Nodal TLFs

There are a number of methods of calculating TLFs at an individual node. For example, the demand increase at an individual node can be met by increasing generation at all generating nodes or at a single slack bus. Alternatively, the TLFs can be obtained directly from the Jacobian of a load flow. Candidates should specify in detail the approach they recommend.

4.1.3 Developing Alternative Scenarios

The majority of the modelling required from the service provider requires the use of actual historic data. However, there is a requirement to examine the sensitivity of TLFs to possible changes in the future, for example, withdrawal of plant, new build or reversal of the interconnector. This analysis will require the development of new scenarios based on historic cases. Candidates should indicate whether they have the capability to aid in the development of these scenarios with tools such as economic dispatch models or whether they will require the group to provide these scenarios.

4.2 Data Analysis/Presentation

The second stage in the modelling process requires the manipulation of marginal nodal TLFs to create the actual data required by the TLFMG. The manipulations required are set out below.

4.2.1 Grouping Nodes into Zones

The modelling process requires grouping individual nodes into zones to calculate zonal TLFs. Mapping information, relating nodes to zones, will be provided by the TLFMG. A demand weighted TLF for each zone is required. It should be noted that there are 2 alternative sets of zones for generation and the model must be capable of switching between these two sets of zones. However, the model should not be limited to the specified zones and should be capable of modelling additional sets of zones.

4.2.2 Scaling Zonal TLFs

One proposal for introducing zonal losses requires the use of scaled zonal TLFs. The model should be capable of applying a specified scaling factor to the fully marginal zonal TLFs. Hence, for example, if the scaling factor was 50%, a TLF of –5% should be scaled to give a TLF of –2.5%, before conversion into TLMs.

4.2.3 Creating Annual TLFs

One proposal for introducing zonal TLFs requires the calculation of an annual TLF by time-weighted averaging of a number of historic scenarios. The model should be capable of producing these annual TLFs for each zone. The weighting of each scenario will be provided as an input.

4.2.4 Calculation of TLMs

Once the zonal TLFs have been calculated they must be converted into TLMs. These TLMs are applied to each BM Unit to calculate the losses allocated to that unit. Under section T of the BSC, the definition of TLMs is such that the losses allocated to 'Delivering' BM units (i.e. those belonging to Trading Units delivering onto the system) is equal to 45% of losses on the system and the losses allocated to 'Off-taking' BM units (i.e. those belonging to Trading Units offtaking from the system) is equal to 55% of losses on the system. The equations for calculating TLMs are contained in the BSC and are attached as Annex 6 of this document.

4.2.5 Data Processing

The TLFMG realise that this modelling exercise will produce large amounts of data. It is therefore important that the data presentation is considered carefully. The model should be capable of performing some statistical analysis and present results in a manner that allow extreme results to be identified quickly. Candidates should indicate the degree of data processing that will be available in the model.

5 OUTPUTS REQUIRED

The service provider will generate the outputs specified under each subsection below. The outputs from the modelling process shall be presented in a standard format. The outputs shall comprise:

- Data in raw format available as both paper copies and in a standard electronic format (such as CSV files);
- Summary tables where appropriate in a standard format to aid comparison between outputs and scenarios; and
- Graphical representations of data including frequency diagrams.

The model shall produce outputs based on the approach for calculating losses identified under Modification Proposal P75 (P75) (marginal losses) and Modification Proposal P82 (scaled marginal losses).

5.1 P75

5.1.1 Output 1: Baseline TLFs & TLMs

The service provider will generate TLFs and TLMs for data set 1 outlined in section 3.3. The data shall be presented in the following formats:

- TLFs for:
  - individual nodes (including Scottish interconnectors as separate nodes)
  - nodes grouped into GSP groups (additional zone for Scottish interconnectors) - this is the base case for demand
  - nodes grouped into NGC TNUoS charging zones - this is the base case for generation
- TLMs calculated using:
  - TLFs for individual nodes
  - TLFs for generation and demand grouped by GSP group
  - TLFs for generation grouped by NGC TNUoS zone and demand grouped by GSP group - this the base case for TLMs
  - TLFs for generation and demand grouped by NGC TNUoS zone
- Heating Losses in each line

5.1.2 Output 2: Variability of TLFs & TLMs

An analysis of the variability of the TLFs and TLMs generated will be presented using data set 10. Outputs will be

- TLFs calculated for:
  - demand, using nodes grouped into GSP groups (additional zone for Scottish interconnectors)

    - generation, using nodes grouped into NGC TNUoS charging zones (additional zone for Scottish Interconnectors)
- TLMs calculated using:
    - TLFs for generation grouped by NGC TNUoS zone and demand grouped by GSP group

The analysis of data will include:

1. An analysis of the variation of TLFs and TLMs for each zone. This should highlight the difference in TLFs and TLMs:
    - between winter and summer
    - between weekdays and weekends
    - between day time and night time
    - between days in summer
    - between days in winter
    - within individual days
    - between similar periods (e.g. as morning pick up)
2. An analysis of the how the zonal differential for TLFs and TLMs varies. This analysis might indicate when particularly high or low loss factors are calculated for some zones or periods. This data could be presented in tabular or graphical format with statistical analysis to highlight, for example, standard deviations, skewing, maxima, minima and means.

5.1.3 Output 3: Sensitivity of TLFs & TLMs to Network Configuration

Having calculated TLFs and TLMs different time periods and zonal groupings, the service provider will analyse the sensitivity of TLFs and TLMs to network configuration. For data sets 2 and 3, the following will be calculated and compared to the results for data set 1.

- TLFs calculated for:
    - demand, using nodes grouped into GSP groups (additional zone for Scottish Interconnectors)
    - generation, using nodes grouped into NGC TNUoS charging zones (additional zone for Scottish Interconnectors)
- TLMs calculated using:
    - TLFs for generation grouped by NGC TNUoS zone and demand grouped by GSP group

5.1.4 Output 4: Sensitivity of TLFs and TLMs to the Inclusion of Constraints in the Calculation Methodology

It is proposed that TLFs are calculated ignoring any constraints on the system. A sensitivity is required in which the methodology for calculating TLFs includes constraints i.e. if any line is constrained then the flow cannot be increased on that line when calculating the TLF. A methodology for including constraints should be used to calculate the TLFs and TLMs for data set 1. If data set 1 has no constraints then the alternative data set 4 should be used. Outputs required are

- TLFs calculated for:
  - demand, using nodes grouped into GSP groups (additional zone for Scottish Interconnectors)
  - generation, using nodes grouped into NGC TNUoS charging zones (additional zone for Scottish Interconnectors)
- TLMs calculated using:
  - TLFs for generation grouped by NGC TNUoS zone and demand grouped by GSP group

5.1.5 Output 5: Comparison of 'Generation' TLFs/TLMs and 'Demand' TLFs/TLMs at the Same Node

TLFs and TLMs calculated for generation should be compared to those calculated for demand at the same node for each of the six periods in data set 1. This comparison should identify any cases where a matched pair of generator and consumer in the same location would have an incentive to artificially increase (or decrease) gross exports and imports whilst leaving the net position unchanged.

TLFs calculated for:

  - demand, using nodes grouped into GSP groups (additional zone for Scottish Interconnectors)
  - generation, using nodes grouped into NGC TNUoS charging zones (additional zone for Scottish Interconnectors)
- TLMs calculated using:
  - TLFs for generation grouped by NGC TNUoS zone and demand grouped by GSP group

5.1.6 Output 6: Comparison of 'Nodal' TLFs/TLMs with 'Zonal' TLFs/TLMs

For data set 1, the following should be calculated:

- TLFs for individual nodes
- TLMs calculated using TLFs for individual nodes.

These should be compared to the base case TLFs for data set 1, that is

TLFs calculated for:

  - demand, using nodes grouped into GSP groups (additional zone for Scottish Interconnectors)
  - generation, using nodes grouped into NGC TNUoS charging zones (additional zone for Scottish Interconnectors)
- TLMs calculated using:
  - TLFs for generation grouped by NGC TNUoS zone and demand grouped by GSP group

This will identify if any nodes are particularly disadvantaged by the proposed zones.

5.1.7 Output 7: Model Performance Characteristics

Data on the model's speed of calculation is required. The process for calculating the TLFs and TLMs on a real-time ex post basis should be considered. This should include:

- data capture requirements and the availability of data from existing systems
- the amount, duration and quality of data (estimated v actual) required to calculate TLFs and TLMs
- the processing required for data input into the model
- the time required to calculate the relevant TLFs and TLMs
- the format and quality of data outputs

5.1.8 Output 8: Sensitivity to Flows on French Interconnector

Analysis is required on the impact of flows on the French Interconnector. The following should be calculated for data set 5.

TLFs calculated for:

- demand, using nodes grouped into GSP groups (additional zone for Scottish Interconnectors)
- generation, using nodes grouped into NGC TNUoS charging zones (additional zone for Scottish Interconnectors)

- TLMs calculated using:
  - TLFs for generation grouped by NGC TNUoS zone and demand grouped by GSP group

These should be compared to the corresponding TLFs and TLMs obtained for data set 1. Any significant differences should be highlighted and any reasons should be identified.

5.1.9 Output 9: Sensitivity to Breakdown/Withdrawal of Plant

Analysis is required on the impact of plant breakdown and withdrawals. The following should be calculated for data sets 6 and 7.

TLFs calculated for:

- demand, using nodes grouped into GSP groups (additional zone for Scottish Interconnectors)
- generation, using nodes grouped into NGC TNUoS charging zones (additional zone for Scottish Interconnectors)

- TLMs calculated using:
  - TLFs for generation grouped by NGC TNUoS zone and demand grouped by GSP group

These should be compared to the corresponding TLFs and TLMs obtained for data set 1. Any significant differences should be highlighted and any reasons should be identified.

5.1.10 Output 10: Sensitivity to Participants Responding to Signals

Analysis is required on the impact of participants responding to signals. The following should be calculated for data set 8.

TLFs calculated for:

- demand, using nodes grouped into GSP groups (additional zone for Scottish Interconnectors)

    - generation, using nodes grouped into NGC TNUoS charging zones (additional zone for Scottish Interconnectors)
- TLMs calculated using:
    - TLFs for generation grouped by NGC TNUoS zone and demand grouped by GSP group

These should be compared to the corresponding TLFs and TLMs obtained for data set 1. Any significant differences should be highlighted and any reasons should be identified.

5.1.11 Output 11: Sensitivity to an Increase in Intermittent Generation

Analysis is required on the impact of a significant increase in wind generation on the system. The following should be calculated for data set 9.

TLFs calculated for:

    - demand, using nodes grouped into GSP groups (additional zone for Scottish Interconnectors)
    - generation, using nodes grouped into NGC TNUoS charging zones (additional zone for Scottish Interconnectors)
- TLMs calculated using:
    - TLFs for generation grouped by NGC TNUoS zone and demand grouped by GSP group

These should be compared to the corresponding TLFs and TLMs obtained for data set 1. Any significant differences should be highlighted and any reasons should be identified.

5.2 P82

5.2.1 Output 1: Variability of TLFs and Calculation of an Annual Average TLF

An analysis of the variability of the TLFs and TLMs generated will be presented using data set 10. Outputs will be

- TLFs calculated for:
    - generation and demand using nodes grouped into GSP groups (additional zone for Scottish Interconnectors)

The analysis of data will include:

1. An analysis of the variation of TLFs for each zone. This should highlight the difference in TLFs:
    - between winter and summer
    - between weekdays and weekends
    - between day time and night time
    - between days in summer
    - between days in winter
    - within individual days
    - between similar periods (e.g. as morning pick up)

2. An analysis of the how the zonal differential for TLFs varies. This could indicate when high or low loss factors are calculated for particular zones or particular periods. This data could be presented in tabular or graphical format with statistical analysis to highlight, for example standard deviations, skewing, maximums, minima and means.
3. In addition, an annual average TLF for each zone will be calculated using weighting factors for each scenario supplied by the TLFMG.

5.2.2 Output 2: Baseline TLFs & TLMs

The service provider will generate TLFs and TLMs for data set 1 outlined in section 3.3. The data shall be presented in the following formats:

- TLFs for:
    - individual nodes (including Scottish Interconnectors as separate nodes)
    - nodes grouped into GSP Groups (additional zone for Scottish Interconnectors) - this is the base case for generation and demand
- TLMs calculated using:
    - TLFs for individual nodes
    - TLFs for nodes grouped into GSP Groups

5.2.3 Output 3: Variability of TLMs

An analysis of the variability of TLMs generated will be presented using data set 10. Outputs will be

- TLMs calculated using:
    - average annual TLFs

The analysis of data will include:

1. An analysis of the variation of TLMs for each zone. This should highlight the difference in TLMs:
    - between winter and summer
    - between weekdays and weekends
    - between day time and night time
    - between days in summer
    - between days in winter
    - within individual days (i.e. between Settlement Periods)
    - between similar periods (e.g. as morning pick up)
2. An analysis of the how the zonal differential for TLMs varies. This could indicate when high or low loss factors are calculated for particular zones or particular periods. This data could be presented in tabular or graphical format with statistical analysis to highlight, for example standard deviations, skewing, maximums, minima and means.

5.2.4 Output 4: Sensitivity of TLFs & TLMs to Choice of Historic Data and Weightings

The TLFMG will supply 2 alternative sets of weightings to apply to data set 10. These should be used to produce 2 alternative annual average TLFs. TLMs for data set 1 should be calculated using these alternative, annual average TLFs and compared to the baseline values.

5.2.5 Output 5: Sensitivity of TLFs and TLMs to the Inclusion of Constraints in the Calculation Methodology

It is proposed that TLFs are calculated ignoring any constraints on the system. A sensitivity is required in which the methodology for calculating TLFs includes constraints i.e. if any line is constrained then the flow cannot be increased on that line when calculating the TLF. A methodology for including constraints should be used to calculate the TLFs and TLMs for data set 1. If data set 1 has no constraints then the alternative data set 4 should be used. Outputs required are

- TLFs calculated for generation and demand using nodes grouped into GSP groups (additional zone for Scottish Interconnectors)
- TLMs calculated using average annual TLF

5.2.6 Output 6: Comparison of 'Nodal' TLFs/TLMs with 'Zonal' TLFs/TLMs

For data set 1, the following should be calculated:

- TLFs for individual nodes
- TLMs calculated using TLFs for individual nodes.

These should be compared to the base case TLFs for data set 1, that is

- Annual average TLFs
- TLMs calculated using annual average TLFs

This will identify if any nodes are particularly disadvantaged by the proposed zones.

5.2.7 Output 7: Sensitivity to Flows on French Interconnector

Analysis is required on the impact of flows on the French Interconnector. The following should be calculated for data set 5.

- TLFs calculated for generation and demand using nodes grouped into GSP groups (additional zone for Scottish Interconnectors)
- TLMs calculated using annual average TLFs

These should be compared to the corresponding TLFs and TLMs obtained for data set 1. Any significant differences should be highlighted and any reasons should be identified.

5.2.8 Output 8: Degree to which a Scaling Factor of 0.5 Recovers Heating Losses

Analysis is required to examine whether a scaling factor of 0.5 recovers the heating losses. For data set 1 the following should be compared

- actual heating losses

- heating losses recovered from applying the nodal TLFs
- heating losses recovered from applying the zonal TLFs

5.2.9 Output 9: Sensitivity to Breakdown/Withdrawal of Plant

Analysis is required on the impact of plant breakdown and withdrawals. The following should be calculated for data sets 6 and 7.

- TLFs calculated for generation and demand using nodes grouped into GSP groups (additional zone for Scottish Interconnectors)
- TLMs calculated using annual average TLFs

These should be compared to the corresponding TLFs and TLMs obtained for data set 1. Any significant differences should be highlighted and any reasons should be identified.

5.2.10 Output 10: Sensitivity to Participants Responding to Signals

Analysis is required on the impact of participants responding to signals. The following should be calculated for data set 8.

- TLFs calculated for generation and demand using nodes grouped into GSP groups (additional zone for Scottish Interconnectors)
- TLMs calculated using annual average TLFs

These should be compared to the corresponding TLFs obtained for data set 1. Any significant differences should be highlighted and any reasons should be identified.

5.2.11 Output 11: Sensitivity to an Increase in Intermittent Generation

Analysis is required on the impact of a significant increase in wind generation on the system. The following should be calculated for data set 9.

- TLFs calculated for generation and demand using nodes grouped into GSP groups (additional zone for Scottish Interconnectors)
- TLMs calculated using annual average TLFs

These should be compared to the corresponding TLFs and TLMs obtained for data set 1. Any significant differences should be highlighted and any reasons should be identified.

6 DOCUMENTATION

In order that the client can assess any assumptions, limitations, issues and risks associated with the use of the model and its output, appropriate documentation should be provided. For any bespoke elements of the model, the User Requirements Specification, Functional Specification and Outline System Design should be available.

ANNEX 1 – MODIFICATION PROPOSAL P75

Modification Proposal

Title of Modification Proposal *(mandatory by proposer)*:

Introduction Of Zonal Transmission Losses

Submission Date *(mandatory by proposer)*: 5 April 2002

Description of Proposed Modification *(mandatory by proposer)*:

The modification proposes that transmission losses are allocated on a zonal rather than on a uniform system wide basis. Currently under Section T2 of the BSC, Transmission Loss Factors (TLF_{ij}) for all BMUs in all settlement periods are set to zero.

It is proposed that a Transmission Loss Factor Agent (TLFA) be appointed to calculate zonal marginal TLFs for each BMU in a given settlement period. Initially NGC would fulfil this role, however BSCCo could, in principle, choose to carry out this activity in-house or procure such a service from a third party other than NGC. TLFs would be calculated in accordance with the Transmission Loss Factor Methodology (TLFM), which would be set out in detail under the BSC. The methodology for deriving TLFs would be a marginal loss approach the exact form of which would be defined by the Modification Group. A suggested approach is summarised as follows:

- Demand and generation would be determined for all nodes on the system for each settlement period on an ex post basis.
- A load flow model would be run to determine how a small increment of demand is met by a suitable increase in generation spread across all nodes.
- Nodal marginal loss factors would then be derived by repeating this process for each node.
- These would then be grouped into the current TNUoS zones for generators and GSP Groups for demand. *(The Modification Group may wish to consider whether other zonal groupings are more appropriate).*
- The resulting zonal marginal TLF data would be submitted to BSCCo by the TLFA as soon as practicable and preferably in time for the Initial Settlement Run. There would be no scaling of these factors.
- Transmission Loss Multipliers (TLMs) would then be calculated in accordance with Section T2.3.1 of the BSC.

Although this proposal preserves the full marginal loss signals from the network modelling, adjustments ($TLMO^{+}_{j}$ and $TLMO^{-}_{j}$) under T2.3.1 ensure Transmission Loss Multipliers (TLM_{ij}) recover the correct volume of total system losses in each settlement period. In addition, to ensure suppliers can manage the customer billing implications of this proposal implementation before 1 April 2003 is <u>not</u> advised.

<u>Governance of future changes to Transmission Loss Factor Methodology (TLFM)</u>

Given the commercial importance of transmission losses, changes to TLFM would only be permitted by means of a modification proposal. As such changes could only be proposed according to the 'normal' modification rules by energywatch, market participants or NGC. This together with incorporation of the TLFM within the BSC will ensure a rigorous appraisal of any future proposed changes to the losses regime.

Description of Issue or Defect that Modification Proposal Seeks to Address *(mandatory by proposer)*:

Currently the cost of transmission losses is not accurately targeted at BSC Parties that are to a greater or lesser extent contributing to those losses. The proposal addresses this defect.

Modification Proposal

By introducing a zonal differentiation in the allocation of losses the proposal will provide appropriate locational signals to parties which will help reduce overall transmission losses in the short-term and encourage more optimal siting of generation and demand in the longer-term. Adoption of a marginal approach ensures that robust economic signals are provided to relevant users.

The current uniform approach to allocation of transmission losses fails to provide appropriate cost signals. It effectively provides hidden cross-subsidies for northern generation and southern demand, whilst unfairly placing additional costs on southern generation and northern demand. The industry has been aware of this long-standing distortion at the heart of electricity trading arrangements, from the inception of the England and Wales Electricity Pool. Indeed OFFER in its 1989 Annual Report stated that their should be locational pricing for the use of NGC's transmission system and made it clear that it envisaged transmission losses should include locational signals.

In 1997 the Pool Executive Committee approved a scheme for the zonal allocation of the cost of transmission losses. Although the project was shelved in the run up to NETA, Ofgem made clear that the issue would be revisited after NETA implementation. The subject has also been discussed at length in various Ofgem Transmission Access and Losses consultation documents dated December 1999, May 2001 and February 2002.

Impact on Code *(optional by proposer)***:**

Changes to Section T2 of the BSC.

Impact on Core Industry Documents *(optional by proposer)***:**

Not known.

Impact on BSC Systems and Other Relevant Systems and Processes Used by Parties *(optional by proposer)***:**

Likely to impact on supplier's customer billing systems.

Impact on other Configurable Items *(optional by proposer)***:**

Justification for Proposed Modification with Reference to Applicable BSC Objectives *(mandatory by proposer)***:**

The proposal more accurately targets the cost of transmission losses. In so doing it removes the cross-subsidies inherent in the current method for allocation of transmission losses between BSC participants, and hence helps ensure effective competition in the generation and supply of electricity.

The short-term effects are likely to be a reduction in the overall cost of system losses, although the longer-term efficiency gains in terms of influencing the locational patterns of generation and supply are likely to be more significant. Overall, this should assist the Transmission Company in the efficient, economic and co-ordinated operation of the Transmission System.

Modification Proposal

Details of Proposer:	
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Details of Proposer's Representative:	
Name:	**Peter Bolitho**
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Details of Representative's Alternate:	
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Organisation:	**Powergen UK plc**
Telephone Number:	**024 7642 4829**
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Attachments:	**No**

ANNEX 2 – MODIFICATION PROPOSAL P82

Modification Proposal

Title of Modification Proposal *(mandatory by proposer)***:**

Introduction Of Zonal Transmission Losses On An Average Basis

Submission Date *(mandatory by proposer)***:** 03 May 2002

Description of Proposed Modification *(mandatory by proposer)***:**

In accordance with Section T of the BSC, losses incurred on the transmission system are allocated to BSC parties in proportion to the energy they meter, whether production or consumption. There is no geographical differentiation in this allocation. Transmission Loss Factors for all BMUs in all Settlement Periods are set to zero.

It is proposed that the BSC be modified to give effect to a zonal differentiation in the allocation of the volume of transmission losses, similar to that set out for the Pool in 1997. A change to Section T of the BSC is proposed to give effect to this whilst adhering to the following principles:

1. the allocation is a simple and cost effective process;
2. the allocation does not introduce unnecessary or untoward risks on parties; and
3. the process should be simple to audit.

Within these principles, losses should be allocated, to a first approximation, according to the manner in which they are incurred, and the degree to which they are due to the energy produced or consumed by each BMU, and give rise to stable economic signals.

It is proposed that the zonal transmission loss allocation is introduced as follows:

For each GSP Group a single Transmission Loss Factor (TLF) would be derived ex ante for application to generation and supply throughout the coming year April to March. The manner in which these would be calculated would be under the governance of the BSC. In principle, nodal marginal TLFs would be derived for a representative collection of historic power system conditions during the previous year January to December. Zonal marginal TLFs would be derived from these nodal figures by demand-weighted averaging, and then annual zonal marginal TLFs would be derived by time-weighted averaging.

The resulting average annual zonal TLFs would be submitted to BSCCo at least two months prior to the implementation of this modification and thereafter by the February prior to their application in the following April to March period. The BSC Panel would be invited to endorse the TLFs prior to their application.

The volume of transmission losses in each Settlement Period would then be allocated amongst individual BMUs by substituting these zonal TLFs, modified by a fixed scaling factor, for the parameters TLFij in Schedule T, Section T2.3.1 of the BSC.

The value of this scaling factor would be fixed from time to time (typically every few years) under the governance of the BSC at a level that, to a first approximation, (a) allocated the heating element of the transmission system losses on an average basis, with little under or over recovery, and (b) resulted in other

Modification Proposal

transmission losses being allocated on a uniform basis through the parameters TLM0+j and TLM0-j. To this extent the value of the scaling factor would be around 0.5. Any inaccuracy in (a) would be compensated for in (b).

Whilst the calculation of the annual TLFs would be under the governance of the BSC, this task would be undertaken by a TLF Agent. The BSC Panel may choose to allocate this task to NGC.

Description of Issue or Defect that Modification Proposal Seeks to Address *(mandatory by proposer)***:**

Currently the volume of transmission losses is allocated amongst BSC Parties regardless of the extent to which they give rise to them. To the extent that long-term locational signals are to be introduced into the energy market, this Modification seeks to address this perceived defect. The Modification does not seek to introduce strong short-term economic signals as it is felt that these would have a detrimental effect on overall efficiency.

Impact on Code *(optional by proposer)***:**

Impact on Core Industry Documents *(optional by proposer)***:**

Impact on BSC Systems and Other Relevant Systems and Processes Used by Parties *(optional by proposer)***:**

Impact on other Configurable Items *(optional by proposer)***:**

Justification for Proposed Modification with Reference to Applicable BSC Objectives *(mandatory by proposer)***:**

This proposal will contribute to the better achievement of the BSC objective of 'promoting effective competition in the generation and supply of electricity, and (so far as consistent therewith) promoting such competition in the sale and purchase of electricity' by introducing long term economic signals for siting of generation and demand. This proposal achieves this by allocating losses in such a manner that does not unduly penalise individual BMUs. It allocates only according to the degree to which individual BMUs give rise to losses.

Transmission losses are an integral part of the energy market and should remain so. For this reason the proposal places the governance of all aspects of their allocation under the BSC. This will allow for implementation in a way that is consistent with BSC objectives.

The proposal introduces zonal transmission losses through annually fixed TLFs so as to avoid unwarranted administrative burden and to provide greater certainty about the costs to be incurred. It is therefore consistent with "promoting efficiency in the implementation and administration of the balancing and settlement arrangements" and will also contribute to the development of competition.

Modification Proposal

Details of Proposer:

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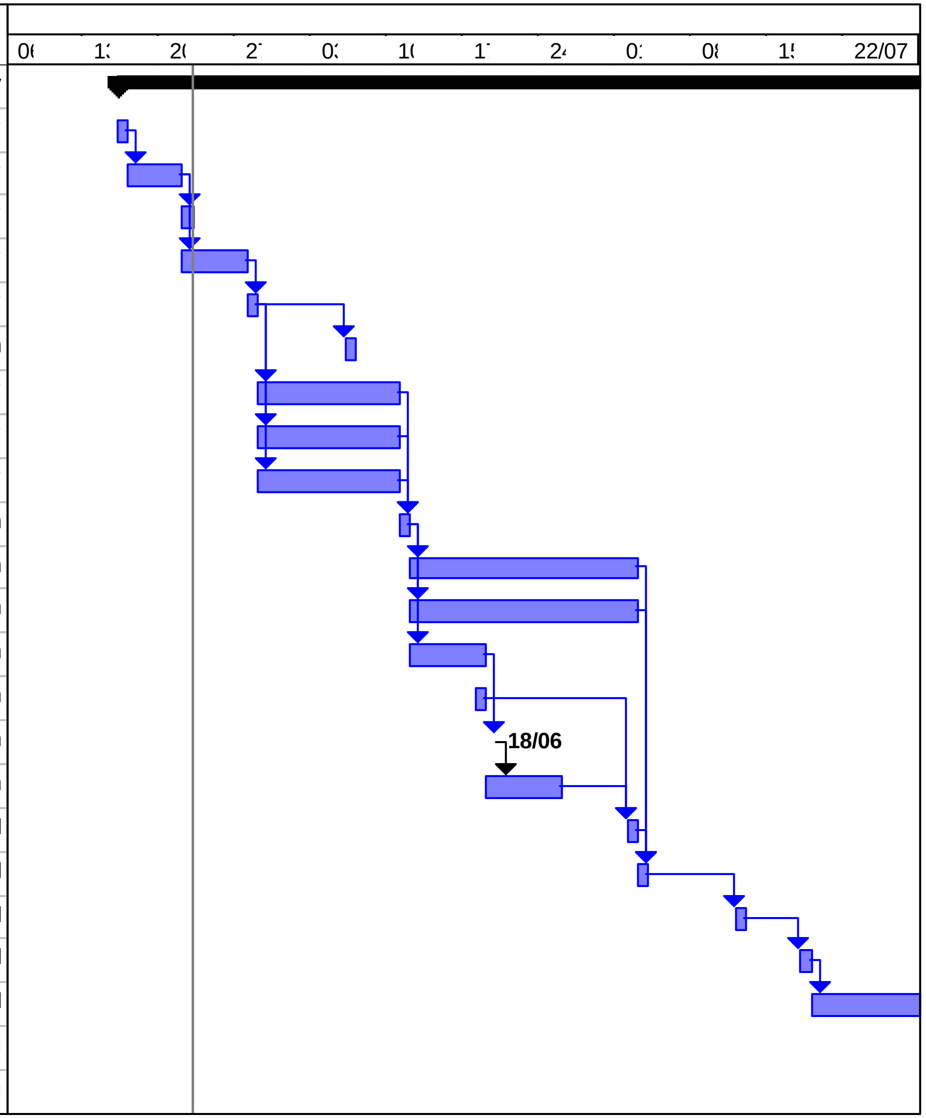
Attachments: NO

If Yes, Title and No. of Pages of Each Attachment:

ANNEX 3 – ASSESSMENT PROCEDURE TIMETABLE

ID		Task Name	Duration	Start
1		**P75/82 Assessment**	**131 days**	**16 May**
2		Panel Meeting	1 day	16 May
3		Review and Baseline Proposal	3 days	17 May
4		Modification Group Meeting	1 day	22 May
5		Establish Assessment Criteria	4 days	22 May
6		Modification Group Meeting	1 day	28 May
7		Modification Group Meeting	1 day	06 Jun
8		High Level Assessment by Mod Group	9 days	29 May
9		HLIA of Agent Procurement/Management	9 days	29 May
10		Establish Modelling Objectives	9 days	29 May
11		Modification Group Meeting	1 day	11 Jun
12		Detailed Level Assessment by Mod Group	15 days	12 Jun
13		Define Model	15 days	12 Jun
14		Prepare Consultation Document (if req'd)	5 days	12 Jun
15		Modification Group meeting	1 day	18 Jun
16		Issue Consultation Document (if req'd)	0 days	18 Jun
17		Consultation Period	5 days	19 Jun
18		Modification Group Meeting	1 day	02 Jul
19		Interm Report to Panel	1 day	03 Jul
20		Panel Paper Day	1 day	12 Jul
21		Panel Meeting	1 day	18 Jul
22		Procure Model	13 days	19 Jul
23		Modification Group	1 day	20 Aug
24		Detailed Analysis using Model	24 days	07 Aug



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ID		Task Name	Duration	Start
25		Modification Group Meeting	1 day	10 Sep
26		Prepare for Seminar	9 days	11 Sep
27		Seminar	1 day	24 Sep
28		Consultation	14 days	25 Sep
29		Draft Legal Text	14 days	25 Sep
30		Detailed Level Impact Assessment	14 days	25 Sep
31		Modification Group Meeting	1 day	15 Oct
32		Draft Assessment Report	8 days	16 Oct
33		Modification Group Meeting	1 day	28 Oct
34		Panel Paper Deadline	1 day	05 Nov
35		Panel Meeting	1 day	14 Nov

ID		Task Name	Duration	Start
1		**P75/82 Assessment**	**131 days**	**16 May**
2		Panel Meeting	1 day	16 May
3		Review and Baseline Proposal	3 days	17 May
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7		Modification Group Meeting	1 day	06 Jun
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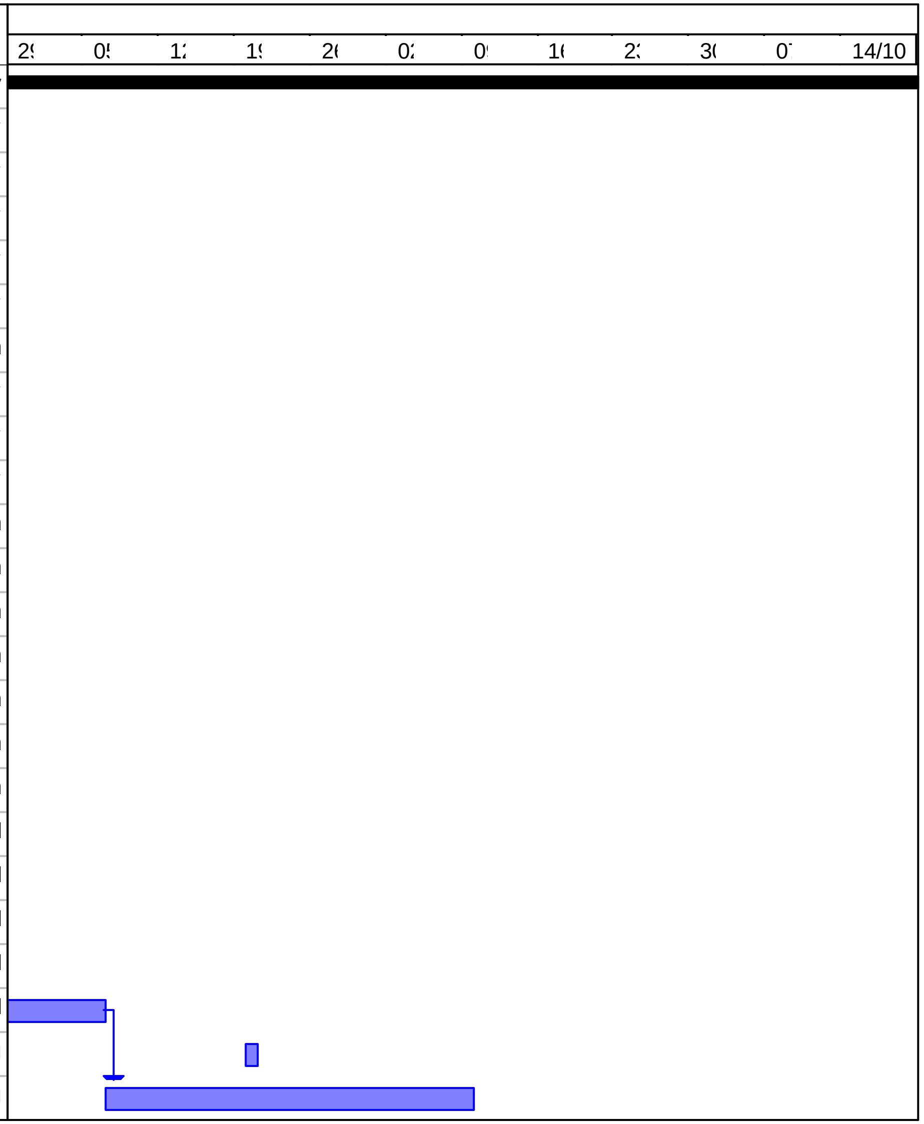
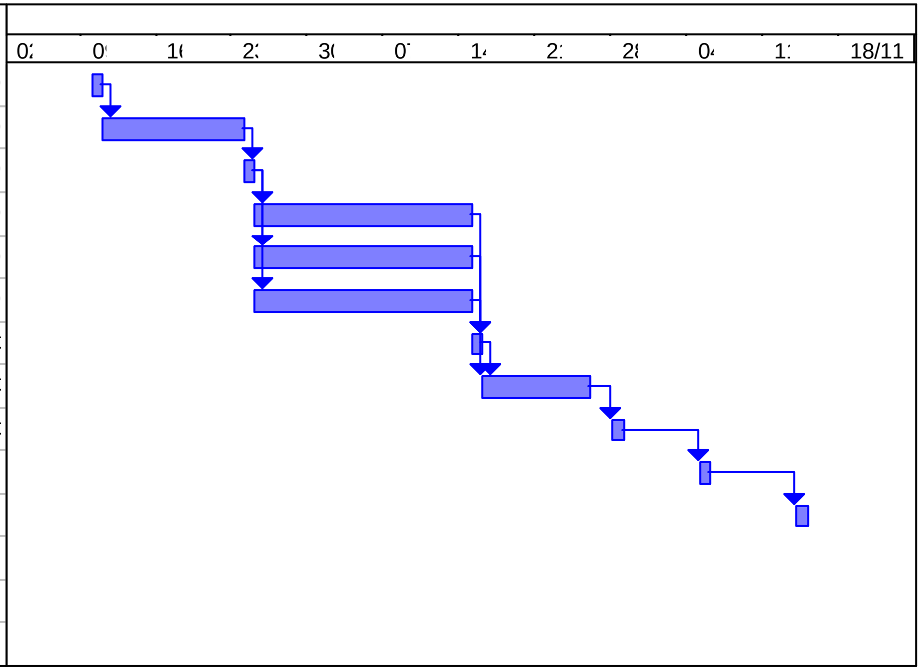
9		HLIA of Agent Procurement/Management	9 days	29 May
10		Establish Modelling Objectives	9 days	29 May
11		Modification Group Meeting	1 day	11 Jun
12		Detailed Level Assessment by Mod Group	15 days	12 Jun
13		Define Model	15 days	12 Jun
14		Prepare Consultation Document (if req'd)	5 days	12 Jun
15		Modification Group meeting	1 day	18 Jun
16		Issue Consultation Document (if req'd)	0 days	18 Jun
17		Consultation Period	5 days	19 Jun
18		Modification Group Meeting	1 day	02 Jul
19		Interm Report to Panel	1 day	03 Jul
20		Panel Paper Day	1 day	12 Jul
21		Panel Meeting	1 day	18 Jul
22		Procure Model	13 days	19 Jul
23		Modification Group	1 day	20 Aug
24		Detailed Analysis using Model	24 days	07 Aug



ID		Task Name	Duration	Start
25		Modification Group Meeting	1 day	10 Sep
26		Prepare for Seminar	9 days	11 Sep
27		Seminar	1 day	24 Sep
28		Consultation	14 days	25 Sep
29		Draft Legal Text	14 days	25 Sep
30		Detailed Level Impact Assessment	14 days	25 Sep
31		Modification Group Meeting	1 day	15 Oct
32		Draft Assessment Report	8 days	16 Oct
33		Modification Group Meeting	1 day	28 Oct
34		Panel Paper Deadline	1 day	05 Nov
35		Panel Meeting	1 day	14 Nov



ANNEX 4 – APPLICABLE BSC OBJECTIVES

The Applicable BSC Objectives are contained in the Transmission Licence, and are as follows:

(a) (the efficient discharge by the Licensee of the obligations imposed upon it by this licence;

(b) the efficient, economic and co-ordinated operation by the Licensee of the Licensee's Transmission System;

(c) promoting effective competition in the generation and supply of electricity, and (so far as consistent therewith) promoting such competition in the sale and purchase of electricity;

(d) without prejudice to paragraph 10, promoting efficiency in the implementation and administration of the balancing and settlement arrangements described in paragraph 2.

ANNEX 5 – MODELLING TASKS

P75

<table>
<tr><th>Task</th><th>Inputs</th><th>Output</th><th>Comments</th><th>No. new load flows</th></tr>
<tr><td>1. Establish baseline TLFs and TLMs

Use 6 settlement periods for baseline
• winter peak
• summer trough
• March day period weekdays
• March overnight period weekdays
• March day period weekends
• March overnight period weekends</td><td>• half-hourly metered data at each node
• indicative network</td><td>For each baseline scenario

TLFs calculated for
• individual nodes
• GSP groups
• TNuoS generation zones

TLMs calculated using
• TLFs for each node
• TLFs by GSP group for demand and TLFs by TNuoS zones for generation

Heating losses in each line</td><td>Allows comparison with current TLMs

Provides a baseline against which sensitivities can be measured

Obtain a ‘feel’ for loss pattern in lines</td><td>6</td></tr>
<tr><td>2. Establish variability of TLFs and TLMs

Use a larger number of settlement periods (200-400?) to investigate variability of TLFs and TLMs by

• time of day
• season
• similar periods</td><td>For each scenario:

• half-hourly metered data at each node
• indicative network</td><td>TLFs calculated for
• GSP groups
• TNuoS generation zones

TLMs calculated using
• TLFs by GSP group for demand and TLFs by TNuoS zones for generation</td><td>Provides information on ability to hedge for losses:

• degree of variation
• any patterns?</td><td>200-400?</td></tr>
</table>

3. Establish sensitivity to network configuration Use a set of alternative networks to establish variability with network	For the 6 baseline scenarios • metered data at each node • indicative/intact/representative networks	For each baseline scenario and network configuration TLFs calculated for • GSP groups • TNuoS generation zones TLMs calculated using • TLFs by GSP group for demand and TLFs by TNuoS zones for generation	Compare to results obtained under task 1 How much difference does the network make?	24
4. Establish whether constraints should be considered in calculation of TLFs	For the 6 baseline scenarios • half-hourly metered data at each node • methodology including constraints	TLFs calculated for • GSP groups • TNuoS generation zones TLMs calculated using • TLFs by GSP group for demand and TLFs by TNuoS zones for generation	TLFs with and without constraints may be quite different. Which should be used?	6
5. Establish difference in TLFs and TLMs for generation and demand at the same node Only requires manipulation of TLFs and TLMs calculated under task 1	Results from the 6 baseline scenarios obtained under task 1	• TLFs and TLMs applying to generation and demand at each node	Determine ability to game the losses system by generating and taking load at same point	0
6. Compare nodal TLFs and TLMs to zonal TLFs and TLMs for generation and demand	Results from the 6 baseline scenarios obtained under task 1	Comparison of TLFs calculated for individual nodes and for zones Comparison of TLMs calculated for individual nodes and for zones	Are any participants particularly disadvantaged by the choice of zone?	0

7. Establish speed of calculation	Timings for each of the 6 baseline scenarios	Speed of calculation of TLFs and TLMs	Is it feasible to do the calculation on a real-time, ex-post basis? Timings should also be given for data preparation and data presentation	0
8. Examine sensitivity to flows on French interconnector Need to create an 'adjusted' sensitivity for each of the 6 baseline cases	For each of the 6 adjusted baseline scenarios • half-hourly metered data at each node • indicative network	For each adjusted baseline scenario TLFs calculated for • GSP groups • TNuoS generation zones TLMs calculated using • TLFs by GSP group for demand and TLFs by TNuoS zones for generation	Compare results from these scenarios with results obtained for task 1 Does reverse flow dramatically alter TLFs and TLMs?	6
9. Examine sensitivity to breakdown/withdrawal of plant For each of the 6 baseline scenarios create 2 new scenarios. Scenario 1 - 500 MW plant in north absent Scenario 2 - 500 MW plant in south absent Need to adjust other plant appropriately	For each of the 12 adjusted baseline scenarios • half-hourly metered data at each node • indicative network	For each adjusted baseline scenario TLFs calculated for • GSP groups • TNuoS generation zones TLMs calculated using • TLFs by GSP group for demand and TLFs by TNuoS zones for generation	Compare results from these scenarios with results obtained for task 1 Does removal of plant introduce more volatility to TLMs and TLFs?	12

10. Examine sensitivity to participants responding to signals For each of the 6 baseline scenarios create a new scenario. 500 MW plant in north moves to south Need to adjust other plant appropriately	For each of the 6 adjusted baseline scenarios • half-hourly metered data at each node • indicative network	For each adjusted baseline scenario TLFs calculated for • GSP groups • TNuoS generation zones TLMs calculated using • TLFs by GSP group for demand and TLFs by TNuoS zones for generation	Compare results from these scenarios with results obtained for task 1 If plant responds to signals do the signals disappear?	6
11. Modelling of intermittent generation For each of the baseline scenarios create at least one alternative scenario with significant penetration of wind farms Need to adjust other plant appropriately	For each of the 6 adjusted baseline scenarios • half-hourly metered data at each node • indicative network	For each adjusted baseline scenario TLFs calculated for • GSP groups • TNuoS generation zones TLMs calculated using • TLFs by GSP group for demand and TLFs by TNuoS zones for generation	What is the effect of having significant amounts of wind farms - how volatile are the TLFs	6

P82

Task	Inputs	Output	Comments	No. new load flows
1. Establish variability of TLFs and calculate average annual TLF Use a larger number of settlement periods (200/400?) to investigate variability of TLFs and TLMs by • time of day • season • month	Nodal TLF results from the scenarios obtained under P75 task 2 Weighting for each scenario	TLFs calculated for each scenario for • individual nodes • GSP groups Average annual TLF for • GSP groups	Provides information on ability to use a single annual TLF • degree of variation • any patterns? • is another timescale for calculating average TLFs appropriate • how many scenarios should be used for calculating annual TLFs	0
2. Establish baseline TLFs and TLMs Use 6 settlement periods for baseline • winter peak • summer trough • March day period weekdays • March overnight period weekdays • March day period weekends • March overnight period weekends	Nodal TLF results and losses from the 6 baseline scenarios obtained under P75 task 1	For each baseline scenario TLFs calculated for • individual nodes • GSP groups TLMs calculated using • TLFs for each node • average annual TLF calculated in task 1	Allows comparison with current loss factors Provides a baseline against which sensitivities can be measured	0
3. Establish variability of TLMs • time of day • season • similar periods	Nodal TLF results and losses from the scenarios obtained under P75 task 2	TLMs calculated for each scenario using • average annual TLF for each zone	How big is the variation in TLM? Can it be hedged?	0

4. Establish sensitivity of TLFs and TLMs to choice of historic data and weightings Create 2 or more alternative sets of weightings for historic scenarios	Nodal TLF results and losses from the scenarios obtained under P75 task 2 Sets of alternative weighting for each scenario	For each set of weightings: Average annual TLFs TLMs calculated for each scenario using • average annual TLF for each zone	How can we establish a 'fair' set of historic data for calculation of annual TLFs? How dependent is annual TLF on choice of weighting	0
5. Establish whether constraints should be considered in calculation of TLFs	Nodal TLF results and losses from the 6 baseline scenarios obtained under P75 task 1	TLFs calculated for • GSP groups	TLFs with and without constraints may be quite different. Which should be used?	0
6. Compare nodal TLFs and TLMs to zonal TLFs and TLMs for generation and demand	Nodal TLF results and losses for the 6 baseline scenarios obtained under P75 task 1	Comparison of nodal TLFs to average annual TLF Comparison of nodal TLMs calculated using nodal TLFs and zonal TLMs calculated using average annual TLF	Are any participants particularly disadvantaged by the choice of zone?	0
7. Examine sensitivity to flows on French interconnector Use scenarios created in P75 task 7	Nodal TLF results and losses for the 6 adjusted baseline scenarios obtained under P75 task 7	For each adjusted baseline scenario TLFs calculated for • GSP groups TLMs calculated using • average annual TLF	Compare results from these scenarios with results obtained for task 2 Does reverse flow dramatically alter TLFs and TLMs?	0

8. Establish the degree to which a scaling factor of 0.5 recovers the heating losses	Nodal TLF results and losses for the 6 baseline scenarios obtained under P75 task 1	For each scenario • actual heating losses • losses calculated from the nodal TLFs • losses calculated from the average zonal TLFs	Does the scaling factor systematically over or under recover the heating losses on a zonal basis?	0
9. Examine sensitivity to breakdown/withdrawal of plant	Results of nodal TLFs and losses for each of the 12 adjusted baseline scenarios of P75 task 8	For each adjusted baseline scenario Average annual TLF TLMs calculated using • average annual TLFs for each zone	Compare results from these scenarios with results obtained for task 2 Does removal of plant introduce more volatility to TLMs and TLFs?	0
10. Examine sensitivity to participants responding to signals	Results of nodal TLFs and losses for each of the 12 adjusted baseline scenarios of P75 task 9	For each adjusted baseline scenario Average annual TLF TLMs calculated using • average annual TLFs for each zone	Compare results from these scenarios with results obtained for task 2 If plant responds to signals do the signals disappear?	0
11. Modelling of intermittent generation	Results of nodal TLFs and losses for each of the 12 adjusted baseline scenarios of P75 task 10	For each adjusted baseline scenario Average annual TLF TLMs calculated using • average annual TLFs for each zone	Compare results from these scenarios with results obtained for task 2 What is the effect of having significant amounts of wind farms - how volatile are the TLFs	0

ANNEX 6 – SECTION T2 OF THE BSC

The current allocation of transmission losses is detailed under section T2 of the BSC. The section reproduced below.

2. ALLOCATION OF TRANSMISSION LOSSES

2.1 Delivering and Offtaking Trading Units

2.1.1 For the purpose of scaling for transmission losses, in respect of each Settlement Period,

(a) a Trading Unit is a "**delivering**" Trading Unit when $\Sigma_i QM_{ij} > 0$ and

(b) a Trading Unit is an "**offtaking**" Trading Unit when $\Sigma_i QM_{ij} \leq 0$

where Σ_i represents the sum over all BM Units belonging to that Trading Unit.

2.2 Transmission Loss Factors

2.2.1 For the purposes of the Code, the Transmission Loss Factor for each BM Unit, and factor α, shall be as follows:

(a) $TLF_{ij} = 0$ for all BM Units, and

(b) $\alpha = 0.45$.

2.3 Determination of the Transmission Loss Multipliers

2.3.1 In respect of each Settlement Period, for each BM Unit, the Transmission Loss Multiplier shall be calculated as follows:

(a) for all BM Units belonging to Trading Units which in the Settlement Period are delivering Trading Units:

$$TLM_{ij} = 1 + TLF_{ij} + TLMO^{+}_{j}$$

(b) for all BM Units belonging to Trading Units which in the Settlement Period are offtaking Trading Units:

$$TLM_{ij} = 1 + TLF_{ij} + TLMO^{-}_{j}$$

where:

$TLMO^{+}_{j} = -\{\alpha(\Sigma^{+}QM_{ij} + \Sigma^{-}QM_{ij}) + \Sigma^{+}(QM_{ij} * TLF_{ij})\} / \Sigma^{+}QM_{ij}$; and

$TLMO^{-}_{j} = \{(\alpha - 1)(\Sigma^{+}QM_{ij} + \Sigma^{-}QM_{ij}) - \Sigma^{-}(QM_{ij} * TLF_{ij})\} / \Sigma^{-}QM_{ij}$; and

Σ^{+} represents the sum over all BM Units belonging to Trading Units that are delivering Trading Units in the Settlement Period;

Σ^{-} represents the sum over all BM Units belonging to Trading Units that are offtaking Trading Units in the Settlement Period.