REQUIREMENTS SPECIFICATION for Modification Proposal P204 'Scaled Zonal Transmission Losses'

Prepared by: P204 Modification Group

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Proposed Modification P204 seeks to introduce a zonal scheme for the allocation of the variable (heating) element of transmission losses, whereby zonal Transmission Loss Factors (TLFs) would be calculated for each BSC Year on an ex-ante (forecast) basis for each GSP Group ('TLF Zone') using a Load Flow Model based on the solution for P198. Under P198, some BM Units in some TLF Zones (e.g. generators in southern GSP Groups and Suppliers in northern GSP Groups) would be credited with energy through the Transmission Loss Multiplier (TLM) as a result of the introduction of zonal TLFs, whilst the Metered Volumes of other BM Units would be scaled down (i.e. they would receive an energy debit). In contrast, P204 seeks to ensure that on average no BM Units are credited with energy (i.e. receive payments) through the TLM. Under P198 a scaling factor of 0.5 is applied to the zonal TLFs. P204 proposes a (or set of) different scaling factor(s) calculated so that on average, for all but the most favourable location, only energy debits due to losses would be sought.

BACKGROUND AND PURPOSE OF IMPACT ASSESSMENT

The BSC Panel considered P204 at it meeting on 13 July 2006 and submitted the proposal to a 3 month Assessment Procedure to be conducted by the P204 Modification Group (formed from members of the P198 and P200 Modification Groups. The P204 Modification Group ('the Group') has met twice to date on 14 July and 1 August 2006 and agreed the requirements for the Proposed Modification. This document sets out the requirements agreed by the Group, and supports impact assessment by BSC Agents, BSC Parties, the Transmission Company and BSCCo.[1] As P204 builds upon the zonal transmission losses solution for P198 with a different Scaling Factor(s) (β), this requirement specification focuses on the calculation and application of β. Therefore, respondents are requested to only identify any impacts or lead times arising from Proposed Modification P204 which are additional to those already identified for Proposed Modification P198.

Respondents are invited to provide cost information to support their impact assessments. Where requested this information can be treated as confidential, although all information will be provided to the Authority. Respondents should therefore clearly indicate if any aspect of their response is confidential.

Any queries regarding the impact assessment requirements should be addressed to Justin Andrews (020 7380 4364), e-mail address justin.andrews@elexon.co.uk.

[1] The Balancing and Settlement Code Company (ELEXON).

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SUMMARY OF IMPACTED PARTIES AND DOCUMENTS

As far as the Modification Group has been able to assess, the following parties/documents would be impacted by P204.

Please note that this table represents a summary of the full initial impact assessment contained in Section 6.

Parties		Sections of the BSC		Code Subsidiary Documents	
Distribution System Operators	☐	A	☐	BSC Procedures	☒
Generators	☒	B	☐	Codes of Practice	☐
Interconnectors	☒	C	☐	BSC Service Descriptions	☒
Licence Exemptable Generators	☒	D	☐	Party Service Lines	☐
Non-Physical Traders	☐	E	☒	Data Catalogues	☐
Suppliers	☒	F	☐	Communication Requirements Documents	☒
Transmission Company	☒	G	☐	Reporting Catalogue	☒
Party Agents		H	☒	Load Flow Model Specification*	☒
Data Aggregators	☐	I	☐	**Core Industry Documents**	
Data Collectors	☐	J	☐	Ancillary Services Agreement	☐
Meter Administrators	☐	K	☐	British Grid Systems Agreement	☐
Meter Operator Agents	☐	L	☐	Data Transfer Services Agreement	☐
ECVNA	☐	M	☐	Distribution Codes	☐
MVRNA	☐	N	☐	Distribution Connection Agreements	☐
BSC Agents		O	☐	Distribution Use of System Agreements	☐
SAA	☒	P	☐	Grid Code	☐
FAA	☐	Q	☐	Master Registration Agreement	☐
BMRA	☒	R	☐	Supplemental Agreements	☐
ECVAA	☐	S	☐	Use of Interconnector Agreement	☐
CDCA	☒	T	☒	**BSCCo**	
TAA	☐	U	☐	Internal Working Procedures	☒
CRA	☒	V	☒	**BSC Panel/Panel Committees**	
SVAA	☐	W	☐	Working Practices	☒
Teleswitch Agent	☐	X	☒	**Other**	
BSC Auditor	☒			Market Index Data Provider	☐
Profile Administrator	☐			Market Index Definition Statement	☐
Certification Agent	☐			System Operator-Transmission Owner Code	☐
Transmission Loss Factor Agent*	☒			Transmission Licence	☐
Other Agents				Network Mapping Statement*	☒
Supplier Meter Registration Agent	☐			Load Flow Model Reviewer*	☒
Data Transfer Service Provider	☐				

*New document/role introduced by P204

1 BACKGROUND

1.1 Types of Transmission Losses

The total metered energy which can be drawn from the Transmission System to meet demand will always be less than that delivered onto the Transmission System by generation, since some energy is used up in the process of transporting electricity. The energy 'lost' from the Transmission System is commonly referred to as '**transmission losses**'. Transmission losses can be considered to comprise two main elements: 'fixed' losses and 'variable' losses.

Fixed losses are those which do not vary significantly with the power flow. In transformers, the losses arise from magnetising the iron core. In overhead lines, they include losses dependent on the voltage levels, length of line and climatic conditions.

Variable losses arise through the heat caused by current flowing through the transformers and lines. Variable losses increase with the current (and associated power flow) and the length of line in which it flows.

References to 'fixed' and 'variable' losses throughout this document have the meaning given above, whilst the term **'total' transmission losses** is used to represent the sum of fixed and variable losses (i.e. the total energy lost from the Transmission System at any given point in time, calculated as the difference between total generation and demand).

1.2 Existing Allocation Mechanism for Transmission Losses

The rules and calculations for allocating transmission losses to Parties are set out in Section T2 of the Balancing and Settlement Code ('the Code'). These involve the adjustment of individual BM Unit Metered Volumes in Settlement to allocate transmission losses, whilst ensuring that total adjusted generation matches total adjusted demand in any given Settlement Period. Transmission losses are thereby allocated to Parties as part of their Trading Charges.

Under the existing Code provisions, both fixed and variable transmission losses in each Settlement Period are allocated to Parties on a 'uniform' (non-locational) basis in proportion to each Party's metered energy. The current allocation of transmission losses therefore does not take account of the extent to which individual Parties give rise to such losses. Although a parameter for a 'differential' allocation of some or all transmission losses is included in the Code, this is currently set to zero so has no practical effect. In the Section T calculation, this parameter is represented by the **Transmission Loss Factor** (TLF=0). This value can only be amended through a modification to the Code.

The formula below represents a simplified version of the Section T calculation for each BM Unit's share of total transmission losses in any given Settlement Period:

$$TLM=1+TLF+TLMO^{+/-}$$

A **Transmission Loss Multiplier** (TLM) is generated for each individual BM Unit, and represents the factor used to scale each BM Unit's Metered Volume in Settlement. The **Transmission Losses Adjustment** (TLMO) uniformly adjusts all generation delivery or all demand offtake to ensure an exact allocation of the actual level of total losses in a given Settlement Period. The calculation of TLMO also includes the application of an '**alpha (α) factor**' of 0.45 such that 45% of these total losses are allocated across all delivering Trading Units in aggregate (through the $TLMO^{+}$) whilst 55% are allocated across all offtaking Trading Units in aggregate (through the $TLMO^{-}$).[2]

[2] In practice, this split is designed to be equivalent to a 50:50 allocation, but with allowance for the fact that metering for most generation connections is on the high voltage side of the supergrid transformer, whereas that for demand is on the low voltage side. The 45:55 allocation of transmission losses is intended to allow for supergrid transformer losses for demand connections which are in addition to the metered flow.

The formulae below represent simplified versions of the $TLMO^+$ and $TLMO^-$ calculations:

> *$TLMO^+$ = -(0.45*(total transmission losses in Settlement Period) + generators' share of transmission losses already allocated through TLF in Settlement Period) / total volume of generation in Settlement Period*
>
> *$TLMO^-$ = (–0.55*(total transmission losses in Settlement Period) – Suppliers' share of transmission losses already allocated through TLF in Settlement Period) / total volume of demand in Settlement Period*

The value of $TLMO^+$ is the same in each Settlement Period for every BM Unit in all delivering Trading Units. The value of $TLMO^-$ is the same for every BM Unit in all offtaking Trading Units.

Since under the existing Code baseline the value of TLF is set to zero, the TLMO is currently the only determining factor in the calculation of each BM Unit's TLM. Two uniform TLM values are therefore currently applied: one to all BM Units in delivering Trading Units, and one to all BM Units in offtaking Trading Units. Each Party's overall allocation of transmission losses is dependent on the Metered Volumes of the BM Units to which this TLM is applied. Metered Volumes for BM Units in 'delivering' (exporting) Trading Units are currently scaled down (multiplied by $1+TLF+TLMO^+$), whilst Metered Volumes for BM Units in 'offtaking' (importing) Trading Units are scaled up (multiplied by $1+TLF+TLMO^-$).

There are currently three other Pending Modification Proposals being progressed in the area of zonal transmission losses, as follows:

- Modification Proposal P198 'Introduction of a Zonal Transmission Losses Scheme' (raised by RWE Npower on 16 December 2005);
- Modification Proposal P200 'Introduction of a Zonal Transmission Losses Scheme with Transitional Scheme' (raised by Teesside Power Limited on 21 April 2006); and
- Modification Proposal P203 'Introduction of a Seasonal Zonal Transmission Losses Scheme' (raised by RWE Npower on 26 June 2006).

In addition, the P198 and P200 Modification Groups have developed Alternative Modifications for both P198 and P200. All of the proposals seek to introduce a locational allocation of variable losses through the calculation of 'zonal' TLF values, although their precise calculations and application of these values differ. A summary of the solutions can be found in Table 1 on the following page, whilst further detail regarding the proposals and their Alternatives can be found in Sections 1.2.1-1.2.4 below.

Please note that all three of these Modification Proposals and their Alternatives are mutually exclusive as well as P204, such that only one could be approved by the Authority for implementation.

Table 1 – Summary of Transmission Losses Modification Proposals

The key aspects of Modification Proposals P198, P200 and P203 are outlined below, and are shown against the P204 solution for comparison.

ASPECT OF SOLUTION	P198 PROPOSED	P198 ALTERNATIVE	P200 PROPOSED	P200 ALTERNATIVE	P203 PROPOSED	P204 PROPOSED
Scope of Zonal TLF Calculation	Scaled Marginal (Variable Losses Only)	Scaled Marginal (Variable Losses Only)	Scaled Marginal (Variable Losses Only)	Scaled Marginal (Variable Losses Only)	Scaled Marginal (Variable Losses Only)	Scaled Marginal (Variable Losses Only)
Scaling Factor	0.5 (Single Scaling Factor Fixed in Code)	0.5 (Single Scaling Factor Fixed in Code)	0.5 (Single Scaling Factor Fixed in Code)	0.5 (Single Scaling Factor Fixed in Code)	0.5 (Single Scaling Factor Fixed in Code)	1a/c – Single Scaling Factor calculated in advance; or 1b/d – Different Scaling Factor for delivery and offtake calculated in advance; or 2 - Different Scaling Factor calculated & applied in each Settlement Period
Aim of Scaling Factor	Ensure Total Variable Losses Allocated Through TLFs	Ensure Total Variable Losses Allocated Through TLFs	Ensure Total Variable Losses Allocated Through TLFs	Ensure Total Variable Losses Allocated Through TLFs	Ensure Total Variable Losses Allocated Through TLFs	Ensure No BM Units are Credited with variable losses through TLM
Applicable Period for TLFs	BSC Year	BSC Season	BSC Year	BSC Season	BSC Season	BSC Year or BSC Season
Nature of TLF Calculation	Ex-Ante	Ex-Ante	Ex-Ante	Ex-Ante	Ex-Ante	Ex-Ante
Frequency of TLF Calculation	Annual	Annual	Annual	Annual	Annual	Annual
Applicable Zones for Production BM Units	GSP Group	GSP Group	GSP Group	GSP Group	GSP Group	GSP Group
Applicable Zones for Consumption BM Units	GSP Group	GSP Group	GSP Group	GSP Group	GSP Group	GSP Group
Mitigation of Impacts?	No	Yes	Yes	Yes	No	No
Type of Mitigation	-	Linear Phasing	Hedging	Hedging	-	-
Period of Mitigation	-	4 Years	15 Years	15 Years	-	-

1.3 Other Transmission Loss Modifications

1.3.1 Modification Proposal P198

P198 is currently part-way through the Assessment Procedure, with an Assessment Report to be presented to the BSC Panel ('the Panel') at its meeting on 10 August 2006.

a) Proposed Modification P198

The solution for Proposed Modification P198 involves the following 'scaled marginal' methodology for calculating zonal TLFs:

1) An electrical model of the Transmission System (a 'Load Flow Model') would be built, containing 'Nodes' to represent points 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 BSCCo. The TLF 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 TLF Zones.

2) TLFs would be calculated on an ex-ante basis (i.e. forecasted) for each BSC Year, 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 (1 April – 31 March), the Load Flow Model would be run by a Transmission Loss Factor Agent ('the TLFA') to calculate how an incremental (or 'marginal') increase (or 'injection') in power at each individual Node would affect the variable losses from the Transmission System. The output of the Load Flow Model would be a TLF value for each Node in each of the Sample Settlement Periods. Positive TLF values would be produced for Nodes where an incremental increase in generation (or reduction in demand) had the effect of decreasing variable losses. Negative TLF 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 0.02 kWh, the TLF for that Node in that Settlement Period would be -0.02.

4) The TLFA would average these raw Nodal TLFs across all the Nodes in each TLF Zone by 'volume-weighted' averaging, to give 14 Zonal TLF values for each Sample Settlement Period (one per TLF Zone). The TLFA would then convert these to Annual Zonal TLFs by 'time-weighted' averaging.

5) The TLFA would adjust the Annual Zonal TLFs by a 0.5 scaling factor such that the volume of energy allocated via the TLFs was comparable to the volume of variable losses calculated by the Load Flow Model (P204 is similar to P198 but would use a different scaling factor). These 14 Adjusted Annual Zonal TLFs (one per TLF Zone) would be made publicly available by BSCCo no less than three months prior to their use in the TLM Settlement calculation for the applicable BSC Year.

6) Each BM Unit would be allocated to a specific TLF Zone by BSCCo on the basis of the Network Mapping Statement, with any question or dispute over their zonal allocation to be resolved by the Panel. Using the Network Mapping Statement, the TLFA would determine the TLF value to be applied to each BM Unit in the TLM Settlement calculation for the applicable BSC Year. This BM Unit-Specific TLF would be the Adjusted Annual Zonal TLF value for the Zone in which the BM Unit was located. All BM Units within a Zone would therefore receive the same single TLF value (the Adjusted Annual Zonal TLF for that Zone), for every Settlement Period within the applicable BSC Year. A positive TLF value would increase the value of TLM used to scale a BM Unit's Metered Volume (a benefit to generators and disadvantage to Suppliers), whilst a negative TLF value would decrease the value of TLM (a benefit to Suppliers and disadvantage to generators).

7) The BM Unit-Specific TLFs 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 within the Balancing Mechanism Reporting Service (BMRS) and Settlement calculations respectively.

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

9) There would be no phased implementation or 'hedging' of exposure to the new zonal TLFs, which would therefore take full effect from the first Settlement Period on the Implementation Date.

Further detail regarding Proposed Modification P198 can be found in the P198 Assessment Report (Reference 1).

b) Alternative Modification P198

Alternative Modification P198 is the same as Proposed Modification P198, except that it comprises:

- An annual ex-ante calculation of four Adjusted Seasonal Zonal TLF values for each TLF Zone, one for each BSC Season; and
- A linear phased implementation of these Adjusted Seasonal Zonal TLF values over the first four BSC Years of the scheme, such that TLFs would be applied at 20% of their full value in BSC Year 1, 40% in BSC Year 2, 60% in BSC Year 3, 80% in BSC Year 4, and 100% in BSC Year 5 and all subsequent years.

Further detail regarding Alternative Modification P198 can be found in the P198 Assessment Report.

1.3.2 Modification Proposal P200

P200 is currently part-way through the Assessment Procedure, with an Assessment Report to be presented to the Panel at its meeting on 10 August 2006.

a) Proposed Modification P200

Proposed Modification P200 seeks to introduce zonal TLFs under the same methodology as Proposed Modification P198 (i.e. an annual ex-ante calculation of one Adjusted Annual Zonal TLF value per TLF Zone), but with the addition of an F-factor 'hedging' scheme to mitigate the impact of TLFs on existing generators over 15 years.

Further detail regarding Proposed Modification P200 can be found in the P200 Assessment Report (Reference 2).

b) Alternative Modification P200

Alternative Modification P200 seeks to introduce zonal TLFs under the same methodology as Alternative Modification P198 (i.e. an annual ex-ante calculation of four Adjusted Seasonal Zonal TLF values per TLF Zone), but with the addition of a 15-year F-factor 'hedging' scheme for existing generators.

Further detail regarding Alternative Modification P200 can be found in the P200 Assessment Report.

1.3.3 Modification Proposal P203

Proposed Modification P203 seeks to introduce an annual calculation of seasonal TLF values which is identical to Alternative Modification P198, except that (unlike P198 Alternative) there would be no phased implementation of these values.

The Initial Written Assessment (IWA) for P203 will be presented to the Panel at its meeting on 13 July 2006, with a recommendation that P203 be submitted to a one-month Assessment Procedure such that the P203 Assessment Report would be presented to the Panel at its meeting on 10 August 2006.

Further detail can be found in the P203 Assessment Report (Reference 3).

1.4 Purpose of Scaling Factor

Losses are not constant with power. Since the Load Flow Model would only establish the relationship between variable losses and power (the TLF) at the margin (i.e. for a marginal injection of power at each Node), applying unadjusted TLFs to whole Metered Volumes would over-allocate variable losses. Under P198 (Proposed and Alternative Modifications), P200 (Proposed and Alternative Modifications) and P203, a scaling factor of 0.5 would be used in the TLF calculation to seek to ensure that the losses allocated through TLFs would be comparable to the level of variable losses calculated by the Load Flow Model. A 0.5 scaling factor aims to ensure that the Adjusted **Nodal** TLFs recover exactly the variable losses.

The detailed modelling exercise carried out by an external consultant on behalf of the P198 Modification Group concluded that 0.5 was the appropriate scaling factor to achieve this intention. One member of the P198 Group – whilst not disagreeing with this conclusion – suggested an 'alternative scaling' approach based on a different principle, whereby it would attempt to ensure that no BM Units were credited with energy through the TLM. This was considered by the Group as a potential option for an Alternative Modification to P198. However, whilst some members were sympathetic to this approach, the Group agreed by majority not to assess it further as part of P198. Some members noted that there could be more than one way of achieving the intention of such an approach, and believed that it would be more appropriate for 'alternative scaling' to be raised as a Standing Issue or a separate Modification Proposal to allow the industry to consider the most appropriate solution. Other members supported this suggestion, believing that the 'alternative scaling' approach would require a substantive assessment in its own right to investigate its impact on the allocation of losses. Other members believed that such an approach would be seeking to address a different defect to P198, and was therefore outside the scope of any P198 Alternative Modification.

P204 has subsequently been raised as a separate Modification Proposal. Further detail regarding the P198 Group's discussions can be found in the P198 Second Assessment Procedure Consultation Document.

P204 was raised on 3 July 2006 by British Energy ('the Proposer'). Like P198, P204 argues that the Code's existing uniform allocation of losses fails to allocate the cost of losses appropriately between BM Units at different locations. Like P198, P204 seeks to introduce a zonal scheme for the allocation of variable losses. However, the principle behind the application of a scaling factor in P204 would be different to that in P198.

a) Principle of P198

Under P198, some BM Units in some TLF Zones (e.g. generators in southern GSP Groups and Suppliers in northern GSP Groups) would be credited with energy through their resulting TLMs. The Metered Volumes of these BM Units would be increased (made more positive), which would be a benefit to both generators and Suppliers since it would respectively increase their volume of generation or decrease their volume of demand. The Metered Volumes of other BM Units would be scaled down (i.e. they would receive an energy debit). The Metered Volumes of these BM Units would be decreased (made more negative), which would be a dis-benefit to both Generators and Suppliers since it would respectively decrease their volume of generation or increase their volume of demand. On average, the amount of downward (more negative) volume adjustment would exceed the amount of upward adjustment by an amount exactly equal to the magnitude of actual losses.

This can be seen in Figures 1 and 2 below, which show the estimated TLMs for delivering and offtaking Trading Units which would have been likely to apply in 2006/2007 under Proposed Modification P198.

Note that BM Units would not be exposed directly to the TLF values calculated by P198, but only to TLMs (where the TLMO would uniformly adjust the TLF values whilst preserving the differentials between Zones, such that losses were allocated 45:55 to generation and demand overall).

Figure 1 – P198 TLMs for 2006/2007 'Peak' Settlement Period

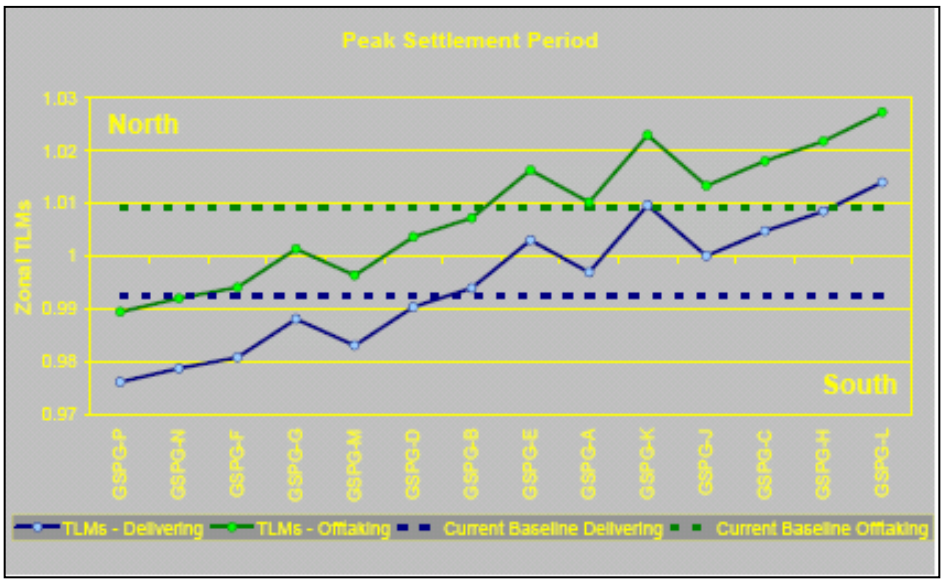
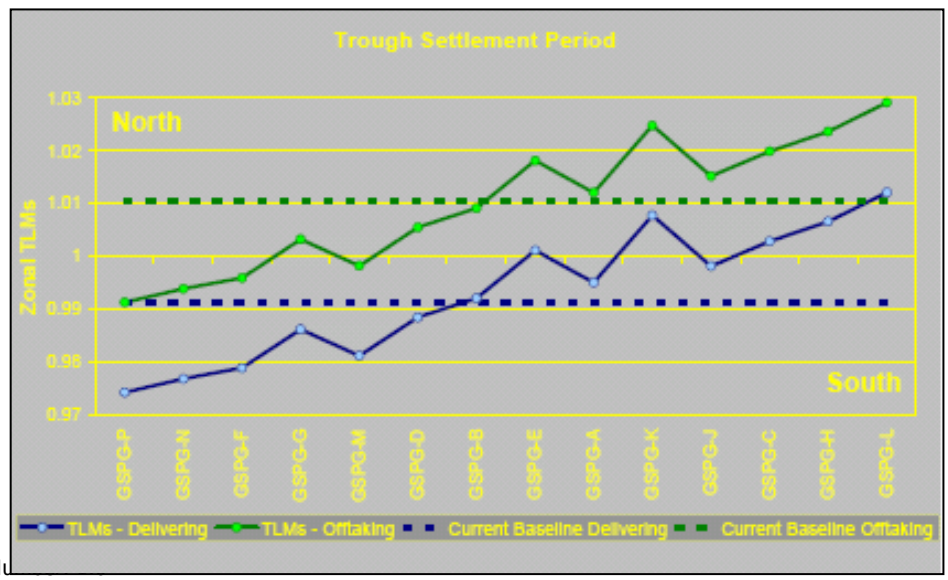


Figure 2 – P198 TLMs for 2006/2007 'Trough' Settlement Period



At a simple level, under P198 southern generation and northern demand would be 'rewarded' for helping to reduce losses, whilst northern generation and southern demand would be 'penalised' for contributing to an increase in losses. Table 2 on the following page shows the likely initial distributional effects of P198, estimated as part of the P198 cost-benefit analysis by an external consultant on behalf of the P198 Modification Group.

Table 2 – Assumed Distributional Impacts of P198 (2006/2007)

	North	South
Generators (Total)	Increase payments by: £43m in Scotland £42m in Northern England	Decrease payments by £85m
Suppliers (Total)	Decrease payments by: £41m in Scotland £40m in Northern England	Increase payments by £81m

These distributional effects are consistent with the belief of the Proposer of P198 that the existing uniform allocation of losses constitutes a 'cross-subsidy', whereby southern Generators and northern Suppliers pay part of the costs of transporting electricity to the south. For the Proposer of P198, the above distributional effects are therefore appropriate – since they are believed to represent the removal of this cross-subsidy, whilst providing economic signals to incentivise the short-term despatch and long-term location of generation closer to demand. Opposing views to this are that these distributional impacts represent windfall gains and losses to Suppliers and Generators. Further detail regarding these arguments can be found in the P198 Assessment Report (Reference 1).

b) Principle of P204: Alternative Scaling Factor(s)

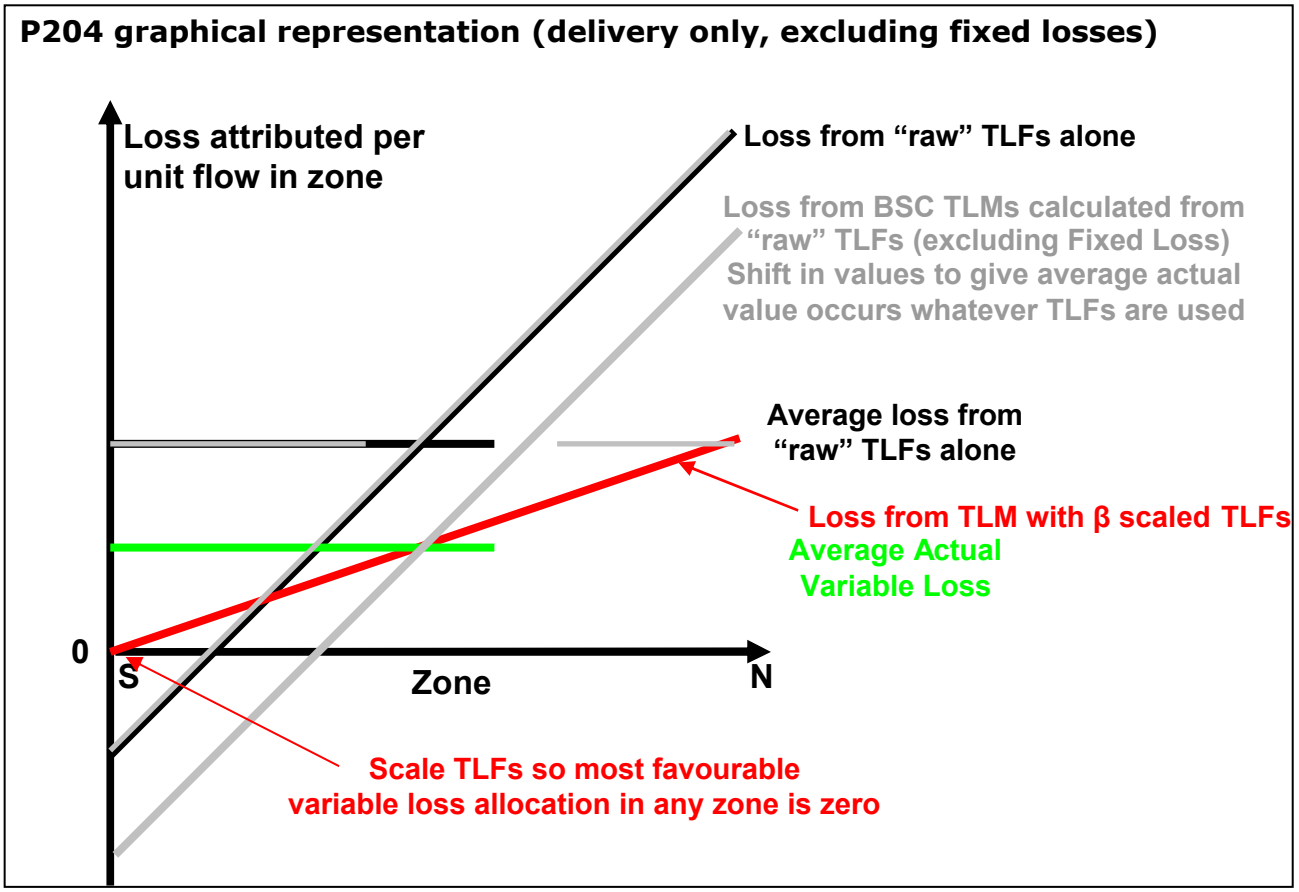
The Proposer of P204 does not believe that such large gross transfers of money are appropriate or necessary to achieve the intention of a zonal transmission losses scheme. The Proposer of P204 believes that:

- The gross volume transfers created by P198 could be comparable or greater than the net actual amount of losses;
- The averaging inherent in an annual zonal TLF calculation could create significant material errors in loss allocation and signals under P198; and
- The economic rationale behind P198 is weakened by the fact that losses are a second-order consideration for most long-term investment and operation, which would therefore be subject to windfall gains and losses.

However, the Proposer believes that it is possible to address the defect of the existing uniform allocation, and create a more appropriate allocation of costs, without creating such large distributional effects. Under the solution proposed by P204, zonal TLF values would still be calculated to allocate variable losses to BM Units on a locational basis, and the existing uniform allocation of fixed losses would be retained (45% to generation and 55% to demand overall). However, TLF values would be scaled such that no BM Units were credited with energy (i.e. received payments) through the application of TLM.

Under this approach, the most favourable outcome for a BM Unit would be a uniform allocation of fixed losses with no allocation of variable losses. This outcome would apply to BM Units in the most advantageous TLF Zone for the flow direction of the BM Unit – and would be a more favourable outcome for these BM Units than at present, where a uniform allocation of total losses (fixed and variable) applies. The least favourable position for a BM Unit would be in the Zone with the 'worst' scaled TLF (i.e. the most negative for generation and most positive for demand), where BM Units would be allocated both fixed losses on a uniform basis and variable losses on a zonal basis. This would be a less favourable outcome for these BM Units than at present, where they receive a uniform allocation of both fixed and variable losses. Other Zones would have intermediate effects depending on the scaled TLF for the Zone. This is illustrated in the following diagram.

Figure 3 Principle of Scaling Factor



It should be noted that this graphical representation illustrates the principle behind P204 and not its application in settlement. P204 is considered to represent the P198 solution with a different scaling factor (or factors) calculated and applied. Thus, this requirement specification focuses on the calculation and application of these scaling factors (β). The β value reduces the spread of zonal TLFs, example calculations from the Proposer showed under P198 (0.5 scaling factor): -1.5% < zonal TLM < 2.5% and under P204 (β = 0.125) 0.2% < zonal TLM < 1.3%.

1.5 Allocation of Losses

Under the current rules losses are allocated on a uniform basis and each BM Unit's metered output is scaled by the TLM. Therefore:

If generation, TLM makes output look smaller, i.e. generated less

If demand, TLM makes demand look bigger, i.e. consumed more

Under P198, the zonal TLFs alter the value of the TLM (see equation in Section 1.2). In the most favourable zones for each of generation or demand, the TLM could be such that (if the full value of the TLF is applied):

If generation, TLM makes output look bigger, i.e. generated more

If demand, TLM makes demand look smaller, i.e. consumed less

This would mean that the relevant generation or demand is effectively allocated a negative amount of losses, in other words a 'credit'.

Under P204, the application of the β scaling factor would mean that in the most favourable zone for each of generation and demand:

If generation, TLM makes output look smaller, i.e. generated less but more than currently

If demand, TLM makes demand look bigger, i.e. consumed more, but less than currently.

2 SCOPE OF PROPOSED MODIFICATION SOLUTION

Proposed Modification P204 is a zonal transmission losses scheme which uses the solution developed for the P198 Proposed Modification, but with the replacement of the scaling factor of 0.5 with a new scaling factor (β). The solution requirements for the calculation of zonal TLFs under Proposed Modification P204 are therefore identical to those set out in the Requirements Specification for Proposed Modification P198 (Reference 4), and the remainder of this Requirements Specification is limited to the additional requirements for the calculation and application of the replacement scaling factor (β). As described in section 1.2.4 b) β seeks to ensure that no BM Units are credited with variable losses through the application of TLM.

Respondents to the impact assessment are requested to only identify any impacts or lead times arising from Proposed Modification P204 which are additional to those already identified for Proposed Modification P198. Copies of the non-confidential Party/Party Agent impact assessment responses received for Proposed Modification P198 can be found on the BSC Website (P198 Modification Proposal).

3 SUMMARY OF PROPOSED MODIFICATION SOLUTION REQUIREMENTS

3.1 Key features of the Proposed Modification Scaling Factor

The key feature of the P204 solution (over and above the solution for P198) is the requirement to calculate a scaling factor β, and apply it to the zonal TLF values before they are used in Settlement. As explained in the attachment to Modification Proposal P204, the mathematical equations for calculating scaling factors β^+j and β^-j that will achieve the intent of P204 in a given Settlement Period j are:

$$\beta^+_j = \min(1, \alpha * VL_j / [\ \mathrm{Max(TLF)} * \Sigma^+(QM) - \Sigma^+(TLF*QM)\ ])$$

$$\beta^-_j = \min(1, (1-\alpha) * VL_j / [\ \mathrm{Min(TLF)} * \Sigma^-(QM) - \Sigma^-(TLF*QM)\ ])$$

where:

- α is the parameter (equal to 0.45) defined in Section T2.2.1(b) of the Code;
- VL_j is the level of Variable Losses in the Settlement Period;
- Max(TLF) and Min(TLF) are the maximum and minimum unscaled TLF values for any BM Unit in that period;
- $\Sigma^+(QM)$ and $\Sigma^-(QM)$ are the total metered volumes for BM Units in delivering and offtaking Trading Units respectively; and

- Σ^{+}(QM*TLF) and Σ^{-}(QM*TLF) are the sum of QM_{ij}*TLF_{ij} over delivering and offtaking Trading Units respectively.

Note that the above equations cap the scaling factors at 1, so that they do not scale up any zonal TLFs.

The Modification Group has identified a number of different options for applying these formulae in practice:

- The actual TLF values used could be Annual (i.e. a single average value per Zone for each BSC Year), or Seasonal (i.e. a single average value per Zone for each BSC Season);
- The calculation of scaling factors could be carried out after the event ('*ex post*') for each Settlement Period; or in advance ('*ex ante*') at the same time as the TLF values are calculated. In the former case, the scaling factors would need to be calculated by the SAA, and reported to Parties for each Settlement Period. In the latter case, the scaling factors would be calculated by the TLFA for each Sample Settlement Period used in the TLF calculation, and then averaged (over each BSC Year or BSC Season) to derive Annual or Seasonal scaling factors. These scaling factors would then be incorporated into the published TLF values before they were passed to SAA for use in Settlement; and
- Separate scaling factors β^{+} and β^{-} could be used in Settlement for delivering and offtaking BM Units; or a combined β value (equal to the minimum of the two) could be used for both.

By combining different elements of these options, the Modification Group has identified five overall options for which impact assessments are required. These are summarised in the following table

Option	Zonal TLF	Scaling Factor Option	Separate values for Delivery and Off-take	Impact on Settlement Process for Calculation
1a	Annual	Ex-ante Annual	No	No
1b	Annual	Ex-ante Annual	Yes	Yes: SAA
1c	Seasonal	Ex-ante Seasonal	No	No
1d	Seasonal	Ex-ante Seasonal	Yes	Yes: SAA
2	Seasonal	Ex-post Settlement Period	Yes	Yes: SAA

Regardless of which of these options is chosen, the calculation and use of the scaling factor of the Proposed Modification P204 can be divided into the following logical steps:

a) A determination (estimation or calculation) of fixed losses or variable losses so that no BM Unit is credited with variable losses through the TLM mechanism (such that the most favourable outcome for a BM Unit would be a uniform allocation of fixed losses with no allocation of variable losses, see section 3.2;

b) Calculation of Scaling Factor/s (β). This would utilise the amount of losses calculated under a) with various options which range from an ex-ante establishment of one annual value, to an ex-post calculation by Settlement Period with separate values for delivery and offtaking BM Units, see section 3.3;

c) Application of Scaling Factor/s (β) in Settlement. The impact of the various approaches depends on the ex-ante/ ex-post solution and granularity of the Scaling Factor (β). Ex-ante values are capable of being applied to the zonal TLFs prior to input into Settlement (as for annual and seasonal values under P198); see section 3.3; and

d) Publication of Scaling Factor/s (β): this depends on the approach to calculation. If an ex-ante calculation were to be used, it would be a one-off process, e.g. similar to publication of zonal TLFs under P198. If ex-post calculation were to be carried out for every Settlement Period, publication would have to be via existing Settlement Reports, see section 3.3.

3.2 Determination of Fixed or Variable Losses

P204 Proposed Modification defines a constraint for the calculation of the Scaling Factor (β) that on average no BM Unit is credited with energy through the TLM mechanism such that "the most favourable outcome for a BM Unit would be an allocation of its uniform proportion of fixed losses". This can be translated into "the most favourable outcome for a BM Unit is that it receives no proportion of variable losses". In order to satisfy the constraint the amount of fixed or variable losses needs to be estimated. Estimation is required because only total losses are directly measurable, not the variable and fixed components. The appropriate method for doing this depends on whether the calculation is performed *ex ante* (i.e. option 1a, 1b, 1c or 1d) or *ex post* (i.e. option 2):

a) If the calculation of scaling factors is carried out *ex post*, the variable losses can be estimated by subtracting an estimate of fixed losses from the total metered losses in each Settlement Period. The estimate of fixed losses (the 'Fixed Loss Parameter', FLP) would be set by the Panel in consultation with Parties. Analysis presented to the Modification Group by both National Grid and ELEXON suggested that a value of approximately 100 MWh would be appropriate, although the actual level of fixed losses does vary from Settlement Period to Settlement Period, depending primarily on weather-related variables (e.g. humidity). For further information see Appendix 1. Some members noted that due to impact of weather on the level of fixed losses, it might be more appropriate for the value to be determined more regularly, for example on a monthly basis.

b) If the calculation of scaling factors is carried out *ex ante*, the variable losses would be estimated for snapshot Settlement Periods in the Load Flow Modelling analysis.

3.3 Calculation and Application of Scaling Factor (β)

As described in section 3.1 above, impact assessments are required for a number of options:

- An ex-ante calculation of average Scaling Factors. This will either be one scaling factor to cover delivery and offtaking BM Units (options 1a and 1c), or separate scaling factors for each (options 1b and 1d); or
- An ex-post calculation of a Settlement Period based value with separate values for delivery and off-take (option 2).

For Options 1a, 1b, 1c and 1d the scaling factors would be recalculated by the TLFA each year similar to the annual process for the calculation of zonal TLFs.

3.3.1 Option 1a and 1c: Ex-ante Annual or Seasonal Scaling Factors

Under options 1a or 1c, the scaling factors would be incorporated into the TLF values provided to the CRA, and there would therefore be no impact on NETA central systems (e.g. CRA, SAA or BMRA).

The calculation of scaling factors could in principle be carried out either by the TLFA, or by BSCCo. However it appears to fit better with the TLFA role, and it is therefore assumed for the purposes of this impact assessment that the TLFA will perform the calculation. The steps to be undertaken are as follows:

1. Estimate total variable losses (in accordance with the methodology in the LFM Specification) in each Sample Settlement Period used by the TLFA for the zonal TLF production. This step is already carried out as part of the calculation of TLF values, and therefore no additional impact is anticipated.
2. Receive from ELEXON a file containing the total metered volumes for each Zone, split by delivering and offtaking, for use in the calculation of scaling factors. The file will contain values of Zonal Delivering Metered Volume QM^{+}_{Zj} and Zonal Offtaking Metered Volume QM^{-}_{Zj} for each Zone and Sample Settlement Period. The data it contains will be sourced from the SAA-I014 Settlement Report (which ELEXON receives from SAA, and loads into the TOMAS system);

3. Determine a scaling factor for delivery and one for off-take for each SP. For option 1a this would be based on using annual zonal TLFs, for option 1c it would use seasonal zonal TLFs (in accordance with the equation in paragraph 7.4A of the draft algebra in Section 4 of this document);

4. For option 1a, calculate a time-weighted average annual scaling factor. This overall scaling factor is the average of the minimum of the two scaling factor values above in each Settlement Period;

5. For option 1c calculate 4 time-weighted average seasonal scaling factors (in accordance with the equation in paragraph 7.4B of the draft algebra in Section 4 of this document). These overall scaling factors are the average of the minimum of the two scaling factor values above in each Settlement Period; and

6. For both options 1a/c apply to zonal TLFs before input in to central systems, therefore no impact on central systems.

3.3.2 Option 1b and 1d: Ex-ante Annual or Seasonal Scaling Factors with separate values for delivery and off-take

These two options are similar to options 1a and 1c respectively, with the difference that separate scaling factors (and hence separate TLF values) are calculated for BM Units in delivering and offtaking Trading Units. These options therefore require amendments to NETA central systems (i.e. CRA, SAA and BMRA) in order to use these separate TLF values.

As for 1a and 1c, these two options to be applied with Annual (1b) or Seasonal (1d) Zonal TLFs. The steps to be undertaken by the TLFA and Neta central systems are as follows:

1. Estimate total variable losses for each Sample Settlement Period (as for options 1a/1c);

2. Receive Zonal Delivering Metered Volume QM^{+}_{Zj} and Zonal Offtaking Metered Volume QM^{-}_{Zj} for each Zone and Sample Settlement Period (as for options 1a/1c)

3. Determine a scaling factor for delivery and one for off-take for each Settlement Period. For option 1b this would be based on using annual zonal TLFs, for option 1d it would use seasonal zonal TLFs (in accordance with the equation in paragraphs 7.4A and B of the draft algebra in Section 4 of this document);

4. For option 1b calculate two time-weighted average annual scaling factors, one for delivery and one for off-take and apply these to the annual zonal TLFs to create TLF^{+} and TLF^{-}, where TLF^{+} and TLF^{-} are the Delivering and Offtaking Transmission Loss Factors;

5. For option 1d calculate eight time-weighted average seasonal scaling factor, four values for delivery and four values for off-take and apply these to the seasonal zonal TLFs to create TLF^{+} and TLF^{-}, where TLF^{+} and TLF^{-} are the Delivering and Offtaking Transmission Loss Factors; and

6. Send these TLF^{+} and TLF^{-} values to the CRA, CRA to send them to BMRA and SAA.

7. Amend the applications for BMRA and SAA to use TLF^{+} and TLF^{-} values in TLM calculations.

NETA Central Systems are impacted as follows:

- CRA must receive and store two TLF values (TLF+ and TLF-) for each BM Unit rather than one;
- BMRA must be amended to use the appropriate TLF value for each BM Unit (based on the registration data provided by CRA); and
- SAA must be amended to use the appropriate TLF value for each BM Unit (based on whether it is in a Delivering of Offtaking Trading Unit);

3.3.3 Option 2: Ex-post Settlement Period based Scaling Factors

In this option, the scaling factors will not be incorporated into the seasonal TLF values, but will instead be calculated for each Settlement Period by the SAA.

Under this option, the TLFA has no involvement in the calculation of scaling factors. The TLFA process is therefore unchanged from P198, except that P204 does not include the P198 requirement to apply a 0.5 adjustment factor to the calculated TLF values.

A potential difficulty of this option is that (unlike the other options described above) it does not allow the BMRS to use the same scaling factors as the SAA (as the SAA will not calculate the scaling factors until after the event). Approaches that could be taken to solving this problem include:

- Option A - Duplicate the option 1(d) process described above, to derive scaled TLF+ and TLF- values, but purely for use in BMRA. SAA would use a single TLF value and calculate its own scaling factor. This has the disadvantage that it requires completely different TLF values in BMRA and SAA, which has a potentially large impact on central systems;
- Option B – Define additional parameters, the Estimated Scaling Factors $E\beta^+$ and $E\beta^-$, for use by BMRA.

For the purposes of this Requirements Specification and impact assessment, it is assumed that Option B is the appropriate way forward.

The key process steps for this option are therefore as follows.

1. In order to allow SAA to estimate the level of variable losses, a Fixed Losses Parameter (FLP, representing the level of fixed losses in each Settlement Period) would be required. As for other similar Code parameters this would be set by the BSC Panel (after consultation with Parties, and with the approval of the Authority). The minimum requirement is for FLP to be determined as one value that is applied throughout the year. One member of the Group suggested that FLP be varied on a monthly basis, as its calculation is dependent on weather. Therefore costs are sought for having this parameter variable by month;
2. In order to provide BMRA with scaling factor values, estimated scaling factors ($E\beta^+$ and $E\beta^-$) would be required. These would be calculated by ELEXON and approved by ISG, in the same way (and at the same time) $ETLMO^+$ and $ETLMO^-$.
3. TLFA issues to CRA the seasonal zonal TLFs and BSCCo to send the FLP to CRA;
4. SAA will need to amend its calculations to:
    a. Use FLP to calculate variable losses in each Settlement Period;
    b. Use the results of the calculation of variable losses in each Settlement Period to calculate separate scaling factors (β^+j and β^-j) for delivery and off-take;
    c. Apply scaling factors to the calculation of TLM_{ij}, $TLMO^+_j$ and $TLMO^-_j$ (in accordance with the equations given in the draft algebra in Section 4 of this document) for each Settlement Period;
5. SAA to amend existing Settlement Reports to identify scaling factors (β^+_j and β^-_j) by Settlement Period; and
6. BMRA will need to amend its calculations to make use of the $E\beta^+$ and $E\beta^-$ scaling parameters provided.

4 INCORPORATION OF SCALING FACTOR ALGEBRA IN CODE

The following algebra gives an illustration of the calculation and application of scaling factors under the Code. Changes to the existing Code baseline are shown in bold and red.

Option 1c – Ex-ante Seasonal TLF and Scaling Factor

Under this option, delivering and off-taking Trading Units have the same scaling factor. Changes to Section 7 of Annex T-2 are as follows (redlined against P198 Proposed):

7.4 For each **BSC Season (the 'relevant BSC Season') in each** BSC Year the TLFA shall determine the **Seasonal** Zonal TLF (**TLF_{Zs}**) for each Zone according to the following formula:

$$\mathbf{TLF_{Zs}} = \Sigma_p ((\Sigma_s TLF_{Zj} / S_{ps}) * J_{ps}) / \Sigma_p J_{ps}$$

where (in relation to the Reference Year):

S_{ps} is the number of Sample Settlement Periods for a Load Period **within a Load Period which fall within the relevant BSC Season**

J_{ps} is the total number of Settlement Periods falling within the Load Period **within a Load Period which fall within the relevant BSC Season**

Σ_s is summation by Sample Settlement Periods within a Load Period **within a Load Period which fall within the relevant BSC Season**

Σ_p is summation by Load Period **within the relevant BSC Season**.

7.4A For each Sample Settlement Period the TLFA shall determine the Delivering Scaling Factor (β^+_j), the Offtaking Scaling Factor (β^-_j) and the Settlement Period Scaling Factor (β_j) according to the following formulae:

$$\beta^+_j = \min(1, \alpha * VL_j / [\ Max_Z(TLF_{Zs}) * \Sigma_Z(QM^+_{Zj}) - \Sigma_Z TLF_{Zs} * QM^+_{Zj})\ ])$$

$$\beta^-_j = \min(1, (1-\alpha) * VL_j / [\ Min_Z(TLF_{Zs}) * \Sigma_Z(QM^-_{Zj}) - \Sigma_Z(TLF_{Zs} * QM^-_{Zj})\ ])$$

$$\beta_j = Min(\beta^+_j , \beta^-_j)$$

where for that Settlement Period:

$Max_Z(TLF_{Zs})$ is the maximum value of TLF_{Zs} for any Zone Z for the BSC Season s in which the Sample Settlement Period j falls;

$Min_Z(TLF_{Zs})$ is the minimum value of TLF_{Zs} for any Zone Z for the BSC Season s in which the Sample Settlement Period j falls;

VL_j is the quantity of heating losses (determined by the TLFA using the Load Flow Model);

Σ_Z is summation by Zone

7.4B For each BSC Season in each BSC Year the TLFA shall determine the Seasonal Scaling Factor (β_s) according to the following formula:

$$\beta_s = \Sigma_p ((\Sigma_s \beta_j / S_{ps}) * J_{ps}) / \Sigma_p J_{ps}$$

where (in relation to the Reference Year):

S_{ps} is the number of Sample Settlement Periods for a Load Period within a Load Period which fall within the relevant BSC Season

J_{ps} is the total number of Settlement Periods falling within the Load Period within a Load Period which fall within the relevant BSC Season

Σ_s is summation by Sample Settlement Periods within a Load Period within a Load Period which fall within the relevant BSC Season

Σ_p is summation by Load Period within the relevant BSC Season.

7.5 For each BSC Year:

(a) the TLFA shall, **not later than 30th November in the preceding BSC Year**:

(i) determine the Adjusted **Seasonal** Zonal TLF (**$ATLF_{Zs}$**) for each Zone **and each BSC Season** according to the following formula:

$$\mathbf{ATLF_{Zs}} = TLF_{Zy} * \sout{0.5}\ \beta_s$$

Option 1d – Ex- ante seasonal Scaling Factors with separate Scaling Factors for Offtaking & Delivering

This option needs additional changes to T2.2 and T2.3, to allow the TLF value to be different for delivering and offtaking Trading Units. Again the changes are redlined against P198 Proposed:

Paragraph 2.2.1(a) shall be amended to read:

2.2.1 For the purposes of the Code, the **Delivering** Transmission Loss Factor**, Offtaking Transmission Loss Factor** and factor α, shall be as follows:

(a) for each BM Unit TLF^{+}_{ij} **and TLF^{-}_{ij}** shall be determined in accordance with Annex T-2;

Paragraph 23 shall be amended to read:

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:

$$TLM_{ij} = 1 + \mathbf{TLF^{+}_{ij}} + TLMO^{+}_{j}$$

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

$$TLM_{ij} = 1 + \mathbf{TLF^{-}_{ij}} + TLMO^{-}_{j}$$

where:

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

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

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.

Changes to Section 7 of Annex T-2 are as follows:

7.4 For each **BSC Season in each** BSC Year the TLFA shall determine the **Seasonal** Zonal TLF (**TLF_{Zs}**) for each Zone according to the following formula:

$$\mathbf{TLF_{Zs}} = \Sigma_p ((\Sigma_s TLF_{Zj} / S_{ps}) * J_{ps}) / \Sigma_p J_{ps}$$

where (in relation to the Reference Year):

S_{ps} is the number of Sample Settlement Periods for a Load Period **within a Load Period which fall within the relevant BSC Season**

J_{ps} is the total number of Settlement Periods falling within the Load Period **within a Load Period which fall within the relevant BSC Season**

Σ_s is summation by Sample Settlement Periods within a Load Period **within a Load Period which fall within the relevant BSC Season**

Σ_p is summation by Load Period **within the relevant BSC Season**.

7.4A For each Sample Settlement Period the TLFA shall determine the Delivering Scaling Factor (β^+_j) and the Offtaking Scaling Factor (β^-_j) according to the following formulae:

$$\beta^+_j = \min(1, \alpha * VL_j / [\ Max_Z(TLF_{Zs}) * \Sigma_Z(QM^+_{Zj}) - \Sigma_Z TLF_{Zs} * QM^+_{Zj})\ ])$$

$$\beta^-_j = \min(1, (1-\alpha) * VL_j / [\ Min_Z(TLF_{Zs}) * \Sigma_Z(QM^-_{Zj}) - \Sigma_Z(TLF_{Zs} * QM^-_{Zj})\ ])$$

where for that Settlement Period:

$Max_Z(TLF_{Zs})$ is the maximum value of TLF_{Zs} for any Zone Z for the BSC Season s in which the Sample Settlement Period j falls;

$Min_Z(TLF_{Zs})$ is the minimum value of TLF_{Zs} for any Zone Z for the BSC Season s in which the Sample Settlement Period j falls;

VL_j is the quantity of heating losses (determined by the TLFA using the Load Flow Model); and

Σ_Z is summation by Zone

7.4B For each BSC Season in each BSC Year the TLFA shall determine the Seasonal Delivering Scaling Factor (β^+_s) and Seasonal Offtaking Scaling Factor (β^-_s) according to the following formula:

$$\beta^+_s = \Sigma_p ((\Sigma_s \beta^+_j / S_{ps}) * J_{ps}) / \Sigma_p J_{ps}$$

$$\beta^-_s = \Sigma_p ((\Sigma_s \beta^-_j / S_{ps}) * J_{ps}) / \Sigma_p J_{ps}$$

where (in relation to the Reference Year):

S_{ps} is the number of Sample Settlement Periods for a Load Period within a Load Period which fall within the relevant BSC Season

J_{ps} is the total number of Settlement Periods falling within the Load Period within a Load Period which fall within the relevant BSC Season

Σ_s is summation by Sample Settlement Periods within a Load Period within a Load Period which fall within the relevant BSC Season

Σ_p is summation by Load Period within the relevant BSC Season.

7.5 For each BSC Year:

(a) the TLFA shall, **not later than 30th November in the preceding BSC Year**:

(i) determine the Adjusted **Seasonal Delivering** Zonal TLF (**$ATLF^{+}_{Zs}$**) **and Adjusted Seasonal Offtaking Zonal TLF (**$ATLF^{-}_{Zs}$**)** for each Zone **and each BSC Season** according to the following formula:

$$ATLF^{+}_{Zs} = TLF_{Zy} * \cancel{0.5}\ \beta^{+}_{s}$$

$$ATLF^{-}_{Zs} = TLF_{Zy} * \cancel{0.5}\ \beta^{-}_{s}$$

(ii) send the Adjusted **Seasonal Delivering** Zonal TLFs **and Adjusted Seasonal Delivering Zonal TLFs** to BSCCo;

(b) BSCCo shall, not later than 31st December in the preceding BSC Year, publish the Adjusted **Seasonal Delivering** Zonal TLF (**$ATLF^{+}_{Zs}$**) **and Adjusted Seasonal Delivering Zonal TLF (**$ATLF^{-}_{Zs}$**)** for each Zone on the BSC Website.

7.6 For each BSC Year:

(a) the **Delivering** Transmission Loss Factor (TLF^{+}_{ij}) and **Offtaking Transmission Loss Factor (**TLF^{-}_{ij}**)** for each BM Unit shall be the Adjusted **Seasonal Delivering** Zonal TLF (**$ATLF^{+}_{Zs}$**) **and Adjusted Seasonal Offtaking Zonal TLF (**$ATLF^{-}_{Zs}$**)** for the Zone in which that BM Unit is located (determined on the basis of the prevailing network mapping statement);

plus knock-on effects to the remainder of 7.6, 7.7 and the TLF definition of Annex X-2 (to reflect that fact that there are now different TLF values for offtaking and delivering)

Option 2 – Ex-post Scaling Factors Per Period (annual zonal TLFs depicted)

For this option, it's the SAA who calculates the scaling factors. Section T2.3.1 amended as follows:

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:

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

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

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

where:

$\beta^{+}_{j} = \min\{1, \alpha * VL_j / [Max_i(TLF_{ij}) * \Sigma^{+}QM_{ij} - \Sigma^{+}(QM_{ij} * TLF_{ij})]\}$;

$\beta^{-}_{j} = \min\{1, (1-\alpha) * VL_j / [Min_i(TLF_{ij}) * \Sigma^{-}QM_{ij} - \Sigma^{-}(QM_{ij} * TLF_{ij})]\}$;

$Max_i(TLF_{ij})$ is the maximum value of TLF_{ij} for any BM Unit in Settlement Period j;

$Min_i(TLF_{ij})$ is the minimum value of TLF_{ij} for any BM Unit in Settlement Period j;

$VL_j = (\Sigma^{+}QM_{ij} + \Sigma^{-}QM_{ij}) - FLP$;

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

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

Additionally, Annex T-2 no longer needs an Adjusted Annual TLF. The TLFA will simply pass the unadjusted TLF values to BSCCo:

7.5 For each BSC Year:

(a) the TLFA shall, not later than 30th November in the preceding BSC Year:

~~(i) determine the Adjusted Annual Zonal TLF ($ATLF_{Zy}$) for each Zone according to the following formula:~~

~~$ATLF_{Zy} = TLF_{Zy} * 0.5$~~

(~~i~~ii) send the ~~Adjusted~~ Annual Zonal TLFs to BSCCo;

(b) BSCCo shall, not later than 31st December in the preceding BSC Year, publish the ~~Adjusted~~ Annual Zonal TLF (~~A~~TLF_{Zy}) for each Zone on the BSC Website.

7.6 For each BSC Year:

(a) the Transmission Loss Factor (TLF_{ij}) for each BM Unit shall be the ~~Adjusted~~ Annual Zonal TLF (~~A~~TLF_{Zy}) for the Zone in which that BM Unit is located (determined on the basis of the prevailing network mapping statement);

5 IMPLEMENTATION OPTIONS

The Proposer has not suggested an Implementation Date for Proposed Modification P204. As P204 utilises the calculation of zonal TLFs as detailed by the solution for the P198 Modification Proposal, it proposed that for P204 follows a similar implementation approach currently being considered for Proposed Modification P198 (earliest date currently 1 April 2008). The Modification Group will use the lead times provided in response to this impact assessment to determine the appropriateness and feasibility of a 1 April 2008 Implementation Date for Proposed Modification P204.

6 ESTIMATED IMPACT OF MODIFICATION ON SYSTEMS, PROCESSES AND DOCUMENTATION

An initial assessment has been undertaken by BSCCo in respect of all BSC systems, documentation and processes, based on the assumption that the Proposed Modification for P204 would consist of the solution for Proposed Modification P198 with the replacement of the 0.5 scaling factor with a new calculation and application in Settlement. Therefore only the additional impacts of Proposed Modification P204 are shown here for clarity. The full impacts of Proposed Modification P198 can be found in the Assessment Report (Reference 1). The non-confidential Party/Party Agent impact assessment responses for Proposed Modification P198 can also be found on the BSC Website (ELEXON - Modification Proposal 198).

The additional impacts of Proposed Modification P204 compared with Proposed Modification P198 are estimated to be (please note that each option requires the calculation of zonal TLFs as per P198):

6.1 Proposed Modification: Options 1a and 1c

6.1.1 BSCCo Impacts

- An annual requirement on BSCCo (from SAA) to create a new data flow to the TLFA (or BSCCo), providing the Zonal Delivering Metered Volume QM^{+}_{Zj} and Zonal Offtaking Metered Volume QM^{-}_{Zj} for each Zone and Sample Settlement Period; and
- A possible minor impact on BSCCo to reflect the revised P204 TLF calculation within relevant documentation.

6.1.2 TLFA Impacts

- An annual requirement for the TLFA to calculate an annual (1a) or four seasonal (1c) scaling factors. The calculation of scaling factors will be based on calculated (unadjusted) TLF values, variable losses estimated by the Load Flow model, and zonal Metered Volumes provided by ELEXON, as described in section 3.3.1 above; and
- An annual requirement to apply the scaling factors to the TLF values, in order to calculate one Scaled Adjusted Annual/Seasonal Zonal TLF value per TLF Zone.

6.1.3 Party Impacts

- A one-off impact on Parties to amend their systems to take account of the revised TLF calculation under P204.

6.2 Proposed Modification: Options 1b and 1d

6.2.1 BSCCo Impacts

- An annual requirement on BSCCo (from SAA) to create a new data flow to the TLFA (or BSCCo), providing the Zonal Delivering Metered Volume QM^{+}_{Zj} and Zonal Offtaking Metered Volume QM^{-}_{Zj} for each Zone and Sample Settlement Period;
- An impact on BSCCo to reflect the revised P204 TLF calculation within relevant documentation;
- A requirement for BSCCo to develop a revised calculation for the Estimated Transmission Losses Adjustment (ETLMO) values used in BMRA calculations, reflecting the revised P204 TLM calculation; and
- A possible requirement to amend BSCCo's Trading Operations Market Analysis System (TOMAS) to reflect the P204 revised TLM calculation.

6.2.2 TLFA Impacts

- An annual requirement for the TLFA to determine two annual (1b) or eight seasonal (1d) scaling factors (separate values for delivery and offtake). The calculation will be based on calculated (unadjusted) TLF values, variable losses estimated by the Load Flow model, and zonal Metered Volumes provided by ELEXON, as described in section 3.3.2 above; and
- An annual requirement to apply the scaling factors to the annual or seasonal zonal TLFs to create TLF^{+} and TLF^{-} for each Zone, where TLF^{+} and TLF^{-} are the Delivering and Offtaking Transmission Loss Factors.

6.2.3 CRA Impact

- Update to CRA to receive the Delivering and Offtaking Transmission Loss Factors (TLF^{+} and TLF^{-}), and forward these to BMRA and SAA.

6.2.4 BMRA Impact

- Amendment to BMRA to apply TLF^{+} and TLF^{-} (annual or seasonal) in the TLM calculation.

6.2.5 SAA Impact

- Amendment to SAA to apply TLF^{+} and TLF^{-} (annual or seasonal) in the TLM calculation.

6.2.6 Party Impact

- A one-off impact on Parties to amend their systems to take account of the revised TLF calculation under P204.

6.3 Proposed Modification Option 2

6.3.1 Panel Impacts

- An annual requirement on the BSC Panel to calculate the Fixed Losses Parameter (FLP).

6.3.2 BSCCo Impacts

- A requirement to calculate Estimated Scaling Factor values ($E\beta^{+}$ and $E\beta^{-}$). This would be done at the same time as (and have the same approval process as) the $ETLMO^{+}_{j}$ and $ETLMO^{-}_{j}$ values;

- A requirement for BSCCo to amend BSC Systems documentation and Code Subsidiary Documents to reflect the revised P204 TLM calculation;
- A possible requirement to amend BSCCo's Trading Operations Market Analysis System (TOMAS) to reflect the P204 revised TLM calculation; and
- A requirement for BSCCo to develop a revised calculation for the Estimated Transmission Losses Adjustment (ETLMO) values used in BMRA calculations, reflecting the revised P204 TLM calculation.

6.3.3 TLFA Impact

- An annual requirement on the TLFA to only calculate unscaled Seasonal Zonal TLF values for each BM Unit (i.e. not to apply the 0.5 Adjustment Factor that formed a part of P198, but does not form a part of P204).

6.3.4 SAA Impact

- Requirement to receive and store the Fixed Losses Parameter (FLP) from ELEXON as and when new values are agreed by the Panel;
- A requirement to amend the TLM and TLMO calculations in the SAA system, to reflect:
    - The inclusion of FLP;
    - The calculation of separate scaling factors for delivery and offtake within each Settlement Period; and
    - The application of scaling factors to the unscaled Seasonal Zonal TLF values.
- Amend Settlement Reports to identify the scaling factors values (β^{+}_{j} and β^{-}_{j}) by Settlement Period.

6.3.5 BMRA Impact

- Requirement to receive and store Estimated Scaling Factor values ($E\beta^{+}$ and $E\beta-$) from BSCCo (typically but not necessarily at the same time as ETLMO values); and
- Requirement to apply Estimated Scaling Factor values when using TLF values to calculate System Prices or Bid Offer payments.

6.3.6 Party Impact

- A one-off impact on Parties to amend their systems to take account of the revised TLM calculation under P204.

7 DEVELOPMENT PROCESS

For the purposes of the impact assessment, respondents should assume that P204 would be implemented as a stand-alone development project managed by BSCCo.

8 TERMS USED IN THIS DOCUMENT

Other acronyms and defined terms take the meanings defined in Section X of the Code.

Acronym/Term	Definition
Ex-ante	Based on forecast data.
Scaling Factor (β)	The Factor to be used in adjusting the Adjusted Annual/Seasonal Zonal TLF instead of scaling factor value of 0.5.
Transmission losses	The energy lost during the flow of power across the Transmission System (calculated as the difference between total generation and total demand).
Transmission Losses Adjustment (TLMO)	The parameter for allocating the proportion of transmission losses which are not allocated through the Transmission Loss Factor, and which is applied on a uniform basis.
Transmission Loss Factor (TLF)	The parameter for allocating some or all transmission losses on a non-uniform basis, and which is currently set to zero.
Transmission Loss Multiplier (TLM)	The factor used to scale BM Unit Metered Volumes in Settlement in order to allocate transmission losses to Parties.
Variable losses	The element of transmission losses which occurs through the heating of transmission lines, cables and transformers, and which increases with the current (and associated power flow) and length of line in which it flows.

9 DOCUMENT CONTROL

9.1 Authorities

Version	Date	Author	Reviewer	Reason for Review
0.1	31/07/06	Justin Andrews	P204 Modification Group	For Modification Group review
0.2	03/08/06	Justin Andrews	P204 Modification Group	For Modification Group review
1.0	11/08/06	P204 Modification Group	BSC Parties, BSC Party Agents, Transmission Company, Core Industry Document Owners	For impact assessment

9.2 References

Ref.	Document Title	Owner	Issue Date	Version
1	P198 Assessment Report ELEXON - Modification Proposal 198	BSCCo	04/08/06	1.0
2	P200 Assessment Report ELEXON - Modification Proposal 200	BSCCo	04/08/06	1.0
3	P203 Assessment Report ELEXON - Modification Proposal 203	BSCCo	04/08/06	1.0
4	Requirements Specification for Proposed Modification P198 'Introduction of a Zonal Transmission Losses Scheme' ELEXON - Modification Proposal 198	BSCCo	13/02/06	1.0

9.3 Intellectual Property Rights, Copyright and Disclaimer

APPENDIX 1. NATIONAL GRID ANALYSIS OF FIXED LOSSES

Please see separate attachment of National Grid initial analysis of level of fixed losses, attachment 1A.

Level and Variability of Fixed Transmission Losses

P204 Modification Group - 1 August 2006

Andrew Truswell

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Fixed Losses – What are they?

- Circuit shunt losses – cable dielectric & corona
- Transformer iron losses

- Comprise (very) approximately 20-30% of losses
- No great wealth of figures on levels of fixed losses
- Only figure published by National Grid is in Seven Year Statement

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Fixed Losses – SYS Data in Table 7.4

Category	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13
Transmission Heating Losses excluding GSP Transformers (MW)	723	775	851	871	758	686	908
Fixed Losses (MW)	**268**	**269**	**285**	**285**	**285**	**285**	**285**
GSP Transformer Heating Losses (MW)	126	135	146	148	159	162	171
Generator Transformer Heating Losses (MW)	154	158	149	152	121	124	135
Total Losses	1271	1337	1431	1456	1323	1257	1499
ACS Peak Demand (MW) excluding Losses and Station Demand	61739	62634	62438	64285	65032	65752	66473
Total Losses as percentage of Demand	2.06	2.13	2.29	2.26	2.03	1.91	2.26

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Fixed Losses – Variability

- Figures in SYS Table 7.4 effectively represent a 'worst case scenario'
  - ACS Peak GB Demand
  - Intact network
  - Assume bad weather – rain and snow – as winter peak
- However, fixed losses relatively insensitive to load
- Type of equipment used in the construction of the system is important, but difference between intact and outage configurations is relatively immaterial

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Fixed Losses – Effect of Weather

- Weather conditions will affect corona
- SYS suggests that “if ‘heavy rain’ or ‘wet snow’ prevails across GB… ‘fixed’ losses could be some 100MW or more higher”
- Figures in Table 7.4 are worst case, so in average weather conditions losses could be 100MW less
- In very good weather conditions could be even less
- So weather is by far the biggest driver

Fixed Losses – Potential Ways Forward

- National Grid could provide some more generic data on weather effects
- However, in practice, ‘fixed losses’ are simply the difference between variable and total losses
- Therefore, undertake modelling using existing snapshots?
- Would calculate volume of variable losses using TLFs
- Network data would not be 100% accurate, but differences should be immaterial
- May not be appropriate for National Grid to undertake this?
- Indeed, PTI may have effectively done it already?

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