POSSIBLE BSC RULES FOR F-FACTORS

A Report for A Consortium of UK Generators

Prepared by NERA

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1. INTRODUCTION AND DEFINITIONS

This report[1] spells out the changes that would be needed in the BSC to implement "F-factors" as a hedging mechanism against the introduction of modification P75, P82 or any other modification that would change the value of TLF_{ij} under the current BSC.

Under the F-factor proposal, each BMU would be allocated losses on the following basis:

- in the case of existing BMUs, in relation to a fixed quantity of output or consumption (F), the BMU would receive an allocation equal to 45% or 55% of average losses, as at present;
- in the case of new BMUs, in relation to a fixed quantity of output or consumption (F), the BMU would be charged losses based on the transmission loss factor (TLF) applicable to it in the year when it commissions;
- for the difference between the fixed quantity (F) and actual production or consumption (QM), the BMU would receive an allocation equal to the future TLF_{ij} loss factor applicable to it (i.e., TLF_{ij} * (QM-F));
- any remaining balance of losses (positive or negative) would be allocated to each BMU as a uniform additive shift in a 45/55 split between generation and suppliers, as at present.

In our proposal we base F-factors on metered volumes in the four whole quarters ending at least a month prior to a BSC Panel decision to introduce non-zero TLFs. For a BSC Panel decision in November or December 2002 or in January 2003, this period would cover October 2001 to September 2002, which avoids the untypical period just after NETA was introduced, and also prevents results from being biased by behaviour during the months when the decision is known. F-factors are defined on a monthly basis in order to average out any unexpected variation in output or consumption (such as outages) from particular days in a month. A monthly approach may also allow some simplification of the BSC payments, which are settled monthly in arrears.

The F-factor scheme provides hedging for a 15-year period as this reflects the typical bank financing timescales for generation. There is a differential treatment of generation (injections) and demand (withdrawals); as generators are in general more vulnerable to stranding issues as a result of changes in loss factors. Demand F-factors are scaled down over 15 years and demand may not opt out of the scheme. Generation F-factors are fixed for 15 years and participants must notify the relevant BSC Agent if they wish to be covered by the F-factor scheme for a 15-year period.

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2. CHANGES TO THE BSC FOR P75 OR P82

In the following we assume that P75 or P82 or any other modification that would change the value of TLF_{ij} under the current BSC, would be implemented in the BSC code by modifying Schedule T, Section T2.2.1 of the BSC, to the following (amendment in ***bold italics***):

> ***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} for all BM Units defined in accordance with the BSC***
>
> ***(b) α = 0.45.***

The F-factor scheme is implemented by modifying section T2.3 of the BSC, which we transcribe below as it currently stands in V6.0 of the code:

> ***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:

$$TLMO_j^+ = \frac{-\left\{\alpha\left(\sum^+ QM_{ij} + \sum^- QM_{ij}\right) + \sum^+ (QM_{ij} * TLF_{ij})\right\}}{\sum^+ QM_{ij}}$$ ***; and***

$$TLMO_j^- = \frac{(\left\{(\alpha - 1)(\sum^+ QM_{ij} + \sum^- QM_{ij}) - \sum^- (QM_{ij} * TLF_{ij})\right\}}{\sum^- QM_{ij}}$$ ***; and***

$\sum^+$ ***represents the sum over all BM Units belonging to Trading Units that are delivering Trading Units in the Settlement Period;***

$\sum^-$ ***represents the sum over all BM Units belonging to Trading Units that are offtaking Trading Units in the Settlement Period.***

3. IMPLEMENTATION OF F-FACTORS

We implement F-factors by:

- modifying T2.3.1 of the current BSC (which defines the TLMs); and
- adding an extra section (T2.3.2) in which F-factors and applicable loss factors are defined.

For ease of exposition, we describe these sections in reverse order.

3.1. Explanation of F-factors Definition (T2.3.2)

We base F-factors (F_{ij}) on metered volumes over a "Baseline Period" – a continuous period of four whole quarters ending at least a month prior to the BSC Panel's decision to implement a modification to change TLFs. (A longer period might be desirable, to smooth out once-off variations in output and consumption, but would require a combination of Pool and BSC data.) F-factors are defined on a monthly basis in order to average out any unexpected shocks (such as outages) from particular days in a month.

Conceptually a generator will be assigned a positive F-factor and a demand point will have a negative F-factor; however some BM units may sometimes inject into the system and at other times withdraw from the system. To accommodate for this we calculate two types of average half-hourly metered quantity allowances, one applicable for a BM unit when it is delivering ($QMHA^+$) another applicable to a units when it is offtaking ($QMHA^-$). The following gives a stylised account of how this calculation is performed.

- For each BM unit in operation before the start of the Baseline Period, we calculate the average half-hourly metered delivering quantity (QMHA+) - for each settlement period ***t*** and each month ***m*** within the Baseline Period (eg October 2001 to September 2002) – taking the average of positive metered quantities in period ***t*** for that BM unit over each day of the month ***m***. In total there are 48 * 12 values for each BM unit. These values are stored and kept as standing data for the calculations.

- For each BM unit i not in operation before the start of the Baseline Period, we calculate the average half-hourly metered delivering quantity (QMHA+) - for each settlement period ***t*** and each month ***m*** within the Baseline Period–

  - taking the average load factor for period t of all exporting BM units in existence over each day of the month m and; multiplying it by

  - the generation capacity of BM unit i (GC_i)

- For each GSP group we define average half-hourly metered offtaking quantity (QMHA-) for a period t and a month m – taking the average of period t non-positive metered quantities over each day of the month for all BM units which belong to the GSP group.

Once the QMHA standing values are defined they need to be assigned to the F-factor of each BM unit applicable in each ***current*** period ***j***. BMUs that are delivering, and which have opted for F-factor hedging, are assigned their corresponding QMHA+ while BMUs that are taking power off the system (ie $QM_{ij}<0$) are assigned a share of the QMHA- for their GSP group equal to their share of total metered consumption within their GSP group.

Section T2.3.2 of the BSC would be structured as follows

- Section T2.3.2.1 defines the standing data QMHA+ and QMHA- values

- Section T2.3.2.2 makes hedging optional for injections into the system by defining variable $\boldsymbol{HED_i}$

- Section T2.3.2.3 matches the historic QMHA values with the F-factor of each BMU for the current settlement period (for which losses are being calculated)

- Section T2.3.2.4 defines loss factor applicable to the F-factor quantity F (ie for existing BMUs 45/55 allocation between generation and demand as at present)

3.2. Adjustment of TLMs for F-Factors (T2.3.1)

This section calculates the shift variables $TLMO^+$ and $TLMO^-$ needed to ensure that losses are split 45/55 between generators and suppliers. Since F-factors affect the amount of losses allocated to each BMU, the definition of these shift variables has to be amended accordingly.

4. DEFINITION OF STANDING DATA (T2.3.2)

4.1. Definition of Standing Data (QMHA) for Existing BMUs (T2.3.2.1)

2.3.2.1 The date on which the BSC Panel approves a modification to the BSC that changes the values of TLF_{ij} such that they no longer equal zero shall be known as the TLF Decision Date. The Baseline Period shall then be the latest period covering four successive whole quarters (January to December, March to February, June to May or October to September, as appropriate) that ends at least one month before the TLF Decision Date.[2]

For each month m in the Baseline Period, the monthly average half-hourly metered reference delivering quantity for each BM unit i, in settlement period t of every day in month m, $QMHA^{+}_{imt}$, will be calculated as described in this section and kept as standing data stored in a database to be used in the calculations described in sections T2.3.2 and T2.3.1.

For each month m in the Baseline Period the monthly average half-hourly metered reference offtaking quantity for each GSP group g, in settlement period t of every day in month m, $QMHA^{-}_{gmt}$, will be calculated as described in this section and kept as standing data stored in a database to be used in the calculations described in sections T2.3.2 and T2.3.1.

(a) For all BM Units in existence before the start of the Baseline Period, $QMHA^{+}_{imt}$, will be calculated as

$$QMHA^{+}_{imt} = \frac{\sum_{mt} \max(QM_{it}, 0)}{D^{+}_{mit}} * YY^{+}$$

where:

- ***YY+ is an indicator, which is initially set to 1 and takes on the value of zero 15 years after a modification comes into effect that results in TLF_{ij} no longer being zero;***
- ***QMit is the quantity metered of BM Unit i in half hour t; and***
- ***D^{+}_{mit} is the number of days in month m in which BM unit i has a positive metered quantity in settlement period t;***
- ***$\sum_{mt}$ denotes the summation over all the days in month m for period t in each day;***

provided that:

[2] Hence, if the BSC Panel approves a change in TLFs in December 2002, the Baseline Period would be October 2001 to September 2002.

- ***if the value of D^{+}_{mit} is zero in any month m, $QMHA^{+}_{imt}$ shall for that month be set equal to zero.***

(b) For all GSP groups, $QMHA^{-}_{gmt}$, will be calculated as

$$QMHA^{-}_{gmt} = \frac{\sum_{gmt} \min(QM_{xt},0)}{D^{-}_{mit}} * YY^{-}$$

where

- ***QM_{xt} is the quantity metered of BM Unit x in half hour t;***
- ***D^{-}_{mit} is the number of days in month m in which BM unit i has a negative metered quantity in settlement period t;***
- ***$\sum_{gmt}$ denotes the summations over all BMUs in GSP group g over all the days in month m for period t in each day; and***
- ***YY^{-} is an indicator which phases the F-factor allocation for withdrawals and takes on the value of $\max(1-\frac{(YC-Y0)}{15},0)$, where YC is the year in which the current financial year ends and Y0 is the end year of the financial year in which a modification comes into effect that results in TLF_{ij} no longer being zero;***

provided that:

- ***if the value of D^{-}_{mit} is zero in any month m, $QMHA^{-}_{imt}$ shall for that month be set equal to zero.***

4.2. Definition of Standing Data (QMHA) for New BMUs (T2.3.2.1)

The following section devises the F-factor applicable to new BMUs, ie, those coming into existence on or after the start of the Baseline Period.[3] In practice, this rule will apply only to new generators, since it uses the term Generation Capacity which, for offtaking BMUs will equal zero.

(c) For all BM Units not in existence beforethe start of the Baseline Period, $QMHA^{+}_{imt}$, will be calculated as

$$QMHA^{+}_{imt} = ALDF_{mt} * GC_i * YY_i$$

[3] In the example given above, the Baseline Period starts on 1 October 2001.

where

- ***YYi is an indicator, which is initially set to 1 and takes on the value of zero 15 years after the latest of the following two dates: (1) the earliest date in which BM unit i registered in the BSC a generation capacity (GC) strictly greater than zero ; and (2) the date a modification comes into effect that results in TLFij no longer being zero.***
- ***GC_i is the generation capacity of BM unit i (as defined in section K3.4.8 of the BSC)***
- ***$ALDF_{mt}$ is the average load factor in month m for half hour t and is defined by***

$$ALDF_{mt} = \left(\frac{\sum_x^{OLD} QMHA_{xmt}^{+}}{\sum_x^{OLD} GC_{xm}} \right)$$

where $\sum_x^{OLD+}$ ***denotes the sum over all BM units in existence before the start of the Baseline Period for which*** $QMHA_{xmt}^{+} > 0$; $QMHA_{xmt}^{+}$ ***is defined as in (a) above; and GC_{xm} is the generating capacity of BM unit x at the end of month m.***

5. GENERATORS OPTING FOR HEDGING (T2.3.2.2, T2.3.2.3)

5.1. Time for Exercising Hedging Option (T2.3.2.2)

BMUs that are injecting into the system will have a zero F-factor unless they notify the CRA that they want to set their hedging on flag HED_i to 1.

> ***2.3.2.2 The hedging flag for BMU unit i ,HED_i, will be set to 0 unless the Lead Party of said unit notifies the CRA of its intention to set its hedging flag equal to 1. The Lead Party must submit this notification no less than 1 day before the latest of the following two dates: (1) the earliest date on which BM unit i registered in the BSC a generation capacity (GC) strictly greater than zero ; and (2) the date on which a modification comes into effect that results in TLF_{ij} no longer being zero. Once set equal to 1, HED_i will remain at that value until 15 years after a modification comes into effect that results in TLF_{ij} no longer being zero.***

5.2. Opting for F-Factor Hedging (T2.3.2.3)

This section takes the standing data (QMHA) for all current BMUs and converts it into F-factors eligible for allocation of transmission losses. F-Factors are set to zero for injecting BM units that have not opted for the F-factor hedging (ie $HED_i=0$)

> 2.3.2.3 ***Let M(j) denote the month in the Baseline Period which corresponds to the month to which period j belongs; and let T(j) denote the half-hour in the day to which period j belongs.***
>
> ***In respect of each Settlement Period, for each BM Unit, the F-factor shall be calculated as follows:***
>
> ***(a) for all delivering BM Units (defined as those for which $QM_{ij}>0$):***
>
> $$F_{ij}=HED_i * QMHA^{+}_{M(j)T(j)}$$
>
> ***(b) for all offtaking BM Units (defined as those for which $QM_{ij}<=0$):***
>
> $$F_{ij} = QMHA_{gM(j)T(j)} \frac{QM_{ij}}{\sum^{-}_{GSPG_i} QM_{ij}}$$
>
> ***where:***
>
> - ***g is the GSP Group that the BM Unit i belongs to; and***
> - $\sum^{-}_{GSPG_i}$ ***is the sum over all BMUs in GSP group g for which $QM_{ij}<0$.***

6. DEFINITION OF APPLICABLE LOSS FACTORS (T2.3.2.4)

This section defines the Applicable Loss Factor, ie, the average loss factor applying to the volume in the F-factor. For existing BMUs, the Applicable Loss Factor is the average factor split 45/55 as at present. For new BMUs the Applicable Loss Factor is derived from the average of TLFs in the previous year, in order to allow new entrants to secure the benefits of advantageous location.

2.3.2.4. The values of ALF_{ij} are defined as follows:

(a) For BM units in existence before any modification comes into effect that results in TLF_{ij} no longer being zero, ALF^{+}_{ij} , is given by

$$ALF_{ij}^{+} = \frac{-\left\{a\left(\sum^{+} QM_{ij} + \sum^{-} QM_{ij}\right)\right\}}{\sum^{+} QM_{ij}}$$

(b) The average loss factor for demand, ALF^{-}_{ij} , is given by

$$ALF_{ij}^{-} = \frac{\left\{(a-1)\left(\sum^{+} QM_{ij} + \sum^{-} QM_{ij}\right)\right\}}{\sum^{-} QM_{ij}}$$

(c) For any BMU not in existence before the coming into effect of any modification that results in TLF_{ij} no longer being zero let Z denote the marginal loss charging zone that is applicable to it and let TT be the set of all periods in the 12 months previous to the month in which it registers in the BSC. ALF_{ij}^{+} ***for this unit is then defined as follows***

$$ALF_{ij}^{+} = \frac{\sum_{zTT} \max(QM_{xt}, 0) * TLF_{xt}}{\sum_{zTT} \max(QM_{xt}, 0)}$$

where QM_{xt} is metered quantity of unit x in period t; TLF_{xt} is the transmission loss factor applicable to unit x in period t as defined in section T2.2.1; and $\sum_{zTT}$ ***denotes the sum over all BM units in zone Z over all periods in TT.***

7. USE OF F-FACTORS TO CALCULATE TLMS (T2.3.1)

Once F-factors have been defined as described above, the risk mitigation scheme would then be implemented through the following modification of Section T2.3 of the BSC.

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:

$$TLM_{ij} = 1 + TLF_{ij} + (ALF_{ij}^{+} - TLF_{ij})\frac{F_{ij}}{QM_{ij}} + TLMO_{j}^{+}$$

where

- ***F_{ij} is an amount defined in accordance with section T2.3.2***
- ***ALF^{+}_{ij} is the value defined in T2.3.2.4.***
- ***The adjustment factor that reconciles charges to actual losses is given by***

$$TLMO_{j}^{+} = \frac{-\left\{a\left(\sum^{+} QM_{ij} + \sum^{-} QM_{ij}\right) + \sum^{+}((QM_{ij} - F_{ij}) * TLF_{ij} + F_{ij} ALF_{ij}^{+})\right\}}{\sum^{+} QM_{ij}}$$

where $\sum^{+}$ represents the sum over all BM Units belonging to Trading Units that are delivering Trading Units in the Settlement Period.

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

$$TLM_{ij} = 1 + TLF_{ij} + (ALF_{ij}^{-} - TLF_{ij})\frac{F_{ij}}{QM_{ij}} + TLMO_{j}^{-}$$

where:

- ***Fij is an amount defined in accordance with section T2.3.2***
- ***- ALF-ij is the value defined in T2.3.2.4.***
- ***The adjustment factor that reconciles charges to actual losses is given by***

$$TLMO_j^- = \frac{(\{(a-1)(\sum^+ QM_{ij} + \sum^- QM_{ij}) - \sum^- ((QM_{ij} - F_{ij}) * TLF_{ij} + F_{ij} ALF_{ij}^-)\}}{\sum^- QM_{ij}}$$

where $\sum^-$ represents the sum over all BM Units belonging to Trading Units that are offtaking Trading Units in the Settlement Period.

8. DATA REQUIREMENTS FOR F-FACTORS UNDER T2.3.2

In order to calculate F factors a database must be compiled with metering data for the Baseline Period (eg, October 2001 to September 2002) for each BMU on a half hourly basis.

Generating capacity for each BM unit in this period must also be compiled and kept on file to generate F-factors for generators commissioned after the start of the Baseline Period.