Meeting name	PSRG
Date of meeting	17 August 2010
Paper title	Strawman Scaling Factors for GSP Group Correction
Purpose of paper	For Decision
Synopsis	This document analyses the major sources of error in the SVA market, in order to estimate the most cost-reflective values of the GSP Group Correction Scaling Weights.

1 Introduction

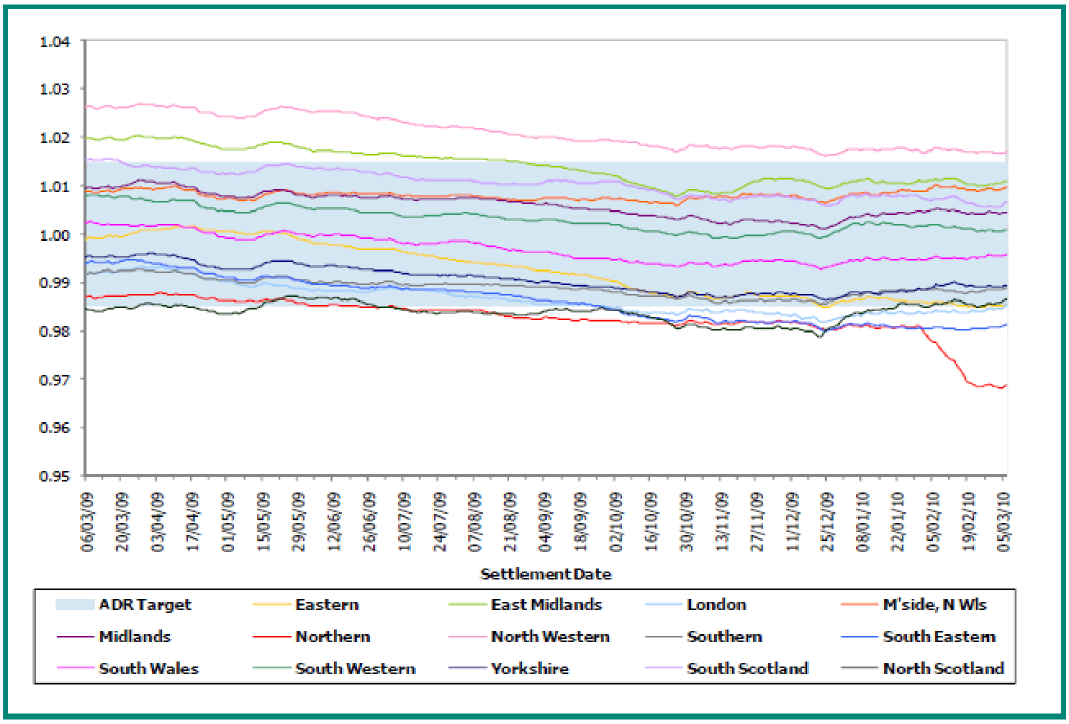
1.1 The equations for GSP Group Correction in paragraph 9 of Annex S-2 of the BSC refer to a GSP Group Correction Scaling Weight (WT_N) for each Consumption Component Class (CCC), which defines how much GSP Group Correction should be applied to that CCC (relative to the others). To date, these Scaling Weights have always been set to 1.0 for NHH CCCs, and 0.0 for HH CCCs i.e. correction applied to NHH consumption only.

1.2 Clearly this is not entirely cost-reflective, in that some of the errors allocated through the mechanism of GSP Group Correction arise from the HH market. The PSRG has therefore asked ELEXON to estimate the different levels of error arising from each CCC, and hence estimate cost-reflective values of W_{TN}. This paper was first presented to the PSRG meeting on 14 July, and has now been updated with comments from that meeting.

2 How Much Energy is Allocated through GSP Group Correction?

2.1 To a first order of approximation, the volumes of energy allocated by GSPGCF sum to zero over the course of a whole year i.e. the errors in settlement are primarily shape errors rather than volume errors. This is demonstrated by the following graph of Annualised Demand Ratios (taken from the most recent Trading Operations Report):

Annual Demand Ratio Values based on Settlement Run Type R2 or later

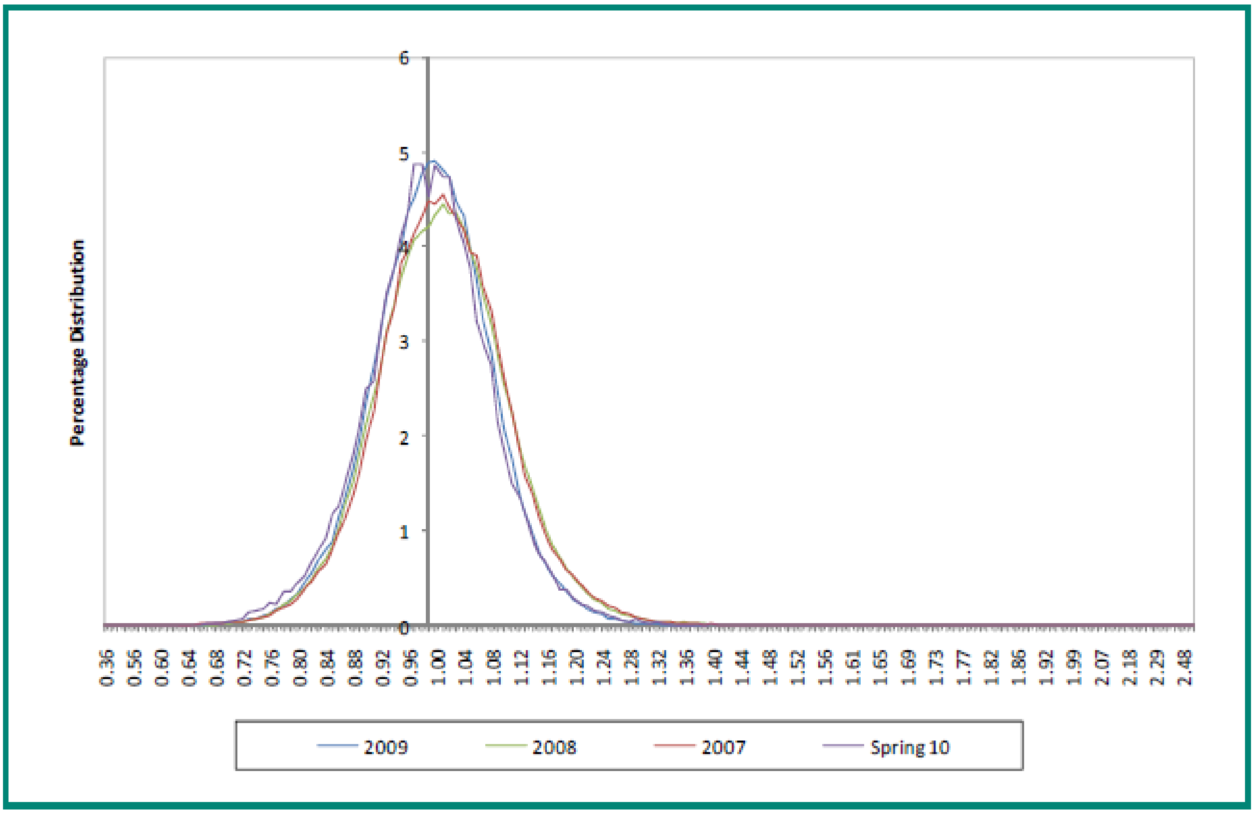


2.2 The Annualised Demand Ratios in the above chart represent the variation between the total annual profiled Non Half Hourly (NHH) consumption and the total annual metered NHH consumption (as deduced from GSP Group Takes and HH consumption). The chart shows that profiled loss-adjusted NHH consumption is too low over the year in some GSP Groups, and too high in others. But the overall range of ADR values for all GSP Groups do appear to be centred around a value of 1.0.

2.3 We believe the reason for ADR values averaging close to 1.0 is that LDSOs are required to include "non-technical losses" in their generic Line Loss Factors. Therefore, some of the discrepancy between the units entering a Distribution System and the units billed to Suppliers will be accounted for through Line Loss Factors (LLFs), not GSPGCF. It should be noted that LLFs are calculated for the next BSC Year with estimates of non technical losses for that year.

2.4 Although the GSPGCF values tend to average to 1.0 over a year, the values in individual Settlement Periods may differ considerably from 1.0, as shown in the following graph (which is also taken from the Trading Operations Report):

Distribution of Half-Hour GSP Group Correction Factors across all GSP Groups



2.5 Although it varies slightly from year to year, the difference between GSPGCF and 1.0 (ignoring the sign, and averaged over all Settlement Periods) is roughly 0.07.

3 A Note on Quantifying Shape Error

3.1 Note that there are potentially two different ways to measure the size of shape errors (i.e. errors that net to zero over the period being considered):

- One approach is to measure the average size of the percentage error in each period (regardless of whether the error is positive or negative). Measured this way, the errors corrected by GSP Group Correction amount to about 7% of total NHH demand (see paragraph 2.5 above).
- The other approach is to measure the percentage of energy that is in the wrong Settlement Period. Measured this way, the error corrected by GSP Group Correction is only 3.5% of NHH demand.[1]

3.2 Both approaches are equally valid, and it is easy to convert from one to the other (by halving or doubling).

3.3 Assuming the total amount of NHH energy is about 180 TWh per year, the 7% error equates to approximately 6 TWh per annum allocated to the wrong Settlement Period (prior to GSP Group Correction).

4 What Components Make up this 6 TWh Shape Error?

4.1 ELEXON has in the past made a number of attempts to assess the various components of error in the SVA market. One of these was the 2004/05 BSC Review ('Review of the SVA Arrangements') the report from which categorised the various types of error as follows:

a) The intrinsic accuracy of components of settlement, such as the accuracy of profiling (thought to be in the range of perhaps 0.5% to 2%), the accuracy of metering (around 1% for individual meters), and the accuracy of Loss Factors

b) Errors due to process failures and non-compliances, such as, for example, errors in energisation status. The BSC Audit has assessed the size of these errors, and concludes they are equivalent to less than 0.3% of the total energy allocated annually by SVA.

c) Inaccuracy due to the use of estimated rather than actual data. The use of Estimated Annual Consumptions (EACs) to provide estimated NHH data in SVA appears to have, in aggregate, only a limited effect on overall accuracy; this is indicated by the relatively small change in total Non Half Hourly volumes between the 3rd Reconciliation Run and Final Reconciliation. This change amounts to about 0.2%%, while the amount of actual data increases from about 80% to about 94%.

4.2 Also in 2004, SVG asked ELEXON to investigate factors that caused ADR values to deviate from 1.0 in some GSP Groups. Arguably this investigation was of less relevance to the setting of GSPGCF, in that it focused on ADR ('volume error') rather than GSPGCF ('shape error'). However, key errors it identified (see SVG40/011) were as follows:

- Possible errors and approximations in the calculation of Line Loss Factors by LDSOs;
- CVA Metering issues
- Energisation Status issues e.g. the volume of energy excluded from settlement due to MPANs incorrectly flagged as de-energised was estimated as 7 TWh per annum (according to the Energisation Status Project Report of March 2003)
- Erroneous EAC and AA values
- Unmetered Supplies

4.3 In addition, the BSC Auditor publishes a report each year that describes any material errors identified in settlement, and assesses their materiality. Over time many of the more significant

[1] Consider two Settlement Periods, each with an uncorrected NHH demand of 100 MWh, but with corrected NHH demand of 93 and 107 MWh respectively. The error in each period is 7 MWh (i.e. 7%). However, GSP Group Correction is only moving 7MWh out of the total 200 MWh, so the percentage of energy allocated to the wrong period (prior to correction) is 3.5%.

errors (such as the errors in de-energisation status referred to above) have decreased in materiality, and are no longer included in the Statement of Significant Matters.

4.4 The following sections of this paper attempt to assess the contribution made by some of the more significant sources of error to the average 7% absolute error in GSPGCF. However, it is important to remember that this 7% figure represents the average absolute **net** error in each period. The total size of all the errors contributing to that 7% may be higher, if some of them act to cancel each other out.

5 Materiality of Profiling Errors

5.1 Appendix VI to the 2004/05 BSC Review attempted to quantify the total impact of profiling error, which it divided into two broad categories:

- Model error i.e. the difference between the half hourly data collected by the load research programme, and the evaluated regression model. This includes the inherent error in the linear regression modelling, and errors arising from applying national profile data to regional GSP Groups. The absolute level of this error (summed over all Settlement Periods in the year) was estimated at **6%**, equating to 3% of NHH energy settled in the wrong period i.e. **5.4 TWh** per annum.
- Load research error i.e. the various errors in the load research data, including sampling error and metering/logger error. This error was estimated as causing up to 2% of total NHH consumption to be wrongly allocated i.e. **3.6 TWh**.

6 Materiality of Approximations in Line Loss Factor Calculation

6.1 According to an overview of distribution losses prepared for Ofgem by Sohn Associates in 2009, the reported volume of total distribution losses is currently about 5% (having decreased from approximately 6% in 2000). The report suggests that not all of this reduction represents a genuine reduction in losses, and some (particularly a large step change in 2002-03) may represent a change in the way losses were calculated.

6.2 The report also provides its own estimates of some of the major components of distribution losses:

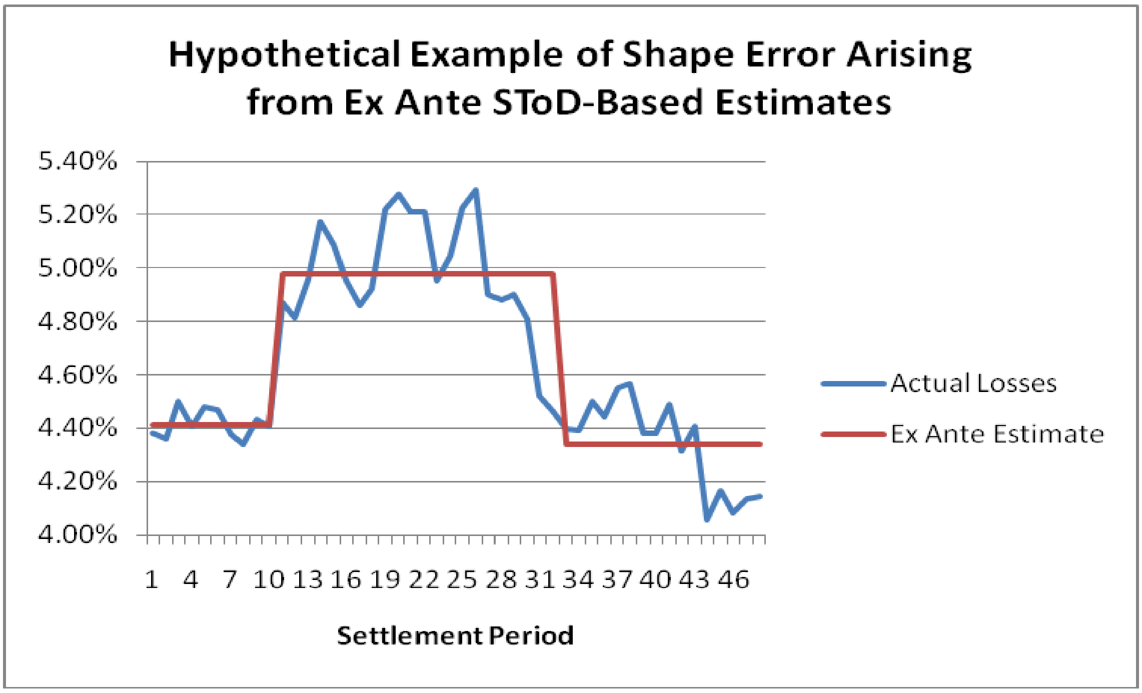
- It estimates technical losses at about 5% of units distributed (comprising one third 'fixed' losses and two thirds 'variable' losses)
- While acknowledging that the volume of theft is extremely hard to quantify, it does quote an 'anecdotal' figure of 1% of units distributed.

6.3 The ADR figures (see section 2 above) suggest that LDSOs are (on average) quite successful at assessing the total volume of losses over a year. However, in any one Settlement Period there may be quite significant errors in the loss factors used in settlement, for the following reasons:

- The settlement Loss Factors are *ex ante* estimates, calculated without any knowledge of actual conditions in that Settlement Period; and
- Additionally, for reasons of simplicity, LDSOs do not provide a separate *ex ante* estimate for each Settlement Period of the year. Instead they provide a single estimated loss factor for each of a relatively small number of Seasonal Time of Day (SToD) time bands.

6.4 The following graph gives a hypothetical example of the errors introduced into settlement by *ex ante* SToD-based estimates. The difference between the red and blue lines represents shape error in Line Loss Factors that will be accounted for through GSP Group Correction Factor:

6.5



Of course, it is difficult to estimate the materiality of these errors because we don't know the real distribution losses in each Settlement Period. One possible (but crude) approach is to look at the shape of losses on the Transmission System (which we do know on a period by period basis). Although the voltage (and hence the level of losses) are very different, many of the underlying physical processes leading to fixed and variable losses (and hence the factors driving the shape of the curve) are the same.

6.6 Analysing transmission losses for two sample time bands shows that:

- Over the night time band (i.e. periods 1-14 all year), average losses are 2.05% of demand. If we use this to estimate losses across the time band (i.e. estimated losses are 2.05% of demand in each period), the average error in our estimated loss values is 10.5% (i.e. 5.25% of losses allocated to the wrong period). Note that this figure only depends on the shape of the loss profile, not the size of the losses.
- Repeating the calculation for a different time band (periods 15-36, August only) gives an error in estimated loss values of 10.3%

6.7 The two time bands used in this calculation were chosen fairly arbitrarily. A more scientific approach would be to algorithmically choose the optimum time bands i.e. the ones that minimise error. Nonetheless, as an initial rough estimate, the data does suggest that shape error in technical losses could amount to 10% of technical losses (i.e. 5% of technical losses allocated to wrong period). Assuming that total units distributed are 300 TWh per annum, and technical losses are 5%, this equates to an error of **0.75 TWh**.

6.8 Shape error in unallocated units (e.g. theft) is even harder to estimate. However, as a rough estimate we will assume that the missing units are 1% of delivered units (as suggested by the Sohn Associates report), and that shape error is 10% (as for technical losses), leading to a total error of **0.15 TWh** from shape error in estimates of missing units.

6.9 Shape errors in technical losses are caused by customers in all CCCs. In contrast, non-technical losses could be seen as more associated with NHH customers (although this may change with smart metering, as HH-capable meters are rolled out to domestic customers).

7 Materiality of Metering Errors

7.1 Each individual meter has standards of accuracy laid out in Codes of Practice and/or legislation. These are typically ±1.5% for HH metering (CoP3 or CoP5), and +2.5%/-3.5% for NHH metering.

7.2 While these are the tolerances for individual meters, the impact on GSP Group Correction depends on the aggregate effect over large numbers of meters. This in turn depends on the distribution of errors of individual meters across the allowed tolerances, which we do not know.

8 Summary of Error Components

8.1 Based on the above discussions, the key components of error for which we have been able to make some sort of estimate are as follows:

TABLE 1 – STRAW MAN SUMMARY OF MAJOR ERRORS IN GSPGCF		
Source of Error	**Total Energy in Wrong Period (Summed over Periods in Year)**	**CCCs Giving Rise to This Error**
Profile Error (from the modelling)	5.4 TWh	NHH only i.e. **3%** allocation error for NHH consumption and losses
Profile Error (from the load research)	3.6 TWh	NHH only i.e. **2%** allocation error for NHH consumption and losses
Shape Errors in Estimation of Technical Losses	0.75 TWh	HH + NHH i.e. **5%** allocation error for all line losses
Shape Errors in Estimation of Non-Technical Losses (e.g. theft)	0.15 TWh	NHH losses only i.e. **1.6%** allocation error for NHH consumption

8.2 Errors **not** included in table 1 are as follows:

- Errors in the total volume of losses (i.e. volume error as opposed to shape error)
- Errors arising from the finite accuracy of metering (see section 7 above)
- Errors arising from process failures in the SVA arrangements e.g. incorrect de-energisation status, large EAC/AA. The findings of the BSC Audit suggest that these are reducing, and are now small relative to the errors in table 1.
- Errors arising from errors in UMS inventories, or the estimation of UMS consumption.

8.3 Based on the very approximate analysis in table 1, we have identified 5% of allocation error for NHH consumption; 11.6% of allocation error for NHH losses; 5% of allocation error for HH losses; and no error significant enough to quantity for HH consumption. This suggests that Scaling Weights (WT_N) for the various Consumption Component Classes should be set as follows:

- 1.0 for NHH consumption (i.e. CCCs 17, 18, 19, 32 & 33);
- 2.3 for NHH line losses (i.e. CCCs 20, 21, 22, 34 & 35);
- 1.0 for HH line losses (i.e. CCCs 3, 4, 5, 7, 8, 11, 12, 13, 15, 16, 25, 26, 30 & 31); and
- 0.0 (as currently) for HH consumption (i.e. CCCs 1, 2, 6, 9, 10, 14, 23 and 28).

8.4 Note that the absolute values of the Scaling Weights are irrelevant – it is only the relative differences between them that has a material impact. We are therefore proposing to leave the Scaling Weights for Non Half Hourly consumption fixed at 1.0, and set all other Scaling Weights relative to those.

8.5 The benefit of more cost-reflective Scaling Weights needs to be assessed against the costs of changing systems and processes to handle amended values. Therefore these costs should be established through an impact assessment on the BSC and all other impacted parties, e.g. Suppliers, agents, distribution businesses.

8.6 If the size of the NHH market falls significantly in the future (due to wider adoption of HH settlement), the need for cost-reflective Scaling Weights will become stronger, in order to avoid placing excessive HH costs on NHH customers.

8.7 One possible avenue for further analysis would be to evaluate the appropriate Scaling Weights for Non Half Hourly micro-generation. The profiles for micro-generation (based on deemed switching times) will be less accurate than demand profiles, and therefore a CCC higher than 1.0 would be appropriate. However, given the very low level of energy settled in these CCCs this is not currently a material issue.

9 Recommendations

9.1 We invite you to:

a) **CONSIDER** the above analysis of the major error components in GSP Group Correction; and

b) **AGREE** that we should issue an industry impact assessment of applying GSP Group Correction to the HH market, based on 'straw man' Scaling Weights of 1.0 for NHH consumption, 2.3 for NHH losses, 1.0 for HH losses and 0.0 for HH consumption.

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