ELEXON

BSC Modification P223: Cost Benefit Analysis

1 Summary

This cost benefit analysis sets out the main potential benefits for Suppliers through the improvements to the load research sample proposed by P223. It also sets out the main cost impacts on the central processes; namely those performed by the Profile Administrator. The main tenet of the benefits to Suppliers is through the following logic:

A more representative sample → lower sampling error → lower regression error → less volatility in GSP Group Correction → better forecast of Supplier's position → decreased Supplier's imbalance costs.

The main cost benefits can be summarised in the table below:

Total Supplier Benefit (application year)	Total Supplier Cost (one-off)	Central Benefits	Central Costs
£2.3m -£12.1m*	*TBA from Supplier IA*	£20k per year	ELEXON implementation costs = £20-30k PrA implementation costs = £5-10k Total Operational costs =£25k-45k per year**

*These figures are for all Suppliers across all GSP Groups. The benefit to individual Suppliers depends on their Market Share and forecasting capability of the Supplier (range goes from good to poor forecasting) and is based on a reduction in exposure to imbalance costs. It should also be noted that it will take two years before the benefits start to be seen by Suppliers as it takes 1 year to collect the data and a year to analyse and produce the profiles. A sampling rebalancing exercise in terms of addressing shortfalls in the sample by size and regional distribution of the sample customers would ensure that the benefits start to be realised at the earliest opportunity.

** Total operational costs consist of ELEXON £5k per year, PrA costs = no change plus potential Change of Supplier cost of £20k (Proposed) or £40k (Alternative) per year. The potential cost is based on the potential number of customers lost in a year and hence new meter installations required. This cost could rise year on year from £20k to £100k (Proposed) and £40k to £200k (Alternative) over 10 years due to the potential loss of customer on a Change of Supplier.

2 Introduction

This note presents the potential cost benefits of BSC Modification P223. It looks at direct cost benefits to Suppliers and Settlement and looks at the associated benefits/costs to central processes run by the Profile Administrator and ELEXON.

To understand the potential cost benefits of BSC Modification P223 it is necessary to understand the relationship between Profile sampling error and its effect on regression error. The regression error associated with the sampling error will manifest itself in Settlement as increased volatility of GSP Group Correction Factors (GSPGCF). This note presents the relationship between the sampling error and the regression error and suggests the extent to which this error might manifest itself in Settlement. The paper will demonstrate that P223 would reduce the error over time and furthermore there is the potential that the sampling error could increase if no action is taken to address the deteriorating sample.

The paper presents the Scenario modelling that has been undertaken to assess the potential impacts on Suppliers of increases and decreases in GSPGCF volatility.

The paper also explores the impacts on the central processes mainly in the processes in the recruitment and construction of the load research sample.

3 Understanding Sampling Error

The Sampling error is associated with both the size of the sample and the basis upon which the sample has been selected (representative nature of the sample). The error is calculated using the sample size and the sample variance. Larger samples are likely to give a lower calculated sampling error. However, the calculated error means little if the sample has not been selected on a representative basis. A simple example can be used to demonstrate this:

The objective is to calculate the average price of soft drinks based on a sample of 10 products and to calculate the error of the estimate. If two people were sent to various stores and one only selected pints of milk and the other selected randomly from the soft drinks section the results might look as given in Table A below:

Milk Only	Price in Pence	Soft drinks	Price in Pence
Pint A	48	Milk	51
Pint B	52	Coca-Cola	63
Pint C	50	Bottled Water	90
Pint D	54	Lemonade	55
Pint E	50	Orange juice	47
Pint F	52	Squash	75
Pint G	56	IRN BRU	68
Pint H	51	7up	57
Pint I	52	Sprite	70
Pint J	45	Pepsi	58
Mean	51		63.4
Variance	9.3		163.4
Standard error	1.0		4.0

Table A: Soft drinks and milk sample

The milk sample gives a mean estimate of 51p ±1p and the random sample an estimate of 63p ±4p. It can be seen that just because the calculated sampling error (calculated as the Square Root of (Variance/ number of Samples)) for the milk sample is smaller than that of the random sample it does not mean that it is a better estimate of the average price of soft dinks.

4 The Profiling Sampling Error

The profile sampling error is calculated from the demand data collected from the load research sample during the profiling year (the calculation is significantly more complex for a stratified random sample than the example in Table A). The Standard Error (SE) of the mean estimate of demand is calculated for each Settlement Period (17,520 values, 17,568 in a leap year). For ease of interpretation the data is averaged across the year and the sampling error is presented as a single value for a Profile Class. For example, the data collection target for Profile Class 1 is 500 (average number of sample participant data per day in the year). In 2002/03 the actual data collection achieved was 518 and the calculated error gave the following results:

Mean Estimate of Demand = 0.45 kW

Standard Error = 0.025kW

Error expressed as a percentage = 5.55%

This means that the mean estimate of demand was around 450 Watts and the error was ±25 Watts. Although 25 Watts does not seem like a big error on its own, it should be noted that there are over 20 million domestic customers that would be settled using this profile (in reality the calculation of the % error is a little more sophisticated than presented above which uses a percentile of Students T distribution and a calculated number of degrees of freedom to express the value at a confidence interval.). However, this error does not manifest itself directly on Settlement. The error affects the accuracy of the regression estimates which will then manifest themselves in Settlement by misallocating volume. The next section relates the sampling error to the error in the regression process used to calculate the half hourly profile coefficients.

5 Regression Error and Sampling Error

The relationship between the regression error and the sampling error is complex due to the use of multi-linear regressions in the construction of the Settlement profiles. However, a simple linear example can be used to demonstrate the effect. Chart A shows the demand at 17:30 hrs on Spring Saturdays plotted against the noon effective temperature (NET, ºF). This is done for the actual demand and for the actual demand with a sampling error of between 0 and 10%. The line of best fit is calculated for both scenarios and plotted on the chart.

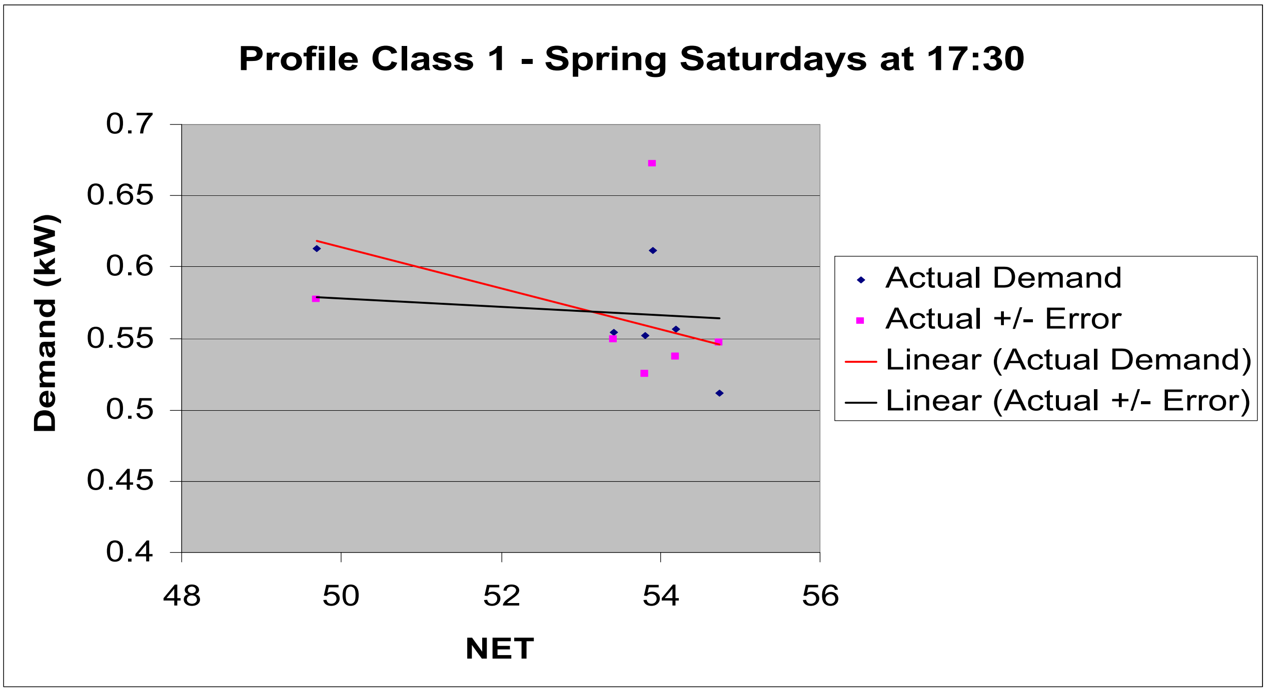


Chart A: Demand versus Noon Effective Temperature (NET) for Profile Class 1 (Spring Saturday at 17:30 hrs)

The error that is likely manifest itself in Settlement is the distance between the two lines and the extent of the error will be dependent on the temperature on the day to which the data is applied. If the Settlement Day has a NET of 53ºF then there will be little error since the lines are close together at that temperature. However, if the Settlement Day was at 50ºF then the error will be much greater. Though the true situation is considerably more complex the analysis can provide indicative data on the relationship between sampling error and regression error. This is explored further in Chart B below which was produced by calculating the net average absolute % error between the lines at each level Standard Error measured over a large number of iterations (10,000 at each % point of standard error). The Chart suggests that a fall of 5% in the sampling error (from 10-5%) would result in approximately 2% decrease in the regression error (3.8-1.9%).

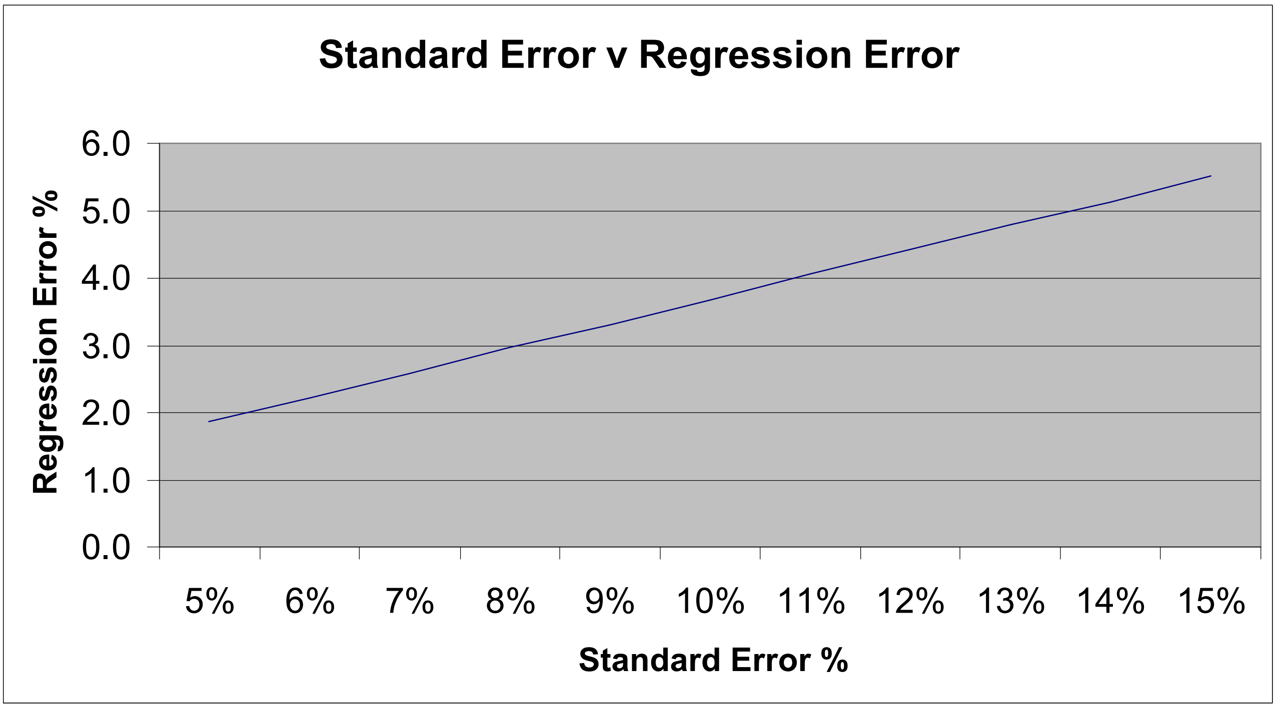


Chart B: Relationship of Standard Error to Regression Error.

These errors still do not directly manifest themselves in Settlement because the profile data divides the year up into proportions. If every Settlement Period had the same error then they would still be in ratio and there would be no Settlement impact. However, it is safe to assume that this will not be the case and for the purposes of the cost benefit analysis it has been assumed that the potential regression error directly affects GSPGCF. The impact will be greater for some Profile Classes than others (e.g. Domestic Profiles provide greater contribution to the total than non-domestic).

It should be noted that there are other sources of profiling error that are not resolved by having more representative samples (e.g. National Profiles, Teleswitch profiling). However, these errors can be ignored since the improvement will be seen over and above the existing error. Therefore, it may be reasonable to assume that **a 2% improvement in regression error may lead to a 2% improvement in GSPGCF.**

6 Scenario Modelling

The extent to which Suppliers are impacted by GSPGCF is dependent on their uncorrected positions, the direction of correction by GSPGCF and their contracted position. This gives four potential states:

1. GSPGCF >1 and the Supplier's uncorrected position is long;
2. GSPGCF <1 and the Supplier's uncorrected position is long;
3. GSPGCF >1 and the Supplier's uncorrected position is short; and
4. GSPGCF <1 and the Supplier's uncorrected position is short.

In each Settlement Period the Supplier's position will be in 1 of the 4 states listed above. The other factors that are likely to define the impact on each Supplier are the Supplier's market share and the accuracy with which the Supplier forecasts its position. However, it is noted that Suppliers have the ability to take historic correction factors into account and can adjust their positions prior to each Settlement Period.

The scenario modelling has therefore looked at several scenarios based on the Supplier's market share and the accuracy of their forecasting in one GSP Group. The model compares the effect of there being no change in GSPGCFs (i.e. the current baseline) with an improvement of between 0 and 2%. The parameters for the scenarios modelled are given in Table B.

Supplier Share % (of Non Half Hourly take)	Forecasting Error		
	Poor Forecasting	**Mid-range Forecasting**	**Good Forecasting**
Large (60%)	0-15%	0-10%	0-5%
Medium (25%)	0-15%	0-10%	0-5%
Small (5%)	0-15%	0-10%	0-5%

Table B: Size of Supplier and Forecasting error scenarios

The three percentages chosen for the size of Supplier are taken from the various sizes of Supplier across all GSP Groups. The values used for the forecasting error (good – mid range - poor) have been based on feedback from the Modification Group which suggests that for a mid-range forecast 5% is a reasonable mid-range forecasting estimate. Therefore a range of 0-10% for mid range forecasts will average out around 5% forecasting over the Settlement year.

7 The Model

The model is an Excel spreadsheet solution which is run with the following defined parameters:

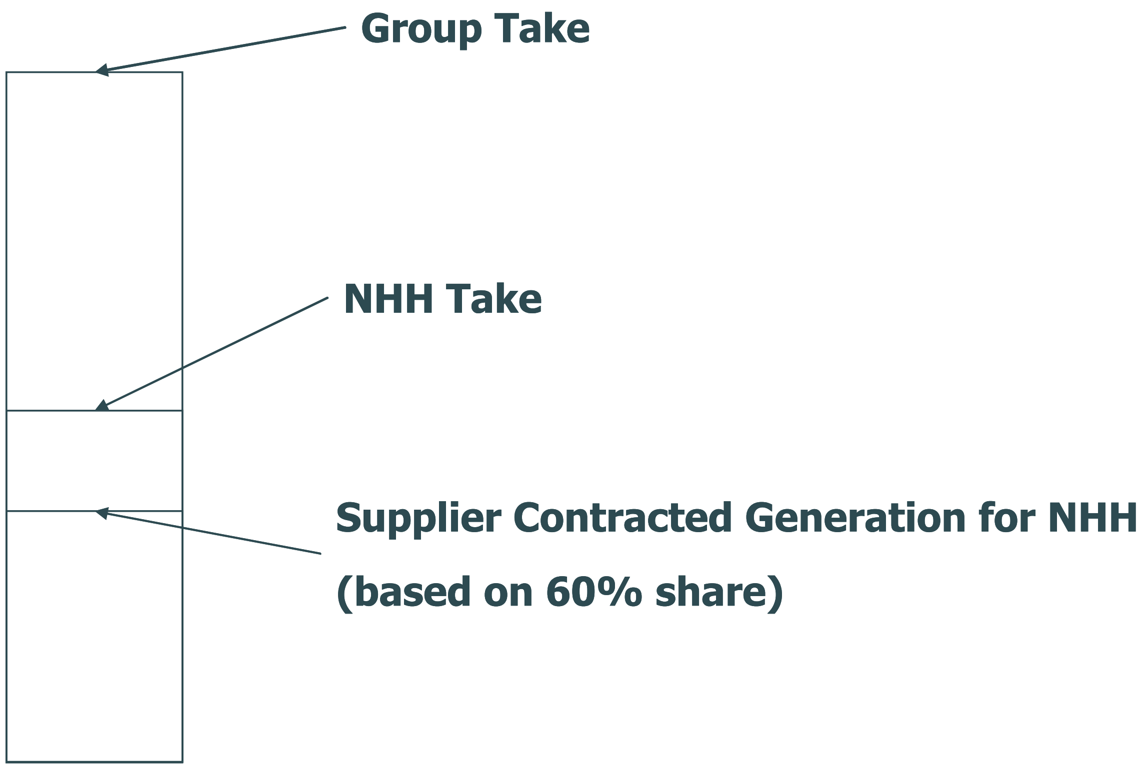
a) The percentage Market Share for a large, medium or small Supplier by GSP Group;
b) The forecasting error for that size of Supplier (poor, mid range or good); and
c) The upper limit of potential improvement to GSPGCF.

Once a set of parameters have been chosen, the model is then run as follows, where it:

1. Randomly determines for each Settlement Period whether the Supplier is long or short and whether GSPGCF is >1 or < 1;
2. Randomly applies an improvement to the GSPGCF which is between 0 and the defined upper limit;
3. Calculates the Supplier's position in £ before and after the GSPGCF is applied;
4. Calculates the net position;
5. Selects the calculation that applies in 1 above;
6. Stores the calculated value for the Settlement Period;
7. Repeats steps 1 to 6 for each Settlement Period in the year; and
8. Calculates the net position for the Settlement year.

The model on which the results presented in this paper are based uses a year's worth of actual GSP Group Takes (2007/08 year) and GSPGCF for on GSP Group (GSP Group E - Midlands). The model also uses the actual System Buy Price and System Sell Price for each Settlement Period for 2007/2008. For ease of calculation the model assumes that the Non Half Hourly (NHH) take is 50% of the GSP Group Take and that the Supplier's contracted generation is proportional to their Market Share. Diagram 1 below shows the situation in any Settlement Period.

Diagram 1: Supplier proportion of NHH Take in relation to GSP Group Take



The model then applies the assumed forecasting error to the Supplier's contracted position to calculate a 'long' and 'short' error. This can be seen in the following Diagram 2:

Diagram 2: Effect on Supplier's contracted position due to Forecasting Error.

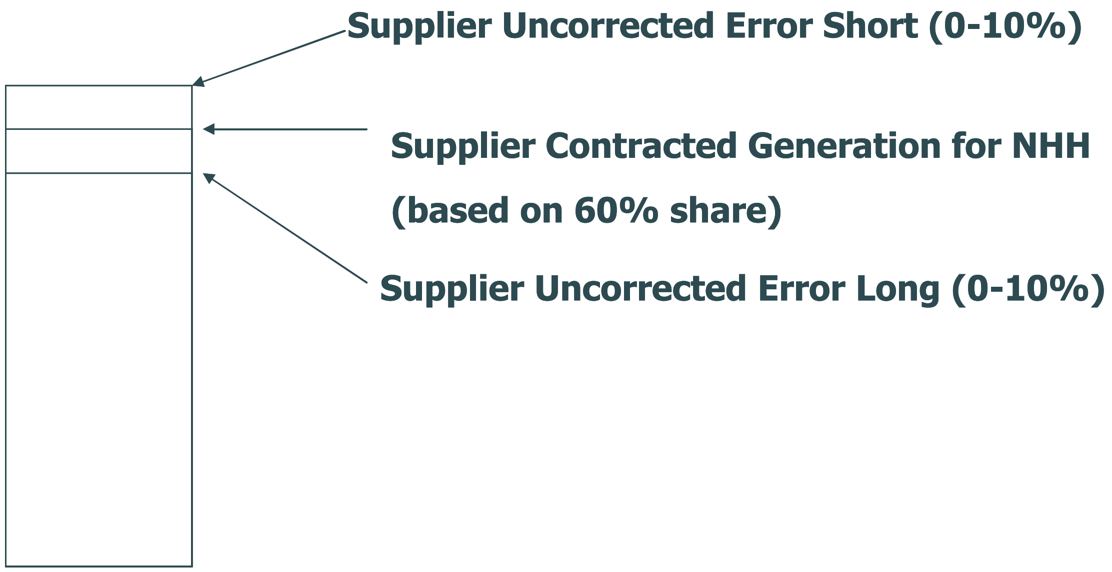
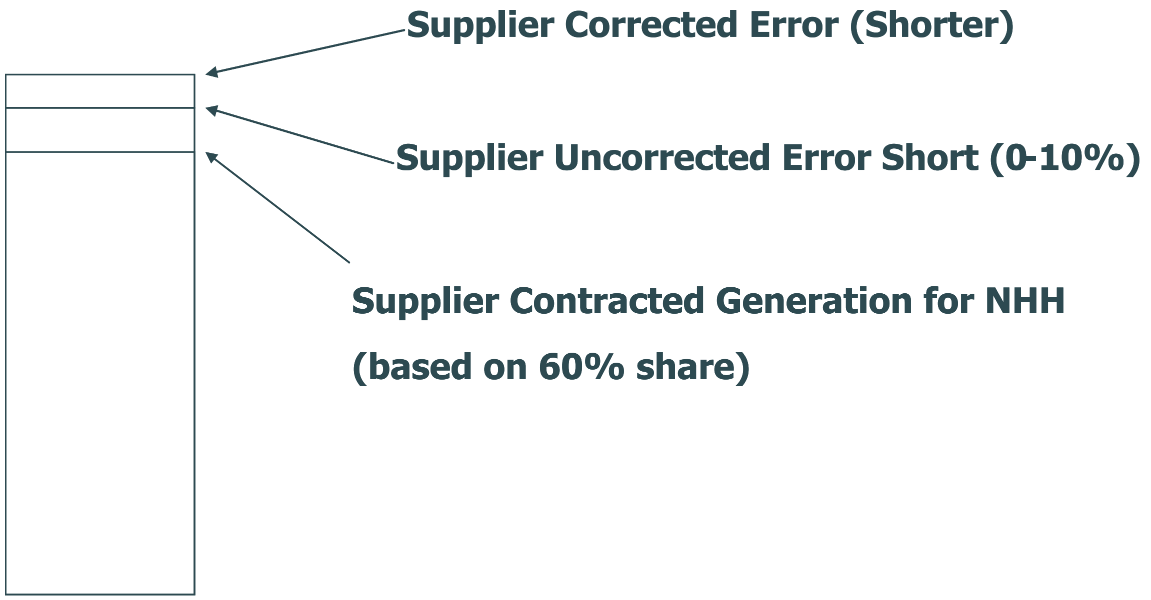


Diagram 3: GSPGCF >1 taking a Supplier to a shorter position

The model then considers the GSPGCF for the Settlement Period and applies it to the 'long' and 'short' energy estimate to assess the Supplier's Corrected position. An example where GCF is >1 and the Supplier is short is given below in Diagram 3.



In the above example the GSPGCF increases the Supplier's short position, exposing it to greater imbalance charges.

The model then determines which of the 4 states the Supplier is in depending on whether the GSPGCF is >1 or <1 and randomly choosing the long or short position:

1. GSPGCF >1 and the Supplier's uncorrected position is long;
2. GSPGCF <1 and the Supplier's uncorrected position is long;
3. GSPGCF >1 and the Supplier's uncorrected position is short;
4. GSPGCF <1 and the Supplier's uncorrected position is short.

The corrected position has the relevant price (SBP or SSP) applied to the energy imbalance and the same calculation is made on the uncorrected position. Theses figures are then netted to calculate the net gain or loss for the Settlement Period.

This process is then repeated for each Settlement Period in the year, varying the forecast percentages within the defined parameter each time a calculation is made. After all Settlement Periods have been calculated a net total for the year is calculated.

This process is then run ten times and an average of the ten runs is calculated. This process can then be re-run but with the GSPGCF adjusted by a defined parameter e.g. between 0 and 2%. This means that in each Settlement Period the GSPGCF is improved by a value of between 0 and 2%. This is achieved by assuming that a GSPGCF of 1 = 100% and a 1% improvement moves a GSPGCF 0.01 closer to 1 (e.g. if the GSPGCF is 1.05 a 1% improvement moves it to 1.04, if the GSPGCF = 0.95 then a 1% improvement moves it to 0.96).

This process is also run 10 times (repeating the calculation for the whole year 10 times) and an average position is calculated. The following example gives the out-turn results for a large Supplier with mid-range forecasting of their position (within 10%) shown in Table C:

Actual GSPGCF		Improved GSPGCF 0-2%	
RUN	Supplier Imbalance costs for year	RUN	Supplier Imbalance costs for year
1	-£6,028,799	1	-£5,500,101
2	-£5,857,456	2	-£5,590,237
3	-£5,772,642	3	-£5,546,879
4	-£5,996,440	4	-£5,636,022
5	-£6,051,653	5	-£5,431,471
6	-£6,019,547	6	-£5,625,593
7	-£5,861,065	7	-£5,403,316
8	-£5,866,857	8	-£5,644,192
9	-£6,049,960	9	-£5,437,655
10	-£5,831,986	10	-£5,710,218
Average	-£5,933,640	Average	-£5,552,568
Difference in cost	£381,072		

Table C: Large Supplier with mid range forecasting, potential improvement in total imbalance costs for year.

Table C shows that improving the GSPGCF between 0-2% could save the Supplier £381,072 per year in one GSP Group. This process has been run for each of the different sizes of Supplier and forecasting scenarios (please note that the actual model can be supplied to interested parties separately on request).

8 Model Results: Supplier Benefits

The following table shows the potential reduction in imbalance costs by size of Supplier per typical GSP Group associated with an improvement in GSPGCF of between 0-2% (based on the results across each scenario modelled):

Supplier Share	Supplier Saving per GSP Group		
	Poor Forecasting 0-15%	Mid-range Forecasting 0-10%	Good Forecasting 0-5%
Large (60%)	£559,552	£381,072	£81,052
Medium (25%)	£208,769	£104,170	£44,620
Small (5%)	£36,436	£28,629	£12,165

Table D: Typical Supplier reduction in imbalance costs

It is likely that each individual Supplier will in reality have a combination of these reductions by GSP Group according to their portfolio and activity in each GSP Group. This analysis is only designed to give 'ball park' estimates of potential benefits to Suppliers given the assumptions in the analysis (see section 10 below).

Furthermore, it should be noted that these reductions are based on a more representative sample and the likely improvement in costs could diminish over a number of years as the sample becomes more and more representative (likely biggest improvement in the first year of application of the new profiles constructed from the more representative sample). However, if P223 were not to be implemented and this resulted in a less representative sample, the risk exists that the Supplier's imbalance charges could increase year on year.

9 Total Supplier Benefits

In order to determine the potential overall effect of P223 across the market for all Suppliers the above results have been extrapolated across all GSP Groups . The market share for each Market Participant Id (MPID) in each GSP Group was calculated and used to extrapolate the results over all Suppliers and all GSP Groups.

The results were extrapolated across all GSP Groups on a per percentage point of share basis by MPID. The value applied to the market share was based on the Small, Medium and Large % as the upper value for the assessment, i.e. an MPID with a 2% Market share and mid-range forecasting in a GSP Group would have a value calculated (using the % of the small Supplier (5%) case as follows:

Annual Cost for 2% Supplier (Mid range)= (5% Supplier/ 5) * 2

= (£28,629/5) *2

= £11,451

The values were calculated for the poor, mid-range and good forecasting Scenarios, and the results were as follows:

Total Supplier reduction in exposure to imbalance costs (across all GSP Groups)		
Poor Forecasting 0-15%	**Mid-range Forecasting 0-10%**	**Good Forecasting 0-5%**
£12.1m	£7.6m	£2.3m

Table E: Total Market for Suppliers in reduction in imbalance costs

10 Assumptions Made

The following assumptions have been made in this analysis in order to facilitate the calculation:

a) That GSPGCF can be improved between 0 and 2% if a more representative sample is achieved through P223 (samples selected on a valid random basis and that the desired sample size is achieved);

b) That NHH take is half of the GSP Group Take in each Settlement Period. This is a reasonable assumption for the purposes of the calculation. The model was tested with both fixed and constrained variable values but the net results showed little change in the ball park estimates since they are net values;

c) That a Supplier's contracted generation is proportional to their market share and is the same in each Settlement Period. This assumption has been made to facilitate the calculation;

d) That the GSP Group chosen for the analysis will be broadly representative of all GSP Groups (Midlands GSP Group_E); and

e) That the Supplier is not deliberately holding a long or short position in each Settlement Period, and that the extent of their imbalance is due to the inaccuracy of their forecasting.

As noted above the analysis undertaken is taken against the current baseline of the GSPGCFs in Settlement and does not estimate the increase in GSPGCFs that could occur were the existing profiling samples were to deteriorate further.

11 Timescales for realisation of benefits

The potential benefits identified will not be gained immediately on the P223 Implementation Date due to the timescales involved in collecting, analysing and producing profiling data. It will take at least two years (one year to collect the data and another to produce the profiles) before the benefits are likely to be seen. Even then the total benefit will not be seen until sufficient sample recruitment and balancing of the sample data has been undertaken. The initial request for sampling data could address particular sample shortfalls in certain regions and consumption bands where the existing samples are known to be weak. Additional benefits will also be seen if new samples are required in the future for different types of customer/usage which are not currently produced, for example a micro-generation sample for export profiling may be required.

12 Central Costs and Efficiency Savings and Benefits

Summary table of costs and savings.

Implementation costs PrA	Implementation costs ELEXON	Operational Costs (per year)	Operational Savings (per year)
£5-10k	*£20-30k*	PrA no change ELEXON £5k CoS costs = £20k-40k per year**	*£20k (recruitment and abort visits)*

** Total operational costs consist of ELEXON £5k per year, PrA costs = no change plus potential Change of Supplier cost of £20k (Proposed) or £40k (Alternative) per year. The potential cost is based on the potential number of customers lost in a year and hence new meter installations required. This cost could rise year on year from £20k to £100k (Proposed) and £40k to £200k (Alternative) over 10 years due to the potential loss of customer on a Change of Supplier.

There are a number of central costs and efficiency savings for the PrA and ELEXON. Some of these costs are quantifiable and are stated below where a reasonable calculation of the benefit can be made:

- There will be no recruitment costs to the PrA for domestic customers (currently the PrA pays £100 per customer as an incentive payment). For example, say 10% of the 2,500 sample recruited a year approx. 125 customers @ £100 - **£12,500** per year);
- There will be potentially less unsuccessful meter installation site visits resulting from space restrictions. The current abort rate is 30% of all new sample recruits then if this was removed by P223 model the aborted visits may be avoided saving **£5,625** per year (75x£75);

These savings will need to be offset against the PrA/ELEXON implementation costs of P223, as well as the implementation costs to Suppliers and Supplier Agents.

Other less quantifiable potential cost benefits and savings in terms of time and effort for the PrA and ELEXON are listed below.

- There should be no active recruitment costs to the PrA, with regards to customers not being willing to sign the PrA's Terms and Conditions. This would provide a cost saving in terms of additional effort to recruit alternative participants. These savings will be potentially offset by the new sample construction requirements;
- ELEXON/PrA cost savings regarding active recruitment costs to address shortfall in samples;
- There would be no need to chase Suppliers for customer data to 'top up' the samples, saving effort for ELEXON and Suppliers. However, this cost has not been quantified;
- The sample participant would have one meter instead of the current two meters (NHH settlement and PrA HH meter). Therefore only one MOA will be associated with the metering system instead of two under the current model. There may be savings for the Supplier with this. However, this saving has not been quantified;
- Additionally, it should be recognised there has already been significant effort expended by SVG, Panel, market participants, ELEXON and the PrA in support to the previous Issues, i.e. Issue 21, Issue 29. However, the cost of this effort has not been quantified.

13 Neutral Central Costs

Under P223 there are a number of additional costs that will be cost neutral since these costs are already borne by the PrA and ELEXON. These include:

- The cost of the HH metering system;
- The installation costs for the metering system;
- The air-time contracts for dialling the metering system.

14 Potential Central Cost Dis-benefits

A recent Ipsos MORI poll found that 19% of electricity customers had changed Supplier during 2007.

Under the Proposed Modification, the New Supplier following a Change of Supplier may choose to discontinue the customer in the sample. In such circumstances, the New Supplier must provide an alternative replacement customer.

If 10% of the sample (250 customers – i.e. roughly half of the 19% who change Supplier) were to be discontinued and replaced each year following a CoS then the additional cost of replacing the sample participants (new metering and installation costs circa £400) could result in an increase in central costs of £100,000 per year which would be funded by the PrA (and ultimately recouped from Parties as part of SVA Costs under the BSC). However, the full impact of this dis-benefit will only be felt at the point where all sample participants are recruited under the new model. If in the first year we recruit 10% of the sample then the cost of replacement would only be 25 *£400 = £10,000. This exposure is more significant if the Alternative Modification were to be approved since, under the Alternative, customers are automatically retired from the sample upon a CoS and no replacement customer is recruited until the following annual recruitment round. If 19% of the 2,500 sample customers were lost and replaced each year, this equates to central costs of £190,000 per year (based on new metering and installation costs of £400 per customer) which would ultimately be recouped from Parties. Once again the full impact of this dis-benefit will not be realised until the whole sample has been recruited using the new model.

Further information regarding the number of sample participants who could be lost on a CoS can be found in ELEXON's separate note 'P223 – Number of customers likely to be requested from Suppliers'.

It should also be noted that, if such a significant proportion of sample customers are lost per year, there is the possibility that the SVG may wish to increase the target sample size in order that there is no deterioration in data. The SVG has the ability to review the sample size at any time, and this would not form part of P223. However, any increase in target sample size would add central costs of £400 per additional customer.

Ideally, sample participants would be retained on a CoS to mitigate these potential costs. However, the central costs of losing and replacing customers will need to be balanced against the costs to Suppliers of putting in place processes to retain customers on a CoS.

15 PrA Operational Costs impacting ELEXON and BSC Parties

There will be a financial benefit to the PrA in providing Agency Services for MSIDs to which their Agents are appointed. This benefit will be a cost to ELEXON and ultimately BSC Parties. However, these costs will be neutral to Suppliers that would have had to pay the costs if their own Agents were providing normal NHH services.

16 Forward Looking Cost Benefits

There are potential cost benefits looking forward if P223 were to be implemented. The model where the PrA nominates its agents will facilitate a more competitive re-procurement of the PrA Contract since the PrA will no longer be required to have MOA, HHDC and NHHDA capabilities itself (i.e. it can nominate other entities to act as these agents on its behalf). The PrA role could be significantly reduced to the management of its Agents and production of the final profile data bringing significant cost benefits. However these costs cannot be quantified until a re-procurement is initiated.

