DCP 266 Method GM model r7678

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2. This document describes a Method GM model developed for the DCP 266 working group.

Overview of model structure

3. Method GM is a new concept, combining a method M (price control disaggregation model) and a method G model which was introduced to resolve the circularities that would be introduced into the CDCM by DCP 266 through an iterative process.

4. The method G model incorporates most of the calculations in the CDCM. It takes the IDNO discounts expressed in p/KWh and calculates, through an iterative process, the ATW tariffs that would result in the recovery of the target CDCM revenue.

Model input data

5. The input data to Method GM are:

   (a) All of the input data to the CDCM, except table 1038. This is in the sheet labelled Input.

   (b) All of the input data to the method M model. This is in the sheet labelled M(Input).

Model outputs

6. The outputs from Method GM are in sheet "G-Discounts". They are:

   (a) Table 4401: CDCM discount percentages for each tariff. These are used in table 1038 of a post-DCP 266 CDCM model. These discounts are capped at 100 per cent.

   (b) Table 4402: All-the-way reference p/kWh values. These are used in table 1185 of a post-DCP 266 EDCM model.

   (c) Table 4403: Discounts in p/kWh for each boundary/end user network level combination. These are used in table 1184 of a post-DCP 266 EDCM model.

Overview of the iterative process

7. The method M part of the Method GM model calculates IDNO discounts expressed in p/kWh for each ATW tariff-boundary combination.

8. The Method G part of the model takes the IDNO discounts expressed in p/KWh and calculates, through an iterative process, the ATW tariffs that would result in the recovery of the target CDCM revenue.

9. The calculations for the iterative process are done in sheet G(Details).

10. The aim of the calculations in sheet G(Details) is to determine a set of CDCM ATW tariffs, that when applied to the volumes in table 1053 would lead to the recovery of the target CDCM revenue.

11. A set of scaling factors is applied to the starting ATW tariffs. Initial values of the scaling factors are set to 1. A set of errors are calculated, which is the difference between the target revenue and revenue from the application of the initial ATW tariffs.

12. Separate scaling factor and error is calculated for each of the following elements of the target CDCM revenue:

    (a) Transmission exit charges

    (b) Other charges

    (c) Matching charges.

13. No scaling factors are applied to asset charges as these are fixed within the CDCM model.

14. The method used to determine the values of the scaling factors to apply that would make the errors close to zero is called the Newton Raphson method. This is a general method for solving a function for its roots.

15. The Newton Raphson method used in the Method GM model involves the following steps:

    (a) Step 1 is to calculate a 3x3 matrix of first derivatives of the multivariate revenue function used to calculate the total revenue in the model. This is done over three iterations (runs 2, 3 and 4 in the table overleaf). Each iteration calculates one set of partial derivatives with respective to each scaling factor.

    (b) Step 2 is to calculate the adjoint of this matrix of partial derivatives.

    (c) Step 3 is to calculate the determinant of the matrix of partial derivatives.

    (d) Step 4 is to multiply the adjoint matrix by the vector of errors, i.e. the difference between the target CDCM revenue and revenue that would be recovered by the application of the scaling factors.

    (e) The result from Step 4 is then divided by its determinant to calculate a new set of scaling factors.

16. The new scaling factors are applied to the ATW tariffs to check that the error, i.e. the difference between the target revenue and the calculated revenue is reduced to near

zero. Steps 4 and 5 are repeated once (in the current version) to reduce the errors to insignificantly small values (currently a fraction of a penny).

17. The results of the iterative process, including the errors calculated at each stage is set out in sheet G(Summary) of the Method GM model.

18. The final ATW tariffs are calculated using the new scaling factors, and a new set of IDNO discounts in percentages are calculated by dividing the p/kWh discounts by the new ATW tariffs.

19. The table below provides an example of the iterative process (involving 5 runs and a final run). The error for each revenue element is reduced to zero in the final run.

Table 1 Illustrative results from the Newton Raphson method (using NPG – Yorkshire data)

	Scaling factor for transmission exit	Error for transmission exit	Scaling factor for other charges	Error for other charges	Scaling factor for matching charges	Error for matching charges
Run 1	1.000	-17,260	1.000	-54,033	1.000	-390,268
Run 2	0.990	-167,016	1.000	54,546	1.000	-541,928
Run 3	0.990	-167,614	0.990	-1,075,469	1.000	-1,573,009
Run 4	0.990	-168,594	0.990	-1,081,061	0.990	-3,392,257
Run 5	1.001	0	1.001	0	1.002	1
Run final	1.001	0	1.001	0	1.002	0