Conditional NTS Capacity Charge Discount (CNCCD) Modification 07XX Analysis & Methodology

Document Revision History

Version / Revision Number	Date of Issue	Notes
V0.1	21 February 2020	Initial Draft
V0.2	26 February 2020	Updated and amended
V1.0	27 February 2020	Initial Publication

Contents

Introduction

1. The following analysis has been completed by National Grid in support of Modification 07XX[1]. It is intended to provide additional information regarding analysis and figures quoted in the Modification text.

2. Due to the commercially sensitive nature of NTS Optional Commodity Charge (NTS OCC) data, this analysis could only be undertaken by National Grid. All data corresponding to the existing NTS OCC and any subsequent charges arising from the analysis will be presented at an aggregated level.

3. Where relevant, the analysis uses the Modification 0678 V3.1 CWD Transmission Services - Sensitivity Model[2]. This is an illustrative model and should always be considered as such. It provides support to Modification 0678A Modification and is a sensitivity tool to demonstrate the way in which charges under Modification 0678A would be calculated, and as a result the same consideration should be taken when reviewing this Optional Charge analysis.

4. This analysis is structured in the following way:

    (a) Description of the assumptions that have been made in order to carry out a consistent method of analysis

    (b) Some non-modification specific analysis, related to actions raised in Review Modification 0670R Workgroup.

    (c) Analysis of optional charge proposed, which consists of:

        i.   an assessment of the number of routes applicable

        ii. the potential under recovery of transmission services revenue the specified charges could generate

        iii. the indicative impact this could have on reference and reserve prices for the relevant Reference Price Methodology (RPM) and the same approach on non-transmission charges.

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[1] https://www.gasgovernance.co.uk/livemods
[2] https://www.gasgovernance.co.uk/index.php/0678/Models

Assumptions

5. In order to carry out the analysis on the prevailing NTS OCC, "Methodology 2" as described in Modifications 0678H/J and the proposal raised in 07XX in a consistent manner, the following assumptions or limitations have been made:

    (a) Users and routes based on NTS OCC historical flows and revenues from October 2017 to September 2018 (Gas Year 2017/18), replicating Gas Year format of the sensitivity tool.

    (b) Assessment is undertaken at NTS OCC route level basis, not shipper level.

    (c) Assessment is undertaken against Modification 0678A as a base case.

    (d) No behavioural changes are assumed. All NTS OCC routes and flows used during Gas Year 2017/18 are considered to use any new optional charge proposed, on the condition the charge is less than the prevailing firm RPM entry and exit prices.

    (e) No consideration is given between users of the proposed optional charges and users that hold Existing Contracts. Where reference prices are referred to, these are prices from the Sensitivity Model, set to the parameters defined in 0678A and calculated based on Gas Year 2020/21, with any over or under recovery recycled until the initial Revenue Recovery Charge (RRC) is set at zero.

    (f) For the purpose of this assessment, the Forecasted Contracted Capacity (FCC) as defined in the FCC Methodology Statement[3] is considered to be 100% accurate.

    (g) For the purpose of calculating adjustments within the sensitivity model, perfect foresight of applicable quantities for the optional charge is assumed in order to give indicative reserve price increases to account for optional charge under recovery.

    (h) Any further modification specific sensitivity analysis or assumptions are stated where necessary

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[3] https://gasgov-mst-files.s3.eu-west-1.amazonaws.com/s3fs-public/ggf/book/2019-03/Forecasted%20Contracted%20Capacity%20v1.0.pdf

Comparison of Prevailing and Alternative Products

6. Rates were first calculated by the Sensitivity Tool using parameters defined by Modification 0678A for the gas year Oct-2020 – Sep-2021. On this baseline, several scenarios were then run.

7. First, we assessed the impact if all users of the current NTS Optional Commodity Charge (NTS OCC) bypassed the NTS entirely. While this scenario is not supported by the likelihood of bypass analysis carried out it gives us a useful set of data to validate against.

	Prevailing NTS OCC
OCC Contribution	£28,695,987.33
Potential TO Socialisation	£97,559,664.09
TO Socialisation as % of MAR	12.9%
SO Socialisation	£57,983,030.86
SO Socialisation as % of MAR	7.7%
Total Socialisation as % of MAR	20.6%
Routes Considered	37
Max Effective Rate Discount	99.3%
Longest Route Considered	244.0

8. The 24.4% quoted in the Modification text relates to the total contribution loss of those sites currently using the prevailing NTS OCC, i.e. the total of their contribution under the NTS OCC and the difference between their NTS OCC contributions and the figures they would be paying if no such product existed.

9. Under Modification 0678 and alternatives a number of options for a new Optional Capacity Charge were proposed. Methodology 1 was dismissed as too generous. Methodology 3 was dismissed as too restrictive. Methodology 2 offered a solution which Ofgem described as too generous, but the Minded to Position also offered a potential change to the formula.

10. When discussed by the 0670 Review group it was proposed that the impact on standard users of the NTS based on Methodology 2 should be compared to an adjusted formula which used FCC rather than MNEPOR.

11. The analysis assumed no changes in behaviour, i.e. only current NTS OCC users would take up the product, they would not make any significant adjustments to their portfolio to shift capacity or flow between existing Entry or Exit Points.

12. Methodology 2 acts as an alternative charge to both the Transmission and General Non-Transmission charges. It also introduces a Minimum Fee for users of a route.

13. NTS costs were calculated for all routes based on the Entry and Exit FCCs along with current NTS OCC Throughput, using the Reserve Prices calculated by the Sensitivity tool and General Non-Transmission Charges. It was assumed that Revenue Recovery Charges would be zero.

14. Using the Same FCC and flow values, the charges incurred under the Alternative Charge and Minimum Fee were also calculated.

15. Where the Alternative Charge costs were lower than the standard costs it was assumed that the user would opt for the cheaper of these and use the Optional Capacity Charge.

16. These calculations were repeated based on the adjustment to the formula proposed by the Review group which transplanted FCC for MNEPOR in to stage one of the calculation.

	Prevailing NTS OCC
OCC Contribution	£28,695,987.33
Potential TO Socialisation	£97,559,664.09
TO Socialisation as % of MAR	12.9%
SO Socialisation	£57,983,030.86
SO Socialisation as % of MAR	7.7%
Total Socialisation as % of MAR	20.6%
Routes Considered	37
Max Effective Rate Discount	99.3%
Longest Route Considered	244.0

	0678H/J	FCC into Stage 1
OCC Contribution	£16,993,934.00	£13,612,172.74
Potential TS Socialisation	£65,207,293.37	£60,920,174.44
TS Socialisation as % of MAR	8.6%	8.1%
Gen Non-TS Socialisation	£42,648,739.22	£39,072,506.45
Gen Non-TS Socialisation as % of MAR	5.6%	5.2%
Total Socialisation as % of MAR	14.3%	13.2%
Routes Considered	14	12
Max Effective Rate Discount	97.6%	95.7%
Longest Route Considered	53.0	27.2

17. The NG Proposal sets a distance cap at 28km based on the likelihood of bypass analysis detailed below. The Maximum Discount applied to be applied to Transmission charges will be 90% at 0km. We do not propose to discount General Non-Transmission charges.

	Prevailing NTS OCC
OCC Contribution	£28,695,987.33
Potential TO Socialisation	£97,559,664.09
TO Socialisation as % of MAR	12.9%
SO Socialisation	£57,983,030.86
SO Socialisation as % of MAR	7.7%
Total Socialisation as % of MAR	20.6%
Routes Considered	37
Max TS Discount	N/A
Max Gen Non-TS Discount	N/A
Max Effective Rate Discount	99.3%
Longest Route Considered	244.0

	0678H/J	NG Discount Proposal
OCC Contribution	£16,993,934.00	£29,932,749.22
Potential TS Socialisation	£65,207,293.37	£59,230,544.91
TS Socialisation as % of MAR	8.6%	7.8%
Gen Non-TS Socialisation	£42,648,739.22	£0.00
Gen Non-TS Socialisation as % of MAR	5.6%	0.0%
Total Socialisation as % of MAR	14.3%	7.8%
Routes Considered	14	22
Max TS Discount	N/A	90.0%
Max Gen Non-TS Discount	N/A	0.0%
Max Effective Rate Discount	97.6%	61.7%
Longest Route Considered	53.0	27.2

18. Based on the NG Proposal, a distance cut-off at 28km, the routes which fall within the distance are as follows:

Entry Point	Exit Point	Straight-Line Distance km	Calculated Discount
Bacton IP	Bacton (BBL)	0.0	90%
Bacton IP	Bacton (IUK)	0.0	90%
Bacton UKCS	Bacton (BBL)	0.0	90%
Bacton UKCS	Bacton (IUK)	0.0	90%
Barrow	Barrow (Black Start)	0.0	90%
Burton Point	Burton Point (Connahs Quay)	0.0	90%
Isle of Grain	Grain Power Station	0.0	90%
St Fergus	Apache (Sage Black Start)	0.0	90%
St Fergus	St. Fergus (Shell Blackstart)	0.0	90%
St Fergus	St_Fergus_Segal	0.0	90%
Teesside	Phillips Petroleum, Teesside	0.0	90%
Teesside	Teesside (BASF, aka BASF Teesside)	0.0	90%
Teesside	Air_Products (Teesside)	0.0	90%
Teesside	Brine Field (Teesside) Power Station	0.0	90%
Hatfield Moor (onshore)	Hatfield Power Station	0.0	90%
Moffat (Irish Interconnector)	Moffat (Irish Interconnector)	0.0	90%
Bacton IP	Bacton (Great Yarmouth)	0.3	88%
Bacton UKCS	Bacton (Great Yarmouth)	0.3	88%
Burton Point	Deeside	0.4	88%
St Fergus	St. Fergus (Peterhead)	0.4	88%
Milford Haven	Pembroke Power Station	0.8	86%
Teesside	Teesside Hydrogen	0.8	86%
Isle of Grain	Medway (aka Isle of Grain Power Station, NOT Grain Power)	1.0	84%
Milford Haven	Upper Neeston (Milford Haven Refinery)	1.2	83%
Teesside	Seal Sands TGPP	1.2	83%
Burton Point	Harwarden (Shotton, aka Shotton Paper)	1.3	83%
Barrow	Roosecote Power Station (Barrow)	1.4	82%
Teesside	Billingham ICI (Terra Billingham)	4.4	68%
Teesside	Enron Billingham	4.4	68%
Teesside	Zeneca (ICI Avecia, aka 'Zenica')	4.4	68%
Isle of Grain	Middle Stoke (Damhead Creek, aka Kingsnorth Power Station)	4.5	67%
Burton Point	Shotwick (Bridgewater Paper)	4.9	65%
Hatfield Moor (onshore)	Eastoft (Keadby Blackstart)	6.7	58%
Hatfield Moor (onshore)	Eastoft (Keadby)	6.7	58%
Hatfield Moor (onshore)	KEADBY_2 PS	10.2	46%
Isle of Grain	Stanford Le Hope (Coryton)	13.6	36%
Hatfield Moor (onshore)	West Burton Power Station	17.7	26%

Easington	Stallingborough	17.7	26%
Burton Point	Shellstar (aka Kemira, not Kemira CHP)	18.2	25%
Hatfield Moor (onshore)	Blyborough (Brigg)	18.7	24%
Hatfield Moor (onshore)	Blyborough (Cottam)	18.7	24%
Hatfield Moor (onshore)	Goole (Guardian Glass)	21.7	19%
Isle of Grain	Barking (Horndon)	21.7	19%
Easington	Rosehill (Saltend Power Station)	23.1	17%
Isle of Grain	Tilbury Power Station	23.1	17%
Murrow	Sutton Bridge Power Station	23.2	16%
Burton Point	Weston Point (Castner Kelner, aka ICI Runcorn)	24.0	15%
Burton Point	Weston Point (Rocksavage)	24.0	15%
Easington	Saltend BPHP (BP Saltend HP)	25.3	13%
Easington	Thornton Curtis (Killingholme)	26.6	12%
Hatfield Moor (onshore)	Drax	26.8	11%
Easington	Thornton Curtis (Humber Refinery, aka Immingham)	27.2	11%

19. Of these, twenty-two routes are considered in this analysis. The other routes which fall within this distance limitation have a zero figure in either Entry Firm FCC, Exit Firm FCC, MNEPOR or current Throughput will mean the route is not considered in the analysis as no discount would be applicable.

20. The Cross Subsidy figures for considered routes which fall within the distance splits below would be as follows:

Distance	Cross Subsidy	% MAR	Cumulative	% MAR
<= 1km	£52,426,065.96	6.93%	£52,426,065.96	6.93%
1km - 10km	£2,844,212.75	0.38%	£55,270,278.71	7.31%
10km - 20km	£1,079,615.59	0.14%	£56,349,894.30	7.45%
20km - 28km	£2,900,512.35	0.38%	£59,250,406.65	7.83%

21. The presence of Existing Contracts at Entry, or traded capacity are both Entry and Exit is not considered in this analysis. These volumes can be used to enable discounts at the opposing end of the route they relate to, but will not be considered for Discount themselves, as detailed in the Modification text. As a result, the figures quoted are "worst case". Over time, the expiry of Existing Contracts and changes to booking and trading behaviours is expected to bring the figures closer to expectation.

22. The impact each of these scenarios could potentially have on the Postage Stamp rates calculated under Modification 0678A is detailed below.

	0678A		Prevailing NTS OCC		0678H/J		FCC Adjustment		NG Proposal	
	Entry	Exit	Entry	Exit	Entry	Exit	Entry	Exit	Entry	Exit
Rate Increase	0.0%		+14.8%		+9.4%		+8.8%		+8.7%	

Likelihood of Bypass

23. In assessing the routes which posed a genuine threat of bypass we have used a set of data published by the Council of European Energy Regulators.[4]

24. From this report, we have taken the formula below as the option presented which "defines better the costs at both ends of the graph, so for small diameters and large diameters":

    Pipeline Construction Cost (€/km) = 642.985 D² (") + 2,464.295 D (") + 398,135.326

    Where D is the pipe diameter in inches.

25. To calculate the pipe diameter for a range of routes we have used the General Flow Equation as below:

$$D = \left(\frac{10^4}{7.574} * \frac{Q\sqrt{K}}{E}\right)^{0.4} * \left(\frac{Ps}{Ts}\right)^{0.4} * \left(\frac{S * L * Z * T}{P1^2 - P2^2}\right)^{0.2}$$

    Where:

    D is the pipe diameter in mm (to be converted to inches)

    Q is the Flow in mscmd, we have used the current MNEPOR as at 31/01/2020

    K is the Friction Factor

    E is the Efficiency of the pipe (assumed to be 1.0 for a new, perfectly efficient pipe)

    P_s is Standard Pressure

    T_s is Pipe Average Temperature

    S is the Specific Gravity of Gas

    L is the Length of Pipe taken from the Distance Matrix as described below

    Z is the Compressibility of Gas

    T is Temperature

    P_1 is the Inlet Pressure

    P_2 is the Outlet Pressure

    All constants are taken from the current TPD Section Y 2.5.2 - The Expansion Constant. This section is used currently in reference to the Long Run Marginal Costs and will be removed from the UNC as part of the implementation of 0678A.

26. This calculation uses two sets of distances. As part of Modification 0678 a Pipeline Distance Matrix was produced, providing point to point distances for all Entry and Exit

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[4] https://www.ceer.eu/1767

Points using the NTS. The prevailing NTS Optional Commodity Charge uses a Matrix of Straight-line Distances created for any Entry and Exit Point currently opting to use the NTS OCC product. The use of Straight-line Distance is proposed in Modification 07XX but these distances are not currently available for all sites. In this calculation, we have used the minimum of the distances currently available for each route.

27. For each potential route a pipe diameter in mm was calculated based on the General Flow Equation, the constants held in Section Y prior to implementation of Modification 0678A, the MNEPOR and the Distance as described above.

28. Each calculated diameter has been scaled up to the next available standard pipe diameter as the minimum size of pipe required to supply the Exit Point at the Maximum Daily Offtake Rate.

29. These diameters have been converted from millimetres to inches by diving by 25.4.

30. This Diameter has been fed in to the CEER equation to produce a cost in EUR for each route.

31. The EUR cost has been divided by 1.17 to give a cost in GBP based on the currency conversion rate[5] at the time this analysis was produced in January 2020.

32. Separate to this, based on the timescales cited in the PARCA process, approximate construction timescales were calculated for each route based on the distance and the pipe size. The minimum time scale quoted, 12 months, has been attributed to a 0km distance for the smallest standard pipe diameter, 50mm. The longest distance quoted, 96 months, has been attributed to a 100km section of the largest standard diameter of pipe, 1250mm. Timescales for distances and pipe sizes between these extremes have been scaled accordingly.

33. A construction timescale figure, in whole months, has been calculated for each route.

34. Based on the MNEPOR, Entry & Exit Reserve Prices and construction timescale, a cost of using the NTS during the period the user is constructing their hypothetical bypass pipeline has been calculated.

35. The Pipeline Construction Costs and Interim NTS Usage Costs have been combined to give a figure for the route. Assuming a simple ten-year repayment period this figure has been divided by 10 to give an annual cost.

36. Using the MNEPOR and Entry & Exit Reserve Prices, an Annual NTS Cost has been calculated.

37. The ratio of these two figures defines the likelihood of a user choosing to bypass the NTS.

38. The highest ratio recorded was 10:1, suggesting that the user with the highest likelihood of bypass, over ten years, would achieve a 90% reduction in transmission costs.

39. It is assumed that a ratio below 1:1 would never consider bypass as the repayment term would exceed 10 years.

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[5] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/855436/exrates-monthly-0120.csv/preview

40. Even above this ratio a user would have to consider the high levels of upfront capital cost, the long-term commitment to operational costs associated with the asset and the loss of access to the NTS increasing the uncertainty around supply security.

41. In addition to this, the longer the distance, the increased level of uncertainty when constructing a pipeline. The increased possibility of delays and additional costs cannot be accounted for but mean a route becomes less attractive as risk levels increase.

Derivation of the Discount Curve

42. The likelihood of bypass, calculated using the CEER pipeline cost equation, provides us with a maximum discount level of 90%. It also suggests the shape of the discount provided, an inverse exponential curve.

43. Given that a 10% discount is available to all users via the interruptible capacity option, a cut-off is proposed where the curve meets a 10% discount. Users can achieve a greater discount via an alternative method, so the product becomes irrelevant below 10%.

44. Based on Maximum Discount, an adjustment is made to the starting point of the curve

45. A constant, 1.6094, is fed in to the equation to ensure that the Discount Curve meets the 10% lower threshold at the distance cap.

46. The likelihood of bypass analysis also suggests that it is highly likely for users within 27.2km to consider bypass, while users beyond that point would be significantly less likely to consider bypass.

47. Based on this analysis a distance cap of 28km is proposed, being the longest distance likely to consider bypass, rounded up to the nearest whole kilometre.

Reassessment of the Distance Cap in line with Cross Subsidy Expectations

48. We will monitor the cross subsidy generated by the Distance Cap, this assessment requires the following inputs:

   i)   confirmation of the Maximum Discount. Expected to remain as 90% in line with the Likelihood of Bypass analysis

   ii)   confirmation of the Minimum Discount. Expected to remain 10% in line with the Interruptible Discount

   iii)   updated Maximum Allowed Revenue figure

   iv)   updates to the Entry & Exit FCC values based on latest calculated figure

   v)   updates to the Entry & Exit Reserve Prices for the Gas Year ahead

   vi)   the latest Optional Capacity Charges

   vii)   the Optional Capacity Charge associated Distance Matrix

49. From the updated Entry & Exit FCCs and the updated Optional Capacity Charge Throughput, an updated Forecasted Eligible Quantity is created.

50. Based on a set range of distances, 5km increments from 5km to 75km, an estimated monetary Socialisation figure is calculated.

51. A graph and trendline can be plotted based on the data calculated

52. From these figures the current Socialisation can be calculated

53. Based on a change in the cross subsidy figure a request for a Review may be triggered and, alongside industry input, the product will be reassessed for future viability.

Eligible Quantity Calculations

54. The Eligible Quantity Calculation is detailed in the Business Rules. Below are a number of examples stepping through possible scenarios using the Business Rules.

Example 1 - Simple

Entry Point A

Date Booked	Source	Type	kWh
01/01/2020	Auction	Firm	105,000
		Entry Flow	90,000

Exit Point 1

Date Booked	Source	Type	kWh
01/01/2020	Auction	Firm	100,000
		Exit Flow	95,000

When considering Route A1, in accordance with BR35.1 we calculate the Initial Entry EQ as follows:

$$IEQEn = Max\big(0, (Min(CAPEn, CAPEx, AEn, AEx) - ECEn)\big)$$

Substituting in the figures quoted the equation is as follows:

$$IEQEn = Max\big(0, (Min(105000,100000,90000,95000) - 0)\big)$$

$$IEQEn = 90,000\ kWh$$

The AQ_{En} in this scenario, as defined in BR35.2 is 105,000 kWh and so, in accordance with BR35, the EQ_{En} is calculated as below:

$$EQEn = Min(IEQEn, AQEn)$$

$$EQEn = Min(90000,105000)$$

$$\boldsymbol{EQEn = 90,000\ kWh}$$

When considering Route A1, in accordance with BR36.1 we calculate the Initial Exit EQ as follows:

$$IEQEx = Min(CAPEn, CAPEx, AEn, AEx)$$

Substituting in the figures quoted the equation is as follows:

$$IEQEx = Min(105000,100000,90000,95000)$$

$$IEQEx = 90,000\ kWh$$

The AQ_{Ex} in this scenario, as defined in BR36.2 is 100,000 kWh and so, in accordance with BR36 the EQ_{Ex} is calculated as below:

$$EQEx = Min(IEQEx, AQEx)$$

$$EQEx = Min(90000,100000)$$

$$\boldsymbol{EQEx = 90,000\ kWh}$$

Example 2 – Existing Contract at Entry

Entry Point C

Date Booked	Source	Type	kWh
01/04/2017	Auction	Existing	105,000
		Entry Flow	90,000

Exit Point 1

Date Booked	Source	Type	kWh
01/01/2020	Auction	Firm	100,000
		Exit Flow	95,000

When considering Route C1, in accordance with BR35.1 we calculate the Initial Entry EQ as follows:

$$IEQEn = Max\big(\,0\,,\,(\,Min\,(CAPEn, CAPEx, AEn, AEx) - ECEn\,)\big)$$

Substituting in the figures quoted the equation is as follows:

$$IEQEn = Max\big(\,0\,,\,(\,Min\,(105000, 100000, 90000, 95000) - 105000\,)\big)$$

$$IEQEn = 0\ kWh$$

The AQ_{En} in this scenario, as defined in BR35.2 is 0 kWh and so, in accordance with BR35 the EQ_{En} is calculated as below:

$$EQEn = Min\,(IEQEn, AQEn)$$

$$EQEn = Min\,(0,0)$$

$$\boldsymbol{EQEn = 0\ kWh}$$

When considering Route C1, in accordance with BR36.1 we calculate the Initial Exit EQ as follows:

$$IEQEx = Min\,(CAPEn, CAPEx, AEn, AEx)$$

Substituting in the figures quoted the equation is as follows:

$$IEQEx = Min\,(105000, 100000, 90000, 95000)$$

$$IEQEx = 90,000\ kWh$$

The AQ_{Ex} in this scenario, as defined in BR36.2 is 100,000 kWh and so, in accordance with BR36 the EQ_{Ex} is calculated as below:

$$EQEx = Min\,(IEQEx, AQEx)$$

$$EQEx = Min\,(90000, 100000)$$

$$\boldsymbol{EQEx = 90,000\ kWh}$$

Example 3 – Traded Capacity at Entry

Entry Point B

Date Booked	Source	Type	kWh
01/01/2020	Trade	Firm	105,000
		Entry Flow	90,000

Exit Point 1

Date Booked	Source	Type	kWh
01/01/2020	Auction	Firm	100,000
		Exit Flow	95,000

When considering Route B1, in accordance with BR35.1 we calculate the Initial Entry EQ as follows:

$$IEQEn \ = \ Max\big(\ 0\ ,(\ Min\ (CAPEn, CAPEx, AEn, AEx)\ -\ ECEn\ )\big)$$

Substituting in the figures quoted the equation is as follows:

$$IEQEn \ = \ Max\big(\ 0\ ,(\ Min\ (105000,100000,90000,95000)\ -\ 0\ )\big)$$

$$IEQEn \ = \ 90,000\ kWh$$

The AQ_{En} in this scenario, as defined in BR35.2 is 0 kWh and so, in accordance with BR35 the EQ_{En} is calculated as below:

$$EQEn \ = \ Min\ (IEQEn, AQEn)$$

$$EQEn \ = \ Min\ (90,000,0)$$

$$\boldsymbol{EQEn \ = 0\ kWh}$$

When considering Route B1, in accordance with BR36.1 we calculate the Initial Exit EQ as follows:

$$IEQEx \ = \ Min\ (CAPEn, CAPEx, AEn, AEx)$$

Substituting in the figures quoted the equation is as follows:

$$IEQEx \ = \ Min\ (105000,100000,90000,95000)$$

$$IEQEx \ = \ 90,000\ kWh$$

The AQ_{Ex} in this scenario, as defined in BR36.2 is 100,000 kWh and so, in accordance with BR36 the EQ_{Ex} is calculated as below:

$$EQEx \ = \ Min\ (IEQEx, AQEx)$$

$$EQEx \ = \ Min\ (90000,100000)$$

$$\boldsymbol{EQEx \ = \ 90,000\ kWh}$$

Example 4 – Multiple Exit Points

Entry Point D

Date Booked	Source	Type	kWh
01/01/2020	Auction	Firm	105,000
		Entry Flow	90,000

Exit Point 1

Date Booked	Source	Type	kWh
01/01/2020	Auction	Firm	45,000
		Exit Flow	40,000

Exit Point 2

Date Booked	Source	Type	kWh
01/01/2020	Auction	Firm	55,000
		Exit Flow	45,000

In accordance with BR37, where a User nominates two routes, to different Exit Points, but originating from the same Entry Point, we apportion the Entry Capacities (CAP_{En}) and Flows (A_{En}) based on the ratio of Exit Capacities and Flows, i.e.

$$37.1 \quad CAPEn1 = \frac{CAPEn}{CAPEx1 + CAPEx2} * CAPEx1 \quad \& \quad CAPEn2 = \frac{CAPEn}{CAPEx1 + CAPEx2} * CAPEx2$$

$$37.4 \quad AQEn1 = \frac{AQEn}{CAPEx1 + CAPEx2} * CAPEx1 \quad \& \quad AQEn2 = \frac{AQEn}{CAPEx1 + CAPEx2} * CAPEx2$$

$$37.3 \quad AEn1 = \frac{AEn}{AEx1 + AEx2} * AEx1 \quad \& \quad AEn2 = \frac{AEn}{AEx1 + AEx2} * AEx2$$

Entry Point D to Exit Point 1

Type	kWh
CAP_{En1}	47,250
AQ_{En1}	47,250
A_{En1}	42,353

Entry Point D to Exit Point 2

Type	kWh
CAP_{En2}	57,750
AQ_{En2}	57,750
A_{En2}	47,647

Exit Point 1

Date Booked	Source	Type	kWh
01/01/2020	Auction	Firm	45,000
		Exit Flow	40,000

Exit Point 2

Date Booked	Source	Type	kWh
01/01/2020	Auction	Firm	55,000
		Exit Flow	45,000

Example 4 (cont.)

When considering Route D1, in accordance with BR35.1 we calculate the Initial Entry EQ as follows:

$$IEQEn \ = \ Max\big(\ 0 \ , (\ Min \ (CAPEn, CAPEx, AEn, AEx) \ - \ ECEn \ )\big)$$

Substituting in the figures quoted the equation is as follows:

$$IEQEn \ = \ Max\big(\ 0 \ , (\ Min \ (47250, 45000, 42353, 40000) \ - \ 0 \ )\big)$$

$$IEQEn \ = 40,000 \ kWh$$

The AQ_{En} in this scenario, as defined in BR35.2 is 105,000 kWh (Firm Entitlement excluding Existing Contracts) once apportioned in-line with 37.4 the AQEn for the route is 47,250. In accordance with BR35 the EQ_{En} is calculated as below:

$$EQEn \ = \ Min \ (IEQEn, AQEn)$$

$$EQEn \ = \ Min \ (40000, 47250)$$

$$\boldsymbol{EQEn \ = 40,000 \ kWh}$$

When considering Route D1, in accordance with BR36.1 we calculate the Initial Exit EQ as follows:

$$IEQEx \ = \ Min \ (CAPEn, CAPEx, AEn, AEx)$$

Substituting in the figures quoted the equation is as follows:

$$IEQEx \ = \ Min \ (47250, 45000, 42353, 40000)$$

$$IEQEx \ = 40,000 \ kWh$$

The AQ_{Ex} in this scenario, as defined in BR36.2 is 45,000 kWh and so, in accordance with BR36 the EQ_{Ex} is calculated as below:

$$EQEx \ = \ Min \ (IEQEx, AQEx)$$

$$EQEx \ = \ Min \ (40000, 45000)$$

$$\boldsymbol{EQEx \ = \ 40,000 \ kWh}$$

Example 4 (cont.)

When considering Route D2, in accordance with BR35.1 we calculate the Initial Entry EQ as follows:

$$IEQEn = Max\big(\, 0\, , (\, Min\,(CAPEn, CAPEx, AEn, AEx) - ECEn\,)\big)$$

Substituting in the figures quoted the equation is as follows:

$$IEQEn = Max\big(\, 0\, , (\, Min\,(57750, 55000, 47647, 45000) - 0\,)\big)$$

$$IEQEn = 45,000\ kWh$$

The AQ_{En} in this scenario, as defined in BR35.2 is 105,000 kWh (Firm Entitlement excluding Existing Contracts) once apportioned in-line with 37.4 the AQEn for the route is 57,750. In accordance with BR35 the EQ_{En} is calculated as below:

$$EQEn = Min\,(IEQEn, AQEn)$$

$$EQEn = Min\,(45000, 57750)$$

$$\boldsymbol{EQEn = 45,000\ kWh}$$

When considering Route D2, in accordance with BR36.1 we calculate the Initial Exit EQ as follows:

$$IEQEx = Min\,(CAPEn, CAPEx, AEn, AEx)$$

Substituting in the figures quoted the equation is as follows:

$$IEQEx = Min\,(57750, 55000, 47647, 45000)$$

$$IEQEx = 45,000\ kWh$$

The AQ_{Ex} in this scenario, as defined in BR36.2 is 55,000 kWh and so, in accordance with BR36 the EQ_{Ex} is calculated as below:

$$EQEx = Min\,(IEQEx, AQEx)$$

$$EQEx = Min\,(45000, 55000)$$

$$\boldsymbol{EQEx = 45,000\ kWh}$$

Example 5 – Complex

Entry Point E

Date Booked	Source	Type	kWh
01/04/2017	Existing	Firm	100,000
01/01/2020	Auction	Firm	50,000
01/04/2020	Auction	Interruptible	50,000
01/07/2020	Trade	Firm	-20,000
		Entry Flow	170,000

Exit Point 1

Date Booked	Source	Type	kWh
01/01/2020	Auction	Firm	50,000
01/04/2020	Auction	Interruptible	20,000
01/07/2020	Trade	Firm	-10,000
		Exit Flow	55,000

Exit Point 2

Date Booked	Source	Type	kWh
01/01/2020	Auction	Firm	60,000
01/04/2020	Auction	Interruptible	30,000
01/07/2020	Trade	Firm	15,000
		Exit Flow	110,000

Example 5 (cont.)

In accordance with BR37, where a User nominates two routes, to different Exit Points, but originating from the same Entry Point, we apportion the Entry Capacities and Flows based on the ratio of Exit Capacities (CAP_{Ex}) and Flows (A_{Ex}).

$$37.1 \; CAPEn1 \; = \frac{CAPEn}{CAPEx1 + CAPEx2} * CAPEx1 \; \& \; CAPEn2 \; = \frac{CAPEn}{CAPEx1 + CAPEx2} * CAPEx2$$

$$37.2 \; ECPEn1 \; = \frac{ECEn}{CAPEx1 + CAPEx2} * ECEx1 \; \& \; ECEn2 \; = \frac{ECEn}{CAPEx1 + CAPEx2} * ECEx2$$

$$37.4 \; AQEn1 \; = \frac{AQEn}{CAPEx1 + CAPEx2} * CAPEx1 \; \& \; AQEn2 \; = \frac{AQEn}{CAPEx1 + CAPEx2} * CAPEx2$$

$$37.3 \; AEn1 \; = \frac{AEn}{AEx1 + AEx2} * AEx1 \; \& \; AEn2 \; = \frac{AEn}{AEx1 + AEx2} * AEx2$$

Entry Point E to Exit Point 1

Type	kWh
CAP_{En1}	45,217
EC_{En1}	34,783
AQ_{En1}	17,391
A_{En1}	56,667

Entry Point E to Exit Point 2

Type	kWh
CAP_{En2}	84,783
EC_{En2}	65,217
AQ_{En2}	32,609
A_{En2}	113,333

Exit Point 1

Date Booked	Source	Type	kWh
01/01/2020	Auction	Firm	50,000
01/04/2020	Auction	Interruptible	20,000
01/07/2020	Trade	Firm	-10,000
		Exit Flow	55,000

Exit Point 2

Date Booked	Source	Type	kWh
01/01/2020	Auction	Firm	60,000
01/04/2020	Auction	Interruptible	30,000
01/07/2020	Trade	Firm	15,000
		Exit Flow	110,000

Example 5 (cont.)

When considering Route E1, in accordance with BR35.1 we calculate the Initial Entry EQ as follows:

$$IEQEn \ = \ Max\big(\, 0 \, , (\, Min \, (CAPEn, CAPEx, AEn, AEx) \ - \ ECEn \,)\big)$$

Substituting in the figures quoted the equation is as follows:

$$IEQEn \ = \ Max\big(\, 0 \, , (\, Min \, (45217, 40000, 56667, 55000) \ - \ 34783 \,)\big)$$

$$IEQEn \ = 5{,}217 \ kWh$$

The AQ_{En} in this scenario, as defined in BR35.2 is 50,000 kWh (Firm Entitlement excluding Existing Contracts) once apportioned in-line with 37.4 the AQEn for the route is 17,391. In accordance with BR35 the EQ_{En} is calculated as below:

$$EQEn \ = \ Min \, (IEQEn, AQEn)$$

$$EQEn \ = \ Min \, (5217, 17391)$$

$$\boldsymbol{EQEn \ = 5{,}217 \ kWh}$$

When considering Route E1, in accordance with BR36.1 we calculate the Initial Exit EQ as follows:

$$IEQEx \ = \ Min \, (CAPEn, CAPEx, AEn, AEx)$$

Substituting in the figures quoted the equation is as follows:

$$IEQEx \ = \ Min \, (45217, 40000, 56667, 550000)$$

$$IEQEx \ = 40{,}000 \ kWh$$

The AQ_{Ex} in this scenario, as defined in BR36.2 is 50,000 kWh and so, in accordance with BR36 the EQ_{Ex} is calculated as below:

$$EQEx \ = \ Min \, (IEQEx, AQEx)$$

$$EQEx \ = \ Min \, (40000, 50000)$$

$$\boldsymbol{EQEx \ = \ 40{,}000 \ kWh}$$

Example 5 (cont.)

When considering Route E2, in accordance with BR35.1 we calculate the Initial Entry EQ as follows:

$$IEQEn = Max\big(0, (Min(CAPEn, CAPEx, AEn, AEx) - ECEn)\big)$$

Substituting in the figures quoted the equation is as follows:

$$IEQEn = Max\big(0, (Min(84783,75000,113333,110000) - 65217)\big)$$

$$IEQEn = 9{,}783\ kWh$$

The AQ_{En} in this scenario, as defined in BR35.2 is 50.000 kWh (Firm Entitlement excluding Existing Contracts) once apportioned in-line with 37.4 the AQEn for the route is 32,609 kWh. In accordance with BR35 the EQ_{En} is calculated as below:

$$EQEn = Min(IEQEn, AQEn)$$

$$EQEn = Min(9783,32609)$$

$$\boldsymbol{EQEn = 9{,}783\ kWh}$$

When considering Route E2, in accordance with BR36.1 we calculate the Initial Exit EQ as follows:

$$IEQEx = Min(CAPEn, CAPEx, AEn, AEx)$$

Substituting in the figures quoted the equation is as follows:

$$IEQEx = Min(84783,75000,113333,110000)$$

$$IEQEx = 75{,}000\ kWh$$

The AQ_{Ex} in this scenario, as defined in BR36.2 is 60,000 kWh and so, in accordance with BR36 the EQ_{Ex} is calculated as below:

$$EQEx = Min(IEQEx, AQEx)$$

$$EQEx = Min(75000,60000)$$

$$\boldsymbol{EQEx = 60{,}000\ kWh}$$