Public – proposed for Authority approval

Methodology for GB Commercial Arrangements relating to Interconnector Capacity Calculation

~~September 2023 – Version 2.0~~[Implementation date] – Version 3.0

NESO
National Energy System Operator

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Note for reviewing purposes only – not for publication in any final approved draft:

Text highlighted in yellow is for information only regarding proposed changes

Text highlighted in green are proposed changes made post-consultation

Introduction

Context

Net Transfer Capacity (NTC) is a value used by System Operators (SOs), including the National Energy System Operator (NESO), in order to set the maximum capacity that an interconnector can import and/or export to that SO's grid for a given Market Time Unit (MTU). Commercial compensation is available for the NTC restrictions set by NESO, using calculations based on relevant and quantifiable data sources.

NTC restrictions are applied for system security reasons. Details of those system security reasons, and the process for the calculation of NTC restrictions, can be found in the separate '~~GB NTC Calculation Policy' document.~~GB NTC Calculation Policy' document.

Purpose

This document outlines the GB methodology for commercial arrangements for payments relating to interconnector ~~(IC)~~ capacity restrictions resulting from NTC restrictions set by ~~National Grid Electricity System Operator (ESO)~~ NESO.

It is a reference for all parties to use to understand the calculations and processes involved in determining compensation value and settlement.

The commercial arrangements in this document should be applied to:

- All interconnector projects (existing and future) that are connected to the GB transmission system~~.~~
- Capacity calculations made both before and after the ~~Firmness Deadline~~FIRMNESS DEADLINE (definitions for capitalised terms can be found in the 'Applicable Terminology' section)~~.~~

This methodology should be applied in full to ensure consistency of NTC compensation arrangements across all interconnectors.

Material changes, resulting in fundamental changes to the operation of interconnectors to cross-border market coupling or the submission of the Capacity Calculation technical procedure under the Trade and Cooperation Agreement (TCA) will trigger a subsequent review of this methodology. In lieu of either of these major events occurring, ~~the ESO~~ NESO will ~~conduct a~~ review ~~by the end of 2025~~ this methodology in line with any recommended

frequency from Ofgem. Ongoing feedback on the methodology should be communicated through the Interconnector Operating ~~Protocol~~ Panel (IOP) meetings or relevant account managers.

~~A number of capitalised terms are defined in section 5 of this document.~~

~~2. Overview of Net Transfer Capacity (NTC)~~

~~What is an NTC?~~

~~NTC or Net Transfer Capacity is a value used by System Operators (SOs) in order to set the maximum capacity that an interconnector can import and/or export to that SO's grid for a given Market Time Unit (MTU). The NTC process is a method of calculating the resulting maximum import and export capacities that an interconnector can release to the market (Final NTC). The Final NTC, which is based on the following inputs, is the lowest of any of these inputs and is calculated independently for each flow direction and MTU:~~

~~Firstly, the asset rating, condition and any relevant outages on the interconnector as determined by the interconnector owner i.e., the interconnector capability;~~

~~Secondly, any restriction to the interconnector's capacity (NTC restriction) submitted by the System Operators (SOs) at each end of the interconnector, i.e. ESO or the Connected System Operator, based on the SO's respective system conditions and possible security limitations required in order to maintain secure system operation (system security).~~

~~Final NTC Calculation processes are carried out at Day-ahead (DA) and Intraday (ID) timeframes during which the interconnector owner can update its capability declaration and the connected SOs can submit or update their NTC restrictions, where operationally required, ahead of the capacity allocation auctions. If ESO has a requirement to restrict an interconnector's capacity and therefore submits an NTC restriction, the resulting effect on the interconnector's capacity depends on the type of capacity affected listed as follows: unallocated capacity, allocated capacity, nominated capacity and curtailed capacity.~~

~~NB; some interconnectors currently use Intraday Trading/Transfer Limits (ITLs) rather than NTCs. ITLs were the initial method to manage interconnector capacity and are subtly different to NTCs. ITLs only limit UNALLOCATED capacity and only feed into ID auctions. They cannot restrict other forms of capacity and cannot be used at the DA~~

~~timeframes. Also, there is no compensation associated with the use of ITLs. ESO is working with the interconnector owners and Connected SOs still utilising ITLs to transition to the use of NTCs.~~

~~How does ESO submit an NTC restriction?~~

~~The processes relating to the submission of SOs' NTC restrictions and the calculation and application of Final NTCs, at each timeframe, for each interconnector are trilaterally agreed with both the interconnector owner and Connected SOs.~~

Commercial Principles

Where NTC restrictions submitted by NESO result in interconnector capacity being restricted, NESO will make compensation payments for the NTC restriction as follows.

~~In certain circumstances, e.g., where the NTC restrictions result in additional income for the Interconnector Owner, the compensation payment will be from the Interconnector Owner to NESO as per item (C) below.~~ The GB commercial arrangements for payments relating to NTC restrictions by ~~ESO~~NESO comply with the following principles:

(A) This methodology covers the commercial arrangements between the interconnector owner and NESO. It does not deal with the terms either between the interconnector owner and the holders of transmission capacity through the interconnector capacity auction processes or the Connected SO.

(B) To ensure cost neutrality, payments to an interconnector owner:

- For reduction to ~~Allocated~~ALLOCATED capacity, should reflect the cost to the interconnector owner of remunerating transmission capacity holders as set out in the relevant interconnector owner's Access Rules~~.~~
- For reduction to UNALLOCATED capacity, should reflect the likely cost to the interconnector owner with the NTC restriction applied, compared to a scenario where the NTC restriction had not been applied~~.~~
- Will be considered on a case-by-case basis ~~T~~to reflect any other cost impacts external to capacity auctions (~~explicit or implicit~~ EXPLICIT or IMPLICIT)~~will be considered on a case-by-case basis~~. Any such additional impacts can and should be raised, and evidenced, via IOP meetings~~.~~

(C) Any payments should recognise that an interconnector owner may generate additional income through a reduction in capacity (e.g., as capacity becomes scarce

this may increase the price of capacity and congestion income may increase, see Calculation Method #4 in the Appendix). Payments should ~~also take into~~ account for instances where an interconnector owner receives congestion income via implicit auctions. This may result in an interconnector owner paying, rather than receiving, payments if congestion revenue exceeds calculated compensation (please refer to the Calculation Method #2 in the Appendix). Any payments made by interconnector owners are via invoices from NESO (see the Invoicing section of this document) and are returned to the consumer via the Balancing Services Use of System (BSUoS) process.

(D) Any payment must only cover the volume of reduced interconnector capacity resulting from NESO's NTC restriction. No payment will be due if the capacity reduction is the result of any other factor, e.g. reduced interconnector capability or NTC restrictions by the Connected SO (unless concurrent in which case see point F). In the case of loss of access resulting from the interconnector owner's assets (such as an interconnector fault/trip by the interconnector), there will be no further compensation to the interconnector owner via this mechanism.

(E) Ex-ante capacity reductions resulting from planned maintenance or works on the National Electricity Transmission System (NETS) shall not result in any compensation between NESO and the interconnector owner if the Bilateral Connection Agreement (BCA) for that interconnector describes a reduction of the Transmission Entry Capacity (TEC) for that specific planned outage condition.

(F) A reduction of capacity can only be paid once and the application of NTC restrictions will be co-ordinated between relevant SOs. ~~s~~Should NTC restrictions by the two SOs result in an equal capacity reduction, in order to avoid duplication of compensation, the GB commercial arrangements shall cover half of the shared NTC restriction. Any additional capacity reduction beyond the shared NTC restriction, will be wholly picked up by the respective SO. For example, if NESO's NTC restriction reduces capacity by 100MW and the Connected SO's NTC restriction reduces capacity by 125MW, the GB commercial arrangements shall be applicable to 50MW only (half of the shared amount). Whereas, if NESO's NTC restriction reduces capacity by 125MW and the Connected SO's NTC restriction reduces capacity by 100MW, the GB commercial arrangement shall be applicable to 75MW (half of the shared amount plus all of the remaining unshared amount, i.e. (100/2)+25.

(G) All parties (the interconnector owner, NESO and the Connected SO) will be responsible for ensuring that the working mechanism for calculating capacity ahead of allocation at the relevant timeframes is carried out as agreed. This can be achieved via any agreed party (or a third party) fulfilling the calculating party role.

(H) This methodology will be implemented via ~~the necessary interconnector agreement changes~~ changes to relevant interconnector Bilateral Ancillary Service Agreements (BASA)/System Operation Agreements (SOA) and relevant settlement agreements, ~~to reflect the NTC calculation process in the operating tools and relevant settlement agreements~~ reflecting the NTC compensation processes.

~~4. Principles of use~~

~~This section provides an understanding of the principles of when and how NTC restrictions are applied by ESO. NTC restrictions are used as a last resort action to ensure secure system operation.~~

~~ESO will submit an NTC restriction that allows maximum interconnector capacity, but which is consistent with secure system operation (System Security).~~
~~The decision to calculate and possibly apply NTC restrictions will be based on:~~

- ~~the best forecast of system conditions at the time;~~
- ~~the best view of credible alternative actions that *are likely to* be available;~~

~~ESO will not submit DA NTC restrictions on a given IC where ID options are available. This means either:~~

- ~~An established explicitID market, where the throughput of energy volumes in the connecting market meets or exceeds that requested by ESO; or~~
- ~~Some other form of ID service provided by either the IC, connecting SO or another third party with reasonable availability and firmness.~~

~~The exception to this is where a new ID market or service is formed, confidence and/or liquidity (i.e., is ESO able to secure the required volumes in the new market or service) would need to be built up before solely relying on this option in lieu of submitting DA NTC limits.~~

~~ESO will seek to move the ALLOCATED flow to within securable limits via trading or other SO-SO trades;~~

~~ID NTC restrictions will be submitted:~~

- ~~In case of further ID (re)nominations;~~
- ~~In case ESO needs to secure market traded or SO-SO traded actions (securing against failed trades for any reason).~~

~~Where multiple ICs jointly contribute/exacerbate a particular constraint, the total NTC restriction will be spread across the multiple ICs equitably, as far as is practicable.~~

- ~~This requires a complex consideration of many elements, such as respective effectiveness of each IC to reduce a constraint and what initial nominations already exist.~~

~~GB Commerical Arrangements Methodology~~Methodology for GB Commercial Arrangements

Applicable Terminology

~~Nominated~~NOMINATED

Capacity that has been sold by an interconnector owner in an auction at any timescale and nominated by the capacity holder before the relevant nomination gate and declared in any corresponding ~~the~~ (Final) Physical Notification. Or under an implicit coupling mechanism, the resulting flow as an output from the coupling algorithm and declared in any corresponding ~~the~~ (Final) Physical Notification.

~~Allocated~~ALLOCATED

Capacity that has been sold to a capacity holder(s) through auctions in any timescale and the nomination gate has not closed. Or capacity that has been implicitly allocated and nominated as a result of an implicitly coupled auction (and therefore scheduled a flow).

~~Unallocated~~**UNALLOCATED**

Capacity that ~~has~~ either:

- Has not been sold in prior rounds of market activity
- ~~Capacity that m~~May have previously been allocated but the nomination gate has passed and the capacity has not been nominated~~, under 'Use-it-or-Lose-it' principle~~
- ~~Capacity~~Has not been nominated under an implicit coupling mechanism

~~Implicit~~**IMPLICIT**

Implicit allocation is in accordance with the market coupling mechanisms where capacity is not bought directly but is implicitly bought with the energy product through a coupled auction and therefore the flow is directly allocated (~~&~~and nominated).

~~Explicit~~**EXPLICIT**

Explicit allocation is where capacity rights are bought directly by parties and are nominated afterwards to produce a flow (but nomination is not mandatory).

~~Firmness Deadline~~**FIRMNESS DEADLINE (FD)**

The point in time after which cross-zonal capacity becomes firm for each interconnector, in accordance with their respective Access Rules.

~~Curtailment~~**~~CURTAILMENT~~**

When an NTC restriction results in ~~allocated~~ ALLOCATED and/or ~~nominated~~ NOMINATED capacity being restricted in the final round of market activity (this is usually the ~~ID~~ intraday phase), which therefore means curtailing the final ~~nominated~~ NOMINATED flow. ~~This should only occur in a 'force majeure' or emergency situation as usually NESO would counter-trade in order to move the scheduled flow below the level of the required curtailment.any required NTC restriction.~~

GB Commercial ~~Methodology~~ Arrangements

Tables 1 & 2 ~~& 3~~ illustrate the GB commercial arrangements for explicit and implicit auctions respectively,~~each capacity regime, on each bidding zone border and where different categories of capacity restriction occur~~ whether restricted in the day ahead (DA) or intraday (ID) timeframes.

These tables represent the different ~~coupling~~ trading arrangements that exist (or will exist) across GB borders, and therefore each table references the relevant mechanism for clarity. The principles of the commercial methodology are consistent across the different ~~coupling~~ trading arrangements. This document will be updated when these arrangements change ~~over time or as new interconnectors connect~~.

For a more in-depth explanation of the settlement methods in each box (labelled 1, 2, 3, 4a, 4b), please see the calculation methods in Appendix 1.

Table 1: GB Commercial Arrangements matrix for ~~explicit~~ EXPLICIT DA, and ~~explicit~~ EXPLICIT ID

For example, IFA, BritNed, ~~NEMO~~Nemo Link, IFA2, ElecLink and Viking Link

Timing of NTC & type of capacity affected	Allocated capacity restricted	Unallocated capacity restricted
Capacity management feeds into ~~D~~day ~~-~~ ahead auctions **(i.e. before DA FD)**	(1) See relevant Access Rules	2) The loss adjusted (~~D~~day ~~A~~ahead) market spread
Capacity management feeds into ~~i~~Intraday auctions (i.e. after DA FD, before ID auction opening)	(3) Net imbalance charge from both markets	(4a) Net capacity revenue loss/gain calculated from unrestricted marginal price (4b) For 0MW auctions; the median marginal price relating to the specific hour and direction for each[1] of the previous 31 days.*

**Where 31 days of data are not available the number of days data that is available will be utilised. However, in the event that this is 0, then agreement will be reached with the affected ~~i~~Interconnector to utilise a number of days in the future.*

[1] Any auctions which produced a null result (due to having 0 capacity available) will be removed from the rolling average calculation so as to not skew the results.

Table 2: GB Commercial Arrangements matrix for ~~implicit~~IMPLICIT DA and/or ID

For example, Moyle, EWIC, ~~and~~ Greenlink and NSL (where applicable)

Timing of NTC & type of capacity affected	~~Allocated~~ ALLOCATED capacity restricted	~~Unallocated~~ UNALLOCATED capacity restricted
Capacity management feeds into d~~D~~ay-ahead auctions (i.e. before DA FD)	~~N/A~~ (1) See relevant Access Rules	~~N/A~~ (2) Where practicable, the difference in congestion rent from a re-run of the coupling algorithm without restriction OR, the loss adjusted (day ahead) market spread
Capacity management feeds into i~~I~~ntraday auctions (i.e. after DA FD, before ID auction opening)	(3) Net imbalance charge from both markets	(2) Where practicable, the difference in congestion rent from a re-run of the coupling algorithm without restriction OR, the loss adjusted~~,~~ (intraday) market spread

~~*Table 3: GB Commercial Arrangements matrix for Implicit DA.*~~

~~*For example, NSL*~~

~~Timing of NTC & type of capacity affected~~	~~Allocated capacity restricted~~	~~Unallocated capacity restricted~~
~~Capacity management feeds into Day-ahead auctions (i.e. before FD)~~	~~N/A~~	~~(2) Where practicable, the difference in congestion rent from a re-run of the coupling algorithm without restriction OR, the loss adjusted (Day-ahead) market spread~~

~~Capacity management feeds into Intraday auctions (i.e. after FD, before ID auction opening)~~	~~N/A~~	~~N/A~~

Implementation Method [new position for this text]

Tripartite discussions between the interconnector, NESO and the Connected SO shall be needed to include the relevant NTC processes in the trilateral Operating Protocol (OP).

In addition, the applicable interconnector specific settlement agreements shall be updated accordingly to align with the processes outlined in the ~~Operating Protocol~~OP.

Future Developments [new position for this text]

- **ITL Transition:** ~~Existing~~ Remaining legacy interconnector agreements which reference ITLs are expected to be updated to NTCs to be consistent with this methodology.
- **Trade and Co-operation Agreement (TCA)**: NTC restrictions shall be used in parallel to the development of the Capacity Calculation arrangements envisaged within the TCA. This document shall be revisited, if needed, following the finalisation of the ~~D~~day ~~-~~ahead and/or ~~i~~Intraday Capacity Calculation technical procedure(s).
- ~~**Loose Volume Coupling:** As part of the TCA a new Day-ahead auction is being developed. It is expected that this will result in a form of IMPLICIT coupling being implemented. As described above, for IMPLICIT auctions the best approach~~

~~is to re-run the new algorithm, with and without NTC limits to determine if the interconnectors gain or lose congestion income.~~

- ~~.~~**Market coupling**: this methodology shall be updated should a form of implicit coupling between GB and connected markets and/or a Coordinated Capacity Calculation Methodology with neighbouring TSOs be developed.

The Calculation Process

Considering the number of variables involved between interconnectors owners, auction regimes and various scenarios, calculating any settlement becomes complex. Below, NESO outlines the process that will be undertaken to run this calculation.

For the avoidance of doubt, the formulae set out in Appendix 1 is illustrative and generalised for all interconnectors. While specific data sources may vary between interconnectors, they represent the same data referenced in the generic formulae in Appendix 1. The final formula will be set out and agreed in the trilateral interconnector settlement agreements.

Where necessary, sign convention may be reversed to indicate credit or debit payment direction.

Where restricted volumes are concerned, losses will be accounted for as appropriate according to each interconnector owner's Access Rules.

A. "Build the Picture"

Before calculating any settlement data, NESO we must build the picture of the volume of each type of capacity restricted at each horizon. This uses the aAuction dData, Interconnector Nominated Flow and Outages/Commercial Availability sources detailed abovebelow.
With this data, NESO can calculate the volume of unallocatedUNALLOCATED and allocated ALLOCATED capacity restricted through NTC restrictions at both the DA and ID stages, for each settlement period.

Data Sources Required:

NESO and Connected SO NTC restriction data

The first step is to ascertain what NTC restrictions have been submitted by both system operators. This data is provided either by the Final NTC Calculating party or by the interconnector owner (as detailed in the individual iInterconnector Operating Protocol and settlement agreement).

Outages/Commercial Availability

To know how much capacity was restricted through NTC restrictions, NESO cannot assume the interconnector could have been available to run at maximum import/export – NESO must account for this by considering the commercial availability/capability of the interconnector at the time of auction. NESO~~'s initial approach has been to~~ utilises Elexon's BM Reports/REMIT data, filtered as appropriate, to determine the maximum capability for the interconnector for each auction. For some interconnectors, this information is provided by the Final NTC Calculating party or by the ~~i~~interconnector ~~O~~owner.

- ~~https://www.bmreports.com/bmrs/?q=remit~~ https://bmrs.elexon.co.uk/remit provides a user interface for exporting data as needed. Elexon also has an API feature which can be used to fetch this data.

Interconnector Nominated Flow

In order to distinguish what capacity was ~~allocated~~ALLOCATED, ~~unallocated~~UNALLOCATED, ~~nominated~~ NOMINATED and unnominated across DA and ID timescales, the Total Nominated Flow is needed.

For DA Auctions:

- The ~~nominated~~ NOMINATED capacity is the sum of nominations made separately across import and export. This value can either be provided directly or derived from the auction specifications (offered capacity) and the commercial availability/capability of the interconnector
- The ~~allocated~~ ALLOCATED but unnominated capacity can ~~then either~~ be calculated as the difference between the ~~two values above or fetched by assessing the~~ volume of capacity sold across all Long Term auctions and the nominated capacity

For ~~Intraday~~ ID auctions, ENTSO-E's transparency platform ~~similarly to DA, the exact source of this data may vary across interconnectors. As an example, Nemo Link's~~can be used to see nominations at Long Term, ~~D~~day~~-~~ ahead and intraday timeframes ~~are available on ENTSO-E's transparency platform~~ - ~~https://transparency.entsoe.eu/transmission-domain/r2/totalCapacityNominated/show.~~ https://newtransparency.entsoe.eu/market/energyPrices

B. Gather Commercial Data

The next step is to gather ~~A~~auction ~~-d~~Data, ~~D~~day~~-~~ ahead prices and ~~I~~imbalance/~~S~~system ~~P~~prices, for each settlement period. NESO can now calculate the ~~D~~day~~-~~ ahead spreads, the net imbalance costs and recalculate explicit auction clearing prices. These calculations are explained in ~~Step C~~Appendix 1.

C. Apply the Settlement Calculation Formulae~~:~~

Depending on the interconnector's specific auction profile (see tables 1 & 2~~-3~~), different calculations apply for different types of capacity restrictions. These calculations are captured by four ~~4~~ methods, labelled 1, 2, 3 or 4 (a/b)~~-4~~ in their respective tables in the 'GB Commercial Arrangements' section above.

Please see Appendix 1 for the illustrative and generalised formulae examples of these four methods.

Reminder: the final formulae (and data sources) will be set out and agreed in the interconnector settlement agreements.

[Formulae relocated to the Annex]

D. Apply Cost-Sharing Principles [new position for this text]

Once we have calculated the settlement figures for each relevant scenario, for each settlement period, we must then consider Commercial Principle F – for each settlement period, ~~what~~ the proportion of the total settlement figure ~~is~~ that NESO is responsible for~~?~~. In practice this involves repeating the calculations in Step A (in the Calculation Process) but calculating how much capacity was restricted individually by NESO and the Connected SO, rather than just using the lower value.

Settlement [new position for this text]

Payments between the interconnector and NESO will only commence ~~when~~following:

i) ~~there is an agreed bilateral a~~agreement for this between the interconnector and NESO, that is in line with the arrangements and principles within this document.

ii) ~~.~~A two-month period to create and test the calculation documentation with the specific data sources for that interconnector.

The detail of the settlement and payment arrangements shall also be outlined in each party's bilateral agreements.

To support the invoicing arrangements, NESO will collect the available data required to support the settlement of the commercial arrangements outlined in this document. Should the data not be able to be retrieved, interconnector~~s~~ owners are requested to provide the data.

There is no set cap to compensation values settled by NESO as compensation is based on the restrictions applied and calculation methods outlined in this document.

Currency [new position for this text]

~~We~~ NESO will look to settle NTC restrictions in Euros where appropriate using HMRC's[2] published monthly GBP:EUR exchange rate for the settlement month (refer to this link: https://www.trade-tariff.service.gov.uk/exchange_rates~~. It does not however make sense to convert GB imbalance costs from GBP to Euros for this purpose~~. Imbalance costs from GB will remain in GBP.

~~This will mean providing two monthly invoices:~~

~~1. Settlement for any incurred GB imbalance from formula3, in GBP;~~

~~2. Settlement for all other compensation formulae, in EUR.~~

[2] https://www.trade-tariff.service.gov.uk/exchange_rates

Invoicing process [new position for this text]

~~Monthly invoices will be produced by the party who is owed money based on the net value of transactions for the month~~NESO will produce a preliminary statement followed by either Self-Billing invoices (for payment to an interconnector owner) or Sales invoices (requesting payment from an interconnector), based on the net value of transactions for the month.

Multiple invoices may be raised in a month if more than one currency is involved:

- Settlement for any incurred GB imbalance from Calculation Method 3, in GBP
- Settlement for all other compensation formulae, in EUR

The invoice will be added, ~~sent in PDF format by email~~in PDF format, to the corresponding NESO SharePoint site for a provider. The standard timescales shall be as follows or as otherwise detailed in respective settlement agreements:

- By the ~~8th~~ eighth business day from the ~~1st~~ first day of the month, the preliminary statement for the previous month shall be issued by NESO to the interconnector owner.

  For example, by 10th June ~~2020~~2026, a preliminary statement will be issued for the NTC transactions which occurred between 01st May ~~2020~~ 2026 to 31st May ~~2020~~2026.

- Data shall be reviewed by the two parties between the issue of the preliminary statement and the issue of the invoice.

- By the ~~18th~~ eighteenth business day from the ~~1st~~ first day of the month, an invoice will be issued ~~by the party who is owed money~~.

- For example, by 24th June ~~2020~~2026, an invoice will be issued.

- From 6 business days from the issue of the invoice, payment will be made.

- For example, the payment outlined on the invoice will be made from 02~~nd~~ July ~~2020~~2026.

The standard payment calendar is available on the Settlements page of the NESO website.

Disputes [new position for this text, previously within 'Settlement']

Any dispute relating to NTC compensation will be resolved as per the terms of the interconnector's BASA or SOA.

For example, ~~O~~on a monthly basis, ~~in between Settlement prelim and final phases,~~ the interconnector is able to flag, after the preliminary statement or invoice has been raised, where fair value has not been experienced by one or both parties. This may be due to additional market activity~~;~~ not considered as part of the calculation in the methodology. Data can be provided by the interconnector to be managed as part of the Settlements dispute process and used in exception to create overriding values where relevant. The assessment will be documented by NESO and approval to override the relevant ~~the~~ settlement period value will be provided by senior management.

~~Please refer to Appendix 1 for details of settlement..~~

Appendix 1 – Settlement Calculation Formulae

['The Calculation Process' sections moved to earlier in the document]

Calculation Method 1: ALLOCATED ~~Allocated~~ Capacity restricted before FD

See the relevant Access Rules for the details of how capacity holders are remunerated. ~~But for illustrative purposes an example calculation for EXPLICIT auctions will broadly be as follows:~~

~~$Settlement_i = PDACLEAR \times VDAALLOCATED$~~

~~Where:~~

~~P^{DA}_{CLEAR} = Clearing price of the Day-ahead auction, where restricted capacity would have been sold.~~

~~$V^{DA}_{ALLOCATED}$ = The Volume of ALLOCATED Capacity restricted through NTC restrictions.~~

~~Data Sources Required~~

~~DA Prices:~~

~~The Day-ahead Wholesale Price is needed in each relevant region to calculate the difference between them – the Day-ahead spread. A common data source for all regions should be used for ESO's compensation calculation – ensuring the final settlement figure is fully cost-reflective and fair across parties. For countries neighbouring GB, ENTSO-E serves as a common source for the DA Price. For GB, whilst single Intra-GB coupling is not in place, a volume-weighted average of the two hubs will be used.~~

~~- https://transparency.entsoe.eu/transmission-domain/r2/dayAheadPrices/show provides the user interface for exporting this data using ENTSO-E's transparency platform. ESO will be using ENTSOE's API to automate the gathering of this data as needed.~~

~~- https://eu.data.energy/#eu provides EPEX Day-ahead Price and Volume data (as well as some imbalance data covered below). This source requires paid membership.~~

~~- Market data | Nord Pool (nordpoolgroup.com) www.nordpoolgroup.com provides historical data on N2EX Day-ahead Prices and Volumes. This source requires a paid subscription~~

Calculation Method 2: ~~Unallocated~~ UNALLOCATED Capacity restricted~~, impacting~~ on an IMPLICIT ~~implicit~~ auction

Any volume of capacity restricted under these conditions will be paid either according to the net loss/gain in congestion rent as determined by the coupling algorithm (Option 1) or the ~~l~~Loss ~~a~~Adjusted, ~~scarcity corrected, day ahead~~ market spread from the relevant auction (Option 2).

Should NTCs be applied to an IMPLICIT interconnector, Option 1 below is the preferred option, providing NESO are given access to the relevant order books~~, but the feasibility of this is yet to be ascertained~~.

Option 1:

~~Here~~ NESO~~we~~ re-run the IMPLICIT ~~implicit~~ market coupling algorithm with the restriction removed. This provides a simulated congestion revenue, which can be calculated using the formula below.

$$\textbf{Settlement}_{2,\ \text{OPTION 1}} = \left(\left(\left(P^{DA}_{GB,RERUN} - P^{CP}_{GB,RERUN}\right) \times R_{GBP_EUR}\right) - \left(P^{DA}_{RE,RERUN} - P^{CP}_{RE,RERUN}\right)\right) \times V^{DA}_{RERUN} V^{CP}_{RERUN}\right) -$$

$$\left(\left(\left(P^{DA}_{GB,ACT} - P^{CP}_{GB,ACT}\right) \times R_{GBP_EUR}\right) - \left(P^{DA}_{RE} P^{CP}_{RE,ACT} - ACT\right)\right) \times V^{DA}_{ACT} V^{CP}_{ACT}\right)$$

Where:

$P^{CP\,DA}_{GB,ACT}$ **= The Coupling Algorithm's "Live Outcome" ~~DA~~ Clearing Price in GB**

R_{GBP_EUR} **= The exchange rate to convert GBP to EUR (see the 'Currency' section of this document for more information)**

$P^{DA}_{RE} P^{CP}_{RE,ACT}$ **= The Coupling Algorithm's "Live Outcome" ~~DA~~ Clearing Price in the Remote-End region**

$P^{DA}_{GB} P^{CP}_{GB,RERUN}$ **= The Coupling Algorithm's "Rerun Outcome" ~~DA~~Clearing Price in GB**

$P^{DA}_{RE}P^{CP}_{RE,RERUN}$ = The Coupling Algorithm's "Rerun Outcome" DA Clearing Price in the Remote-End region

$V^{DA}_{ACT}V^{CP}_{ACT}$ = The Interconnector Flow determined by the Coupling Algorithm's "Live Outcome"

V^{DACP}_{RERUN} = The Interconnector Flow determined by the Coupling Algorithm's "Rerun Outcome"

Option 2:

Should access to the coupling algorithm prove impracticable, we will pursue the following method.

The Loss Adjusted spread will be used to approximate a value of the capacity restricted by ESO.NESO. Losses will be applied from the relevant end of the interconnector, e.g., the high price zone*.

Settlement *2, OPTION 2** = $((P^{CP}_{GB,LA}P_{DAGB,LA} \times R_{GBP_EUR}R_{GBP_EUR}) - P^{CP}_{RE,LA}P_{DARE,LA}) \times V^{CP}_{UNALLOCATED}V_{DAUNALLOCATED}$

Where:

$P^{DA}_{GB}P^{CP}_{GB,LA}$ = The Loss Adjusted day aheadclearing Wholesale Price in GB (volume-weighted between EPEX and NordPool)

R_{GBP_EUR} = The exchange rate to convert GBP to EUR

$P^{DA}_{RE}P^{CP}_{RE,LA}$ = The Loss Adjusted day aheadclearing Wholesale Price in the Remote-End region

*losses applied to the respective high price zone only

$V^{CPDA}_{UNALLOCATED}$ = The Volume of UNALLOCATED Capacity restricted through NTC restrictions

Data Sources Required:

Market ~~DA~~ Prices (spread):

The ~~day ahead~~ Wholesale Price is needed in each relevant region to calculate the difference between them – the ~~day ahead~~ spread. ~~A common data source for all regions should be used for NESO's compensation calculation~~ The published prices from the relevant auction platform hosting the coupled auction should be used – ensuring the final settlement figure is fully cost-reflective and fair across parties. For countries neighbouring GB, ENTSO-E serves as a common source for the DA Prices. ~~For GB, whilst single intra-GB coupling is not in place, a volume-weighted average of the two hubs will be used.~~ For specific auctions the relevant host should be used, e.g. Nordpool or EPEX.

- Transparency Platform provides the user interface for exporting this data using ENTSO-E's transparency platform. NESO will be using ENTSO-E's API to automate the gathering of this data as needed.
- https://eu.data.energy/#eu provides EPEX ~~D~~day-ahead price and volume data (as well as some imbalance data covered below). This source requires paid membership.
- Market data | Nord Pool (nordpoolgroup.com) provides historical data on N2EX ~~D~~day-ahead Prices and Volumes.

Calculation Method 3: ALLOCATED~~Allocated~~ Capacity restricted after FD

***Net Imbalance* Settlement~~3~~ = (P^{IMB}_{GB}~~P_{IMBGB}~~ x $V^{ID}_{ALLOCATED}$~~$V_{IDALLOCATED}$~~ x S_{GB}~~S_{GB}~~) + (P^{IMB}_{RE}~~P_{IMBRE}~~ x $V^{ID}_{ALLOCATED}$ ~~$V_{IDALLOCATED}$~~ ~~x~~ S_{RE})**

***Where*:**

P^{IMB}_{GB} **= The imbalance price in GB**

$V^{ID}_{ALLOCATED}$ **= The Volume of ALLOCATED Capacity restricted through NTC restrictions**

S_{GB} **= A binary value (either -1 or +1) to describe if the GB system was either in surplus or deficit**

P^{IMB}_{RE} **= The imbalance price in the Remote-End region**

~~$V^{ID}_{ALLOCATED}$ = The Volume of ALLOCATED Capacity restricted through NTC restrictions,~~

~~S_{GB} = A binary value (either -1 or +1) to describe if the GB system was either in surplus or deficit,~~

S_{RE} **= A binary value (either -1 or +1) to describe if the Remote-End system was either in surplus or deficit**

Any volume of capacity restricted under these conditions will be paid such as to hold the relevant interconnector whole on imbalance, netted across both market zones. By doing this, NESO holds the cost/risk for such restrictions.

Data Sources Required:

Imbalance/System Prices and Volumes

There is no single source for System Prices across Europe (ENTSO-E is inconsistent in this area). Some sources have been outlined:

- EnAppSys ~~(https://eu.data.energy/#fr/elec/pricing)~~(https://eu.data.energy/#fr/elec/pricing) - FR, NO
- TenneT ~~(https://www.tennet.org/english/operational_management/export_data.aspx) -~~ (https://www.tennet.eu/nl-en/grids-and-markets/transparency-data-netherlands/settlement-prices) - NL
- ~~Re.alto (https://portal.realto.io/browse-apis/elia-imbalance-data-be/details)~~ Elia Open Data (https://opendata.elia.be/explore/dataset/ods161/information/) - BE
- SEM-O ~~(https://www.sem-o.com/market-data/dynamic-reports/#BM-026) -~~ (https://www.sem-o.com/market-data/dynamic-reports) - ISEM

Calculation Method 4: UNALLOCATED~~Unallocated~~ Capacity restricted ~~, impacting~~ on an EXPLICIT~~explicit~~ auction

4a. Unrestricted vs restricted revenues

Restricting the capacity going into an ~~explicit~~ EXPLICIT- auction introduces scarcity in that auction. To compensate for these restrictions, ~~ESO~~NESO will look to calculate the unrestricted clearing price~~,~~ – ~~ESO~~NESO looks at answering the question "without the restriction, what would the auction have cleared at?"

The amount to be paid for capacity restricted under these conditions will be equal to the difference in the restricted and unrestricted auction revenue. It could be positive or negative – the settlement looks to hold the interconnector financially whole.

Settlement~~4a~~ = ($P^{CLEAR}_{WITH\ NTC}$ ~~$P_{CLEARWITH_NTC}$~~ x $V_{WITH\ NTC}$) – ($P^{CLEAR}_{WITHOUT\ NTC}$ ~~$P_{CLEARWITHOUT_NTC}$~~ x $V_{WITHOUT\ NTC}$ ~~$V_{WITHOUT_NTC}$~~)

Where:

$P^{CLEAR}_{WITH\ NTC}$ **= The Auction Clearing Price, when the NTC restriction is applied,**

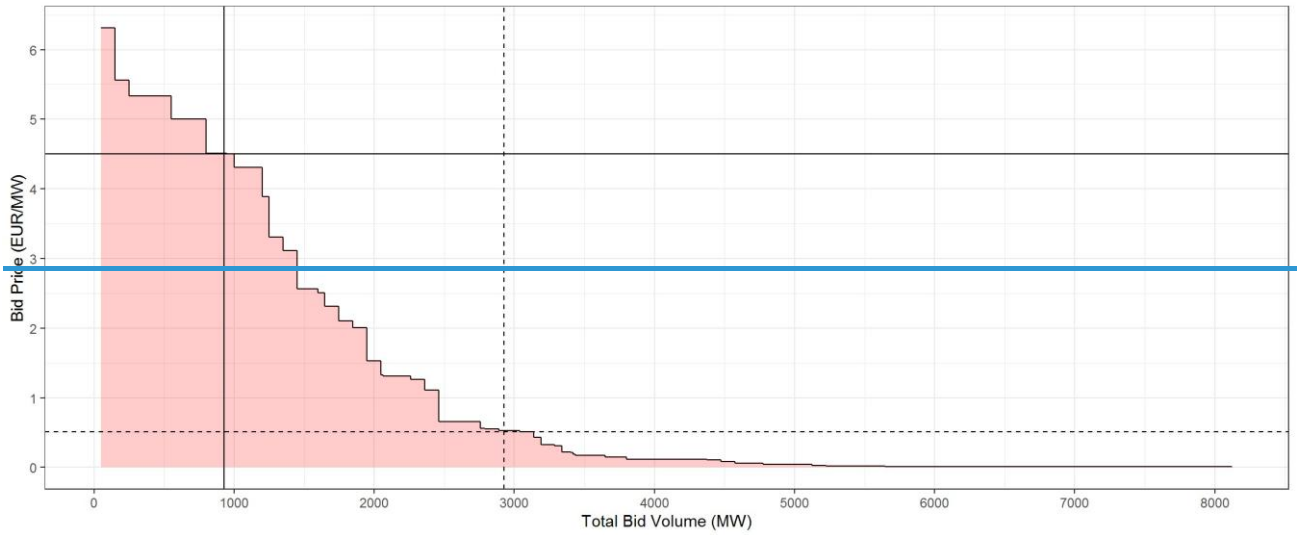
$P^{CLEAR}_{WITHOUT\ NTC}$ **= The Auction Clearing Price, when the NTC restriction is not applied,**

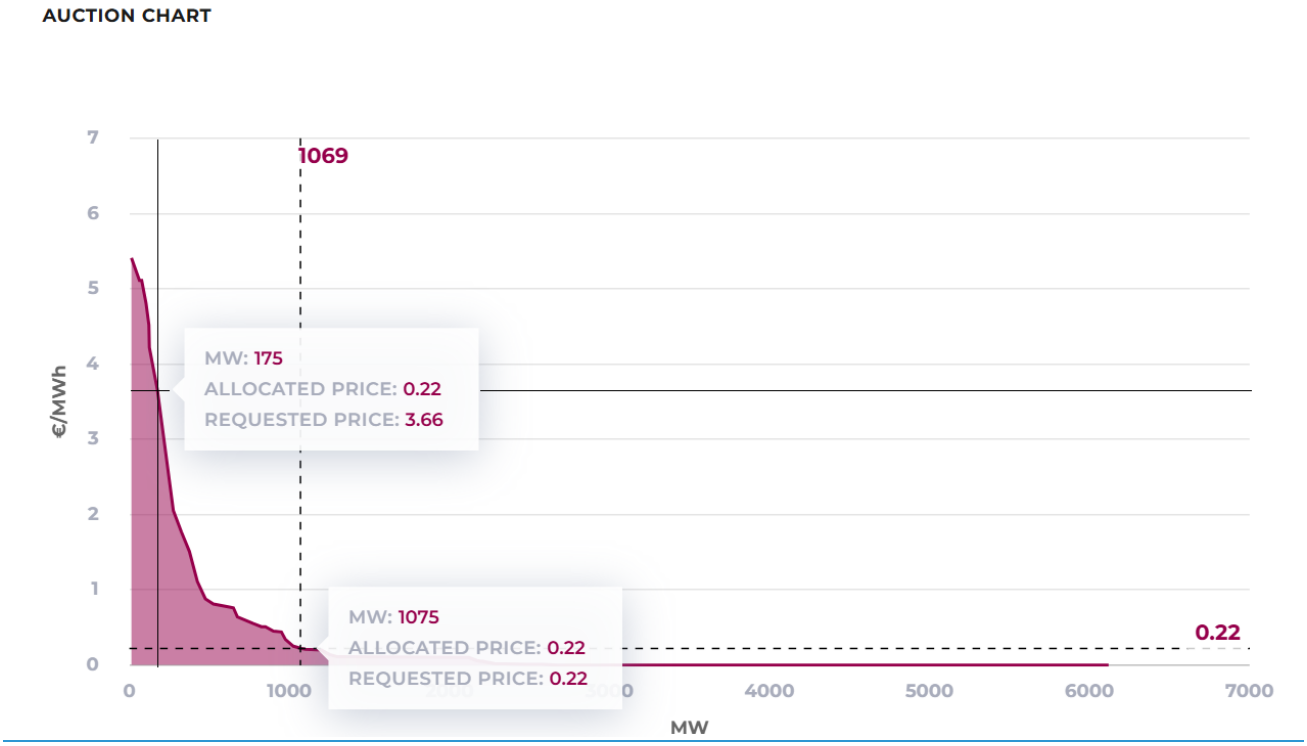
$V_{WITH\ NTC}$ **= The volume of capacity ALLOCATED- in the auction with the NTC restriction applied**

$V_{WITHOUT\ NTC}$ ~~**= V_WITHOUT_NTC**~~ **= The volume of capacity that would have been ALLOCATED- if the NTC restriction had not been applied. This can be calculated as: =MINIMUM((Requested Capacity), (V_WITH_NTC+NTC Restriction))**

This value is essentially the sum of $V_{WITH\ NTC}$ and the volume of capacity restricted due to the NTC restriction (calculated as part of "Build the Picture").

To further visualise this, please see the example plot below. This is an ~~explicit~~EXPLICIT auction bid ladder, with intercept lines to highlight volumes and clearing prices both with and without NTC restrictions.





4b. 0MW auctions

Restrictions on capacity under these conditions may result in 0MW capacity being offered in the auction – in other words, the auction doesn't take place. NESO will assess the historical clearing prices in both the import and export directions for the relevant hour of the day. NESO will look at the previous 31 days' auction data and calculate ~~both~~

the median ~~and mean~~ clearing price. ~~The lower of these two prices will be used to compensate restrictions of this type.~~

Settlement$_{4b}$ = MEDIAN(P^{CLEAR}) x $V_{WITHOUT\ NTC}$

Where:

P^{CLEAR} = A list of the previous 31 days' hourly, directional auction clearing prices, excluding any 'null' results. For example, if 5 of the 31 days had 'null' results, the median will be taken from 26 days' values.

$V_{WITHOUT\ NTC}$ = The volume of capacity that would have been sold, had no NTC restriction been applied.

Data Sources Required:

~~**DA Prices:**~~

~~The Day-ahead Wholesale Price is needed in each relevant region to calculate the difference between them – the Day-ahead spread. A common data source for all regions should be used for ESO's compensation calculation – ensuring the final settlement figure is fully cost-reflective and fair across parties. For countries neighbouring GB, ENTSO-E serves as a common source for the DA Price. For GB, whilst single Intra-GB coupling is not in place, a volume-weighted average of the two hubs will be used.~~

- ~~https://transparency.entsoe.eu/transmission-domain/r2/dayAheadPrices/show provides the user interface for exporting this data using ENTSO-E's transparency platform. ESO will be using ENTSOE's API to automate the gathering of this data as needed.~~
- ~~https://eu.data.energy/#eu provides EPEX Day-ahead Price and Volume data (as well as some imbalance data covered below). This source requires paid membership.~~
- ~~Market data | Nord Pool (nordpoolgroup.com) provides historical data on N2EX Day-ahead Prices and Volumes.~~

EXPLICIT Auction and Bid Data:

Auction specifications, bid ladders and results for ~~explicit~~ EXPLICIT capacity auctions. The exact source of this data varies across each interconnector, but JAO serves as a publicly available ~~example~~ source of the data, covering data for IFA, IFA2 and Nemo Link~~.~~

- ~~https://www.jao.eu/main~~ https://www.jao.eu/auctions#/ provides a user interface to export data manually from JAO. NESO will be using JAO's new API tool to import this data automatically as needed.