

Single Electricity Market

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| Final REcommendation ReportMod\_05\_19 amendment to uninstructed imbalance charge (cunimb) to correct for negative price scenarios Version 224 May 2019 |

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Document History

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| --- | --- | --- | --- |
| **Version** | **Date** | **Author** | **Comment** |
| 1.0 | 24 May 2019 | Modifications Committee Secretariat | Issued to Modifications Committee for review and approval |
| 2.0 | 07 June 2019 | Modifications Committee Secretariat | Issued to Regulatory Authorities for final decision |

Reference Documents

|  |
| --- |
| **Document Name** |
| [Trading and Settlement Code](http://www.sem-o.com/MarketDevelopment/MarketRules/TSC.docx) |
| [Modification Proposal Form](https://www.sem-o.com/documents/market-modifications/MOD_05_19/Mod_05_19AmendmenttoUninstructedImbalanceCharge%28CUNIMB%29Calculation.docx) |
| [Presentation 1](https://www.sem-o.com/documents/market-modifications/MOD_05_19/Mod_05_19AmendmenttoUninstructedImbalanceCharge%28CUNIMB%29tocorrectfornegativepricescenarios.pptx) |
| [Modification Proposal v2](https://www.sem-o.com/documents/market-modifications/MOD_05_19/Mod_05_19_V2_AmendmenttoUninstructedImbalanceCharge%28CUNIMB%29CalculationVersion2.docx) |
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# MODIFICATIONS COMMITTEE RECOMMENDATION

## Recommended for approval– Unanimous vote subject to legal drafting

|  |
| --- |
| **Recommended for Approval by Unanimous Vote**  |
| Siobhan O’Neill | Interconnector Member | Approve |
| Jim Wynne | Supplier Member | Approve |
| Robert McCarthy | DSU Alternate | Approve |
| Cormac Daly | Generator Member | Approve |
| Rochelle Broderick | Supplier Alternate | Approve |
| William Carr | Generator Alternate | Approve |
| Sean McParland | Generator Alternate | Approve |
| Sinead O’Hare | Generator Member | Approve |
| William Steele | Supplier Member | Approve |
| Julie Anne Hannon | Supplier Member (Chair) | Approve |

# Background

This Modification Proposal was raised by SEMO and was received by the Secretariat on 6th February 2019. Initially discussed at Meeting 89 on 20th February 2019 and then version 2.0 of this proposal was raised and voted on at Meeting 90 on 11th April 2019.

The Uninstructed Imbalance Charge (CUNIMB), calculated in Trading and Settlement Code paragraph F.9.4, is designed to calculate a premium to the charge applied to under generation outside prescriptively defined under generation tolerance levels and a discount to the payment for over generation outside over generation tolerance levels. This is in order to incentivise compliance with Dispatch Instructions centrally issued by the Transmission System Operators.

The level of premium or discount is parameterised and set by the Regulatory Authorities using the parameters Premium for Under Generation Factor (FPUG) and Discount for Over Generation Factor (FDOG) where both are currently set at 0.2 resulting in a 20% additional charge under generation or lesser payment for over generation for Uninstructed Imbalances outside of tolerance levels based on the difference between Loss Adjusted Metered Quantity and Loss Adjusted Dispatch Quantity and taking account of the unit specific Loss Adjusted Tolerance for Over or Under Generation as appropriate.

The premium or discount is applied to the product of the Imbalance Price (PIMB) and the Outside Tolerance Undelivered Quantity (QUNDELOTOL) and then an additional element of the algebra adds the premium or discount for the difference between the Imbalance Price and the Bid Offer Price (PBO) for any accepted bid where PBO is less than PIMB or any accepted offer where PBO was greater than PIMB to ensure that the premium or discount is applied at the same price at which the energy was settled where an Uninstructed Imbalance relates to an Accepted Bid or Offer Quantity. The intention here is to apply a 20% increase or decrease as appropriate for Uninstructed Imbalances outside a tolerance, at the appropriate rate, being that on which the volume was originally settled for BOAs and at the Imbalance Price otherwise.

This formulation works as intended where prices and bids are positive; however, where the Imbalance Price and/or a Bid Offer Price are negative this can result in incorrect charges being calculated and in some extreme scenarios can even lead to the Uninstructed Imbalance Charge becoming a payment and therefore a perverse incentive to not comply with Dispatch Instructions. An example of this is illustrated below;

Consider an Under-Generation Uninstructed Imbalance whereby a unit has an Outside Tolerance Undelivered Quantity (QUNDELOTOL) of -4 MWh, an Outside Tolerance Undelivered Accepted Offer Quantity (QAOUNDELOTOL) of 3 MWh, for a Bid Offer Price of 50 €/MWh and the Imbalance Price is -100 €/MWh. Applying the algebra in F.9.4.1 with a Discount for Under Generation Factor of 0.2 yields a charge of €10:

CUNIMB = Min(-4,0)\*((0.2\*-100))+(-0.2)(Max(50-(-100),0)\*3

 = (-4\*-20)+(-0.2\*150\*3)

 = 80 +(-90) = €-10

If the Imbalance Price in this example were -200 €/MWh this would result in a payment of €70 as follows;

CUNIMB = Min(-4,0)\*((0.2\*-200))+(-0.2)(Max(50-(-200),0)\*3

 = (-4\*-40)+(-0.2\*250\*3)

 = 160 +(-150) = €10

The correct outcome here is a charge for 1 MWh, which does not relate to an accepted offer, at the 20% of the Imbalance Price and a charge for 3 MWh at 20% of the Bid Offer Price for the Outside Tolerance Accepted Offer Quantity where the Bid Offer Price is greater than the Imbalance Price.

For the second Imbalance Price of -200 €/MWh this should yield €-70.

Calculating this intuitively by evaluating it directly on the applicable volumes (as opposed to applying PIMB to the entire outside tolerance quantity and then bringing it back to PBO for the accepted offer portion) yields:

CUNIMB = (0.2\*1\*-200)-(0.2\*3\*50)

 =-40-30

 = €-70

There are various scenarios of negative Imbalance and/or Bid Offer Price which result in incorrect outcomes based on the existing formulation.

Since the current algebra seeks to take an elegant approach by applying PIMB to the entire Outside Tolerance Uninstructed Imbalance Volume, and then bringing the accepted bid or offer portion to the PBO, rather than calculating the volume at the appropriate rate directly, we have aimed to retain this elegant drafting approach while proposing changes that ensure the correct outcomes regardless of the sign of the Imbalance or Bid Offer Price.

This is because the alternative/direct approach would be algebraically more cumbersome both for the legal drafting and the associated system change while the approaches are equivalent in outcome. For this example, the more elegant approach would evaluate as follows:

CUNIMB = (0.2\*4\*-200)-((50-200)\*0.2\*3)

 = -160-(-90)

 = €-70

The proposed approach achieves the required outcomes by taking the absolute/modulus of the applicable prices and applying the product of Accepted Bid Offer Quantities and price difference only where for any accepted bid the PBO is less than PIMB or for any accepted offer the PBO was greater than PIMB prescriptively as opposed to using Maximum and Minimum of the price difference around zero.

This is done by using binary operators of the form Min/Max(A-B,0)/A-B, which returns a value of one where the difference between the Bid Offer and Imbalance Prices is negative or positive for over-generation accepted bids and under-generation accepted offers respectively and applying this to the difference between the absolute values of the prices.

Otherwise, the binary operator returns a zero where the Accepted Bid or Offer Quantity would have settled at the Imbalance Price, due to the relative position of PBO and PIMB, as appropriate.

This is similar to what the existing max/min drafting seeks to achieve, and returns the same outcomes for positive Prices, but corrects the issues with incorrect price differentials being applied for negative prices. This approach, along with taking the modulus of the prices on application for both PIMB and PBO ensures that the outcome is always a 20% (or otherwise depending on FPUG/FDOG values) charge for each outside tolerance Uninstructed Imbalance volume at the appropriate price.

This approach has been scrutinised from the point of view of the principles that apply and has also been explicitly tested by calculating the CUNIMB for 34 scenarios for different Over/Under Generation Uninstructed Imbalance and relative price positions and signage and has been confirmed as resulting in the correct settlement outcome for each of these scenarios.

For the second example with a PIMB of -200 €/MWh described above this evaluates as follows (where the binary operator is underlined):

CUNIMB = [Min(-4,0)\*(0.2\*200)]-[0.2\*((50-200)\*3\*(Max(50-(-200),0)/(50-(-200)))]

 = (-4\*40)-[0.2\*-150\*3\*(250/250)]

 =-160-(-90)

 =€-70

While the algebraic formulation here has some complexity the principle aim of this proposal is reasonably straightforward. The aim is to move from a calculation of Uninstructed Imbalance **Charge** that applies Bid Offer and Imbalance Prices as charging rates when positive and payment rates when negative to one that applies them as charging rates throughout, including where the Imbalance volume itself was a payment to decrease generation or a charge to increase generation (without being instructed to do so) due to a negative price.

In this way, the mechanism is always as disincentive for deviations from dispatch and never incentivises such uninstructed deviations so that the intended incentive to comply with dispatch is not reversed where Prices are negative and also does not result in increased Dispatch Balancing Costs in error.

Note that the structural change to introduce the ‘If PBO-PIMB ≠/= 0 ’, ‘then’ construct, along with the introduction of UNIMBA*u****oi****γ* is merely to avoid the mathematical oddity of a divide by zero in the binary operator, where PBO=PIMB, which cannot be evaluated.

This is done by removing the binary operator from the calculation where PBO=PIMB along with the rest of the calculation to adjust back to PBO as it is not required where PBO=PIMB.

Evaluating the summations over bands and BOAs over the UNIMBA*u****oi****γ* variable which has been introduced rather than within the overall algebra is also neater and is the clearest way to capture the fact that that the summation applies to each entire UNIMBA*u****oi****γ* value which has been evaluated for each BOA band.

**Explanation for Additional Change Added to Version 2:**

Version 2 introduces an additional change which is to **remove** the minus sign immediately before the FDOG variable which commented in the legal drafting. This is to address an additional signage issue identified with the calculation of Uninstructed Imbalance Charges for QABUNDELOTOL. Since this is a removal of a minus sign and the entire drafting from vesion 1 is in tracked change it is not very clear to reflect this in the legal drafting as a tracked change hence the sign we propose removing is commented.

The reason for this change is that the existing drafting (and therefore the updated drafting proposed in version 1 also) contains a further error whereby the signage for the adjustment for undelivered accepted bid quantities is incorrect. This is because the algebra treats this as though it is a positive value where it is in fact a negative value due to being an offtake/purchase of power. The element of this algebra that relates to QAB should result in a positive adjustment (decrease in magnitude) for this Uninstructed Imbalance Charge so that it reduces the rate applied to any Outside Tolerance Undelivered Accepted Bid Quantity (QABUNDELOTOL) from PIMB to PBO where PBO is less than PIMB to reflect the fact that the Accepted Bid Quantity would originally have settled at PBO in this scenario via a discount charge applying i.e. the lesser of the PBO and PIMB applies to the charge for the energy therefore and the same should apply to the Uninstructed Imbalance. Due to this signage issue the QABUNDELOTOL component of the algebra is incorrectly increasing rather than reducing the Uninstructed Imbalance Charges in the scenario where there is an undelivered accepted bid quantity for which PBO is less than PIMB.

This is illustrated in the following examples:

Consider and Over-Generation Uninstructed Imbalance whereby a unit has an Outside Tolerance Undelivered Quantity (QUNDELOTOL) of 4 MWh, an Outside Tolerance Undelivered Accepted Bid Quantity of -3 MWh, for a Bid Offer Price of 50 €/MWh and the Imbalance Price is 100 €/MWh. Applying the algebra in F.9.4.1 with a Discount for Over Generation Factor of 0.2 yields a charge of €110:

CUNIMB = Max(4,0)\*(-(0.2\*100))+(-0.2\*(Min(50-100,0)\*(-3)

 = (4\*-20)+(-0.2\*-50\*-3)

 =-80+(-30)

 =-€110

The correct outcome here is for a Charge of 20% of the Imbalance Price for 1 MWh and 20 % of the PBO for 3 MWh to apply. The algebraic formulation seeks to achieve this by charging the entire 4 MWh at the Imbalance Price and correcting back to PBO for the 3 MWh QABUNDELOTOL; however, due to the additional signage issue identified, the QABUNDELOTOL adjustment is incorrectly being applied as an increase to the charge where PBO is less than PIMB where this should be a decrease to the Charge.

This is to account for the fact that the energy volume purchase for the accepted bid quantity would have settled at the more favourable PBO rate due to it being the lesser value. Intuitively the outturn CUNIMB value for this example should be a charge of €50 as follows:

CUNIMB = -(0.2\*1\*100)-(0.2\*3\*50)

 = -20-30

 =€-50

The correction proposed here would result in this being evaluated to the same amount but via the approach of applying PIMB to the full volume and then adjusting back to PBO for the accepted bid quantity as follows:

CUNIMB = (4\*-0.2\*100)+[0.2\*(Min(50-100,0)/(50-100))\*(50-100)\*-3]

 =-80+30

 =€-50

The updated drafting for version 2 of this proposal has been robustly tested using the same 34 scenarios as for version 1 and has resulted in the correct outcomes throughout including for negative price scenarios where Undelivered Accepted Bid Quantity adjustments apply.

This second version also proposes making a change to the new adjustment variable introduced so that it is clear that it is not an Uninstructed Imbalance Charge in and of itself but rather an adjustment to those charges. It also includes a glossary entry in the list of variables and parameters for the new uninstructed imbalance adjustment variables (UNIMBA*u****oi****γ*) the proposal utilizes which was omitted from version one.

Version 2 changes have been highlighted in yellow to aid clarity (see appendix 1).

# PURPOSE OF PROPOSED MODIFICATION

**3A.) justification of Modification**

This proposal seeks to correct the calculation of Uninstructed Imbalance Charges where negative prices apply so that this always results in a charge and therefore an incentive to comply with Dispatch Instructions at a rate governed by the appropriate energy price.

This would also mean that Uninstructed Imbalance Charges appropriately reduce Dispatch Balancing Costs rather than increasing them where negative prices occur.

**Justification for Additional Change Added to Version 2:**

The changes in Version 2 seek to correct an additional issue with the Uninstructed Imbalance Charge algebra whereby adjustments for Outside Tolerance Undelivered Accepted Bid Quantities at Bid Offer Prices which are less than the Imbalance Price are being applied in the wrong direction due to a further signage issue.

This change would ensure the correct treatment of these adjustments so that Uninstructed Imbalance Charges are correctly reduced by the adjustment rather than being increased in error which is currently the case.

**3B.) Impact of not Implementing a Solution**

If this proposal is not implemented a perverse incentive not to comply with dispatch where Imbalance or Bid Offer Prices are negative will remain and inappropriate increases (rather than reductions as should be the case) in Dispatch Balancing Costs will continue to occur where there are Uninstructed Imbalance ‘Charges’ with negative prices applied.

**Implication for Additional Change Added to Version 2:**

If the additional change is not implemented, Uninstructed Imbalance Charges for the Outside Tolerance Undelivered Accepted Bid Quantities it seeks to correct will continue to be calculated at an elevated level in error.

**3c.) Impact on Code Objectiv****es**

* + - * 1. to ensure no undue discrimination between persons who are parties to the Code; and

By ensuring that the 20% increase or decrease applied for Uninstructed Imbalances outside tolerance bands applies equally to those with such imbalances at times of negative and positive Imbalance Prices and also equally to those with negative and positive Bid Offer Prices.

* + - * 1. to promote the short-term and long-term interests of consumers of electricity on the island of Ireland with respect to price, quality, reliability, and security of supply of electricity.

By ensuring that the appropriate reduction in Dispatch Balancing Costs is caused by levying Uninstructed Imbalance Charges and that they are not inappropriately increased by these resulting in payments where prices are negative.

**Objectives Furthered for Additional Change Added to Version 2:**

* + - * 1. to ensure no undue discrimination between persons who are parties to the Code; and

By ensuring that Generators with an Outside Tolerance Undelivered Accepted Bid Quantity have Uninstructed Imbalance Charges calculated on an equitable basis with other Uninstructed Imbalance Charges so that the charge is based on the same rate as the power was settled for all volumes.

# Working Group and/or Consultation

N/A

# impact on systems and resources

Changes to SEMO settlement systems required to apply the amended algebra.

# Impact on other Codes/Documents

N/A

# MODIFICATION COMMITTEE VIEWS

## Meeting **89 – 20 February 2019**

SEMO made a request for this modification to be deferred as there was an additional change required for the same paragraph which was identified after this proposal was submitted. The proposer also noted that there was an error in one of the examples in the original proposal. They wished to submit a version 2 of this for consideration at Meeting 90.

## Meeting **90 – 11 April 2019**

The proposer delivered a [presentation](https://www.sem-o.com/documents/market-modifications/MOD_05_19/Mod_05_19AmendmenttoUninstructedImbalanceCharge%28CUNIMB%29tocorrectfornegativepricescenarios.pptx) referring to the original version 1 proposal relating to Uninstructed Imbalance Charges. They confirmed that version 2 of this proposal contains an additional fix to the charges where there is an Outside Tolerance Undelivered Accepted Bid Quantity. 34 scenarios were tested with various relative positions of Bid Offer Acceptance Prices and Imbalance Prices and Outside Tolerance Uninstructed Bid/Offer Acceptance Quantities to ensure that the proposed approach is robust. Proposer noted minor typos in the proposal form relating to the positioning of brackets for maximum/minimum functions.

The RAs raised an issue with the uninstructed imbalance adjustment variable the modification proposes introducing as it does not align with the drafting style for existing variables SEMO Member stated they would work to suggest an approach that is more in keeping with the drafting style used elsewhere and that this could be captured in the FRR if the committee were happy to proceed with the proposal. SEMO observer noted a similar construct elsewhere in the Code that could be replicated for this proposal and suggested making changes to that end.

Legal drafting changes were agreed for inclusion in the FRR to change the drafting approach for the adjustment variable and to address the issue with incorrectly placed brackets. The committee agreed to move to a vote subject to these changes being captured.

# Proposed Legal Drafting

As set out in Appendix 1 plus changes as agreed at meeting 90 highlighted below.

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		4. **Calculation of Uninstructed Imbalance Charges**
			1. Subject to paragraph F.9.4.2, the Market Operator shall calculate the Uninstructed Imbalance Charge (CUNIMBuγ) for each Generator Unit, u, in each Imbalance Settlement Period, γ, as follows:

where:

* + - * 1. QUNDELOTOLuγ is the Outside Tolerance Undelivered Quantity for Generator Unit, u, in Imbalance Settlement Period, γ.
				2. QAOUNDELOTOLuoiγn is the Outside Tolerance Undelivered Accepted Offer Quantity for Generator Unit, u, for Bid Offer Acceptance, o, for Band, i, in Imbalance Settlement Period, γ.
				3. QABUNDELOTOLuoiγn is the Outside Tolerance Undelivered Accepted Bid Quantity for Generator Unit, u, for Bid Offer Acceptance, o, for Band, i, in Imbalance Settlement Period, γ.
				4. PIMBγ is the Imbalance Settlement Price in Imbalance Settlement Period, γ, calculated in accordance with Chapter E (Imbalance Pricing);
				5. PBOuoiγ is the Bid Offer Price for each Outside Tolerance Undelivered Accepted Bid Quantity and Outside Tolerance Accepted Offer Quantity for Generator Unit, u, for Bid Offer Acceptance, o, for Band, i, in Imbalance Settlement Period, γ;
				6. is a summation over all Bid Offer Acceptances, o;
				7. is a summation over all Bands, i;
				8. FPUGuγ is the Premium for Under Generation Factor for Generator Unit, u, in Imbalance Settlement Period, γ;
				9. FDOGuγ is the Discount for Over Generation Factor for Generator Unit, u, in Imbalance Settlement Period, γ;
				10. CUNIMBAuoiγ is the Uninstructed Imbalance Adjustment Charge for Generator Unit, u, for Bid Offer Acceptance, o, for Band, i, in Imbalance Settlement Period, γ which is an interim amount required to calculate the final value for CUNIMBuγ.
				11. |PIMBγ| is the absolute value of the Imbalance Settlement Price in Imbalance Settlement Period, γ, calculated in accordance with Chapter E (Imbalance Pricing); and
				12. |PBOuoiγ| is the absolute value of the Bid Offer Price for each Outside Tolerance Undelivered Accepted Bid Quantity and Outside Tolerance Accepted Offer Quantity for Generator Unit, u, for Bid Offer Acceptance, o, for Band, i, in Imbalance Settlement Period, γ.

**Glossary List of Variables and Parameters**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Variable | CUNIMBAuoiγ | Uninstructed Imbalance Adjustment Charge | An interim amount used as an adjustment to the Uninstructed Imbalance Charge for each Generator Unit, as required for some scenarios where there is an Outside Tolerance Undelivered Accepted Bid or Offer Quantity in the applicable Imbalance Settlement Period. | € |

# LEGAL REVIEW

 N/A

# IMPLEMENTATION TIMESCALE

It is proposed that this Modification implemented as the Modifications Committee have Recommended it for Approval and on a Settlement Day following receipt of the RA Decision.

# Appendix 1: Mod\_05\_19 amendment to uninstructed imbalance charge (cunimb) to correct for negative price scenarios Version 2

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| **Proposer***(Company)* | **Date of receipt***(assigned by Secretariat)* | **Type of Proposal***(delete as appropriate)* | **Modification Proposal ID***(assigned by Secretariat)* |
| **SEMO** | **28 March 2019** | **Standard** | **Mod\_05\_19\_V2** |
| **Contact Details for Modification Proposal Originator** |
| **Name** | **Telephone number** | **Email address** |
| **Christopher Goodman** |  |  |
| **Modification Proposal Title** |
| **Amendment to Uninstructed Imbalance Charge (CUNIMB) to correct for negative price scenarios Version 2** |
| **Documents affected***(delete as appropriate)* | **Section(s) Affected** | **Version number of T&SC or AP used in Drafting** |
| **T&SC Part B** | **F.9.4.1****Part B Glossary List of Variables and Parameters** | **Version 20** |
| **Explanation of Proposed Change***(mandatory by originator)* |
| The Uninstructed Imbalance Charge (CUNIMB), calculated in Trading and Settlement Code paragraph F.9.4, is designed to calculate a premium to the charge applied to under generation outside prescriptively defined under generation tolerance levels and a discount to the payment for over generation outside over generation tolerance levels. This is in order to incentivise compliance with Dispatch Instructions centrally issued by the Transmission System Operators.The level of premium or discount is parameterised and set by the Regulatory Authorities using the parameters Premium for Under Generation Factor (FPUG) and Discount for Over Generation Factor (FDOG) where both are currently set at 0.2 resulting in a 20% additional charge under generation or lesser payment for over generation for Uninstructed Imbalances outside of tolerance levels based on the difference between Loss Adjusted Metered Quantity and Loss Adjusted Dispatch Quantity and taking account of the unit specific Loss Adjusted Tolerance for Over or Under Generation as appropriate.The premium or discount is applied to the product of the Imbalance Price (PIMB) and the Outside Tolerance Undelivered Quantity (QUNDELOTOL) and then an additional element of the algebra adds the premium or discount for the difference between the Imbalance Price and the Bid Offer Price (PBO) for any accepted bid where PBO is less than PIMB or any accepted offer where PBO was greater than PIMB to ensure that the premium or discount is applied at the same price at which the energy was settled where an Uninstructed Imbalance relates to an Accepted Bid or Offer Quantity. The intention here is to apply a 20% increase or decrease as appropriate for Uninstructed Imbalances outside a tolerance, at the appropriate rate, being that on which the volume was originally settled for BOAs and at the Imbalance Price otherwise.This formulation works as intended where prices and bids are positive; however, where the Imbalance Price and/or a Bid Offer Price are negative this can result in incorrect charges being calculated and in some extreme scenarios can even lead to the Uninstructed Imbalance Charge becoming a payment and therefore a perverse incentive to not comply with Dispatch Instructions. An example of this is illustrated below;Consider an Under-Generation Uninstructed Imbalance whereby a unit has an Outside Tolerance Undelivered Quantity (QUNDELOTOL) of -4 MWh, an Outside Tolerance Undelivered Accepted Offer Quantity (QAOUNDELOTOL) of 3 MWh, for a Bid Offer Price of 50 €/MWh and the Imbalance Price is -100 €/MWh. Applying the algebra in F.9.4.1 with a Discount for Under Generation Factor of 0.2 yields a charge of €10:CUNIMB = Min(-4,0)\*((0.2\*-100))+(-0.2)(Max(50-(-100),0)\*3 = (-4\*-20)+(-0.2\*150\*3) = 80 +(-90) = €-10If the Imbalance Price in this example were -200 €/MWh this would result in a payment of €70 as follows;CUNIMB = Min(-4,0)\*((0.2\*-200))+(-0.2)(Max(50-(-200),0)\*3 = (-4\*-40)+(-0.2\*250\*3) = 160 +(-150) = €10The correct outcome here is a charge for 1 MWh, which does not relate to an accepted offer, at the 20% of the Imbalance Price and a charge for 3 MWh at 20% of the Bid Offer Price for the Outside Tolerance Accepted Offer Quantity where the Bid Offer Price is greater than the Imbalance Price. For the second Imbalance Price of -200 €/MWh this should yield €-70.Calculating this intuitively by evaluating it directly on the applicable volumes (as opposed to applying PIMB to the entire outside tolerance quantity and then bringing it back to PBO for the accepted offer portion) yields: CUNIMB = (0.2\*1\*-200)-(0.2\*3\*50) =-40-30 = €-70There are various scenarios of negative Imbalance and/or Bid Offer Price which result in incorrect outcomes based on the existing formulation.Since the current algebra seeks to take an elegant approach by applying PIMB to the entire Outside Tolerance Uninstructed Imbalance Volume, and then bringing the accepted bid or offer portion to the PBO, rather than calculating the volume at the appropriate rate directly, we have aimed to retain this elegant drafting approach while proposing changes that ensure the correct outcomes regardless of the sign of the Imbalance or Bid Offer Price. This is because the alternative/direct approach would be algebraically more cumbersome both for the legal drafting and the associated system change while the approaches are equivalent in outcome. For this example, the more elegant approach would evaluate as follows:CUNIMB = (0.2\*4\*-200)-((50-200)\*0.2\*3) = -160-(-90) = €-70The proposed approach achieves the required outcomes by taking the absolute/modulus of the applicable prices and applying the product of Accepted Bid Offer Quantities and price difference only where for any accepted bid the PBO is less than PIMB or for any accepted offer the PBO was greater than PIMB prescriptively as opposed to using Maximum and Minimum of the price difference around zero. This is done by using binary operators of the form Min/Max(A-B,0)/A-B, which returns a value of one where the difference between the Bid Offer and Imbalance Prices is negative or positive for over-generation accepted bids and under-generation accepted offers respectively and applying this to the difference between the absolute values of the prices. Otherwise, the binary operator returns a zero where the Accepted Bid or Offer Quantity would have settled at the Imbalance Price, due to the relative position of PBO and PIMB, as appropriate.This is similar to what the existing max/min drafting seeks to achieve, and returns the same outcomes for positive Prices, but corrects the issues with incorrect price differentials being applied for negative prices. This approach, along with taking the modulus of the prices on application for both PIMB and PBO ensures that the outcome is always a 20% (or otherwise depending on FPUG/FDOG values) charge for each outside tolerance Uninstructed Imbalance volume at the appropriate price.This approach has been scrutinised from the point of view of the principles that apply and has also been explicitly tested by calculating the CUNIMB for 34 scenarios for different Over/Under Generation Uninstructed Imbalance and relative price positions and signage and has been confirmed as resulting in the correct settlement outcome for each of these scenarios. For the second example with a PIMB of -200 €/MWh described above this evaluates as follows (where the binary operator is underlined):CUNIMB = [Min(-4,0)\*(0.2\*200)]-[0.2\*((50-200)\*3\*(Max(50-(-200),0)/(50-(-200)))] = (-4\*40)-[0.2\*-150\*3\*(250/250)] =-160-(-90) =€-70 While the algebraic formulation here has some complexity the principle aim of this proposal is reasonably straightforward. The aim is to move from a calculation of Uninstructed Imbalance **Charge** that applies Bid Offer and Imbalance Prices as charging rates when positive and payment rates when negative to one that applies them as charging rates throughout, including where the Imbalance volume itself was a payment to decrease generation or a charge to increase generation (without being instructed to do so) due to a negative price. In this way, the mechanism is always as disincentive for deviations from dispatch and never incentivises such uninstructed deviations so that the intended incentive to comply with dispatch is not reversed where Prices are negative and also does not result in increased Dispatch Balancing Costs in error.Note that the structural change to introduce the ‘If PBO-PIMB ≠/= 0 ’, ‘then’ construct, along with the introduction of UNIMBA*u****oi****γ* is merely to avoid the mathematical oddity of a divide by zero in the binary operator, where PBO=PIMB, which cannot be evaluated. This is done by removing the binary operator from the calculation where PBO=PIMB along with the rest of the calculation to adjust back to PBO as it is not required where PBO=PIMB.Evaluating the summations over bands and BOAs over the UNIMBA*u****oi****γ* variable which has been introduced rather than within the overall algebra is also neater and is the clearest way to capture the fact that that the summation applies to each entire UNIMBA*u****oi****γ* value which has been evaluated for each BOA band. **Explanation for Additional Change Added to Version 2:**Version 2 introduces an additional change which is to **remove** the minus sign immediately before the FDOG variable which commented in the legal drafting. This is to address an additional signage issue identified with the calculation of Uninstructed Imbalance Charges for QABUNDELOTOL. Since this is a removal of a minus sign and the entire drafting from vesion 1 is in tracked change it is not very clear to reflect this in the legal drafting as a tracked change hence the sign we propose removing is commented.The reason for this change is that the existing drafting (and therefore the updated drafting proposed in version 1 also) contains a further error whereby the signage for the adjustment for undelivered accepted bid quantities is incorrect. This is because the algebra treats this as though it is a positive value where it is in fact a negative value due to being an offtake/purchase of power. The element of this algebra that relates to QAB should result in a positive adjustment (decrease in magnitude) for this Uninstructed Imbalance Charge so that it reduces the rate applied to any Outside Tolerance Undelivered Accepted Bid Quantity (QABUNDELOTOL) from PIMB to PBO where PBO is less than PIMB to reflect the fact that the Accepted Bid Quantity would originally have settled at PBO in this scenario via a discount charge applying i.e. the lesser of the PBO and PIMB applies to the charge for the energy therefore and the same should apply to the Uninstructed Imbalance. Due to this signage issue the QABUNDELOTOL component of the algebra is incorrectly increasing rather than reducing the Uninstructed Imbalance Charges in the scenario where there is an undelivered accepted bid quantity for which PBO is less than PIMB.This is illustrated in the following examples:Consider and Over-Generation Uninstructed Imbalance whereby a unit has an Outside Tolerance Undelivered Quantity (QUNDELOTOL) of 4 MWh, an Outside Tolerance Undelivered Accepted Bid Quantity of -3 MWh, for a Bid Offer Price of 50 €/MWh and the Imbalance Price is 100 €/MWh. Applying the algebra in F.9.4.1 with a Discount for Over Generation Factor of 0.2 yields a charge of €110:CUNIMB = Max(4,0)\*(-(0.2\*100))+(-0.2\*(Min(50-100,0)\*(-3) = (4\*-20)+(-0.2\*-50\*-3) =-80+(-30) =-€110The correct outcome here is for a Charge of 20% of the Imbalance Price for 1 MWh and 20 % of the PBO for 3 MWh to apply. The algebraic formulation seeks to achieve this by charging the entire 4 MWh at the Imbalance Price and correcting back to PBO for the 3 MWh QABUNDELOTOL; however, due to the additional signage issue identified, the QABUNDELOTOL adjustment is incorrectly being applied as an increase to the charge where PBO is less than PIMB where this should be a decrease to the Charge. This is to account for the fact that the energy volume purchase for the accepted bid quantity would have settled at the more favourable PBO rate due to it being the lesser value. Intuitively the outturn CUNIMB value for this example should be a charge of €50 as follows:CUNIMB = -(0.2\*1\*100)-(0.2\*3\*50) = -20-30 =€-50The correction proposed here would result in this being evaluated to the same amount but via the approach of applying PIMB to the full volume and then adjusting back to PBO for the accepted bid quantity as follows:CUNIMB = (4\*-0.2\*100)+[0.2\*(Min(50-100,0)/(50-100))\*(50-100)\*-3] =-80+30 =€-50The updated drafting for version 2 of this proposal has been robustly tested using the same 34 scenarios as for version 1 and has resulted in the correct outcomes throughout including for negative price scenarios where Undelivered Accepted Bid Quantity adjustments apply.This second version also proposes making a change to the new adjustment variable introduced so that it is clear that it is not an Uninstructed Imbalance Charge in and of itself but rather an adjustment to those charges. It also includes a glossary entry in the list of variables and parameters for the new uninstructed imbalance adjustment variables (UNIMBA*u****oi****γ*) the proposal utilizes which was omitted from version one.Version 2 changes have been highlighted in yellow to aid clarity. |
| **Legal Drafting Change***(Clearly show proposed code change using* ***tracked*** *changes, if proposer fails to identify changes, please indicate best estimate of potential changes)* |
| 1.
2.
3.
4.
5. 1.
	2.
	3.
	4.
	5.
	6.
	7.
	8.
	9. 1.
		2.
		3.
		4. Calculation of Uninstructed Imbalance Charges
			1. Subject to paragraph **Error! Reference source not found.**, the Market Operator shall calculate the Uninstructed Imbalance Charge (CUNIMBuγ) for each Generator Unit, u, in each Imbalance Settlement Period, γ, as follows:

where:* + - * 1. QUNDELOTOLuγ is the Outside Tolerance Undelivered Quantity for Generator Unit, u, in Imbalance Settlement Period, γ.
				2. QAOUNDELOTOLuoiγn is the Outside Tolerance Undelivered Accepted Offer Quantity for Generator Unit, u, for Bid Offer Acceptance, o, for Band, i, in Imbalance Settlement Period, γ.
				3. QABUNDELOTOLuoiγn is the Outside Tolerance Undelivered Accepted Bid Quantity for Generator Unit, u, for Bid Offer Acceptance, o, for Band, i, in Imbalance Settlement Period, γ.
				4. PIMBγ is the Imbalance Settlement Price in Imbalance Settlement Period, γ, calculated in accordance with Chapter E (Imbalance Pricing);
				5. PBOuoiγ is the Bid Offer Price for each Outside Tolerance Undelivered Accepted Bid Quantity and Outside Tolerance Accepted Offer Quantity for Generator Unit, u, for Bid Offer Acceptance, o, for Band, i, in Imbalance Settlement Period, γ;
				6. is a summation over all Bid Offer Acceptances, o;
				7. is a summation over all Bands, i;
				8. FPUGuγ is the Premium for Under Generation Factor for Generator Unit, u, in Imbalance Settlement Period, γ;
				9. FDOGuγ is the Discount for Over Generation Factor for Generator Unit, u, in Imbalance Settlement Period, γ;
				10. UNIMBAuoiγ is the Uninstructed Imbalance Adjustment for Generator Unit, u, for Bid Offer Acceptance, o, for Band, i, in Imbalance Settlement Period, γ.
				11. |PIMBγ| is the absolute value of the Imbalance Settlement Price in Imbalance Settlement Period, γ, calculated in accordance with Chapter E (Imbalance Pricing); and
				12. |PBOuoiγ| is the absolute value of the Bid Offer Price for each Outside Tolerance Undelivered Accepted Bid Quantity and Outside Tolerance Accepted Offer Quantity for Generator Unit, u, for Bid Offer Acceptance, o, for Band, i, in Imbalance Settlement Period, γ.

**Glossary List of Variables and Parameters**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Variable | UNIMBAuoiγ | Uninstructed Imbalance Adjustment | An adjustment to the Uninstructed Imbalance Charge for each Generator Unit, as required for some scenarios where there is an Outside Tolerance Undelivered Accepted Bid or Offer Quantity in the applicable Imbalance Settlement Period. | € |

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| **Modification Proposal Justification***(Clearly state the reason for the Modification)* |
| This proposal seeks to correct the calculation of Uninstructed Imbalance Charges where negative prices apply so that this always results in a charge and therefore an incentive to comply with Dispatch Instructions at a rate governed by the appropriate energy price. This would also mean that Uninstructed Imbalance Charges appropriately reduce Dispatch Balancing Costs rather than increasing them where negative prices occur.**Justification for Additional Change Added to Version 2:**The changes in Version 2 seek to correct an additional issue with the Uninstructed Imbalance Charge algebra whereby adjustments for Outside Tolerance Undelivered Accepted Bid Quantities at Bid Offer Prices which are less than the Imbalance Price are being applied in the wrong direction due to a further signage issue. This change would ensure the correct treatment of these adjustments so that Uninstructed Imbalance Charges are correctly reduced by the adjustment rather than being increased in error which is currently the case. |
| **Code Objectives Furthered***(State the Code Objectives the Proposal furthers, see Section 1.3 of Part A and/or Section A.2.1.4 of Part B of the T&SC for Code Objectives)* |
| * + - * 1. to ensure no undue discrimination between persons who are parties to the Code; and

By ensuring that the 20% increase or decrease applied for Uninstructed Imbalances outside tolerance bands applies equally to those with such imbalances at times of negative and positive Imbalance Prices and also equally to those with negative and positive Bid Offer Prices.* + - * 1. to promote the short-term and long-term interests of consumers of electricity on the island of Ireland with respect to price, quality, reliability, and security of supply of electricity.

By ensuring that the appropriate reduction in Dispatch Balancing Costs is caused by levying Uninstructed Imbalance Charges and that they are not inappropriately increased by these resulting in payments where prices are negative.**Objectives Furthered for Additional Change Added to Version 2:*** + - * 1. to ensure no undue discrimination between persons who are parties to the Code; and

By ensuring that Generators with an Outside Tolerance Undelivered Accepted Bid Quantity have Uninstructed Imbalance Charges calculated on an equitable basis with other Uninstructed Imbalance Charges so that the charge is based on the same rate as the power was settled for all volumes.  |
| **Implication of not implementing the Modification Proposal***(State the possible outcomes should the Modification Proposal not be implemented)* |
| If this proposal is not implemented a perverse incentive not to comply with dispatch where Imbalance or Bid Offer Prices are negative will remain and inappropriate increases (rather than reductions as should be the case) in Dispatch Balancing Costs will continue to occur where there are Uninstructed Imbalance ‘Charges’ with negative prices applied.**Implication for Additional Change Added to Version 2:**If the additional change is not implemented, Uninstructed Imbalance Charges for the Outside Tolerance Undelivered Accepted Bid Quantities it seeks to correct will continue to be calculated at an elevated level in error. |
| **Working Group***(State if Working Group considered necessary to develop proposal)* | **Impacts***(Indicate the impacts on systems, resources, processes and/or procedures; also indicate impacts on any other Market Code such as Capacity Marker Code, Grid Code, Exchange Rules etc.)* |
| Not required | Changes to SEMO settlement systems required to apply the amended algebra. |
| ***Please return this form to Secretariat by email to*** balancingmodifications@sem-o.com |