Recommended Uninstructed Imbalance Parameters

Calendar Year 2025

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EirGrid SONI semo Single Electricity Market Operator

Contents

1. Obligations and Criteria 4
   1.1. Overview of SEM 4
   1.2. Overview of Data for Analysis 4
2. MW Tolerance and Engineering Tolerance 5
   2.1. Parameters for MW Tolerance and Engineering Tolerance 6
   2.1.1. Conventional Units 7
   2.1.2. Wind and Solar Units 9
   2.1.3. Demand Side Units 12
   2.1.4. Battery Units 15
   2.1.5. Pump Storage Units 17
   2.1.6. Interconnector Units 19
3. Over and Under Generation Factors 21
   3.1. Background 21
   3.2. Consideration 21
4. System per Unit Regulation Factor 23
   4.1. Background 23
   4.2. Considerations 23
5. Conclusions and Recommendations 24

Acronyms

Acronym	Long Name
CUNIMB	Uninstructed Imbalance Charge
DQ or QD	Dispatch Quantity
DSU	Demand Side Unit
FDOG	Discount for Over Generation Factor
FPUG	Premium for Under Generation Factor
FUREG	System per Unit Regulation Factor
MW	Megawatt
MWh	Megawatt Hour
NI	Northern Ireland
PIMB	Imbalance price
QM	Meter Quantity
ROI	Republic of Ireland
SO	System Operator
TOLENG	Engineering Tolerance
TOLMW	MW Tolerance

1. Obligations and Criteria

1.1. Overview of SEM

Under section F.9.1 of Part B Single Electricity Market Trading and Settlement Code, the SOs are required to report to the Regulatory Authorities proposing parameters to be used in the calculations of Uninstructed Imbalance Quantities and Charges at least four months before the start of the Trading Year if requested by the Regulatory Authorities. This document provides the SOs' recommendations, and the rationale used in determining the SOs' recommendations, for the following parameters considered under section F.9.1 of the Code:

- Engineering Tolerance,
- MW Tolerance,
- Discount for Over Generation Factor,
- Premium for Under Generation Factor,
- System per Unit Regulation Factor.

Uninstructed Imbalances and Charges do not apply to the below units;

- An Assetless Unit,
- A Trading Unit,
- A Generator Unit which is not Dispatchable and not Controllable or
- An Interconnector Residual Capacity Unit.

1.2. Overview of Data for Analysis

Throughout the paper, please note references to Generator units considers Conventional Generators, Wind & Solar, Battery, Demand Side and Interconnector within this category.

The Historical Assessment Period by settlement trading period has been categorized for each different technology types of Conventional Generators, Wind & Solar, Battery, Demand Side and Interconnector.

A data set range from 1st January 2022 through to 30th April 2024 was used for the analysis with the exception of Demand Side Unit (DSU) data. DSU Metering Quantity (QM) data was substituted with Scada Metering for the purpose of this analysis.

The analysis has excluded some data periods where the difference between the metering (QM) and dispatch quantity (DQ) is so minimal that it would not be applicable for Uninstructed Imbalance charges.

In order to adjust values and considering volume of data it was necessary to remove data periods that are not factoring into the materiality of the current Uninstructed Imbalance charges and will have a negligible impact on future Uninstructed Imbalance charges with the proposed parameter amendments.

- Review Settlement data,
- Change baseline values,
- Review of impact on Charge component,
- Review impact on Under or Over Generation.

2. MW Tolerance and Engineering Tolerance

In operation, even at constant steady state frequency, a Generator Unit instructed to a given MW value is unlikely to be able to maintain its output at exactly the dispatched MW level for any period of time. With a small tolerance within which a Generator Unit should be deemed to be complying with its Dispatch Instruction. Throughout this document when reference to Generator Unit it includes technologies such has batteries and Demand Side Units (DSU).

These parameters should be set to values which represents a trade-off between being sufficiently high and sufficiently low that it:

- Does not result in Uninstructed Imbalance Charges for typical imbalances resulting from the normal operation of a generator to match a dispatch instruction which do not have an impact on system costs

- Reflects the increased challenges in maintaining frequency control for the Irish and Northern Irish systems over large interconnected systems, and therefore the increased importance for generators to follow Dispatch Instructions

- Reflects the impact of being in imbalance by that amount on system security and system costs

- Allows for the Engineering Tolerance to differentiate between the impacts of units dispatched to a larger output versus units dispatched to a smaller level of output (i.e., not having a MW Tolerance so large or Engineering Tolerance so small that the Engineering Tolerance is never used)

- Accounts for the cost reflectiveness of the impact of imbalances, acknowledging that there may typically be small imbalances through the normal operation of a generator to meet an instructed output level which are not directly related to frequency response

- Is not such a large value that it removes, the incentive to generate close to an instructed output level from those Generator Units, that receives Dispatch Instructions to operate at a low MW level.

- Is large enough that those imbalances which have negligible cost-based impact on system actions are ignored in the calculation of Uninstructed Imbalance Charges

2.1. Parameters for MW Tolerance and Engineering Tolerance

MW Tolerance and Engineering Tolerance are used along with QD (Dispatch Quantity) and Imbalance Settlement Period duration to determine the Engineering Limit quantity, this in turn feeds into Uninstructed Imbalance Tolerance Quantities along with Nominal System Frequency, Average System Frequency, Registered Capacity and System per Unit Regulation Factor (FUREG) resulting in Tolerance Quantities for Over or Under Generating. Different calculations are used when the system frequency deviates from the Nominal System Frequency, it is expected that Generator Units vary their output to compensate this is known as frequency regulation. The relationship between frequency and the output response of units acting under frequency regulation on the Uninstructed Imbalance mechanism is addressed through the FUREG.

The Outside Tolerance Under or Over delivered Quantities are determined using loss adjusted factors for QM, QD, Tolerance Quantities and Imbalance Settlement Period .

The tolerance parameter set in the SEM to date are 1 MW has been used for the MW Tolerance and 1% has been used for the Engineering Tolerance and is the maximum of:

- the MW Tolerance for each Trading Day, known as TOLMWt (where $0 \leq TOLMWt$); and
- the Engineering Tolerance, known as TOLENG (where $0 \leq TOLENG \leq 1$) multiplied by the Dispatch Quantity divided by Imbalance Settlement Period.

The TOLMWt and TOLENG are inputs that feed into tolerance parameters and they feed into a wider calculation that sets uninstructed imbalance tolerance quantities taking the size of the unit into consideration. Depending on the component being inputted, it can occur that a large sized unit with QD of 206.7MWh and QM of 208MWh is inside minimum tolerance quantity therefore no charge is applied whereas a much smaller unit has a DQ of 0MWh and QM of 0.777MWh it will receive a charge as it is deemed outside of minimum tolerance quantity with an over delivered quantity calculated.

MW Tolerance will be referenced as TOLMW throughout the document and values have been adjusted from baseline of 1.0 to 1.1,0.9,0.8,0.75 and 0.5 (where data available) in order to determine anonymity and reviewing trends. Analysis of the data available has been carried out to determine the affect the results depending on the methodology used.

Engineering Tolerance will be referenced as TOLENG throughout the document and values have been adjusted from baseline of 1% to 0.84% and 1.5% in order to determine anonymity and reviewing trends. Analysis of the data available has been carried out to determine the affect the results depending on the methodology used. With the exception of section 2.1.2 for Wind and Solar Units were adjusted from baseline of 1% to 8.4% in line with MOD_13_23.

2.1.1. Conventional Units

- Study period from 1st January 2022 to 31st April 2024
- Where the difference between the metering (QM) and dispatch quantity (DQ) does not exceed 0.5MWh or -0.5MWh the following conventional unit's data sets have had these values removed for analysis

Prior to adjusting parameters, a review was conducted of current volumes and charges applied.

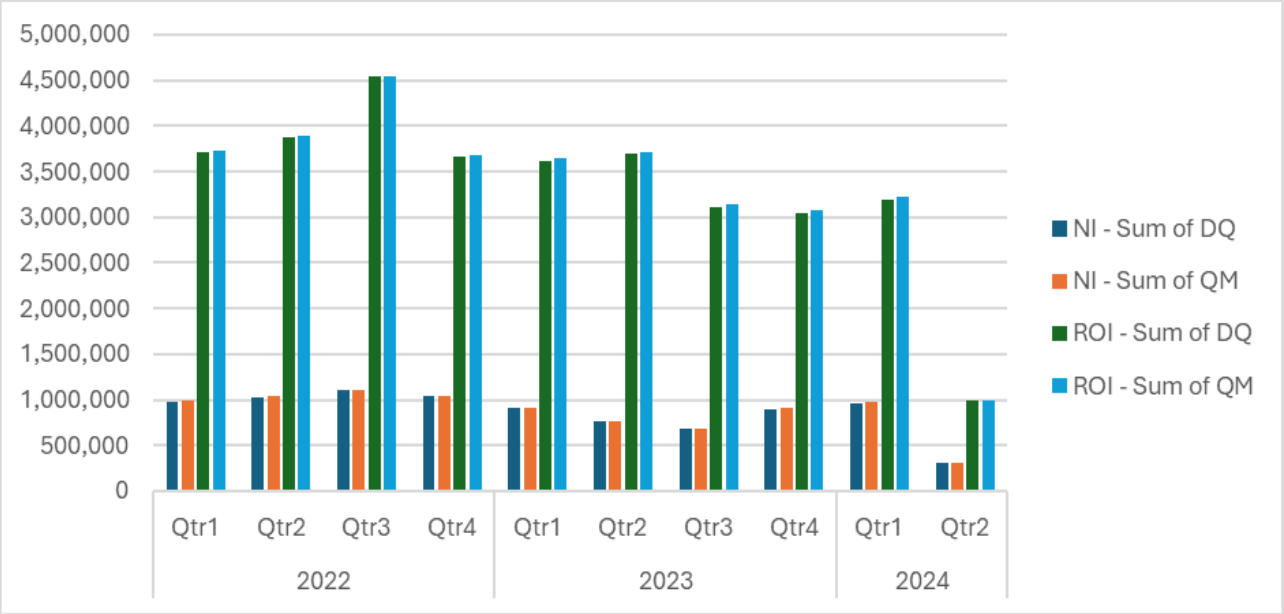

Figure 1: Conventional Units Volume of DQ and QM by Quarter and Jurisdiction

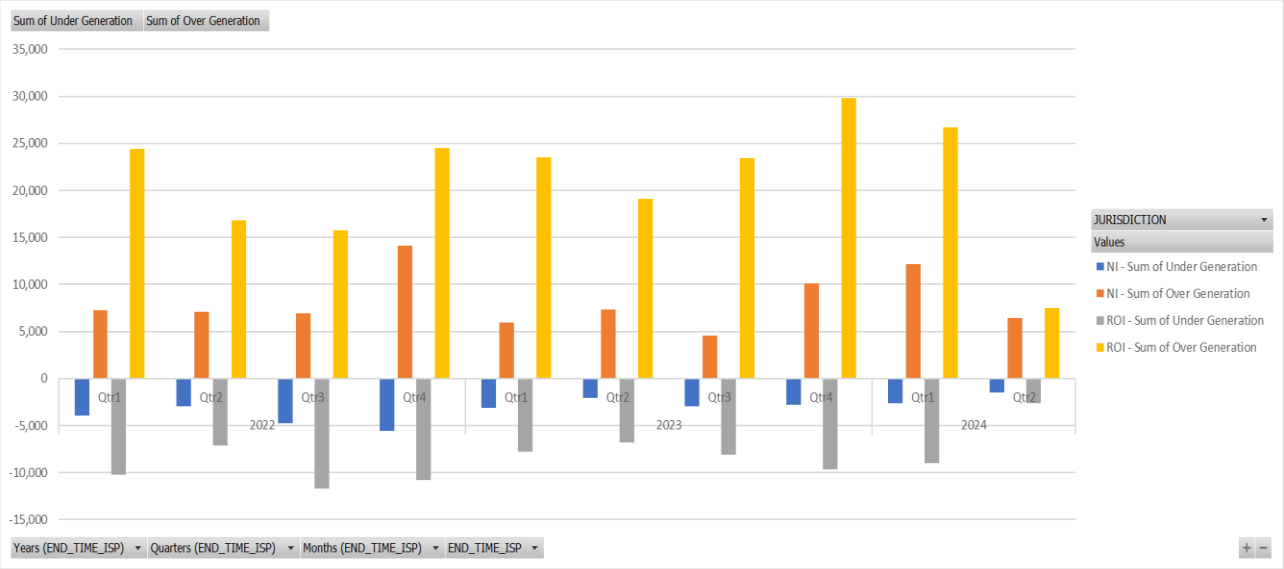

Figure 2: Conventional Units Volume of Under or Over Generation by Quarter and Jurisdiction

Row Labels	Sum OF CUNIMB	Sum of Under Generatio	Sum of Over Generation
NI	-€3,689,706	-32,225	79,509
2022	-€2,160,513	-17,192	32,908
2023	-€1,044,361	-10,909	27,957
2024	-€484,832	-4,124	18,645
ROI	-€9,152,799	-82,223	199,060
2022	-€5,295,342	-39,384	74,133
2023	-€3,029,143	-31,677	92,944
2024	-€828,313	-11,162	31,982
Grand Total	-€12,842,505	-114,448	278,569

Table 1: Conventional Units Uninstructed Imbalance Qty and Charge by Year and Jurisdiction

Figure 1 shows the Dispatch Quantity (DQ) and Meter Quantity (QM) that had a difference in order to be considered for Uninstructed Imbalance Charge, that is detailed in Table 1. Table 2 shows the volume used to calculate Charge.

A reduction in Under Generation quantities can be observed from 2022 to 2023 in both jurisdictions, while an increase in Over generation quantities occurred in ROI from 2022 to 2023. Significantly higher quantities of Over generation have occurred.

The baseline (grey lines) is the current parameter, table 2 and table 3 illustrates the additional changes if the parameter were to be adjusted, all non-grey figures represent a delta from the baseline and should be added in isolation and adjusted from the baseline values.

Another element to consider when using subsite data is the volumes being considered, of all Dispatch Quantity in the baseline that under or over generated.

Year	TOLMW	Sum of CUNIMB	Qty of Under Generation	Qty of Over Generation
2022	1.1	-116,376	-750	-1,833
	1	-7,455,855	-56,579	107,041
	0.9	112,277	778	1,641
	0.8	216,653	1,534	3,143
	0.75	264,111	1,850	3,852
	0.5	458,028	3,200	6,689
2023	1.1	-73,196	-781	2,153
	1	-4,073,504	-42,586	120,901
	0.9	66,113	826	1,793
	0.8	128,571	1,641	3,459
	0.75	157,482	2,003	4,255
	0.5	280,769	3,633	7,499
2024	1.1	-19,230	-277	-696
	1	-1,313,145	-15,286	50,627
	0.9	17,602	295	588
	0.8	35,248	599	1,172
	0.75	43,883	744	1,464
	0.5	82,473	1,442	2,707

Table 2: Results of changing TOLMW - Conventional Units

Year	TOLENG	Sum of CUNIMB	Qty of Under Generation	Over Generation
2022	0.84%	-339,179	-2,834	4,115
	1%	-7,455,855	-56,579	107,041
	1.5%	946,264	7,590	-12,512
2023	0.84%	-143,823	-1,800	3,874
	1%	-4,073,504	-42,586	120,901
	1.5%	435,435	4,841	-12,608
2024	0.84%	-38,922	-609	1,264
	1%	-1,313,145	-15,286	50,627
	1.5%	110,087	1,443	-4,039

Table 3: Results of changing TOLENG - Conventional Units

Following the two examples from section 2.1 while changing the TOLMW and TOLENG parameter to different values the larger sized unit remained outside the minimum tolerance quantity therefore no charge was applied whereas the smaller unit had increased charge as it remained outside minimum

tolerance quantity with an over delivered quantity calculated as registered capacity factor is taken into consideration.

2.1.2. Wind and Solar Units

- Study period from 1st January 2022 to 31st April 2024
- Where the difference between the metering (QM) and dispatch quantity (DQ) does not exceed 0.375MWh or -0.375MWh the following data sets have had these values removed for analysis and ranges vary for TOLME and TOLEG.
- NI Solar units have been excluded from the study, due to a known system issue they are currently exempt from Uninstructed Imbalance charges and a formal query is outstanding.
- Mod_13_23 proposed that TOLENG tolerance parameter could be defined differently for each unit type and discussed below

Prior to adjusting parameters, a review was conducted of current volumes and charges that potentially could have been applied.

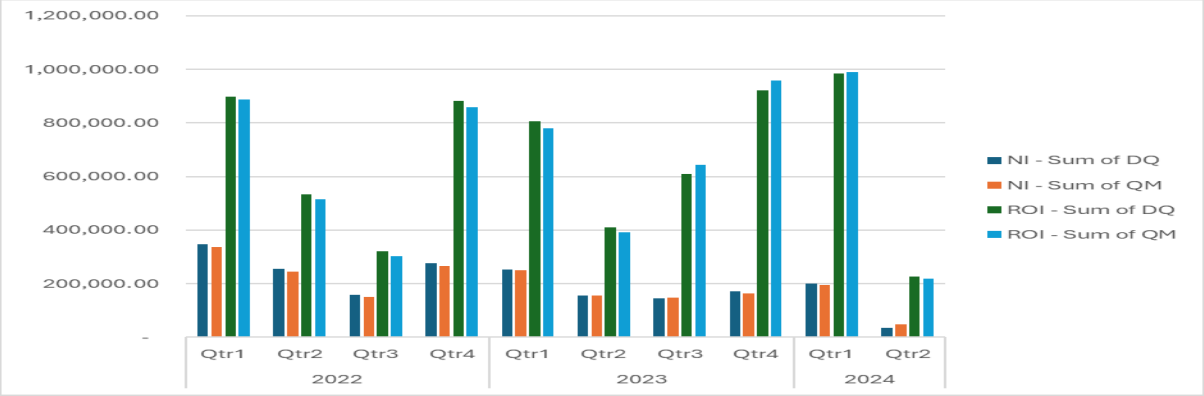

Figure 3: Volume of DQ and QM considered by Quarter and Jurisdiction- Wind and Solar

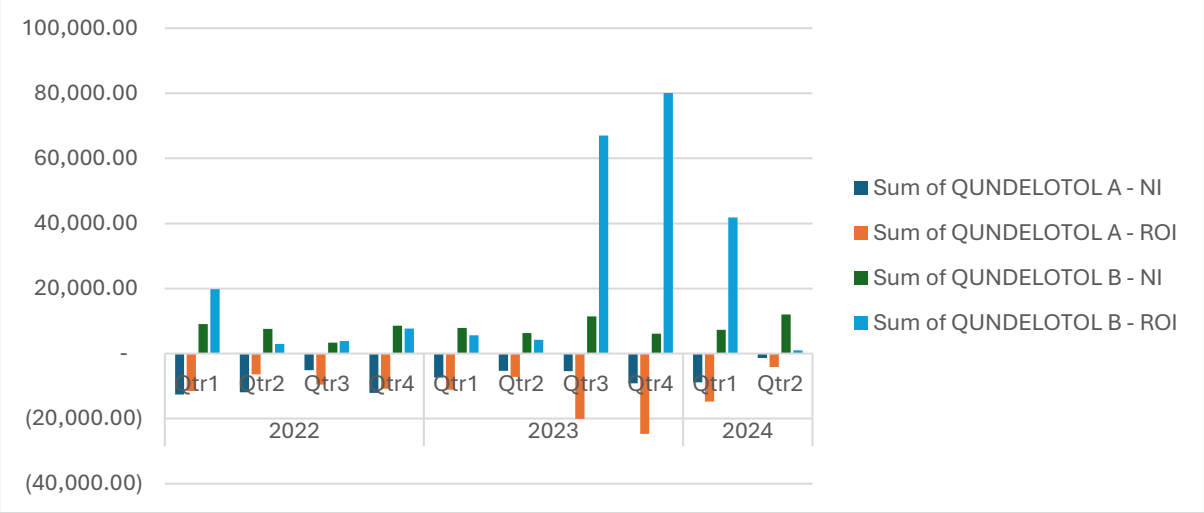

Figure 4: Volume of Under or Over Generation by Quarter and Jurisdiction - Wind & Solar

Please note that QUNDELOTOL A represent Under Generation while QUNDELOTOL B represents Over Generation

	Sum of Under Generation		Sum of Over Generation	Sum of CUNIMB	
NI	-	79,153	79,436	-€	3,831,831
2022	-	41,736	28,447	-€	2,184,420
2023	-	27,237	31,707	-€	1,133,648
2024	-	10,181	19,282	-€	513,763
ROI	-	120,231	234,140	-€	7,798,150
2022	-	38,247	34,355	-€	2,534,500
2023	-	63,107	156,982	-€	4,222,927
2024	-	18,877	42,804	-€	1,040,723
Total	-	199,385	313,576	-€	11,629,981

Table 4: - Wind and Solar Qty and Charge by Year and Jurisdiction

Year	TOLMW	Sum of CUNIMB	Qty of Under Generation	Qty of Over Generation
2022	1.1	270	1	-4
	1	-9,592	-9	427
	0.9	-2,080	-19	28
	0.8	-2,820	-26	34
	0.75	-7,511	-77	82
2023	1.1	1,417	6	-55
	1	-51,247	-16	2,415
	0.9	-3,313	-42	112
	0.8	-7,426	-109	235
	0.75	-9,844	-155	302
2024	1.1	173	0	-10
	1	-5,875	-3	394
	0.9	-509	-11	21
	0.8	-1,175	-29	45
	0.75	-1,578	-41	59

Table 5: Results of changing TOLMW- Wind and Solar (note range changed)

	Sum of Under Generation		Sum of Over Generation	Sum of CUNIMB	
NI	**-**	**16**	**2,644**	**-€**	**53,727**
2022	**-**	**3**	**330**	**-€**	**6,630**
2023	**-**	**11**	**2,008**	**-€**	**42,588**
2024	**-**	**2**	**305**	**-€**	**4,510**
ROI	**-**	**13**	**592**	**-€**	**12,991**
2022	**-**	**6**	**97**	**-€**	**2,967**
2023	**-**	**6**	**406**	**-€**	**8,659**
2024	**-**	**1**	**89**	**-€**	**1,365**
Total	**-**	**29**	**3,236**	**-€**	**66,718**

Table 6: Results of changing TOLMW - Wind and Solar Units

Table 5 reviews changing values of TOLMW (CUNIMB for dispatch between 0.8MWh and 1.2MWh (i.e. filtered on 0.4MWh <= QD <= 0.8MWh) and Table 4 reviews impact on Uninstructed Imbalance Volumes and Charges for Dispatch between 0.75MWh and 1.1MWh (baselines in grey are actual values, other values shown relative to baselines)

Mod_13_23 (Review of TOLENG)

Market systems assume instantaneous ramping for performance reasons in reality, these units are limited to ramp at 20% of MEC per minute.

To counter this, Mod_13_23 proposed that TOLENG tolerance parameter could be defined differently for Wind and Solar unit type.

TOLENG (% of QD) was selected to change rather than TOLMW (absolute MW value) so that for lower QD values the tolerance bands would not be unnecessarily wide. TOLENG at present is 0.01 (1% of QD), TOLMW is 1MW. The tolerance used for calculation of the Uninstructed Imbalance charge is at least the greater of TOLENG and TOLMW (can be further increased depending on system frequency).

Analysis showed that to remove all risk of Uninstructed Imbalances resulting from difference between actual and assumed instantaneous ramp, a TOLENG value of 0.084 would be required. This worst case would occur in a case where a unit was instructed to ramp from 0 to MEC and was not instructed to ramp down again at all in a trading period (or vice versa).

Analysis of NI and ROI wind and solar data from 2022, 2023 and 2024 (to date) showed that increasing TOLENG from 0.01 to 0.084 would decrease the total Uninstructed Imbalance charge by approx. 15%, decreasing from €11.6m to €9.9m in total. The impact decreases with each year, likely due to the decreasing Imbalance Price in this time.

	Decrease in Under Generation		Decrease in Over Generation		Decrease in CUNIMB
NI	**16,900**	**-**	**6,261**	**€**	**650,951**
2022	**9,384**	**-**	**3,344**	**€**	**424,735**
2023	**5,644**	**-**	**2,159**	**€**	**178,065**
2024	**1,874**	**-**	**758**	**€**	**48,151**
ROI	**40,519**	**-**	**5,962**	**€**	**1,107,992**
2022	**13,530**	**-**	**2,104**	**€**	**513,871**
2023	**20,400**	**-**	**2,831**	**€**	**471,410**
2024	**6,589**	**-**	**1,029**	**€**	**122,711**
Total	**57,420**	**-**	**12,224**	**€**	**1,758,944**

Table 7: Difference Caused by Increasing TOLENG to 0.084

From early 2025 a number of wind and solar units will be scheduled and dispatched without priority dispatch status. Another option for the TOLENG parameter is to apply the proposed value above to non-priority controllable wind and solar only.

Non-Priority Controllable Wind and Solar

Non-priority units are likely to be dispatched up and down more than priority units because they will have energy balancing actions as well as constraint and curtailment, and so will be more exposed to the difference between actual and assumed instantaneous ramp.

When priority units are dispatched down for constraint or curtailment the QD follows their availability if lower than the setpoint. This is not the case for MWOF instructions which these non-priority units will receive (although new MWOFs will be generated at regular intervals for them with a value equal to availability). This means that non-priority units will have a greater risk of uninstructed imbalance due to fluctuating underlying wind or solar resource.

2.1.3. Demand Side Units

- Study period from 19th May 2022 to 30th April 2024
- Where the difference between the metering (QM) and dispatch quantity (DQ) does not exceed 0.25MWh or -0.25MWh the following data sets have had these values removed for analysis
- There were no Uninstructed Imbalance Charges during the study period for DSUs as under the Trading and Settlement Code QM for DSUs is set equal to QD, so it is not possible for Uninstructed Imbalance Charges to apply. In order to replicate what the potential charges could be, the QM data was replaced with Scada Metering Data for the purpose of this analysis. These are estimated values, parameters such as notice time or value checks hasn't been considered which may reduce charges.

Prior to adjusting parameters, a review was conducted of current volumes and charges that potentially could have been applied.

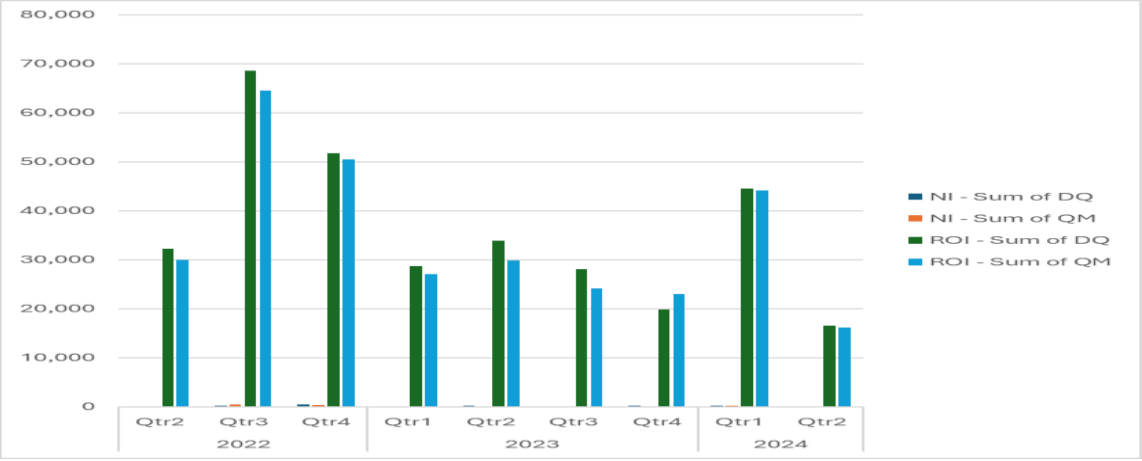

Figure 5: DSU Volume of DQ and QM by Quarter and Jurisdiction

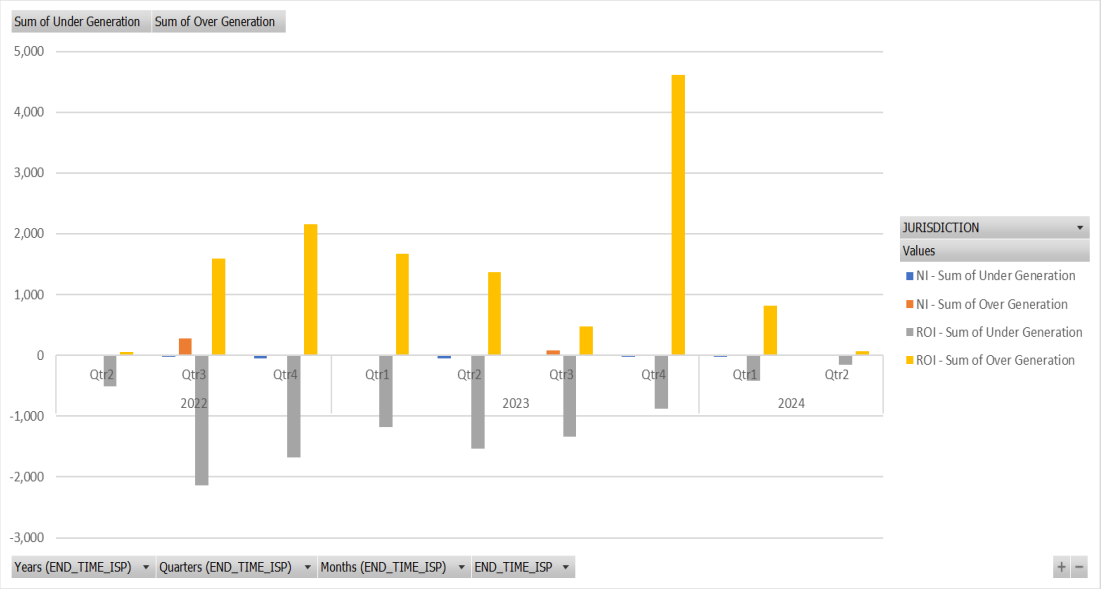

Figure 6: DSU Volume of Under or Over Generation by Quarter and Jurisdiction

	Sum of DQ	Sum of QM	Sum of Under Generation	Sum of Over Generation	Sum of CUNIMB
NI	1,472	1,488	-211	385	-38,529
2022	693	854	-89	292	-29,822
2023	516	437	-93	89	-6,961
2024	263	197	-30	4	-1,746
ROI	324,242	309,666	-9,817	12,828	-785,579
2022	152,598	145,113	-4,300	3,656	-402,988
2023	110,556	104,172	-4,923	7,871	-342,681
2024	61,088	60,381	-561	865	-39,911
Grand Total	325,714	311,154	-10,028	13,213	-824,108

Table 7: DSU estimated Qty and Charge by Year and Jurisdiction

Sum of CUNIM	OVER GENERATION	UNDER GENERATION	Grand Total
NI	-€24,135	-€14,394	-€38,529
2022	-€22,258	-€7,564	-€29,822
2023	-€1,803	-€5,157	-€6,961
2024	-€74	-€1,673	-€1,746
ROI	-€371,697	-€413,882	-€785,579
2022	-€155,187	-€247,801	-€402,988
2023	-€194,737	-€147,944	-€342,681
2024	-€21,773	-€18,138	-€39,911
Grand Total	-€395,833	-€428,275	-€824,108

Table 8: DSU estimated Charge by Year and Jurisdiction

The baseline (grey lines) is the current parameter, table 9 and table 10 illustrates the additional changes if the parameter were to be adjusted, all non-grey figures represent a delta from baseline and should be added in isolation and adjusted from the baseline values.

For 2022, 2.9% was considered for under generation and 2.6% for over generation for this entire year.

For 2023, 4.5% was considered for under generation and 7.2% for over generation for this entire year.

For 2024, 1.0% was considered for under generation and 1.4% for over generation for this entire year.

Year	TOLMW	Sum of CUNIMB	Qty of Under Generation	Qty of Over Generation
2022	1.1	26,465	339	-182
	1	-432,810	-4,389	3,949
	0.9	-29,304	-379	200
	0.8	-63,323	-825	427
	0.75	-82,349	-1,080	548
	0.5	-217,526	-3,001	1,302
2023	1.1	21,759	462	-379
	1	-349,642	-5,016	7,960
	0.9	-25,403	-574	422
	0.8	-55,709	-1,291	896
	0.75	-73,511	-1,731	1,151
	0.5	-211,542	-5,532	2,665
2024	1.1	2,777	59	-54
	1	-41,657	-590	869
	0.9	-3,266	-74	62
	0.8	-7,062	-163	134
	0.75	-9,186	-215	174
	0.5	-23,918	-620	413

Table 9: Results of changing TOLMW- DSU estimates

The baseline (grey lines) is the current parameter, table 9 illustrates the additional changes if the parameter were to be adjusted, with each parameter compared to baseline and to be added on.

Year	TOLENG	Sum of CUNIMB	Qty of Under Generation	Qty of Over Generation
2022	0.84%	4,837	11	123
	1%	-432,810	-4,389	3,949
	1.50%	0	0	0
	2%	0	0	0
2023	0.84%	1,028	11	261
	1%	-349,642	-5,016	7,960
	1.50%	0	0	0
	2%	0	0	0
2024	0.84%	0	0	0
	1%	-41,657	-590	896
	1.50%	0	0	0
	2%	0	0	0

Table 10: Results of changing TOLENG – estimated for DSU

The baseline (grey lines) is the current parameter, table 10 illustrates the additional changes if the parameter were to be adjusted, with each parameter compared to baseline and to be added on.

2.1.4. Battery Units

- Study period from 1st January 2022 to 31st April 2024
- Where the difference between the metering (QM) and dispatch quantity (DQ) does not exceed 0.5MWh or -0.5MWh the following data sets have had these values removed for analysis
- Battery that are in charging mode don't have Uninstructed Imbalance Charges applied until

Prior to adjusting parameters, a review was conducted of current volumes and charges that potentially could have been applied.

Battery volumes of DQ and QM are not plotted in the graph as negative metering would leave it misleading due to being charged in these conditions.

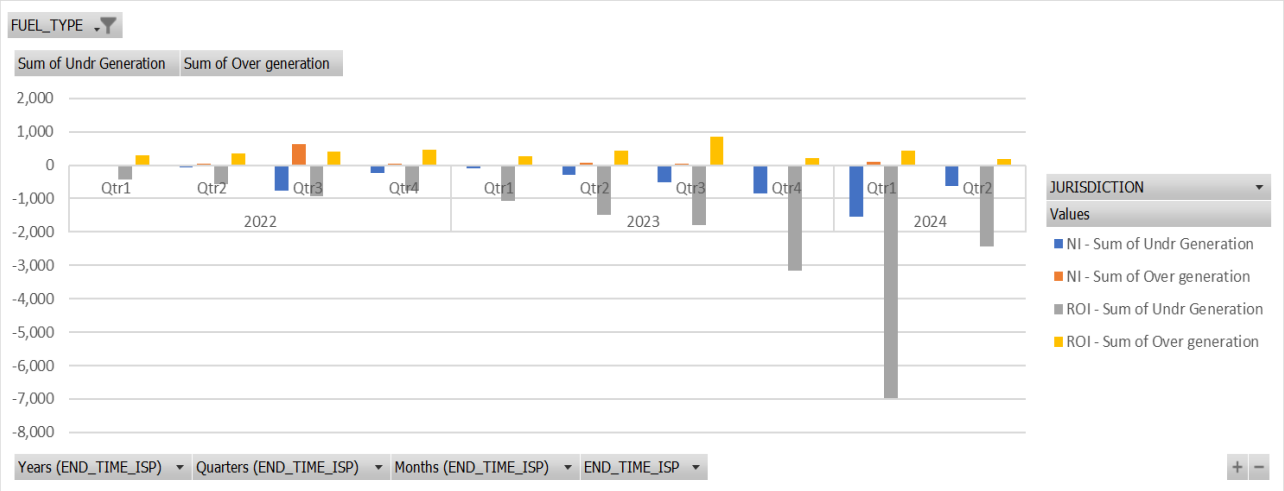

Figure 7: Battery Volume of Under or Over Generation by Quarter and Jurisdiction

FUEL_TYPE	BATTERY		
Row Labels	**Sum of Under Generation**	**Sum of Over Generation**	**Sum of CUNIMB**
NI	**-4,958**	**978**	**-€48,888**
2022	**-1,046**	**736**	**-€42,055**
2023	**-1,737**	**130**	**-€3,623**
2024	**-2,175**	**112**	**-€3,209**
ROI	**-19,611**	**3,855**	**-€144,145**
2022	**-2,701**	**1,489**	**-€75,432**
2023	**-7,487**	**1,759**	**-€51,412**
2024	**-9,423**	**608**	**-€17,301**
Grand Total	**-24,569**	**4,833**	**-€193,034**

Table 11: Battery Qty and Charge by Year and Jurisdiction

The baseline (grey lines) is the current parameter, table 12 and table 13 illustrates the additional changes if the parameter were to be adjusted, all non-grey figures represent a delta from baseline and should be added in isolation and adjusted from the baseline values.

Year	TOLMW	Qty of Under Generation	Qty of Over Generation	Sum of CUNIMB
2022	1.1	156	-34	1,799
	1	-3,747	2,225	-117,488
	0.9	-164	34	-1,847
	0.8	-333	69	-3,718
	0.75	-418	87	-4,659
	0.5	-858	176	-9,416
2023	1.1	410	-19	743
	1	-9,224	1,889	-55,035
	0.9	-433	19	-765
	0.8	-877	39	-1,540
	0.75	-1,102	49	-1,932
	0.5	-2,253	99	-3,926
2024	1.1	354	-11	464
	1	-11,598	719	-20,511
	0.9	-365	11	-488
	0.8	-734	22	-991
	0.75	-921	28	-1,247
	0.5	-1,865	58	-2,539

Table 12: Results of changing TOLMW - Battery

Year	TOLENG	Qty of Under Generation	Qty of Over Generation	Sum of CUNIMB
2022	0.84%	0	0	0
	1%	-3,747	2,225	-117,488
	1.50%	0	0	0
2023	0.84%	0	0	0
	1%	-9,224	1,889	-55,035
	1.50%	0	0	0
2024	0.84%	0	0	0
	1%	-11,598	719	-20,511
	1.50%	0	0	8

Table 13: Results of changing TOLENG - Battery

2.1.5. Pump Storage Units

- Study period from 1st January 2022 to 31st April 2024
- Where the difference between the metering (QM) and dispatch quantity (DQ) does not exceed 0.5MWh or -0.5MWh the following data sets have had these values removed for analysis

Prior to adjusting parameters, a review was conducted of current volumes and charges that potentially could have been applied.

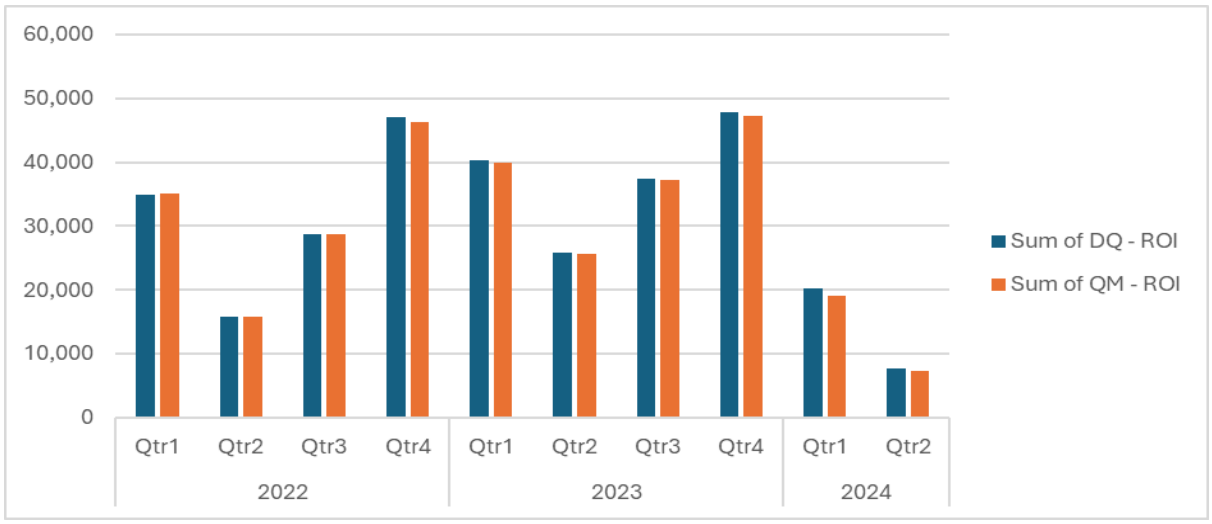

Figure 8: Pump Storage Volume of DQ and QM considered by Quarter and Jurisdiction

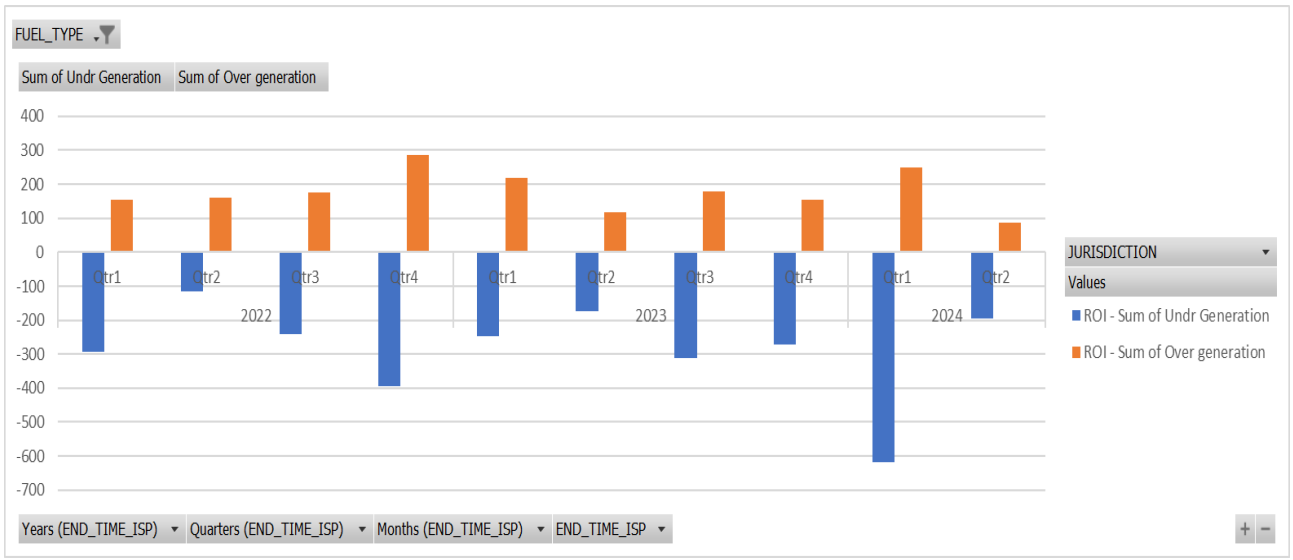

Figure 9: Pump Storage Volume of Under or Over Generation by Quarter and Jurisdiction

FUEL_TYPE	PUMP STORAGE		
Row Labels	**Sum of Under Generatio**	**Sum of Over Generation**	**Sum of CUNIMB**
ROI	**-2,857**	**1,775**	**-€164,318**
2022	**-1,045**	**773**	**-€91,257**
2023	**-1,002**	**668**	**-€49,505**
2024	**-811**	**334**	**-€23,556**
Grand Total	**-2,857**	**1,775**	**-€164,318**

Table 14: Pump Storage Qty and Charge by Year and Jurisdiction

The baseline (grey lines) is the current parameter, table 15 and table 16 illustrates the additional changes if the parameter were to be adjusted, all non-grey figures represent a delta from baseline and should be added in isolation and adjusted from the baseline values.

Year	TOLMW	Qty of Under Generation	Qty of Over Generation	Sum of CUNIMB
2022	1.1	89	-56	8,185
	1	-1,045	773	-91,257
	0.9	-101	61	-9,168
	0.8	-215	128	-19,328
	0.75	-278	163	-24,810
	0.5	-529	362	-50,095
2023	1.1	89	-62	4,570
	1	-1,002	668	-49,505
	0.9	-100	67	-5,090
	0.8	-213	138	-10,719
	0.75	-274	175	-13,775
	0.5	-491	373	-26,433
2024	1.1		-27	1,897
	1	-811	334	-23,556
	0.9	-69	30	-2,124
	0.8	-145	62	-4,529
	0.75	-187	79	-5,835
	0.5	-286	158	-9,992

Table 15: Results of changing TOLMW - Pump Storage

Year	TOLENG	Qty of Under Generation	Qty of Over Generation	Sum of CUNIMB
2022	0.84%	0	0	0
	1%	-1,045	773	-91,257
	1.50%	20	0	1,149
2023	0.84%	0	0	0
	1%	-1,002	668	-49,505
	1.50%	19	-1	598
2024	0.84%	0	0	0
	1%	-811	334	-23,556
	1.50%	28	-3	573

Table 16: Results of changing TOLENG - Pump Storage

2.1.6. Interconnector Units

- Study period from 1st January 2022 to 31st April 2024
- Where the difference between the metering (QM) and dispatch quantity (DQ) does not exceed 0.5MWh or -0.5MWh the following data sets have had these values removed for

Prior to adjusting parameters, a review was conducted of current volumes and charges that potentially could have been applied.

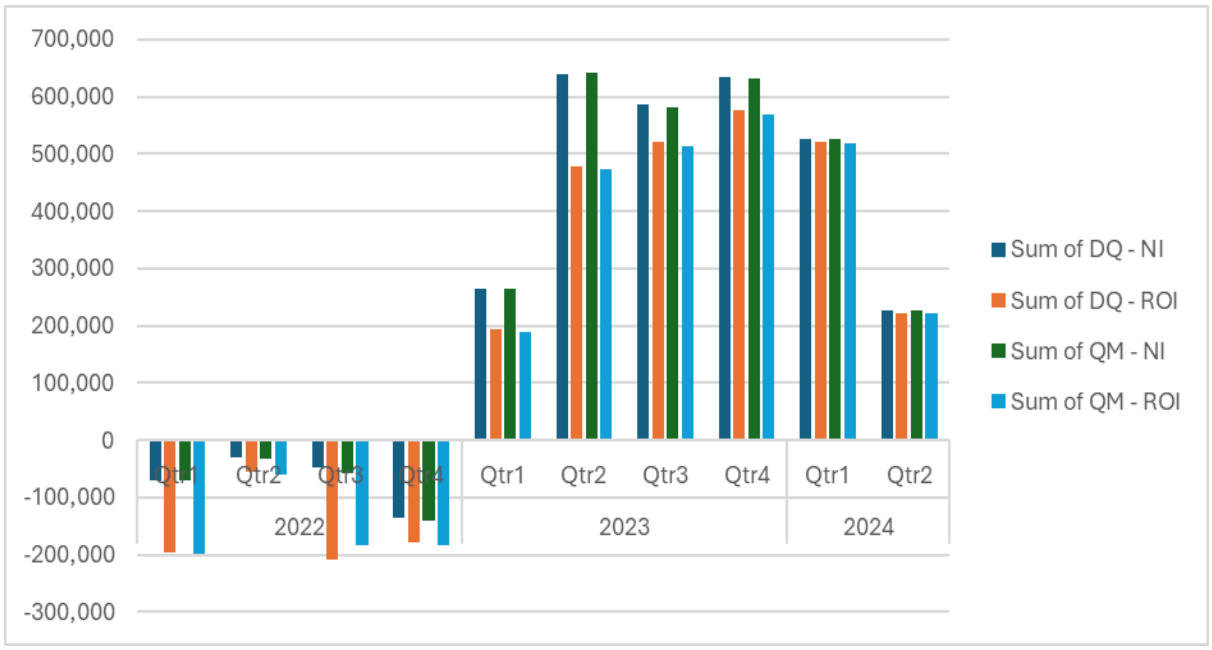

Figure 10: Interconnector Volume of DQ and QM considered by Quarter and Jurisdiction

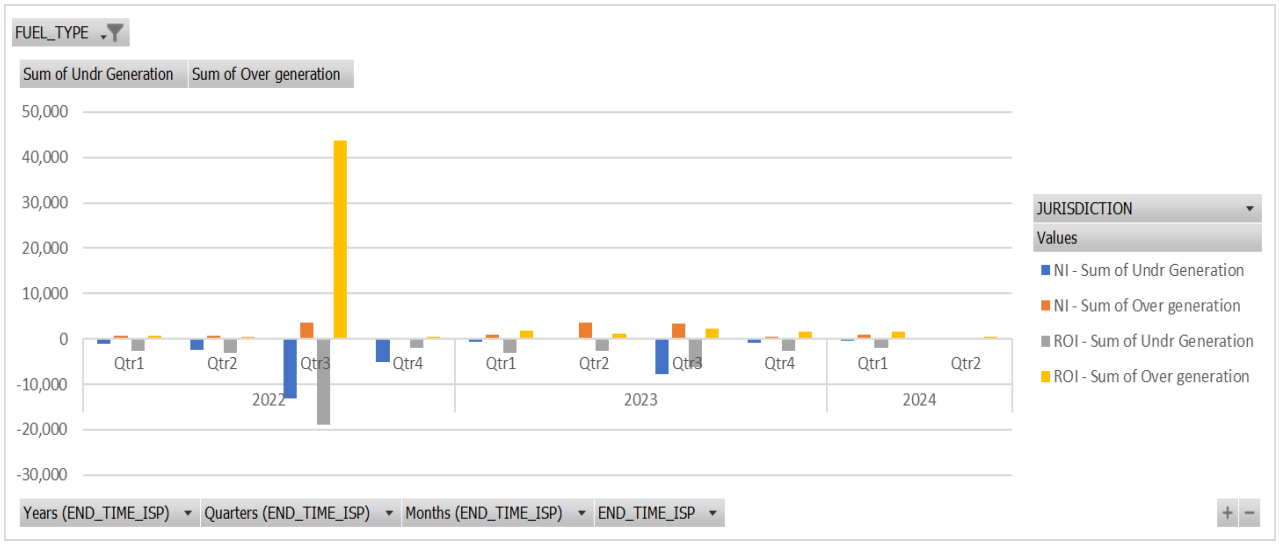

Figure 11: Interconnector Volume of Under or Over Generation by Quarter and Jurisdiction

FUEL_TYPE	INTERCONNECTOR		
Row Labels	**Sum of Under Generation**	**Sum of Over Generation**	**Sum of CUNIMB**
NI	**-31,555**	**14,942**	**-€1,895,892**
2022	**-21,641**	**5,480**	**-€1,534,489**
2023	**-9,428**	**8,558**	**-€337,060**
2024	**-486**	**905**	**-€24,343**
ROI	**-43,219**	**54,093**	**-€4,017,696**
2022	**-26,741**	**45,185**	**-€3,497,555**
2023	**-14,372**	**6,914**	**-€460,660**
2024	**-2,107**	**1,994**	**-€59,481**
Grand Total	**-74,774**	**69,036**	**-€5,913,588**

Table 17: Interconnector Qty and Charge by Year and Jurisdiction

The baseline (grey lines) is the current parameter, table 18 and table 19 illustrates the additional changes if the parameter were to be adjusted, all non-grey figures represent a delta from baseline and should be added in isolation and adjusted from the baseline values.

Year	TOLMW	Qty of Under Generation	Qty of Over Generation	Sum of CUNIMB
2022	1.1	373	-31	19,408
	1	-48,382	50,665	-5,032,045
	0.9	-393	36	-20,429
	0.8	-785	71	-40,720
	0.75	-982	90	-50,908
	0.5	-1,907	172	-98,609
2023	1.1	331	-18	8,011
	1	-23,799	15,472	-797,719
	0.9	-328	19	-7,981
	0.8	-649	39	-15,815
	0.75	-809	49	-19,728
	0.5	-1,529	82	-37,009
2024	1.1	71	-4	1,207
	1	-2,593	2,898	-83,824
	0.9	-74	5	-1,249
	0.8	-147	10	-2,485
	0.75	-185	13	-3,116
	0.5	-356	21	-5,918

Table 18: Results of changing TOLMW- Interconnector

Year	TOLENG	Qty of Under Generation	Qty of Over Generation	Sum of CUNIMB
2022	0.84%	-368	295	-30,910
	1%	-48,382	50,665	-5,032,045
	1.50%	851	-504	64,584
2023	0.84%	-623	59	-15,700
	1%	-23,799	15,472	-797,719
	1.50%	1,258	-179	33,090
2024	0.84%	-90	14	-1,809
	1%	-2,593	2,898	-83,824
	1.50%	194	-36	3,999

Table 19: Results of changing TOLENG – Interconnector

The baseline (grey lines) is the current parameter, table 18 and 19 illustrates the additional changes if the parameter were to be adjusted, with each parameter compared to baseline and to be added on.

3. Over and Under Generation Factors

3.1. Background

The Discount for Over Generation Factor for each Generator Unit in each Imbalance Settlement Period (known as FDOGuγ in the Trading and Settlement Code) and the Premium for Under Generation for each Generator Unit in each Imbalance Settlement Period (known as FPUGuγ in the Trading and Settlement Code) are the parameters which form the basis for the Uninstructed Imbalance Charges. The basis for the charges is a fraction of the price at which the unit would be settled for the volume which was outside of the tolerance band around their instructed dispatch level. The Discount for Over Generation and the Premium for Under Generator Factors are the fractions which are applied to the price to determine the additional adjustment for this volume. The fraction of the price chosen should be set such that it acts as a clear economic signal to be balance responsible with respect to matching physical generation with instructed generation, while being cost reflective to the extent possible

FDOG and FPUG has been adjusted from baseline of 0.2 to 0.25, 0.3 and 0.4 in order to determine anonymity and reviewing trends. Analysis of the data available has been carried out to determine the affect the results depending on the methodology used.

3.2. Consideration

With the variation between the quantities been charged for Under or Over generation, the review conducted was independent. Example when FPUG was changed to value 0.25, FDOG remained at 0.2 and vice versa.

The baseline (grey lines) is the current parameter, all tables illustrate the additional changes if the parameter were to be adjusted, all figures represent a percentage increase in charge and should be added in isolation and adjusted from the baseline values.

Conventional Gen	2022_NI	2023_NI	2024_NI	2022_ROI	2023_ROI	2024_ROI
FPUG& FDOG @ 0.2	-2161k	-1044k	-485k	-5295k	-3029k	-828k
FPUG @ 0.25	10.1%	7.4%	3.4%	9.6%	6.9%	7.4%
FPUG @ 0.3	20.2%	14.8%	6.8%	19.2%	13.7%	14.9%
FPUG@ 0.4	40.3%	29.5%	13.6%	38.3%	27.5%	29.7%
FDOG @ 0.25	14.9%	17.6%	21.6%	15.4%	18.1%	17.6%
FDOG@ 0.3	29.8%	35.2%	43.2%	30.8%	36.3%	35.1%
FDOG@ 0.4	59.7%	70.5%	86.4%	61.7%	72.5%	70.3%

Table 20: Results of changing FPUG or FDOG – Conventional Units

Wind and Solar Units	2022_NI	2023_NI	2024_NI	2022_ROI	2023_ROI	2024_ROI
FPUG & FDOG @ 0.2	-2184K	-1134K	-514K	-2535K	-4223K	-1041K
FPUG @ 0.25	26.6%	20.5%	13.1%	14.0%	7.4%	7.5%
FPUG @ 0.3	43.3%	34.2%	22.4%	28.1%	14.8%	15.0%
FPUG @ 0.4	76.8%	61.4%	41.1%	56.2%	29.7%	30.0%
FDOG @ 0.25	25.6%	32.3%	25.9%	11.0%	17.6%	17.5%
FDOG @ 0.3	37.3%	47.8%	43.6%	21.9%	35.2%	35.0%
FDOG @ 0.4	60.8%	78.9%	79.0%	43.8%	70.3%	70.3%

Table 21: Results of changing FPUG or FDOG – Wind and Solar Units

DSU Estimate	2022_NI	2023_NI	2024_NI	2022_ROI	2023_ROI	2024_ROI
FPUG& FDOG @ 0.2	-30k	-7k	-2k	-403k	-343k	-40k
FPUG @ 0.25	6.3%	18.5%	23.9%	15.4%	10.8%	11.4%
FPUG @ 0.3	12.7%	37.0%	47.9%	30.7%	21.6%	22.7%
FPUG@ 0.4	25.4%	74.1%	95.8%	61.5%	43.2%	45.4%
FDOG @ 0.25	18.7%	6.5%	1.1%	9.6%	14.2%	13.6%
FDOG@ 0.3	37.3%	13.0%	2.1%	19.3%	28.4%	27.3%
FDOG@ 0.4	74.6%	25.9%	4.2%	38.5%	56.8%	54.6%

Table 22: Results of changing FPUG or FDOG – DSU Estimate

Battery Units	2022_NI	2023_NI	2024_NI	2022_ROI	2023_ROI	2024_ROI
FPUG& FDOG @ 0.2	-42k	-4k	-3k	-75k	-51k	-17k
FPUG @ 0.25	0.3%	8.7%	5.9%	1.0%	2.2%	8.7%
FPUG @ 0.3	0.6%	17.4%	11.9%	1.9%	4.5%	17.4%
FPUG@ 0.4	1.2%	34.9%	23.8%	3.9%	8.9%	34.8%
FDOG @ 0.25	24.7%	16.3%	19.1%	24.0%	22.8%	16.3%
FDOG@ 0.3	49.4%	32.6%	38.1%	48.1%	45.5%	32.6%
FDOG@ 0.4	98.8%	65.1%	76.2%	96.1%	91.1%	65.2%

Table 21: Results of changing FPUG or FDOG – Battery Units

Pump Storage Uints	2022_ROI	2023_ROI	2024_ROI
FPUG& FDOG @ 0.2	-91k	-50k	-24k
FPUG @ 0.25	15.3%	14.1%	17.2%
FPUG @ 0.3	30.6%	28.1%	34.3%
FPUG@ 0.4	61.2%	56.2%	68.6%
FDOG @ 0.25	9.7%	10.9%	7.8%
FDOG@ 0.3	19.4%	21.9%	15.7%
FDOG@ 0.4	38.8%	43.8%	31.4%

Table 22: Results of changing FPUG or FDOG – Pump Storage Units

Interconnector Units	2022_NI	2023_NI	2024_NI	2022_ROI	2023_ROI	2024_ROI
FPUG& FDOG @ 0.2	-1534k	-337k	-24k	-3498k	-461k	-59k
FPUG @ 0.25	19.3%	9.7%	8.8%	10.3%	16.2%	12.9%
FPUG @ 0.3	38.6%	19.4%	17.5%	20.6%	32.4%	25.9%
FPUG@ 0.4	77.3%	38.8%	35.0%	41.2%	64.8%	51.7%
FDOG @ 0.25	5.7%	15.3%	16.2%	14.7%	8.8%	12.1%
FDOG@ 0.3	11.4%	30.6%	32.5%	29.4%	17.6%	24.1%
FDOG@ 0.4	22.7%	61.2%	65.0%	58.8%	35.2%	48.3%

Table 23: Results of changing FPUG or FDOG – Interconnector Units

4. System per Unit Regulation Factor

4.1. Background

The System per Unit Regulation Factor (known as FUREG in the Trading and Settlement Code) is the parameter reflecting the automatic response of a generating unit, due to their governor droop settings, to variations in the system frequency which is used to calculate the Tolerance for Over Generation and the Tolerance for Under Generation for use in the calculation of Uninstructed Imbalance Charges.

4.2. Considerations

Based on Grid Code requirements for governor/droop operating characteristics, the FUREG is set to 0.04 based on an assumption that all generating units typically have a 4% speed droop.

The EirGrid Grid Code states that Generator Units must be able to provide Frequency response using governor control systems (CC.7.3.7). This states that it must be operated to European Standards and will normally be operated with regulation (i.e., with a droop speed characteristic) between 3% and 5%.

The SONI Grid Code states that Generator Units must similarly be able to provide Frequency Control using governor controls systems (CC.S1.1.5.2, CC.S2.2.4.2). For gas turbine Generating Units the nominal droop operating characteristic must be 4%.

The European regulation for Requirements for Grid Connection of Generators (EU 2016/631) states that droop shall be specified by the SOs (Article 13(2)(a), Article 15(2)(c)(i)), and that the settings shall be in the range of 2-12% (Article 13(2)(d), Article 15(2)(c)(i)).Therefore there is no signal from integrating with the European arrangements requiring a change in droop operating.

5. Conclusions and recommendations

Throughout the document, CUMIB (Uninstructed Imbalance Charge) component has been shadow calculated to illustrate impact of changing different parameters, it is worth noting that the Imbalance charge component has significantly changed €232 was its average in 2022, €124 was its average in 2023 and €98 was its average in 2024.

Conventional Generators has the highest charge and 72% of this is for over generation.

Wind, Solar and Battery quantities will change once modification or system changes comes into effect next year.

With DQ been used in SEMO Settlements as a substitute for QM, DSU will not be receiving a charge, the study was conducted to capture impact on units that are currently available and dispatched to lower levels for a period in time.

Interconnector units has third highest quantities with similar quantities in Over or Under Generation.

TOLMW current value is 1, increasing or decreasing this factor would have a bigger impact and increase quantity considered for under generation, while the main instances occur for Over generation therefore the SOs recommends, retaining the current value.

TOLENG is currently set at 0.01, the SOs' recommends changing TOLENG from 0.01 to 0.084 for Wind and Solar only (once modification comes into effect MOD_13_23[1]) and retaining the current value for all other technology types.

FPUG considering the lower level of quantities the SOs' recommends, retaining the current value.

FDOG considering the higher level of quantities the SOs' recommends, increasing the value from 0.2 to 0.25. The rationale being that all uninstructed imbalances create a system charge and increasing the cost of the most predominant trend will incentivise improved behaviour.

FUREG Since the Grid Code provisions relating to values of governor settings in normal operation have not changed, and a single value of FUREG is required, it is proposed and retaining the current value for all other technology types.

It is worth noting during next year release contains system changes therefore batteries will be exposed to Uninstructed Imbalance while in charging mode.

The recommended values for the SEM tariff year are proposed within the below table 24.

[1] https://www.sem-o.com/documents/market-modifications/Mod_13_23/Mod_13_23SDP_01TreatmentofNon-PriorityDispatchRenewables.pdf

Parameter	2024 SEM current values	2025 SEM Proposed Values
TOLMW MW Tolerance	1	1
TOLENG Engineering Tolerance, except for Wind and Solar Units	0.01	0.01
TOLENG Engineering Tolerance for Wind and Solar Units	0.01	0.084
FPUGuγ Premium for Under Generation Factor, except for Interconnector Error Units	0.2	0.2
FPUGuγ Premium for Under Generation Factor for Interconnector Error Unit	0	0
FDOGuγ Discount for Over Generation Factor except for Interconnector Error Units	0.2	0.25
FDOGuγ Discount for Over Generation Factor for each Interconnector Error Unit	0	0
FUREG System per Unit Regulation Factor	0.4	0.4

Table 24: 2024 current values and proposed for 2025