Integrated Single Electricity Market

(I-SEM)

Locational Capacity Constraints Methodology

Decision Paper

SEM-17-040

03 July 2017

EXECUTIVE SUMMARY

This decision paper adds to the complement of CRM detailed design decision papers published to date and represents the decision associated with the methodology for the Locational Capacity Constraints. The decisions within this paper follow on from the associated consultation (SEM-17-027) which closed on 16 May 2017 and from the Location Issues Decision Paper (SEM-16-081) published on 8 December 2016.

The all-island transmission system includes constraints which limit the ability to transfer power from one part of the island to another and this poses a risk to security of supply. Therefore the Locational Issue Decision Paper (SEM -016-081) determined that it was appropriate to include Locational Capacity Constraints within the CRM.

The TSOs were tasked with developing a methodology to identify significant capacity constraints and to calculate the levels of generation required in constrained areas to ensure security of supply.

The methodology includes a detailed network capacity assessment to identify network capacity constraints within the meshed network which limit power transfer and for which generation in an area would be required to mitigate those constraints.

The outputs from the Locational Capacity Constraints Methodology are the identification of Constraint Areas, identified as a set of transmission or distribution nodes; and the calculation of the Minimum MW per Constraint Area, given in de-rated MW.

The consultation also set out a proposed amendment to the methodology described in SEM-016-082a for the calculation of De-Rating Factors. The amendment is designed to improve stability of De-Rating Factors from year to year. The paper also provided an update on the indicative De-Rating Factor values that were provided in the SEM-16-051a consultation document.

11 responses to the consultation were received. The respondents raised a number of key themes including a request for further clarity within the methodology and comments on the impact of proposed changes to the De-Rating Factor Methodology to the De-Rating Factors.

The SEM Committee have considered these responses and set out our position on the various points raised in this paper on both the Locational Capacity Constraints Methodology and the amendments to the De-Rating Factor methodology. A number of points were addressed to the TSOs and are specifically responded to within Annex 1.

We consider that respondents did not raise any issues that would require a significant change to either methodology. Respondents did raise process concerns around the clarity and transparency of the Locational Capacity Constraints Methodology, but the SEM Committee considers that overall the methodology offers sufficient detail for its purpose and notes that no alternative methodologies were suggested by respondents. However, where respondents have requested more detail in specific areas we have worked with the TSOs to provide further information in these sections, particularly in relation to demand inputs. These changes can be seen in the revised methodology included in Appendix 1.

The SEM Committee has decided that the Locational Constraints Methodology will apply as set out in Appendix 1. The SEM Committee has also approved the amendments to the De-Rating Factor Methodology and the final methodology is set out in Appendix 2.

The final results of both the Locational Capacity Constraints methodology and the De-Rating Factors Methodology will be published in the Initial Auction Information Pack on 3 July 2017.

The introduction of the CRM involves notifying the proposed mechanism to the European Commission (EC) in relation to State Aid, a process which is led by the Department of Communications, Climate Action & Environment (DCCAE) and the Department of the Economy (DfE). This decision is subject to the outcome of this notification process.

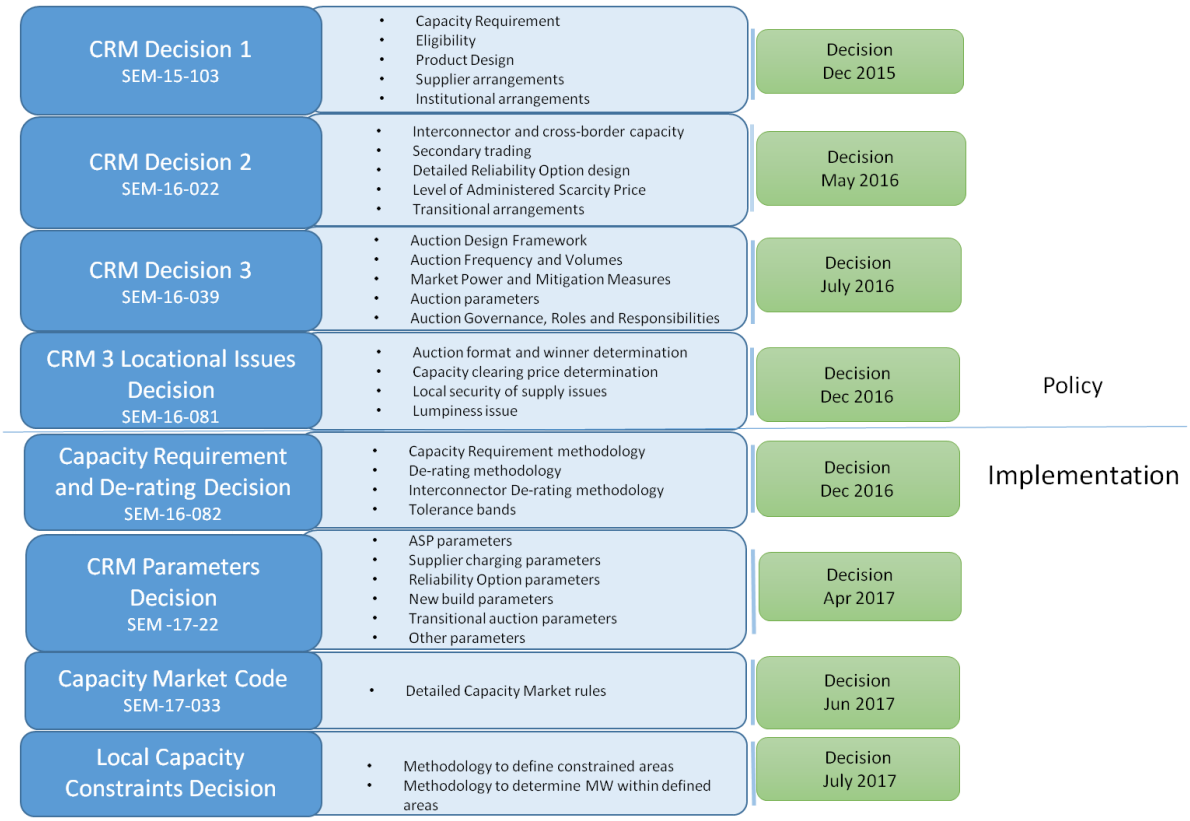
Contents

1. INTRODUCTION

1.1 BACKGROUND

1.1.1 The purpose of the CRM Detailed Design is to develop through consultation the specific design features of the new capacity mechanism. This process is illustrated in Figure 1 below.

Figure 1: Overview of CRM Policy Development



1.2 PURPOSE OF THIS PAPER

1.2.1 This paper and appendices are focused on the methodology designed to determine the Locational Capacity Constraints which will be included for the first transitional auction. It also sets out the definition of the Constrained Areas and the minimum MW requirements in each area. The paper also includes an amendment to the de-rating process.

1.2.2 The paper includes a summary of the responses made to the consultation paper issued on 13 April 2017, SEM-17-027, and sets out the SEM Committee's response to the key points raised.

1.2.3 This decision paper is structured as follows:

- **Locational Capacity Constraints Methodology:** Section 2 discusses the details of the methodology for determining Locational Capacity Constraints sets out the SEM Committee decisions;
- **De-Rating Factor methodology** Section 3 discusses the amendments to the methodology for determining the De-Rating Factors;
- **Appendix 1**: Detailed Locational Capacity Constraints methodology provided by the TSOs;
- **Appendix 2**: Amendments to the De-Rating Factor Methodology provided by the TSOs

Each policy section sets out a summary of the issues consulted upon, provides an overview of respondent's views, sets out the SEM Committee's response to the key points raised and then specifies the SEM Committee's decision on each matter.

1.3 RESPONSES TO CONSULTATION

1.3.1 This paper includes a summary of the responses made to the Locational Capacity Constraints Methodology consultation paper (SEM-17-027) which was published on 13 April 2017.

1.3.2 A total of 11 responses to the consultation were received. These were submitted from a wide range of interested parties. Of the 11 responses received; one included an annex which was marked confidential. The 11 responses are outlined below and copies can be obtained from the SEM Committee website.

- AES
- BGE
- Bord na Mona
- Electric Ireland
- Energia
- ESB
- Gaelectric
- Power NI PPB
- RUSAL Aughinish
- SSE
- Tynagh

1.4 KEY DECISIONS FROM LOCATIONAL ISSUES DECISION PAPER (SEM-16-081)

1.4.1 Within the Locational Issues Decision Paper (SEM-16-081) the SEM committee made the following high level decisions.

- The likely level of transmission constraints and the potential scale of exit creates a security of supply issue for the first transitional auctions
- In as far as is practical, the SEM Committee wishes to implement a market based solution for dealing with transmission constraints that affect capacity deliverability;
- The scale of the risk to security of supply is such that it is appropriate to incorporate locational constraints within the CRM.

1.4.2 The SEM Committee decision also identified a number of key principles which would be appropriate for any locational capacity framework within the CRM:

- Any locational constraints taken into account within the CRM mechanism would only be used to represent local capacity deliverability constraints.
- A locational need would only be included in the CRM mechanism where the need is clear and significant.
- The means by which local capacity deliverability constraints are identified and quantified would be simple and transparent to the maximum extent practicable.

1.5 ASSESSMENT CRITERIA

1.5.1 The assessment criteria for the detailed design of the CRM (including the auction design) are based on the same principles as those applied to the I-SEM High Level Design and as agreed with the Departments in the Next Steps Decision Paper published March 2013. We have developed detailed descriptions of these criteria to focus on issues that are relevant to procuring capacity and tailored to the detailed design elements of the capacity remuneration mechanism.

1.5.2 These assessment criteria are set out below:

- **The Internal Electricity Market:** the market design should efficiently implement the EU Target Model and ensure efficient cross border trade.
- **Security of supply:** the chosen wholesale market design should facilitate the operation of the system that meets relevant security standards.
- **Competition**: the trading arrangements should promote competition between participants; incentivise appropriate investment and operation within the market; and should not inhibit efficient entry or exit, all in a transparent and objective manner.
- **Equity:** the market design should allocate the costs and benefits associated with the production, transportation and consumption of electricity in a fair and reasonable manner.

- **Environmental:** while a market cannot be designed specifically around renewable generation, the selected wholesale market design should promote renewable energy sources and facilitate government targets for renewables.
- **Adaptive**: The governance arrangements should provide an appropriate basis for the development and modification of the arrangements in a straightforward and cost effective manner.
- **Stability:** the trading arrangements should be stable and predictable throughout the lifetime of the market, for reasons of investor confidence and cost of capital considerations.
- **Efficiency:** market design should, in so far as it is practical to do so, result in the most economic overall operation of the power system.
- **Practicality/Cost**: the cost of implementing and participating in the CRM should be minimised; and the market design should lend itself to an implementation that is well defined, timely and reasonably priced.

1.5.3 Fundamental to the SEM Committee's consideration of the overall CRM design are the Guidelines on State Aid for Environmental Protection and Energy 2014-2020. Furthermore, we are actively engaged with the Departments (DCCAE and DfE) and the European Commission as we finalise the capacity market design as ultimately EC State Aid approval is required for the CRM auctions to commence.

2. LOCATIONAL CAPACITY CONSTRAINTS METHODOLOGY

2.1 INTRODUCTION

2.1.1 The all-island transmission system includes constraints which limit the ability to transfer power from one part of the island to another and this poses a risk to security of supply. Therefore the Locational Issue Decision Paper (SEM-016-081) determined that it was appropriate to include Locational Capacity Constraints within the CRM.

2.1.2 Locational Capacity Constraints are required to apply in a Capacity Auction to ensure that a minimum quantity of de-rated capacity is cleared in an auction for areas where constraints have been identified on the transmission network.

2.1.3 The TSOs have developed a methodology for the determination of the Locational Capacity Constraint Areas. The methodology will identify significant capacity constraints and calculate the levels of generation required in constrained areas to ensure security of supply. The methodology is based on the key principles as set out in the Locational Issues Decision Paper (SEM-16-081);

- Any locational constraints taken into account within the CRM mechanism would only be used to represent local capacity deliverability constraints.
- A locational need would only be included in the CRM mechanism where the need is clear and significant.

- The means by which local capacity deliverability constraints are identified and quantified would be simple and transparent to the maximum extent practicable.

2.1.4 The Locational Capacity Constraints decision paper forms part of the overall CRM design process which has been extensively consulted upon at each stage of design.

2.1.5 The methodology as set out by the TSOs is consistent with that used to identify transmission network constraints and is consistent with a reasonable and prudent TSO approach.

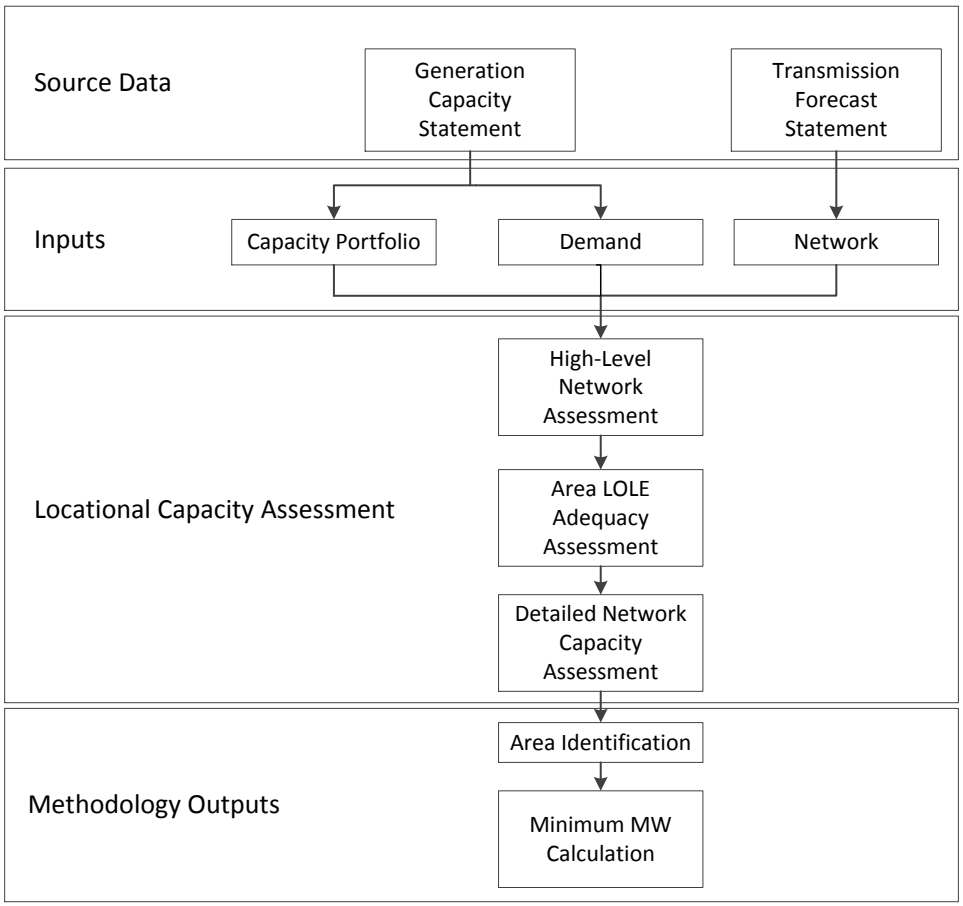
2.1.6 The proposed Locational Capacity Constraints methodology determined the Locational Capacity Constraint Areas and the minimum MW requirement in each such area.

2.1.7 The TSOs also proposed an amendment to the De-Rating Factor methodology described in SEM-016-082a which is designed to improve the stability of De-Rating Factors from year to year.

2.2 CONSULTATION SUMMARY

2.2.1 The TSOs' detailed proposed methodology was appended to the consultation paper. An overview of this methodology is outlined in Figure 3 below.

Figure 3: Overview of the Methodology



2.2.2 The methodology as set out in the consultation is designed to be consistent with that used to identify transmission network constraints and their corresponding reinforcements.

Inputs –Demand Forecasts

2.2.3 The demand forecasts were taken from the latest Generation Capacity Statement (GCS) as per the Capacity Requirement and De-Rating Factor Methodology.

2.2.4 For the first capacity auction it is proposed that the Capacity Requirement will be based on the demand forecast for the 21/22 Capacity Year.

Inputs –Network Forecasts

2.2.5 The consultation proposed to use the All-Island Ten Year Transmission Forecast Statement to determine the network to be assessed.

2.2.6 It is proposed to use the same portfolio of capacity providers as for the Capacity Requirement and De-Rating Factor Calculation, based on the portfolio of plant listed in the GCS adjusted for any known new plant or plant closures that would occur prior to the start of the Capacity Year in question.

Locational Capacity Assessment

2.2.7 A high level network topology assessment will be completed which will identify the extent to which the all island system is meshed. Preliminary results show that NI and ROI are not meshed.

2.2.8 The demand scenario for the unconstrained auction capacity requirement is selected using the least worst regrets analysis as per the Capacity Requirement and De-Rating Factor Methodology.

2.2.9 A LOLE assessment is used to set the lower bound of the MW requirement. A LOLE adequacy assessment will be performed for the non-meshed areas in a similar approach to the all-island Capacity Requirement analysis; however the demand profiles and portfolios used will be those applying to the non-meshed areas. It is proposed to use an 8 hour LOLE standard for each non meshed area, the GCS uses an 8 hour LOLE standard for Ireland adequacy assessments and a 4.9 standard for Northern Ireland adequacy assessments.

2.2.10 A detailed network capacity assessment is carried out to identify network capacity constraints within the meshed network which limit power transfer and for which generation in an area would be required to mitigate those constraints.

Methodology Outputs

2.2.11 The outputs from the Locational Capacity Constraints Methodology are the identification of Constraint Areas, identified as a set of transmission or distribution nodes; and the calculation of the Minimum MW per Constraint Area, given in de-rated MW.

2.2.12 The Locational Capacity Constraint Areas will be identified as Level 1 and level 2 areas, Level 2 areas must reside fully within a Level 1 area. These areas will be listed within the Initial Auction Information Pack.

2.3 SUMMARY OF RESPONSES

Locational Capacity Constraints Methodology

2.3.1 There was broad support for the Locational Capacity Constraints methodology however most respondents requested more detail be provided, with a number of respondents claiming that it was not possible to perform a meaningful assessment of the methodology without more detail. One respondent stated that it would be beneficial to have a document which details the process of identifying and managing locational constraints from start to finish. Another respondent requested a worked example in order to make evidence based decisions on the issue.

2.3.2 One respondent requested that any additional costs incurred by consumers due to constraints in the system are visible and transparent.

2.3.3 A number of respondents stated that a cost benefit analysis should be completed to identify if a transmission solution may be more cost effective for dealing with constraints within the market.

2.3.4 One respondent commented that Locational Capacity Constraints should be included in all auctions over all contract durations to facilitate competitive long term security of supply solutions.

2.3.5 A number of respondents also stated that there should be a limit on the number of constraint areas in place.

2.3.6 There was also a request for clarification on the interaction between the Locational Capacity Constraints and bidding zones.

Inputs – Demand

2.3.7 A couple of respondents questioned whether it was appropriate to use 2021/22 demand to identify local constraints in an auction for a Capacity Year commencing in May 2018 and ending in September 2019. They suggested that this approach may overstate the level of constraints, the argument being that if network reinforcement keeps pace with demand growth, the approach may identify constraints where they will not actually materialise or overstate the minimum MW that will be needed in a given area at any point during the transitional period to the end of 2021/22.

Inputs – Network Forecasts

2.3.8 A number of respondents expressed concern at the use of an 8 hour LOLE adequacy standard for both NI and ROI when the GCS uses a LOLE standard of 4.9 hours for NI. Some respondents supported this proposal stating that it avoids the possibility of ROI consumers subsidising the cost of NI constraints.

2.3.9 One respondent questioned if a 3 hour LOLE standard would provide a better solution than the current 8 hour LOLE proposal given the current lumpiness at non-meshed levels.

2.3.10 One respondent commented that contingencies should be in place and additional capacity procured in cases where there is real delivery risk that the forecasted network infrastructure may not be delivered in time for the capacity year.

2.3.11 One respondent stated that capacity constraints are at odds with previous CRM decisions and the expectations of a single bidding zone for energy and capacity. They commented that including Locational Capacity Constraints in the capacity market auction and the capacity market code (CMC) is undesirable in the lead up to the first transitional auction and from a broader I-SEM perspective.

Overall Comments

2.3.12 A couple of respondents queried the inclusion of out of market contracting flexibility and targeted contracting mechanisms within the State Aid application.

2.3.13 One respondent proposed rewording for Environmental Assessment Criteria 1.5

...the selected wholesale market design should promote primary energy savings, promote carbon emission reduction and facilitate government targets for increased renewable generation.

2.4 SEM COMMITTEE RESPONSE

Locational Capacity Constraints Methodology

2.4.1 The SEM Committee considers that overall the methodology offers sufficient detail for its purpose. The intention of the methodology is not to enable participants to calculate the precise boundaries or MW limits of the Constrained Areas but rather to understand how the boundaries and MW limits will be calculated by the TSOs for the Initial and Final Auction Information Packs respectively. We note that no alternative methodologies were suggested by respondents. However, where respondents have requested more detail in specific areas we have worked with the TSOs to provide further information in these sections of the methodology, particularly in relation to demand inputs. These changes can be seen in the revised methodology included in Appendix 1.

2.4.2 The SEM Committee considers that there will be transparency on the cost of constraints. Stakeholders will be able to calculate the incremental capacity costs resulting from constraints from the data published by the TSOs following each Capacity Auction (as set out in section F.9.5 of the CMC) [1].

2.4.3 In relation to the comments on cost benefit analysis for the first transitional auction, covering the Capacity Year starting in May 2018, Locational Capacity Constraints must be addressed within the market as there is insufficient time to reinforce the transmission network sufficiently to resolve the constraints in question.

2.4.4 On the inclusion of Locational Capacity Constraints in all auctions, the SEM Committee would like to re-emphasise that this paper considers only the applicable constraints for the first T-1 auction.

2.4.5 The SEM Committee has previously stated in SEM-16-081 that a locational need must be clear and significant to be included within the CRM mechanism. This policy effectively prevents the emergence of a proliferation of small L2 zones. Furthermore, the SEM Committee does not consider it is appropriate to place a particular limit on the number of L2 areas if the imposition of such a limit could cause local security of supply issues.

2.4.6 The terminology used within the Locational Capacity Constraint Methodology is consistent with that used within the CMC. The Locational Capacity Constraint is defined in Section C.2 of the Capacity Market Code.

Inputs – Demand

2.4.7 The rationale for using the demand forecast for 2021/22 in the methodology is essentially the same as used in SEM-16-022 to set the all-island Capacity Requirement. I.e., there is a risk that plant which loses the 2018/19 auction in December 2017 could close[2] by December 2020. If this capacity is required in 2021/22 to meet load growth between 2018/19 and 2021/22 it may not be possible to replace it in less than T-4 timescales at reasonable cost.

2.4.8 The SEM Committee notes that use of the demand forecast for 2021/22 will only over-state the level of constraints where there is material transmission investment planned which may ease a Locational Capacity Constraint prior to 2021/22.

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[1] The TSOs will be required to publish the MW of Awarded Capacity and the price paid to each winning offer. Stakeholders will be able to use this data to work out the incremental capacity cost resulting from constraints. From the TSO data, the interested stakeholders will be able to work out how many MWs of pay-as-bid capacity have been awarded, and how much each offer has been paid in excess of the clearing price. The incremental cost due to constraints in the capacity market can then be calculated as the product of the amount that each unit of pay-as-bid capacity is paid in excess of the clearing price and its volume. This calculation will represent an upper bound of the constraint cost, as it does not take into account:

- any energy market savings that may result if the paid-as-bid capacity is instrumental in delivering greater competition in the energy market, resulting in lower energy market prices; or
- the impact of greater competition in auctions for subsequent years.

[2] Having given three years' notice under the Grid Code or such shorter period as agreed in a derogation.

2.4.9 The key planned transmission reinforcement that may impact on capacity requirements between now and the end of 2021/22 is the planned second North-South interconnector, which could reduce the minimum MW required in Northern Ireland[3]. This investment is yet to complete all necessary planning approvals, and is not expected to be in place before 2021. Therefore, it is prudent to reflect the demand forecast for 2021/22 in the 2018/19 auction.

2.4.10 The SEM Committee notes that the TSOs' 2017 Generation Capacity Statement[4] peak demand forecasts for Northern Ireland are relatively flat throughout the transitional period. Even in the High Case forecast, the transmission peak demand is expected to grow by around 1% from 2018 to 2022. Therefore, in this case, the choice between using the 2018/19 demand forecast and the 2021/22 is not material in cost terms.

Inputs – Network Forecasts

2.4.11 The SEM Committee is of the view that it is appropriate to use the same LOLE standard across Northern Ireland and Ireland. If a 4.9-hour standard were to be applied in Northern Ireland and an 8 hour standard was applied in Ireland, this would potentially result in customers across the whole island paying higher capacity prices to ensure that only consumers in Northern Ireland benefitted from a higher security standard.

2.4.12 Additionally if the SEM Committee adopted a lower 8 hour LOLE standard in Ireland, with a 4.9 hour standard for Northern Ireland, the capacity mechanism could distort capacity provision in favour of Northern Ireland capacity.

2.4.13 Therefore the SEM Committee considers that it is more equitable to apply the same 8 hour LOLE standard for both Level 1 areas.

2.4.14 The SEM Committee agrees that the lumpiness problem is magnified in Constraint Areas as units are larger in proportion to the minimum MW requirement than at the all-island level. However, the minimum MW requirement always required the auction to award at least that minimum MW, provided the volume is offered at a price less than or equal to the Auction Price Cap. The smaller size of an area increases the probability that the minimum MW will be exceeded in percentage terms.

2.4.15 The first transitional auction, which takes place in December 2017 for capacity delivery from May 2018, does not build in any expectation of network infrastructure being delivered between the auction and the start of the Capacity Year. Constraints for future auctions will be consulted upon at a later date. At that time, the SEM Committee will give appropriate consideration to the extent that it is appropriate to factor in the risk of non-delivery of forecasted network infrastructure into the auction.

[3] It could also reduce the minimum MW required in Ireland, but this is less likely to be a binding constraint in the auction

[4] http://www.soni.ltd.uk/media/documents/Operations/CapacityStatements/Generation%20Capacity%20Statement%202017-2026.pdf

2.4.16 In relation to comments stating that the capacity constraints are contrary to previous CRM decisions the SEM Committee has consulted extensively on whether to include capacity constraints within the T-1 auction as part of the Local Security of Supply consultation and set out the reasons behind our decision to include them in the first transitional auction in SEM-17-022.

Overall Comments

2.4.17 Comments in relation to any additional targeted mechanisms go beyond the scope of this consultation. Any such mechanism will be consulted on separately by the SEM Committee/TSOs.

2.4.18 In relation to proposed rewording for the Environmental Assessment Criteria the SEM Committee considers that the assessment criteria were adopted at the I-SEM High Level Design stage. The criteria were consulted on at that time, and the same criteria and wording have been used consistently since.

2.5 SEM COMMITTEE DECISIONS

2.5.1 The SEM Committee has decided that the Locational Capacity Constraints Methodology will apply as set out in Appendix 1.

2.5.2 The introduction of the CRM involves notifying the proposed mechanism to the European Commission (EC) in relation to State Aid, a process which is led by the Department of Communications, Climate Action & Environment (DCCAE) and the Department for the Economy (DfE). This decision is subject to the outcome of this notification process.

3. DE-RATING FACTOR AND CAPACITY REQUIREMENT

3.1 INTRODUCTION

3.1.1 The TSOs are required to calculate the Capacity Requirement for the Capacity Market and also to recommend the De-Rating Factors that will be applied to units participating in the auction and secondary trading. The methodology being used to calculate these is outlined in decision paper SEM-016-082 and associated appendices.

3.1.2 The consultation set out a proposed amendment to the methodology described in SEM-016-082a that is designed to improve stability of De-Rating Factors from year to year. The paper also provided an update on the indicative De-Rating Factor values that were provided in the SEM-16-051a consultation document.

3.2 CONSULTATION SUMMARY

3.2.1 The methodology described in SEM-016-082a specifies that the Capacity Requirement and the final De-Rating Factor Curves for each Technology Class will be those that are calculated for the specific Demand Scenario selected by the Least-Worst Regrets analysis.

3.2.2 Under the current methodology, each historical profile year will provide different De-Rating Factor Curves for each Technology Class, since the marginal benefit of a unit to the system will to some degree depend on the demand profile used.

3.2.3 In order to improve stability of De-Rating Factors from year-to-year the consultation proposed the following change to the methodology;

- Take the demand forecast level that applies to the Least-Worst Regret demand scenario
- The final De-Rating Factor Curves will be formed by averaging the De-rating Factor Curves from all the demand scenarios at this demand forecast level (i.e. average across all historical profile years at that demand level)
- The final Capacity Requirement will be formed by averaging the Capacity Requirements from all the demand scenarios at this demand forecast level (i.e. average across all historical profile years at that demand level)

3.2.4 The consultation provided an update on indicative De-Rating Factors for the first transitional T-1 auction based on changes made to the calculation inputs.

3.3 SUMMARY OF RESPONSES

3.3.1 One respondent expressed concern about whether customers were best represented through the use of proposed technology groupings.

3.3.2 One respondent commented that lumpy plant should receive at least its bid price for its full de-rated capacity.

3.3.3 One respondent stated that the RAs should revisit interconnectors de-rating levels and ensure that the approach uses the most relevant inputs and errs on the side of caution.

3.3.4 Some respondents expressed concern about the signalled likely reduction in marginal De-Rating Factors proposed by the TSOs. While these respondents were comfortable that the previous De-Rating Factors were consistent with the operational performance of their plants (availability after consideration of planned and forced outages), they are now concerned that the TSOs will de-rate the plant below the operational capability of their plant, and wish to see non-zero tolerance bands reinstated for generators in this first auction.

3.3.5 One respondent stated that non zero tolerance bands for de-rating of DSUs would be beneficial.

3.3.6 Several respondents stated that the final Constraint Areas and De-Rating Factors should be published as soon as possible.

3.4 SEM COMMITTEE RESPONSE

3.4.1 The SEM Committee approved the TSOs' proposed de-rating methodology in SEM-16-082, including the proposed technology groupings. There has been no substantive new evidence which would lead the SEM Committee to review these groupings.

3.4.2 The SEM Committee wishes to clarify that any inflexible offer will have to be accepted either in its entirety or not at all. If it is accepted, it will receive at least its bid price on the whole offer.

3.4.3 The SEM Committee set out its approach to setting interconnectors de-ratings in SEM-16-082 and published the key input assumptions for the forced outage rate, scheduled outage rate and the External Market De-Rating Factor. These values are inputs into the overall calculation of the marginal De-Rating Factor for an interconnector.

3.4.4 The overall De-Rating Factor for the interconnectors will change as a result of any difference between the indicative marginal de-rating curves previously published, and the final de-rating curves, which will be published in the Initial Auction Information Pack.

3.4.5 The SEM Committee note that there has been a reduction in the marginal De-Rating Factors as a result of the TSOs' updated modelling, but does not agree that this a reason to review tolerance bands for generators.

3.4.6 The decision to implement zero tolerance bands for generators in the transitional auctions was set out in SEM-16-082, along with the reason for this decision, and was not dependent on the indicative estimates of marginal De-Rating Factors that the TSO had produced at that time. The TSOs' revised estimates of marginal de-rating therefore have no bearing on that decision.

3.4.7 The SEM Committee notes that, in line with the decision in CRM Decision 1 (SEM-15-103), the De-Rating Factor for a unit should be based on its marginal contribution to meeting a capacity requirement. It is not surprising that its marginal contribution to meeting the Capacity Requirement is different to its average availability. This has always been evident, for instance from the marginal de-rating curves for wind which have been published previously (e.g. in SEM-15-103) which show how the marginal capacity contribution of a wind unit is a function of the total amount of wind, and is also substantially less than the average output of most individual wind units.

3.4.8 In relation to non-zero tolerance bands the SEM Committee would like to re-iterate the decision taken in [SEM-17-022] that negative tolerance band for a DSU (DECTOL) will be set to 100%, which means that DSUs have flexibility to bid anywhere between their de-rated capacity and zero.

3.4.9 The final Constraint Area definitions and the De-Rating Factors will be published in the Initial Auction Information Pack in early July, in time for the opening of Qualifying for the December 2017 auction.

3.5 SEM COMMITTEE DECISIONS

3.5.1 The SEM Committee has approved the amendments to the methodology for calculating De-Rating Factors. Appendix 2 sets out the De-Rating factor methodology updated with the approved amendments and the methodology set out in this paper will be applied for the Capacity Requirement and De-rating process.

3.5.2 The introduction of the CRM involves notifying the proposed mechanism to the European Commission (EC) in relation to State Aid, a process which is led by the Department of Communications, Climate Action & Environment (DCCAE) and the Department for the Economy (DfE). This decision is subject to the outcome of this notification process.

4. NEXT STEPS

4.1.1 All the above papers will be published on the SEM Committee website:

www.semcommittee.com

4.1.2 The TSOs will publish approved definitions of the actual Level 1 and Level 2 areas in the Initial Auction Information Pack on 3 July. Aggregators will need to ensure that their Qualification applications align with the definition of these Locational Capacity Constraints if they wish to be considered as contributing towards such a constraint. I.e. aggregated units will not be considered as contributing to a Locational Capacity Constraint unless all the component Generators or Generators Units are normally connected to a connection point located within that constraint, as set out section E.8.9 of the Capacity Market Code. This section was added into the published version of the CMC to firmly establish the principles set out in the consulted draft, which consultation responses noted lacked clarity.

4.1.3 Following completion of the Qualification process, the TSOs will then publish the SEM Committee approved minimum MW requirements in each Level 1 and Level 2 area in the Final Auction Information Pack to be published 2-3 weeks prior to the first transitional auction to be held on 15th December. These minimum MW will take account of any capacity which the TSOs expect to be available in Capacity Year 2018/19, but which has chosen not to participate in the auction.

4.1.4 The TSOs will publish the SEM Committee approved De-Rating Factors by technology and unit size in the Initial Auction Information Pack, and these factors will apply during Qualification and the first transitional auction.

5. ACRONYMS

CRM	Capacity Remuneration Mechanism
DCCAE	Department of Communications, Climate Action and Environment
DECTOL	Decrease Tolerance
DfE	Department for the Economy
DSU	Demand Side Unit
EC	European Commission
EU	European Union
GCS	Generation Capacity Statement
I-SEM	Integrated Single Electricity Market
LOLE	Loss of Load Expectation
MW	Megawatt
NI	Northern Ireland
RA	Regulatory Authority
ROI	Republic of Ireland
SEM	Single Electricity Market
TSO	Transmission System Operator

6. ANNEX 1 – TSO RESPONSES

This document provides TSO responses to items raised during the consultation. The items listed were identified by the Regulatory Authorities and the TSO responses are given in blue.

Locational Capacity Constraints Methodology

6.1.1 There was general support for the Locational Capacity Constraints Methodology however a number of respondents raised the issue of transparency in regards to performing an assessment of the methodology. More detail around how constraints will be applied in the market was requested. One respondent advised it would be beneficial if a document were to be provided that detailed the process of identifying and managing locational constraints from start to finish. Another respondent requested the provision of a worked example as they believe the evidence is not presently available.

The final methodology is included as Appendix 1 to this SEMC decision paper. The methodology sets out the principles applied to calculate constraint areas and minimum MW requirements. The methodology is based on SEMC decisions, existing adequacy and network planning procedures and information in public documents. Additional detail has also been provided in Appendix 1 of this decision paper.

The methodology describes how constraints are to be identified using the tests required in the Transmission System Security and Planning Standards, which are consistent with those employed by the System Operators across Europe and much of the world. The data and models identified in the methodology are taken from published documents that are themselves produced using standard and well-established analysis methodologies and which are provided with every annual publication of the Ten Year Transmission Forecast Statement and Generation Capacity Statement.

Details of how the locational constraints will be applied in the auction are included in the Capacity Market Code.

6.1.2 One respondent requested that constraints should be limited to the Transmission Network. They stated there should be no allowance for power flow constraints on the Distribution Network; however advise that an output can reference a Distribution System or a node on the Distribution system.

The constraints analysis is focused on the transmission network. Distribution nodes are listed in the constraint area definition in order to: a) clearly identify all nodes in the constraint area; and b) identify any generation that can contribute to mitigating the transmission constraint. Distribution connected generation is accounted for in the analysis.

6.1.3 One respondent commented that they believe the approach taken was too open ended and it should include limits on the size of L2 constraints and limitations stating L2 constraints must be within one of the biggest two capacity zones. They have also stated that an overall limit on the number of L2 constraint zones should be implemented.

This methodology was developed to meet the requirements set out in the SEMC decision on locational issues (SEM-16-081). As set out in that decision, the TSO methodology is designed to identify the clear and significant constraints. Limits also exist in relation to the LCCs in that they cannot overlap on the same level and L2s must be wholly within L1s. Setting other size limits without any justification would unduly restrict the methodology.

Inputs – Demand

6.1.4 A number of respondents queried the lack of details around how regional demand is allocated and requested clarity on what demand will be used in L2 network analysis studies. Several respondents requested greater detail around how demand growth will be determined.

The assumptions used for the Level 1 LOLE adequacy assessments is based on the peak demand forecasts for Ireland and Northern Ireland listed in the Generation Capacity Statement. We will be publishing the stations that are to be included in the Greater Dublin Level 2 constraint area in the Initial Auction Information Pack on July 3rd. Information on demand assumptions for these nodes is provided in the TYTFS. The TYTFS takes account of regional demand growth, including domestic, commercial and data centre load. This is described in Chapter 3 of TYTFS. The latest TYTFS (i.e. TYTFS 2016-2025) is expected to be published Q3 2017. Extra detail on demand assumptions has also been provided in Section 5.1.1 of the methodology set out in Appendix 1 of this decision paper.

6.1.5 One respondent stated that using the 2021/22 demand would likely overstate constraints are the network has yet to be reinforced to support the 2021/22 demand. They have noted that adjustments to the current network assumptions will be required.

An assessment of the pros and cons of the different forecast years was illustrated in Table 2 of the consultation. The choice to the 2021/22 demand forecast aligns with the desire to avoid closure of units that are likely to be required in 2021/22. It will identify existing constraints on the network and the constraints that will likely persist between the 2018/19 and 2021/22. It is also consistent with the Auction Capacity Requirement demand forecast.

6.1.6 One respondent commented they do not believe the demand scenario for the Unconstrained Auction Capacity Requirement should be used to identify constrained area requirements.

Given the price caps (Existing Capacity Price Cap and Auction Price Cap) in place in the auction, the value of capacity assumption used in the Least-Worst Regrets analysis (i.e. Net-CONE) is still valid for the LCC analysis. Consequently, it is also appropriate to use the Capacity Requirement Least-Worst Regrets demand forecast level in the LCC analysis.

Inputs – Network Forecasts

6.1.7 A number of respondents requested clarification on how generation outages within L2 regions are taken into account.

Generation outages are taken into account in the Transmission System Security Planning Standards (TSSPS) which have been utilised in this methodology.

6.1.8 One respondent stated that network forecasts for a T-4 auction should be reflective of the expected network in its respective delivery year.

The methodology does not restrict the choice of network for T-4 auctions. The choice of network is discussed in Section 5.1.2 which states that *"If Locational Capacity Constraints are to be included in the T-4 Capacity Market auctions special consideration may need to be given to changes to the transmission infrastructure whose timing is likely to have a significant impact on network constraints."*

6.1.9 One respondent commented that the method of calculating the locational MW quantity to be used in the auction appears deficient. They stated, based on statistical mechanisms, that it is only appropriate when applied to a significant population of power plants and breaks down when applied to a smaller area with a small number of plants.

The methodology is based on existing adequacy and network planning procedures. We do not agree that the methodology breaks down at the level at which it is applied in this analysis. The way in which the minimum MW are determined is to assess constraints for a range of dispatches. That is, a range of system dispatches are used to determine the level of capacity required within an area to mitigate the constraint. For both the Level 1 and Level 2 analysis a range of portfolios and scenarios are analysed to provide robust results. Consequently, the methodology remains appropriate for this application.

6.1.10 It was requested by a respondent that the TSOs indicate which specific networks tests, within sets of tests set out in the TSSPS, will be applied to determine the existence of an L2 area and its boundaries.

Steady state load flow tests that are required by the TSSPS to be carried out have been applied to assess the network for capacity related constraints.

6.1.11 One respondent queried whether the TSOs anticipated experiencing any complications in the application of the methodology give the 'nested' and overlapping constraints currently existing in Dublin.

The methodology will meet the requirements set out in SEM-16-081 and will appropriately identify the constrained areas on the network.

6.1.12 One respondent stated that secondary trading may not occur between generators within the same constraint zone due to a limited generation source to trade with.

Secondary trading is outside the scope of this consultation. Secondary trading can only take place where there is a legitimate technical reason. The TSOs are only likely to approve a planned outage on the basis that there is sufficient capacity elsewhere on the system at that time to operate the system securely. As such, where a generator unit in an LCC area is granted a planned outage, this implies that the generator unit is not needed for the period of the outage. In this way, a generator unit outside the LCC area can take on the obligations associated with the awarded capacity without compromising on security of supply. Essentially, the outage approval process enables the secondary trading of awarded capacity within the LCC area.

6.1.13 A respondent raised the issue that it is not clear, based on the Generation portfolio used, that it will consider all the scenarios relevant to a localised site.

The methodology has been specifically designed to assess constraints under a very wide range of scenarios. Consequently it is expected that all relevant scenarios to localised sites have been tested. The generation portfolio assumptions used in this methodology are based on the Generation Capacity Statement and align with the assumptions used for the Capacity Requirement analysis. Then multiple different generation combinations and dispatches are used to test the network and identify locational capacity constrained areas. This applies to all areas.

Outputs

6.1.14 One respondent advised that whilst they support the proposed outputs these should also include the identification of the minimum number of units required.

The constraint to be applied in the auction is based on capacity and not the number units. Therefore the Locational Capacity Constraint is in terms of MW as per the SEMC decision.

6.1.15 Concerns were raised that boundaries may be more volatile and dependent on assumptions indicated by the paper.

The methodology utilises the appropriate network standards and tools and applies a high degree of computational rigour. The boundaries will reflect the requirement for the capacity year in question.

6.1.16 One respondent commented on a lack of details around the composition of capacity with an L2 area.

The portfolio aligns with the Generation Capacity Statement and Capacity Requirement and De-rating Factor assumptions.

6.1.17 There was a request for clarity around how units will demonstrate they are wholly within an area to be included in the Location Capacity Constraints Area for the auction.

All generator units/generators demand sites associated with demand side units must be directly connected to the transmission system stations listed in the Locational Capacity Constraint Area; or distribution system node at a point that is normally connected to one of the transmission system nodes listed in the Locational Capacity Constraint Area.

A list of the stations in each Locational Capacity Constraint Area will be provided in the Initial Auction Information Pack on July 3rd.

6.1.18 There was a request for confirmation that constraints could not exist on the Transmission and Distribution network. The respondent has advised the paper indicates that constraints could exist.

The constraints analysis is focused on the transmission network. Distribution nodes are listed in the constraint area definition in order to clearly identify all nodes in the constraint area where generation could contribute to mitigating the transmission constraint.

De-rating Factor and Capacity Requirement Amendment

There was a general trend in the comments requesting additional information regarding the requirement for averaging, which we now provide below. Some respondents assumed that averaging would reduce the overall capacity requirement. The information below shows that this is not necessarily the case.

Analysis of provisional data has shown that several demand scenarios can have maximum regret costs that vary only slightly between them. However the variation in de-rating curves and capacity requirement can be more significant. The graph below (based on provisional results for the 2019/19 T-1 auction) shows the gas turbine de-rating curve for the four demand scenarios with the lowest maximum regret costs (i.e. the four Least Worst Regret scenarios). These scenarios all come from within the same demand level. Some variation in the de-rating factor curves is observed between these four Least Worst Regret scenarios, despite them having very similar maximum regret costs.

The dashed line shows the de-rating curve obtained by averaging de-rating values across all scenarios at the demand level of the Least-Worst Regret scenario. Note that in this case the de-rating curve marked LWR #1, representing the Least-Worst Regrets demand scenario, is very slightly below the average curve.

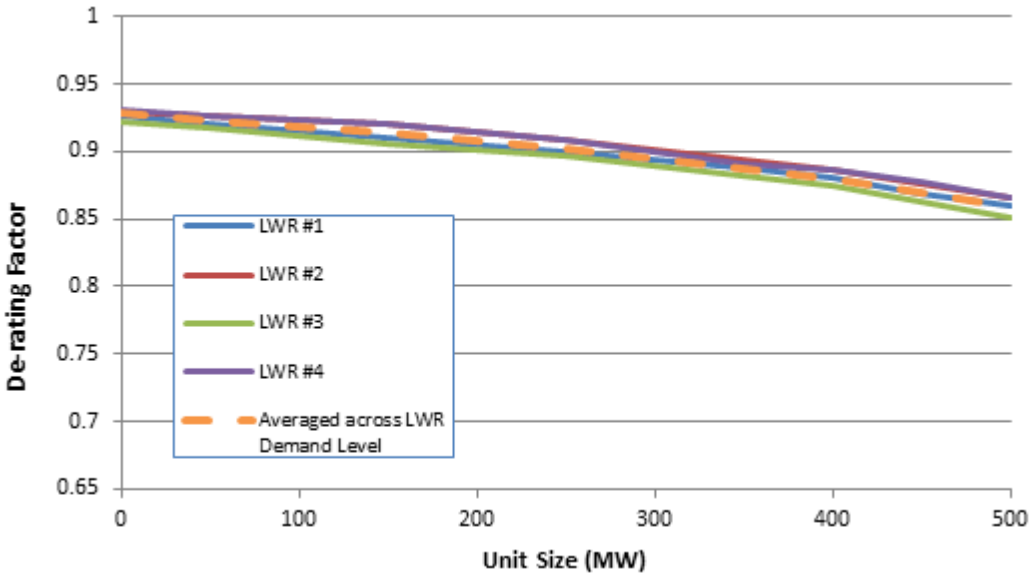

Figure 1 The Gas Turbine de-rating factor curve for the four Least Worst Regrets demand scenarios, compared to the de-rating curve obtained by averaging all values at the LWR demand level.

The Capacity Requirements across the four Least-Worst Regret scenarios show similar behaviour to the de-rating factor values. Switching between the first and second Least Worst Regret scenarios would change the Capacity Requirement by approximately 50 MW. The scenario capacity requirement marked LWR #1 represents the Least-Worst Regrets demand scenario. When the capacity requirement is averaged across all demand scenarios at that demand forecast level it results in the Capacity Requirement illustrated by the green bar. In this instance, this results in a final Capacity Requirement that is slightly above the Least-Worst Regrets demand scenario.

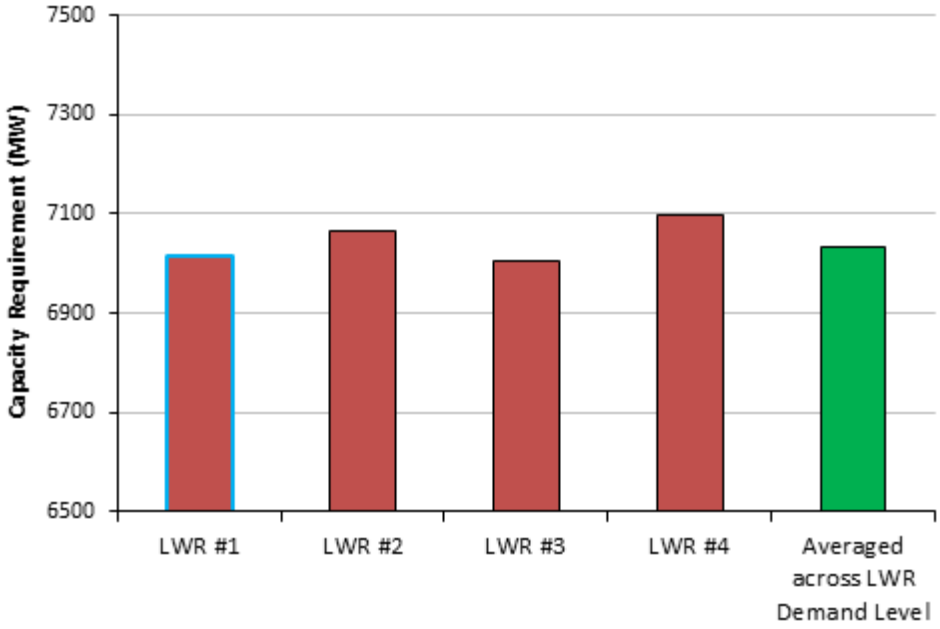

Figure 2 The Capacity Requirement for the four Least Worst Regrets demand scenarios, compared to the Capacity Requirement obtained by averaging all values at the LWR demand level.

Since the four Least-Worst Regret scenarios above all have similar max regret costs, a small change in inputs could lead to a different scenario being selected as **the** Least-Worst Regret scenario. Averaging results across the demand forecast level increases the stability of the results.

As shown above, the amendment to the methodology does not necessarily result in either lower de-rating factors or lower capacity requirements. By using this averaging approach, the final Capacity Requirement will also be consistent with the final De-rating Factors.

6.1.19 One respondent stated there was no rationale for the amendment to the methodology in regards to averaging the capacity required across demand profile scenarios as opposed to letting the least-worst regrets method select the demand profile scenario.

Averaging across the demand profiles ensures consistency with the de-rating factors. It should be pointed out that the least-worst regret does not always select a scenario with a higher requirement that the average for that demand level.

6.1.20 A number of respondents raised concerns in relation to movement in de-rating factors and the degree on year on year variability. More information in regards to this was requested.

Detail has been provided above. The rationale for the change (along with reducing volatility) is primarily based on first principles. The intended purpose of the least-worst regrets analysis is to decide on the demand forecast to use. The use of multiple demand profiles helps to ensure the results are robust.

6.1.21 One respondent stated concerns with the consequence of a decrease in the de-rating factor across all technologies of 3-5%. It has been requested that the de-rating factors for the first auction be published as soon as possible.

De-rating curves will be available to participants as part of the Auction Information Pack, which is expected to be published in July.

6.1.22 One respondent stated the de-rating changes will improve stability at the expense of providers and recommended that any loss in revenues should be fully recycled. It was suggested the revenues to providers be restored to the original level they would have been.

The change in the de-rating factors from the indicative values provided in the consultation document is not due to this amendment to the methodology. It is also important to point out (as shown above) that the averaging across profile years does not necessarily result in lower De-rating Factors or lower Capacity Requirements.

The value of Net-CONE for the auction uses the latest de-rating factor of the Best New Entrant Plant. Therefore, the Auction Price Cap and Existing Capacity Price Cap will reflect the latest de-rating factor results.

6.1.23 There was also a request for the TSOs to identify the contribution of changes in composition of plant on the system in the observed year on year volatility.

The impact of generation mix on de-rating factors is minor, and is further reduced by averaging across multiple capacity adequate portfolios. De-rating factors are primarily driven by the unit's outage statistics and size.

6.1.24 One respondent called for the TSOs to carefully assess whether the proposed modification undermines the application of the least-worst regrets approach.

It does not undermine the least-worst regrets analysis. The intended purpose of the least-worst regrets analysis is to decide on the demand forecast to use. The use of multiple demand profiles helps to ensure the results are robust.

6.1.25 One respondent raised concerns at the movement of de-rating factors and that they had expected to see a comparison of inputs between the original analysis and undated dataset. They had also expected this to include a precise description of what the expanded statistics were and what improvements would be made.

De-rating factors provided previously were indicative only and provided before the methodology and tools were finalised.