Mixed Customer Sites Expert Group:

PART 2 FINAL REPORT

Purpose: The Mixed Customer Sites group was set up to consider the way in which particular configurations of equipment are dealt with by the Connection Network Codes and, where applicable, to make recommendations on possible improvements to the Codes that could ensure more equitable treatment in these situations to balance the costs to smaller connecting parties and the benefits to system security.

In part 1 of their work the group came up with a number of options to resolve the issues identified. As a continuation, in part 2 of the group's work they were tasked with considering the options produced in part 1 and selecting a single option, supported by quantifiable evidence and draft code text, that could be recommended to take forwards.

Rather than repeating in full the material in the 'part 1' report, this document is designed to be read in conjunction with and following on from this.

TABLE OF CONTENTS

ABOUT THIS DOCUMENT

This is the final 'part 2' report of the Mixed Customer Sites (MCS) Expert Group, established by the Grid Connection European Stakeholder Committee (GC ESC) in the autumn of 2018 to consider the suitability of the three Connection Network Codes (RfG, DCC and HVDC) to mixed equipment configurations within a single site and to develop and recommend possible future improvements to the Codes to address any issues identified. The group was tasked by the Sept 2019 GC ESC to continue in 'part 2' of their work to select and justify a single solution to recommend taking forwards from those options considered in part 1 and to produce the draft code text required to support this.

DOCUMENT CONTROL

Version	Date	Change Reference
0.1	18 February 2020	First draft
0.2	20 March 2020	Revisions for meeting
0.3	8 April 2020	Revised recommendation
0.4	23 April 2020	Revisions for meeting
0.5	14 May 2020	Revisions after final meeting
0.6	17 June 2020	Typo corrections post GC-ESC

Any Questions?

Rob Wilson
Expert Group Chair
Robert.wilson2@nationalgrid.com

Ioannis Thomas Theologitis
ENTSO-E
ioannis.theologitis@entsoe.eu

GC-SO ESC/ENTSO-E
GC-SOESC@entsoe.eu

INTRODUCTION

On 11 June 2018, the Grid Connection European Stakeholder Committee (GC ESC) decided to establish three Expert Groups (EG) to consider and clarify the requirements on particular groups of users as applicable under the three European Connection Codes (CNCs); namely, Requirements for Generators[1] (RfG), HVDC[2] and Demand Connection[3] (DCC).

The areas to be considered by the three EGs were:

- Pumped Storage[4] (hydro);
- Storage (non-Pumped Storage); and
- Mixed Customer Sites (MCS), where these could be a combination of generation, demand and/or storage facilities.

The creation of these EGs was proposed by ENTSO-E to elaborate on the three CNCs issues which had been raised by stakeholders during the national implementation of the CNCs; including as a result of a stakeholder survey to identify priority topics for which future revisions to the CNCs could be considered.

The groups submitted their final reports to the 11 Sept 2019 GC ESC meeting which duly approved these but also set out a continuation of their work to continue to detail and justify their conclusions and to produce draft code text of a single chosen option to take forwards.

The full terms of reference for the EG MCS5 were approved by the 14 Sept 2018 GC ESC and subsequently with a minor amendment by the 13 Dec 2018 GC ESC; for part 2 of the work revised terms of reference were approved by the 11 Sept 2019 GC ESC.

[1] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=OJ:JOL_2016_112_R_0001

[2] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32016R1447

[3] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L_.2016.223.01.0010.01.ENG&toc=OJ:L:2016:223:TOC

[4] Defined in RfG Article 2(21).

[5] https://www.entsoe.eu/Documents/Network%20codes%20documents/GC%20ESC/MSC/Annex_EG_MCS_final.pdf

PURPOSE

Objectives

The objectives of the EG MCS, as agreed by the Grid Connection European Stakeholder Committee on 14 September 2018 and extracted from the paper submitted to the GC ESC, are:

- to provide clarification regarding the application of the three Network Codes on Requirements for Generators connection (NC RfG) Demand Connection Code (NC DC) and HVDC connection (NC HVDC) to MCS with generation, demand and storage (to the extent that storage might in future be classed as separate from generation or demand);
- identify differences and similarities of MCS which are Closed Distribution System Operators (CDSOs) and non-CDSOs;
- in the context of MCS:
    - assess types of MCS to be considered;
    - to assess the MCS case against the current definition of system users, found in the Directive 2009/72/EC[6];
    - to review the definitions of Synchronous Power Generating Module (SPGM)/Power Park Module (PPM); and
    - to provide clarification in terms of the Type A-D generator categorisation[7] or applicability of RfG for mixed or novel sites addressing cases such as:
        - mixed generation only sites where a small PGM (e.g. PV) is installed within the connection site of a larger generator;
        - small PGMs connected to a ≥110kV network due to unavailability of lower voltage connection points[8]
        - combined heat and power generating facilities connected at ≥110kV (where Type A-C would be excluded from certain RfG requirements)
        - clarification on arrangements for point of connection to TSO, DSO or CDSO if that will determine the voltage of connection and therefore 'type'

[6] https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=celex%3A32009L0072

[7] Further information on the categorisation can be found in NC RfG Article 5. This is also explored further in Section 5 of this report,

[8] Defined in RfG Article 2 (15) as "'connection point' means the interface at which the power-generating module, demand facility, distribution system or HVDC system is connected to a transmission system, offshore network, distribution system, including closed distribution systems, or HVDC system, as identified in the connection agreement;"

(additional point added after initial GC ESC approval on September 14, 2018 and approved by 13 Dec 2018 GC ESC)

In part 2 of the group's work, as approved by the GC ESC on 11 Sept 2019, the objective was to finalise a single option as the proposed solution and to produce text that could be used in a future revision of the Requirements for Generators code.

Task description

Mixed customer sites with generation and demand are subject to the three Connection Network Codes (Requirements for Generators, HVDC and Demand Connection) that determine the technical specification and capability requirements of equipment connected to the system.
Furthermore, as set out by Article 6 of NC RfG and Article 5 of NC DCC, specific provisions apply to industrial sites connected to the electrical system.
Feedback received from stakeholders has highlighted questions relating to this type of site, especially regarding the classification of onsite generation.
The EG MSC is tasked with the following actions:

- compile and categorise questions from stakeholders relating to MCS;
- identify possible solutions to questions regarding the application of the current CNC requirements; and
- investigate potential improvements to the CNC for a better application of the CNCs to the MCS.

To meet these goals, the EG MSC should be guided by the objectives of the 3rd Energy Package and take into account existing national examples and national network code[9] provisions.
As set out in the objectives, the task will include assessments of the connection to the electrical system of plant at higher voltages either where this is more cost-effective due to the unavailability of lower voltage networks, or where the connection is within a mixed customer site; i.e. the differing treatment of connections to a variety of networks or configurations. In all of these cases this may determine the default classification of a generator to 'Type D' in RfG on the basis of its connection voltage and independent of its capacity.

[9] Often referred to nationally as 'Grid Codes' or 'Connection Rules'

Deliverables

The EG MCS was tasked with delivering a report in which stakeholder questions and issues as defined in the group's objectives are explored, and in which, where possible, solutions to stakeholders' questions are developed, including proposals of improvements to one or more of the CNC regarding mixed customer sites. Where such recommendations are made these should be quantified in terms of the benefits and any potential risks.

In part 2 of the work of the group, the specific ACER requests to deliver against were:
a) a more detailed assessment of the policy options (including economic metrics);
b) a proposed wording for network codes; and
c) the agreement and determination of a single policy option.

ACER also noted that, should the expert group fail to agree on the preferred policy option, then proposed wording needed to be developed for all but the do-nothing policy option.

RECAP OF OPTIONS FROM PART 1

The earlier work of the group highlighted that the specific issues to do with stakeholder feedback on disproportionate treatment of generators in the application of the Requirement for Generators (RfG) network code stemmed mainly from the default to RfG 'type D' where connection to the network was made at or above 110kV. It was acknowledged that while the voltage default was not perfect, during the drafting of RfG it had been the best option available to also take into account the ACER FWGL which state (on page 8):

'The minimum standards and requirements shall be defined for each type of significant grid user and shall take into account the voltage level at the grid user's connection point.'

However, in the 'whereas' recitals of RfG, it is also clear that the application of RfG was intended to be proportionate and related to the size of a machine hence:

'(9) The significance of power generating modules should be based on their size and their effect on the overall system.'

The following options were considered by the group during part 1 for the revision of the voltage criteria:

- Use an 'interface point' to determine all connection requirements (see Figure 1 below); or
- Use an interface point just to determine the connection voltage and therefore Type (other requirements, including reactive capability, would still apply at the Connection Point); or
- Increase the voltage criteria to be >220kV; or
- Remove 'Type A' from the voltage criteria (i.e. Type A only decided by MW capacity); or
- Remove 'Types A&B' from the voltage criteria; or
- Remove 'Type A' plus some requirements of Type B (e.g. perhaps FRT or reactive range) from the voltage criteria (ie mitigate the impacts); or
- Remove the voltage criteria completely, so determining all of Types A-B-C based on MW capacity only, not their connecting voltage.

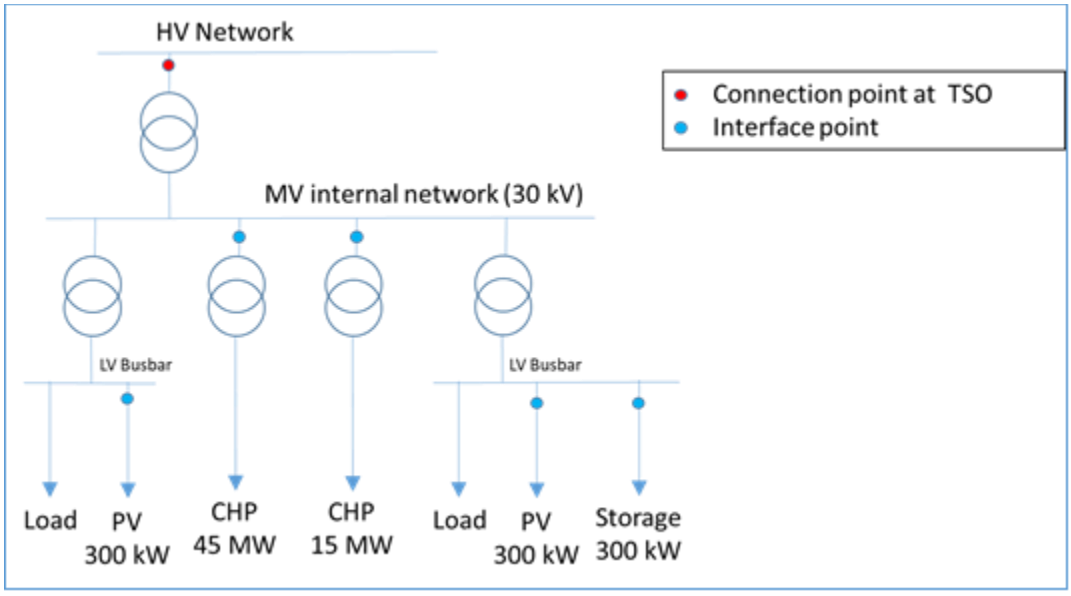

Fig 1: Interface point vs Connection point

The recommendations of the group at the conclusion of part 1 and based on their analysis of the evidence was that one of the following options should be taken forwards:

- **(either) Remove the voltage criteria completely, so making the assessment of Type purely on the basis of machine/module MW capacity size.**

This is in keeping with the basic ethos of RfG in linking the level of technical requirement to MW size but moves away from the ACER framework guideline requirement to include voltage in the assessment. The EG MCS agreed that this was potentially the simplest solution but noted that it will cause some TSOs to reassess their thresholds where the removal of the voltage criteria results in a significant reduction in network support by reducing the volume of generators required to comply with a higher 'Type' technical specification. It could also be necessary for the same reason to consider amending the fault ride through voltage profile requirements in type B to give two profile options for connection at above and below 110kV.

- **(or) Remove the voltage criteria from Type A and B generators (ie Type C by MW capacity, where connected at >110kV, would still default to Type D.**

Types A & B are similar to product standards while Types C & D are fairly similar; this option is therefore not unduly discriminatory against Type C generators but for many Member States it is also not greatly different to removing the voltage criteria completely. If applying this option, consideration should also be given to extending the specific exclusions noted in RfG Article

6(4) for CHP Types A-C to Type D; this may be reasonable on the basis of MW capacity but is arbitrary if on the basis of voltage.

- **(or) Introduce the concept of 'interface points' for the application of all technical requirements other than Fault Ride Through, and for use in the voltage criteria assessment.**

While the principle of this option is straightforward, it was seen by network operators represented on EG MCS as a significant legal and operational challenge; and also to introduce complexities in having to assess compliance within an embedded network with limited visibility – and possibly needing further support at the Connection Point to the system, the cost for which would be socialised rather than being borne by the connectee.

Agency Comments

The Agency commented on the total removal of the voltage criteria as being a simplistic proposal because of the likely reassessment of the capacity thresholds (i.e. the values in MW), or other reassessment of technical requirements, that some TSOs would need to carry out due to the reduced volume of generators that would be required to comply with a higher 'Type' technical specification, and therefore the reduction in system support from low capacity PGMs which are determined as other than Type D, in order to guarantee and maintain secure and correct system performance.

The Agency also drew the attention of the group to the requirement in the ACER Framework Guidelines to include voltage criteria in any considerations, and particularly pointed out the context for this in that the classification of certain low-capacity PGMs as Type D (with the consequent application of more technically demanding requirements) should be seen more as a partial side effect of the correct application of voltage criteria when determining the significance of a PGM. Again, quoting from the Framework Guidelines *"The criteria and methodology for the definition of significant grid users [...] shall be based on a predefined set of parameters which measure the degree of their impact on cross-border system performance via influence on control area`s security of supply, including provision of ancillary services ("significance test")."*

The inclusion of voltage criteria was seen to be clearly in line with the Framework Guidelines but moreover, the identified issues arose more from the definition of the physical connection

point rather than necessarily the voltage levels. The correct definition of the physical connection point was again required by the Framework Guidelines to be formulated when developing the network codes(s) since *"The network code(s) shall define the physical connection point between the significant grid user's equipment and the network to which they apply"* [page 8 (paragraph 6) of the FG EGC]

Hence, the Agency recognised the aim of the MCS EG to find an effective and practical solution to the identified issues.

REFRESH OF VOLTAGE CRITERIA OPTIONS

The group carried out a review of the work undertaken in part 1 and the evidence presented, summarizing the options and also considering whether each of the solutions could be defined to only apply to mixed sites or should be considered for application to all generators.

A further option was added at this stage being the removal of the voltage criteria up to a defined capacity threshold which could either be set exhaustively or left to national processes, possibly within a range.

One of the main issues identified previously was that a removal of the voltage criteria in whole or part could cause significant movements of generation between 'types', and therefore changes in system support, necessitating TSOs to seek to revise the national 'type' thresholds as were set nationally during the implementation of RfG.

Case Studies

To help to assess the potential impact of any changes and to consider the evidence around each of the options, three case studies were examined for GB, Austria and Spain representing a range of different systems, topographies and national threshold settings. These are presented below showing the application of the thresholds on the basis of both capacity and voltage criteria.

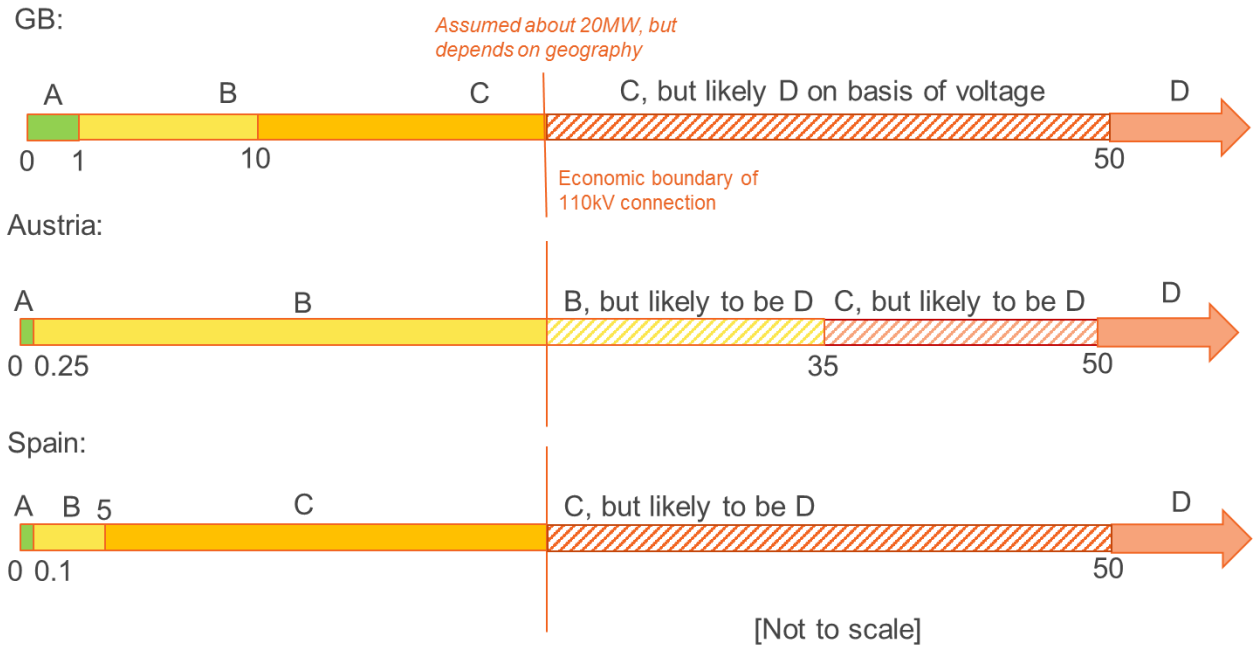

Figure 2: Pictorial view of threshold settings – case studies

Great Britain

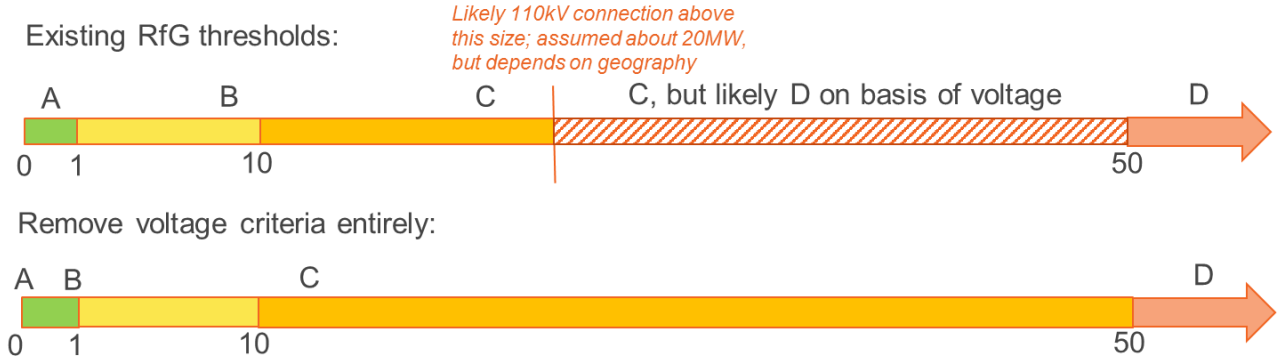

Fig 3 – GB settings

In GB, if the voltage criteria was removed entirely then, based on the projections used during the work to set the GB thresholds, roughly 2.9GW of generation connecting in the future at 132kV (the highest distribution voltage in England and Wales) would change from type D to type C, while 30MW would become type B.

This seems low but is not that surprising given that the threshold in GB for connection at 132kV seems to be about 20-30MW. Only small numbers of generation projects are in the size range

30-50MW which will therefore connect at 132kV and be impacted by a removal of the voltage criteria.

Spain

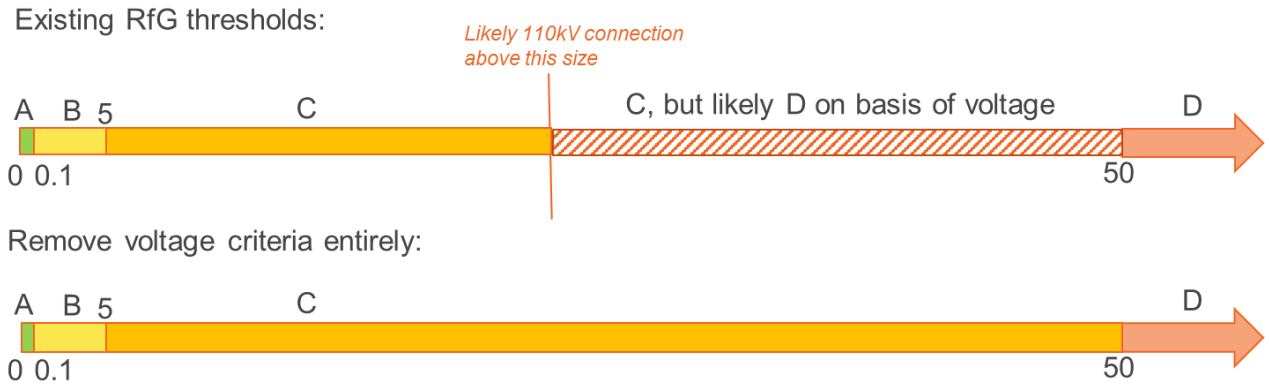

Fig 4 – Spanish settings

In Spain, if the voltage criteria was removed entirely then for generators connecting to the transmission system (i.e. from 220 kV+) then:

- For generators already in service, 16GW would become Type C instead of Type D. 48 MW would become Type B.
- For generators not in service but that have access permission, 35.5 GW would become Type C. 90 MW would become Type B.

This is because in Spain significant volumes of smaller generators are connected to the transmission system.

Austria

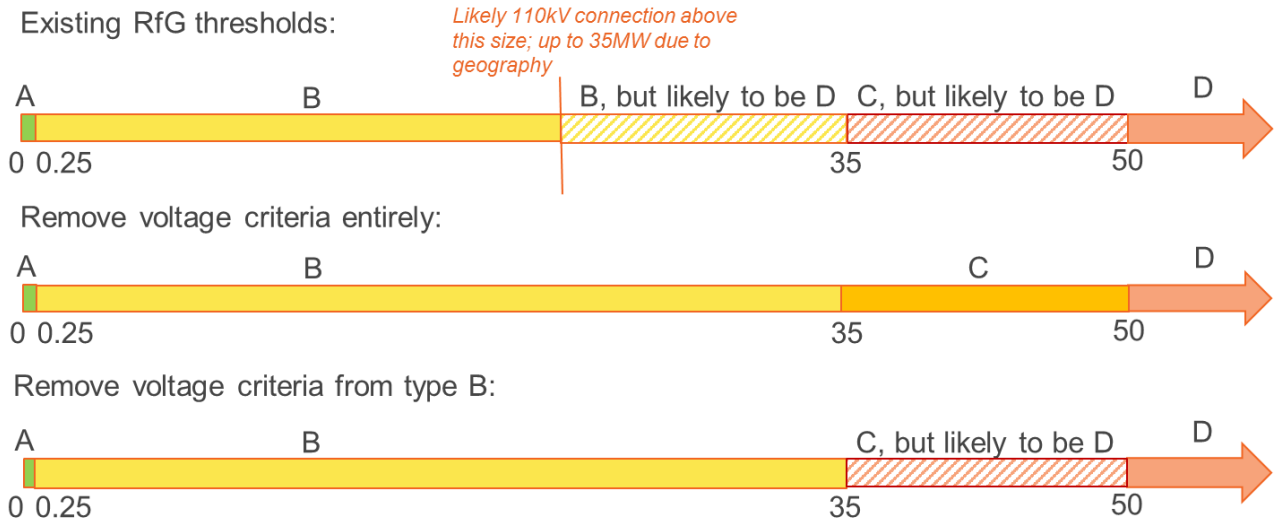

Fig 5 – Austrian settings

If the voltage criteria was removed completely, following replanting then of all type D generation (35 TWh) in Austria 45% would move to Type B and 10% would move to Type C. This equates to, of 15.2GW installed type D, 3.7GW would become Type B and 1,4 GW would be type C.

This is due in Austria to a combination of the national selection of a high B/C threshold (35MW), combined with geographical challenges relating to hydro schemes leading to smaller generators of this type being connected to the transmission system.

Conclusion of Case Studies

The conclusion of the case studies was that a total removal of the voltage criteria could not be carried out without some member states requiring a reassessment of their capacity thresholds. While demonstrated by the examples of Austria and Spain (although for somewhat different reasons), a number of other member states sharing their characteristics of significant volumes of smaller transmission connected generators or a high B/C capacity threshold would be similarly affected.

Further, removal of the voltage criteria from type A and leaving a national choice to remove from type B would for member states with a high B/C threshold again result in the movement of unacceptable volumes of generation to a lower type and therefore leave a choice of either

not removing it (which would not resolve MCS issues) or needing to reassess their capacity thresholds.

This does also highlight the lack of harmonization in the selection of national thresholds and the range of different values that have been selected, which makes finding a solution that works across all member states rather harder.

Interface Points

The 'interface point' option is seen as an elegant solution but with numerous consequences outside the scope of the immediate issues that the MCS group is seeking to resolve. Establishing the principles of interface points could need an Expert Group of its own and feels to be a much broader issue. Using it to address the MCS issues feels like solving a small problem by causing a much bigger one. There is logic to the principle though, and with increasing IDNO networks it is worthy of further attention at some stage, although there are many questions that would need to be addressed such as how it would be applicable to PPMs & PGMs (ie Could you establish interface points within a network of smaller generation units such as a windfarm? And could this be abused?), how reactive contributions to the network could be assessed, and how network operators could have visibility within a network.
In the end, the 'black box' approach of applying requirements at a connection point to whatever sits behind it does work and was more acceptable to network operators, although interface points could be more suited for compliance demonstration, and the conclusion of the group was that this question is complex and requires wider consideration beyond the scope of the NCS group.

The conclusion was that the 'interface point' option while not without its merits is too complex and with too widespread consequences to address within a limited scope and timeframe so should be ruled out.

Mitigating the impact of changes in 'Type'

This would be typically as within the option of removing the voltage criteria from type A and with some provisions for the removal from type B for the replacement of key elements of network

support, for example by establishing a 'Type B, connected at 110kV or above' fault ride through voltage characteristic.

TSOs considered the major consequences if generation moved from type D to type B would be:

- The Emergency & Restoration code / National Defense and Restoration Plans particularly apply requirements to type C & D generators – also the list of SGUs according to E&R Art 11(4), so a lower type categorization would lead to a redrafting of the scope and the SGU list
- Various emergency functions (schemes against voltage collapse, over/under-frequency control scheme) are focused mainly on Type D generation.
- Various elements of the System Operation Guideline (SOGL) including droop settings and certain requirements for data exchange apply to generators in types C&D
- The particular elements of RfG that would be lost in recategorization of generators from D to B include:
    - RfG provides only retrospective application of requirements in case of modernisation of existing C/D units (Art 4.1)
    - Fault ride through (the type B characteristic for post-fault voltage is much less onerous and does not include a 0V requirement
    - LFSM-U
    - Q compensation of connection line/cable
    - Issues with reconnection schemes for HV (automatic vs. manual)
    - less stringent operational notification procedures
    - less stringent simulations
    - less stringent compliance testings

The group concluded that any mitigation strategy would be too broad in scope and complex to achieve in a reasonable timeframe.

It was noted that smaller generators probably below about 10MW in some cases are unable to comply with type D requirements – two examples were given of exothermal plant which is unable to operate flexibly and diesel generators that are unable to deload mechanical power quickly enough to ride through a type D 0V fault.

SUMMARY OF OPTIONS ASSESSMENT

Option	Consider Applying to all	Consider Applying only to MCS
Remove voltage criteria completely	No – ruled out as does not respect framework guidelines and requires reassessment of some national thresholds	No – not viable
Remove from A & B, national choice to remove from C	Potentially same as total removal hence ruled out	No
Remove from A, national choice to remove from B	No - as in some member states the selection of thresholds leaves 'type B' as too broad a category	No
Interface point	[Will be pressure to extend any MCS arrangements and to standardise]	Possible, although would be pressure to apply to all. Not viable - complex change with wide impacts, and can't be addressed within scope of MCS group
Remove voltage criteria from threshold (eg 10MW)	Possible, requires consideration	No
Remove from A & B, try to mitigate impact	No – impacts are too diverse and complex to simply resolve and extend to E&R and SOGL requirements as well as RfG	No
Do nothing	Only if all other options exhausted	N/A

These options are taken from the work done in part 1 and discussed above. By a process of elimination, the remaining option to take forwards is a further consideration of the removal of the voltage criteria up to a threshold and the options to implement this.

Options for removal up to a threshold

By a process of elimination, the group had found that the available options were reduced to the removal of the voltage criteria up to a threshold.

Broadly the options to do this need to consider whether greater harmonization is achievable, and need to allow for as simple a solution as possible, both of which would ideally mean using either a default or existing threshold – or allowing this option at least in a national process – but also need to respect the wide range of national type settings in existence and the reasons for these.

Ways in which this could be achieved were as follows:

(i) Codifying a figure exhaustively to apply across all member states. This has the advantages of not requiring any further national process or evidence to set a threshold, and achieving some harmonization, but it was questioned whether a single figure could easily apply given the considerable differences in scale across synchronous areas and member states. In addition, setting a figure exhaustively would mean that in the future if it was found that this was inappropriate, perhaps due to system or generation technology changes, to amend it would need a further change to the code.

(ii) Codifying a set of figures to apply exhaustively in each synchronous area. Similar to option (i) although with some ability to scale but losing harmonization.

(iii) Allowing thresholds to be set nationally within the range of type B. Given the large differences in network topographies and the settings made nationally for thresholds, this was not felt to offer enough scope (ie in many member states selection would only be possible up to 5MW whereas in others it would be up to 40MW)

(iv) Allowing thresholds to be set nationally within the range of type B or C. This would be somewhat more flexible but still with similar drawbacks to (iii) as the combined range for B/C can be as low as 10MW or as high as 75MW. This is illustrated in fig 6 below.

(v) Set a threshold nationally from a minimum figure that would also become the default setting if no effort were made to increase it. This allows harmonization and flexibility where required and also allows a further lengthy national threshold setting process to be avoided unless considered necessary.

"x shall be specified in the range A/B < x < C/D by each relevant TSO"

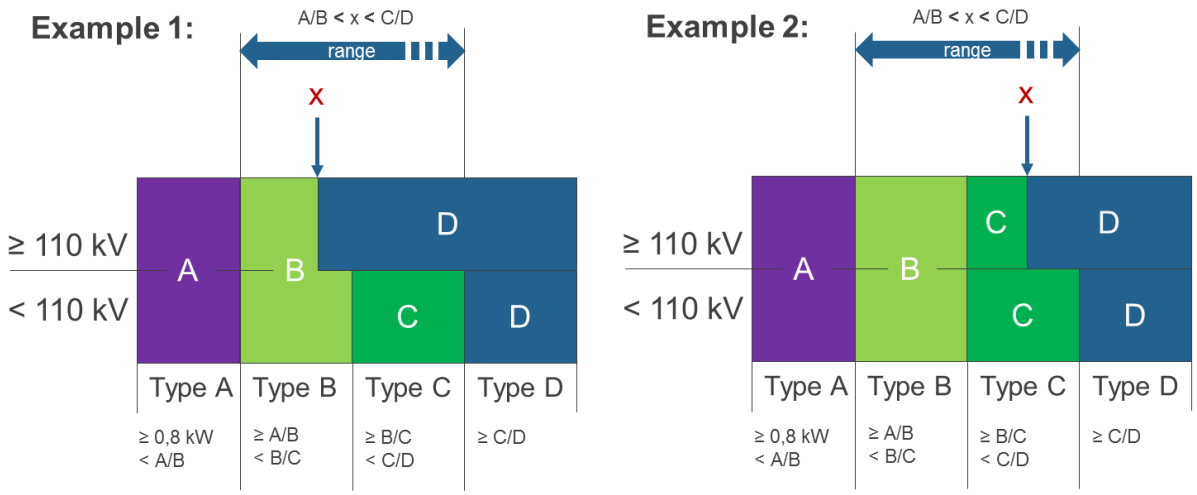

Fig 6 - Setting a threshold for the voltage criteria

Summary of Voltage Criteria Threshold Setting Options

Option for Removing Voltage Criteria	Need to revise capacity thresholds	Harmonised?	Need to set new threshold for voltage criteria	Can cover type C	Comment & will it work?
Remove completely	Yes	N/A	No	Yes	No - ruled out by ACER as need to respect framework guidelines and would require some TSOs to reset capacity thresholds
Remove up to a threshold of X* MW *(suggested 10MW)	Possibly	Yes	No	Possibly	No – can't find a harmonised value that works for all member states
Remove up to a threshold of X MW which can be set higher	Possibly	Possibly	Possibly	Yes	Could work if initially set low enough but then leads most member states to need to make settings
Remove up to a threshold of X MW which can be set higher or lower	No	Possibly	Possibly	Yes	Flexible solution with a default harmonised value
Remove up to a threshold of X MW which can be set higher up to a member state's threshold from which a power generating module is type C	Possibly	Possibly	Possibly	No	Could work if initially set low enough but then leads most member states to need to make settings
Remove up to a threshold which can be set within a member state's threshold from which a PGM is type C (ie within type B)	No	No	Yes	No	All member states will need to make settings. Doesn't cover type C.
Remove up to a threshold which can be set above a member state's threshold from which a PGM is type B (ie within type B and C)	No	No	Yes	Yes	All member states will need to make settings. Could in effect lead to total removal of voltage criteria.
Remove up to a default of the threshold from which a power generating module is type C (and can be set lower within a member state's thresholds for type B)	No	No	Possibly	No	Not harmonised and doesn't cover type C but avoids imposing having to make settings
Remove up to a default of the threshold from which a power generating module is type C (and can be set higher or lower within a member state's thresholds for type B&C	No	No	Possibly	Yes	Not harmonised but avoids imposing having to make settings

CONCLUSIONS

It was generally agreed by the group that power generating modules[10] below about 10MW in size are seldom connected to the transmission system and are generally not interactive operationally with code requirements being more suitably applied through a 'product standard' approach. This is backed up by the results of the case studies in which minimal volumes of generation moved from a type D to B classification in GB and Spain when the voltage criteria was removed, and also by the selection of national B/C thresholds where the majority of member states have chosen either 5 or 10MW which confirms the view that type A/B generators are more mass market and C/D a more interactive and operationally supportive proposition.

The group further considered that using a default starting point for the setting of the threshold from which the voltage criteria would apply would, if applied correctly, help to minimize work from member states by in as many cases as possible removing the need for a further threshold setting exercise to be undertaken on a national basis.

Finally, the group recognized the wide variety of national thresholds and the need to make sure that whatever solution was identified could be made to work in all cases.

With these points in mind, the option to be selected needed to have a default value that could if suitable then apply nationally without any further setting process but also needed as much flexibility as possible. Bearing in mind the existing thresholds set by member states, and to get to a value that would be acceptable to as many member states as possible, either using the B/C threshold or a value of 5 or 10MW would appear to have merits. In either case, the maximum flexibility that could be afforded would be to allow the threshold to be amended anywhere within the national settings for type B and C. The group noted that it would be generally more acceptable to stakeholders to increase the threshold (ie making the code less onerous) and harder to reduce it further than a default setting.

[10] A PGM is defined in the RfG code as an indivisible set of units, either being synchronous or connected through power electronics, that are not independently controllable.

RECOMMENDATION

The recommendation of the group of a single solution to take forwards as set out in the 'part 2' terms of reference is the removal of the voltage criteria for smaller generators with the following steps being followed:

- **a default value of 10MW being set in the code**
- **national flexibility being allowed to amend this through a process similar to the setting of the capacity thresholds either**
  - **Down to the higher of 5MW or the member state's B/C boundary; or**
  - **Up to the member state's C/D boundary**

This combines the potential for harmonisation and flexibility and respects the boundaries already chosen by member states for B/C of which the most common are 5 or 10MW.

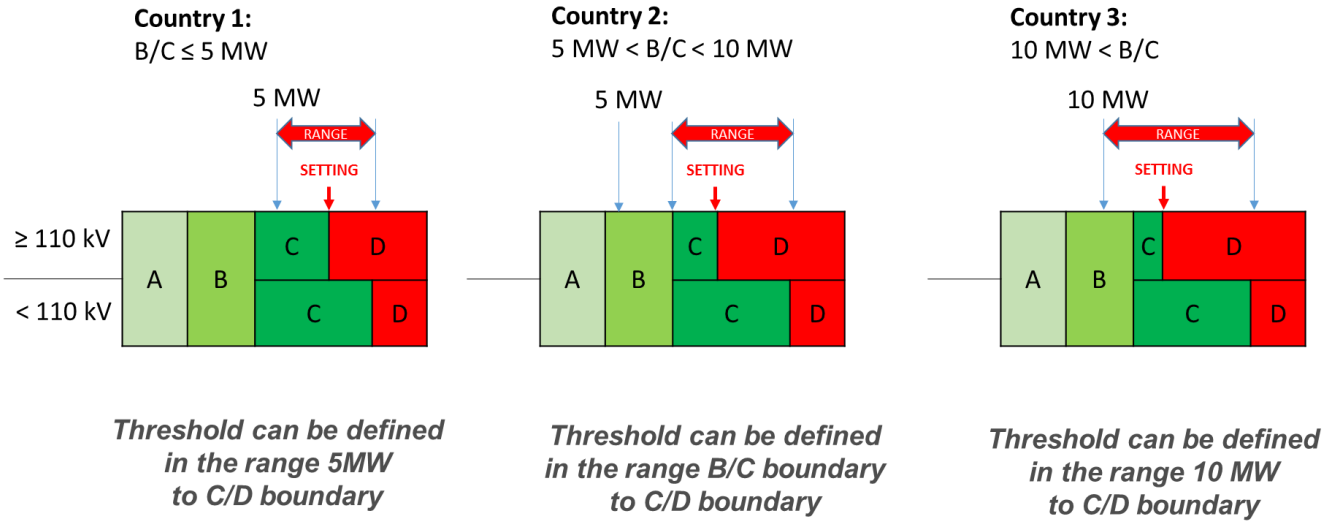

Fig 7: Scenarios to illustrate recommended solution

Proposed legal text for this solution is presented in annex 1 to this report.

All members of the group agreed that the presented solution solved most of the issues presented focusing in particular on smaller generators and was the best compromise available that respected all of the various points made including the need for harmonization, to find a

solution that worked for all parties and to avoid the need for any member state to need to reset their capacity thresholds.

IFIEC Europe in particular commented as follows:
'Although IFIEC Europe appreciates the efforts done by this expert group and has actively participated in its functioning, it wants to express clearly that the proposed compromise solution is only partial and does not completely solve the problem, in particular for those generation assets on sites connected above 110kV that are above the threshold to be defined according to the proposal in this document. IFIEC Europe thus strongly wants to urge the European Stakeholder Committee, the Agency and the National Regulatory Authorities as well as the European Commission to monitor the potential negative impact for these installations compared to similar installations that are connected to the grid in alternative constellations and remediate any undue negative effects, as these could lead to undue underinvestment in such assets.'

ANNEX 1: PROPOSED LEGAL TEXT

(shown in redline mark-up from the published version of RfG Regulation (EU) 2016/631 establishing a network code on requirement for grid connection of generators which entered into force on 17 May 2016)

Article 5 – Determination of Significance

1. The power generating modules shall comply with the requirements on the basis of the voltage level of their connection point and their maximum capacity according to the categories set out in paragraph 2.

2. Power generating modules within the following categories shall be considered as significant:

   (a) maximum capacity of 0.8 kW or more (type A);

   (b) where the capacity of the power generating module is less than the threshold at which the connection voltage at its connection point will also be considered, as specified in accordance with the procedure set out in paragraph 4:

      (i) maximum capacity at or above a threshold proposed by each relevant TSO in accordance with the procedure laid out in paragraph 3 (type B). This threshold shall not be above the limits for type B power generating modules contained in Table 1;

      (ii) maximum capacity at or above a threshold specified by each relevant TSO in accordance with paragraph 3 (type C). This threshold shall not be above the limits for type C power generating modules contained in Table 1; or

      (iii) ~~connection point at 110 kV or above (type D). A power generating module is also of type D if its connection point is below 110 kV and its~~ maximum capacity ~~is~~ at or above a threshold specified in accordance with paragraph 3 (type D). This threshold shall not be above the limit for type D power generating modules contained in Table 1.

   (c) where the capacity of the power generating module is greater than or equal to the threshold at which the connection voltage at its connection point will also be considered, as specified in accordance with the procedure set out in paragraph 4:

      (i) connection point below 110 kV and maximum capacity at or above a threshold proposed by each relevant TSO in accordance with the procedure laid out in paragraph 3 (type B). This threshold shall not be above the limits for type B power generating modules contained in Table 1;

      (ii) connection point below 110 kV and maximum capacity at or above a threshold specified by each relevant TSO in accordance with paragraph 3 (type C). This

threshold shall not be above the limits for type C power generating modules contained in Table 1; or

(iii) connection point at 110 kV or above (type D). A power generating module is also of type D if its connection point is below 110 kV and its maximum capacity is at or above a threshold specified in accordance with paragraph 3. This threshold shall not be above the limit for type D power generating modules contained in Table 1.

[TO INSERT: TABLE 1]

3. Proposals for maximum capacity thresholds for types B, C and D power generating modules shall be subject to approval by the relevant regulatory authority or, where applicable, the Member State. In forming proposals the relevant TSO shall coordinate with adjacent TSOs and DSOs and shall conduct a public consultation in accordance with Article 10. A proposal by the relevant TSO to change the thresholds shall not be made sooner than three years after the previous proposal.

4. The capacity threshold from which the connection voltage of a power generating module will also be included in the determination of significance as set out in paragraph 2 will be set initially at 10MW. Where the relevant TSO wishes to amend this threshold, such a proposal may be made:

(i) To decrease the threshold from 10MW down to a value greater than or equal to the higher of either 5MW or the capacity threshold at which a power generating module is of type C as set in paragraph 3; or

(ii) To increase the threshold from 10MW up to the capacity threshold at which a power generating module is of type D as set in paragraph 3

Such a proposal shall be subject to approval by the relevant regulatory authority or, where applicable, the Member State. In forming proposals the relevant TSO shall coordinate with adjacent TSOs and DSOs and shall conduct a public consultation in accordance with Article 10. A proposal by the relevant TSO to change the thresholds shall not be made sooner than three years after the previous proposal.

ANNEX 2: CAPACITY THRESHOLDS SET DURING NATIONAL IMPLEMENTATION

Correct at March 2019 - Values published on Active Library site: https://docs.entsoe.eu/cnc-al/

Member State	Type Threshold Proposals		
	A/B	B/C	C/D
AL	No limits defined	No limits defined	The minimum power threshold for a generating module to be connected to the transmission system network will be 15 MW for voltage level 110 kV at the connection point and 50 MW for voltage level 220 kV at the connection point
AT	250 kW	35 MW	50 MW
BA			
BE	1MW	25 MW	75 MW (25 MW if>110 kV)
BG	1 MW	5 MW	20 MW
CH	200-300 KW	36 MW	45 MW
CY			
CZ	A1: 11 KW A2: 100 KW	B1: 1 MW B2: 30 MW	75 MW
DE	135 KW	36 MW	45 MW
DK	125 KW	3 MW	25 MW
EE	0.5 MW	5 MW	15 MW
ES	100 KW	5 MW	50 MW
FI	1 MW	10 MW	30 MW
FR	1 MW	18 MW	75 MW
GB	1 MW	10 MW	50 MW
GR	1 MW	15 MW	75 MW
HR	500 kW	5 MW	10 MW
HU	200 KW	5 MW	25 MW
IE	100kW	5MW	10MW
IS			
IT	11,08 kW	6 MW	10MW
LT	250 kW	5 MW	15 MW
LU	135 KW	36 MW	45 MW
LV	0,5 MW	5 MW	15 MW
ME			
MK			
NL	1 MW	50 MW	60 MW
NO	1,5 MW	10 MW	30 MW
PL	200kW	10MW	75MW
PT	1 MW	10 MW	45 MW
RO	1 MW	5 MW	20 MW
RS	1 MW	50 MW	75 MW
SE	1,5 MW	10 MW	30 MW
SI	10 kW	5 MW	20 MW
SK	100 KW	5 MW	20 MW

LIST OF PARTICIPANTS (phase 2)

Name	Organisation	Representation at GC ESC
Robert Wilson	National Grid	ENTSO-E
Manuel Froschauer	APG	ENTSO-E
Francesco Celozzi	ENTSO-E	ENTSO-E
Ioannis Theologitis	ENTSO-E	ENTSO-E
Eric Dekinderen	VGB	VGB
Jean-Noël Marquet	EDF	VGB
Anneli Teelahk	EASE	EASE
Michael Van Bossuyt	IFIEC	IFIEC
Luca Guenzi	SOLARTURBINES	EUTURBINES
Alberto Bridi	EDYNA	CEDEC
Paul de Wit	Alliander	CEDEC
Marc Malbrancke	CEDEC	CEDEC
Frederik Kalverkamp	FGH	EFAC
Garth Graham	SEE	EURELECTRIC
Mike Kay	ENA	GEODE
Karol O'Kane	ESB	EURELECTRIC
Ellen Phelan	ESB	EURELECTRIC
Benjamin Düvel	BDEW	EURELECTRIC
Michael Wilch	Innogy	EDSO for Smart Grids
Andrés Pinto-Bello Gomez	smartEn	smartEn
Marcus Müller	Tesla	smartEn
Katrin Schweren/Stefan Doering	Tiko	smartEn
Raffaele Rossi	SolarPower Europe	SolarPower Europe
Gunnar Kaestle	B.KWK	COGEN Europe
Vincenzo Trovato	ACER	ACER