An Coimisiún um Rialáil Fóntais
Commission for Regulation of Utilities

Consultation on Sharing of Maximum Export Capacity (MEC) behind a Single Connection Point

Consultation Paper

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CRU Strategic Plan 2022-24

Our Mission

- Protecting the public interest in water, energy and energy safety.

Our Vision

- Safe, secure and sustainable supplies of energy and water, for the benefit of customer now and in the future

Our Strategic Priorities

- Ensure Security of Supply
- Drive a Low Carbon Future
- Empower and Protect Customers
- Enable our People and Organisational Capacity

Executive Summary

Hybrid electricity generation projects are projects that combine two or more types of electricity generation and/or storage units connecting through a single connection point. Hybrid projects present opportunities to increase the production of renewable electricity by increasing the output (i.e. raising the capacity factor) at the connection point, thereby making more efficient use of grid infrastructure. A key barrier to the full implementation of hybrid projects is the inability to dynamically share a contracted Maximum Export Capacity (MEC) between different technology types sharing a single connection point. This consultation paper seeks comments on the proposal for sharing of MEC by multiple forms of technology or generators behind a single connection point at a hybrid project.

Under current rules, it is possible to seek and obtain a connection for a hybrid project and participate in the market. However, each unit must be registered separately in the market, be separately scheduled and dispatched and have its own dedicated MEC which is then summated at the connection point. This means that projects which seek to install a different generation technology type at an existing connection point are required to increase the MEC at the connection point or split the current MEC between all units, so that contracted MEC is not breached. Increasing the MEC of a site requires applying to the electricity System Operators (SOs) for additional capacity, which will often require additional grid infrastructure to be built at additional cost to the developer.

To simplify and expedite the connection of hybrid generation projects at existing and new sites, the electricity SOs (EirGrid and ESB Networks) were requested to jointly develop a proposal for the sharing of MEC behind a single connection point. The principal aim is to facilitate installation of more renewable generation and maximise the use of existing grid infrastructure by allowing different technology types behind a single connection point to dynamically share a single MEC. Hybrid co-located projects contain different generation unit types that are registered separately in the market. Each separate unit type in a hybrid co-located project is registered as the technology type of that particular unit, (i.e. wind, solar, etc) and operates, in general, as per the rules of that particular unit type. The proposal does not cater for integrated hybrid projects which would comprise multiple technologies registered as a single market unit. Integrated hybrid projects would require the development of a new market unit type and significant modification to the current market and operational rules and systems. The CRU will consider the needs case for potential facilitation of integrated hybrid projects as part of a separate future work programme.

It should also be noted that the proposal set out in this consultation applies to onshore developments only at this time. This proposal does not apply to hybrid electricity interconnection or offshore wind developments.

This consultation paper is for the attention of all members of the public and the energy industry. It will be of particular interest to existing generators, consultants and developers. The CRU welcomes

comments on this consultation to be submitted via CRU Consultation Portal[1] by 5.30pm on Monday 14th April 2025.

[1] typeps://consult.cru.ie/

Public/ Customer Impact Statement

According to the current policy, an electricity generating unit in Ireland requires a contracted Maximum Export Capacity (MEC) for connecting and exporting to the electricity transmission or distribution system.

Co-located hybrid projects combine two or more types of electricity generation technologies connecting through a single connection point on the electricity network, for example, a combination of renewable technologies, such as solar photovoltaic (solar PV) and wind turbines, or generation co-located with battery storage. The facilitation of hybrid projects as proposed in this consultation, has significant potential to increase renewable electricity on the grid by increasing the capacity factor at the connection point and facilitating faster build times because minimal infrastructure upgrades are needed on the electricity network. It may also add to system flexibility by integrating complementary technologies and storage systems at the same connection point.

Currently, if a single technology site seeks to add additional generation from a different technology type to become a hybrid project, the connection agreement needs to be modified. The project may also need to apply for an increase in MEC if it is participating in the market. In this case, a project must apply for additional capacity as per the Electricity Connection Policy – Generation and System Services process[2], which has the potential to add significant cost to the project, in particular where infrastructure upgrades are required. New hybrid projects face similar issues as the MEC assigned at the connection point is assigned to each different technology type, resulting in a fixed limit on the output of each unit. If the MEC is calculated at the connection point rather than at the unit level, it will enable more efficient use of the connection point with the MEC being used by the generation units according to resource availability, e.g. when wind or solar energy is available, and may reduce the need for additional grid infrastructure.

The principal drivers behind this consultation on a policy to allow sharing of MEC are outlined below.

- **Environmental goals:** Allowing the sharing of MEC is expected to significantly enable hybrid projects, thereby increasing the supply of renewable electricity to the grid by facilitating additional generation. Increasing the proportion of electricity generated from renewable sources will help to reduce the carbon intensity of the electricity system and supports Ireland's Government energy and climate policy goals.

[2] Electricity Connection Policy – Generation and System Services in 2025 (CRU2024101)

- **Optimise the use of existing infrastructure:** Enabling the sharing of MEC for hybrid projects will optimise the output at the connection point. Single technology sites do not fully use their contracted MEC at all times. The amount of electricity produced by a generator at a given site depends upon the capacity factor of the technology used. By combining different renewable generator types with different generation profiles e.g. wind and solar, the capacity factor at the connection point can be increased. Thus, facilitating hybrids may allow for more efficient use of current electricity network infrastructure and reduce the need to upgrade/ build network infrastructure.

Facilitating the sharing of MEC for hybrid projects will enable a higher energy export at a connection point meaning a higher availability of electricity. There is a risk that, due to higher availability of electricity (capped at the MEC), some generators may experience a higher level of dispatch down (this is a reduction in electricity output based on the capacity of the electricity network) and may need to be compensated, the cost of which would be borne by the consumers. In an analysis by the System Operators it has been shown that the increase in dispatch down will not be significant when compared to the benefits associated with development of hybrid projects. The increased production of renewable electricity from different technologies with varied production profiles, lower connection costs and better use of grid infrastructure will lead to a reduction of cost and customer savings, balancing out the higher risk of compensation payment.

Table of Contents

Glossary of Terms and Abbreviations

Abbreviation or Term	Definition or Meaning
1999 Act	Electricity Regulation Act, 1999
AIE Regulations	European Communities (Access to Information on the Environment) Regulations 2007 to 2014
Autoproducer	As defined in CER/03/237, a person who has entered into a connection agreement with the TSO or DSO and generates and consumes electricity in a single premises, or on whose behalf another person generates electricity in the single premises, essentially for the first person's own consumption in that single premises. Once an exporting autoproducer's MEC reaches or exceeds twice the MIC, then the exporting autoproducer is deemed to be a generator.
CAP	Climate Action Plan
CER	Commission for Energy Regulation (now, Commission for Regulation of Utilities or CRU)
CMC	Capacity Market Code
COPP	Connection Offer Policy and Process
CRU	Commission for Regulation of Utilities (formerly, Commission for Energy Regulation or CER)
DECC	Department of the Environment, Climate and Communications
DSO	Distribution System Operator (ESB Networks)
DTUoS	Demand Transmission Use of System
ECP	Enduring Connection Policy
ECP-GSS	Electricity Connection Policy – Generation and System Services
ESPS	Energy Storage Power Station
Electricity system	Transmission and distribution electricity systems
EU	European Union
FASS	Future Arrangement for System Services
FCLAF	Combined Loss Adjustment Factor
FOI Act	Freedom of Information Act 2014
GTUoS	Generator Transmission Use of System
GWhrs/yr	Gigawatt hours per year
ICC	Installed Capacity Cap
kW	Kilowatt
MEC	Maximum Export Capacity
MIC	Maximum Import Capacity
MPRN	Metering Point Registration Number

Abbreviation or Term	Definition or Meaning
MW	Megawatt
PPMs	Power Park Module
PSO levy	Public Service Obligation Levy
PN	Physical Notification
QTP	Qualification Trial Process
RES	Renewable Energy Sources
RES-E	Renewable energy share in electricity (RES-E)
RESS	Renewable Electricity Support Scheme
RfG	Requirements for Generators
RTU	Remote Terminal Unit
SEM	Single Electricity Market
SEMC	Single Electricity Market Committee
Solar PV	Solar photovoltaic
SOs	System Operators (i.e. TSO and DSO)
SPGMs	Synchronous Power Generating Modules
TDD	Total Dispatch Down
TLAFs	Transmission or Distribution Loss Adjustment Factors
TSO	Transmission System Operator (EirGrid)
T&SC	Trading & Settlement Code
WFPSs	Wind Farm Power Stations

1 Introduction

This section summarises the context and background for the CRU's proposals for the policy on sharing of MEC behind a single connection point. The first sub-section explains the CRU's role in setting the regulatory framework for new connections, and the roles of EirGrid the transmission system operator (TSO), and ESB Networks the distribution system operator (DSO), collectively the "system operators" (SOs), in the consequent delivery of connection services to network users.

The rest of the section describes the background to the sharing of MEC, the process that CRU has followed leading up to this consultation, lists the relevant policy documents and outlines the procedure to respond to this consultation.

1.1 Legal context

Under Section 34 of the Electricity Regulation Act 1999, as amended (the 1999 Act), the CRU may give directions to the transmission system operator (TSO) and distribution system operator (DSO), collectively the "system operators" (SOs) on the terms and conditions of access to the distribution and transmission system. Specifically, Section 34 (2) (c) of the 1999 Act provides that the CRU's directions may provide for "the terms and conditions upon which an offer for connection to the transmission or distribution system is made".

The CRU's functions and duties are set out principally in Section 9 of the 1999 Act. According to Section 9 (4) (a) of the 1999 Act, the CRU shall carry out its statutory functions in a manner which does not discriminate unfairly between relevant stakeholders, and have regard, among other things, to the need to:

- protect the interests of final customers and to secure that all their reasonable demands for electricity are satisfied.
- promote the continuity, security and quality of supplies of electricity.
- promote competition; and
- promote efficiency and the use of renewable, sustainable or alternative forms of energy.

The CRU is mindful of these responsibilities in relation to decisions it makes on connection policy issues. Furthermore, the CRU is cognisant of the requirements of European legislation related to the internal market in energy, including the Third Energy Package (Directive 72/2009/EC, Regulation 714/2009), the Clean Energy Package for all Europeans (including Directives 2019/944, 2018/2001, 2023/2413 and Regulation 2019/943), and the EU Network Codes.

1.2 Background to Hybrids connection and the proposal for sharing of MEC

In January 2023, as part of CAP 21, Action 125, the CRU received a submission from the SOs providing a technical assessment of the options for sharing MEC at a single connection point, identifying a range of definitions, documentation and practices that may require modifications to accommodate the sharing of MEC at co-located generation sites. The objective of the proposal was to facilitate installation of more renewable generation and maximise the use of existing grid infrastructure.

Hybrid electricity generation projects combine two or more modes of electricity generation or storage together, often using renewable technologies such as solar PV and wind turbines. There may be fossil fuelled generators and/or energy storage systems incorporated within the hybrid plants providing higher reliability and security of supply. Hybrid connections allow developers to increase the energy output at a single connection point by installing a combination of technologies that complement each other by generating at different times. For example, the addition of solar PV to an existing windfarm could allow for better use of the connection point and available network capacity due to the different generation profiles of these technologies. Where this is feasible, it provides an opportunity to reduce grid connection costs, make more optimal use of existing network infrastructure and reduce the need for additional grid development.

1.2.1 Definition of Hybrid Projects

Hybrid projects may have several configurations. For the purposes of this consultation the CRU proposes to limit the scope to hybrid co-located projects. A **Hybrid Co-located Project** is any project that combines multiple forms of generation and/or storage technology behind a single connection point. The generation units for the different technologies are registered separately in the market and operate independently of one another for market, settlement, and dispatch purposes and are sub-metered. The generation units share a single connection point with an associated MEC. In addition, a control mechanism is required to ensure the MEC at the point of connection is not exceeded. Figure 1 provides an illustrative example of how an existing single technology plant can be modified into a hybrid co-located project under current regulatory policy.

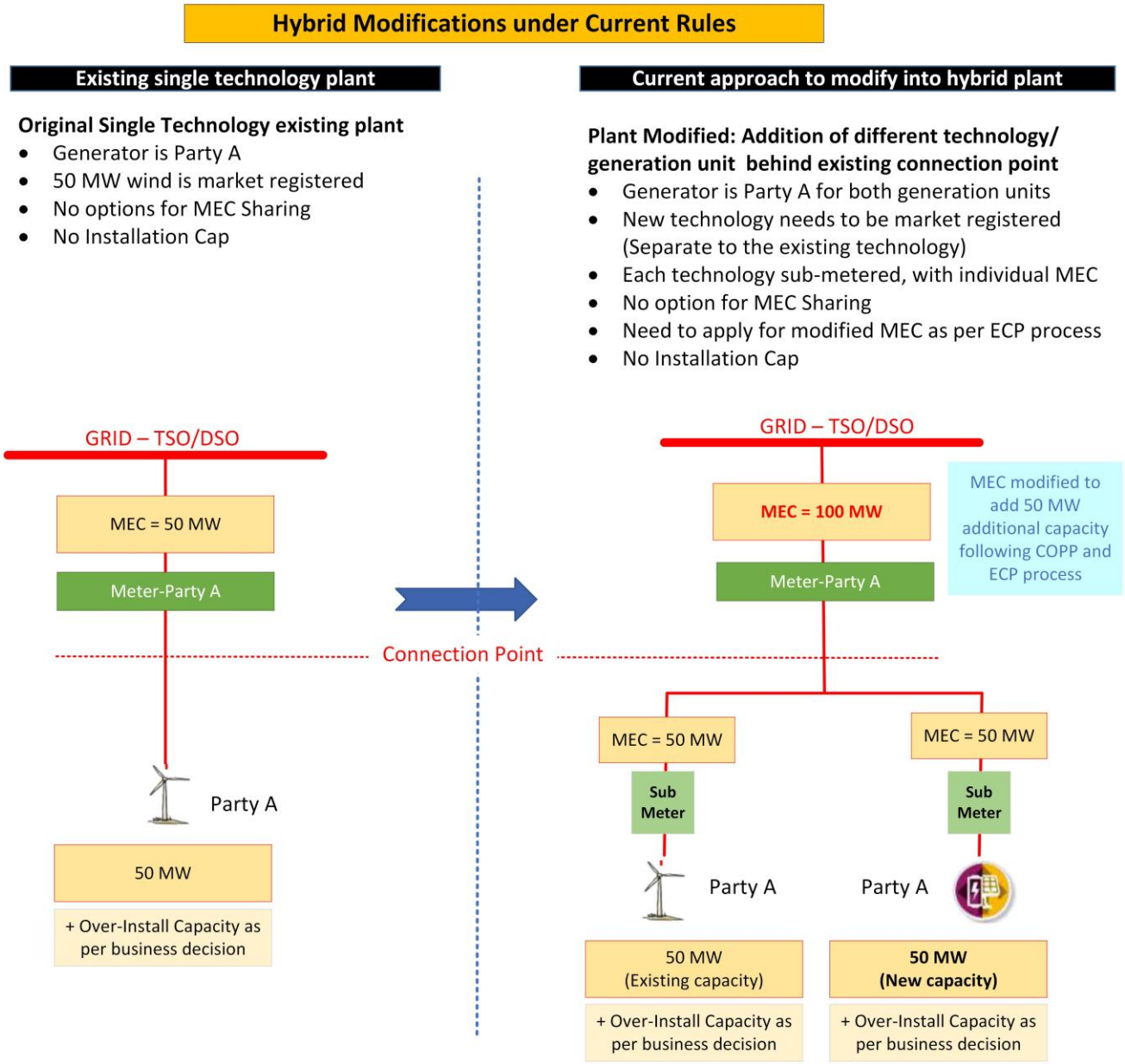

Figure 1: Current approach to modify a single technology plant to a hybrid plant

This proposal does not cater for integrated hybrid projects which can be defined as any project that has multiple generating units which utilise multiple primary energy sources or technology types, registered in the market as one single market unit with a single meter. Integrated hybrid projects would require the development of a new market unit type and significant modification to the current market and operational rules and systems and are out of scope for this consultation.

It should be noted that, under current arrangements in Ireland, the different generating units behind a single connection point cannot be owned and operated by different legal entities. This has been identified as a barrier to be addressed as part of the wider work to facilitate hybrid connections.

Q1.	Do stakeholders agree on the classification and the definition of hybrid co-located projects?
Q2.	Do stakeholders believe that the sharing of MEC for co-located hybrid projects should be pursued ahead of integrated hybrid projects?
Q3.	When do stakeholders foresee the need to facilitate integrated hybrid projects in the power system? Please provide rationale for your answer.

1.2.2 Current policy on Maximum Export Capacity (MEC) and Installed Capacity Cap

According to the current regulatory policy, an electricity generating unit in Ireland requires a contracted MEC for connecting to the transmission or distribution system. A generator applies for an MEC based on the size of the generation unit they are planning to connect, and this forms part of the connection offer issued by the TSO or DSO. Prior to January 2024, an installed capacity cap of 120% of MEC was allowed at a site. A recent decision paper from CRU (CRU202402[3]) details CRU decisions to remove the installed capacity cap for both single technology and hybrid sites, subject to a review and update of operational processes by the SOs relating to aspects such as forecasting, and availability associated with mixed technology sites. The SOs (EirGrid[4] / ESBN[5]) have since conducted their review and the decision was implemented on 17th of June 2024. For projects with existing connection agreements, any changes to the installed capacity would be required to go through the process of Modifications to Generation Connection Offers and be assessed by the SOs.

Under current rules regarding registered capacity in the market, generators wishing to register in the Single Electricity Market (SEM) must hold MEC for each of the generating units that they wish to register. For example, a windfarm allocated a 50 MW MEC at the point of the connection can register 50 MW in the market. If the generation site wishes to add a 50 MW solar plant behind the same connection point, this will require a total of 100 MW of MEC at the point of connection if the participant wishes to utilise all 50MW of solar and 50MW of wind independently in the market. Therefore, the generator must apply for an extra 50 MW MEC from the SOs through the process outlined in Electricity Connection Policy – Generation and System Services (ECP-GSS[6]). Current hybrid co-located projects have the individual MEC for each unit detailed in their connection agreement. In

[3] https://www.cru.ie/publications/27917/
[4] https://cms.eirgrid.ie/sites/default/files/publications/SO-Installed-Capacity-Cap-Review-and-Implementation-Timelines.pdf
[5] https://www.esbnetworks.ie/docs/default-source/publications/so-installed-capacity-cap-review-and-implementation-timelines.pdf?sfvrsn=78c325a7_12
[6] https://www.cru.ie/publications/28316/

many cases, the hybrid co-located projects do not require additional MEC and could benefit from being able to operate both technologies separately while limiting export to the existing MEC. This would avoid some of the following challenges:

- The need to apply for additional MEC at the connection point through the application process.
- The risk of requiring additional network reinforcements to support the additional capacity.

These challenges can be addressed if different generation types connected in a hybrid co-located project could dynamically share a single MEC at their shared connection point rather than having to increase the MEC at the connection point.

The significance of the decision paper on Installed Capacity Cap (CRU202402) is that generators are allowed to install higher capacity at their existing generation sites, allowing complementary technologies to be co-located. However, each unit type currently needs its own assigned MEC. The proposals outlined in this paper seek to enable the different generation technologies behind a single connection point to dynamically share the MEC at the connection point and maximise the benefits imparted by co-locating different technology types.

1.3 Purpose and structure of the consultation paper

The purpose of this CRU consultation paper is to gain stakeholder feedback on the proposal for sharing MEC for hybrid co-located projects. The subsequent decision paper will contribute towards framing a policy for onshore hybrid co-located projects, work towards removing existing barriers for hybrid projects and will provide a roadmap for hybrid technology roll-out in Ireland.

This paper is structured as follows:

- Section 1 summarises the context and background to the hybrid generation technology, sharing of MEC, and the installed capacity cap
- Section 2 outlines the proposed decision for sharing of MEC
- Section 3 Summarises the consultation questions
- Section 4 concludes and provides the next steps

1.4 Related policy documents

This consultation should be read in conjunction to the following documents published or approved by CRU.

Table 1: Related Policy Documents

Document number	Document Title	Type of document
CRU202402	*Installed Capacity Cap*	*Decision Paper*
CRU20060	*Enduring Connection Policy Stage 2 (ECP-2)*	*Decision Paper*
DOC-240820-FVX	*Ruleset for ECP-2*	*ESBN Ruleset*
CRU202326	*Enduring Connection Policy – 2.4 (ECP-2.4)*	*Decision Paper*
CRU/2024101	*Electricity Connection Policy – Generation and System Services*	*Decision Paper*
DOC-090611-BIN (ESBN document)	*Connection Offer Policy and Process Paper (COPP)- approved by CRU*	*Policy & Process Paper*

1.5 Responding to the CRU

This paper is for the attention of all members of the public and the energy industry. It will be of particular interest to the generators, consultants and developers. Responses to this Consultation Paper should be submitted through the dedicated CRU consultation platform which can be found through the CRU website[7] by 5.30pm on Monday 14th April 2025.

It is not mandatory to answer all the questions in this consultation. Unless marked confidential, all responses from companies or organisations will be fully published on the CRU's website. Respondents may request that their response is kept confidential. The CRU shall respect this request, subject to any obligations to disclose information. Respondents who wish to have their responses remain confidential should clearly state that in their response and include the reasons for confidentiality. All respondents may be listed in summary of responses, even those who request that elements of their response should be treated as confidential. Responses from identifiable members of the public will be anonymised prior to publication on the CRU website unless the respondent explicitly requests their personal details to be published.

Respondents should note that all material held by the CRU, including confidential consultation submissions, are subject to the Freedom of Information Act 2014 ('FOI Act') and the European Communities (Access to Information on the Environment) Regulations 2007 to 2014 ('AIE Regulations'). Therefore, such submissions may potentially be released in response to requests made under the FOI Act and the AIE Regulations. The CRU privacy notice sets out how we protect the privacy rights of individuals here[8].

[7] https://consult.cru.ie/
[8] www.cru.ie/privacy-statement

2 Sharing of MEC

Hybrid connections allow developers to increase the energy output at a single connection point by installing a combination of technologies that can complement each other by generating at different times. For example, the addition of solar PV to an existing windfarm could allow for better use of the connection point and available network capacity due to the different generation profiles of these technologies. Where this is feasible, it provides an opportunity to reduce grid connection costs, make more optimal use of existing network infrastructure and reduce the need for additional grid development.

There is a substantial potential benefit for the system if existing or planned connection assets are better utilized. Hybrid co-located projects support better utilization of connection assets by increasing the capacity factor of the site through installation of additional generation behind the same connection point. However, the main benefits of this can only be realised if different technology types are allowed to dynamically share the existing MEC assigned at the connection point, reducing the need for additional infrastructure that may otherwise be required to facilitate an increase in MEC.

A policy that facilitates the sharing of MEC has the potential to introduce system benefits to market participants, customers and to system operation. Benefits include the potential to increase the renewable energy share in electricity (RES-E) on the grid, a steadier profile of electricity generation at a single connection point, and allowing for existing grid assets to be utilised with greater efficiency, potentially reducing or delaying the need for additional network investment. However, to ensure this proposal delivers on the potential benefits, consideration must be given to the potential implications for market arrangements, system operation and network planning, among other things. Section 2.2 and the Appendices look at some of the challenges and impacts that have been identified by the SOs in relation to implementing the sharing of MEC.

2.1 Proposal for sharing of MEC behind a connection point

The concept for this proposal is to facilitate a single MEC at the point of connection for hybrid co-located projects which could be dynamically shared between different registered unit types. The general details of how this proposal could work is as follows:

- The individual unit types comprising the hybrid co-located project would continue to operate as separate units for the purpose of scheduling and dispatch, market participation and system services.
- Currently no mechanism exists to register a single Hybrid Unit in the market. As part of the technical assessment, the SOs have proposed that each Generator unit type is registered separately in the market, in line with the current set up for Hybrid Co-Located Sites. With regards to the sharing of MEC the SOs have set out two options:

  - Option 1: Registering all Generator units under a single Trading Site[9] (dependant on technology mix e.g. Wind-Solar hybrid)
  - Option 2: Registering each Generator unit under separate Trading Sites.

  These options are expected to be fully explored in an implementation roadmap which is to be developed by the SOs. Feedback is welcome on these two options.
- The power export from the Hybrid co-located site would not be allowed to exceed the contracted MEC at the connection point, meaning that the combined generation, and combined dispatch of the units behind that connection point would be limited to the contracted MEC at all times.
- How the MEC is used between technologies at a hybrid co-located project would be a matter for the party managing the market interactions to manage appropriately and in line with relevant policy and rules. This includes all relevant availabilities relating to active power and system services combined at the connection point, which must remain within the MEC at all times.
- This proposal does not facilitate energy sharing between the units behind the connection point, e.g. the use of otherwise constrained or curtailed wind to charge co-located storage.
- Where an existing connected project seeks to add another technology type to their connection to become a hybrid project and no increase in MEC is required, it will apply through the Modifications to Generation Connection Offers process.
- Hybrid projects seeking a new connection or an increase in MEC will be required to apply for grid capacity through the process outlined in the recently published ECP-GSS (CRU2024101) decision.
- This proposal would only be applicable to a single legal entity behind the connection point.
- This proposal applies to onshore developments only.

Section 2.2 outlines some of the possible impacts of the proposal on market arrangements, grid codes and operational policies. These are also discussed in the Appendices of this consultation paper.

This proposal, if approved, will allow the MEC to be dynamically shared between different generation unit types, depending on system conditions and resource availability, removing the need to apply for increased MEC or to sub-divide the MEC between each unit type. Therefore, the 50 MW MEC wind farm in the example in sub-section 1.2.2 can install an additional 50 MW market registered solar plant without increasing the total site MEC to 100 MW or sub-dividing the existing 50 MW MEC between the wind and newly installed solar units. The power export from this site would not be permitted to exceed 50 MW at any time, which would be stated in the connection agreement. For

[9] As defined in the Trading and Settlement Code.

the avoidance of doubt, this consultation is not proposing that the MEC at the connection point dynamically changes, the MEC at the connection point will be a static figure as stated on the connection agreement.

Figure 1 in Section 1.2.1 provides an illustrative example of how an existing plant can be modified into a hybrid project under current arrangements under existing regulatory policy. Figure 2 provides an illustration of the proposal presented in this consultation paper of converting an existing single technology site to a hybrid project. In this example, each technology has its own submeter and the existing MEC is shared between the two technologies behind the connection point. The ability to share the MEC removes the need to increase the MEC to cover the registered capacity of both units.

It should be noted that if renewable generators with priority dispatch seek to convert the site to a co-located hybrid project and/or avail of the sharing of MEC, this is likely to be classified as a significant modification as per Article 12 of 2019/943, effected through SEM-20-072 and the generator would then lose priority dispatch status.

While the sharing of MEC is expected to facilitate co-location of different types of renewable generation and/or storage, the CRU does not propose to limit the sharing of MEC to specific generation or technology types at this time. The CRU would welcome feedback on whether there are risks associated with the sharing of MEC being applicable to all generation technologies, e.g. existing connection points for renewable or conventional generation seeking to add new technologies, or for new hybrid units combining renewable, conventional and/or storage technologies.

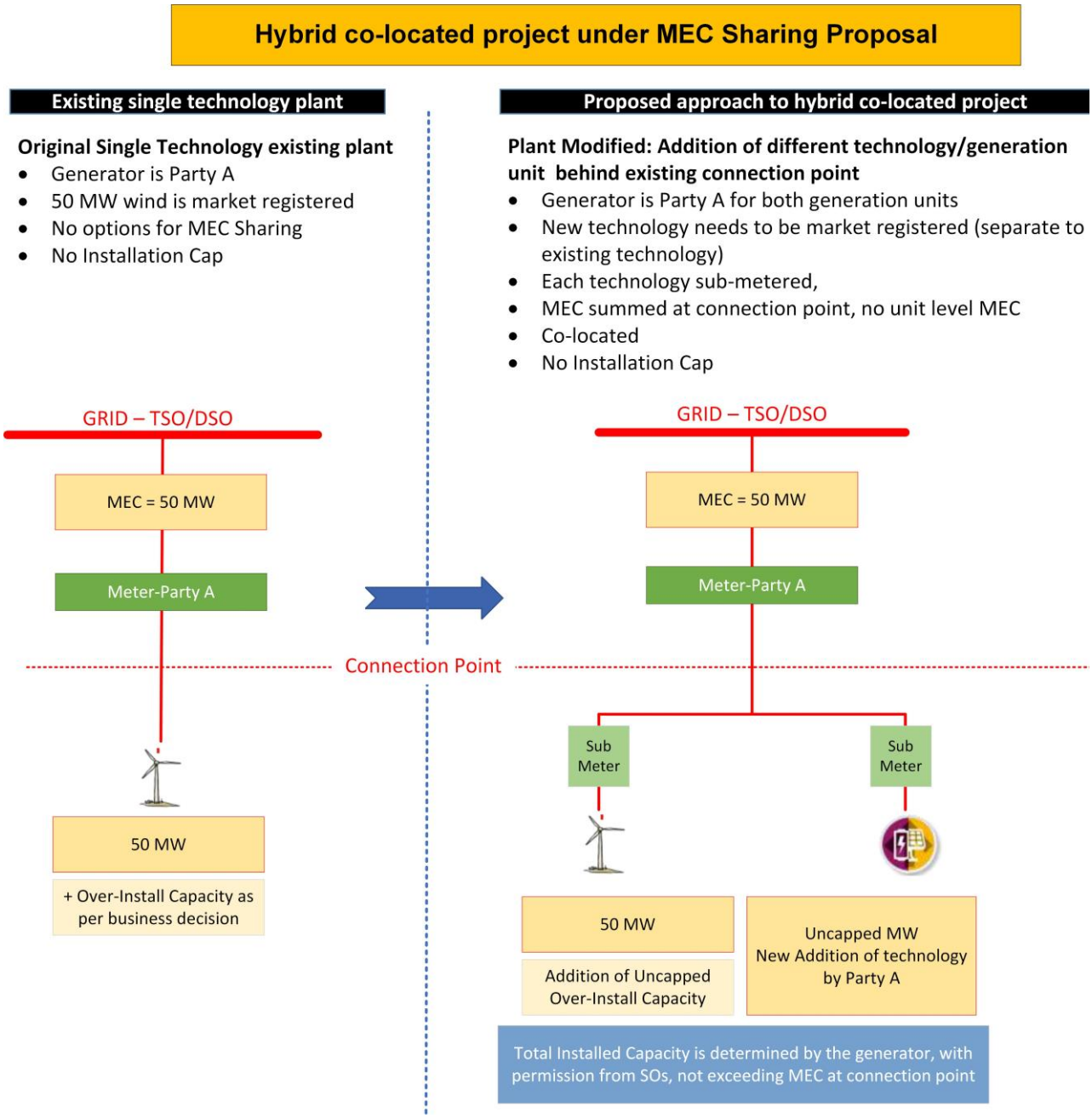

Figure 2: Proposed approach to sharing of MEC for hybrid co-located project

Q4.	The CRU invites feedback from stakeholders on the benefits associated with the potential implementation of sharing of MEC. Is there a net benefit to the consumer in terms of costs and other potential benefits?
Q5.	Are there any drawbacks associated with this proposal on MEC sharing? Please elaborate on the risks.
Q6.	Do stakeholders support the proposal to allow for the sharing of MEC behind a single connection point for hybrid co-located projects? Will this facilitate additional renewable electricity production?
Q7.	Do respondents foresee any difficulty with ensuring the export for a hybrid co-located project is limited to the MEC at all times?

Q8. Do participants envisage challenges with managing the interaction of different market and availability requirements (e.g. declarations of availability for active power and system services) at the connection point?

Q9. The CRU notes that this proposal does not facilitate energy sharing between units behind a connection point, however feedback is invited from stakeholders as to what measures may be required to address this and whether this can be addressed in ongoing workstreams.

Q10. Feedback is requested on whether there are risks associated with the sharing of MEC being applicable to all generation technologies, e.g. existing connection points for renewable or conventional generation seeking to add new technologies, or for new hybrid units combining renewable, conventional and/or storage technologies.

2.2 Possible impacts of the proposal and changes required

The SOs have identified several areas that need to be reviewed in advance of the potential introduction of a policy on MEC sharing. It is intended to publish an implementation roadmap with the CRU decision paper which will detail a more comprehensive set of required actions and timelines, and clarify which organisation will be responsible for delivery. The main issues identified by the SOs are outlined in the following paragraphs, with further detail from the SOs' proposal from 2023 provided in Appendices B, C, D and E at the end of this document.

2.2.1 Financial Securities

New processes for setting and administering the Connection Charges bond and Capacity Charges Bond may be required to be developed by the SOs for Hybrid co-located projects wishing to share MEC.

2.2.2 Connection Agreements

Current connection agreements as set out by the SOs define the terms and conditions for each party with respect to the power generating facility. This includes the rights of both the legal entity and the relevant SO. The connection agreement outlines the capacity limits (MEC) and the potential right to de-energise the plant for breaching the limits. The connection agreement also sets out, among other things, the details relating to the connection charges, and the testing and financial security arrangements that are linked to the contractual MEC. For the introduction of sharing of MEC, the SOs will need to propose amendments to the connection agreement that allows for the sharing of MEC between individual units within a hybrid project while maintaining the necessary safeguards for the system.

2.2.3 Network Planning Impacts

Hybrid sites and technologies which combine multiple forms of technology would have different technical and dispatch profiles in comparison to the single technology generation units, leading to an increase in the complexity and time for conducting technical studies. These studies are required

for assessing the impact of a connection on the network and ensuring the safe design and operation of the power system. Customers would need to submit software models that reflect an accurate representation of the total site and each of the Generator Units that are connecting behind the connection point prior to the connection of such hybrid units to the grid.

Due to the expected increased capacity factor at a site with multiple generation technologies, the estimate of total dispatch down (TDD), especially at constrained locations may increase due to sharing of MEC. A study carried out by the TSO and referenced in the CRU Consultation on Installed Capacity Cap (CRU/2023/88) highlighted that, in the case of hybrid co-located technology combinations, there is expected to be minimal impact on the current forecast levels of TDD. This is due to the complementary nature of the technology i.e. where technologies such as wind and solar generation produce energy at different times. However, the SOs may need to review the approach to modelling TDD considering mixed technologies at a given connection point. Network Planning Impacts are discussed in Appendix C.

2.2.4 SEM Energy Market Impacts

SEMO and the TSO would need to assess the current market systems to facilitate the sharing of MEC. Under the current Market Registration process, each Generator Unit has an individual MEC which is input to the market systems at registration and is validated by the TSO. Each trading site also has a MEC which combines the MEC of all the units which share that trading site. Current market and operational systems, signals and codes are not established in a manner that allows multiple separate units to share a single MEC dynamically. As part of the assessment of market systems, SEMO and the TSO may identify necessary modifications to the Trading & Settlement Code (T&SC) to fully account for sharing of MEC. These would need to be reviewed and updated as required through the T&SC modifications process.

The impact on Market Systems are discussed in Appendix D.

2.2.5 Capacity Market Impacts

The eligibility of generation/storage units within co-located hybrid projects to be qualified for participation in the Capacity Market auctions would need to be considered by the TSO, along with associated parameters, in particular the appropriate “de-rating” factors which would need to reflect the level of grid access of the individual units. Currently, MEC is used in the qualification process for participating in the Capacity Market to determine the initial capacity of a unit. The de-rating factors are currently applied to the lesser of the registered capacity of the generating unit and the MEC specified in the connection agreement. Therefore, introducing sharing of MEC may require a different approach to be taken if each individual unit is being considered separately in the Capacity Market. The manner in which “de-rating” factors are applied would need to be assessed. This is discussed in Appendix D.

2.2.6 System Services Impact

Each technology type will be registered as a separate service provider as is the case currently. Service providers would be required to manage the declared availability for services of each of the resources comprising the Hybrid Co-located Site, such that the sum of the availabilities across the units behind the single connection would not exceed the single shared MEC. An interim settlement solution may need to be developed by the SOs for facilitating payment of System Services. For an enduring policy, this should be considered as part the Future Arrangement for System Services (FASS) to ensure Hybrid technology can be accommodated. These are discussed in Appendix D.

2.2.7 Tariffs, Levies and Charges

While the SOs do not envisage a significant impact on the calculation of tariff arrangements around GTUoS, DTUoS and PSO levy, these would need to be reviewed, along with any associated impact on the retail market. These are discussed in Appendix D.

2.2.8 Local Flexibility Market

The DSO would need to review the definitions regarding the local flexibility market to ensure that hybrid projects do not introduce any inconsistencies. This is discussed in Appendix D.

2.2.9 System Operations Impact

Various system operations business processes may require updates to facilitate the sharing of MEC and some additional business functions associated with these processes may need to change. Real-time data will be needed to assess the full extent of such changes. The following areas have been identified by the SOs' as initial requirements to accommodate the sharing of MEC for hybrid projects and are described in detail in Appendix E:

- Site Controllability Requirements
- Meter Arrangements
- Site Controllability Set Points
- Availability Declarations
- Forecasting
- Central Dispatch Arrangements Options
- Grid Code and Distribution Code Compliance
- Application of Network Codes

Q11.	Some of the changes needed in existing policies and processes are noted in Section 2.2. What are your views on these changes? Are there other changes in current processes needed to facilitate the sharing of MEC?
Q12.	How can the associated control requirements (e.g. MEC limit at connection point) and mechanisms for sharing MEC be implemented?
Q13.	Do respondents consider it feasible to submit software models that are an accurate representation of the total site and each of the Generator Units that are connecting behind the connection point prior to the connection of such hybrid units to the grid?
Q14.	Do respondents have concerns over potential unintended consequences on the SEM Energy Markets, Capacity Market and System Services and, if so, how these can be prevented or mitigated?
Q15.	Comments are sought on the predicted impacts on the system operations discussed under Section 2.2.10 and Appendix E.
Q16.	Are there any other risks that should be considered as part of the decision-making process, and how can these risks best be mitigated?

2.3 Potential Pilot

As part of the initial submission, the SOs raised the possibility to assess the proposal as part of a joint TSO/DSO pilot project on the sharing of MEC. While a pilot could provide valuable learnings, the CRU considers that this could significantly add to the timeframe for implementation of the proposed policy, potentially limiting the addition of renewable capacity to support 2030 targets. Feedback is sought from stakeholders as to whether a pilot should be considered.

Q17.	Do stakeholders believe that conducting a Pilot project is warranted to provide learnings in advance of full implementation of the sharing of MEC proposals?
Q18.	Are there any additional considerations that should be taken into account in the formation of this policy?

3 Summary of Consultation Questions

CRU is seeking comments from the stakeholders on the proposed decisions listed in the Table 2. In addition to the questions included in previous sections of the document, the CRU is seeking feedback on any additional considerations that should be taken into account in the formation of this policy.

Table 2: Summary of request for comments on Proposed Decisions.

Q1. Do stakeholders agree on the classification and the definition of hybrid co-located projects?
Q2. Do stakeholders believe that the sharing of MEC for co-located hybrid projects should be pursued ahead of integrated hybrid projects?
Q3. When do stakeholders foresee the need to facilitate integrated hybrid projects in the power system? Please provide rationale for your answer.
Q4. The CRU invites feedback from stakeholders on the benefits associated with the potential implementation of sharing of MEC. Is there a net benefit to the consumer in terms of costs and other potential benefits?
Q5. Are there any drawbacks associated with this proposal on MEC sharing? Please elaborate on the risks.
Q6. Do stakeholders support the proposal to allow for the sharing of MEC behind a single connection point for hybrid co-located projects? Will this facilitate additional renewable electricity production?
Q7. Do respondents foresee any difficulty with ensuring the export for a hybrid co-located project is limited to the MEC at all times?
Q8. Do participants envisage challenges with managing the interaction of different market and availability requirements (e.g. declarations of availability for active power and system services) at the connection point?
Q9. The CRU notes that this proposal does not facilitate energy sharing between units behind a connection point, however feedback is invited from stakeholders as to what measures may be required to address this and whether this can be addressed in ongoing workstreams.
Q10. Feedback is requested on whether there are risks associated with the sharing of MEC being applicable to all generation technologies, e.g. existing connection points for renewable or conventional generation seeking to add new technologies, or for new hybrid units combining renewable, conventional and/or storage technologies.
Q11. Some of the changes needed in existing policies and processes are noted in Section 2.2. What are your views on these changes? Are there other changes in current processes needed to facilitate the sharing of MEC?
Q12. How can the associated control requirements (e.g. MEC limit at connection point) and mechanisms for sharing MEC be implemented?
Q13. Do respondents consider it feasible to submit software models that are an accurate representation of the total site and each of the Generator Units that are connecting behind the connection point prior to the connection of such hybrid units to the grid?

Q14. Do respondents have concerns over potential unintended consequences on the SEM Energy Markets, Capacity Market and System Services and, if so, how these can be prevented or mitigated?

Q15. Comments are sought on the predicted impacts on the system operations discussed under Section 2.2.10 and Appendix E.

Q16. Are there any other risks that should be considered as part of the decision-making process, and how can these risks best be mitigated?

Q17. Do stakeholders believe that conducting a Pilot project is warranted to provide learnings in advance of full implementation of the sharing of MEC proposals?

Q18. Are there any additional considerations that should be taken into account in the formation of this policy?

4 Conclusion and next steps

The CRU welcomes comments on any of the issues and questions raised in this consultation paper. The CRU will consider the responses to this paper prior to making a decision on the sharing of MEC for hybrid co-located projects. The CRU will direct the SOs to develop a roadmap which will provide further clarity on the challenges highlighted in this consultation and show projected timelines for the implementation of the Sharing of MEC.

In summary following the publication of this consultation, the next steps are proposed as:

- Assessment of responses received and stakeholder support for this proposal.
- Assess whether a pilot project would be appropriate.
- Engagement with SOs to further develop the requirements and timelines associated with facilitating the sharing of MEC at the point of connection.
- Develop and publish a decision paper.
- The CRU will direct the SOs to develop and submit a roadmap for publication alongside the decision paper.

Appendices

These appendices contain extracts from the proposal that was submitted by the System Operators (SOs) to the CRU on 12 January 2023 as part of the 2021 Climate Action Plan. The information in these appendices represent the SOs' submission at that time. In some cases, references have been updated to reflect the current version of the document. These changes are identified by [square brackets].

Appendix A: SOs' Hybrid & Co-located Site Terminology

As part of the work that was conducted by the SOs, working definitions were developed for Hybrid Units and Hybrid Co-located Sites as per following paragraphs.

Hybrid Co-Located Site – is any project that has multiple generating units or power generating modules which utilise multiple primary energy sources or technology types in generating/storing electricity and is electrically connected behind a single defined Connection Point to a licensed System Operator. The generation units within a Hybrid Co-located Site operate independently of one another for market, settlement and dispatch purposes. The only link between the generation units is the Point of Connection and MEC of the site. In addition, the site is required to have a control/tripping mechanism to ensure the MEC at the point of connection is not exceeded.

Hybrid Unit – is any project that has multiple generating units or power generating modules which utilise multiple primary energy sources or technology types in generating/storing electricity and is electrically connected behind a single defined Connection Point to a licensed System Operator. The site is registered in the market as one single market unit and operates as one single unit for the purpose of settlement and dispatch.

The following Appendices B, C, and E are quoted from the SOs' technical paper and should be read considering the above definitions from the SOs. However, as stated in Section 1.2.1, this CRU consultation defines hybrid co-located projects in section 1.2.1.

Appendix B: Impact on Financial Securities

B.1 Connection Charges Bond

The Connection Charges bond can be described as follows:

The connecting demand customer or generator must provide security in the form of a bond in respect of the connection charges set out in the Connection Agreement. It is calculated using the shallow costs of the connection. The Connection Charges Bond is due at Consents Issue Date and covers the balance of the Connection Charges yet to be paid.

To facilitate the introduction of sharing of MEC for existing projects, a new process may be required for the Connection Charges Bond. For existing projects that are seeking to co-locate technologies, the Capacity Bond Charge would already have been achieved for the overall site export capacity required to meet the Connection Charges Bond. The issue for co-locating arises in the fact developers would not be seeking to increase MEC, so in theory a new bond would not be required.

B.2 "Maximum Export Capacity Bond" or "Capacity Bond"

The "Maximum Export Capacity Bond" or "Capacity Bond" is set out as follows:

The TSO define the "Maximum Export Capacity Bond[10]" as the bond to be provided to the Company by a bank or financial institution with an Approved Credit Rating in the form set out in the Connection Agreement in relation to Maximum Export Capacity or any replacement or substitute thereof approved and received by the Company which has not expired or been cancelled or released by the Company. For the avoidance of doubt, the Customer is not required to provide such a bond where the MEC is less than or equal to 5MW.

At distribution level, for generator customers with an MEC greater than 5MW, a bond will be required as security for the Company providing an agreed export capacity to the Customer "Capacity Bond". The amount of the bond is specified in the Quotation Letter and is based on the Maximum Export Capacity in Schedule 1 of this Standard Connect Agreement[11].

In the case of a new Hybrid Co-located Site, for example a 50 MW wind farm and 50 MW solar farm that seeks to co-locate will potentially have a contractual MEC of 50 MW, as opposed to existing policy that would require a Capacity Bond reflective of 100 MW. Several options would need to be considered by the SOs with input from industry and CRU. For example, if a co-located project were to be completed in more than one phase, it may be possible to allow for the capacity test to be conducted sequentially. On completion of each individual capacity test, the overall site would be considered passed, and Capacity Bond returned. This approach would be in-line with the existing connection policy, but procedural changes would be required.

Another option, that may be more appropriate for new sites, is the allocation of the Capacity Bond to the greater of the co-located generation based on the installed capacity of each of the individual units.

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[10] https://www.eirgridgroup.com/site-files/library/EirGrid/GeneralConditionsofConnectionandUseofSystem(July-2013).pdf

[11] https://www.esbnetworks.ie/docs/default-source/publications/standard-connection-agreement.pdf?sfvrsn=3f4b33f0_4

The capacity bond would then not be returned until the greater of the MEC associated with the individual generation units has passed the capacity test.

B.3 MEC Capacity Breach

Section 4.2 of the TSO connection agreement outlines the Capacity limits and potential right to De-Energise the plant for breaching the limits. The current wording of the connection agreement may require modification to allow “Sharing of MEC”. In addition, as part of the connection agreement, the control philosophy and mechanisms for co-locating sites would be required to be set out to ensure the total output of the generation units does not exceed the contractual MEC at the point of connection.

Appendix C: Impact on Network Planning Assessment

C.1 Network Planning Studies

The introduction of sharing of MEC for both transmission and distribution connected generation would be likely to have an impact on future planning of the network. The needs of the system are determined by assessing the long-term future network performance against technical standards. Both Hybrid Co-Located Sites and Hybrid Units that combine multiple forms of technology would have different technical and dispatch profiles in comparison to the generation units that are currently connected.

As a result, this would lead to an increase in the complexity of setting up technical studies and thus the time taken to conduct these studies. Prior to connection of any Hybrid Co-Located Sites, it would be a requirement for customers to submit software models that are an accurate representation of the total site and each of the Generator Units that are connecting behind the connection point. In addition, the models that are submitted to the SOs would be required to be such that the SOs could study each of the individual generation units independently.

C.2 Dispatch Down

The current Enduring Connection Process (ECP) provides developers with an estimate of the level of generation constraints in Ireland. The reports are beneficial in providing an estimate of the Total Dispatch Down in available solar and wind generation i.e. the sum of over-supply, curtailment and constraints in different locations for future projects. In assessing the possible impact of introducing sharing of MEC, it is possible that sites would see an increase in the current estimate of Total Dispatch Down. However, this may also reduce with the introduction of technologies that are complementary to reducing the level of Total Dispatch Down in certain locations, as the forecast values are an indication of constraints based on a given set of assumptions.

In the reporting of Total Dispatch Down, it may be necessary to consider the methodology that is applied to a site that is co-locating two technologies. For example, if a site is operating at maximum export, but a second resource is available, it is the view of the SOs this should not be considered part of the current reporting of the Total Dispatch Down, but rather a technical limitation of the site. Furthermore, projects should be sized appropriately by a developer, as this is a commercial decision in project design.

Appendix D: Impact on Market Assessment

This section of the report presents a high-level analysis of some of the market systems and rules that will be impacted by introducing sharing of MEC. To facilitate the sharing of MEC, there will be a requirement for SEMO and the TSO to assess the current systems in place to facilitate Hybrid Co-located connections of different technology types.

Within the market systems/arrangements, generator types are either dispatchable, non-dispatchable but controllable, or non-dispatchable and non-controllable. There are a range of generation units subtypes available, but currently there is no existing subtype for a Hybrid Unit that can accommodate a single unit that is formed from multiple technology types.

In addition, there will be a requirement to undertake a review of the Trading and Settlement Code to assess the requirements for Hybrid Co-located Sites integration. Finally, the SOs would like to emphasise that the treatment of Hybrid Co-Located Sites in the market may necessitate changes to current market monitoring policies.

While the SOs believe that co-locating technologies may benefit the system, unintended consequences with respect to market rules should be avoided. At this time, the technical assessment does not fully consider the implications of such. These can only be fully assessed when there is clarity on the market requirements for sharing of MEC, which may necessitate T&SC modifications to ensure Hybrid Co-Located Sites follow the market rules.

D.1 Balancing Market

D.1.1 Registration – Current Arrangements

As per Section B.6 of the Trading and Settlement Code (T&SC), the de minimis threshold for mandatory participation in the Balancing Market is an MEC of 10MW. Under the current market registration process, each Generator Unit has an individual MEC which is input to the market systems at registration and is validated by the TSO. Each Trading Site also has a MEC which combines the MEC of all the units which share that Trading Site.

The issue of sharing MEC is complicated when different parties are operating individual Generator Units in the market. Under this scenario, it is not possible to share a Trading Site and therefore each unit is registered to a different Trading Site with a separate MEC. In addition, current rules set out in the TSC may lead to potential issues with Hybrid Co-Located Sites that combine Generation and Demand, for example wind and energy storage power station (ESPS).

The current rules mean that modifications to the T&SC are likely to be required to facilitate sharing of MEC along with a review of the market systems. However, the use of MEC in the balancing market processes is relatively limited other than in registration requirements, and therefore the relative impact of changing the approach to sharing of MEC is likely to be small in this market arrangement.

D.1.2 Registration – Options

To enable the registration of hybrid technology in the market, several options are possible depending on how the sites are integrated into the market systems. However, currently no mechanism exists to register a single Hybrid Unit in the market. In terms of an enduring market solution for a single Hybrid

Unit, there may be a need to introduce a new category of generation unit type to the market. This category would seek to combine different technologies under one market unit. The rationale is to allow for the further integration of technology that combines generation and demand.

As part of this technical assessment, the SOs have set out the following options for a Hybrid Co-Located Site connecting to a single connection point. Furthermore, the options set out below are dependent on one single legal entity at the single connection point. In the scenario presented previously in Figure 2 above, the site would have one Metering Point Registration Number (MPRN). Downstream of the point of connection, depending on the technology arrangements, the SOs would require that each of the technologies be required to have individual sub-metering installations to allow for differentiating between each of the Generator Units for the purpose of settlement, market operations and calculation of Transmission or Distribution Loss Adjustment Factors (TLAFs).

The two Generator Units may be electrically connected as part of the internal collector network but would operate independently and have individual market registration for energy market dispatch. To enable the registration of Hybrid Co-Located Sites in the market, two options are being proposed based on the technology mix:

- In the case of a Wind-Solar hybrid, each of the Generator Units would be registered in the market as a separate Generator on a single site, providing only one party is managing the market interactions.
- If different market participants are operating individual Generator Units in the market, each of the Generator Units will be registered to different Trading Sites. In the case of a co-located site that includes an ESPS, the current rules of the T&SC do not permit an ESPS to be part of a Trading Site (acknowledging that a different approach is currently in place for interim arrangements, and further developments may be considered for enduring arrangements under the Scheduling and Dispatch Project). In this case, it would be a requirement for each of the Generator Units to be registered on separate Trading Sites.

D.2 Capacity Market

The Capacity Market plays a vital role in ensuring adequate capacity is available to meet the demands of the Ireland and Northern Ireland power system. Successful applicants to the auction process receive payment for each MW of capacity they sold successfully to the market in the auction. Capacity providers are required to follow the Capacity Market rules set out in the Capacity Market Code (CMC) and the Trading and Settlement Code (T&SC). The introduction of sharing of MEC may require a detailed review of the CMC and the T&SC. By co-locating technology, it would result in the total installed capacity behind the connection point being greater than the contractual MEC at the point of connection, which may give rise to overestimating the actual capacity available to support the power system.

Several scenarios for co-located projects seeking to participate in the Capacity Market may materialise in the future depending on individual projects and technology combinations. Currently renewable generation units do not tend to participate in the Capacity Market, as they are often in receipt of subsidies. The outlook for co-located projects is likely to predominantly be a combination of renewable generation and storage, and as such, an analysis of co-located projects' eligibility for the Capacity Market would be required to determine the most suitable policy.

It may be the case that the ESPS element of a co-located project could participate individually in the Capacity Market, however the methodology associated with "de-rating" factors would need to be assessed. This is because the windfarm would reduce the grid access of the storage element and may reduce the overall capacity factor of the storage device.

The TSOs currently implement a detailed approved methodology to calculate the "de-rating factors" that apply to each unit in the qualification process. MEC is one of the main inputs for the capacity of a unit in the qualification process for the capacity market prior to de-rating. Therefore, introducing sharing of MEC may require a different approach to be taken if each individual unit is being considered separately in the capacity market.

D.3 System Services

Future co-located resources sharing MEC should be eligible to participate in the System Services arrangements where they meet the requirements. As the Hybrid Co-Located Site proposal sets out that each of the units would be represented individually in the market and would have separate metering, they would act as separate service providers. The units would be subject to the same requirements as other providers and would need to meet the requirements as set out in the contractual terms and conditions.

Furthermore, service providers would be required to manage the declared availability for services of each of the resources comprising the Hybrid Co-located Site, such that the sum of the availabilities across the units behind the single connection would not exceed the single shared MEC. The approach foreseen is that the service provider would be responsible for managing the availability of each unit and meeting the limits and performance standards.

In scenarios where one resource is providing maximum generation and no additional MEC is available at the point of connection, the service provider should not declare the second technology available for the provision of services. The SOs are also considering the need to conduct a Qualification Trial Process (QTP) for co-located technology to develop future requirements for co-located technology providing System Services.

In terms of settlement for System Services, the MEC is currently only applied to ensure no over payment for provision of Fast Frequency Response and Primary Operating Reserve through the use of Emulated Inertia by Wind Farm Power Stations (WFPSs), so the use of the MEC for the purpose of settlement of System Services is limited. However, further assessment will be required for Hybrid Co-Located Sites and the settlement logic that is applied. Currently Hybrid Co-Located Sites are not facilitated as part of the settlement systems and would be required to be settled as independent service providers. The SOs would also need to be able to send dispatch signals for dispatchable services and make sure that the correct unit was paid for services. As such, an interim settlement solution would need to be developed for facilitating payment of System Services. Finally, for an enduring policy, this should be considered as part the Future Arrangement for System Services (FASS) to ensure Hybrid technology can be accommodated.

D.4 Tariffs/Charging & Settlement

For Hybrid Co-Located Sites, it is assumed that use of systems charges will continue to apply to the MEC for the site and not be applied to individual Generator Units. Under the current tariff arrangements, the following areas have been initially identified:

- GTUoS is charged based on an MEC multiplied by a tariff rate. Based on the proposed design, the logic for charging would remain the same, as no additional MEC is being allocated to the point of connection. However, further investigation would be required to consider in further detail if an aggregate charge for the combination of technologies should be applied.
- DTUoS – This charge is based only on MIC and consumption. If ESPSs are considered as part of a co-located site, it is likely to increase these charges for developers due to the consumption element (not the MIC element), but there is likely no changes required to current business processes.
- Public Service Obligation (PSO) levy– PSO charges will be calculated based on the House Load MIC verified in the commissioning tests. The sharing of MEC is not anticipated to result in changes to the current logic for PSO levy charging.
- Balancing Market Settlement - MEC is not used in Instruction Profiling. The only area identified that uses MEC is the calculation of Combined Loss Adjustment Factor (FCLAF) for Trading Site Supplier Units as per TSC F.4.2.13. No other Balancing Market settlement calculations will be impacted, assuming each unit at the co-located site is registered as a separate market unit.

D.5 DSO Local Flexibility Market

The DSO local flexibility market is in its infancy and there are several flexibility pilots being undertaken. The SOs will be mindful for the potential for sharing MEC in the definition of any new flexibility products procured through local flexibility markets, and how they are measured and remunerated. The DSO will need to undertake a review of all the existing flexibility definitions to ensure there are no inconsistencies with what is being proposed in this paper.

Appendix E: Impact on System Operations

This section discusses the potential impacts on system operations business processes. It should be noted that addressing the impacts that have been identified in this section may lead to additional processes and changes being required in separate business functions. The optimised operational requirements of the co-located sites will only become known through collection and analysis of real-time data. The areas that have been identified below outline the SOs' initial requirements to potentially accommodate Hybrid Co-located Sites in the future.

E.1 Hybrid Co-Located Site Controllability Requirements

For co-located sites, in order to give effect to operation as separate market units as described above, it is proposed that each technology block connecting will be required to have independent metering and control signals. In line with existing policy, new connections at transmission or Power Park Module (PPMs) >1MW at distribution level would be required to install a Remote Terminal Unit (RTU).

For distribution connections, where one component of the hybrid or co-located site comprises one or more Synchronous Power Generating Modules [SPGMs], this may drive a new requirement to extend the controllability threshold of 1MW that currently applies to Controllable PPMs, to such SPGMs. For existing sites, if currently not controllable, this would drive RTU installations. If already controllable, the RTUs may have to be expanded as required and new signal lists issued.

E.2 Meter Arrangements

It is expected that for existing and new co-located sites, each technology may be required to install submeters and would be required to comply with the standards set out in the current CRU Metering Code[12] and Section [C.6.1.7] of the Trading & Settlement Code.

As per section 5.4.5 of the CRU Metering code: 'Where sub-metering of certain Generator Units is required, with the agreement of Relevant Meter Operator, a User may supply metering class CTs and VTs for use on the sub-circuits. This equipment must comply with the standards set out in this Metering Code. Such equipment shall be subject to acceptance testing by Relevant Meter Operator for each site.'

Under Section [C.6.1.7] of the T&SC[13], If a Party does not have adequate metering installed in respect of any of its Units under paragraph [C.6.1.4] or [C.6.1.5] or appropriate equipment to permit real-time monitoring of Generator Unit availability by the System Operator under paragraph [C.6.1.3] to facilitate Settlement under the rules of the Code without further netting, aggregation or estimation rules, the Meter Data Provider shall determine, subject to accuracy, practicality and cost, in consultation with the affected Party, and subject to the prior written approval of the Regulatory Authorities, the appropriate bespoke netting, aggregation, or estimation rules to allow for Settlement of that Unit under the Code.

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12 https://www.esbnetworks.ie/docs/default-source/publications/metering-code-for-the-single-electricity-market.pdf?sfvrsn=5f229859_16#:~:text=5%20Where%20sub%2Dmetering%20of,out%20in%20this%20Metering%20Code.

13 https://www.sem-o.com/rules-and-modifications/balancing-market-modifications/market-rules/Trading-and-Settlement-Code.docx

E.3 Site Controllability Set Points

The management of the combined generation output at the point of connection will be a key part of facilitating sharing of MEC behind a single connection point. Under the SOs' proposal, it would be the responsibility of the customer to ensure the contractual MEC is not exceeded at the point of connection. To ensure this can be achieved, the SOs propose that it would be a requirement for the customers to install an internal control system to limit the generation output of the facility and also the generation of one or more of the individual units, so that the site output does not exceed contractual and operational limits.

Initially the SOs are proposing that the details of the control system requirements would be assessed on a case-by-case basis depending on the configuration of the site. If future policy enables the sharing of MEC, the SOs would look to develop a guidance note on requirements that industry stakeholders would be expected to meet for Hybrid Co-located Sites that utilise sharing of MEC. As the co-located sites would have control systems that lead to interaction of the individual technologies behind the connection point, a ruleset for how often the site would be permitted to re-declare availability of each unit is also likely to be required.

If the availability forecasted and declared by the individual units meets the proposed requirement to not exceed the shared site MEC when aggregated, then, as a result, the dispatch instructions by the relevant system operator on those individual units would not exceed the shared site MEC. However, dispatch tools may need to be updated to accommodate reallocating MEC and changing availabilities, as each technology may declare availability via a separate system/tool.

As such, safeguards may be required to ensure a co-located unit cannot declare availability in separate systems that could result in the issuing of dispatch instructions to both units that could result in potential breaches in MEC at the point of connection.

E.4 Availability Declarations

Under the current Grid Code and Distribution Code, Availability is defined as "At any given time, the measure of Active Power a Generation Unit(s) is capable of delivering to the Connection Point and the term "Availabilities" shall be construed accordingly. This can be calculated as a gross figure."

To facilitate sharing of MEC, the co-located sites will be required to declare the Availability of each generation unit, in line with the technical capability of the units except where this would result in output which exceeds the point of connection MEC. Where the point of connection MEC would be exceeded, the site should not declare availability that exceeds the point of connection MEC. For example, the declared Availability for each unit on the co-located site should be such that the summation of the availabilities does not exceed the point of connection MEC. This may have a knock-on impact on the market positions possible for each of the units. As a result, new operational policy focused on ensuring real-time availability signals reflect the actual status of each technology on the site may be required to facilitate the introduction of sharing of MEC.

E.5 Forecasting

To ensure the SOs can maintain the safe and secure operation of the system, the SOs will require Hybrid Co-Located Sites to submit accurate day-ahead forecasts for the energy generation availability from

each of the generation units behind the point of connection. For example, in the case of a wind/battery project, the forecasting should show the individual wind forecast and expected charge/discharge pattern of the ESPS. In addition, as co-located sites will contain mixed forms of technology, the SOs may need to modify existing tools to ensure the forecast of both individual units and total sites is accurately captured in the control centres. This would be dependent on completion of a pilot project to assess the impact of co-locating technology.

E.6 Central Dispatch Arrangements Options

Currently Dispatchable units must submit Physical Notifications (PNs) and their priority dispatch status will apply to their PN'd quantities as far as the secure operation of the power system allows. Any availability above the PN'd quantity will not be treated as priority dispatch but in normal economic order. Non-dispatchable units may submit PNs however they will run to their actual availability subject only to operational security constraints. The introduction of sharing of MEC may introduce an additional layer of operational complexity, due to the management of additional units behind the point of connection, the changing levels in expected MW output and the different treatment depending on whether a technology is Dispatchable or Non-Dispatchable.

The current scheduling process is optimised to schedule and dispatch units to manage the many operational constraints and requirements, maximise priority dispatch and efficiently operate the balancing market. As such, the sharing of MEC will likely introduce a new layer of complexity to the process and one the system operators need to consider in further detail to ensure appropriate mechanisms are in place.

The initial thinking of the system operators is that it may be possible that the management of technologies could be done by market participants, via the submission of a Physical Notification (PN) reflecting a participant's intended MW output for each of its units. As such, the existing design could potentially facilitate this, so long as participants submit accurate and up-to-date technical and commercial information to ensure the multiple technologies sharing MEC are not scheduled in a manner that is not feasible due to dependencies between the units.

However, the system operators need to assess the potential implications in detail and design appropriate safeguards prior to any decision on the most appropriate mechanism to ensure there are not unintended consequences on the scheduling and economic dispatch of units.

E.7 Grid Code and Distribution Code Compliance

The current Grid Code and Distribution Code standards for individual technologies may require modification to facilitate sharing of MEC. To maintain the existing standards, co-located technologies at a unit level will still be subject to existing Grid Code/Distribution code provisions. At a site level, clarifications will be required for reactive power and voltage control requirements, which are assessed at the point of connection.

In the case of a co-located site, with individual units, most requirements apply to Registered Capacity, which is determined based on the lower value of Installed Capacity and MEC. Applied to a Hybrid Co-Located site, this approach could lead to a reduction by half of the reactive power that could be provided compared to what could be provided if the unit level technical capacity of each site is summed.

As a result, the SOs will need to consider an appropriate policy for reactive power contribution to ensure there is no unintended impact on the system and that the individual units' ability to participate in system services and operation is maximised. Further investigation is required to determine the most suitable approach and policy on the subject. It is also likely that consultation with industry would be required to determine an enduring policy.

It should also be noted that the SOs are currently undertaking a review of the existing definition of Registered Capacity, including its relationship to other defined terms such as MEC. The outcomes of this review will need to be considered for any future policy that facilitates the sharing of MEC. When all the issues identified above have been worked through and there is clarity as to how the Hybrid Co-Located Sites will be treated, the signals required, the performance expected, data submissions required etc. then the necessary Grid Code and/or Distribution Code changes can be made.

Finally, for units that co-locate, it is proposed that the site will be required to install a master-slave controller arrangement. This would allow for appropriate voltage setpoints and reactive power requirements to be issued at a site level. It would then be the responsibility of the site to achieve the required set-points. For the avoidance of doubt, all applicable Grid Code /Distribution Code requirements would apply individually to each market unit or at overall site level, as appropriate. Any such capabilities shall apply, irrespective of whether they are dispatched or not at any given instant.

E.8 Application of Network Codes

Currently, the application of Requirements for Generators (RfG) Network Code does not apply to existing power-generating modules (PGMs). However, should a PGM owner substantially modify its generation plant then certain requirements of the RfG will apply to that generation plant.

The introduction of sharing of MEC for Hybrid Co-Located Sites on the system may lead to the need for a significant level of modification to existing connected units, which may involve modernisation, refurbishment or equipment replacement for existing connections. In this case, the SOs have previously published a guidance note on the potential implications for industry[14]. These may also reflect a significant modification which would trigger the loss of priority dispatch status under the Clean Energy Package regulation EU 2019/943 and as outlined further in SEMC decision SEM-20-072, but further clarification will be needed on this.

[14] https://www.eirgridgroup.com/site-files/library/EirGrid/Guideline-for-the-Application-of-Connection-Network-Codes-to-Existing-Users-V1.0.pdf