ACER

European Union Agency for the Cooperation of Energy Regulators

CEER

Council of European Energy Regulators

Fostering energy markets, empowering consumers.

ACER and CEER REFLECTION ON THE

EU STRATEGY TO HARNESS THE POTENTIAL OF OFFSHORE RENEWABLE ENERGY FOR A CLIMATE NEUTRAL FUTURE

11 April 2022

1. EXECUTIVE SUMMARY

(1) On 19 November 2020, the European Commission published a strategy to harness the potential of offshore renewable energy for a climate neutral future. This strategy provides a potential evolution of offshore renewable energy, as well as possible regulatory and policy measures aimed at supporting their deployment.

(2) ACER and CEER understand that this strategy mainly addresses new challenges arising from the hybrid offshore systems gradually giving rise to meshed offshore networks. ACER and CEER broadly support this strategy, as well as possible solutions to address the challenges to large-scale deployment of offshore renewable energy in hybrid systems. In a few specific cases, ACER and CEER still advise caution and call for further analysis before any legislative proposals are developed. In particular, at this stage, not all the challenges are known and fully understood. The appropriate solutions could be developed and implemented gradually, addressing the foreseeable challenges.

(3) ACER and CEER broadly support the European Commission’s proposals on how to integrate offshore renewable energy into the internal energy market (namely with offshore bidding zones (OBZs)). However, current market rules governing real-time trading, favour the home market approach more than OBZs. As a consequence, this aspect needs to be addressed in a way that does not discriminate between internal and cross-zonal trade close to real-time. ACER and CEER therefore acknowledge that there are a wide range of challenges which will need consideration for the implementation of the OBZ model. ACER and CEER recommend the European Commission further analyse the option of creating OBZs for the integration of hybrid systems as well as analyse potential mitigation measures to address possible concerns.

(4) ACER and CEER agree that the allocation of congestion income to offshore renewable energy sources (RES), would help support these investments with less reliance on other support mechanisms. However, ACER and CEER identified several serious concerns regarding the disruptive effects such a solution could have. The objective of supporting offshore investment may be achieved by traditional renewable support systems (where and until needed) with fewer disruptive effects and more targeted to the specific needs of offshore RES.

(5) Furthermore, ACER and CEER do not see the need for specific solutions regarding the network development and financing of offshore RES. The existing framework of ten-year network development plans (TYNDP), cost-benefit analysis (CBA) methodology and cost allocation principles provide a good starting framework for addressing the challenges arising from offshore projects. Yet, ACER and CEER fully support integrated network development and planning for offshore networks, as well as harmonisation of connection and operation rules to facilitate the deployment of hybrid systems.

2. INTRODUCTION

(6) On 19 November 2020, the European Commission published a communication on an EU Strategy to harness the potential of offshore renewable energy for a climate neutral

future[1]. This strategy *"presents a general enabling framework, addressing barriers and challenges common to all offshore technologies and sea basins but also sets out specific policy solutions adapted to the different state of development of technologies and regional contexts."* Together with this strategy, the European Commission published an accompanying staff working document that provides guidance on electricity market arrangements supporting the integration of offshore renewable energy, into the internal energy market.

(7) In this document, ACER and CEER provide a common position and response to the European Commission's strategy - supporting it to a large extent. In a few specific cases, ACER and CEER outline certain risks which should be considered in any legislative proposals that are subsequently developed.

2.1. Offshore renewable energy

(8) At present, offshore RES is mostly offshore wind farms (OWF). However, in the future, these OWFs may include other types of generation technologies, as well as consumption or storage. Current OWFs are mostly connected to onshore grids radially (i.e., with one connection only). In the future, more hybrid connections are expected between one or several OWFs and more than one onshore bidding zone. These connections would be expected to have a dual purpose, namely (i) to transport energy from OWFs to onshore and (ii) to serve as an interconnector between two or more onshore bidding zones, to facilitate cross-border trade. To this end, the position of ACER and CEER distinguishes between radial and hybrid systems as the appropriate solutions and policies for both types of systems can differ.

(9) Radial offshore systems do not pose a significant challenge, because they do not combine two roles. Hence, the arrangements governing the investment and operation of such systems can follow the specific national rules applicable for the Member States (MS) in which they are built.

(10) Hybrid systems on the other hand, offer significant new challenges as they combine the production of energy from offshore RES and the cross-border trade between bidding zones or MS. It is assumed that hybrid systems are developed when it is beneficial to combine these two purposes, namely, to diversify the possibilities for OWFs to sell electricity and to better utilise interconnectors, especially at times with low wind production. To this end, it is very likely that large-scale deployment of offshore renewable energy will result in a gradual development of a meshed offshore network, which will connect several OWFs with several onshore bidding zones. As this development is likely to be inevitable, the European Commission's strategy rightfully identifies significant challenges that need to be addressed to support these developments.

[1] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52020DC0741&from=EN

(11) Therefore, the position of ACER and CEER mainly **targets hybrid offshore systems,** and addresses the unique challenges that the deployment of these systems brings to the internal energy market.

(12) Nevertheless, hybrid systems are yet to be developed in Europe (the only example so far being the Kriegers Flak Combined Grid Solution). It is therefore, difficult to establish clear and unequivocal rules for hybrid systems at this early stage. As shown in Annex I, the experience from the United Kingdom (UK) shows that a more proactive and top-down approach is needed to plan and incentivise offshore investments. Therefore, ACER and CEER support a proactive approach to providing a supportive legal and regulatory framework for hybrid systems. However, the deployment of these systems will be gradual and not all the challenges are known and understood at this point. It may therefore be necessary to develop the rules gradually by addressing the foreseeable future challenges.

3. BALANCE RESPONSIBILITY AND REAL TIME CONGESTION AND FREQUENCY MANAGEMENT

(13) The Regulation (EU) 943/2019 sets out that, in general, all market participants must be financially responsible for the imbalances they cause in the system. Today, the rules on balance responsibility, together with the principles for national terms and conditions, roles, and responsibilities of market participants and transmission system operators (TSOs), are set by the Commission Regulation (EU) 2017/2195 (Electricity Balancing Regulation).

(14) It is important to note that since most OWFs are only connected to onshore through high voltage direct current (HVDC) (exception: Kriegers Flak Combined Grid Solution is based on alternating current), there is no need for balancing. This is due to the fact that there is no frequency in a direct current (DC) network that needs to be maintained. The power balance still needs to be ensured, but any frequency deviations resulting from the power imbalance are only identified in a physical form on the onshore network (although commercially they may be attributed to OWF).

(15) Due to changing wind conditions in the short-term, OWFs always face significant power imbalances which need to be addressed by trading in the market. OWFs forming part of onshore bidding zone may adjust their position close to real time within the national intraday market, whereas OWFs located in a separate bidding zone may not do so in the last hour before real time. This is because cross-border intraday trading is no longer possible in the last hour. In such a case, these imbalances need to be resolved via balancing in the onshore grid, done by TSOs in the balancing market (such as future EU platforms for exchanges of balancing energy).

(16) It is worth noting that these differences are not inherent, as they largely depend on the national and EU-wide market rules. The ability of the OWFs in the Home Market

(HM) approach[2] to trade close to real time, depends on national trading rules and whether the connection cable is physically able to accommodate such trading (e.g., if the cable is already fully utilised, more infeed can only be solved with curtailment). On the other hand, the ability of the OWFs in the OBZ approach[3] to trade close to real time, depends on cross-border trading rules. For example, allowing cross-border trade for OWFs closer to real time and shortening the trading products (e.g., with 5 min market time unit), would allow OWFs in the OBZ approach to trade out their imbalances, equivalent to OWFs in the HM approach.

(17) These proposals may entail major changes to the regulatory framework and market design. Allowing cross-border trading up to real time could initially be limited to OWFs, since such rules between onshore bidding zones would significantly interfere with the current balancing processes and would require a significant paradigm shift. However, such changes might become essential to tackle the non-discriminatory treatment of market participants trading in onshore and offshore, and in general those trading within and between biding zones.

(18) Where adjusting the imbalances of OWFs is not possible because of congestion problems in the offshore grid, the wind needs to be physically curtailed in one way or another. Technically, this is done in a controlled and coordinated manner (i.e., the output of OWFs is technically limited by the capacity limits of the HVDCs), which requires system operation rules for the real-time control of the offshore system. Commercially, however, such curtailment represents redispatching instructed by a TSO (and subject to compensation) in the case of the HM approach. In the case of the OBZ approach, such curtailment is voluntary, as the OWF would not be able to trade out its imbalance due to congestion (i.e. zero cross-zonal capacity) and would voluntarily reduce production.

(19) In the current legal framework, balance responsibility is defined and enforced by the ‘connecting TSO(s)’, which defines terms and conditions for balancing service providers (BSPs) and balance responsible parties (BRPs) for providing services and for balancing responsibility. Therefore, each OWF needs to fall under clear terms and conditions for BSPs and BRPs established by the connecting TSO(s). For OWFs located in a single MS this is straightforward, as it is up to a MS to designate a competent TSO and regulatory authority. In bidding zones which span over a territory of two or more MS, it is less straightforward to appoint the competent TSO and regulatory authority. The set up and governance of the OBZs is further discussed in the governance section below.

(20) Regarding the balancing services provision and imbalance settlement, it is important that the TSO responsible for operating the OWF participates in the European platforms for the exchange of balancing energy (pursuant to Articles 19 to 22 of the EB Regulation). The existing frameworks for the balancing platforms are already

[2] See Chapter 5 for the description of the HM approach
[3] See Chapter 5 for the description of the OBZ approach

suitable for accommodating the inclusion of OBZs, since the requirements are set at connecting (participating) TSO level. Participation in the balancing platforms would ensure, on one side, the possibility for OWFs to be BSPs and to sell balancing energy, and on the other side, that TSOs can use the most efficient resources, including the OWFs.

(21) In the case of a DC network in an OBZ, there is no frequency that needs to be managed and therefore no need to balance out any system imbalance of the OBZ by activation of balancing energy. The energy imbalance of the OBZ will be visible only in onshore networks and balanced there. However, the financial settlement of the imbalances of the BRPs of the OBZ would still be settled with the imbalance settlement price of the OBZ. Such contractual imbalances would be calculated for the OBZ separately, but the balancing energy can be activated offshore or onshore, depending on where it is cheaper. Balancing platforms provide a cross-border marginal clearing price for each participating bidding zone, and this can serve as a basis for defining the imbalance price.

(22) Principles concerning the imbalance settlement rules must be set out in the terms and conditions defined by the connecting TSO(s), ensuring adherence to the EU regulatory framework. EU Regulation 2019/943 (Article 6(6)) requires that the imbalance price area is equal to a bidding zone. Therefore, in the OBZ approach, the relevant TSOs must calculate the imbalance price for each OBZ based on the balancing energy price calculated for the OBZ by the respective European platform for the exchange of balancing energy (as mentioned in the paragraph above). Given that the potential balancing actions might come from different bidding zones, participation in the European balancing platforms is of utmost importance. This is because the marginal pricing scheme allows the setting of a robust price for the satisfied demand of the imbalance price area, even though resources used to balance the system are located outside the area.

(23) The methodology for the imbalance settlement harmonization adopted by ACER with its Decision 18/2020, is the relevant framework that TSOs must implement in their terms and conditions. Currently, the methodology appears general enough to address the settlement of BRPs in OBZs, without the need for specific amendments since the requirements are set on a connecting TSO level.

(24) In conclusion, the regulatory framework on the balance responsibility, balancing services provision (including congestion and frequency management) and imbalance settlement seems to require some changes to the legal framework to allow OBZs to have equal access to the network, as in the case of the HM approach. These changes are particularly needed in the case of the OBZ approach and multinational bidding zones, whereas in the case of the HM approach, no specific rule adjustments are needed.

4. MARKET DISPATCH AND REDISPATCH

(25) The current legal framework, notably the Electricity Regulation, imposes that RES should also be subject to a market-based dispatch mechanism, while keeping some exemptions for small-scale installations. This implies that OWFs need to compete

with other (onshore) generation units inside the bidding zones and cross-border exchanges.

(26) ACER and CEER support the EU strategy that offshore RES should be dispatched in a competitive market-based way, and that their dispatch cannot justify reduction to cross-zonal trade or discriminatory access to network infrastructure. This is important in the context of meeting the minimum cross-zonal capacity requirements pursuant to Article 16 of Electricity Regulation – namely that the dispatch of offshore RES should not justify any systematic derogations or exemptions to these requirements.

(27) Therefore, ACER and CEER do not support systematically applying derogations or exemptions to the minimum cross-zonal capacity requirements due to dispatching of offshore RES.

5. MODELS TO INTEGRATE OFFSHORE WIND FARMS INTO SHORT-TERM MARKETS

(28) The proper integration of offshore RES in the integrated electricity market is crucial to ensure that it delivers on its promise of providing clean, affordable energy while not endangering the security of the electricity system.

(29) In the current zonal approach, OWFs may be assigned as part of one of the onshore bidding zones (the HM approach) or to a dedicated OBZ, grouping one or more OWFs (the OBZ approach). It is important to note that this choice is particularly important when congestion between an OWF and onshore network is frequent. The subsequent analysis focuses on the frequent situation where connecting cables are unable to transport full wind generation onshore because of their limited capacity.

(30) For hybrid systems, the HM approach implies that OWFs would be integrated into a bidding zone of the home market but would also have a connection to another bidding zone, which would serve as an interconnector. OWFs would first compete with onshore generators in the home market's bidding zone, whereas all the bids in the home market bidding zone would equally compete for interconnector capacity. The problem with this approach arises when the connection between OWFs and the home market is unable to transport full wind generation, as well as provide 70% of its capacity for the cross-border trade. In such a case, a TSO facing congestion on this connection has two choices: (i) offer 70% to cross-border trade and, if congestion occurs, reduce the physical flow by curtailing wind output or countertrading or (ii) not adhere to the 70% requirement and only offer the remaining capacity that is not expected to be used by OWF generation. Frequent use of this option would imply the need for some sort of derogation or exemption from the 70% requirement.[4]

(31) The crucial difference between the two approaches is that the flows resulting from offshore generation constitute internal flows under the HM approach, which cannot negatively impact cross-border flows (hence TSOs need to apply corrective

[4] Such derogation is applied in Kriegers Flak Combined Grid Solution

measures/remedial actions to allow sufficient cross-border flows). Through the choice for an OBZ, these flows are considered cross-border (allocated) flows, therefore contributing to the interconnection use targets (70% rule) in the Electricity Regulation.

(32) The implementation of the HM approach is simple. Nonetheless, the need to not discriminate cross-border flows with respect to internal flows may require the use of remedial actions (e.g., wind curtailment, redispatching, countertrading) in the subsequent regional operational security coordination. Yet, despite these possible mitigation measures, the HM approach still has two important disadvantages. Firstly, relying on mitigation measures creates the risk that these will not be available or sufficient, giving the right to TSOs to reduce cross-border capacity as a last resort measure. Secondly, systematic use of redispatching or countertrading, significantly distorts market price signals resulting in distorted dispatching decisions and incorrect interconnector flows.

(33) Besides these short-term inefficiencies, the HM approach may also dis-incentivise investments into hybrid systems. Namely, if most OWFs are integrated into the home market, the incentive to build interconnectors between these OWFs would be severely diminished since the use of these interconnectors would not follow the minimum capacity requirements (they would very likely apply derogations from 70% requirement) meaning these interconnectors would be largely underutilised. Such arrangements would therefore significantly stifle development of hybrid systems which have the potential to not only transport offshore RES to onshore, but also to integrate the onshore markets more closely with increased interconnection. The HM approach would effectively facilitate only the former policy.

(34) The OBZ approach does not suffer from these deficiencies. It provides efficient price signals to all actors involved and fully corrects interconnector flows. OWFs have more choice in selling their energy to the market where energy is most needed and can therefore better maximise their revenues. It also provides an effective incentive to connect OWFs among themselves and to other OBZs, and create hybrid systems. As acknowledged in Chapter 2, a change in cross-border trading rules would be required to extend these advantages to real-time.

(35) With regard to the process of establishing OBZs, the Electricity Regulation and Regulation (EU) 2015/1222 ("Capacity Allocation and Congestion Management - CACM Regulation) facilitate these decisions by establishing national and multinational bidding zone review procedures. As these procedures have been developed for highly meshed onshore networks, they are complex, lengthy, and burdensome. To facilitate efficient OBZs, these procedures need to be optimised and adjusted to the extent that is fit for the purpose of OBZs. It may be considered that this is a special case of "local" bidding zone review, where individual TSOs (or any group of participating TSOs) study and redefine the bidding zone configuration, without the involvement of all EU TSOs.

(36) In conclusion, from a market design and efficiency perspective, the OBZ approach is preferred to avoid market distortions and ensure compliance with the interconnection requirements of the Electricity Regulation, allowing the TSOs to apply a market-based solution to manage possible congestions and increase cross-zonal capacities.

However, this needs to be balanced with the changes needed to ensure OBZs have equal access to trading close to real time, as in the HM approach.

6. CONGESTION INCOME DISTRIBUTION AND USE

(37) Under the current legal framework, the congestion income generated by congestion between bidding zones is first distributed to the TSOs that own the interconnectors between the concerned bidding zones and subsequently allocated for the purpose of maintaining or increasing the cross-zonal capacities or offsetting the network tariffs. This congestion income should be used in the interest of network users and not accrue to the TSOs as additional profit.

(38) ACER and CEER supports the European Commission's intention to provide a stable and supportive investment framework for investors into OWFs. This could be facilitated by allocating congestion income to such OWFs. However, such a solution may have several undesired consequences and might not be the most optimal measure to achieve the desired goal. ACER and CEER outline below some of the possible drawbacks.

(39) The Commission Staff Working Document presents the problem that generators in some bidding zones would face loss of generation revenue due to low zonal prices caused by congestions, a problem that is not unique to OBZs. Such problems may equally occur in all onshore bidding zones with excess generation. Opening the door for allocating the congestion income to offshore generators may raise similar expectations and requests from onshore generators facing similar situations on the grounds of non-discrimination.

(40) ACER and CEER note that in case of congestion, OWFs would not necessarily receive significantly lower prices than in the onshore bidding zones (e.g. due to zero marginal costs). In case of OWFs also combining consumption or storage units, the price of OBZs could be similar to onshore bidding zones. On the other hand, if OWFs systematically receive the congestion income, their total income would become less dependent on the established market price. This could put a distortive incentive on bidding, since it could incentivise OWFs to bid excessively low or even at negative prices to stay in-the-money, while being shielded from such a strategy due to additional congestion income. They would thus be more competitive than any onshore renewable generation, which could lead to distortive price signals and discrimination.

(41) The allocation of congestion income to OWFs would contradict the important congestion management principle (defined in recital (30) of the Electricity Regulation) that generators should be exposed to locational price signals, i.e., lower revenues, when they are located in areas where electricity is less needed. Therefore, ACER and CEER propose that the same rules for congestion income distribution are applied for onshore and OBZs, where congestion income is allocated to TSOs owning the interconnectors between the bidding zones concerned.

(42) ACER and CEER consider it important to keep the funds for the network and funds for the renewable subsidies strictly separated. The first is defined by the regulatory authorities and the latter by the MS or their designated authorities. As network

financing from congestion income and network financing from network charges are largely equivalent, the strict separation required by Article 18(1) of the Electricity Regulation (network charges shall not include unrelated costs supporting unrelated policy objectives) would be applicable by analogy.

(43) Congestion income and network investments are tightly correlated in the sense that congestion income is generated only when cross-zonal capacity is scarce. This indicates the need for more capacity, which can be achieved by either new investment or the maximisation of capacity through the use of remedial action. The amount of congestion income directly corresponds to the urgency and added value of additional capacity. Congestion income is therefore a signal of the need for additional capacity. Diverting the offshore congestion income to generators would disturb this relationship as the revenues, which are aimed to increase capacities, are diverted to some other channels.

(44) ACER and CEER understand that the potential use of congestion income for supporting investments in OWFs would be similar to subsidies for RES, namely, to support RES investments in case their revenues would be insufficient to attract investments. Nevertheless, allocating congestion income to OWFs might not be sufficient to attract such investments, in which case they would still need to be complemented with support subsidies. On the other hand, allocating congestion income to OWFs might be more than what is needed to attract investments. Renewable support schemes, when designed appropriately, do not suffer from this under- or over-support as they complement the market generated revenue with just enough support to make the investment profitable.

(45) ACER and CEER therefore have serious concerns about the proposal for allocating congestion income to OWFs, due to the potential consequences outlined above. The renewable support policies, such as renewable subsidies, should be investigated as an alternative as they have a higher potential to achieve the desired policy objectives in a more appropriate and less disruptive manner.

7. ADEQUACY

(46) The current legal framework defines how to forecast and ensure resource adequacy, and how to manage adequacy crises. In particular:

(a) European and national resource adequacy assessments forecast resource adequacy at bidding-zone level for the upcoming 1-10 years; and

(b) Risk-preparedness plans describe how to manage electricity crises, including simultaneous electricity crises (involving more than one MS).

7.1. Neighbouring MS should reflect possible OBZs in their adequacy assessments

(47) While in the HM approach the adequacy assessment is straightforward, special attention needs to be paid in the OBZ model. Given that a significant share of European generation may be located in OBZs, resource adequacy assessments should model the impact of these bidding zones in detail. Given that national resource adequacy assessments have a regional scope, they should also include the

neighbouring OBZs. MSs connected to OBZs should ideally reflect, in detail, how the whole network of OBZs affects adequacy onshore. The modelling should reflect the market and operational rules applied within the OBZs (e.g., risk-preparedness plans and simultaneous crisis scenarios, see below), to ensure a realistic estimate of the contribution of these OBZs to adequacy in the various onshore bidding zones. Modelling can only be carried out jointly.

7.2. At first, reliability standards should only apply onshore

(48) The reliability standards reflect a socioeconomic balance between the cost of additional capacity resources and energy not served. As there will initially be minimal electricity consumption in OBZs, the reliability standard and identification of resource adequacy concerns should initially focus on onshore bidding zones. If electricity consumption increasingly becomes located in OBZs, MS may jointly define an offshore reliability standard, reflecting the cost and value of electricity supply within the OBZ.

7.3. MS would have to define rules to operate OBZs during simultaneous electricity crises

(49) To mitigate the potential impact of electricity crises, MS should define risk-preparedness plans. Such plans should include measures to manage simultaneous electricity crises, to enable trust and predictable behaviour between MS. As a significant share of generation may be in OBZs, these measures should define how exports from these bidding zones should be shared between MS when simultaneous adequacy crises occur. MS would have to coordinate such measures at the regional level to ensure a consistent approach among OBZs. Once agreed upon, a newly created neutral entity (e.g., market coupling operator when allocating cross-zonal capacity) could be empowered to apply them to ensure their full application during electricity crises.

8. GRID CONNECTION OF OFFSHORE ENERGY SOURCES

(50) The connection of OWFs is currently governed by the Network Code (NC) on HVDC[5]. However, to cover the full scope of hybrid systems, an extension of the current provisions and requirements laid down in the NC HVDC is likely necessary, which will require further analysis. This is particularly necessary for largescale deployment of hybrid systems in the future, which would require setting up a meshed off-shore DC grid (currently out of scope of the NC HVDC).

8.1. Regulatory challenges for hybrid systems

[5] Commission Regulation (EU) 2016/1447 of 26 August 2016 establishing a network code on requirements for grid connection of high voltage direct current systems and direct current-connected power park modules

(51) Potential barriers towards the connection of hybrid systems may arise from the current EU regulatory framework dealing with HVDC grid connections. Like other NCs in the field of grid connection, some of the requirements of the NC HVDC are not exhaustively defined[6] in these regulations and therefore require further decisions at the national level. In other words, each MS, pursuant to the proposal of the TSO(s) and the approval of the relevant designated entity[7], may establish its own settings or thresholds with respect to a certain capability required in the NC. The lack of harmonization between the connection requirements to the power networks of two or more MS or synchronous areas, may hinder the deployment of hybrid systems at best and lead to interoperability issues at worst. This is because different connection requirements may lead to the deployment of OWFs, which later cannot be connected into hybrid networks because this would lead to interoperability problems (such as stability or voltage problems).

(52) Moreover, an increasing penetration of hybrid systems will likely lead to the development of a meshed offshore DC network. However, the lack of rules on the capabilities of the meshed offshore DC grid may delay the cost-effective development of hybrid systems.

8.2. The creation of AC-hubs: further challenges

(53) In addition, an even more advanced future frontier for the connection and operation of hybrid systems is represented by AC-hubs. AC-hubs are small/medium size offshore AC grids which connect offshore generation units (e.g., wind, floating photovoltaic (PV) assets etc.), offshore storage units and offshore loads (e.g., green hydrogen from electrolysis). Such AC-hubs can be connected to two or more onshore networks of different MSs or synchronous areas via HVDC systems, creating a cross-border power network in which the AC part resembles an AC-island. This implementation may be scaled up by interconnecting two or more AC-hubs via HVDC systems, connecting them to the networks of two or more MS or synchronous areas.

(54) Currently, the deployment of meshed offshore networks made of AC-hubs is still constrained by the poor maturity of the relevant technology[8]. Moreover, the grid connection network codes (NC RfG, NC DC and NC HVDC) have been developed assuming the presence of a sufficient amount of inertia and are, as such, not applicable to island systems. Hence, a straightforward extension of this legal framework is likely not possible for offshore networks made of AC-hubs.

[6] https://eepublicdownloads.entsoe.eu/clean-documents/Network%20codes%20documents/Implementation/CNC/161116_IGD_General_guidance_on_parameters.pdf
[7] The designated entity shall be the regulatory authority unless otherwise provided by the MS in accordance with the Article 5 of the NC HVDC.
[8] There is a current lack in the practical experience. Similar solutions are microgrids, which are also limited. AC-hubs would face similar challenges of large AC power networks characterised by a significantly large (or full) penetration of converter-interfaced generation.

8.3. Suggestions

(55) As mentioned above, the regulatory framework in the field of grid connection for HVDC assets is the NC HVDC, while AC-hubs fall under the scope of topics addressed by the NC RfG and NC DC. To tackle the limitations identified in the previous sections, and thus to promote the secure and cost-effective connection of hybrid systems (including AC-hubs), ACER suggests the following:

(a) To conduct a case study on existing hybrid offshore systems (i.e., Kriegers Flak Combined Grid Solution[9]) to identify whether the project encountered regulatory bottleneck/barriers in the field of grid connection and/or interoperability[10].

(b) To coherently increase, based on the case study, the level of harmonisation between the requirements and parameters in the NC HVDC, which are defined at national level (i.e., the so-called non-exhaustive requirements). Beside other aspects, a more harmonised EU-wide framework would largely facilitate the intrinsic feature of interoperability of hybrid systems[11], potentially ensuring the multi-vendor operability[12].

(c) To assess the need for setting additional technical requirements in the NC HVDC aimed at ensuring the security of the meshed offshore DC grid, connecting several hybrid systems to the AC networks of two or more MS or synchronous areas. These requirements should be designed in a way that promotes a cost-effective future development of offshore meshed grids. It is worth noting that the establishment of specific requirements on the offshore DC component of the hybrid system, could potentially avoid the need for a higher degree of harmonisation on the onshore AC component[13].

(d) To provide, in accordance with the preamble [14] of the NC HVDC, DC-connected power park modules which are already, or will be, connected to one network via a radial configuration. With the possibility to apply, via an expedited process, for derogations from requirements that will only be needed where these modules become connected to a meshed offshore grid and which consider circumstances on a case-by-case basis.

(e) To amend, in the long run, the NC RfG, NC DC and NC HVDC to set specific requirements on the connection of relevant system users to offshore AC-hubs. However, in the face of the low maturity of the relevant technology, ACER

[9] Relavant information avalable at: https://eepublicdownloads.entsoe.eu/clean-documents/tyndp-documents/TYNDP%202016/projects/P0036.pdf
[10] Thus beyond the consideration of the 70%-criterion pursuant to CACM.
[11] Which connect the networks of two or more MS or synchronous areas.
[12] Additional information available at: https://www.entsoe.eu/events/2021/06/21/webinar-on-how-to-manage-the-interoperability-challenge-in-multi-vendor-hvdc-systems/
[13] This conclusion was suggested in a dedicated study requested by the European Commission - available here.
[14] Whereas (16) of the NC HVDC.

suggests that the technical needs and relevant regulatory frameworks for the development of offshore AC-hubs, should be properly monitored first.

(56) Accomplishing the aforementioned recommendations could involve a profound revision of the current NC HVDC (and the NC RfG and DCC in the long term). Due to the cross-border nature of hybrid systems, the amendment process towards a new version of the NC HVDC will require a high degree of coordination between TSOs, NRAs, ACER, ENTSO-E, the European Commission and all the relevant stakeholders represented in the Grid Connection – European Stakeholders Committee[15] (GC ESC). In particular, ad hoc Expert Groups[16] within the GC ESC should be created and tasked to propose amendments. In turn, these will be formally assessed by ACER and the European Commission and adopted through comitology, if required. While amending the NC HVDC, ACER recommends setting or referring to common EU-level technical standards, especially for certain technical aspects on the DC-side of the grid introduced by hybrid systems.

9. SYSTEM OPERATION

(57) In future, the feasibility of integrating a growing number of hybrid systems will need to be evaluated in the context of System Operation (SO) NCs. In this field, the relevant EU regulations are the Commission Regulation (EU) 2017/2196[17] – Emergency and Restoration (NC ER) and the Commission Regulation (EU) 2017/1485[18] – System Operation Guideline (SOGL). The first deals with the processes that the TSOs must follow when they face an incident on their grid. The second specifies the rules for the correct operation of the interconnected European system. Due to the ever-increasing interconnection of the European power system and market integration, the Electricity Regulation Coordination necessitates the mandatory participation of TSOs in regional security coordinators.

(58) The complexity associated with the operation of hybrid systems is expected to grow in accordance with their level of deployment and interconnections (i.e. individual OWFs gradually merging into meshed hybrid network).

(59) In the short term, whilst the deployment of hybrid systems would possibly remain limited to individual and uncoordinated projects[19], it could be sufficient to improve the level of coordination between the TSOs and NRAs relevant to the MS involved in such projects. Fostering regional coordination is already envisaged at EU level through the formation of the Regional Coordination Centres (RCCs)[20], which will enter operation in 2022. In the long term, the deployment of hybrid systems will likely require the establishment of a fully meshed, offshore DC grid (or even more advanced offshore interconnected AC-hubs). The operation of such meshed offshore grids, both

[15] https://www.entsoe.eu/network_codes/esc/#gesc
[16] https://www.entsoe.eu/network_codes/cnc/expert-groups/
[17] https://www.entsoe.eu/network_codes/er/
[18] https://www.entsoe.eu/network_codes/sys-ops/
[19] e.g. connecting the AC-networks of two power systems.
[20] In accordance with the definition in Article 35 of the Electricity Regulation (EU) 2019/943.

in normal conditions and, especially, in emergency situations, is expected to become significantly complex requiring management by a more holistic approach.

(60) Hence, the TSOs whose AC-systems are connected to the meshed offshore DC grid, may agree to operate the meshed offshore DC network with the support of RCCs. However, this might prove inefficient in a highly meshed offshore DC grid because of the growing complexity of tasks involving the large number of non-conventional assets involved (including AC-hubs), different directions of power flows and responsibilities concerning the security of the DC network itself following faults. To safely operate meshed offshore DC grids and coordinate the prescribed system operation tasks across different System Operation Regions, relevant TSOs and NRAs may decide to strengthen the structural cross-border coordination by establishing an offshore Independent System Operator (ISO).

(61) ACER and CEER acknowledge that a strong structural cross-border coordination of TSOs, potentially resulting in the establishment of an ISO, to manage the short-term operation of the meshed offshore grids and, at the same time, design long-term plans for their further development and expansion, could help manage the technical challenges of the DC offshore infrastructure and the uncertainty and variability of renewable generation connected to them. Additional supporting information concerning the benefits stemming from the introduction of offshore RCCs and ISOs are included in the Commission Staff Working Document, issued by the European Commission in November 2020[21].

(62) Therefore, ACER and CEER recommend the creation of an ad-hoc group to foster the coordination of TSOs and NRAs with respect to challenges that accompany the operation of hybrid systems, under simple and more complex implementation, and with respect to the current SO NCs. If necessary, amendments to the SO NCs should also be discussed and proposed in close coordination with the SO ESC. ACER and CEER are committed to working with all the relevant stakeholders, especially with the European Commission and the NRAs in respect of the governance arrangements and regulatory functions of potential ISOs managing offshore grids.

10. NETWORK PLANNING AND DEVELOPMENT

(63) Offshore grid development has historically been limited to radial connections. As hybrid connections are more complex and additional elements need to be considered, ACER and CEER agree on the need to revise the principles of network development to accommodate these changes. ACER and CEER strongly emphasise the need for a proactive and top-down approach in the planning and development of offshore networks. The experience from GB (See Annex I) shows that the lack of such top-

[21] The Commission Staff Working Document accompanying the document: Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions - An EU strategy to harness the potential of offshore renewable energy for a climate neutral future" is available here.

down planning would likely create barriers for efficient development of the offshore hybrid networks.

(64) As the growing offshore wind capacity, together with the interconnection capacity of hybrid systems will have an important impact on infrastructure development, ACER and CEER deem that when developing offshore hybrid networks, appropriate synergies with the existing network development processes should be pursued, in particular by fully incorporating offshore network development planning in the preparation of the EU-wide TYNDP. Separating the onshore and offshore network development processes could result in:

(a) The introduction of a new process requiring more resources and causing difficulties in maintaining the much-needed connection with onshore network development;
(b) The network development scenarios risk being different, leading to a mismatch on important assumptions for the development of the onshore and offshore grids;
(c) The different CBA methodology for offshore grids, risks causing different assessments of similar assets, favouring one over others, undermining the credibility of planning.

(65) The recent agreement on the revision of the TEN-E Regulation provides for ENTSO-E, with the involvement of the relevant TSOs, NRAs, MSs, EC to develop and publish, as a separate report part of the EU-wide TYNDP, high-level strategic integrated offshore network development plans for each sea basin, considering environmental protection and other uses of the sea. The high-level offshore plans will be consistent with regional investment plans published pursuant to Article 34(1) of Regulation (EU) 2019/943 and integrated within the TYNDP, in order to ensure coherent development of onshore and offshore grid planning and the necessary reinforcements.

(66) ACER and CEER deem that a strong integration of high-level strategic offshore network development plans in the existing TYNDP processes would foster a better (offshore and onshore) network development.

(67) ACER is ready to provide inputs to such integration by means of its opinions on the upcoming TYNDPs and high-level strategic integrated offshore network development plans.

(68) For all infrastructure development aspects, especially those pertaining to technical assessments (such as consistency with onshore infrastructure development), ACER and CEER propose implementing a strong regulatory oversight. In the absence of the latter, there is a high risk of inefficient infrastructure development decisions, resulting in higher costs for consumers and possibly even stranded assets.

11. COST SHARING AND NETWORK FINANCING

(69) ACER and CEER emphasise that, as a general principle, all networks are financed by network tariffs, which can be complemented by congestion income, avoiding double remuneration.

(70) According to the Electricity Directive, NRAs have the duty of fixing or approving network tariffs or their methodologies, as well as the methodologies used to calculate or establish the terms and conditions for connection and access to national networks, allowing the necessary network investments.

(71) When carrying out such activities, NRAs aim to define tariffs that recover efficiently incurred costs. To also safeguard the application of this objective for the offshore network development, NRAs' powers and duties for an efficient network development, should also be maintained for hybrid systems.

(72) Once an offshore transmission project is deemed efficient by the relevant NRAs, its costs should be properly allocated to the involved countries and parties. The methodologies for how to allocate these costs are yet to be developed. Cost allocation is addressed in the case of projects of common interest (PCIs), by the TEN-E Regulation.

(73) According to ACER's Fourth Monitoring Report on CBCA, from 2013 to mid-2020, 17 CBCA decisions for electricity PCIs were adopted by the relevant NRAs (or, in one instance, by ACER), corresponding to a total investment of over €8 billion. The NRA decision-making was supported by two ACER recommendations (07/2013 and 05/2015) on this subject.

(74) The recent agreement on the revision of the TEN-E Regulation provides guidance on a cost-sharing methodology for the deployment of the sea-basin integrated offshore network development. Such guidance should be developed and updated by the Commission, together with the MS and relevant TSOs, ACER and NRAs.

(75) To respect the roles and responsibilities set by the Clean Energy Package and to account for current practices, any cost-sharing guidance for offshore networks should be fully aligned with (i) ACER and NRA practices in cost allocation, (ii) ACER Recommendation 05/2015 on Good Practices for the Treatment of the Investment Requests for Electricity PCIs and (iii) the upcoming ACER recommendation pursuant to Article 16 of the revised TEN-E.

(76) Finally, in addition to the existing recommendations on charges for generators outlined in ACER Opinion 09/2014[22], ACER and CEER support the objective of further transparency and coordination of national policies on tariffs and charges for the OWFs,

[22] As required by Regulation (EU) No 838/2010, the Agency published an Opinion in April 2014 on the appropriate range of G-charges for the period after 1 January 2015. The Opinion concluded that the increasing interconnection and integration of the European electricity market implies an increasing risk that different levels of G-charges could distort competition and investment decisions in the internal market. Consequently, the Agency recommended that energy-based G-charges should not be used to recover infrastructure costs and thus, except for the recovery of losses or ancillary services costs, they should be set at 0 €/MWh. The Agency also concluded that different levels of power-based or lump-sum G-charges can be used and that it is not necessary to propose restrictions on such charges as long as they reflect the costs of providing transmission infrastructure services to generators, are properly justified and set in an appropriate and harmonised way.

as well as further investigation of best practices and the potential need for further harmonisation.

12. GOVERNANCE

(77) ACER and CEER share the European Commission's view on the future governance of OBZs. Establishment of new OBZs is possible under existing legislation. However, the process of establishing and amending the bidding zones would need to be simplified to enable quicker adaptations to the changing nature of offshore grids. If there are no disputes about the establishment of such new offshore bidding zones, the process of establishing them should be simple and fast. A lengthy and complex multilateral bidding zone review process is only necessary when the concerned TSOs and MS are not able to agree on them. In case of such disputes a bidding zone review is accompanied with dispute resolution and becomes legally binding in the end.

(78) The governance of OBZs located in the exclusive economic zone or territorial waters of only one MS (or OWFs integrated with the HM approach) does not raise any new challenges since the jurisdiction is clear. Namely, the concerned MS is competent to designate a TSO and regulatory authority for such a bidding zone.

(79) The proposal for tackling the question of governing multinational bidding zones located in the exclusive economic zone or territorial waters of more than one MS is firstly with joint governance established on a voluntary basis, i.e. outside EU legal requirements. Such was the case in the common Germany-Austria-Luxemburg bidding zone and in the current Single Electricity Market (SEM) in Ireland. Only later, if needed, would EU legislation be used to establish a legal basis for formal transnational governance.

(80) The cases of Germany-Austria-Luxemburg and the SEM in Ireland provide useful experience. The multinational OBZs located in the exclusive economic zone or territorial waters of more than one MS can only be efficiently developed and operated by one system operator. The legal jurisdiction for them is not clear in the sense that there is no single default regulatory authority competent for such a bidding zone. Nevertheless, the SEM model with establishment of a joint decision-making body and integrated system operation by TSOs, could be sufficient for such cases in the short term.

(81) Nevertheless, the question arises whether such voluntary cooperation would be efficient to facilitate the fast deployment of offshore hybrid systems. If voluntary cooperation does not keep pace with the gradual deployment of hybrid systems, an EU legal framework mandating and standardising such cooperation would help to provide stability and certainty for deployment of such systems.

(82) The need for more top-down governance increases when the offshore grids gradually become meshed, as this raises new challenges for network development, financing (cost sharing) and system operation. Common bodies such as ISO or RSC performing these tasks and regulated by regional or EU regulatory bodies are needed to address these challenges.

13. CONCLUSION

(83) The European Commission's Strategy to harness the potential of offshore renewable energy for a climate neutral future provides a comprehensive and useful overview of the potential evolution of offshore renewable energy, as well as the challenges associated with supporting their deployment.

(84) ACER and CEER's analysis shows that the strategy correctly identifies the main challenges and dilemmas, and broadly confirms the possible solutions to address these challenges. Nevertheless, in a few specific cases, ACER and CEER advise care, and that further analysis is conducted before any legislative proposals are developed. At this stage, not all the challenges are known and understood. The appropriate solutions could be developed and implemented gradually by addressing the foreseeable challenges.

(85) As a preliminary conclusion, ACER and CEER broadly support the European Commission's proposals on how to integrate offshore renewable energy into the internal energy market, especially concerning hybrid systems (namely with OBZs). It also notes that current market rules governing real-time trading, favour the home market approach more than OBZs. This aspect therefore needs to be addressed, not only for OBZs, but also in general to stop discrimination between internal and cross-zonal trade. ACER and CEER therefore acknowledge that there are a wide range of challenges in need of consideration for the implementation of the OBZ model. Hence, ACER and CEER recommend further analysis of the creation of OBZs as an option for integrating hybrid systems and potential mitigation measures to address possible concerns.

(86) ACER and CEER have serious concerns about the proposal to allocate congestion income to offshore RES, due to various concerns about the disruptive effects such a solution would bring. ACER and CEER agree that the underlying objectives can be adequately achieved with renewable support mechanisms targeted to the specific needs of offshore RES.

(87) ACER and CEER also do not see the need for specific solutions regarding the network development and financing for offshore RES. The existing framework of TYNDP, CBA methodology and cost allocation principles provide a good starting framework for addressing the challenges arising from offshore systems. Yet, ACER and CEER fully support integrated network development and planning for offshore networks as well as harmonisation of connection and operation rules to facilitate the deployment of hybrid systems.

14. ANNEX I: OFFSHORE NETWORK PLANNING COORDINATION – UK CASE STUDY

(88) In the UK, the current approach to design and build offshore transmission infrastructure has been primarily developer-led and incremental. Whilst this approach has been successful initially, it might not be well suited to support the deployment of the substantial amount of offshore generation, transmission and interconnection assets required to meet Net Zero.

(89) The GB NRA, Ofgem, is currently exploring how to improve coordination in the planning and development of offshore assets, also by considering what role the national Electricity System Operator (ESO) can play in supporting the decarbonisation of the energy system.

14.1. Offshore radial connections

(90) The Offshore Transmission Owner (OFTO) regime was designed to de-risk the delivery of offshore wind projects. Under the regime, windfarm developers can select either the OFTO-build or generator-build route. To date, all projects have gone through the generator-build route, through which the generator develops and builds their own transmission asset, which is then transferred by Ofgem to an OFTO through a competitive tender process. This approach has contributed to significant cost reductions in offshore wind energy; however, it has also led to the uncoordinated construction of numerous, individual radial connections to shore.

(91) Due to the cumulative environmental and social impacts of transmission infrastructure, both onshore and offshore, this radial approach now presents a major barrier to the delivery of increasingly ambitious offshore wind targets of 40GW by 2030 and Net Zero by 2050. Reaching these objectives is also hindered by an extremely long and complex process for planning, developing, and connecting offshore assets, which involves multiple government departments, national regulators, statutory bodies, devolved administrations and industry parties.

(92) Recent analysis carried out by National Grid ESO, commissioned by Ofgem, has concluded that greater coordination from 2025 could deliver up to £6bn in consumer savings compared to the status quo, and that the number of new electricity infrastructure assets associated with offshore connections, including cables and landing points, could reduce by approximately 50%[23] .

(93) To achieve these costs savings and to better understand how to transition to a more centrally planned and coordinated offshore network development model, the UK Government launched the Offshore Transmission Network Review (OTNR) in July 2020[24]. The aim of the review is to ensure that future connections for offshore wind

[23] The final Phase 1 report in our Offshore Coordination project | National Grid ESO
[24] Offshore transmission network review - GOV.UK (www.gov.uk). A decision is expected by Q1-2022

are delivered with increased coordination while ensuring an appropriate balance between environmental, social and economic costs.

(94) To achieve this, the OTNR will:

(a) identify and facilitate opportunities for increased coordination in the near term of projects in advanced stages of development, through to changes to the existing regulatory regimes;

(b) drive coordination of offshore projects connecting before 2030, developing a holistic onshore and offshore network design framework and delivery models;

(c) develop a new post-2030 framework that drives and delivers coordination from the earliest stages of an offshore project across multiple government departments.

(95) The OTNR is also exploring which amendments to the current regulatory and legal framework are required to facilitate the development of multi-purpose interconnectors (MPIs), also known as hybrid systems. Since an MPI would combine onshore, offshore and interconnection assets, it is currently unclear to industry which regulatory approach would apply to its various components, or whether changes in primary legislation are required.

14.2. The energy system operation of the future

(96) Within this context, Ofgem and the UK government are also reconsidering the role that ESO can play in decarbonising the energy system.[25] The transition to Net Zero will require a much more integrated energy system and will increase the complexity of operational and planning challenges across both electricity and gas. This creates the need for new and enhanced roles and functions which cut across both the electricity and gas systems and are based on deep technical understanding of system operation.

(97) The newly proposed Future System Operator (FSO) would group in a single, independent, expert and accountable entity the roles and functions carried by the gas and electricity system operators which are currently separated. The FSO would undertake strategic onshore and offshore network planning, long-term forecasting, and market strategy functions. It could also support decisions by Government, Ofgem and other organisations by providing targeted advice based on its expertise on the impact of different potential decisions on the energy system.

(98) These network planning functions are expected to be largely advisory, providing analysis and recommendations allowing Ofgem to make decisions when approving investment. However, British authorities have indicated that in the future, it is possible that these functions could develop to the point where the FSO could take on a stronger role in electricity network planning, potentially recommending network designs and

[25] Energy Future System Operator Consultation Energy Future System Operator Consultation | BEIS

tendering for and/or contracting with parties to build and operate network assets, particularly in areas that deliver efficient 'whole system' solutions (such as solutions that deliver efficiencies through coordination across the GB transmission network, gas and electricity networks, and/or transmission and distribution networks).