# Workshop MOG 2

elia

Market design

6<sup>th</sup> of February 2023

Overview of exchanges on grid design for MOG 2 with stakeholders and scope of the
 market design workshop today





# Market design & OBZ process

Steve Van Campenhout Thomas Van Den Broucke



### Scope of today's workshop



- 1. What is driving the OBZ
- 2. What is driving the scope of an OBZ
- 3. Ideal target model to foster EU's offshore ambition: UK return to implicit market coupling + offshore

bidding zone + advanced hybrid coupling

- 4. Legal framework to define OBZ
- 5. Annex: list of received questions and our answers





## **1. What is driving the OBZ**



## General principles of market functioning: capacity calculation



- TSOs have the obligation to calculate the cross-zonal capacities available for electricity exchanges between bidding zones.
- Day-ahead: capacity calculation starts 2 days < real-time, in order to feed the allocation taking place 1 day ahead of real-time.
- Capacity calculation involves a complex modelisation by TSOs using a series of assumptions: grid, market, weather...
- Regulatory framework to enable a non-discriminatory, efficient & transparent approach



## General principles of market functioning: capacity allocation



#### Implicit coupling

- SDAC: single day-ahead coupling = one implicit price coupling across all European bidding zones as implemented today
- Implicit means that cross-zonal capacity & energy (demand and supply) are allocated together to maximize social economical welfare. Capacity is thus made *implicitly* available to the market participants.

#### **Explicit coupling**

- Since Brexit the UK is no longer part of the European single implicit price coupling.
- Explicit means transmission capacity and electricity are now traded at two separate auctions. The capacity of each UK-EU interconnector is thus made available in an *explicit* way to the market participants.
- Market participants take decisions based on price forecasts. This sometimes leads to inefficient use of the capacity, meaning electricity flowing from the expensive to the cheaper market.



## Role of an offshore bidding zone: manage congestion efficiently



- Bidding zones form the cornerstone of our European zonal market model: they are the largest geographical area within which market participants are able to exchange electricity without having to acquire transmission capacity. Within a bidding zone the wholesale market price is uniform.
- Bidding zone borders must reflect structural congestions in the transmission network in order to ensure an
  efficient congestion management and to maximize overall market efficiency.
- When adding an offshore bidding zone, the congestion between the Energy Island and the coast is thus internalized into the market functioning in order to maximize the welfare:
  - Result of allocation: each bidding zone receives a net position that defines how much electricity the bidding zone imports or exports. In an equivalent way this is expressed as how much electricity flows through each bidding zone border (interconnector).
  - By adding an offshore bidding zone there is an additional parameter for the allocation algorithm to optimally match the available cross-zonal capacity with the buy/sell bids of electricity.
- A new bidding zone gives the market an **additional "degree of freedom" to optimize the allocation**.

## Role of an offshore bidding zone: manage congestion efficiently



#### Structural congestion appears when an interconnector is integrated onto the Energy Island.

An offshore bidding zone reflects the structural congestion. It allows to efficiently allocate the 3.5 GW transmission capacity between the Energy Island and the coast, thus doing the economic arbitrage in the market between offshore wind and import through the interconnector.



#### **Example result of allocation:**

the 3.5 GW transmission capacity of the energy island is allocated for 2.5 GW to offshore wind and for 1 GW to import through the interconnector with UK



As long as we are in an explicit coupling context, there is no point in establishing an offshore bidding zone as it cannot realize its objective of efficient allocation



## Explicit coupling does not fit with EU's offshore ambition



- Integrating 300 GW of offshore wind in a cost-efficient way requires both:
  - − An efficient planning of capacities → hybrids and meshed offshore grids
  - An efficient use of the capacities
- Explicit coupling however fosters a more complex approach and less efficient use of capacities:
  - Market participants will make mistakes when forecasting prices
  - Economic arbitrage in a hybrid set-up is not possible. Instead, TSOs have to ex-ante split capacities based on forecasts, leading to:
    - − Missed opportunities: too much wind forecasted → too little capacity provided to the allocation
    - − More system costs: too little wind forecasted → too much capacity provided to the allocation → redispatching

Explicit coupling is not scalable towards EU's offshore ambition

# Scenario's leading to implicit coupling and thus the application of an offshore bidding zone for MOG II







## 2. What is driving the scope of an OBZ



# Scope of OBZ: which part of the 3.5 GW wind connected to MOG II will end up in the offshore bidding zone?



This depends on the feasibility to operate the DC and AC part of the MOG II grid as 1-node



For simplification purpose the explanation on scope is applied to the scenario "early" thus illustrated with only Nautilus in the scheme.

## Scope of OBZ: ambition = 1-node operation



#### Result: the full 3.5 GW wind is part of the OBZ.

Does this imply a temporary period where the wind connected prior the arrival of Nautilus is in home-market until Nautilus arrives?

- If at that moment there is no certainty that the drivers to create an OBZ are met: YES
- If at that moment there is certainty that the drivers to create an OBZ are met: implementation choice



## Scope of OBZ: situation under 2-node operation



#### **Result:**

- The 1.4 GW wind connected to the DC node is part of the OBZ.
- The 2.1 GW wind connected to the AC node is in home market.

Exception: for a long duration outage of the HVDC or of one of the AC cables, it could make sense to switch part of the production from one side to the other. This would have also an impact on the market setup for those parties. This is to be further analyzed.





# 3. Ideal target model to foster EU's offshore ambition



## North Seas Energy Cooperation and UK establish cooperation framework to facilitate the development of offshore renewable energy





#### Dec 18, 2022

Through this MoU, the EU and UK aim to strengthen their joint action on offshore renewable energy and put in place a framework of cooperation following Brexit. The MoU specifies that the cooperation covers technical and expert dialogue, information exchange and sharing of best practices. The MoU provides a framework that is distinct yet complementary to NSEC's own work. The Commission and the NSEC member state acting as Co-Presidency will now work on the implementation of this MoU.

Welcoming the signature of the MoU, Commissioner Simson said:

"The Memorandum signed today provides the NSEC members and the UK with a basis to cooperate on offshore energy. Given the significant potential of offshore renewable energy in the North Seas, this cooperation is important to help achieve our joint renewable offshore ambitions. The exchanges will build on the successful work of NSEC to deliver concrete outputs."

# What is the most efficient market model: implicit capacity allocation, with OBZ and Advanced Hybrid Coupling





#### Capacity calculation

Capacity of the DC interconnections is provided to the market

2 Core: wind in home-market gets priority access to Core grid through best forecast – *TSO responsibility* 

Core: calculate how much capacity of the Core grid <u>can be made available</u>, jointly for Core interconnectors + UK interconnectors + offshore wind in OBZ

#### **Capacity allocation**

Α

В

**OBZ:** allows competition between wind in OBZ & flows from/to UK for the capacity of the DC link between OBZ and BE

#### Advanced Hybrid Coupling:

Implicit market coupling between, which will be applied in Core as target model.

Advanced Hybrid Coupling is seen as the EU target model. It is from a welfare point of view the most efficient way for the implicit market coupling between regions. Therefore it is important to understand how it works and how it impacts the formation of the price in the OBZ.

## What is Advanced Hybrid Coupling? (1/3)



Each Capacity Calculation Region (CCR) is responsible for calculating the cross-zonal capacity for the bidding zone borders assigned to the CCR. The resulting capacities are submitted as "constraints" to the market coupling algorithm, together with a mathematical representation of "how much capacity of each grid element would be used by each border of the CCR if the market coupling algorithm assigns an exchange to the border".

**Exchanges on bidding zone borders external to the CCR also create flows in the CCR's grid.** For example, the bidding zone border between Norway and the Netherlands is assigned to CCR Hansa yet any market exchange through this border will not only use the capacity of the NorNed HVDC interconnector, but will also capacity of grid elements in CCR Nordic and CCR Core.

There are two ways to take into account how capacity of grid elements in a CCR is used by external borders:

- <u>Standard Hybrid Coupling (SHC)</u>: exchanges on the external border are forecasted during the capacity calculation step <u>currently implemented in Core</u>
- <u>Advanced Hybrid Coupling (AHC)</u>: no forecast needed anymore. The effect of an exchange over the external border is mathematically calculated and used as input for the welfare optimization of the implicit market coupling - <u>implementation is expected in the coming years</u> <u>in the Core, Nordic and Hansa CCRs</u>

Note: the technical concept of AHC can also be applied to HVDC borders inside the same CCR. This is called evolved flow-based (EFB). This solution is already applied today on the ALEGrO interconnector between BE and DE

#### **Current configuration of CCRs**



## What is Advanced Hybrid Coupling? (2/3)



#### Approach in Standard Hybrid Coupling (SHC):

Step 1: what is done in the capacity calculation?

- The exchange over the external border is forecasted.
- The impact of this forecast is seen as a fixed feed-in/feed-out, thus the capacity of a grid element is ex-ante split between how much is used by external borders and how much is available for the bidding zone borders inside the CCR.

Step 2: what is done in the capacity allocation?

- In the market coupling the exchange across the external border is a parameter which can vary between 0 and 100% of the available transfer capacity (ATC) of the border.
- This means that the allocated amount of exchange can be different from what was forecasted...which brings inefficiencies:
  - Forecast < allocated (Underestimation) :
    - Risk of overloading of the grid elements which may require redispatching
  - Forecast > allocated (Overestimation):
    - Unused capacity (causing welfare losses) might remain

These inefficiencies of Standard Hybrid Coupling are not ideal, which is why the target model is Advanced Hybrid Coupling

# Ex-ante capacity split





## What is Advanced Hybrid Coupling? (3/3)

#### Approach in Advanced Hybrid Coupling:

- There is no need to make an ex-ante split of the capacity based on forecasts.
- In addition, the capacity calculation step now also includes the mathematical representation of how much capacity of each grid element is used by market exchanges over the external borders with AHC.
- The available capacity of each grid element is offered directly to the market coupling, together with the mathematical representation of "how much capacity of each grid element is used by each border".
- The market coupling has now all information to decide how to allocate the available capacity most efficiently across all borders in order to maximize the welfare.





## Application of the target model on MOG



#### Target model assumed:

- Implicit market coupling with UK
- Advanced Hybrid Coupling (to UK and to Denmark)
- DC breaker technology available (Triton is connected to MOG II)



#### There are two set-ups possible for the application of AHC

#### Set-up A: 1-sided Advanced Hybrid coupling:

- AHC is applied on the BE side of the OBZ
- The connection to the other bidding zone remains in ATC. This is likely the set-up when UK returns to implicit market coupling

#### Set-up B: 2-sided Advanced Hybrid coupling:

- AHC is applied on the BE side of the OBZ
- AHC is also applied on the connection to the other bidding zone = likely set-up for DK interconnector

A mix can exist, for example where the interconnector from the OBZ to UK applies ATC (1-sided AHC) and the interconnector from OBZ to DK applies AHC (2-sided AHC).

\*AHC represents the technique to model the impact of offshore exchanges (interconnector + wind) to the onshore hub. It does not take prejudice whether the bidding zone borders OBZ-BE and OBZ-DK are external or internal borders of the Core FB region.

## Effect of Advanced Hybrid coupling on price of the OBZ



#### Set-up A: 1-sided AHC = likely set-up for Nautilus once UK returns to implicit

- Flow-based allocation: in case of congestion in the Core Flow-Based region, a price delta will occur between all bidding zones of the Core region. This also applies to the OBZ.
- The price of the OBZ can be:
  - The same as the price of the BE bidding zone. When? If there is no congestion in the FB region  $\rightarrow$  all FB bidding zones see the same price
  - Different from the BE & UK bidding zone price. When? If the congestion in the FB region does not limit the flow on the interconnector between OBZ & UK.
  - The same as the price of the UK bidding zone. When? If the congestion in the FB region limits the flow on the interconnector between OBZ & UK.



Note: for the purpose of this example, it is assumed that only 800 MW wind output from MOG II was expected and offered to the Day-Ahead market coupling

## Effect of Advanced Hybrid coupling on price of the OBZ



#### Set-up B: 2-sided AHC = likely set-up for Triton

- With 2-sided AHC, both sides of the OBZ are subject to the effect of the FB allocation.
- This has an impact on the price formation of the OBZ and can lead to situations where the price of the OBZ is going beyond the price range of the connected onshore hubs.
- This effect is caused by non-intuitive exchanges. A non-intuitive exchange is an exchange from a high to a low price zone. This exchange
  frees up capacity in the FB region, hereby making room for other exchanges to generate more welfare.
- The price of the OBZ can therefore be:
  - The same as the price of the BE bidding zone. When? No congestion in the Core FB region  $\rightarrow$  all Core bidding zones see the same price
  - The same as the price of the DK bidding zone. When? No congestion in the FB region at DK side  $\rightarrow$  all bidding zones on DK side see same price.
  - Different from the BE & DK bidding zone price. The price of the OBZ can be in between, but can also be higher or lower.





Example 1 – OBZ price is lower than BE & DK: there is congestion in the Core FB region. An export from BE to OBZ frees up capacity on the congested element to enable other exchanges in the Core region generate more welfare The allocation will realize this export even if this lead to a non-intuitive price difference between BE and OBZ.

Example 2 – OBZ price is higher than BE & DK: there is congestion in the DK region. An import from OBZ to DK frees up capacity on the congested element to enable other exchanges in the DK region generate more welfare The allocation will realize this import even if this lead to a non-intuitive price difference between OBZ and DK.



## 4. Legal framework to define OBZ





**Commission Regulation (EU) 2015/1222 (CACM)** of 24 July 2015 sets out detailed guidelines on cross-zonal capacity allocation and congestion management in the day-ahead and intraday markets. Articles 32 and 34 of the CACM set out rules on review of bidding zone configuration.

➔ full bidding zone review process = heavy process taking 2-3 years to come to a decision to review the bidding zone configuration

**Commission Regulation (EU) 2019/943 (CEP Regulation)** of 5 June 2019 on the internal market for electricity offers the possibility to follow CEP Article 14 instead of CACM

→ offers an alternative way to decide on a review of the bidding zone configuration without having to apply the full bidding zone review process

## A national approach with relative short lead times is possible



- **Step 1:** Elia writes a structural congestion report. Content of the report is not pre-determined. Elia's preliminary view:
  - Explain the anticipated structural congestion by referring to the hybrid grid design approved in most recent national development plan. Explaining the triggers, the status of implementation of those triggers, etc.
  - Introduce OBZ and the conditions to be met for the OBZ to be an efficient solution to manage the structural congestion.
  - Justify introduction of OBZ has a negligible impact on the neighboring TSOs → decision can be made by Belgium alone
- Step 2: CREG approves the structural congestion report. This comes along with a <u>public consultation</u> as per national rules. Anticipate this takes <u>3 months</u>.
- Step 3: Elia and CREG notify the neighboring transmission system operators that, on basis of the approved structural congestion report, Belgium initiates a review of its bidding zone configuration.
- Step 4: Belgium as Member State has 6 months to consult the relevant stakeholders, take a reasoned decision on the creation of an OBZ and notify this to ACER & EC. The decision should mention an implementation date.
  - Relevant stakeholders
    - CEP regulation Art 14(7) states other Member States may submit comments
    - CEP is not explicit on who are the relevant stakeholders and hence if a public consultation is required. When we more concretely prepare this process, it is to be assessed if the public consultation organized by CREG in step 2 is sufficient.
  - Reasoned decision: content is build up in previous steps. Best practice to wrap-up comments received (if any) from relevant stakeholders and how these have been taken account of.
  - Implementation date: hints that the decision can be made sufficiently firm
- Step 5: Publication of the decision

## Approach to integrate OBZ in the MOG II planning





With a lead time of 2-3 years, the formal process to create the OBZ can be initiated when there is a firm decision on the implementation of the drivers of the OBZ

years

2-3



## 5. Annex: list of received questions and our answers on topics "Market design" and "OBZ process"





| Questions Market design   | Answers   |
|---|---|
| Regarding AC or DC connection for offshore generation, does it have an impact on the OBZ of HM choice?  | Tackled in today's presentation   |
| What would be the governance of such a OBZ - role of TSO, of regulator?   | <ul> <li>This is prescribed by European legislation</li> <li>At one side there is the legal process to establish an OBZ</li> <li>On the other side there are the requirements stemming from CEP, CACM, FCA, SOGL, EGBL that have both</li> <li>o A pan-EU dimension, for example integration into balancing platforms and allocations</li> <li>o A regional dimension as each bidding zone border has to be assigned to a capacity calculation region (CCR) that governs capacity calculation and operational security analysis processes. In addition, there are also SORs (system operation regions) to coordinate some of the activities for which RCCs (regional cooperation centers) are responsible on a level at least as large as the CCR.</li> </ul> |
| What are the implications of changes in the allocation process for the Nautilus interconnector with the UK (explicit/implicit/advanced hybrid coupling), and is the planning for these changes compatible with the timeline of the offshore wind auction in Belgium?  | Tackled in today's presentation   |
| What are the detailed implications and pro's and con's of alternative regulatory solutions, as f.i. deviation and/or derogations to the EU framework? A full mapping and detailed comparison is deemed appropriate.   | Exemptions and derogations from 70% regulation do not offer a proper (market-<br>based) solution to manage the structural congestion.   |
| What is the long-term perspective of the evolution of the proposed offshore<br>bidding zone and related interconnectors/export capacity? Will the Belgian nodal<br>offshore bidding zone in the future merge with other offshore bidding zones to<br>create a large zonal bidding zone? This long-term view is essential for the offshore<br>wind developers to be able to develop their view on price and volume expectations<br>in order to prepare their bids; | The purpose of the OBZ is to manage structural congestion efficiently, so we expect OBZs to emerge on a case-by-case basis where a hybrid set-up is being implemented.  |



| Questions Market design  | Answers  |
|--|--|
| What is the market arrangement for the period starting with the first operational wind farm in the PE zone and ending with the realization of the Nautilus interconnection with UK? In this period without interconnector, will a Home Market arrangement be put in place?   | Tackled in today's presentation  |
| What in case the Nautilus project experience delays, will there be any liability arrangement be put in place?  | Please elaborate your question   |
| Can you provide an overview of the DA prices in the UK for the last [2-3] years and the occurrence of negative prices, in comparison to BE DA prices?  | Link to public available information through ACER : Microsoft Power BI   |
| Does a NEMO (Epex, Nordpool,) need to open a new market for the OBZ (DA and ID)? If yes, has this been discussed with the Nemo's? Is the timing towards implementation compatible?   | Tackled in today's presentation: the OBZ will indeed have to be integrated into the SDAC/SIDC systems, and such implementation track is to be started up when the formal process to decide on OBZ is started.  |
| Elia TF MOG2 1 April 2022: "Our goal is to create visibility on the market integration and grid design scenarios, whilst acknowledging these are inherently subject to legal/political context. This visibility should help the assessment of volume risk by parties bidding into the tender."   | Tackled in today's presentation  |
| According to Elia, when a hybrid interconnector is built, the use of an OBZ is<br>better than the 'home market approach' to optimise the use of the limited grid<br>capacity. Can Elia share the calculations which demonstrates that the OBZ market<br>design in the specific case of the PEZ provides additional social welfare for the<br>Belgian society compared to the home market design? The conclusions of large-<br>scale theoretical and generalized assessments demonstrating the merits of OBZ<br>on social welfare may not apply to a bidding zone located this close to its home<br>market. | <ul> <li>Under a home market design the transmission capacity between Energy Island<br/>and coast will have to be ex-ante split during the capacity calculation process in D-<br/>2 based on forecasts. Forecasts come along with forecast errors, leading to<br/>situations where:</li> <li>Forecast of offshore wind is underestimated =&gt; redispatch needed</li> <li>Forecast of offshore wind is overestimated =&gt; underutilisation of the capacity<br/>thus welfare loss</li> </ul> |



| Questions Market design  | Answers   |
|--|---|
| Can you explain the difference between re-dispatching costs and congestion<br>rents, and how they are dealt with in Elia? Are they passed-through via the tariffs<br>(i.e. redispatch costs leading to higher tariffs and congestion rents leading to lower<br>tariffs)? Do both redispatching costs and congestion rents incentive the TSO to<br>invest in grid-capacity? | <ul> <li>Redispatch Redispatch is a corrective action taken after the market coupling to keep the grid secure. The process of redispatch and the sharing of its associated costs is for Elia's grid (being part of CCR Core) subject to the respective Core methodologies. Redispatch costs are pass through to the tariffs, whilst at the same time Elia is being incentivized to keep these costs low.</li> <li>Investing in the grid is driven by a TOTEX approach. So indeed, an increasing level of redispatch cost (OPEX) leads in a natural way to look at grid investments (CAPEX) to alleviate the congestion.</li> <li>Congestion rent Congestion rents are a direct result of allocations. Allocations exist already for yearly, monthly and daily timeframes and are being implement for the intraday timeframe. The use of congestion rents is regulated (2019/943 regulation Article 19) and is to be used for: A) guaranteeing the actual availability of the allocated capacity including firmness compensation. B) maintaining or increasing cross-zonal capacities through optimisation of the usage of existing interconnectors by means of coordinated remedial actions, where applicable, or covering costs resulting from network investments that are relevant to reduce interconnector congestion.</li> </ul> |



| Questions OBZ process   | Actions/Answers  |
|---|--|
| What are the legislative changes required to introduce an OBZ for the PE zone (at BE and EU level)?   | Tackled in today's presentation  |
| What is the process and timeline to define the regulatory framework for the introduction of an OBZ for the PE zone, both at a national and at and EU level?   | Tackled in today's presentation  |
| Who finally decides whether or not an OBZ will be installed? If this is the Minister of Energy, have discussions with the Cabinet been started? Are they been involved?   | Tackled in today's presentation. Yes, they have been involved.   |
| What is the planning of Elia to implement these changes and how does it match with the planning of the offshore wind auction, without introducing additional delays?  | Tackled in today's presentation  |
| Has the UK or National Grid formally approved the concept of the OBZ? Should they? By when? What if they don't?   | No   |
| When the OBZ has evolved and multiple interconnectors have been installed between other countries, will the OBZ still be governed by Elia or governed/transferred by/to a new entity at EU level (offshore TSO?)? | The purpose of the OBZ is to manage structural congestion efficiently, so we expect OBZs to emerge on a case-by-case basis where a hybrid set-up is being implemented. |



# Thank you.

