

# Delivering the European Offshore Electricity System

Public workshop | 06 June 2023 | Brussels



Join at  
**slido.com**  
**#3963 128**



Join at  
**slido.com**  
**#3963 128**



# Introduction

Gerald Kaendler, Chair of ENTSO-E System Development Committee

# Housekeeping rules

## 1. Join the conversation

Go on <https://www.slido.com/> and enter **#3963128**

Or scan this QR code



## 2. Know the rules



- This session is recorded -> Slides will be available on [entsoe.eu](https://entsoe.eu)



- All remote participants are muted by default



- No questions in the chat -> use Slido, in person attendees please raise your hand

# Agenda

Join at

**slido.com**

**#3963 128**



10.00	<b>Introduction</b> by Gerald Kaendler, Amprion
10.15	<b>The future of offshore</b> Antje Orths, Energinet Vasiliki Klonari, WindEurope Antonella Battaglini, Renewables Grid Initiative Q&A moderated by Bojana Mihic (TenneT) and Bente Haaland (Statnett)
11.30	Coffee break
11.50	<b>How to develop the needed offshore infrastructure</b> Introduction by Joachim Balke, European Commission DG Energy About TYNDP 2024 - Rodrigo Barbosa, ENTSO-E ENTSO-E's ONDPs - Antje Orths (Energinet) and Francesco Celozzi (ENTSO-E) Q&A moderated by Edwin Haesen, ENTSO-E
12.45	<b>Conclusion</b> by Gerald Kaendler, Amprion

Join at  
**slido.com**  
**#3963 128**



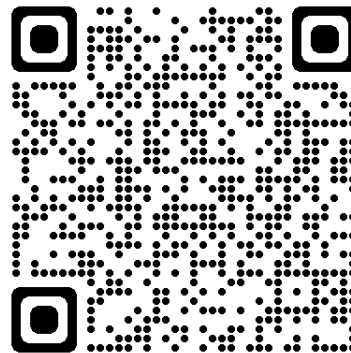
## ENTSO-E's views on the future of offshore

Antje Orths, Convenor of ENTSO-E's Offshore Development Core Group from 2020 to 2022, Energinet.dk



# Context

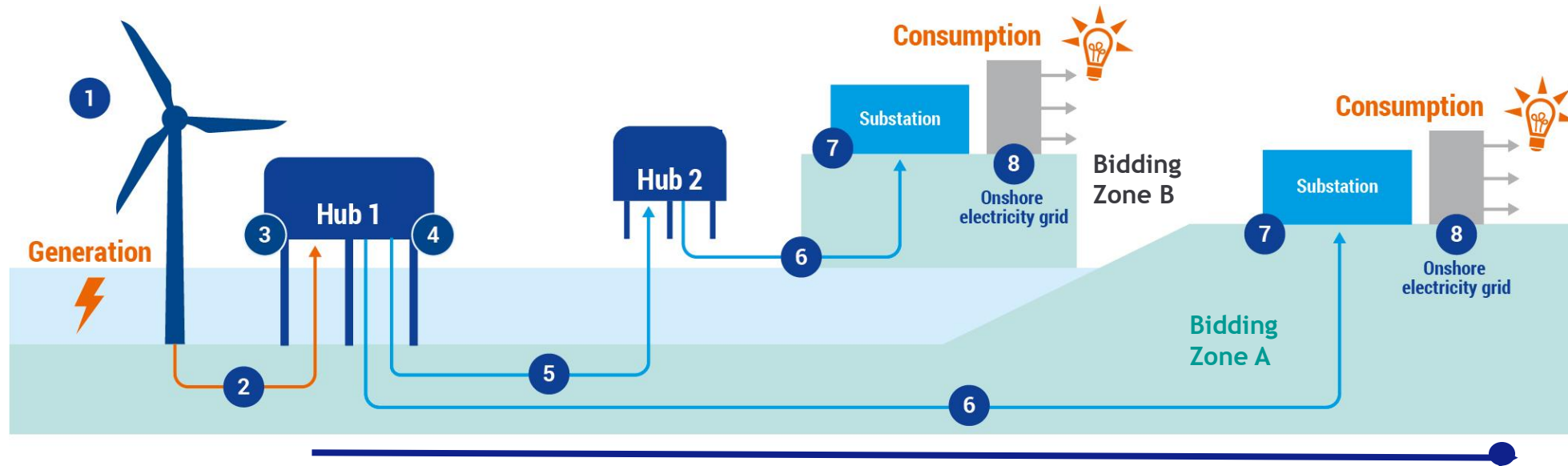
- EC's offshore RES strategy projects 300 GW offshore wind & 40 GW ocean energies by 2050
- ENTSO-E contributes via series of position papers  
<https://www.entsoe.eu/outlooks/offshore-development/>



# Definition and Scope: Offshore Hybrid Projects

## Ensuring a common Terminology onshore & offshore

In ENTSO-E's view, the term “**offshore hybrid project**” refers specifically to the **transmission infrastructure** connecting two countries (or bidding zones) and connecting the OWF to shore. Generation assets are out of scope.



### Asset List:

- 1 Offshore RES
- 2 Cables connecting offshore wind farm to hub

- 3 DC Connection Point
- 4 On hub assets

- 5 Interconnector cables from hub to hub
- 6 Transmission cables from hub to shore

- 7 Onshore Substation
- 8 Onshore Grid Reinforcements

# Ensuring Optimal and Timely Development for the Offshore Systems

The integration of the enormous offshore RES potential offered by the European sea basins form a key building block toward the decarbonisation of the energy system.

ENTSO-E has identified **five pillars for a successful offshore development**, which is key to achieving the European carbon neutrality targets.



**Holistic planning and timeliness**



**A modular and stepwise approach based on consistent planning methods**



**Interoperability, unlocking smarter integrated and secure system operations**



**Keeping energy bills and environmental footprint low through innovation**



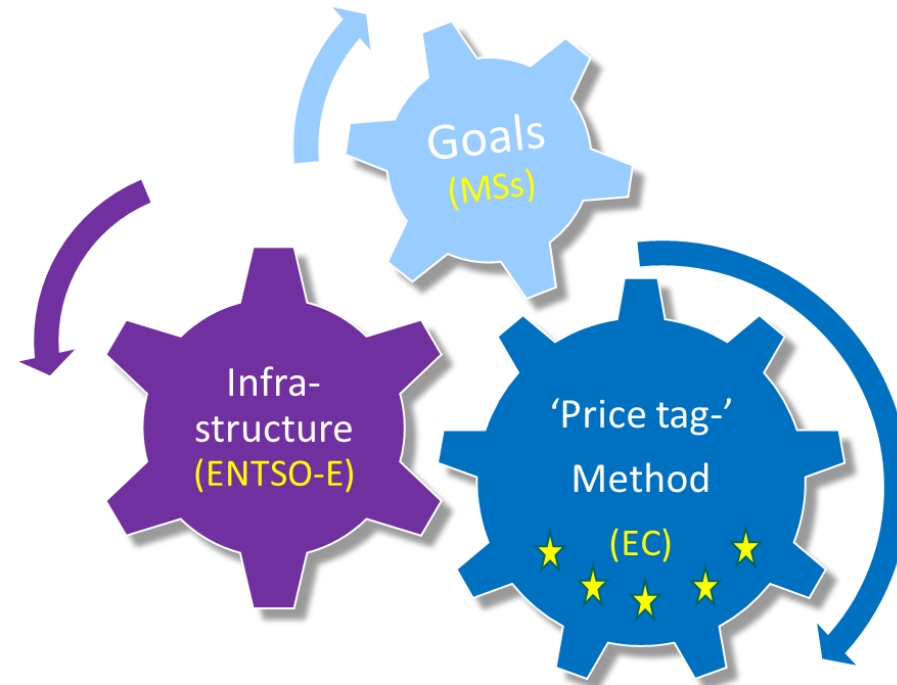
**A future-proof regulatory framework**





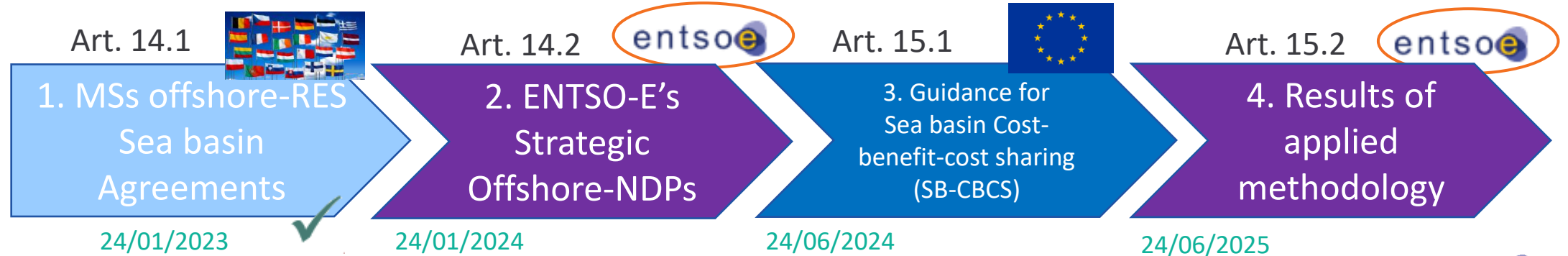
# Revised TEN-E: Enabling Infrastructure Development

TEN-E regulation  
(EU) 2022/869

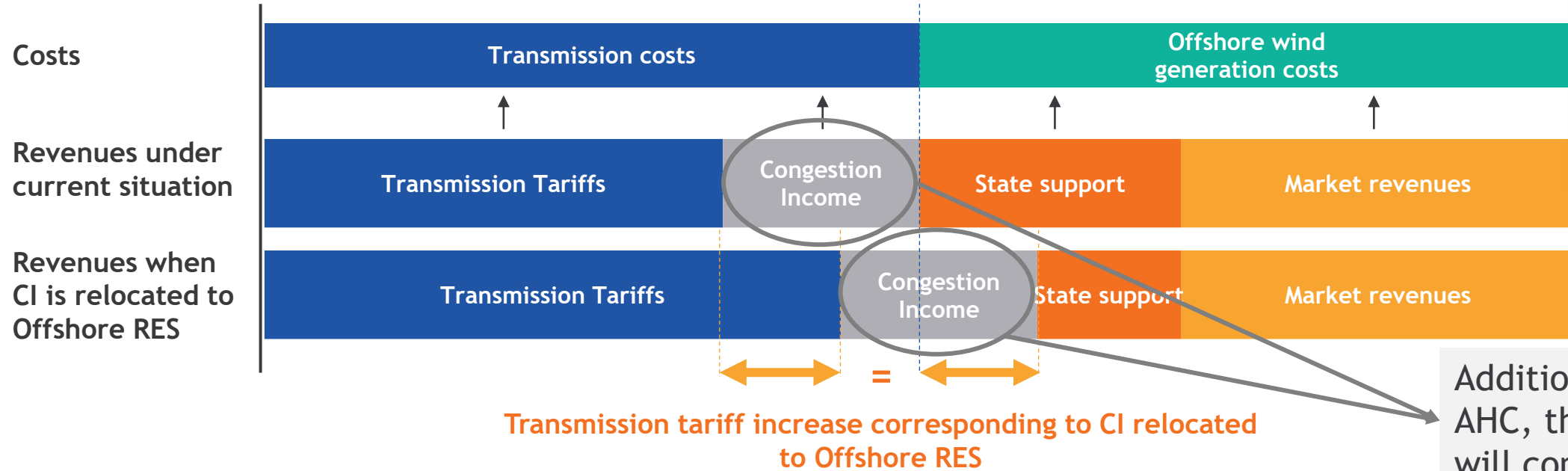
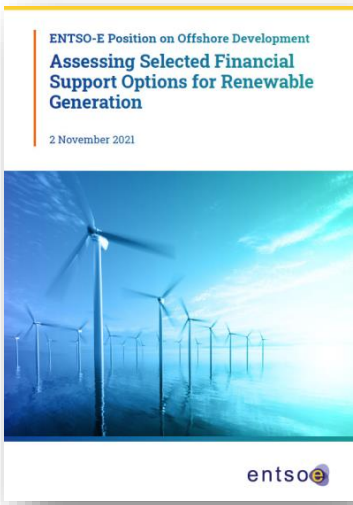


Collaboration  
at all levels  
is essential  
to make this a  
success!

## Who does what ?



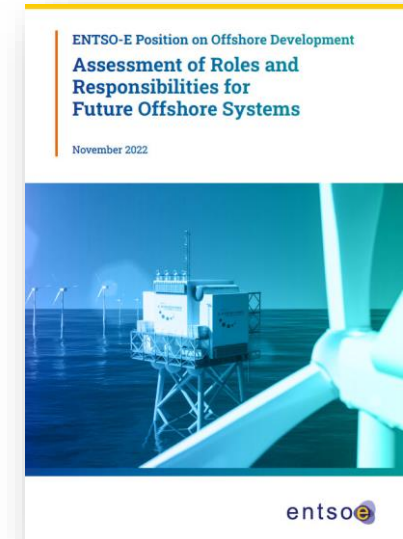
# Dynamics of Congestion Income Re-allocation



Independently from the market organisation (NTC or AHC), reallocating a share of congestion income to offshore RES would violate several articles of several regulations.

# Investigation of Roles and Responsibilities

Models ↓	Network planning	Asset design & building	Ownership	Maintenance	Operation
Onshore TSO	Onshore TSO	Onshore TSO	Onshore TSO	Onshore TSO	Onshore TSO
Offshore TSO	Offshore TSO Onshore TSO	Offshore TSO	Offshore TSO	Offshore TSO	Offshore TSO
Competitive Light	Onshore TSO	Third party	Onshore TSO	Onshore TSO	Onshore TSO
Competitive	Onshore TSO	Third party	Third party	Third party	Onshore TSO
Competitive ISO	ISO Onshore TSO	Third party	Third party	Third party	ISO



# Assessment of the Models

How robust is each model option against each of the following criteria?

	Criteria	Onshore TSO	Offshore TSO	Competitive Light	Competitive	Competitive ISO
Efficient Development and Operations	Anticipatory investments	●	●	●	●	●
	Pace of development	●	●	●	●	●
	Integration of innovative solutions	●	●	●	●	●
	Coordination Onshore-Offshore	●	●	●	●	●
Financing Offshore Infrastructure	Availability of Equity	●	●	●	●	●
	Equity Remuneration	●	●	●	●	●
	Cost Recovery	●	●	●	●	●
	Risks and Liabilities	●	●	●	●	●
Regulatory and Legal Framework	Certification	●	●	●	●	●
	Regulatory Oversight	●	●	●	●	●
	Compliance with existing Regulatory Frameworks	●	●	●	●	●
	Rules for Cost Sharing	●	●	●	●	●
	Permitting process across Countries	●	●	●	●	●

Legend

Model is fit-for-purpose



● Further analysis is needed

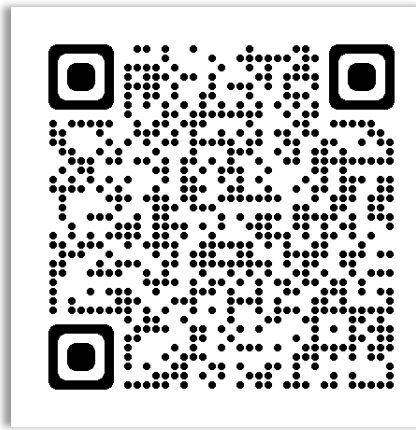
Model poses significant barriers



# Thank you!

Antje Orths  
Convenor ENTSO-E ONDP Central Group

[ano@energinet.dk](mailto:ano@energinet.dk)



Find also our position papers at our dedicated offshore page:  
[ENTSO-E's views on offshore development \(entsoe.eu\)](https://entsoe.eu)



# DELIVERING THE EUROPEAN OFFSHORE ELECTRICITY SYSTEM

Vasiliki Klonari, Head of energy system integration

Maria Kotofolou, Manager offshore system integration

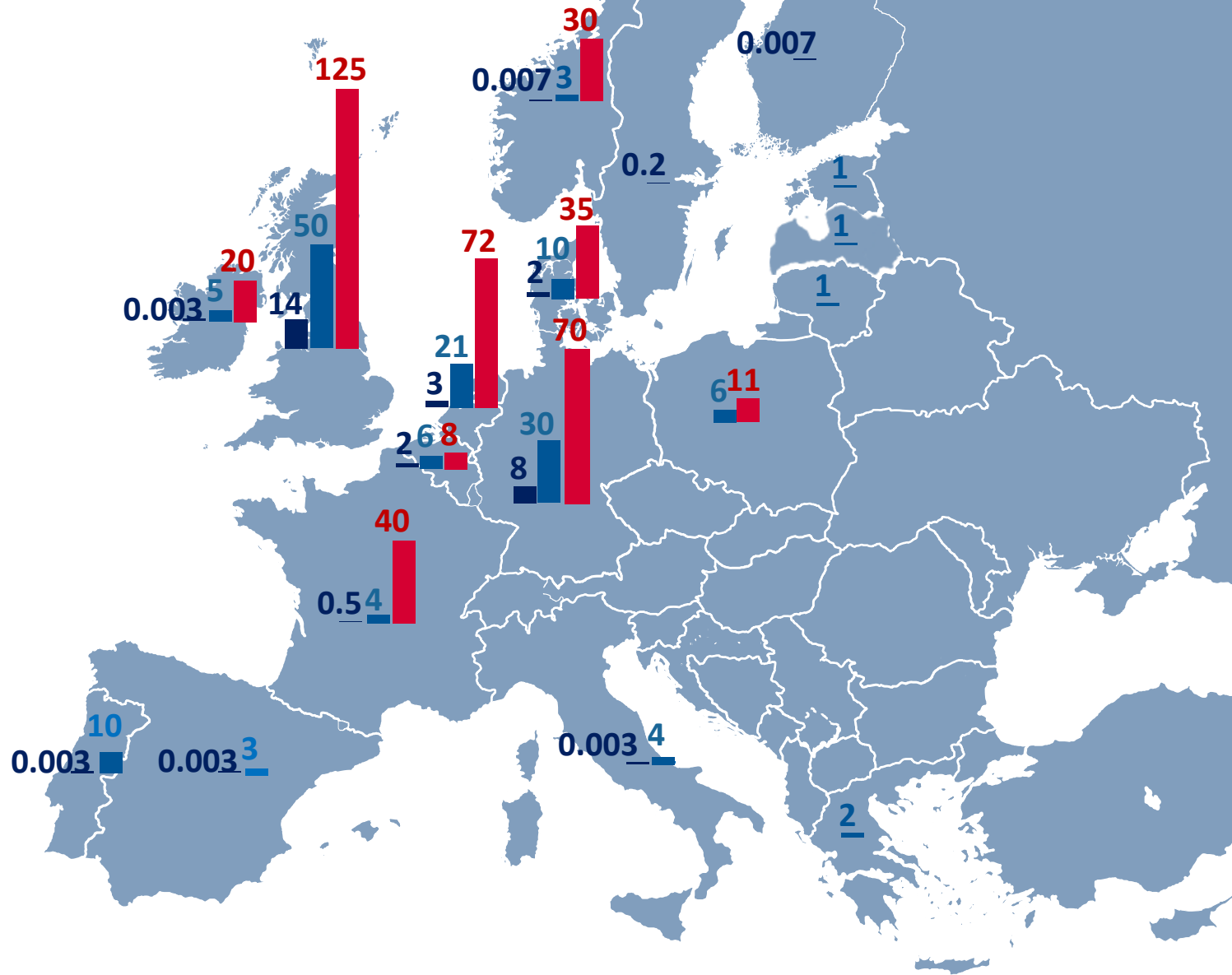
A map of Europe showing the number of COVID-19 deaths per 100,000 people for various countries. The map uses a color scale from blue (low) to red (high). The data is as follows:

Country	Deaths per 100,000
Iceland	0.007
Norway	0.007
Sweden	0.2
Finland	1
Denmark	1
Poland	1
Czech Republic	1
Slovakia	1
Hungary	1
Romania	1
Bulgaria	1
Greece	2
Turkey	2
Italy	3
Spain	3
France	4
Germany	4
United Kingdom	5
Ireland	5
Portugal	6
Greece	6
Italy	8
Spain	8
France	8
Germany	10
United Kingdom	14
Ireland	14
Portugal	20
Greece	21
Italy	26
Spain	26
France	26
Germany	30
United Kingdom	30
Ireland	30
Portugal	35
Greece	35
Italy	35
Spain	35
France	35
Germany	35
United Kingdom	50
Ireland	50
Portugal	70
Greece	70
Italy	70
Spain	70
France	70
Germany	70
United Kingdom	125
Ireland	125
Portugal	125
Greece	125
Italy	125
Spain	125
France	125
Germany	125

30 GW

3%  
of Europe's  
electricity demand

156GW by 2030  
and at least  
437GW by 2050

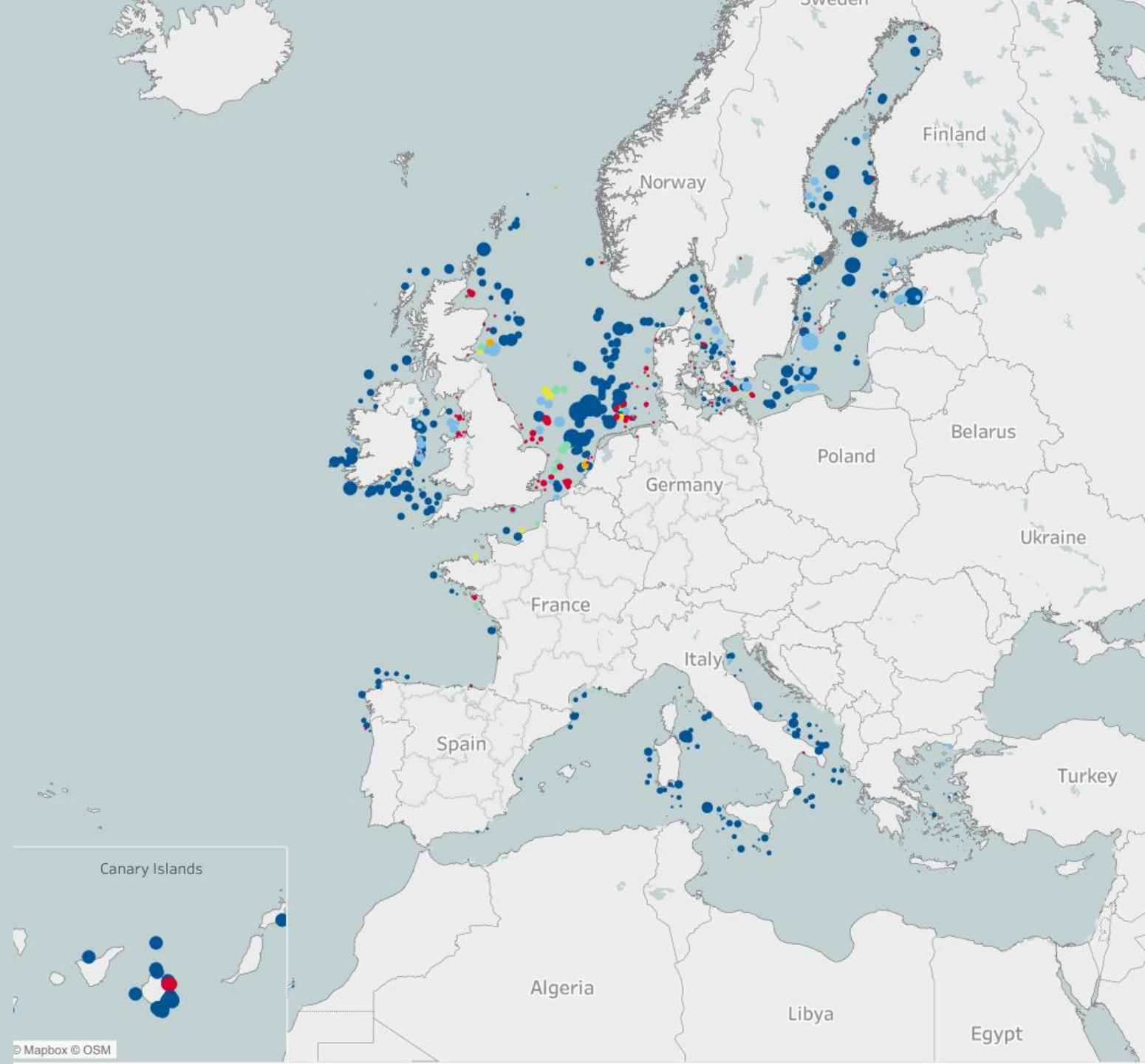


- GW installed
- GW in 2030
- GW in 2050

# Europe's offshore wind farms

## Status of Offshore Wind Projects

- Online
- Partially online
- Under construction
- With permits
- Under permitting procedure
- Planned



# Grid connection

## Point-to-point

- Decisions at national level but require cross-border coordination for uniformity on connection charges and technical requirements
- Some experience gained: more certainty for WF developer/investor

## Offshore hybrids

- Require cross-border coordination on market and technical aspects from early planning stage
- Lack of regulatory framework: high uncertainty for WF developer/investor

# Offshore hybrids on their way

## Project status

- Operational
- Cooperation signed
- Under discussion

Most of them in early conception or intent stage

Connecting up to 40GW of wind

## Offshore hybrid projects

- 1 Kriegers Flak
- 2 ELWIND
- 3 LionLink
- 4 Bornholm Energy Island
- 5 North Sea Energy Island
- 6 North Sea Wind Power Hub
- 7 Nautilus
- 8 Belgian North Sea Island
- 9 Sørilige Nordsjø II
- 10 Baltic WindConnector



# Wind farm developer wish list

- 1) **Timely grid connection** including
  - protection by regulation in case of delays (e.g. onshore grid reinforcement)
  - **temporary** solutions for fast grid access (flexible contracts)
- 2) **Reduce volume risk:** firm export capacity, minimised curtailment
- 3) **Reduce price risk:** market design enabling investment pay back on estimated times
- 4) **Level-playing field across national systems/markets**

# Radial connections

- **Connection charges and rules:** standardised ways to set charges and technical requirements → level playing field across different countries
- **Timely grid access for full requested capacity** including protection against delays, **temporary** flexible connection agreements
- **Efficient incentives and clear rules for system integration,** co-location with other technologies

# Offshore hybrids

- **Volume risk**
  - Impossible to forecast limits in export capacity & price implications (operational deratings\*) in Offshore Bidding Zone

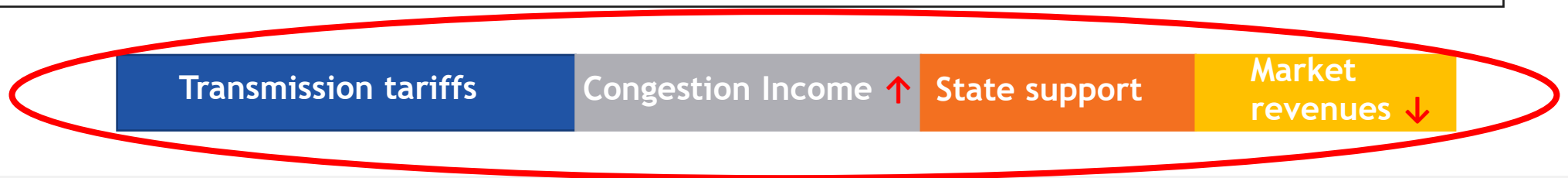
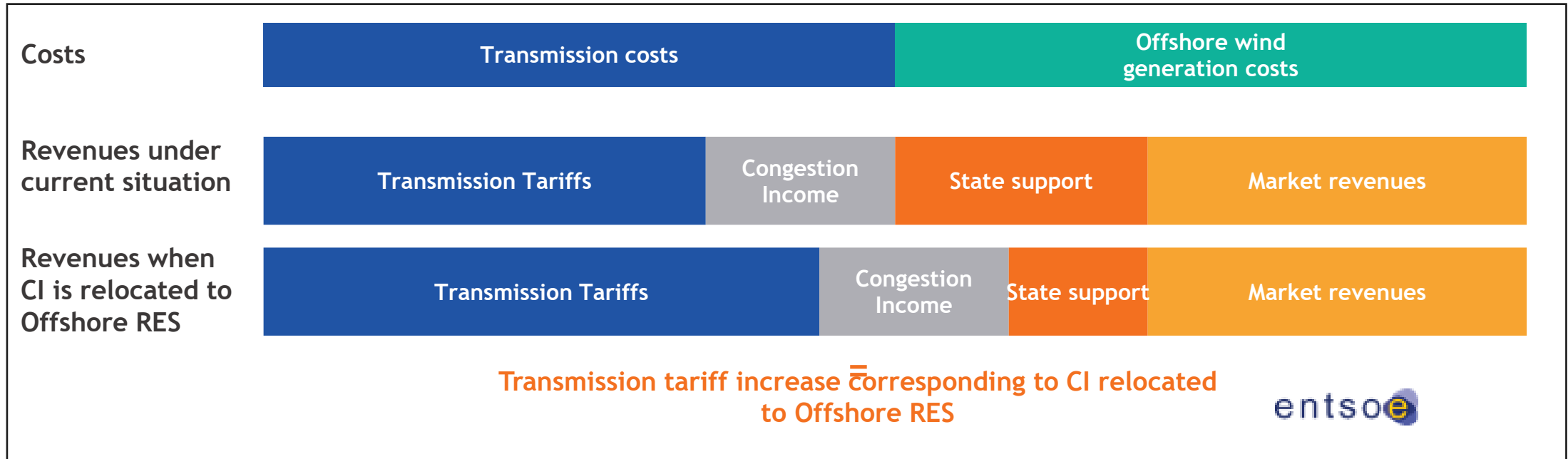
**\*Source:** Engie Impact, Support on the use of congestion revenues for Offshore Renewable Energy Projects connected to more than one market

# EC proposal on market design

## Electricity Regulation

- **Article 19, paragraph 2.c:** We support the proposal but recommend to make it more specific; The compensation paid to the offshore renewable generator shall be proportional to **the higher (incremental) revenue** of the interconnector
- **Article 18:** We support the principle of the proposal about tariff methodologies and the consideration of **CAPEX and OPEX in anticipatory investments to enable optimisation solutions** (including offshore hybrid projects for instance?)
- **Article 50 (and Article 31 of Electricity Directive): Flexible connection contracts** should be available also for generation, both at distribution and transmission level, but temporary until necessary grid reinforcement takes place

# Congestion Income Re-allocation



Urgent to recognize and act with targeted regulatory changes:

- That a dedicated framework is needed for offshore hybrid projects
- Generation is not out of scope but is the scope. The vast majority of these projects will be built to connect wind energy

Otherwise targets and plans for offshore wind deployment will be violated



The logo features the word "Wind" in a large, bold, white sans-serif font, with a small white dot above the final 'd'. Below it, the word "EUROPE" is written in a smaller, all-caps, white sans-serif font. The background of the entire image is a dark, atmospheric photograph of a wind farm on a mountain ridge, with a large, curved blade of a wind turbine in the foreground.

**Wind**  
EUROPE

[windeurope.org](https://windeurope.org)



**WindEurope**, Rue Belliard 40  
1040 Brussels, Belgium

Join at  
**slido.com**  
**#3963 128**



# Antonella Battaglini

CEO, Renewables Grid Initiative

# The Future of Offshore – Q&A Session

10.15 to 11.30

Moderation by  
**Bojana Mihic** (TenneT) & **Bente Haaland** (Statnett)

Go to <https://www.slido.com/> and enter #3963128

In person participants please raise your hand



Join at  
**slido.com**  
**#3963 128**



Join at  
**slido.com**  
**#3963 128**



**COFFEE BREAK (20 minutes)**

Join at  
**slido.com**  
**#3963 128**



## Session 2. How To Develop The Needed Offshore Infrastructure

11.50 to 12.45





# Delivering the European offshore electricity system

European Commission, DG ENER

Joachim Balke

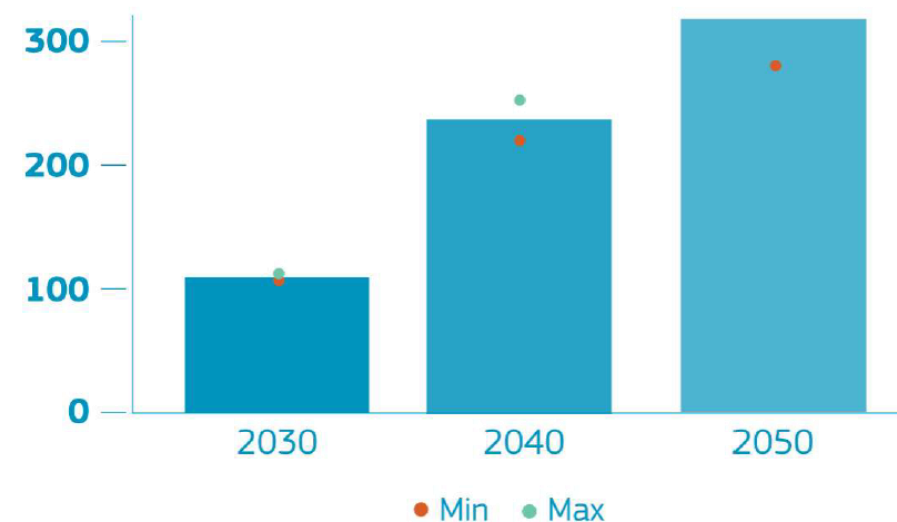
Head of Unit Infrastructure and Regional Cooperation

6 June 2023  
ENTSO-E Workshop

# From Esbjerg to Ostende: higher offshore ambitions will require more cooperation



Non-binding offshore renewable energy goals in the EU  
(in GW)



European  
Commission

## REDII

Overall RES share

**At least 32%**  
EU binding  
MS contributions + formula



## REDII revision

**At least 42.5%**  
EU binding target  
MS contributions + formula  
**+ additional indicative target of 2.5%**



European  
Commission

# Maritime spatial planning

- Maritime spatial planning essential for a **sustainable management of space and resources** (multi-use & biodiversity)
- **Member States to integrate objectives of offshore renewable energy** in MSPs, in line with NECPs and the European Green Deal.
- **Greater North Sea initiative** on energy, nature protection and food (fisheries and aquaculture), launch event in Paris, 23 May 2023

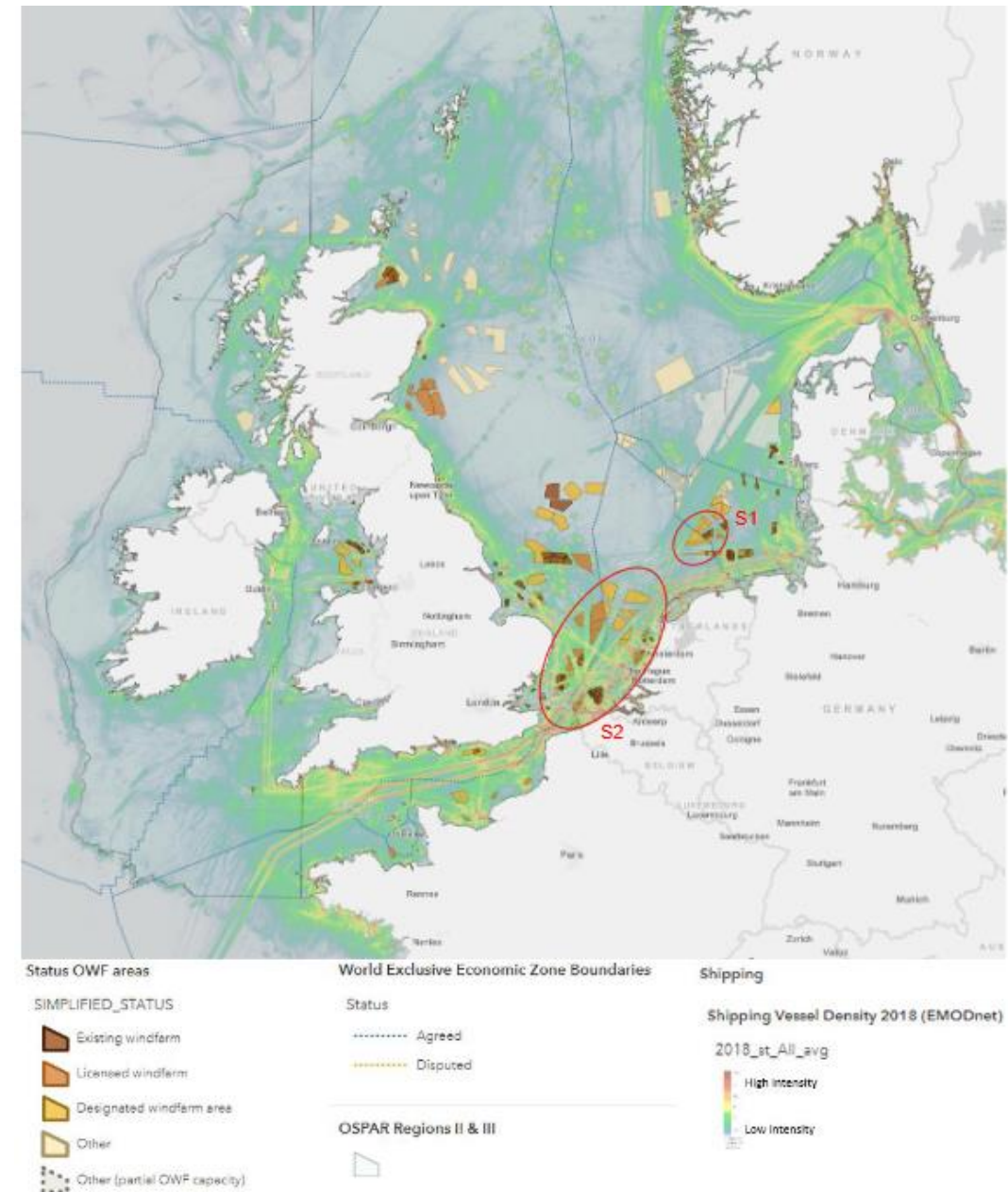


Figure 4.5 Shipping in relation to OWF 2030. Hotspots S1 and S2 identify areas with substantial constraints for shipping.



# Trans-European Energy Networks (TEN-E)

- EU policy framework to accelerate the deployment of **cross-border energy infrastructure – Projects of Common Interest (PCIs) and Projects of Mutual Interest (PMIs)**
- Increased focus on **offshore grids** covered under five dedicated priority corridors reflecting Europe's sea basins and building on **regional cooperation strengths**.
- Adoption of **1st PCI/PMI list covering new offshore corridors** under revised TEN-E by November this year - 13 candidate projects in 4 offshore corridors (radials and hybrids), next RG meeting 9 June

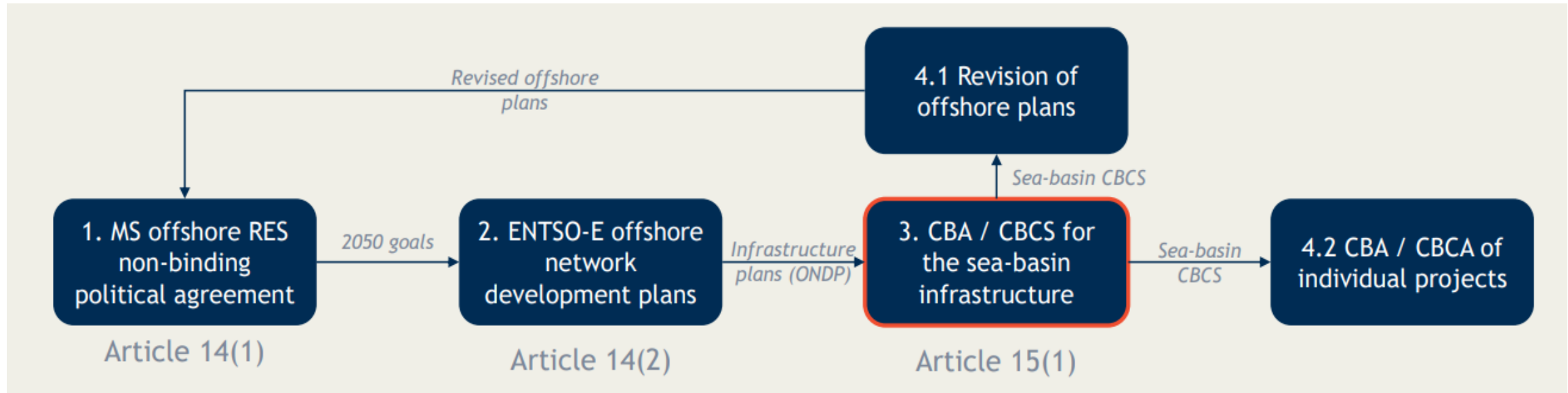
# Offshore network development plans

- High-level outlook on offshore generation capacities potential and resulting **offshore grid needs**
- Potential needs for interconnectors, **hybrid projects, radial connections, reinforcements, and hydrogen infrastructure**;
- **ENTSO for Electricity** with the involvement of the relevant TSOs, the national regulatory authorities, Member States, of the Commission;
- Taking into account **environmental protection and other uses of the sea**;
- **Updated every two years.**



# Allocation of costs and benefits for offshore infrastructure

- **Mid-2024:** Commission guidance on cost-benefit and cost-sharing for the deployment of the sea-basin integrated offshore network development plans
- **End 2024** update of non-binding agreements
- **Mid 2025:** Presentation of the results of the application of the cost sharing to the priority offshore grid corridors by the ENTSO





# Market and investment framework for Offshore RES

## ***Electricity market rules:***

- ☐ Application of horizontal IEM rules
- ☐ Bidding zone configuration
- ☐ Transmission access guarantee

## ***Revenue stabilization instruments:***

- ☐ Contracts for difference
- ☐ Non-price criteria (NZIA)
- ☐ PPAs

# EU financial support

- **Connecting Europe Facility for Energy (CEF):** call for proposal Projects of Common Interest (PCIs): open until **5 September 2023** – **available budget: EUR 750 million.**
- **CEF Renewables and Renewable Energy Financing Mechanism**
- **Recovery and Resilience Facility (RRF)**

=> *EU financial support supplementary to market revenues and national support*

**R&I:** Offshore-related calls in **Horizon Europe**, among others:

- ❖ Wind energy in natural and social environments
- ❖ Innovation on floating
- ❖ Innovative materials and recycling technologies
- ❖ Wave, tidal techs
- ❖ Foundations
- ❖ HVDC interoperability
- ❖ ...

# Conclusion

- Increased offshore ambitions can only be achieved with new approach based on more cooperation
- Enabling hybrid projects remains key, also in view of “squeeze for space”
- Central role of ONDPs and subsequent cost-sharing
- More complex financial and regulatory structures
- Instruments to reduce risk identified, need to conclude ongoing negotiations rapidly

Thank you!

Join at  
**slido.com**  
**#3963 128**

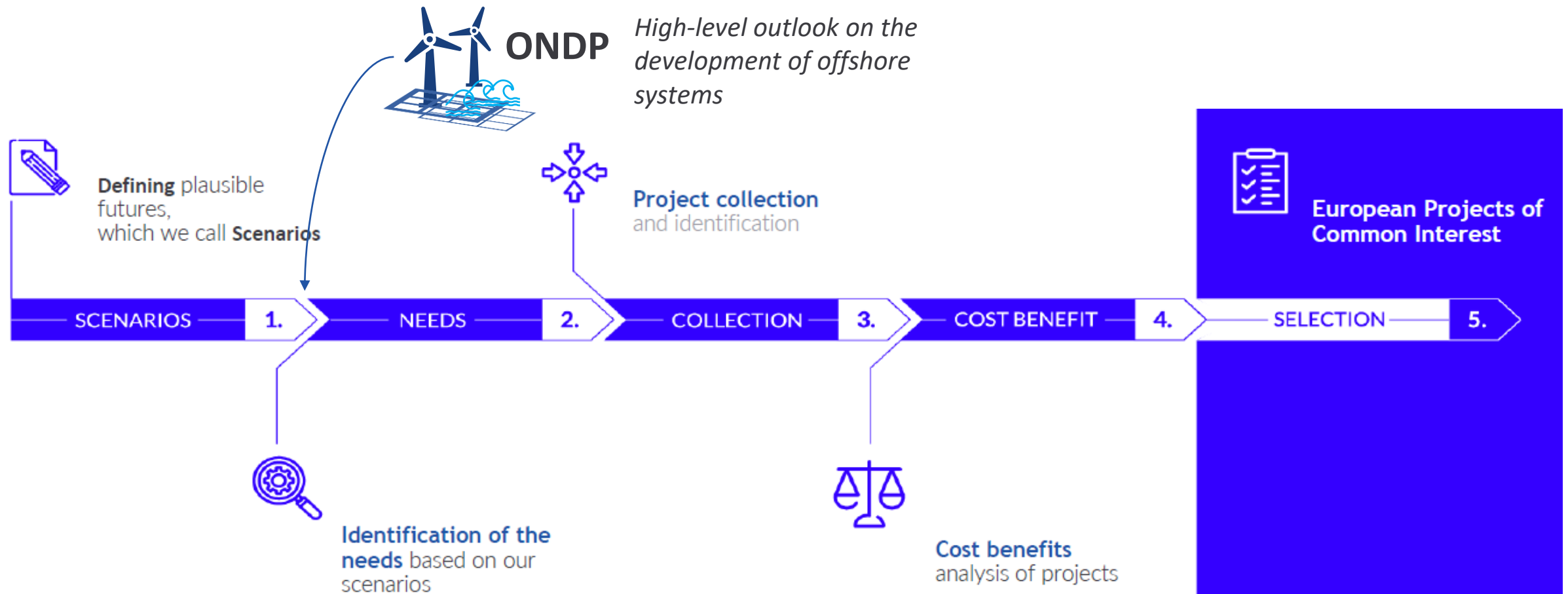


# Offshore Network Development Plans in TYNDP 2024

Rodrigo Barbosa, Long-Term Planning Manager, ENTSO-E

# Offshore Network Development Plans and the TYNDP

The ONDP are a new product part of the TYNDP. They will be developed in coherence with the TYNDP 2024 package.





# The Scope of the Offshore Network Development Plans

The ONDPs, will deliver the following information for each time horizon (2030, 2040, 2050) and sea basin.



## Overview of the Offshore RES capacity clusters located in the different sea basins.

How much RES in the different timeframes?  
Located where? Are there any potential conflicts with other sectors?



## Possible configuration of the transmission infrastructure

What are the possible configurations for connecting the different clusters, considering the space available and the relevant technological assumptions?



## A high-level overview over related transmission categories, as required in Art. 14.2 of (EU) 2022/869: Offshore grid needs, including the potential needs for

- Interconnectors,
- hybrid projects,
- radial connections,
- reinforcements and
- hydrogen infrastructures.

What is the amount of investments per category [km/ number/ €] needed to integrate the offshore RES potential?



*A15(2) - results of the application of the cost-benefit and cost-sharing to the priority offshore grid corridors*

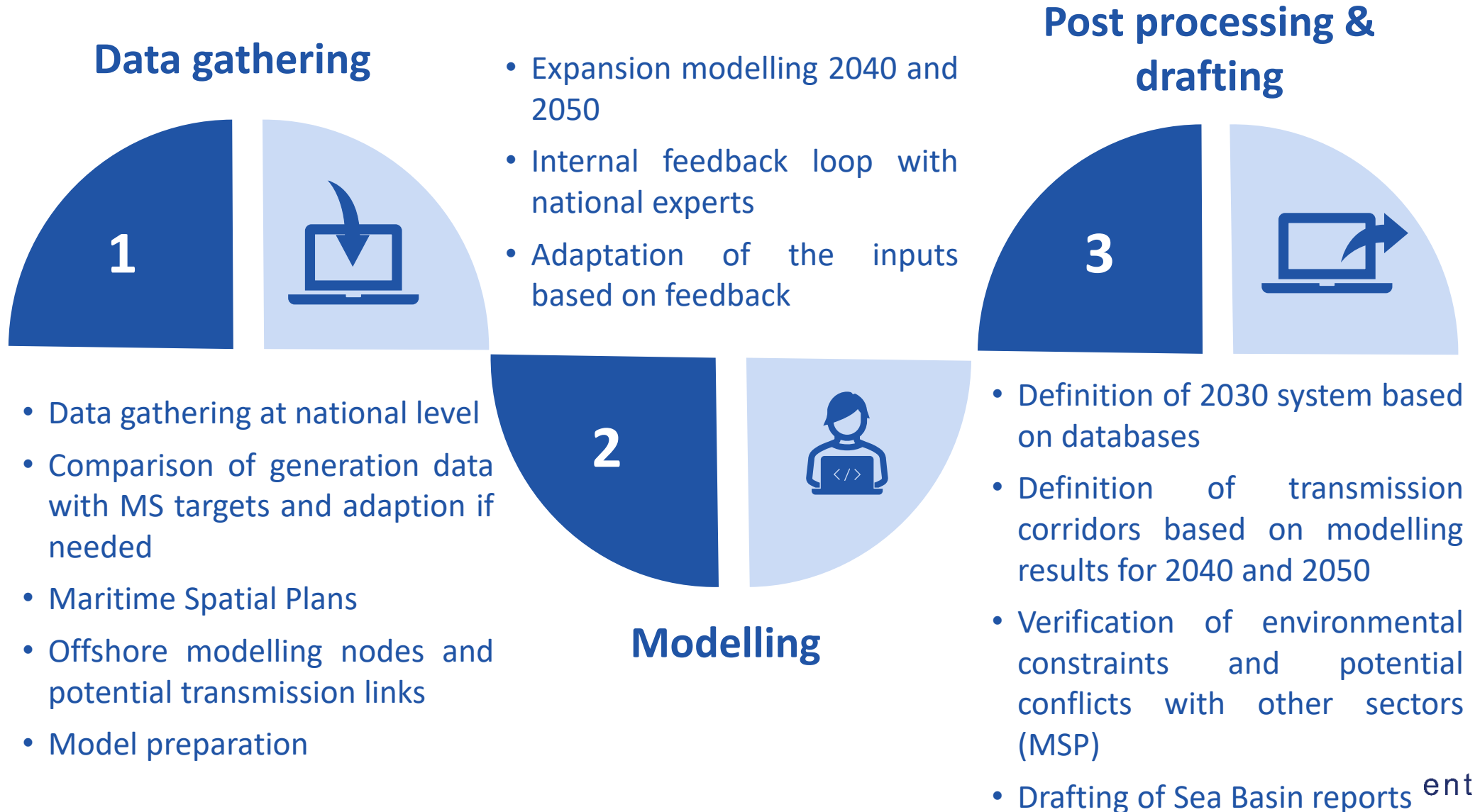
Join at  
**slido.com**  
**#3963 128**



# Offshore Network Development Plans 2024

Antje Orths (Energinet), Convener of the ENTSO-E ONDP Central Group  
Francesco Celozzi, ONDP Project Manager, ENTSO-E

# How is it done?



# Offshore Network Development Plans: integration in the existing TYNDP process

How ENTSO-E is adapting the TYNDP 2022 models with Member States' latest information on offshore RES.

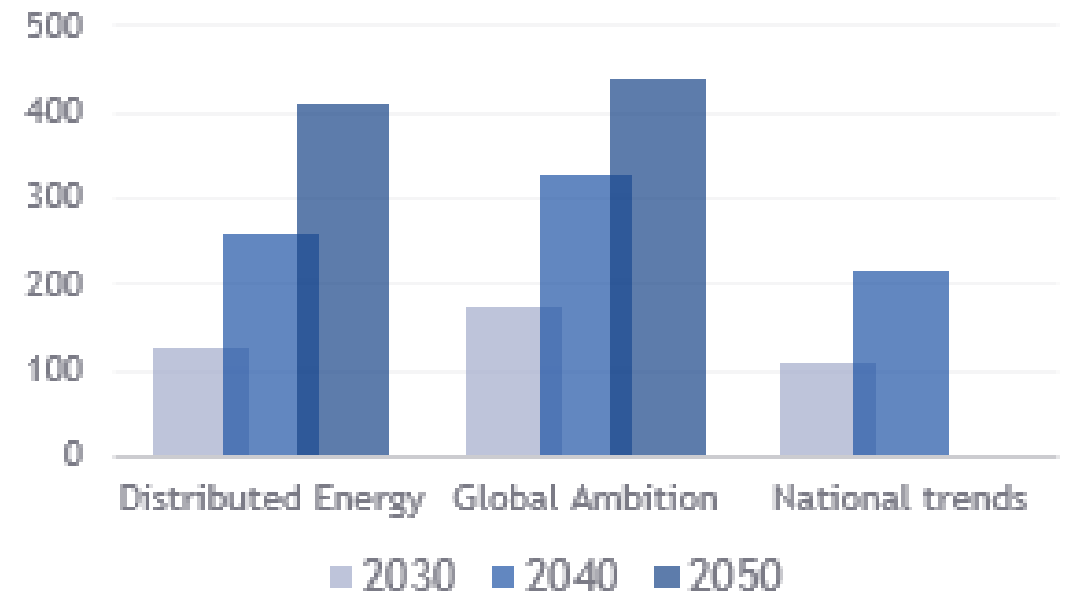
## 1) Updating the offshore figures: Member States' joint targets to be implemented

TYNDP 2022 Distributed Energy scenario is aligned with the overall capacities included in the MS targets., but some further work is needed to ensure model convergence.

## 2) Adapt the input figures to ensure a balanced model and minimize the RES curtailment

## 3) Discuss updated parameters for the expansion model

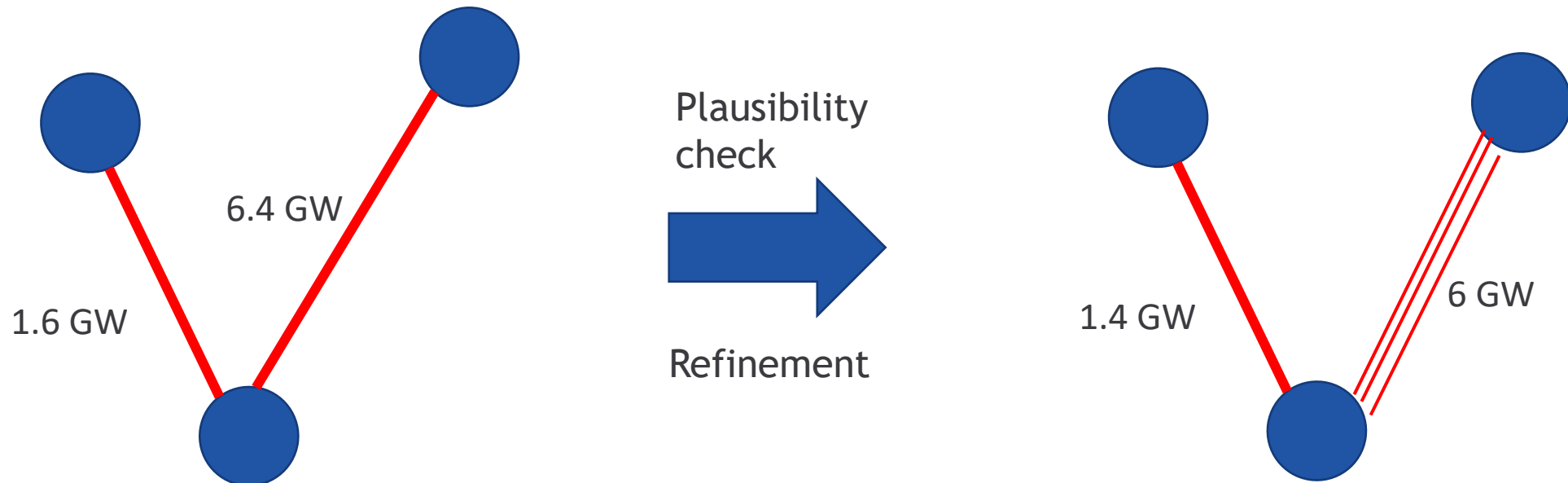
### Offshore wind capacity in Scenarios 2022 [GW]



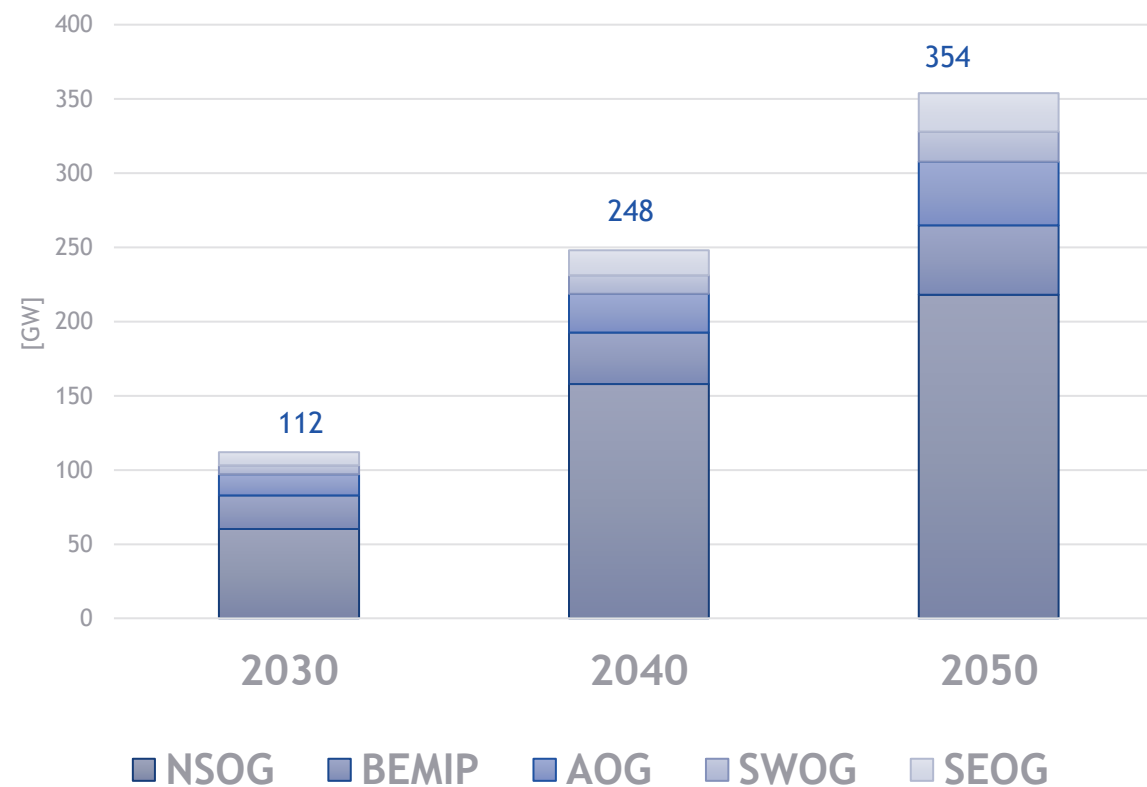
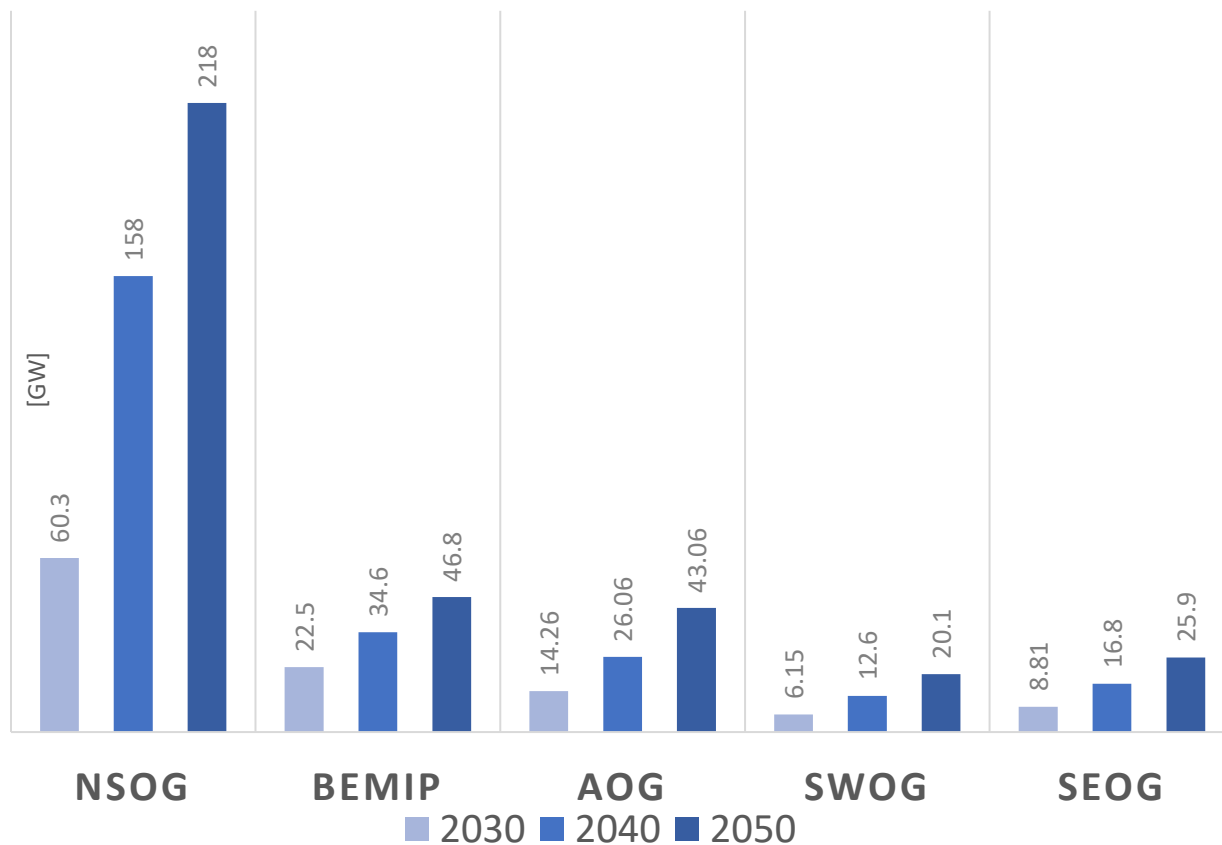
# Offshore Network Development Plans: Modelling Methodology

(EU) 2022/869, Art 14(2): ONDPs must deliver “high-level strategic integrated offshore network development plans for each sea-basin”. - But what does “high-level” mean in practical terms?

ONDPs would translate the term “high-level” as fulfilling the request to deliver information on the **potential expansion of the transmission infrastructure between aggregated offshore generation nodes**. Results are transmission corridors rather than the assessment of single projects.



# Joint Non-binding Member States Agreements on Offshore Goals - 20.1.2023



+ (100 ...150) GW in GB  
+ ~11 GW in NO



# ENTSO-E Guidance Document for the MS

For each time horizon:

2030, 2040, 2050

Higher granularity information on

- Offshore RES Capacities
- Offshore RES Locations
  - > e. g. necessary for cable lengths
- Maritime spatial plans
  - > what do we have to bypass?

Published  
Sept 2022

European Network of  
Transmission System Operators  
for Electricity **entsoe**

## OFFSHORE NETWORK DEVELOPMENT PLANS 2024 – GUIDANCE DOCUMENT

Final Draft -6 September 2022

From: ONDP Central Group

### Disclaimer

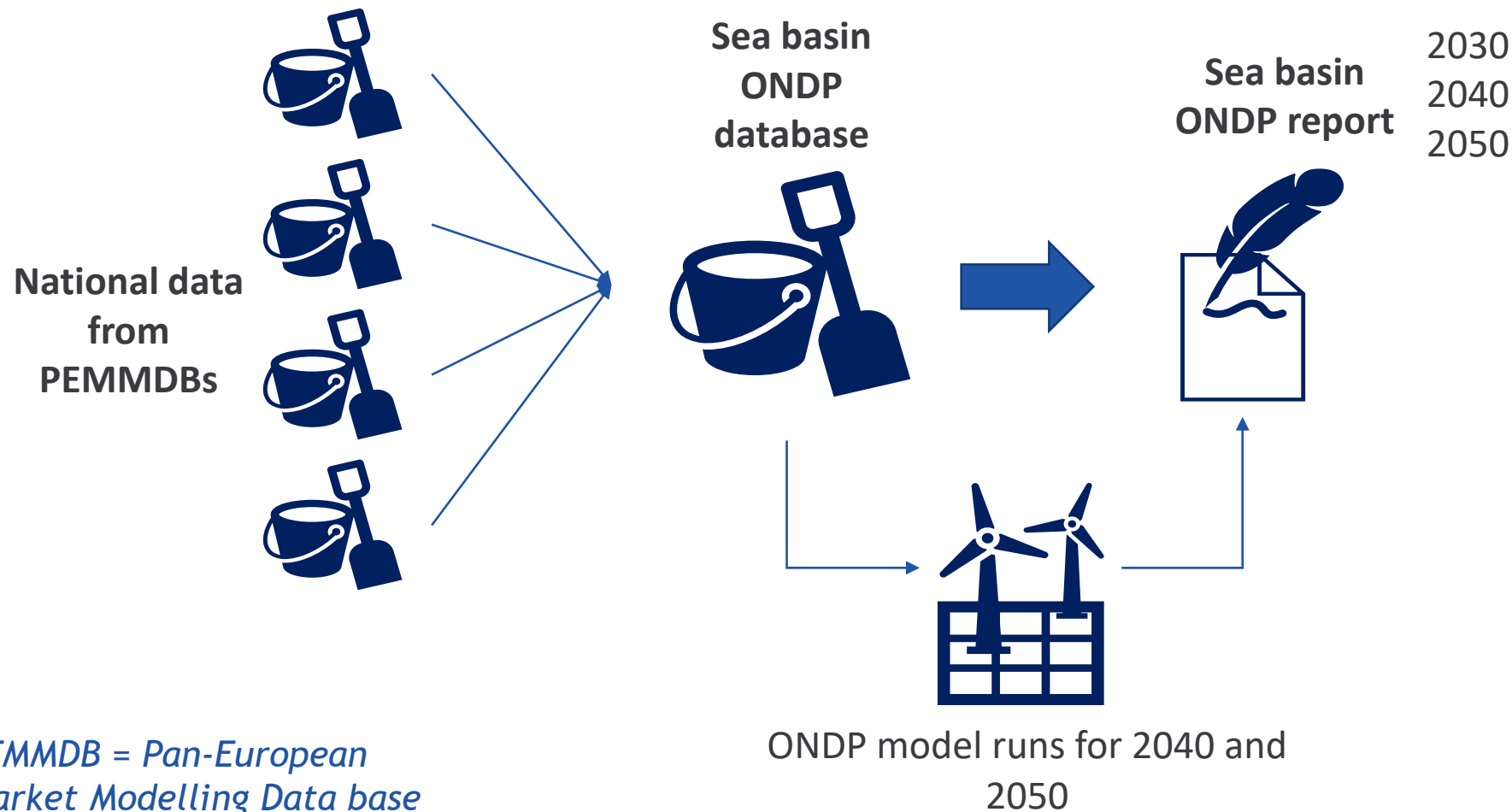
This paper does not present any ENTSO-E or member-TSO position, is not part of the next TYNDP or ONDP itself and should be seen as guidance related to data collection developed jointly with the EC, to provide to TEN-E corridors and high-level groups for the cooperation of Member States.

# **ONDP Methodology – Putting the Modelling Approach into Practice**

## **Step by Step Approach**

# Step 1 – Data gathering and Model Preparation

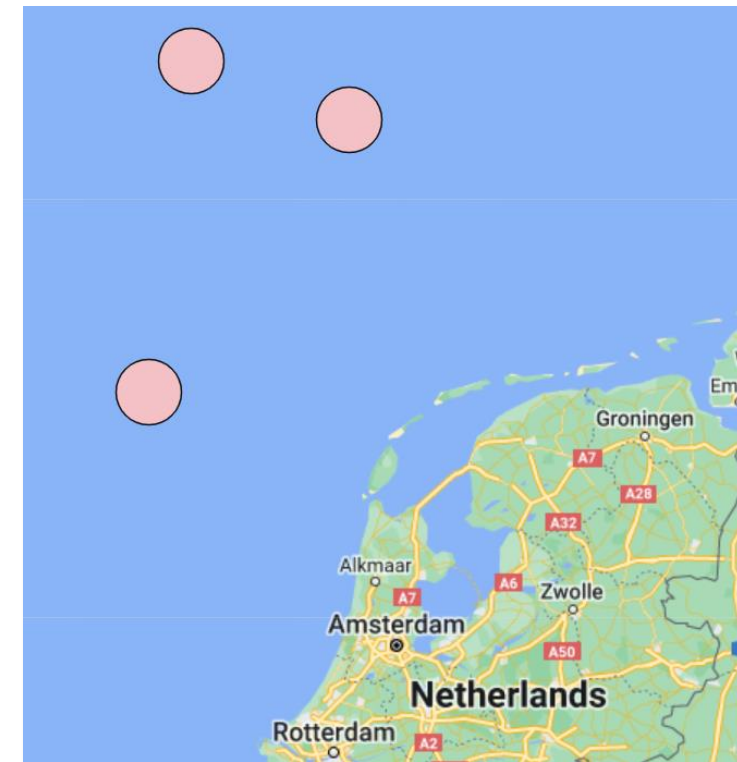
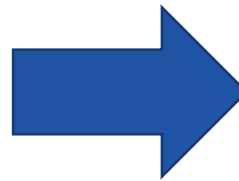
The first step is to ensure that adequate data on offshore are available, and that the TYNDP2022 model is updated



# Step 1 : Definition of offshore nodes and Maritime Spatial Planning

When defining the offshore nodes in the sea basins, ENTSO-E considered the available info from the national Maritime Spatial Planning deliverables.

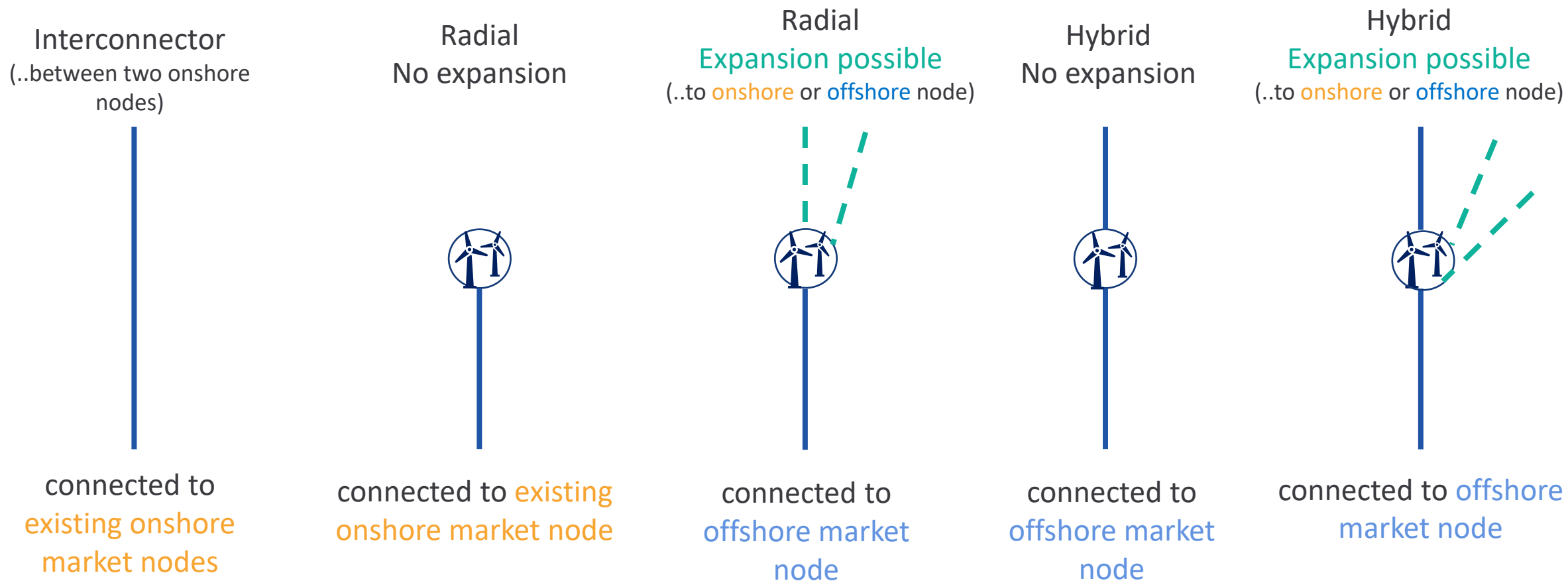
Example of how Netherlands MSP info has been translated into the locations of the aggregated capacities (to be connected through hybrid) to be modelled in ONDP, for the Dutch waters.



*Radial connections are not shown*

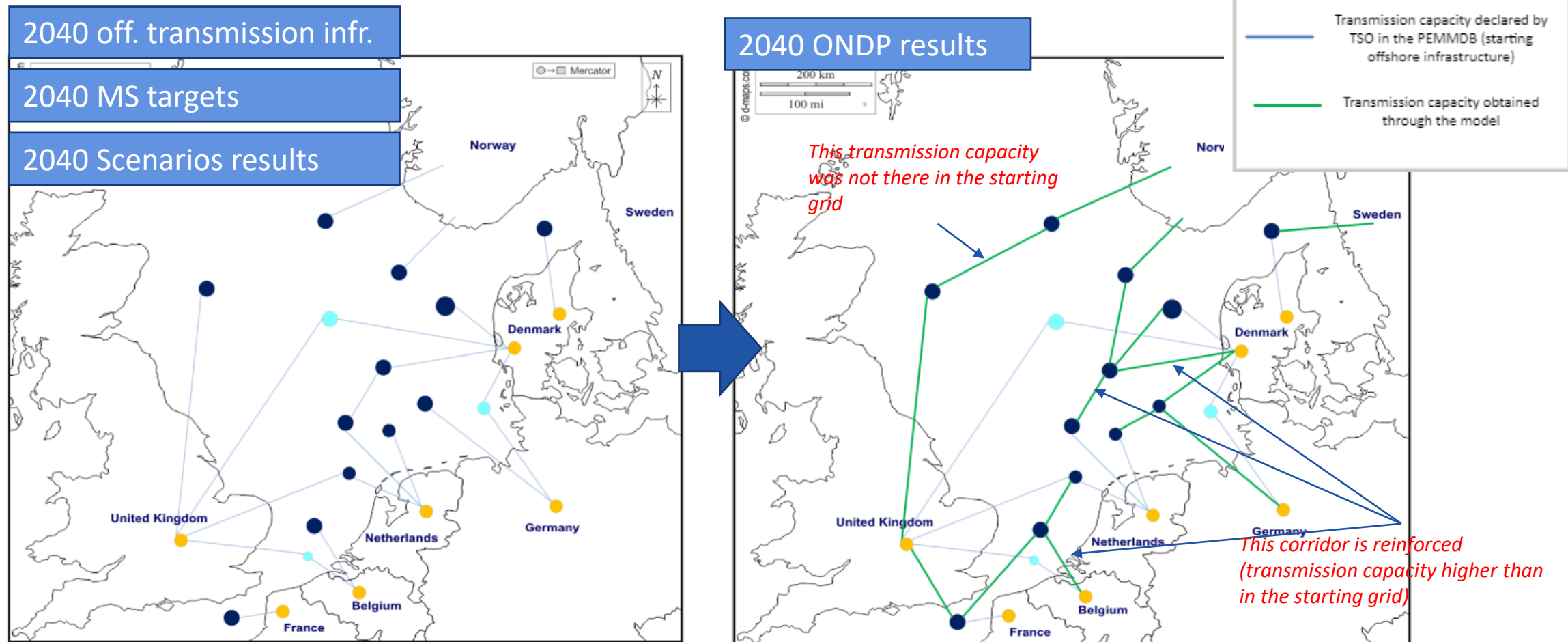
# Step 1 – Data gathering and Model Preparation

ONDPs will cover 5 types of offshore electrical infrastructure, modelled in the expansion models



## Step 2 – Starting grid and modelling runs

The objective is to explore the potential expansion of the offshore hybrid transmission infrastructure and interconnector to integrate offshore RES.

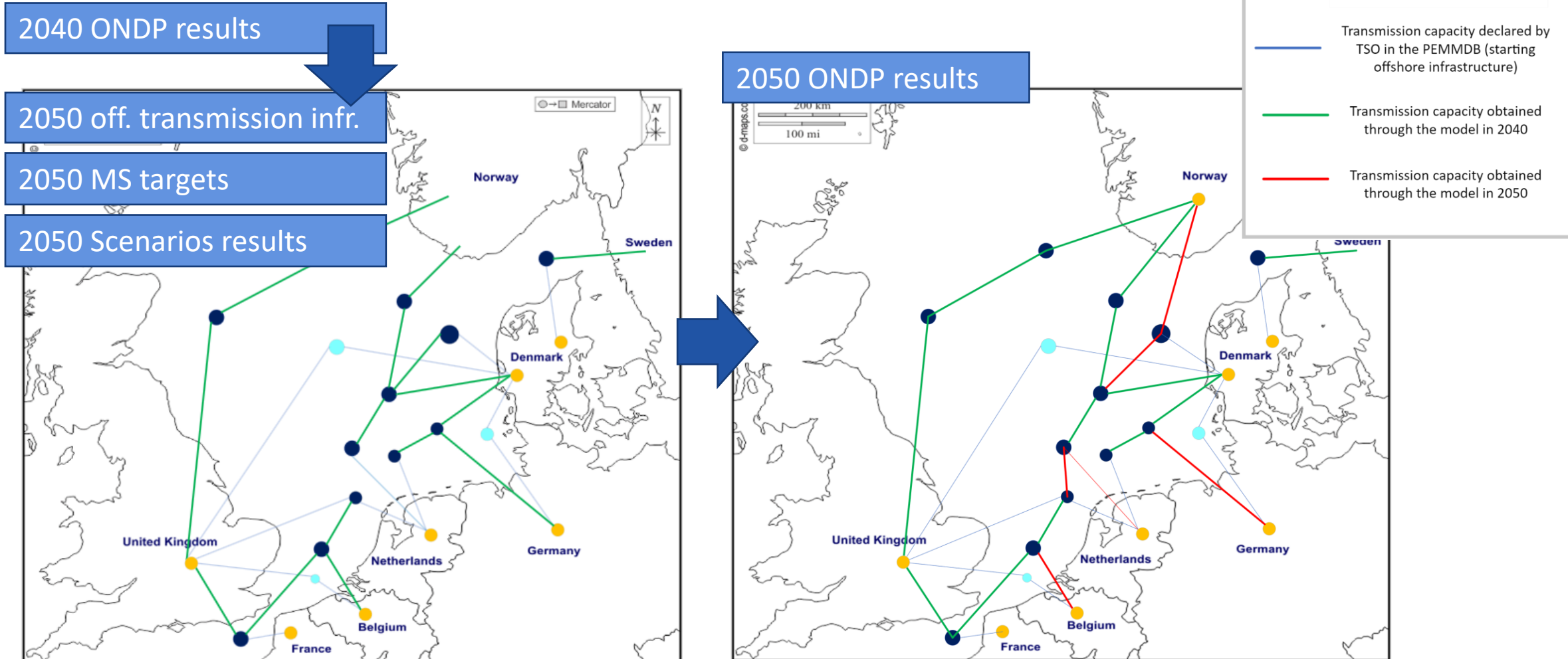


The map is a qualitative representation of the potential structure of the offshore model in the North Sea, not based on the real data under gathering



## Step 2 – From 2040 to 2050

The final configuration of the system will depict the potential expansion in 2050

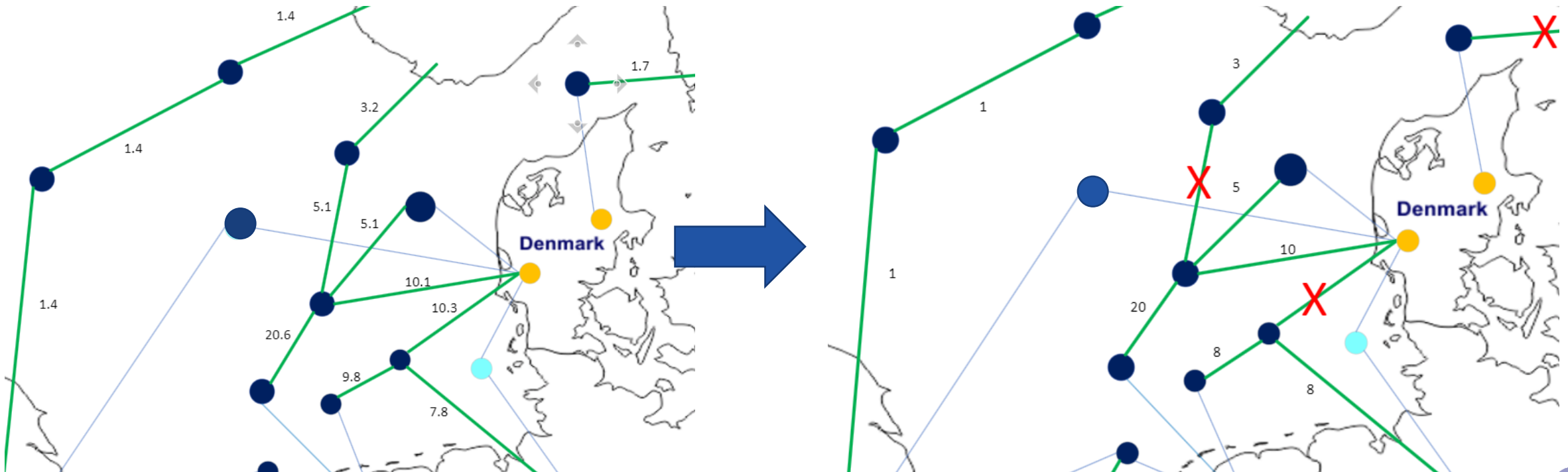


The map is a qualitative representation of the potential structure of the offshore model in the North Sea, not based on the real data under gathering

## Step 3 – Post-processing of the outcomes and drafting of the reports

The reports will be drafted starting from the info gathered under step 1 (2030) and the outcomes of the simulations (2040 and 2050).

The post processing of the results from the modelling runs will assess which new connections make sense, the size of the transmission corridors, and adjust them to discrete values, evaluating the relevant technical assumptions.

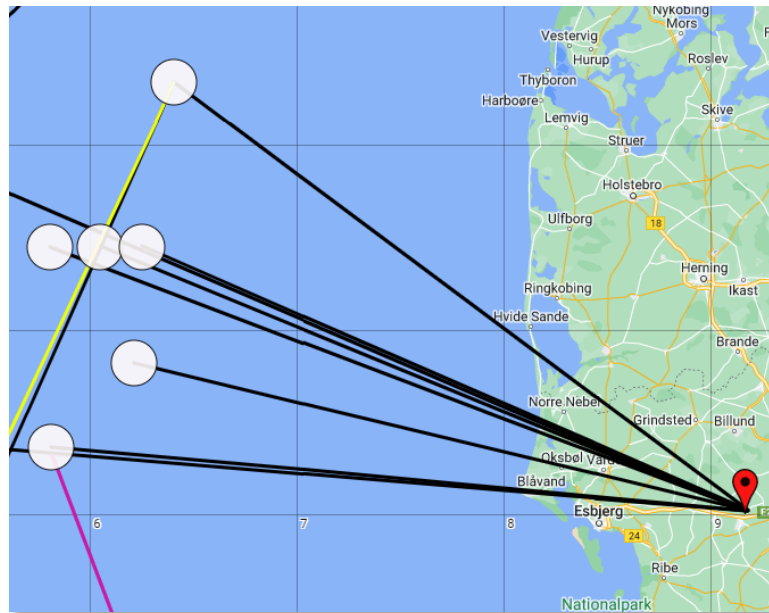


## Step 3 – Post processing and MSP crosscheck

Maritime Spatial Planning is the first source of info to protect the maritime environment and avoid clashes with other sectors.

Transmission corridors will be assessed and potentially adapted to consider MSP data on environment and other sectors

*ONDP Assessment of potential cable corridors and landing zones through MSP data*



*Example: Danish MSP, highlighted natural protected areas*



# Contents of the Reports

# High level reports require high level communication

Reports will not go into details, any existing plans/projects will not be questioned.

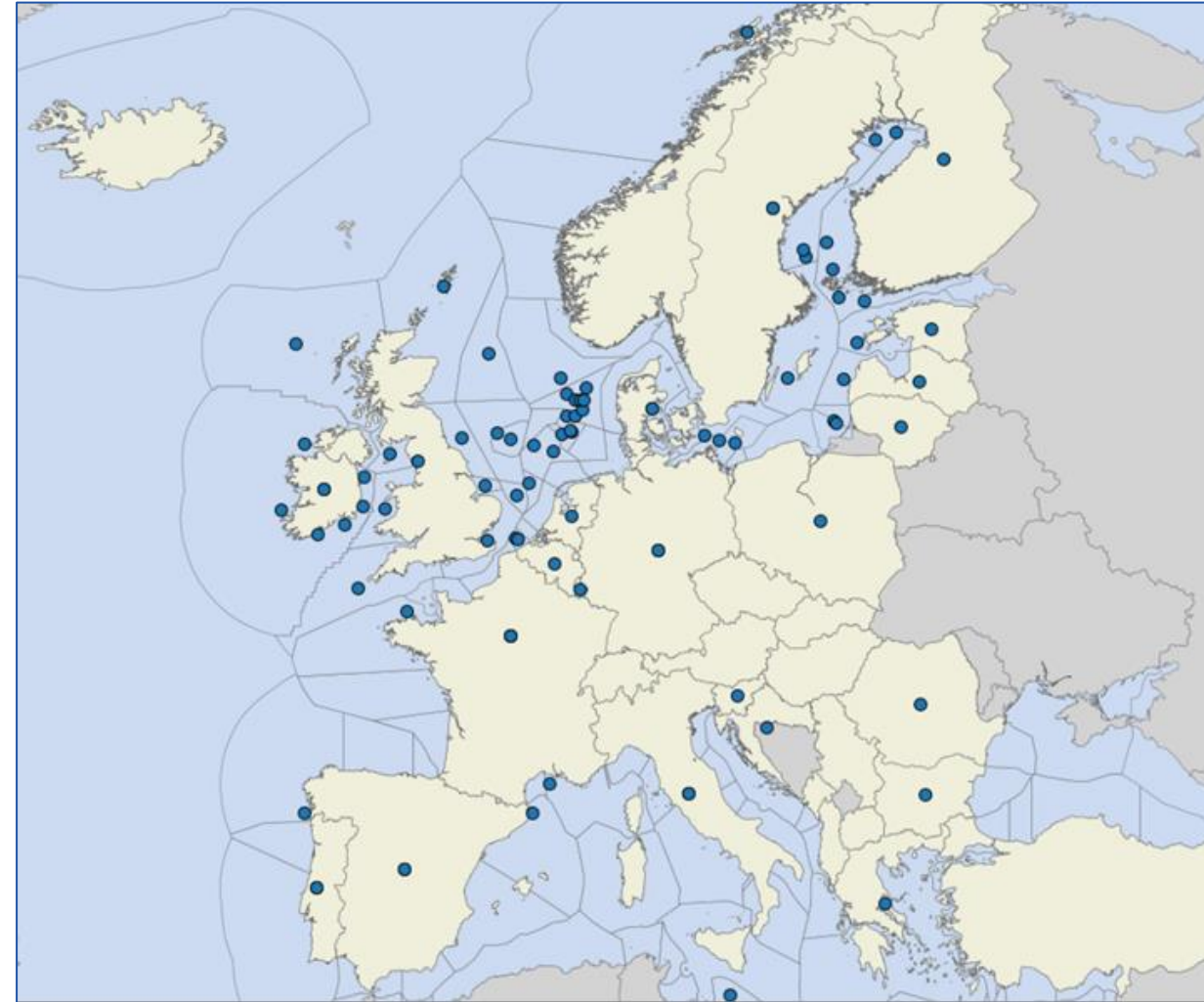
This is a non-binding high-level exercise based on non-binding targets.

Visual representation of the results, per sea basin, and information on e. g. ranges of

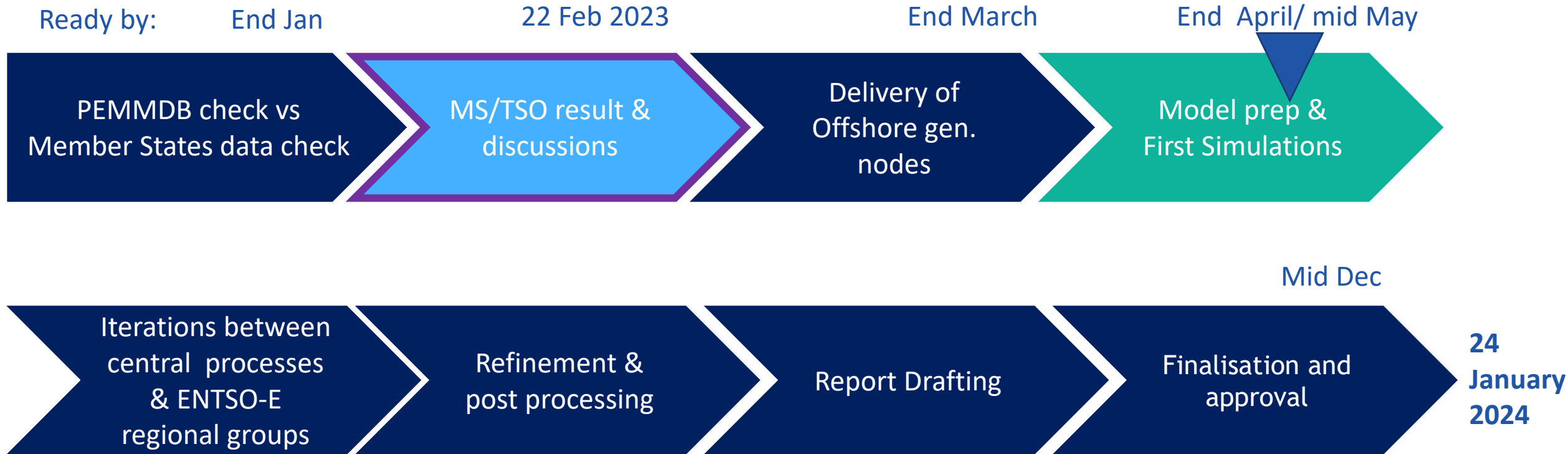
- Line lengths per cable type; number of offshore substations, onshore substations, other transmission assets
- Above information translated into CAPEX per asset type

Relevant input assumptions will be included as well.

Along with the ONDPs, a methodology document will be published, describing what you have seen today, and what is further developed until then.



# Overall Timeline



- Reports publication deadline 24/01/2024
- TEN-E corridors kept continuously informed in 2023



# Thank you!

Antje Orths / Francesco Celozzi

[ano@energinet.dk](mailto:ano@energinet.dk)

[francesco.celozzi@entsoe.eu](mailto:francesco.celozzi@entsoe.eu)



Reliable Sustainable Connected



Find also our position papers at our dedicated offshore page:  
[ENTSO-E's views on offshore development \(entsoe.eu\)](https://entsoe.eu)



# How To Develop The Needed Offshore Infrastructure – Q&A Session

Moderation by

**Edwin Haesen** - Head of System Development, ENTSO-E

Go on <https://www.slido.com/> and enter #3963128

In person participants can raise their hands



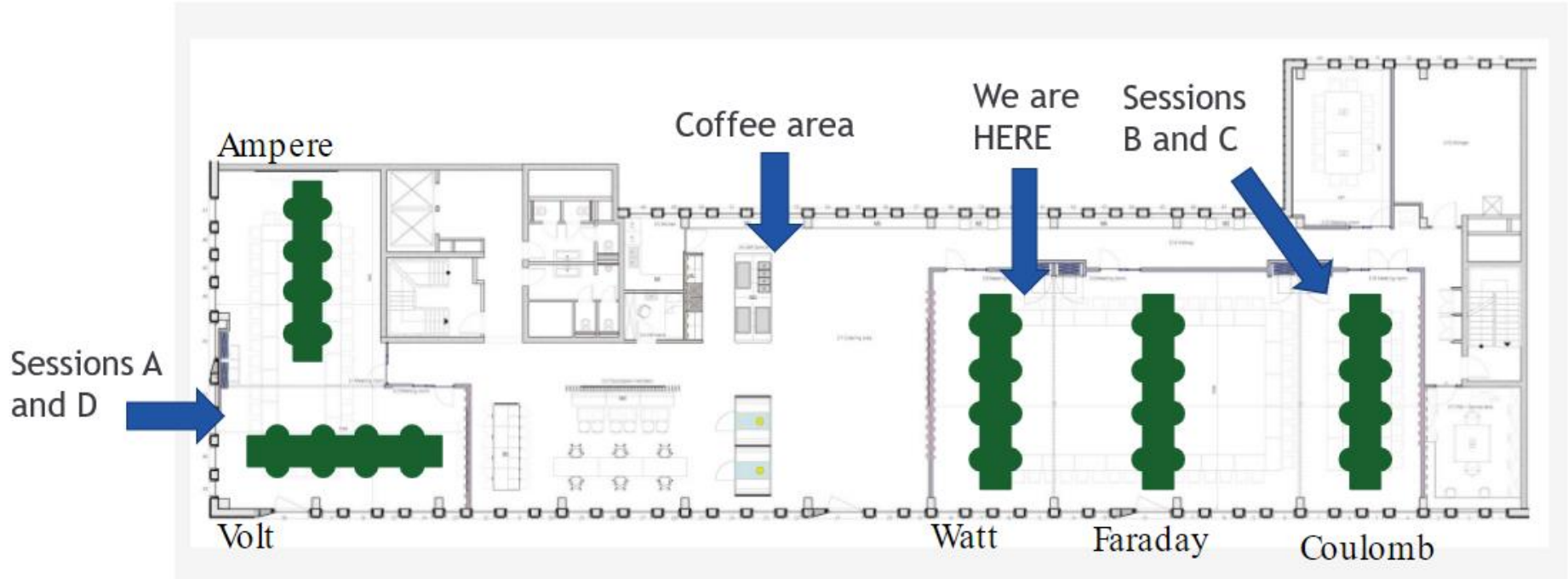
11.50 to 12.45

# Conclusion

Gerald Kaendler, Chair of ENTSO-E System Development Committee

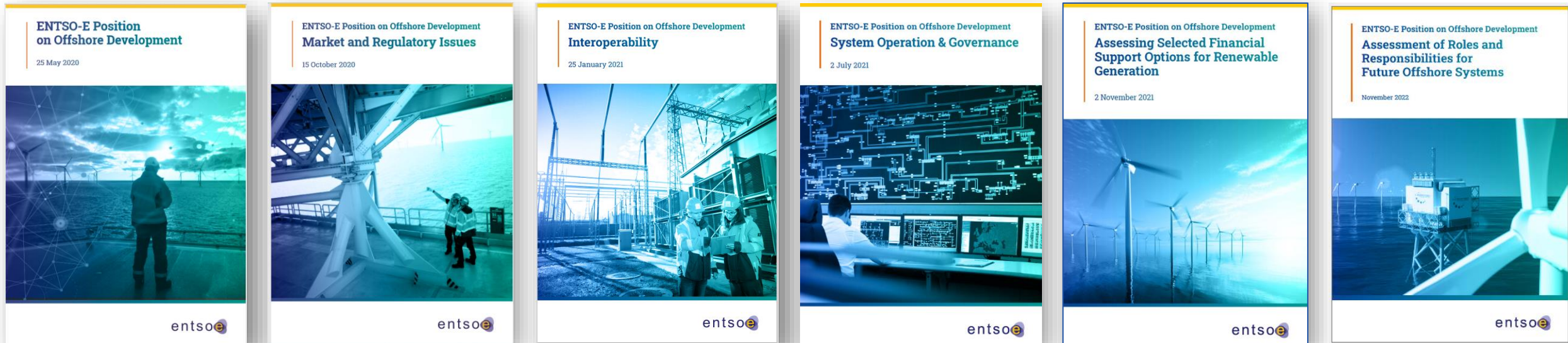
# Afternoon roundtables

	Room VOLT	Room COULOMB
14.00	Session A - How can we increase the pace of offshore grid development?	Session B - System operations: what are coming challenges and how to solve them?
14.50	Break	
15.10	Session D - How to make technology interoperable?	Session C - How to form a market design that provides the rights incentives to investments in infrastructure and production?



Please note that your chosen sessions are indicated on your badge.

# Thank you very much for your attention



Find also our position papers at our dedicated offshore page:  
[ENTSO-E's views on offshore development \(entsoe.eu\)](https://entsoe.eu)