Hybrid Public Workshop on the CBA 4.0 Guideline

Brussels, 17 January 2023, at 14.30 - 17.30h

entsoe

Reliable Sustainable Connected

Agenda

No	Subject	TIME	WHO
	Snacks and welcome coffee	***13.30-14.30 60 min***	
1.	Introduction	14.30-14.40 10 min	**Gerald Kaendler** (Amprion) *Chairman of the ENTSO-E System Development Committee*
2.	General overview	14.40-15.00 20 min	**Nils Schindzielorz** (TenneT TSO GmbH) *Convenor of the DT CBA*
3.	Multi-sector assessment	15.00-15.20 20 min	**Philipp Fortenbacher** (Amprion) *Member of the DT CBA*
4.	Assessment of hybrid projects	15.20-15.40 20 min	**Fabiola Aravena** (RTE) *Member of the DT CBA*
5.	Assessment of commissioning years	15.40-16.00 20 min	**Nils Schindzielorz** (TenneT TSO GmbH) *Convenor of the DT CBA*
	Coffee break	***16.00-16.30 30 min***	
6.	Contribution to the Union targets	16.30-16.50 20 min	**Belén Segura** (REE) *Member of the DT CBA (Convenor of RG Continental South-West)*
7.	Discussions	16.50-17.10 20 min	**All**
8.	CBA in the TYNDP process	17.10-17.20 10 min	**Patricia Labra** (REE) *Convenor of the TYNDP Steering Group*
9.	Conclusions and next steps	17.20-17.30 10 min	**Nils Schindzielorz** (TenneT TSO GmbH) *Convenor of the DT CBA*
	End of workshop	***17.30***	

DT CBA: Drafting Team Cost-Benefits Analysis (ENTSO-E), RG: Regional Group (ENTSO-E)

Housekeeping rules

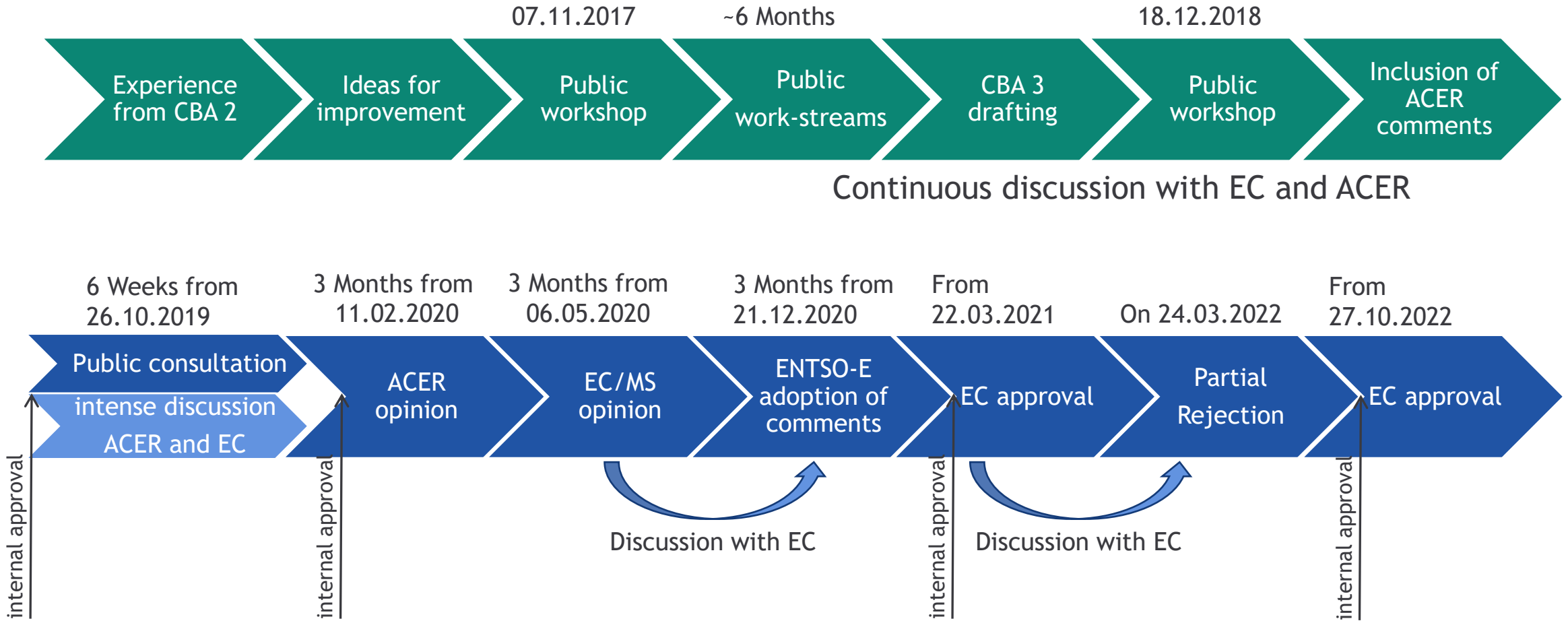
- **Questions can be posted anytime during the webinar and will be answered at the end. You are welcome to post your questions directly through Sli.do (#3532821)**
- **Chat and raised hand features of Teams will not be used.**
- **The workshop will be recorded and made available on our website**

Join Sli.do here →

General overview

General overview

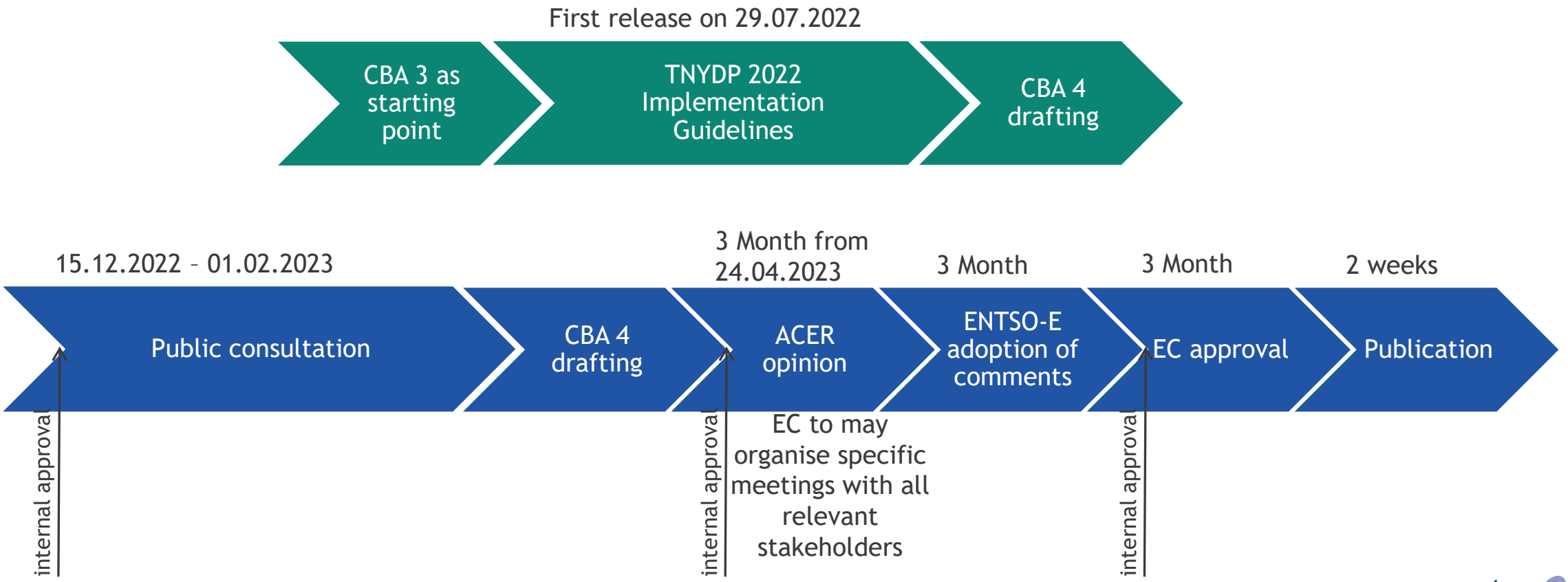
CBA 3 development and approval process



General overview

CBA 4 development and approval process

TEN-E (Regulation (EU) 2022/869) requires to publish and submit an updated version by 24.04.2023



General overview

CBA 4 main improvements

In addition to wording improvements and rearranging some of the sections to improve the readability, the following bigger updates have been implemented;

- New: text about how the Energy Efficiency First principle is considered → TEN-E requirement
- New: several sensitivities added → TEN-E requirement
- New: methodologies for “Contribution to Union Energy Targets” → TEN-E requirement
- New: methodology for assessing the commissioning year
- Updated: The Black Start Service indicator has been improved
- Updated: Further elaborated parts about generalized multi-sectorial modelling
- Included: Methodology for assessment of hybrid/radial projects included
- Deleted the section on Grid Transfer Capacity → not applied in TYNDP
- Deleted the section on Assessment of Storage → Methodology to be provided by EC

Overview of TEN-E requirements

ANNEX V – Energy system-wide cost-benefit analysis

Article	Content	Included
1	What the area for the analysis shall cover, and who ENTSO-E shall cooperate with.	✓
2	List over the sensitivity analyses that should be included in each CBA.	✓
3	That the methodology shall establish the analysis to be carried out, determining the impact with and without each project	✓
4	The methodology shall give guidance for the development and use of modelling necessary for the CBA. What the modelling shall allow for.	✓
5	The methodology shall include an explanation on how the energy efficiency first principle is implemented in all the steps of the TYNDP	✓
6	The methodology shall explain that the development and deployment of renewable energy will not be hampered by the project	Not yet included

Overview of TEN-E requirements

ANNEX V – Energy system-wide cost-benefit analysis

Article	Content	Included
7	That Member States on which the project has a net positive impact, the beneficiaries, the Member States on which the project has a net negative impact, and the cost bearers **shall be identified**	Included the split between EU and non-EU MS benefits
8	What the methodology shall take into account, what it shall give guidance on, and methodologies that shall be included → see slide on article 8	Mostly, see next slide
9	Climate adaptation measures taken for each project are assessed and reflect the cost of greenhouse gas emissions and that the assessment is robust and consistent with other Union policies in order to enable comparison with other solutions which do not require new infrastructures.	Not yet included

Methodologies that shall be included (Annex V, article 8)

The Guideline shall take into account, shall give guidance on, and include the following;	Included:
Shall take into account, at least; the CAPEX costs, the OPEX costs, as well as the costs induced for the related system over the technical lifecycle of the project as a whole, such as decommissioning and waste management costs, including external costs	✓
Shall give guidance on discount rates, technical lifetime and residual value to be used for the cost-benefit calculations	✓
Shall include a mandatory methodology to calculate benefit-to-cost ratio and the NPV, as well as a differentiation of benefits in accordance with the level of reliability of their estimation methods.	**Part of the Guideline**
Methods to calculate the climate and environmental impacts of the projects and the contribution to Union energy targets, such as renewable penetrations, energy efficiency and interconnection targets **shall also be taken into account**;	✓

What the modelling shall allow for (Annex V, article 4)

The modelling shall allow for;	Does allow for the following;
a full assessment of economic benefits, including;	✓
market integration,	✓
security of supply and competition,	✓
as well as lifting energy isolation	✓
social and environmental and climate impacts	✓
including the cross-sectorial impacts	✓

Sensitivities that shall be included (Annex V, article 2)

Each CBA shall include sensitivity analyses concerning the input data set, including;	Included
The cost of generation and green house gases	✓
The expected development of demand and supply	✓
including with regard to renewable energy sources,	✓
and including the flexibility of both,	✓
the availability of storage	✓
the commissioning date of various projects in the same area of analysis	✓
climate impacts and other relevant parameters	

Multi-sectorial assessment

Multi-Sector CBA Assessment - TEN-E Background

Article 11. ENERGY SYSTEM WIDE COST-BENEFIT ANALYSIS

1. The ENTSO-E and the ENTSOG shall draft consistent single sector draft methodologies, *including the energy network and market model referred to in paragraph 10* of this Article, for a harmonised energy system-wide cost-benefit analysis at Union level for projects […]

10. By 24 June 2025, […], the ENTSO-E and the ENTSOG *shall jointly submit* to the Commission and ACER *a consistent and progressively integrated model* that will provide consistency between single sector methodologies based on common assumptions including electricity, gas and hydrogen transmission infrastructure as well as storage, LNG and electrolysers, covering the energy infrastructure priority corridors and the areas *drawn up in line with the principles laid down in Annex V*

Annex V. ENERGY SYSTEM-WIDE COST-BENEFIT ANALYSIS

The methodology shall give guidance for the development and use of energy network and market modelling necessary for the CBA. *The modelling shall allow for a full assessment of* economic benefits, including market integration, security of supply and competition, as well as lifting energy isolation, social and environmental and climate impacts, *including the cross-sectorial impacts*. The methodology shall be fully transparent including details on why, what and how each of the benefits and costs are calculated;

Multi-Sector CBA Assessment – Inclusion in CBA 4.0

- Implementation of MSPS (multi-sectorial planning support) roadmap
- Concept is…
  - general
    - Multiple sectors can be included → dual (sector) CBA
    - Any sector can be considered → no limitations
    - Sectors could be…
      - energy carriers for which markets exist e.g. hydrogen, methane
      - final demand sector e.g. mobility, heat
  - optional
    - Adaptive changes on socio-economic welfare (SEW) indicator (B1)
- Details will be drafted in the TYNDP 2024 implementation guidelines

CBA 4.0 paves the road for multi-sector CBA assessment

Several modelling options allow for coherency with the TEN-E

Welfare calculation approach	Integrated multi-sector modelling	Single sector modelling
Generation cost approach	**global** socio-economic welfare	socio-economic welfare for electricity
Total surplus approach	**global** socio-economic welfare with additional optional component **cross-sector rent**	socio-economic welfare for electricity with optional **cross-sector rent** adjustment

Global socio-economic welfare (SEW) captures the entire benefit of a project

No double counting or missing benefits

All mutual influences of sector coupling are intrinsically captured

Calculation and adaptive changes in green

Generation Cost Approach	Global SEW = sum of Generation costs without the project over all sectors- sum of Generation costs with the project over all sectors
Total Surplus Approach	Global SEW = sum of Total surplus with the project over all sectors - sum of Total surplus without the project over all sectors

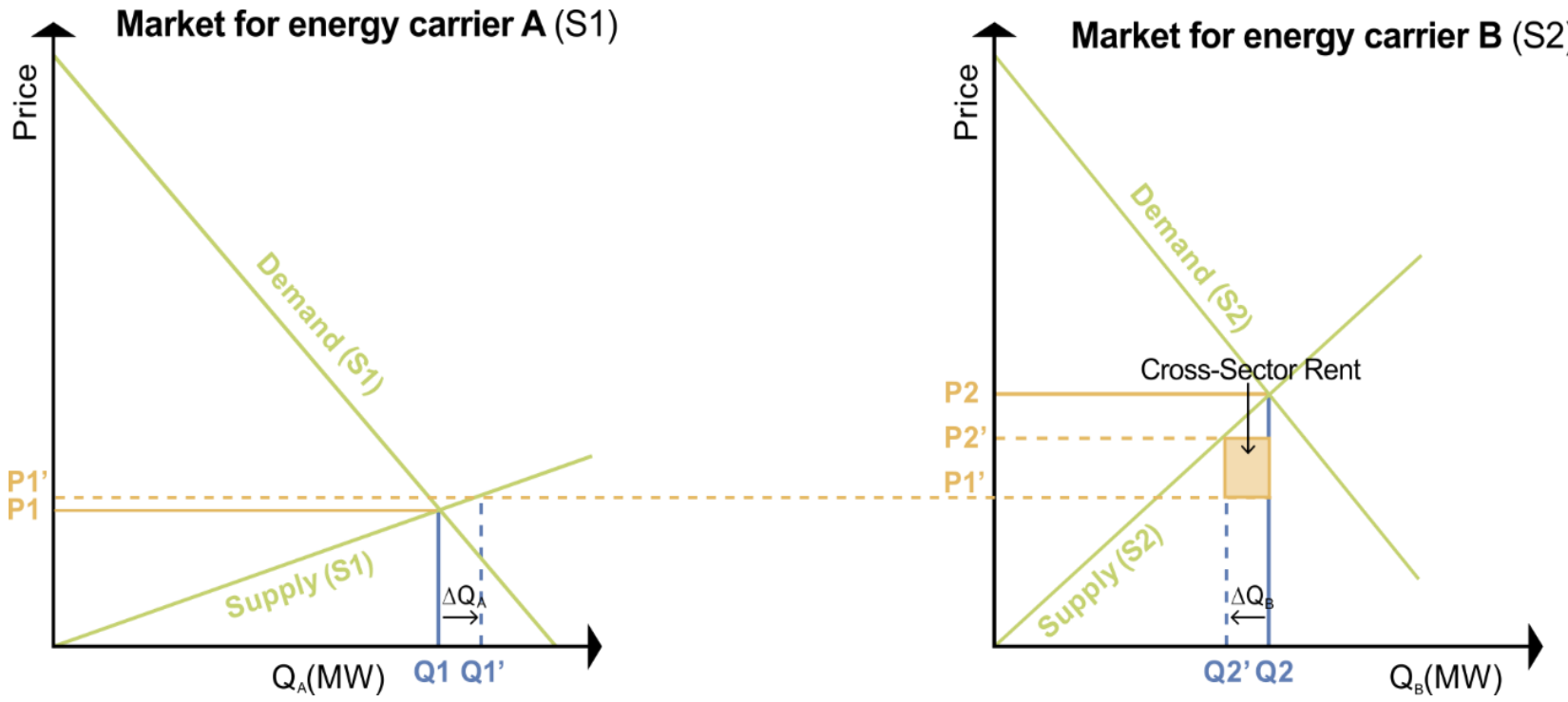
Total surplus = Producer Surplus + Consumer Surplus + Congestion Rents + Cross-Sector Rents

standard components

new component

What are cross-sector rents?

Cross-sector rents describe the welfare movement along sectors and capture monetized cross-sectorial impacts



depend on the price difference (P2‘-P1‘) as analogous to congestion rents

slido

Do you see this as a valuable and reasonable approach to work towards multi-sectorial CBA for future editions of the TYNDP?

ⓘ Start presenting to display the poll results on this slide.

slido

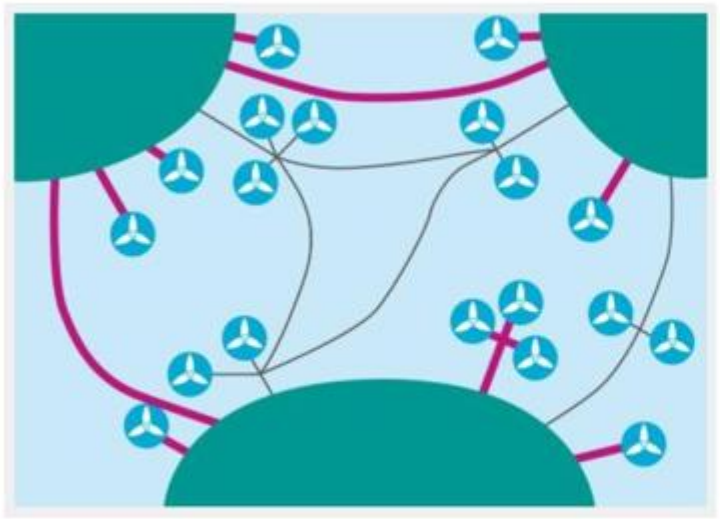
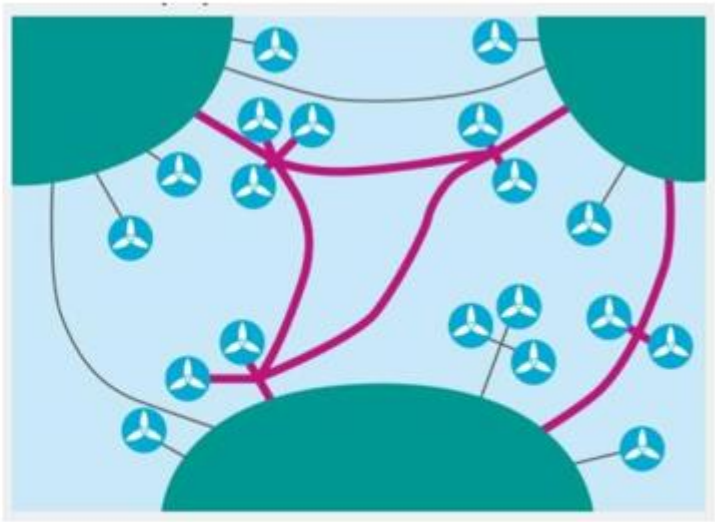
Which sector(s) do you think need to be specifically modelled/integrated and with what priority?

ⓘ Start presenting to display the poll results on this slide.

Assessment of hybrid projects

Assessment of Hybrid projects

Definition

	
Single purpose	Dual purpose (= Hybrid)

Assessment of Hybrid projects

- The hybrid interconnection setup and dual purpose can be defined **as a project which enables an interconnector function between bidding zones** (either onshore or offshore) **while simultaneously facilitating a client connection with a certain technology** (RES or non-RES; generation, load or storage; AC (e.g. Kriegers Flak) or DC (e.g. North Sea Windpower Hub)).
- Two CBA setups are possible for CBA analysis :

Option 1:
The project is built on top of an already existing or planned radial connected RES by ***enabling only an additional interconnector function.***

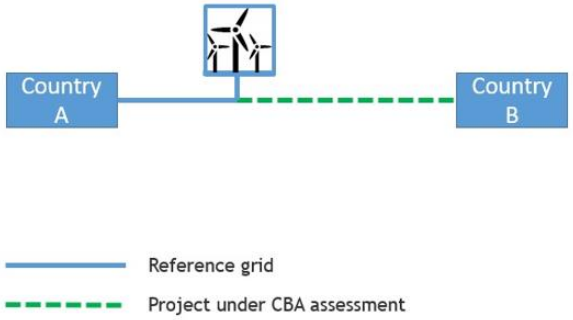
Option 2:
The project ***enables both the RES-integration function*** (i.e. additional OWF capacity is integrated into the system through the project) ***and the additional interconnector function***; and the project is developed anew as a hybrid interconnector

*For illustration purposes, only the offshore wind technology setup is illustrated.

Assessment of Hybrid projects

Option 1:

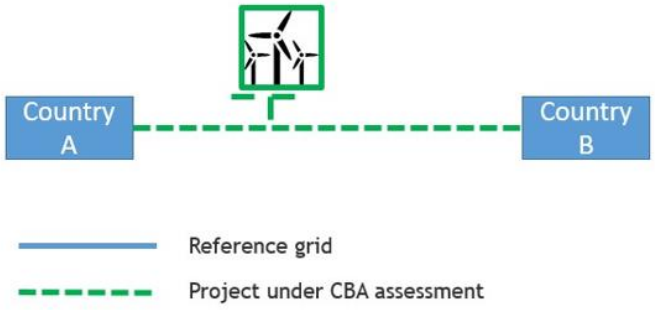
Variant 1 – only IC benefits (second leg)



Project Costs	Project Benefits	Assessment type
2nd XB-IC leg + offshore substation delta's if applicable	IC-benefits from CBA guideline (B1, B2, …) via indirect NTC A-B - Reduced NTC if HM - 2 separate NTCs if OBZ	**CBA option 1** PINT No delta in total OWF capacity

Option 2:

Variant 2 – IC + RES addition benefit (setup = both legs + wind)



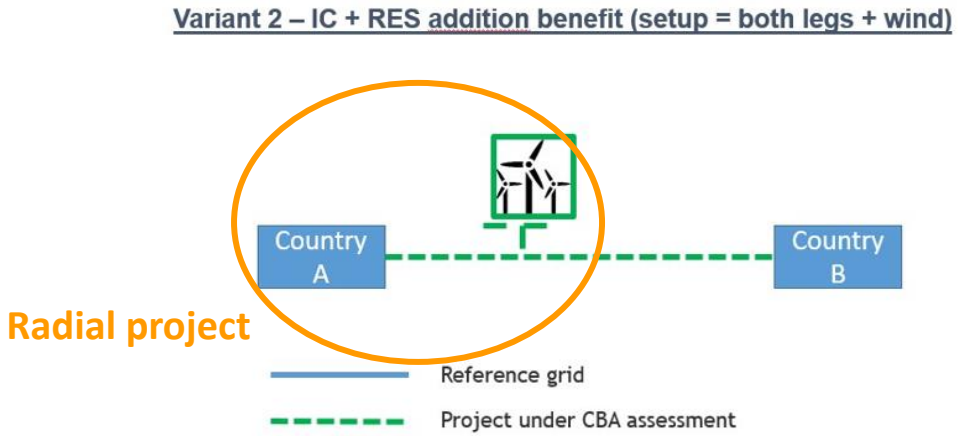
Project Costs	Project Benefits	Assessment type
Both legs + Substation platform	IC-benefits from CBA guideline (B1, B2, …) via indirect NTC A-B OWF integration benefits changing net OWF capacity minus OWF-Producer Surplus	**CBA option 2** PINT delta in total OWF capacity

Note: A sanity check would be needed to define a proxy for the costs of the RES installed capacity. To be defined in the Implementation Guidelines

Assessment of Radial projects

- Option 2 can also be applied to **radial projects**
- **Only RES integration benefits** to be considered (no trade benefits)
- The same sanity check needs to be applied to get a proxy for the RES investment
- Costs: only include the grid connection costs (cables and platforms), the RES asset itself are excluded

Option 2:



slido

What are your views on the proposed methodology?

ⓘ Start presenting to display the poll results on this slide.

slido

Do you see any element, information or guidance missing from the proposed methodology?

ⓘ Start presenting to display the poll results on this slide.

Assessment of commissioning years

Assessment of commissioning years

Starting point for the definition of the commissioning date has to be the year of the respective study

The time t for the duration until a projects submitted to the study will be commissioned can be calculated as:

$$t = (t_{pre-perm} + t_{perm} + t_{const}) \cdot f_1 \cdot f_2 \cdot f_3 \cdot f_4 \cdot f_5$$

Where:

- $t_{pre\text{-}perm}$ is the assumed mean standard time of all projects to entering the permission period
- t_{perm} is the assumed mean standard time for the permitting process
- t_{const} is the assumed mean standard time for the construction phase
- f_1 is a standard factor indicating the complexity of the project with respect to its technology (AC or DC)
- f_2 is a standard factor indicating the complexity of the project with respect to its setup whether it is an overhead line, cable, substation etc.
- f_3 is a standard factor indicating the complexity of the project with respect to whether it is an on- or offshore project
- f_4 is a standard factor indicating the complexity of the project with respect to whether it is a completely new project or an update
- f_5 is a standard factor indicating the complexity of the project with respect to environmental and social impacts of the project (see sections 5.13, 5.14 and 5.15)

slido

Do you find an assessment of commissioning years necessary in the CBA Guideline?

ⓘ Start presenting to display the poll results on this slide.

slido

Do you think this simplification is sufficient in order to define a reasonable approximation for a possible commissioning year?

ⓘ Start presenting to display the poll results on this slide.

Coffee break 16.00-16.30

Contribution to the Union targets

Contribution to Energy Union Targets (ET)

ET1: Interconnection Targets

The development of additional interconnections should be considered if any of the following three thresholds is triggered:

- ✓ **Minimising price differentials:** 2 €/MWh between relevant countries, regions or bidding zones is the indicative maximum threshold to consider developing additional interconnectors.

- ✓ **Ensuring that electricity demand, including through imports, can be met in all conditions:** in countries where the nominal transmission capacity of interconnectors is below 30% of their peak load options for further interconnectors should be urgently investigated:

$$\frac{Nominal\ transmission\ capacity}{Peak\ load\ 2030}$$

- ✓ **Enabling export potential of excess renewable production:** in countries where the nominal transmission capacity of interconnectors is below 30% of their renewable installed generation capacity options for further interconnectors should urgently be investigated:

$$\frac{Nominal\ transmission\ capacity}{Installed\ renewable\ generation\ capacity\ 2030}$$

Any project related to interconnection capacity, helping the Member States reach any of the 30% thresholds, must apply for inclusion in the Ten Year Network Development Plan and future lists of Projects of Common Interest

Contribution to Energy Union Targets (ET)

ET2: Energy Efficiency

The EC has set an **energy efficiency target** of at least 32,5% by the year 2030, which translates to lower primary and final energy consumption. Energy efficiency (EF) can be defined as

$$EF = \frac{final\ energy\ consumption}{primary\ energy\ consumption}$$

- ✓ **Primary energy consumption** can be regarded as an input to the energy system and is the overall consumption of all energy carriers that can be determined from the market simulations.

- ✓ **The final energy consumption** is the conventional demand of end-use appliances and can also be extracted from the market simulations.

Any variation in energy efficiency unlocked by a project contributes to the overall European target and can be reported in the study specific project sheets.

$$ET2 = EF^{with} - EF^{without}$$

Contribution to Energy Union Targets (ET)

ET3: Renewable Penetration

The **share of energy from renewable sources** shall be calculated as the gross final consumption of energy from renewable sources divided by the gross final consumption of energy from all energy sources, expressed as a percentage.

$$ET_{res} = \frac{RES\ generation}{total\ consumption}$$

- ✓ The **'gross final consumption of electricity from renewable energy sources'**, shall be calculated as the quantity of electricity produced in a Member State from renewable energy.
- ✓ The **'gross final consumption of electricity'** is, for the purpose of the calculations defined as the generation from all energy sources.

For both numerator and denominator a detailed overview of generation sources considered have to be defined within the respective study specific implementation guidelines. The evaluation of a project impact on the renewable penetration ET3 will then be calculated as a delta comparison of the RES penetration with and without the project

$$ET3 = ET_{res}^{with} - ET_{res}^{without}$$

slido

Do you find the addition of these Union targets contributions useful?

ⓘ Start presenting to display the poll results on this slide.

slido

What other indicators would be of interest to be considered for the assessment of Union Energy Targets contribution?

ⓘ Start presenting to display the poll results on this slide.

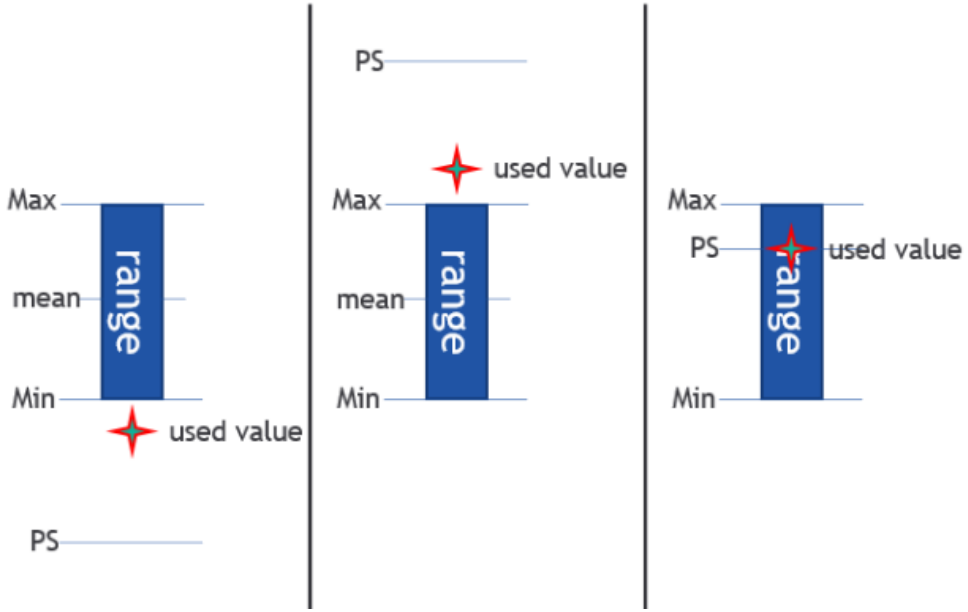
Discussion

Sanity check for Hybrid Projects TYNDP 2022

Added the methodology for assessing hybrid and radial projects (taken from Implementation Guidelines – made more general to allow also for radials)

Methodology:

- apply cost range based on annuity
  - If standard costs used (TYNDP 2022 scenario building)
    - Min: based on GA2040
    - Max: based on DE2030
  - If detailed costs from Project Promoter available
    - define the range based on +-20%
- use the PS as a proxy for the OWP costs
  - if PS below range: use (PS+mean)/2
  - if PS above range: use (PS+mean)/2
  - if PS within range: use PS
- used value to be subtracted from ΔSEW



slido

Audience Q&A Session

ⓘ Start presenting to display the audience questions on this slide.

CBA in the TYNDP process

The TYNDP is the European electricity infrastructure development plan.

It provides a pan-European vision of the future power system and investigates how power links and storage can be used to make the energy transition happen in a cost-effective and secure way.

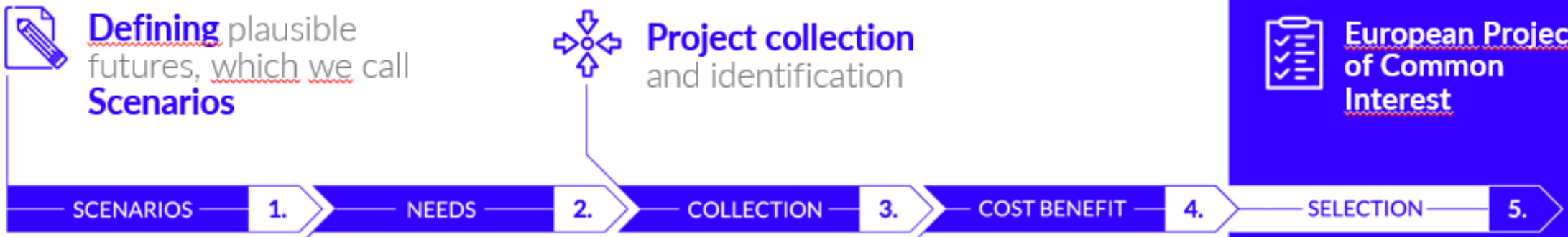
The Process behind the Ten Year Network Development Plan at ENTSO-E

Process of European Projects of Common Interest led by the European Commission

Defining plausible futures, which we call **Scenarios**

Project collection and identification

European Projects of Common Interest



Identification of the needs based on our scenarios

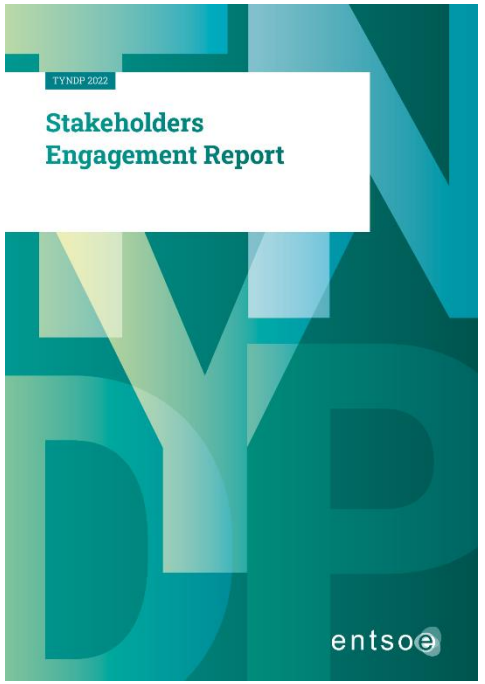
Cost benefits analysis of projects

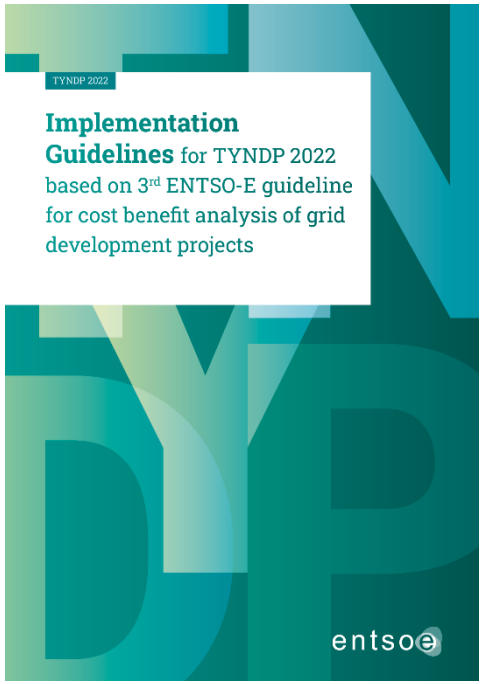
Package content

Dive deeper into the TYNDP 2022

High-Level report TYNDP 2022

Your entrance key to the TYNDP 2022, with the main findings, process overview, Q&A and next steps.





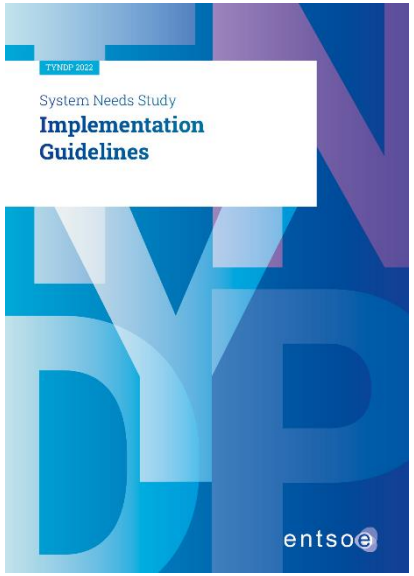
Package content

Get a closer look at the System Needs study 2022

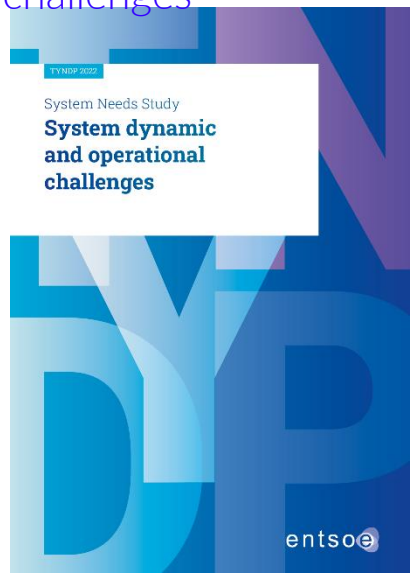
System Needs Study 2022

Main report

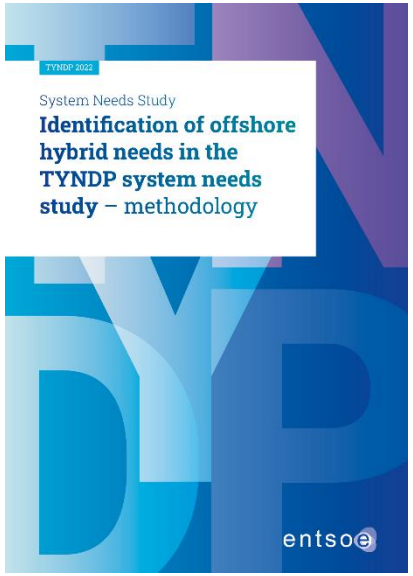
Methodology



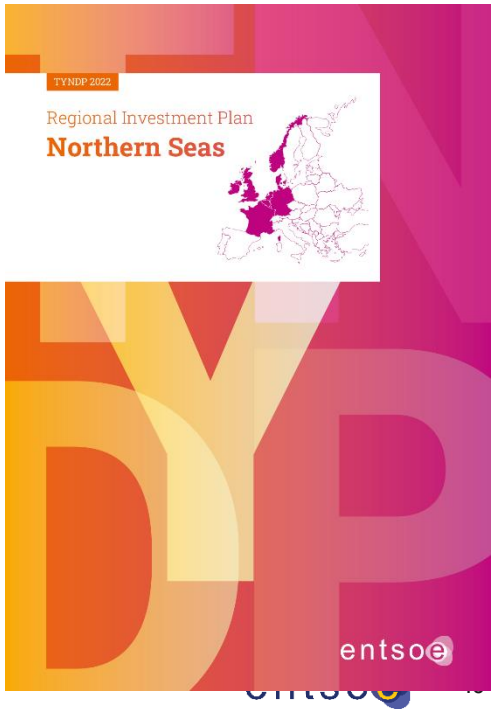
Side-study on operational challenges



Draft methodology on needs for hybrid infrastructure



Six Regional Investment Plans

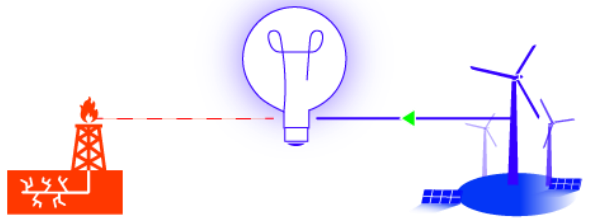


TYNDP 2022 system needs study

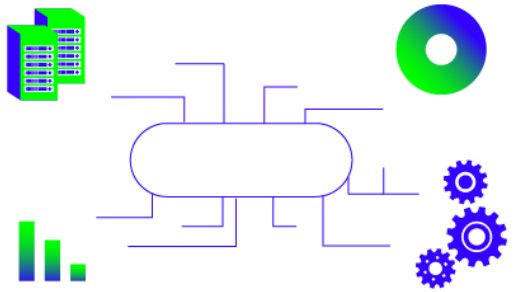
Three key findings

1. Opportunities for improving the power system exist all over Europe.

2. Addressing system needs reduces Europe's dependance on gas-based power generation



3. Coordinated planning will be needed across sectors.



TYNDP 2022 system needs study

Opportunities for increased cross-border transmission, storage and peaking capacity exist all over Europe

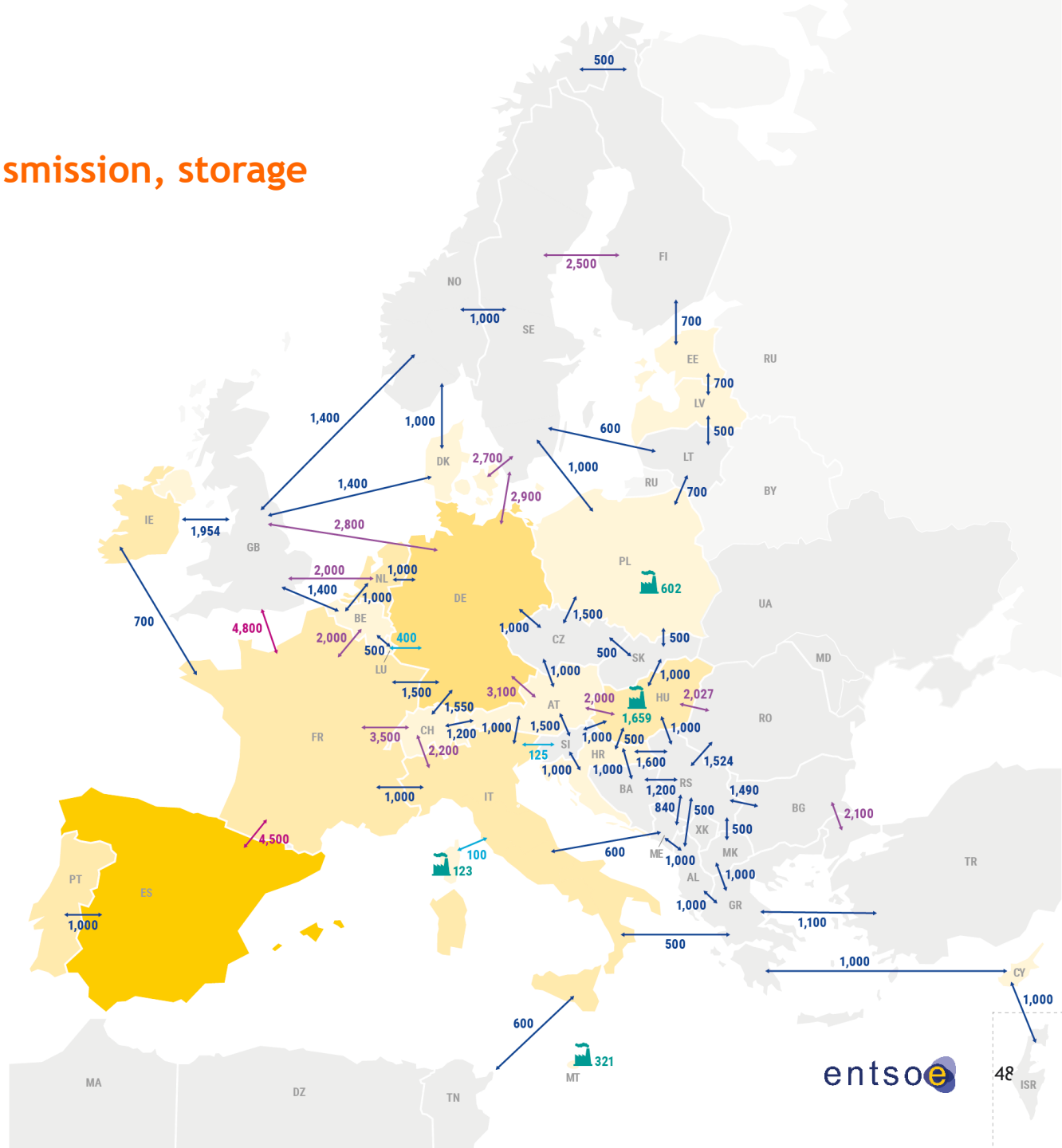
CROSS-BORDER CAPACITY INCREASES NEEDS IN MW (ADDITIONAL TO THE STARTING GRID 2025)

- < 500 MW
- 500 → 2,000 MW
- 2,000 → 4,000 MW
- > 4,000 MW

STORAGE NEEDS IN MW (ADDITIONAL TO BATTERY CAPACITIES IN NT2030 AND TO 2040 CAPACITIES FOR OTHER STORAGE TECHNOLOGIES)

- < 1,000 MW
- 1,000 → 5,000 MW
- 5,000 → 10,000 MW
- > 10,000 MW

CO_2-FREE PEAKING UNIT NEEDS PER COUNTRY IN MW

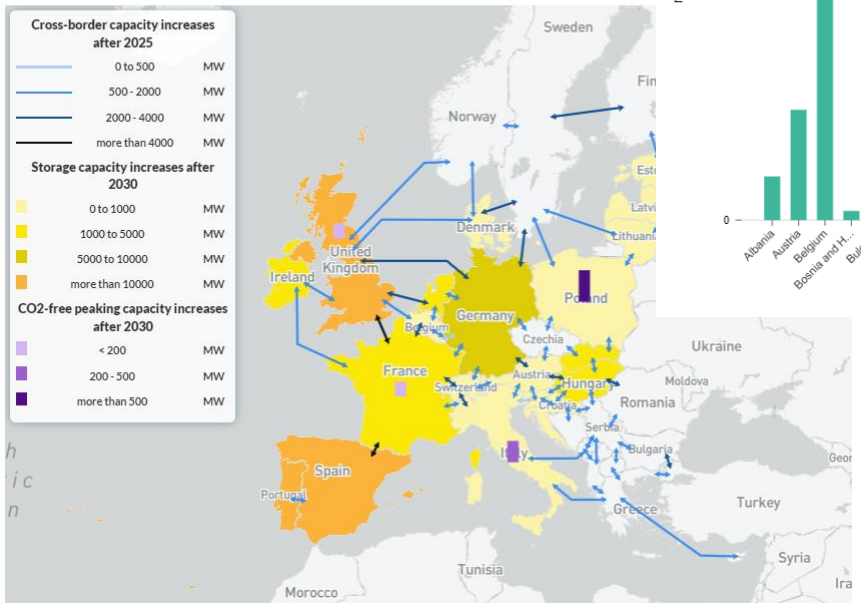


Data visualization of the system needs study

Visualise and download the results on our online platform : needs.entsoe.eu

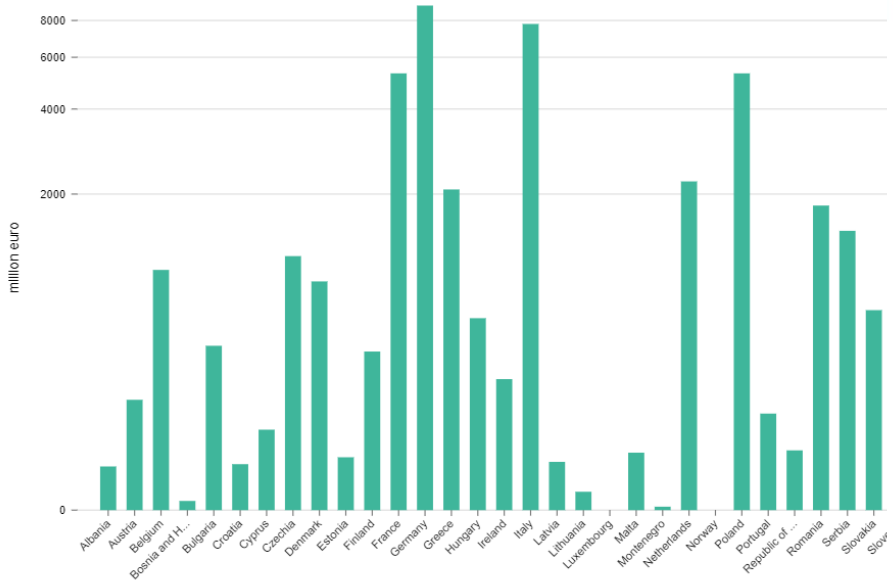
Economic needs additional to 2025

Pan European | By PCI Corridor | By country



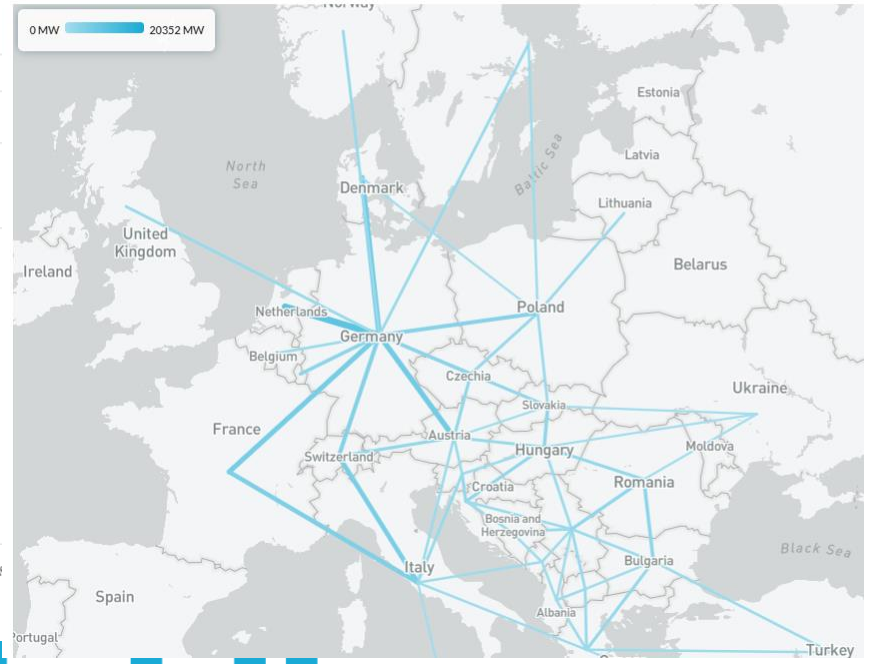
Generation costs

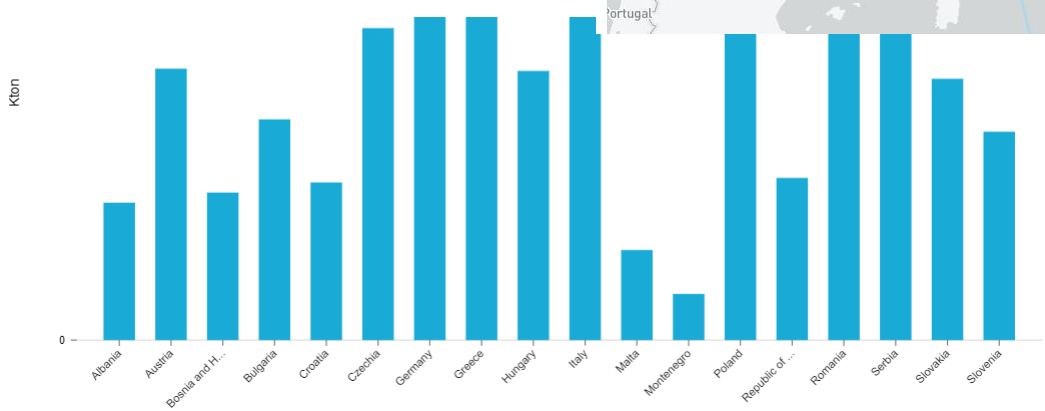
Pan European | By PCI Corridor | By country



Flows

Pan European | By PCI Corridor | By country





How to understand the results of the system needs study

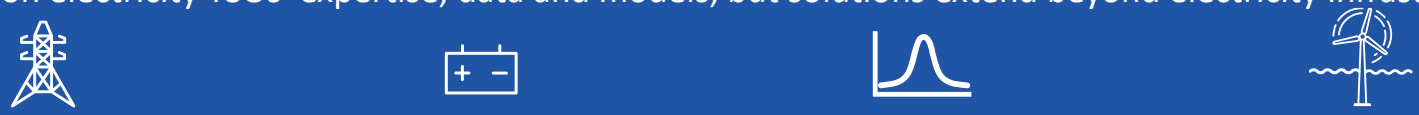
One economic needs configuration, multiple solutions

Non-infrastructure solutions

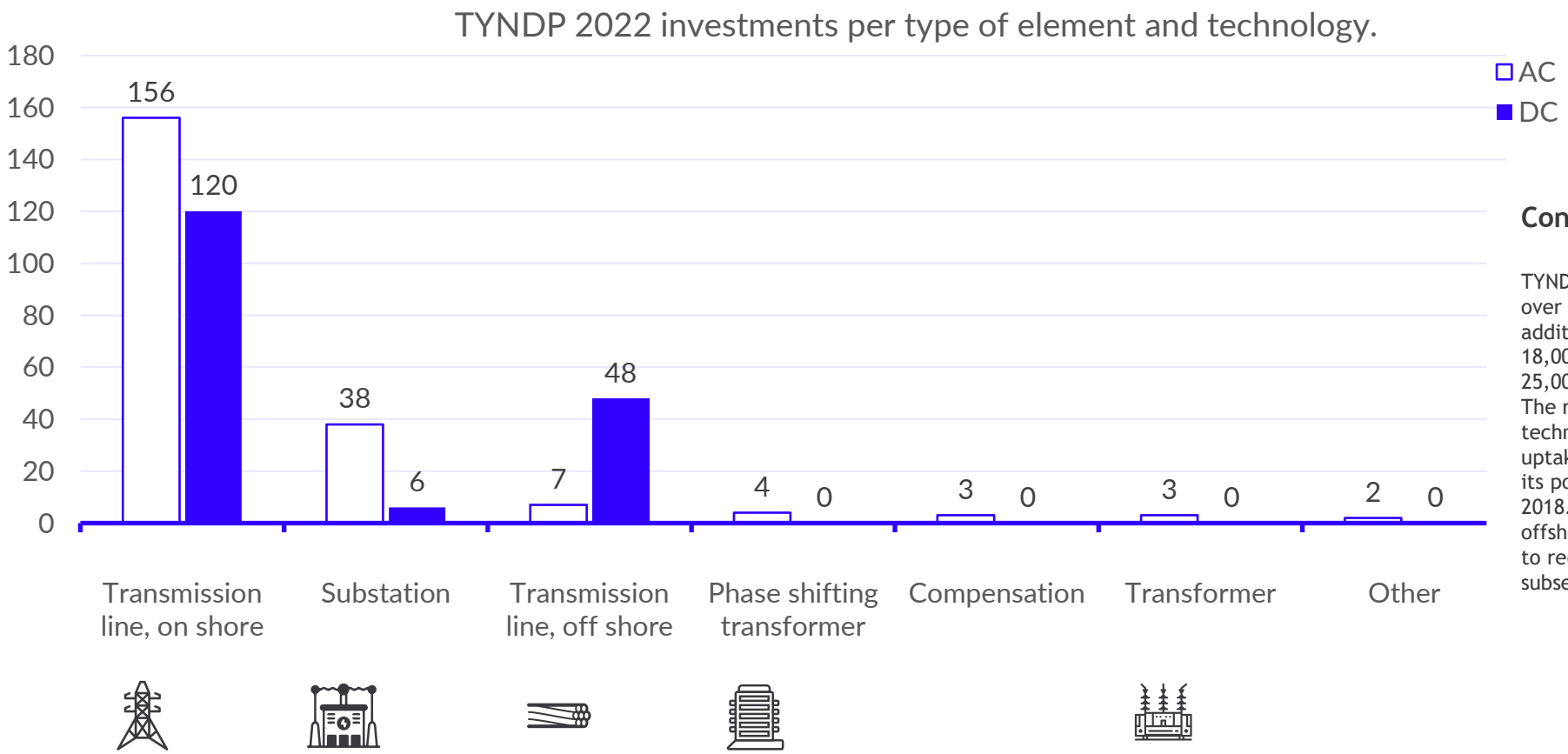
Addressing tomorrow's challenges will require the parallel development of a diverse range of solutions, including for example storage, the role of prosumers and generation, in addition to reinforcing the transmission grid.

Electricity infrastructure solutions

Our study uses interconnection transmission capacity and storage and peaking flexibility to express the needs because it is based on electricity TSOs' expertise, data and models, but solutions extend beyond electricity infrastructure.



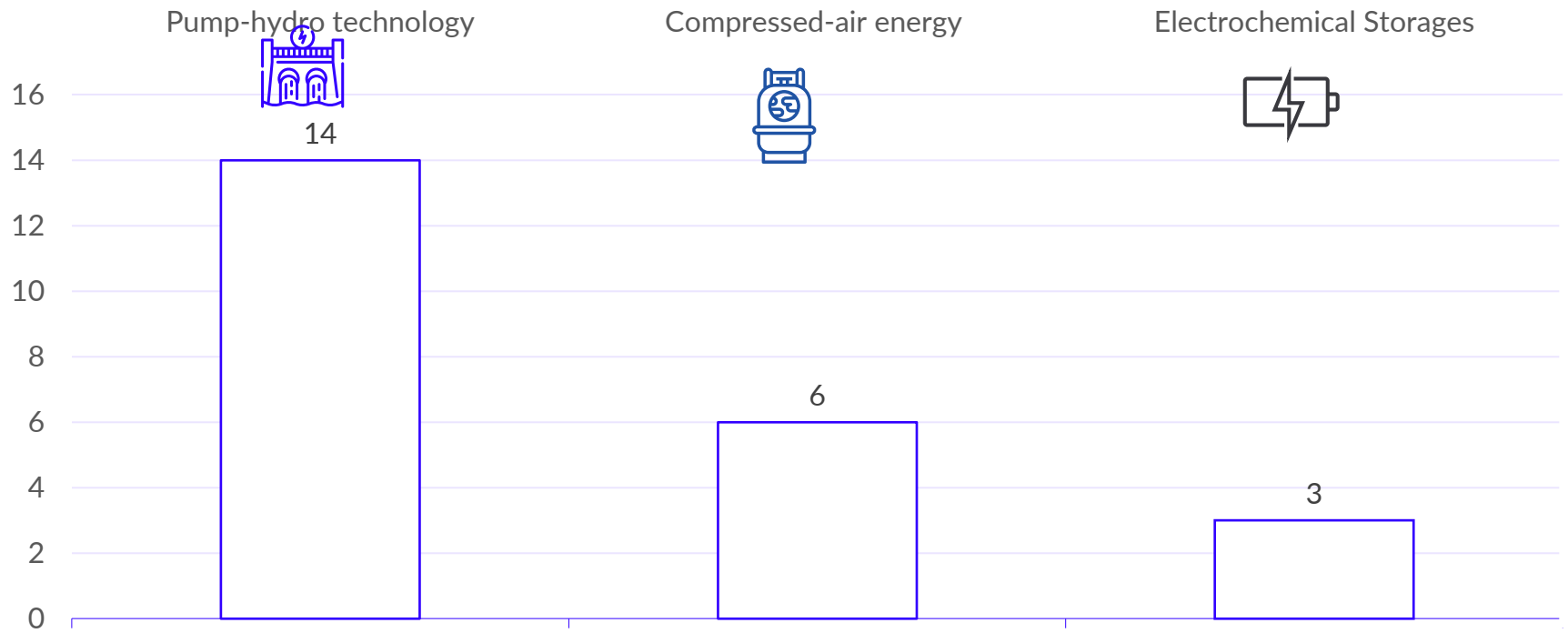
Project portfolio: 141 Transmission projects



Context

TYNDP 2022's portfolio projects with over 43,000 km of potential additional cables and lines, of which 18,000 km (42%) are AC and 25,000 km (58%) encompassesare DC. The rapid advancement of DC technology has led to improved uptake of this technology and seen its portfolio share grow since TYNDP 2018. The ongoing development of offshore infrastructure is expected to require increased investment in subsea DC cables.

Project portfolio - 23 Storage Projects



Context

The TYNDP 2022 portfolio includes 23 storage projects, of which 14 use pump-hydro technology. six compressed-air energy storage projects and three electrochemical storage projects complete the portfolio.

None of the projects has started the construction phase, while 12 are under consideration. One is in planning but has not completed the permitting phase, and 10 are in permitting. TYNDP 2022 includes three fewer storage projects than in 2020.

Takeaway

A robust Cost Benefit Analysis is key for a neutral and transparent project assessment at the TYNDP

Collaboration and questions at

tyndp@entsoe.eu

Find the key messages and data you need to make a change on

tyndp.entsoe.eu

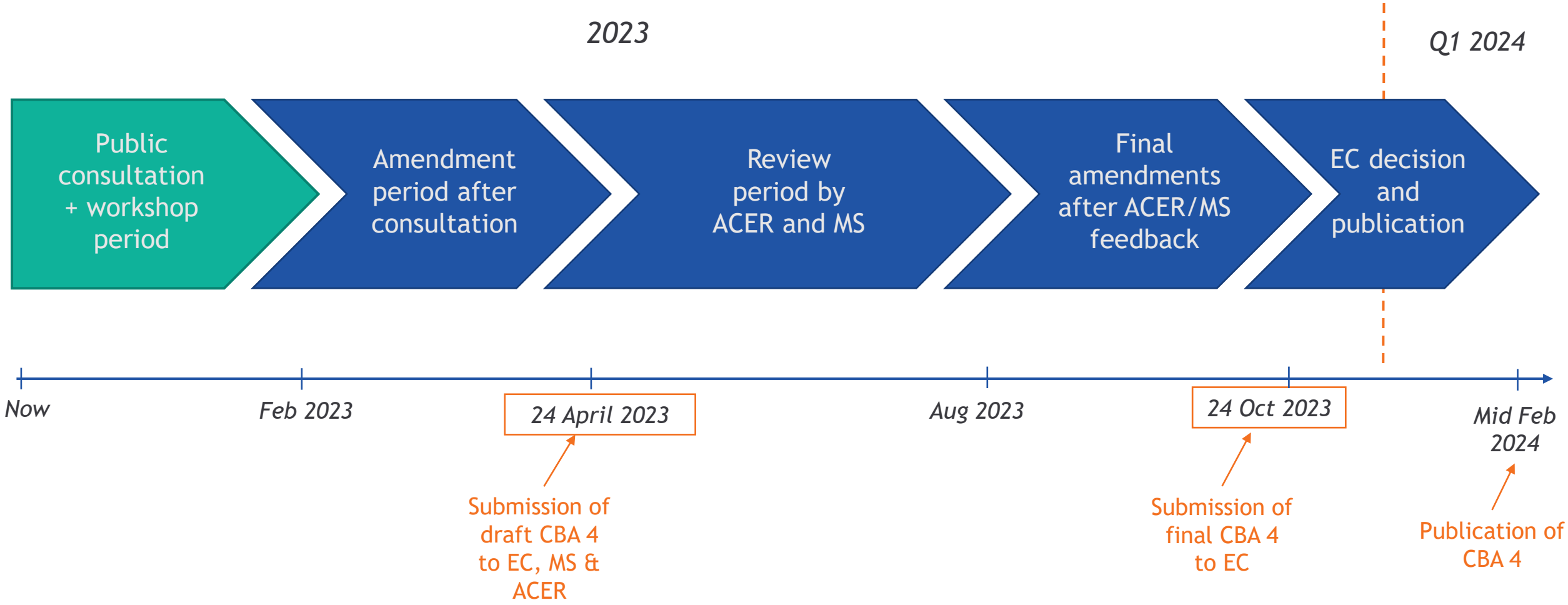
Conclusion and next steps

General improvements

- B8.1 indicator: works ongoing based on TNYDP 2022 PLI submissions
- B8.2
- Climate adaptation measures
- explain that the development of RES will not be hampered by the project

Improvements based on consultation comments and from this workshop

Conclusion and next steps



Thank you very much for you attention

Our values define who we are, what we stand for and how we behave.
We all play a part in bringing them to life.

EXCELLENCE

We deliver to the highest standards. We provide an environment in which people can develop to their full potential.

TRUST

We trust each other, we are transparent and we empower people. We respect diversity.

INTEGRITY

We act in the interest of ENTSO-E

TEAM

We care about people. We work transversal and we support each other. We celebrate success.

FUTURE THINKING

We are a learning organisation. We explore new paths and solutions.

We are ENTSO-E

Backup slide