Regional challenges and opportunities – A TYNDP 2022 webinar

31 January 2023

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Agenda

10.00 - Welcome and introduction - Patricia Labra, Red Electrica

10.05 - TYNDP 2022 after public consultation – Léa Dehaudt, ENTSO-E

10.15 - Current challenges & opportunities from a regional perspective

- Europe's changing generation portfolio: Examples from the North Sea and Iberian peninsula
  Arno Haverkamp (TenneT), Belen Segura (Red Electrica)
- Interconnection of Continental Europe with neighbouring countries
- Andrew Kasembe (CEPS), Michael Heit (50 Hertz)
- How to make the system fit for future needs? Examples from Southern Europe
  Antonio Conserva (Terna), Vladan Ristic (JSC EMS)

11.00 - Q&A on Slido

11.25 - Conclusion - Patricia Labra, Red Electrica

11.30 - End of webinar

We welcome your questions and comments

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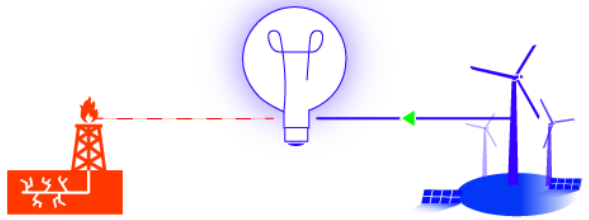
The TYNDP is the European electricity infrastructure development plan.

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.

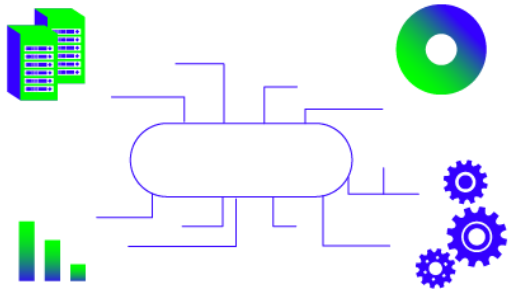
Three key findings

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

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



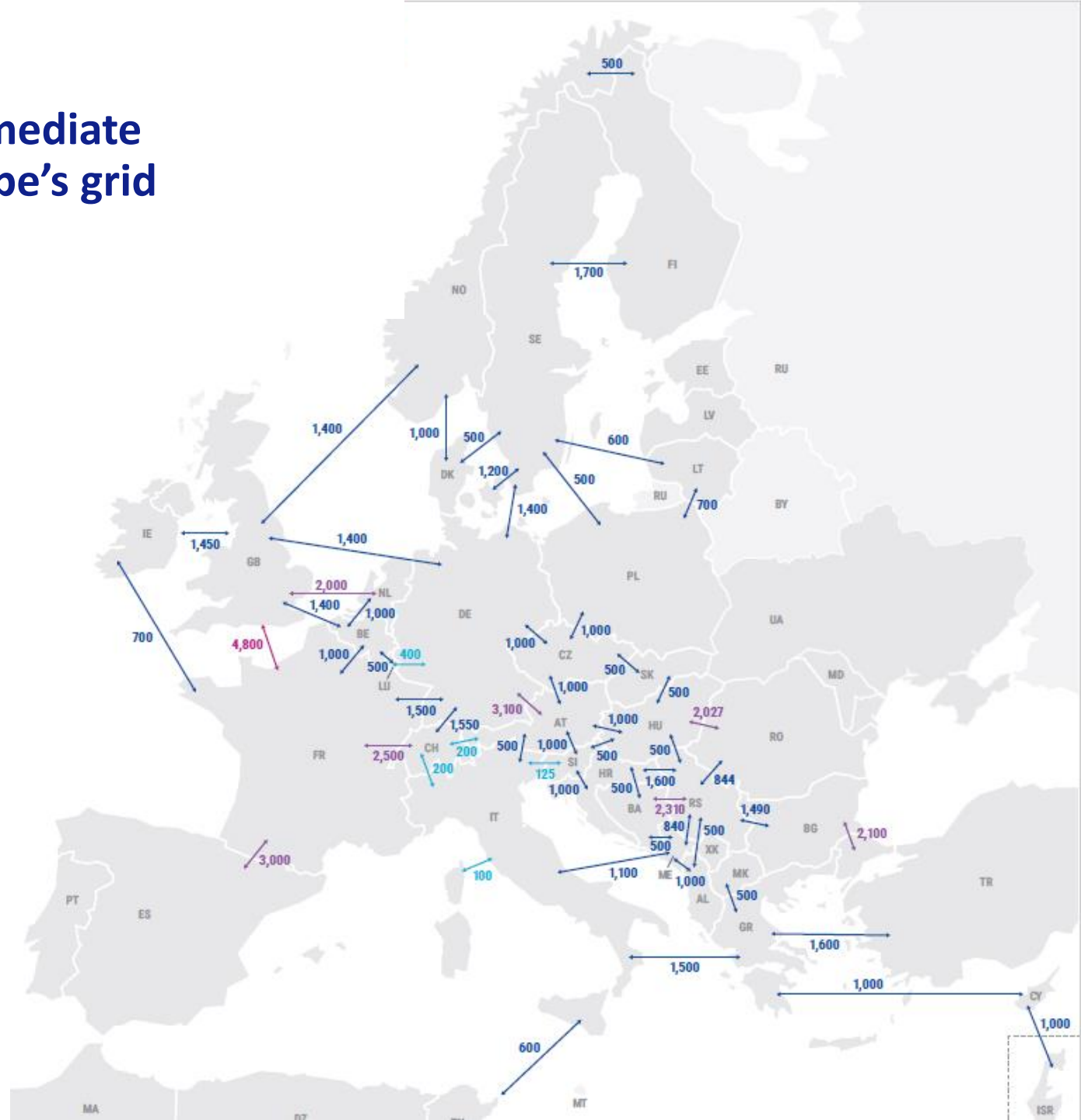
3. Coordinated planning will be needed across sectors.



Identified needs in 2030 show the immediate economic interest of investing in Europe's grid

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



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

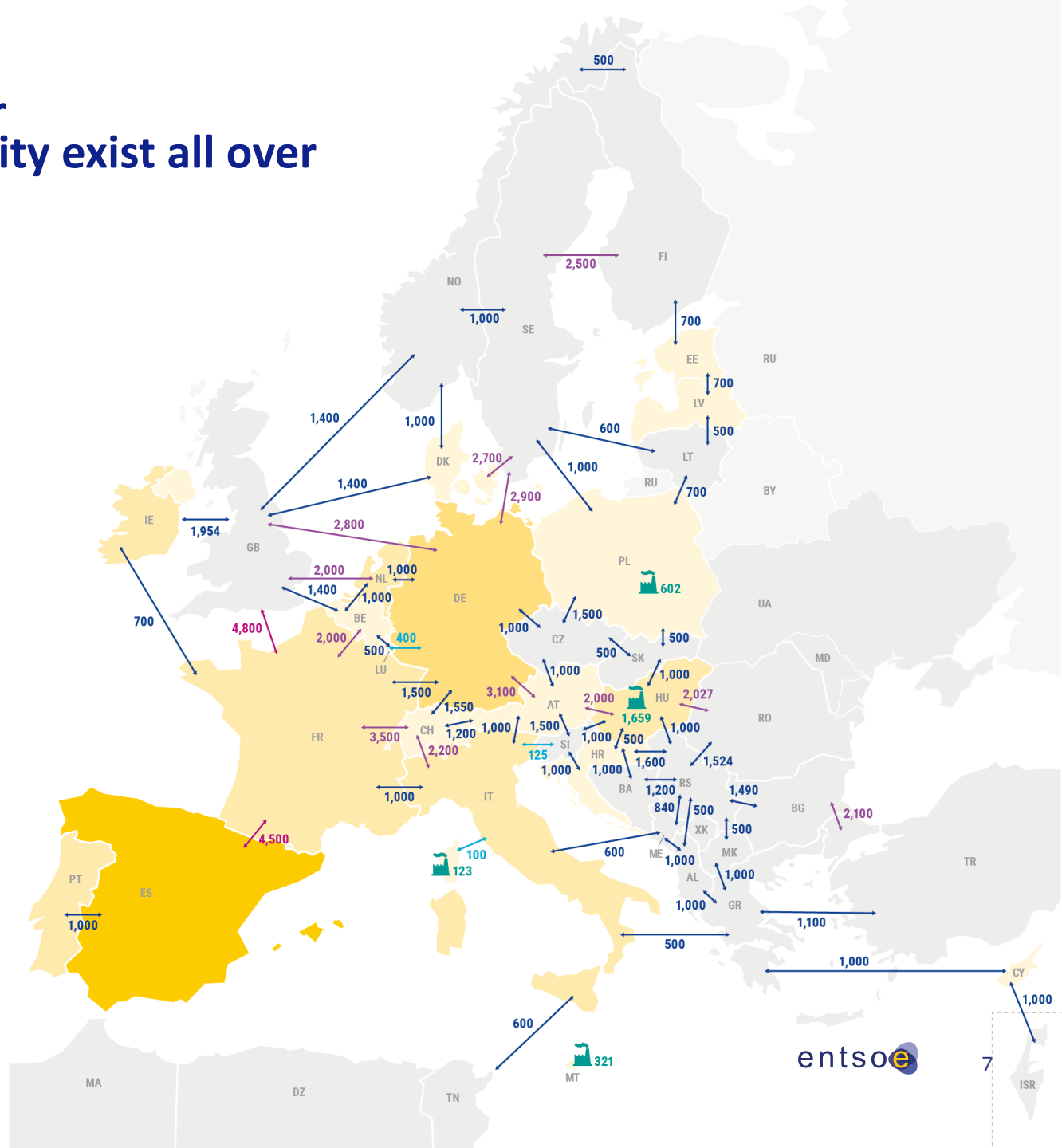
CROSS-BORDER CAPACITY INCREASES NEEDS IN MW (ADDITIONAL TO THE STARTING GRID 2025)

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

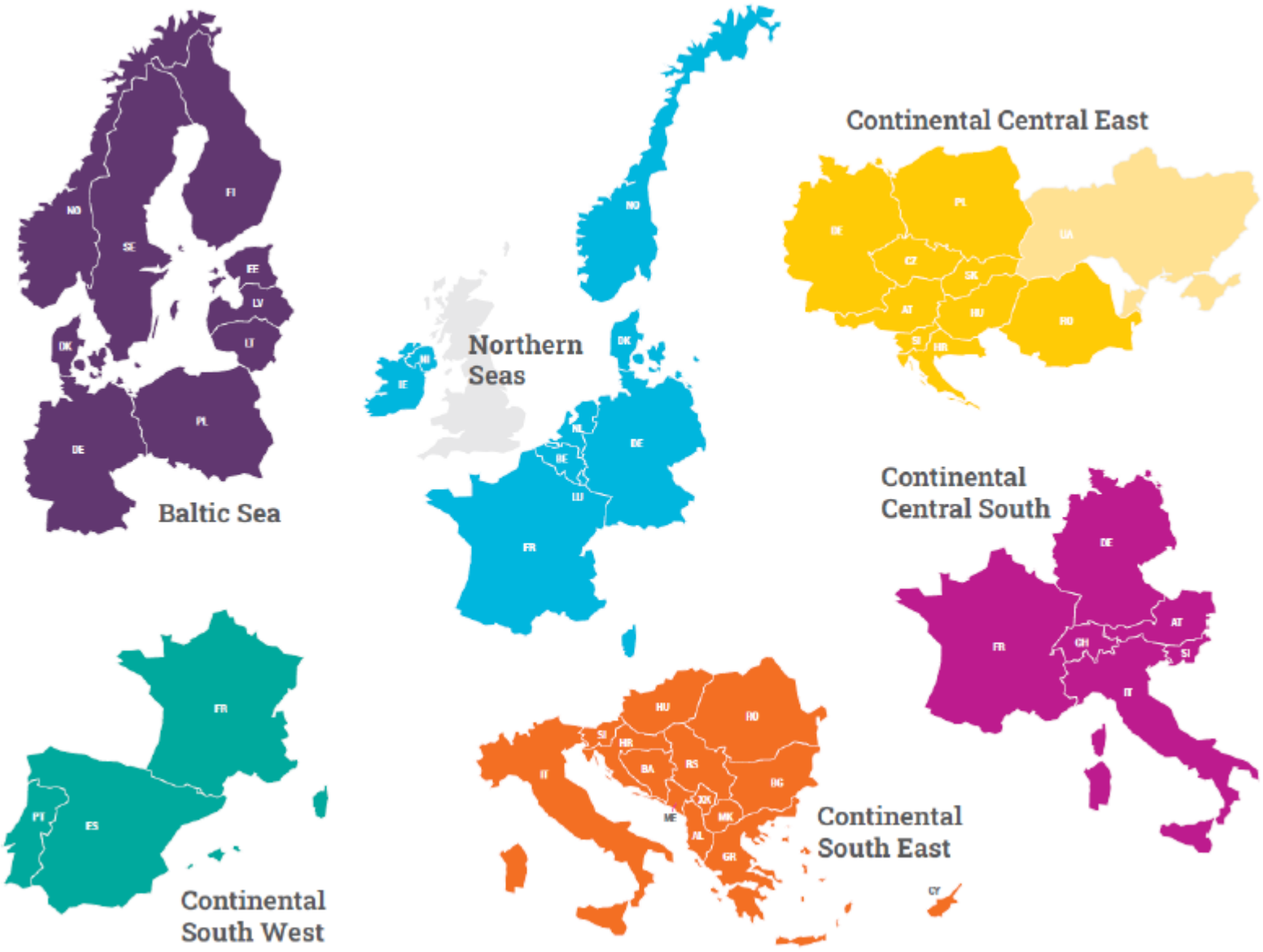
STORAGE NEEDS IN MW (ADDITIONAL TO BATTERY CAPACITIES IN NT2030 AND TO 2040 CAPACITIES FOR OTHER STORAGE TECHNOLOGIES)

- < 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



Regions in TYNDP 2022



- 6 Regional Investment Plans

- Online system needs visualization platform
- 141 cross-border or internal transmission projects and 23 storage projects assessed in TYNDP 2022

TYNDP 2022 after public consultation

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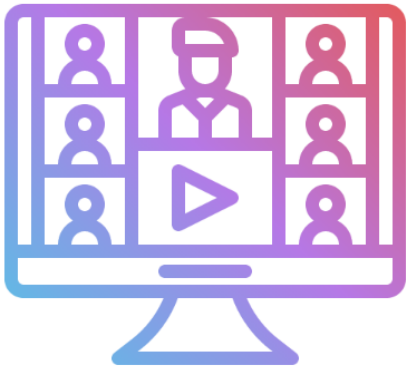
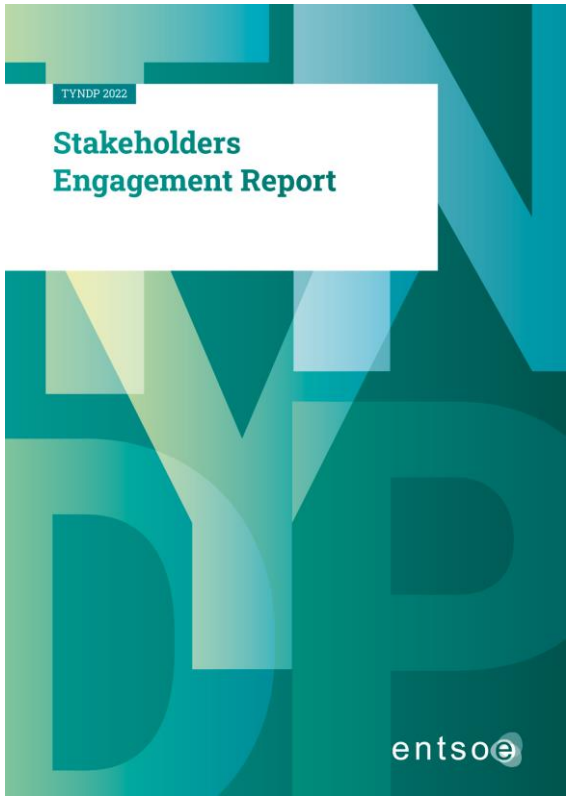
Stakeholder engagement in TYNDP 2022

All feedback and our answers

5 public consultations



12 webinars / workshops



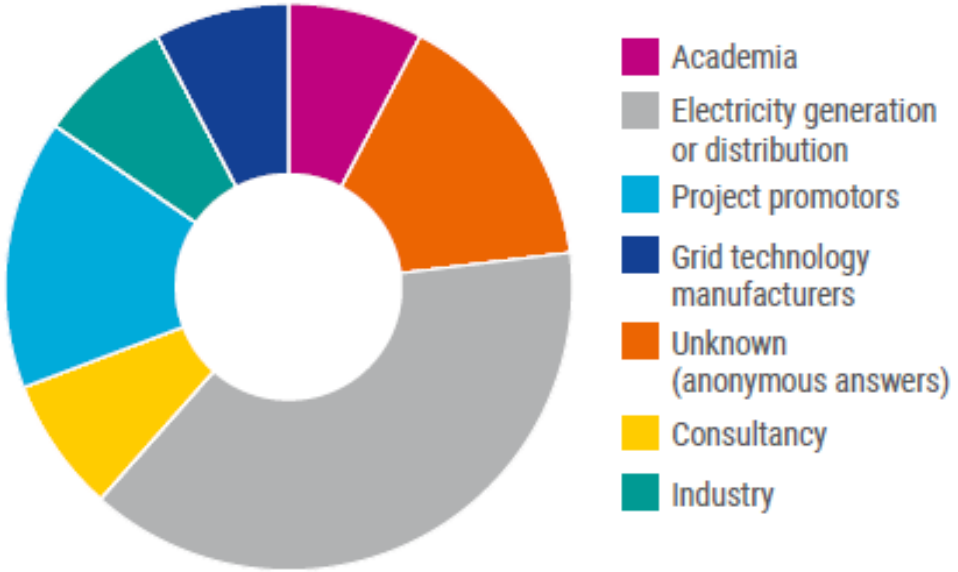
For the 1st time in TYNDP 2022:

- early stakeholder engagement on the identification of system needs methodology
- early consultation on the key improvements to the Implementation Guidelines

TYNDP 2022 public consultation outcome

- 14 stakeholders representing diverse interests and viewpoints

- Stakeholders generally liked:
  - quality of deliverables
  - early stakeholder engagement
  - improvements to system needs identification methodology
  - development of a specific draft methodology to evaluate needs for offshore hybrid assets, …



Calls for improvement in next TYNDP(s)

- Availability and transparency of scenarios data: Improvements to data visualization platform, more explanation on assumptions
- ‘outdated’ scenarios (developed before the war in Ukraine)
- Calls for further changes to the system needs identification methodology (investment candidates, …)
- Scenarios assessed by the system needs study
- Request to analyse investments gaps in Regional investment plans
- Explaining technical interlinks with ERAA
- Requests for events at regional or national level

Future challenges & opportunities from a regional perspective

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Part 1. Europe’s changing generation portfolio: Examples from the North Sea and Iberian peninsula

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Acceleration towards a CO2-neutral system for North Sea countries

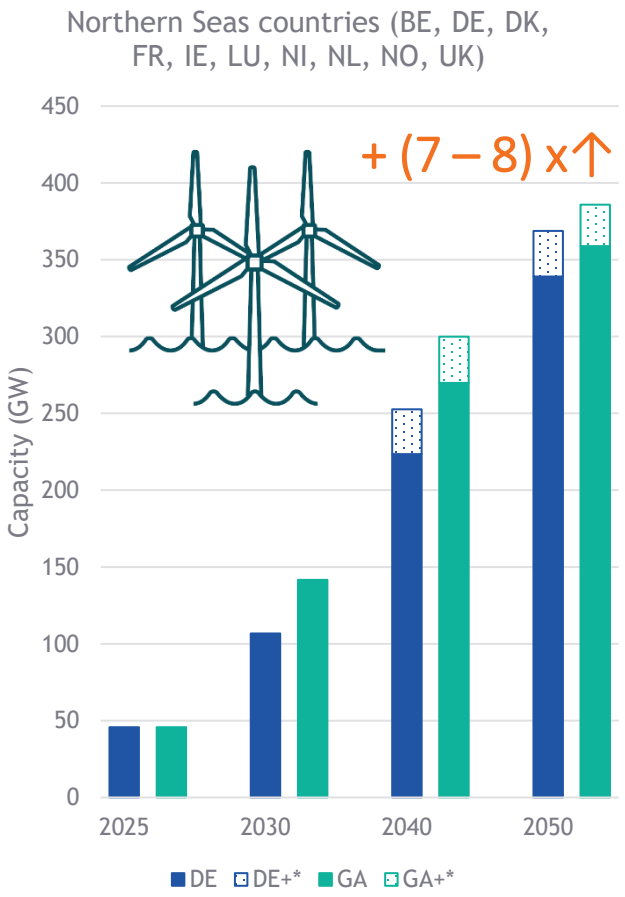
- Energy transition and acceleration with the REPowerEU
  - Grow in CO2 free supply
  - Offshore wind for Northern Sea countries

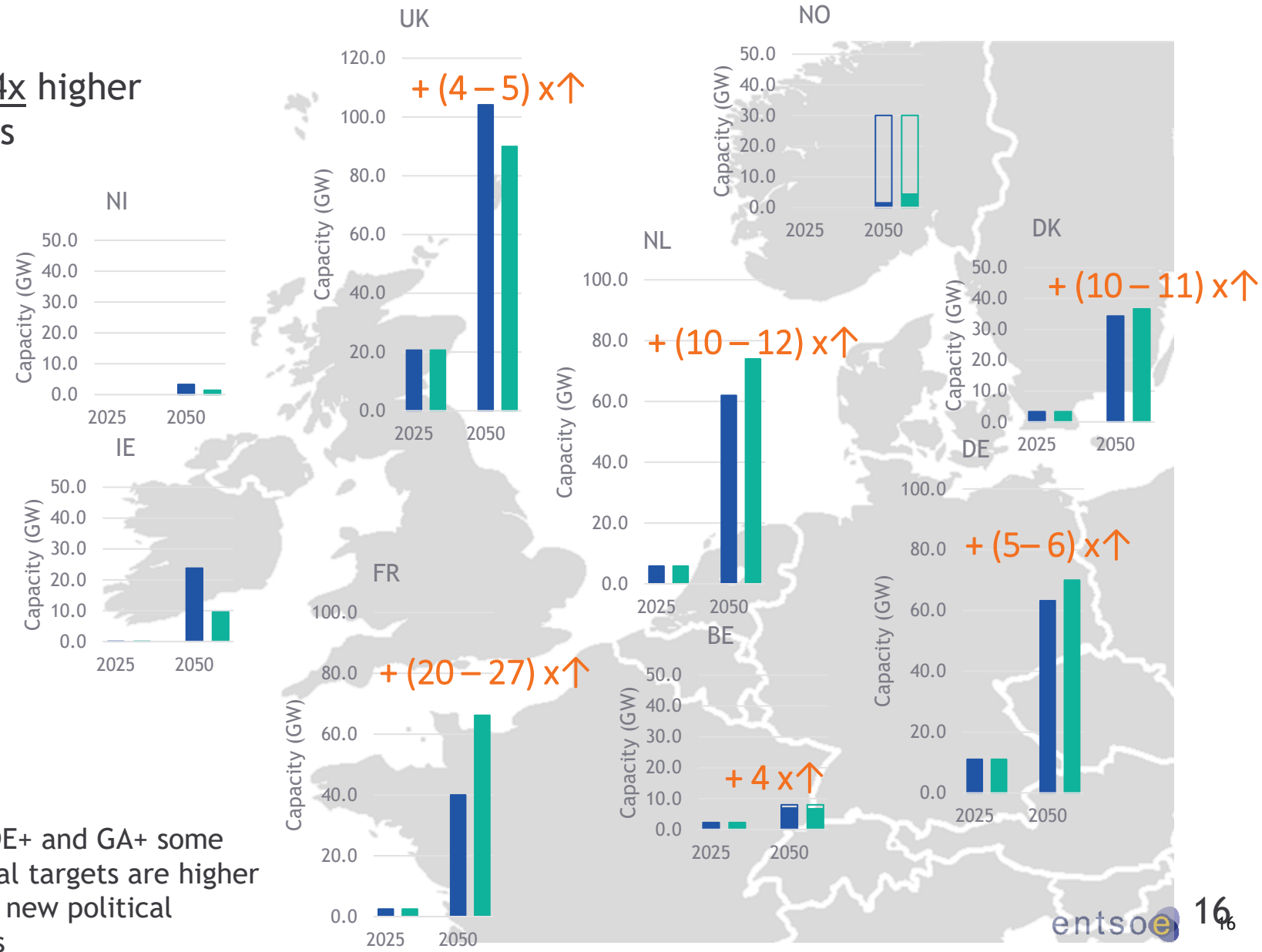
- Power system infrastructure = key enabler for decarbonisation of other sectors:
  - Electrification in industry to decarbonize leads higher electricity demand. → additional ‘stress’ to power system.

- Northern Sea countries are energy intensive
  - High need for renewable energy
  - Require reinforcement of electricity transmission networks

Offshore generation increases 7-8 fold in Northern Seas countries until 2050

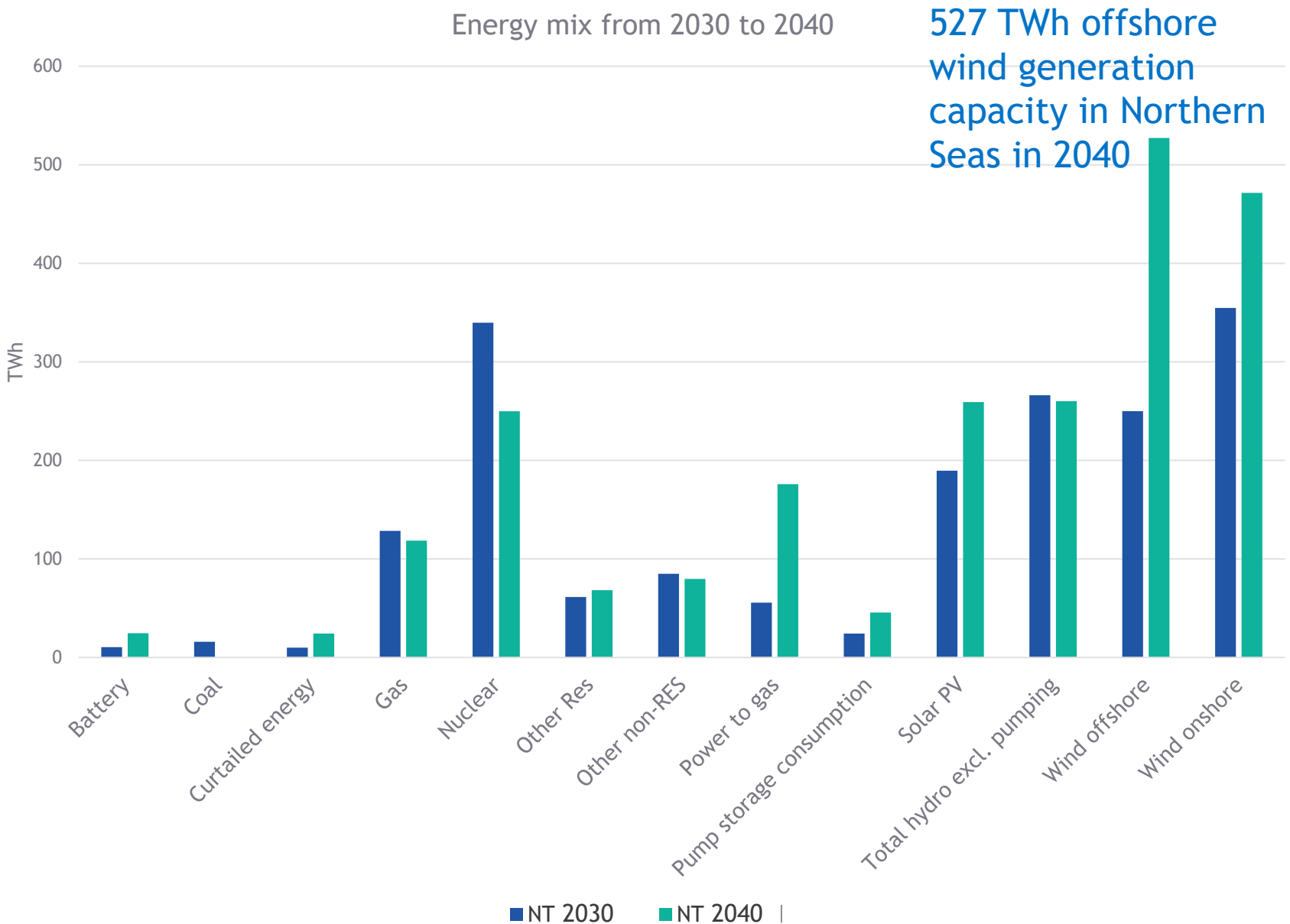
- Development speed needs to be 3-4x higher than today to reach national targets





* For DE+ and GA+ some national targets are higher due to new political targets

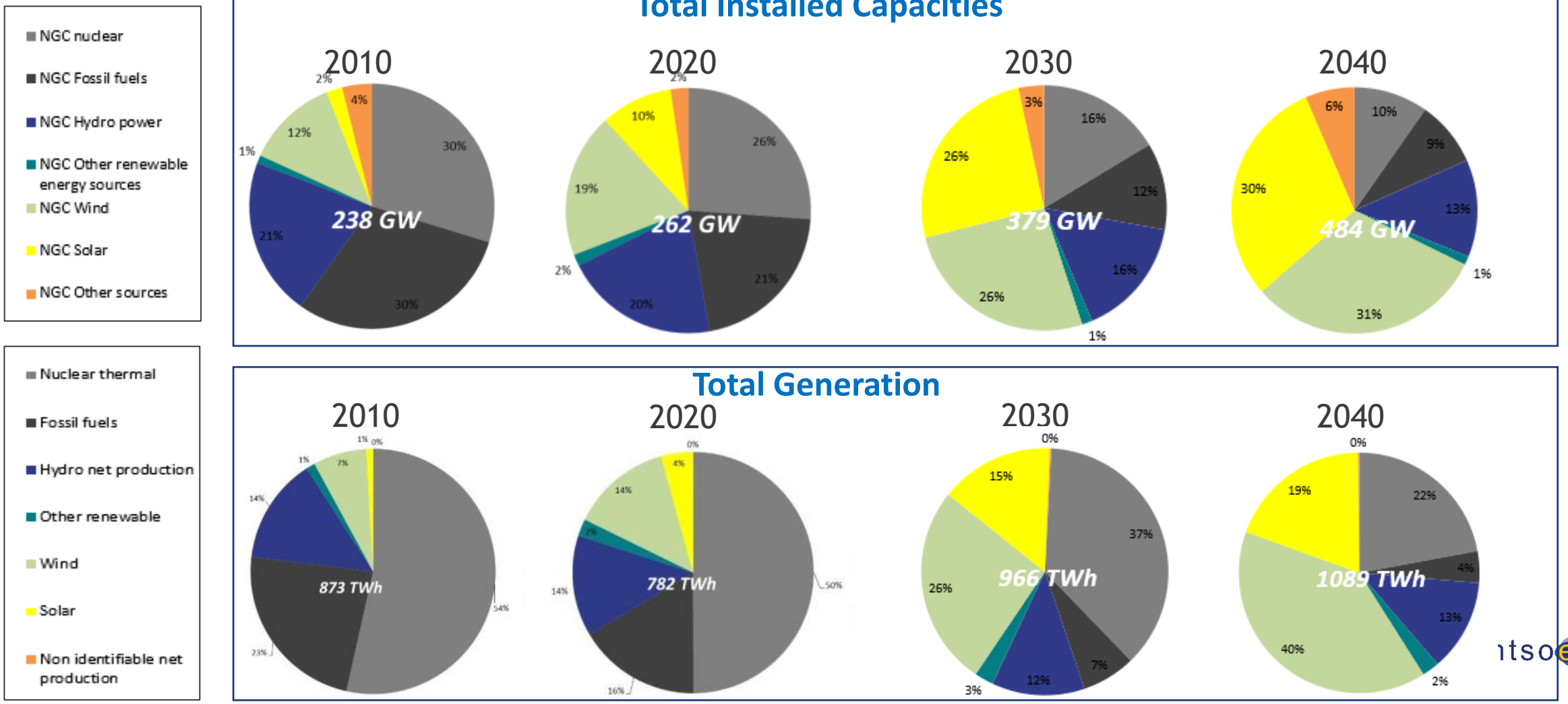
Increase of variable RES will require grid reinforcements



- The transmission network needs to handle large flows from supply areas to mayor demand centres
- Reinforcements needed onshore and a new grid offshore. To be further investigated in Offshore Network Development Plans (January 2024)
- High amounts of variable RES will also require (net CO2 free) flexibility in the whole energy system and all sectors

Example from South-Western Europe: Change in generation portfolio towards a carbon-free system

The 2030 and 2040 scenarios show a **transition from thermal to renewable generation,** including the partial phase-out of nuclear in France, a complete phase-out of nuclear in Spain and a complete phase-out of coal in the Iberian Peninsula



The system will experience new power flow patterns and important investment needs

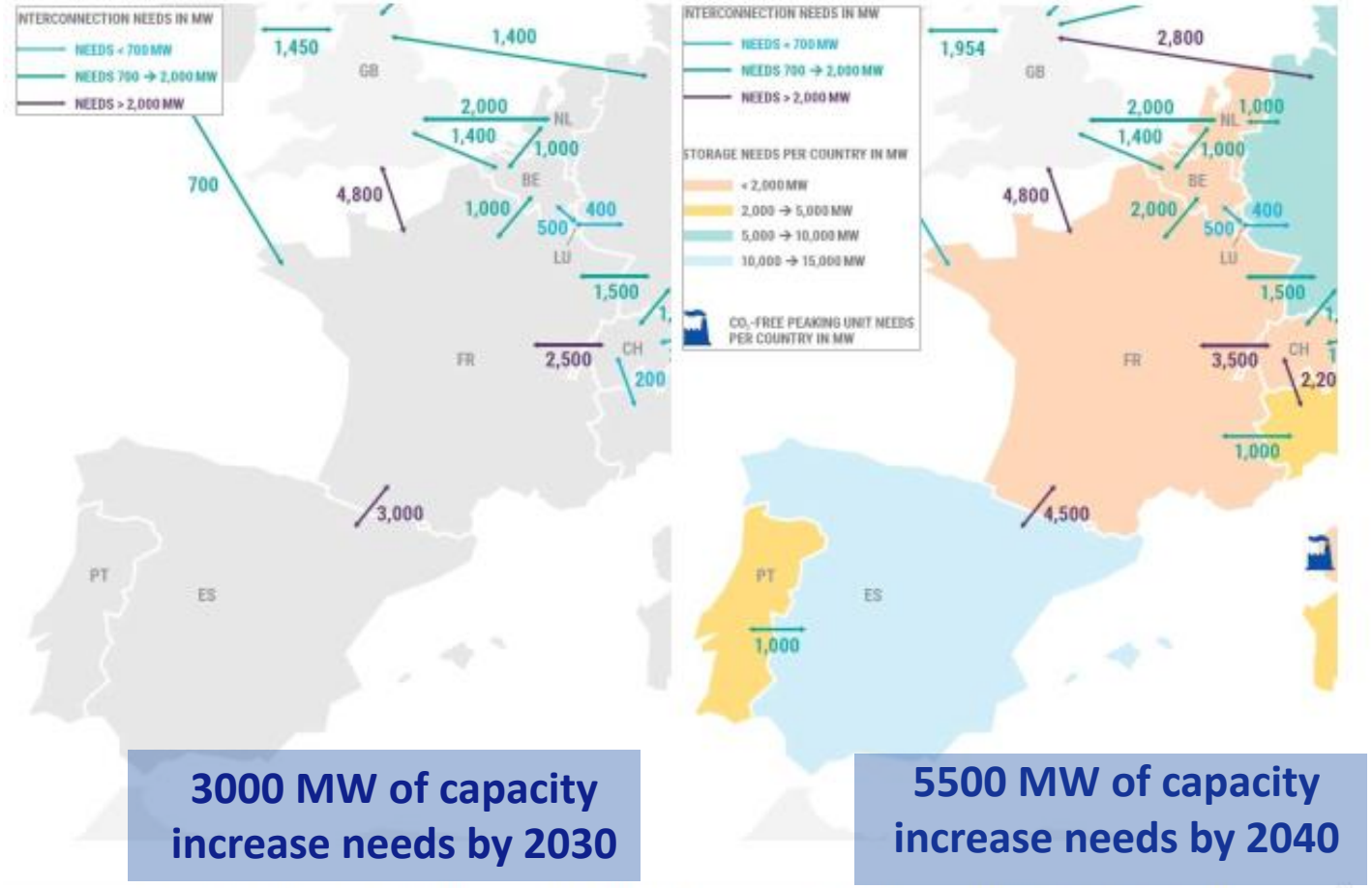


Figure 1: Identified grid reinforcements and other flexibility solutions needs for 2030 and 2040

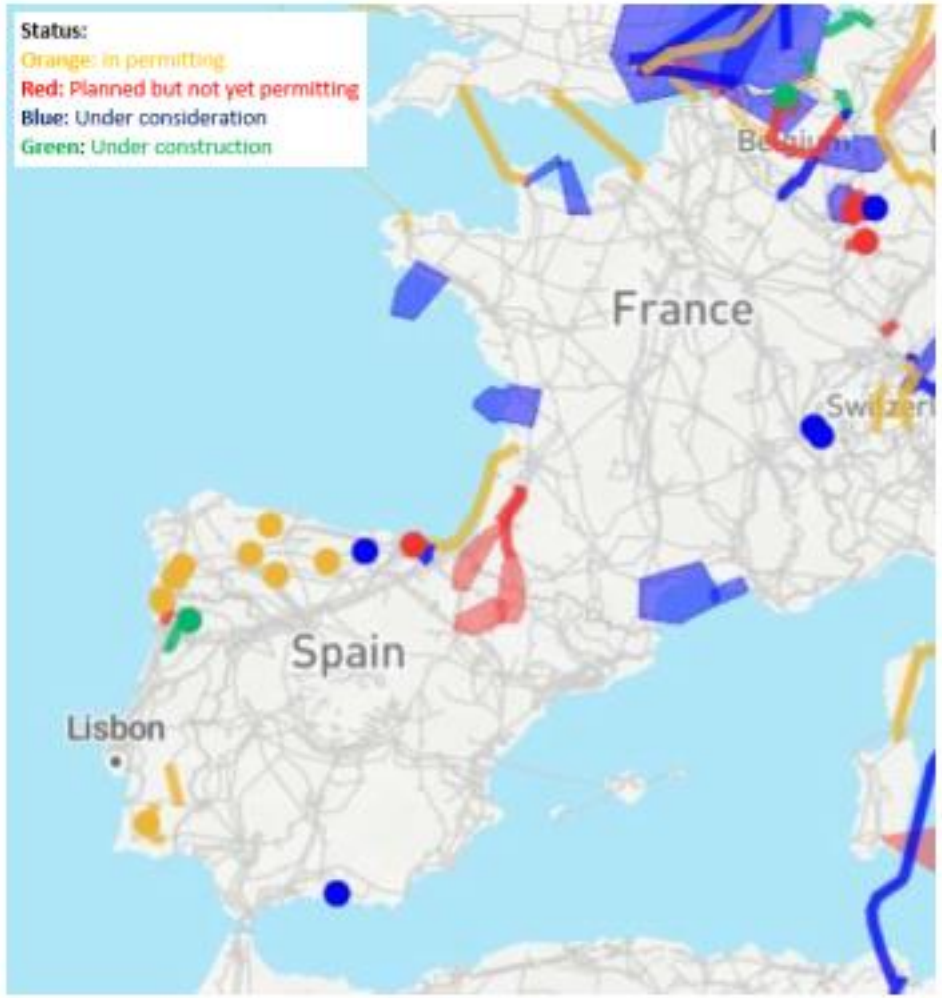
Impact of addressing the needs in 2040 (TYNDP 2022 system needs study):

- **878 M€/year reduction** of **generation costs** in the region
- **24 €/MWh reduction** of marginal **cost spread** between France and Spain
- **Integration** of an additional **9.7 TWh/year** of **renewable energy** which would otherwise be curtailed. This value represents 1.1% of the total demand in the CSW region or 1.5% of the total production from wind and solar energy in the region in the 2040 scenario
- Up to **3.7 Mtons/year reduction** of **CO2 emissions** in Europe of CO2 emissions in the region

From needs to projects

Cross-border transmission projects

- New northern interconnection between Portugal and Spain
- Biscay Gulf project between Spain and France
- Navarra Landes and Pyrénées Atlantiques-Aragon between Spain and France



Storage projects

- Purifying Pumped Hydroelectric Energy Storage (P-PHES), Navaleo, in León
- Purifying Pumped Hydroelectric Energy Storage (P-PHES), Cúa, in León
- Purifying – Pumped Hydroelectric Energy Storage 'Velilla del Río Carrión', in Castilla y León
- Purifying Pumped Hydroelectric Energy Storage,Buseiro in Asturias
- Reversible Hydraulic Power Plant Aguayo in Cantabria
- Reversible Hydraulic Power Plant Los Guajares, Andalucía

In addition to these projects there are still gaps to reach the identification of a system needs optimum. Other solutions are needed

Part 2. Interconnection of Continental Europe with neighbouring countries: examples of Ukraine and the Baltic States

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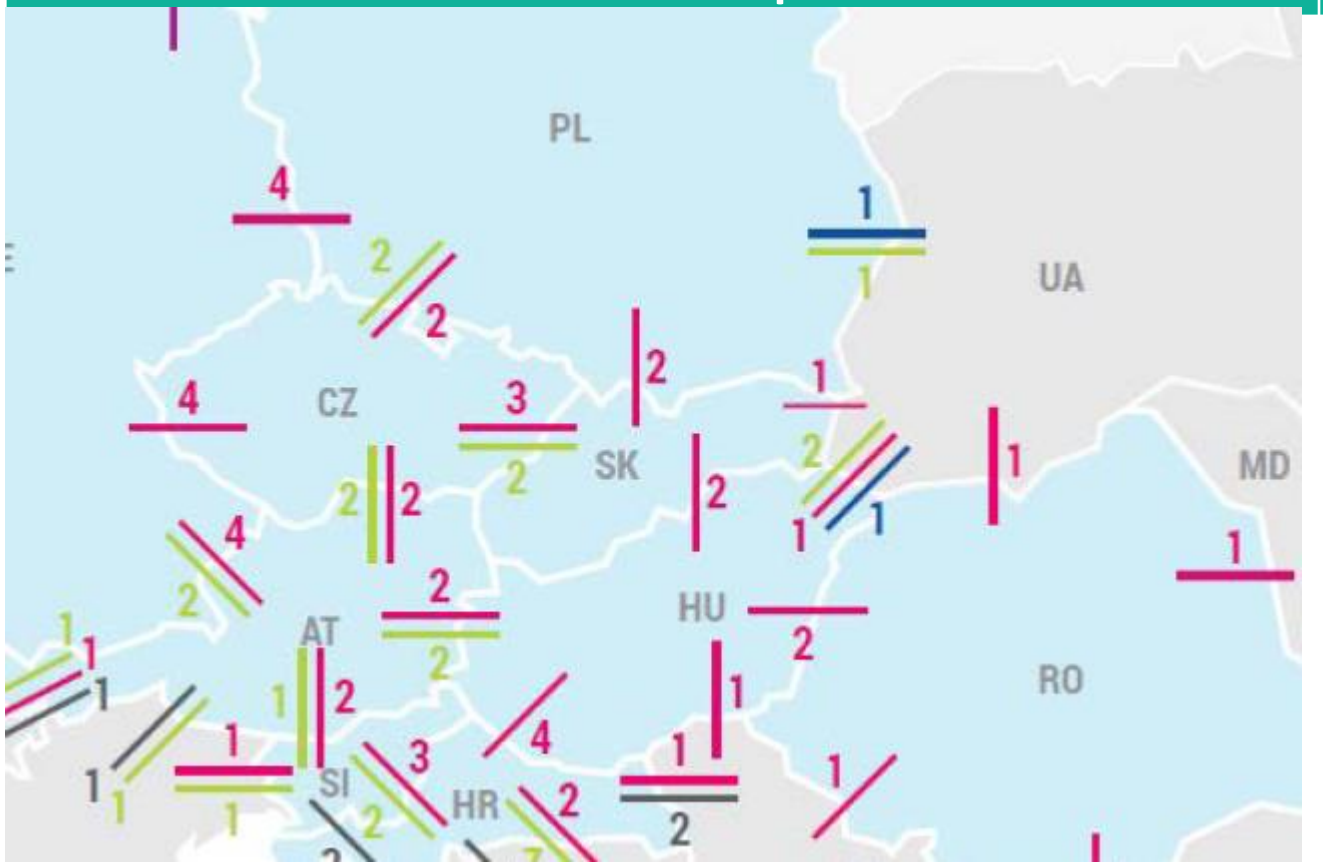
Interconnection of Continental Europe with Ukraine

Numbers of cross-border interconnectors in central-Eastern Europe



Reasons for Connecting Ukraine to the European Grid

- ✓ Increase energy security for Ukraine and is on the EU political agenda
- ✓ Reduce overall greenhouse gas emissions, with Ukraine and European countries being able to sell surplus electricity from RES to their neighbours instead of shutting down RES
- ✓ Both Ukraine and the EU will benefit from lower electricity production cost

Connection agreement, additional study, isolated mode test

- July 7, 2017 – Contract on Future Interconnection (CFI), a Catalog of measures including a list of necessary additional studies (static and dynamic stability) and a roadmap.
  → To ensure a smooth implementation and set-up of commitments on both side a CFI was necessary

- December 2021 – Studies confirmed the possibility of a synchronous operation.
  → To ensure cross-border electricity exchanges during synchronous operation, the implementation of a set of countermeasures regarding the improvement of dynamic stability is necessary.

- February 24, 2022 - the power systems of Ukraine and Moldova (UA/MD control block) went to an isolated mode of operation. All tests were successful.
  → To verify the ability of the system to operate stably.

- March 16, 2022 – emergency synchronization of the UA/MD control block with the power system of continental Europe.
  → To ensure a successful emergency synchronization the CFI was supplemented with an additional Catalog of Measures.

- **June 30, 2022 - first commercial electricity exchange between UA/MD control block and neighboring EU countries.**

Past and future grid development

According to the steady-state stability analysis, the secure cross-border electricity exchange between the UA/MD control block and continental Europe can reach about ≈1700 MW.

Several measures are still required for a full commercial electricity exchange:

- Retuning of Power System Stabilizers (PSSs) and Automatic Voltage Regulators (AVRs) on Ukrainian power plants (Q1-Q2 2023);
- Installation by Ukrenergo of STATCOM devices at 750 kV and 330 kV substations of the Ukrainian grid (Q3-Q4 2023).

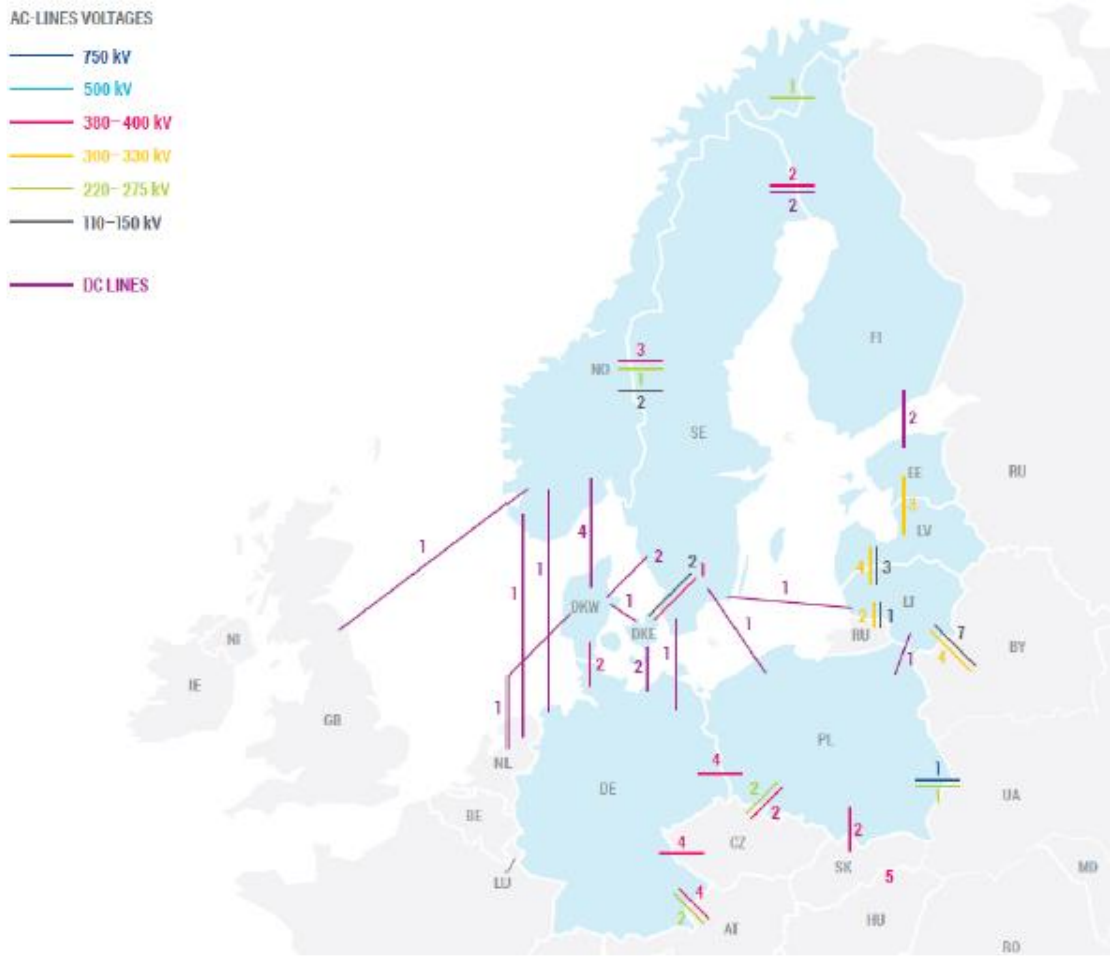
New interconnectors development plans:

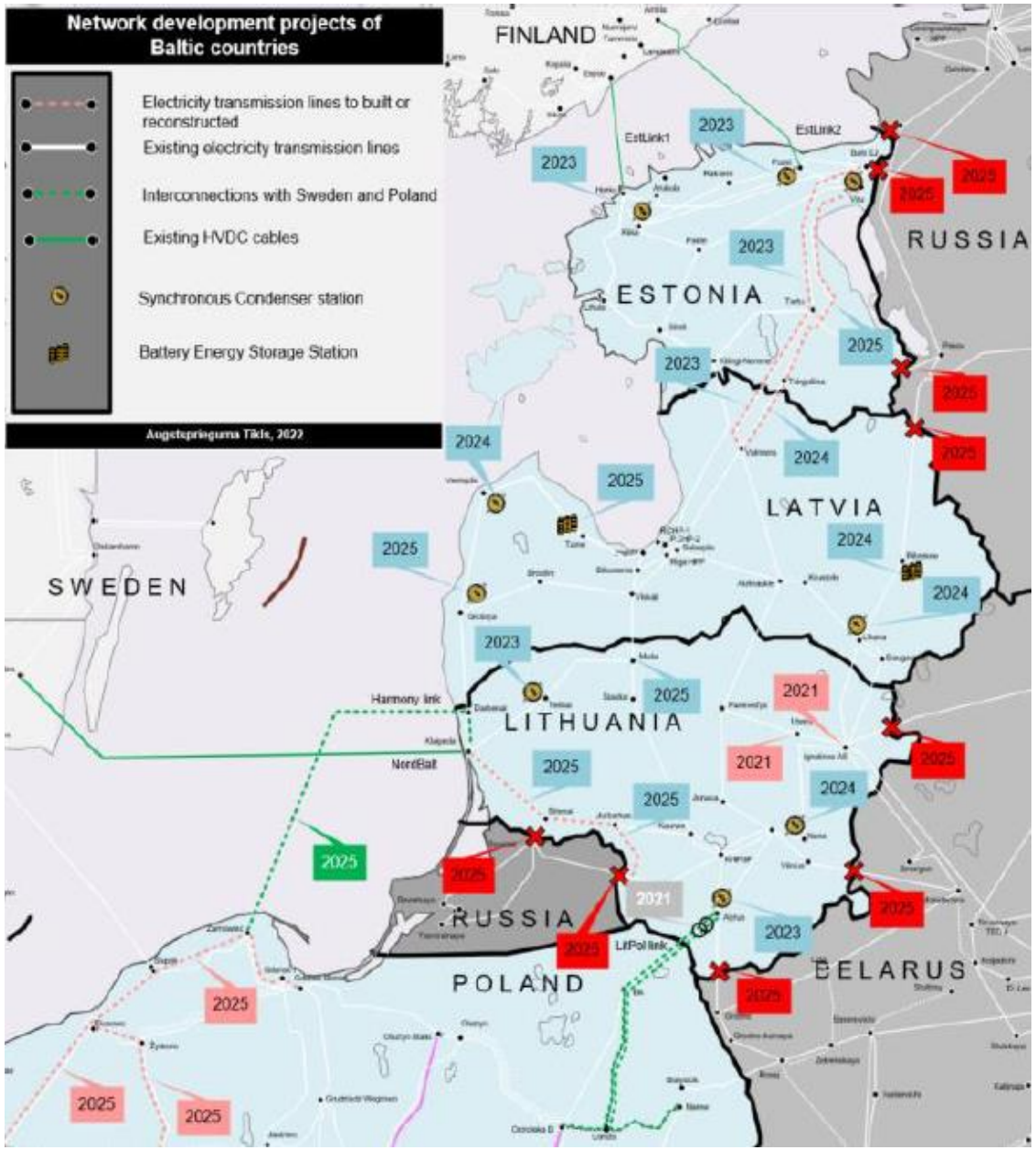
- Put into operation OHL 400 kV Khmelnytska NPP (UA) – Rzeszow (PL) /(2023)
- Modernization OHL 400 kV Mukacheve (UA) – Velke Kapusany (SK) /(2024 on UA side & after 2030 on SK side)
- Construction of the 750 kV Prymorska substation and rebuilding the OHL Prymorska (UA) – Isaccea (RO) (2027
- Construction of the new OHL 400 kV Suceava (RO) – Balti (MD) (2030)

→ The envisaged time schedule between 2023-2030 depends on the war situation in Ukraine.

Baltic States Power Systems Introduction

Synchronous areas and existing interconnections in the Baltic Sea region





Topology of investments for Baltic States included in the Baltic synchronisation project.

Baltic States Power Systems synchronization with Continental Europe Synchronous Area

Initiation of the process

- 21 September 2018: the Polish TSO submitted the application for the extension of CESA by the BSPS;
- 9 October 2018: RGCE Plenary found the extension procedure feasible and established PG Baltic;
- 4 December 2018: RGCE Plenary initiated works on *Agreement on the Conditions of the Future Synchronous Interconnection between BS and CESA power systems* (**CFI Agreement**).

CFI Agreement

- Entered into Force on 27 May 2019; valid until **31 December 2025** (with BS TSOs right to extend for 3 years);
- Catalogue of Measures: list of technical conditions ensuring safe synchronous interconnection with BSPS.

Overview of CFI Synchronization studies

Scope of the Studies:

- Transient Study;
- Small Signal Oscillatory Stability Study;
- Island Frequency Operation Stability Study;
- Frequency Stability Assessment System;
- Frequency Restoration Controllers.

Synchronisation studies were finalized in November 2022

Baltic Power States Systems synchronization with CESA
Highlight on implementation of key investment (as of Q3/2022)

Last commissioned project:

Upgrades in Alytus substation in Lithuania

Ongoing projects status update:

1. Final production and instalment of **Synchronous Condensers**: Q4 2024 in Lithuania, Q2 2024 in Estonia and Q2 2025 in Latvia.
2. The implementation of **transmission lines** and substation projects are going according to schedule
3. **Harmony Link** project is at the procurement phase: tenders of 2 converter stations (1 in LT, 1 in PL) and Marine HVDC cable are at the final offer phase.
4. Procurement and development of **new system control tools**.
5. **Battery Energy Storage System** is under development, the procurement is ongoing, submission of offers is expected on 01/2023 with conclusion of agreement with constructor in 04/2023.
6. **The IT and SCADA system improvements** in Latvia, Estonia and Lithuania are in progress, agreements are concluded and the rest of investment items are going according to the planned schedule.

Part 3. How to make the system fit for future needs? Examples from Southern Europe

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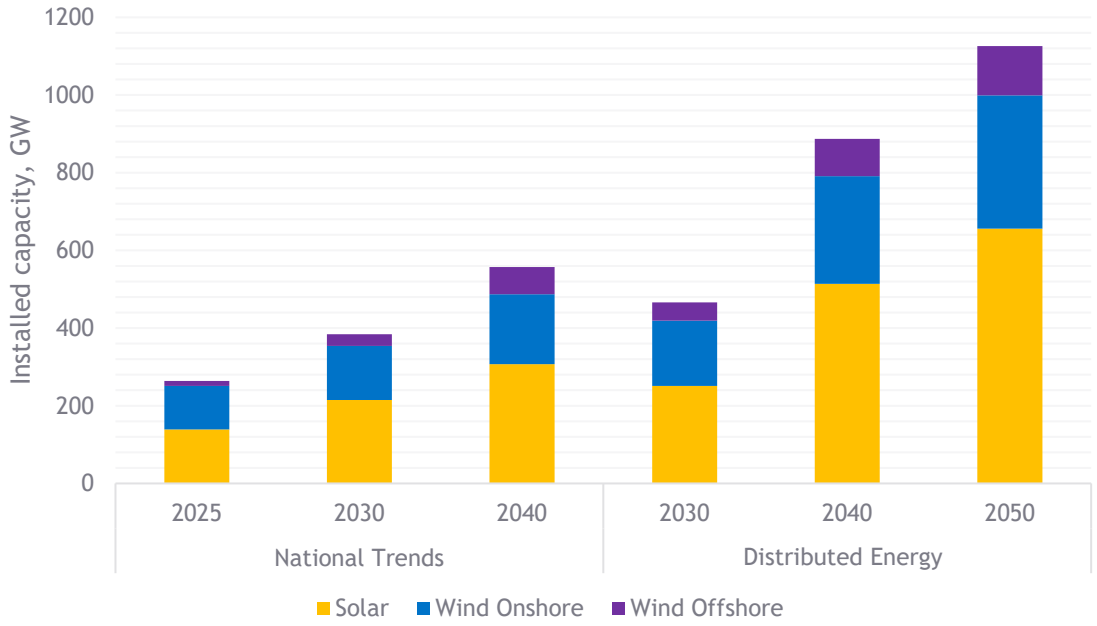
RES expansion drives the further development of transmission infrastructure

LARGE SCALE TRANSMISSION REQUIRENMENT FOR THE NATIONAL GRIDS IN THE REGION IS EXPECTED

Large share of wind power generation esp. wind offshore in the North Sea area, while PV dominates in southern part of the region

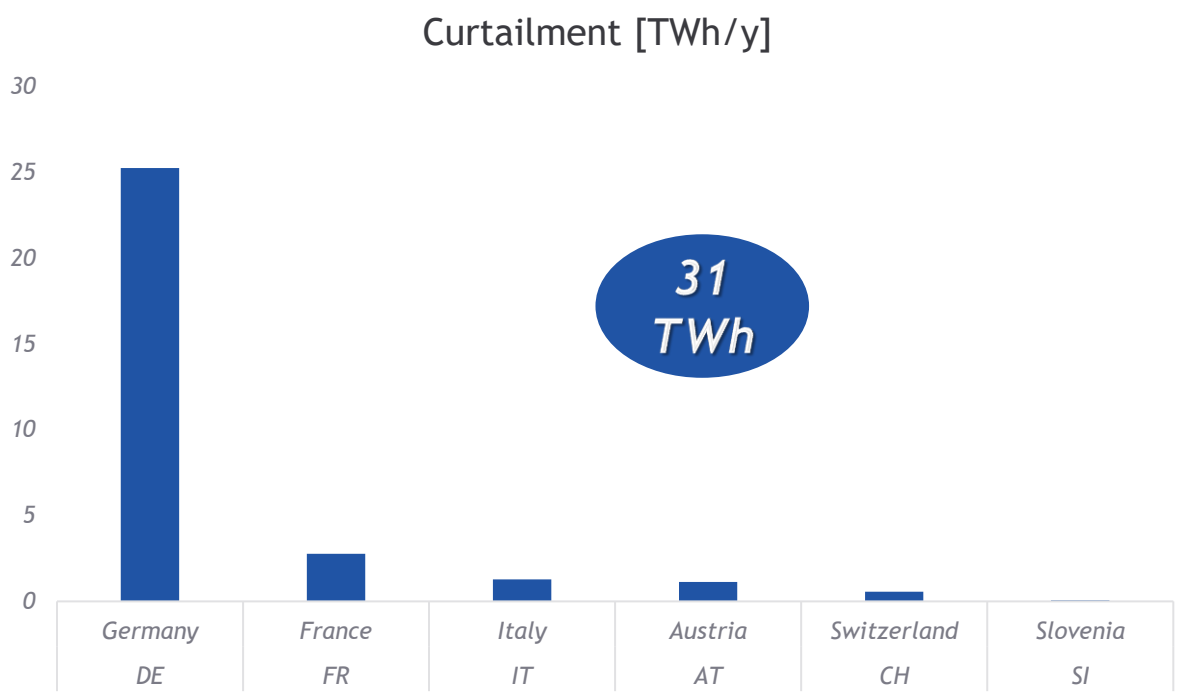


EXTENSIVE DEVELOPMENT OF THE ELECTRICAL GRID IN THE REGION IS NECESSARY

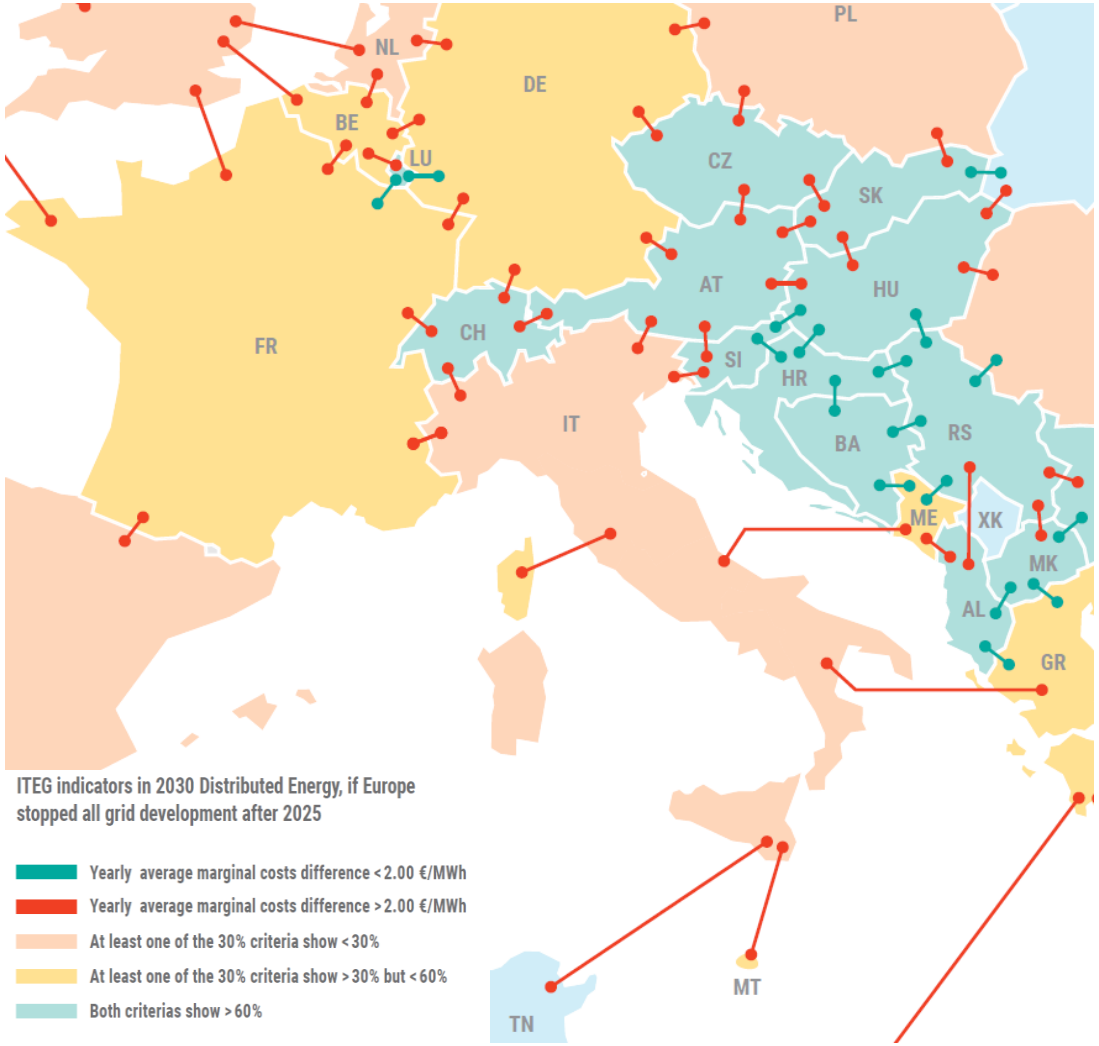
- Critical situation with high RES generation and heavy transit flows in the North-South
- In addition to interconnections, further development of internal national grids is crucial to meet future transmission requirements

Main barriers for power exchange

The main borders due to market integration needs refer to the Italian northern border and the boundary between Italy and Southern-East border, the Swiss Northern border, the French north-eastern border and the Austrian-German border



Curtailed Energy [TWh] for NT 2040 with 2025 grid



ITEG Indicators for DE 20300 with 2025 grid

Integrating the Italian peninsula

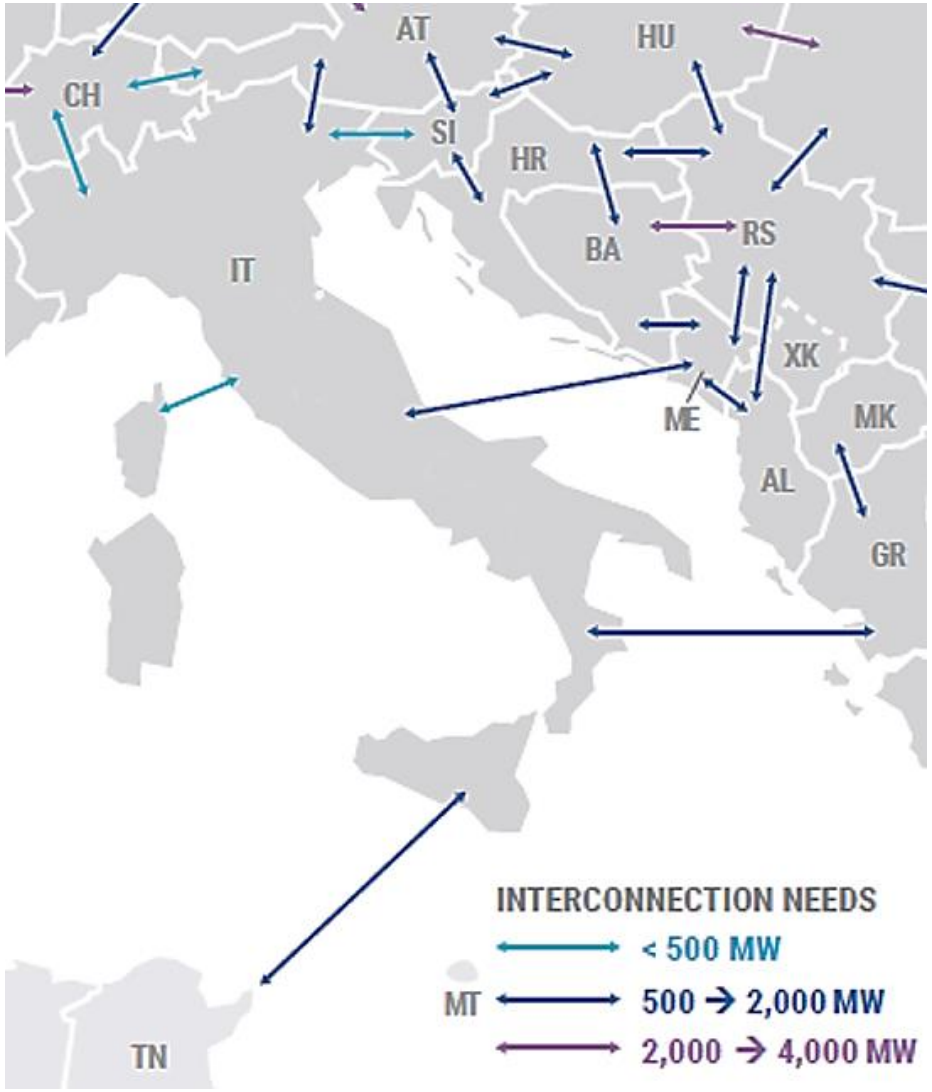
- The **Northern Italian border is one of the most congested in Europe**, due to the high market price differential between Italy and neighboring markets.
- **Italy** is a **peripheral area** of the European system, **with one of the highest level of RES penetration** in Europe.
- Main drivers for the development of the transmission capacity at the Italian Northern boundary:

  exploitation of new generation, mainly located in the North CCS Region (mostly Germany, Austria and France) and in the South of Italy.

  interconnections **with the Balkans, North-Africa and Greece** will also contribute **to market development and integration, RES usage** and **system security**.

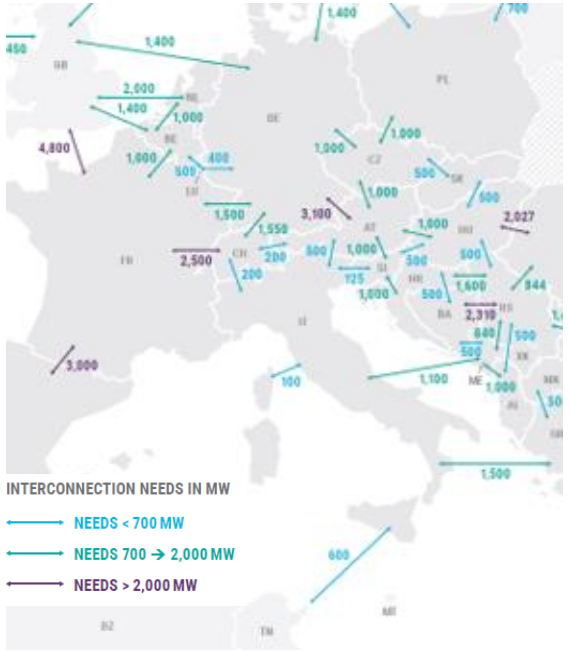
- **interconnecting Corsica** within the European system is of major relevance for **security of supply** and market integration.

Strengthening the links between the Italian peninsula and South-East Europe



- TYNDP 2022 finds needs for both new **tie-lines on dry land and the submarine DC links** from Italy to South-East Europe.
- The strengthening of the highlighted links could aid **reducing energy price differences** between Italy and South-East Europe.
- It could help avoiding curtailment and **integrating large amounts of RES** in Italy and in South-East Europe.
- The new corridors will be important for exports and imports of/from Italy to South-East Europe.

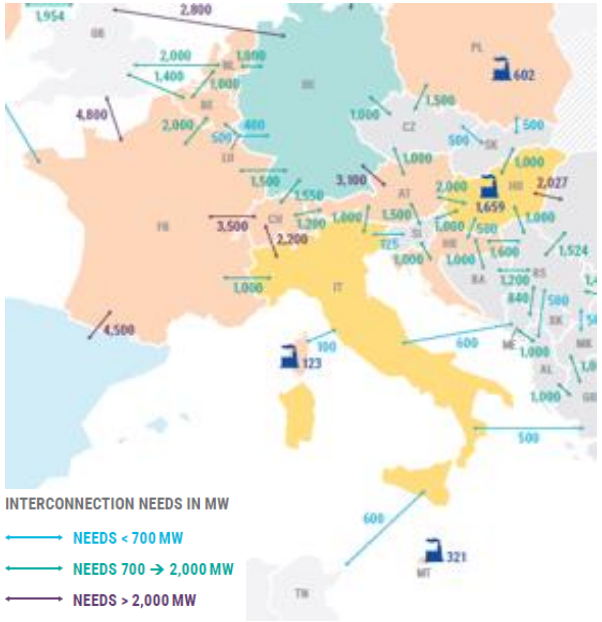
From needs… to projects



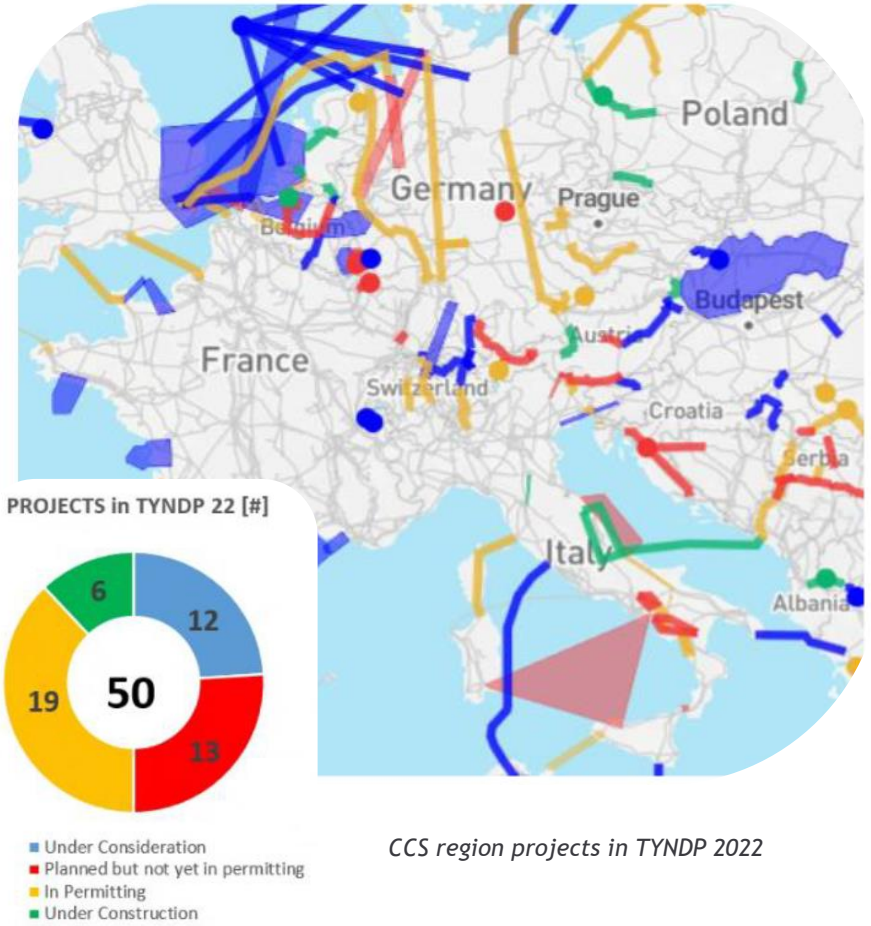
Identified capacity increase in 2030

More than 13 GW by 2030

More than 14 GW by 2040



Identified capacity increase in 2040

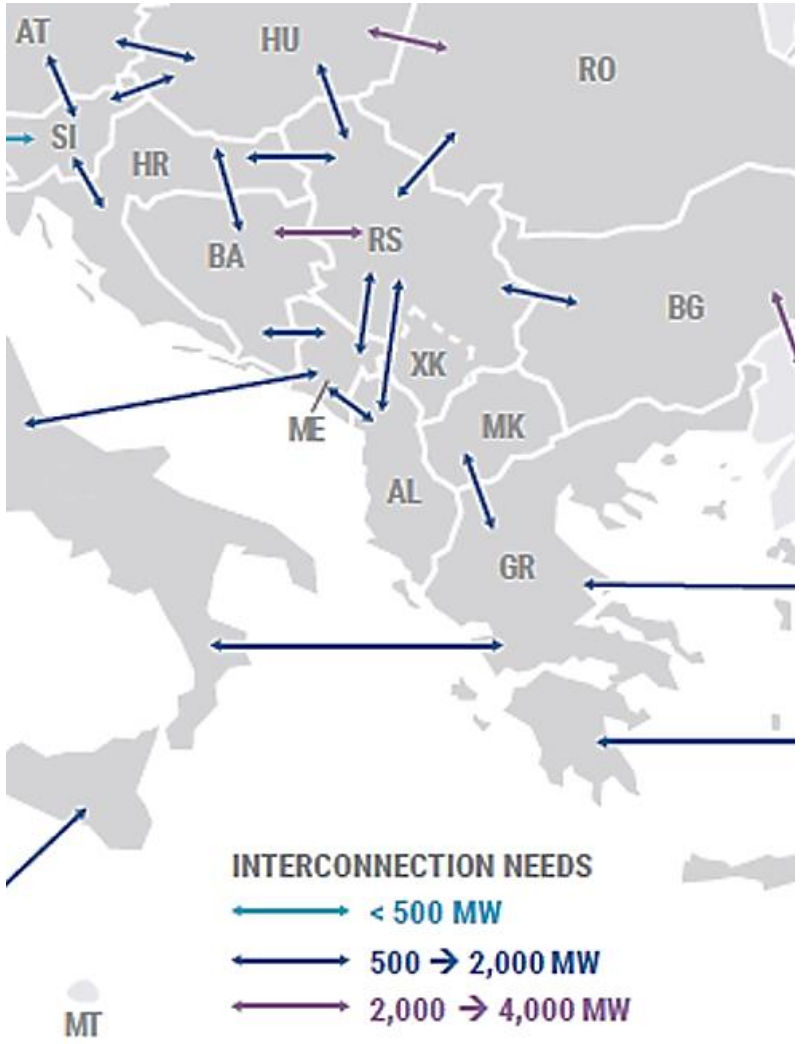


CCS region projects in TYNDP 2022

*The outcomes of the investigations confirmed the **importance of past projects** (from TYNDP 2020) to meet **market integration needs, increase the sustainability** of the transmission system by integrating **more RES generation and improving the SoS**.*

South-East Europe: Needs for stronger connections between EU and non-EU members

- The established transmission corridors could prove to be vital for exchanging energy between the different parts of the EU in the future.
- The newly built tie-lines will need to be followed by **investments in national networks** to ensure maximal benefits.
- Addressing these needs could not only reduce the **price differences** in the region, but also contribute to system **stability and reliability** in the coming years.



Connections with Turkey, Ukraine and Moldova

- In addition to the reinforcements needed within the region, TYNDP 2022 finds needs for increasing capacities on the borders with Turkey.
- Two projects (P1066 and P1067) were assessed in TYNDP 2022, one involving Bulgaria and the other involving Greece.

- The first cycle of SECI TSP project assessed the effects of the synchronization with Ukraine on South-East Europe.
- An interconnection project between Romania and Moldova is being considered.

RES integration and the second cycle of SECI TSP project

- South East Europe is also facing **challenges that are directly related to the connection of the renewable sources** to the grid.

- The second cycle of the SECI TSP project will evaluate the impact of RES integration in South-East Europe region.

- SECI TSP will also develop **unified market and network models** of the systems in the region that TSOs can later use for their studies.

Q&A

Ask your questions at slido.com #4340 066

TYNDP 2024 stakeholder engagement timeline (tentative)

Q1 2023

20 February: Webinar on TYNDP 2024 scenarios state of play – Registration will open soon
Set up of scenarios Stakeholder engagement group

Q2 2023

- March/April: 1st Public consultation on TYNDP 2024 scenarios (input parameters)
- April/May 2023: Public consultation on TYNDP 2024 Guidance for project promoters
- June: Webinar on submitting a project to TYNDP 2024

Q3 2023

- Improvements to the methodology to identify system needs
- 2nd Public consultation on TYNDP 2024 scenarios (draft results)
- CBA Implementation Guidelines

Q3-Q4 2024

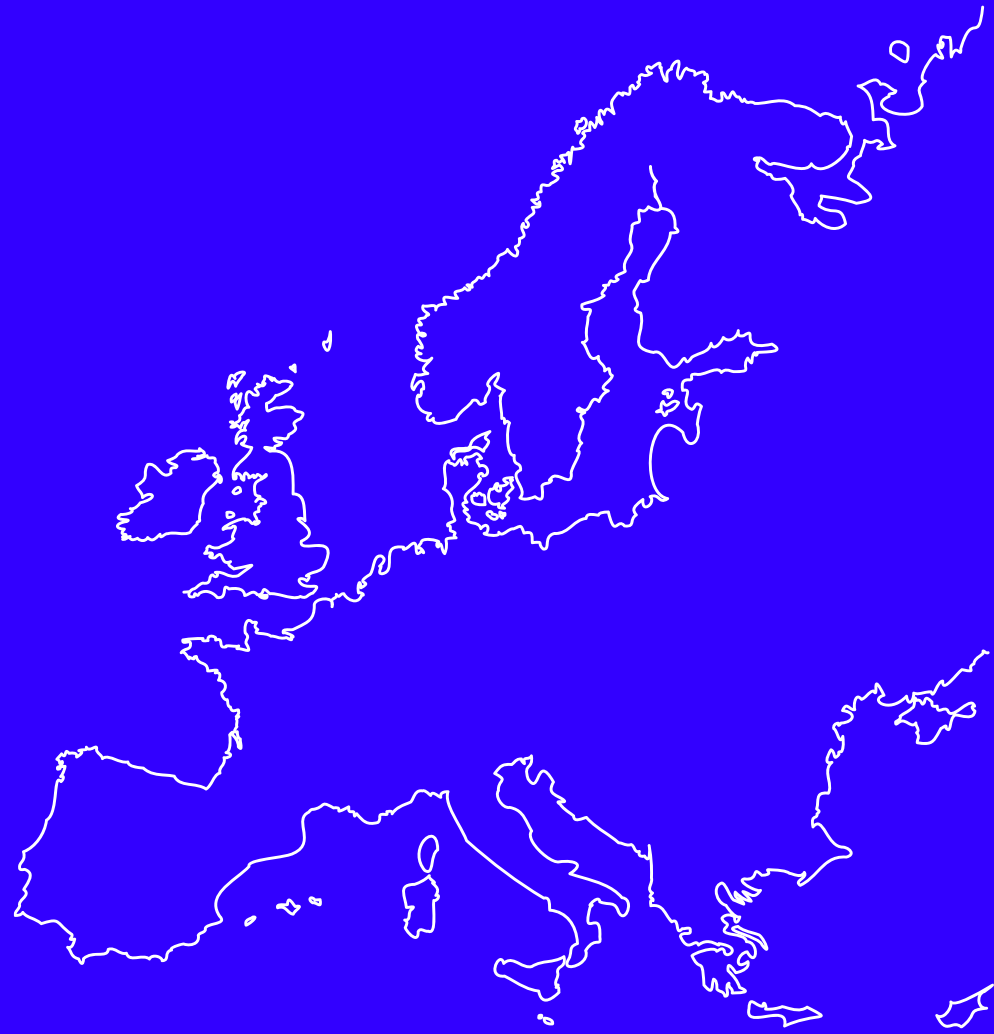
- Draft TYNDP 2024 package

Collaboration and questions at

tyndp@entsoe.eu

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

tyndp.entsoe.eu



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We all play a part in bringing them to life.