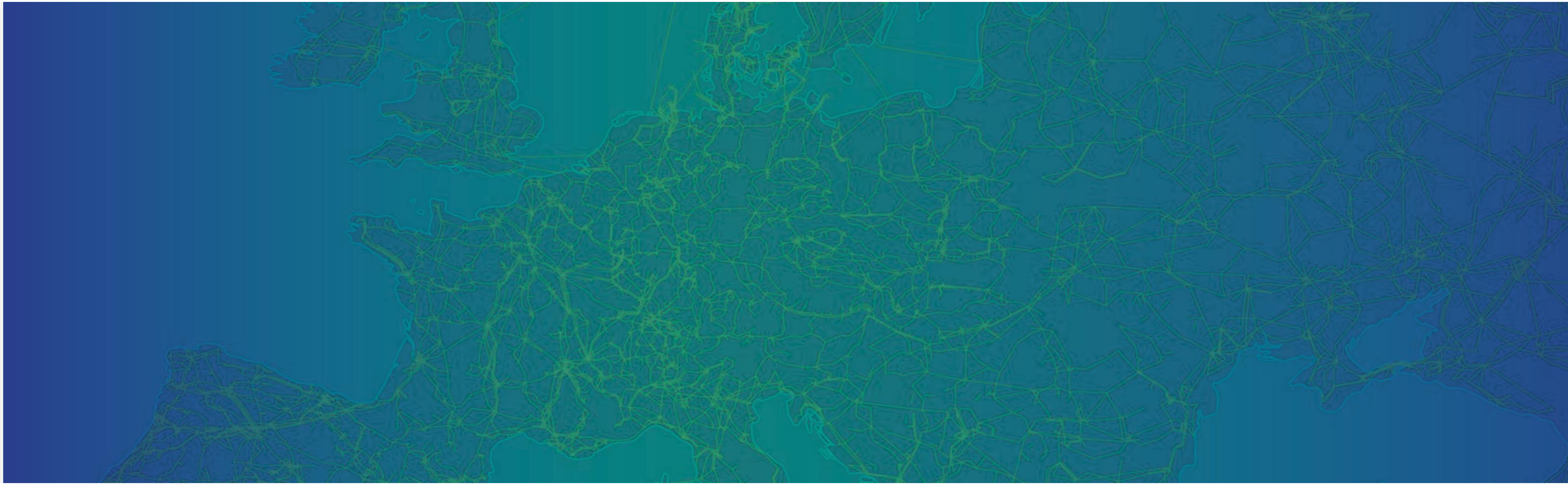
Presentation of the TYNDP 2020 for consultation & TYNDP 2022 kick-off

ENTSO-E public webinar, 4 December 2020



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Agenda

10.00	Welcome	Lea Dehaudt, ENTSO-E
10.05	Overview of the TYNDP 2020	Dimitrios Chaniotis, Rte & ENTSO-E System Development Chair
10.35	How electricity infrastructure development will help Europe's economic recovery	Patricia Labra, Red Eléctrica de España
10.40	Real-life examples of TYNDP projects - Ultranet - North Sea Wind Power Hub	 Tomasz Okraszewski, Transnet BW Antje Orths, Energinet
10.50	Q&A	
11.35	Kicking-off TYNDP 2022 Mentimeter poll	Guillermo Areosa Bäuml, Amprion Jean-Baptiste Paquel, ENTSO-E Simon Norambuena, ENTSO-E
12.20	Wrap-up and next steps	Jean-Baptiste Paquel, ENTSO-E

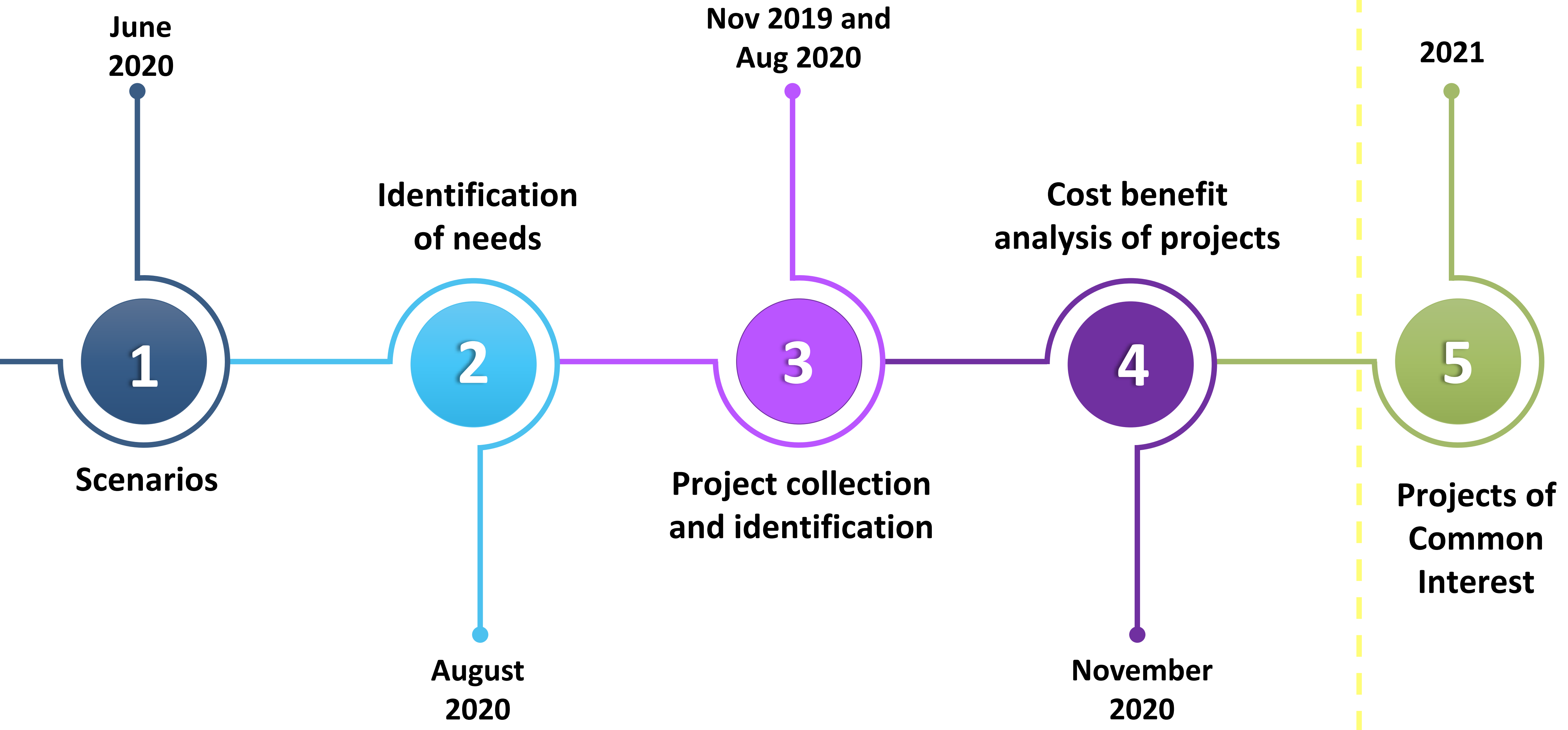
The TYNDP 2020 package

Dimitrios Chaniotis (RTE), ENTSO-E System Development Chair

The TYNDP process

TYNDP process

Projects of Common Interest process



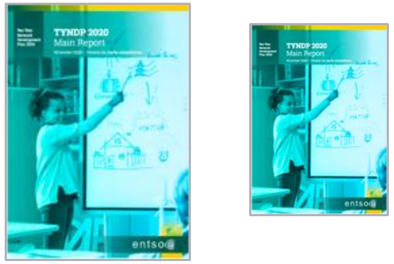
Package content

Scenarios

Projects sheets

Deep dive

Main report & highlights



Power system needs

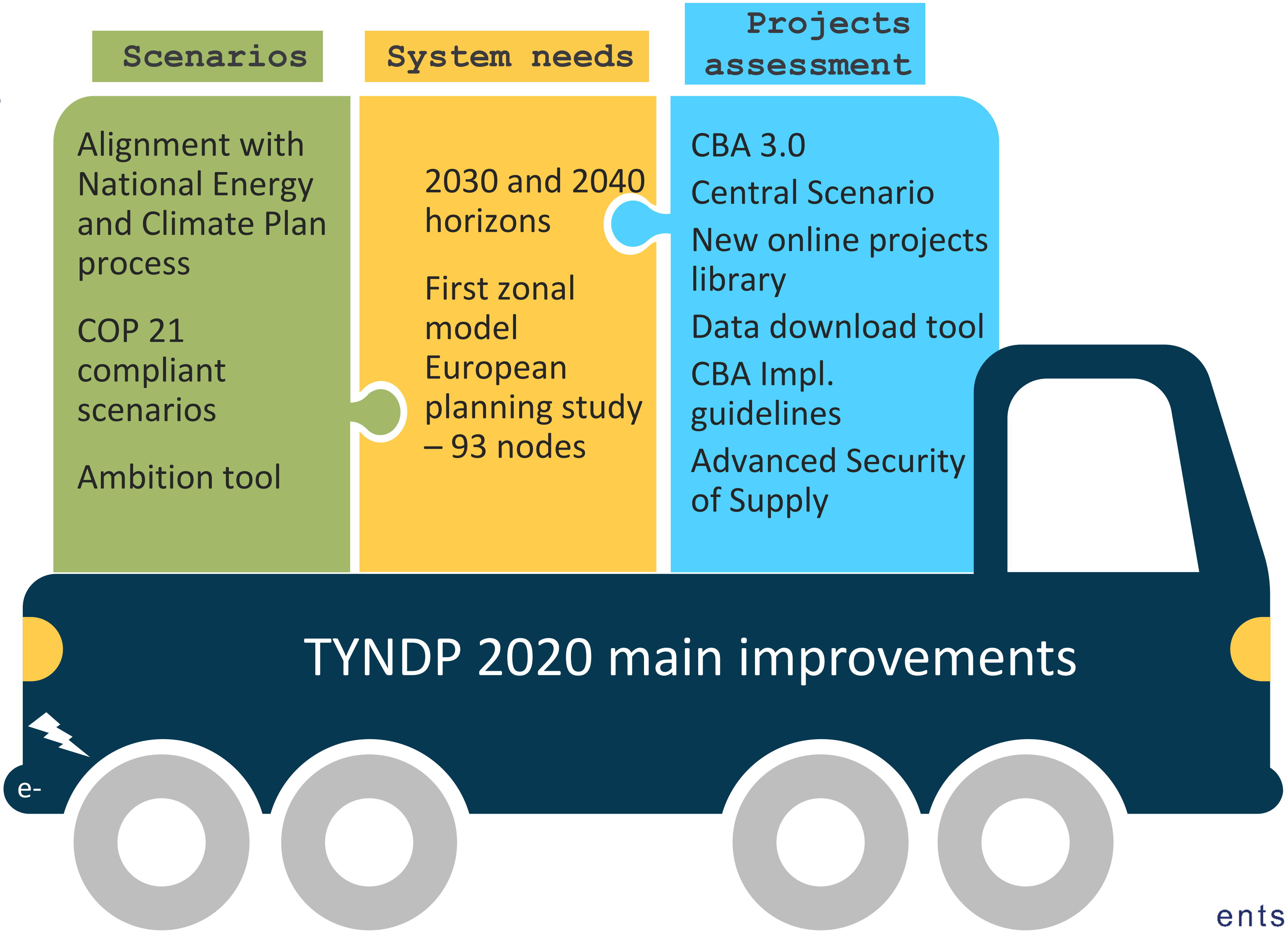
Main report and highlights

Regional Investment Plans

Country factsheets

CBA implementation guidelines

TYNDP 2020 improvements



Scenarios

TYNDP 2020 storylines ENTSO-E and ENTSOG scenarios

National Trends

- Policy Scenario based on member states' National Energy and Climate Plans (NECPs)
- EU 2030 Energy and Climate Framework (-40% CO2, 32 % RES, 32.5 % energy efficiency)
- EC 2050 Long-Term Strategy: 80 – 95 % CO_2 reduction

PARIS2015
COP21·CMP11

2 x COP 21 scenarios

+1.5°C target with 66.7 % probability

Carbon neutrality by 2050

Benchmarked with EC Long-Term Strategy

Distributed Energy

De-centralised approach to the energy transition: active customers, small-scale solutions, circular approach

Global Ambition

Centralised approach to the energy transition: large-scale renewables, imports and decarbonisation

TYNDP 2020 sensitivity storyline: Current Trends

Requested by ACER

The Sensitivity case was built using the Trajectory data collected from the TSOs and 2025 data.

The parameters varied from National Trends are:

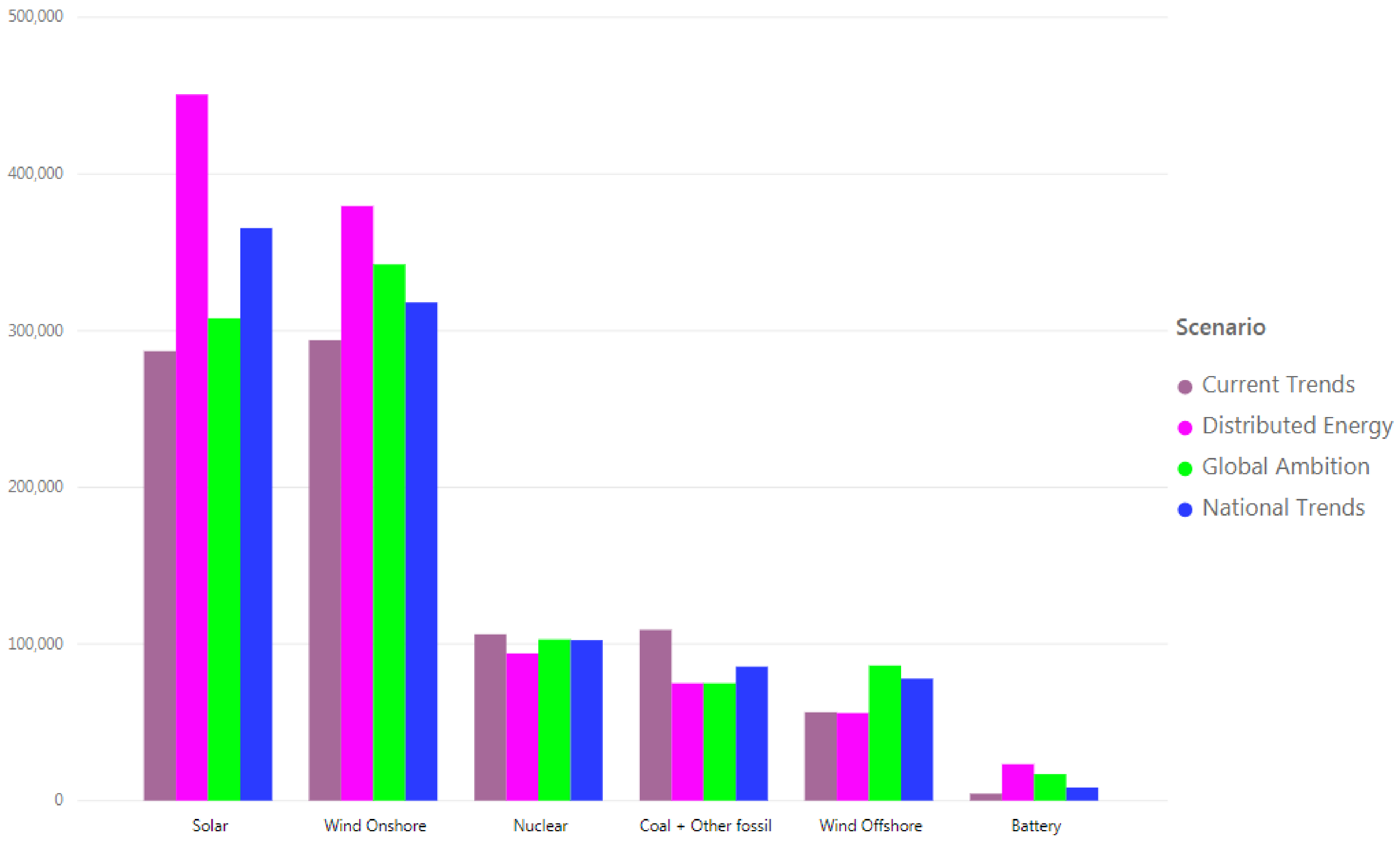
- Coal & Lignite
- Nuclear

Highest value in trajectories selected

- Wind
- Solar
- Batteries
- Hydro

Low trajectories selected

TYNDP 2020 scenarios: Installed capacities (GW)



More on the scenarios?

Visualisation platform

Data available to download online + guidance for any other request

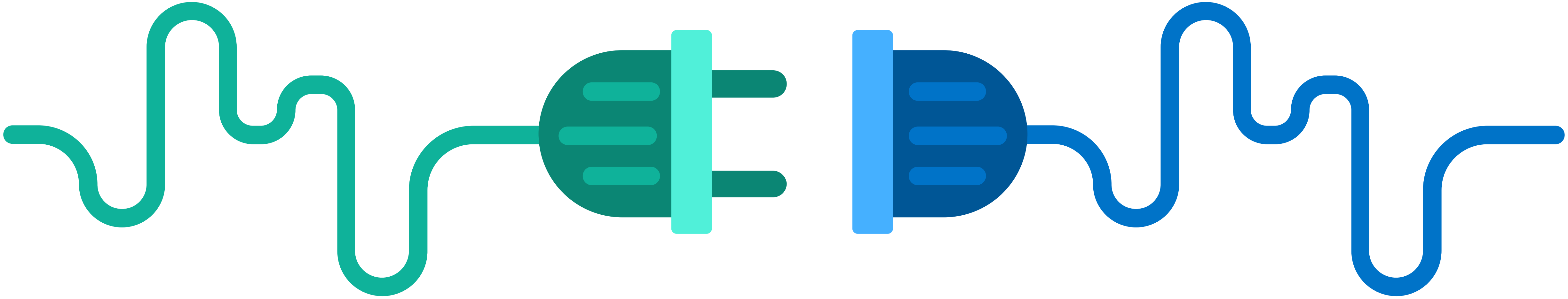
Website

See previous webinar recordings
and ask us questions

Identification of System Needs

Understanding System Needs to determine the best action course

Where is action needed to ensure continuous electricity access and deliver on the climate agenda ?



2030

- Investors
- Policy makers
- Regulators
- Smart grids or storage promoters

2040

- Project promoters (transmission, generation, storage)
- TSOs

2018 & 2020 System Needs Studies

TYNDP 2020

2030

Automated European expansion study
NTC model - One node per country with some exceptions

Automated European expansion study
Zonal model – 93 nodes represent Europe

2040

Additional & regional studies
Additional studies: SEW vs GTC - No grid - System stability - Experts analysis

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TYNDP 2018

2030

"Expert base" European expansion study
NTC model

2040

Additional & regional studies
Additional studies: SEW vs GTC - No grid - System stability - Experts analysis

From System Needs to solutions

1 Identify **economically viable interconnectors** within a set scenario

2 Viable links prove the existence of at least **one more beneficial configuration**

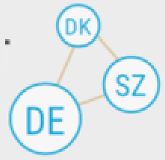
3 Identified Needs are used by project promoters to **explore, propose and justify solutions**

Increased transmission capacity	Storage	Generation	Hybrid offshore projects	Smart grids/ sector integration	Power to gas	?

‘Economic grid’ - European Expansion Study: process overview

SCENARIO NATIONAL TRENDS 2030 & 2040

NODAL MARKET STUDY



CLUSTERING

REFERENCE GRID: THE STARTING POINT

ZONAL GENERATION AND LOAD ASSUMPTIONS

PREPARATION PHASE

ZONAL MARKET STUDY 2040 AND NTC MARKET STUDY 2030

IMPLEMENTATION PHASE

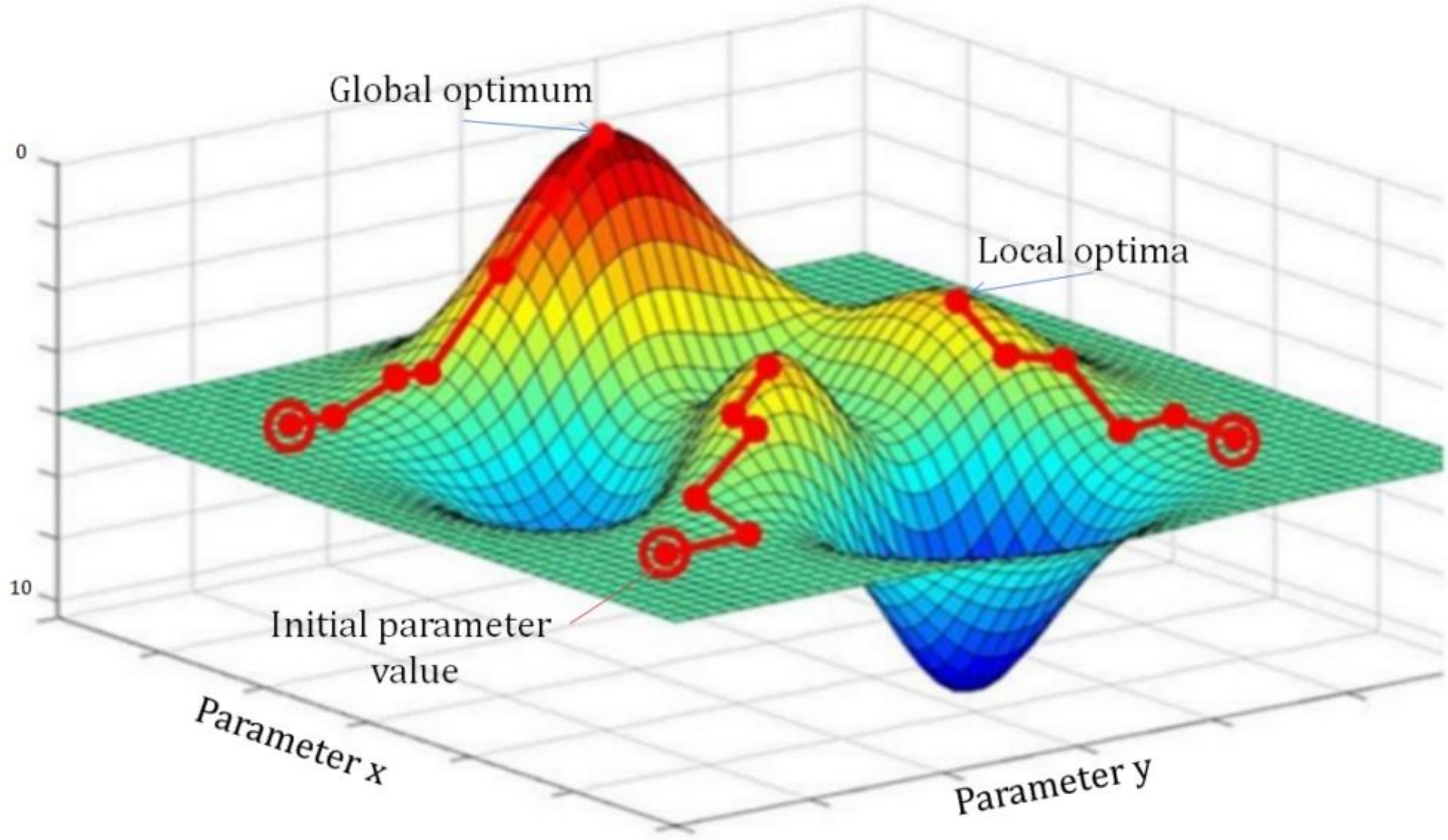
SEW-BASED CAPACITY INCREASES

Economic needs grid

SYSTEM NEEDS

Needs beyond the starting point

Why do we need a starting point?



2020 European identification of System Needs: 3 key findings

1 New solutions are needed throughout Europe

- Increased transmission capacity
- Storage
- Generation
- Hybrid offshore projects
- Smart grids/ sector integration
- Power to gas

→

- Deliver on **Climate Agenda**
- Respond to **RES flexibiliy challenges**
- Lower **Energy costs**
- Realise the **Green Deal**

2 New internal network reinforcement and system flexibility needs are triggered by cross-border flows and changes in generation

3 **Smarter planning** will be required to get to **next level offshore wind**

The system in 2030: generation costs savings

Most of all possible economic benefits are achieved by the « Economic Needs Grid »

proving that at least one more optimal configuration exists for Europeans

1 Economic needs grid 2030

Identified in ENTSO-E's **based needs socio-economic** study

+50GW transmission

1,3 b€/year investment

2 Copper plate

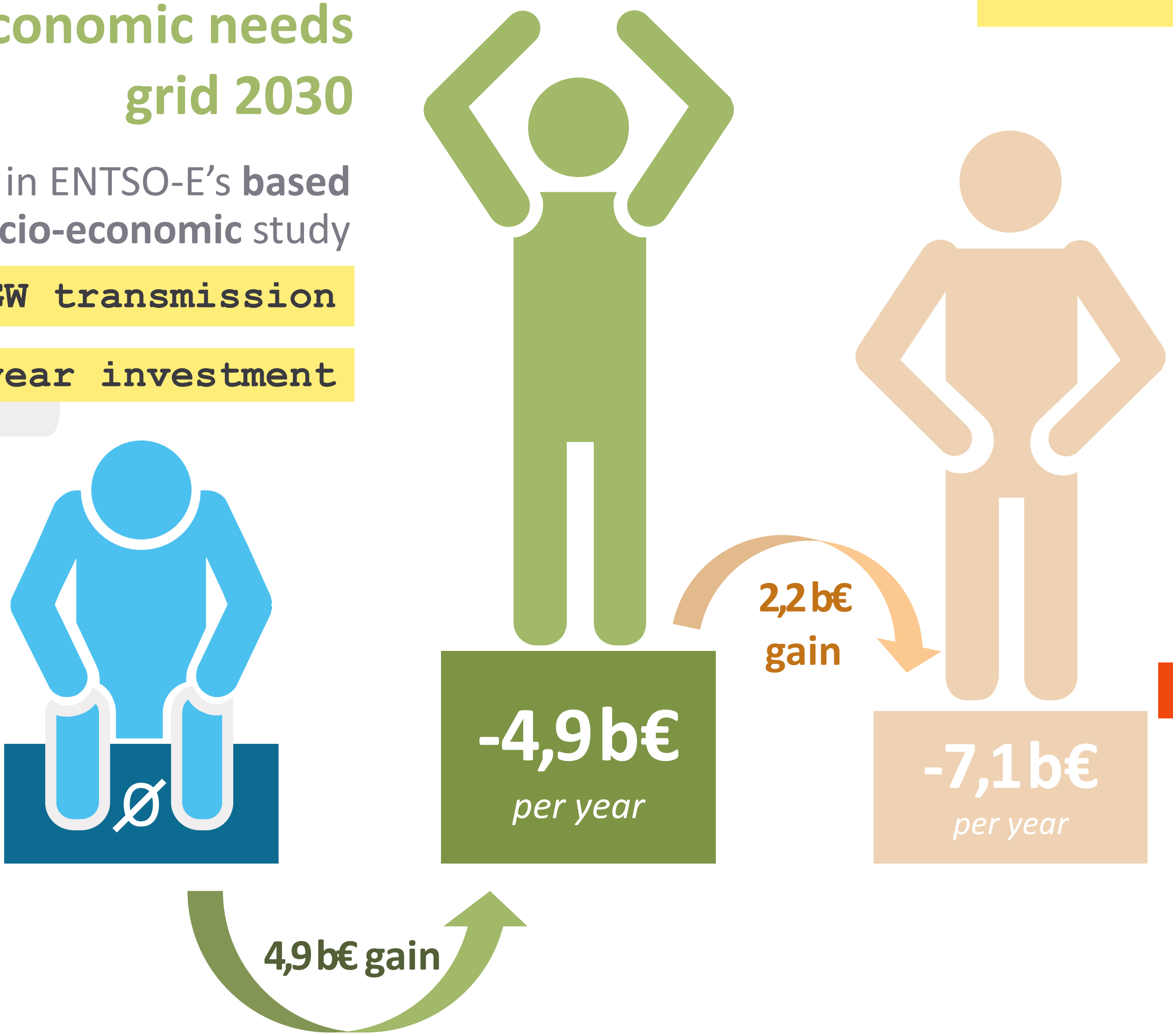
Theoretical unlimited transmission across all points of Europe

+infinite grid

+infinite b€

3 No action since 2020

2030 generation and demand upon the **2020** grid



The system in 2040: generation costs savings

Most of all possible economic benefits are achieved by the « Economic Needs Grid »

proving that at least one more optimal configuration exists for Europeans

1 Economic needs grid 2040

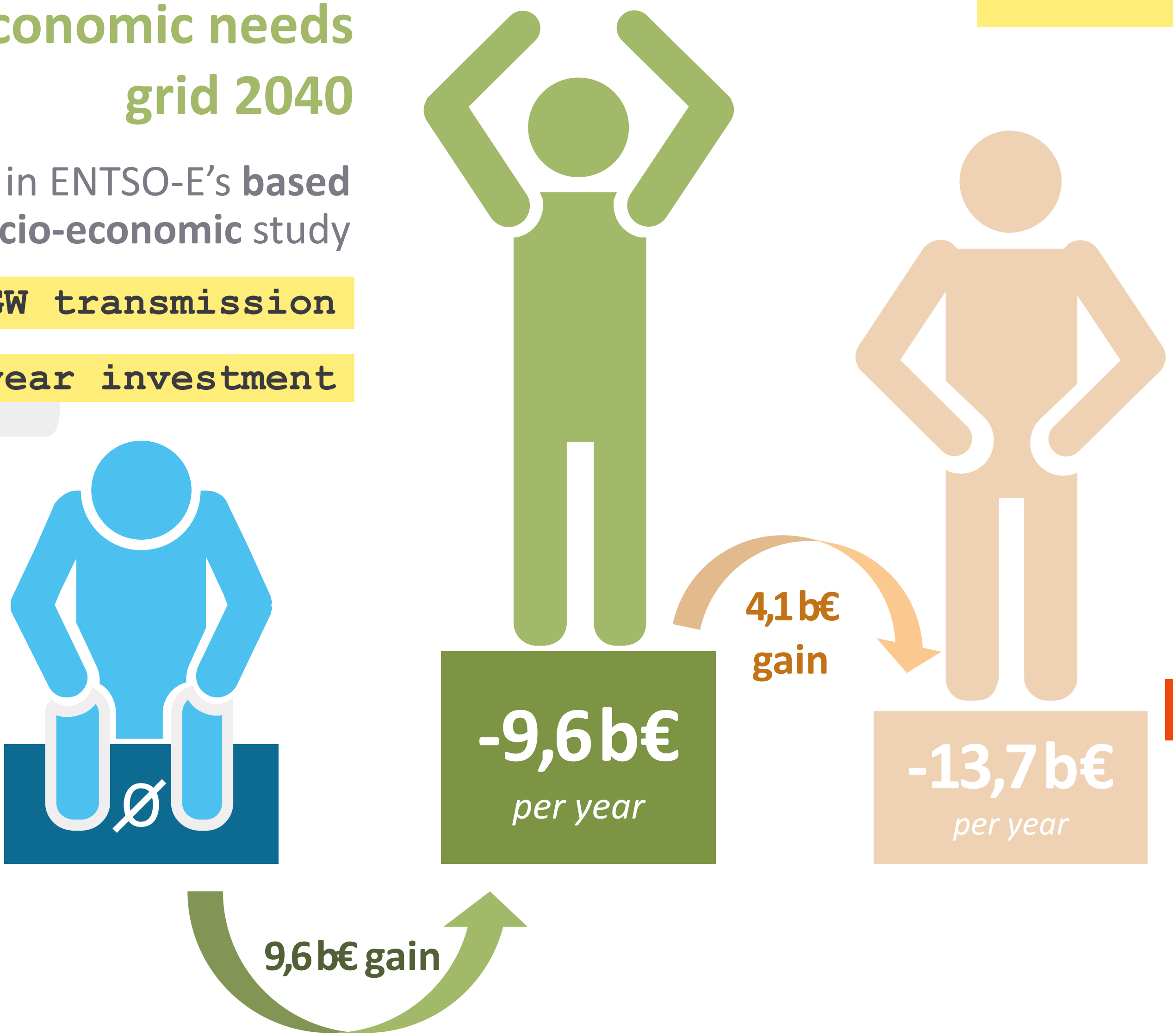
Identified in ENTSO-E's **based needs socio-economic** study

+93GW transmission

3,4 b€/year investment

3 No action since 2025

2040 generation and demand upon the **2025** grid



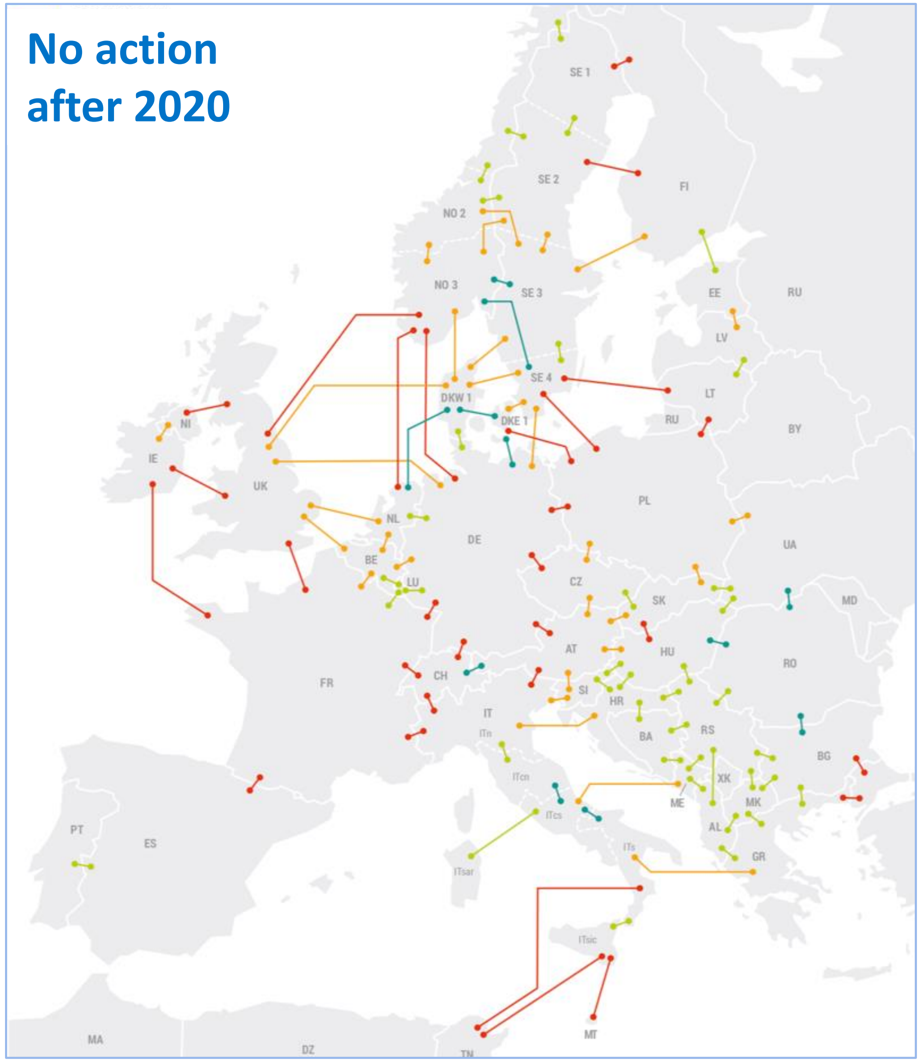
2 Copper plate

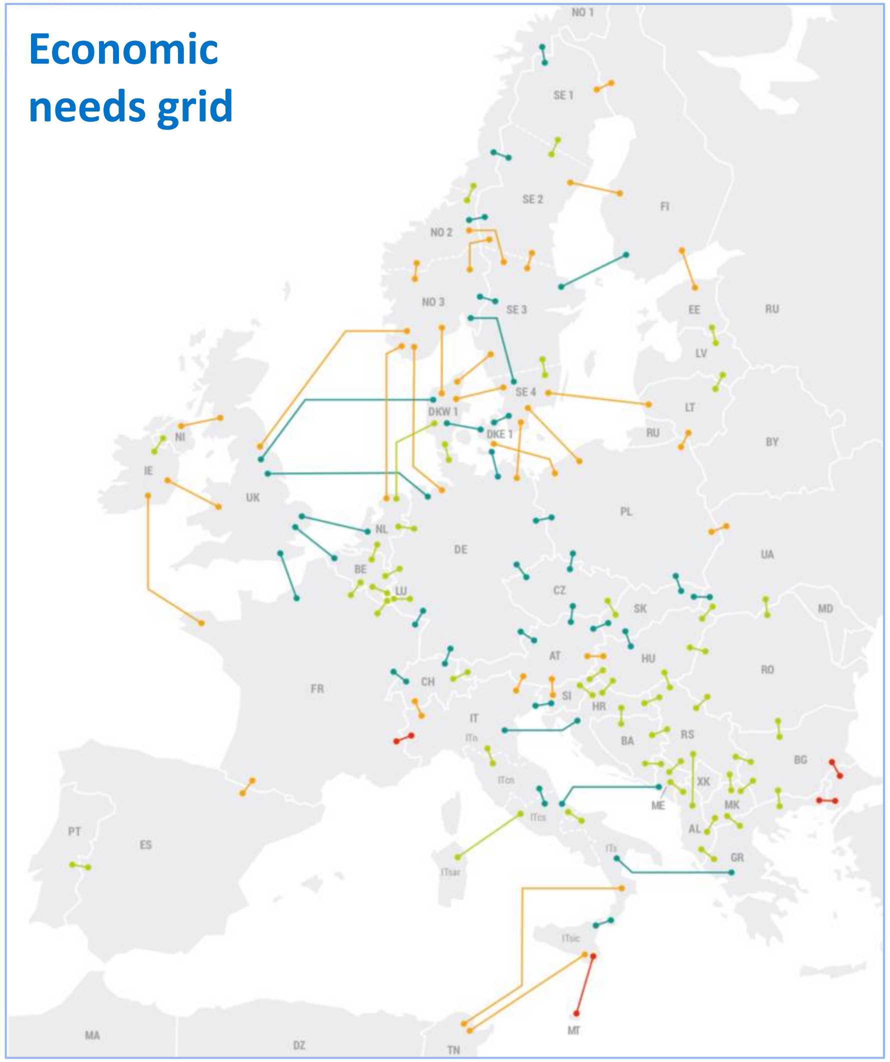
Theoretical unlimited transmission across all points of Europe

+infinite grid

+infinite b€

Price convergence between countries - 2030



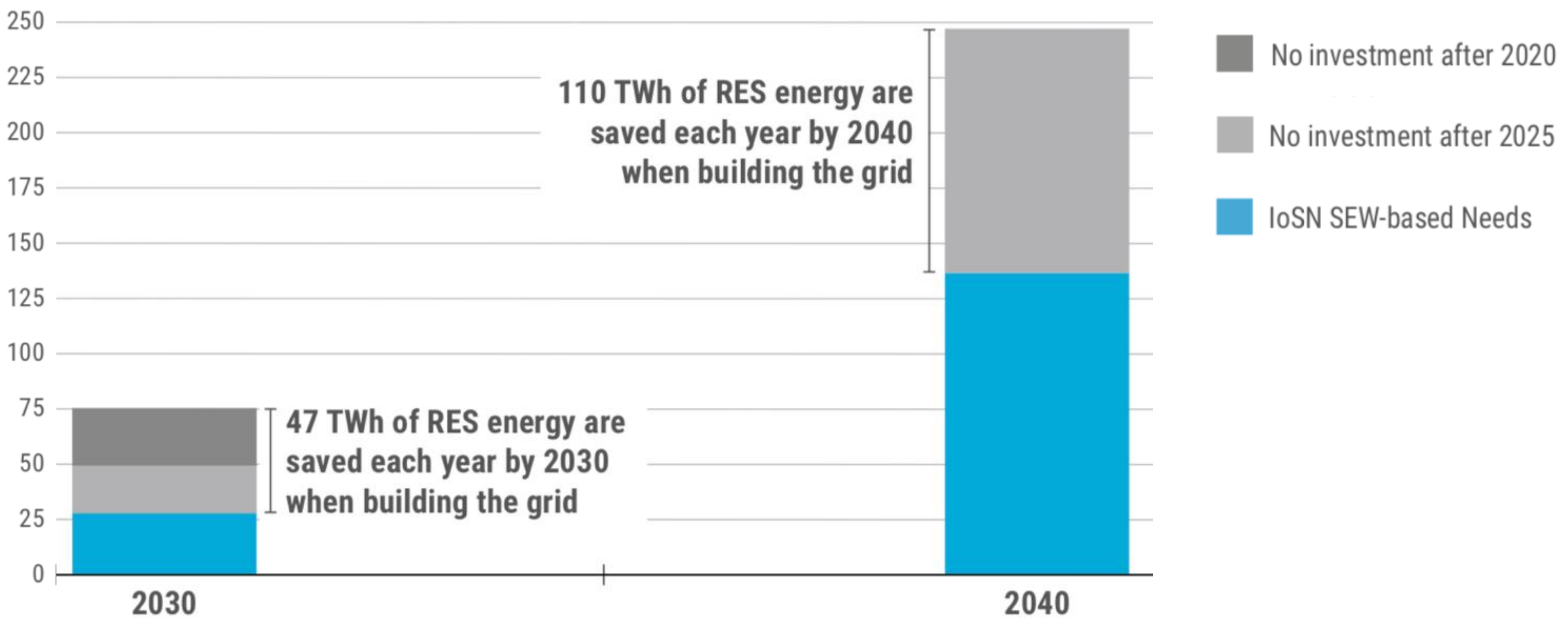


- <2.00€/MWh
- 2.00–5.00€/MWh
- 5.00–10.00€/MWh
- >10.00€/MWh

Marginal cost difference between zones in 2030 scenarios

The system in 2030 and 2040: curtailments

Curtailed energy in TWh in the 2030 and 2040 scenarios



Access to **higher price market** is necessary to ensure most of the renewable or storage investments foreseen in the scenarios and avoid a slower energy transition

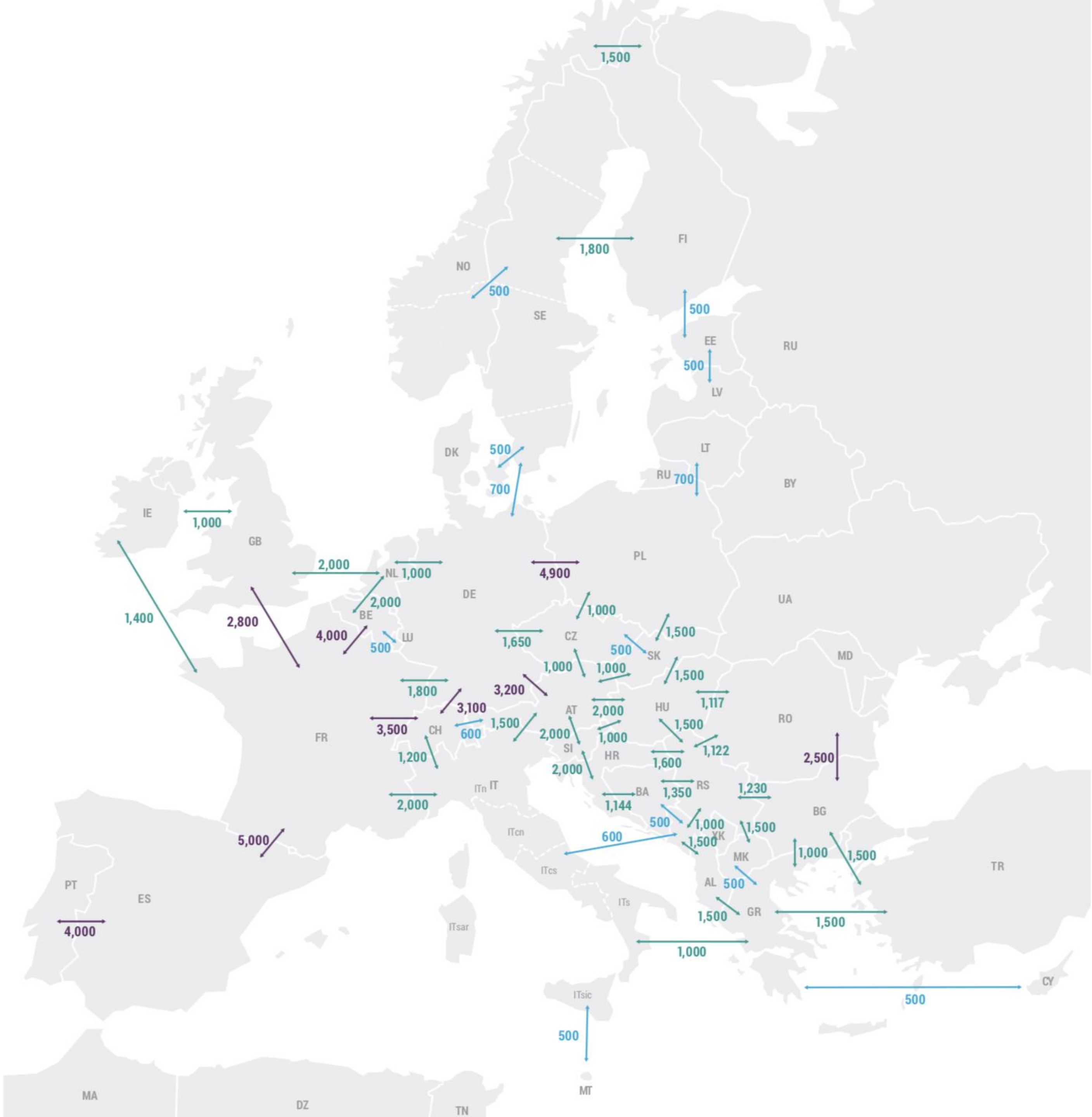
Economic needs grid 2030

Needs < 700 MW

Needs 700 - 2000 MW

Needs > 2000 MW

Economic needs grid 2040



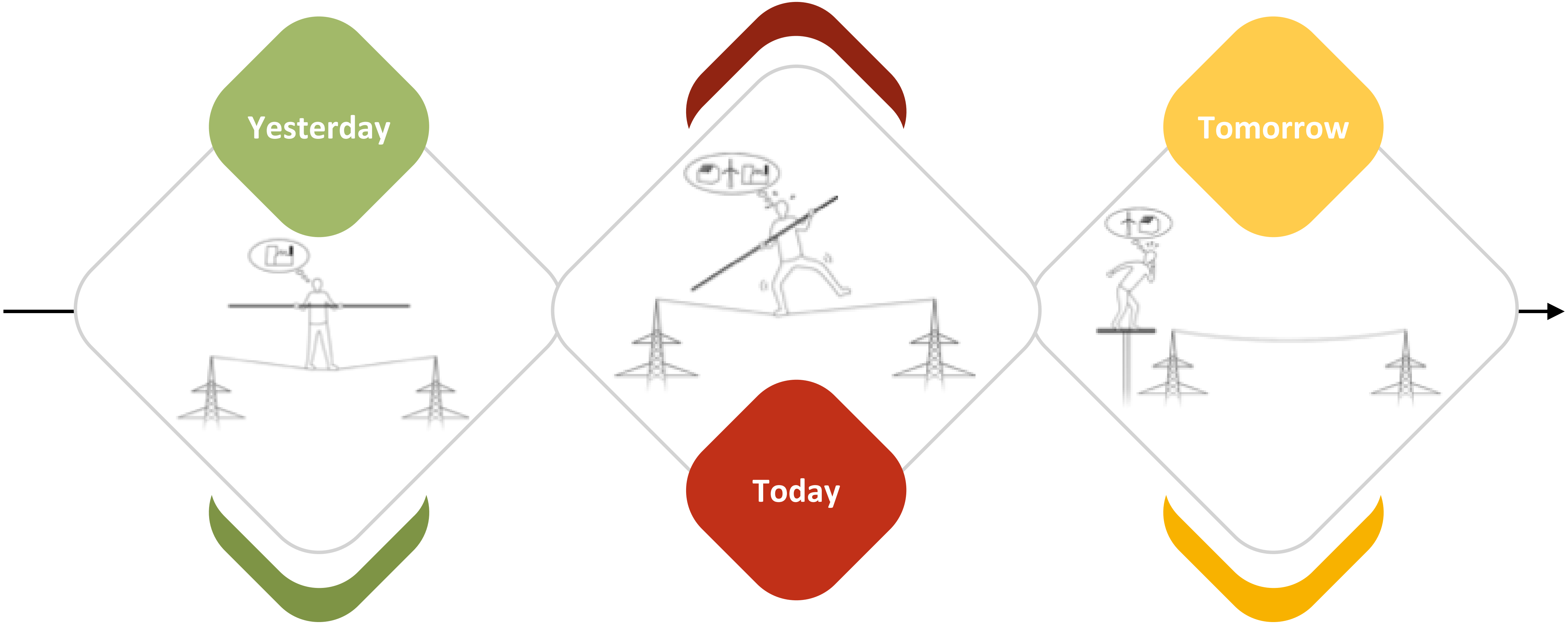
Needs < 700 MW

Needs 700 - 2000 MW

Needs > 2000 MW

New system stability, new needs

Variable RES do not provide Inertia. Share of thermal generators decreases.
Inertia decreases.

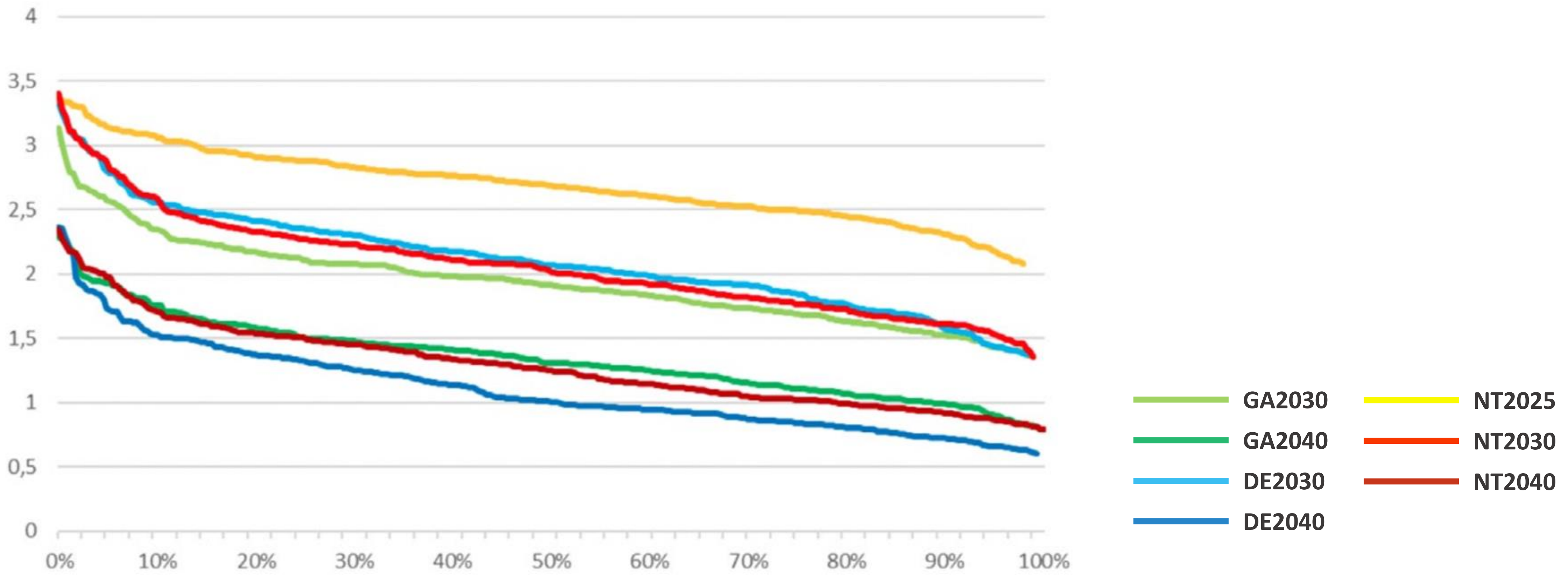


Inertia of the large rotating generators immediately contained deviations

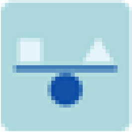
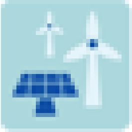
Very low levels of inertia available

Frequency management: system inertia trends

Duration curves of system inertia for the Continental Europe synchronous area in ENTSO-E's 2025, 2030 and 2040 scenarios

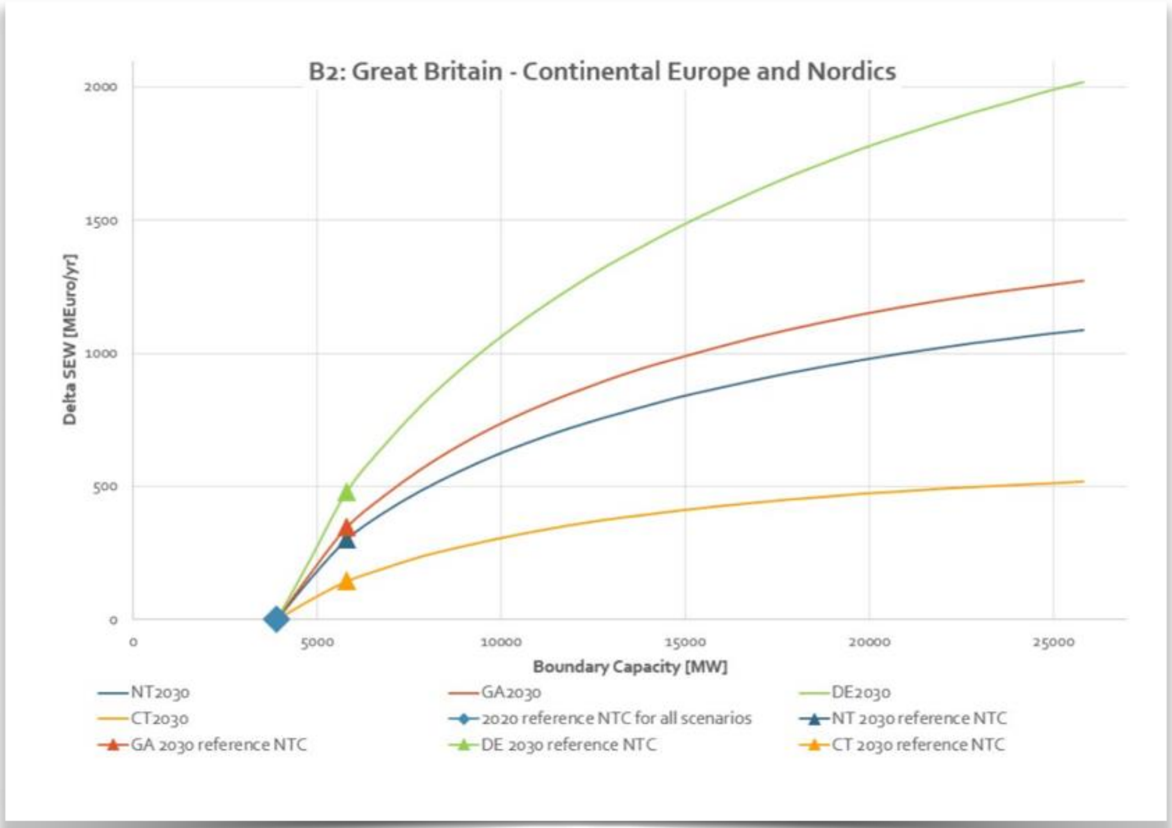


System Needs in the Project Sheets

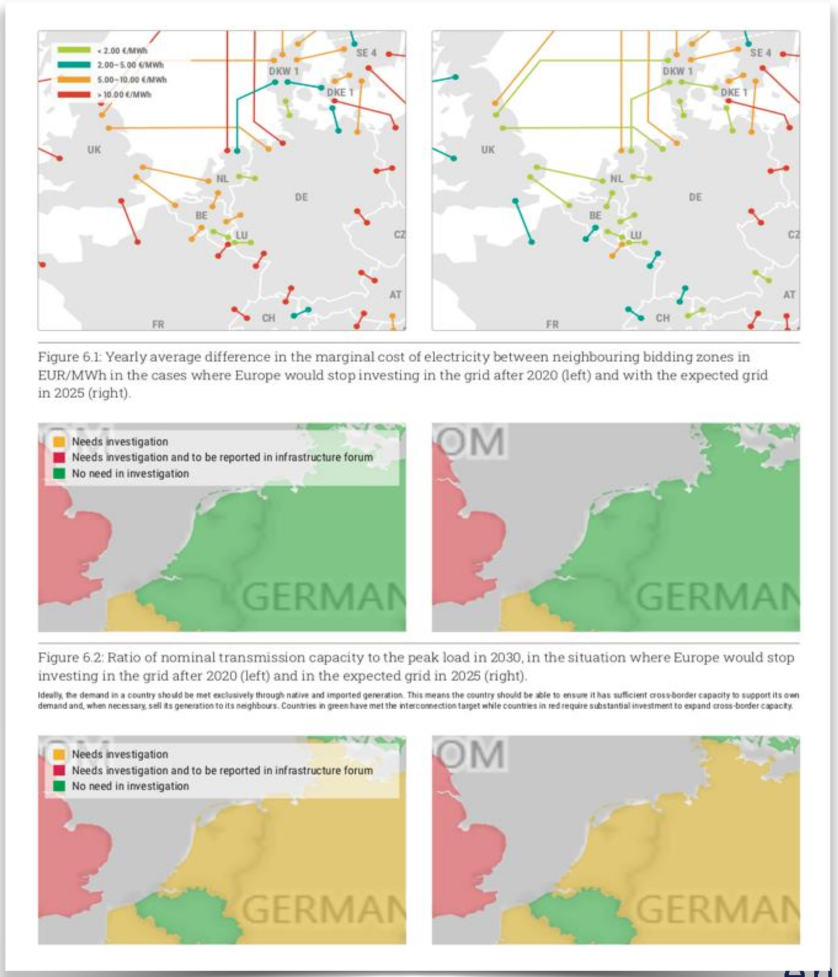
Infrastructure Needs		Projects Promoters Solutions
	• Address system adequacy deficiencies • Mitigate the risk of power failures	Adequacy needs identified in Portugal mainly due to : - expected decommissioning of old power plants - increasing levels of variable generation Integration of Hydro power plants with pumping (included in this project) are necessary in order to comply with national adequacy standards.
	Improve system flexibility and stability • Improve system or local ramp rate • Improve transient stability or RoCoF to meet system Needs	Flexibility is the ability of a power system to respond to changes in power demand and generation. Storage facilities such as pumped storage and hydro storage schemes with peak generation are one of the solutions to cope with high power ramps.
	• Enable cost-efficient grid connection of high volumes of RES • Reduce RES curtailment	Integration of Hydro power plants with pumping

Other available material

SEW vs GTC curves



Interconnection targets

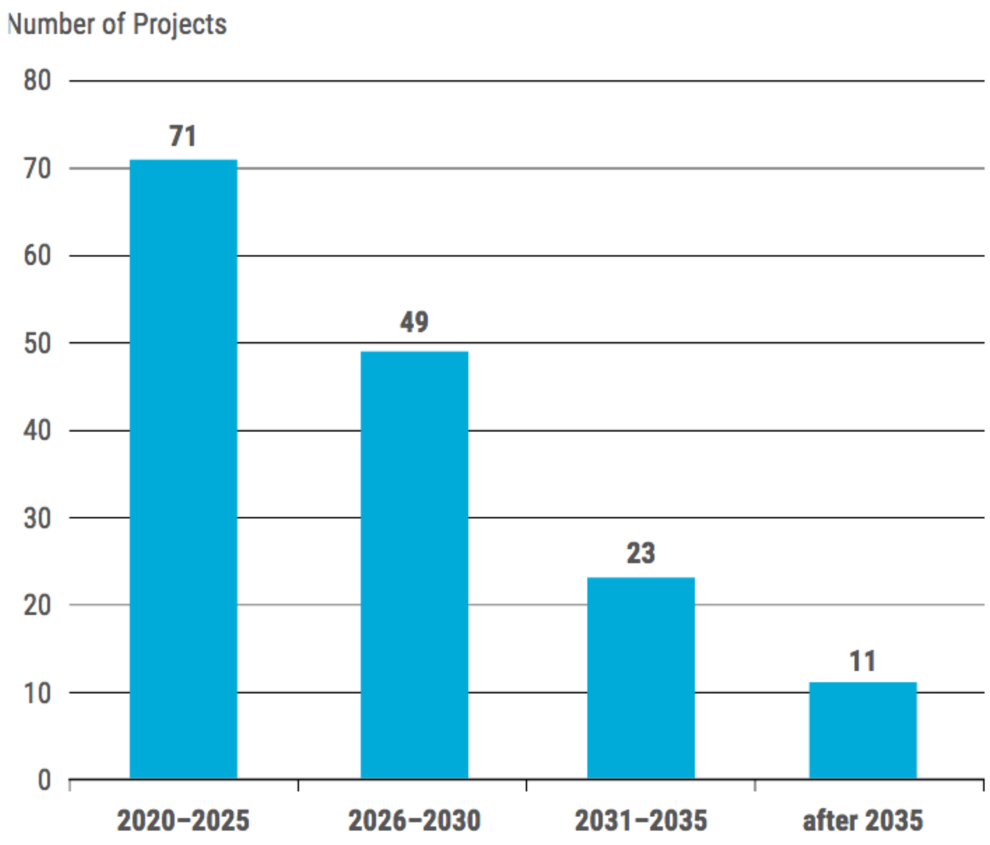


Transmission and Storage Projects Assessment

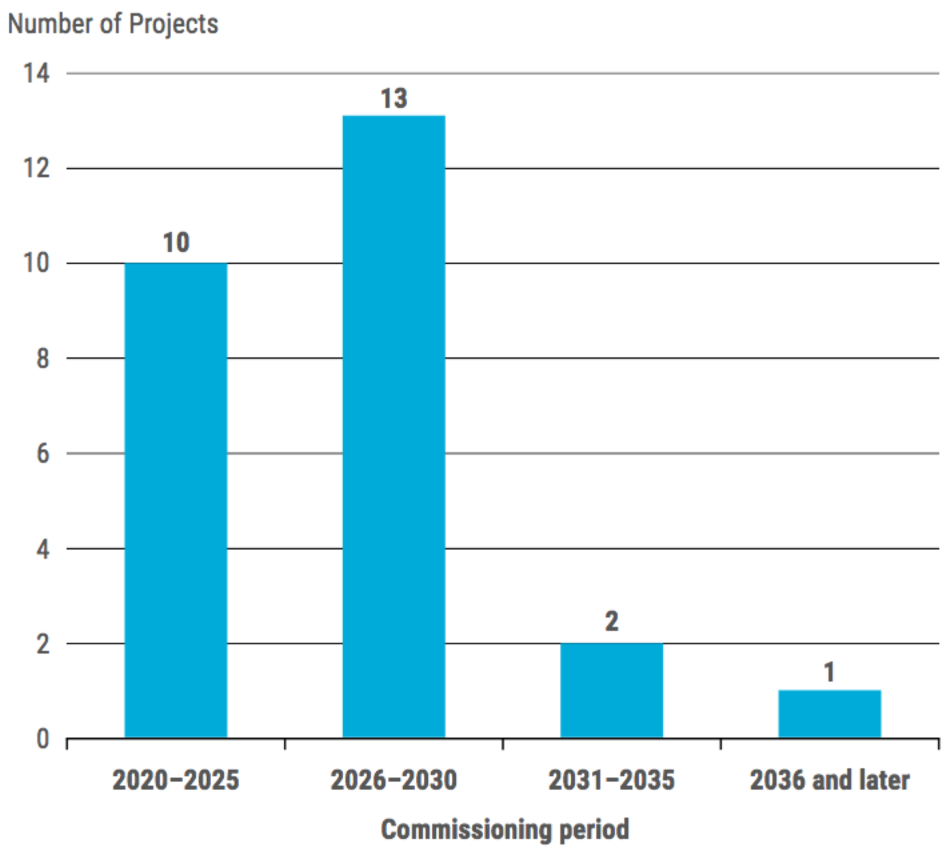
Project portfolio: Transmission projects

Projects portfolio – storage

Project portfolio: Per commissioning year

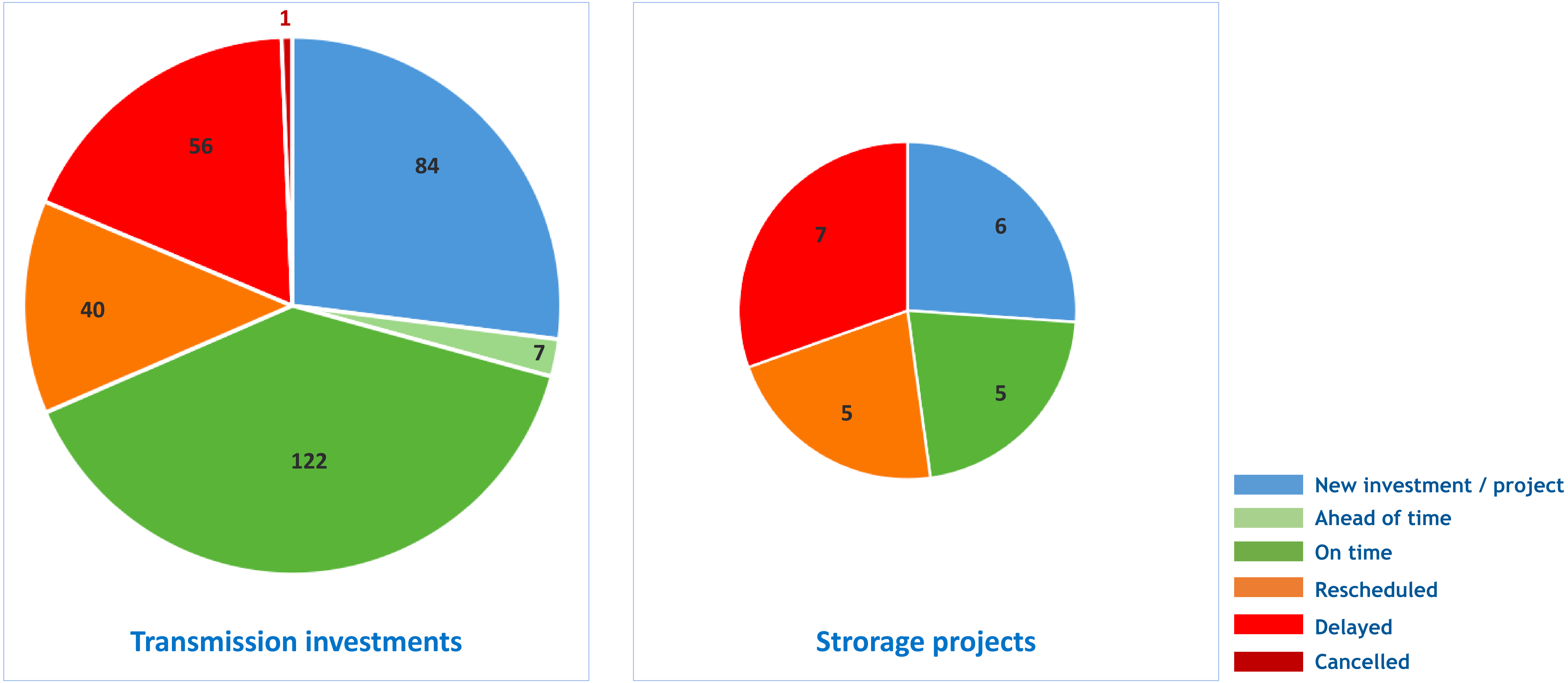


Transmission



Storage

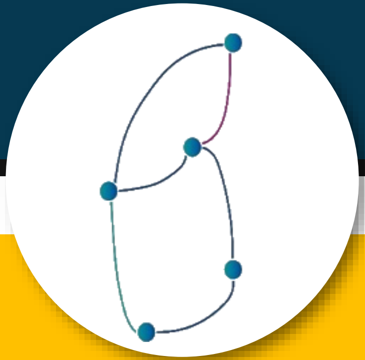
Project portfolio: Evolution since TYNDP 2018



Cost Benefit Analysis: General principle

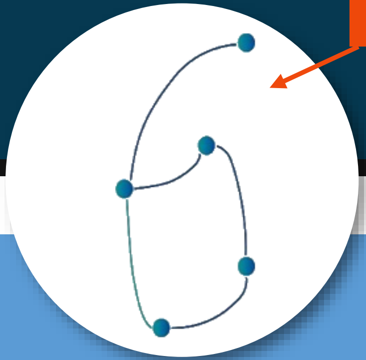
COST BENEFIT ANALYSIS

Reference grid



Basis against which analysis are conducted.
Includes a selection of TYNDP projects to 2025 prepared with regulators

Projects included in the ref. grid

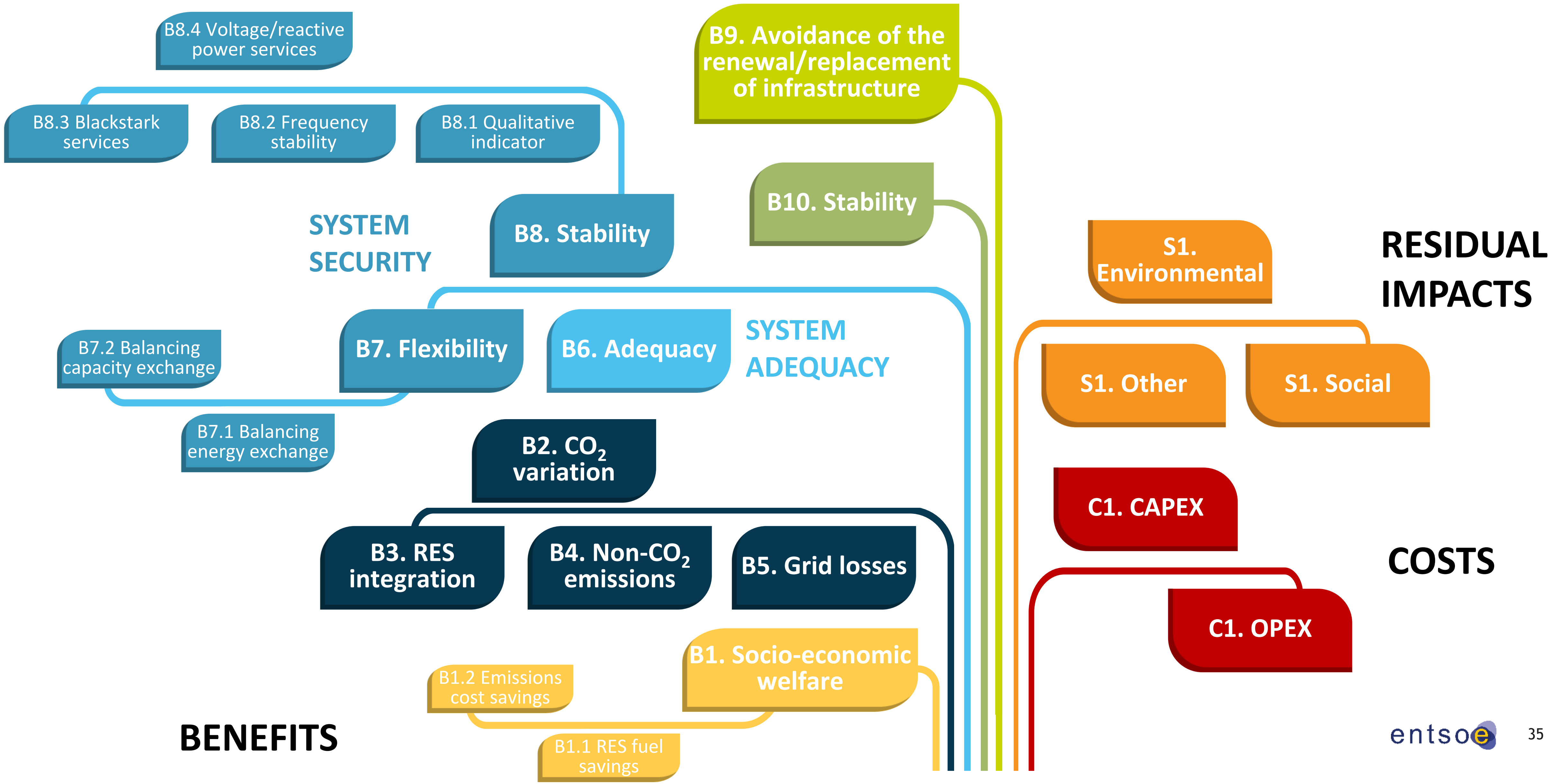


Remove project from the ref. grid and compare cases with and without the analysed project to evaluate costs and benefits.

Projects not included in the ref. grid

Add the project to the reference grid and compare the new grid to reference grid to evaluate costs and benefits.

Project Cost Benefit Analysis: Indicators



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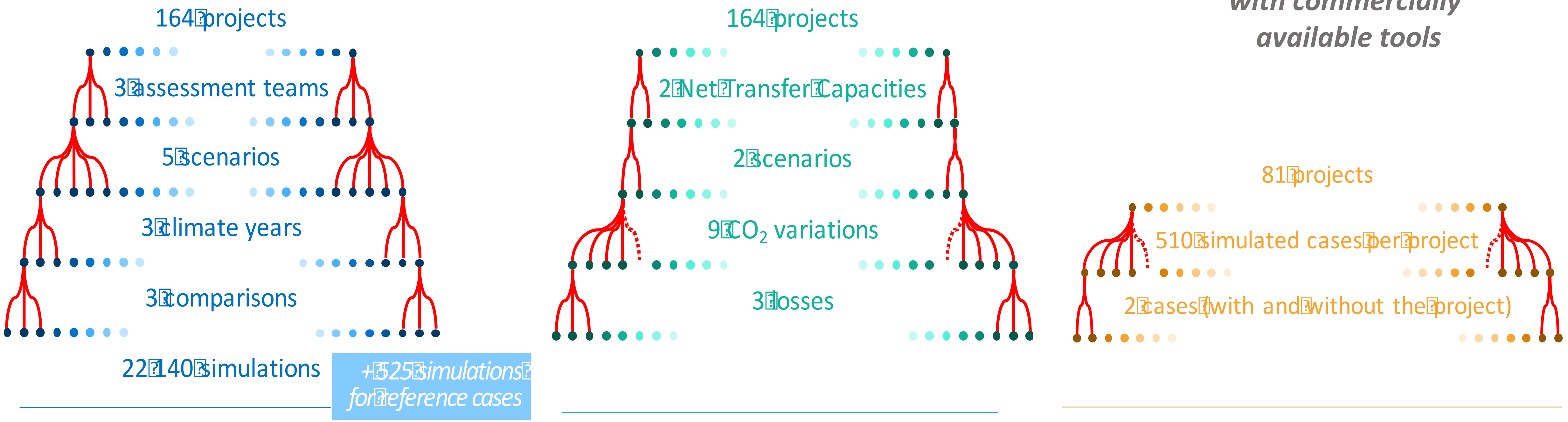
A pan European study, 2020 – Simulations details

Study conducted with commercially available tools



= 22 665 MARKET SIMULATION

= 11 020 NETWORK SIMULATION

= 81 600 SECURITY OF SUPPLY SIMULATION

Each simulation is conducted for **the entire continent** over a year, ie. **8 760 hours**.

> 1 Million instant renderings of the European electricity system

+30% since TYNDP 2018

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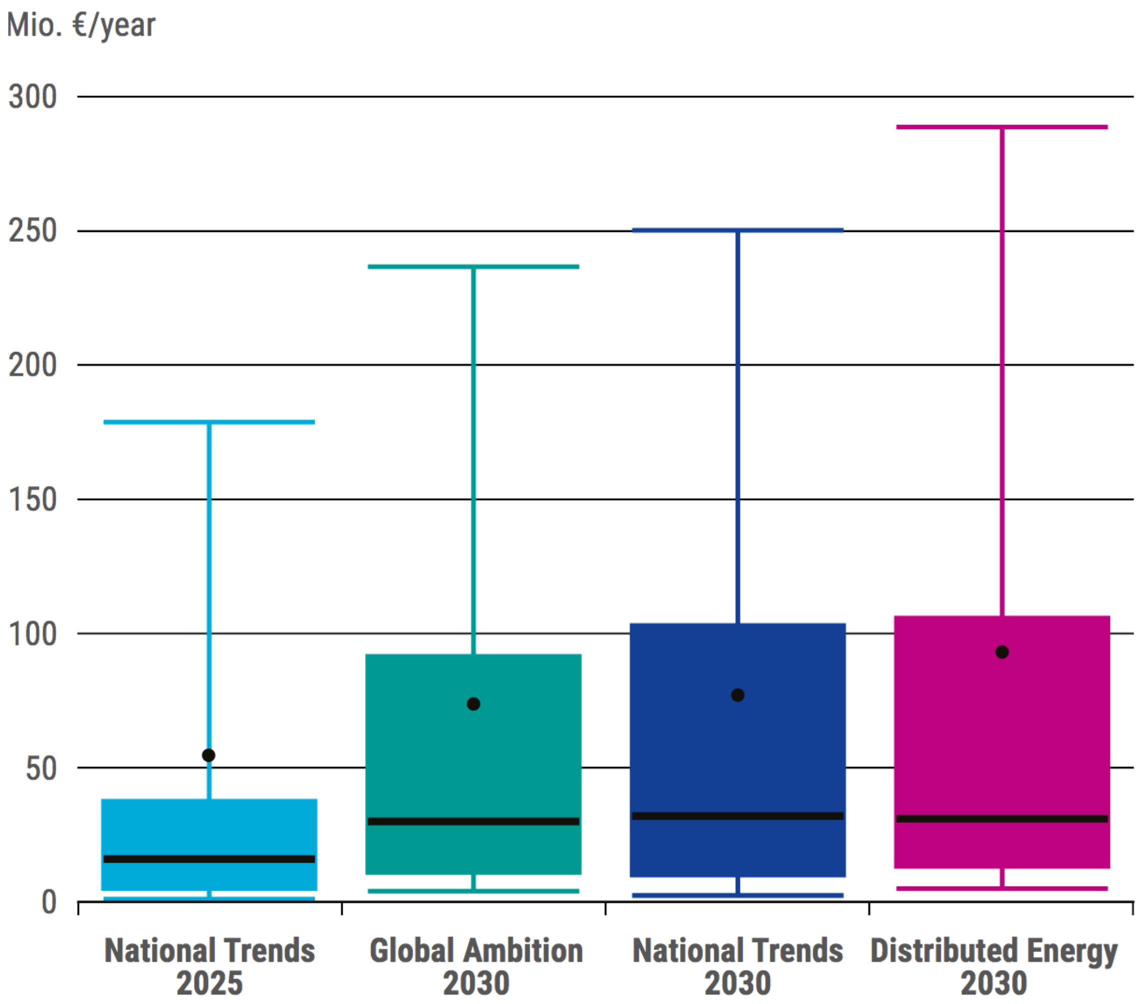
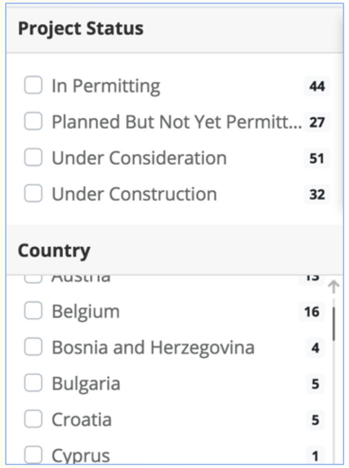
Benefits for Europe grow with the transition

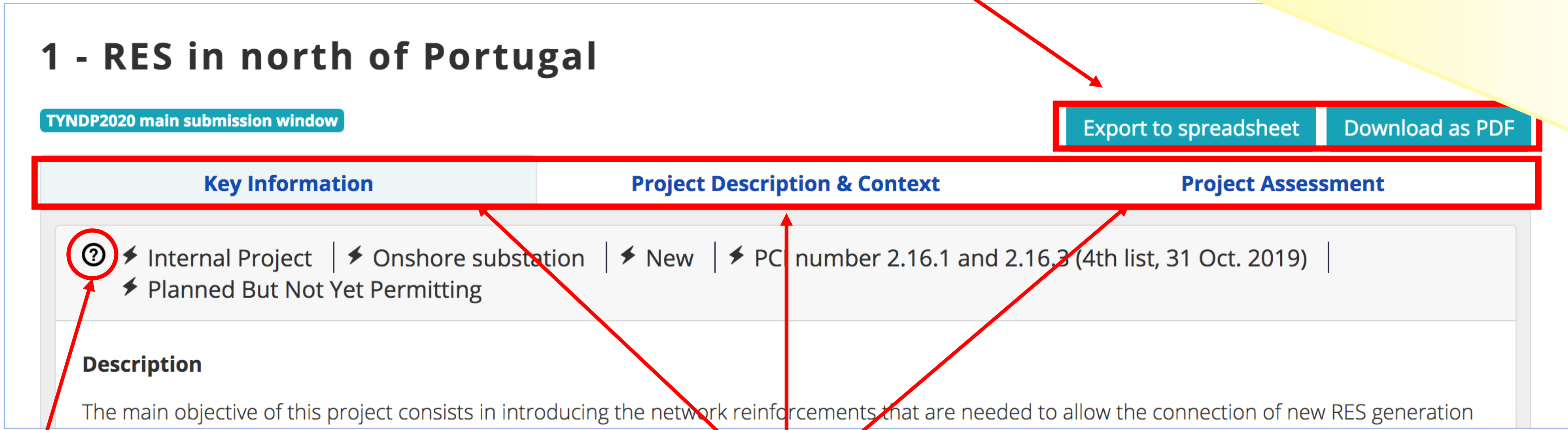


Distribution of Socio Economic Welfare for the TYNDP 2020 portfolio per scenario

What is in the project sheets?

New user-friendly search/filter/export options





Technical elements details

Information distributed in 3 pages:

- Key information
- Project description and context
- Project assessment

Cost Benefit Analysis: In the project sheets

Visual indicator for **COP 21 scenarios** when available

Central scenario

Actor in charge of the assessment

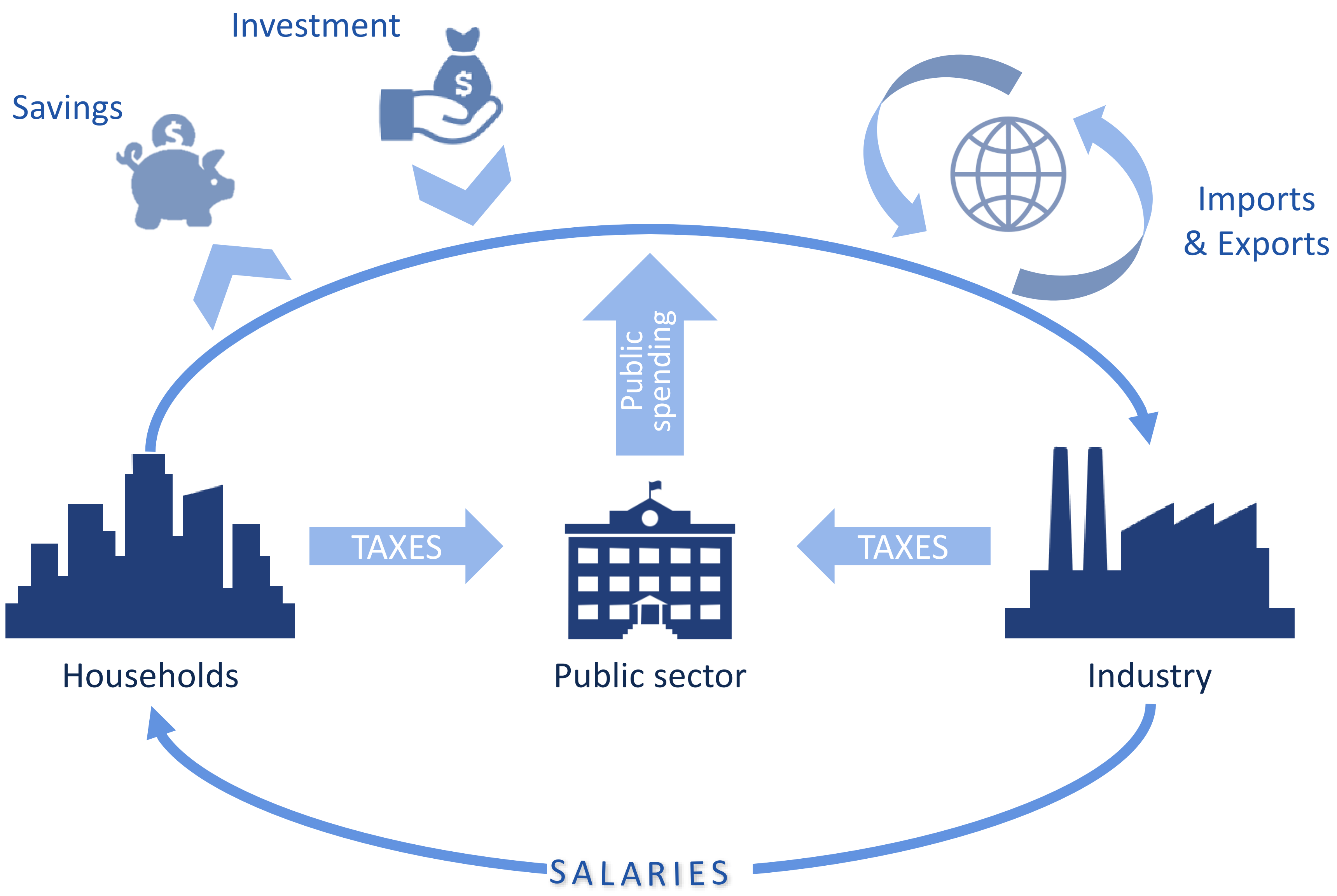
		NT2025	NT2030	Comparison of the COP21 scenarios with NT2030 average result: DE2030 is < or > than NT2030	GA2030 is < or > than NT2030	
Increase in socio-economic welfare						
B1 Annual Socio-Economic Welfare (SEW) increase (M€ / year)	max	25	37			ENTSO-E assessment
	average	**24**	**27**	>	<	
	min	23	16			

Full numerical results are also available for all scenarios and for Current Trend Sensitivity *(by scrolling lower in Project Sheet or downloading spreadsheet version)*

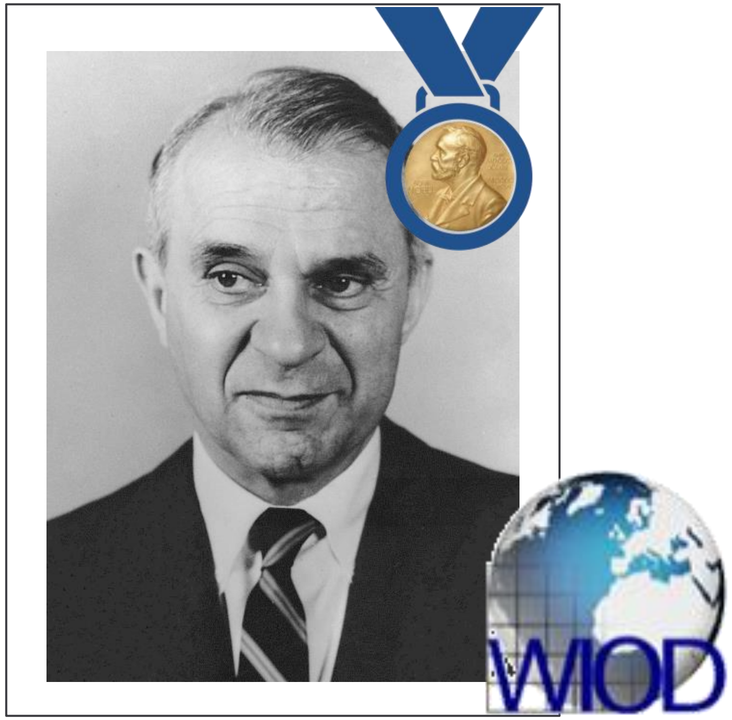
How electricity infrastructure development will help Europe's economic recovery

Patricia Labra, Red Eléctrica de España

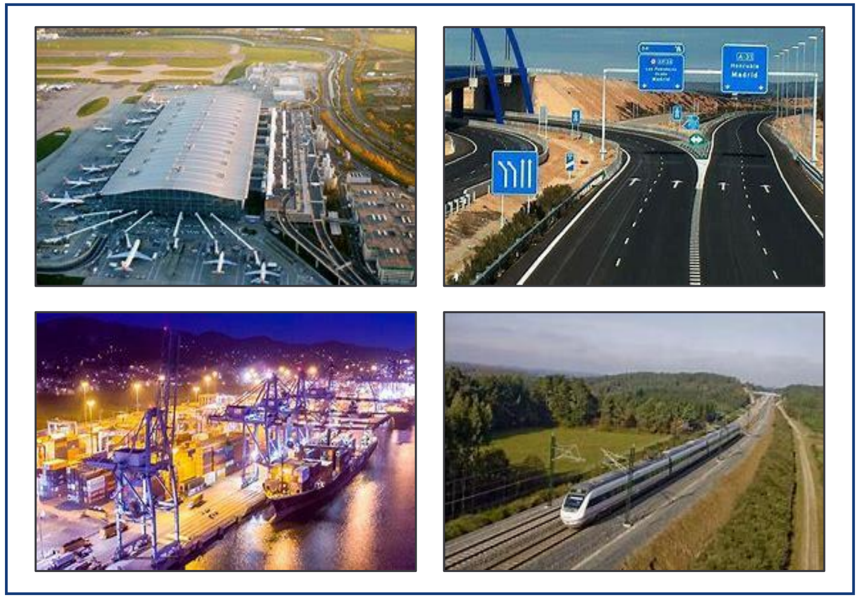
Any investment stimulates the economy



Methodology - Theoretical foundations

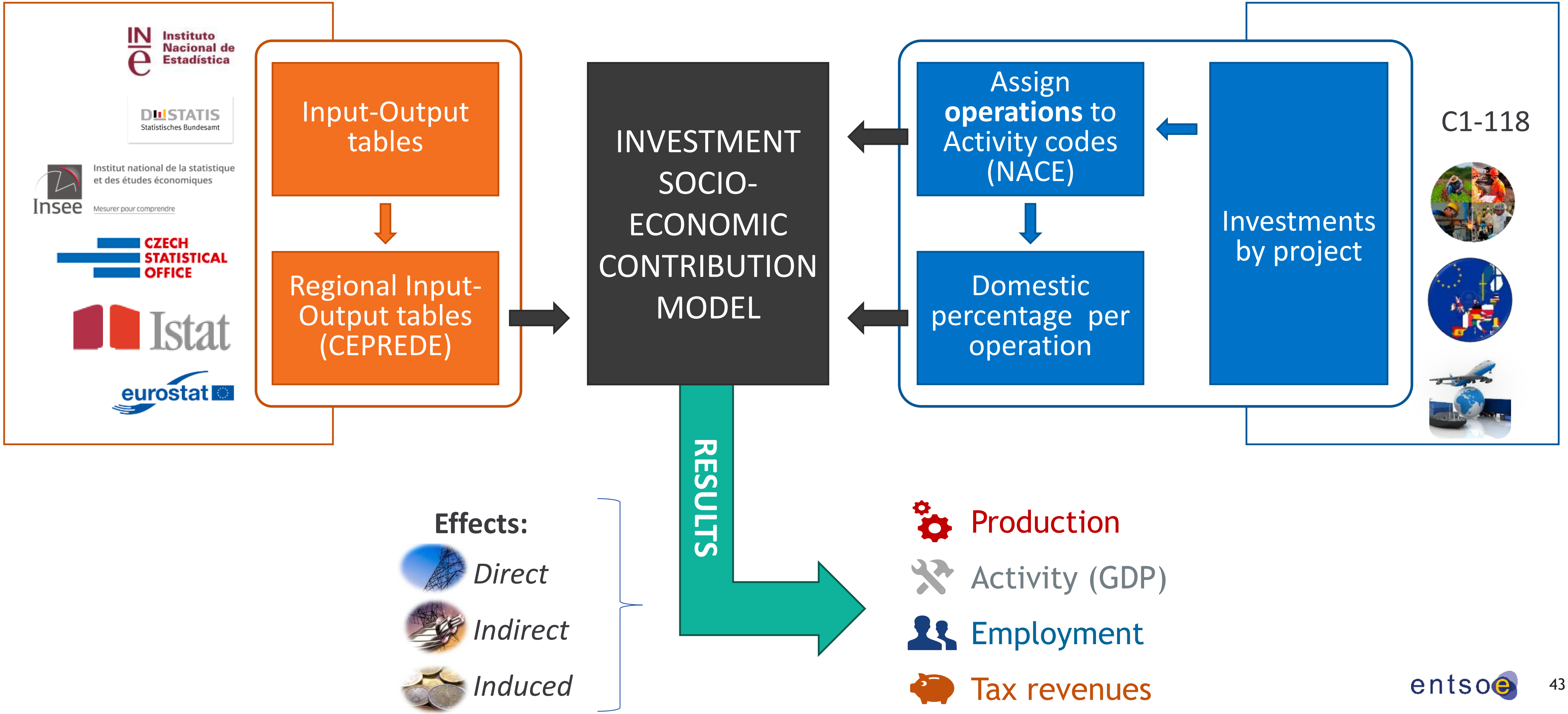


Wassily Leontief was awarded the Nobel Memorial Prize in Economic Sciences in 1973 for the development of the input-output method and for its application to important economic problems.

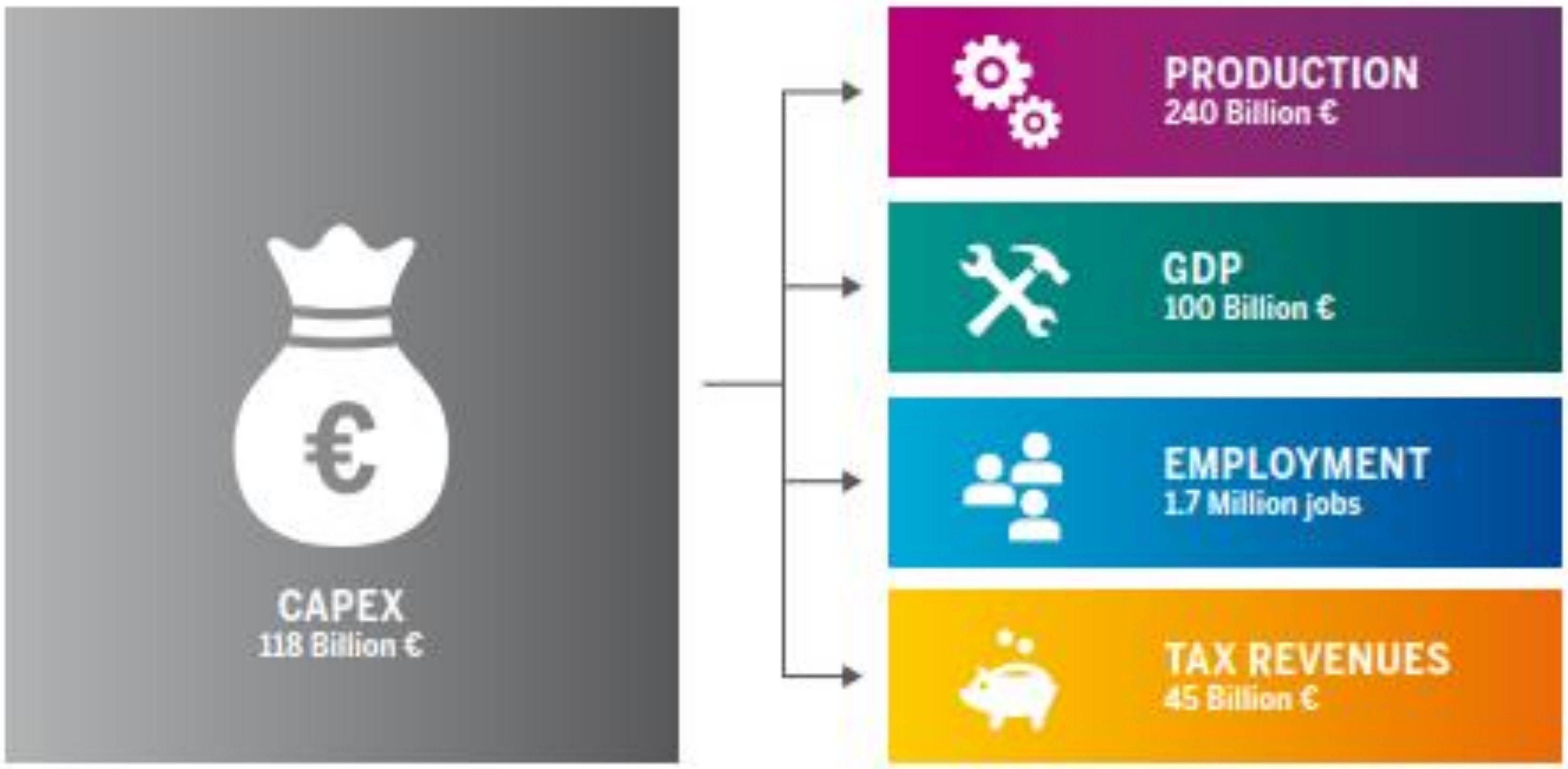


Used in other infrastructure sectors.

Methodology. Inputs and Outputs



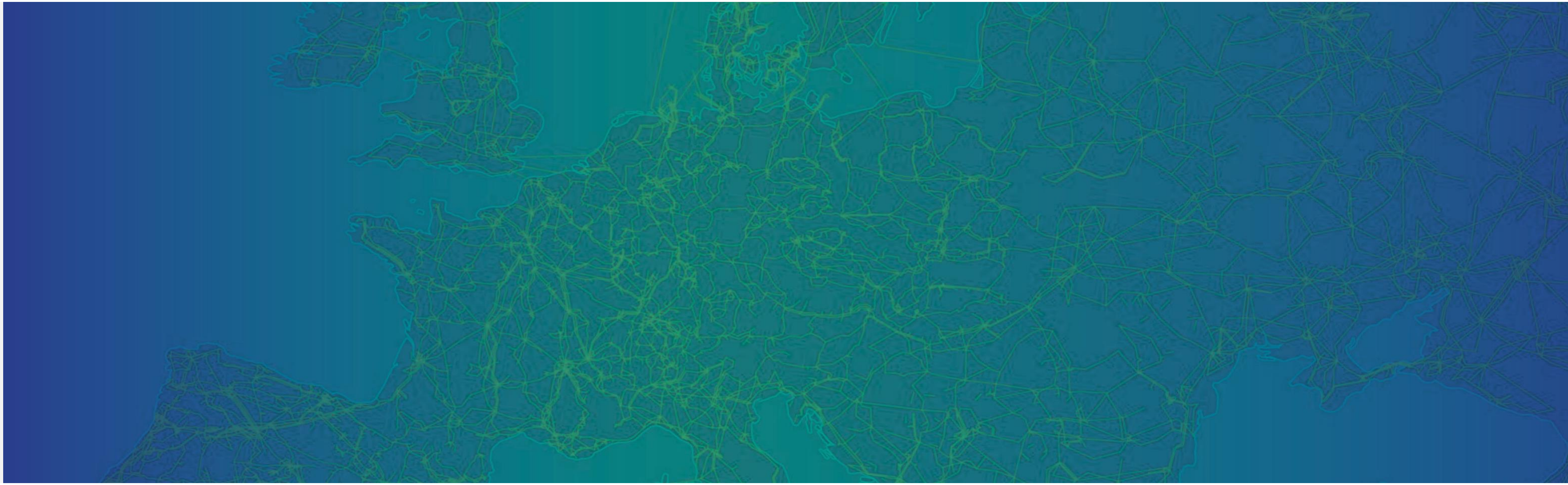
Investing in electricity infrastruture will contribute to the European economic recovery



Planning the future power system: Examples of two real-life projects

Project ULTRANET (TYNDP 2020 project 254)

Tomasz Okraszewski, Transnet BW



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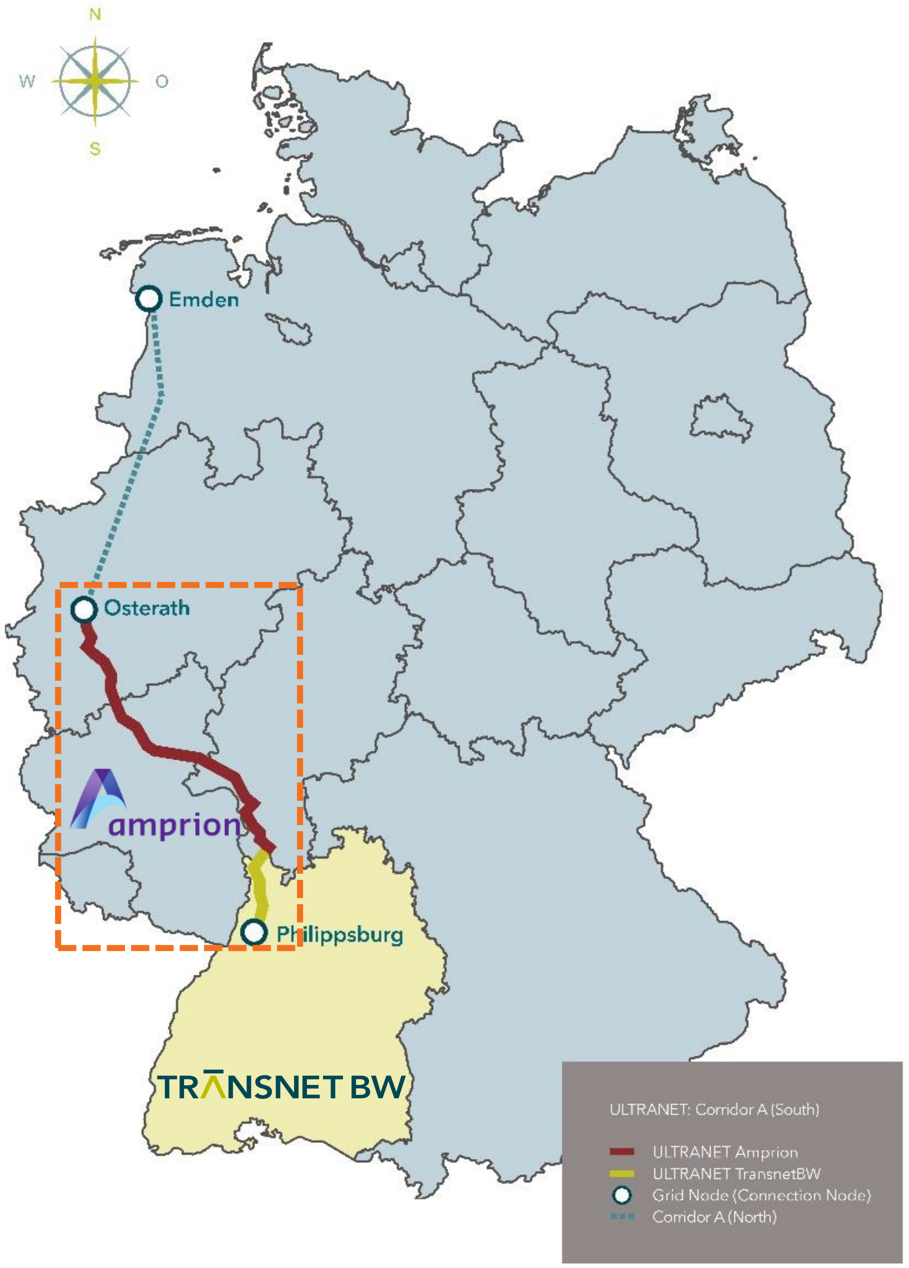
Introducing ULTRANET

- Project promoters: **Amprion GmbH** and **TransnetBW GmbH**
- Project inception date: **2012**
- Description: **HVDC-Link between Osterath and Philippsburg (Length: 340km)**
- Operating Voltage: **380kV**
- Power Transfer Capacity: **2.000 MW**
- Design: **Hybrid Overhead Line with innovative converter technology**
- Commissioning Date: **2024**

ULTRANET enables bi-directional power transfer between two German Federal States (North Rhine-Westphalia and Baden Württemberg). Together with the DC-line from Emden to Osterath (Corridor A-North) it linkes North-Sea renewables with the South of Germany.

ULTRANET significantly increases the flexibility of the German transmission system by enabling optimal dispatch of the installed generation capacities all over Germany (renewable and conventional power plants in the North and in the South).

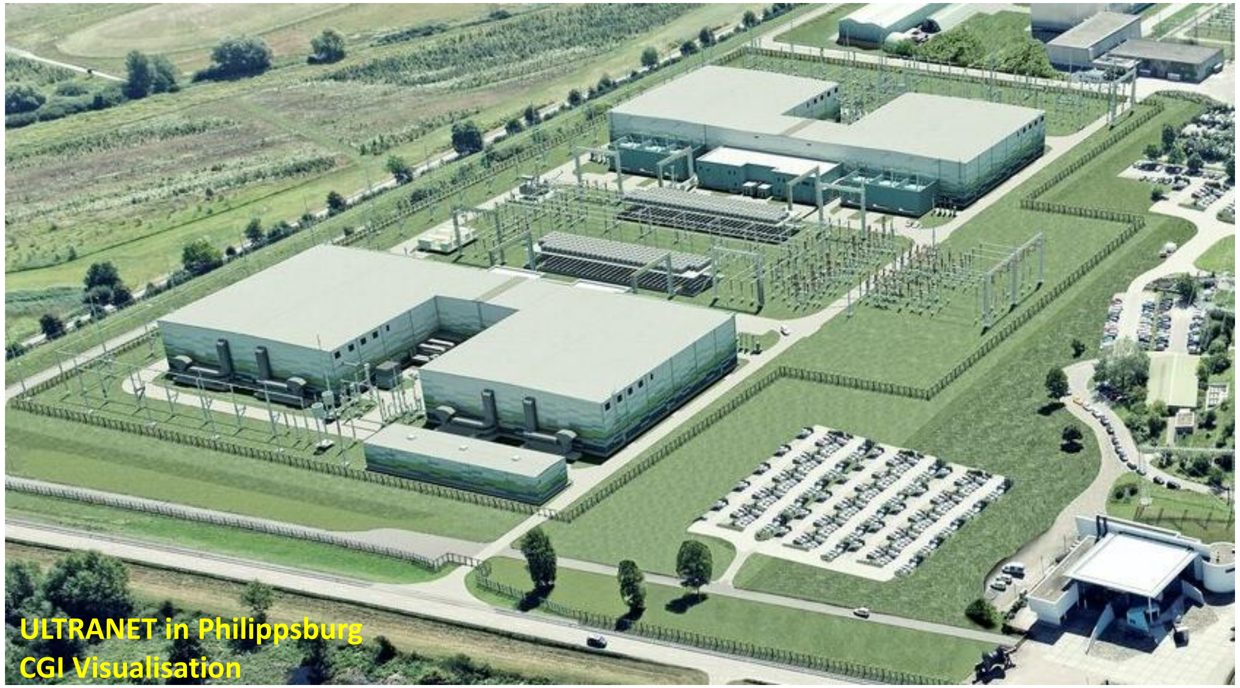
ULTRANET and Corridor A-North have to be regarded as integrated projects.



ULTRANET – A Step towards Super-Grid

ULTRANET is a true pioneer project paving the way towards the European interconnected system. It offers a solid basis for further, long term grid planning. Together with Corridor A-North it links the Renewables in the North to the South of Germany as a multi terminal DC system.

ULTRANET has been facing many permitting challenges resulting in project implementation delays. The official recognition of the undisputable value of the ULTRANET project for the European society as a whole is an important step but at the same time it does not reduce the time needed for dialogue with citizens and local political bodies responsible for environmental studies.


ULTRANET in Philippsburg
CGI Visualisation

Amprion and TransnetBW are convinced that a strong and transparent European political support complemented by an appropriate legal framework could successfully facilitate the current impediments and accelerate implementation of innovative projects like **ULTRANET** so they could start serving the society as planned.

North Sea
Wind Power Hub
Programme

North Sea Wind Power Hub programme

Facilitating connection and integration of large-scale North Sea offshore wind

Antje Orths, Energinet

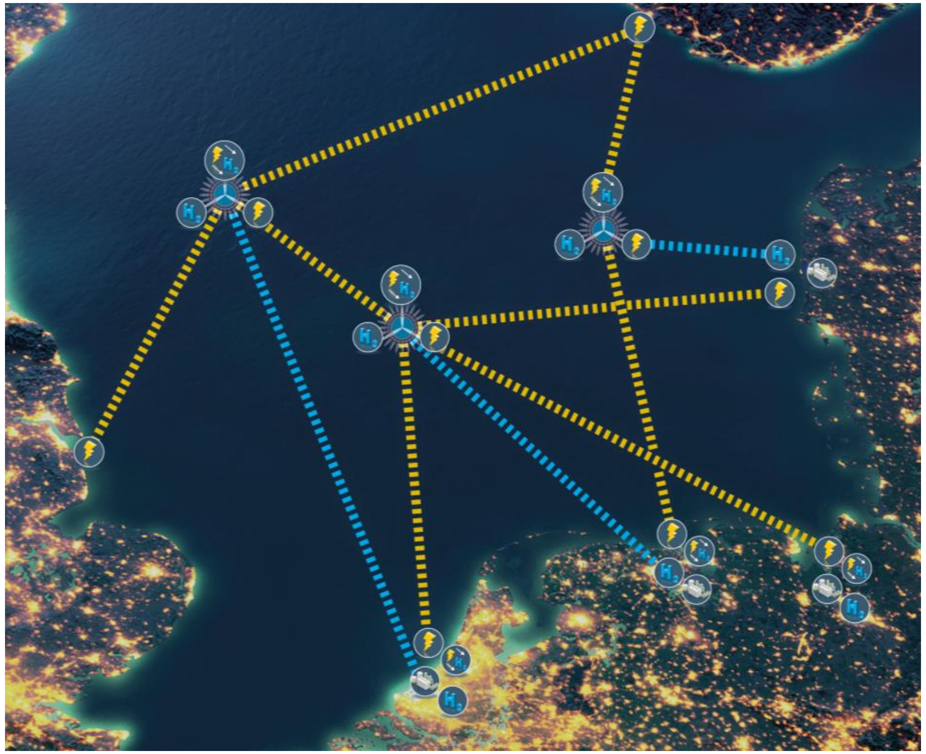
North Sea Wind Power Hub – The Consortium

Northseawindpowerhub

ENERGINET — Danish transmission system operator working for a green, reliable and sustainable energy supply of tomorrow

gasunie — European energy infrastructure company serving the public interest by providing integrated infrastructure services

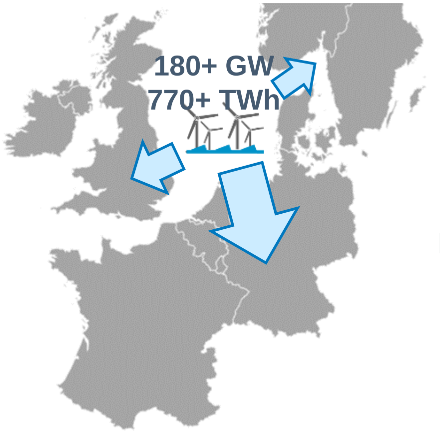
TenneT — Dutch-German electricity TSO and one of Europe's major investors in national and cross-border grid connections on land and at sea in order to establish the energy transition

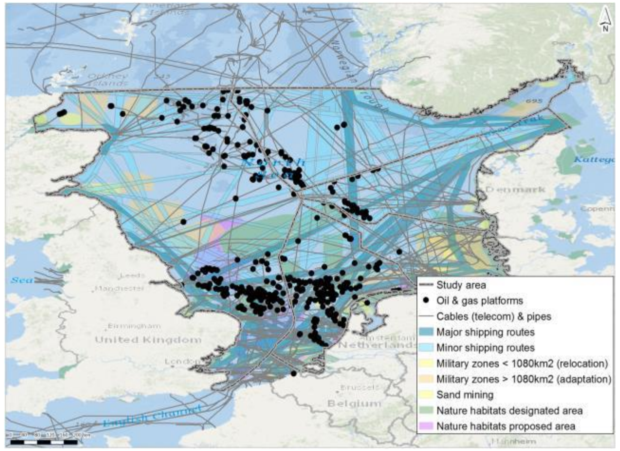


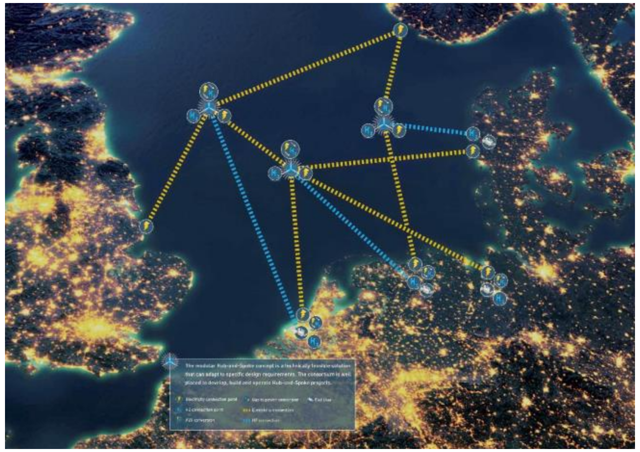
The NSWPH Project (**TYNDP #335**) is on the fourth PCI list as part of the TEN-E Priority Corridor "Northern Seas Offshore Grid (NSOG)" (**PCI 1.19**)

Facilitating the required large scale roll-out of offshore wind

The accelerated deployment of large-scale offshore wind and its integration in the energy system needs international coordination, long term policy targets and a robust regulatory framework







Need for sector-coupling, …

- offshore wind energy needs to be transported to deep inland demand centres
- sector-coupling and grid extension are needed to cope with variable renewable energy generation

… integral system development …

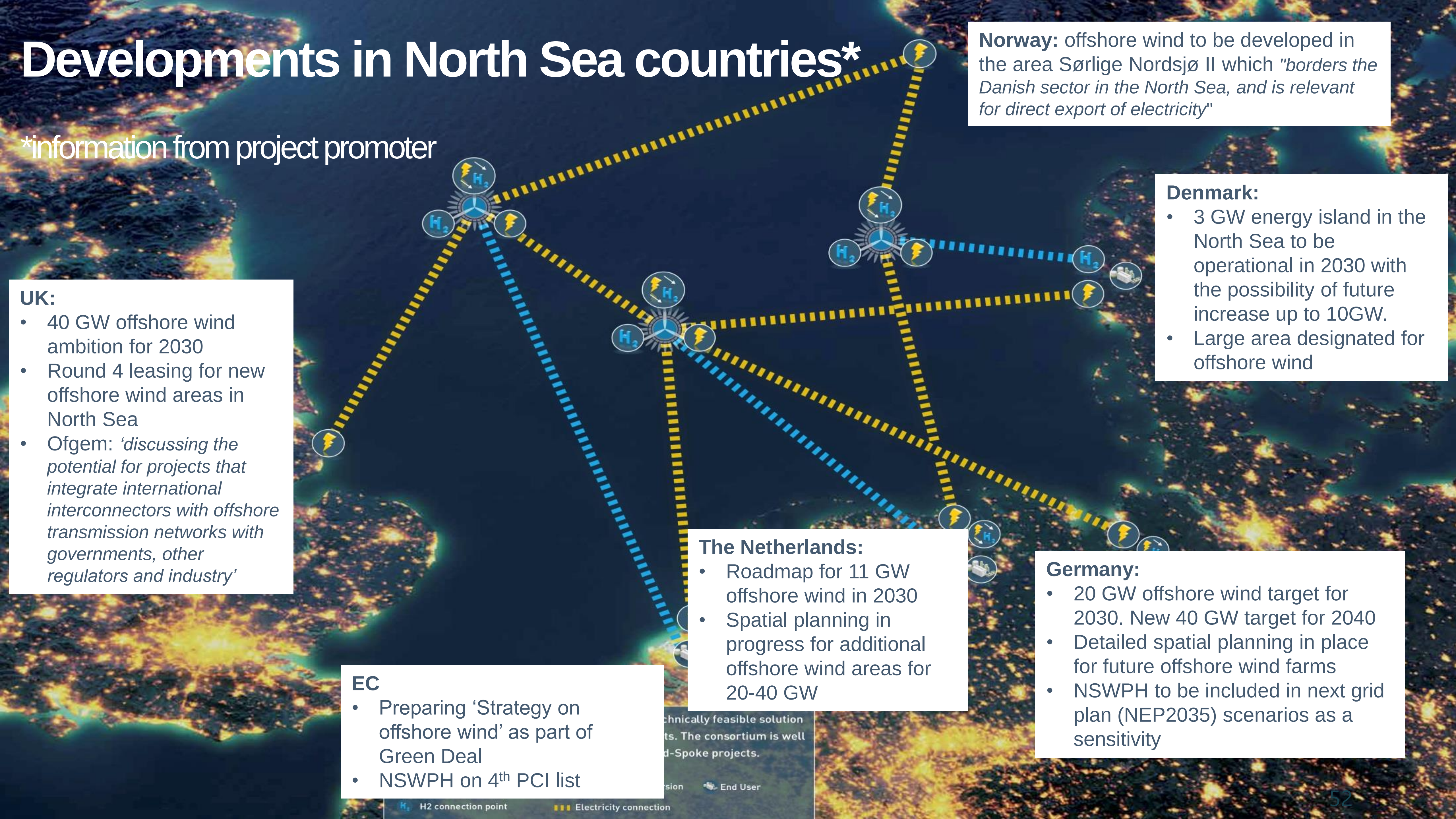
- energy systems should be planned, designed and operated across energy sectors
- large scale roll-out of offshore wind requires international coordination on spatial planning

and supporting mechanisms

- combining offshore wind connection and cross border interconnection
- connecting wind farms from one country to demand centres in another
- cross energy sector coupling at scale

Developments in North Sea countries*

*information from project promoter



Norway: offshore wind to be developed in the area Sørlige Nordsjø II which *"borders the Danish sector in the North Sea, and is relevant for direct export of electricity"*

Denmark:
- 3 GW energy island in the North Sea to be operational in 2030 with the possibility of future increase up to 10GW.
- Large area designated for offshore wind

UK:
- 40 GW offshore wind ambition for 2030
- Round 4 leasing for new offshore wind areas in North Sea
- Ofgem: *'discussing the potential for projects that integrate international interconnectors with offshore transmission networks with governments, other regulators and industry'*

The Netherlands:
- Roadmap for 11 GW offshore wind in 2030
- Spatial planning in progress for additional offshore wind areas for 20-40 GW

Germany:
- 20 GW offshore wind target for 2030. New 40 GW target for 2040
- Detailed spatial planning in place for future offshore wind farms
- NSWPH to be included in next grid plan (NEP2035) scenarios as a sensitivity

EC
- Preparing 'Strategy on offshore wind' as part of Green Deal
- NSWPH on 4th PCI list

Q&A

Towards the TYNDP 2022

Jean-Baptiste Paquel, ENTSO-E
Guillermo Areosa Bäuml, Amprion
Simon Norambuena, ENTSO-E

Use of scenarios and time horizons in the TYNDP 2022

Central Policy Scenario

Only scenario for full CBA and full needs analysis

COP 21 Scenarios

Sensitivities and additional studies for the needs identification

Light projects CBA

Current trends Scenario (slow transition)

Light projects CBA
(Confirmation in TYNDP 2022 pending discussions with institutional and regulatory partners)

Time horizons considered for the TYNDP 2022

2030 and 2040, with a look to 2050

Transparency in the TYNDP

New data visualisation tools

Enhanced projects library with additional and clarified information, easy data download

Availability of datasets, data download and data request centers

Public consultation, public webinars

New public consultation on the Projects Selection Guidelines

Replicability of studies:

Publication of the complete CBA Implementation Guideline and the modeling scenario methodology. Use of an open source Antares zonal model and commercially available models.

Open door policy

Equal treatment of all projects in the TYNDP

New public consultation on the Projects Selection Guidelines

Rejection appeal process led by external stakeholders

Additional period of time for 3rd party (non TSO) promoters for the second window of projects selection

Enhanced project promoters platform to easily monitor information provided to and by ENTSO-E on projects

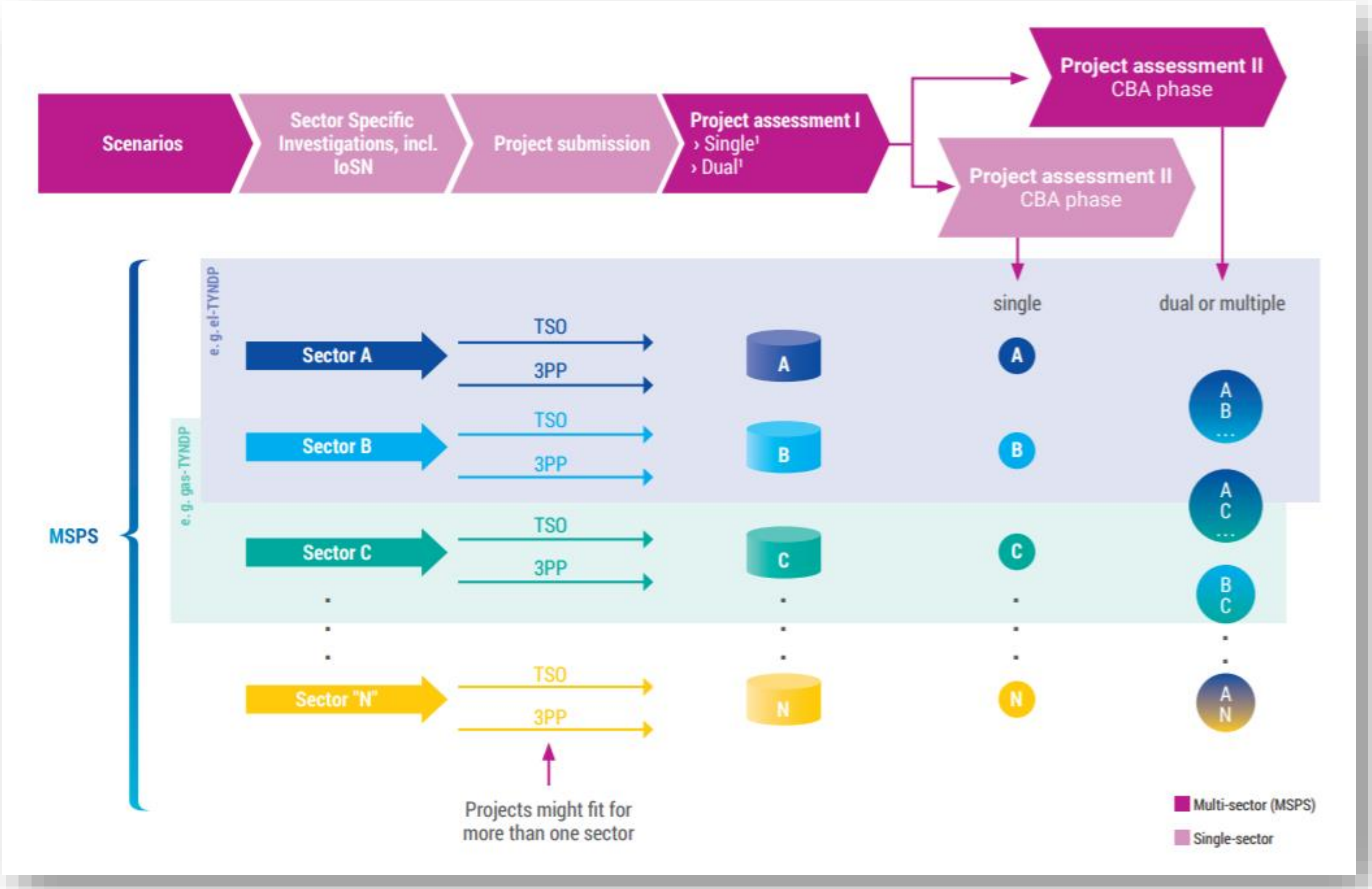
Regular webinars and information for project promoters

“Promoters corner” on the TYNDP website

Open door policy

ENTSO-E's Roadmap for a Multi-Sectorial Planning Support: paving the way to smart sector and energy system integration

- **Greater coordination** across sectors of the infrastructure planning & scenario building
- Increased **stakeholder collaboration**
- One energy **system view**
- **Multi-sectorial elements** in the scenario building and project assessment phases (interlinked model)
- Multi-sectorial **cost-benefit analysis and indicators**



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TYNDP 2022 specific policy issues

Pre-aligning with new TEN-E provisions and EU objectives fulfilment

Implementation of CEP Art.16.8:
Provision of at least 70% of the interconnection capacity to the market

Analysing offshore wind configurations

Smart sector integration

Dual Gas Electricity CBA of relevant projects

Smart sector integration

Dual Gas Electricity CBA of relevant projects

Wrap up and next steps

Participate in the public consultation now

http://tyndp.entsoe.eu

CONSULTATION OPEN UNTIL 4 JANUARY 2021

ENTSO-E RESPONDS INDIVIDUALLY TO EACH COMMENT

All comments and responses published

Next steps

TYNDP 2020

Publication of consultation responses.

February 2021

Submission to ACER of the TYNDP after consultation.

February 2021

ACER opinion

Release of final TYNDP

PCI process ongoing

2021

TYNDP 2022

TYNDP 2022 projects selection guidelines public consultation

Q3 2021

TYNDP 2022 call for projects

Q4 2021

Thank you for your attention

Contact: tyndp@entsoe.eu

The recording and slides will be published shortly on tyndp.entsoe.eu