ENTSO-E TYNDP and RegIPs

Presenter:
Andriy Vovk, TYNDP PMO Advisor

Athens, 01 June 2017

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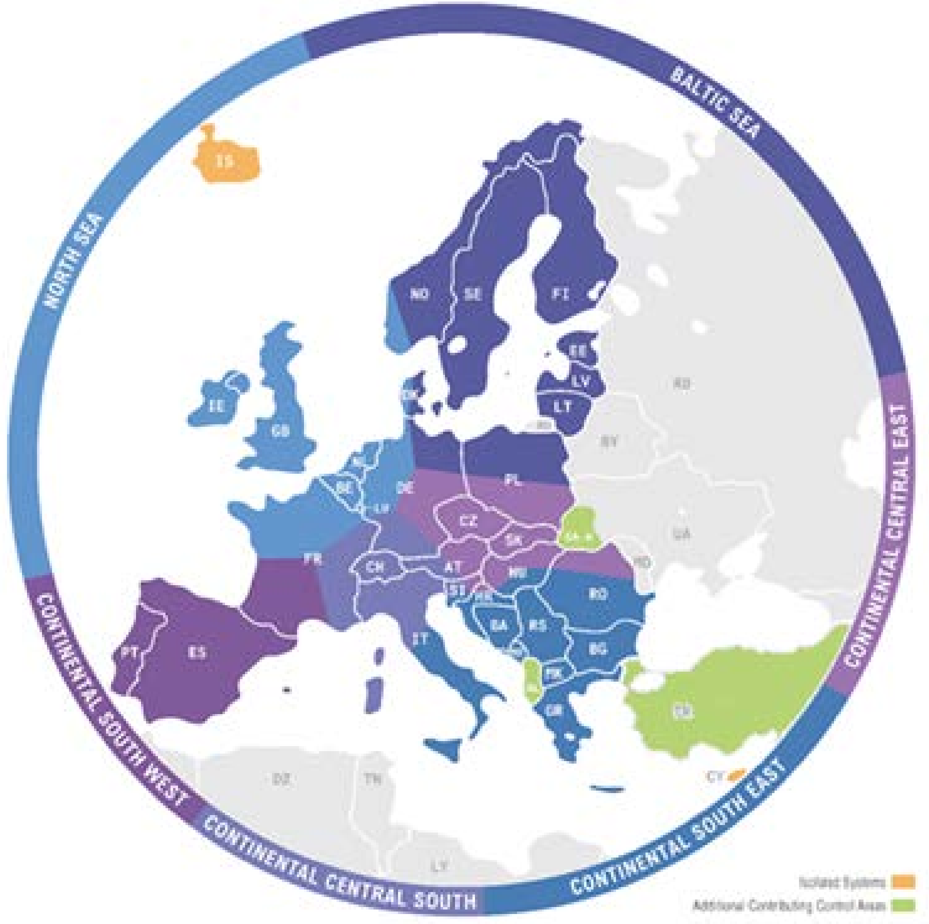
CONTENT

- Objectives
- Organization
- Timeline for all deliverables
- Scenario Building
- Identification of the System Needs
- Project assessments



OBJECTIVES OF TYNDP

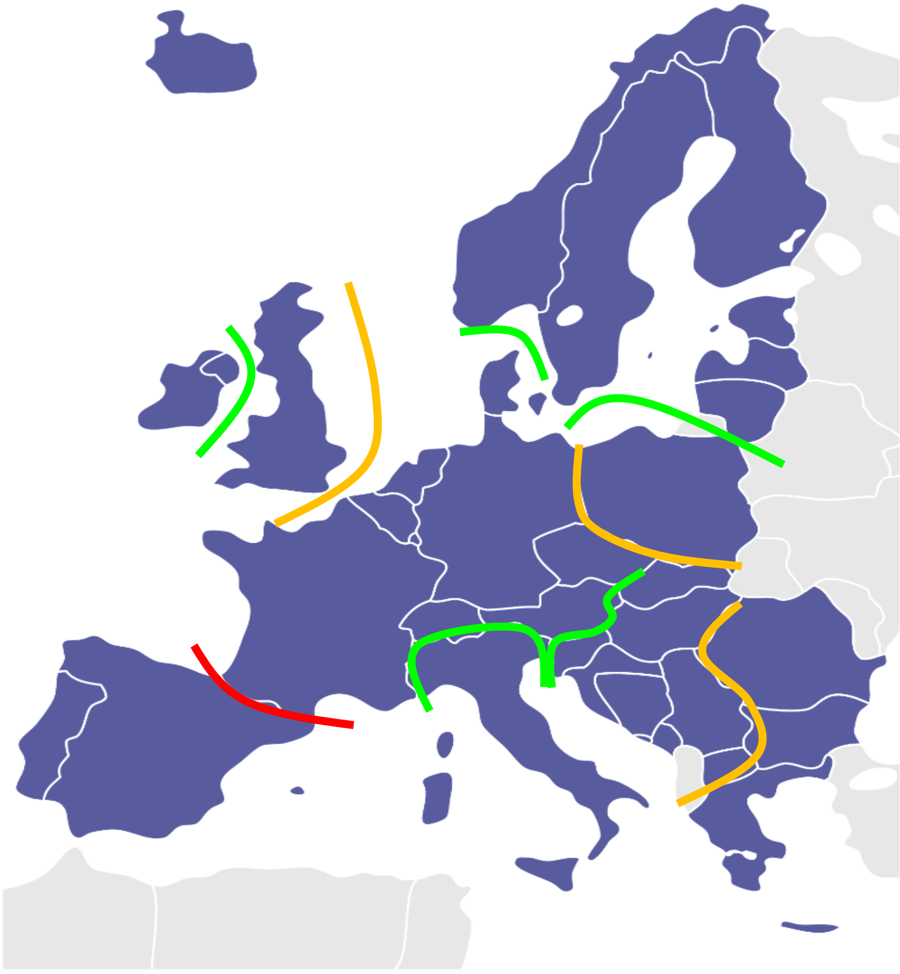
- Explore and explain a vision of the future power system
- Highlight investment needs based on coordinated regional planning studies
- Assess cost/benefits of projects of pan-European relevance in a transparent and non-discriminatory manner
- Provide data, assumptions, methodologies

TYNDP PROJECTS – EUROPE NEEDS THEM BUILT

2x more interconnection capacities by 2030

Integrating up to 60% renewable energy sources

Up to 5 €/Megawatt hour reduction on bulk power prices



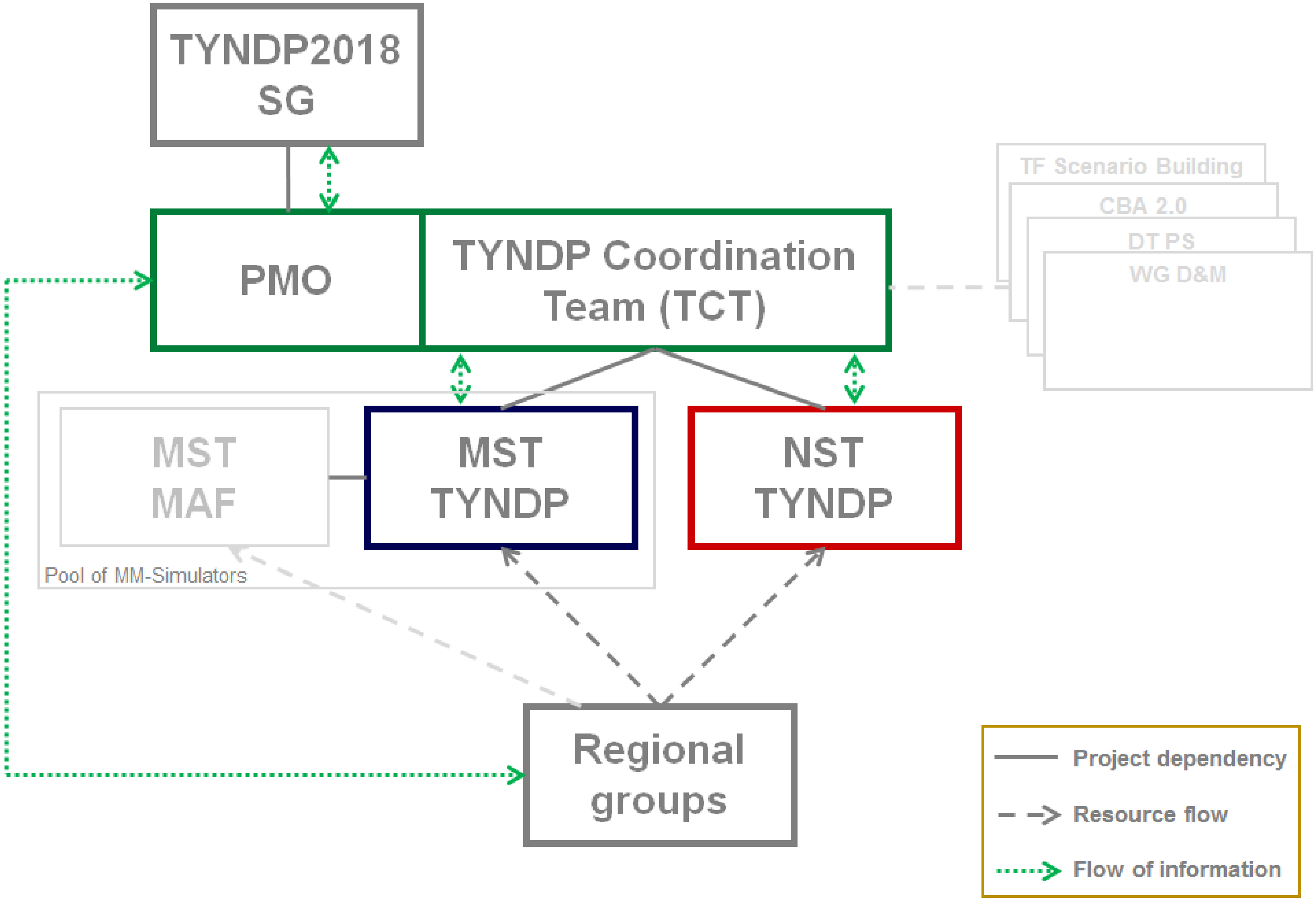
1% increase in the total consumer bill

€150 billion investment

Proper return for investors

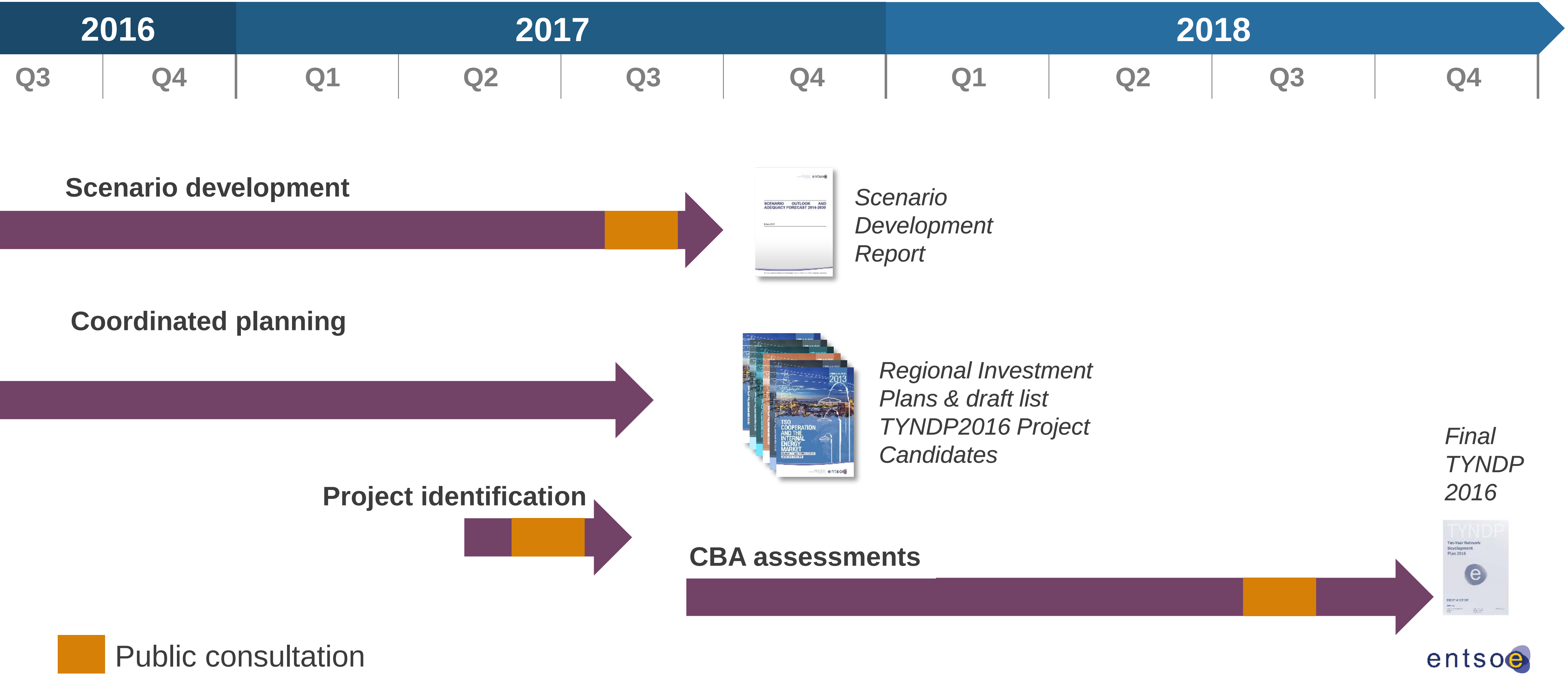
Gain support from local communities

TYNDP 2018 MAF 2017 Organisation



TYNDP 2018: DELIVERABLES

TYNDP 2018 TIMELINE



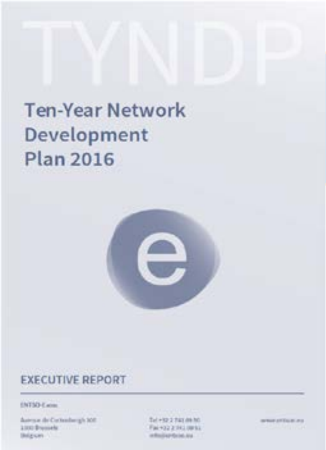
TYNDP 2018 & MAF 2017 scenario building framework

Short term — uncertainty increase → Long term

1 year | 5 years | 10 years | 15 years

GOAL	• Security of supply • Generation adequacy outlook	- Grid "as it should be" to achieve the "vital" Interconnected European grid - Pan-EU system adequacy
INPUT	• Grid "as it is" + project commissioned • • Best national info on generation mix	- Best national prospective on… - climate policy target 2030 - energy efficiency
SCENARIOS	• 'predictive' scenarios → forecast • Bottom-up → "*build on national outlook*"	- 'exploratory' scenarios → differ enough from each other → NO forecast - top-down → Pan-EU optimization
ENTSO-E's REPORT	Mid-term Adequacy Forecast 2016	TYNDP package

Up to 10 years → time need to complete a high-priority electricity infrastructure projects across Europe



TYNDP package

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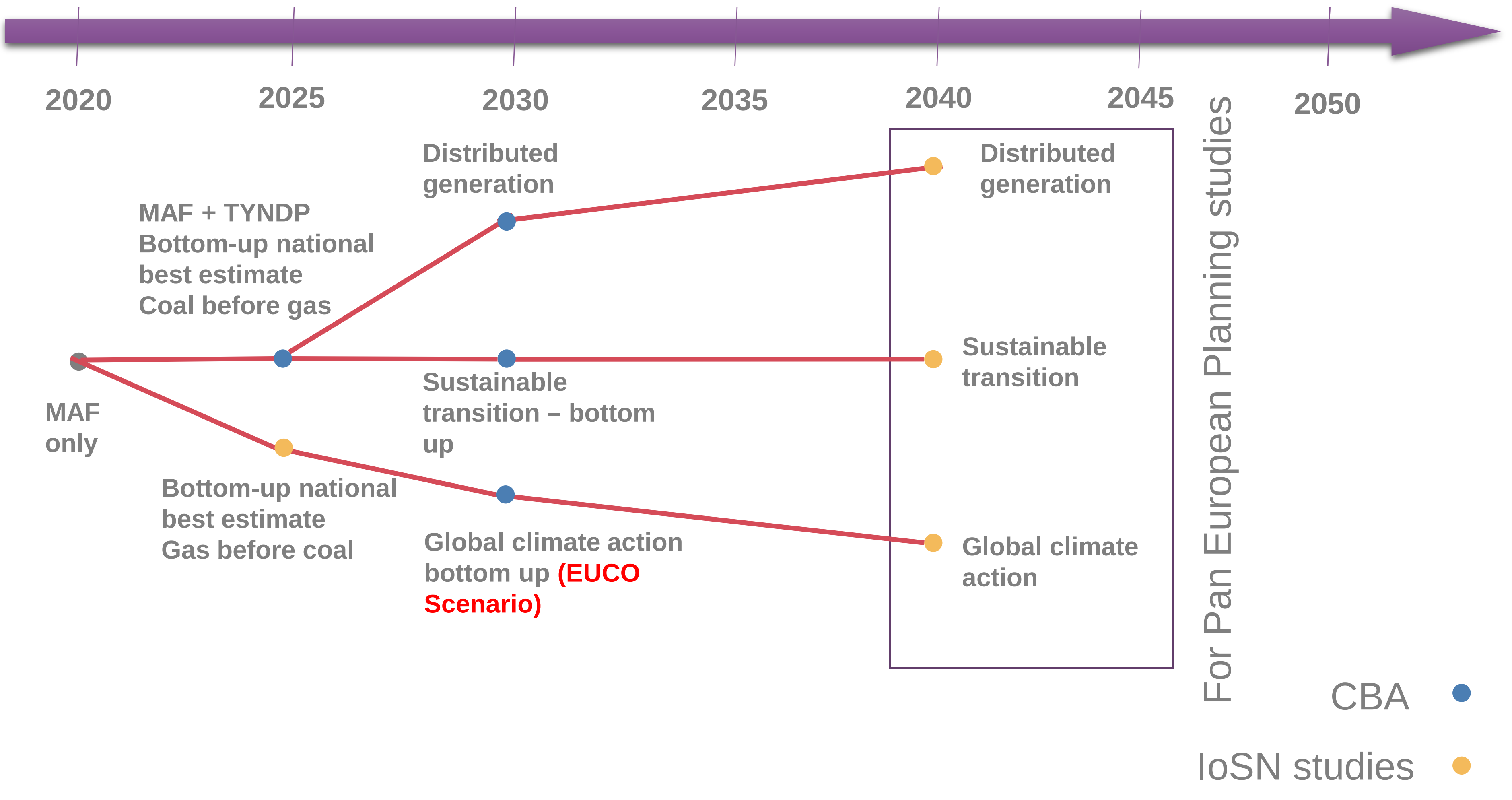
CURRENT SCENARIO BUILDING STORYLINES



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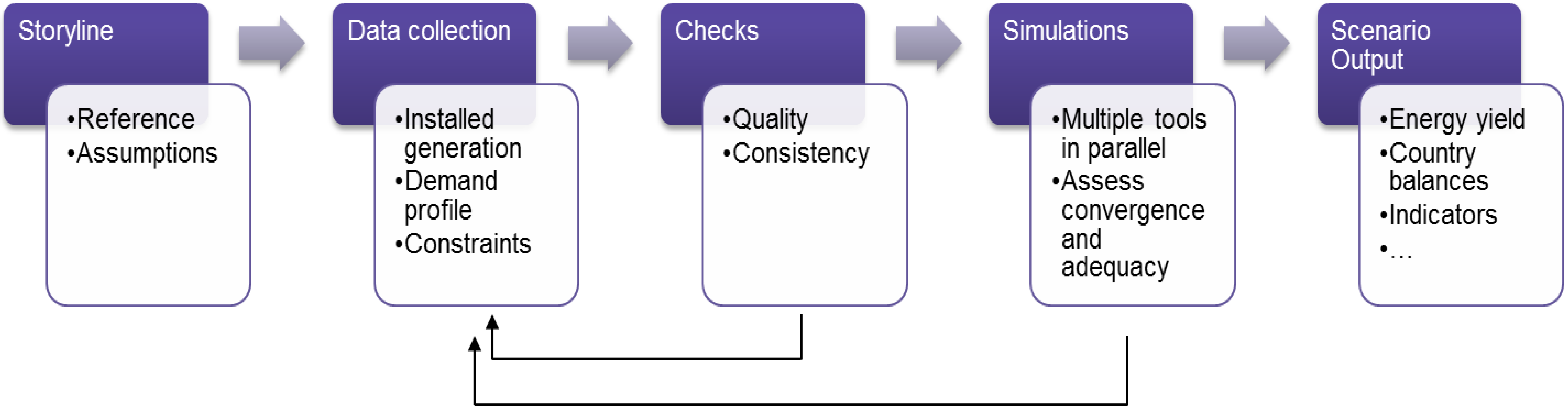
SCENARIO BUILDING – METHODOLOGY

- What do you need to build scenarios?
- How do you handle complexity?
- What do you get out of it?



IDENTIFICATION OF THE SYSTEM NEEDS : PAN-EUROPEAN REPORT AND REGIONAL INVESTMENT PLANS

PLANNING STUDIES

Scenarios and sensitivities

↓

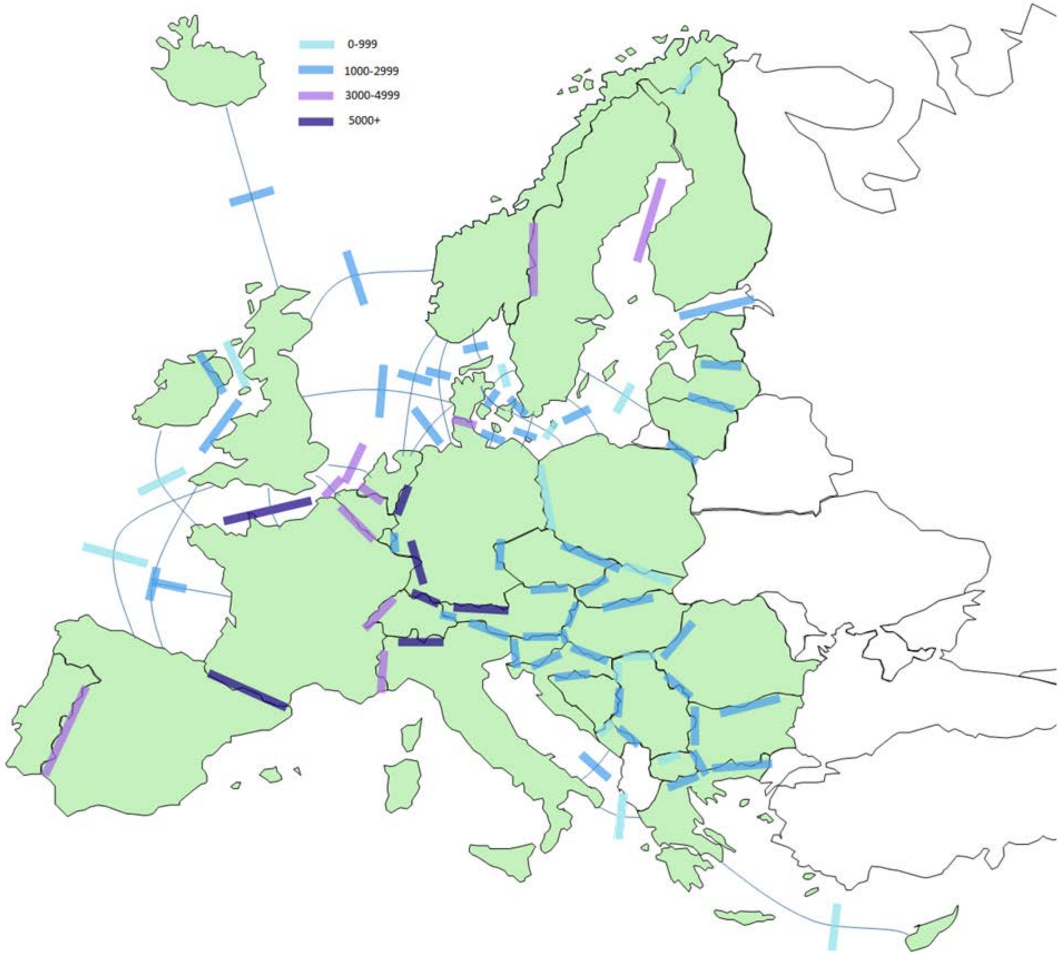
Market-based target capacities

↓

Network studies

↓

Investment needs & Project candidates



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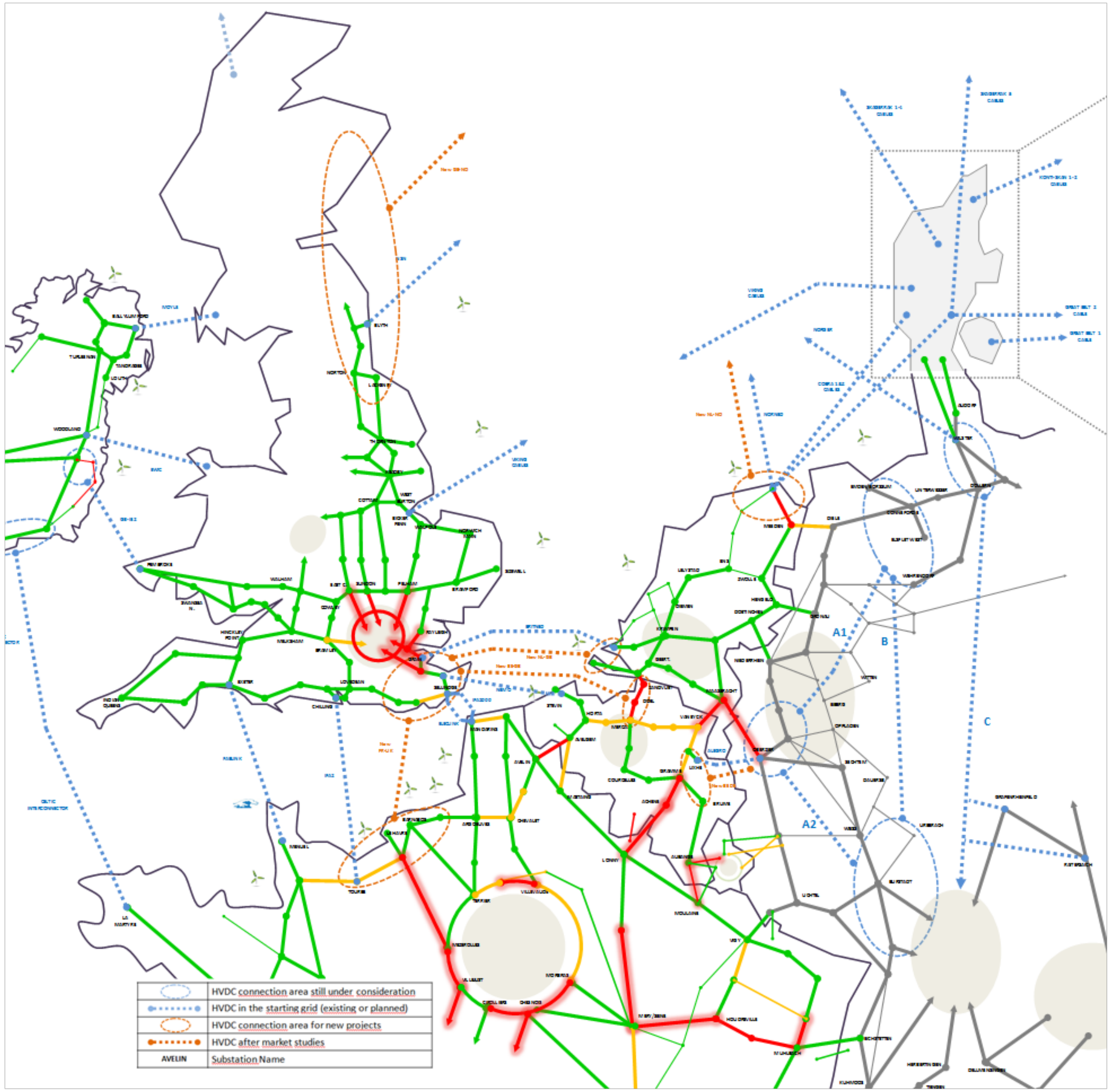

Example of North Sea region

PLANNING STUDIES

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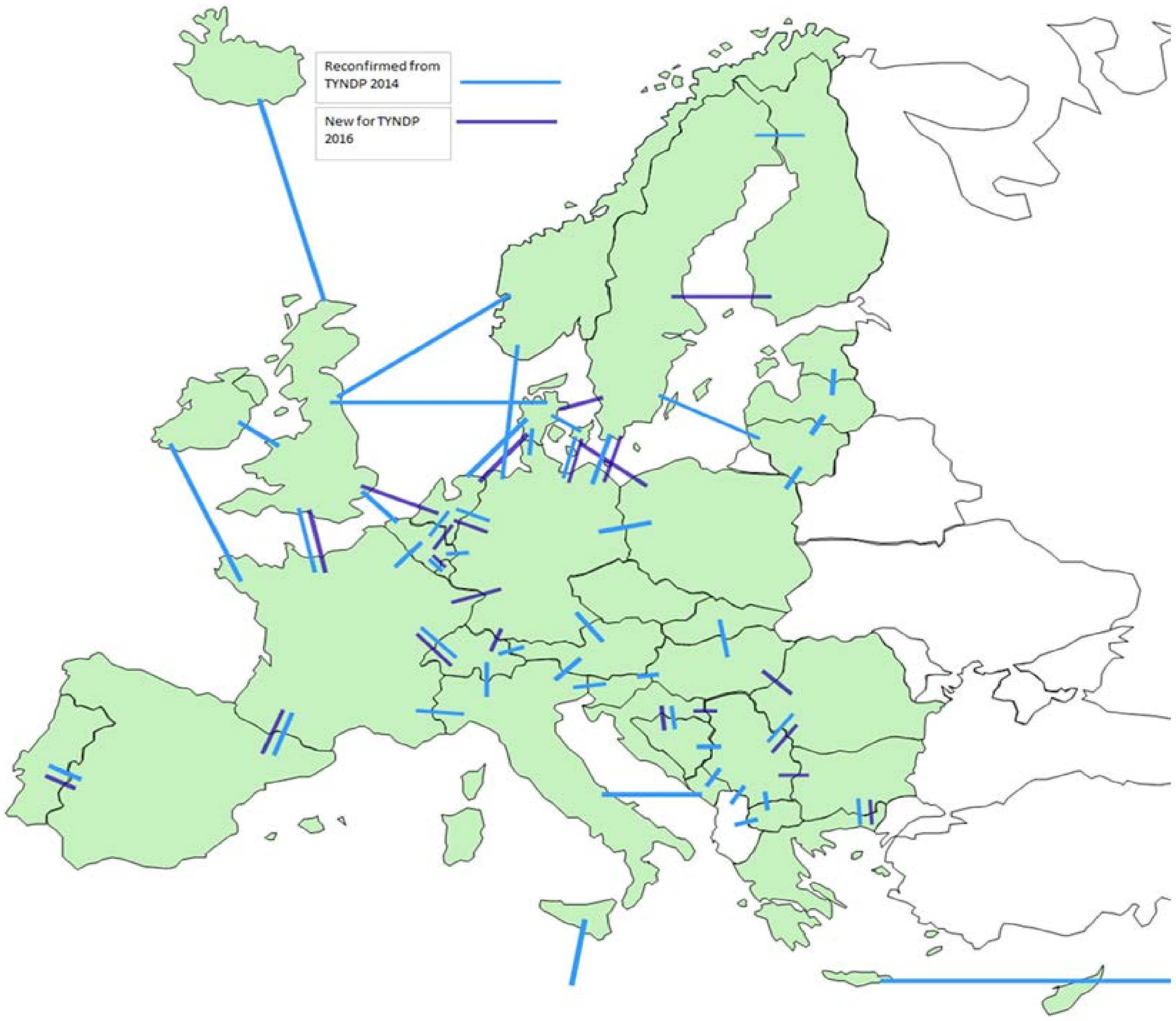
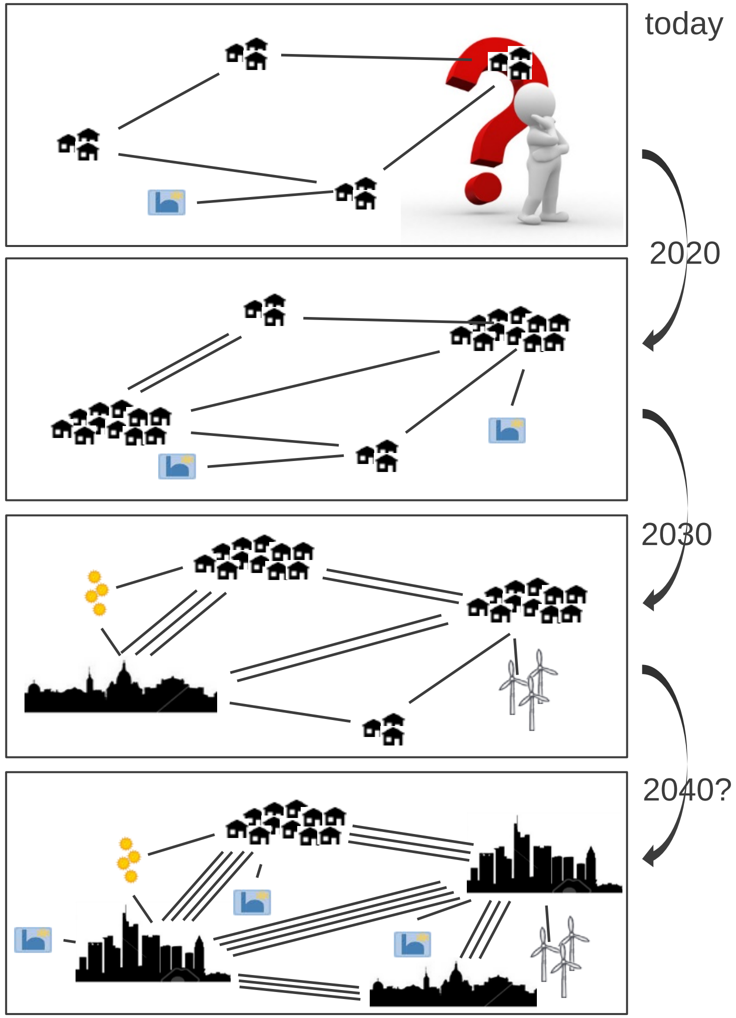


Note: map focuses on cross-border projects only

PROJECT ASSESSMENT

- **Most projects influence each other**
- **How do we ensure an objective and transparent assessment?**

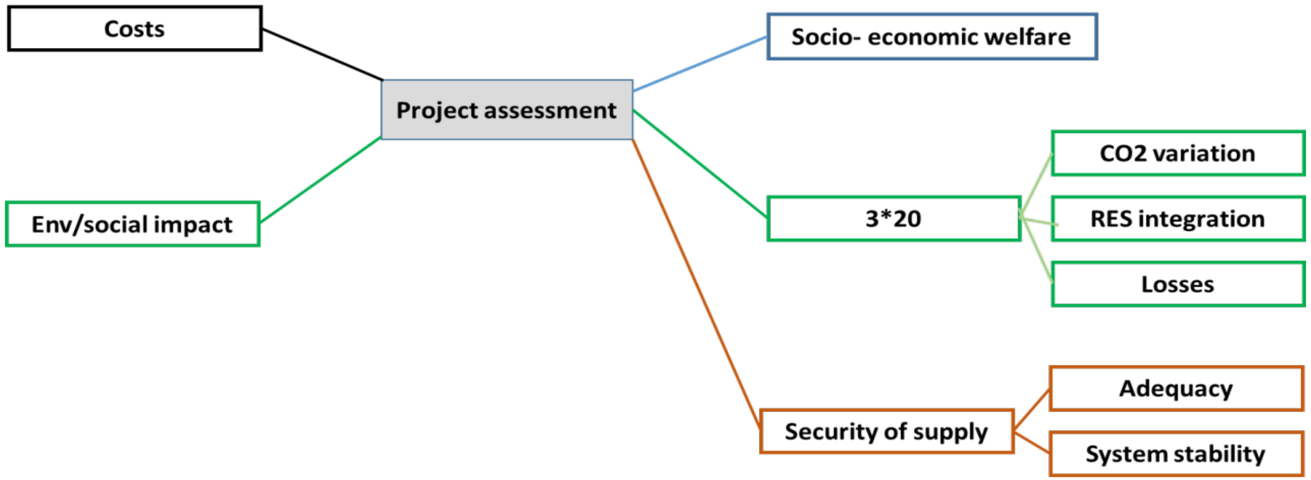
  - Impact is based on taking a project out of the reference; or adding it on top of the reference
  - A reference grid for each time horizon, which includes all mature projects
  - Impact is measured by several indicators
  - Full approach documented in Cost Benefit Analysis Methodology, developed by ENTSO-E in past years, reviewed and approved by ACER and EC.



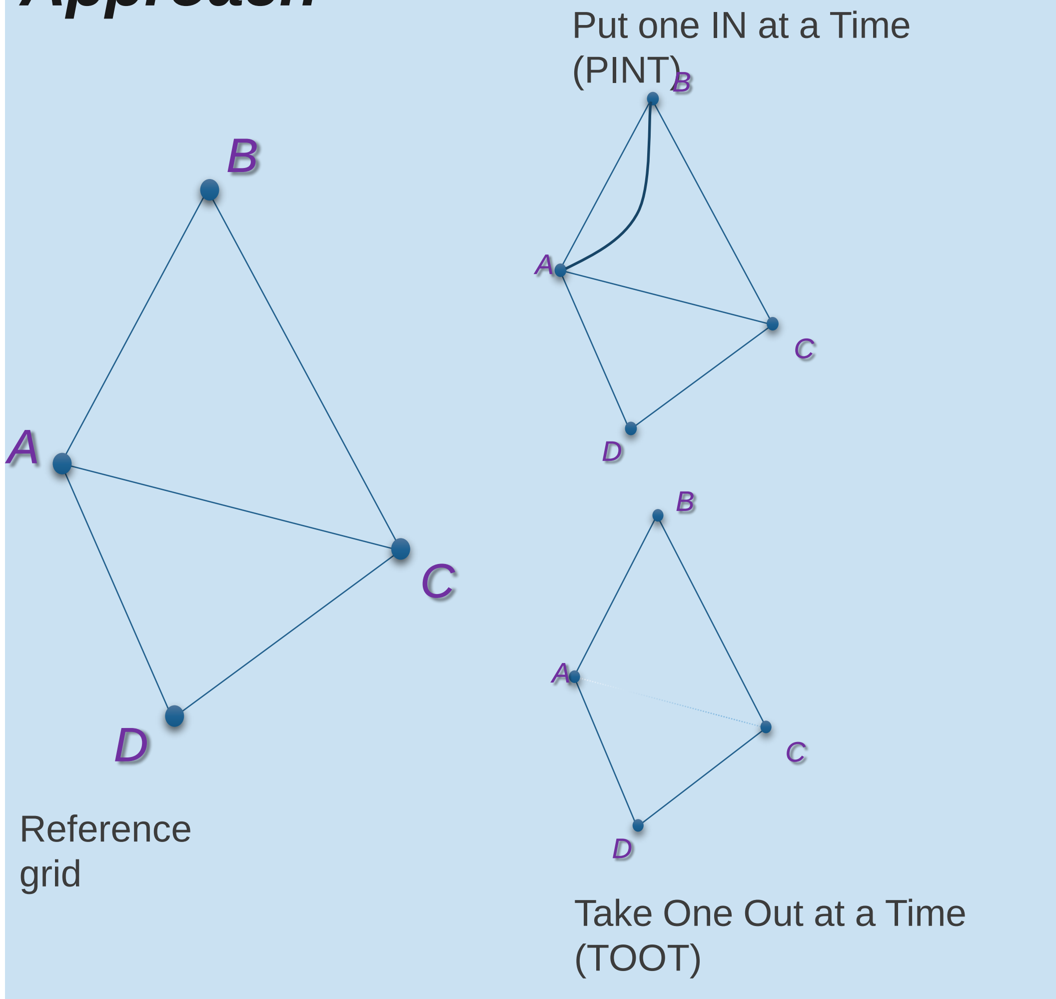
CBA 2.0 – MAIN PROJECT ASSESSMENT INDICATORS

Indicators

- Multi-criteria approach
- Some criteria scenario-specific
- Coordinated ENTSO-E study
- Specific tailoring for storage projects
- Based on scenario/project data available on ENTSO-E website



Approach



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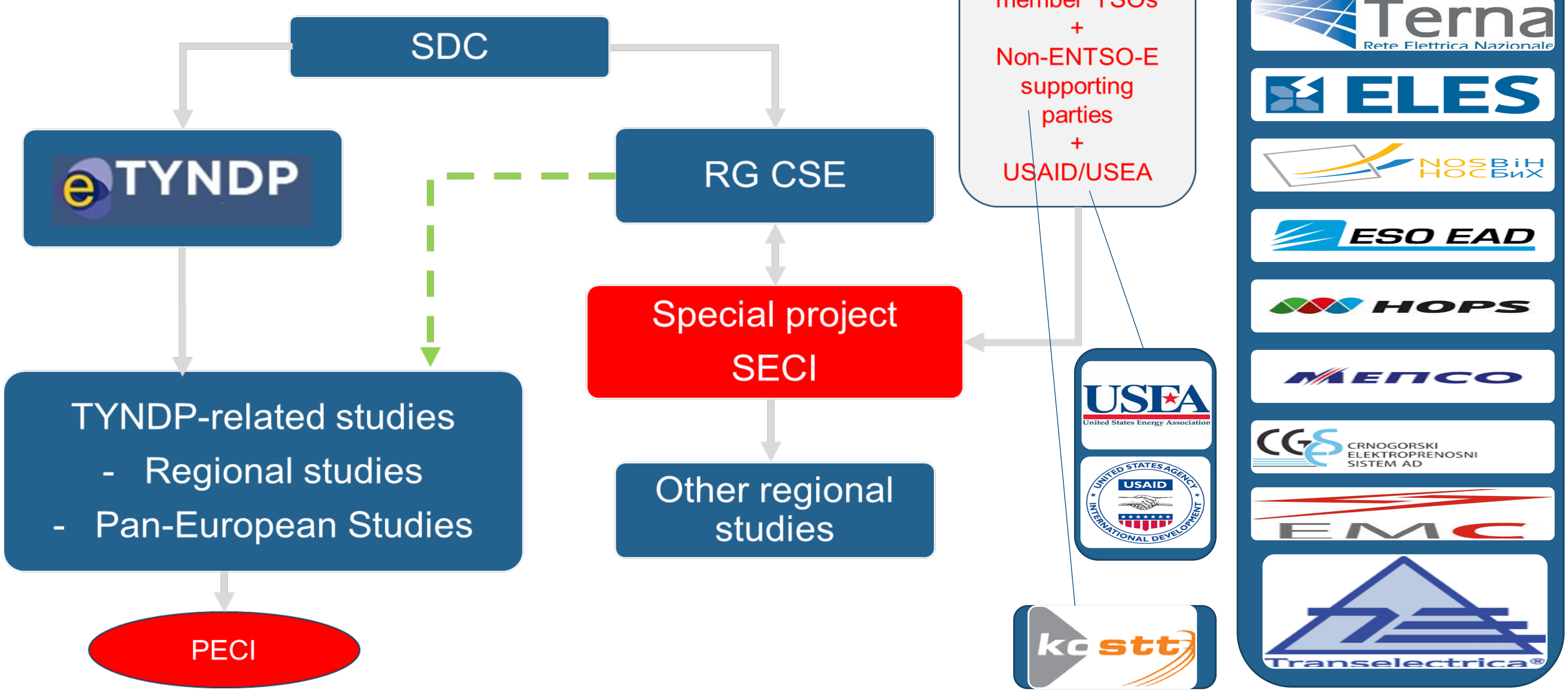
SECI INTEGRATION UNDER ENTSO-E UMBRELLA

- ✓ Terms of Reference for SECI TSP approved by SDC - 23 May, Reykjavik. Duration: 2 years.



ENTSO-E TYNDPs and RgIPs from RG Continental South East point of view

Presenter:
Nebojsa Vucinic, Convener of RG CSE

Athens, 01 June 2017

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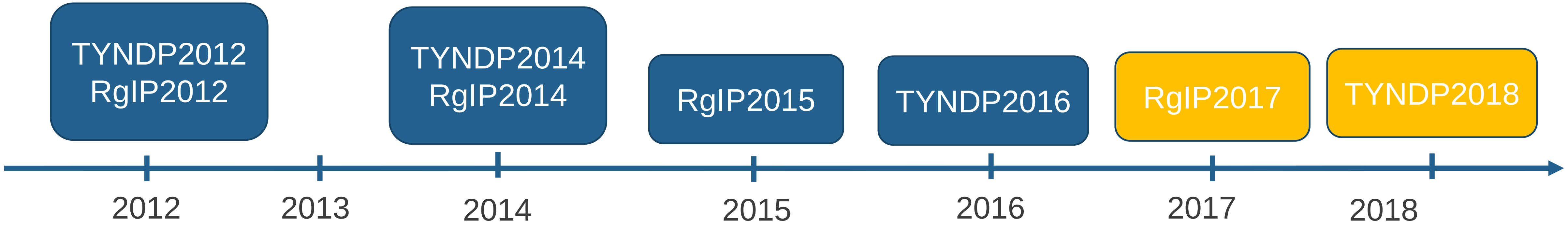
Regional investment plans as part of TYNDP packages

The TYNDP 2016 and the six Regional Investment Plans associated are supported by regional and pan-European analyses and take into account feedback received from institutions and stakeholder associations. The work of TYNDPs is splitted in two key phases:

- The first phase is devoted to **common planning studies** and results in the six Regional Investment Plans and the identification of a list of TYNDP2016 project candidates. During this phase also a set of TYNDP scenarios are developed.
- The second phase will be dedicated to coordinated project assessments using the Cost Benefit Analysis Methodology (CBA) and based on common scenarios. The results are published in the main TYNDP report.

These **common planning studies** aim to identify the grid bottlenecks and potential investment solutions of pan-European significance for a 2030 time-horizon, in a robust, unified and consistent manner based on best available joint TSO expertise.

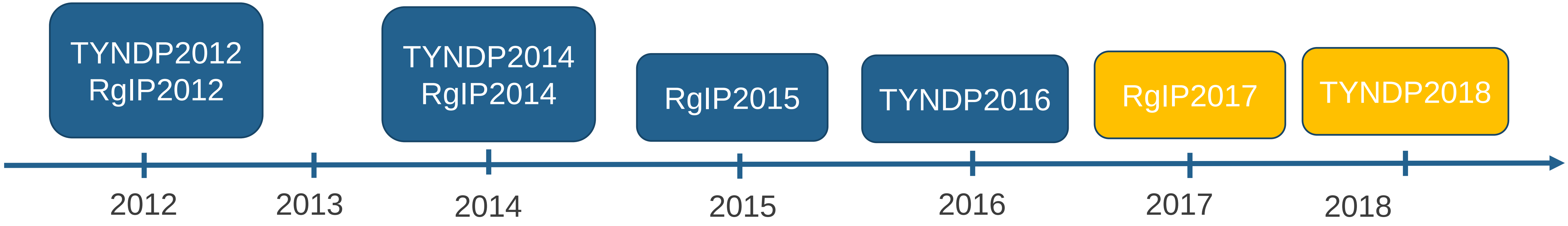


Last Regional investment plan 2015 of CSE

The RgIP2015 for RG CSE comprises results and findings already reported in the TYNDP2014 and the relevant RgIP 2014 and the main findings of the Common Planning Study (CPS) for the region.

The CPS was a necessary step for the efficient transmission planning of the region and important findings came out:

- compared to the projects included in the TYNDP2014,
- new needs were detected and
- some new candidate projects to further strengthen the major North to South and East to West corridors have been determined and proposed to be added to the RgIP and to be assessed in the view of the TYNDP2016.



Key messages of the Continental South East region

Main drivers of grid development in the CSE region can be briefly summarized to the following:

- Increase of Transfer Capacities and Market Integration facilitation: The grid in the CSE region is rather sparse compared to the rest of the continent. This leads to insufficient transfer capacities; the increase of existing transfer capacities (both cross-border and internal) is a prerequisite for the market integration in the region. Also, the price difference between the Balkan region and Italy comprises a major driver to increase the transfer capacities to Italy through undersea links across the Adriatic Sea and the SI-IT borders.

- Massive RES integration: The exploitation of RES in the Region is lacking (except GR, BG, RO). The anticipated largest RES integration (mainly wind, PV and hydro) in the region in order to achieve EU and National targets require extensive grid developments.

- Evacuation of future conventional generation mostly in the West part of the Region.

Market Results in RgIP2015

All regions have jointly investigated all borders in order to identify the most beneficial ones based on a criteria of SEW/cost-ratio. The SEW indicator represents the socioeconomic welfare of a full-year market simulation. The cost indicator is an estimation of the capex of a potential cross-border capacity increase, including necessary internal reinforcements.

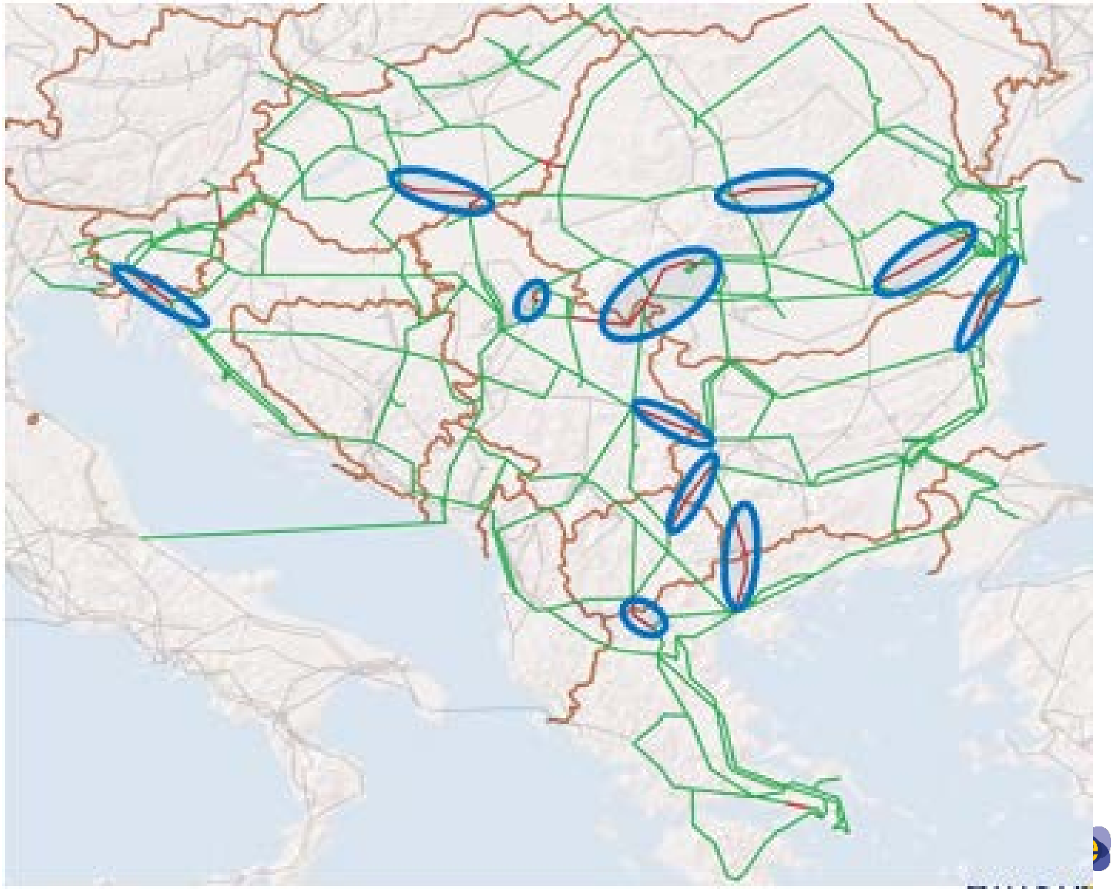
On the basis of the four iterations performed under the framework of the Common Planning Studies for the *Reference scenario*, eight of the most beneficial borders within RG CSE have been identified.

Border	Additional Interconnection Capacity [MW]
BA-HR	500
BA-ME	No additional capacity
BA-RS	No additional capacity
BG-GR	1500
BG-MK	500
BG-RO	No additional capacity
BG-RS	500
GR-AL	500
GR-ITS	No additional capacity
GR-MK	500
HR-ME	No additional capacity
HR-RS	500
HU-RS	No additional capacity
ME-AL	No additional capacity
ME-RS	No additional capacity
MK-AL	No additional capacity
MK-RS	No additional capacity
RO-RS	500
RS-AL	No additional capacity

Network Results in RgIP2015

In the framework of the CPS in RG CSE in Vision 4 from TYNDP2014, and based on market simulations, screenshots were made for all hours in the year 2030 and load flow calculations were carried out on them (year round calculation). The results of power flow calculations on the Vision 4 of TYNDP2014, which can be defined as extreme vision for the CSE region, showed that the network in CSE is heavily loaded, even in base case. In base case overloads are seen 27% of the time.

percent's range of loadings	OHL 400 kV Niš 2 (RS) - Sofia West (BG)	OHL 400 kV Djerdap 1 (RS) - Portile de Fier (RO)	OHL 400 kV Blagoevgrad (BG) - Thesalloniki (GR)	OHL 400 kV Melina (HR) - Divaca (SI)	OHL 400 kV Ceverna Mogila (BG) - Stip (MK)	OHL 400 kV Florina (GR) - Bitola 2 (MK)	OHL 400 kV Subotica 3 (RS) - Shandorfalva (HU)	OHL 400 kV Varna (BG) - Medigidia (RO)	OHL 400 kV Bekescsaba (HU) - Nadab (RO)
0 - 60	3252	6826	5301	7717	6342	7155	7002	8454	7594
60 - 80	1893	1163	1752	694	1897	1022	1402	248	730
80 - 100	1652	282	1242	265	469	543	317	30	407
100 - 120	1129	147	377	59	27	15	14	3	4
120 - 140	616	198	63	0	0	0	0	0	0
140 - 160	168	111	0	0	0	0	0	0	0
160 - 180	25	8	0	0	0	0	0	0	0
More	0	0	0	0	0	0	0	0	0



List of new projects identified like system needs in RgIP2015 (1)

In order to answer the overloads occurring in analysed scenario (V4 TYNDP2014) the representatives of CSE TSOs agreed on a list of new projects.

Lines overload at the borders between Bulgaria and Serbia, Bulgaria and FYR of Macedonia, as well as Romania and Serbia will be solved with two new projects: double 400 kV OHL Sofia West (BG) - Nis 2 (RS) and the doubling of the existing 400 kV Djerdap 1 (RS) - Portile de Fier (RO).

Constraints on the transmission line on the border between Bulgaria and Greece, which is observed on the future 400 kV Maritsa East (BG) - Nea Santa (GR) will be solved by doubling that transmission line.

Overload at the border between Romania and Hungary will be solved by building a new 400 kV OHL Debrecen (HU) - Oradea (RO).

List of new projects identified like system needs in RgIP2015 (2)

In order to support increase of cross-border capacity, and at the same time, according to the national needs for upgrading the existing 220 kV network to 400 kV level, two internal projects were nominated in Serbia.

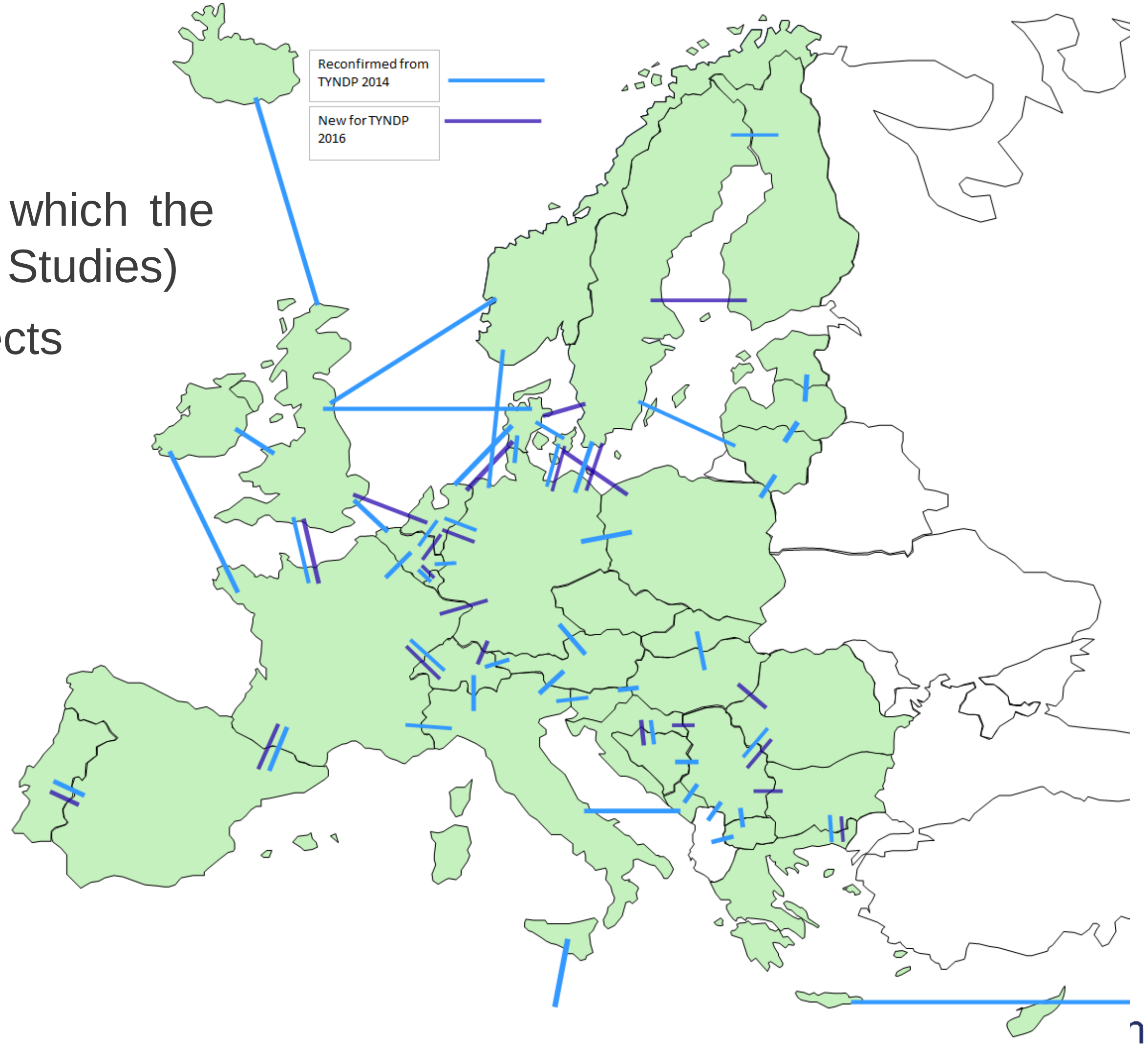
The first project consists in upgrading the existing 220 kV voltage network in central Serbia to 400 kV voltage level. This project is directly related to increasing the cross border capacity between Serbia and Bulgaria as well as increasing the cross border capacity between Serbia and Montenegro and Serbian and Bosnia-Herzegovina.

The second internal project in Serbia consists in closing the 400 kV ring around the city of Belgrade. This project resolves overloads that were noticed on the OHL 400 kV Pancevo 2 (RS) - Belgrade 20 (RS) in Common planning studies.

Borders with reconfirmed or new projects for TYNDP2016 assessment

Dark blue – new TYNDP projects (among which the ones identified during the Common Planning Studies)

Light blue – re-confirmed TYNDP2014 projects

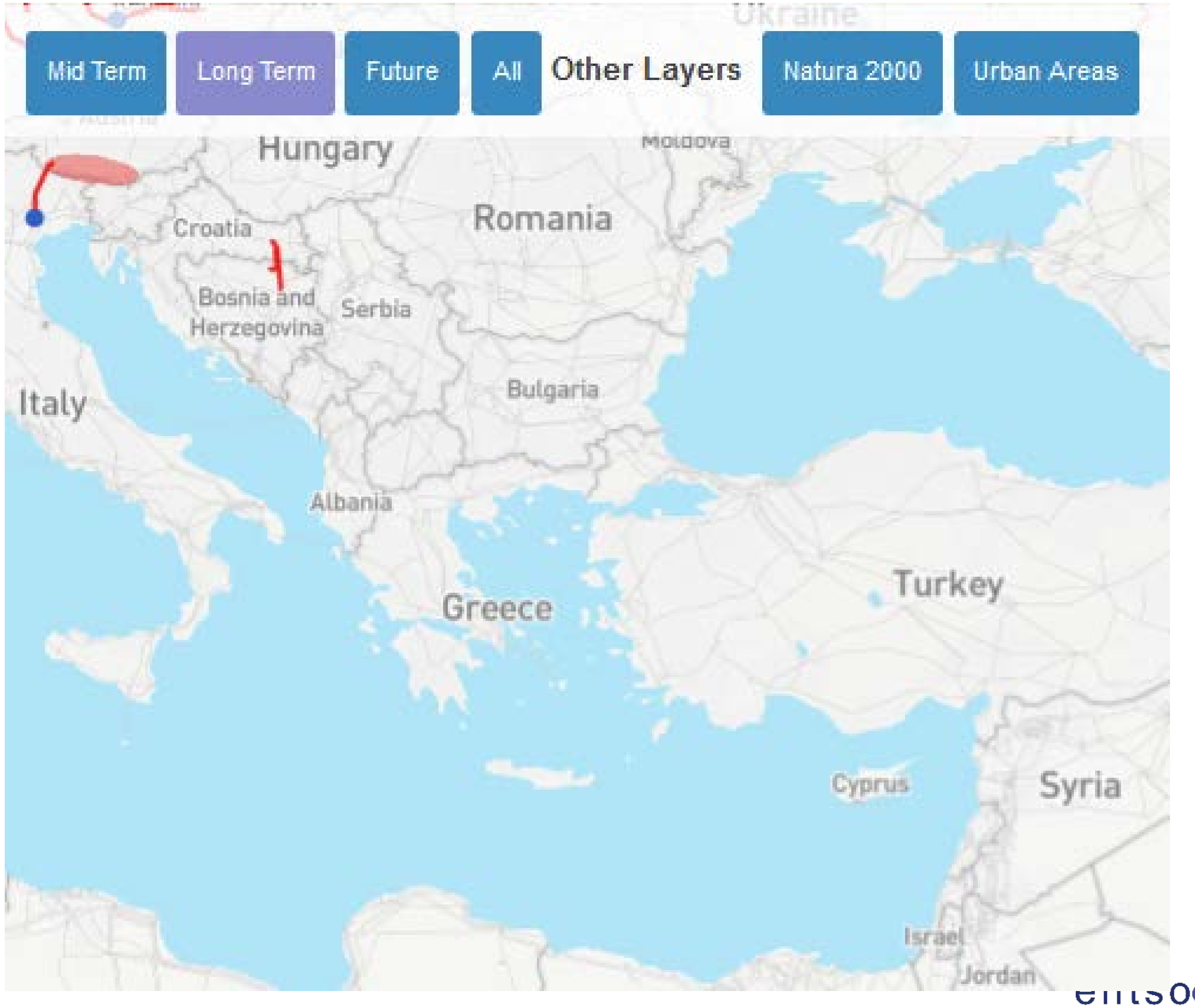


CSE Projects classified like mid-term projects

Mid-term projects: Projects to be commissioned by 2022 and they are assessed by TOOT method against the expected 2020 network if is acknowledged in the latest national plans or is having intergovernmental agreement;

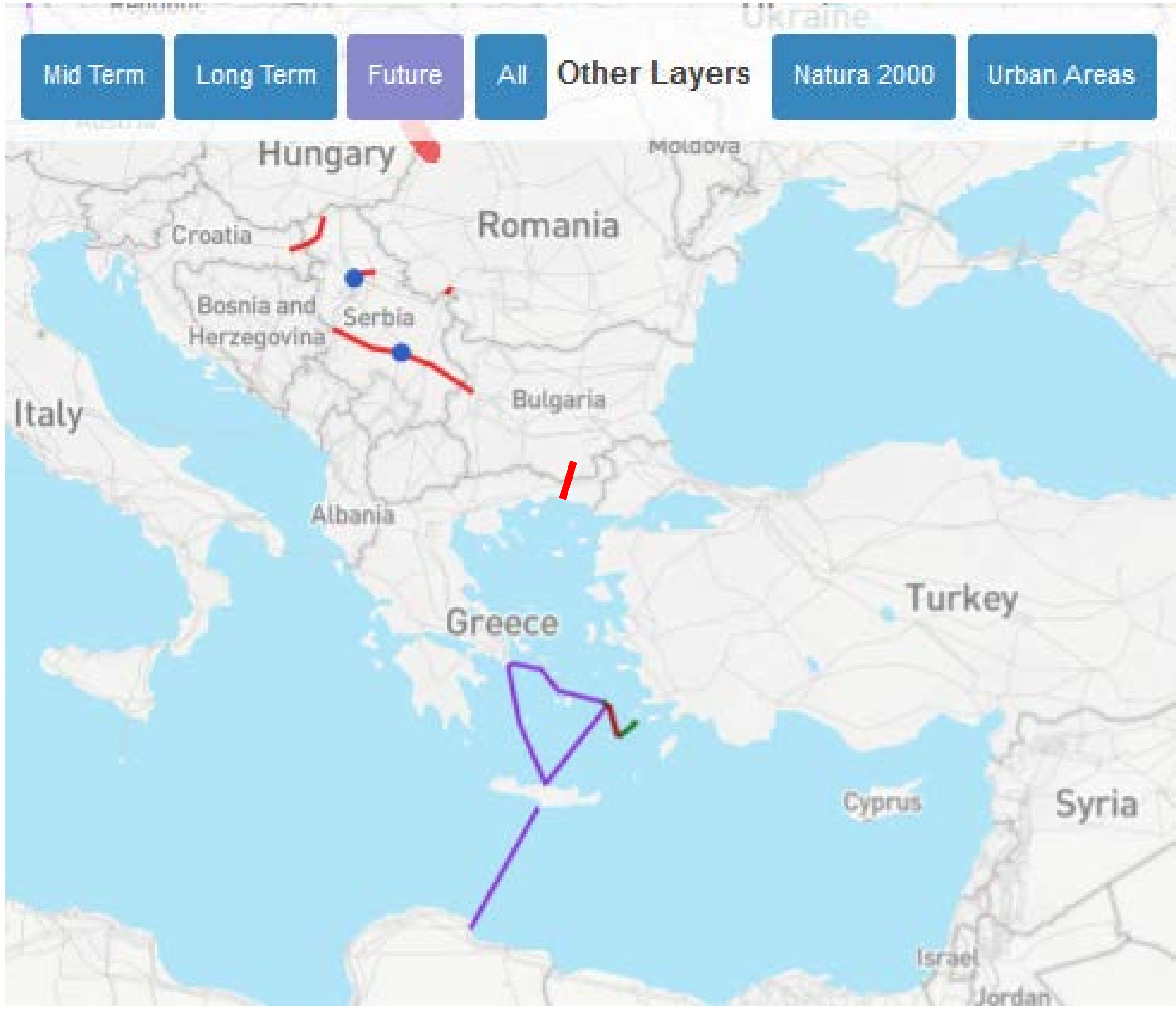
CSE Projects classified like long-term projects

Long-term projects: Projects to be commissioned by 2030 and they are assessed by TOOT method against the expected 2030 network and PINT method against the expected 2020 network if the project is acknowledged in the latest national plans or is having intergovernmental agreement;



CSE Projects classified like future projects

Future project: All other projects which do not fall under the previous categories and they are assessed with PINT method against the expected 2030 network.

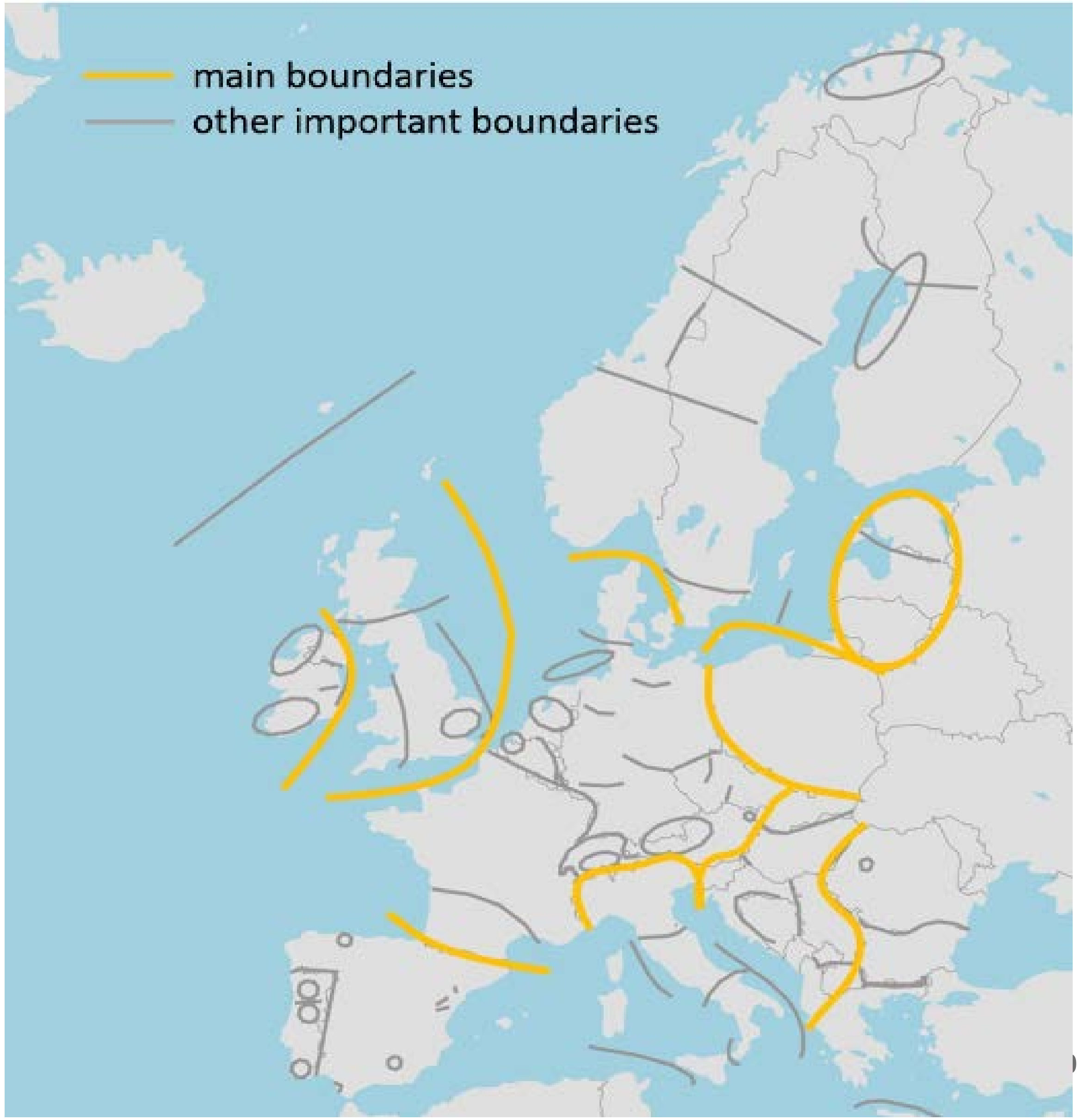


Main barriers for power exchanges in CSE region

In TYNDP2016 it has been identified ten main barriers for power exchanges.

CSE barriers:

- Further interconnection of Italy with its neighboring countries: to link the Italian RES capacities and load with the Alpine hydro-storage on the North frontiers, and to connect the Italian system and main islands to the heart of the European market, to the Balkans and North African countries (8)
- Further interconnection of South-East Europe with Central Europe, to allow for mutual support (9) ,
- Further interconnection across the Balkan peninsula (10), taking advantage of the high RES potential in the East (e.g. Romanian wind, Greek solar) to supply load centers in the West, from Serbia through Montenegro to Italy.



Eastern Balkan boundary (1)

Strengthening the interconnection from BG, RO and GR to the rest of South-East Europe

Strengthening the E→W and the N→S corridors is a prerequisite for market integration and the exploitation of the high RES potential in the East part of South-East Europe.

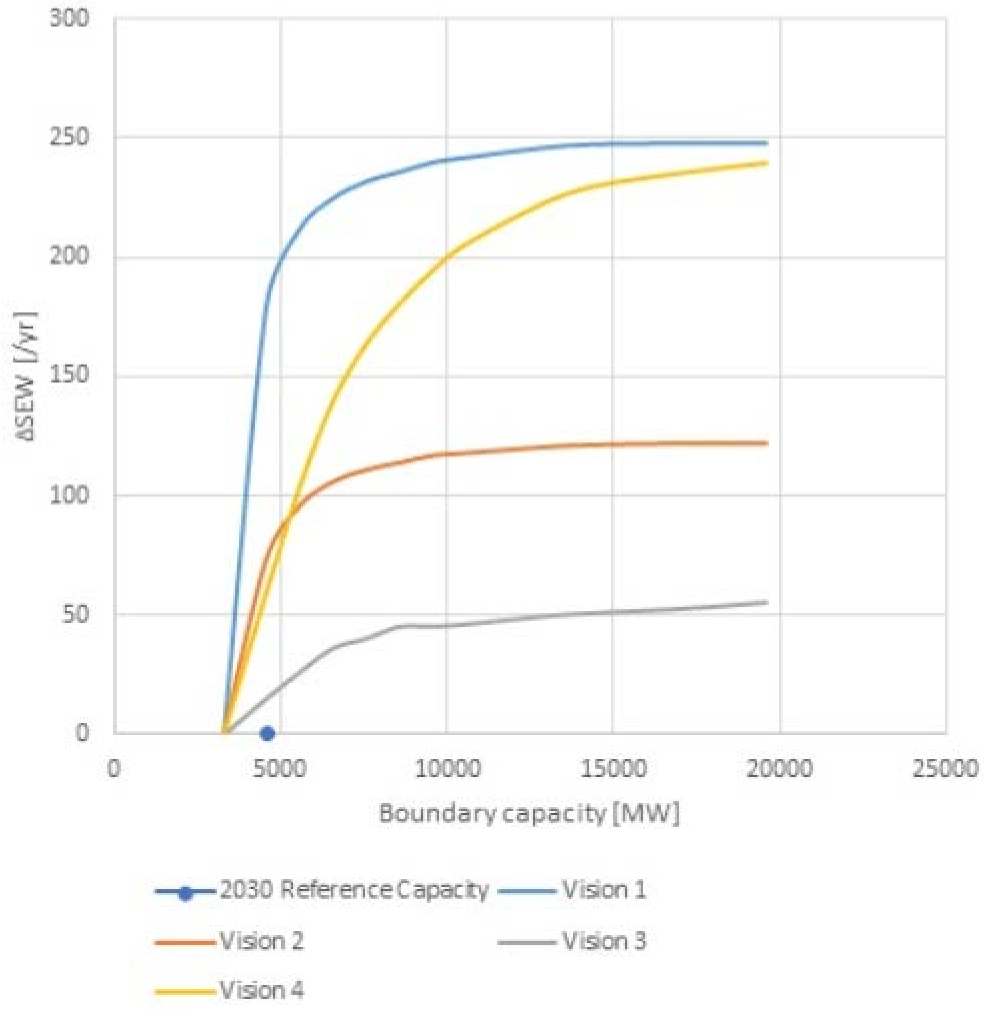
Increase of transfer capacity through the boundary at the West borders of Bulgaria and Romania and the North borders of Greece, will allow the increase of exports to West Europe and, through the Balkan, to Italy both from thermal low cost generation in Bulgaria and Romania and from RES installed in Bulgaria, Romania and Greece, depending
on the examined Vision

Eastern Balkan boundary (2)

Strengthening the interconnection from BG, RO and GR to the rest of South-East Europe

The analyses show that increase of transfer capacity over the examined boundary, results in an increase of societal welfare (ΔSEW) in all visions, up to a certain point where the respective variation curve reaches a saturation region. The highest saturation values for ΔSEW appear in Visions 1 and 4.
Detailed TYNDP project CBAs show that average SEW contributions per project in the perimeter of this boundary range from 20 to 50MEuro/year. This corresponds to about 62 MEuro/year per additional GW of transfer capacity.

Interconnection target for 2030
Making the balance between societal welfare gain and infrastructure investment costs for increasing levels of interconnection, the optimal level of interconnection ranges from 5 GW to 8.5 GW.



Looking forward to new RgIP2017 and TYNDP2018

- The new RgIP2017 will be released in autumn in 2017.
- The TYNDP2018 and RgIP2017 will more then ever focus on identifying longer – run pan – European relevance system needs(beyond ten-fifteen years).
- 2040 scenarios will be explored and corresponding investment needs; CBA project assessments will be examined for two mid-term study years (2025, 2030).
- Market simulations will take into account 34 year climate database.
- System identification needs will be performed on the same scenarios as projects will be assessed.
- RG point of view it is expected to confirm system needs by IoSN for every future projects identified in RgIP2015.

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Reliable Sustainable Connected