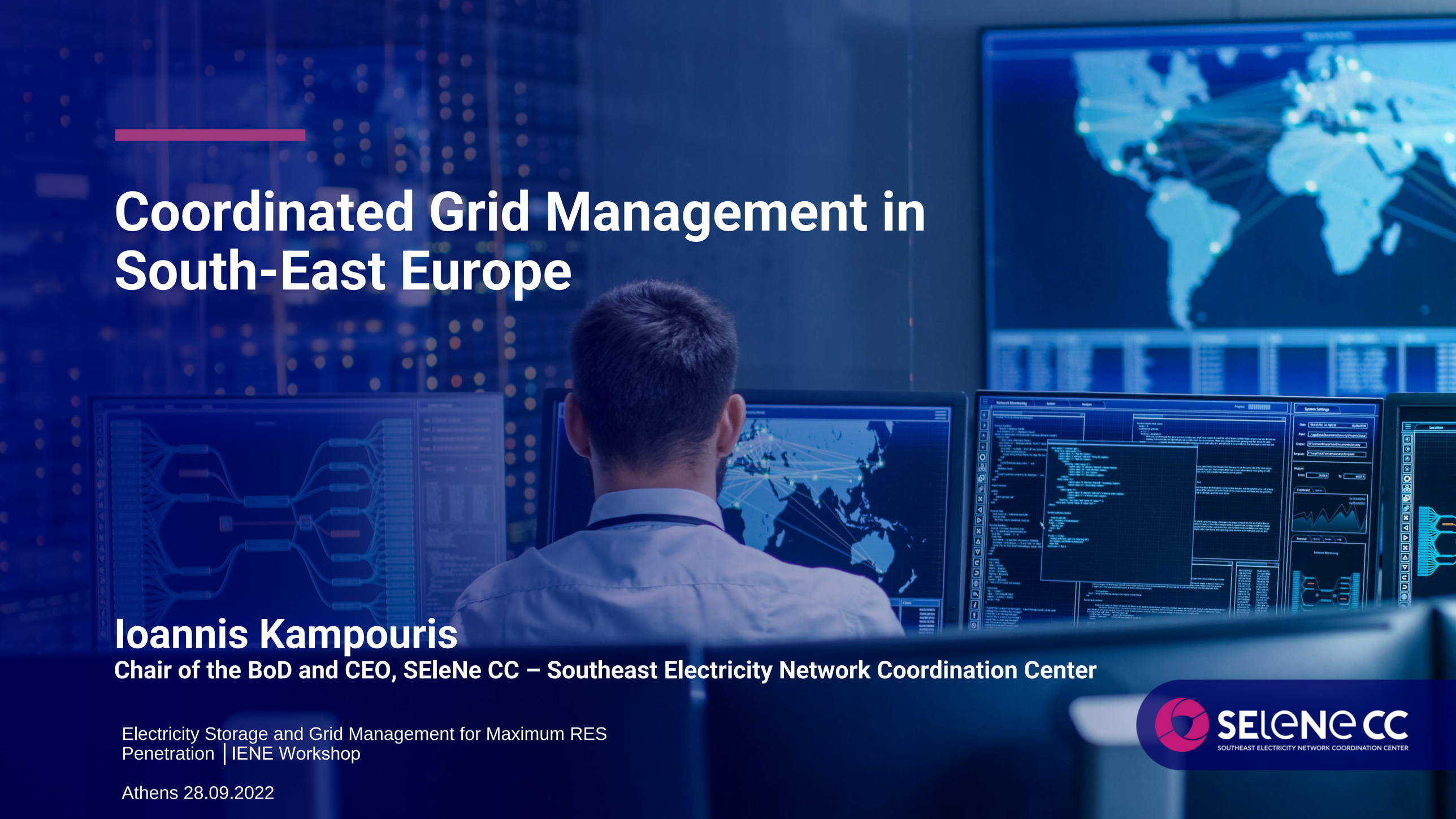
Coordinated Grid Management in South-East Europe



Ioannis Kampouris

Chair of the BoD and CEO, SEleNe CC – Southeast Electricity Network Coordination Center

Electricity Storage and Grid Management for Maximum RES Penetration | IENE Workshop

Athens 28.09.2022

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01

Towards the Integration of Electricity Market in EU

- Environmental targets, RES exploitation and Integration of an Internal Electricity Market consist the main and stable policy lines for Europe last decades;
- Harmonization of legislation through energy policy “Packages” (Regulations adopted by the European Parliament);
- Specific targets for Emissions, Renewables, Energy conservation and Interconnectors have ben set;
- Common market structure (Target Model) to allow for Market coupling – the crucial role of interconnectors;
- High degree of harmonization already (Grid Codes, Market rules, common capacity auctions etc.);
- **Increased risks due to high RES, market behavior, bulk power transfers etc;**
- Pan-European Legislation on Security and transmission capacities;
- **The 3rd package led to market coupling in all EU and started to treat security as a global manner;**
- The **Clean Energy Package (CEP)** is the next important implementation.

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The Green transition Challenge & the role of TSOs (1/2)

- High RES penetration
- Development of electricity Markets
- The crucial role of TSOs and ENTSO-E; ENTSO-E is the crucial facilitator of the implementations to ensure and improve security;
- Market facilitator
- Network Development
- High interferences among TSOs lead to:
  - Common market model → “target model”
  - Need for Regional Coordination in:
    - √ System Operation
    - √ System Planning

Incorporated in major EU legislation

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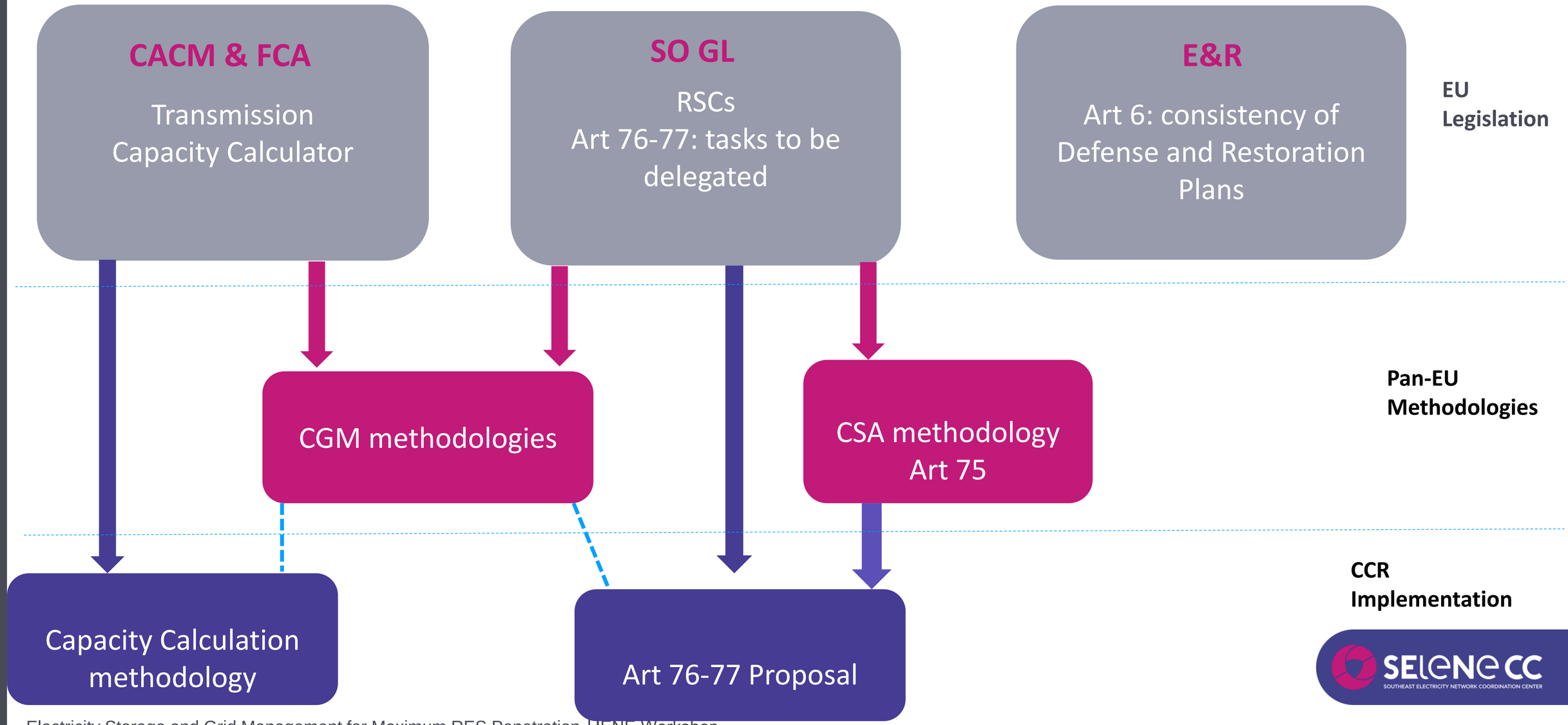
Relevant Regulations and secondary Legislation



The Green transition Challenge & the role of TSOs (2/2)

Technical challenges

- Volatility of RES
- Bulk power transfers in long distances
- Increased cross-border transfers
- Market operations puts additional difficulties to TSOs

The role of TSOs

- Ensuring security
- Facilitating RES integration
- Facilitating the markets

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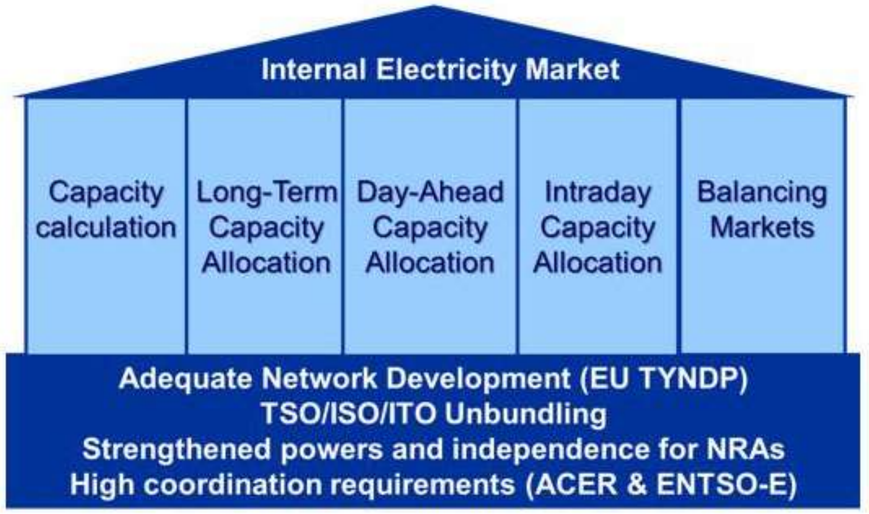
Internal Electricity Market sequence

- Capacity Calculation – TSO/RCC
- Forward Capacity Allocation - TSO
- Day Ahead Market - NEMO
- Intra Day Market - NEMO
- Balancing Market - TSO



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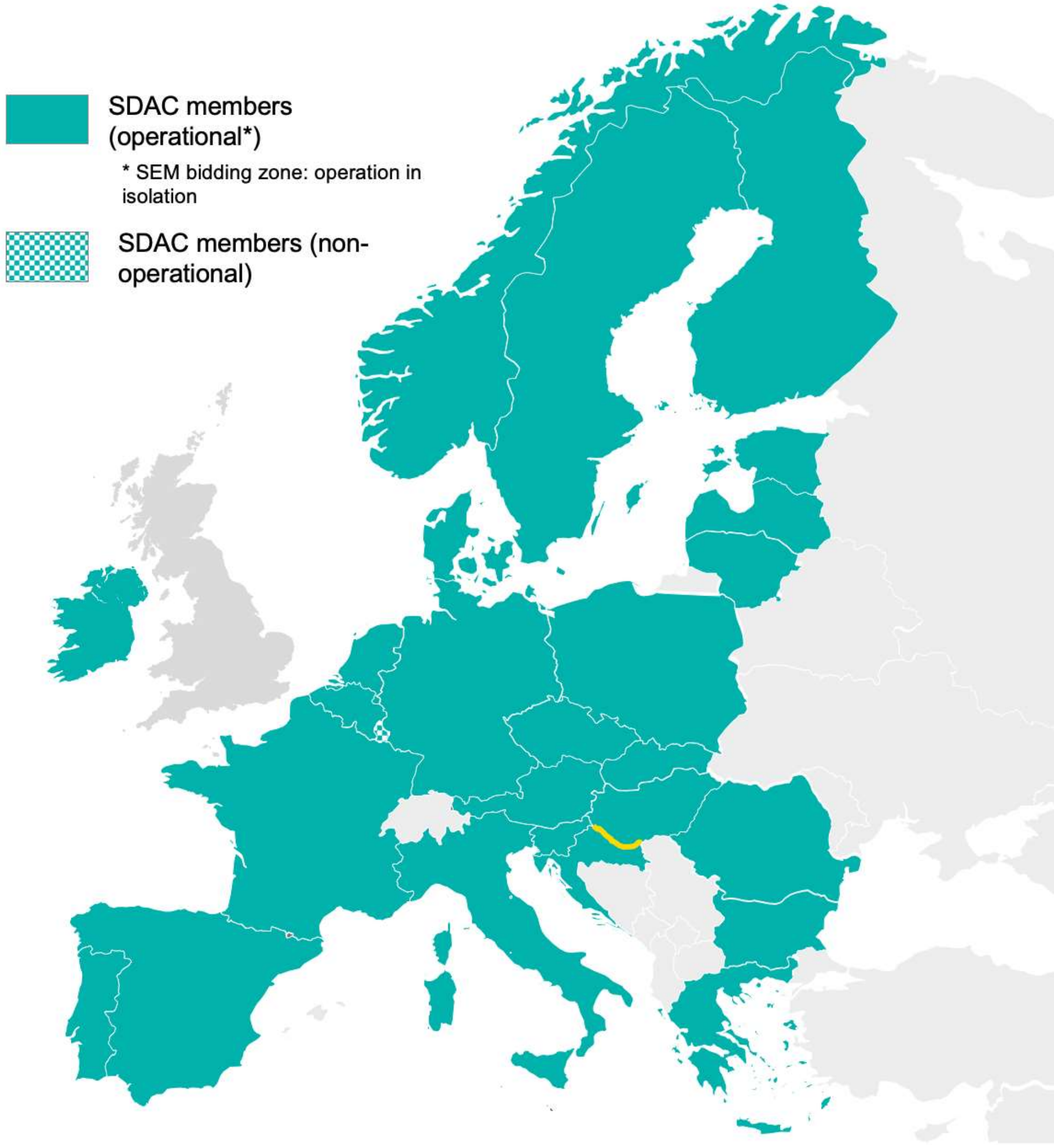
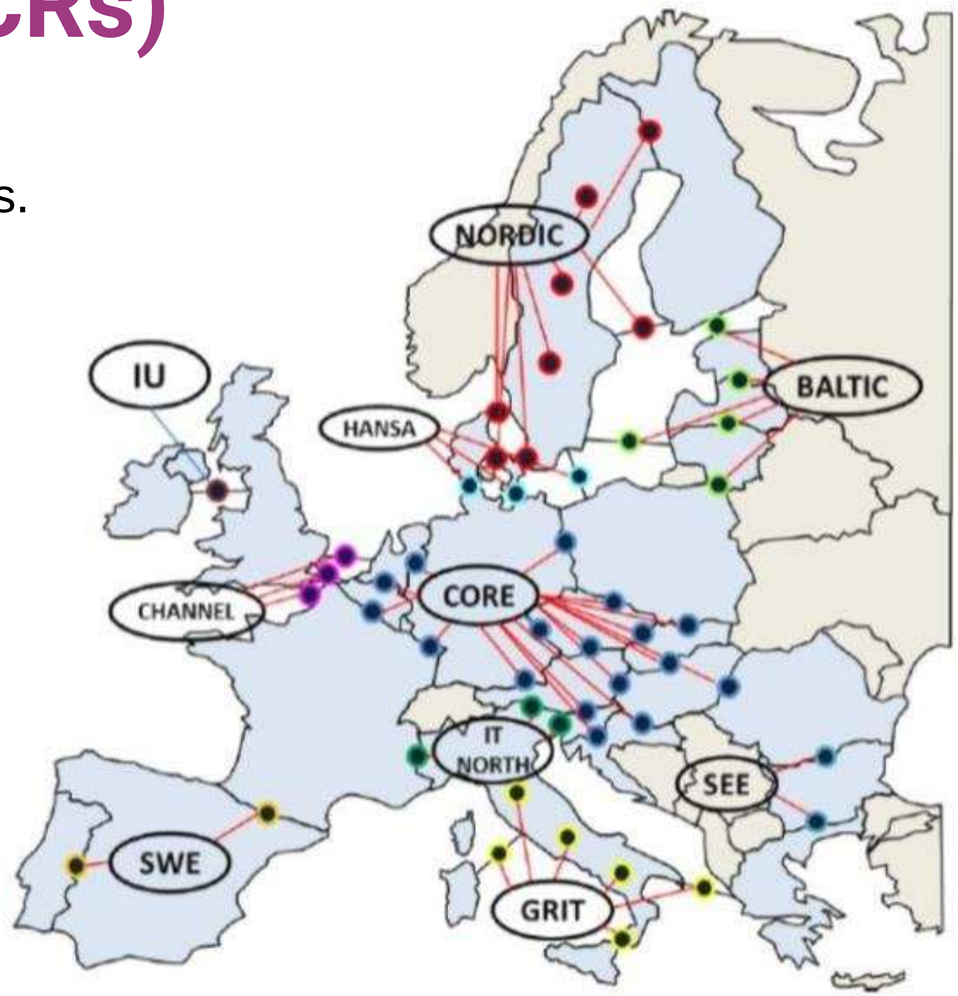
Market Coupling: A major step for market integration

- Target: Use the cheapest generation across the continent → A unique price on wholesale markets.
- Pan-European algorithm to solve the market
- Interconnectors set limits in the integration
- By 2021 all markets in EU are coupled. Common algorithm for the market for all EU territory so that to maximize social welfare at Pan European level
- Necessary to know in advance the NTCs of the interconnectors;



Bidding Zones (BZ) and Capacity Calculation Regions (CCRs)

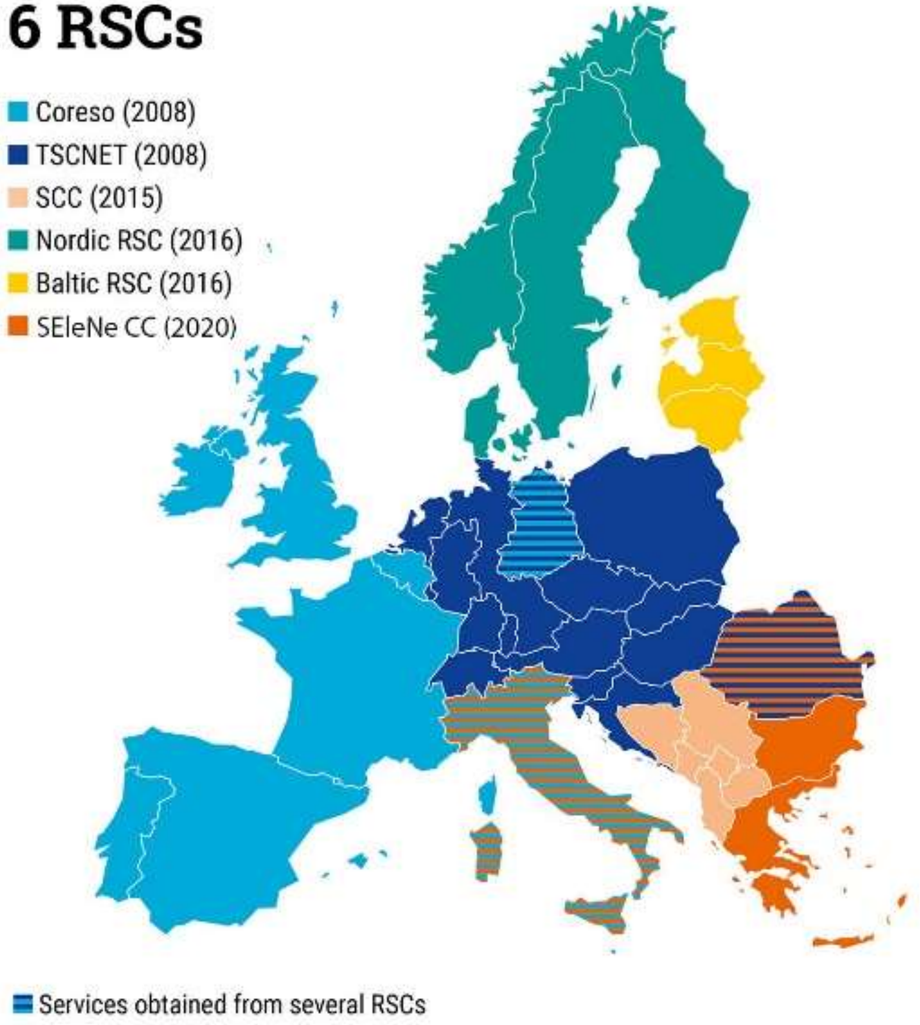
- Bidding zones: geographical areas with no systematic congestions. One TSO may consist of more than one BZ (e.g., Italy);
- Capacity Calculation regions: the interconnectors among bidding zones. Need to calculate prior to the operation day the secure transfer limit;
- Markets coupled through the interconnectors;
- Numerous CCRs recognized by ACER in EU territory;
- The calculation of the transfer capacities crucial for the market operation;
- Common methodologies per CCR: ATC or flow based;
- Capacity calculations per year/ month/ day to estimate the ATC & NTC.



Source: ACE

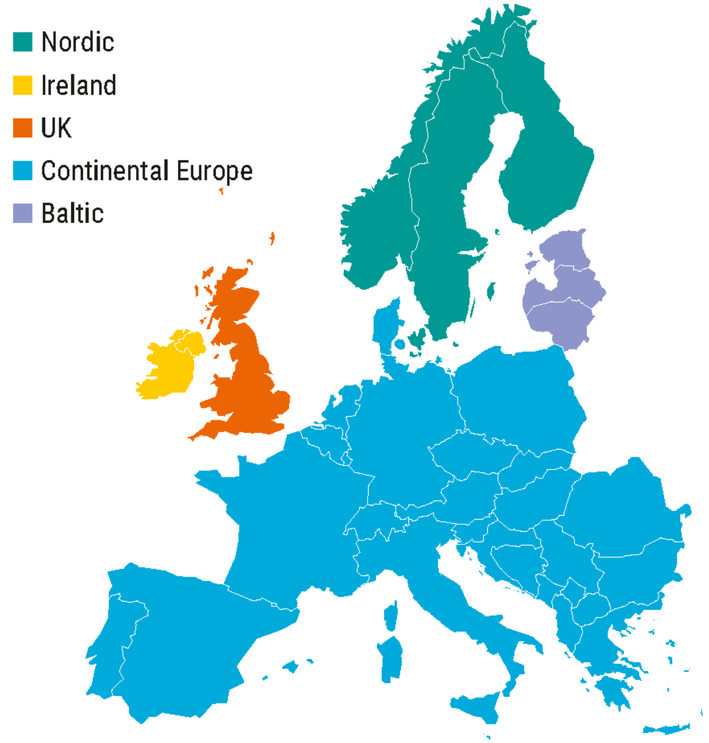
Regional Security Coordinators (RCSs) towards Regional Coordintion Centers (RCCs): at a glance

- The Regional Coordination in Europe started with the RSCs which were companies owned by TSOs (established under the 2017/1485 EU Regulation – SOGL).
- An important step towards “coordinated security” in Europe
- Mission:
  - to perform services for the TSOs under a broader view of the network at the regional level
  - to enhance security under the new challenging environment: facilitation of the European electricity market/ large RES penetration
  - 6 RSCs in Europe
- From 1st July 2022 on, the transition to RCCs has been implemented according to CEP (Clean Energy Package)

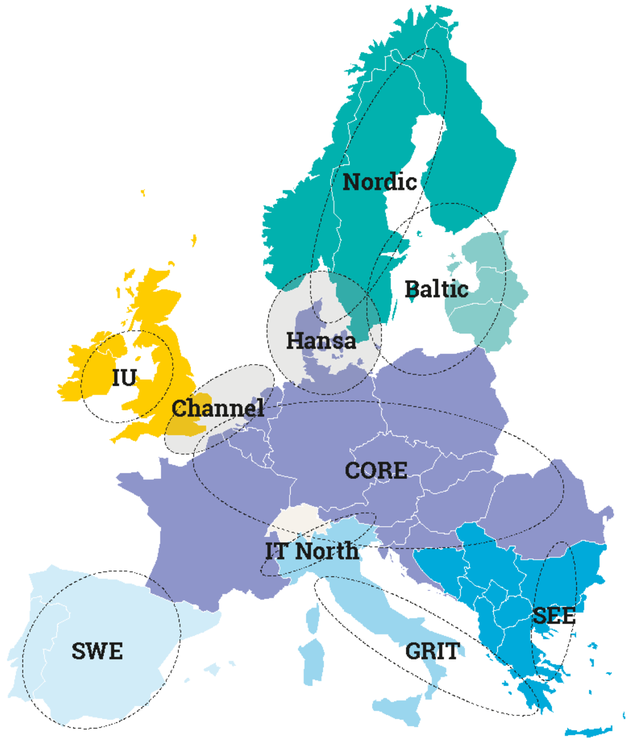


TSOs regional coordination: State of play

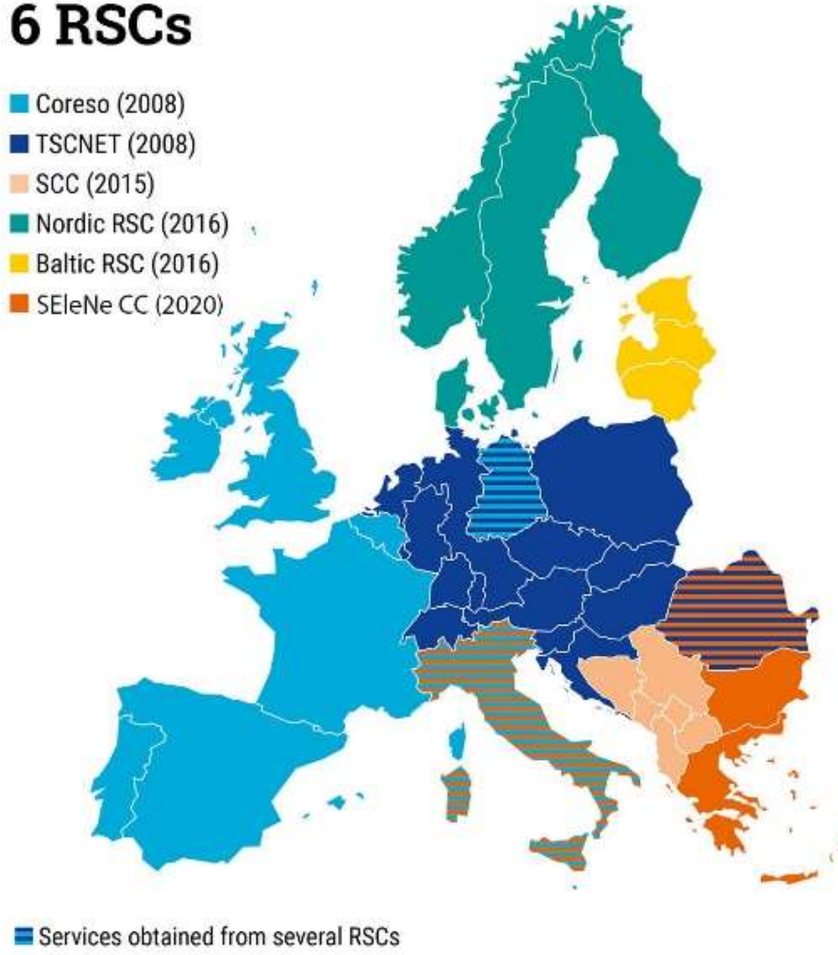
5 Synchronous Areas



11 CCRs



6 RSCs



State of play of TSOs' regional coordination in markets and system operations.

Source: Joachim Vanzetta, Chair of the Board, ENTSO-E, Enhanced TSO coordination for Europe, RSC Conference, Copenhagen, October 2019

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Regional coordinated services

1. European data model delivery *(Individual Grid Models from TSOs → Common Grid Model)*

2. Security Analysis *(focus: static analysis of flows and remedial actionws*

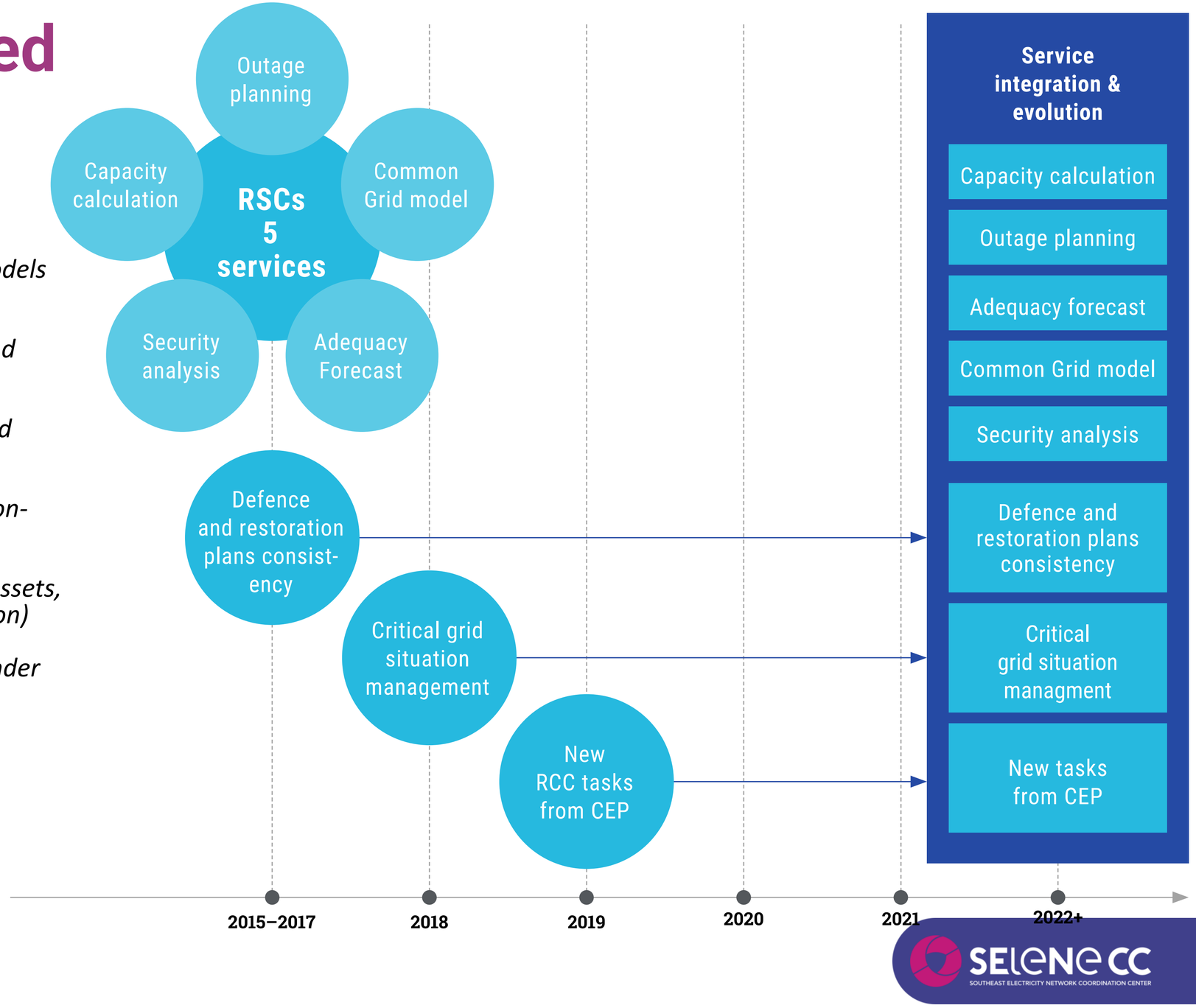
3. Regional Capacity Calculation *(input for day ahead markets),*

4. Short-term Adequacy *(short term match generation-load; availability of MW's; link with balancing)*

5. Outage planning coordination *(optimized use of assets, incl PST (Phase Shifter Transfo) and HVDC coordination)*

6. Coordination in Management of Emergencies *(Under development)*

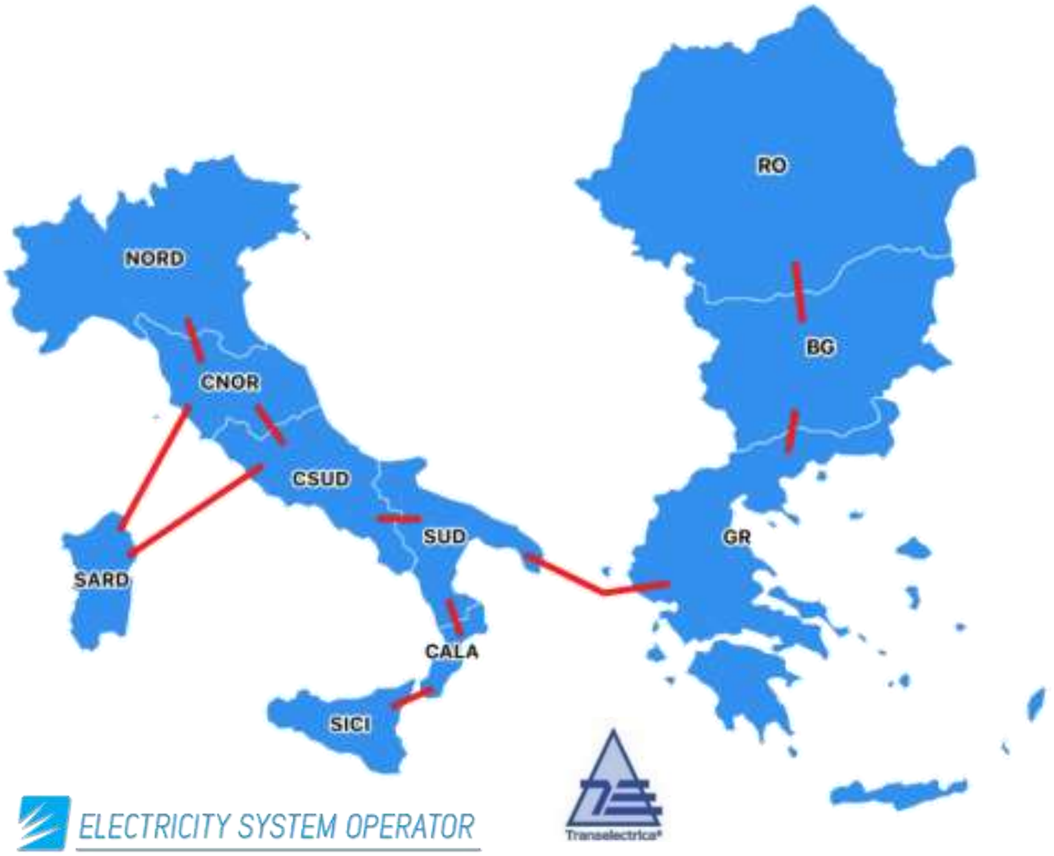
RCCs issue **recommendations** to the TSOs.



Southeast Electricity Network Coordination Center (SEleNe CC)

- Regions covered by each RSC reflect specific Capacity Calculation Regions (CCRs)
- SELENE CC comprises and serves 2 CCRs: **SE Europe** and **GRIT**
- SEleNe CC (Southeast Electricity Network Coordination Center) was established and put in operation during the pandemic. The company created on 22 May 2020 with the help of ENTSO-E.
- SEleNe was the last Regional Security Coordinator (RSC) established
- The participating Transmission System Operators (TSOs) were ESO-EAD(Bulgaria), IPTO (Greece), TERNA (Italy) and Transelectrica (Romania) being shareholders of equal portion (25% each).
- SEleNe CC is located in Thessaloniki (Greece).
- A subsidiary has been established under the name Esperia (located in Rome) dealing with the internal bidding zones of Italy
- 16 employees - all of them highly qualified with excellent engineering skills

Southeast Europe and GRIT CCRs



Transition to Regional Coordination Centers

- The “Clean Energy Package for all Europeans” (in particular Regulation (EU) 2019/943) introduces Regional Coordination Centres (RCCs) which replaced the Regional Security Coordinators
- 17 Services will be performed by RCCs (11 New Services are added)

Implementation of System Operation Regions (SOR)

- The “Clean Energy Package” introduces also the System Operation Regions (SORs) to be served by the RCCs
- **Three** SORs cover the Continental Europe: The Central European (CORE), the Iberian and the SEE.

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Transition to enters

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Implementation of S

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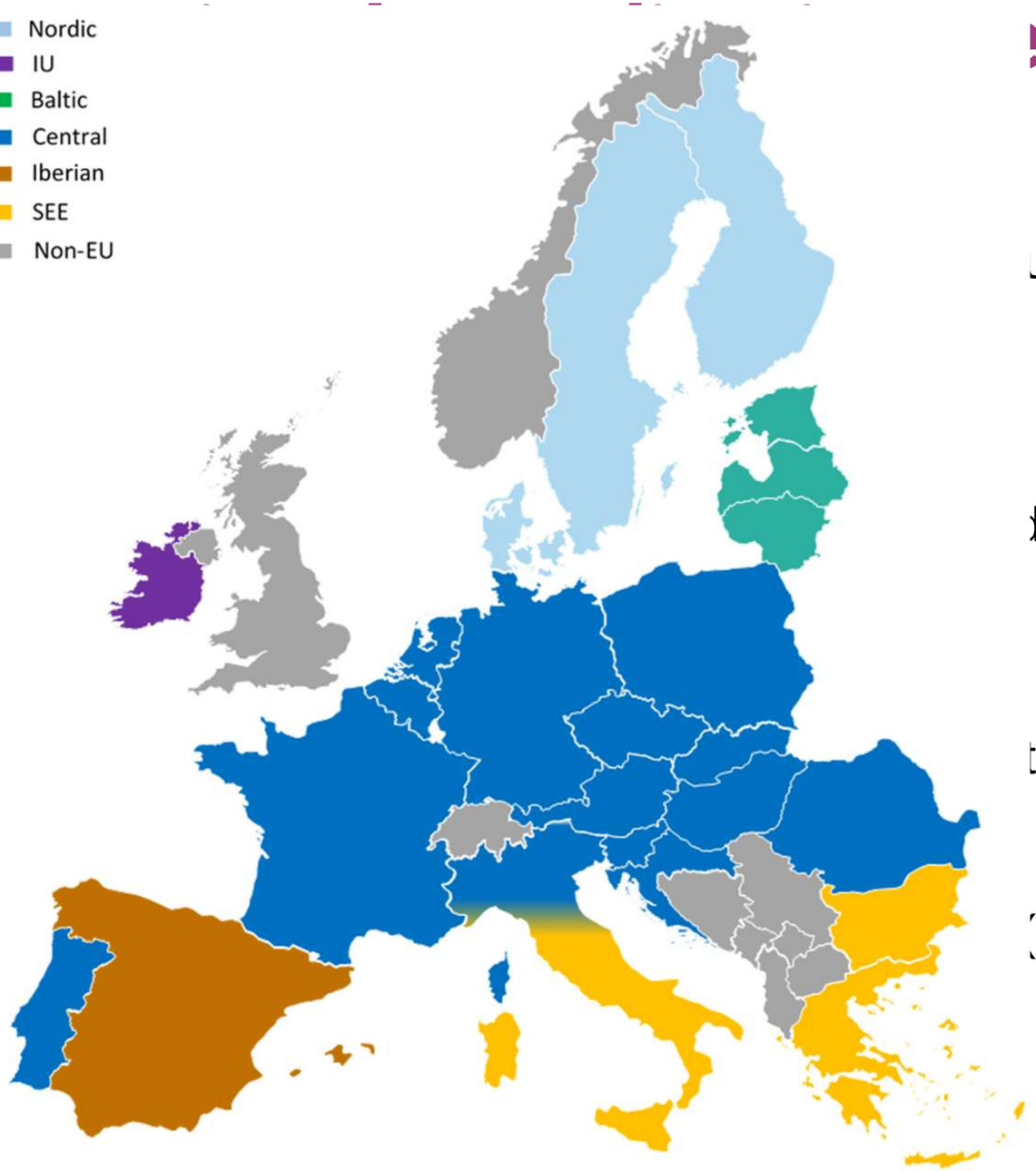

New Services under RCC regime

1. Support the coordination and optimization of regional restoration
2. Post event (Operation & Disturbance) analysis and reporting
3. Regional sizing of reserve capacity
4. Facilitation of regional procurement of balancing capacity
5. Training and Certification of RCC staff
6. Optimization of inter-transmission system operator compensation mechanisms
7. Identification of regional electricity crisis scenarios
8. Identification of needs for new transmission capacity, for upgrade of existing transmission capacity or their alternatives – TYNDP Related
9. Calculation of the maximum entry capacity available for the participation of foreign capacity in capacity mechanisms
10. Preparation of seasonal adequacy assessments
11A. Regional Adequacy Assessment (RAA)
11B. Cross Regional Adequacy Assessment (CRAA)

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Collaboration in Network Development

- Every two years ENTSO-E publishes a Pan-European Network development plan (**Ten Year Network Development Plan – TYNDP**) and **Regional Investment Plans**
- TYNDP: A Global view of future transmission needs at Pan-European level to facilitate all stakeholders
- Coordinated planning with ENTSO-G
- Main drivers:
  - ✓ RES facilitation
  - ✓ Connecting new generation
  - ✓ Increase of cross-border interconnections capacity
- The vast majority of new projects are related to RES integration

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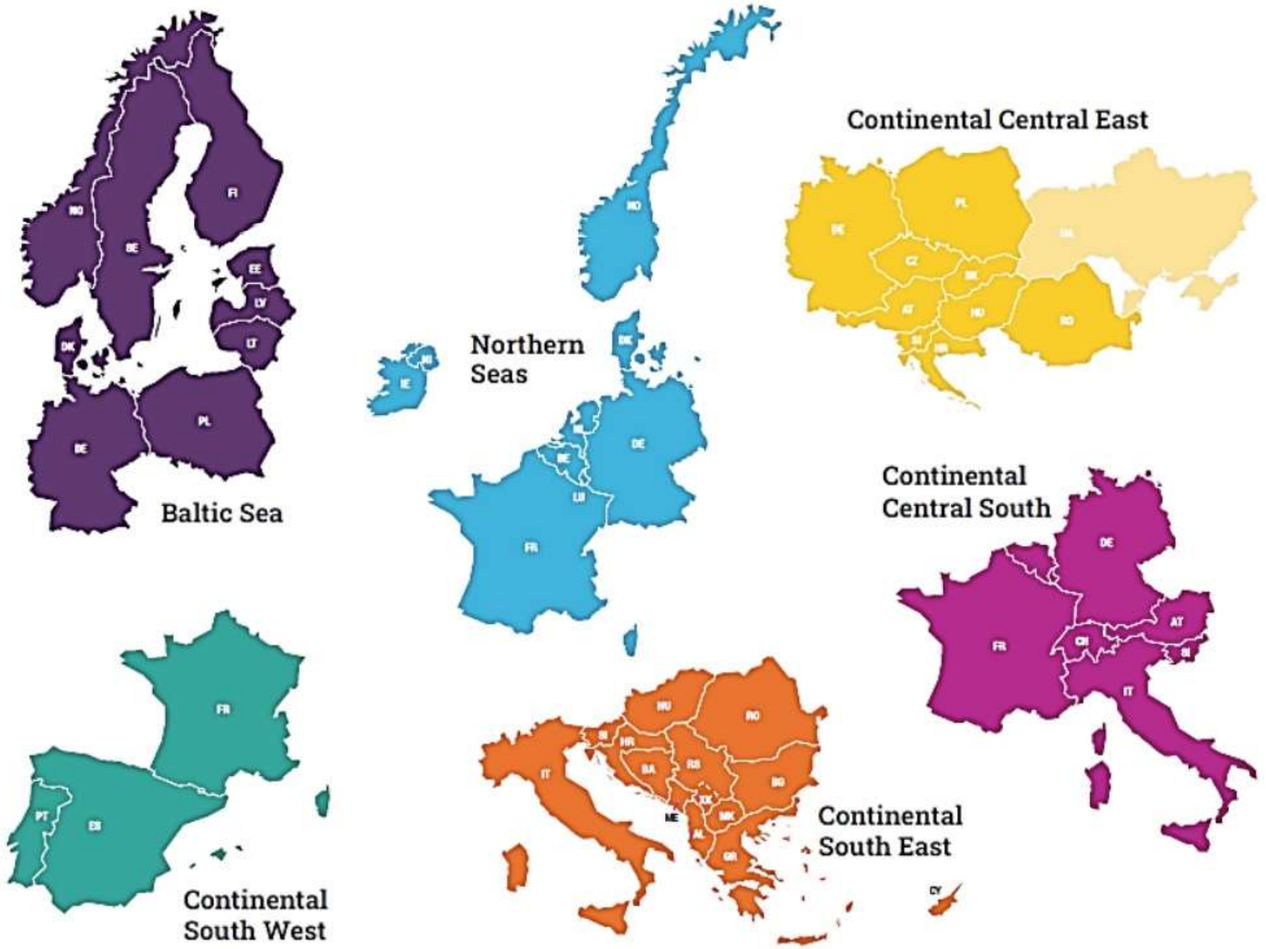
ENTSO-E's System Development regions



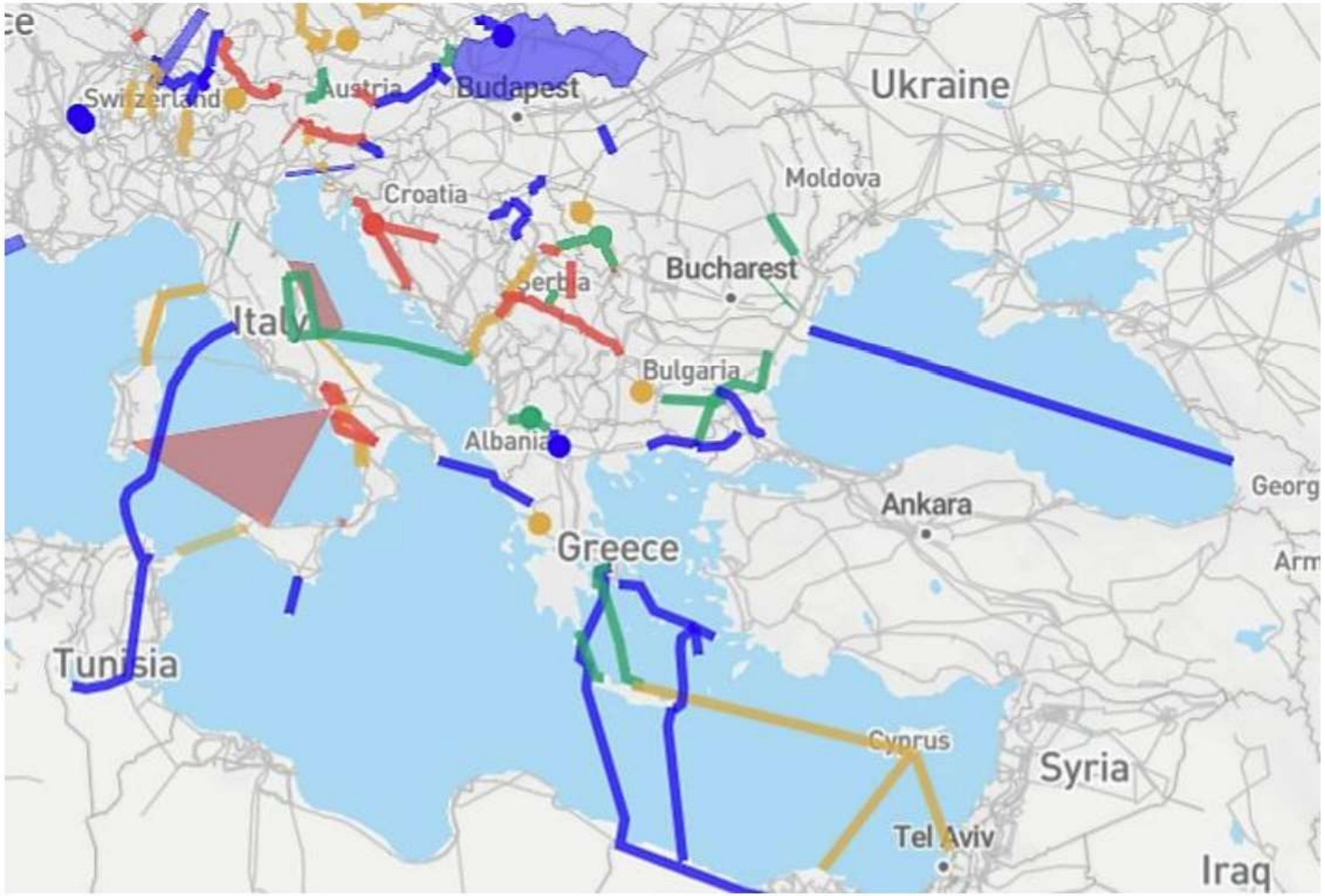
Each region issues its own Regional Investment Plan

Source: ENTSO-E

Interconnections in SE Europe

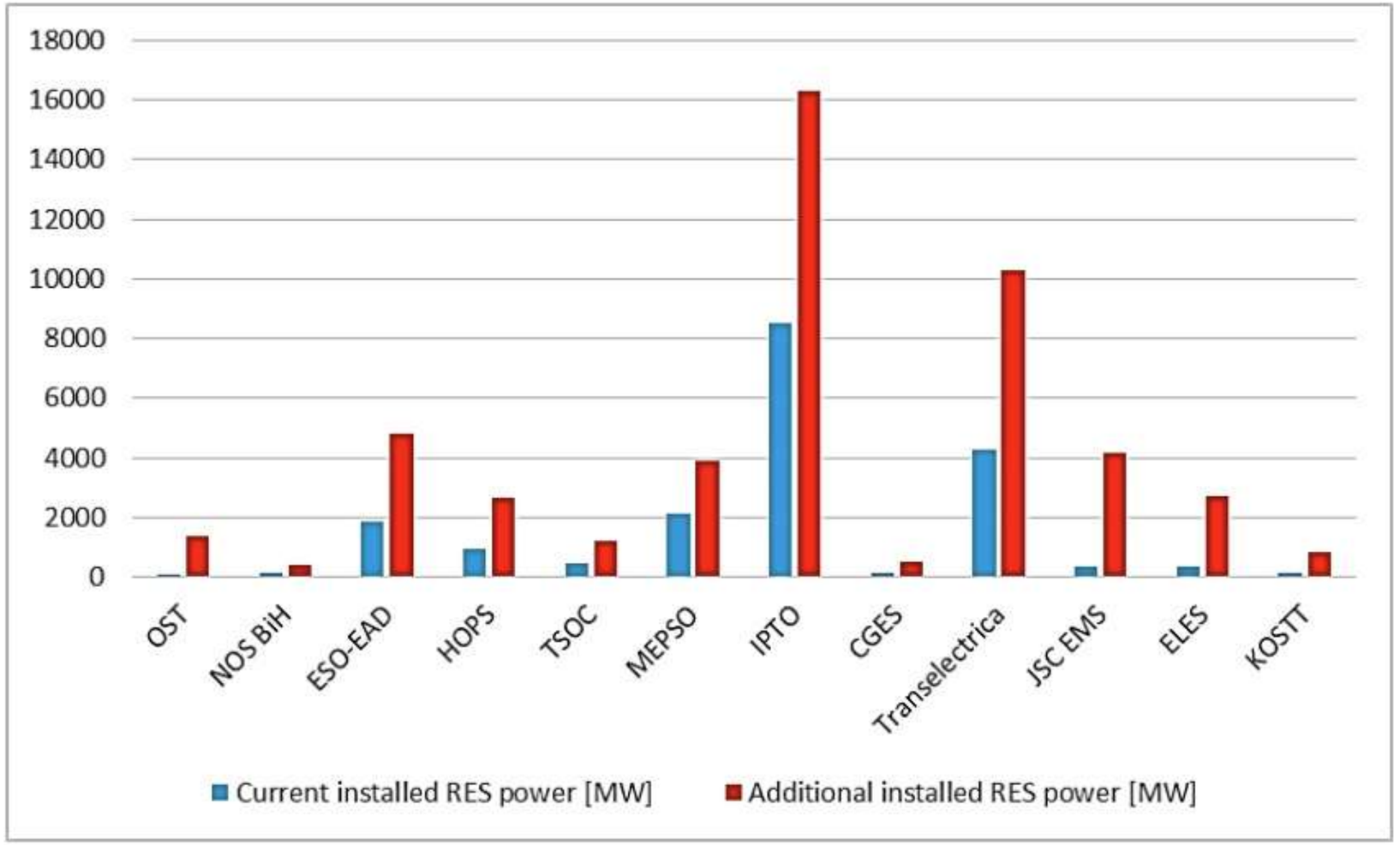
Source: IPTO

Further Extensions to Africa & Asia



Source: ENTSO-E

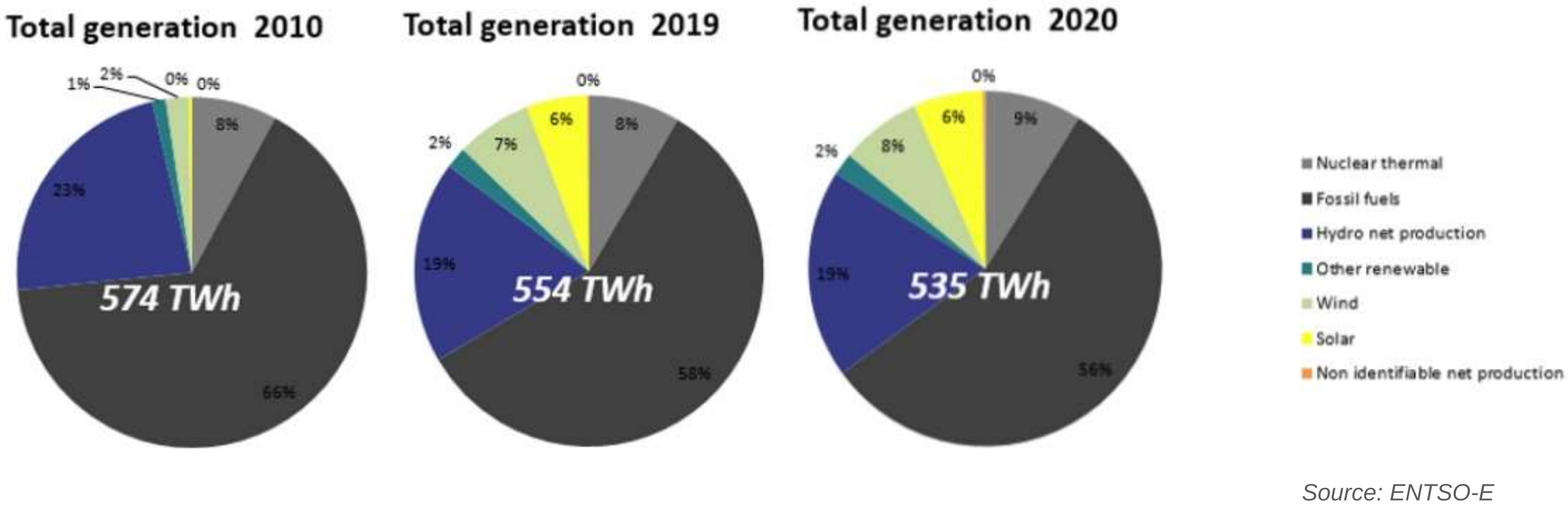
Current & additional installed RES powers in the region [MW]



Current and the expected additional RES capacities of the renewables to be connected to the transmission grid in the next ten years

Source: ENTSO-E

Energy production in the SouthEast region



Source: ENTSO-E

Low NTC values on borders in the CSE region

Source: ENTSO-E

Specificities and Challenges in SE Europe

Regional specificities and challenges

- Sparse transmission network
- Low interconnectivity (sensitivity in disturbances)
- Low RES
- **But also different market models and rules**
- Special effort should be paid to facilitate the participation of the non-EU TSOs of the region in the processes in order to enhance security;
- Need to harmonize basic rules between EU and non-EU TSOs;
- Need for new investments in transmission (crucial role of TSOs and Regulators);

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Challenges towards Electricity Sector Decarbonization

- Need for significant network development
- Balancing markets have been developed, operated by TSOs
- Cross-border exchanges for balancing are foreseen
- The operational challenge:
  - ✓ System balancing
  - ✓ Generation flexibility (fast ramping)
  - ✓ Voltage control
  - ✓ **Lack of inertia**
  - ✓ Apply any market rules/ continuous changes in markets structure

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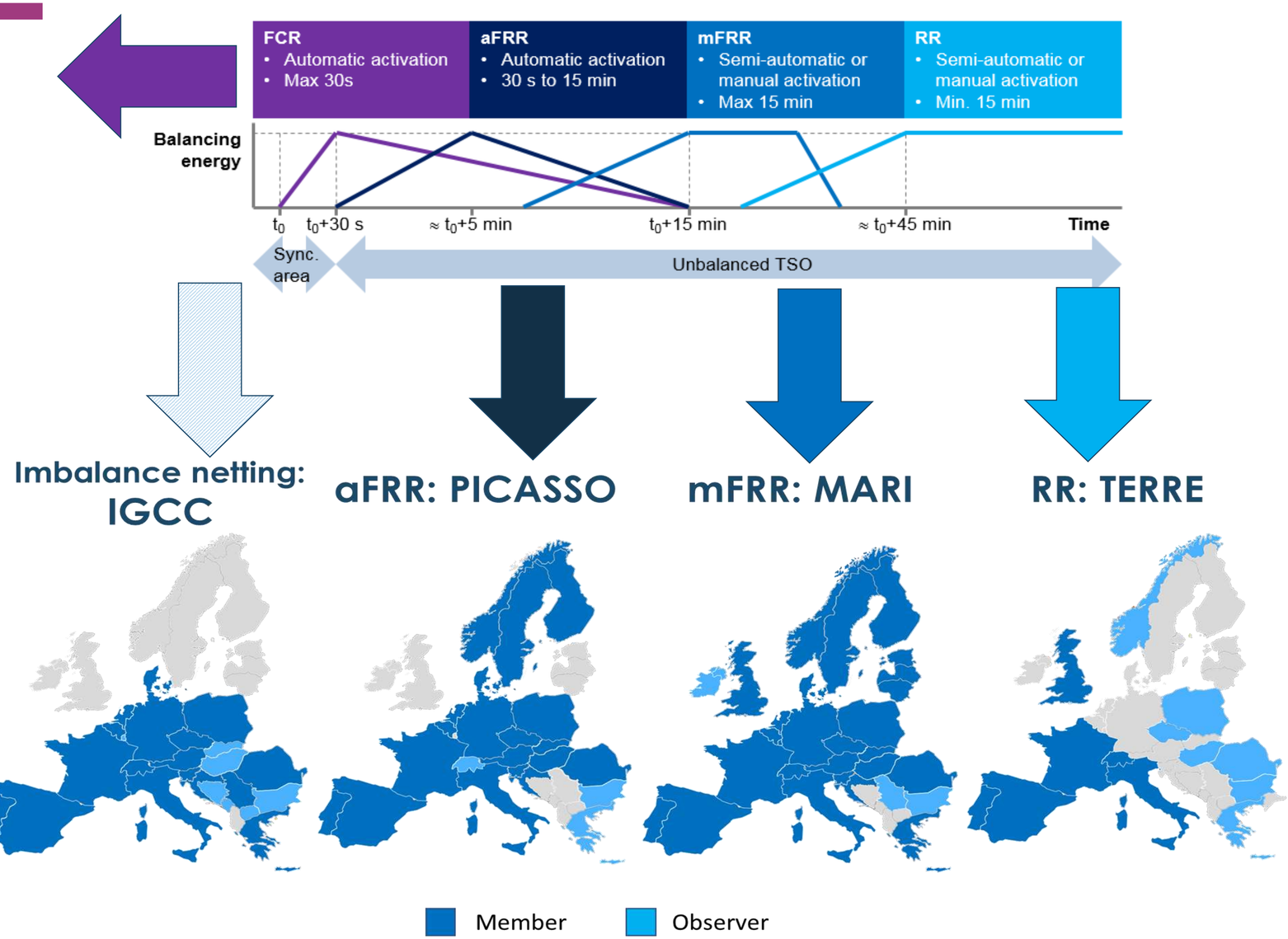
Pan-European Balancing Platforms



The role of Storage

- Storage technologies:
  - ✓ Pump-storage
  - ✓ Batteries
  - ✓ Thermal
  - ✓ other
- Potential use of storage and provision of ancillary services:
  - ✓ Avoid curtailments of RES
  - ✓ Avoid investments in new transmission/ distribution projects
  - ✓ Contribution to system balancing
  - ✓ Offer alternative to the lack of inertia (fast acting batteries)

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Is bulk Storage the Solution?

- **Storage systems can be operated:**
  - by producers (to cope with their own obligations in the markets)
  - by TSOs to provide ancillary services:
    - ✓ Balancing
    - ✓ Substitute inertia
    - ✓ Congestion management
    - ✓ Voltage regulation
- **The most efficient tool for TSOs to ensure system security**
- Regulatory issues:
  - ✓ Lack of harmonized rules
  - ✓ Development of relevant markets
  - ? Cost and materials issue (supply of key role materials etc)
  - ? Need for state-aid to enter the market

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In conclusion

- Under the current and foreseen environment with high RES penetration and bulk power exchanges among countries Regional cooperation is of crucial importance in order to guarantee system security and facilitate the market integration in EU
- The market coupling has been completed and the RCCs have been developed to support security at the regional level
- CEP calls for further developments in regional coordination and the new structures (RCCs / SORs) are operational by 1st July 2022
- Optimization and sharing of reserves at the regional level is the most challenging task
- Storage options is the most convenient tool for TSOs to allow much higher RES penetration
- South-East Europe faces specific challenges:
  - need to increase interconnectivity
  - Legislative changes for the non-EU countries
- Storage options is the most convenient tool for TSOs to allow much higher RES penetration

Thank you for your attention!

Ioannis Kampouris

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