



TSOs' perspective of the CACM requirements

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- 2. Elements of the target model**
- 3. Capacity calculation: CCRs and flow-based**
- 4. Challenges in the implementation of CACM GL**
- 5. Conclusions**

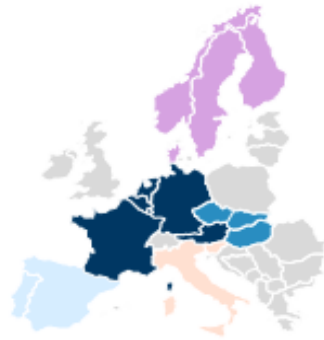
Introductory remarks

- Value creation
- Elements of the target model

Step-wise integration of European Markets



Triateral market coupling (2006)



CZ-SK-HU Market Coupling (2012)



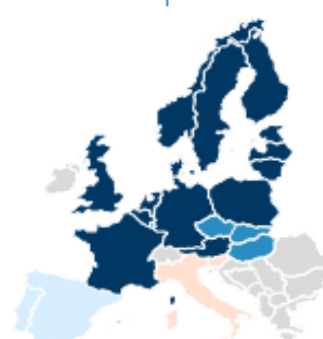
Market coupling of SWE and NWE (2014)



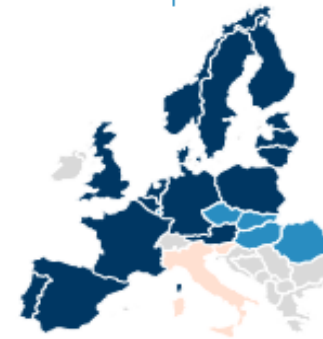
Market coupling « Italian Borders » (2015)



Market coupling CWE (2010)



Market coupling NWE (2014)



4M Market coupling (2014)

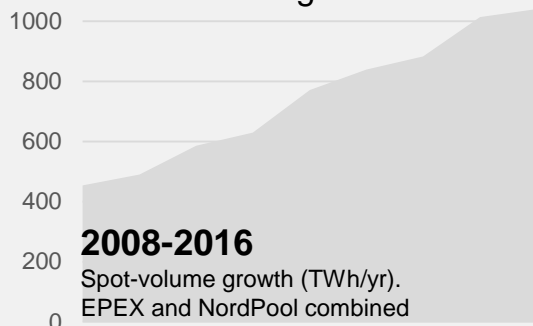
Source: ENTSO-E & FTI study on NC value creation

Step-wise integration of European Markets

Value creation

DAY-AHEAD MARKETS

- **1 B€** in social welfare
- **~100 M€** year of benefits from flow-based in CWE
- **84%** efficient use of capacity given to the market
- **1500 TWh** (~50% of consumption) traded on exchanges



INTRADAY MARKETS

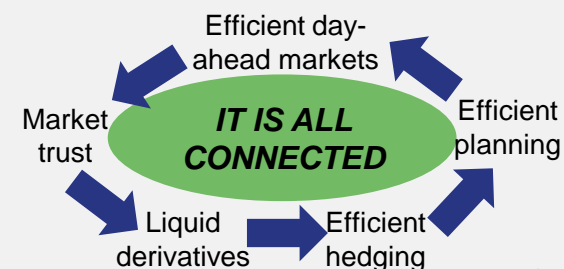
- **120 TWh** traded on main power exchanges in 2016
- **3,6%** average annual volume growth last 5 years

STATES WITH INTRADAY MARKETS

- ✓ **Continuous trading**
- ✓ **Auctions**
- ✓ **Interim solutions before XBID**



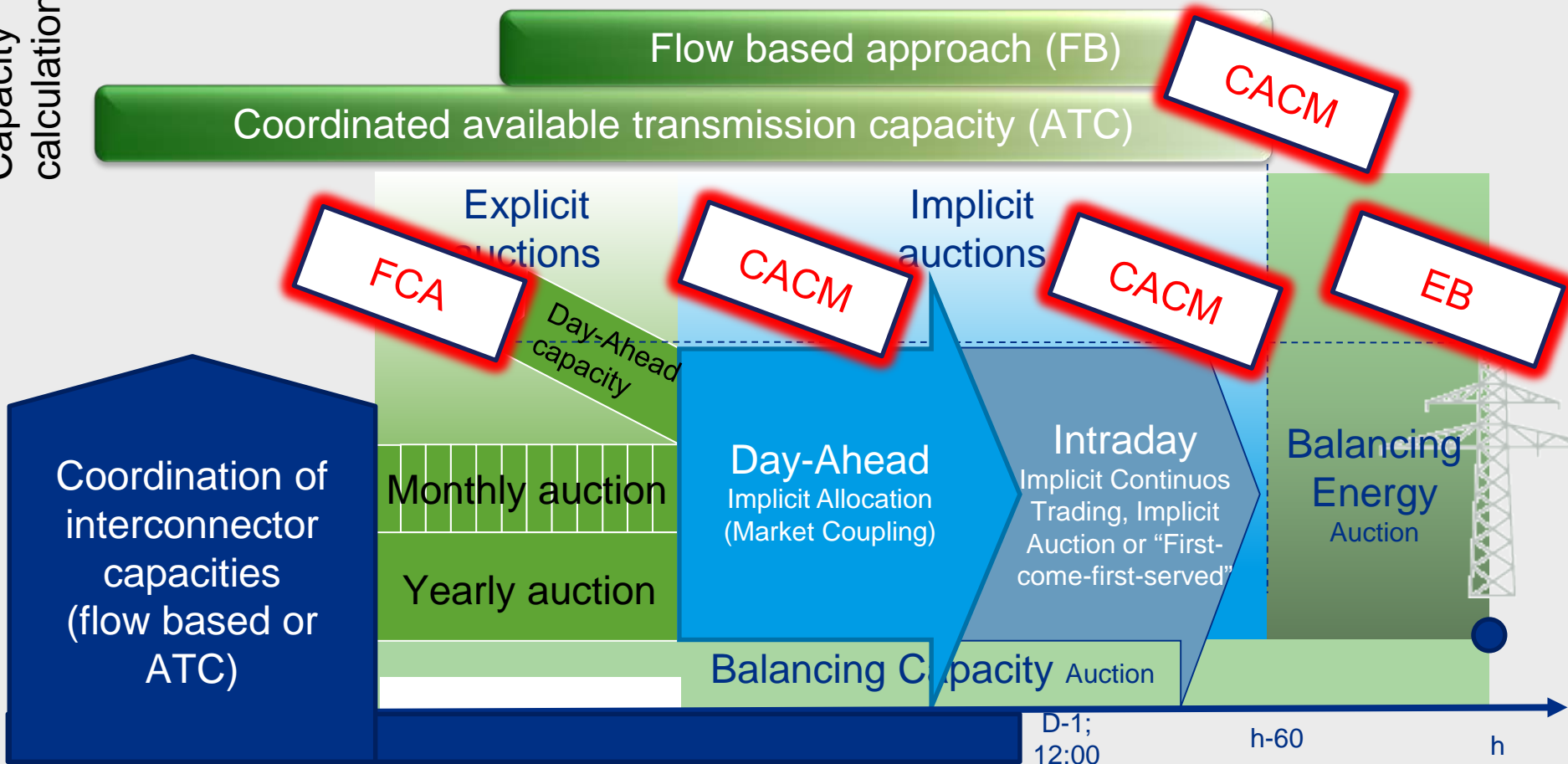
DERIVATIVES MARKETS



Source: ENTSO-E & FTI study on NC value creation

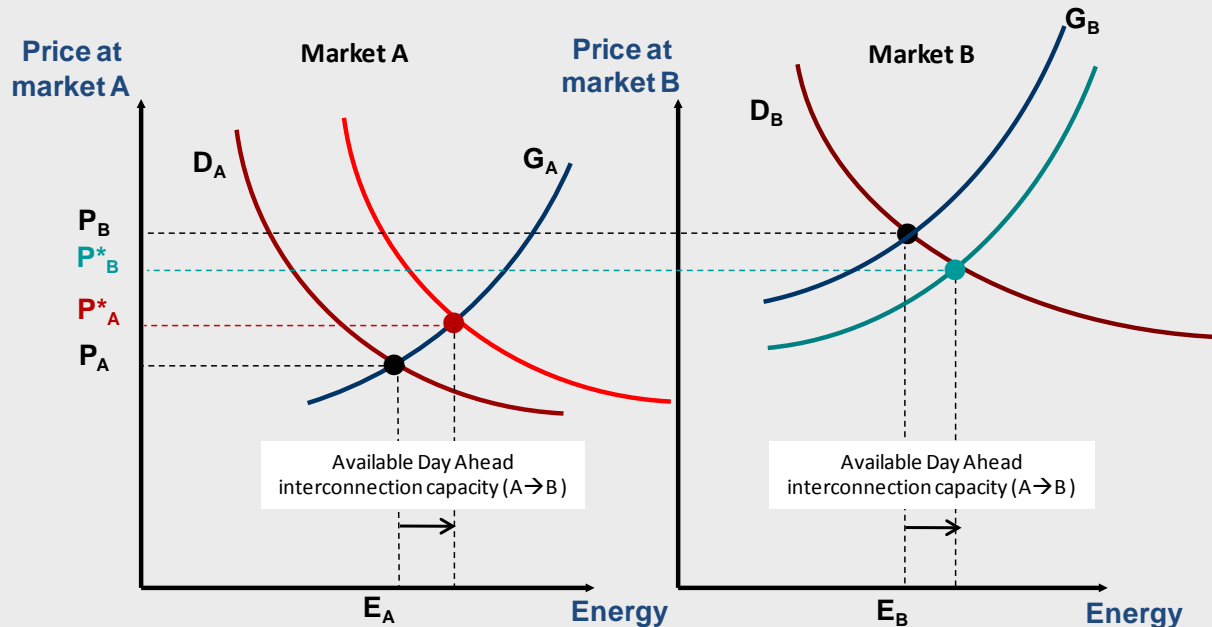
Elements of the target model

Capacity calculation



Elements of the target model

Day-ahead market – Market coupling

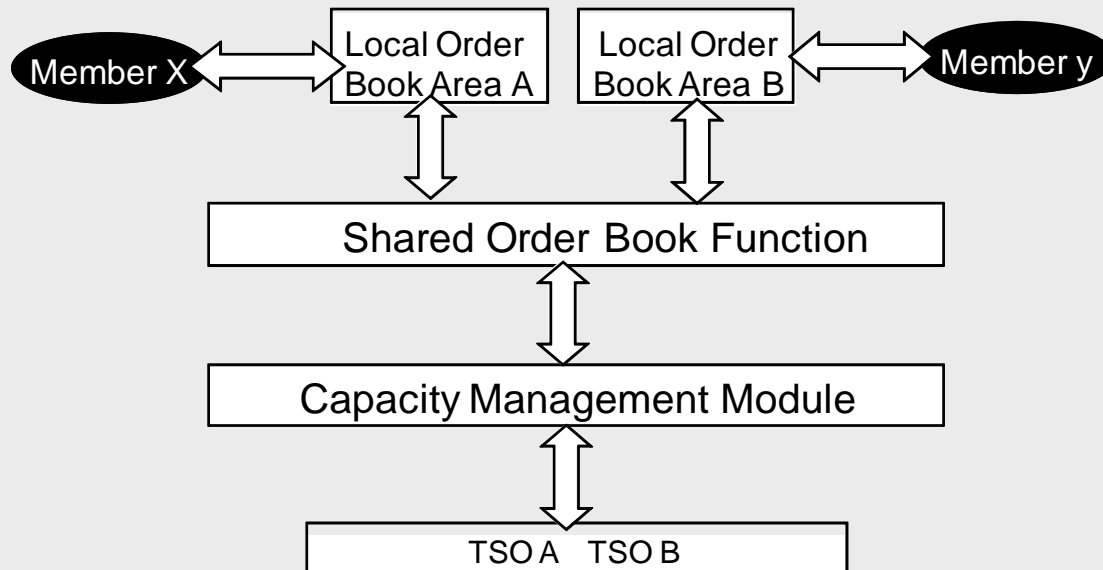


Market coupling enables an efficient use of the transmission grid through strong interactions between local markets and an efficient European wide price formation

A single price coupling algorithm to be defined across Europe

Clearing prices, net positions for all bidding zones and cleared orders are calculated by the Price Coupling Algorithm

Intraday market – Continuous trading



European target model cross-zonal intraday (XBID) capacity allocation and energy trading based on implicit continuous allocation (continuous trading)

A continuous intraday market let positions be fine-tuned close to real time. This is vital to managing wind and solar variability.

The target models setup pools all liquidity to maximize economic benefits.

Capacity Calculation

- CCRs
- Flow-based market coupling

What is a capacity calculation region (CCR)?

- A geographical area in which coordinated capacity calculation is applied.

What is coordinated capacity calculation?

- Interdependencies between the respective borders are considered
- Capacity calculation is reliable and optimal capacity is made available to the market

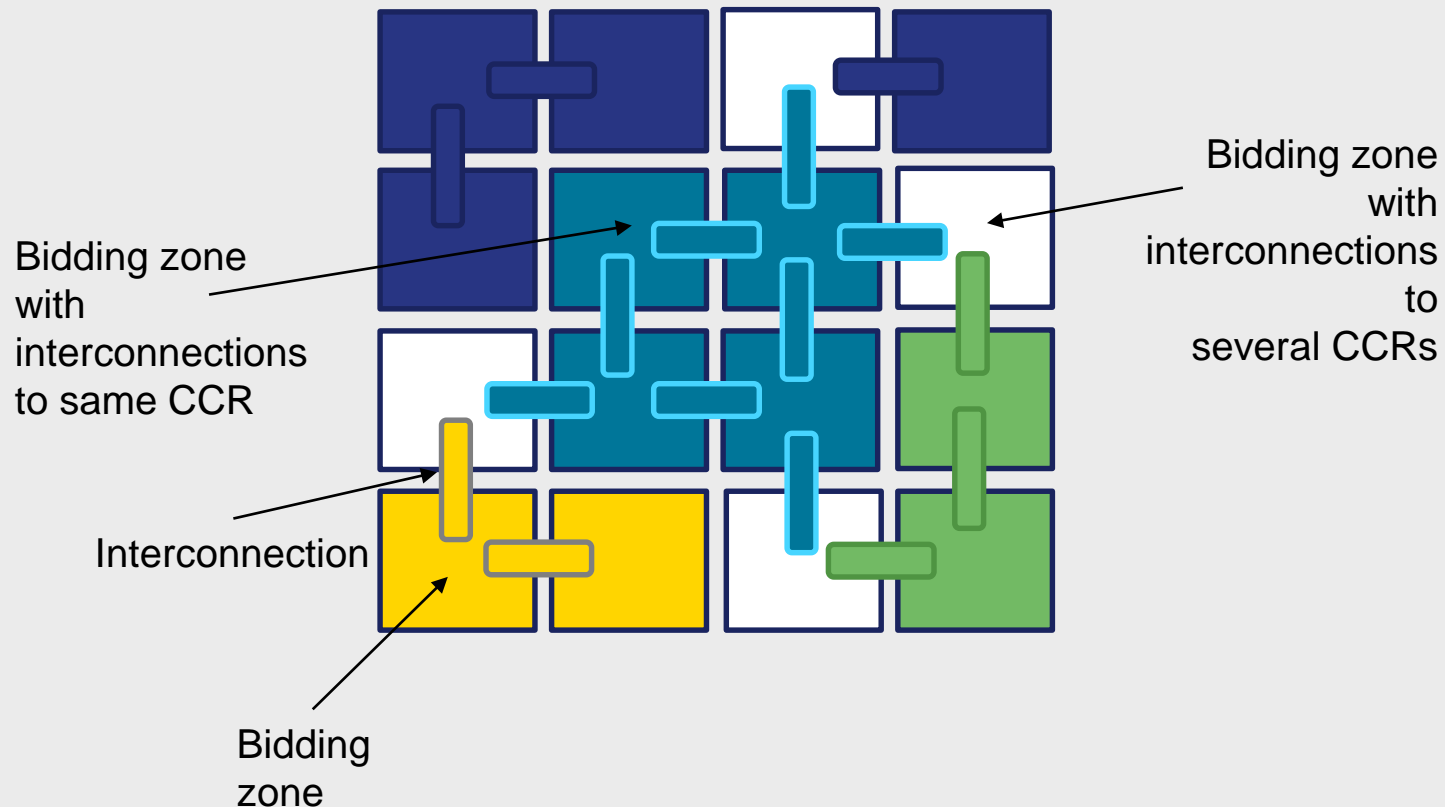
How are the CCRs defined?

- The CCRs are defined by bidding zone borders
- Each bidding zone border can be only assigned to one CCR

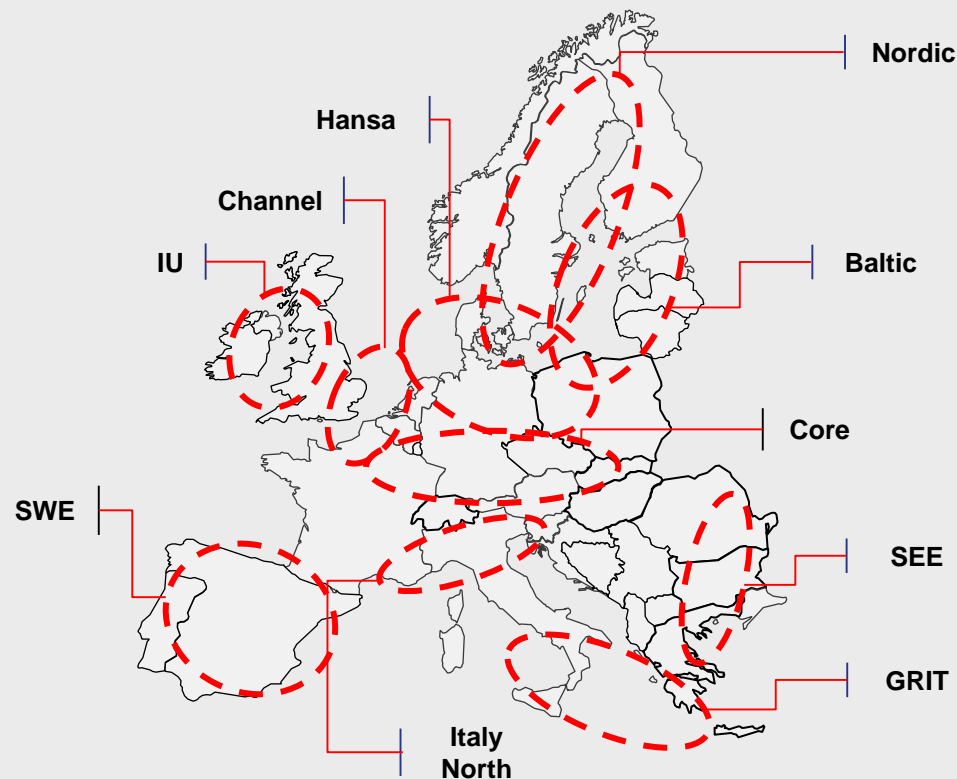
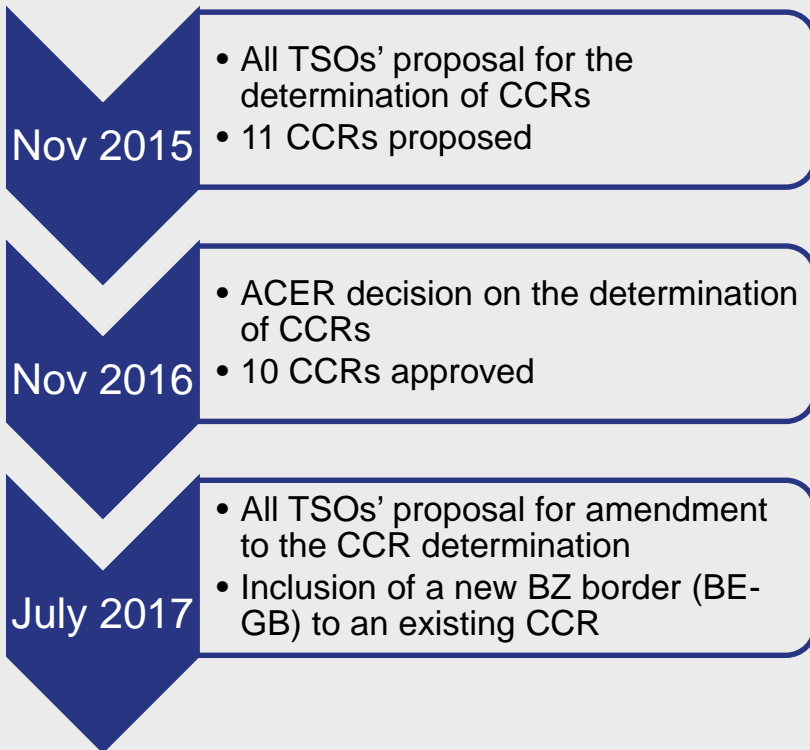
Impact of the definition of CCRs?

- CCRs will also be the basis for the regional work defined in the CACM Regulation, such as the capacity calculation methodologies, countertrading and redispatching methodologies and cost sharing

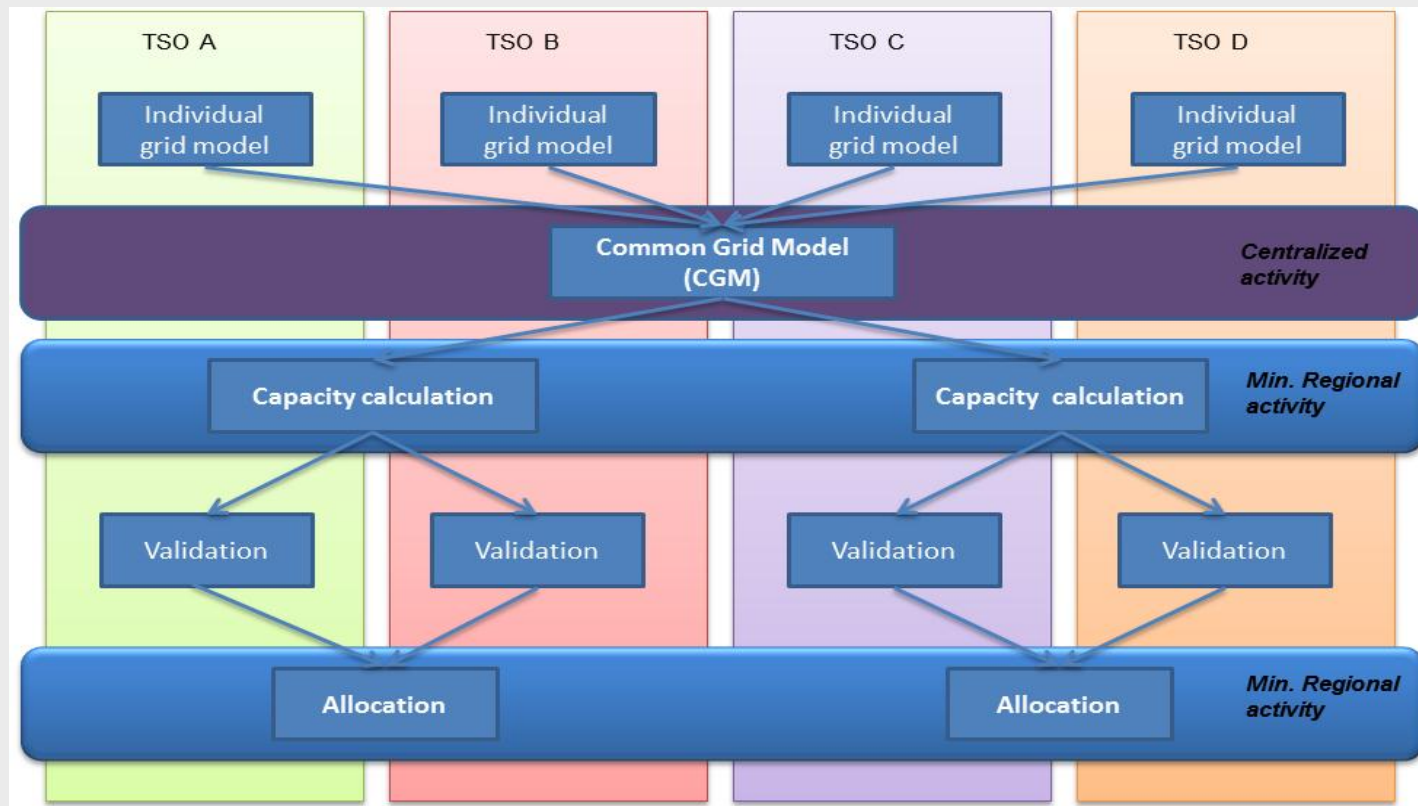
Each Bidding Zone border shall be attributed to one Capacity Calculation Region according to CACM regulation



Capacity calculation

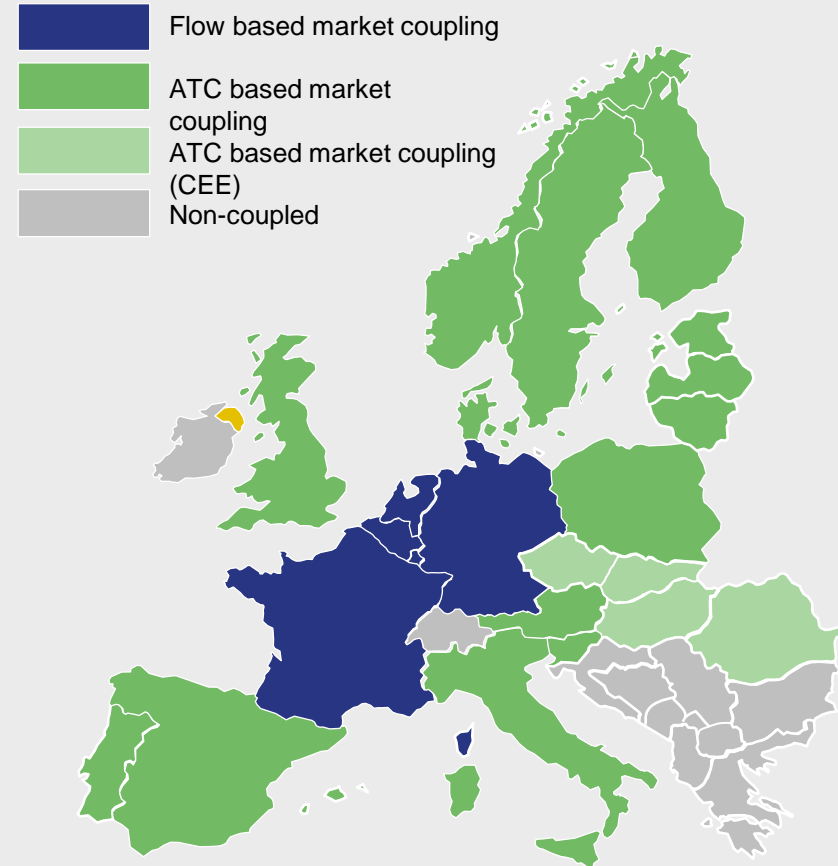


The Common Grid Model



Flow-based market coupling

- Flow-based market coupling is the target model for the future
- Flow-based methodology in the CWE region go-live: May 2015
- The current model is in principle scalable and can be extended to other regions
- Ongoing project for extending the flow-based capacity calculation to the whole CORE region
- Methodology to be developed and implemented by Q1 2019



To start with: the zonal concept

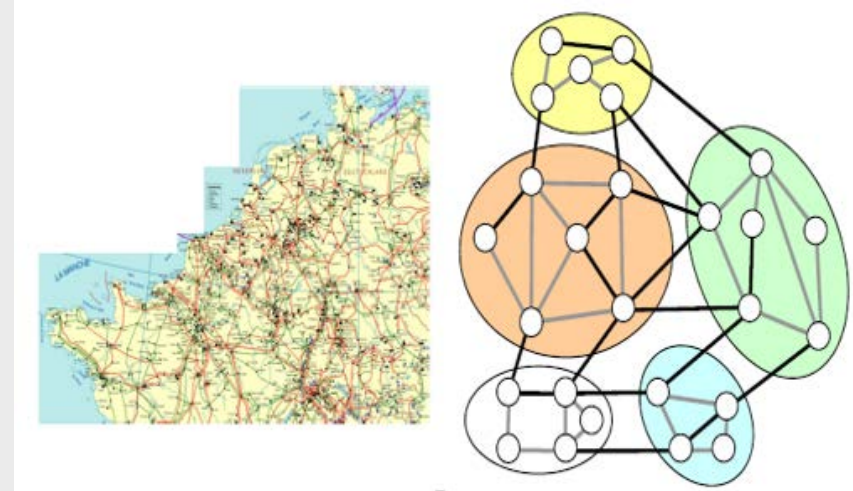
Assumptions

- “Perfect grid” inside each zone
- All commercial transactions inside the zone are guaranteed
- No trading restrictions within the zone
- Cross-border congestions are visible to the market
- Aiming at boosting liquidity

Result

- Internal congestions within the zone are not visible to the market
- TSOs have to solve those internal congestions

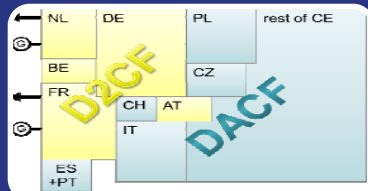
Reality ← → Zonal model



Solution

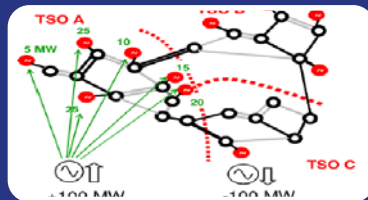
- Flow-based market coupling as an attempt to maximise welfare and optimise the capacities

The basic elements of flow-based in CWE



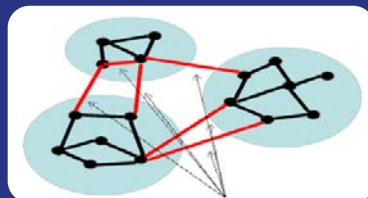
Base case

- Grid model used for capacity calculation
- Created considering foreseen exchanges



Generation Shift Keys (GSK)

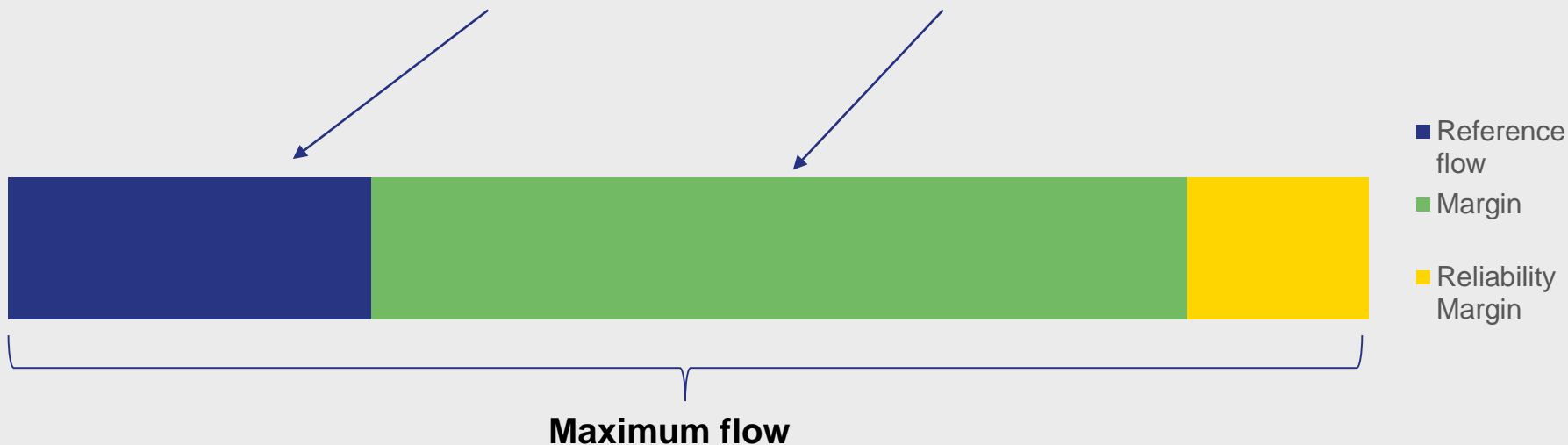
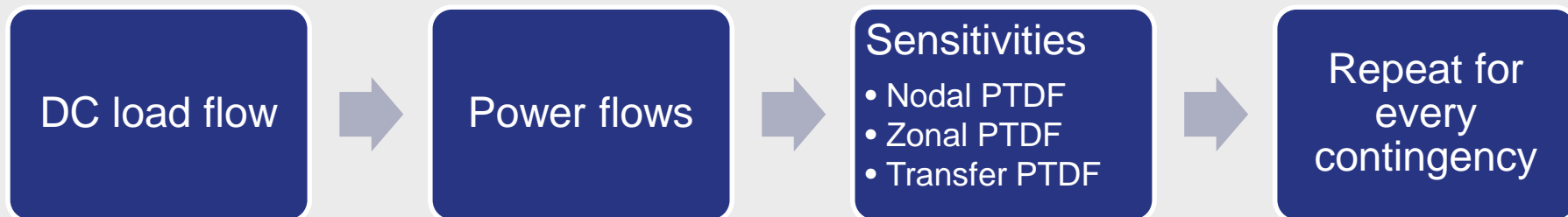
- Approximation of power plants behaviour
- Linking the TSO balance to the individual power plants



Critical Branch

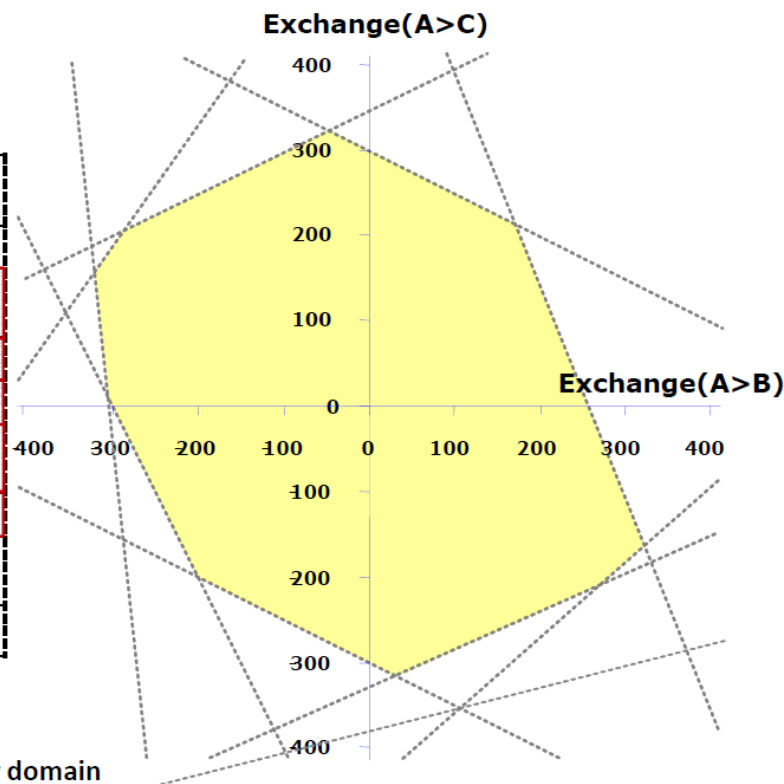
- How much can we exchange between zone?
- Definition: Branch + outage + remedial action

Calculation steps



Creation of the flow-based domain

Monitored Lines	Outage scenario	Margin left (MW)	Influence of exchange on lines (PTDF)		
			A→B	A→C	B→C
Line 1	No outage	150	1%	10%	3%
	Outage 1	120	5%	20%	1%
	Outage 2	100	6%	25%	1%
Line 2	No outage	150	-2%	0	5%
	Outage 3	100	-12%	0	10%
Line 3	No outage				
	Outage 4				



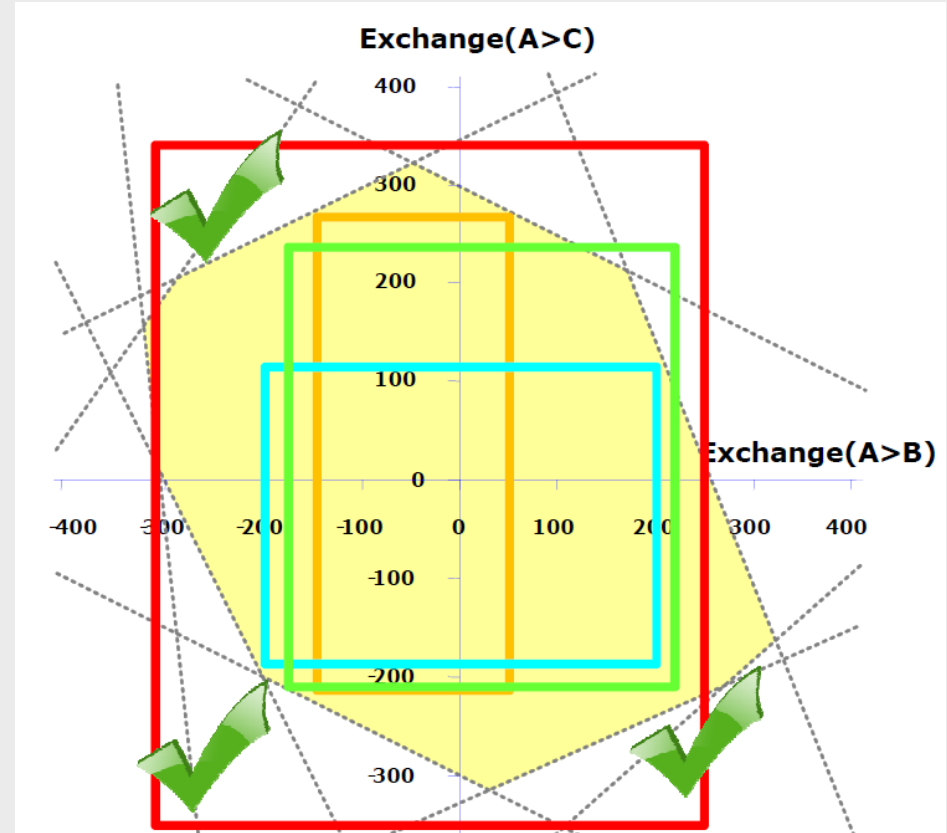
Comparing with ATC

ATC coupling

- Supply and demand for two areas coupled
- Coupling is limited by the technical import/export limits

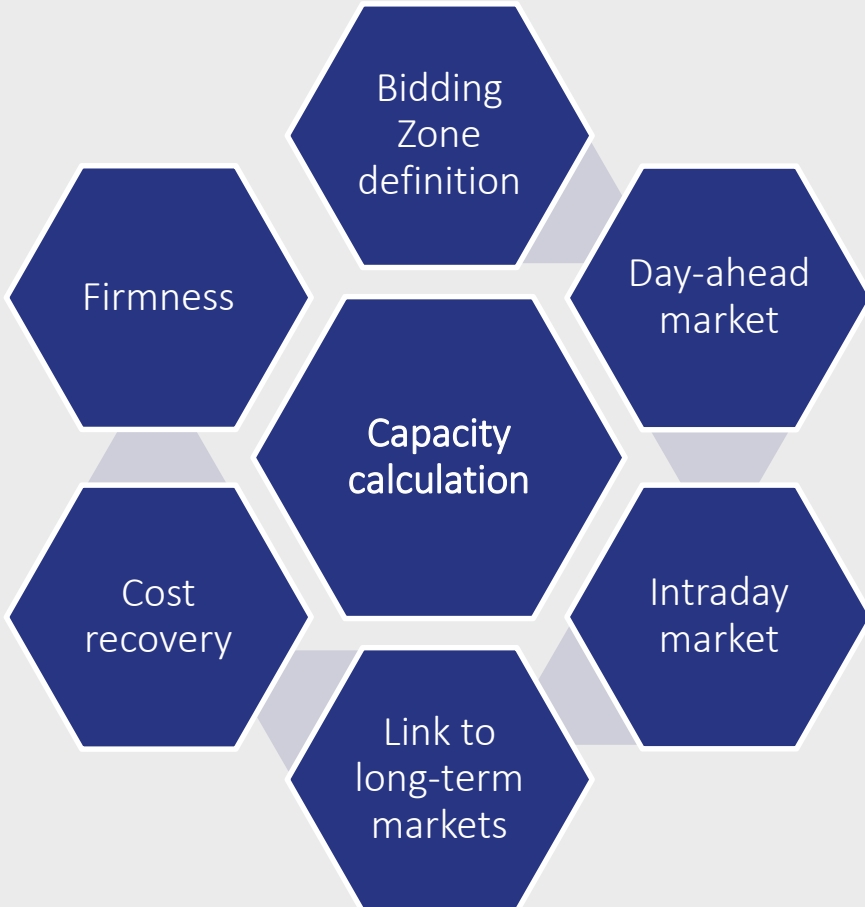
Flow-based coupling

- Global process for optimising on regional level
- Goal is to maximise the exchanges taking into consideration the physical limitations



Challenges in the implementation

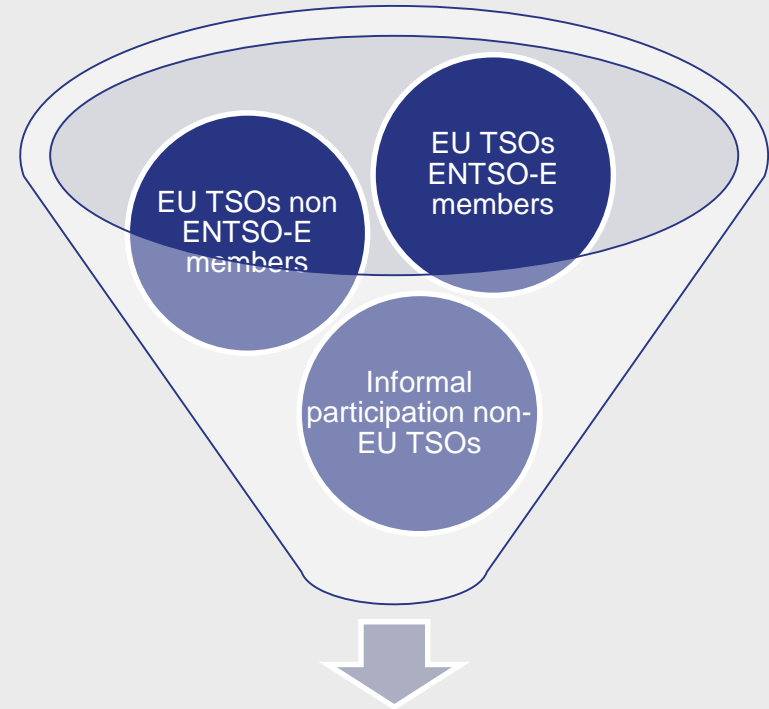
- Agents to be involved
- TSOs-NEMOs relation



- Involved parties
 - All TSOs
 - TSOs in each capacity calculation region
 - NEMOs
 - ACER/ NRAs
 - ENTSO-E
 - ENTSO-E in cooperation with ACER
 - MESOC
 - CACM Coordination Group

Pan-European deliverables

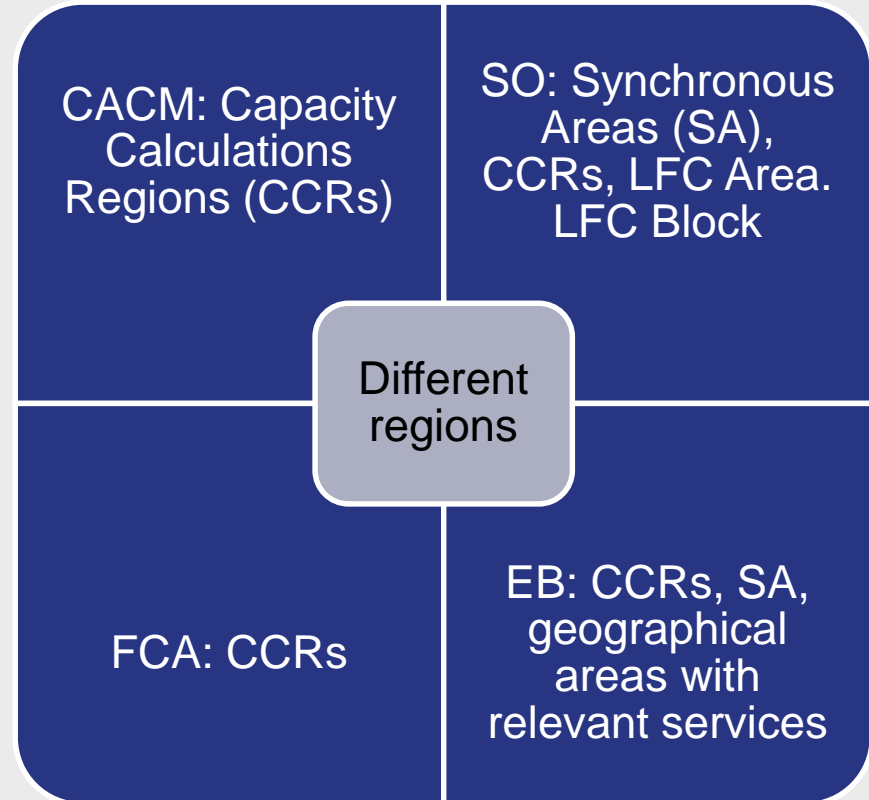
- Qualified majority voting (QMV) if no consensus
 - TSOs / NEMOs representing at least 55% of the Member States (MS); and
 - TSOs or NEMOs representing MS with at least 65% EU population
- One vote per MS / allocation voting powers if multiple TSOs / NEMOs



ENTSO-E All TSOs Process

Regional deliverables

- TSOs qualified majority voting (QMV) if no consensus + at least 5 MS
 - representing at least 72% of the MS + MS with at least 65% of the region population
 - blocking minority
- If regions with less than 5 MS: consensus



Governance of the single DA and ID coupling

CACM target model

- Single DA and ID coupling
- Based on existing regional projects

Cooperation TSOs / NEMOs on CACM deliverables

- Algorithms
- Back-up procedures
- Multi-NEMOs arrangements

Day-to-day management

- Joint organisation;
- EC and ACER observer.

Concluding remarks

- CACM is the first Market-related Guideline to enter into force
- CACM introduces rules for cross-zonal capacity allocation and congestion management in the day-ahead and intraday markets
- The harmonisation of the requirements and methodologies is to be conducted both on pan-EU and regional level
- TSOs play a pivotal role in the implementation of CACM
- Since the entry into force, all the pan-EU required methodologies have been submitted to the NRAs
- Important focus is also put on the regional proposals and developments