CROATIAN ENERGY
REGULATORY AGENCY

Regulatory approach for Coordinated Capacity Calculation

Regulatory School Training
Coordinated Capacity Calculation in Electricity

Vienna, February 13th 2019

Agenda

1. Importance of DA CC
2. DA CC relations to other acts and time frames
3. Cooperation with stakeholders
4. Core CCR DA CC process
5. Clean Energy Package

Day-ahead capacity calculation (DA CC)

- Probably the most important capacity calculation
- Results of the calculation are DA cross-zonal (cross-border) capacities when using Net Transmission Capacity (NTC) method, and PTDF (power transfer distribution factor) and RAM (remaining available margin) values when using Flow-Based (FB) method, respectively
- Results of the DA CC have major impact on market coupling
- Market coupling has many benefits for liquidity of the DA market, and consequently can foster the implementation of other wholesale products (ID products, long-term financial products...)

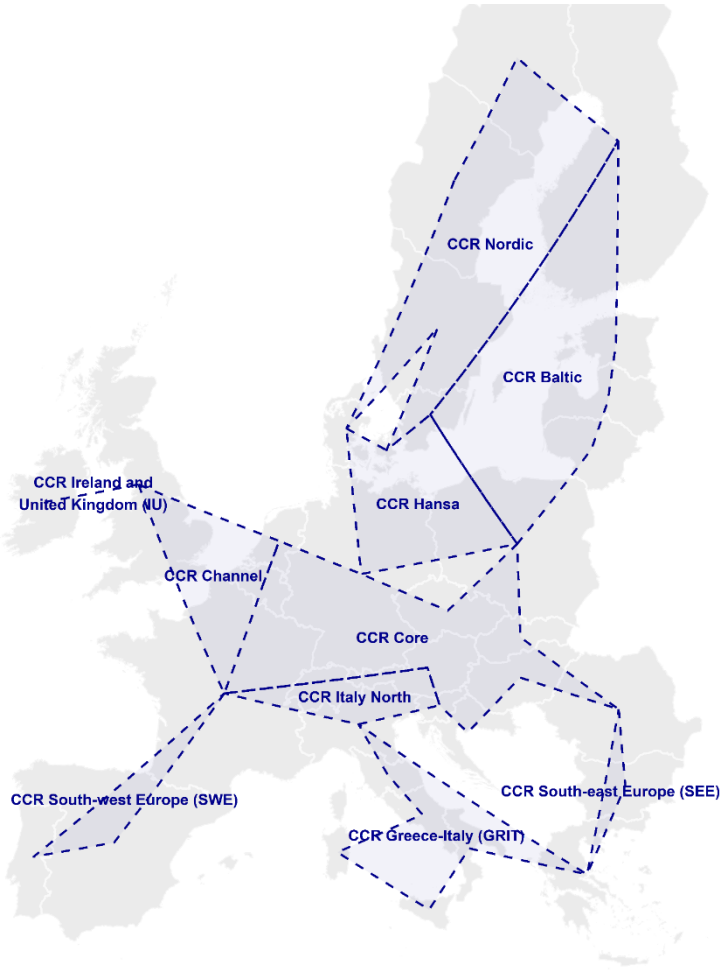
Capacity calculation region (CCR)

Currently:

- In most countries CC is done individually by TSO
- Coordination only in the context „take lower value" for cross-border capacity
- No exchange of data between TSOs

In future:

- Intermediate step is to coordinate activities in the CCR
- Gradually harmonize the practices between CCRs



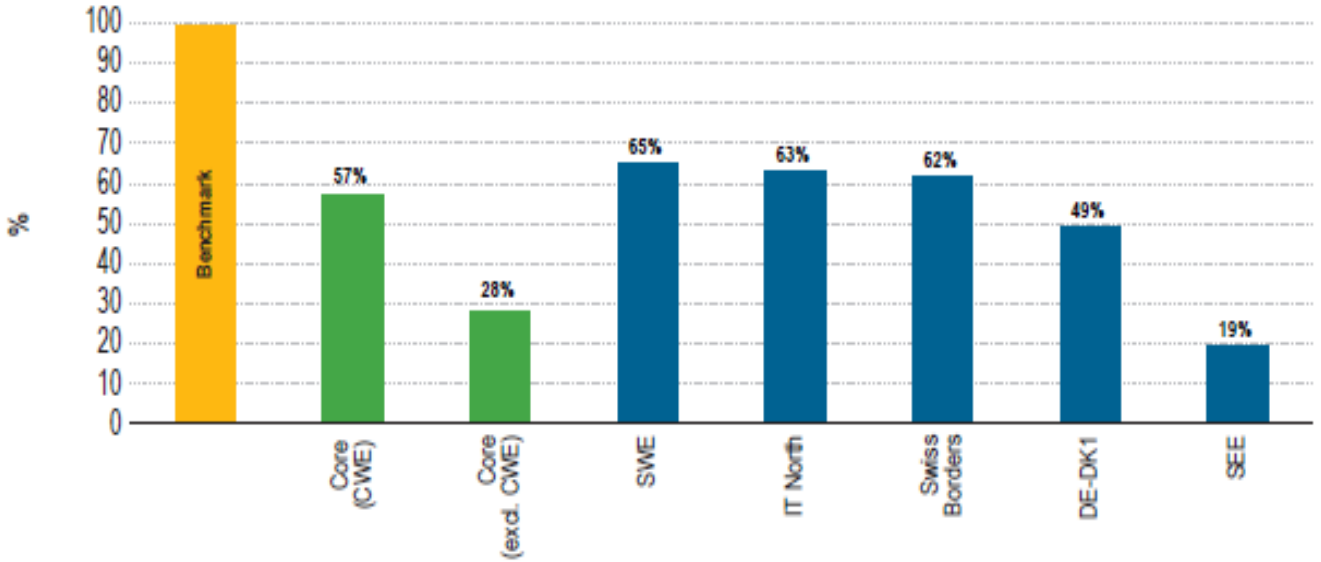
Source: Kaisinger (E-control) –ACER - ECRB Workshop on CACM GL – Duties of TSOs, 21. September 2018

CACM Regulation

- Commission Regulation (EU) 2015/1222 of 24 July 2015 establishing a guideline on capacity allocation and congestion management (CACM Regulation)
- The most important regulation among all Network Codes and Guidelines
- Encompass more than 50 deliverables (methodologies, terms, conditions, reports, arrangements)
- ACER Monitoring report on the implementation of the CACM Regulation and the FCA Regulation
- Covers DA and Intraday processes
- NEMO designation and DA CC are the main drivers for all other activities (market coupling arrangements, operational network activities and remedial actions arrangements)

Usage of cross-zonal lines

Figure i: Ratio of available tradable capacity to benchmark capacity on HVAC borders per CCR – 2017 (%)



Source: ACER-CEER MMR for 2017 – Electricity Wholesale Market Volume

South East Europe

- Trigger in CACM Regulation: All South East Europe Energy Community Contracting Parties (i.e. WB6 countries) participate in single DA coupling (SDAC)
- 6 months after participation in SDAC, TSOs should propose methodologies for DA CC and ID CC
- Aim is to couple neighbouring FB regions
- Optimal way is to transpose CACM Regulation in its entirety (transfer all rights and obligations)
- Challenges: status of ID markets in WB6 and ACER's competences

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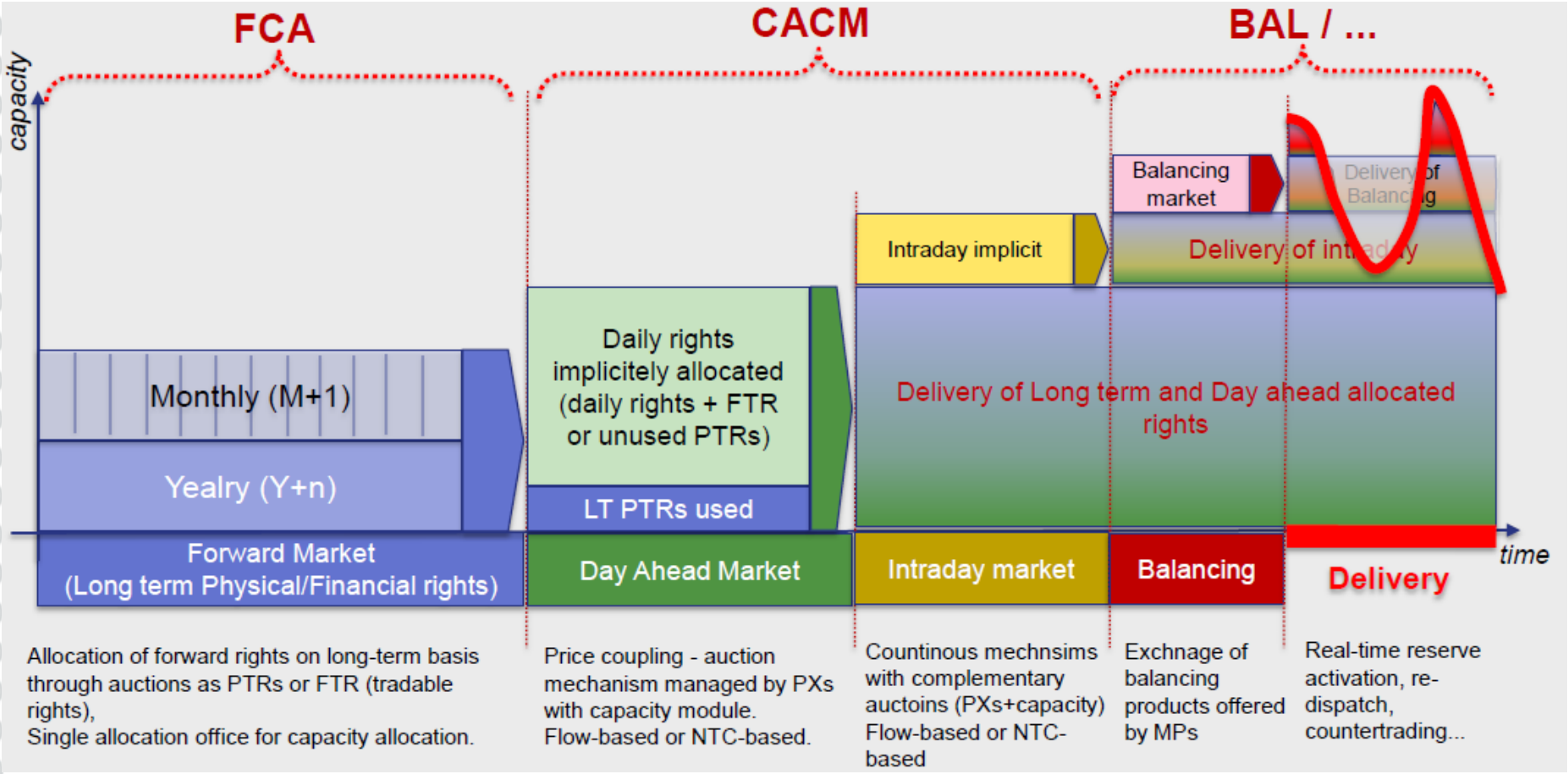
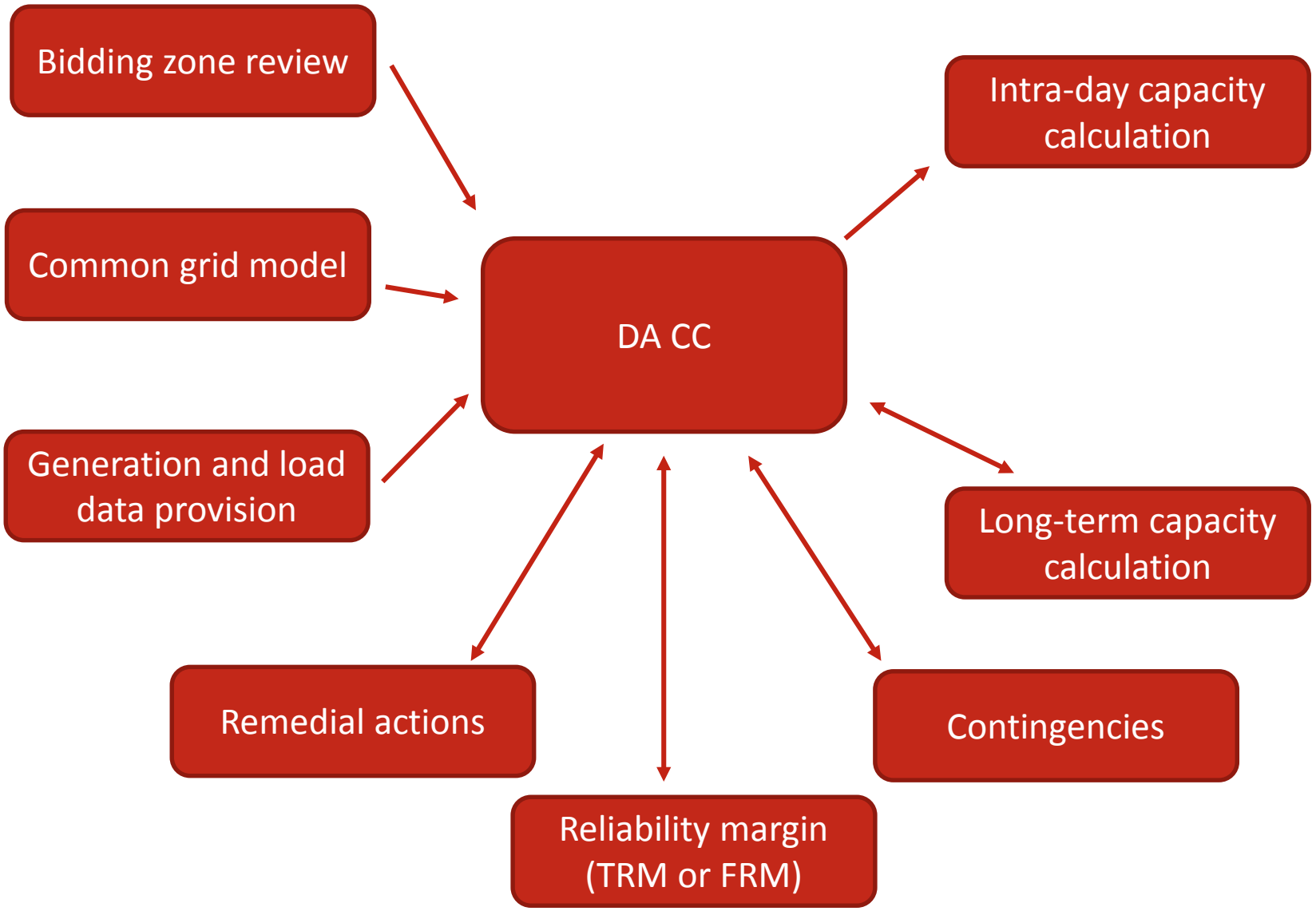
Connection between market guidelines



Source: Energy Community Secretariat - Introduction to Market Network Codes -

Implementation of electricity network codes in the Energy Community , 25. April 2017

Relations


Bidding zone review
Common grid model
Generation and load data provision
DA CC
Intra-day capacity calculation
Long-term capacity calculation
Contingencies
Reliability margin (TRM or FRM)
Remedial actions

Financial burden of costly remedial actions

Proper design of CC process and especially rules for defining critical network element for CC or remedial actions that have cross-border influence is crucial for not jeopardising the TSOs' tariff financial level since CCR costs shall be redistributed among all TSOs in that specific CCR

Table 2: Evolution of the costs of remedial actions – 2017

Country	Total volume (GWh)	Cost of RAs to preserve/ increase XB capacity (thousand euros)	Total cost (thousand euros)	Relative change 2017/2016	Cost of RAs per MWh load (euros/MWh)
DE	24,313	0	1,161,368	93%	2.2
ES	12,182	5,362	371,475	-28%	1.6
AT	1,757	0	92,405	192%	1.5
GB	10,569	8,978	373,625	24%	1.2
PT			44,525	-63%	1.0
NL	685	37,659	62,355	-5%	0.6
LT	77		1,549	NAP	0.2
NO	896	NA	12,522	-27%	0.1
HU	9	0	2,612	NAP	0.1
LV	4	0	311	-19%	0.0
BE	185	260	2,488	-24%	0.0
FI	35	461	1,756	NAP	0.0
FR	272	2,200	8,583	1289%	0.0
EE	4	102	102	-75%	0.0
CZ	9	0	602	-70%	0.0
SI	2	13	83	NAP	0.0
Total	**51,001**	**55,035**	**2,136,361**	**129%**	

Source: ACER-CEER MMR for 2017 – Electricity Wholesale Market Volume

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Levels of cooperation

Core RCC (Regional Coordination Committee)

- NRAs operative level (ACER as observer)
- Technical and legal discussions

CERRF (Core Energy Regulators' Regional Forum)

- NRAs high level
- Memorandum of Understanding and Rules of Procedures – define how NRAs will act and closely cooperate and try to find unanimous decision (approve, request for amendment, ask for prolongation of decision, referral to ACER)
- Position paper as unofficial prove of agreement

Core IG (Implementation Group)

- TSOs + NRAs (ACER as observer) operative level
- Mostly physical meetings, sometimes organized for specific topics

Core CG (Consultation Group)

- TSOs + NRAs + NEMOs + Market Participants
- Usually TSOs present their work to market participants
- https://www.entsoe.eu/network_codes/ccr-regions/#core

ACER's role

- Decides on (regional) proposals when NRAs could have not reached a consensus (unanimous decision)
- For ACER's decision prerequisite is positive opinion of the NRAs (2/3 majority of all NRAs)
- Monitor that regional methodologies are not too much distant from each other
- Recommendation of the Agency No 02/2016 of 11 November 2016 on the common capacity calculation and redispatching and countertrading cost-sharing methodologies

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Coordinated NTC vs flow-based method

Table 1: Principles, similarities, main differences and parameters of the CNTC and FB CC processes

	CNTC	FB CC
Principle	CC method based on the principle of assessing and defining ex ante a maximum energy exchange between adjacent bidding zones.	CC method in which energy exchanges between bidding zones are limited by a set of constraints intended to represent the physical limits of the network. These constraints are determined by Power Transfer Distribution Factors (PTDFs) and available margins on critical network elements (CNEs). These margins determine the capacity that can be offered to the market in order to be allocated to where its value is the highest.
Similarities	• Both are intended to maximising tradable cross-zonal capacity while safeguarding the operational security standards of the transmission system. • Both result in the determination of a capacity domain. This is the domain of possible commercial capacity that can be allocated for each direction on each bidding zone border.	
Differences	• The actual exchange between two given bidding zones is not dependent on the exchanges across adjacent borders. • The maximum bilateral exchanges are fixed ex ante. The combination of possible exchanges (on a set of adjacent borders) cannot be optimised via the capacity allocation algorithm. • Lower visibility of the location of physical congestions. • It is an acceptable CC method for non-meshed networks (provided that a sufficient level of coordination is applied).	• The actual exchange between two bidding zones is dependent on the exchanges across adjacent borders within a Capacity Calculation Region (CCR). Energy exchanges between bidding zones are limited by PTDFs and available margins on CNEs. • The combination of possible exchanges is optimised via the FBMC algorithm. • Higher visibility of the location of physical congestions. • It is the most efficient CC method for meshed networks.

Source: ACER-CEER MMR for 2016 – Electricity Wholesale Market Volume

The most crucial issues for Core DA CC

1. Selection of the Critical Network Element & Contingencies (CNEC)
2. Operational Security Limits (Imax)
3. Generation Shift Key (GSK)
4. Remedial Actions Optimization (RAO)
5. Capacity Validation
6. Timescale for implementation
7. Avoidance of undue discrimination
8. Inclusion of the long-term capacities
9. Redispatching costs

Source: Core NRAs' Non-paper on Core DA and ID CC, Market European Stakeholder Committee, 5/12/2018

Selection of CNEC (1/6)

Critical Network element – CNE

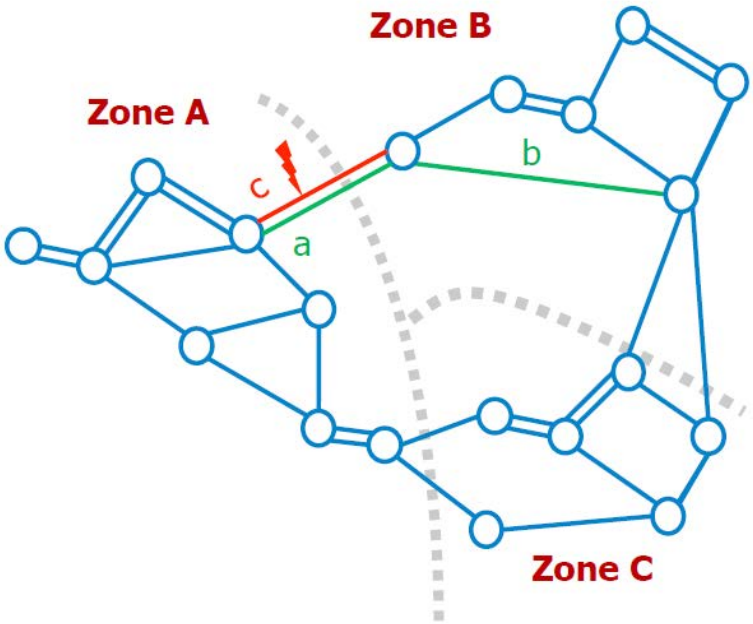
line a or line b

Contingency – C

outage of line c

Critical network element with contingency – CNEC

line a or b with an outage of line c

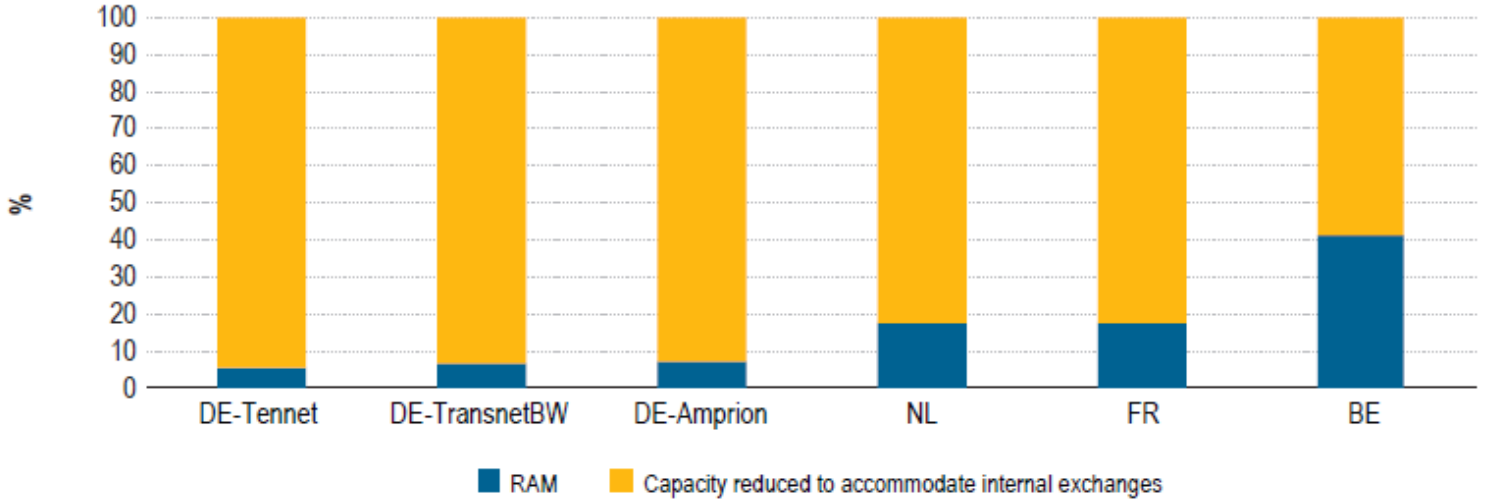


Source: Core DA FB CC Concept – Core CG meeting, 6/7/2017 – Munich

Selection of CNEC (2/6)

Current status: requests for internal exchanges get unlimited and prioritized access to the scarce network capacity, whereas requests for cross-zonal exchanges get only part of the network capacity which in not already used by internal exchanges

Figure 15: Weighted-average RAM (expressed as a percentage of Fmax) for cross-zonal exchanges in internal-to-bidding-zone CNEs per TSO control area in 2017 (%)



Source: ACER-CEER MMR for 2017 – Electricity Wholesale Market Volume

Selection of CNEC (3/6)

ACER's Recommendation – Principle 1. – Limitations on internal network elements should not be considered in the cross-zonal capacity calculation methods.

If congestion appears on internal network element, in principle it should be resolved with remedial actions in the short term, with the bidding zone reconfiguration in the mid-term and efficient network investments in the long term.

Increase cross-zonal capacities to foster efficient functioning of the internal electricity market.

Reconfiguration of the bidding zones is a political issue, financing the infrastructure projects, distributions of the redispatching cost.

Deviations in case of operational security and economic efficiency.

Selection of CNEC (4/6)

Current status: Loop flows are significantly reducing the amount of cross-zonal capacities and have a negative impact on a functioning of the market

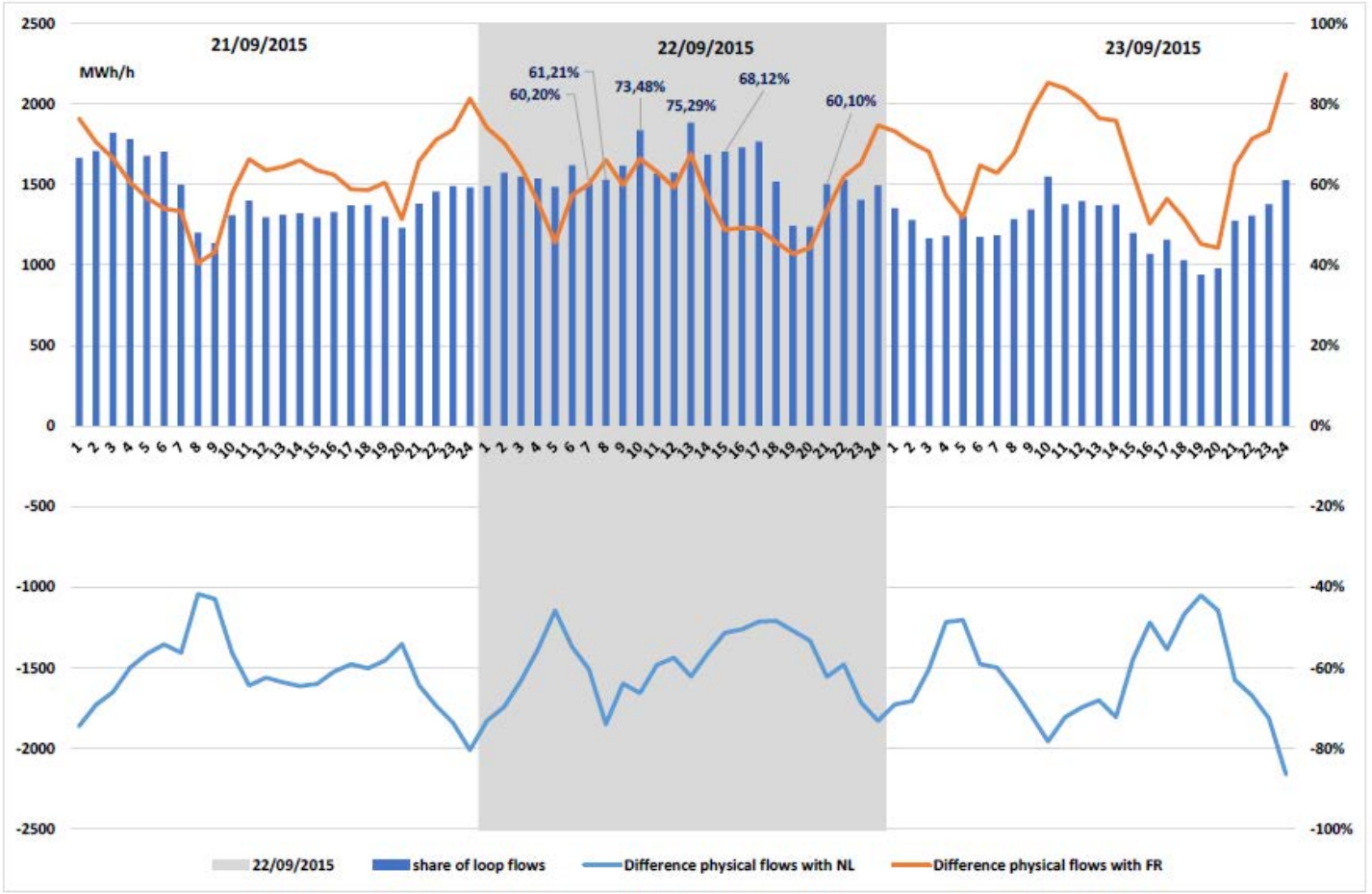


Figure 41 –Difference between measured physical flow and calculated physical flow based on long-term nominated and day-ahead allocated commercial exchanges as a measure for non-competitive flows, including their share relative to the available physical import capacity on the border between the Netherlands and Belgium..

Source: CREG – Study (F) 160324-CDC-1520

Selection of CNEC (5/6)

ACER's Recommendation – Principle 2. – The capacity of the cross-zonal network elements considered in the common capacity calculation methodologies should not be reduced in order to accommodate loop flows.

In practice, in a zonal market design, and even with an appropriate configuration of bidding zones, it is likely that a minimum level of loop flows could be justified in terms of economic efficiency, and if so, may constitute an acceptable deviation from the general principle.

Maximum level of the interconnection capacity of the interconnections and/or the transmission network affecting cross-border flows shall be made available to market participants, complying with safety standards of secure network operation.

Reconfiguration of the bidding zone is a political issue, financing the infrastructure projects, distributions of the redispatching cost. Deviations in case of operational security and economic efficiency.

Selection of CNEC (6/6)

- CACM Regulation: *if the operational security limits and contingencies used in capacity calculation are not the same as those used in operational security analysis, TSOs shall describe in the proposal for the common capacity calculation methodology the particular method and criteria they have used to determine the operational security limits and contingencies used for capacity calculation*

- NRAs insist on detailed reasoning for inclusion of CNE, especially in case of internal CNE

- Aim: discretionary decisions of individual TSO should be suppressed

Operational Security Limits

$$F_{max} = \sqrt{3} \cdot I_{max} \cdot U \cdot cos(\varphi)$$

Fmax - maximum admissible active power flow on a CNEC

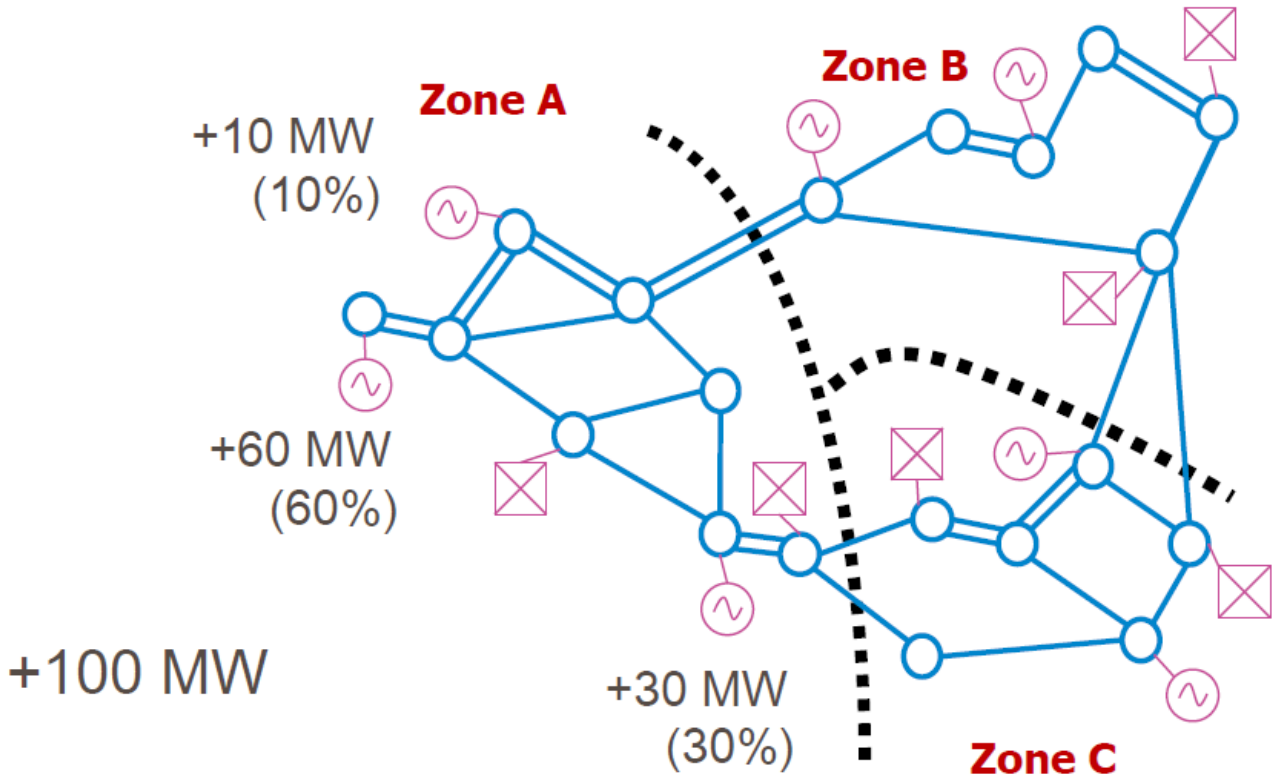
NRAs view:

1. Imax should be changed due to weather conditions – target solution is dynamic line rating, fallback solution is seasonal values
2. $\cos(\varphi)$ - detailed rules should be established, during validation phase TSO can accommodate these value but only with predefined situation

GOAL: restrict discretionary power of individual TSO

Generation Shift Key (GSK) (1/3)

GSK is the best estimation how the change of net position of a specific bidding zone influence the specific injection increase/decrease in the common grid model



Source: Workshop - Core DA FB CC Concept – Core CG meeting, 6th of July 2017 – Munich

Generation Shift Key (GSK) (2/3)

- Different bidding zones have different characteristics of the generation (mix of different production units with different production pattern)
- Options: market driven plants with statistical approach behaviour, pro-rata based on production, pro-rata based on minimum and maximum production levels, participation factors
- It is not sensible that all bidding zones have the same GSK method
- Inclusion of specific Load Shift Key (LSK) can improve the quality of GSK due to inclusion of smaller dispersed production units
- Possible specific requirements:
  - extreme import/export situations (min/max level of GSK factors)
  - small dispersed units connected to lower voltage levels are considered in the GSK in order to achieve more realistic flow patterns when the net position shifts

Generation Shift Key (GSK) (3/3)

NRAs' view:

- Clear and transparent rules, that effectively serve to avoid TSO discretionary intervention as far as possible
- Good level of representativeness of effective power shifts, through the application of automatic, harmonized and transparent measures taking into account weather and wind forecasts (for solar and wind generation)
- Potential progress in harmonization:
  - disregard of nuclear power plants
  - disregard plants under maintenance or outage
- Long-term task, so before some level of harmonization is achieved, experimentation and/or real data are needed

Remedial Actions Optimization (RAO)

- CACM explicitly states that only non-costly (topological measures, PST) RA will be used
- Sometimes, if all the non-costly RA are exhausted, costly RA could be used for relieving the congestion on particular CNE
- NRAs' view
  - clear rules for compensating the costs for potential costly RA
  - clear order for activation of the RA
  - detailed information exchange about RA application with neighbouring CCRs
  - evidence that application of the RAO on one particular CNEC does not negatively affect trading over different CNE

Capacity Validation

- CACM explicitly states that each TSO validate and have the right to correct cross-zonal capacity relevant to the TSO's bidding zone borders for reasons of operational security during the validation process
- Usual usage in case: unplanned outages, not sufficient RAs, voltage conditions
- NRAs' view:
  - in case of failure of input data, procedure must be ensured that TSO can not take advantage of it
  - it is preferred that verification tool for validation is used by CCC
  - clear rules for compensating potential costly RA (for increasing cross-zonal capacity)

Timescale for implementation

- Although CACM requires that DA CC provide concrete implementation date, implementing it depends on many issues
- Experimentation phase is necessary (internal only including TSOs, and external including also power exchanges)
- Sometimes, it is very hard to use one-size-fits-all approach
- CCCs and RSCs are currently starting to be functional
- Main goal of NRAs: limit the discretionary power of TSO
- It is expected that continues progress in DA CC process will be needed (possibly reflection on DA CC methodology via amendment process)

Avoidance of undue discrimination

- CACM Regulation requires that the CCMs shall include rules to avoid undue discrimination between internal and cross-zonal exchanges
- Different views among NRAs

View A	View B
Use of cross-zonal lines for internal trade in base case should be minimised: 1. Individual grid models are congestion-free 2. Stricter CNEC selection (higher values of PTDF) 3. Higher amount of minimum remaining capacity of CNEC for DA trade	1. EU target model is zonal -> some level of loop flows are inherent 2. Zonal model in principle gives priority to internal trade inside zone 3. Trade-off is needed between increasing of cross-zonal trade and welfare loss due to redispatching costs for allowing cross-zonal trade 4. National grid security concerns and energy transformation policies (RES infeed plans) should be respected

Redispatching costs (1/2)

ACER's Recommendation – Principle 3. – The costs of remedial actions should be shared based on the 'polluter-pays principle', where the unscheduled flows over the overloaded network elements should be identified as 'polluters' and they should contribute to the costs in proportion to their contribution to the overload.

Cross-zonal exchanges should not be considered as the ones causing congestion and thus should not be considered as 'polluters'.

All 3 ACER's principle should be applied together (redistribution of costs should be known in advance of the providing CC methodology).

Redispatching costs (2/2)

- Process for cost redistribution for costly RA (redispatching and counter-trading) depends on CC methodology (CACM) and activities in operational security analysis (SOGL)
- Observations and recommendation from ACER Monitoring report on the implementation of the CACM Regulation and the FCA Regulation:

1. polluter pays principle should apply when relevant
2. methodology for cost sharing should be clear and enforceable, amended when needed (especially after testing it in real time situations)
3. clear definition which congestions are cross-border relevant and thereby need to be solved in a coordinated manner
4. process to coordinate redispatching and countertrading should focus on economic optimisation to solve congestion

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Clean Energy Package (CEP) relevant point

One of deliveries will be the amended Electricity Regulation.

Regardless of the used CC method (flow-based approach or coordinated NTC method), margin for minimum capacity for cross-zonal exchange will be set.

Significantly increase cross-zonal capacities.

TSOs will need to apply a lot of corrective measures (remedial actions) by adjusting the output of generation units throughout Europe. Redispatching market will become possibly more attractive for generators than current markets (long term and spot markets). Additional costs on the consumers' bill.

Re-defining the social welfare?

Social welfare = production surplus + consumer surplus + congestion income

Net social welfare = production surplus + consumer surplus + congestion income – redispatching costs

Thank you for your attention

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