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Market coupling mechanism for integrating DAMs in South-East Europe

Which benefits can be expected?

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- **Market Coupling (MC): trade of energy with (implicit) capacity allocation**

Both a mechanism for matching orders on power exchanges (PXs) and an implicit cross-border capacity allocation

- Capacity Allocation & Congestion Management Network Code (CACM NC) defines:

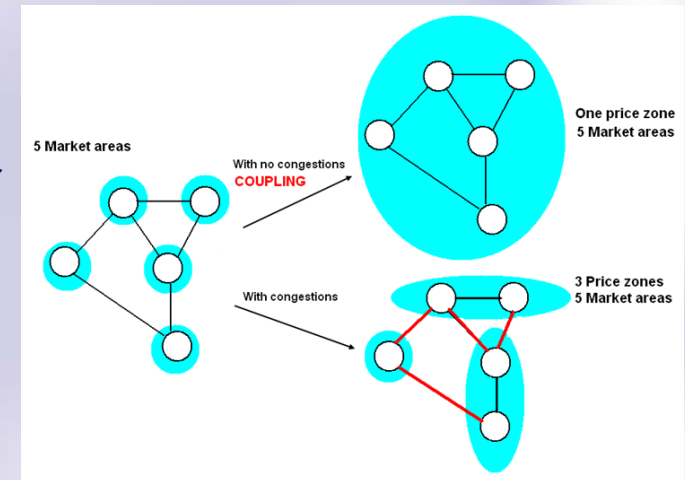
Target mechanism for day-ahead market in Europe:

Pan-European single Market (Price) Coupling

→ MC is in perspective the only choice for future D-1 markets!

→ Explicit capacity allocation to exist only as transitional or fallback solutions

- Over Energy Community Treaty, pan-European MC will become obligatory for the SEE region also

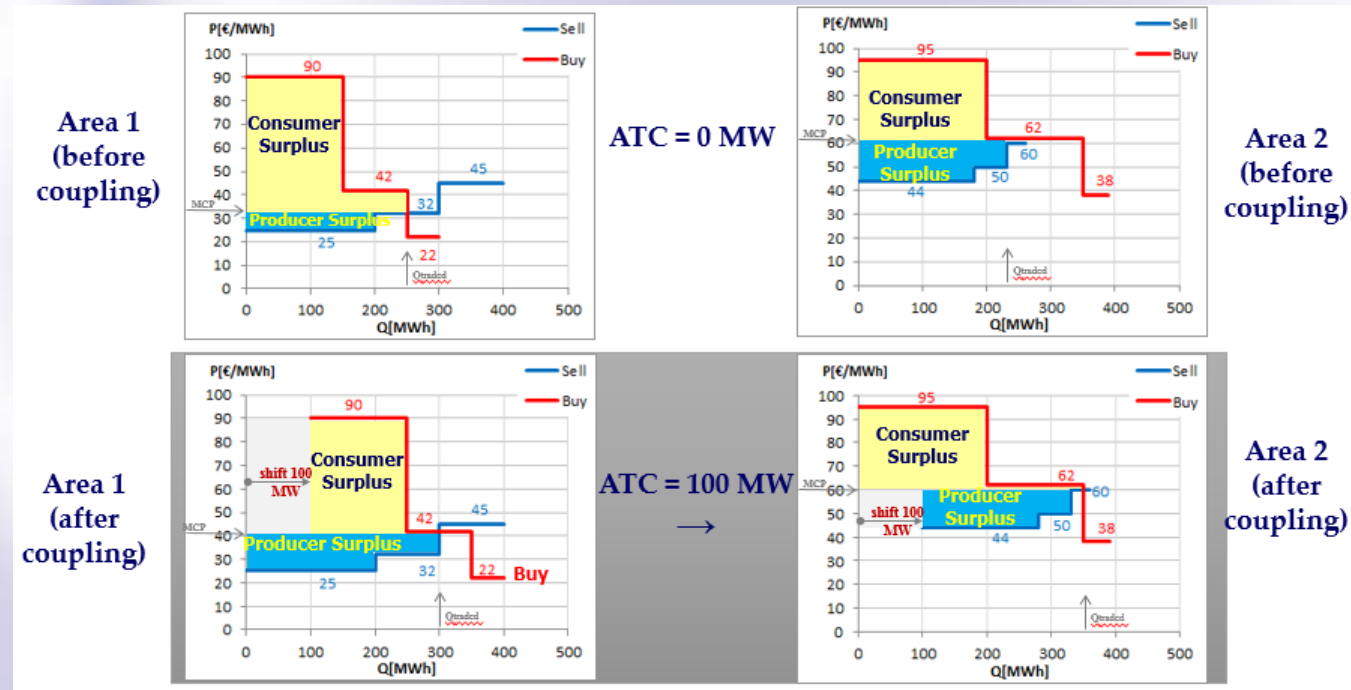




Market coupling – objective function

- Matching the buy and sell curves of coupled markets jointly, according to the overall merit order, with respecting the transmission constraints
 - ✓ Transmission constraints: ATC-based, or Flow-based (PTDF/RAM)
 - ✓ The overall aim: to maximize the social economic welfare (SEW)

Example: Two areas, coupled over ATC



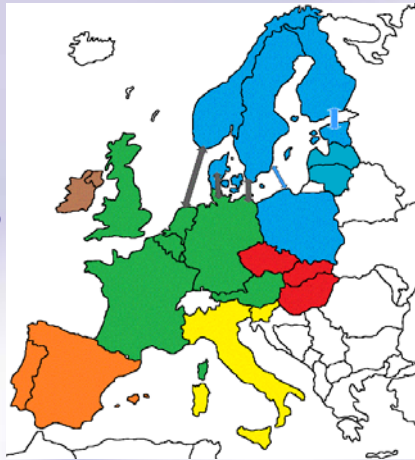


Market integration in Europe – ongoing process

November 2013

Several parallel processes in place

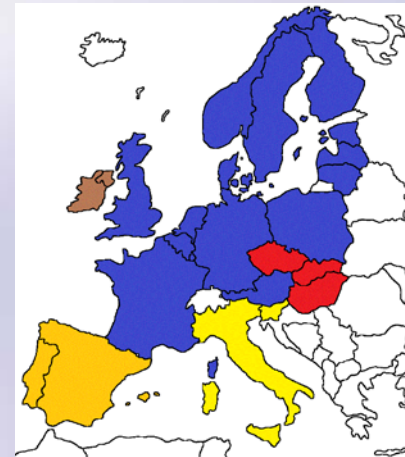
Development of a single price coupling algorithm - Euphemia



February 2014

NE and CWE merged in single ATC-based Price Coupling of Regions (PCR)

Market optimization done under single price coupling algorithm - Euphemia

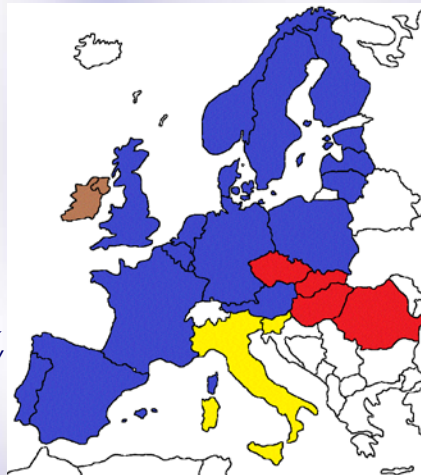


May 2014

SWE (Spain, Portugal) joined PCR

November 2014

Romania joined CEE market coupling (CZ, SK, HU) to form 4M MC

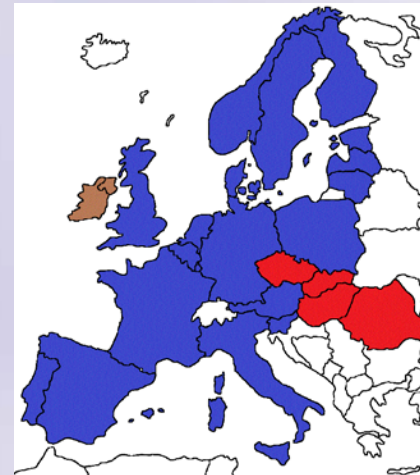


February 2015

Coupling of Italian northern borders with PCR – Italy and Slovenia joined PCR to form MRC (Multi-Regional Coupling)

May 2015

CWE (DE/AT, FR, NL, BE) implemented flow-based market coupling



Multi-Regional Coupling: 19 countries ≈ 55 billion € annual turnover



Current status in the South-East Europe

- Countries with established PXs and participation in market coupling:
 - ✓ Hungary and Romania within 4M MC with Czech Republic and Slovakia
 - ✓ Slovenia in MRC with implicit allocation on border with Italy
- Countries with organized DAMs not yet participating in market coupling:
 - ✓ Greece
 - ✓ Bulgaria (IBEX as of January 2016)
 - ✓ Croatia (CROPEX as of February 2016)
 - ✓ Serbia (SEPEX as of February 2016)
- In other countries functional DAM yet to be established → countries to join existing PXs or creation of new PXs?
- Further development Market Coupling initiatives in the SEE is inevitable!



Benefits from market coupling implementation

- Trading of energy & transmission capacities performed in one step
- Enables netting of flows
- The market value of the transmission capacities is identical to the price difference between the bidding zones → congestion income only arises when real constraints exist
- More efficient transmission network utilization which leads to...
 - ✓ Increase in social economic welfare
 - ✓ Higher level of price convergence

...a major step towards a more integrated European market!



Impact on social welfare – the case of SEE region

- Demonstration case is created to overview the potential benefits from market integration in the SEE region
- Simulation analysis is performed on electricity market model created for the SEE region and 2020 as target year



- Impact on social welfare are assessed in the following manner:
 - ✓ **Benefits of cross border trading** – calculated as increase of SEW comparing simulations of fully integrated (in MC mechanism) markets VS isolated markets in the SEE region (i.e. benefits from “zero” to full market integration)
 - ✓ **Benefits of market coupling*** – calculated as increase of SEW comparing simulations of fully integrated markets VS 80%-90% integrated markets in the SEE region (i.e. working assumption for simulations were that explicit auctions create inefficiency and reduce potential for cross border trading by 10%-20%)
- Effects were measured on interconnection capacities among the SEE countries

**European practice in implementing market coupling solution (e.g. NWE region) has shown that explicit auctions of transmission capacities + separate energy trading compared to market coupling result in less efficient utilization of transmission capacities (suboptimal flows, FAPD...)*

Benefits of cross border trading

(integrated Vs isolated markets)

271 mil. € on annual level

Benefits of market coupling

In range of:

14.5 - 28 mil. € on annual level

(for 10%-20% more efficient interconnectors utilization compared to explicit auctions)



The main finding is that the gains from market coupling implementation are considerable in absolute terms, and at least an order of magnitude larger than the costs; still, it should be recognized that they are rather modest compared to the total value of wholesale turnover



Further steps in DAMs development in the SEE region

Bidding zones configuration assessment in the SEE region

STEP 1

Bidding zones configuration scenarios

STEP 2

Modelling & simulations

Network & market modelling

Market coupling simulation

Capacity calculation

Load flow

STEP 3

Evaluation of market & network indicators

Economic surplus & market liquidity

Operational security

Price signals

Re-dispatch cost

Market concentration & power

BZ stability & robustness

Proposal for bidding zones configuration



Further steps in DAMs development in the SEE region

Implementation of the flow based market coupling in the SEE region

ATC network constraints:

Defined per each border
Commercial constraint



Flow-based: PTDF matrix/MF:

Defined per each physical critical branch
Physical constraint



TSO	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
RS	190.0	190.0	190.0	190.0	190.0	190.0	190.0	190.0	190.0	190.0	190.0	190.0	190.0	190.0	190.0	190.0	190.0	190.0	190.0	190.0	190.0	190.0	190.0	190.0
HU	250.0	250.0	250.0	250.0	250.0	250.0	250.0	250.0	250.0	250.0	250.0	250.0	250.0	250.0	250.0	250.0	250.0	250.0	250.0	250.0	250.0	250.0	250.0	250.0
HU	300.0	300.0	300.0	300.0	300.0	300.0	300.0	300.0	300.0	300.0	300.0	300.0	300.0	300.0	300.0	300.0	300.0	300.0	300.0	300.0	300.0	300.0	300.0	300.0
RS	320.0	320.0	320.0	320.0	320.0	320.0	320.0	320.0	320.0	320.0	320.0	320.0	320.0	320.0	320.0	320.0	320.0	320.0	320.0	320.0	320.0	320.0	320.0	320.0
RS	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0
RO	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0
RO	380.0	380.0	380.0	380.0	380.0	380.0	380.0	380.0	380.0	380.0	380.0	380.0	380.0	380.0	380.0	380.0	380.0	380.0	380.0	380.0	380.0	380.0	380.0	380.0
RS	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0
HU	500.0	500.0	500.0	500.0	500.0	500.0	500.0	500.0	500.0	500.0	500.0	500.0	500.0	500.0	500.0	500.0	500.0	500.0	500.0	500.0	500.0	500.0	500.0	500.0
RO	500.0	500.0	500.0	500.0	500.0	500.0	500.0	500.0	500.0	500.0	500.0	500.0	500.0	500.0	500.0	500.0	500.0	500.0	500.0	500.0	500.0	500.0	500.0	500.0
HU	250.0	250.0	250.0	250.0	250.0	250.0	250.0	250.0	250.0	250.0	250.0	250.0	250.0	250.0	250.0	250.0	250.0	250.0	250.0	250.0	250.0	250.0	250.0	250.0
HU	250.0	250.0	250.0	250.0	250.0	250.0	250.0	250.0	250.0	250.0	250.0	250.0	250.0	250.0	250.0	250.0	250.0	250.0	250.0	250.0	250.0	250.0	250.0	250.0

Branch	Outage	Area From	Area To	Tmf	Amf+	Amf-	AT → AL	BA → AL
XVD_PO21 0PODG12 1	XZE_KA11 AZEMLA1 1	AL	ME	266.60	145.90	294.00	-0.28653	-0.299101
XKA_PG11 0PODG21 1	XZE_KA11 AZEMLA1 1	AL	ME	1331.20	1188.90	1167.20	-0.461798	-0.472765
XFL_FR21 AFIERZ2 1	XZE_KA11 AZEMLA1 1	RS	AL	296.90	414.60	78.10	0.251669	0.228132
XFL_BH1 GMELIT12 1	XZE_KA11 AZEMLA1 1	MK	GR	904.70	626.10	962.40	-0.037419	-0.023566
XBG_TH11 GTHES12 1	XZE_KA11 AZEMLA1 1	BG	GR	1256.60	1042.10	1179.70	0.034383	0.022282
XTH_DU11 GTHES11 1	XZE_KA11 AZEMLA1 1	MK	GR	904.60	780.60	807.60	-0.021824	-0.013666
XZE_HH11 HZEP1A1 1	XZE_KA11 AZEMLA1 1	HR	HR	1266.20	1066.70	1166.10	0.033651	-0.029174

PTDF/MF matrix:
line XX (cb), in case of an outage YY (co), has a free capacity of 1234 MW
PTDF ba-al: 23.4% of BA-AL transfer would flow over it
PTDF bg-al: 45.6% of BG-AL transfer would flow over it ...
...



Conclusions

- Market coupling is advanced, efficient form of day-ahead electricity trade
- Instead of two steps (buying first the capacity and then trading via the exchange or otherwise), parties are able to trade in one step in an automatically coupled international market
- Market coupling will soon be a single pan-European day-ahead solution
- For the SEE region...
 - *On short term horizon, the goal is to establish the liquid DAM with market coupling mechanism in place*
 - *On mid term horizon, the aim should be to examine bidding zones configurations as well as potentials for implementing FB solution in order to increase benefits and maximize social welfare*



THANK YOU FOR YOUR ATTENTION