



Allocation of cross-border capacities: Croatian experience

GME AEEG Workshop

**A POSSIBLE WAY FORWARD TO A WELL-INTEGRATED AND
COMPETITIVE ELECTRICITY MARKET IN SOUTH EAST EUROPE**

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Outline

- Croatian power system
- Market model
- Allocation of cross-border capacities



Croatian power system

(1/3)

CROATIAN TRANSMISSION SYSTEM SCHEME



HEP - OPERATOR PRILIENOSNOG SUJSTAVA d.o.o.
(HEP-Transmission System Operator LLC)

Legend

- | | | |
|---|--|--|
| Substations | Power Plants | Transmission lines |
| <ul style="list-style-type: none"> ● 400 / 220 / 110 kV ○ 400 / 110 kV ○ 220 / 110 kV ○ 220 / 35 kV ○ 110 / x kV • 35 / x kV ▲ Railway Traction Substation | <ul style="list-style-type: none"> ■ Thermal Power Plant (connected to the transmission network) ■ Hydro Power Plant (connected to the transmission network) ■ Industrial Power Plant (connected to the transmission network) ■ Wind Power Plant | <ul style="list-style-type: none"> — 400 kV — 220 kV — 110 kV |

July 2012

Area: 56 542 km²

Population: 4.3 mil

HPP = 2 141 MW

TPP = 2 025 MW

WPP = 167 MW

Others = 32 MW

Capacity = 4 365 MW

Peak load = 3 193 MW

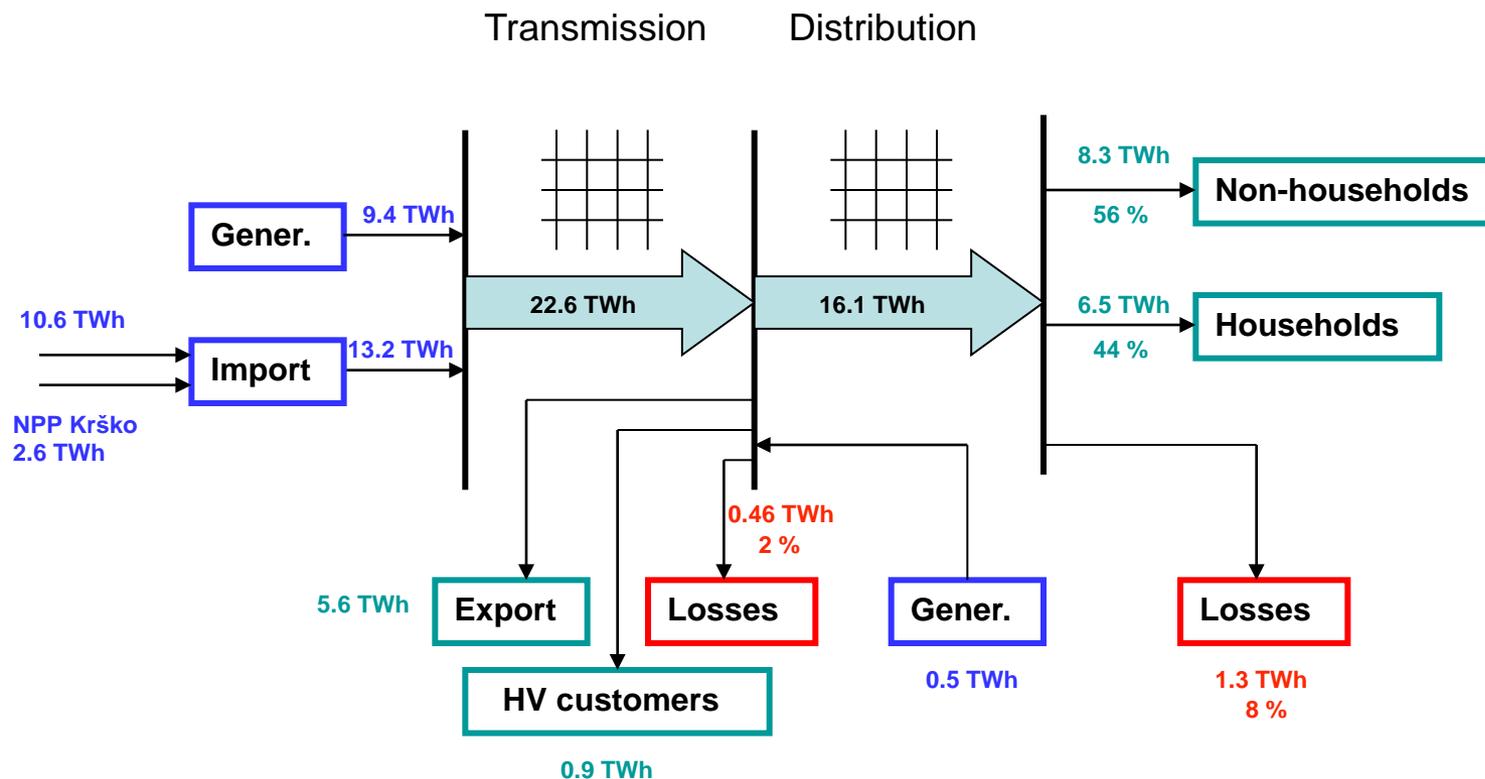
Consumption = 17.5 TWh



Croatian power system

(2/3)

Balance of electric energy in 2012



Net import (excluding NPP Krško) = 5 TWh (28%)

Customer metering points ≈ 2.35 mil

Transit = $\min(13.2, 5.6) = 5.6$ TWh



Croatian power system

(3/3)

Network tariffs

Tariff models		Tariff elements					
		Active energy			Active power	Excess reactive energy	Metering fee
		ST	HT	LT			
		€/kWh)	(€/kWh)	(€/kWh)	(€/kW)	(€/kvarh)	(€/mo.)
		Tariff items					
HV*	White		0.67	0.27	1.93	2.1	9.1
MV	White		2.27	1.07	3.93	2.0	8.8
LV	Red		3.33	1.60	5.93	2.0	5.5
	White		4.67	2.27		2.0	5.5
	Blue	4.13				2.0	5.5

* only transmission

1 € = 7.5 HRK

Transmission = 1.16 €/kWh

Distribution = 2.9 €/kWh



Market model

(1/2)

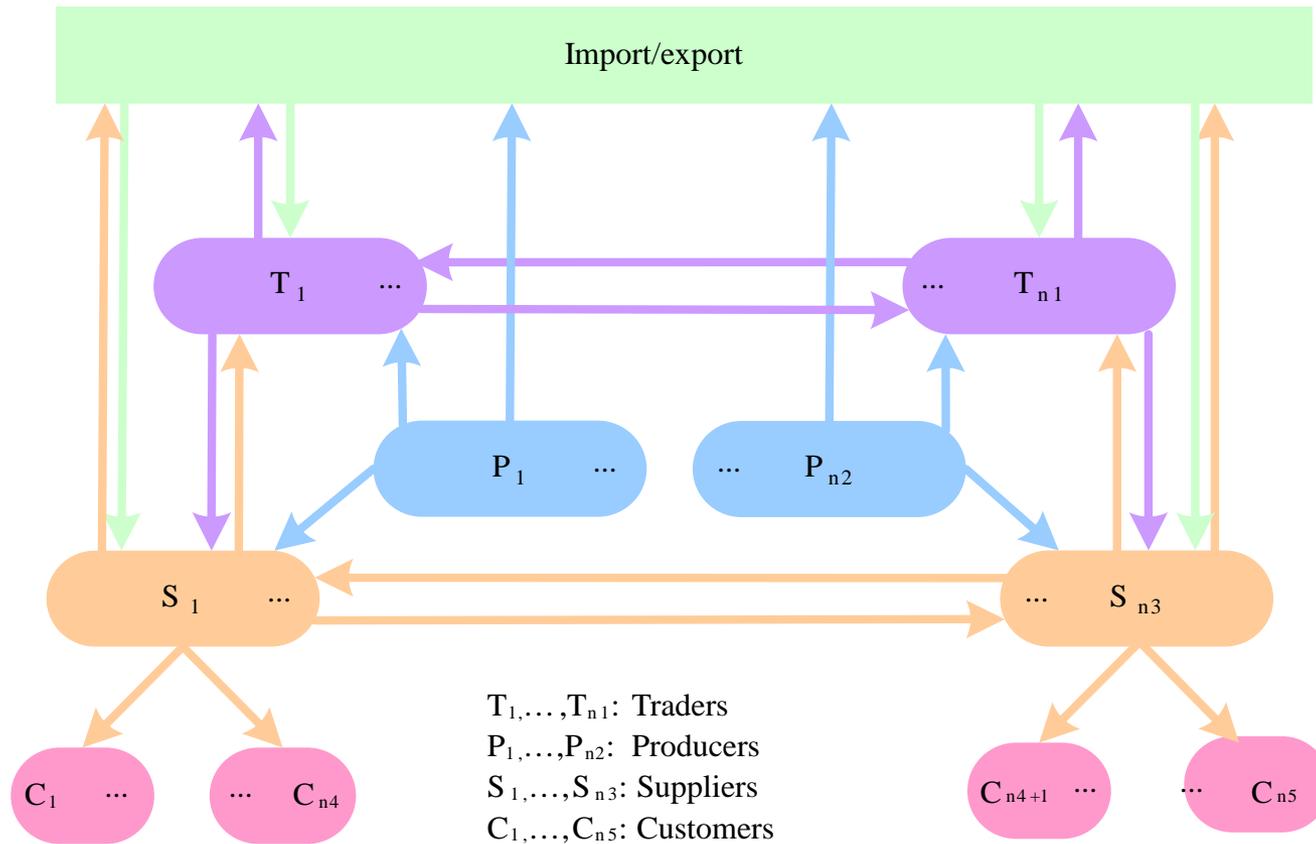
Market opening

- Completely, from 1st July 2008
 - households enjoy universal service (average price is 63 €/MWh)
- 18 traders
- 12 suppliers (9 active)



Market model

(2/2)



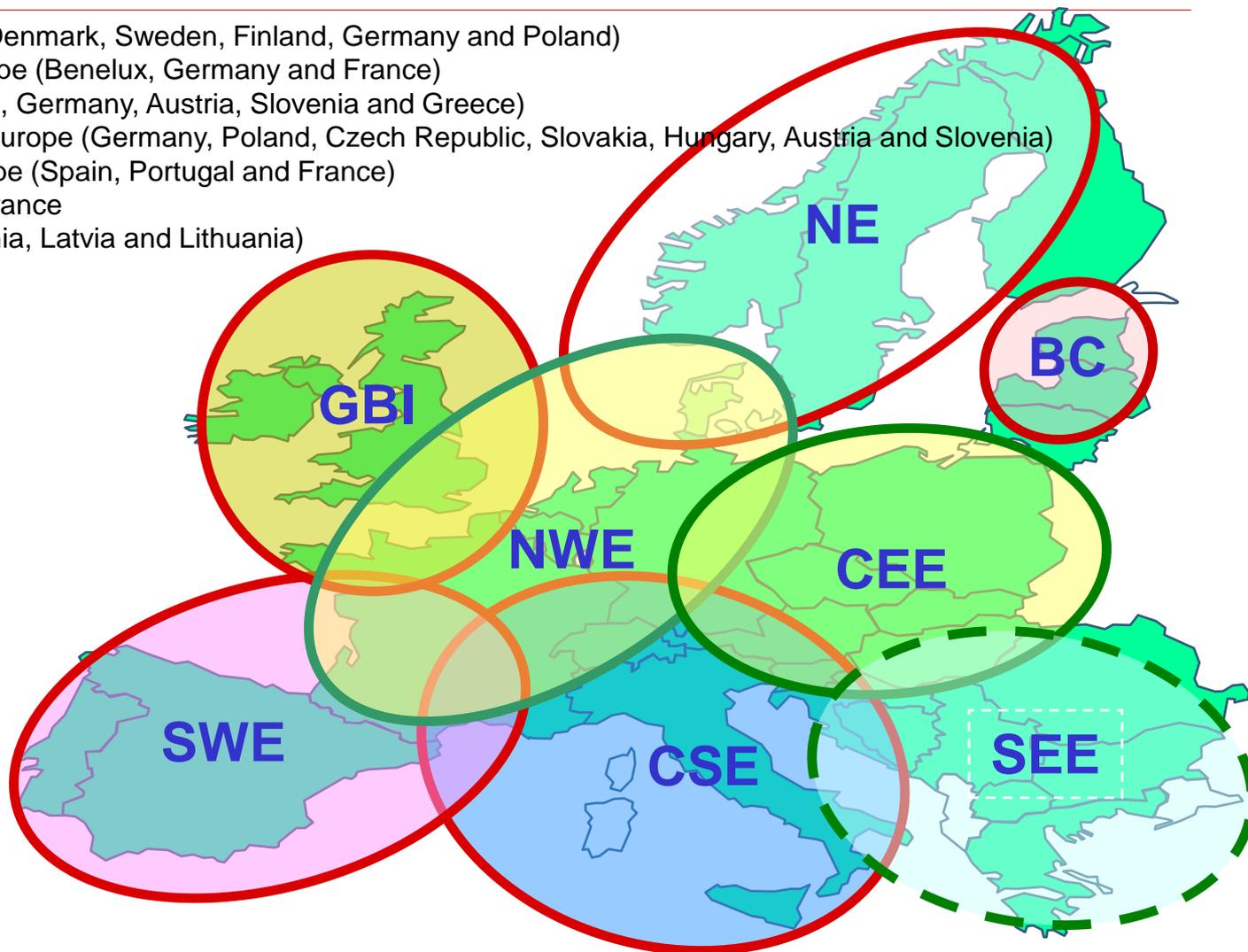


Allocation of cross-border capacities

(1/14)

Regions defined by Regulation (EC) 714/09

1. **NE** – Northern Europe (Denmark, Sweden, Finland, Germany and Poland)
2. **NWE** – North-West Europe (Benelux, Germany and France)
3. **CSE** – Italy (Italy, France, Germany, Austria, Slovenia and Greece)
4. **CEE** – Central Eastern Europe (Germany, Poland, Czech Republic, Slovakia, Hungary, Austria and Slovenia)
5. **SWE** – South-East Europe (Spain, Portugal and France)
6. **GBI** – UK, Ireland and France
7. **BC** – Baltic states (Estonia, Latvia and Lithuania)

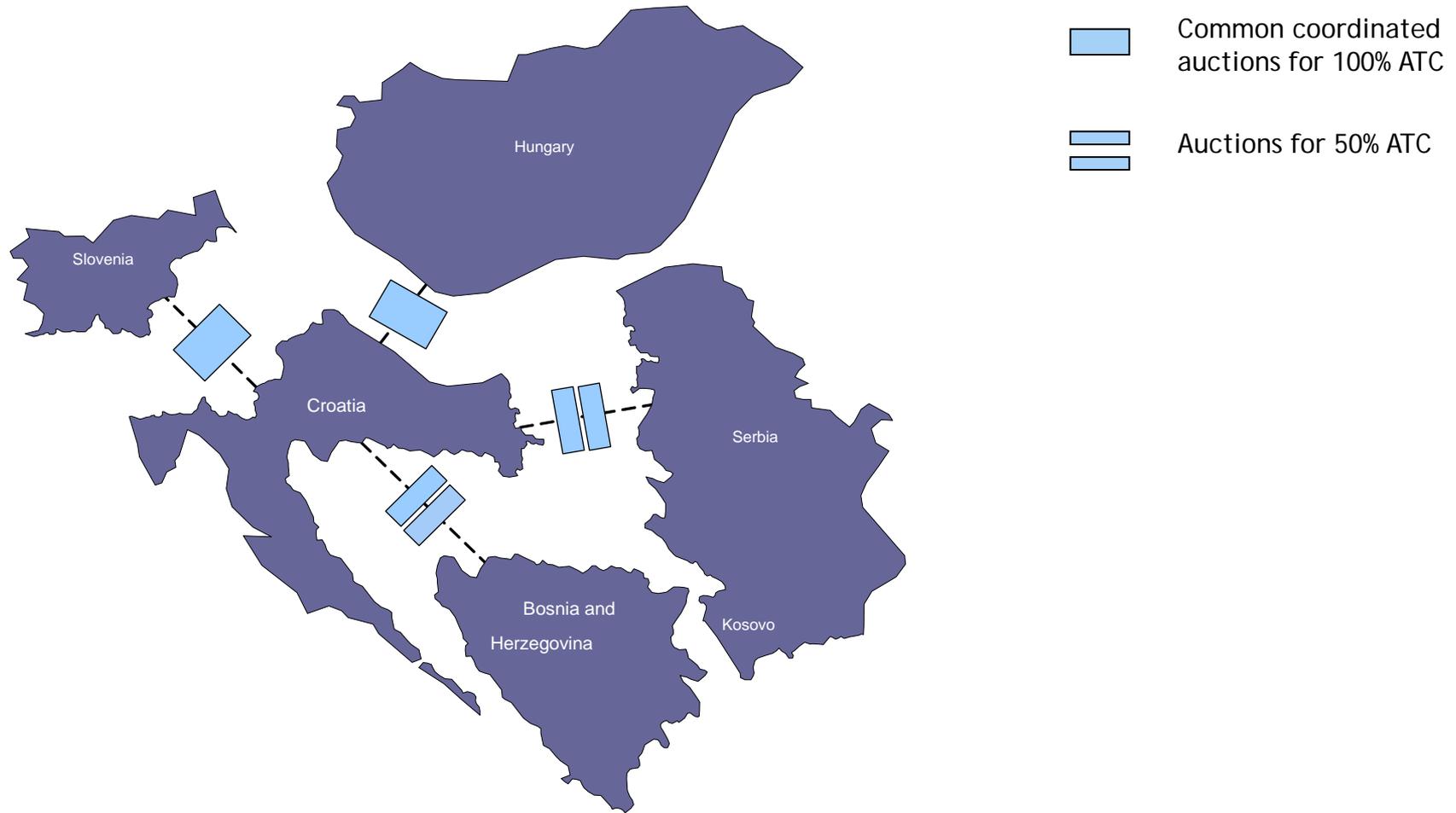




Allocation of cross-border capacities

(2/14)

Croatian borders





RS-HR and BA-HR borders

- Rules on allocation and use of cross-border transmission capacities
 - Yearly, monthly and daily auctions and intraday allocation of Croatian part of ATC-a on the border with Bosnia and Herzegovina
 - Yearly, monthly and daily auctions of Croatian part of ATC-a on the border with Serbia

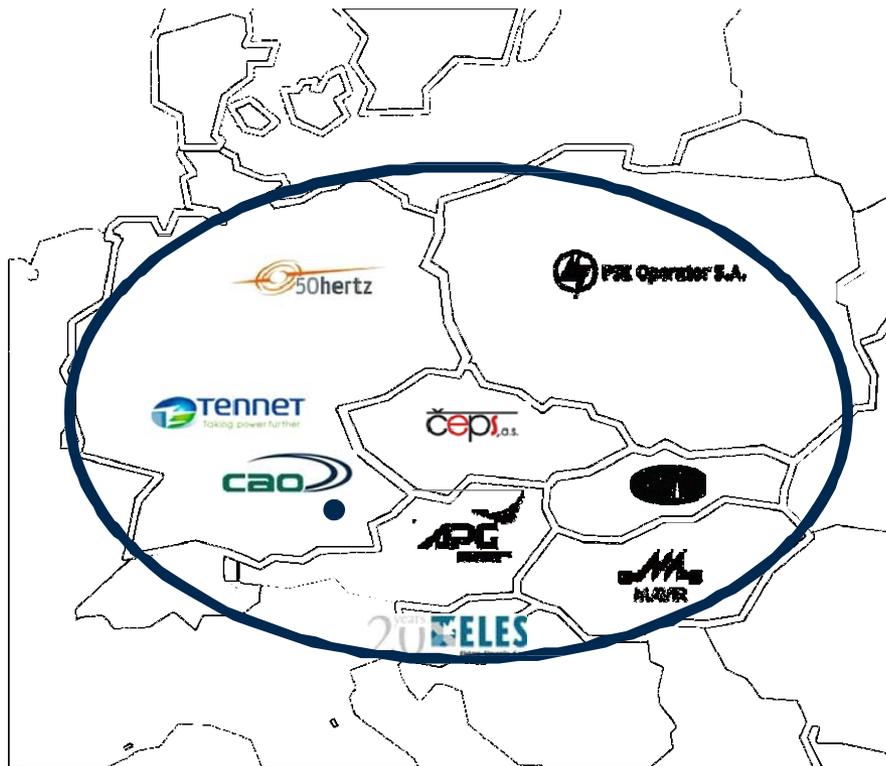


Allocation of cross-border capacities

(4/14)

HU-HR and SI-HR borders (CAO Freising)

- Annex 4: Rules for coordinated auction of transmission capacity on the HU-HR and SI-HR border for 2013
 - Yearly, monthly and daily auctions



CEE region



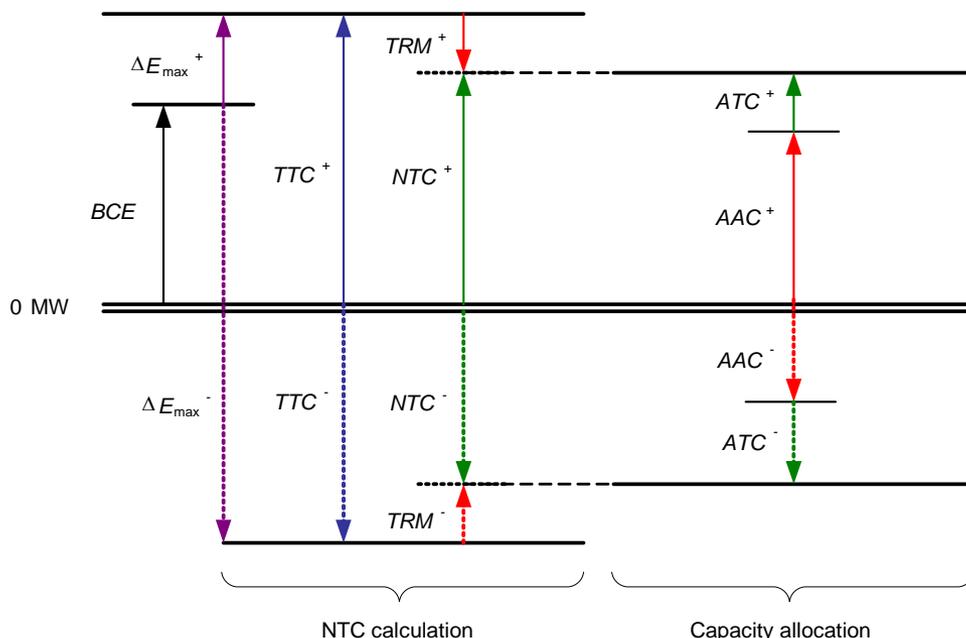
- Annex 5: Intraday Capacity Access Rules for 2013 between the control areas of ELES and HEP OPS
 - Intraday allocation for both directions SI-HR



Allocation of cross-border capacities

(6/14)

NTC calculation



$$NTC = TTC - TRM$$

$$NTC = \overbrace{BCE + \Delta E}^{TTC} - TRM$$

$$P_{new}^{inc} = P_i + \Delta E \frac{P_i^{max} - P_i}{\sum_{i=1}^n (P_i^{max} - P_i)}$$

$$P_{new}^{dec} = P_i + \Delta E \frac{P_i^{min} - P_i}{\sum_{i=1}^n (P_i^{min} - P_i)}$$

$$|\Delta E| \leq \left| \sum (P_i^{max} - P_i) \right|$$

$$|\Delta E| \geq \left| \sum (P_i^{min} - P_i) \right|$$

TSOs define values:

- BCE (Base Case Exchange)
- TRM (Transmission Reliability Margin)

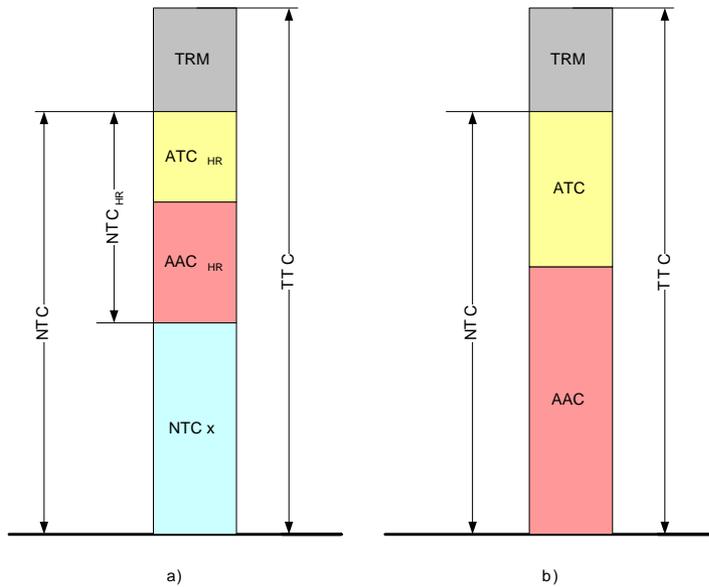
n-1 criterion



Allocation of cross-border capacities

(7/14)

NTC calculation



a) Unilateral auctions
(BA - Bosnia and Herzegovina, RS - Serbia)

b) Bilateral auctions
(HU - Hungary, SI - Slovenia)



Allocation of cross-border capacities

(8/14)

NTC calculation

Typical monthly values of BCE for HR borders (MW)

To / From	BA	RS	HU	SI
HR	-130	-150	-620	100

Adjacent TSOs calculate NTC values independently.
As a rule, lower NTC is accepted.

HR TSO calculates yearly and monthly values of the NTC.

- Yearly auctions are based on yearly NTC
- Monthly, daily and intraday auctions are based on monthly NTC



Allocation of cross-border capacities

(9/14)

Types of auctions

Freq. Border	Yearly	Monthly	Daily	Intraday
Slovenia	+	+	+	+
Hungary	+	+	+	-
Serbia	+	+	+	-
Bosnia and Herzegovina	+	+	+	+

-  Coordinated (CAO Freising)
-  Bilateral (SI TSO)
-  Unilateral (HR TSO)
-  No auctions



Allocation of cross-border capacities

(10/14)

Use of allocated capacities

The terms of use (nomination) of allocated transmission capacities within the Croatian electricity system are the following:

- obtaining **licence** for energy activity
- signing contract on balancing energy with TSO (HEP-OPS)
- obtaining the EIC code from the Croatian issuing office
- signing agreement regulating mutual relations with Croatian energy market operator



Allocation of cross-border capacities (11/14)

Use of allocated capacities

The use of transmission capacity is registered to HEP-OPS within the following deadlines:

- use of yearly and monthly transmission capacity at the borders with BIH and Serbia – by 9:45 of the D-1 (the trading day)
- use of yearly and monthly transmission capacity on Croatian-Hungarian and Croatian-Slovenian border – by 17:00 of the D-2
- use of the daily transmission capacity on all borders is registered in the trading day not later than the deadline for contracted schedules delivery in accordance with the Electricity market rules



Allocation of cross-border capacities

(12/14)

Total NTC values in 2011 and 2012

Average winter and summer total NTC values [MW]

Winter values						Summer values					
Direction			2011	2012	Change	Direction			2011	2012	Change
HR	←	BA	667	677	1%	HR	←	BA	658	650	-1%
HR	→	BA	445	520	17%	HR	→	BA	452	542	20%
HR	←	SI	967	1161	20%	HR	←	SI	983	1117	14%
HR	→	SI	900	933	4%	HR	→	SI	900	983	9%
HR	←	RS	392	418	7%	HR	←	RS	361	343	-5%
HR	→	RS	433	449	4%	HR	→	RS	422	392	-7%
HR	←	HU	1075	1183	10%	HR	←	HU	1075	1150	7%
HR	→	HU	750	1000	33%	HR	→	HU	700	950	36%
Import			3101	3439	11%	Import			3077	3259	6%
Export			2528	2902	15%	Export			2474	2867	16%

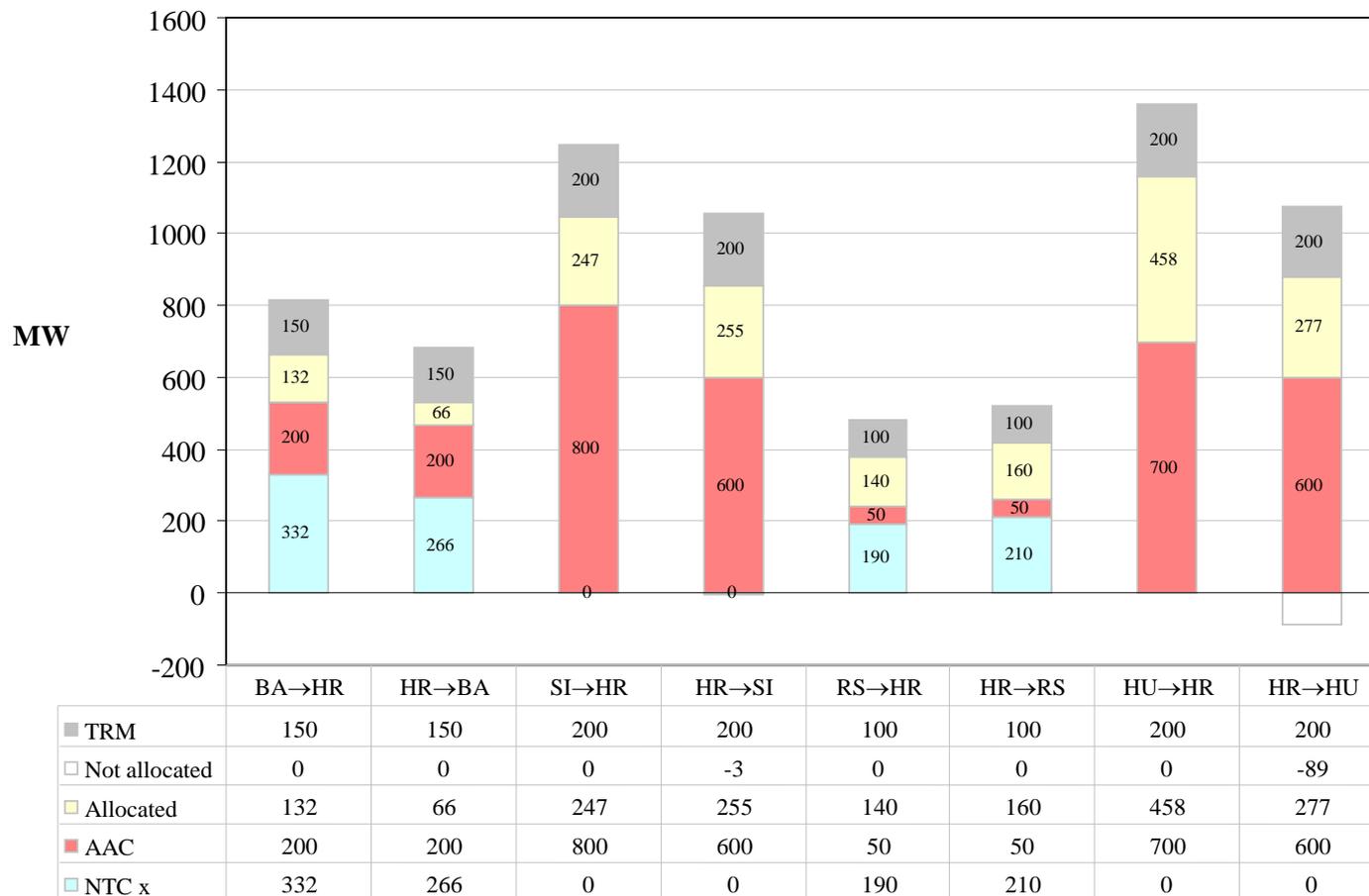


Allocation of cross-border capacities

(13/14)

Capacity values in 2012

Average monthly values of capacities





Allocation of cross-border capacities

(14/14)

Yearly capacity and revenue values in 2012

NTC, allocated capacities and revenues of the yearly auction

Direction			NTC [MW]	NTC _{HR} [MW]	TRM [MW]	Number of participants	Number of participants whose bids were accepted	Allocated [MW]	HEP-OPS revenue [€]
HR	←	BA	400	200	150	10	2	200	1.317.280
HR	→	BA	400	200	150	10	7	200	386.427
HR	←	SI	800	800	200	9	7	800	1.013.333
HR	→	SI	600	600	200	9	5	600	1.078.938
HR	←	RS	100	50	100	10	3	50	164.380
HR	→	RS	100	50	100	10	4	50	315.440
HR	←	HU	700	700	200	11	7	700	1.379.793
HR	→	HU	600	600	200	11	8	600	208.004
									5.863.595



Allocation of cross-border capacities: Croatian experience

Thank you for your attention!

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