

The Electric Power System

- Croatia -

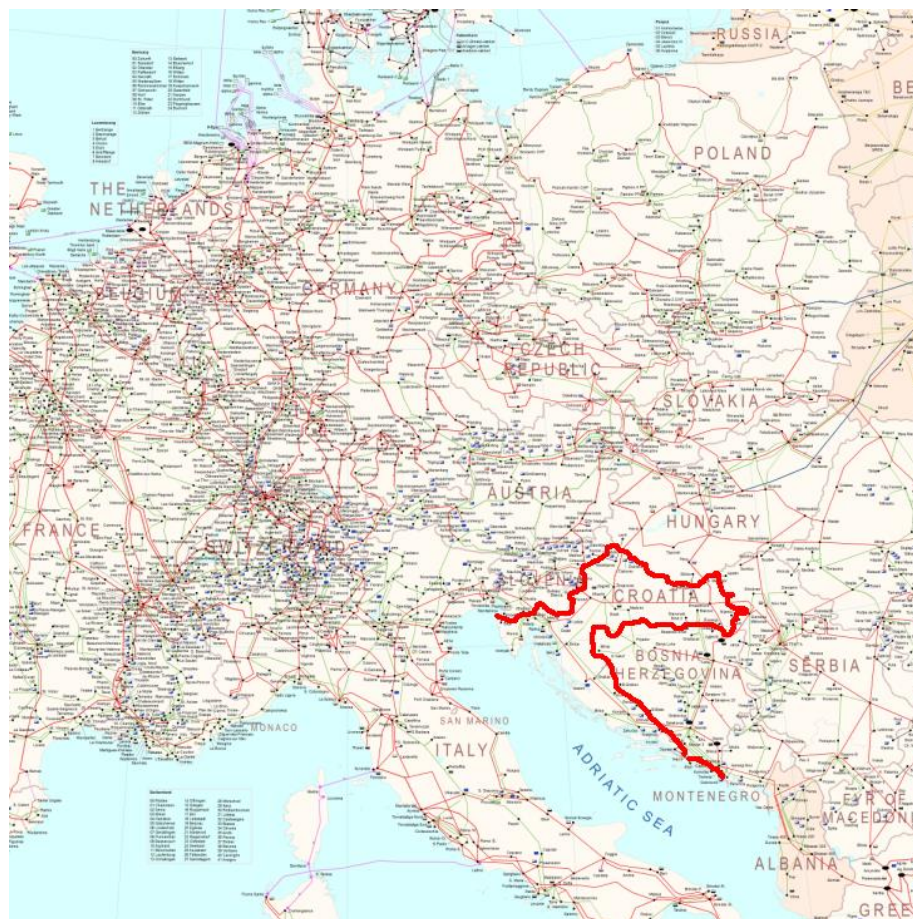
Basic facts

- ☐ Area: 56 594 km²
- ☐ Population: 4 284 889 (census 2011)
- ☐ Number of electricity consumers: *“There are more than 2.3 million electricity customers and/or metering points in Croatia.”* (www.hep.hr)
- ☐ Number of TSOs: 1
- ☐ Number of DSOs: 1 DSO (21 distribution area)
- ☐ Peak load: 3193 MW
- ☐ Average interruption of electricity (2014): 60.3 min/interruption

Global map of the grid and of its interconnections

□ Interconnectors with:

- Bosnia and Herzegovina;
- Slovenia;
- Serbia;
- Hungary.

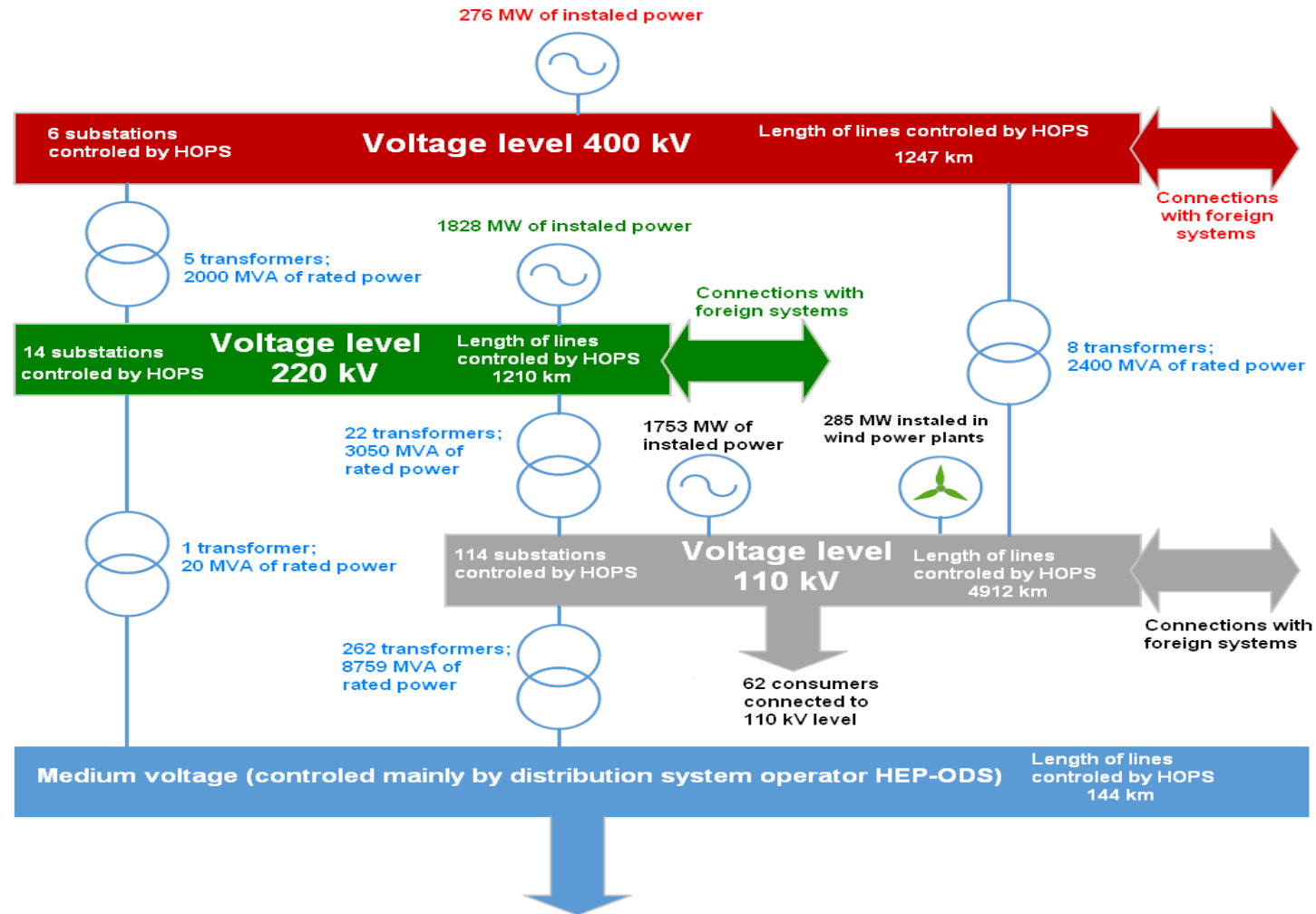


Grid facts and characteristics

Substations			Lines	
Voltage level	Number	MVA	Voltage	Total length [km]
400/x kV	6	4.400	400 kV	1.247
220/x kV	13	3.070	220 kV	1.210
110/x kV	114	8.759	110 kV	4.912
Total	163	16.229	Medium voltage	144
			Total	7.513

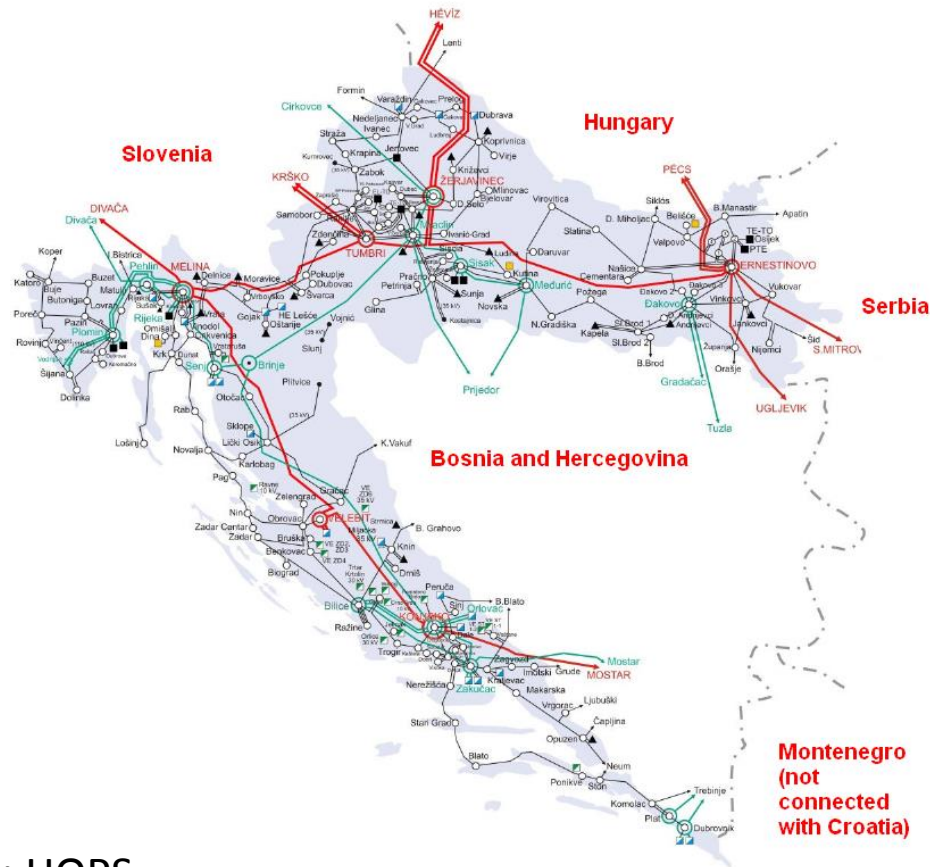
Source: HOPS

Updated on 11th March 2015



Technical indicators of Croatian power system according to voltage levels
(situation at the end of 2014; source: HOPS)

Map of the high voltage grid



Source: HOPS

Information on TSO

- ☐ Name: Hrvatski operator prijenosnog sustava (HOPS)
- ☐ Network length 7513 km
- ☐ Served area 56 594 km²
- ☐ Annual transmitted energy (in 2014) 22.4 TWh
- ☐ website: <http://www.hops.hr>

Cooperation of TSO and DSOs

□ Transmission and distribution

Hrvatski operator prijenosnog sustava d.o.o. (HOPS - Croatian Transmission System Operator) and HEP Operator distribucijskog sustava d.o.o. (HEP ODS - Distribution System Operator) are providers of public services of electricity transmission and distribution, respectively, for the needs of participants in the Croatian market.

Scope of HOPS and HEP ODS cooperation is defined by a national legislative, and corresponding agreements and contracts between two system operators.

Responsibilities of TSO

- ☐ Transmission of electricity generated in power plants connected to transmission grid or imported from adjacent power systems, at least cost while maintaining electricity quality standards and safety of the power system at the highest possible level,
- ☐ Control, maintenance and development of high voltage grid.

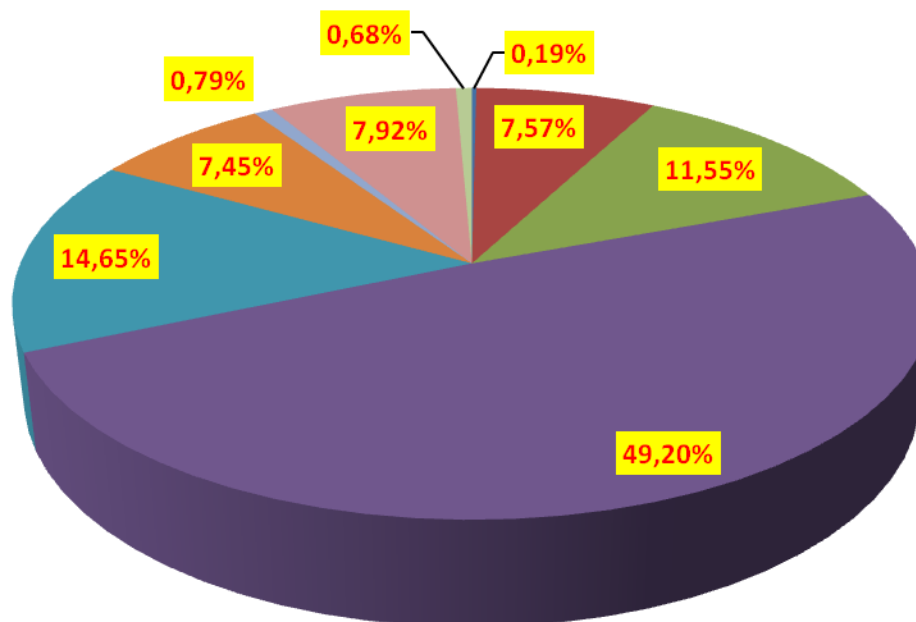
Responsibilities of DSO

- ☐ Distribution of electricity generated in power plants connected to distribution grid or delivered from transmission grid, at least cost while maintaining electricity quality standards and safety of the power system at the highest possible level,
- ☐ Control, maintenance and development of medium and low voltage grids.

Power structure of the country

Percentage of installed capacities of the plants for electricity production

■ Biomass ■ Coal ■ Gas ■ Hydro power ■ Mixed (gas and oil) ■ Oil ■ Solar power ■ Wind power ■ Others

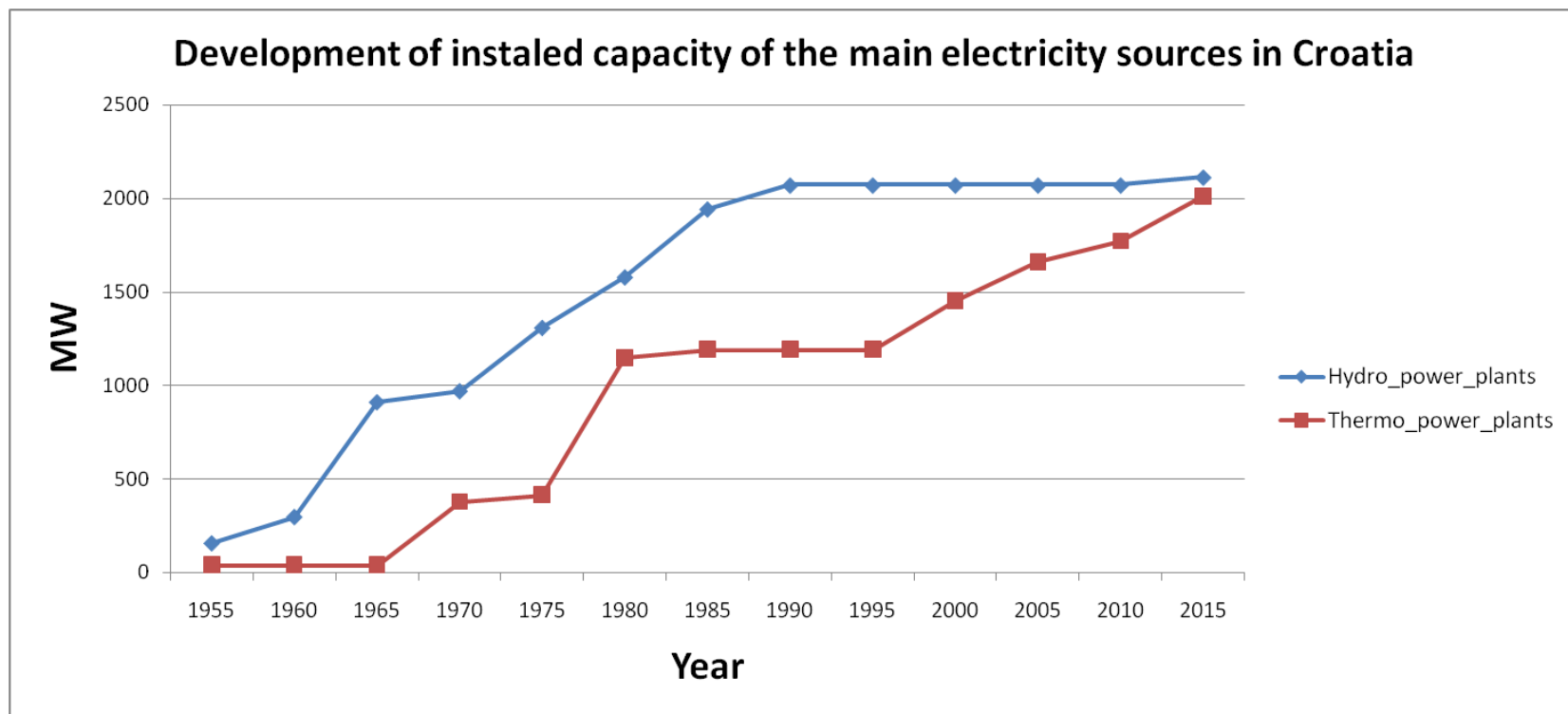


Energy production with reference to primary resources

□ Electricity generated (TWh), year 2014

Nr.	Primary Source	Installed capacity (GW)	Electricity generated (TWh)
1.	Biomass	0.008	0.05
2.	Coal	0.325	2.137
3.	Gas	0.496	0.444
4.	Hydro power	2.112	8.326
5.	Mixed (gas and oil)	0.629	0.346
6.	Oil	0.32	0
7.	Solar power	0.034	0.035
8.	Wind power	0.34	0.73
9.	Others	0.029	0.114
10.	Total	4.293	12.182

Development of generation capacity since 1955



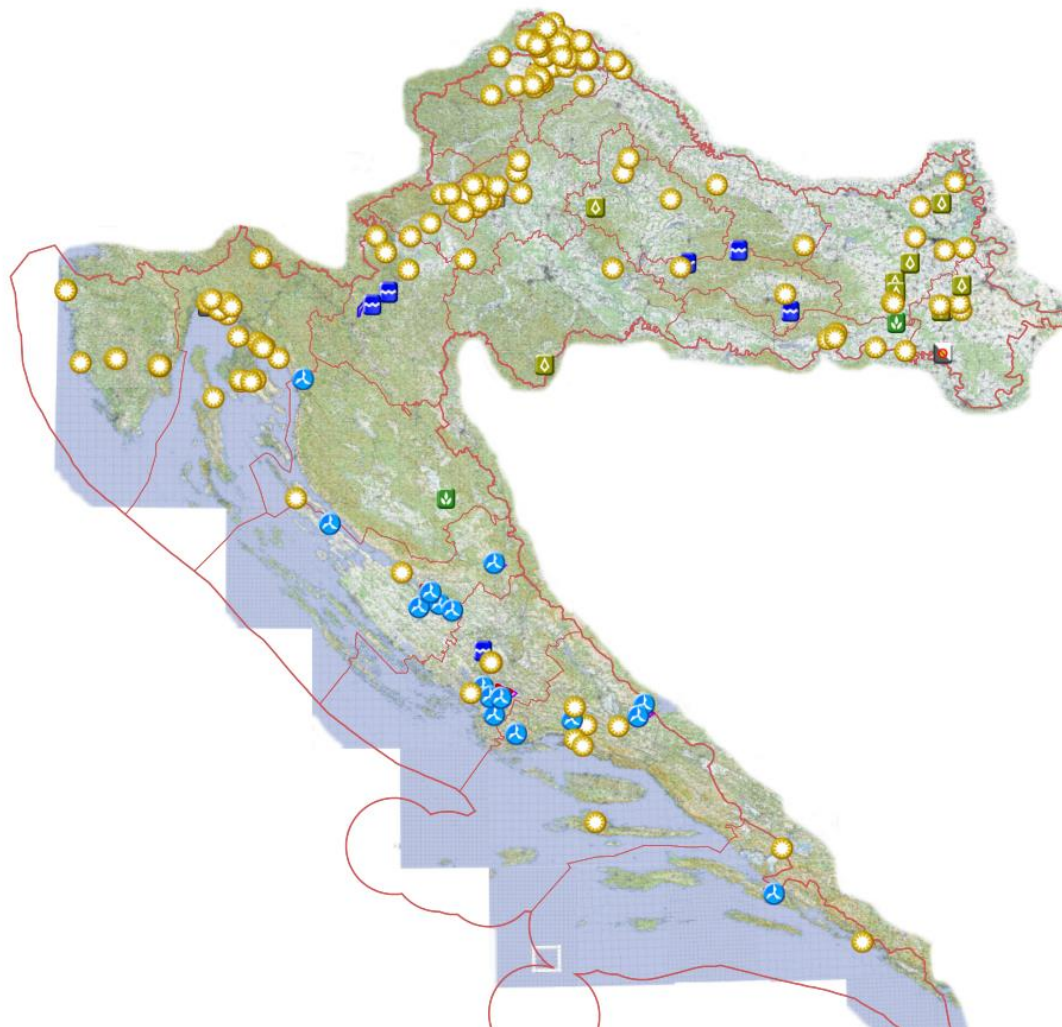
Consumption per customer groups

- Electricity consumption classes and indicative peak power for the consumers from the category "Entrepreneurship" in accordance with EUROSTAT

Nr.	Electricity consumption class	Minimal consumption [MWh/year]	Maximal consumption [MWh/year]	Lowest value [kW]	Highest value [kW]	Entrepreneurship - Total values	
						Consumption (%)	Number (%)
1.	Ia	–	<20	5	20	9.7	79.4
2.	Ib	20	<500	10	350	29.5	19.3
3.	Ic	500	<2 000	200	1 500	11.6	0.7
4.	Id	2 000	<20 000	800	10 000	21.7	0.5
5.	Ie	20 000	<70 000	5 000	25 000	20.7	0.1
6.	If	70 000	<=150 000	15 000	50 000	6.8	0.0
Source: HEP-ODS and HOPS							

Location of renewable energy sources

Solar power plant		
Hydro power plant		
Wind power plant		
Biomass power plant		
Geothermal power plant		
Biogas powerplant		
Liquid biofuel power plants		
Landfill gas power plant and gas from the plant		
wastewater treatment		
Cogenerations		
Other		

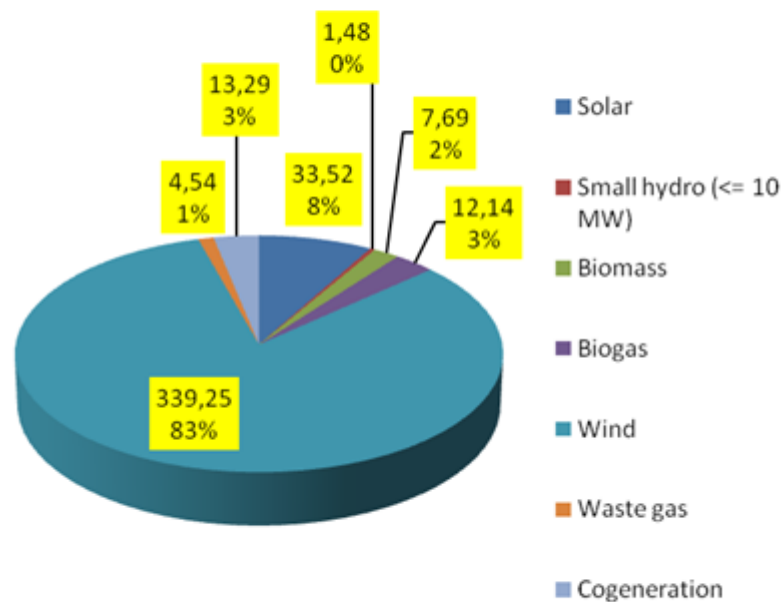


Source: Ministry of economy

Data about renewable energy sources

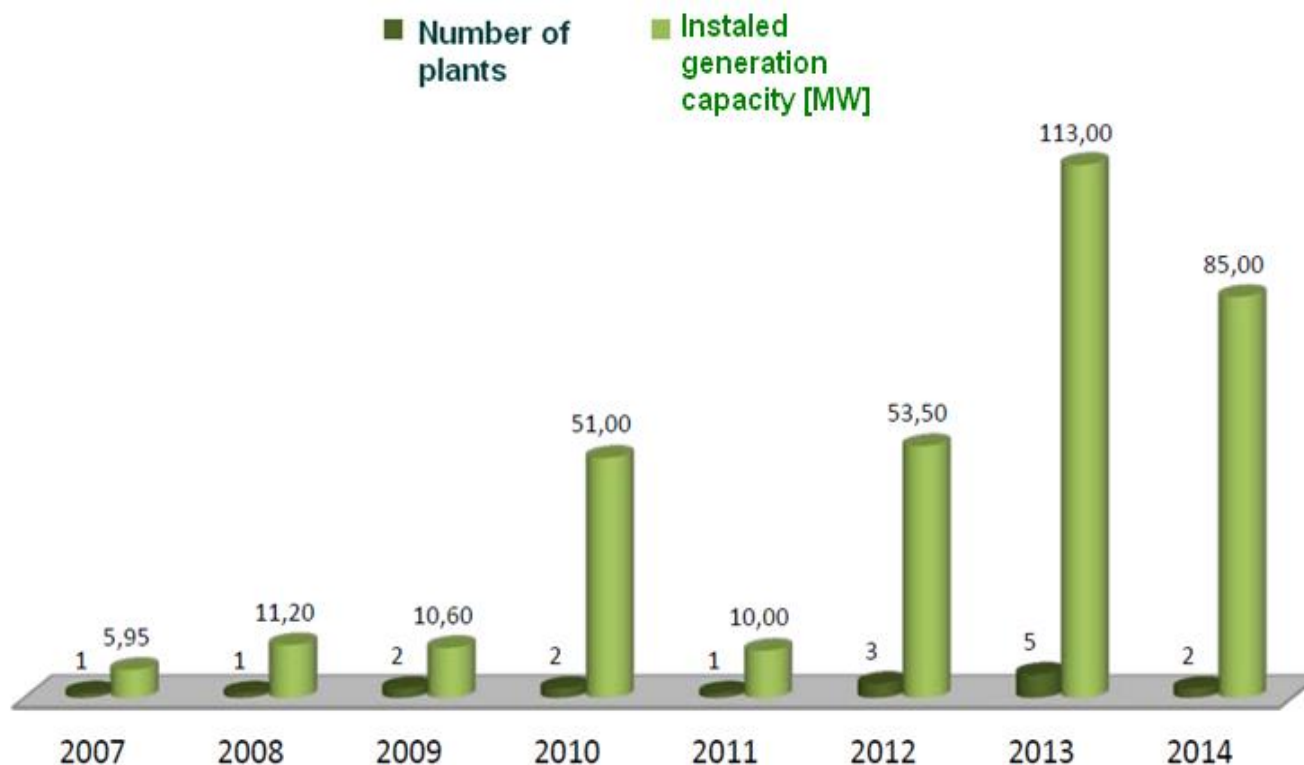
Nr.	Technology	Number of plants	Installed power (MW)
1.	Solar	1022	33,52
2.	Small hydro (<= 10 MW)	6	1,48
3.	Biomass	4	7,69
4.	Biogas	12	12,14
5.	Wind	16	339,25
6.	Waste gas	2	4,54
7.	Cogeneration	5	13,29
8.	Total	1067	411,90

Instaled capacity (MW) of RES and cogeneration in Croatia



Source: HROTE

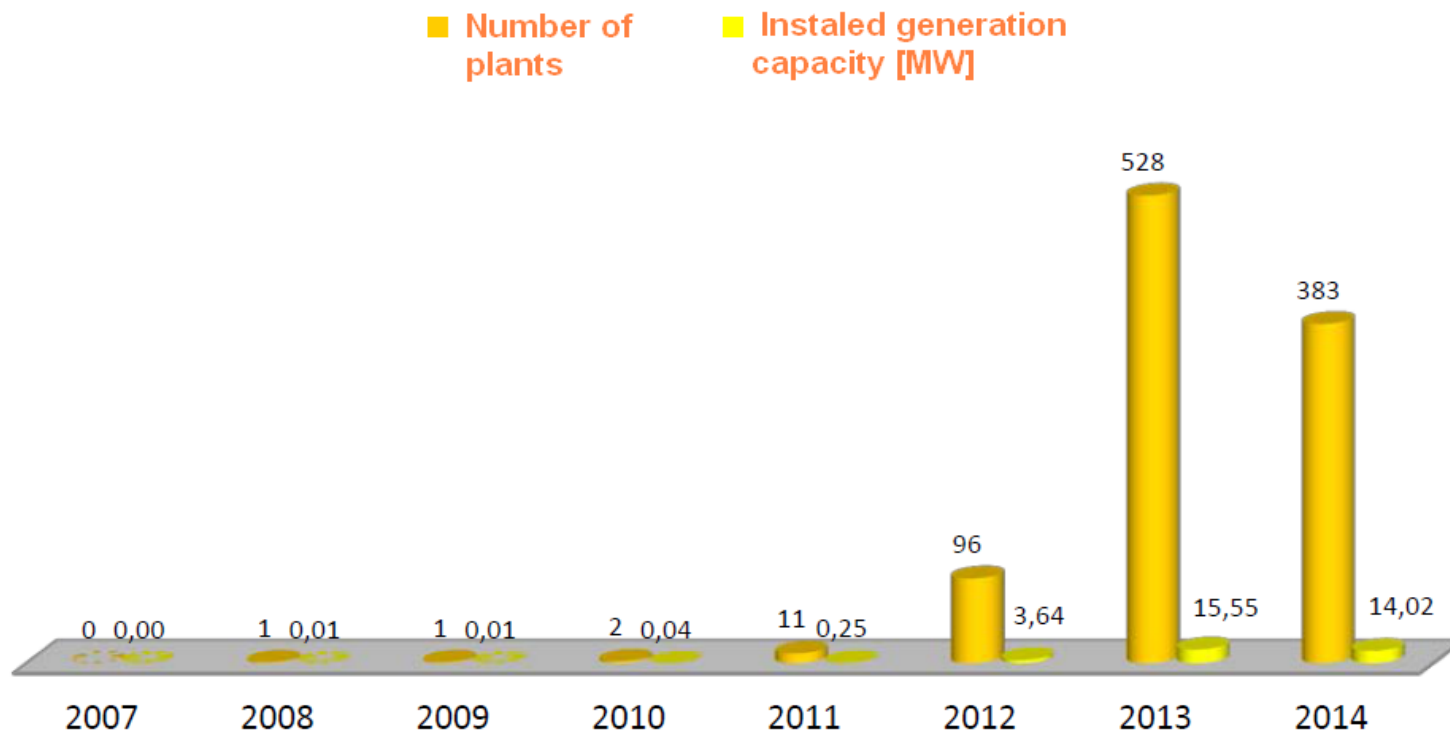
Development of wind power



Number of plants and installed generation capacity of wind power plants in particular year

Source: HROTE

Development of photovoltaic power



Number of plants and installed generation capacity of solar power plants in particular year

Source: HROTE

RES installed capacity and production 2014

□ Energy produced by particular technologies in 2014 (Source: HROTE)

Nr.	Month	Wind power plants	Hydro power plants (<= 10 MW)	Solar power plants	Biogas power plants	Biomass power plants	Waste gas power plants	Mikro-cogeneration (<= 50kW)	Small cogeneration (from 50 kW to 1 MW)	Medium cogeneration (from 1 MW to 35 MW)	Total (GWh)
1.	January	62,89	0,68	0,72	7,45	3,70	0,00	0,00	0,35	0,00	75,80
2.	February	69,98	0,67	1,17	6,65	3,93	0,00	0,01	0,39	0,00	82,79
3.	March	60,25	0,76	2,91	7,45	3,96	0,44	0,00	0,38	0,00	76,17
4.	April	48,68	0,72	3,31	7,29	4,07	1,09	0,01	0,35	0,00	65,51
5.	May	36,96	0,86	4,54	7,11	4,29	1,32	0,01	0,32	0,00	55,41
6.	June	41,81	0,77	4,85	7,10	4,36	1,27	0,00	0,23	0,50	60,88
7.	July	76,04	0,75	4,83	7,46	4,40	0,98	0,00	0,28	0,36	95,09
8.	August	38,32	0,76	4,52	7,53	3,65	1,19	0,00	0,20	0,29	56,45
9.	September	46,65	0,72	2,90	6,87	4,39	1,24	0,00	0,21	0,38	63,37
10.	October	51,01	0,77	2,52	7,96	4,56	1,31	0,00	0,29	0,34	68,76
11.	November	67,40	0,75	1,56	7,47	4,47	1,17	0,01	0,29	0,29	83,41
12.	December	129,99	0,80	1,35	7,57	4,36	1,00	0,01	0,27	0,25	145,61
13.	Total for 2014	729,97	9,01	35,17	87,93	50,16	11,00	0,04	3,56	2,42	929,26



Price development for households and industry consumers (“entrepreneurship”)

Average electricity prices for terminal consumers (kn/ kWh) (exchange rate: 1 € ≈ 7.5 kn)

Category of terminal consumer	Year						
	2008	2009	2010	2011	2012	2013	2014
Consumers at medium voltage	0.49	0.58	0.58	0.58	0.61	0.60	0.58
Consumers at low voltage (<i>Entrepreneurship</i>)	0.64	0.72	0.74	0.73	0.79	0.78	0.75
Consumers at low voltage (<i>Households</i>)	0.64	0.70	0.70	0.70	0.78	0.82	0.79

Source: HEP-ODS

Electricity market organisation (part 1)

- ❑ The framework for performing energy activities in the electricity market is established by energy related acts, while secondary legislation elaborates legal provisions.

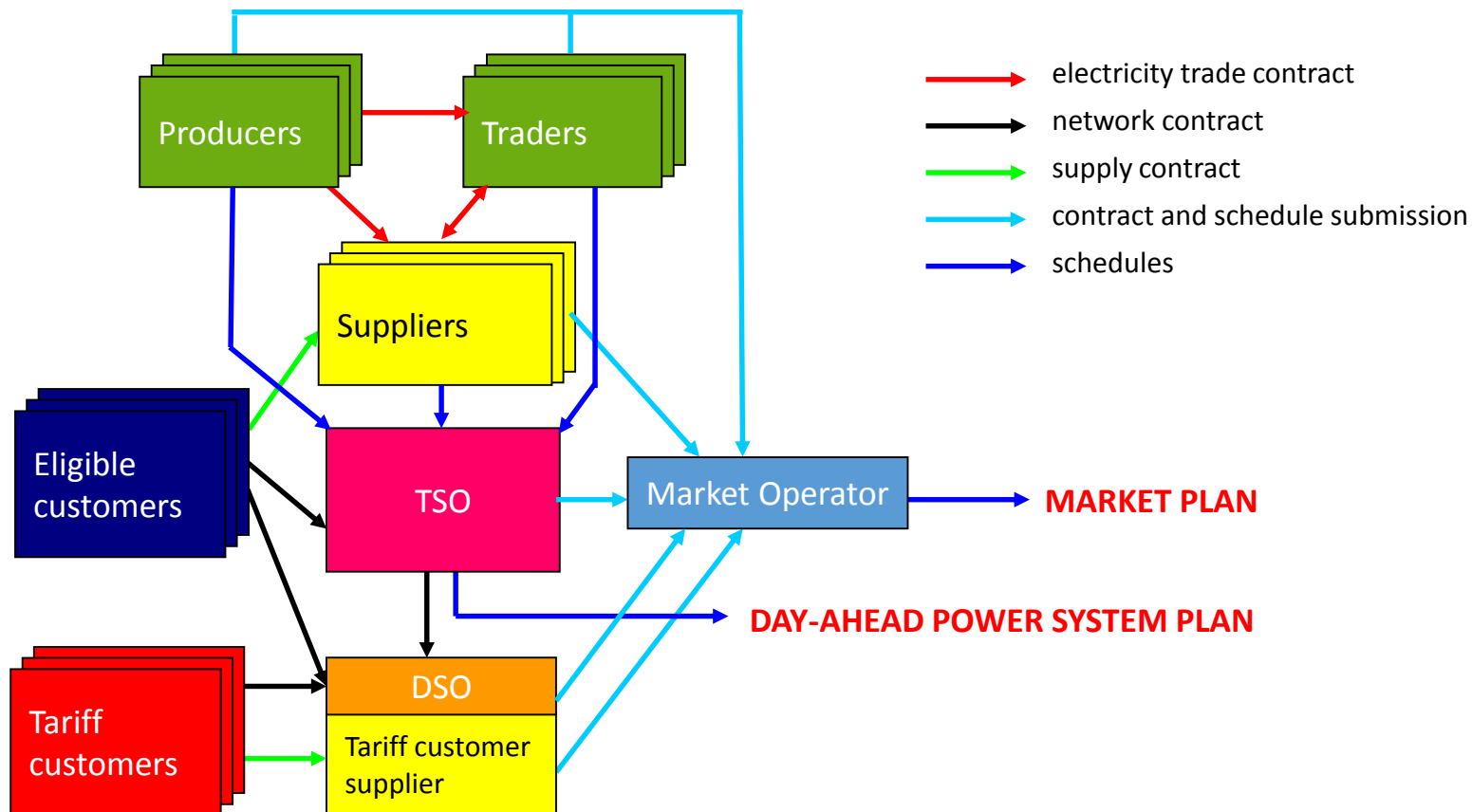
In Croatia we distinguish:

1° public service obligation of tariff customers' electricity supply,
2° electricity market.

- ❑ According to the Electricity Market Act, tariff customers are supplied by the energy entity having public service obligation of tariff customers' electricity supply. This task is performed by HEP Group. Electricity prices for tariff customers are regulated by the Energy Act and the Tariff System for Energy Activities Performed as Public Services. The number of tariff customers shall decrease by gradual market opening.

(Source: HROTE)

Electricity market organisation (part 2)



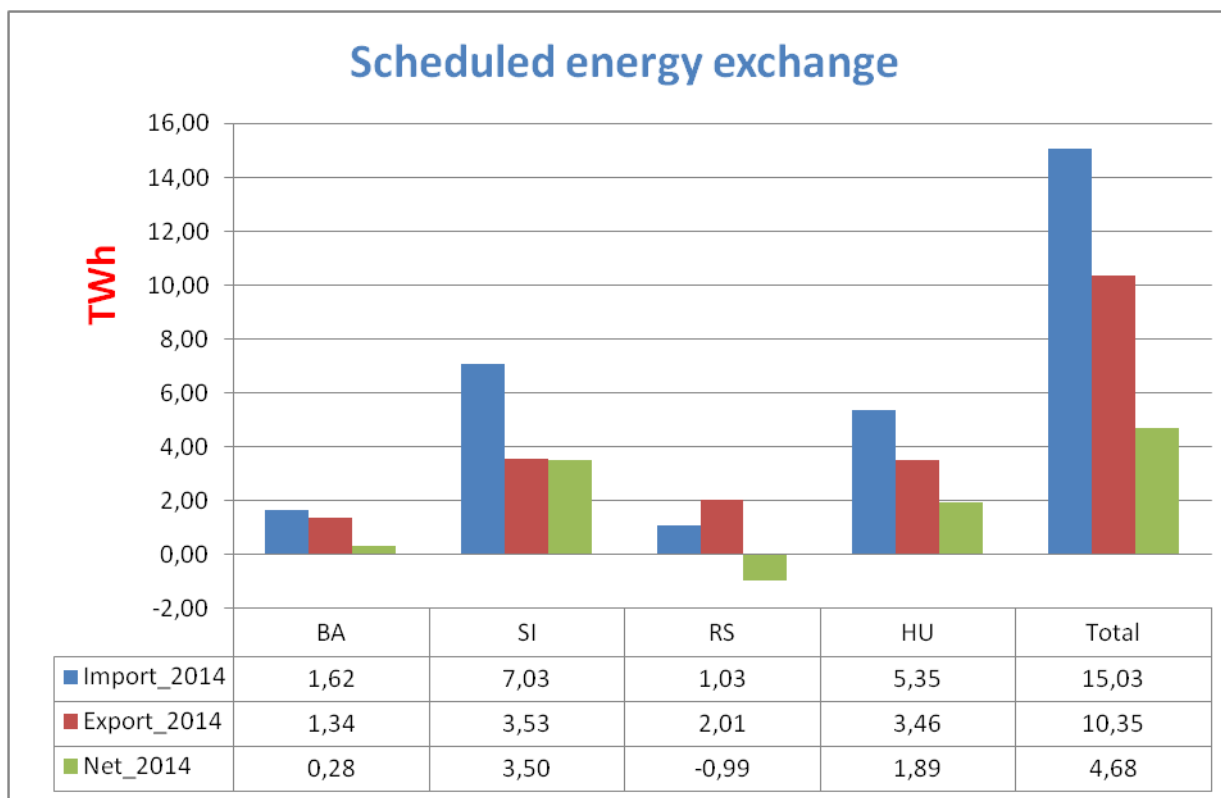
Power balance in 2014

- ☐ Generation (TWh)
- ☐ Consumption (TWh)
- ☐ Imports (TWh)
- ☐ Exports (TWh)
- ☐ Losses (TWh)

Nr.	Electricity balance	Energy (GWh)
1.	Total generation	12 192
2.	Import	10 899
3.	Total supply (1. + 2.)	23 091
4.	Export	6 227
5.	Physical net import (2. – 4.)	4 672
6.	Total consumption (3. – 4.)	16 864
7.	Supply from distribution network	544
8.	Losses	430
9.	Consumption of transmission network (6. – 7. – 8.)	15 890
10.	Delivery to the terminal consumers at high voltage (110 kV)	746
11.	Pumps and other own consumption	171
12.	Delivery to distribution network from transmission network (9. – 10. – 11.)	14 973
13.	Transit (min (2. , 4.))	6 227

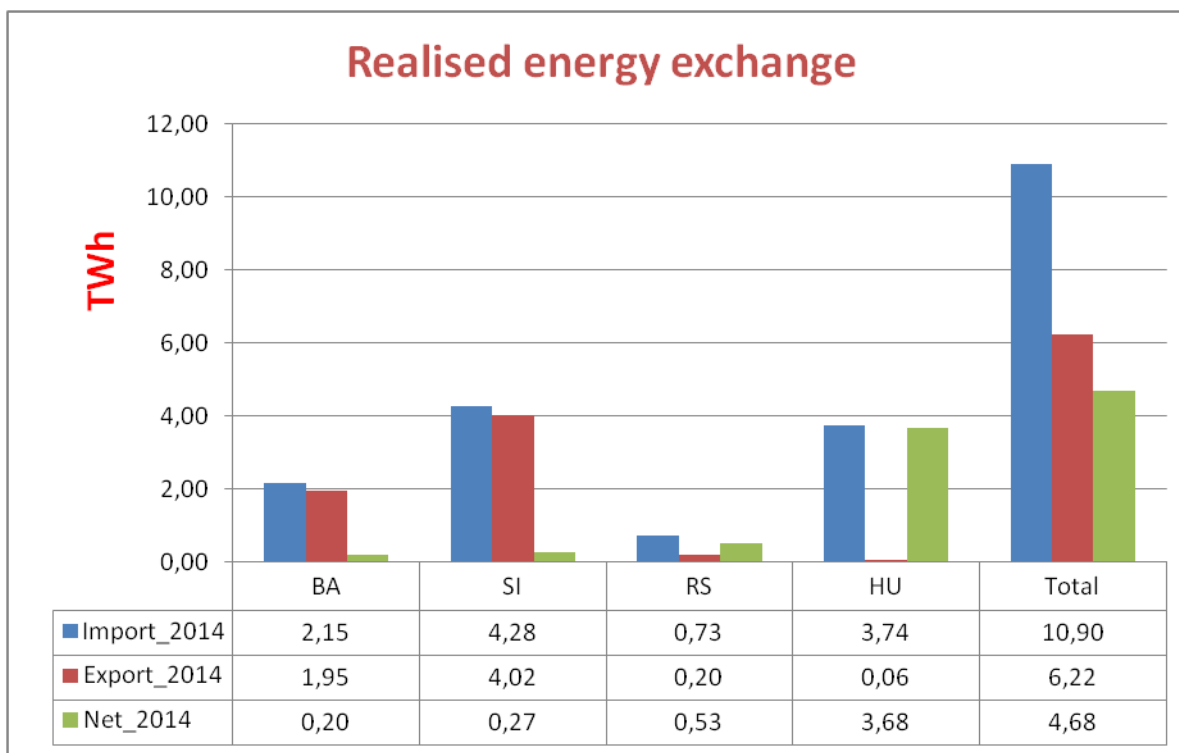
Energy exchanges in 2014

Commercial flows



Energy exchanges in 2014

Physical flows



Specific aspects of the electricity market

- ❑ Bilateral Day-ahead and Intraday Market
- ❑ Coordinated Cross-border capacity allocation:
 - HR-SI and HR-HU border: JAO (Joint Allocation Office) Luxembourg
 - HR-BA: SEE CAO (South East Europe Coordinated Auction Office) Podgorica, Montenegro
 - HR-RS: bilaterally organized by HOPS and EMS, TSOs in Croatia and Serbia, as allocation offices
- ❑ Power Exchange established in 2015
 - Operational from December 2015
- ❑ Market coupling to be introduced in the Q2/2016

