



The Electric Power system

Croatia



cigre

For power system expertise

Power system of Croatia

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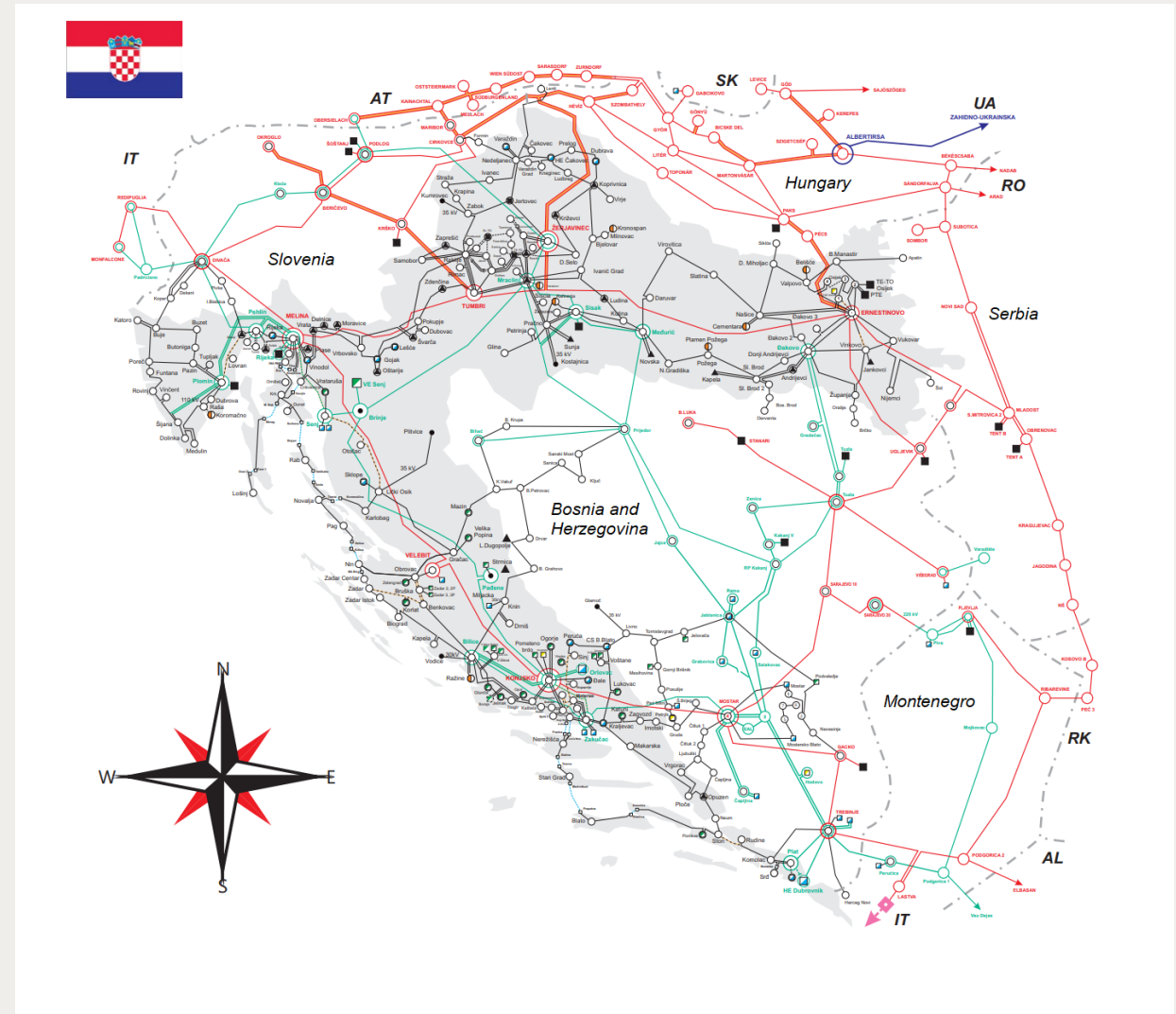


Basic facts

- Area: 56 594 km²
- Population: around 3.9 million
- Number of electricity consumers: around 2.5 million
- Number of TSOs: 1
- Number of DSOs: 1
- Peak load: 3363 MW (July 2024)
- Average interruption of electricity (2024): 85 min/interruption

Global map of the grid and of its interconnections

- Interconnectors with:
 - *Bosnia and Herzegovina;*
 - *Hungary;*
 - *Serbia;*
 - *Slovenia.*



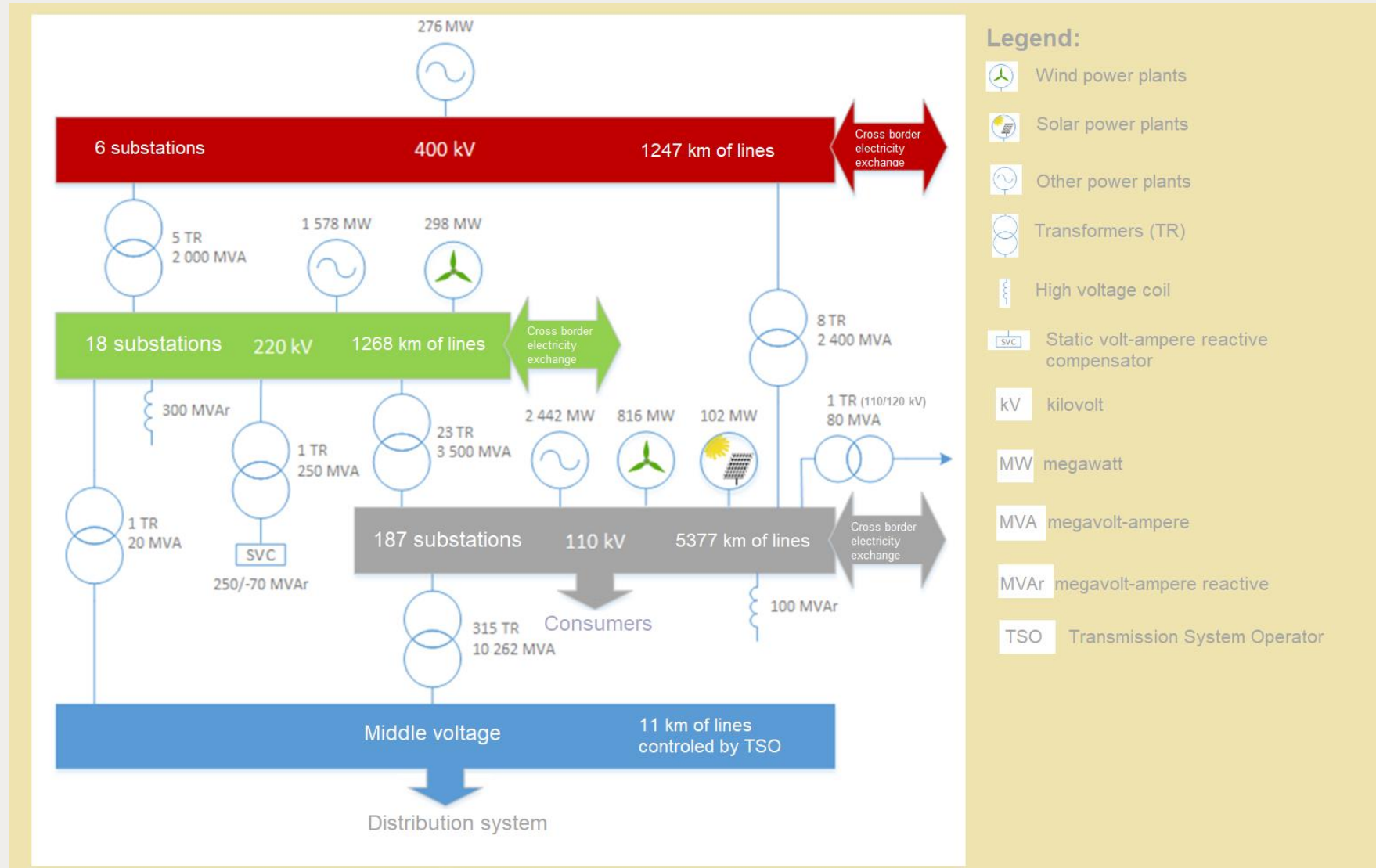
Grid facts and characteristics

- Transmission network (part of network operated by TSO)

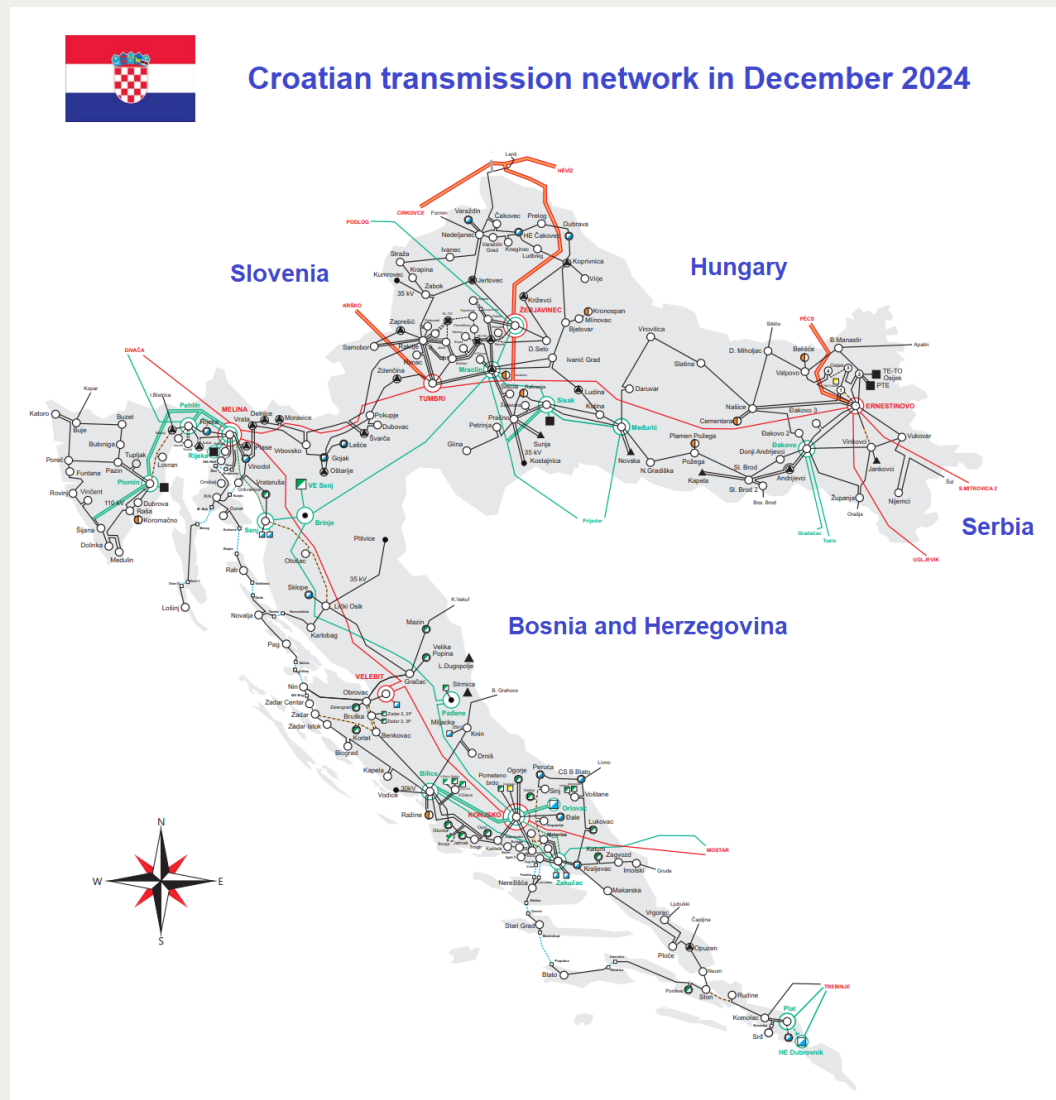
Substations	Voltage ratio	Number of substations	Installed capacity of power transformers (MVA)
	400/x kV	6	4400
	220/x kV	18	3770
	110/x kV	187	10262
	All ratios	211	18432

Lines	Voltage level	Length (km)
	400 kV	1247
	220 kV	1268
	110 kV	5377
	Under 110 kV	11
	All levels	7903

Structure of electrical power system



Map of the high voltage grid



Legend:

- | | |
|--|--|
| 400 kV double OHL | substation 400/220/110 kV |
| 400 kV OHL | substation 400/110 kV |
| 220 kV double OHL | substation 220/110 kV |
| 220 kV OHL | substation 220/35 kV |
| 220 kV planned OHL | substation 110/x kV |
| 110 kV OHL | substation (switchyard) 110 kV + railway traction substation |
| 110 kV cable | substation 110/x kV under construction |
| 110 kV underwater cable | substation 35/x kV |
| substation (switchyard) 220 kV + thermal power plant | railway traction substation |
| substation (switchyard) 220 kV + hydro power plant | thermal power plant |
| substation (switchyard) 110 kV + wind power plant | hydro power plant |
| substation (switchyard) 110 kV + hydro power plant | wind power plant |
| substation (switchyard) 110 kV + thermal power plant | |
| substation (switchyard) 110 kV of customer | |
| 110 kV cable station | |

Information on TSO(s)

- Name: Hrvatski operator prijenosnog sustava d.d.
- Network length (km): around 7900 km
- Served area (km²): 56 594
- Annual transmitted energy (TWh): 24.6 TWh in 2023, 25.2 TWh in 2024
- website: <http://www.hops.hr>



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Headquarters: Croatia, Zagreb, Kupska 4

Date of incorporation: 2nd July 2013

Registration: Electricity Transmission Activity

Number of employees: around 1200

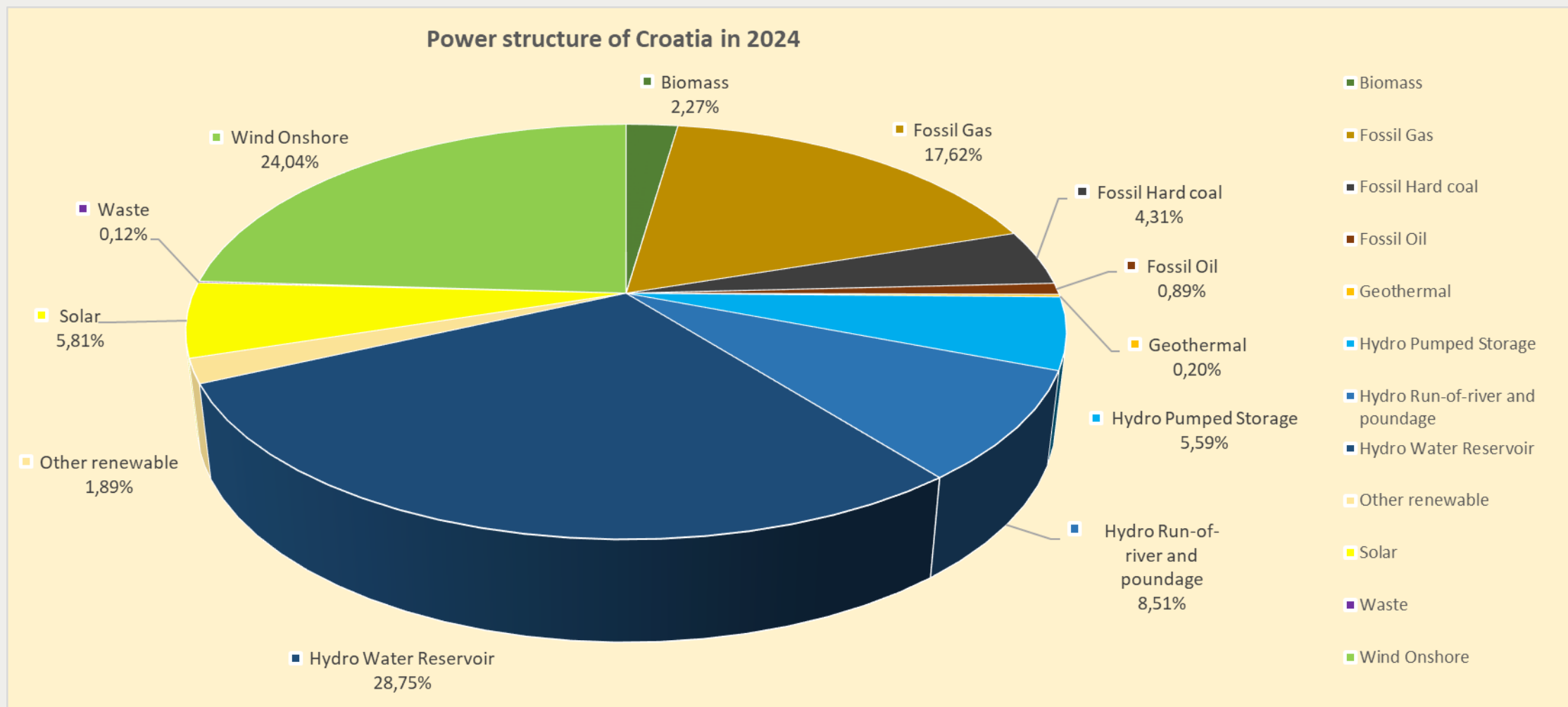
Cooperation of TSO and DSO

- Hrvatski operator prijenosnog sustava d.d. (HOPS - Croatian Transmission System Operator Plc.) 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 & DSO

- 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
 - Safe supply to customers. 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 / countries



Installed capacity with reference to primary resources

Nr.	Primary resource	Installed capacity in 2024 (GW)
1.	Biomass	0.11
2.	Fossil Gas	0.89
3.	Fossil Hard coal	0.22
4.	Fossil Oil	0.05
5.	Geothermal	0.01
6.	Hydropower	2.16
7.	Others	0.10
8.	Solar power	0.29
9.	Waste	0.01
10.	Wind power	1.21

Energy production with reference to primary resources

Nr.	Primary resource	Energy production in 2024 (TWh)
1.	Biomass	0.61
2.	Fossil Gas	2.88
3.	Fossil Hard coal	0.73
4.	Fossil Oil	0.00
5.	Geothermal	0.00
6.	Hydropower	6.04
7.	Others	0.32
8.	Solar power	0.24
9.	Waste	0.02
10.	Wind power	2.62

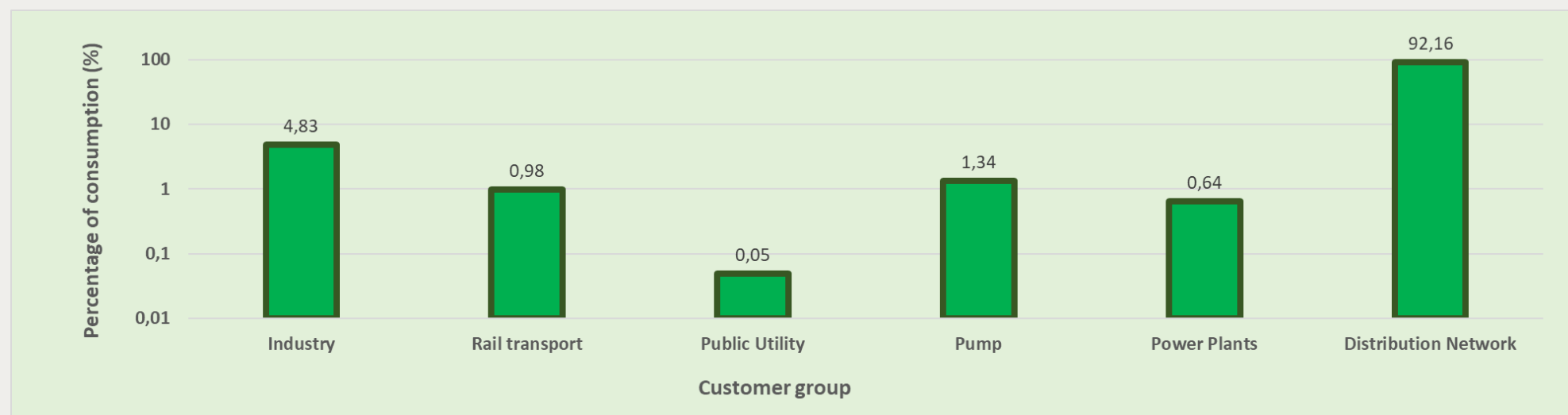
Development of generation capacity

Nr.	Primary resource	Generation capacity in particular year (GW)				
		2020	2021	2022	2023	2024
1.	Biomass	0.09	0.11	0.11	0.11	0.11
2.	Fossil Gas	0.74	0.74	0.75	0.77	0.89
3.	Fossil Hard coal	0.33	0.22	0.22	0.22	0.22
4.	Fossil Oil	0.94	0.08	0.08	0.05	0.05
5.	Geothermal	0.01	0.01	0.01	0.01	0.01
6.	Hydro Pumped Storage	0.28	0.28	0.28	0.28	0.28
7.	Hydro Run-of-river and poundage	0.42	0.43	0.43	0.43	0.43
8.	Hydro Water Reservoir	1.44	1.45	1.45	1.45	1.45
9.	Other renewable	0.05	0.05	0.06	0.08	0.10
10.	Solar	0.05	0.09	0.10	0.14	0.29
11.	Waste	0.01	0.01	0.01	0.01	0.01
12.	Wind Onshore	0.74	0.80	0.93	0.98	1.21

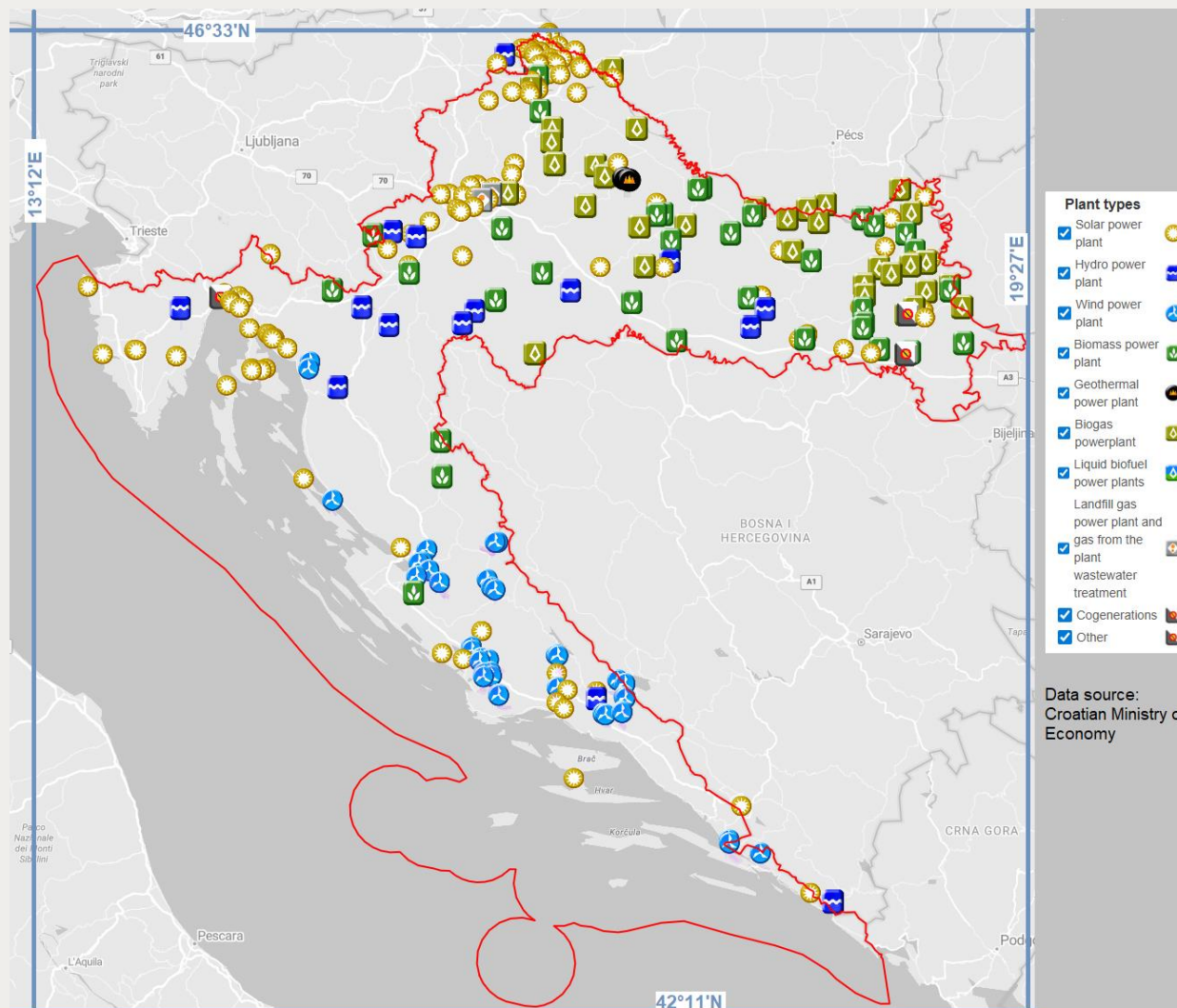
Consumption per customer groups

- Data for transmission network

Nr.	Customer group	Consumption in 2024 (TWh)
1.	Industry	0.81
2.	Rail transport	0.16
3.	Public Utility	0.01
4.	Pump	0.23
5.	Power Plants	0.11
6.	Distribution Network	15.50

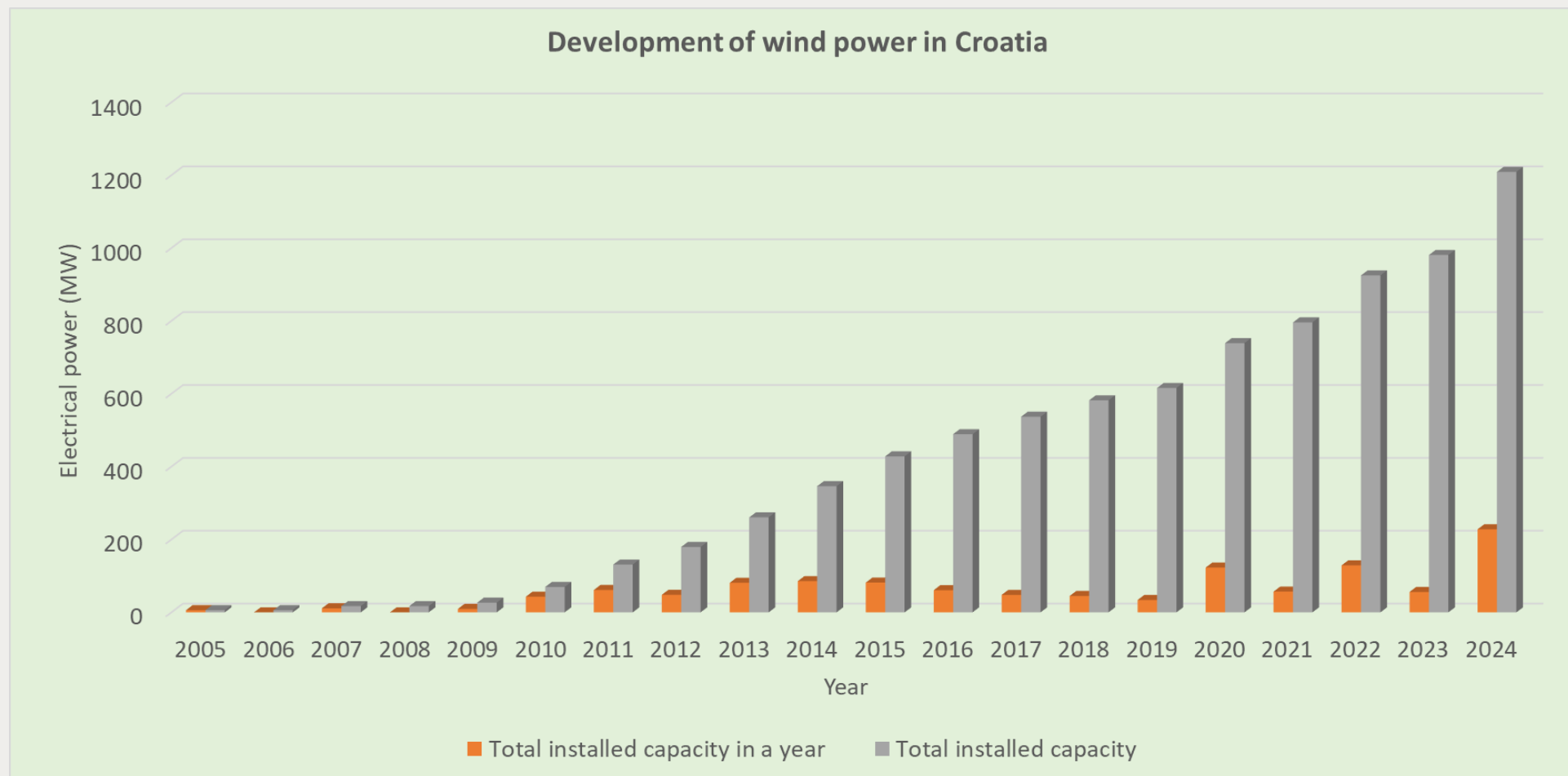


Location of renewable energy sources



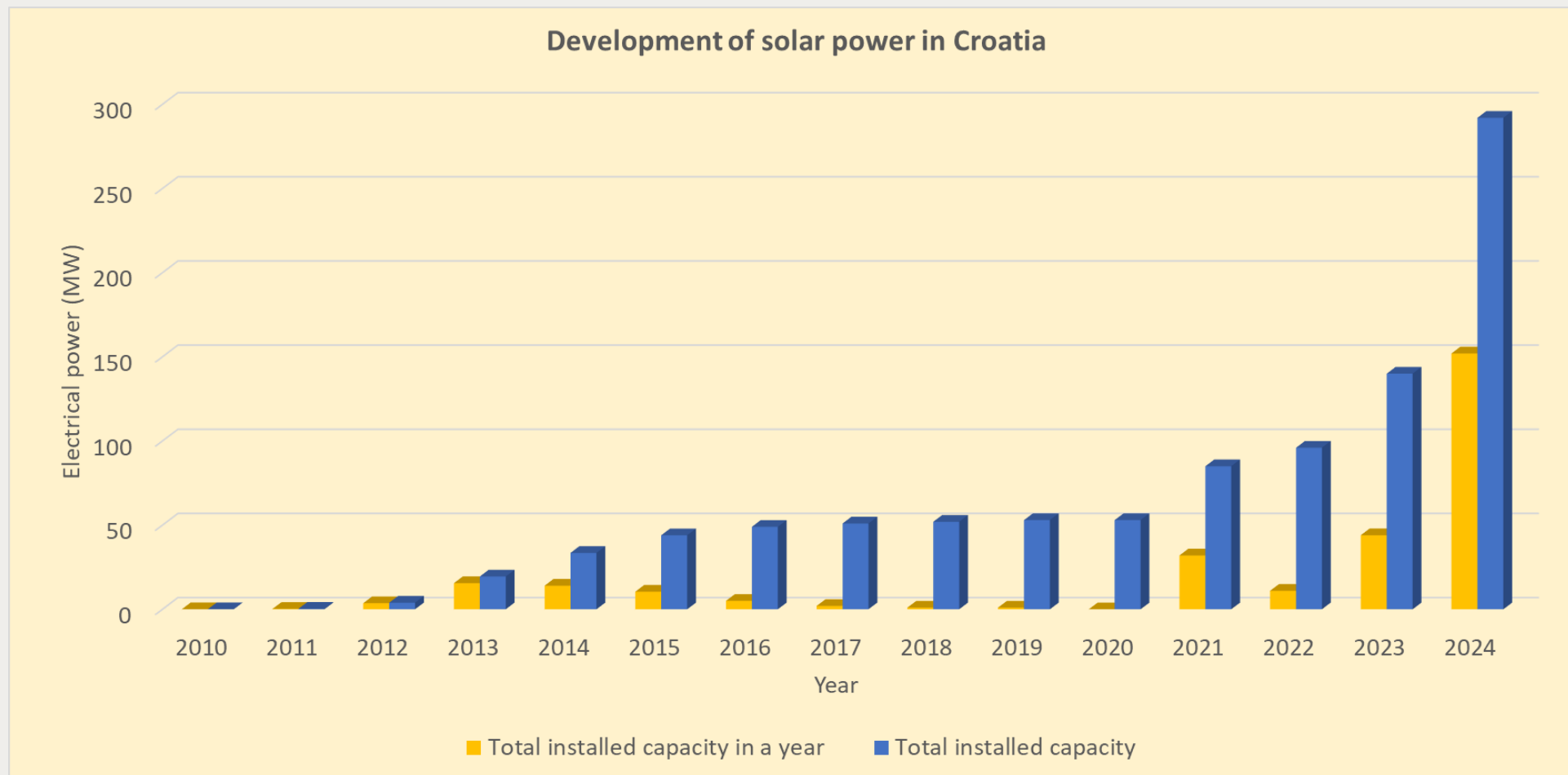
Development of wind power

- Development began in 2005

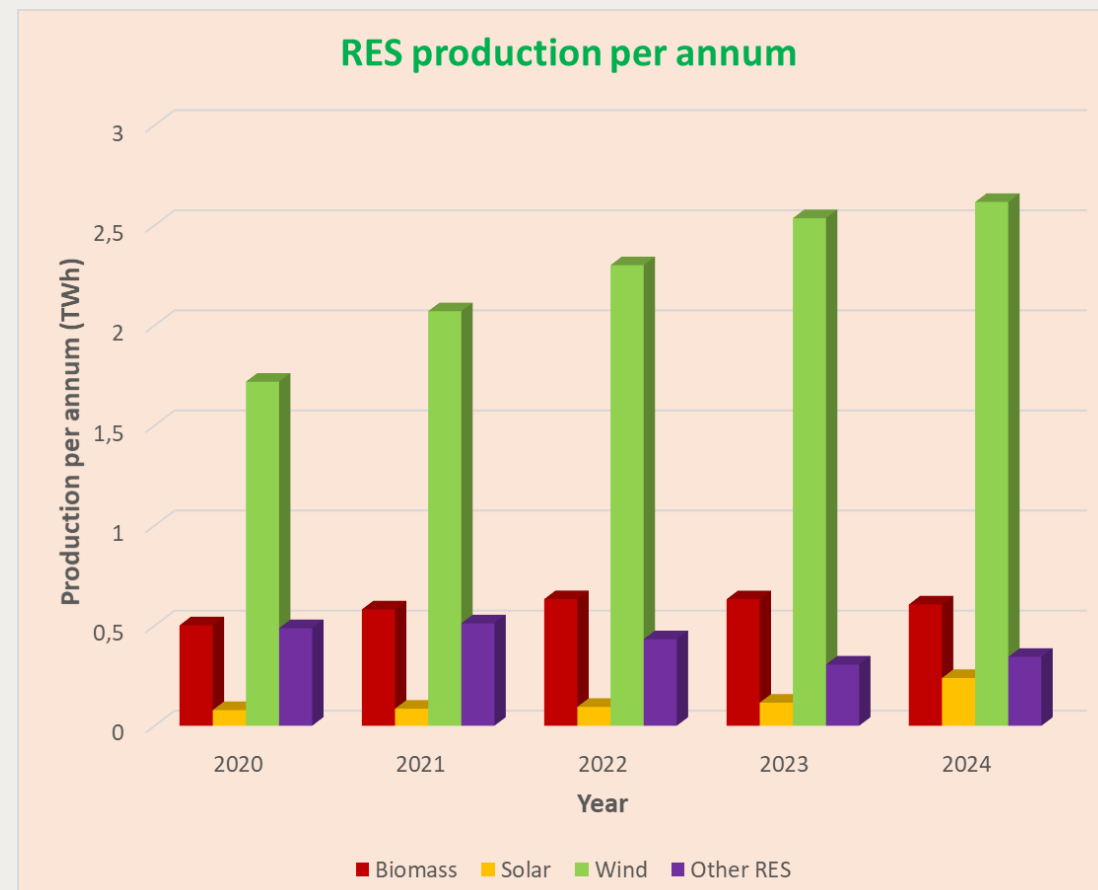
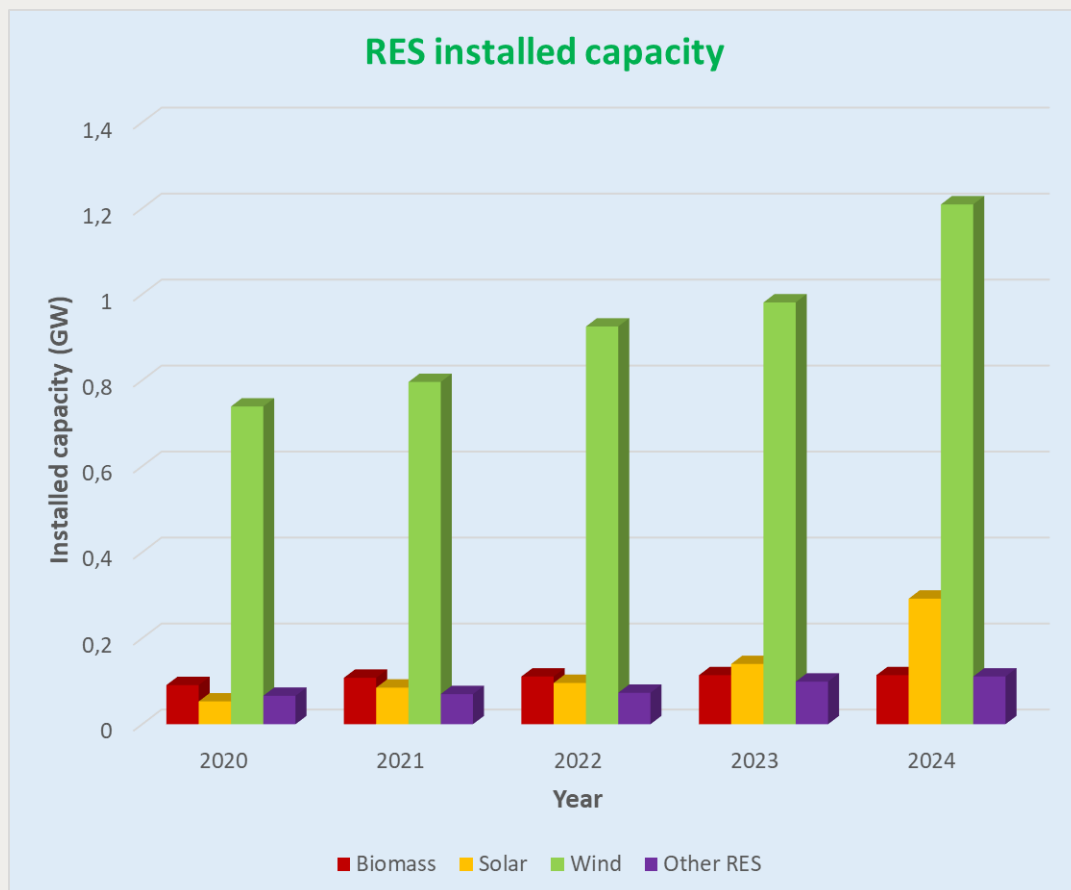


Development of photovoltaic power & CSP

- Significant development began in 2010



RES installed capacity and production per annum



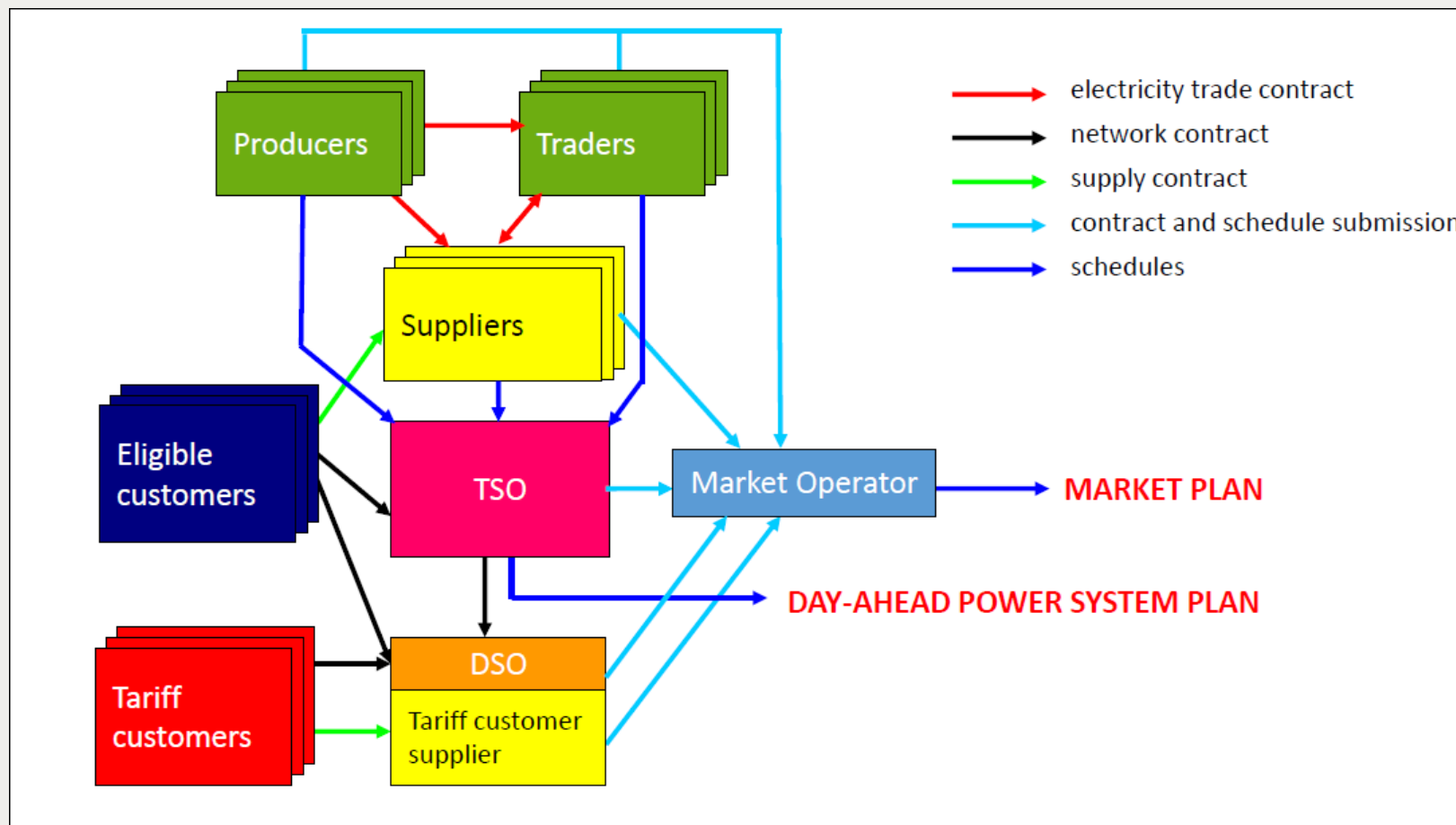
Price development for industry consumers

Nr.	Consumer category	Voltage level	Average energy price in particular year (euro cent / kWh)					The average total sales price of electricity in 2023 with a reduction based on the "Regulation on removing disruptions in the domestic energy market"
			2019	2020	2021	2022	2023	
1.	Industry	medium	7.70	7.96	8.36	12.87	20.16	14.73
2.	Industry	low	9.95	10.22	10.49	15.79	22.98	14.70

Price development for households

Nr.	Consumer category	Voltage level	Average energy price in particular year (euro cent / kWh)					The average total sales price of electricity in 2023 with a reduction based on the "Regulation on removing disruptions in the domestic energy market"
			2019	2020	2021	2022	2023	
1.	Household	low	10.35	10.49	10.49	11.15	12.20	12.20

Electricity market organization



Power balance in 2023 / 2024

- Data for transmission network

Nr.	Item	Amount in 2023	Amount in 2024
1.	Generation (TWh)	14.26	11.92
2.	Consumption of all consumers directly connected to transmission network (TWh)	1.26	1.32
3.	Delivery from transmission to distribution network (TWh)	15.08	15.50
4.	Delivery from distribution to transmission network (TWh)	0.30	0.30
5.	Imports (TWh)	10.04	13.01
6.	Exports (TWh)	7.80	7.95
7.	Losses (TWh)	0.46	0.47

Energy exchanges in 2023 / 2024

- Commercial flows

Commercial flows	Nr.	Direction	Country	Unit	2023	2024
	1.	Import from...	Hungary	TWh	1.85	3.40
	2.	Import from...	Slovenia	TWh	4.48	7.53
	3.	Import from...	Bosnia and Hercegovina	TWh	2.49	2.16
	4.	Import from...	Serbia	TWh	2.03	1.26
	5.	Export to...	Hungary	TWh	1.72	0.93
	6.	Export to...	Slovenia	TWh	2.42	0.99
	7.	Export to...	Bosnia and Hercegovina	TWh	2.01	4.10
	8.	Export to...	Serbia	TWh	2.52	3.33
	9.	Import from...	all countries	TWh	10.85	14.35
	10.	Export to...	all countries	TWh	8.67	9.35
	11.	Balance (Import - Export)	all countries	TWh	2.18	5.00

- Physical flows

Physical flows	Nr.	Direction	Country	Unit	2023	2024
	1.	Import from...	Hungary	TWh	2.69	4.02
	2.	Import from...	Slovenia	TWh	2.69	6.30
	3.	Import from...	Bosnia and Hercegovina	TWh	3.34	2.05
	4.	Import from...	Serbia	TWh	1.32	0.64
	5.	Export to...	Hungary	TWh	0.71	0.40
	6.	Export to...	Slovenia	TWh	4.70	2.56
	7.	Export to...	Bosnia and Hercegovina	TWh	2.06	3.62
	8.	Export to...	Serbia	TWh	0.33	1.37
	9.	Import from...	all countries	TWh	10.04	13.01
	10.	Export to...	all countries	TWh	7.80	7.95
	11.	Balance (Import - Export)	all countries	TWh	2.24	5.06

Specific aspects of the electricity market

- Two types of electricity markets in Croatia: Bilateral and organized Day-ahead & Intraday Market
- Cross-border capacity allocation:
 - HR-SI, HR-RS and HR-HU border: JAO (Joint Allocation Office) Luxembourg – long term allocations (HR-RS also day-ahead allocations)
 - HR-BA: SEE CAO (South East Europe Coordinated Auction Office) Podgorica, Montenegro – long term and day-ahead allocations
- Power exchange CROPEX operational since February 2016,
 - Croatian Power futures 2024
 - Intraday 15-Minute Products 2024
- Market coupling:
 - Croatian day-ahead market is coupled with European SDAC market via HR-SI and HR-HU border
 - European Single Intraday Coupling - SIDC (ex. XBID project)
 - Croatian organized intraday Market successfully coupled with European Intraday Market via HR-SI and HR-HU borders since 19th November 2019
 - IDA (intraday auctions) operation go-live since 13th June 2024
- Day Ahead Core flow based market coupling (2022)
 - all Core CCR ("capacity calculation region") cross-zonal borders (except HR-SI) after the operational go-live of the Core Flow-based Market Coupling Project now have FTR-Options (Financial Transmission Rights – Options)
 - Note: Croatian Core CCR borders: HR-HU and HR-SI
- SDAC 15MIN MTU go-live on 30th September for 1st October 2025
- Future outlook: market integration through market coupling projects on HR-RS and HR-BA borders