

Deliverable D.T2.2.1


Infrastructure Report (SERBIA)

Activity A.T2.2: Infrastructure analysis

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Short Description
The potential for exploitable organic residue for each participating country listing key aspects such as location, amount, transport options and costs.

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1. METHODOLOGY

This document provides the overview of the several infrastructure data in the case of Republic of Serbia. For gathering of the information several sources were used, mainly registers of the Serbian Ministry of mining and energy (MRE), and Energy Agency of the Republic of Serbia (AERS) Public company Electric power industry (EPS) of Serbia and Public company Serbiagas (SG).

In the case of industrial powerplants, the information has been taken from the regular web site of Serbian Ministry of mining and energy and Public company Electric power industry of Serbia.

Connection points for various energy sources were searched for using the available geographical information. Most of the data collected referred to the electrical connection points (transformation stations available in the country), which were obtained through communication with the EPS. However, the remaining data was difficult to collect – the starting point was the schematic representation of the network provided by the national electric energy company (EPS), which soon proved to be difficult to analyze, as well as time consuming. In the end, it was used as a reference for gathering detailed location information. The second source used was EPS database with correct placement of all the transformation stations. That database is not public, and it was obtained upon request. Information provided there was cross checked with the satellite imagery and the schematic representation mentioned earlier and proved to be a valid source of spatial information. The same source was used when searching for the information regarding the transnational connections, as well as providing the type of voltage connection for each point.

In terms of water connections, utility companies providing the service, were contacted, with the intention of trying to find specific points for P2G hubs to connect to the water grid. However, the feedback from utility companies was that connection points were possible anywhere near the existing water grids. As the Tool for Optimizing Sector Coupling Hubs cannot incorporate the entire water grid, only specific locations, it is considered that P2G hub can be connected anywhere along the water grid. Through communication with utility companies, it was concluded that the connection to the water grid, in financial terms, is quite low, especially in comparison to the entire P2G hub.

Regarding the gas grid in Serbia in this moment there are no plans for injecting of biogas to transmission nor distribution gas grid. All production of biogas is using at the production location for electrical and heat power production.

As far as transport hubs are concerned, there were several located, with first ones mentioned earlier, which were a part of the industrial plants. As most of the inland transport in Serbia is done by road, the work was focused on industrial freight train facilities (road-rail transport hub) which would be capable of handling larger amounts of goods. The list of these industrial train stations was found in several reports. Additionally, several river Danube ports are being listed. Five river ports act as hubs with three modes of transportation since they usually include the train and road vehicle loading facilities and three act as a water-road hubs.

2. BRIEF DESCRIPTION OF SERBIAN INFRASTRUCTURE LANDSCAPE

In the recent years there has been some progress in renewable energy infrastructure installation. However, compared to other countries, Serbia still has much to improve. This is clearly visible in the case of harvesting the potential of solar energy and biomass. Despite its beneficial geographical location Serbia has less than 10 MW of installed photovoltaic production capacities. Due to the lower installation costs, there has been some improvement in small photovoltaic installations (housing), but not so much on the larger scale. Wind energy has been harvested in higher extent, also with some new planned projects. Serbia has also traditionally relied on the coal-fired thermal and hydro powerplants, with some of the recent new project being held due to environmental concerns.

2.1 ELECTRICAL ENERGY SECTION

Tariffs for access to the transmission system

Tariff element	Billing element	Unit	Tariff [EUR]
Power	calculated power	kW	0,493
	excessively taken power	kW	1,970
Active energy	higher tariff - HT (day 07:00-23:00)	kWh	0,004

	<i>lower tariff - LT (night 23:00 - 07:00)</i>	<i>kWh</i>	<i>0,002</i>
<i>Reactive energy</i>	<i>reactive energy</i>	<i>kvarh</i>	<i>0,002</i>
	<i>excessively taken reactive energy</i>	<i>kvarh</i>	<i>0,004</i>

Achieved average prices of access to the distribution system

<i>Consumption category</i>	<i>Price [EUR/kWh]</i>
<i>35 kV</i>	<i>0,012</i>
<i>10 (20) kV</i>	<i>0,015</i>
<i>Low voltage (0.4 kV I stage)</i>	<i>0,039</i>
<i>0.4 kV II stage</i>	<i>0,041</i>
<i>households</i>	<i>0,036</i>
<i>Public lighting</i>	<i>0,029</i>
<i>AVERAGE</i>	<i>0,031</i>

Tariffs for the category of consumer goods by consumption zones

<i>Wide consumption</i>	<i>Price [EUR/kWh]</i>
<i>Cost of public supplier</i>	<i>1,415</i>
<i>Calculated power</i>	<i>0,453</i>
<i>Active energy</i>	
<i>HT, green, up to 350 kWh/month (07:00-23:00)</i>	<i>0,064</i>
<i>LT, green, up to 350 kWh/month (23:00-07:00)</i>	<i>0,016</i>
<i>UT, green, up to 350 kWh/month (0:00-24:00)</i>	<i>0,056</i>
<i>HT, blue, 351-1600 kWh/month (07:00-23:00)</i>	<i>0,095</i>
<i>LT, blue, 351-1600 kWh/month (23:00-07:00)</i>	<i>0,024</i>
<i>UT, blue, 351-1600 kWh/month (0:00-24:00)</i>	<i>0,083</i>
<i>HT, red, over 1600 kWh/month (07:00-23:00)</i>	<i>0,191</i>
<i>LT, red, over 1600 kWh/month (23:00-07:00)</i>	<i>0,048</i>
<i>UT, red, over 1600 kWh/month (0:00-24:00)</i>	<i>0,167</i>

Achieved average annual retail prices on the free market for end customers

<i>Consumption category</i>	<i>Price [EUR/kWh]</i>
<i>High voltage (110 kV)</i>	<i>0,066</i>
<i>35 kV</i>	<i>0,071</i>
<i>10 (20) kV</i>	<i>0,082</i>
<i>Total high and medium voltage</i>	<i>0,077</i>
<i>Low voltage (0.4 kV I stage)</i>	<i>0,105</i>

0.4 kV II stage	0,104
households	0,105
Public lighting	0,082
Total low voltage	0,102
TOTAL AVERAGE	0,085

The structure of the realized average annual retail price on the free market for end customers

Elements	Price [EUR/kWh]
<i>HIGH VOLTAGE - (110 kV) on transmission</i>	
<i>total price</i>	0,066
<i>Transfer fee</i>	0,005
<i>The price of electricity</i>	0,061
<i>MEDIUM VOLTAGE (35 kV + 10 (20) kV)</i>	
<i>total price</i>	0,080
<i>Transfer fee</i>	0,014
<i>The price of electricity</i>	0,066
<i>MEDIUM VOLTAGE - (35 kV)</i>	
<i>total price</i>	0,071
<i>Transfer fee</i>	0,012
<i>The price of electricity</i>	0,059
<i>MEDIUM VOLTAGE - (10/20 kV)</i>	
<i>total price</i>	0,082
<i>Transfer fee</i>	0,014
<i>The price of electricity</i>	0,068
<i>LOW VOLTAGE (0.4 kV I degree)</i>	
<i>total price</i>	0,105
<i>Transfer fee</i>	0,036
<i>The price of electricity</i>	0,069
<i>WIDE CONSUMPTION</i>	
<i>total price</i>	0,105
<i>Transfer fee</i>	0,035
<i>The price of electricity</i>	0,069
<i>Wide consum - Commercial and others (0.4 kV II degree)</i>	
<i>total price</i>	0,105
<i>Transfer fee</i>	0,035
<i>The price of electricity</i>	0,069

<i>Wide consum - household</i>	
<i>total price</i>	0,105
<i>Transfer fee</i>	0,035
<i>The price of electricity</i>	0,070
<i>PUBLIC LIGHTING</i>	
<i>total price</i>	0,082
<i>Transfer fee</i>	0,029
<i>The price of electricity</i>	0,053
<i>TOTAL SALES ON THE DISTRIBUTION NETWORK</i>	
<i>total price</i>	0,088
<i>Transfer fee</i>	0,022
<i>The price of electricity</i>	0,067
<i>TOTAL ON TRANSMISSION AND DISTRIBUTION NETWORKS</i>	
<i>total price</i>	0,084
<i>Network fee</i>	0,020
<i>The price of electricity</i>	0,066

- *Peak monthly pricing*

15-minutes PEAK POWER price is 3,82 [€/kW]

- *TAX*

Excise tax is 7,5% and VAT is 20%. VAT is calculated for price with excise tax added.

In 2020 (data for 2021 is not published yet), the power plants in the Republic of Serbia achieved a total production of 35.540 GWh. Of that, coal-fired thermal power plants produced 68,6%, hydropower plants connected to the transmission system 26,5%, thermal power plants-heating plants 0,5%, wind power plants connected to the transmission system 2,5% while other power plants (small power plants connected to the distribution system) produced 1,9% of the total electricity produced

Table shows data for Energy production and consumption in Serbia for 2020. Data for 2021 are not available yet.

<i>PRODUCTION</i>	<i>GWh/year</i>
<i>Hydropower plants</i>	9.419
<i>Coal-fired power plants</i>	24.331
<i>Thermal power plants - heating plant</i>	192
<i>Wind farms connected to transmission grid</i>	905
<i>Other power plants connected to distribution grid (sun, biogas, wind)</i>	693
TOTAL PRODUCTION	35.540
<i>Other (UNMIK)</i>	3
<i>Import of EPS and suppliers for trade in Serbia</i>	4.444
TOTAL AVAILABLE	39.987
<i>Export of EPS and suppliers - el.en. produced and purchased in Serbia</i>	4.708
<i>Pumping needs</i>	1.082
<i>Other (UNMIK)</i>	337
GROSS CONSUMPTION	33.853
<i>Transmission network losses</i>	798
<i>Distribution network losses</i>	3.587
TOTAL LOSSES	4.385
<i>Losses in relation to gross consumption</i>	13,00%
FINAL CONSUMPTION	29.468

- unit cost for transmission electrical grid connection, average for 400 kV, 220 kV and 110 kV is 0,50 [€/ kW * km]
- unit cost for distribution electrical grid connection, average for 35 kV, 20 kV, 10 kV and 0,4 kV is 0,80 [€/ kW * km]
- capacity cost for transmission electrical grid connection, average for 400 kV, 220 kV and 110 kV is 1,80 [€/ kW]
- capacity cost for distribution electrical grid connection, average for 35 kV, 20 kV, 10 kV and 0,4 kV is 2,90 [€/ kW]

2.2 NATURAL GAS ENERGY SECTION

NATURAL GAS PRICES FOR PUBLIC SUPPLY

Tariffs	Customer categories						
	Category 1 ($p < 6$ bar)				Category 2 ($6 \leq p \leq 16$ bar)		
	Small consumption	Extraordinary consumption C1	Even consumption C1	Uneven consumption C1	Extraordinary consumption C2	Even consumption C2	Uneven consumption C2
Energy (EUR / kWh)	0,03	0,03	0,03	0,03	0,03	0,03	0,03
Capacity (EUR / kWh / day / year)	0,00	0,06	0,14	0,16	0,04	0,08	0,10
Fee per place of delivery (EUR / place of delivery / year)	1,38	1,38	1,38	1,38	13,82	13,82	13,82

PRICES OF ACCESS TO THE NATURAL GAS DISTRIBUTION SYSTEM

Tariffs	Delivery points						
	Category 1 ($p < 6$ bar)				Category 2 ($6 \leq p \leq 16$ bar)		
	Small consumption	Extraordinary consumption C1	Even consumption C1	Uneven consumption C1	Extraordinary consumption C2	Even consumption C2	Uneven consumption C2
Energy (EUR / kWh)	0,007	0,004	0,004	0,004	0,003	0,003	0,003
Capacity (EUR / kWh / day / year)	0	0,063	0,135	0,158	0,039	0,083	0,098

PRICES OF ACCESS TO THE NATURAL GAS TRANSPORT SYSTEM

Capacity tariffs		Continuous capacity (EUR / kWh / day)	Interrupt capacity (EUR / kWh / day)	Return capacity (EUR / kWh / day)
Annual tariff	input capacity from the transport system	0,13	0,13	0,03
	input production capacity	0,18	0,18	0,04
	input capacity warehouse	0,11	0,11	0,02
	domestic consumption output capacity	0,08	0,08	0,02
	interconnector output capacity	0,29	0,29	0,06

Capacity tariffs		Continuous capacity (EUR / kWh / day)	Interrupt capacity (EUR / kWh / day)	Return capacity (EUR / kWh / day)
Monthly tariff	<i>input capacity from the transport system</i>			
	<i>January, February, December</i>	0,042	0,042	0,009
	<i>March, November</i>	0,032	0,032	0,006
	<i>April, October</i>	0,021	0,021	0,004
	<i>May, June, July, August, September</i>	0,011	0,011	0,002
	<i>input production capacity</i>			
	<i>January, February, December</i>	0,056	0,056	0,011
	<i>March, November</i>	0,042	0,042	0,008
	<i>April, October</i>	0,028	0,028	0,006
	<i>May, June, July, August, September</i>	0,014	0,014	0,003
	<i>input capacity warehouse</i>			
	<i>January, February, December</i>	0,034	0,034	0,007
	<i>March, November</i>	0,025	0,025	0,005
	<i>April, October</i>	0,017	0,017	0,003
	<i>May, June, July, August, September</i>	0,009	0,009	0,002
	<i>domestic consumption output capacity</i>			
	<i>January, February, December</i>	0,024	0,024	0,005
	<i>March, November</i>	0,018	0,018	0,004
	<i>April, October</i>	0,012	0,012	0,002
	<i>May, June, July, August, September</i>	0,006	0,006	0,001
<i>interconnector output capacity</i>				
<i>January, February, December</i>	0,092	0,092	0,018	
<i>March, November</i>	0,069	0,069	0,014	
<i>April, October</i>	0,046	0,046	0,009	
<i>May, June, July, August, September</i>	0,023	0,023	0,005	

Heating value 10,55 [kWh/m³]

VAT for gas business is 10%

unit cost for gas grid connection 0,10 [€/ (kWh/h) * km] Transmission grid

unit cost for gas grid connection 0,15 [€/ (kWh/h) * km] Distribution grid

capacity cost for gas grid connection 0,40 [€/ (kWh/h)] Transmission grid

capacity cost for gas grid connection 0,65 [€/ (kWh/h)] Distribution grid

2.3 BIOCHAR SUPPLY SECTION

There is no commercial production of biochar in Serbia.

2.4 WATER SUPPLY SECTION

Price for individual and business consumers are given in the next tables. Price includes operators/grid fees and taxes

Individual consumers	[€/m ³]
Water	0,466
Sewage	0,294

Business consumers	[€/m ³]
Water	1,099
Sewage	0,691

Unit cost for water grid connection [€/ (m³/h) * km] depends on the terrain configuration and place of construction (city, village, urban or rural environment, in or outside a populated area) and it can be within very wide limits. The price goes from 100 to more than 1000 [€/ (m³/h) * km]. Average it is about 350 [€/ (m³/h) * km].

Capacity cost for water grid connection [€/ (m³/h)] also depends on different conditions and can be from 300 up to 1000 [€/ (m³/h)]. Average it is about 550 [€/ (m³/h)].

The drilled water well price in Serbia is about 100 [€/m] for wells with next characteristics:

- diameter of well up to 450 mm;
- steel and pvc well constructions from Ø 110 mm to Ø 323 mm;
- depth up to 300 m.