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National Residual Mix Annual Report for Serbia for 2023

Belgrade, May 2024

1 The methodology of determining the origin of electricity

Pursuant to Article 55, paragraph 5 of the RES law ("Official Gazette of RS", No. 40/2021-23), the Ministry of Miningand Energy brings the Disclosure regulation ("Official Gazette of RS" No. 2/2023) (hereinafter referred to as "Disclosure regulation").The Disclosure regulation prescribes the way in which the share of all types of energy sources of the sold electricity is calculated and shown to the end consumer, as well as the calculation control and verification.

The Transmission system operator, in accordance with Article 55, paragraphs 1 and 2 of the RES law,calculates and publishes share of all types of energy sources in the electricity sold to end consumers in the Republic of Serbia.

In this calculation the Transmission system operator shall take into account, in particular, the cancelled and expired guarantees of origin.

The shares of energy sources are divided in accordance to the following 12 attributes (types):

1) Solar energy
2) Wind energy
3) Hydropower
4) Geothermal energy
5) Energy from biomass
6) Energy from renewable sources which source is not specified (Unspecified renewable energy sources)
7) Energy from hard coal
8) Energy from brown coal and lignite
9) Energy from the natural gas
10) Energy from oil
11) Energy from fossil fuels which source is not specified (Unspecified fossil energy sources)
12) Nuclear energy

2 Registry of guarantees of origin for Serbia in 2023

The RES law stipulates that the Transmission system operator shall issue a guarantee of origin, at the request of a producer from renewable energy sources, and shall be responsible for its accuracy, reliability and protection from misuse. The Transmission system operator shall keep the Registry of guarantees of origin in an electronic form and publish the data from the Registry on its website. In 2023, 44 market participants and 34 production units were registered in guarantees of origin system in the Republic of Serbia. Total number of issued Guarantees of Origin for electricity produced in 2023 is 8,685,978 while the total number of cancelled Guarantees of Origin for the electricity consumption in 2023 is 1,909,203.

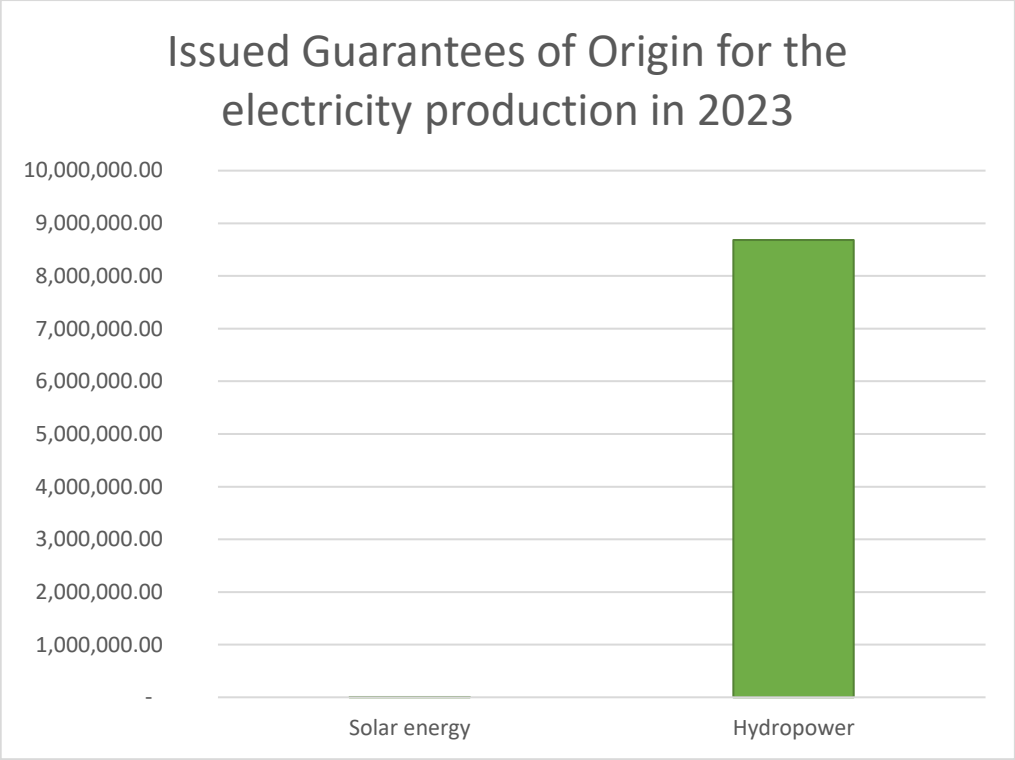

Chart 1 – Issued Guarantees of Origin for the electricity production in 2023, by source type

Further information on registered market participants, production units and Issued, Transferred, Cancelled and Expired Guarantees of Origin can be found on public web-address on following link: G-REX (grexel.com).

3 Calculation of the share of all types of energy sources in total sold electricity

In accordance with the Disclosure regulation, the Annual Report on the National Residual Mix in the Republic of Serbia for 2023 contains the following data:

1) data on production and consumption of electricity in the Republic of Serbia, import and export of electricity, taking into account the structure of electricity,
2) data on issued, expired and cancelled guarantees of origin for electricity in the Republic of Serbia,
3) data on the structure of the national residual mix and the data used in determining the structure of the national residual mix,
4) the share of each particular energy source in the national residual mix.

3.1.Electricity production in the Republic of Serbia

Based on the data of the Transmission system operator, the distribution system operator and the closed distribution system operator, the structure of electricity produced in the Republic of Serbia in 2023 is:

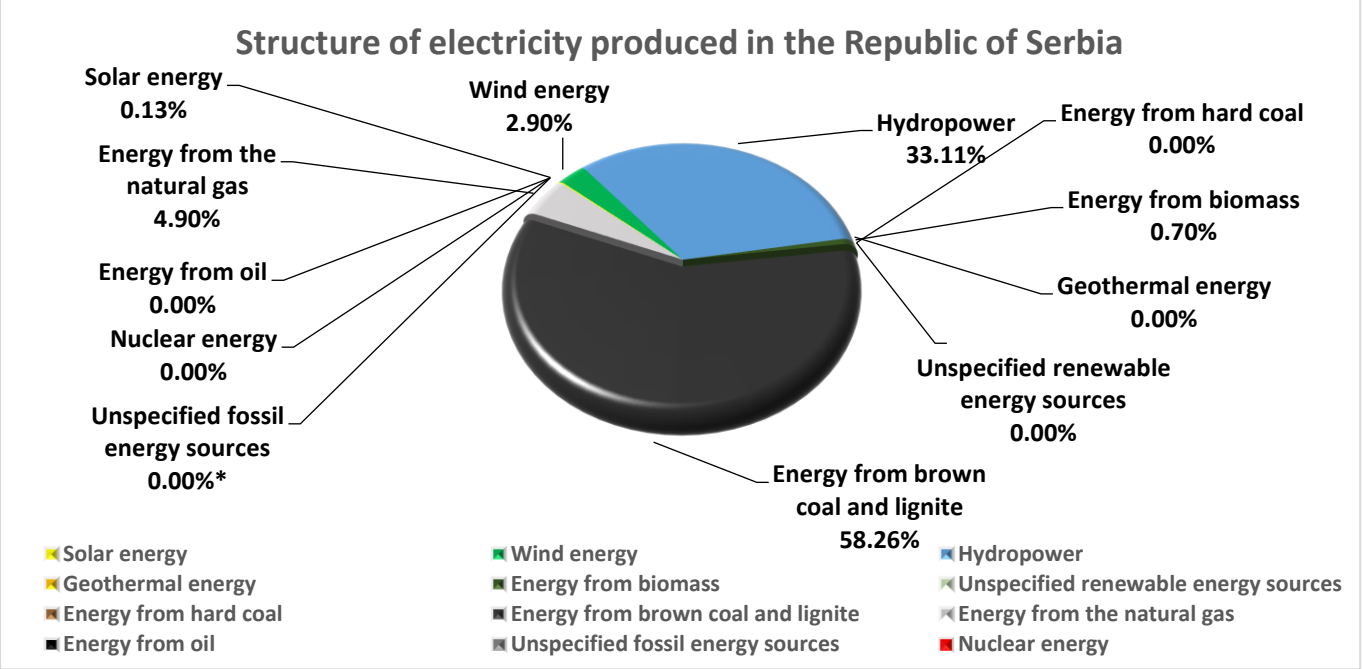

Chart 2 – Structure of electricity produced in the Republic of Serbia

The following table shows the production of electricity in 2022 in MWh per type.

Type of electricity source	MWh
Solar energy	46,212.550
Wind energy	1,052,502.330
Hydropower	12,030,606.500
Geothermal energy	-
Energy from biomass	253,717.560
Unspecified renewable energy sources	-
Energy from hard coal	-
Energy from brown coal and lignite	21,170,510.490
Energy from the natural gas	1,781,877.480
Energy from oil	-
Unspecified fossil energy sources	617.950
Nuclear energy	-
Total:	**36,336,044.86**

Table 1 – Structure of electricity produced in the Republic of Serbia

3.2.Exchange of electricity with third areas

On 27.09.2019. EMS AD Belgrade gained full membership in the European Association of Guarantees of Origin (AIB), making Serbia the first member state of the Energy Community to become part of the Association of Guarantees of Origin. From the day of joining the AIB (September 27, 2019), in accordance with the Ordinance, the third areas are considered only countries, i.e. regulatory areas whose attribute structure is not included in the calculation of the European attribute mix. The European Attribute Mix (EAM) includes 34 European countries, among which are Serbia, Hungary, Romania, Bulgaria, Croatia, Bosnia and Herzegovina and Montenegro.

Based on the data of transmission, distribution and closed distribution system operators, the total exchange of electricity of the Republic of Serbia with third areas in 2023 was:

The area with which Serbia has the import/export of energy	Energy direction (from the position of Serbia)	Quantity (MWh)
North Macedonia	Import	223,212.100
	Export	823,011.990
Autonomous Province of Kosovo and Metohija[1]	Import	291,187.650
	Export	1,620,408.730

Table 2 – Exchange of electricity

After 27.09.2019. countries whose attribute structure is included in the calculation of the European attribute mix (Hungary, Romania, Bulgaria, Croatia, Bosnia and Herzegovina and Montenegro) are not considered third areas.

The following figure shows the exchange of electricity of the Republic of Serbia with third areas in 2023 - the direction of taking over electricity:

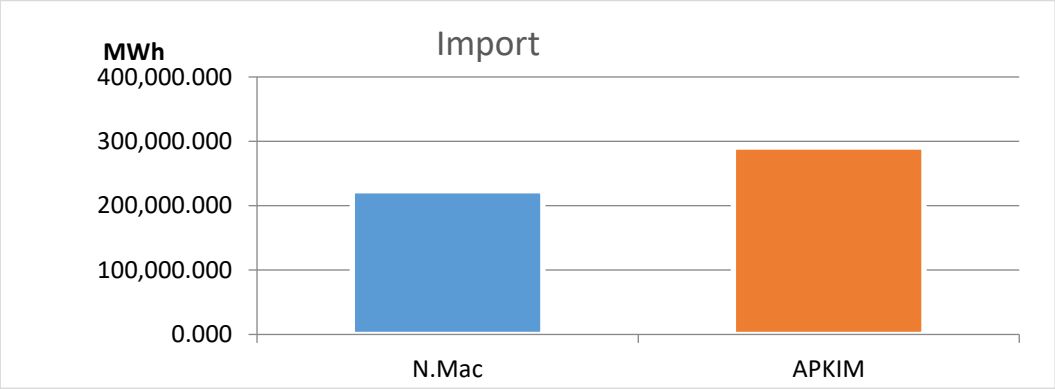

Chart 3 – Electricity exchange of the Republic of Serbia with third areas - import

The following chart represents the exchange of electricity of the Republic of Serbia with third areas - export:

[1] transferred electricity over the administrative line with the Autonomous Province of Kosovo and Metohija

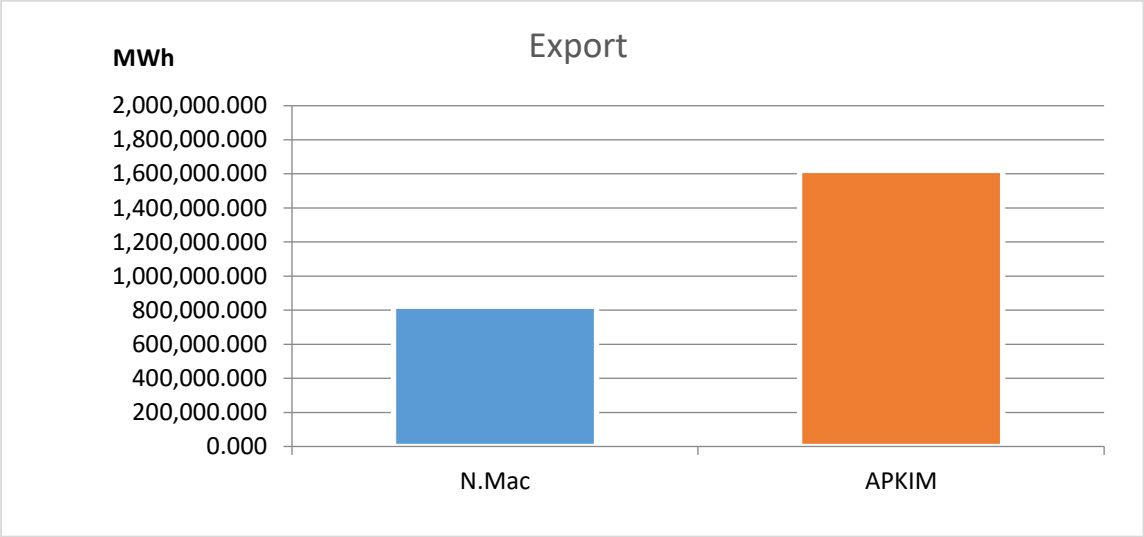

Chart 4 – Electricity exchange of the Republic of Serbia with third areas - export

Electricity imported from third areas is imported in the shares of the electricity generation structure in this field. The following table shows the production structure of these areas.

Type of electricity source	N.MK	APKIM
Solar energy	-	-
Wind energy	1.85	-
Hydropower	20.72	-
Geothermal energy	-	-
Energy from biomass	-	-
Unspecified renewable energy sources	-	-
Energy from hard coal	-	-
Energy from brown coal and lignite	47.56	-
Energy from the natural gas	23.56	-
Energy from oil	6.30	-
Unspecified fossil energy sources	-	100.00
Nuclear energy	-	-

Table 3 – Structure of electricity generation from third areas

3.3.Structure of produced electricity in the incentive system

The structure of electricity produced in the incentive system is determined for the total electricity generated by the privileged electricity producers in the previous calendar year.

The Guaranteed Supplier determines and publishes on its website a report on the quantities and structure of electricity produced in the incentive system by the end of February of the current year, for the previous year.

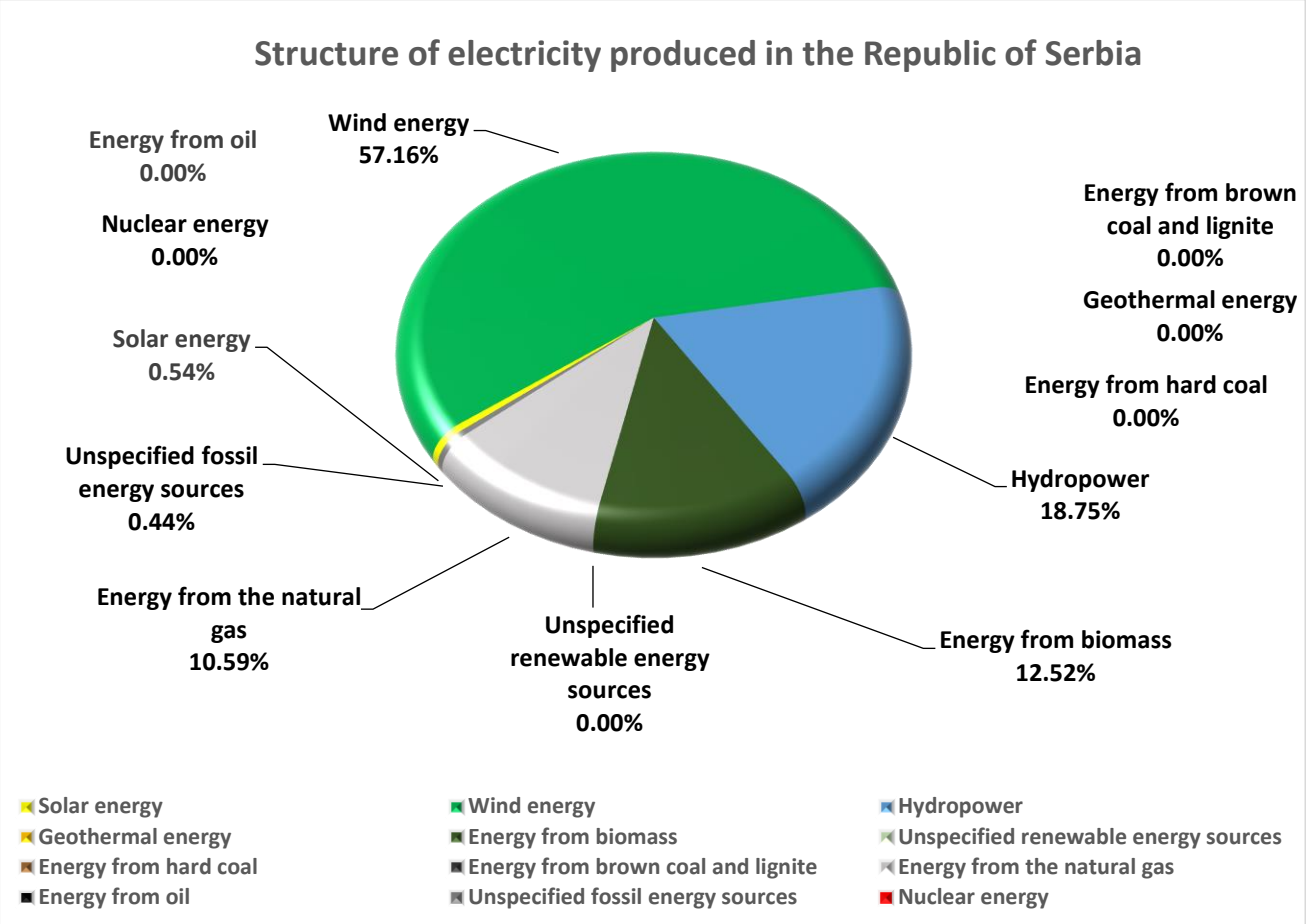

Chart 5 – Structure of generated electricity in the incentive system

Incentive system		
Type of electricity source	**MWh**	**%**
Solar energy	9,671.32	0.54
Wind energy	1,032,695.84	57.16
Hydropower	338,827.46	18.75
Geothermal energy	-	-
Energy from biomass	226,172.62	12.52
Unspecified renewable energy sources	-	-
Energy from hard coal	-	-
Energy from brown coal and lignite	-	-
Energy from the natural gas	191,405.11	10.59
Energy from oil	-	-
Unspecified fossil energy sources	7,859.41	0.44
Nuclear energy	-	-
Total:	**1,806,631.76**	**100.00**

Table 4 – Structure of electricity production in the incentive system

3.4.Consumption of electricity of unknown origin in the Republic of Serbia

The amount of consumed electricity of unknown origin is determined based on the amount of total electricity sold to end consumers in the Republic of Serbia and electricity for covering losses in the transmission, distribution and closed distribution system, cancelled guarantees of origin for consumption in the 2023 calendar year and total produced electricity in the incentive system in Serbia.

Consumption of electricity	**MWh**
Total consumption in the Republic of Serbia[2]	34,149,317.310
Cancelled guarantees of origin for consumption in the 2023 calendar year	1,909,203.000
Total production in the incentive system in the Republic of Serbia	1,806,631.760
Total consumption of electricity of unknown origin	**30,433,482.550**

Table 5 – Consumption of electricity of unknown origin in the Republic of Serbia

[2] Realized consumption after the recognized correction of consumption at the distribution level for 2022.

3.5. Exchange of electricity attributes with the European attribute mix

The Transmission system operator shall calculate the National Residual Mix in accordance with the Disclosure Regulation and the Methodology for the Calculation and Disclosure of the Share of all types of energy sources in the electricity sold to the end consumers, based on:

1) data on the producer's produced electricity for each production unit that is connected to the transmission, distribution or closed distribution network,
2) data on total electricity sold to all end consumers in the transmission, distribution or closed distribution network,
3) data on electricity losses in the transmission, distribution or closed distribution network,
4) data on the realized electricity exchange by individual borders,
5) data on the exchange of attributes with the European mix of attributes (EAM) in accordance with the Ordinance,
6) data on cancelled and expired guarantees of origin.

The National Residual Mix without correction with the European attribute mix is shown in the following graph:

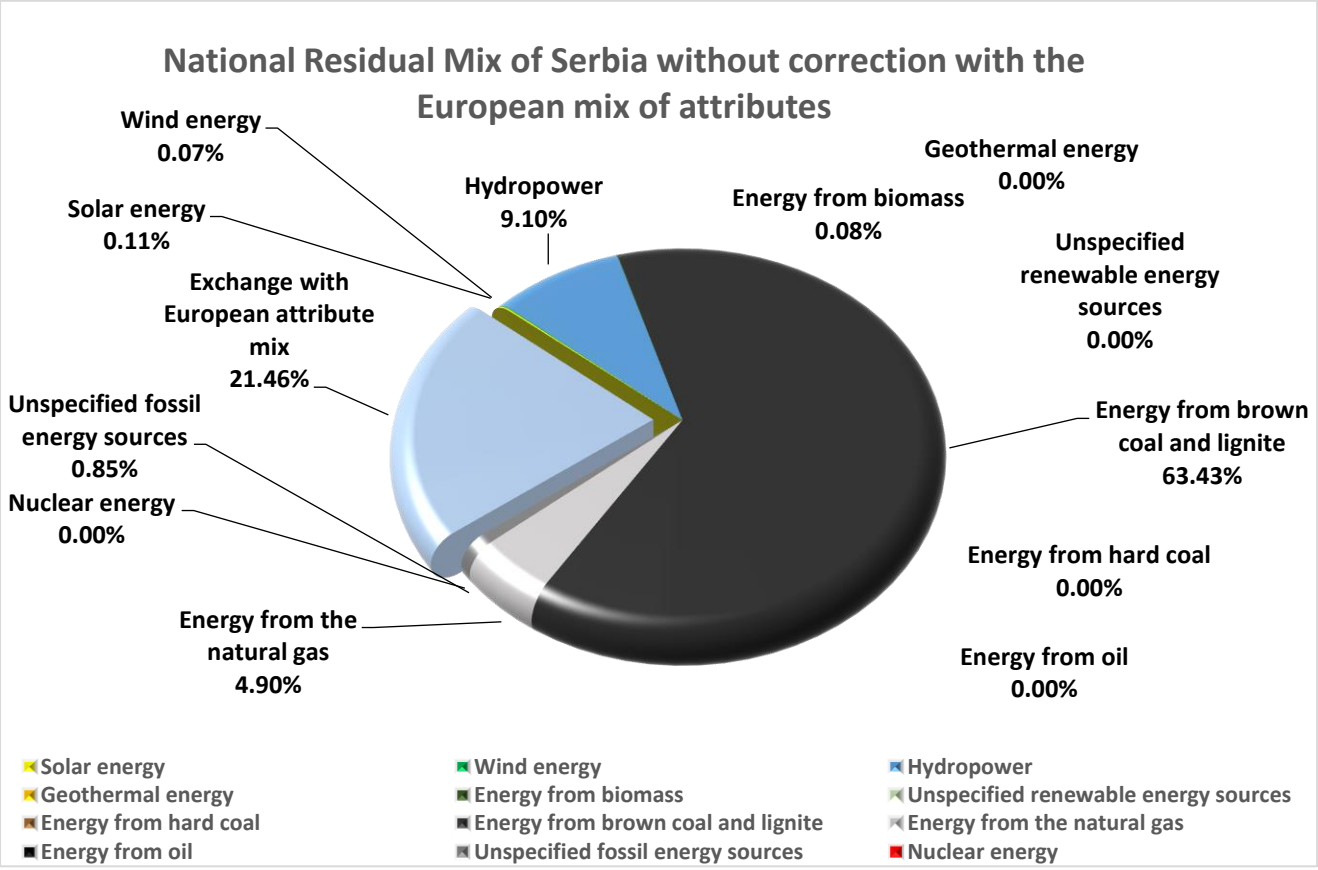

Chart 6 - National Residual Mix without correction with the European attribute mix for 2023

National Residual Mix of Serbia without correction with the European mix of attributes		
Type of electricity source	**[NRMbE] (MWh)**	**%**
Solar energy	32,680.254	0.11
Wind energy	21,712.449	0.07
Hydropower	2,769,730.258	9.10
Geothermal energy	-	0.00
Energy from biomass	24,990.136	0.08
Unspecified renewable energy sources	-	0.00
Energy from hard coal	-	0.00
Energy from brown coal and lignite	19,303,255.270	63.43
Energy from the natural gas	1,490,673.753	4.90
Energy from oil	-	0.00
Unspecified fossil energy sources	257,610.092	0.85
Nuclear energy	-	0.00
Total:	**23,900,652.212**	**78.54**

Table 6 - National residual mix of Serbia without correction with the European mix of attributes

In accordance with the Ordinance, the National Residual Mix respects the structured exchange energy with the European Attribute Mix (EAM), which can either be delivered to the European Attribute Mix or taken over to the National Residual Mix.

Attribute exchange with European attribute mix	**MWh**	**%**
Electricity consumption of unknown origin (1)	30,433,482.55	100.00
National residual mix of Serbia without correction with European mix of attributes (2)	23,900,652.21	78.54
EM - Energy exchange with European attribute mix (1) - (2)	6,532,830.34	21.46

Table 7 - Exchange of electricity attributes with the European attribute mix

The exchange with the European attribute mix that we are harmonizing is:

EM = 6,532,830.34 MWh (EM > 0),

i.e. the national residual mix takes attributes from the European attribute mix.

AIB publishes the calculation of the European residual mix and the structure of the European attribute mix (EAM) for 2023 on its official website. More information on the budget methodology itself as well as data from previous years can be found at the following link: https://www.aib-net.org/facts/european-residual-mix.

Type of electricity source	EAM (%)
Solar energy	2.41
Wind energy	-
Hydropower	-
Geothermal energy	-
Energy from biomass	-
Unspecified renewable energy sources	-
Energy from hard coal	46.40
Energy from brown coal and lignite	0.13
Energy from the natural gas	32.72
Energy from oil	2.01
Unspecified fossil energy sources	5.13
Nuclear energy	11.20
Total:	**100.00**

Table 8 - European Attribute Mix for 2023

The structured exchange energy with the European mix of attributes [EM] (import) is calculated in accordance with the Ordinance and is given in the following table:

Type of electricity source	[EM] = EM * EAM (MWh)
Solar energy	157,441.21
Wind energy	-
Hydropower	-
Geothermal energy	-
Energy from biomass	-
Unspecified renewable energy sources	-
Energy from hard coal	3,031,233.28
Energy from brown coal and lignite	8,492.68
Energy from the natural gas	2,137,542.09
Energy from oil	131,309.89
Unspecified fossil energy sources	335,134.19
Nuclear energy	731,677.00
Total:	**6,532,830.34**

Table 9 - Structured energy exchange with the European mix of attributes

3.6. National Residual Mix

The national residual mix of Serbia is calculated, in accordance with the Ordinance, based on the structured energy of the national residual mix of Serbia without correction with the European attribute mix [NRMbE] (Table 6) taking into account the structured energy exchange with the European attribute mix [EM] (Table 9) according to the following formula:

$$[NRM] = [NRMbE] + [EM]$$

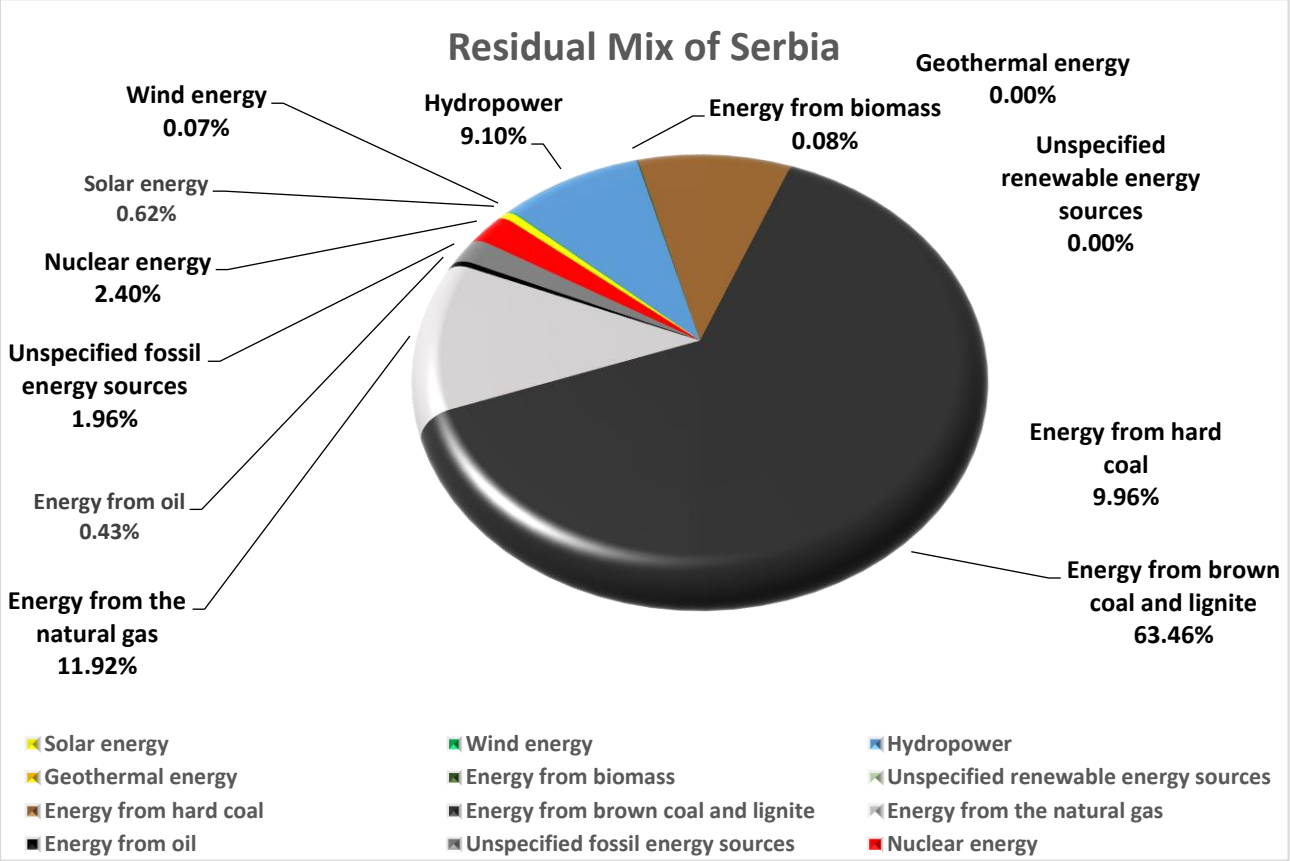

Chart 7 - National residual electricity mix after correction with the European attribute mix for 2023

National Residual Mix for the Republic of Serbia		
Type of electricity source	**[NRM] (MWh)**	**%**
Solar energy	190,121.46	0.62
Wind energy	21,712.45	0.07
Hydropower	2,769,730.26	9.10
Geothermal energy	-	-
Energy from biomass	24,990.13	0.08
Unspecified renewable energy sources	-	-
Energy from hard coal	3,031,233.28	9.96
Energy from brown coal and lignite	19,311,747.95	63.46
Energy from the natural gas	3,628,215.84	11.92
Energy from oil	131,309.89	0.43
Unspecified fossil energy sources	592,744.29	1.96
Nuclear energy	731,677.00	2.40
Total:	**30,433,482.55**	**100.00**

Table 10 - National residual mix of Serbia after correction with European attribute mix

4 Conclusion

All the data used for the purpose of calculating and compiling this report are collected from the following sources:

- Distribution system operator
- Closed distribution system operator
- Transmission system operator
- ENTSO-E Transparency platform
- Report and the data from the Guaranteed Supplier
- Relevant institutions at European Union level
- Association of issuing bodies (AIB)

In accordance with Article 55, paragraph 3 of the RES Law, suppliers are obliged to calculate and present to end customers data on the share of each source of electricity in total electricity sold, using data on used guarantees of origin, data on electricity from incentive systems and data on the national residual mix from Table 10.

Suppliers are obliged to present the shares of all types of energy sources in electricity sold to their end consumers in 2023, in the form of reports, in accordance with the Disclosure Regulation, from 1st of July till 31st of July 2024.