Overcoming barriers for renewable energy deployment in the Western Balkans:

The case of North Macedonia and Serbia

CAN
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Drafted by:
Dr. Ana Stojilovska, eclareon (North Macedonia)
Marko Kolovrat, eclareon (Serbia)

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Executive summary

North Macedonia and Serbia are working on aligning their energy and climate goals with those of the EU, in line with their obligations towards the Energy Community, which means reaching a carbon-neutral society and increasing the share of renewables (RES) in their energy mix. However, both countries face challenges due to a historical dependency on fossil fuels, predominantly coal, for their energy needs and a legacy of lower electricity prices than those in the EU.

Despite the pledge of North Macedonia to decarbonise, the energy crisis prompted it to stick to its domestic thermal power plant capacities. Hydro energy dominates RES projects in North Macedonia. Even though there is a promising recent increase in photovoltaic (PV) installations, there is not sufficient support for prosumers, energy communities, and vulnerable citizens. Hydro energy and wind power dominate RES projects in Serbia, although there has been a very significant increase in installed prosumer PV capacities recently. The Government of Serbia has also started to implement ambitious plans to install multiple gigawatts (GWs) of RES capacities in wind and solar (PV) energy in the country. However, energy communities, energy vulnerable citizens, and subsidies for RES prosumer capacities still suffer from overly complex and lengthy procedures in Serbia. In North Macedonia, RES projects also face complex and opaque administrative procedures, with the grid connection procedure taking the longest time. The grid capacity in North Macedonia is insufficient to meet the needs of the energy transition, but also not adequately researched. Grid balancing is also an issue in Serbia, which is why the Government aims to incentivise utility-scale project developers to also invest into energy storage.

The key policy recommendation for North Macedonia is to improve good governance in the energy sector by ensuring transparency, accountability, and the oversight of the monopolistic behaviour of dominant energy companies with vested interests. Conditions to improve the development of RES projects also need to be furthered.
Key policy recommendations for Serbia are to simplify subsidy procedures for prosumer PV installations, to simplify procedures for the incorporation and grid connection of energy communities, to implement an obligation for public actors to install RES systems for electricity supply and/or heating, as well as to enable investors to inspect the grid quality in a geographical area digitally instead of the currently lengthy paper procedure which precedes any utility-scale investment.

Table 1: Key policy recommendations

North Macedonia	Serbia
Improve good governance in the energy sector	Simplify subsidy procedures for prosumer PV installations
Enable conditions for the development of RES projects	Simplify procedures for incorporation and grid connection of energy communities
Fully transpose the 2018 Renewable Energy Directive	Implement an obligation for public objects to install RES systems for electricity supply and/or heating
Ensure that early and meaningful consultation with the local communities takes place for larger RES projects or projects in more sensitive locations	Enable investors to inspect the grid quality in a geographical area digitally, instead of the currently lengthy paper procedure which precedes any utility-scale investment

REPORT FOR NORTH MACEDONIA

1. Introduction

The energy crisis resulting from the Russian attack on Ukraine has prompted the EU to accelerate its shift away from Russian fossil gas in its ongoing energy transition driven by climate concerns. The Western Balkan countries which are implementing the EU energy and climate acquis through the legally binding Energy Community Treaty, have been strategically planning their energy, transport, and industry sectors to phase out fossil fuels and increase the share of renewables. However, due to their oil and fossil gas dependency and legacies from the socialist system when energy prices were below the market prices because they were subsidised, they are ill-prepared to implement a socially just energy transition that demands not only a decarbonised energy system but also decentralised and democratic. North Macedonia is a small market that has been hit hard by rising energy prices and scarcity, which had polarising effects. The crisis led to a U-turn of national policies towards fossil fuels to ensure national energy security, but also to an increase in the investment in renewables among the private sector. The 'return to fossil fuels' took place before the war in Ukraine when the country in two instances declared in October 2021 and August 2022 an energy crisis. However, despite the external shocks and efforts to strategically plan the decarbonization process, the share of renewable energy is below the country's potential.

Therefore, this study aims to identify country-level barriers in North Macedonia that impede the deployment of renewable energy capacities by focusing on electricity production from solar and wind. This report intentionally does not include hydro energy which is known for its adverse environmental impacts and has already reached its maximum capacity. The report results in policy recommendations to improve the roll-out of renewables in North Macedonia. The project is implemented by CAN Europe with the support of eclareon.

To explore the barriers related to the deployment and integration of solar and wind electricity projects, the report analyses the policy and economic frameworks shaping wind and solar projects. The policy framework encompasses the administrative and grid connection procedures, while the economic framework includes the energy market and the support policies. Three types of specific projects are inspected: 1) utility-scale, 2) individual and collective self-consumption (eg. households, SMEs, schools, etc.), and 3) energy communities[1]. The methods included a questionnaire and semi-structured interviews aimed to collect information from relevant stakeholders on the barriers to renewable energy deployment. In total, 8 experts were interviewed. Additionally, this report is developed with secondary data such as policy reports, a review of legal documents, and statistics.

/ 1/ Macedonian legislation communities are called cooperatives. These notions are used as synonyms. Energy cooperatives have been defined in the new Law on Cooperatives as: A cooperative is an association of natural and/or legal persons, who voluntarily come together for the purpose of achieving economic, social, cultural and other interests, jointly owned and democratically managed.

2. Overview of the national electricity sector

2.1 Electricity market and key stakeholders

North Macedonia has no domestic oil or fossil gas resources and heavily relies on the import of electricity and its coal reserves. Its post-socialist legacy has predetermined its current challenges with the carbon neutral transition process. It has structurally high unemployment, and low-quality dwellings, while the energy sector is still going through the process of energy liberalisation. The domestic electricity is generated from lignite mainly from one large power plant REK Bitola, and the largest source of domestic electricity capacity, which is planned to be phased out by 2027 if the current Energy Strategy's green scenario is followed.

On the policy level, the government is focusing especially on big infrastructure projects, as well as developing its energy legislation and defining the support policies for renewables. The Department for Energy within the Ministry of Economy is responsible for renewable energy policy-making and follows the implementation of energy laws and strategies. Furthermore, the Energy Agency supports the implementation of renewable energy and energy efficiency.

On the regulatory level, the Energy and Water Services Regulatory Commission is an independent body that regulates the prices of electricity, district heating, fossil gas, oil, and renewable energy sources. It issues licences for energy activities, including the production of electricity which can be from solar and wind. The Regulatory Commission also issues decisions on 'temporary preferential' and 'preferential' producers of electricity from renewables, which are those supported by feed-in tariffs.

On the utility and market level, Elektrani na Severna Makedonija (ESM) is the largest domestic producer of electricity and owns the largest thermal power plant REK Bitola, but also the only working wind energy project in the country – the wind park Bogdanci. The power transmission system is operated by MEPSO in state ownership, while Elektrodistribucija is the privately-owned distribution system operator. The affiliated company of Elektrodistribucija, EVN Elektrani owns and produces electricity from three photovoltaic power plants. The National Electricity Market Operator (MEMO) is responsible for the organisation, functioning, and development of the markets with bilateral agreements and balancing activities. Preferential electricity producers are those supported by feed-in tariffs, meaning they produce electricity from renewables, which are then purchased at preferential prices (higher than market prices) from the market operator. Thermal power plants are the main source of electricity, followed by hydro energy, and the combined production of electricity and heat, while the share of solar in the electricity production in 2022 is 1,36% and the share of wind is 1,91% (Table 2).

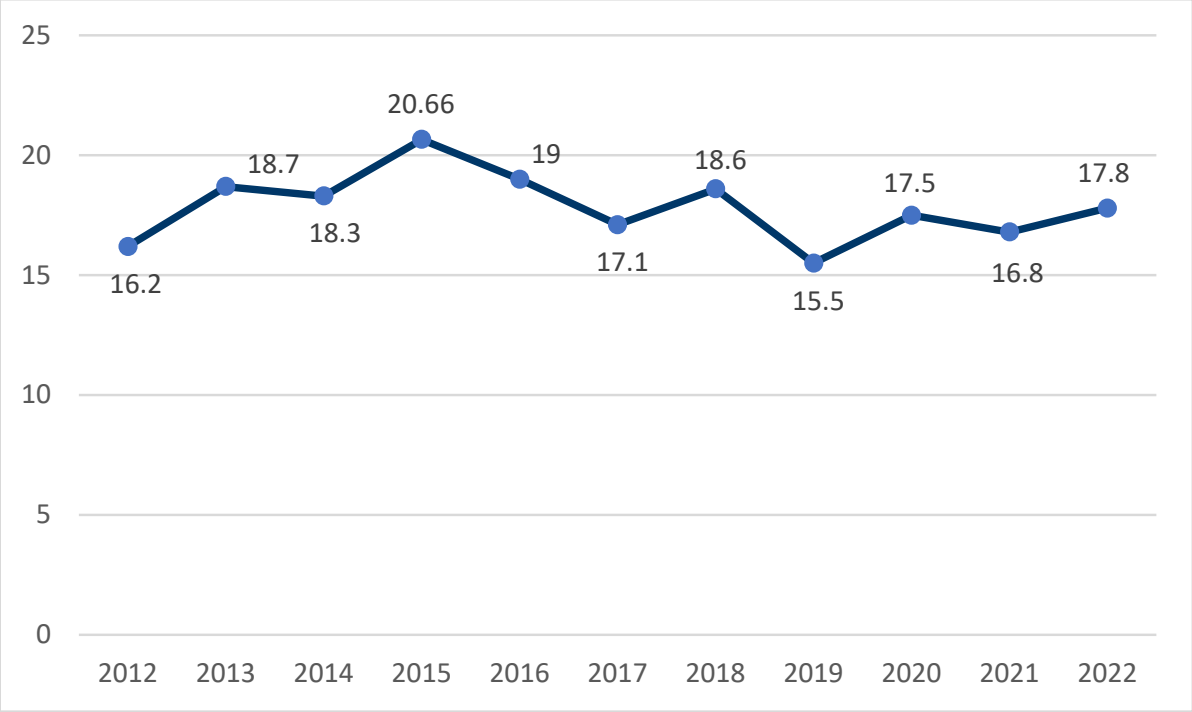
Table 2: Share of specific technologies in electricity production and their installed capacity in 2022

	Thermal power plants	Hydro power plants	Combined electricity and heat production	Wind power plants	Photovol-taic power plants	Biogas power plants
GWh	3.034	1.397	967	108	77	51
%	53,85	24,80	17,17	1,91	1,36	0,91
Installed capacity (MW)	1.034	719,1	287,4	72,8	144,2	9

Source: (Energy and Water Services Regulatory Commission, 2023a)

An eleven-year overview of the share of RES in gross final energy consumption (2012–2022) in Figure 1 shows a pessimistic development of the RES share with a slight increase of 9%. Output peaked in 2015 at 20,66%. Hydropower plays the dominant role in the overall RES share, as seen in Table 3. Therefore, the share of RES is still determined by the share of hydro and with that by the availability of precipitation and water flows.

Table 3: Share of RES in gross final energy consumption (actual values) in %



Source: (State Statistical Office, n.d.)

If only wind and photovoltaics are considered, according to the register of RES power plants by September 2023 (Table 4), there is only one wind power plant with an installed capacity of 36,8 MW and 336 photovoltaic plants with a total installed capacity of 102,53 MW.

Table 4: Register of RES power plants by September 2023

Type of RES	Number of facilities	Installed capacity	Planned yearly production
Wind	1	36,8 MW	100.000 MWh
Photovoltaics	336	102,53 MW	112.138 MWh

Source: (Energy Agency, n.d.)

2.2 Energy policies and legislative framework

North Macedonia has been aligning its legislation framework with that of the EU in terms of setting up decarbonisation goals and prioritising the use of renewables, however the 2018 Renewables Directive is still not fully transposed. According to its Energy Strategy until 2040, Long-Term Strategy for Climate Action and the National Energy and Climate Plan (NECP) it plans to achieve decarbonisation goals by increasing the share of renewable energy. Table 5 summarises the emission reduction goals and the intended share of RES by 2030, 2040, and 2050 respectively. Important is to menton that North Macedonia needs to update its NECP to align it with the Energy Community's 2030 targets.The Long-Term Strategy for Climate Action follows an ambitious goal of decarbonisation, climate resilience, improving competitiveness, and social cohesion (Ministry of Environment and Spatial Planning, n.d.). Additionally, the draft law on climate action is in preparation and it will include the carbon tax.

Table 5: Overview of decarbonization and RES share goals of key energy strategies

Strategies (goals)	Envisaged decarbonisation goal	Envisaged RES share
NECP (2030)	82% GHG net emissions reduction compared to the levels in 1990	38% share of renewables in gross final energy consumption
Energy Strategy (green scenario, 2040)	61,5% GHG net emissions reduction compared to 2005	45% share of renewables in gross final energy consumption
Long-Term Strategy for Climate Action (2050)	72% GHG net emissions reduction compared to the levels in 1990	49% share of renewables in gross final energy consumption

Source: (Government of North Macedonia, 2019b, 2022)

The legislative framework in the area of renewables draws on the Energy Law from 2018 which has gone through several amendments as a result of the efforts to accommodate the transposition of EU legislation in the area. There are several secondary acts to support the implementation of renewable energy projects, such as the Rulebook on Renewable Energy, the Rulebook on Preferential Producers, the Decree on Measures to Support RES, and the Program to Support RES and EE in Households. The Law on Cooperatives is a recent law that solidifies the legal basis for energy communities in North Macedonia. Some of the secondary acts support the development of other inspected RES projects – utility-based and self-consumption (described below). Table 6 lists the key legislation in renewable energy linking it to the relevant type of RES project.

Table 6: Key legislation in the area of RES

Legislative act (only core documents linked, some have amendments)	Type of legisla-tion	Description	Type of RES project
Energy Law	Primary law	It defines the goals of the energy policy, the construction of the energy facilities, the energy markets, the role of the Energy Regulatory Commission, the role of public energy service, and the support for RES.	Utility-based, individual and collective self-consumption, energy communities
Law on Cooperatives	Primary law	Only its draft version is available online. A cooperative is an association of natural and/ or legal persons voluntarily united for their economic, social, cultural, and other needs, jointly owned and democratically managed.	Energy communities
Rulebook on Renewable Energy	Secondary law	It prescribes the type of RES plans, how the excess produced RES intended for own consumption is handed over, the way the wind potential is measured and approved, the way the guarantees of origin are issued and recognized, and the content of the register of RES producers and guarantees of origin.	Utility-based, individual and collective self-consumption
Rulebook on Preferential Producers using Preferential Tariff	Secondary law	It prescribes the procedure for preferential producers of electricity from RES and uses the preferential tariff.	Utility-based
Decree on Measures to Support Electricity Production from RES	Secondary law	It describes the two types of available support: a) preferential tariff as a prescribed amount of money that is awarded for the purchased electricity by the market operator, or b) premium as an additional amount to the price that he realised with the sale of produced electricity on the wholesale electricity market.	Utility-based

Sources: (ENER, 2019; Energy and Water Services Regulatory Commission, 2019; Government of North Macedonia, 2019a, 2023; Ministry of Economy, 2018; Parliament of North Macedonia, 2018)

2.2.1 Competition between RES market players

There are concerns about competition between the different renewable energy market players such as larger utility-based projects or those run by private companies on one side and households and energy communities on the other. It is a misconception that freeing the market for citizens and cooperatives will endanger the position of companies[2]. Opening the market for different actors has benefits, such as the freedom of consumers to choose, resulting in an opportunity to make savings (EUR-LEX, 2007).

During the energy crisis in 2021 and 2022 when REK Bitola was not producing sufficient electricity, citizens and cooperatives could become relevant energy producers[3]. Some suggest that utility-based projects run by state-owned companies should not receive state support as large-scale projects usually enjoy access to finances from multilateral development banks[4] on the other hand, as prosumers and energy communities are a novelty on the market, there is a need to support them more directly. When energy communities were a new market player in Germany, they were supported which was crucial for them to then be able to participate in the RES market[5]. It is worth mentioning that energy communities and citizens-prosumers are a recent novelty from 2023 and 2021 respectively. The energy communities[6] were enabled with the Law on Cooperatives, and there is still no such entity registered in the country[7]. The procedure for prosumers through the use of photovoltaics has been simplified without the need to get a permit from the municipality[8].

2.2.2 Crisis as an incentive

The increase in the electricity price in the European markets during the energy crisis was the biggest driver of investments in RES compared to any support policies. The market price is the biggest driver of RES investments[9]. However, one can expect that the electricity price would be stabilised in the domestic electricity market[10], which raises the question of having a continued interest in investing in RES projects. The fluctuation of the price can be a challenge, there are reports about negative prices on the European markets, but it still does not mean the investment would not return[11]. However, the increased demand for the RES project has also overloaded the system and slowed down the process[12].

/ 2/ Interview with FES Skopje, personal communication, 3 August 2023
/ 3/ Interview with FES Skopje, personal communication, 3 August 2023
/ 4/ Interview with CEE Bankwatch Network, personal communication, 13 July 2023
/ 5/ Interview with FES Skopje, personal communication, 3 August 2023
/ 6/ Although added in the Law on cooperatives they are still not confirmed and defined with the law on energy.
/ 7/ Interview with FES Skopje, personal communication, 3 August 2023
/ 8/ Interview with CEE Bankwatch Network, personal communication, 13 July 2023.
/ 9/ Interview with the Energy Regulatory Commission, personal communication, 17 July 2023
/ 10/ Interview with the Energy Regulatory Commission, personal communication, 17 July 2023
/ 11/ Interview with the Energy Regulatory Commission, personal communication, 17 July 2023
/ 12/ Interview with Ceprosard, personal communication, 19 September 2023

According to Regulation (EU) 2019/943, TSO needs to be able to facilitate the implementation of a fully integrated, interconnected, and digitalised European electricity market by making available the maximum possible level of cross-zonal transmission capacities (European Community Secretariat, 2023b). In fact, TSOs in the Energy Community are legally obliged to make available a minimum amount of cross-zonal capacity ('70% target') to market participants, a process supported by the Energy Community Secretariat by providing a flow-based capacity calculation methodology (European Community Secretariat, 2023a). Furthermore, the crisis has shown that investment in RES is an opportunity to improve energy security. A good example comes from Montenegro whose national company has supported citizens to invest in photovoltaics to be self-sufficient because, in times of crisis, it will help them be more resilient[13].

2.2.3 Demand for good governance

There is a demand for good governance in the energy sector over the need to develop certain support policies. These observations have been found for the entire Western Balkan region which is weighed down by bureaucracy making energy data less accessible (SELDI, 2016). Historically, large energy projects in the region have been marked by corruption which has driven away potential investors (Prelec, 2014). The same observations exist today as well. The energy sector is considered mismanaged and corrupt[14].

The process of granting strategic project status to certain investments is not transparent enough, due to political influence and vested interests[15]. Even more, this perception increases the costs of an investment and the return on investment[16]. The regulatory and corruption risks make a RES investment in North Macedonia more costly than in Germany which deters investors from the country[17]. Therefore, improving the market conditions rather than giving out direct subsidies is more effective in ensuring more affordable investments[18]. This means that subsidies should be active for a limited period of time - to help the new technologies penetrate the market.

/ 13/ Interview with FES Skopje, personal communication, 3 August 2023
/ 14/ Interview with Eko-Svest, personal communication, 4 August 2023
/ 15/ Interview with RES Expert 1, personal communication, 6 August 2023
/ 16/ Interview with RES Expert 2, personal communication, 19 July 2023
/ 17/ Interview with RES Expert 2, personal communication, 19 July 2023
/ 18/ Interview with RES Expert 2, personal communication, 19 July 2023

2.3 Incentive mechanisms

There is RES support directed towards utility-based projects (also by private companies) (Table 7), and partial subsidy support directed towards households to install photovoltaics with a capacity of up to 6 kW. Energy communities receive no direct support yet.

Although the feed-in tariff has been the dominant way of supporting renewable energy since 2007, its role diminished as the RES market was able to develop. The support for feed-in tariff for photovoltaics began at 46 EUR cents/kWh for a capacity of ≤ 50 MW in 2008 and had a duration of 20 years which has been decreasing over the years (Stojilovska, 2011). The current feed-in tariff does not support photovoltaics and is 8,9 EUR cent/kWh for wind (Table 7).

There has been criticism that the government changed feed-in tariffs abruptly within short periods, not providing investors with signals and stability (Stojilovska, 2011). Currently, both solar and wind are supported with a premium. The premium is calculated under the prescribed methodology and it is assigned to a preferential producer as an additional fixed amount of the price achieved by the sale of each produced kWh on the electricity market wholesale energy (Government of North Macedonia, 2019a). As such it is considered a model that supports RES in a less market-distortive manner.

Table 7: Overview of feed-in tariff and premium support for wind and solar

Type of RES	Feed-in tariff	Premium
Wind power plant ≤ 50 MW	8,9 EUR cent /kWh (20 years)	Available, calculated under prescribed methodology (20 years)
Photovoltaic power plant	Not available	Available, calculated under prescribed methodology (15 years)

Source: (Energy and Water Services Regulatory Commission, n.d.; Government of North Macedonia, 2019a)

Only about a quarter of registered RES power plants are supported by a feed-in tariff (Tables 3 and 8). The issue of the 'preferential status' and the 'temporary preferential status' is based on a request submitted to the Energy Regulatory Commission, which means companies have to be interested in applying for the status of preferential producer of electricity from renewables [19]. Applicants are rejected in case of incomplete application[20]. The process of application is available on the website of the Regulatory Commission and is easily accessible.

The lack of interest in submitting a request for a feed-in tariff can be explained by the fact that the RES market for private companies and utility-based projects is mature enough to function on its own and does not need any direct financial support. On the other hand, the quota for feed-in tariffs for solar energy is always full and considered hard to make use of [21]).

/ 19/ Interview with the Energy Regulatory Commission, personal communication, 17 July 2023
/ 20/ Interview with the Energy Regulatory Commission, personal communication, 17 July 2023
/ 21/ Interview with Ceprosard, personal communication, 19 September 2023.

Table 8: Preferential and temporary preferential feed-in tariff status for wind and solar until 30 January 2023

Type of RES	Preferential (installed capacity)	Temporary (installed capacity)
Photovoltaic ≤ 50 kW	62 (2.914,91 kW)	None
Photovoltaic > 50 kW ≤ 1MW	17 (9.424,505 kW)	None
Wind	1 (36,8 MW)	5 (123,20 MW)

Source: (Energy and Water Services Regulatory Commission, 2023b, 2023c)

Based on the number of existing wind (1) compared to existing solar projects (336) (Table 3), pursuing wind power projects is more difficult. Although the procedure for preferential status is the same for both wind and solar, wind requires additional technical documents due to the different technology in question[22]. Wind power plants are usually larger, and as seen in their yearly production 336 photovoltaics produce only 12% more electricity than 1 wind power plant (Table 3). Installing a wind power plant requires considering its impact on the environment, biodiversity, and location[23].

A positive trend is seen in five wind projects that have the status of temporary preferential producers (Table 8). Interestingly, there is a sort of 'monopoly' in this wind market as again the same owner of the single functioning power plant ESM is the owner of the existing wind power plant project in the same location, while another company holds two of the five upcoming wind power plants (Energy and Water Services Regulatory Commission, 2023b, 2023c). Wind projects face many more barriers, and there are not many areas available for them, while overall the price of capital is high because foreign investors perceive the market as risky due to low investment security[24].

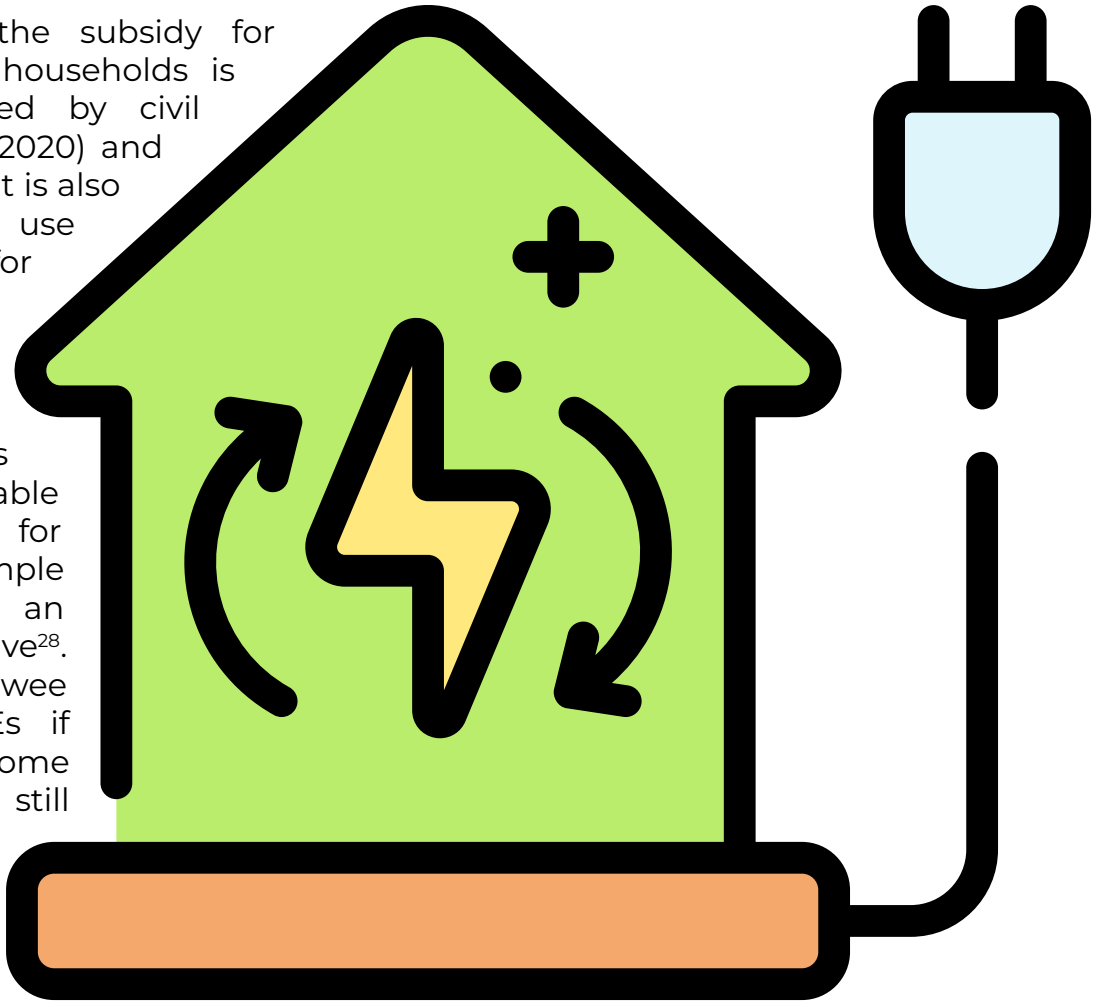
/ 22/ Interview with the Energy Regulatory Commission, personal communication, 17 July 2023
/ 23/ Interview with Ceprosard, personal communication, 19 September 2023
/ 24/ Interview with RES Expert 2, personal communication, 19 July 2023

2.3.1 Support for households and energy communities

RES projects by private companies and utilities have been supported through feed-in tariffs in the past 15 years, while since 2021 and 2023 natural persons are legally allowed to install photovoltaics on their roofs and organise themselves in an energy community, respectively. Natural persons are eligible to only receive partial subsidies to install photovoltaics and these funds are subject to governmental budget availability (Government of North Macedonia, 2023).

This discrepancy in support between companies and natural persons to develop RES projects has been raised by several interviewees. Utility-scale solar and wind are considered mature technologies that do not need feed-in-tariffs to develop[25]. Economic support should be directed primarily towards households[26]. In particular, the allowed installed PV capacity for households (currently at 6 kW) should be increased, while excess energy from households needs to be compensated by the supplier, which is now given back to the operator for free[27]. This observation is in line with a study of the Rulebook on Renewable Energy which suggests increasing the installed capacity of photovoltaics for households from 6 to 9 kW (Minovski & Aneva, 2023).

An increase of the subsidy for photovoltaics for households is also recommended by civil society (Ekosvest, 2020) and this kind of support is also warranted for the use of photovoltaics for heating as well (Djinlev, 2022). Similarly, there is a need to open energy offices that make available information for citizens, for example how to open an energy cooperative[28]. One interviewee argues that SMEs if they want to become prosumers might still need support because they pay electricity at market price[29].



2.3.2 Support for vulnerable consumers

Not only should households be supported to partake in RES projects, but vulnerable consumers in particular. North Macedonia suffers from a high share of energy poverty – 23,8% in 2020 (Eurostat, 2023) which is durable due to a combination of widespread material deprivation, poorly insulated dwellings, and overdependence on fuelwood use (Stojilovska, 2020). Vulnerable consumers cannot be considered as investors, they need to be supported to be able to invest[30]).

The current energy poverty subsidy which is based on household income and size and paid as a reimbursement is limited and offers little alleviation, their vulnerability needs to be reduced to make them fit to participate in the energy transition[31]. This also requires greater policy cohesion between social and economic policies as vulnerability is not solved with additional financial support but also investment such as in social housing[32] .

North Macedonia shows policy cohesion between climate and energy policies (Stojilovska et al., 2022), but this is not reflected in the actual measures against energy poverty and to support RES in households. For instance, vulnerable consumers practise fuel stacking[33] . General measures to support RES projects in households end up subsidising those who can already afford them by using the first come – first served principle in calls for subsidies[34]. At the moment, the subsidy for photovoltaics does not support vulnerable categories directly (Trpevski, n.d.).

/25/ Interview with CEE Bankwatch Network, personal communication, 13 July 2023; Interview with RES Expert 2, personal communication, 19 July 2023
/26/ Interview with CEE Bankwatch Network, personal communication, 13 July 2023; Interview with Eko-Svest, personal communication, 4 August 2023
/27/ Interview with Eko-Svest, personal communication, 4 August 2023
/28/ Interview with FES Skopje, personal communication, 3 August 2023
/29/ While the companies pay a market price, households are sorted out in 4 blocks and pay electricity based on their consumption.
/30/ Interview with RES Expert 3, personal communication, 31 August 2023
/31/ Interview with RES Expert 3, personal communication, 31 August 202
/32/ Interview with RES Expert 3, personal communication, 31 August 2023
/33/ Interview with RES Expert 3, personal communication, 31 August 2023
/34/Interview with RES Expert 3, personal communication, 31 August 2023

3. Overview of administrative and grid connection procedures

3.1 Site selection

One of the key concerns about the site selection is the conflict between the use of land for energy and food production. An issue is when agricultural land is repurposed for renewables[35]. It has also happened that the land bought by businesses for installing a solar plant is part of Natura 2000 (a network committed to nature, with over 27 000 land and marine protected sites across Europe) which they found out during a public consultation, meaning that there is a conflict between energy projects and conservation goals[36].

Therefore, it is important to mark lands in relevant cadasters and its purchase must be subject to special permits and consultations[37]. Better use of surfaces for photovoltaics without worry about conflict with environmental goals are roofs[38]. Another good use is the transformation of depleted mines (brownfields) to RES power plants[39]. These should be considered as sites for potential new RES projects because they need to be developed near available transmission and distribution networks (MANU, 2022).

3.2 Electricity production licence

The electricity generation licence is one of many steps RES projects utilities and private companies need to obtain. Households using photovoltaics do not need a construction permit from the municipality[40]. The electricity generation licence is issued by the Energy Regulatory Commission and is one of the last steps before being able to start the RES project (Table 9)[41].

One observation is that wind power plants need a few more steps compared to photovoltaics, such as authorisation of construction and measurement of wind power potential (Table 9).

/35/ Interview with RES Expert 1, personal communication, 6 August 2023
/36/ Interview with CEE Bankwatch Network, personal communication, 13 July 2023
/37/ Interview with CEE Bankwatch Network, personal communication, 13 July 2023
/38/ Interview with FES Skopje, personal communication, 3 August 2023
/39/ Interview with CEE Bankwatch Network, personal communication, 13 July 2023
/40/ Interview with CEE Bankwatch Network, personal communication, 13 July 2023; Interview with FES Skopje, personal communication, 3 August 2023
/41/ These steps refer to both RES projects receiving and not receiving feed-in tariffs, however the steps regarding the feed-in tariff procedures only refer to the category of projects which have applied for a feed-in tariff

Table 9: Overview of the procedure for photovoltaics and wind power plants both receiving and not receiving feed-in tariffs

Procedure steps for RES project (by private entity) / utility-based in a sequential order	Photovoltaic plant (order or steps)	Wind power plant (order or steps)
Establishing a company	1	1
Measurement of wind power potential	/	2
Land use checks	2	3
Environmental Impact Assessment Study or shorter 'Elaborat' study	3	5
Approval for the connection to the (transmission) distribution system	4	4
Authorisation of construction of wind power plant	/	6
Construction Permit	5	7
Award of temporary status of preferential producer (step only for those which applied for a feed-in tariff)	6	8
Design and construction of the connection	7	9
Use permit	8	10
Energy generation licence	9	11
Registration in the registry of RES electricity generation facilities	10	12
Award of status of preferential producer (step only for those which applied for a feed-in tariff)	11	13

Source: (Ministry of Economy, n.d.a, n.d.b)

Households installing photovoltaics for self-consumption that statics of the roof needs to be revised which slows down the procedure[42]. This is because there are only a few companies that have the licences to do such revisions, while they are preoccupied with the large RES plants because they are financially more appealing to them[43].

An expert claims that the solar collector for which there are also subsidies can have higher safety risks although they do not need to go under revision[44]. Furthermore, there are concerns that households might be dealing with non-licenced installers of photovoltaics because the licensed ones are preoccupied with the large photovoltaic[45].

3.3 Administrative authorisations

The administrative process for a RES project is complex and lacks transparency. For instance, no website maps out the procedure and there is no official list of potential RES locations[46]. It is suggested the potential for wind and solar to be publicly available, as well as any relevant administrative data to help interested investors reach a decision[47].

Legislation and procedures may change, while an investor is trying to obtain the necessary permits, which can take up to two years, prolonging the process and making it more costly[48]. Corruption and 'personal relations' with someone in the permit-issuing municipality are also crucial in understanding how one should manoeuvre the challenges of the administrative process for RES projects[49].

The administrative process is considered complex for any type of RES project. Public institutions, such as municipalities face even more challenges. On one hand, their managers are subject to a limited mandate of 4 years which is a short period, making them hesitant to work on such a complex project[50]. On the other hand, as public institutions, they need to submit more documents because they are institutions of public character[51].

3.4 Grid connection permit

The grid connection process is the longest and the most difficult to obtain due to the vested interests of the dominant transmission and distribution system operators, the lack of transparency, and the lack of grid capacity. MEPSO is the Transmission System Operator (TSO) and issues grid permits for projects with an installed capacity above 10 MW, while Elektrodistribucija is the distribution system operator (DSO) and provides permits for smaller projects (<10 MW). Generally speaking, there is no sufficient information about the state of the current grid, its capacity, and how much renewable generation it can integrate[52]. The grid is in a poor state and it gets congested, if more requests for nearby locations come in the future[53]. Overall, it is difficult to track who applied for a permit, when, and what was the decision[54].

A key issue is getting a grid permit for projects above 10 MW. MEPSO is reluctant to issue grid access to a project[55]. Thereby, private investors find it easier to pursue projects below 10 MW so that they do not need to deal with MEPSO.

/42/ Interview with FES Skopje, personal communication, 3 August 2023
/43/ Interview with FES Skopje, personal communication, 3 August 2023
/44/ Interview with FES Skopje, personal communication, 3 August 2023
/45/ Interview with RES Expert 3, personal communication, 31 August 2023
/46/ Interview with CEE Bankwatch Network, personal communication, 13 July 2023
/47/ Interview with CEE Bankwatch Network, personal communication, 13 July 2023
/48/ Interview with RES Expert 2, personal communication, 19 July 2023
/49/ Interview with Eko-Svest, personal communication, 4 August 2023
/50/ Interview with Ceprosard, personal communication, 19 September 2023
/51/ Interview with Ceprosard, personal communication, 19 September 2023
/52/ Interview with FES Skopje, personal communication, 3 August 2023; Interview with RES Expert 2, personal communication, 19 July 2023
/53/ Interview with CEE Bankwatch Network, personal communication, 13 July 2023
/54/ Interview with CEE Bankwatch Network, personal communication, 13 July 2023
/55/ Interview with RES Expert 2, personal communication, 19 July 2023

MEPSO charges for the connection but not for the upgrade of the grid, the latter which should be available to all citizens and energy communities, and not only private companies[56]. If big companies connect to the grid without adequate compensation, they are taking opportunities from households and energy communities if they want to install larger capacities of RES[57].

The procedure is also considered long and complex which is not the case in countries such as Germany, Switzerland, or Czechia where one only has to inform the operator that they are producing electricity from RES, and the distribution operator is obliged to change the meter[58]. Even households, to install photovoltaics, need to submit a study, title deed, and many documents which require a lot of time[59].

3.5 Corporate-fiscal

The lack of transparency invites a lot of speculation in the market which further discourages investment in RES. To address these concerns, there is a need for greater transparency and mapping of the land in advance. For example, there is a need to publish transparent information about the price of land per municipality and where it is suitable to build a RES power plant[60].

This is because these new markets are subject to speculation and some companies would buy land to resell it later[61]. There is a need for clear regulation – publicly available price lists, rulebooks, and regulations so that investors can calculate in advance the investment[62]. The only available handbook about RES project steps is hard to find on the website of the Ministry, there is no year of publication (Ministry of Economy, n.d.a, n.d.b)[63].

3.6 Other

Consultation with the local community before building a solar or wind power plant does not take place although it is necessary to incorporate the view of the local community impacted by these projects. If the processes are clear and transparent, they will be more easily accessible and understandable for the public[64].

If local communities are informed of the project during its late stages when there is not sufficient time to consult experts who can understand technical analyses and not enough time to comment on the project[65]. Another study also finds that the involvement of relevant experts as well as public participation should be ensured during spatial planning and renewables are seen as an important part of this (Colovic Lesoska, 2022).

/56/ Interview with FES Skopje, personal communication, 3 August 2023
/57/ Interview with FES Skopje, personal communication, 3 August 2023
/58/ Interview with Ceprosard, personal communication, 19 September 2023
/59/ Interview with Ceprosard, personal communication, 19 September 2023
/60/ Interview with RES Expert 2, personal communication, 19 July 2023
/61/ Interview with RES Expert 2, personal communication, 19 July 2023
/62/ Interview with RES Expert 2, personal communication, 19 July 2023
/63/ It is likely published before 2018 because of a reference to the old energy law before 2018.
/64/ Interview with CEE Bankwatch Network, personal communication, 13 July 2023
/65/ Interview with Eko-Svest, personal communication, 4 August 2023

3.7 Specific features to ease administrative procedures

Introducing one-stop-shop systems are foremost a legal obligation under the 2018 Renewable Energy Directly and seen by several bodies (e.g. European Commission) as a way to substantially simplify the administrative procedure for RES projects. As illustrated in Table 9 and confirmed by an interviewee, the execution of a project in North Macedonia requires dealing with several authorities.

Setting up one-stop-info offices, which is an obligation from the 2018 Renewable Electricity Directive, within each municipality equipped with an administration that helps fill out the forms and apply is suggested[66]. A good example, at least theoretically, is the recently introduced model of an energy community in the legislation.

The new Law on Cooperatives enables setting up an energy cooperative within a day after submitting to the Central Registry Office the statute and the technical documentation[67]. There is a need for a campaign to raise awareness about the opportunity to join an energy community that is not widely known[68].

/66/ Interview with Eko-Svest, personal communication, 4 August 2023
/67/ Interview with FES Skopje, personal communication, 3 August 2023
/68/ Interview with Ceprosard, personal communication, 19 September 2023

4. Identified barriers hindering solar PV and wind energy deployment

4.1. Political and economic framework

Other than the already mentioned challenges, there are concerns that there is a lack of long-term coherent policy and economic support for RES projects. For instance, despite being a positive development, there are concerns about the law on cooperatives that citizens will face challenges when they establish a cooperative.

Because the Law on Cooperatives was just published, none have been established so far. Nonetheless, an issue is that the Law on Cooperatives states that if something is not regulated by that law then the Energy Law is applicable[69]. That can mean that for a larger investment, additional procedures might apply which would prolong the time of setting up an energy community[70].

Another barrier is the lack of policy cohesion around impacts of RES projects. While there is a genuine interest by all stakeholders to speed up RES projects, fast-tracking RES projects can have adverse environmental implications. This can mean reduced procedures for Environmental Impact Assessment (EIA), creating irreversible damage to biodiversity and the entire ecosystem[71]. Important is to emphasize that North Macedonia has not yet properly transposed the EU EIA Directive, despite its obligation under the Energy Community Treaty (Energy Community Secretariat, 2022a).

Renewable energy projects should not be developed at a cost to biodiversity and ecosystems. Cases, such as when wind power plants are placed in locations that are in the migratory routes of birds, should be avoided[72]. Conservationists should be involved in the planning phases of a RES project to identify its environmental impacts and mitigate those issues (Colovic Lesoska, 2022).

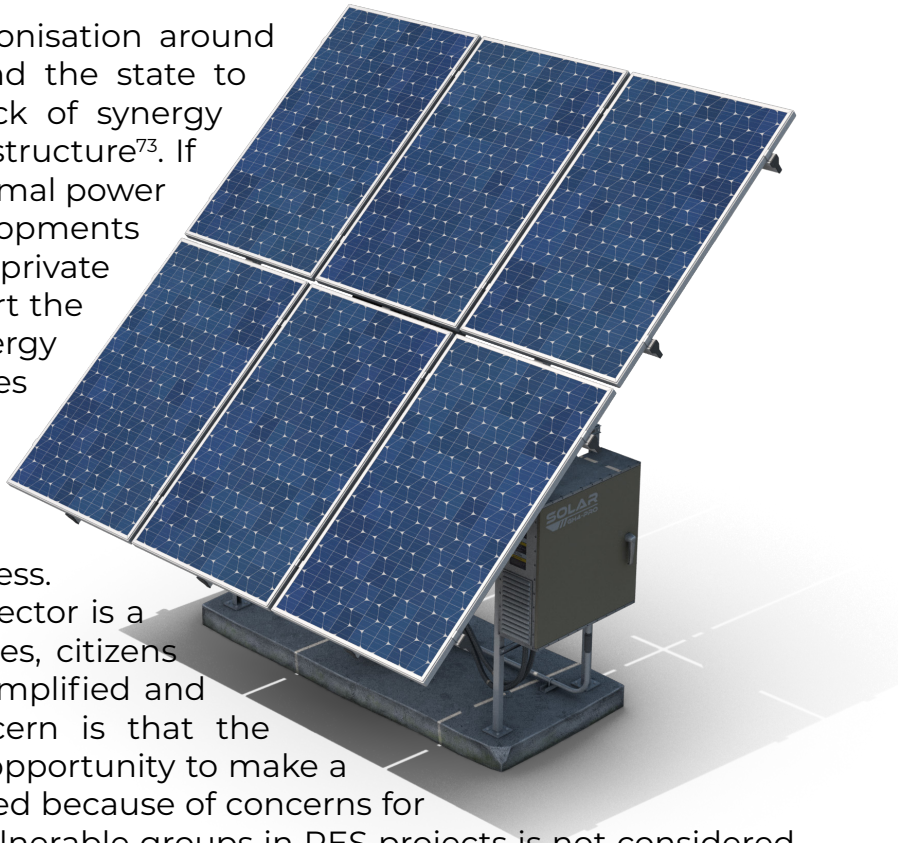
4.2. Market structure

The key issues found around the market structure include the lack of policy integration between national RES policy and the RES policy developed by the private sector; and the lack of including vulnerable groups in RES projects.

The green scenario in the national energy strategy signaled the move towards renewable energy, however, the share of RES in the gross final energy consumption in 2022 is 17,8% and still below its potential and far from its intended goal for 2030 (38% according to the NECP).

/69/ Interview with FES Skopje, personal communication, 3 August 2023
/70/ Interview with FES Skopje, personal communication, 3 August 2023
/71/ Interview with CEE Bankwatch Network, personal communication, 13 July 2023
/72/ Interview with CEE Bankwatch Network, personal communication, 13 July 2023

There is also a lack of policy harmonisation around the efforts of the private sector and the state to increase the share of RES. This lack of synergy prevents further investment in infrastructure[73]. If the country continues to rely on thermal power plants, it will be left out of the developments in the RES market borne by the private sector[74]. The government can support the process by creating a renewable energy fund or giving government guarantees for RES projects (IRENA, 2021).



To foster a socially just energy transition, every participant in the market should benefit from the process. One concern is that while the RES sector is a profitable business for big companies, citizens should be able to participate in a simplified and supported manner[75]. Another concern is that the RES sector is exclusively seen as an opportunity to make a profit and that people are not involved because of concerns for climate change[76]. The inclusion of vulnerable groups in RES projects is not considered. Vulnerable groups are not able to take on loans to invest in RES, therefore they do not have an interest or an opportunity to get involved[77]. The capacity of 6 kW for photovoltaics allowed for natural persons is considered too low to cover their energy needs[78].

4.3. Administrative processes

Other than the entire administrative process being complex, risky, and costly, the choice of which renewable energy sources are subject to support is found unclear. There are still feed-in tariffs for small hydropower plants, crowding out the support for solar and wind plants[79]. Small hydro projects are still being subsidised although they can hurt biodiversity. Thus, RES support policies are not in line with current energy and climate strategies and plans[80]. A recent study concluded that the feed-in tariff support achieved its maturity for small hydro plants and that this reduced the support for wind and solar (Trpevski, 2022).

On the other hand, collective self-consumption is singled out as complicated. A collective building can only use the produced electricity for the joint use of the building (lighting of staircases, elevator, and similar uses), but the electricity cannot be divided among the households sharing the building which poses a barrier to wider penetration of solar in collective buildings[81]. Another identified barrier for private RES investors is the land property questions as it can take some time to be resolved. For instance, it depends on whether the owner is the municipality or a natural person[82].

/73/ Interview with RES Expert 2, personal communication, 19 July 2023
/74/ Interview with RES Expert 2, personal communication, 19 July 2023
/75/ Interview with RES Expert 3, personal communication, 31 August 2023
/76/ Interview with RES Expert 3, personal communication, 31 August 2023
/77/ Interview with RES Expert 3, personal communication, 31 August 2023
/78/ Interview with RES Expert 3, personal communication, 31 August 2023
/79/ Interview with CEE Bankwatch Network, personal communication, 13 July 2023; Interview with RES Expert 1, personal communication, 6 August 2023
/80/ Interview with Eko-Svest, personal communication, 4 August 2023
/81/ Interview with CEE Bankwatch Network, personal communication, 13 July 2023
/82/ Interview with RES Expert 2, personal communication, 19 July 2023

4.4. Grid regulation and infrastructure (including flexibility and storage challenges)

Investment in renewables needs to take place in parallel with grid improvements, the latter regarding which North Macedonia is lagging. According to the website of MEPSO, the transmission operator, there is a need to improve the grid as a way to ensure that it can absorb the increasing share of renewables. MEPSO claims that the grid can connect 750 MW of RES but the demands for connection are 10 times higher (Fazliu, 2022). However, there is no study about the state of the grid[83]. Investments in the grid as well as in small-scale pump storage are needed to unlock the decentralised production of electricity and stimulate energy communities and prosumers[84].

The state of the grid is also related to the issue of ownership. The Macedonian grid is not in national ownership but is owned by the private distribution operator Elektrodistribucija[85]. This is linked to the question of who should invest. If foreign investors use the grid for free and sell RES on the open market under market prices is not helpful for the country[86]. The operator of the distribution system is obliged to continuously develop the infrastructure[87]. If the distribution system operator does not have money to invest in the grid, it should return it to the state[88]. It has happened that potential RES investors' requests for connection have been declined because the operator of the distribution grid has underdeveloped infrastructure in certain regions[89].

4.5. Other

The need for greater policy cohesion was highlighted. There is a need to align investment in RES with climate goals (IRENA, 2021). For instance, the national spatial plan that is currently being developed needs to take into account energy and climate and identify land suitable for solar and wind projects[90]. Similarly, when policies are created, there is little awareness about the actual situation on the ground and how the envisaged policy would affect it. The support for vulnerable citizens is not functional because they cannot fulfil the criteria for the intended energy poverty subsidy.

For example, vulnerable citizens might not have a title deed of their property[91]. It seems as if it is expected that vulnerable consumers would solve their issues on their own[92]. Regarding energy communities, citizens are not interested in joining and working together because of poor neighbourly relations[93]. Municipalities can be found as intermediates that will invest in photovoltaics and allow citizens to participate[94].

The increasing importance of municipalities as an actor in the energy transition through the development of renewable energy projects can contribute to energy independence, local employment opportunities, and access to electricity (Colovic Lesoska, 2022). Municipalities can also support households to make the switch to more efficient heating systems (Djinlev, 2022).

/83/ Interview with FES Skopje, personal communication, 3 August 2023
/84/ Interview with CEE Bankwatch Network, personal communication, 13 July 2023
/85/ Interview with FES Skopje, personal communication, 3 August 2023
/86/ Interview with FES Skopje, personal communication, 3 August 2023
/87/ Interview with RES Expert 1, personal communication, 6 August 2023
/88/ Interview with RES Expert 2, personal communication, 19 July 2023
/89/ Interview with RES Expert 1, personal communication, 6 August 2023
/90/ Interview with CEE Bankwatch Network, personal communication, 13 July 2023; Interview with Eko-Svest, personal communication, 4 August 2023
/91/ Interview with RES Expert 3, personal communication, 31 August 2023
/92/ Interview with RES Expert 3, personal communication, 31 August 2023
/93/ Interview with RES Expert 3, personal communication, 31 August 2023
/94/ Interview with RES Expert 3, personal communication, 31 August 2023

5. Identified good practices

Although with still many open questions around its implementation, the launch of the Law on Cooperatives and the opportunity to create an energy community can be considered a good example of more democratic and decentralised energy production in North Macedonia. Theoretically, the registration should be done within a day which is a promising trend considering that the other procedures for natural persons and private companies take a long time.

The value of an energy community is that it has a different motive than a typical company which is not to make a profit but to create benefits for the members of the community, such as reducing their energy costs and reducing the impact on the environment[95]. The decision-making is more democratic and there are overall more social benefits for the community[96].

Opening up energy offices in Croatia to disseminate information about the possibilities of citizen's participation in the RES project is a good example. The Croatian energy offices offer information for prosumers and energy communities and at the same time promote new technologies[97]. They can also calculate the return on investments for free[98]. The energy offices are financed by the producers of technologies which see a benefit in having their technology promoted[99].

Some examples include energy agencies founded by cities and countries in Croatia which offer a range of services for citizens, as well as for the public and private sector. Services addressing citizens include how to use the free consultation regarding the co-financing of the renovation of family houses and how to install photovoltaics on the roof (Dalmatian Energy Agency, 2023; Regional Energy Agency North, 2023).

Easing the bureaucratic procedure in Croatia while making sure that companies are interested in investing rather than speculators is another good practice in Croatia. Because the grid connection is not transparent in North Macedonia, a process has to be introduced such as in Croatia to support interested investors in which prospective investors who just want to occupy the land and not build anything are filtered out[100].

This is done by demanding more information, such as their capital flow and other information[101]. On the other hand, introducing digitalisation in the process of installing photovoltaics which exists in Serbia and Croatia should be followed (Trpevski, n.d.).

/95/ Interview with FES Skopje, personal communication, 3 August 2023
/96/ Interview with FES Skopje, personal communication, 3 August 2023
/97/ Interview with FES Skopje, personal communication, 3 August 2023
/98/ Interview with FES Skopje, personal communication, 3 August 2023
/99/ Interview with FES Skopje, personal communication, 3 August 2023
/100/ Interview with RES Expert 2, personal communication, 19 July 2023
/101/ Interview with RES Expert 2, personal communication, 19 July 2023

6. National policy recommendations

6.1 Legislative framework

- Update the renewable energy legislation to fully transpose the 2018 Renewable Energy Directive, to update the EIA legislation and, fully transpose the EU Habitats, Birds, and Water Framework Directives
- Propose and protect Nature 2000 sites
- Make sure the legislation is clear and that any changes to the legislation are easily available to potential investors and citizens prosumers;
- Stipulate that service providers of RES projects are certified and the information about them is publicly available;
- Ensure that early and meaningful consultation with the local communities takes place for larger RES projects or projects in more sensitive locations;
- Ensure that RES projects with a potentially significant environmental impact go through an environmental impact assessment, based on the criteria from Annex III of the EU EIA Directive;
- Ensure that there is better policy cohesion between renewable energy and related areas, such as climate, biodiversity, land use, agriculture, and social policy.

6.2Support policies

- Phase out support for private RES projects such as feed-in tariffs;
- Allocate more support for energy communities and prosumers including special lines to support vulnerable consumers;
- Make sure that the support policies are in line with the legislation and the relevant energy strategies, as well as EU state aid rules;
- Support projects that involve a collaboration between municipalities and energy communities which share jointly the costs and benefits of investing in RES projects.

6.3 Administrative transparency

- Map the potential RES locations in suitable locations, such as brownfield, and non-agriculture land after having performed a sensitivity analysis and in a coordinated manner with local authorities;
- Make the mapped RES locations publicly available and accessible;
- Publish good practices of RES projects and procedures;
- Publish basic information necessary for potential investors in RES to help them in the calculation of the investment, such as prices of land, grid connection, and other costs;
- Make the entire procedure for all types of RES projects publicly and easily available;
- Make sure that the potential RES locations have no unresolved land ownership issues;
- Introduce a one-stop-shop system for wind and solar projects;
- Open energy offices to disseminate information about the possibilities of developing a RES project.

6.4 Grid development

- Conduct a long-term study assessing the capacity of the grid to absorb RES and identify improvements needed;
- Return the grid to state ownership;
- Invest in the grid to absorb RES;
- Make the information about the grid's capacity for RES publicly available;
- Allocate slots in the grid for prosumers and energy communities;
- Simplify the procedure for grid connection by ensuring that it takes place in an allocated deadline and the respective operator complies with their obligation to issue a grid access if conditions for it are fulfilled;
- Ensure that the TSO can make the available maximum possible level of cross-zonal transmission capacities by following Energy Community Secretariat's a flow-based capacity calculation methodology to facilitate the implementation of a fully integrated, interconnected and digitalised European electricity market.

REPORT FOR SERBIA

1. Introduction

Serbia is a signatory country to the legally binding Energy Community Treaty, which is meant to provide for a creation of an integrated energy market between the EU and the contracting parties. The treaty is available to countries which are potential candidates for accession into the European Union and it involves the implementation of the acquis communautaire in the fields of energy, environment, competition, and renewable energies.

As such, Serbia is obligated to integrate EU energy laws into its own national legislative framework. However, the legacy of coal mining and production of electricity from thermal power plants, which provides for lower electricity prices in the country, have slowed down the progress of energy decarbonisation and the uptake of RES in Serbia in recent years.

Furthermore, Serbia has been strategically navigating the geopolitical landscape between the EU and the Russian Federation for many years. For example, Serbia has entered into a free trade agreement with the Eurasian Economic Union in 2019, which Serbia should withdraw from if it joins the EU. This stance has become even more controversial after the invasion of Ukraine by Russia, especially in terms of energy security. Since Russian companies are a large supplier of fossil gas to Serbia and own the only Serbian fossil gas storage facility, such a position has the potential to slow down Serbia's energy transition to renewable energy sources.

This study aims to identify country-level barriers in Serbia, which impede the deployment of RES projects, as well as examples of good practice with respect to RES projects in the country. The type of RES projects in focus is electricity production from solar panels (PV) and wind turbines. Additionally, the report offers policy recommendations, which should help to accelerate the uptake of RES in the Republic of Serbia.

To provide readers with an understanding of identified barriers, examples of good practice, and of given policy recommendations, an overview of the energy sector, incentive mechanisms (i.e. feed in tariffs and feed in premiums), and procedures for RES investments in Serbia is first given in chapters "Overview of the national electricity sector" and "Overview of administrative and grid connection procedures". More specifically, the report provides a background to the barriers, examples of good practice, and given

policy recommendations through dimensions of policy and economic frameworks. The policy framework includes administrative and grid connection procedures, the legislative framework, energy policies, and an overview of competent institutions, while the economic framework includes an analysis of the energy market, key stakeholders, electricity production capacities, energy storage infrastructure, and incentive mechanisms for investments in RES.

The methodology for identification of barriers, examples of good practice, and for providing policy recommendations is based on interviews with stakeholders and subject-matter experts in the field of RES projects, as well as a questionnaire provided to partners of CAN Europe, which are stakeholders and subject-matter experts in the field of RES investments. In total, 5 structured interviews with experts were conducted. Moreover, chapters on the national electricity sector and the overview of administrative and grid connection procedures were drafted with secondary data, such as energy policy reports, energy laws and subordinate legislation, and energy statistics from competent national institutions.

RES projects are analysed in terms of three orders of magnitude:
1) individual and collective self-consumption (i.e. prosumer households, businesses, institutions, housing communities),
2) utility-scale, and
3) energy communities.

Utility-scale RES projects refer to large-scale projects, with installed capacity on a MW scale. There are no energy communities in Serbia yet, so energy communities in this report refer to two kinds of energy sharing: energy cooperatives and prosumer housing communities.

The project is implemented by CAN Europe with the support of a consulting firm eclareon GmbH, which enables the report to draw from the extensive know-how of the company in conducting EU-wide energy policy projects, e.g. RES Simplify and RES Monitor projects.

2. Overview of the national electricity sector

2.1 Electricity market and key stakeholders

In 2021, Serbia had a yearly primary energy production of 118 326 GWh (Government of the Republic of Serbia, 2022). The energy mix of primary energy production of Serbia in 2021 was roughly comprised of:

Table 10: Overview of the energy mix of primary energy production of Serbia in 2021

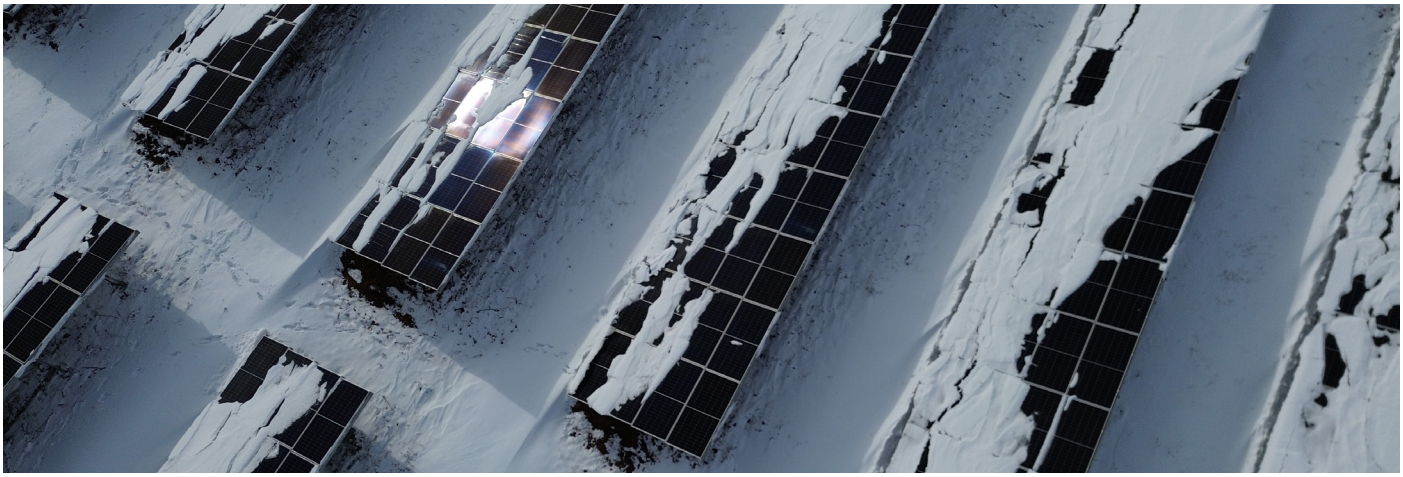
% of total	Primary energy
0,01%	Solar energy
0,91%	Wind energy
61,73%	Coal
9,53%	Hydropower (without pumped hydro)
8,68%	Crude oil (with semi-refined products)
2,83%	Fossil gas
15,71%	Biomass

Source: Government of the Republic of Serbia, 2022

A more detailed table is available in the Appendix. Serbia imported 84 349 GWh of energy and exported 18 616 GWh, so net imports amounted to 65 721 GWh. Imports were mostly crude oil (including semi-refined products) and fossil gas, comprising over 80% of energy imports together. The predominant form of exports was also crude oil (including semi-refined products), comprising 62,98% and followed by electricity with 34,02%.

The import dependence of Serbia was 34,81%, since its total energy supply amounted to 187 349 GWh. Solar energy and wind energy made up only 0,59% of the total energy supply, which stands in stark contrast to coal's 43,34%, petroleum's 24,25%, and fossil gas's 14,86% (Government of the Republic of Serbia, 2022). Total gross electricity generation in Serbia amounted to 38 236 GWh in 2021.

Solar PV and wind turbines accounted for only 2,86% of Total gross electricity generation, while thermal power plants accounted for 62,07% and their largest source of fuel was coal. Additionally, hydro power plants accounted for 33,15% of Total gross electricity generation (Government of the Republic of Serbia, 2022). Therefore, Serbia is currently heavily dependent on thermal power plants and coal, crude oil, and fossil gas for its energy needs. For full statistical tables and official conversion factors, refer to the Appendix of this report.



2.1.2 Electricity production capacities

Overall, over 8 GW of electricity production capacities are currently installed in Serbia[102] (Government of the Republic of Serbia, 2021). 90,9% of total installed power plant capacities are owned by the joint stock company Elektroprivreda Srbije (EPS) (Energy Agency of the Republic of Serbia, 2023a), which is 100% owned by Serbia and represented by the Government of Serbia. There are 6 thermal power plants and 3 CHP (Combined Heat and Power) plants owned by EPS in Serbia[103] (Elektroprivreda Srbije, 2023a; Ministry of Construction, Transport and Infrastructure, 2021).

Thermal power plants have an installed net capacity of 4079 MW and CHP plants have an installed net capacity of 297 MW (Elektroprivreda Srbije, 2023a, Ministry of Construction, Transport and Infrastructure, 2021), jointly comprising almost 55% of the total electricity production capacity. All thermal power plants are powered by coal, while CHP plants are powered by fossil gas and fuel oil.

There are 16 hydro power plants (HPPs) owned by EPS, with an installed capacity of 3015 MW (Elektroprivreda Srbije, 2023a; Ministry of Construction, Transport and Infrastructure, 2021), comprising almost 38% of the total electricity production capacity. Of these, there is one reversible hydropower plant (pumped hydro storage), RHPP Bajina Bašta (Elektroprivreda Srbije, 2023b).

Additionally, there is one pumped storage plant, PAP Lisina, which pumps water from an artificial accumulation lake (Lisina) into another (main) semi-artificial lake (Vlasina) for hydropower production when needed (Ministry of Construction, Transport and Infrastructure, 2021; Elektroprivreda Srbije, 2023c). In 2022, there were 156 small hydro power plants (<10 MW) with a total installed capacity of 128 MW (Energy Agency of the Republic of Serbia, 2023a). In Serbia, small hydropower plants are defined as having less than 10 MW of installed capacity.

There are 8 wind power plants (WPPs) with an installed capacity of about 398 MW[104] (Energy Agency of the Republic of Serbia, 2023a; Radio-televizija Vojvodine, 2023; BBC, 2021), comprising almost 5% of the total electricity production capacity. There are currently more than 1 GW of wind power plant investments planned in Serbia (Balkan Green Energy News, 2023a). In 2021, 1084,541 GWh of electricity was produced from wind power plants in Serbia (Statistical Office of the Republic of Serbia, 2023).

/102/ See Appendix
/103/ For a list of thermal and CHP power plants in Serbia, refer to the Appendix.
/104/ For a list of wind power plants in Serbia, refer to the Appendix.

There are currently around 60 MW of installed solar (including both ground-mounted and rooftop) photovoltaic (PV) power plants in Serbia, comprising less than 1% of the total electricity production capacity in the country. There is no publicly available information on the exact number of currently operating solar PV power plants of either kind in the country. In 2021, official estimates declared the installed net output solar PV capacity as 12 MW (Government of the Republic of Serbia, 2021).

The figure for currently installed capacities cannot be found in official reports, since official reports lag at least two years behind. Instead, this number was obtained through summing up the figures from the Registry of prosumers of the distribution system operator (DSO) Elektrodistribucija d.o.o. (Elektrodistribucija, 2023a; Elektrodistribucija, 2023b) and public statements and reports on opening of new PV power plants in the country (Balkan Green Energy News, 2023b), since the time of the last official report. According to the International Renewable Energy Agency (IRENA), in 2021 there were 51,84 MW of solar PV power plants in operation in Serbia (IRENA, 2021), which does not align with official government sources.

In 2021, a new Law on the Use of Renewable Energy Sources[105] was adopted, which enabled the rise of the prosumer model in the country. This initiated a sharp rise in the total installed capacity over the past year. As a result, there are now more than 1800 household prosumers (with 15 MW installed capacity) and around 600 non-household and non-energy sharing prosumers (with 23 MW installed capacity) in Serbia, comprising about 2400 prosumers in total with a total installed capacity of about 38 MW as of November 2023 (Elektrodistribucija, 2021a; Elektrodistribucija, 2021b; Balkan Green Energy News 2022; Bloomberg Adria 2023).

There are currently a few hundred MW more going through administrative procedures for prosumers (Balkan Green Energy News,2022). Prior to the adoption of the new Law, there were only 51 prosumer contracts concluded with EPS (Energija Balkana, 2023a). Additionally, the largest solar PV power plant in the country was opened in 2023 – the DeLasol power plant – with an installed capacity of 9,9 MW, which contributed to the rise of the total installed capacity significantly (Balkan Green Energy News, 2023b).

In 2021, 13,516 GWh (0,001 mtoe) of electricity was produced from solar PV panels in Serbia (Government of the Republic of Serbia, 2022; Statistical Office of the Republic of Serbia, 2023). A sharp rise can be expected for 2022 and 2023, which data in Energy balances for 2024 and 2025 is set to reflect.

There are no geothermal or nuclear power plants producing electricity in Serbia yet (Energy Agency of the Republic of Serbia, 2023a). Building of nuclear power plants has been forbidden by law in Serbia since 1989, though there have been sporadic discussions in the public about possible projects (euronews, 2022).
Most of the statistical data for energy in Serbia is currently reliable up to the year 2021, owing to their schedule of publishing[106].

/105/ "Law on the Use of Renewable Energy Sources", Official Gazette of the RS No. 40/2021, 35/2023
/106/ See Appendix

2.1.3 Energy storage infrastructure

Serbia relies mostly on fossil gas storage, crude oil and refined products storage, and reversible hydroelectric power plants to secure its critical energy needs. There is one underground gas storage (UGS) in Serbia, UGS Banatski Dvor, with 427 million m3 capacity. There are plans to increase the UGS Banatski Dvor capacity to more than 710 million m3 (eKapija, 2023). Gazprom owns a 51% stake in the storage facility, while Srbijagas owns the remaining 49% stake (Energy Agency of the Republic of Serbia, 2023a; Serbian Business Registers Agency, 2023a).

Srbijagas is a state-owned fossil gas supplier, trader, and a distribution system operator. There are also crude oil and refined products storage capacities in the country in the amount of two months of average daily consumption. Oil companies must also possess operational reserves in the amount of four days of average sales in the last three years (Radio Television of Serbia, 2022).

There is one reversible hydroelectric power plant, RHPP Bajina Bašta, and one pumped storage facility, PAP Lisina. There are no other storage technologies, like compressed air energy storage, liquid air energy storage, ice or snow storage, heat storage (e.g. molten salts), green hydrogen peak shaving, large-scale battery storage capacities, etc. There are plans for building of several more reversible hydroelectric power plants (Government of the Republic of Serbia, 2021; Politika.rs, 2023a, energetika-net.com, 2023).

There is an incentive to build a battery system in the new amendments to the Law on the Use of Renewable Energy Sources. If the grid operator determines a possible risk to the balancing of the power grid as a result of a RES project, which uses an intermittent energy source, it can defer the grid connection process. However, the investor can avoid deferral of the grid connection process by, among other options, installing an energy storage system.

The conditions are slightly different for connections to the distribution and transmission grid, but the storage system should have at least 20% of the power plant installed capacity and 0,4 MWh per MW of power plant installed capacity if it's a battery storage system (Balkan Green Energy News, 2023c; Balkan Green Energy News, 2023d; National Assembly of the Republic of Serbia, 2023).

There are two energy communities, or energy cooperatives, namely Elektropionir and Sunčani krovovi Šabac. However, there have not been

any operational RES-E energy community projects yet. Elektropionir successfully crowdfunded and placed two 5 kW solar PV power plants on two roofs as part of the Solarna Stara project in August 2023 (Balkan Green Energy News, 2023e).

These power plants are not producing electricity just yet, as certain administrative steps still have to be taken. Sunčani krovovi Šabac also plans to undertake its first solar PV power plant project in the near future (Batas, 2023). It should be mentioned that there are currently only two operational energy sharing projects (multiple users in one building sharing a RES system) in Serbia (Elektrodistribucija, 2023c).

Serbia is well connected in terms of power grid interconnections with its neighbouring countries[107], which provides a good basis for growth of the electric energy sector, especially in terms of exporting electricity surpluses from intermittent electricity sources, like RES. Additionally, this provides national energy security as it's possible to import electricity in case of lower production.

2.1.4 Competent institutions and market players

The ministry competent for energy is the Ministry of Mining and Energy. Within the Ministry, there are sectors for electrical energy and for renewable energy sources, among others.

The state energy regulatory agency is the Energy Agency of the Republic of Serbia (AERS). It is established by the national Law on Energy[108] as a regulatory body with competences over electricity, fossil gas, oil, oil products, and CHP heat energy sectors. It also keeps a public registry of licences for performing energy activities, both in printed and electronic form (Energy Agency of the Republic of Serbia, 2023b).

The national electric Transmission System Operator (TSO) is the joint stock company Elektromreža Srbije (EMS), which is in complete state ownership. The national electric Distribution System Operator (DSO) is Elektrodistribucija Srbije (EDS) a limited liability company, which is also in complete state ownership. There is no one energy market operator for the entire country. For the electricity market, also the nominated electricity market operator (NEMO) is a joint stock company SEEPEX. The fossil gas market is a bilateral market, managed by Transportgas Srbija d.o.o. using a virtual platform "Serbian balance point" (SBT).

There are 70 entities with issued licences for performing electricity supply services in Serbia. According to the Energy Agency, there were 11 entities which were active in the open retail market for electricity supply in 2021 (Energy Agency of the Republic of Serbia, 2021). The predominant electricity supplier in the country is Elektroprivreda Srbije A.D. (EPS A.D.) through its EPS Snabdevanje (EPS Supply) branch. EPS Snabdevanje has around 97% stake in the national electricity supply market (Government of the Republic of Serbia, 2021; EPS Snabdevanje, 2023).

/107/ Serbia has power grid interconnections with all of its neighbouring countries. Currently, there are 19 interconnections, which use either 400, 220 or 110 kV interconnection lines. There are 23 interconnections in total with Kosovo's interconnections with Montenegro, Albania, and North Macedonia (Elektromreža Srbije, 2023a; Government of the Republic of Serbia, 2021). According to the Security of Supply statement of the Republic of Serbia to the Energy Community Secretariat for 2021, 22 of 23 interconnection lines are active (Government of the Republic of Serbia, 2021).

/108/ "Law on Energy", Official Gazette of the RS, No. 45/23

There are also 36 entities with licences issued for electricity production and 11 entities with licences issued for combined heat and power production (Energy Agency of the Republic of Serbia, 2023c). The largest for both groups is Elektroprivreda Srbije A.D. (EPS A.D.). Its electricity production capacities have been outlined in this chapter.

2.2 Energy policies and legislative framework

2.2.1 Strategies

There are several strategies outlining Serbia's energy policy. The most prominent ones are: the "Energy Sector Development Strategy of the Republic of Serbia for the period by 2025 with projections by 2030", the "Low Carbon Development Strategy of the Republic of Serbia for the period from 2023 to 2030 with projections until 2050", and the draft "Integrated National Energy and Climate Plan of the Republic of Serbia for the period 2030 with the projections up to 2050" (the NECP).

The Energy Sector Development Strategy defines strategic priorities for development of each part of the energy sector. It was adopted at the end of 2015 and it is valid until 2025. Since the energy development paradigm was largely different at the time of drafting and adoption, the Strategy has become very outdated by now.

The Low Carbon Development Strategy was adopted in June 2023. Adoption of the Strategy is an obligation under the Law on Climate Change in order to establish a strategic, political, and legislative framework to combat climate change, in line with obligations of Serbia as a candidate for EU membership and obligations under the Energy Community Treaty and the UN Framework Convention on Climate Change and the Paris Agreement. Its adoption comes more than three years after the public consultation on it was held (Ministry of Environmental Protection, 2023; Balkan Green Energy News, 2023f).

The Serbian NECP draft has been prepared by the Ministry of Mining and Energy and it is still in the process of being finalised. Comments from the public were being accepted until 28th July 2023 within the scope of the public consultation procedure. Adoption of the NECP is in accordance with obligations of Serbia under the Energy Community Treaty and its candidate status for EU membership. The NECP defines how the EU countries intend to address the 5 dimensions of the energy union: decarbonisation, energy efficiency, energy security, the internal energy market, as well as research, innovation and competitiveness.

The new Energy Sector Development Strategy until 2040 with projections until 2050 is going to be prepared on the basis of the new NECP (European Commission, 2023; European Commission, 2022; OECD, 2022; LDK Consultants, 2022). Therefore, the new Energy Sector Development Strategy can be expected only after adoption of the NECP. In June 2023, the government also adopted a document called "Starting points of Plan for the development of energy infrastructure and energy efficiency measures for the period up to 2028 with projections until 2030". The document prioritises projects and adopts guidelines for the drafting of the Energy Development Strategy, but at the time of writing the document is not yet public (Energija Balkana, 2023b; Serbia-business.eu, 2023).

According to the Security of Supply Statement of Serbia to the Energy Community Secretariat for 2021, other strategic documents are also currently under development.

2.2.2 Programs

Regarding the implementation of the Energy Sector Development Strategy, there is the Program of the Energy Development Strategy of the Republic of Serbia. The Program defines conditions, manner, dynamics, and measures for the implementation of the Strategy. The Program is adopted by the government for a period of up to six years on the proposal of the competent Ministry for energy. The current Program is in force from 2017 until 2023.

2.2.3 Laws and regulations

The main law governing energy in Serbia is the Law on Energy[109]. The Law on Energy provides the energy policy objectives and manner of its implementation, conditions for supply of energy, protections of energy customers, conditions of performing energy activities, conditions for the construction of new energy facilities, competences of the Energy Agency of the Republic of Serbia, organisation of energy markets, etc.

The Law on the Use of Renewable Energy Sources[110] regulates the usage of energy from renewable energy sources (RES), integration of energy from RES into the energy market, subsidy systems for RES electricity production, guarantees of origin of electricity, self-supply of electricity with RES, procedures relating to building and grid connection of RES energy facilities, cooperation with other countries in the field of RES, the manner of determining the share of RES in gross final energy consumption, etc. The Law introduced market premiums instead of feed-in tariffs, which were kept only for small plants and demonstration projects, and it introduced the concept of buyer-producers for the self-supply of electricity. Also, the law introduced a ban on the construction of hydropower plants in protected areas.

The Law on Energy Efficiency and Rational Use of Energy[111] aims to promote energy savings, the sustainable use of natural resources, and reducing the impact of the energy sector on the environment. The Law harmonises Serbian law with EU directives concerning, for example, eco-design regulations, labelling of household appliances, and high-efficiency cogeneration.

Among other things, the Law provides for the founding of the Administration for Financing and Encouraging Energy Efficiency within the Ministry of Mining and Energy, which should enable citizens to receive subsidies for energy renovations (e.g. replacement of windows, doors, building insulation, and heating systems).

The Law also defines the energy management and advisory system, Energy Service Company (ESCO) model contracts, and energy audit obligations for large companies.
A significant regulation on the Serbian energy market is the Decree on market premium and feed-in tariff[112]. It defines the procedure to obtain the market premium (known as the feed-in premium), the procedure to obtain the feed-in tariff, the procedure for auctions for the market premium and the feed-in tariff, and regulates the status of a privileged producer attained by receiving the market premium.

Quotas for capacities of solar PV and wind power plants within the auction subsidy system are provided in the Decree on determining the quota in the market premium system for wind power plants[113] and in the Decree on determining the quota in the market premium system for solar power plants[114]. The quota currently set for capacity of wind power plants within the auction system is 400 MW, while this is 50 MW for solar power plants.

If some part of the quota for each type of power plant remains unallocated, this can be allocated in the next auction call. Accordingly, the government should amend or issue a new decree each time the quota nears full allocation. The Serbian RES auction incentive mechanism is presented in greater detail in the next subchapter.

The Decree on Energy Vulnerable Customers[115] defines the categories of citizens who have the right to subsidies of their energy bills. This category of citizens is important since it would arguably benefit the most from the uptake of RES in comparison to unsubsidised citizens, due to the energy independence and alleviation from energy poverty RES could provide for them. However, there are issues with funding energy renovations for energy vulnerable citizens in Serbia, as is outlined in the chapter on identified barriers for RES projects.

Serbia uses the Guarantee of Origin System. Guarantees of Origin are electronic documents which have a function to provide evidence to a customer that a share, or a quantity, of energy which was delivered by a supplier was produced from renewable sources. The Guarantees of Origin System uses certificates that guarantee that 1 MWh of electricity provided originated from renewable energy sources.

Provided by the Law on the Use of Renewable Energy Sources adopted in April 2021, Elektromreža Srbije (EMS AD), as the TSO, has been assigned the role of the Issuing body for Guarantees of origin in Serbia and the role of the Registry Operator for Guarantees of origin (Elektromreža Srbije, 2023b).

/109/ Official Gazette of the RS, No. 145/2014, 95/2018 – other law, 40/2021, 35/2023 – other law, 62/2023
/110/ Official Gazette of the RS No. 40/2021, 35/2023
/111/ Official Gazette of the RS, No. 40/21
/112/ Official Gazette of the RS, No. 45/23
/113/ Official Gazette of the RS, No. 107/21
/114/ Official Gazette of the RS, No. 45/23
/115/ Official Gazette of the RS, No. 137/2022, 46/2023 – other regulation

2.3 Incentive mechanisms

Available incentive mechanisms for solar PV and wind power plants in Serbia are the market premium, a feed-in tariff, and a subsidy of the Ministry of Mining and Energy for prosumers.

Serbia published its first call to auction for the market premium (known also as the feed-in premium) in June 2023. Quotas are awarded to lowest bidders until fulfilment of the quota. The market premium is an incentive mechanism in which the investor offers an electricity price at an auction and, if the offer is successful, the state compensates the difference between the reference market price and the offered price for produced electricity during the contract period. The reference market price is an average electricity market price during a specified time period.

In Serbia, the reference market price is determined according to the electricity price on the SEEPEX power exchange (Government of the Republic of Serbia, 2023a; Biznis.rs, 2023a). Nevertheless, the investor sells electricity from the power plant at any price on the electricity market and he is additionally paid a difference between the original offered price and the reference price as a safety and incentive mechanism for investments into RES. That is a contract-for-difference (CfD) model. RES auctions in Serbia are more closely

regulated by the Decree on market premium and feed-in tariff [116] (Feed-in-Premium Decree, Uredba o tržišnoj premiji i fid-in tarifi). The FiP Decree defines the procedure to obtain the market premium, the procedure to obtain the feed-in tariff, the procedure for auctions for the market premium and for the feed-in tariff, and it regulates the status of a privileged producer attained by receiving the market premium.

Awarding of auction quotas to investors is based on the lowest declared prices. However, the Ministry has indicated that further criteria will be added in the future auctions (Balkan Green Energy News, 2023g).

In case the reference market price is larger than the offered price, the investor pays the difference between the reference price and the offered price to the state. In case the reference price is negative, the state does not pay anything to the investor nor does the investor pay anything to the state. The original offered price can sometimes be indexed periodically (e.g. according to the consumer price index, inflation, etc.), so the reference price can also be periodically indexed by the state. There is a maximum possible offered price at auctions, suggested by the Energy Agency of the Republic of Serbia and determined by the government (Balkan Green Energy News, 2021).

The auction for the market premium has only been available for wind power plants and solar PV power plants so far, while the law provides that hydroelectric (up to 30 MW), biomass, biogas, geothermal, biodegradable waste, landfill gas, and sewage gas power plants can also achieve the right to a market premium in Serbia. The same is valid for the feed-in tariff, albeit with an installed capacity limit of 3 MW for wind power plants and 500 kW for other power plants (National Assembly of the Republic of Serbia, 2023).

The market premium total auction quota for wind power plants is currently 400 MW and 50 MW for solar PV power plants. Wind power plants should have the capacity of at least 3 MW, while solar power plants should have the capacity of at least 500 kW. If some part of the quota for each type of power plant remains unallocated, that part of the quota can be allocated in the next auction call. This means that the government should amend, or issue a new, decree each time the quota nears full allocation.

Quotas for capacities of solar PV and wind power plants within the auction subsidy system are provided in the Decree on determining the quota in the market premium system for wind power plants[117] and in the Decree on determining the quota in the market premium system for solar power plants[118]. The first auction for the market premium in Serbia was open until 14 August 2023.

This auction was only the first part of the three-year auction plan to auction 1300 MW of wind and solar capacities in Serbia until March 2025. According to the "Incentive System Plan for the Use of Renewable Energy Sources for the Period 2023-2025", adopted on 1 June 2023 by the government, the next auction for awarding the market premium will be held in the first quarter of 2024[119], where the auction quota will be 300 MW for wind power plants and 100 MW for solar power plants, and then in the first quarter of 2025, where the auction quota will be 300 MW for wind power plants and 150 MW for solar power plants (Balkan Green Energy News, 2023g). Therefore, the total capacity eligible for incentives in the market premium system in the next three years will be 1000 MW for wind power plants and 300 MW for solar PV power plants (Serbia-energy.eu, 2023). The incentive period for a project is 15 years.

The contract on the market premium is concluded with the guaranteed supplier, currently Elektroprivreda Srbije (EPS), as regulated by Article 24 of the Law on the Use of Renewable Energy Sources. The guaranteed supplier is also obligated to assume the balancing responsibilities for privileged producers which are receiving a market premium. This obligation expires six months after the Serbian intra-day organised electricity market has merged with the unique European intra-day market or 30 months after the establishment of the organised intra-day market in Serbia.

A feed-in tariff is an incentive mechanism in which the state pays out a fixed price to the investor based on the production of electricity during the contract period. In Serbia, it can be awarded in an auction procedure where the lowest bidders, within the predetermined capacity quota, win the auction.

The feed-in tariff is available for the same type of power plants as the market premium is. However, the installed capacity limitation for awarding of the feed-in tariff in Serbia is 500 kW. For wind power plants, it is 3 MW (National Assembly of the Republic of Serbia,

2023). The feed-in tariff can also be awarded for demonstration projects, which are economically unfeasible, but innovative RES usage technologies. The incentive period for a project is 15 years.

The contract on the feed-in tariff is concluded with the guaranteed supplier, currently Elektroprivreda Srbije (EPS), as regulated by Article 37 of the Law on the Use of Renewable Energy Sources. The guaranteed supplier is also obligated to assume the balancing responsibilities for privileged producers which are receiving a feed-in tariff for power plants with less than 400 kW installed capacity (and less than 200 kW installed capacity from 1st January 2026). This obligation expires after the feed-in tariff for the power plant expires.

Additionally, in July 2023 the Ministry of Mining and Energy launched a public call for selection of a strategic partner, which would construct "self-balanced high-capacity" solar PV power plants with total installed capacity of 1 GW (1000 MWAC/1200 MWDC) and with battery systems for electricity storage of at least 200 MW installed power and the possibility of storing 400 MWh of electricity, which would be owned and managed by Elektroprivreda Srbije (EPS) (Balkan Green Energy News, 2023h). At the end of October 2023, the Government of Serbia published its selection of a consortium, made up by Hyundai Engineering, Hyundai ENG America, and UGT Renewables, as the strategic partner for building of the high capacity solar power plant (Balkan Green Energy News, 2023n; Biznis.rs, 2023b).

The Government has also published its intent to find a strategic partner for installation of 1 GW of wind capacity in the future, as part of the "Starting points of Plan for the development of energy infrastructure and energy efficiency measures for the period up to 2028 with projections until 2030" document. It is planned to adopt the Plan by the end of 2023 (Balkan Green Energy News, 2023i).

Another nationally available incentive for solar PV plants is the subsidy awarded by the Ministry of Mining and Energy. This subsidy is aimed at energy renovation of households, within the scope of which solar PV power plants can be subsidised. Therefore, the subsidy can be used for self-supply of electricity for households (prosumers) (Ministry of Mining and Energy, 2023; Balkan Green Energy News, 2023j, Centre for Information and Development, 2023). The program is not available for prosumers utilising wind power plants, or any other type of electricity production, yet (Biznis.rs, 2023c, Centre for Information and Development, 2023).

The program is set up so that the Ministry, based on a public call, awards funds for energy renovations to units of Local Self Government (LSG). After publishing the results, the units of LSG then publish a call for selection of private companies which are going to provide materials and perform the energy renovations.

Afterwards, a call is published for citizens to apply in order to receive subsidies for energy renovations. Until the call in June 2023, the maximum amount of awarded subsidy per project was 50%, but it has now become possible to subsidise up to 65% of the investment (Balkan Green Energy News, 2023j).

The units of LSG must match the amount of subsidy awarded to them by the Ministry. For instance, if the Ministry awarded 1 million euro to a unit of LSG, then the unit of LSG must provide 1 million euro by itself and, therefore, make 2 million euro available in its public call for the energy renovation. Units of LSG which are in an economically poorer or more polluted area do not have to match the entire amount of the state subsidy.

This subsidy is made available by a cooperation of Serbia with the International Bank for Reconstruction and Development (IBRD), which provides a loan to the Republic of Serbia for this purpose. Reportedly, 50 to70 million euro has been made available so far in this subsidy program to citizens (Balkan Green Energy News, 2023j). The latest call was published by the Ministry in June 2023.

/116/ Official Gazette of the RS, No. 45/23
/117/ Official Gazette of the RS, No. 107/21
/118/ Official Gazette of the RS, No. 45/23
/119/ All auctions will be available at https://oieaukcije.mre.gov.rs.

3. Overview of administrative and grid connection procedures

3.1 Site selection

Regarding self-supply projects, solar PV power plants are usually located on the roof of the prosumer's building. There are not any known wind turbines used for self-supply in Serbia yet.

The site selection of utility-scale projects is based on the geographical and geomorphological features of the area as well as desired technical parameters of the system, coupled with economic and practical implications of the project. For example, such factors are insolation, inclination, orientation, wind speed and wind power density at certain altitudes, available technology, available funds, proximity of roads and other infrastructure, land ownership, etc.

Additionally - spatial plans, maps of habitats, and maps of protected areas should be consulted in order to determine land purposes, conditions for land use, to account for possible conflicting interests with the project, and to eliminate sensitive or prohibited areas from planning. As land disputes can arise, property rights should be dealt with at an early stage in order to avoid judicial conflicts later on. It is also advisable to find out, as early as possible, the willingness of local authorities to support the project.

Spatial maps should be available on the website of the ministry competent for spatial planning[120], while there are several resources available for maps of protected habitats and nature[121]. Serbia does not have a Natura 2000 network yet, but it's working on establishing one[122]. Under the Bern Convention, Serbia has a number of nominated candidate Emerald Network sites, which must be considered when planning projects in order to avoid jeopardising their condition before these sites are legally protected (Council of Europe, 2022; Bankwatch, 2023).

As far as the local grid is concerned, the Serbian Transmission system operator (TSO) Elektromreža Srbije (EMS), or the Distribution system operator (DSO) Elektrodistribucija (EDS), should be contacted at an early stage in order to find out the available grid capacity in the desired area.

Same regulations would apply to energy communities if they would invest into ground-mounted PVs. However, there have not been any such investments in Serbia yet.

/120/ Currently the Ministry of Construction, Transport and Infrastructure, https://www.mgsi.gov.rs/
/121/ Environmental Protection Agency http://www.sepa.gov.rs/index.php; State Enterprise "Srbijašume" https://srbijasume.rs/en/; Institute for Nature Conservation of Serbia https://zzps.rs/; Institute for Nature Conservation of Vojvodina Province https://pzzp.rs/.
/122/ http://www.natura2000.gov.rs/en/natura-2000-network-in-serbia/

3.2 Electricity production licence

Regarding prosumers, the electricity production licence does not need to be obtained (Energy law, Article 21 par. 1 item 2). However, there is an administrative procedure, which is described in the next sub-chapter.

Regarding utility-scale power plants, these need to obtain a Licence for Carrying out Energy Activities from the Energy Agency of the Republic of Serbia (AERS) for production of electricity. The Licence is required for power plants with installed capacity of over 1 MW. It is also required for subjects which produce electricity from multiple power plants with a total joint capacity of over 1 MW, regardless of whether these power plants are connected or not (Energy law, Article 21 par. 1 item 1).

Electricity producers which have a Licence for Carrying out Energy Activities are entered into the public Licence Register kept by AERS. The licence is issued for a period of 30 years. The process of obtaining the licence is mainly governed by the Energy Law and the Rulebook on Licence for Carrying out Energy Activities and Certification.
Regarding energy communities, the same regulations as for prosumers, or utility-scale projects, apply, depending on the size of the project.

3.3 Administrative authorisations and grid connection permit

For household prosumers, the administrative procedure is relatively simple and straightforward. The Distribution System Operator (DSO) Elektrodistribucija (EDS) has the whole process outlined on its website and information is available at multiple websites online. The maximum installed capacity of the solar PV power plant can be 10,8 kW, but not above the contracted power of the household. The building permit, location permit, etc. are not needed for this type of power plant. Generally, the entire process lasts about a month or two for household prosumers (Environment Improvement Center 2023).

The DSO issues the general technical conditions[123] which the rooftop PV power plant has to satisfy and the installation firm must abide by. After installation, the DSO inspects the power plant and ensures a zero voltage state while the installation firm instals a new metering point for the household. After establishment of voltage at the metering point, the household enters into a "Full Supply Contract with Net Metering" with the chosen electricity supplier. The DSO must obtain this contract before conducting the final test of the power plant to issue the grid connection confirmation and enter the household into the Prosumer Registry (Environment Improvement Center 2023; Elektrodistribucija, 2023d).

/123/ "General conditions for grid connection of PV modules to internal installations of an existing customer object for: - individual households with direct measurement, - object of a customer which is not a household or a housing community with installed production capacity of PV modules up to 10,8 kW"

For prosumers which are not a household nor an energy-sharing community, the maximum installed capacity of a solar PV power plant can be 150 kW (Law on the Use of Renewable Energy Sources, Art. 58 par. 4 point 3). These are usually commercial entities, institutions, etc. However, there is currently a grace period in the same law, which allows such entities to apply for the prosumer status with a maximum installed power plant capacity of 5 MW until 1st July 2024 (Article 23). Since such entities are usually businesses, they will be referred to as businesses in this subchapter.

There are several categories of possible power plant installations for business prosumers, marked by installed capacity. Procedures are different if a business aims to install up to 10,8 kW, between 10,8 and 50 kW, or above 50 kW of power plant capacity.

For installations of up to 10,8 kW, the installation procedure for businesses is identical to the procedure for household prosumers (described above) (Environment Improvement Center 2023; Elektrodistribucija, 2023d).

For installations with capacity between 10,8 and 50 kW, the procedure for these installations is somewhat different. The business must request a grid connection study of the production facility from the DSO, based on the project concept or the envisaged technical data of the installation. After requesting and receiving the approval for grid connection of the production facility, the business can conclude a contract for the grid connection service with the DSO. After the power plant is built, the procedure is almost the same as for household prosumers. However, the business enters into a “Full Supply Contract with Net Billing” with the chosen supplier. The key difference between net metering and net billing is that, in net billing, the price of electricity taken from the grid does not have to match the price of electricity delivered to the grid (which is the case for household prosumers). After building of the grid connection, the business can start the trial operation of the plant for a maximum of six months, during which the business is already entered into the Prosumer Registry. After the end of the trial period, the DSO issues a confirmation on permanent grid connection of the production facility (Elektrodistribucija, 2023e).

For installations with above 50 kW capacity, procedures are not yet available on the website of the DSO or in other official sources[124].

For utility-scale projects, much more authorisations are needed.

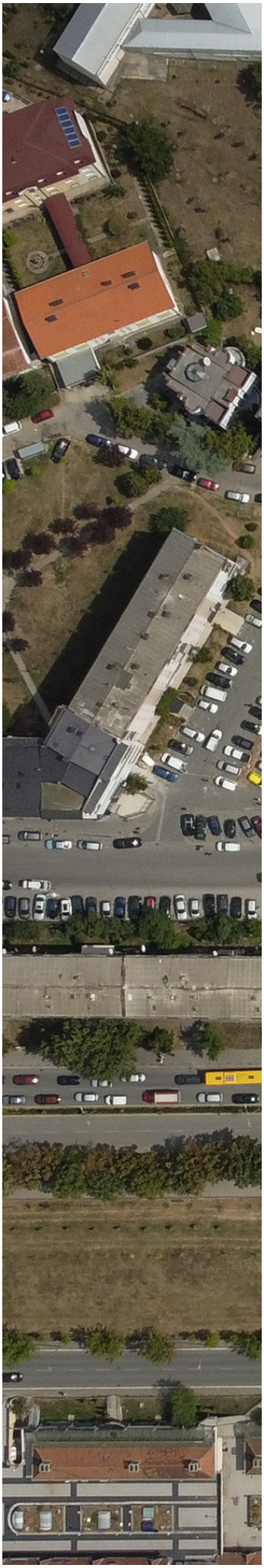
Spatial planning and the Location permit

In Serbia, the location permit has been replaced by the "location conditions". Location conditions determine all urban planning, technical, and other conditions for preparation of technical documentation, which is important for obtaining the construction permit later (USAID Serbia, 2017). The application, together with the conceptual design, can be submitted through the Central Information System (CIS) under the integrated process of issuing documents for obtaining the right to construct and use facilities at the Serbian Business Registers Agency (SBRA) (Serbian Business Registers Agency, 2023b; USAID Serbia, 2017). Competent institutions can be the ministry in charge of urban planning affairs, the competent authority of an autonomous province, or a unit of LSG (USAID Serbia, 2017).

Environmental Impact Assessment (EIA)

An Environmental Impact Assessment assesses direct and indirect impacts of a project on its surroundings (DG ENER, 2023). The EIA procedure in Serbia is mainly governed by the Law on Environmental Impact Assessment[125] and the Decree on the List of Projects for Which an Estimate of Influence on the Environment Is Compulsory[126]. It is compulsory to conduct an EIA for installations with 50 MW or more of installed power. For projects with installed power between 1 and 50 MW, or wind power plants above 10 MW and hydro power plants above 2 MW, an EIA may be requested by a competent state body, but it is not compulsory.

The investor must submit an enquiry to the competent state body for a decision on the necessity of the EIA in that case, as a positive decision on the environmental impact is necessary when applying for the energy approval and the construction permit.
An EIA may be requested by a competent state body for all power plants, irrespective of size, if the construction site is in protected natural areas, in the protected vicinity of an immovable cultural good, or in other special purpose areas. The competent state body is either the ministry competent for the environment, the authority of an autonomous province competent for the environment, or an authority of the unit of LSG competent for the environment, depending on the type and size of the project. After conducting the EIA, the investor must request an Approval of the EIA by the competent state body.



/124/ It is recommended to follow the Solar Calculator website at https://solarnikalkulator.rs/procedure/ostali/, as an outline of such procedures for prosumers is planned to be published on the website. For these power plants, a building permit is required.
/125/ Official Gazette of RS, No. 135/2004, 35/2009 (Law on Environmental Impact Assessment)
/126/ Official Gazette of RS, No. 114/2008 (Regulation on determining the list of projects for which an impact assessment is mandatory and the list of projects for which an environmental impact assessment can be requested)

Energy approval

Prior to obtaining the building permit, the investor also must obtain the energy approval (also known as the energy permit) in case of building a power plant (CEE Legal Matters, 2023; Stojković Advokati, 2022). It contains technical and economic data regarding the power plant, approved by the ministry competent for energy. If an EIA is necessary for the project, a positive EIA is required in order to apply for the Energy approval. The Energy approval is then submitted along with the application for the building permit.

The Energy approval must be obtained for power plants with installed capacity of over 1 MW, for hydro power plants with installed capacity of up to 1 MW, and certain other energy objects. Issuing is mostly regulated by the Energy Law and more closely by the Rulebook on the Energy approval[127] .

Building permit

The procedure for obtaining the construction/building permit in Serbia is mainly governed by the Law on Planning and Construction[128] . The competent authority for issuing the construction permit is either the ministry competent for urban planning affairs, the authority of an autonomous province competent for urban planning affairs, or an authority of the unit of LSG competent for urban planning affairs, depending on the type and size of the project (USAID Serbia, 2017). The application is submitted digitally through the CIS of the Serbian Business Registers Agency (SBRA) (Serbian Business Registers Agency, 2023b). The investor must submit documents such as the EIA and the approval of the EIA (if required), as well as designs for the power plant, and the evidence of appropriate rights over the land (USAID Serbia, 2017).

Electricity production licence

The procedure for obtaining the Electricity production licence is described in the previous sub-chapter. Note that, if the investor wishes to sell electricity directly to consumers, it also has to register as an electricity supplier and obtain a licence for electricity supply from the Energy Agency of the Republic of Serbia. If the investor wishes to participate in the Organised Electricity Market (SEEPEX), it does not need to obtain an additional licence from AERS if the company is domestic to Serbia (SEEPEX, 2023).

Grid connection

The procedure for grid connection is different based on whether the power plant will be connected to the distribution grid or the transmission grid. For connecting to the transmission grid, the investor must first obtain the opinion on the conditions and possibilities of a transmission grid connection from the TSO[129]. The TSO and the investor then develop several technical and planning documents, studies, and contracts regarding the construction of the connection. In order for the grid connection to be successfully built and tested, close cooperation between the TSO and the investor is essential to ensure a successful grid connection (Elektromreža Srbije, 2023c). For connecting to the distribution grid, the investor also must first obtain the opinion on the conditions and possibilities of a distribution

/127/ Official Gazette of RS, No. 15/15, 44/18

/128/ Official Gazette of RS, No. 72/09, 81/09 - rectification, 64/10 – CC decision, 24/11, 121/12, 42/13 - CC decision, 50/13 - CC decision, 98/13 - CC decision, 132/14, 145/14, 83/18, 31/19, 37/19 – other law, 9/20, 52/21, 62/23 (Law on Planning and Construction)

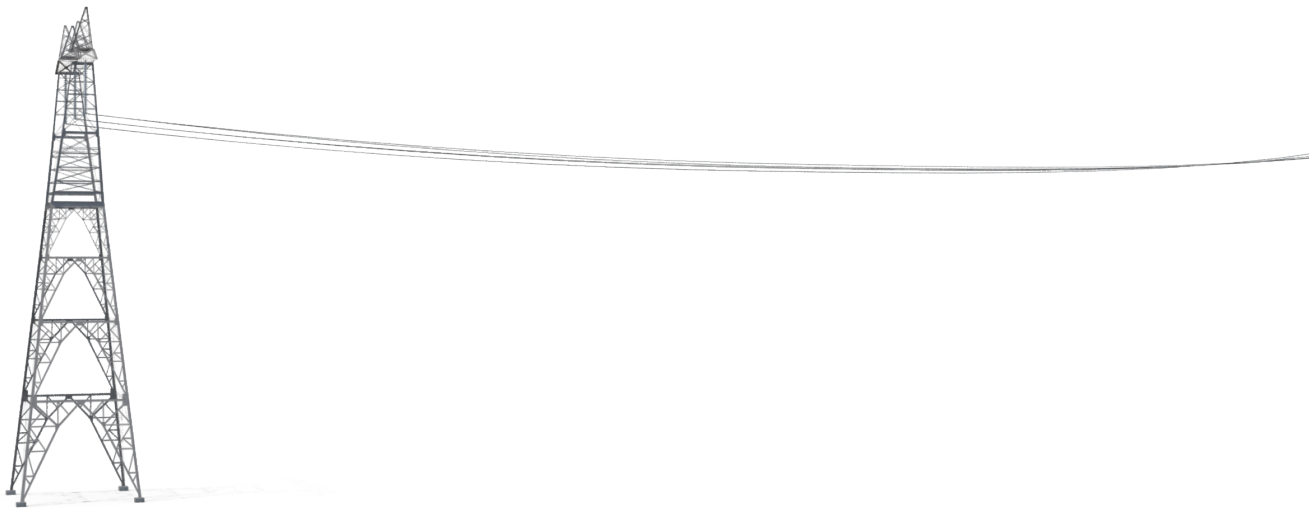
/129/ Refer to the Appendix for a list of legislation which governs the transmission grid connection procedure.

grid connection from the DSO[130]. The DSO and the investor then also develop several technical and planning documents, studies, and contracts regarding the construction of the connection (Elektrodistribucija, 2023e). The DSO has an obligation to keep a Registry of grid connection applications on its website.

Usage permit

The competent authority for issuing the usage permit is the same authority which issued the building permit (USAID Serbia, 2017). The application is submitted digitally through the CIS of the Serbian Business Registers Agency (SBRA) (Serbian Business Registers Agency, 2023b). It is necessary to submit the report of the technical inspection committee along with the final design and the geodetic study (USAID Serbia, 2017). The procedure is mostly regulated by the Law on Planning and Construction, the Law on State Geodetic Survey and Cadaster[131], and the Rulebook on content and manner of technical inspection of structures[132].

For energy communities, the regulations differ for prosumers (meaning household community prosumers or an energy-sharing community) and for energy cooperatives. For energy cooperatives, procedures depend on the size of the project (e.g. prosumer or utility-scale). For household community prosumers, a general outline of the procedure is published on the website of the Distribution system operator (DSO) Elektrodistribucija[133] (EDS). However, there does not exist a clear legal framework for energy communities in Serbia (Batas, 2023; Zečević, 2023). This includes both energy cooperatives and household communities prosumers. Those that are currently trying to implement the model are paving the way for energy communities in Serbia (Batas, 2023; Zečević, 2023).



/130/ Refer to the Appendix for a list of legislation which governs the distribution grid connection procedure.
/131/ Official Gazette of RS, No. 72/09, 18/10, 65/13, 15/15 – CC decision, 96/15, 47/17 – authentic interpretation, 113/17 – other law, 27/18 – other law, 41/18 – other law, and 9/20 – other law
/132/ Official Gazette of RS, No. 27/15, 29/16, and 78/19
/133/ https://elektrodistribucija.rs/usluge/postupak-prikljucenja-na-dsee/postupak-sticanja-statusa-kupca-proizvodjaca/stambene_zajednice

3.4 Corporate-fiscal

A self-supply producer of electricity (prosumer) does not have to register with any fiscal authorities regarding the matter. A prosumer cannot use the feed-in tariff, the market premium or guarantees of origin (Law on the Use of RES, Article 58 par. 2).

If the prosumer is a household or a housing community, the supplier is obligated to conclude a Full Supply Contract with Net Metering with the prosumer (Decree on the criteria, conditions, and methodology of accounting claims and obligations between a buyer-producer and the supplier; OG RS No. 83/21, 74/22; Article 3, par. 2).

This means that the prosumer is not monetarily reimbursed for the amount of electricity produced, but rather that his electricity bills are reduced for the corresponding amount in the future period (until the end of the accounting year). It should be noted that the value of electricity is not the same during the higher and lower tariff time (e.g. day tariff and night tariff).

If the prosumer is not a household or a housing community (e.g. the prosumer is a business entity), the supplier is obligated to conclude a Full Supply Contract with Net Billing with the prosumer (Decree on the criteria, conditions, and methodology of accounting claims and obligations between a buyer-producer and the supplier; Article 3, par. 3).

This means that the value of the electricity produced by the prosumer, and other conditions, can be freely arranged with the supplier in the contract. However, the value of the electricity produced in the accounting period still cannot surpass the value of the electricity consumed.

At the end of the accounting year, the prosumer relinquishes the right to any compensation if the amount of electricity produced still exceeds the amount of electricity consumed[134]. The calendar (accounting) year for net metering in Serbia starts on 1st April[135]. If a household would like to become a net producer of electricity (while still using the produced electricity for its own consumption), such a case is still not defined by legislation in Serbia and it is not possible (Environment Improvement Center 2023).

If an investor would like to become a producer of electricity in Serbia, it would have to incorporate a company and satisfy criteria from the Law on Energy, starting with Article 94. Additionally, if an investor would like to become a producer of electricity from RES, he would have to satisfy criteria from the Law on the Use of RES, starting with Articles 47 and 48.

A producer of electricity from RES in Serbia has the right to guarantees of origin (Law on the Use of RES, Article 47 par. 2). Guarantees of origin are regulated by the Law on the Use of RES, Article 47 to 55. A producer of electricity also must obtain a licence for production of electricity from the Energy Agency of the Republic of Serbia, as described in the sub-chapter on the Electricity production licence.

/134/ Law on the Use of RES, Article 59 par. 4; Decree on the criteria, conditions, and methodology of accounting claims and obligations between a buyer-producer and the supplier; Article 25, par. 7

/135/ Law on the Use of RES, Article 59 par. 3; Decree on the criteria, conditions, and methodology of accounting claims and obligations between a buyer-producer and the supplier, Article 25 par. 1

3.5 Other

Temporary privileged producer and a Privileged producer

A Temporary privileged producer of electricity from RES is a legal entity or an entrepreneur which has obtained the right to a feed-in tariff or a market premium in an auction and has other rights and obligations envisaged by the Law on the Use of RES.

If an investor has made a successful bid at an auction for a feed-in tariff or a market premium, the investor gains the status of a Temporary privileged producer (Law on the Use of RES, Article 23). The investor then needs to deliver a financial security instrument to the Ministry of Mining and Energy and sign a Contract on the market premium or a Contract on the feed-in tariff.

The Temporary privileged producer gains the status of a Privileged producer if it has obtained a licence for conducting an energy activity from AERS (where the licence encompasses the power plant for which the feed-in tariff, or the market premium, was obtained), achieved a permanent grid connection of the power plant, obtained the Usage permit, and fulfilled other criteria laid out in the Law on the Use of RES, Article 29. A Privileged producer of electricity from RES is a legal entity or an entrepreneur which produces electricity from RES and has obtained the right to a feed-in tariff or a market premium in accordance with the Law on the Use of RES.

3.6 Specific features to ease administrative procedures

Table 11: Specific features to ease administrative procedures

Specific feature	Existing	Short description
Simultaneous procedures	No	
National contact points and one-stop-shops	Yes/No	There is an integrated procedure for the exchange of documents with authorities regarding construction in Serbia (Location conditions, Building permit, Usage permit, etc.), but it does not include the grid access or the location information procedure.
Application of 2+1 and 1+1 rules	No	
Simple notification procedure	Yes/No	The DSO is obligated by the Law on the Use of RES (Article 68) to publish the method of the 30-day simple notification procedure. The DSO has not done so yet.
Pre-planning	No [subject to confirmation by investors]	
Pre-application consultation	No	
Project acceptance measures	No	
Measures to streamline litigation by third parties	No	
Other	/	

4. Identified barriers hindering solar PV and wind energy deployment

4.1. Political and economic framework

The European reality is that there is very little production capacity for PV panels in Europe, especially in comparison with the Chinese production capacity and with the incoming challenge from the USA with the Inflation Reduction Act (IRA), which offers generous funding support for PV panels production capacity (Intersolar Europe, 2023). Likewise, there were no PV panels production capacities in Serbia until November 2023, when the country's first-ever PV panels manufacturing facility went online (PV Magazine, 2023). Nevertheless, one production facility will hardly satisfy the PV demand of the entire country, so most of the PV panels installed in Serbia are still going to have to be imported (Batas, 2023; SolarPower Europe, 2023), which raises the price of the product for end consumers.

Prosumers are not able to sell excess electrical energy produced by PV panels, nor does there exist a model through which prosumers would be able to register and/or incorporate in order to sell excess electricity, as it exists in Croatia through the active buyer model (Radojević, 2023; Art. 25 Electricity Market Act).

There are subsidies for avoiding energy poverty. However, obtaining subsidies from these funding calls is not actually possible for the supposed target group – the poorest citizens. For a complete energy renovation, which includes the installation of photovoltaic (PV) systems, around 65% of the entire expenditure is financed. This is excellent for citizens with enough funds to finance the remaining 35%. However, energy renovations are expensive and the poorest citizens do not have nearly enough funds to cover the remaining part. At least 90%, if not all, of the expenditure should be subsidised in order to achieve the effect of the poorest citizens escaping energy poverty (Zečević, 2023; Gajić, 2023; Radojević, 2023). Furthermore, there is no sliding scale, or a ranking, applied in these funding calls in-between regions in terms of poverty.

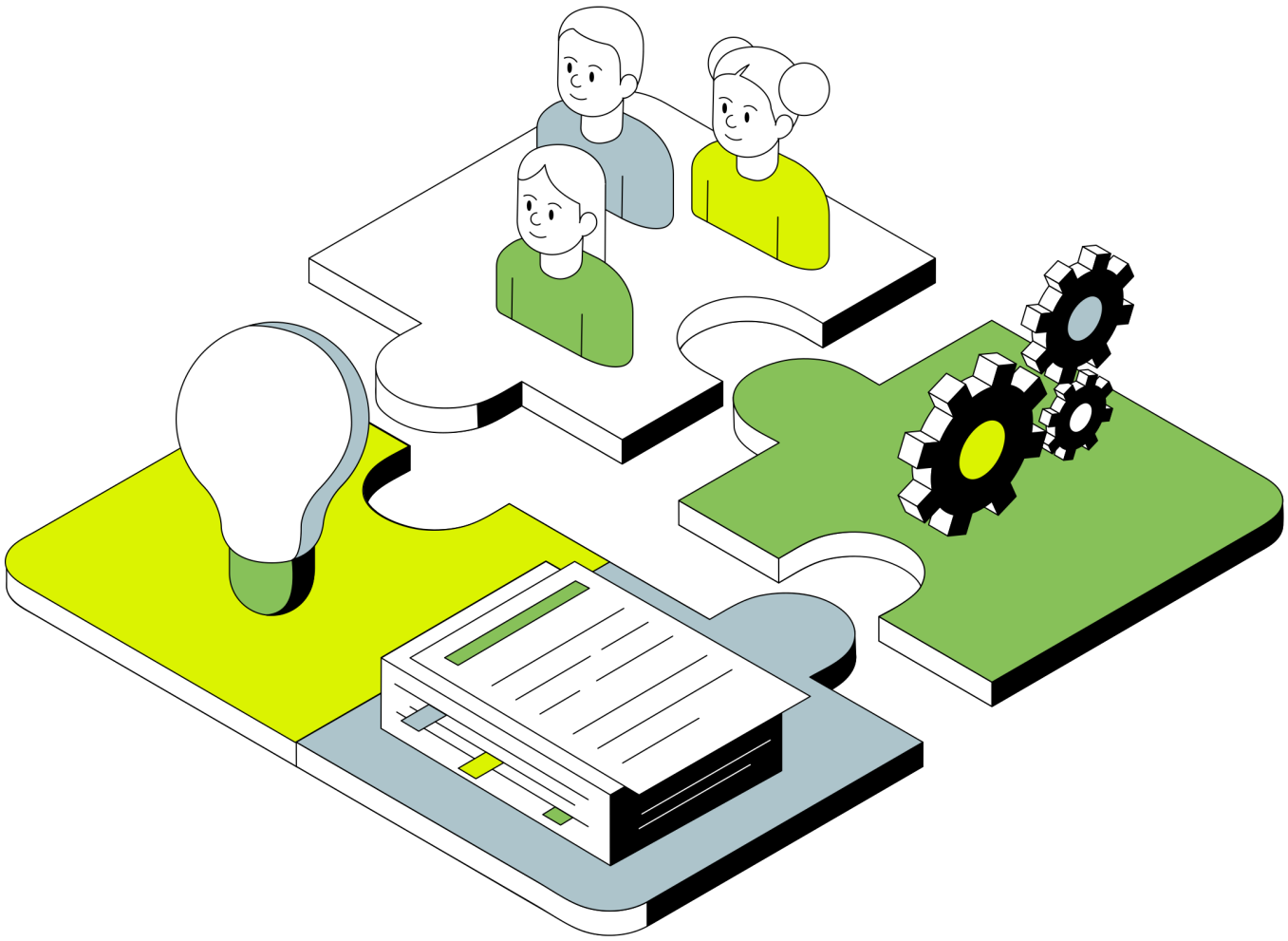
There is an example of Croatia, where a sliding scale is applied to the subsidy percentage depending on the region the applicant. This is because certain regions in Croatia are poorer than other regions and citizens in designated areas require larger subsidies in order to be able to invest (Batas, 2023). Such regional considerations for public subsidies are aided by a special law in Croatia, which designates Areas of Special State Concern (Act on Areas of Special State Concern). Sliding scales for public subsidies have also been included for regions struck by natural disasters, such as earthquakes (in 2020) and/or flooding.

In Serbia, the lack of such special considerations leads to poorer citizens continuing to incur financial losses and staying in energy poverty, while only wealthier citizens can escape energy poverty (Batas, 2023). The competent ministry claims that a regional sliding scale is not applied due to possibilities of misuse of funds or fraud, though the veracity of such statements are questionable, since any changes in the subsidy system would also incur more work for the competent ministry, which is why it might be reluctant to make any changes (Batas, 2023). Barriers concerning administrative capacities are presented in subchapter 4.3. Administrative processes.

Bankwatch has expressed concern in 2023 that the reference to strategic projects in the Law on the Use of RES is too loose and allows for ad hoc state aid for projects outside of the auctions system, which would make these susceptible to corruption and a poor value for public money (Bankwatch, 2023).

The direction of future policies of Serbia, especially with regards to all barriers indicated in this report, is unknown even to experts interviewed for this research, which indicates a lack of communication and predictability in decision making from the competent ministry or the government. Even so, many barriers have been alleviated in the last few years with enabling the boom of the household prosumer model (Zečević, 2023) and implementation of the feed-in premium model.

The Government also has clear plans to build balancing capacities, such as RHPP Bistrica (Gajić, 2023), and searches for a strategic partner in building additional balancing capacities (Balkan Green Energy News, 2023k). However, until incorporation of all energy communities is made easier, these balancing capacities will benefit almost solely utility-scale investments, while citizens of Serbia are going to finance the balancing capacities through public investments (Zečević, 2023).



4.2. Market structure

A few interviewees indicated that there is a lack of companies and qualified technicians for installation of PV panels (Batas, 2023; Gluščević, 2023; Gajić, 2023). There does not exist an official state licence, or a certificate, for qualified technicians for installation of PV panels. The subordinate legislation (e.g. decrees, rulebooks) on qualified installers are still lacking (Batas, 2023). However, few interviewees have also indicated that there has been a significant increase in companies offering PV systems installation (Zečević, 2023; Radojević, 2023).

Energy Net Academy organises free PV systems installation courses in collaboration with GIZ (Gesellschaft für Internationale Zusammenarbeit) and the competent ministry (Zečević, 2023; Balkan Green Energy News, 2023l), in addition to its paid courses (Zečević, 2023). Zečević, 2023 indicates that the situation is becoming better and that the market is adjusting to the demand, while electricians should have no problems with earning the PV systems installer qualification. However, Radojević, 2023 indicates that the number of companies might be increasing, though it is questionable whether they have enough qualified personnel for installation of PV systems or not.

Regarding utility-scale projects, there is a significant lack of competent personnel for conduction of projects, from the engineering phase to the implementation phase, including physical labour (Gajic, 2023). Furthermore, investors generally do not have an operational plan for the power plant (i.e. for the period after the power plant is built) in advance and they, generally, do not have a knowledge of how to obtain the necessary licences for operation (such as from the AERS, etc.) (Gajić, 2023). There is also a lack of qualified technical personnel to work at the power plant after it's built (Gajić, 2023).

Gajić, 2023 also indicated that importers of PV panels, generally, are not very interested in working on smaller projects (meaning households, housing communities, etc.), but they would rather do business with larger, utility-scale, buyers (on the MW order of magnitude), so households or housing communities sometimes lack supply of PV panels.

Many citizens do not have enough funds to invest into prosumer PV power plants and they are unable to obtain high enough loans to finance such an investment. If they are going to use subsidies, the investment cost could be somewhat higher because of the subsidies, which is also going to increase the payback period and reduce the likelihood of investing. However, these kinds of market circumstances provide energy communities a great chance to grow (Batas, 2023).

There exist a few ESCO firms in Serbia, but the legal framework for their operation has nott been fully defined (Batas, 2023; Zečević, 2023; Gajić, 2023). Moreover, these firms have almost solely worked with units of local self-government on public lighting modernization so far (Zečević, 2023; Radojević, 2023).

There is an indication that a connection of these companies with governing bodies of the local government is in the backdrop of this type of ESCO business, since the payback period of a public lighting modernization investment is around 4-6 years, while the payback period with ESCO companies is 13-15 years (Zečević, 2023). Additionally, a characteristic of ESCO companies is know-how transfer towards the recipient of the services, while there is no knowledge transfer occurring in a simple change of type of public lighting (Zečević, 2023).

The full legal framework for ESCO companies should include stipulations on energy performance contracting and energy supply contracting, especially for public buildings, since this does not yet exist in Serbia (Zečević, 2023). The Chamber of Commerce and Industry of Serbia has an obligation to keep a register of ESCO companies, but there is not an obligation of companies to register as an ESCO company, so it is not known exactly how many ESCO companies there are in Serbia (Gajić, 2023). An increased presence of ESCO companies for prosumers would be very beneficial for the uptake of renewable energy in Serbia (Gajić, 2023).

4.3. Administrative processes

There is a lack of personnel in competent institutions tasked with working on administrative processes and the legal framework of the RES investments process. This includes both the competent ministry and local units of self-government (Gluščević, 2023; Zečević, 2023; Gajić, 2023; Radojević, 2023). Within the scope of energy renovation funding calls or PV systems installation funding calls, a commission of the municipality has to inspect the current state of property of each applicant before and after the investment.

The commission is often comprised of people without technical or engineering backgrounds because of a lack of qualified personnel at the municipality, and the work is often burdensome for the members of the commission (Gluščević, 2023; Zečević, 2023; Radojević, 2023). Some members are contracted specifically for that purpose, while others are not specifically paid for participation, as they are selected for the duty within the scope of their workplace obligations at the municipality (Zečević, 2023; Radojević, 2023). The latter are then overwhelmed with work, as this is only one of their many duties at the workplace (Zečević, 2023; Radojević, 2023).

The lack of personnel for administration of RES investments depends on the area, as a few units of local self-government have dedicated offices for such purposes, though the number of such municipalities is estimated to less than 10 (Radojević, 2023).
A few important people left the competent ministry recently to take positions in other institutions (Gluščević, 2023). There are no signs of major hirings in public institutions and the limit on hiring in public institutions is still in effect (Gajić, 2023) and will continue to be in effect for, at least, the next three years (Politika.rs, 2023b).

Legal obligations for units of local self-government, or for public institutions, to implement energy renovations or install RES energy systems in public buildings do not exist (Gluščević, 2023; Zečević, 2023; Gajić, 2023; Radojević, 2023). There are some municipalities which implement such intentions into their action plans, but these are seldom realised (Gajić, 2023). A few municipalities indeed systematically install RES systems on public buildings (Gajić, 2023), though in many municipalities these are donations, like from GIZ in Vranje or from UNICEF and the Government of Norway on a kindergarten in Užice (Gluščević, 2023; Radio Luna, 2023; Zečević, 2023).

There has been a yearly funding call from the ministry competent for energy for energy renovations of public buildings since 2016, sometimes even twice a year, though funds in this call are scarce and only about 15 municipalities manage to obtain subsidies for their projects per call (Radojević, 2023). The funds allocated for subsidies of household prosumers are much greater than funds allocated for subsidies of energy renovation of public buildings on a yearly level (Radojević, 2023).

Furthermore, the procedure for awarding subsidies from funding calls for household prosumers is unnecessarily long (Zečević, 2023; Gajić, 2023). The funding call is conducted in three phases. Firstly, the Ministry of Mining and Energy, based on a public call, awards funds for subsidies of energy renovations to LSGs. Secondly, the units of LSG then publish a call for selection of private companies which are going to provide materials and perform the energy renovations. In the third phase, the unit of LSG publishes a call for citizens to apply in order to receive subsidies for energy renovations, which include installation of PV systems. The process is prolonged even more by the aforementioned obligation of local commissions to inspect the state of the property of each applicant before and after the investment.

The rationale from the Ministry for requesting applications from private companies is that citizens are going to have more trust in the system if companies have been vetted or approved by municipalities (Gajić, 2023; Radojević, 2023). However, this is not a guarantee that the investment process will be without problems, as there has been an instance where a selected firm failed to deliver anything to the clients. The issue was resolved by transferring all clients from the previously selected firm to another selected one(Radojević, 2023). A prosumer cannot be accepted into the prosumer system without approvals of the DSO (Elektrodistribucija), so the inspection process of the municipality commission and the qualifying process for private companies is unnecessary (Gajić, 2023). The funding process would be much simpler and quicker if a state fund (e.g. an agency) would award subsidies directly to prosumers without a call for municipalities and private companies, as is the case in regional EU-member countries, like Slovenia and Croatia.

Subsidies for prosumers are rarely published for housing communities. Even if a funding call is published for housing communities, it contains complicated and unrealistic procedures, so almost no-one applies to these (Gajić, 2023). The standard Full Supply contract for housing communities is also very unfavourable in comparison with Full Supply contracts for household prosumers (Gajić, 2023).

There does not exist a clear legal framework for energy communities in Serbia (Batas, 2023; Zečević, 2023). This includes both energy cooperatives and household communities prosumers. Those that are currently trying to implement the model are paving the way for energy communities in Serbia (Batas, 2023; Zečević, 2023). In that case, the investor is dependent on the mercy of the state, the tax administration, and state inspections in case of any unintentional mistakes in the process (Batas, 2023). Other than energy cooperatives and household community prosumers, there are not any real energy communities as defined by EU law (Zečević, 2023). There are only a few housing community prosumers currently. Even energy cooperatives have not yet fully implemented their projects, though Elektropionir is very close to starting electricity production with their project Solarna Stara.

National and local spatial plans are not necessarily overwhelmingly restrictive towards RES projects, but they are not explicitly enabling either (Batas, 2023). Feasible locations are not explicitly marked in spatial plans and it would be beneficial for the development of RES projects if spatial plans would contain explicitly marked favourable locations, land plots or areas for RES projects or if there would exist such a special cadastre published by the government (Gajić, 2023; Radojević, 2023).

Serbia's draft national spatial plan for 2021 - 2025 was subject to flawed public consultation in 2021 and still has not been adopted, which creates a lack of clarity on land suitable for RES projects (Bankwatch, 2023).
The installation procedure is simplified for housing objects, but often a land conversion in the spatial plan is needed for utility-scale installations. In some cities or municipalities, investors have an influence great enough so that this does not present a great issue (Gluščević, 2023; Radojević, 2023). However, some interviewees have indicated that it takes a long time for a land conversion, if regular procedures and timelines are followed, which can present an issue for investors (Zečević, 2023; Radojević, 2023).

Oftentimes, the local unit of self-government completes the land conversion for investors, but the justification of the land conversion is questionable. The community experiences a long-term loss of agricultural land, or land with urban development potential, while better locations could be available nearby. Therefore, one of the interviewees opines that the public resistance for such projects is going to be greater in the future (Gajić, 2023), unless the government steps in with a special cadastre.

Under Serbia's current Law on Planning and Construction and the Law on EIA, it is possible to issue a construction permit before the EIA has been finished (Bankwatch, 2023). Construction cannot start without an EIA, but legal challenges against the EIA process can start after the construction permit has been issued (Bankwatch, 2023). The Energy Community currently has an open case against Serbia for failure to properly transpose the 2011 and 2014 EIA Directives and this is one of the issues raised in the case. A new Law on EIA, which would resolve this issue, was drafted several years ago, but it has not been adopted yet and the reasoning for the delay is not clear (Energy Community Secretariat, 2022b; Bankwatch, 2023).

Serbia has also not transposed the Annex III criteria from the EU's EIA Directive yet, so it is not clear on what basis decisions are made for projects that 'may require an EIA' (Bankwatch, 2023). Since many RES projects do not require a mandatory EIA, under the Serbian law or the EU's EIA Directive, the lack of clear criteria makes the decision-making on the necessity of the EIA not transparent. Serbia's 2 MW threshold defining whether an EIA is needed for small hydropower plants led to issues with local populations, as citizens were not even aware of the potential construction of hydroelectric power plants until construction began (Bankwatch, 2023).

It needs to be clear that even if such a threshold exists, an EIA may be required depending on the Annex III criteria from the EIA Directive. The 2021 Law on Nature Protection (Art. 35) bans hydropower plant construction in protected areas as a result of the uncontrolled development in recent years (Bankwatch, 2023). However, Bankwatch received reports that there remained unclarities regarding projects that were already planned before the law was changed.

4.4. Grid regulation and infrastructure
(including flexibility and storage challenges)

Household prosumers can wait a long time for grid connection approvals in some municipalities, while there are no such issues in other municipalities (Gluščević, 2023; Batas, 2023; Zečević, 2023; Radojević, 2023). This depends on the experience and level of organisation of the local DSO office (Batas, 2023; Zečević, 2023; Radojević, 2023).

If the local DSO office has not had any experience with setting up prosumer installations and contracts, the procedure is going to take longer for the initial prosumers. However, once a certain number of first cases is resolved, others are handled much quicker. The reason is that proper training and information have not yet been given to all local DSO offices (Zečević, 2023). One interviewee indicated that there is a lack of information as to when the DSO is going to complete the procedure once the initial application has been submitted, which can result in a failure of spending the public funds allocated in the budget for that purpose (e.g. for public institutions) (Radojević, 2023).

If the prosumers are housing communities, the procedure is certainly completely new to the local DSO office and it is going to last longer (Gajić, 2023; Radojević, 2023). There are only a few existing housing communities prosumers in the entire country (Gajić, 2023; Radojević, 2023). Additionally, the competent ministry has mostly focused on household prosumers in calls for subsidies, which does not aid in the proliferation of housing communities prosumers (Radojević, 2023).

Overall, there is a very large number of requests for grid connection in Serbia, which is often mentioned as a reason for lengthy grid connection procedures (Batas, 2023). Reportedly, grid connection requests amounted to 17 GW in Serbia in 2023, including prosumers and utility-scale projects (Balkan Green Energy News, 2023). The grid capacity is definitely not large enough for all installed or planned capacities in all areas (Gluščević, 2023). The investor has to officially submit a request for conditions for grid connection to the DSO or the TSO and then wait for an official response, which can be a lengthy process for the investor. It would be simpler to enable investors to inspect grid quality in a certain area beforehand by online tools with digital information available to the DSO or the TSO at any time (Zečević, 2023).

If needed, building of the grid substation must be financed by the investor, while the owner of the substation is the DSO or the TSO, which presents an additional cost for the investor (Zečević, 2023). Grid balancing could be a problem in the short-to-medium term, but the state has clear plans for the building of grid balancing capacities, so there should not be grid balancing problems for utility-scale investments in the future (Gajić, 2023). Of course, household prosumers should not have any issues because of grid balancing either, except in extreme circumstances (Gajić, 2023).

4.5. Other

A certain number of citizens is at a disadvantage because of a lack of knowledge about the details of the investment process for prosumers and about the operational details of the installation (Batas, 2023; Radojević, 2023), though this is less of a problem now in comparison with previous times (Zečević, 2023).

There is a narrative in the public indicating this is not a profitable investment, owing to taxes and RES surcharges on customers' monthly electricity bills, though this is not correct (Gajić, 2023) and citizens are definitely interested in achieving savings (Radojević, 2023). Citizens are, however, possibly in danger due to their lack of knowledge in a sense that they could choose a PV system supplier and/or installation company which is not reliable or which is going to overdesign the power plant in order to achieve a greater financial benefit (Radojević, 2023).

It should be noted that there is now a maximum installed capacity for prosumer PV power plants (10,8 kW, but not above the contracted power of the household) set by law in Serbia (Art. 58 Law on the Use of RES) precisely because many installations were overdesigned (Energija Balkana, 2023a).

5. Identified good practices

Digitalisation of the process for obtaining location, building, and use permits has been carried out a considerable time ago and it has become the standard procedure for any construction investments (UNDP Serbia Construction manual; Batas, 2023; Zečević, 2023; Gajić, 2023). Even though there is not an official cadastre of land proposed for RES projects, The Nature Conservancy (TNC) published a map of 100 most suitable locations for solar power plants in Serbia, which maps the areas with the most potential for electricity production from PVs (Batas, 2023; The Nature Conservancy, 2023).

The auction system for feed in premiums and tariffs was finally implemented in Serbia and the first auction for market premiums was published in June 2023. There exists a follow up to declared plans of the ministry competent for energy, as installed PV capacities have increased five-fold in the last two years, as a result of newly-implemented laws, subordinate legislation, and state subsidies. The Ministry of Mining and Energy has initiated procedures for finding strategic partners for installation of 1 GW of solar PV power plants and 1 GW of wind power plants, together with balancing capacities. Additionally, reversible hydroelectric power plants are built in order to provide balancing capacities for future projects.

Power purchase agreement (PPA) regulations for RES have finally been implemented, which means banks have sufficient guarantees and funding for projects is going to be more easily available (Batas, 2023). The first commercial PPA was signed in 2023 (Balkan Green Energy News, 2023m; Karanović & Partners, 2023). The organised intraday electricity market in Serbia was established in July 2023, which enables trading of greater volumes of electricity and better balancing possibilities (Batas, 2023).

In conversation with interviewees, it is clear that there are ambitions, awareness, and a motivation among citizens and entrepreneurs to achieve a high level of energy communities, such as utility-scale PV power plants or wind power plants investments. Since there has not been any fully realised energy community or energy cooperative PV projects so far, and housing communities prosumers are few and far between, there is a lot of space for growth in Serbia.

One of the interviewees conducted the second housing community prosumer project in Serbia, the MAGDON Niš project (Gajić, 2023). The project has been implemented through the ESCO model together with the Government of Japan, UNDP Serbia, the Ministry of Mining and Energy, and the Ministry of Environmental Protection (CORE, 2023).

The project comprises three residential buildings with 134 apartments and about 400 tenants in total, which have invested into rooftop PV panels with the capacity of 74,5 kW and a few electric vehicle chargers. The electricity is used for communal energy consumption, such as elevators, internal and external lighting, pumps for the pool and the fountains, electric vehicle charging, etc. (Gajić, 2023; CORE, 2023).

Another interviewee indicated that some units of local self-government in Serbia often participate in exchanges of experiences, and examples of good practice with cities from the region, and these exchanges are usually funded as projects through EU funding programmes (Radojević, 2023).

Radojević, 2023 also mentions that a few units of local self-government in Serbia, like Kragujevac, have dedicated offices for administration of local RES investments.

This results in efficient running of administration processes and does not place a burden on municipal employees which are not subject matter experts.
The city of Vranje has a calculation tool for prosumers online, which any citizen of Vranje can access and calculate their potential electricity production, the time for return on investment, etc. (Gajić, 2023).

6. National policy recommendations

6.1 Legislative framework

- Implement an obligation for public objects to undergo energy renovations or install RES systems for electricity and/or heating (e.g. waterworks, hospitals, schools, administrative buildings, etc.) Investments into PV panels for public buildings are smaller and easier than investments into energy renovations, as, for example, schools consume much more heating/cooling energy than electricity;
- Implement the Nearly Zero Energy Building (NZEB) standard for new and renovated buildings.
- Update the Rulebook on energy efficiency of buildings (OG RS No. 61/11), since it is more than 10 years old in Serbia;
- Complete the legislation for energy communities;
- Complete the legislation for ESCO firms;
- Incentivise insurance companies to offer insurance products for RES installations;
- Implement state certifications for RES installers;
- Implement a procedure for awarding subsidies for energy renovations, and installation of rooftop PVs, where a state fund (e.g. an agency) awards subsidies directly to prosumers without separate calls for municipalities and private companies, as is the case in regional EU-member countries, like Slovenia (Ekosklad) and Croatia (FZOEU).
- Adopt the new national spatial plan, with inclusion of designated, or favourable, locations, land plots or areas for RES projects, building upon research such as the TNC's 'Mapping 100 Priority Locations for Solar Energy in Serbia';
- Proper implementation and updating of EIA legislation, according to EU directives;
- Full transposition of the EU Habitats, Birds and Water Framework Directives.
- Legally protect Emerald sites;
- Propose and protect Natura 2000 sites;
- Implement appropriate assessments for projects which may have significant impacts on Emerald sites or proposed Natura 2000 sites and implement [Art. 4(7)] assessments for projects that may deteriorate the status of water bodies or prevent them reaching good status;
- Align the 500 kW threshold for feed-in tariffs for small hydropower plants (adopted on the basis of the European Commission's EEAG state aid guidelines) with the newer CEEAG, also obligatory in Energy Community Contracting Parties, which require a lower threshold of 400 kW until 2026 and 250 kW after that.

6.2 Support policies

- Include designated or favourable locations, land plots or areas for RES projects in the spatial plan;
- Enable employment of additional and skilled personnel in public institutions tasked with administration of RES projects;
- Implement a model for prosumers by which prosumers would be able to sell the extra electricity supplied to the grid, e.g. the active buyer model in Croatia;
- Apply a sliding scale, or a ranking, in-between regions (in terms of poverty) to subsidies for energy renovations and/or PV panels installation;
- Improve conditions of subsidies for PV panels installation for housing communities prosumers;
- Improve conditions of the standard Full supply contracts for housing communities prosumers;
- Publish an official calculation tool for prosumers online, which anyone could access and calculate their potential electricity production, the time for return on investment, etc. For example, the city of Vranje has such a tool for its citizens;
- Improve the training of local DSO (Elektrodistribucija) offices for resolving prosumer applications.

6.3 Administrative transparency

- Better defined, or better adhered to, deadlines for administrative processes for prosumers and installation of rooftop PVs for the DSO (Elektrodistribucija);
- Bankwatch, 2023 proposes to abolish the strategic project concept in the Law on the Use of RES and make all larger projects that seek incentives subject to the auction process;
- The ministry competent for energy should improve its communication with the public, and with experts, about resolving investment process bottlenecks in the future, such as with the subsidies process, the missing legislation on ESCO and energy communities, obligations of energy renovations or rooftop PVs for public institutions, etc.

6.4 Grid development

- Enable investors to inspect the grid quality in a certain area by an online tool containing digital information available to the DSO or the TSO at any time, instead of having to request conditions for grid connection and waiting for an official response before, which can be a lengthy process for the investor.

7. Conclusions

The development of RES projects in North Macedonia looks good on paper, as the key strategies envisage decarbonisation relying on the increase of renewables. However, in practice, the country has not significantly increased the share of electricity produced from wind and solar energy, although the recent promising interest in solar projects is a positive development. In Serbia, the development of PV and wind projects has long been stagnant, but changes in the legislative framework have recently changed this.

Nonetheless, the overall installed capacities of PV and wind power plants in Serbia remain low in European terms. There is also a large discrepancy between the two technologies, since the currently installed PV capacity is around 60 MW, while wind capacity is around 398 MW. It is noteworthy that a growth from 12 to 60 MW of installed PV capacities in Serbia was achieved in only two years.

Even though the legislative changes enabled a recent boom of the prosumer model in Serbia, there are several process bottlenecks hindering the stronger growth of rooftop PV capacities. Implementation of the auction system has been a long-awaited novelty in Serbia, but only 3 applications were received for PV power plants and 8 applications were received for wind power plants. The search for strategic partners to develop solar and wind projects on a GW scale, together with incentives for investing into balancing capacities and adoption of the new regulatory framework for RES, show initiative from the Serbian Government to lead the country's energy transition.

Nevertheless, it is still necessary to fully define the legal framework of some participants of the RES investment process, such as energy communities and ESCO firms. An obligation to implement energy renovations or install RES energy systems in public buildings should be implemented by way of example of EU countries. Enabling prosumers to financially benefit from excess produced electricity would also be beneficial for the uptake of RES projects.

Policies mainly support larger companies in North Macedonia, while the support for households and energy communities is limited or non-existent. The key finding is that the poor governance in the energy sector, such as the vested interests of the dominant transmission and distribution system operators, the lack of transparency, and complex administrative processes for RES projects prevent an accelerated penetration of RES in North Macedonia.

Having an enabling environment is considered crucial to unlocking the penetration of RES projects, while targeted support policies are of secondary importance. Furthermore, there is a lack of measures to ensure that vulnerable citizens can partake in RES projects in North Macedonia.

The pursuit of RES projects has to be seen integrally at the cross-section of land use, biodiversity, social, and climate policies to anticipate any adverse impacts from RES projects and include a greater distribution of the benefits in both countries. The role of grid operators is crucial to ensure fast and simplified access to the grid, while the government should steer the support policies towards the "new" participants in the RES market, such as households and energy communities.

Investments into the grid are essential and overall transparency of the process is needed. As shown in the chapter on examples of good practice, there is a lot of potential for growth in this sector in Serbia and North Macedonia, especially with an interested and motivated population.

Currently, coal and thermal power plants remain the top source of electricity for both countries. It is high time for Serbia and North Macedonia to harness the full potential of domestic renewable energy and secure a robust, resilient, affordable, and renewable energy future for their citizens.

8. Appendix

[102] There are no comprehensive and current lists of all installed electricity production capacities (i.e. power plants) currently in operation or on stand-by in Serbia from official sources. There also does not exist a publicly available comprehensive and current map of all utility-size power plants in Serbia. Furthermore, the current publicly available "Registry of privileged producers, temporary privileged producers, and producers from RES" on the website of the Ministry of Mining and Energy was last updated on 11th August 2022.

The Registry does not include the current status of the project and it has no statistical functionalities. Updating of the Registry has probably stopped because of a new procedure for obtaining the privileged producer status in accordance with the Law on the Use of RES. The "Registry of energy approvals" is not up-to-date as well. Moreover, the condition for entry into the Registry is an energy approval, which does not imply that a project has started operation. These registries should be under reconstruction in cooperation with Gesellschaft für Internationale Zusammenarbeit (GIZ), which should enable a more comprehensive and current overview, as well as more functionalities.

[103] Thermal power plants in Serbia are: TPP Nikola Tesla A (TENT-A "Obrenovac"), TPP Nikola Tesla B (TENT-B "Ušće"), TPP Kolubara, TPP Morava, TPP Kostolac A, and TPP Kostolac B.
CHP plants are: CHPP Zrenjanin, CHPP Sremska Mitrovica, and CHPP Novi Sad.

[104] The currently operating WPPs in Serbia are: WPP Devreč I, WPP Kula, WPP La Piccolina, WPP Malibunar, WPP Alibunar, WPP Kovačica, WPP Košava I, and WPP Čibuk I. WPP Kitka is often included on lists of WPPs in Serbia, though it is located on the territory of Kosovo.

[106] Energy production and consumption data are available from the Government of the Republic of Serbia, in its yearly 'Energy Balance of the Republic of Serbia' publication (Energetski bilans Republike Srbije) and from the Statistical Office of the Republic of Serbia, in its yearly 'Energy Balances' publication (Energetski bilansi). The "Energy Balance of the Republic of Serbia" is published at the beginning of each calendar year and it contains data for the three latest consecutive years. For the first year, it contains actual data. For the second year, it contains estimated data, while for the third year it contains planned data. For example, in the 2023 edition, figures for 2021 are verified data, figures for 2022 are estimated data, and figures for 2023 are planned data.
The "Energy balances" are published only for the year preceding the previous year. Therefore – in 2023, "Energy balances" for 2021 were published. Also, "Energy balances" are usually published at the beginning of the calendar year.

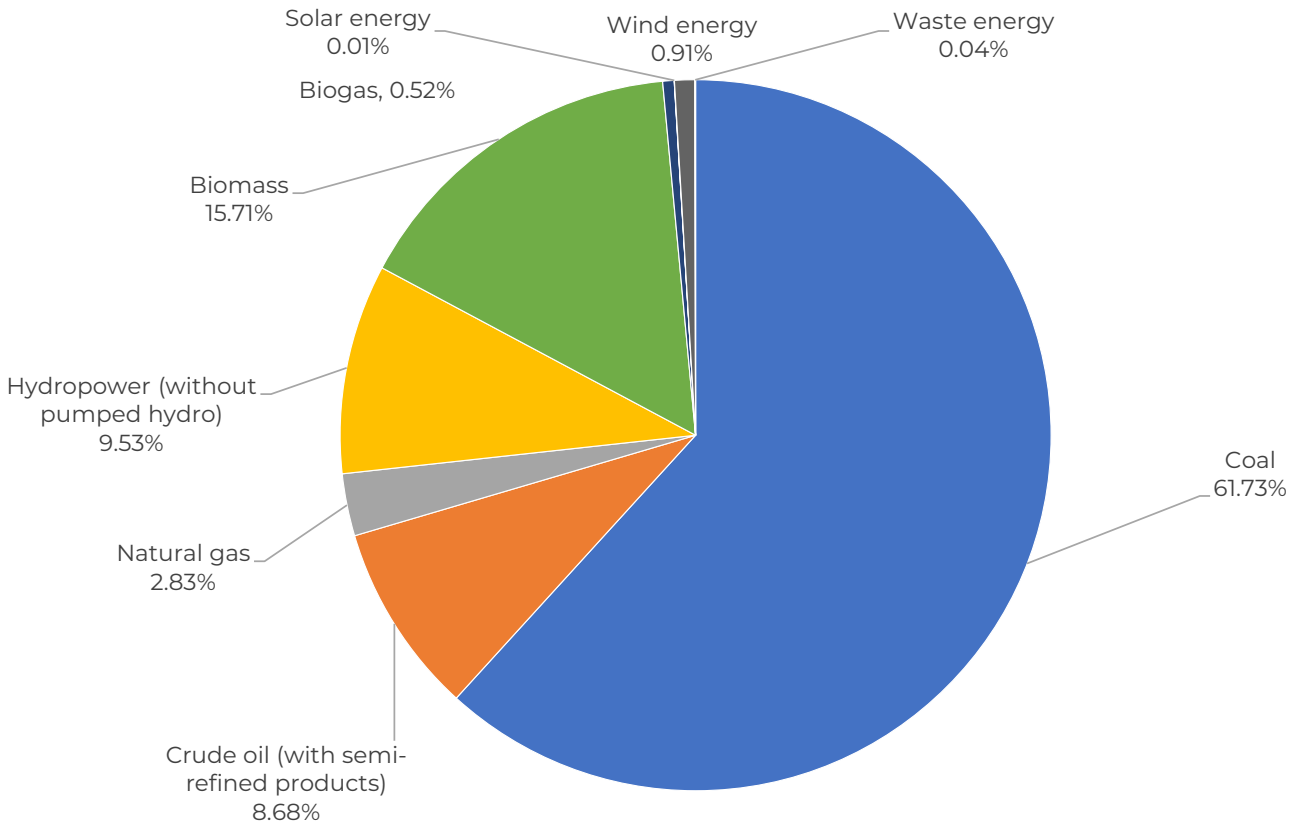
Secondary energy data is available from government publications, like the "Draft Spatial Plan of the Republic of Serbia from 2021 to 2035" (Prostorni plan Republike Srbije od 2021. Do 2035. Godine, Nacrt), the "Water Management Strategy for the Territory of the Republic of Serbia until 2034" (Stategija upravljanja vodama na teritoriji Republike Srbije do 2034. Godine), the "River Basin Management Plan for the Territory of the Republic of Serbia 2021-2027" (Plan upravljanja vodama na teritoriji Srbije za period od 2021. do 2027. Godine), and the draft Integrated National Energy and Climate Plan (NECP) of Serbia for the period 2030 with the projections up to 2050.

[129] Connection to the transmission system is governed by multiple laws and subordinate legislation, such as the Energy Law, the Law on Planning and Construction, the Decree on conditions of electricity delivery and supply (OG RS No. 63/13, 91/18), the Rules on energy permit (OG RS No. 15/15, 44/18 – other law), the Transmission Grid Code (OG RS No. 60/2020), the Methodology for calculating costs of connection to electricity transmission and distribution system (OG RS, No. 109/15), the Rules on establishing the costs for connection to the electricity transmission system, and internal procedures of the TSO.

[130] Connection to the distribution system is mostly governed by the Energy Law, the Law on Planning and Construction, the Rules on the Operation of the Distribution System, Regulation on grid rules relating to grid connection of power plants (OG RS No. 95/22), Methodology for determining the price of access to the electricity distribution system, Methodology for calculating costs of connection to electricity transmission and distribution grid (OG RS, No. 109/15), the Decree on Location Conditions, and other subordinate legislation and internal procedures of the DSO.

Energy balance of Serbia for 2021

Primary energy production mix of Serbia, 2021



The energy mix of primary energy production of Serbia in 2021:

Mtoe	% of total	Primary energy
6,282	61,73%	Coal
0,883	8,68%	Crude oil (with semi-refined products)
0,288	2,83%	Fossil gas
0,970	9,53%	Hydropower (without pumped hydro)
0,002	0,02%	Geothermal energy
1,599	15,71%	Biomass
0,053	0,52%	Biogas
0,001	0,01%	Solar energy
0,093	0,91%	Wind energy
0,004	0,04%	Waste energy
0,000	0,00%	Landfill gas
10,176	**100%**	**Total**

Energy imports of the Republic of Serbia in 2021:

Mtoe	% of total	Primary energy
0,674	9,29%	Coal
4,054	55,87%	Crude oil (with semi-refined products)
1,883	25,95%	Fossil gas
0,601	8,28%	Electricity
0,042	0,58%	Biomass
0,001	0,01%	Biodiesel
7,255	**100%**	**Total**

Energy exports of Serbia in 2021:

Mtoe	% of total	Primary energy
0,008	0,50%	Coal
1,009	62,98%	Crude oil (with semi-refined products)
0	0,00%	Fossil gas
0,545	34,02%	Electricity
0,004	2,50%	Biomass
1,602	**100%**	

Total

Net imports of energy amounted to 5,652 mtoe. Energy inventory balance amounted to 0,410 mtoe and, therefore, Total available energy amounted to 16,238 mtoe. Storages for international maritime transport accounted for 0,013 mtoe of energy. Therefore, Total domestic consumption amounted to 16,225 mtoe.

International air transport accounted for 0,112 mtoe of energy. Therefore, Total energy supply in Serbia amounted to 16,112 mtoe in 2021. Import dependence was 34,809%.

The energy mix of Total energy supply was comprised from the following in 2021:

% of total	Energy source
43,341 %	Coal
24,254 %	Petroleum
14,861 %	Fossil gas
0,347 %	Electricity
6,022 %	Hydro Potentials
0,009 %	Geothermal energy
10,228 %	Biomass
0,329 %	Biogas
0,007 %	Solar energy
0,579 %	Wind energy
0,024 %	Waste
-	Landfill and sewer gas
0,004 %	Biodiesel

Transformation input amounted to 13,682 mtoe in 2021. By energy transformation plant type:

Mtoe	Energy transformation plant type
0,97 mtoe	Hydro power plants
0,093 mtoe	Wind turbines
0,001 mtoe	Solar photovoltaic
0,082 mtoe	Used for Pump storage /Reversible hydro power plants
6,074 mtoe	Thermal power plants
0,224 mtoe	CHP
0,377 mtoe	Autoproducers
0,59 mtoe	District heating plants
0 mtoe	Oil and gas extraction
4,497 mtoe	Refineries and petrochemical refinery
0,001 mtoe	For blending with motor gasoline/diesel/kerosene
0,049 mtoe	Products transferred
0,134 mtoe	Backflow/returns from petrochemical industry
0,498 mtoe	Blast furnace plants
0 mtoe	Coal mines
0,094 mtoe	Coal transformation
0,014 mtoe	Charcoal kilns and retorts
0,127 mtoe	Producers of wood pellets
0,013 mtoe	Producers of wood briquettes
0,022 mtoe	Other

Transformation output amounted to 9,122 mtoe in 2021. The breakdown for electricity generation is as follows:

Mtoe	Electricity source
3,288 mtoe	**Total gross electricity generation**
2,041 mtoe	Thermal power plants
0,064 mtoe	CHP
1,03 mtoe	Hydro power plants
0,029 mtoe	From that small hydro
0,06 mtoe	Reversible hydro power plants
0,001 mtoe	Solar photovoltaic
0,093 mtoe	Wind turbines
0,058 mtoe	Other
0,02 mtoe	Biogas
0,002 mtoe	Biomass
0,001 mtoe	Waste
0 mtoe	Landfill gas
0,013 mtoe	Fossil gas in high efficiency cogeneration
0,023 mtoe	Industrial power plants

Consumption in the energy sector amounted to 0,901 mtoe. Losses amounted to 0,524 mtoe. Energy available for final consumption amounted to 9,948 mtoe, of which Final non-energy consumption amounted to 0,720 mtoe and Final energy consumption amounted to 9,258 mtoe.

Per consumption sector, Final energy consumption amounted to:

Mtoe	Sector
2,046 mtoe	Industry
0,06 mtoe	Construction
2,513 mtoe	Transport
3,55 mtoe	Households
0,14 mtoe	Agriculture
0,949 mtoe	Other users

Per energy source, Final energy consumption amounted to:

Mtoe	Energy source
0,299 mtoe	Coal
0,015 mtoe	Blast furnace gas
2,915 mtoe	Petroleum derivatives
1,092 mtoe	Fossil gas
2,511 mtoe	Electricity
0,777 mtoe	Heat energy
1,649 mtoe	RES (geothermal energy, biomass, biogas)
0,001 mtoe	Waste
0,058 mtoe	Other
0,02 mtoe	Biogas
0,002 mtoe	Biomass
0,001 mtoe	Waste

Conversion rates for energy used by Serbia

Into:	TJ	Gcal	Mtoe	MBtu	GWh
From:					
Terajoule (TJ)	1	238,8	2,388 x 10^-5	947,8	0,2778
Gigacalorie (Gcal)	4,1868 x 10^-3	1	10^-7	3,968	1,163 x 10^-3
Million of tonnes of oil equivalent (Mtoe)	4,1868 x 10^4	10^7	1	3,968 x 10^7	11630
Million of British thermal unit (MBtu)	1,0551 x 10^-3	0,252	2,52 x 10^-8	1	2,931 x 10^-4
Gigawatt hour (GWh)	3,6	860	8,6 x 10^-5	3412	1

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