SMART Balkans
Civil Society for Shared Society in the Western Balkans

ceves
CENTAR ZA VISOKE EKONOMSKE STUDIJE

WEBecon

POTENTIAL FOR ENERGY SUPPLY SAFETY THROUGH PROMOTION OF PROSUMER MARKET

Norway

CPCD
Centar za promociju civilnog društva

Institute for Democracy and Mediation

CRPM Center for Research and Policy Making
... policy impact since 2004

POTENTIAL FOR ENERGY SUPPLY SAFETY THROUGH PROMOTION OF PROSUMER MARKET

Lazar Ivanović
Center for Advanced Economic Studies – CEVES, Belgrade
lazar.ivanovic@ceves.org.rs

Pavle Medić
Center for Advanced Economic Studies – CEVES, Belgrade
pavle.medic@ceves.org.rs

The study benefited from two rounds of peer review and contributions: by Mr. Ljubo Maćić, Mr. Dejan Stojadinović and by the colleagues from GAP institute, a member of the WEBecon Network.

This publication was developed with the support of the "SMART Balkans – Civil Society for Shared Society in the Western Balkans" regional project implemented by the Centar za promociju civilnog društva (CPCD), Center for Research and Policy Making (CRPM) and Institute for Democracy and Mediation (IDM) and financially supported by the Norwegian Ministry of Foreign Affairs (NMFA). The content of the publication is the sole responsibility of the project implementers and does not necessarily reflect the views of the Norwegian Ministry of Foreign Affairs (NMFA) or SMART Balkans consortium partners.

CONTENTS

LIST OF ACRONYMS 5

EXECUTIVE SUMMARY 6

CHAPTER I: INTRODUCTION TO ELECTRIC ENERGY SYSTEMS 9

How Electricity Is Delivered to Consumers 9

Generation 9

Transmission, Distribution and Supply 9

Usage and production over the year (what drives high/low production/ consumption) 10

Basics of Electric energy markets 11

How are prices formed? 11

Wholesale electricity market 13

Retail electricity market 14

Models of electricity systems – history and reform 15

CHAPTER I – ELECTRIC ENERGY OVERVIEW FOR WB COUNTRIES 19

WB6 general energy overview 19

WB6 electrical energy overview 21

CHAPTER II - KEY ELECTRICITY SUPPLY RISKS AND ISSUES FOR THE WB6 37

Energy sector governance inefficiencies 27

Impact of COVID-19 and Russo-Ukraine conflict 30

The EU Green Agenda and the WB6 31

CHAPTER III - PROSUMER'S POTENTIAL TO INCREASE ENERGY RESILIENCE IN SERBIA: CURRENT CHALLENGES AND POTENTIAL SOLUTIONS 34

What are prosumers and why are they relevant for energy supply safety? 34

Technical potential and actual prosumer market development in Serbia 35

Legislative framework governing prosumers in Serbia 36

How to become a household prosumer in Serbia? 36

The required level of investment and the expected payback period 38

Subsidies for solar panel installation 39

Key challenges for household prosumers in Serbia 39

Household prosumer market development - best international practices 42

Recommendations to streamline the development of household prosumers in Serbia 44

REFERENCES 47

LIST OF CHARTS

Chart 1. Daily consumption of electricity in Germany, 2021-2023.	10
Chart 2. Electricity generation changes in one week in Germany in February 2023	11
Chart 3. Stylised merit-order model with different renewables shares	12
Chart 4. Liberalization of energy markets	16
Chart 5. Wholesale electricity prices changes in the EU since 2018	16
Chart 6. Elements of energy transition processes	17
Chart 7. Gross available energy in the WB6 and the EU27 by fuel types - 2021 (%)	19
Chart 8. Electricity production capacities in the WB6 and EU27 by fuel types - 2021 (%)	22
Chart 9. Structure of net electricity generation from renewable energy sources in the WB6 – 2016 and 2021	23
Chart 10. Distribution losses in the CEU and WB6	28
Chart 11. Electricity prices for household consumers in the EU27 and WB6 (euro per kWh)	30
Chart 12. Implementation Performance of EU Energy Legislation by EnC Contracting Parties 2023	33

LIST OF TABLES

Table 1. Net energy dependency in the WB6 and the EU in 2021 (thousand tonnes of oil equivalent and %)	20
Table 2. Electricity imports and exports as a % of the final consumption in the WB6 and EU – 2021	24
Table 3. Share of taxes and levies in electricity prices for household consumers in the EU and WB6 - Consumption from 2 500 kWh to 4 999 kWh - band DC - EUR per kWh and %	25
Table 4. Market share of the largest generator in the electricity market in the Central and Eastern European Countries and the WB6 – 2021	26

LIST OF BOXES

Box 1: Solar calculator	38
Box 2. Som Energía - a renewable energy cooperative in Spain	43

LIST OF ACRONYMS

CBAM	Carbon Border Adjustment Mechanism
DSO	Distribution System Operator
EnC	Energy Community
ENTSO-E	European Network of Transmission System Operators for Electricity
EPS	Elektroprivreda Srbije (Electric Power Industry of Serbia)
ESCO	Energy Service Company
EU	European Union
EU27	The 27 Member States of the European Union
GDP	Gross Domestic Product
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit (German Corporation for International Cooperation)
GWh	Gigawatt-hour
HPPs	Hydroelectric Power Plants
ktoe	thousand tonnes of oil equivalent
kWh	Kilowatt-hour
NECP	National Energy and Climate Plan
OECD	Organisation for Economic Co-operation and Development
PPS	Purchasing Power Standards
PVPs	Photovoltaic Parks
RES	Renewable Energy Shares
SEPEEX	Serbian Power Exchange Market Operator
TPPs	Thermal Power Plants
TSOs	Transmission System Operators
VAT	Value Added Tax
WB	Western Balkans
WB6	Western Balkans Six (referring to the six Western Balkan countries)

EXECUTIVE SUMMARY

This document provides a comprehensive analysis of electrical energy supply security in the Western Balkans with a particular focus on the role of prosumers in achieving clean, efficient, and sustainable energy development.

When it comes to energy generation, WB6 dominantly rely on fossil fuels and oil, are mostly self-sufficient, and highly energy intensive. WB6 dominantly generate their energy from solid fuels and oil (around 80%, except in Albania with 45%), which is markedly higher than the EU27. Energy generation from renewable sources is mostly comparable to or higher than in the EU27, yet gas and nuclear energy are far less common in the WB6 (9% vs. 36%). When it comes to energy dependency, WB6 import between a quarter to a third of their total energy needs, except for North Macedonia, which relies on imports for almost 70%. To generate an equivalent amount of GDP, these countries require approximately 50% more energy than the EU, and there has been no notable enhancement in their energy efficiency relative to the EU over the past five years.

Hydropower and combustible fuels account for almost complete electricity generation capacity and are divided in equal splits. Renewable energy contributes to over half of the total electricity production capacities, supported by substantial hydropower capacities mostly present in Albania (the opposite being a case in Kosovo). However, during the last six years, the regional renewables capacities have been growing almost three times slower than in the EU, while fossil fuels still constitute the majority of electricity production in the region. In addition, although the per capita electricity consumption between Western Balkan and EU households is comparable, the former's economies are less energy efficient than the EU since they consume two thirds more electricity for every unit of GDP they create. The ratio of electricity imports to exports varies significantly not only between countries but also for same countries in different years, with Bosnia and Herzegovina being the only long-term exporter.

WB6 countries impose strict state control over their respective energy markets. The Western Balkan countries' power sectors are characterized by a strong government and political party control over highly centralized, state-owned utilities, completely opposite to the EU's liberalized electricity market. These utilities, such as Serbia's Elektroprivreda Srbije (EPS), which owns all major coal and hydropower resources, are crucial to their economies, providing significant employment, government revenue, and business collaboration. However, this political framework leads to a lack of transparent, inclusive, and institutionalized dialogue on energy decision-making between key stakeholders while it also fosters a conflict between the main energy sector strategic goals.

Until recently, electricity prices for households in the Western Balkans were set not only much lower than in the EU but also below the actual cost of generation and supply, causing financial strains on utilities, and hindering investments. The low prices were made possible through subsidies for electricity generation, which not only undermine short-term energy conservation efforts, but also discourage any operational enhancements, and investments in energy efficiency. However, as the region progresses towards market liberalization, the inevitable rise of electricity prices will create a significant risk of exacerbating energy poverty, especially given the lower incomes in the WB6 compared to the EU. Recent price increases highlight the challenge of balancing necessary price adjustments with the need to protect vulnerable consumers. Without a carefully designed market to protect lower-income households, there's a risk that these increases will be blamed on climate policies, highlighting the intricate balance between economic, social, and environmental goals.

The energy transition in the Western Balkans is primarily driven by the EU accession process rather than local political agendas. Despite a heavy reliance on coal (except in Albania), the region's decarbonization strategies lack ambition, aiming to simply

increase renewable energy shares (RES) without a clear, legally binding timeline for coal reduction (except for North Macedonia, which does not even have coal). Furthermore, huge employment in coal mines and thermal power plants (TPPs) significantly complicates the social aspect of energy transition in the region. Moreover, prevailing energy myths, reinforced by the recent energy crisis, encourage continued investment in coal fired TPPs and mines, under the guise of "energy supply security" and resistance to foreign dependance. Finally, although halved since 2016, large coal subsidies persist, inhibiting diversification and energy efficiency investments, with countries varying in their subsidy levels and support mechanisms.

The perfect storm comprised of strong post-pandemic economic recovery and the Russo-Ukrainian war, have led to unprecedented global energy price increases, impacting the WB6. For instance, net energy importers like North Macedonia, vulnerable to regional wholesale electricity market price shocks have experienced huge increases in household electricity prices. Even countries traditionally self-sufficient in electricity such as Serbia, faced a need to import expensive electricity due to coal shortages and a major thermal power plant accident. In contrast, Bosnia and Herzegovina, a net electricity exporter, saw limited retail price impacts. This energy crisis highlighted the region's multiple electricity supply vulnerabilities, with inadequate investments in new production facilities and infrastructure being the most serious. Governments responded with emergency measures to ensure energy supply and affordability, including financial support, energy price caps, and even temporary power rationing. As in the rest of Europe, the crisis also led to postponing or even abandoning coal phase-out plans while long term measures towards increasing energy efficiency and improving poor households' access to renewable sources remain limited in most countries.

The EU is the main driver of the green transition in the WB6, but apart from the perspective of future membership, its capacity to streamline this process is very limited. The Western Balkans committed to green transition via the Sofia Declaration, but the lack of specific deadlines and delivery mechanisms challenges its implementation. Nevertheless, the introduction of the EU's Carbon Border Adjustment Mechanism (CBAM) in 2026 will necessitate an accelerated pace of decarbonization within the region to safeguard the competitiveness of their businesses and consequently, their economies. Generally speaking, the pace and nature of the Western Balkans' green transition hinge on energy resources, technology, and capital availability, challenged by a lack of natural gas, nuclear options, and unfavorable conditions for low carbon hydrogen, with regional cooperation and enhanced institutional capacities seen as vital for overcoming these obstacles.

Finally, focusing on Serbia as a case study, this document explores the potential and challenges in integrating prosumers into its energy market This aims to streamline the adoption of renewable energy sources, encouraging energy efficiency and enhancing grid efficiency, flexibility, and resilience. Serbia boasts considerable solar energy potential, thanks to its favorable location and climate, with an estimated technical solar potential which could cover almost 80% of its current gross electricity production. Despite this potential, the development of the prosumer market in Serbia has been rather sluggish, significantly lagging behind its Western Balkan peers like Albania, North Macedonia, and even much smaller Montenegro.

In addition, we have also provided a short review of best international policy practices when it comes to household prosumer market development. Tax incentives, as seen in Spain, Croatia, and the USA, play a crucial role in reducing the financial barriers to renewable energy installations by offering significant tax breaks and credits. The community energy model further democratizes energy production, as evidenced by Spain's collective self-consumption scheme, allowing multiple consumers to benefit from a single solar panel installation. Simplification of regulatory processes in countries like Romania has significantly eased the burden on households wishing to become prosumers, removing bureaucratic hurdles and streamlining application procedures.

This study identifies several challenges and barriers impeding the growth of household prosumer market in Serbia and proposes recommendations[1] to facilitate their development:

- Inform potential prosumers thoroughly about acquiring prosumer status, with state energy companies offering dedicated support services.
- Establish a certification scheme for solar panel installers and publish a list of certified installers.
- Digitalize and standardize the procedure of obtaining prosumer status and ensure uniform expertise the Distribution System Operator (DSO) staff across the country (especially outside of Belgrade).
- Conduct a Hosting Capacity Analysis to determine the distribution grid's capacity for expanding the number of prosumers.
- Ensure prosumers receive the same benefits as other end-consumers, including discounts for orderly payment and rational consumption.
- Revise local subsidy awarding rules to favor competent contractors and prioritize energy-poor households.
- Come up with a solution for enabling the same conditions for multi-apartment buildings and stand-alone houses.
- Legally recognize renewable energy communities as entities eligible to become prosumers, offering them specific incentives.
- Amend laws to allow third-party installation and operation of solar power plants, enabling broader access to prosumer benefits.
- Explore and implement the ESCO model for residential prosumer projects, providing expertise and capital for solar panel installations.
- Broaden the legal framework to encourage the formation and participation of energy communities in the prosumer market.
- Amend the Law on Energy to oblige the Distribution System Operators to create favorable conditions for high penetration of renewable energy sources connected into distribution grid.
- Introduce specific tax incentives with the aim of promoting the prosumer market development.

1 More detailed recommendations available in the recommendations section.

CHAPTER I: INTRODUCTION TO ELECTRIC ENERGY SYSTEMS

HOW ELECTRICITY IS DELIVERED TO CONSUMERS

Generation

Electricity can be generated through multiple methods, each based on different types of energy sources. There are three major types of non-renewable energy sources: 1) coal; 2) natural gas; and 3) nuclear energy. Coal and natural gas (also known as fossil fuels) are used to generate electricity through the process of combustion (using thermal power), while uranium generates electricity through nuclear fission (nuclear power), all of them utilizing their heat for boiling water and rotating steam turbine.

Among renewable energy sources, there are four major types: 1) solar energy - where sunlight is directly converted into electricity (photovoltaics); 2) wind energy - where wind generates rotation energy which is converted into electricity; 3) hydro energy - running water rotates water wheel to generate power; 4) geothermal – where magmatic heat boils underground water to rotate steam turbine and generate power.

Although the global energy sector has traditionally been based on fossil fuels with very high carbon emissions, it is currently in the midst of profound changes that are set to transform it in the coming decades to one increasingly dominated by renewables and other clean energy technologies. Therefore, a new global energy economy is emerging ever more clearly, with the rapid growth of new technologies regarding solar and wind energy including batteries, electric vehicles and other such as electrolysers for hydrogen and heat-pumps.

Generators are companies owning power plants fueled by wind, solar, hydro, coal, gas, nuclear, and other sources, producing and selling electricity wholesale or directly to consumers.

Transmission, Distribution and Supply

Transmission system operators (TSOs) are responsible for transporting electricity on a regional or national level from generators to consumers, assessing demand, managing the flows on interconnectors and, most importantly, ensuring the secure operation of the electricity system in real-time. TSOs must ensure a second-by-second balance of electricity supply and demand. On a European level, TSOs are coordinated through regional centers as well as through their association ENTSO-E, that has been mandated by the European Union with several coordination tasks.

Distribution system operators (DSOs) own and operate the electricity distribution system that connects most consumers and an increasing number of distributed storage and small generation assets to the distribution system. Their role becomes ever more critical to the functioning of growing numbers of heat pumps and electric vehicles and the further decentralization of the energy system. In addition, DSOs organize measuring, which is the process of collecting data on the flow and quality of electricity as it is distributed from transmission systems to end consumers. They are responsible for preventing congestions, re-establishing connection in case of power cuts, and cooperating with TSOs to enable the effective functioning of retail, wholesale and balancing markets.

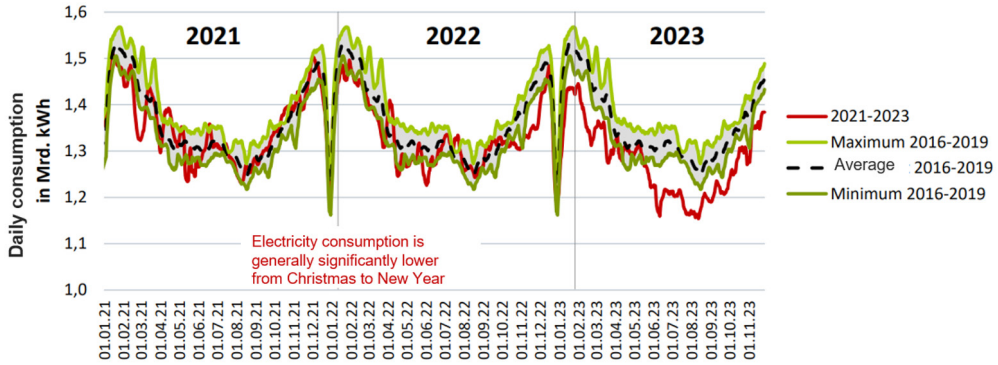
Transmission and distribution are typically considered natural monopoly activities within the electricity sectors, and as such, are regulated by national regulatory bodies (i.e. network pricing, access and usage conditions etc.).

Finally, suppliers - companies selling electricity to final consumers, providing competitive rates - also have an important role in electric energy systems. Since the liberalization of the electricity market, customers can freely choose their supplier based on their particular needs.

Usage and production over the year (what drives high/low production/consumption)

Changes in electricity consumption during the year can vary significantly by country. In continental countries, consumption is noticeably higher in the winter months (up to about 50%), and in Mediterranean countries it is uniform throughout the year. Consumption is lower on weekends, and during the day it is significantly lower at night than during the day. Consumption is significantly affected by outside temperatures in winter, and even more so in summer. Such relations have been valid for decades without significant changes. The Chart shows the changes in consumption in Germany by day in the previous three years (the drop in consumption during the Christmas and New Year holidays is characteristic).

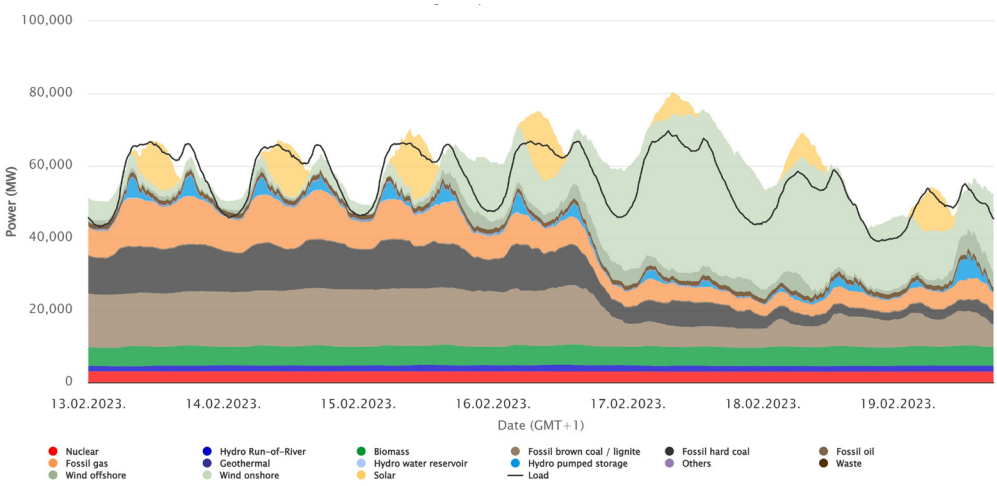
Chart 1. Daily consumption of electricity in Germany, 2021-2023.



Source: BDEW Die Energieversorgung 2023 – Jahresbericht (own representation and calculation based on the Federal Network Agency data

Changes in electricity generation are very significant and caused by numerous factors. Traditional technologies face uncertainty due to factors like significant variations in water inflow for hydropower plants (by over ten percent) and the reliability issues and failures of thermal power plants. In addition, the share of variable, non controllable energy from the sun and wind is growing, and it could increase the requirements for providing the flexibility of the power systems. The fluctuations can be very large in very short time intervals (next Chart).

Chart 2. Electricity generation changes in one week in Germany in February 2023



Source: BDEW; Electricity Production | Energy-Charts

Climate changes affects the water flow regime and reduces water inflow, bring extreme weather conditions which could impact electricity consumption and generation in hydro power plants and cause power outages. The latest IPCC report suggests that WB6 region, is a high risk region regarding climate change. Geopolitical turbulence limits and interrupts the supply of energy, and in the future, the supply of critical minerals.

To maintain system balance under all circumstances, more adaptable resources will be required, including both supply (such as storage) and flexible demand. Currently, power generation from natural gas (later hydrogen) is the best suited to compensate for prolonged low outputs from renewables and to mitigate the variability in solar and wind energy production due to weather conditions.

BASICS OF ELECTRIC ENERGY MARKETS

How are prices formed?

The retail electricity price is the amount that customers pay per kWh of electricity used during a certain period of time. In general, the electricity bill includes three components:

- price of consumed electricity,
- transmission and distribution network fees,
- taxes and levies.

In the European Union, in awerage, the electricity component represents more than 30% of the electricity bill, while network tariffs account for less than 30% and taxes and levies about 41%, although its structure is subject to changes.

The wholesale electricity price is the price at which suppliers buy the electricity they use to supply to end consumers. Wholesale electricity prices are usually determined through bilateral transactions or through centralized auctions.

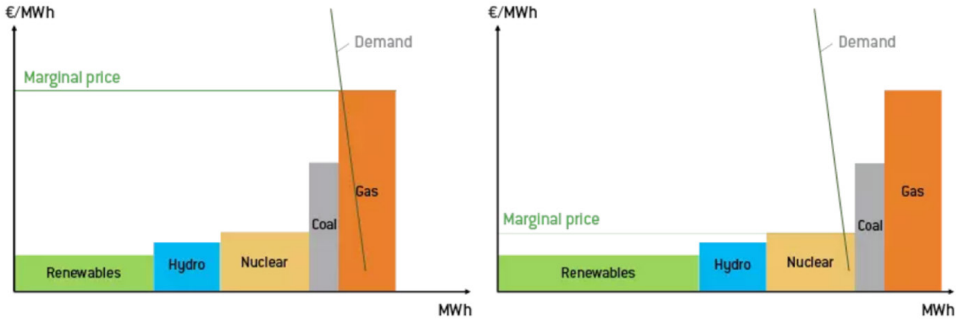
Power exchanges provide an organized and transparent platform for energy actors to buy and sell electricity, including cross-border transactions.

The price formation on spot markets is based on marginal cost, which indicates how much it costs a producer to generate one additional MWh of electricity. Power plants

are put on the market by the merit order of their marginal variable production cost, starting with the least expensive The last activated plant sets the price. All producers are paid the same price €/MWh for the same product: electricity.

Since gas-fired generation is dominantly the marginal generator (i.e. the most expensive generator), the cost of gas often determines the marginal electricity price (Figure below, left panel). If the electricity-generation mix is changed by adding more renewables, run-of-river hydropower or nuclear, gas generation is pushed out of the merit order (Figure below, right panel).

Chart 3. Stylised merit-order model with different renewables shares



Source: Breugel

Wholesale electricity market

Current electricity market design involves a complex interaction between generators, traders, retail suppliers (connect wholesale and retail electricity markets to serve the demand of their consumers), regulatory authorities, system operators, and consumers2.

Various forms of power trading are possible depending on the market design, ranging from anonymous short-term spot markets to long-term over-the-counter markets. These markets allow electricity trading between power producers, large industrial consumers, and electricity retailers. Since this trade is conducted before the electricity is delivered to end consumers, they are often called the wholesale electricity markets.

The initial idea of a simple wholesale electricity market restructuring («energy-only», replacing the regulated electricity price with the market-defined one) did not work out, thus the competitive wholesale electricity market structure is quite complex.

Electricity markets differ substantially from other commodity markets, inter alia, since electricity cannot yet be stored in large volumes economically.

Electricity wholesale markets consist of a sequence of markets that allow participants to make and refine decisions as more information becomes available closer to the delivery time.

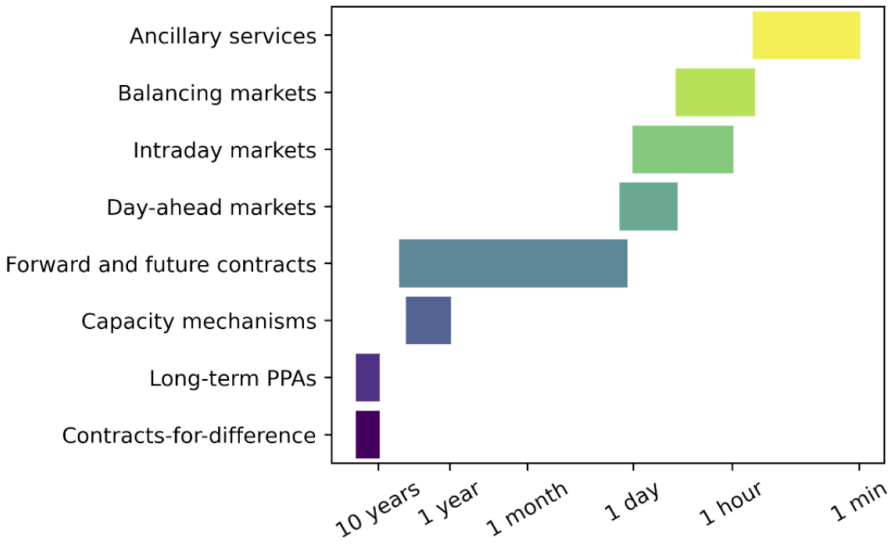
In short, there are[3]:

- Subsidy schemes by governments and de-risking of investments typically provide a guaranteed price to renewable projects for a period of 15 to 20 years. Capacity mechanisms are typically nationally organised remuneration schemes intended to ensure that a certain amount of capacity is available on a one-to-three year ahead timescale.
- Meanwhile, mid-term physical and financial electricity markets allow producers and consumers to hedge part of their volume and price risks. They do this by trading in forward and future contracts.
- Closer to real time, day-ahead (spot) markets are where the merit order is established for each hour of the following day. The day-ahead markets are central benchmark for the aforementioned long-term markets.
- Intraday markets take place between the day-ahead markets and the delivery of electricity.
- Balancing markets are operated by the transmission system operators in the respective regions to correct any imbalances between supply and demand close to real time. For example, a power plant may suddenly go offline, meaning more generation is required. Balancing markets consist of balancing capacity markets and balancing energy markets.
- Finally, reserve and ancillary service markets provide remuneration for specific services that are required to ensure security and quality of supply, but for which costs cannot be recovered from other markets. These services typically occur over a period of minutes or even seconds

2 Zachmann, G., Hirth, L., Heussaff, C., Schlecht, I., Mühlenpfordt, J., Eicke, A. The design of the European electricity market, Publication for the committee on Industry, Research and Energy, Policy Department for Economic, Scientific and Quality of Life Policies, European Parliament, Luxembourg.

3 Zachmann, G. and C. Heussaff (2023) 'Phased European Union electricity market reform', Policy Brief 06/2023, Bruegel

Electricity market trading windows



Source: Breugel

Market operators manage the business of an energy exchange.

National regulatory authorities are state agencies tasked with administering the legislation in the electricity sector oversee market functioning and regulate the natural monopoly - networks.

National governments are critical agents in electricity markets, affecting the distribution of costs and benefits through taxation rules, setting frameworks for network regulation, mandating levies, designing capacity mechanisms and other elements of national electricity markets and driving investment through auctions for long-term state support such as contracts-for-difference[4].

Retail electricity market

A retail electricity market exists when end-use customers can choose their supplier from competing electricity retailers.

Since the early 2000s, the EU legislation has begun to require from its member-states to open their retail energy markets to competition. The liberalization of these markets was driven by a belief that competition between different retailers would incentivize efficiency, decrease retailers' profit margins and thus lower prices for consumers.

A well-functioning retail market requires a sufficient number of active suppliers and robust competition among them. With the liberalization of the market, customers now have the freedom to change providers and choose the utility that best meets their requirements

Despite the request to cancel regulated prices, the number of EU MSs with price regulation in place remains high, especially for the household segment.

4 Zachmann, G., Hirth, L., Heussaff, C., Schlecht, I., Mühlenpfordt, J., Eicke, A. The design of the European electricity market, Publication for the committee on Industry, Research and Energy, Policy Department for Economic, Scientific and Quality of Life Policies, European Parliament, Luxembourg.

Models of electricity systems – history and reform

More than a century ago, from the beginning of power plant integration into power systems, power companies all over the world operated traditionally:

- Typically being vertically integrated, where a single company managed electricity generation, transmission, distribution, and sales;
- Functioning as national monopolies, centrally controlling power plants, transmission, and often distribution networks;
- Experiencing minimal fundamental technological shifts in generation, relying on hydro, coal, fuel oil, gas-fired thermal power plants, and later nuclear power plants;
- Utilizing dispatchable power plants equipped with large rotating masses and inertia essential for sustaining system functions;
- Having prices regulated by the state, which allowed electricity companies to earn profits adequate for the planned development of power plants and networks to meet forecasted demand and ensure national energy security;
- Engaging in long-term development planning.

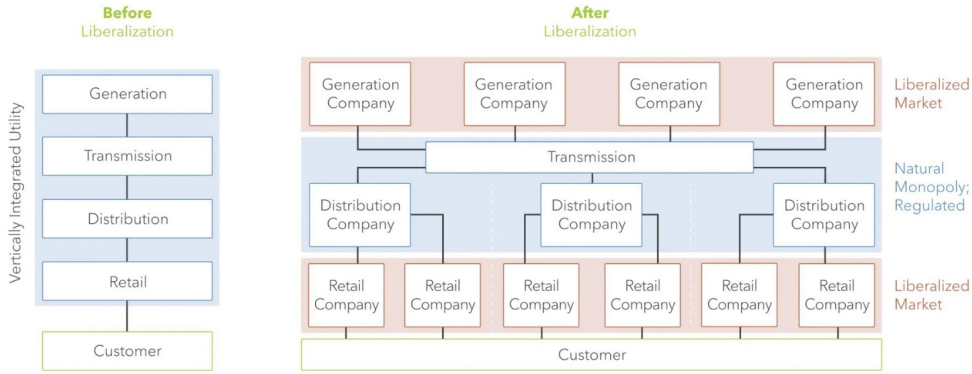
Over the last three decades, power companies in Europe and in many non-European countries have experienced two major changes: one at the regional and national levels, and the other on a global scale.

The first major change has been the introduction of market dynamics into the power industry. Starting in the 1990s, market principles began to infiltrate the electricity sector, initially in Great Britain and subsequently across the continental part of the EU, where market reforms and extensive integration were executed on a national scale. These changes were followed by similar changes in the natural gas sector. The market was introduced in various ways in a number of countries, and to varying degrees in half of the US states.

These reforms were driven by the belief that the process of liberalization (referred to as such in Europe and as deregulation in the USA), by introducing competition in electricity generation and ensuring free, non-discriminatory access to regulated energy networks (acknowledged as natural monopolies), would enhance system efficiency. The anticipated outcomes were lower electricity prices, more effective than prior cost control and price regulation of energy generation and secured long-term energy supply. Such changes included, inter alia:

- customers get the right to choose their supplier;
- vertical functional and legal unbundling of electricity and gas network activities, and in the case of transmission networks, ownership unbundling (with some modalities) from generation and trade;
- promoting competition in generation sector;
- establishing electricity exchanges where pricing is based on short-term marginal costs (i.e., variable costs, with fixed costs not always accounted for);
- regulating network activities as monopolies by independent regulatory bodies;
- facilitating market coupling to create regional markets, and in Europe's case, a pan-European market.

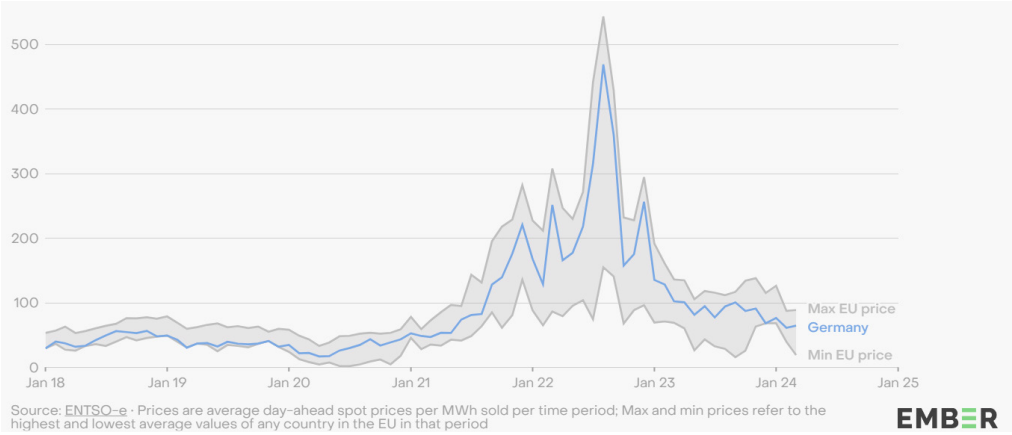
Chart 4. Liberalization of energy markets



Source: Next Krftwerke

Following the enactment of the first EU market directives, electricity prices initially began to decrease, largely due to an excess of generation capacity that compelled operators to reduce prices in response to competitive pressures. However, from 2003 onwards, prices have generally been on an upward trend for a variety of reasons, despite occasional fluctuations. Some of key factors were: for the rise in electricity prices till Global financial crisis 2008 - influence of growing oil and gas prices and increasing of consumption; for dramatic decline after Crisis – decline of fuel prices and electricity consumption, over-optimistic power plant investments; for dramatic increase since 2021 – imbalances on the gas market and especially war in Ukraine (see next chart).

Chart 5. Wholesale electricity prices changes in the EU since 2018



Nonetheless, it is stated by EU Commission that price increases would have been more ignificant without the influence of market reforms. The initiatives that began in the mid-1990s have persisted to the present day, evolving and being enhanced through four EU reform packages aimed at establishing a liberalized pan-European electricity and gas market.

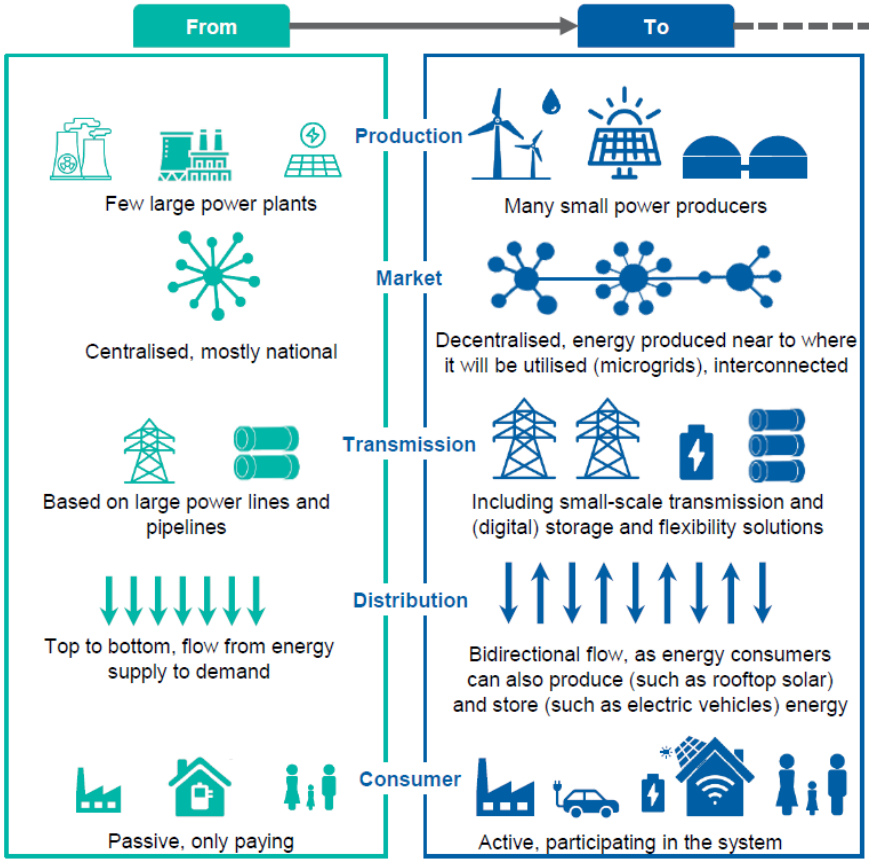
Another significant, indeed transformative global shift is the energy transition, which has notably accelerated, both normatively and in practice, especially during the past decade, demanding the most substantial changes in the power industry. In most countries, the electricity industry is the largest source of greenhouse gas (GHG) emissions, particularly carbon dioxide, due to its predominant reliance on fossil fuels. This is why decarbonization and its implementation measures are primarily focused

on electricity generation. Globally, the energy sector, along with transportation, accounts for approximately 73% of GHG emissions, with buildings contributing about 18%. Hence the transition to zero carbon technologies is one of the key responses to climate change.

The ongoing changes are focused on diminishing the utilization of fossil fuels and enhancing the proportion of renewable energy sources, predominantly wind and solar. Given that wind and solar power facilities are not dispatchable, expanding energy storage capacity with both existing and emerging technologies, flexible generation, demand side response which could significantly contribute to peak loads decreasing and flattering the consumption, network and interconnectors reinforcement and market coupling and improved market design, are essential for their integration into the system while maintaining stability and ensuring a secure supply of electricity. Additionally, the operational dynamics of power systems are evolving: generation is becoming more decentralized, also with fast growing number of prosumers, so called because they produce and consume energy, and systems are increasingly digitized, inter alia to manage a growing base of intelligent energy devices owned by consumers (refer to the next Chart). These developments collectively contribute to an increased share of electricity in the overall energy mix.

The future grid will need new complex techniques and technologies that work together to efficiently match bi-directional energy supply and generally control increased share of distributed generation. In the future, much larger investments in the development of network, especially distribution networks, are necessary.

Chart 6. Elements of energy transition processes



Source: EBRD, Energy Sector Strategy 2024-28, December 2023

There are many challenges and risks, some yet to be fully understood, on the path to achieving transition goals. These goals, contingent upon specific conditions, include crucial technologies that are essential for success but have not yet been fully developed or commercialized. Small countries are in a particularly precarious position, often finding themselves in a passive role, limited to adopting technologies, solutions, and models due to a lack of capacity to participate in development. However, through activism and creativity, some manage to carve out opportunities for their industries and innovative applications.

Overall, transitioning to green energy represents one of today's most significant challenges, particularly for countries that have traditionally relied heavily on fossil fuels for energy generation.

Following the introduction of market mechanisms in the electricity industry, there was a prevailing belief that the government should recede, entrusting regulatory functions—including market oversight and guidance—to independent regulatory bodies. It was anticipated that the market itself, guided by the "invisible hand," would naturally steer towards the most beneficial outcomes for energy consumers, including secure supply, in both the short and long term. This philosophy has been predominantly adopted since the mid-1990s.

With the initiation and acceleration of the energy transition, governments are reassuming critical roles: they establish explicit energy and climate objectives within the framework of energy policy formulation and adoption, outline the direction of change and the incentive mechanisms aimed at achieving these goals, and dictate measures to facilitate this transition without causing socio-economic upheaval. In doing so, states—or their governments—take on the responsibility for the success and sustainability of the goals and measures they implement. However, the approaches vary widely, ranging from ambitious strategies that rely on faith in technological advancement (as seen in the EU) to more cautious, security-focused strategies that draw on practical, available domestic and international resources. Meanwhile, countries like China are pragmatically embracing technologies and dominating the global equipment market.

The European Green Deal, launched in December 2019, stands as the EU's most ambitious and complex initiative, aiming for climate neutrality by 2050 through comprehensive policies across energy, industry, and natural resources to transform the economy and lead the global fight against climate change. On the other hand, the largest single-country government initiative towards decarbonization is the US Inflation Reduction Act (IRA), marking an unprecedented investment in U.S. history towards accelerating the energy transition, offering significant incentives for renewable energy, electric vehicles, and energy efficiency to reduce carbon emissions and promote clean energy technologies. Its implementation has started effectively and has sparked concern in the EU and other countries due to fears of competitive disadvantage, potential trade distortions, impacts on global supply chains, and the pressure to increase its own green subsidies, challenging the alignment of transatlantic strategies on the energy transition. Therefore, the EU is forced to intervene in its market, contrary to the previous rigorous principles of state aid, to protect its international market position and role.

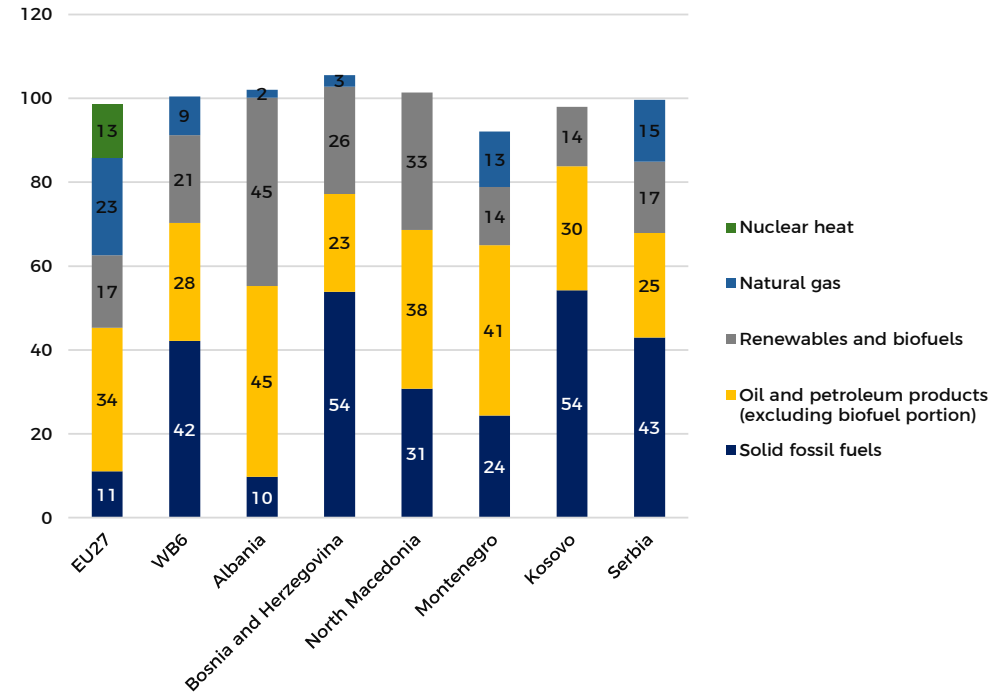
The recent energy crisis and significant volatility in natural gas and electricity prices have compelled governments, particularly those of EU member states and the EU as an entity, to hesitantly undertake or announce interventions that challenge the previously inviolable structure of the energy market. These actions, driven by concern over macroeconomic and social repercussions, signify a reluctant but necessary re-engagement of the state in the energy sector. Despite these efforts, a clear path to stable normalcy remains elusive, with energy security re-emerging as a critical and prioritized concern.

CHAPTER I – ELECTRIC ENERGY OVERVIEW FOR WB COUNTRIES

WB6 GENERAL ENERGY OVERVIEW

Although the energy mix of WB6 has a higher share of renewable energy sources than the EU, carbon-intensive and highly polluting solid fossil fuels have almost 4 times greater share. WB6 countries generally have comparable (14-17% in Serbia, Kosovo and Montenegro), or even higher share (26-45% in the rest) of energy production from renewable sources compared to the EU 27 (17%). However, at the same time, in all WB6 countries, apart from Albania, fossil fuels comprise almost 80% of gross available energy (in comparison to 45% in the EU27). Moreover, more clean energy types (natural gas and nuclear energy) make a third of gross available energy in EU27, while these are marginal in almost all WB6 countries, except Serbia and Montenegro. When it comes to solid fossil fuels, the positions are reversed, as this is a dominant energy source in Kosovo, Montenegro and Serbia, while being marginal in the EU27.

Chart 7. Gross available energy in the WB6 and the EU27 by fuel types - 2021 (%)



Source: Eurostat

Note: For secondary products, which are produced as transformation output in the middle block of energy balances, the Gross available energy can be negative as it reflects only on the trade and stock changes. That is why the total percentages for Albania and Bosnia exceed 100%.

Western Balkans households, industry and agriculture consume comparatively less energy from fossil fuels and more from renewables than its EU peers. When it comes to the final energy consumption, in 2021 fossil fuels comprised 49% in the WB6 countries as opposed to 59% in the EU. This is mainly due to natural gas since the end users in the EU countries consume much more of it when compared to the Western Balkans (23%>7%). Among the Western Balkan countries, only Serbia had a natural gas consumption in double digits (12%), while Kosovo and Montenegro do not have natural gas network and supply. On the other hand, compared to the EU, renewable energy had higher shares in final consumption in all Western Balkan countries except in North Macedonia.

All Western Balkan countries import only a quarter to around third of their total energy needs with the exception of the highly energy-dependent North Macedonia. Energy import dependency for WB6, measured as net energy imports divided by gross available energy, was significantly below the EU27 level (34,7% < 55,6%) in 2021 (table 1). However, depending on the concrete country, these numbers were highly variable, depending on available natural resources, from Albania (23,8%), abundant with hydropower, and Bosnia and Herzegovina (27,2%), with its coal reserves, to North Macedonia, which imports almost 70% of its total energy needs.

Table 1. Net energy dependency in the WB6 and the EU in 2021 (thousand tonnes of oil equivalent and %)

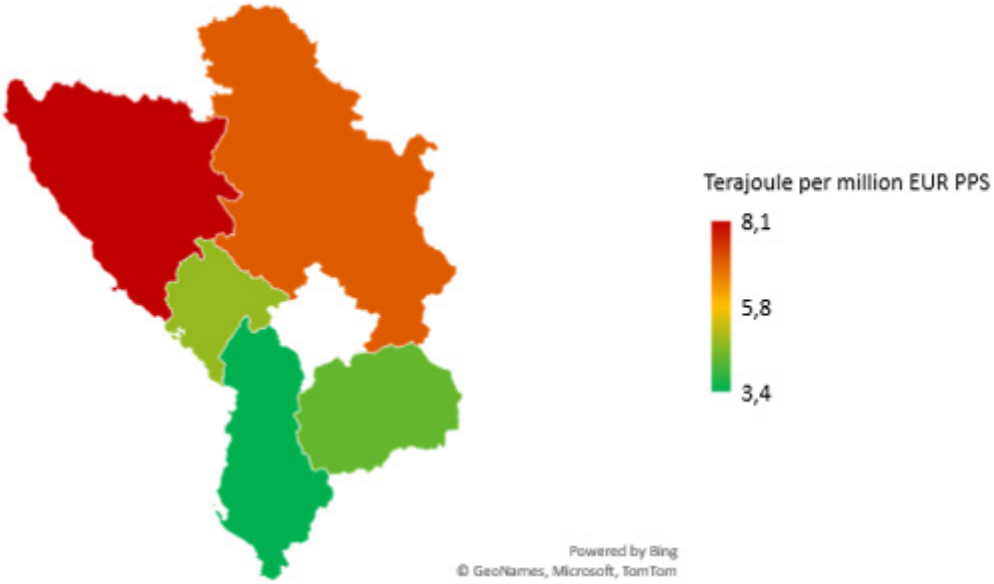
2021	EU27	WB6	Albania	Bosnia and Herze-govina	Monte-negro	North Mace-donia	Kosovo	Serbia
Imports (ktoe)	1.224.025	16.484	1.466	3.257	885	2.396	1.227	7.251
Exports (ktoe)	412.327	5.173	913	1.255	546	574	285	1.600
Net imports (ktoe)	811.699	11.311	553	2.002	340	1.822	942	5.652
Gross avail-able energy (ktoe)	1.460.454	32.612	2.327	7.374	1.093	2.678	2.888	16.251
Net energy dependancy	55,6%	34,7%	23,8%	27,2%	31,1%	68,0%	32,6%	34,8%

Source: Eurostat

Western Balkan countries[5] on average need around 50% more energy than the EU to produce the same amount of GDP and their relative energy efficiency have not improved in the last five years. Energy intensity in the WB6, measured as gross available energy divided by GDP (in purchasing power standards), in the five-year period from 2017 to 2021 decreased by 13%. However, since the EU has also improved its energy efficiency, the region did not make any relative convergence to the EU. Moreover, as seen on the map below, there are huge differences among WB6 countries, on the one hand, Albania's economy in 2021. was even less energy intensive than the EU's (3,4<4,2 terajoule per million EUR PPS), while on the other hand, Bosnia's energy intensity was almost twice as high (8,1 terajoule per million EUR PPS). The region's high energy usage results from the availability of inexpensive electricity derived from lignite and hydro sources, coupled with the sluggish implementation of investments in energy efficiency.

5 Data for Kosovo was not publicly available.

Map 1. Total energy intensity in the WB6 - 2021

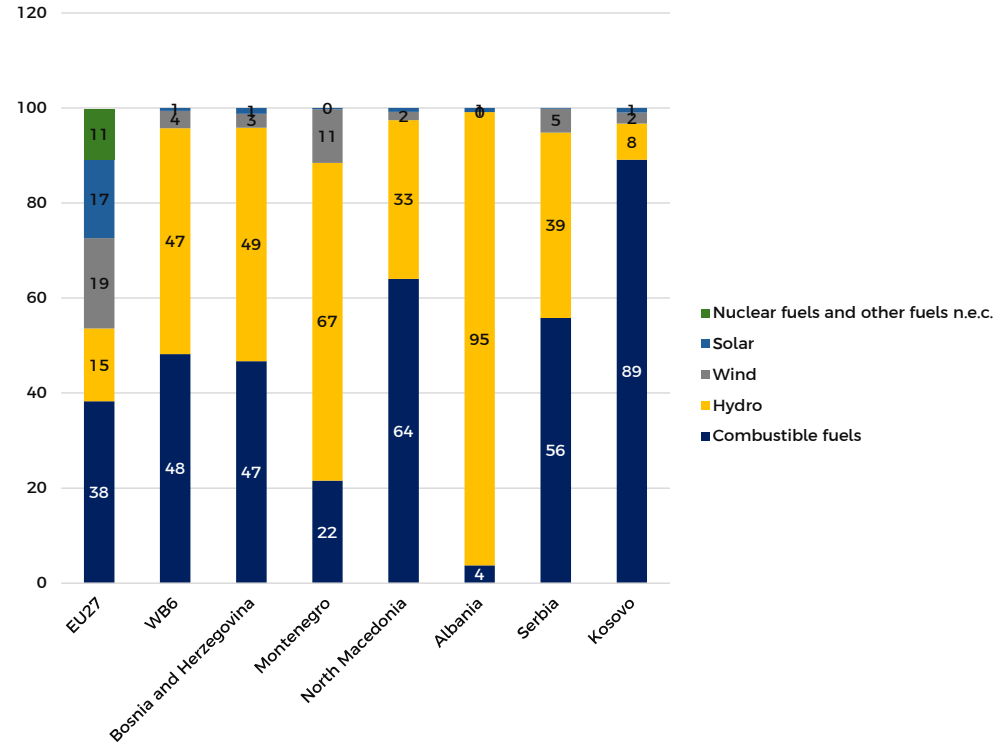


Source: Eurostat
Note: Data for Kosovo not publicly available

WB6 ELECTRICAL ENERGY OVERVIEW

Due to the very high share of hydropower capacities, renewable energy accounts for more than 50% of the Western Balkan's total electricity production capacities although variable RES have been increasing almost three times slower than the EU in the last six years. In the period between 2016 to 2021, the share of renewable energy in the WB6's installed electrical capacities has overtaken the share of fossil fuels and exceeded half of total electrical energy capacities. However, other than hydro power, which is „over inflated" in the Western Balkans due to Albania basically having no other source of electrical energy, the share of other renewables (wind, solar etc) in 2021. comprised less than 5%. Moreover, in the same time period, the share of variable renewables (solar and wind) increased by a mere 3,7 percent points whereas the EU achieved 10,9 p.p. growth (Ember climate data and Eurostat, 2024).

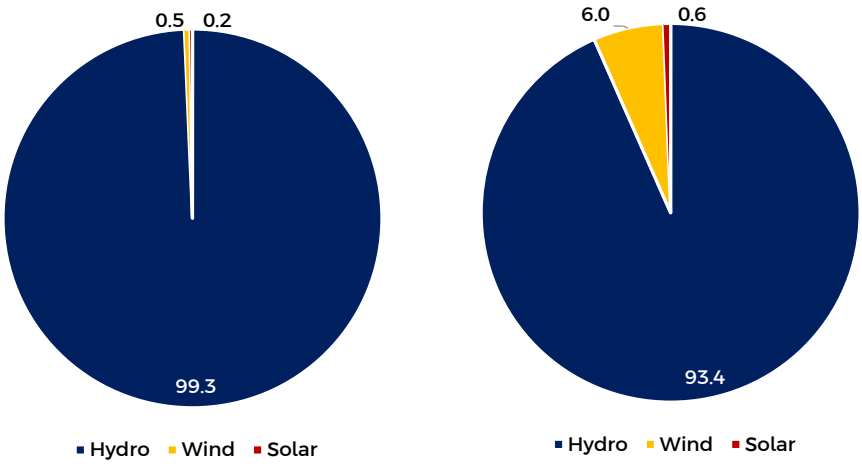
Chart 8. Electricity production capacities in the WB6 and EU27 by fuel types - 2021 (%)



Source: Eurostat

Fossil fuels make up more than half of electricity generation in the Western Balkans while the share of renewables, although higher than in the EU, has been increasing at a slightly slower pace in the last six years. In 2021, both gross and net renewable electricity generation share in the WB6 have been around 10 p.p. higher than in the EU, exceeding 40% of total energy mix. However, its growth has not exceeded 5 p.p. which was relatively slower than the EU (6,5 p.p.) Regarding its structure, as seen on the Chart 3, electricity generated by the wind and solar grew more rapidly than hydro energy thus increasing their shares in the total (net) renewable energy mix for WB6 by 12 and 3 times, respectively. Country wise, Bosnia and Herzegovina has had the largest increase in both gross and net electricity generation shares of renewable energy (by 7,2 and 7,5 p.p., respectively) while North Macedonia even had a decrease (by 7,4 and 7,6 p.p, respectively).

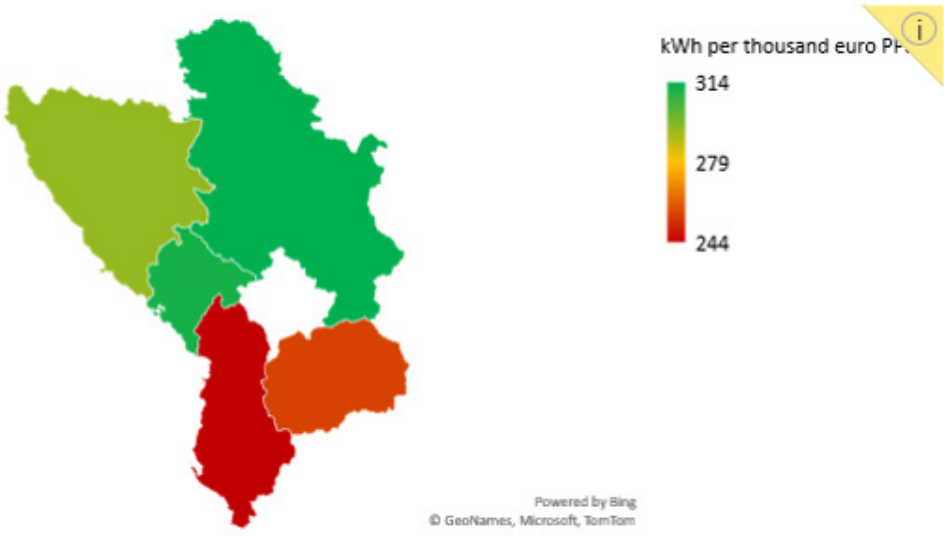
Chart 9. Structure of net electricity generation from renewable energy sources in the WB6 – 2016 and 2021



Source: Eurostat

Western Balkan and EU households on average[6] consume similar amounts of electricity per capita while the WB6 economies consume two thirds more electricity for every unit of GDP than the EU average. Household final consumption of electricity per capita for WB6 in 2021 was 1,8 MWh per capita which was around the EU average (1,7 MWh per capita). Country wise, Albania has the least household consumption per capita (1,2) while Montenegro had the highest (2,2). On the other hand, Western Balkan economies are clearly less energy efficient than the EU since their final electricity consumption per GDP was 67% higher[7] than the EU average in 2021 (292 kWh per thousand-euro PPS). Serbian economy had the least electrical energy efficiency and lagged by almost 80% behind its EU peers.[8]

Map 2. Final consumption of electricity per GDP in WB6 and EU – 2021



Source: Eurostat
Note: Data for Kosovo not publicly available

6 Data for Bosnia and Herzegovina was not publicly available
7 Data for Kosovo not publicly available.
8 Eurostat, 2024.

While the EU in 2021 imported slightly more electrical energy than it exported, Western Balkan countries were the net exporters of electricity, but the figures significantly varied between countries. In the longer term, Bosnia and Herzegovina is the only electricity exporting country in WB6. In 2021, the EU on average imported electricity in amount of a mere 0,3% of its total available for final consumption while the WB6 exported around 2,6%. Country wise, while Bosnia and Herzegovina, with its vast thermal plants, was a significant net exporter (42,6%), North Macedonia imported more than third of its total final electricity consumption (37,4%). In addition, the region as a whole slightly worsened its net electricity trade position since 2016 when it exported more than 6% of its electricity available for final consumption.

Table 2. Electricity imports and exports as a % of the final consumption in the WB6 and EU – 2021

2021 (GWh)	Imports of electricity	Exports of electricity	Net imports of electricity	Available for final consumption	Net imports as a percentage of electricity available for final consumption (%)
EU27	401.426	394.108	7.317	2.568.423	0,3
WB6	28.556	30.215	-1.659	64.300	-2,6
Bosnia and Herzegovina	3.259	8.014	-4.755	11.147	-42,7
Montenegro	5.318	5.489	-171	2.978	-5,7
North Macedonia	7.407	4.930	2.478	6.636	37,3
Albania	2.252	2.800	-548	7.031	-7,8
Serbia	6.984	6.333	651	30.570	2,1
Kosovo	3.336	2.649	687	5.938	11,6

Source: Eurostat

Western Balkan households on average pay 63% less for electricity consumed when compared to their European peers while this difference widened recently. The average price of electricity for WB6 households in the period between the first half of 2019 and the first half of 2023 amounted to only 8,5 eur cents per kilowatt hours (including taxes and levies) which was 37% of the EU average in the same period. However, when looking at the latest data for the first half of 2023, we can see that WB6 countries paid only 32% of the EU average price. This clearly shows that the price of electrical energy is still the social category in the Western Balkans, especially in countries like Serbia and Kosovo where the prices are even lower than the WB6 average.

The weight of all taxes and levies for electricity was lower for consumers in all the Western Balkans countries compared to the EU although Serbia was a significant outlier. Share of taxes and levies paid by Western Balkans household consumers for electricity in the first half of 2023 was 2,7 percent points lower than the EU' average (19,2%) with both shares of VAT and other taxes lower. However, Serbian consumers paid as much as 29% of their total price in taxes and levies, mostly due to unproportionally high share of other taxes and levies (12,8%).

Table 3. Share of taxes and levies in electricity prices for household consumers in the EU and WB6 - Consumption from 2 500 kWh to 4 999 kWh - band DC - EUR per kWh and %

2023-S1	EU 27	Western Balkans	Bosnia and Herzegovina	Montenegro	North Macedonia	Albania	Serbia	Kosovo
Excluding taxes and levies	0,2335	0,0771	0,0742	0,0798	0,0957	0,0842	0,0686	0,0603
Excluding VAT and other recoverable taxes and levies	0,2484	0,0804	0,0747	0,0845	0,0957	0,0842	0,0809	0,0621
All taxes and levies included	0,2890	0,0923	0,0874	0,0968	0,1053	0,1010	0,0964	0,0671
Total taxes and levies	0,0555	0,0152	0,0132	0,017	0,0096	0,0168	0,0278	0,0068
Share of total taxes and levies	19,2%	16,5%	15,1%	17,6%	9,1%	16,6%	28,8%	10,1%
VAT	0,0406	0,012	0,0127	0,0123	0,0096	0,0168	0,0155	0,005
Share of VAT	14,0%	13,0%	14,5%	12,7%	9,1%	16,6%	16,1%	7,5%
Other taxes and levies	0,0149	0,0032	0,0005	0,0047	0,	0,	0,0123	0,0018
Share of other taxes and levies	5,2%	3,5%	0,6%	4,9%	0,0%	0,0%	12,8%	2,7%

Source: Eurostat

Most Western Balkan countries have vertically integrated, highly centralized, and state-owned electricity utilities as evidenced by the dominant market presence of the largest electricity producer. The market share of the largest generator in the electricity market, which monitors the extent of electricity market liberalization, is comparatively much higher in the WB6 countries than its Central and Eastern European peers in the European Union (Table 4). Although this has been gradually reducing, it is still true for almost all Western Balkan countries except Bosnia and Herzegovina with its unique government structure where basically all the power and responsibilities are divided between the two political entities: Republika Srpska and Federation of Bosnia and Herzegovina.

Table 4. Market share of the largest generator in the electricity market in the Central and Eastern European Countries and the WB6 – 2021

%	2017	2021
Bulgaria	35,6	36,1
Czechia	67,1	62,6
Estonia	82,5	64,0
Croatia	86,1	75,5
Hungary	51,3	63,0
Poland	17,7	16,9
Romania	23,1	29,6
Slovenia	48,5	50,5
Slovakia	71,4	63,7
Bosnia and Herzegovina	46,3	39,2
Montenegro	96,0	86,4
North Macedonia	78,0	62,0
Serbia	98,6	95,0
Kosovo	96,6	95,0

Source: Eurostat

CHAPTER II - KEY ELECTRICITY SUPPLY RISKS AND ISSUES FOR THE WB6

ENERGY SECTOR GOVERNANCE INEFFICIENCIES

Western Balkan countries are characterized by highly centralized, state-owned electric power systems with profound economic, political and social influence. Contrary to the fully liberalized model of the EU's electricity power market, power utilities in the WB6 are not only predominantly state-owned but are also among the largest employers in their national economies. In addition, they make a substantial contribution to government revenues and collaborate with numerous businesses within their supply chains. For instance, Serbia's Elektroprivreda Srbije (EPS) is known as a very dominant utility, possessing ownership of all the nation's coal and major hydropower facilities, along with the majority of its coal mines (FES, 2021). Out of all the electricity players in WB6 comprising electricity generators, electricity transmission operators, electricity distribution, and electricity supply companies – only electricity distributions in Kosovo and North Macedonia are privatized.

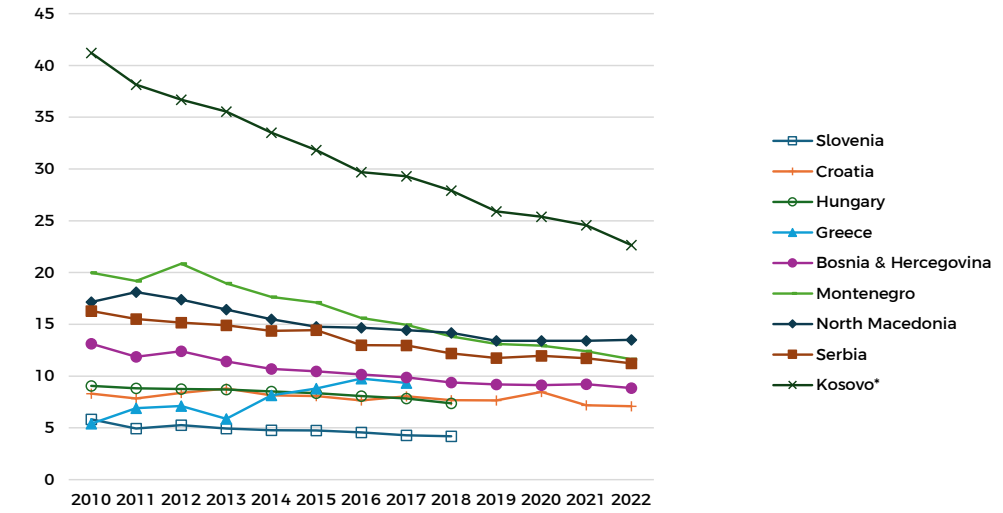
The primary characteristic of the power sector utilities in the Western Balkans is the significant control exercised by national governments and dominant political parties and an evident lack of transparency in decision making. This control extends to key industry players, including power utilities, operators of transmission and distribution systems, and regulators. Generally speaking, WB countries lack a transparent, inclusive, institutionalized dialogue on energy decision-making between public entities and the private sector, civil society and academia. For instance, Serbia made a direct deal with China, carried out behind closed doors, with no tenders included – about the construction of the Kostolac B coal power plant.

One of the major negative consequences of this political set-up framework is the conflicting nature of key strategic goals imposed by the Western Balkan governments. On the one hand, national authorities often emphasize their commitment to achieving "energy sovereignty" and exporting energy on the one hand, while, on the other hand, they are still keeping electricity prices artificially low by subsidizing them in order to maintain "social peace". Furthermore, WB6 governments take pride in undertaking significant investment projects, particularly in power generation, while, at the same time, sustaining very high employment levels in the sector, irrespective of its financial performance (RESET, 2023).

Crucial components of the Western Balkan's energy infrastructure are outdated and require a complete overhaul. The region's primary security of supply issue is due to its reliance on aged, unreliable technology in TPPs, that are over 40 years old, and were insufficiently maintained in the 1990s, thus having higher maintenance costs. Distribution losses are gradually decreasing, but they are still high, mostly over 10% (Chart 4) while in most EU countries they are below 8%. The penetration rate of smart meters is very low, with the exception of Montenegro - which is even better than the EU average.

Integrating increasing quantities of variable renewable energy, such as wind and solar, necessitates a holistic approach to grid development. This involves not only physical upgrades to the grid to accommodate more energy, but also adopting new technologies and innovative solutions to effectively manage the inherent variability and unpredictability of these energy sources. For instance, digitalization plays a pivotal role in providing the grid operators with the data needed to make informed decisions and respond swiftly to changes in energy supply and demand. Another critical aspect of grid modernization is enabling the participation of consumers as producers, often referred to as "prosumers" (who will be central to the later part of this study). Furthermore, integrating renewable energy requires supporting infrastructure such as heat pumps, which can efficiently provide heating and cooling by leveraging electricity from renewable sources. Finally, the expansion of electric vehicle (EV) charging infrastructure is another critical component. This not only supports the growth of e-mobility but also offers potential storage solutions that can help balance the grid.

Chart 10. Distribution losses in the CEU and WB6



Source: CEER, national regulatory bodies

Energy efficiency is high on the agenda of the WB6 national governments' priorities, but implementation is lacking. Energy efficiency is often treated as an afterthought rather than a priority, as seen in the very poor quality of building retrofits frequently involving basic measures like attaching Styrofoam to buildings. Although energy efficiency policies have recently gained momentum in strategic documents, it is improving at a very slow pace while challenges such as insufficient technical personnel, limited budget in relevant institutions, absence of building certifications, and a lack of trained and certified auditors are hindering its progress (OECD, 2022).

The long-standing practice of maintaining low energy prices, supported by affordable domestic electricity, has resulted in prolonged disincentives that undermine short-term energy conservation efforts, operational enhancements, and investments in energy efficiency. The average electricity price (including taxes and levies) for household consumers in the Western Balkans in the period between the first half of 2019 and the first half of 2023 was 8,5-euro cents/kWh, which was 2.7 times lower than the average price in the EU in the same period (Eurostat, 2024). This was largely due to government actively supporting carbon intensive electricity generation, as evidenced by the 2019 Energy Community (EnC) Secretariat study, which revealed that residential electricity prices would be about 30% higher than current rates if these subsidies were eliminated.

However, as the region moves towards market liberalization, their recent inevitable rise will potentially exacerbate already widespread energy poverty. While it is true that households in the WB6 pay less for electricity than their EU peers, due to their much lower incomes, electricity in these countries is relatively more expensive. For instance, while the EU's average share of population below 60% of median equalized income with arrears in utility bills equaled 16% in 2020, this indicator in Serbia, Albania and North Macedonia amounted to 44%, 45%, and 59%, respectively (Eurostat, 2024). In addition, WB6 governments have recently started with electricity price increases (i.e. in Serbia, household electricity prices had increased three times by 8% in 2023 alone). This brings about a very complex issue: on the one hand, electricity prices need to be raised, while on the other, the impact on consumers – particularly vulnerable ones – needs to be mitigated. Therefore, if the regional governments fail to design a market which is able and willing to protect lower-income households from higher energy prices, these increases will inevitably be blamed on climate policies (RESET, 2023).

Generally speaking, the key driver for energy transition in WB6 is the EU accession process and EU legislation, and not a local political agenda. Although heavily reliant on coal for electricity production (except Albania), WB6's main decarbonization strategy is quite unambitious: to simply increase the share of RES while gradually reducing production of coal - without any clear and legally binding timeline. None of the countries, except North Macedonia (), have legally set a "coal exit" date, and even North Macedonia postponed its initial 2028 coal phase-out target to 2030. This is no surprise if we consider that in the Western Balkan's TPPs and coal mines, there were approximately 46,000 directly employed and an additional 80,000-100,000 indirectly employed workers. Just this fact, along with aforementioned price increases, transforms energy transition into a huge social issue (RESET, 2023).

In addition, prevailing energy myths not only support the status quo but also lead to increasing investments in reconstruction and modernization of the coal-fired thermal power plants and affiliated coal mines. The recent energy crisis has further reinforced WB6 governments' reliance on coal-based electricity generation, justifying investments in thermal power sectors as crucial for ensuring energy supply security. In fact, proponents of coal-based power generation often justify its use as a base load power and even as a transitional fuel, citing widespread myths that the EU is mandating the closure of TPPs to increase region's dependence on costly renewable energy imports from the EU, and that constructing RES, mainly Wind Power Plants (WPPs) and Photovoltaic Parks (PVPs), demands substantial foreign investment, leading to reliance on electricity not controlled by national public utilities. These myths are then politically exploited to justify public utilities' investment choices, focusing mainly on ecological upgrades of existing TPPs to align with certain EU directives[9] and even constructing new TPP capacities, such as "freshly" opened TPP Kostolac B3 in Serbia (RESET, 2023).

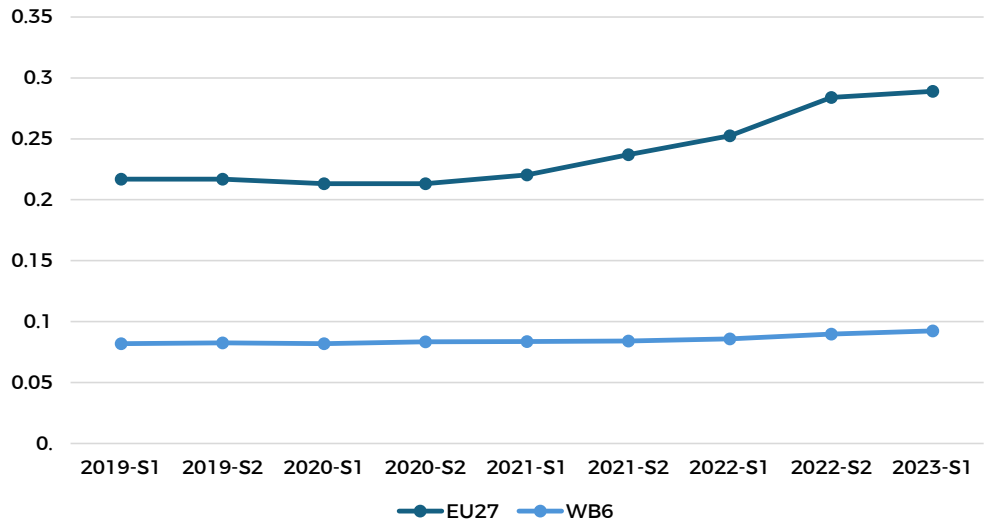
Western Balkan countries still provide significant subsidies to coal which hinders energy diversification and investments in energy efficiency. Although the total amount of subsidies has halved since 2016, according to the EnC Secretariat, the trend of using public resources to support coal production persists in all countries but Albania. For instance, based on preliminary data for 2022, Bosnia and Herzegovina and Serbia implemented all types of subsidies, dominantly through direct budget financing, contributing EUR 34 million and EUR 48 million respectively. In 2022, Montenegro and North Macedonia reduced their subsidies to a third of their 2020 levels, offering support only through tolerance of arrears and debts, while Kosovo was the only country which increased its coal subsidies, although keeping them at a median level among Contracting Parties and below its five-year average (ENC, 2023).

9 The Industrial Emissions Directive (IED) is the main EU instrument regulating pollutant emissions from industrial installations. It aims to achieve a high level of protection of human health and the environment taken as a whole by reducing harmful industrial emissions across the EU.

IMPACT OF COVID-19 AND RUSSO-UKRAINE CONFLICT

Geopolitical turbulences have caused the global energy prices to soar to unprecedentedly high levels, affecting all Western Balkan countries, although not equally. The combination of a strong post pandemic economic recovery and more recent Russo-Ukrainian war have seriously disrupted global energy markets and impacted retail energy prices. Since most WB6 countries are net importers of electrical energy, they are particularly vulnerable to price shocks in the regional wholesale electricity markets. For instance, according to the data from Eurostat, more than 37% of North Macedonia's electricity available for final consumption had to be imported in 2021, thus leading to rising electricity prices for household consumers in just one year (from 2021 to 2022) by more than 25%. Even Serbia, which could traditionally satisfy all its electricity needs from domestic production, had to resort to importing large amounts of electricity at enormous prices in late 2021 and early 2022, mainly due to coal deficit and lack of adequate investments into new lignite mines, joined by accident at its largest thermal power plant. However, global energy markets disruptions had a limited effect on retail prices in Bosnia and Herzegovina, a dominant net exporter of electricity (mainly from coal generators) (OECD, 2022).

Chart 11. Electricity prices for household consumers in the EU27 and WB6 (euro per kWh)



Source: Eurostat
Note: Consumption from 2 500 kWh to 4 999 kWh - band DC

The 2021/2022 energy crisis in the Western Balkans (WB) region highlighted multiple critical vulnerabilities in its electricity supply security, primarily on the supply side. Key factors included heavy reliance on outdated thermal power plants (TPPs) using low-grade coal (lignite), operational and financial issues in coal mines, dependence on hydroelectric power plants (HPPs) vulnerable to hydrological conditions, slow progress in renewable energy sources like photovoltaic parks (PVPs) and wind power plants (WPPs), and a shortage of skilled personnel for large power generation projects. However, the root issue plaguing the power sectors across all Western Balkans countries is the lack of investment in new production facilities and adequate infrastructure. Thus, a perfect storm scenario comprised of concurrent failures in several TPPs throughout the region, coupled with a lack of adequate coal supply or its low quality, and decreased output from HPPs due to unfavorable hydrological conditions, forced the region to import substantial amounts electricity (RESET, 2023).

The energy crisis in the Western Balkans has led governments to implement emergency measures for securing energy supply and affordability. Liquidity and guarantees have been provided to transmission/distribution system operators in countries like Albania, North Macedonia, Kosovo, and Serbia. To support businesses, liquidity and energy efficiency loans have been provided in North Macedonia while energy price caps were introduced in Serbia. Additionally, countries like Kosovo adopted measures to lower energy demand such as awareness campaigns, tariff adjustments, and even temporary power rationing. As in the rest of Europe, some nations are postponing coal phase-out dates (North Macedonia) or even abandoning clear timelines to do so (Serbia, Bosnia and Herzegovina, Montenegro) with North Macedonia negotiating for more lignite imports and even restarting a long-dormant fuel oil-fired plant (Negotino). While all WB countries focused on limiting price increase for households during 2022 and Serbia even increased efforts to assist vulnerable consumers, long term measures increasing energy efficiency and improving poor households' access to renewable sources remain limited, with only North Macedonia taking significant steps in this direction (ENC, 2023).

THE EU GREEN AGENDA AND THE WB6

The EU is the main driver of the green transition in the Western Balkans, but apart from the perspective of future membership, its capacity to streamline this process is very limited. To align with the Paris Agreement, the EU adopted the European Green Deal (the Green Deal), a growth strategy which aims to transform Europe into „the first climate neutral continent" by 2050, focusing not just on coal, which has to be phased out much earlier, but also on oil and gas. In addition, the EU extends its support for green transition in the WB by proposing the Green Agenda for the WB as a regional development strategy and establishing the Economic and Investment Plan for the WB, to support this strategy financially. In November 2020, the WB6 countries signed the EU's Sofia Declaration on the Green Agenda for the WB, committing to the EU's Climate Law and decarbonization by 2050, along with other environmental initiatives; however, the absence of specific deadlines and delivery mechanisms in the declaration makes its success reliant on future action plans coordinated by the Regional Cooperation Council (FES, 2021).

The EU supports decarbonization in the Western Balkans primarily through the Energy Community (EnC) which gradually moved from a regional approach of reforming WB power sectors to a direct integration with the EU electricity market. All six countries in the Western Balkans are members of the Energy Community Treaty, which helps them prepare for the energy related EU accession requirements through gradual alignment with the EU market reforms and renewable energy initiatives. Although initial plans included establishing a regional power exchange as a transitional stage as well as coordinated power system balancing in the WB to increase the capacity for the integration of variable RES, these were not implemented. Instead, in 2021 the EU initiated the EnC Decarbonization Roadmap where a direct coupling with the EU trading and balancing platforms was proposed. This shift in strategy marks a transition from a regional approach to a direct integration of the WB power sectors with the EU electricity market (RESET, 2021).

Businesses in the Western Balkans are preparing for the European Union's carbon border tax, set to be implemented in 2026, which is expected to expedite the region's decarbonization efforts. The EU's primary strategy for managing energy system decarbonization is through its carbon pricing scheme, the EU Emission Trading System (EU ETS), which operates on a "cap and trade" model. Revenues generated from the EU ETS allowance auctions are allocated for funding decarbonization initiatives. Additionally, under the Green Deal in 2023, the EU established the Carbon Border Adjustment Mechanism (CBAM), imposing a carbon tax on imports of carbon-heavy products like steel, cement, and electricity. EU policymakers widely believe that the CBAM will motivate Western Balkan countries to adopt a carbon pricing mechanism

aligned with the EU ETS, thereby accelerating the decarbonization of their energy systems (RESET, 2021).

However, the influence of CBAM application on the Western Balkans countries will vary significantly. Impact on Bosnia and Herzegovina, as a large exporter with high coal share will be very high. On the other side, impact of CBAM on Serbia will be negligible compared to possible costs of EU ETS, if it would be applied. The EU should offer financial support, proportional to GDP per capita and the current share of coal or to cover the opportunity cost of coal-generated electricity, and show a more flexible approach in the implementation of carbon pricing and integration of energy markets, and on the other side, the WB countries should be far more ambitious in defining and implementing decarbonization.

Another big challenge for WB is integration of increasing share of variable renewable energy in systems now mostly dominated by coal base power. WB energy systems should, at the national, regional level and together with the EU, look for market solutions for providing future basic energy, and also energy from flexible sources and balancing, which guarantee security of supply. A full market integration of Contracting Parties of Energy Community Treaty into the single European market is finally enabled by the Ministerial Council's adoption of the legally binding framework, the so-called Electricity Integration Package, on 15 December 2022. It sets the ground for the WB6 electricity markets to join the single day-ahead coupling, the single intraday coupling and the European balancing platforms. In fact, during 2023, power exchanges with day-ahead markets have been established in all WB countries except Bosnia and Herzegovina, making it the only European country lacking it (Serbian SEPEEX day ahead market is already active since 2016).

The balancing market is operational in most WB countries[10], with some initial forms of cross-border cooperation[11]. As in some EU countries, balancing markets still lack maturity and competition. The integration of various technologies and other possibilities in the balancing markets, such as storage units – hydro pump storage plants and batteries, hybrid RES generation plants, demand response and various distributed flexibility providers through aggregators, is seen as essential for increasing the ability of the system to operate with a high share of generation from renewable sources. Flexibility resources could also come from interconnection capacities in the region and with EU, at all timescales and from availability of interconnection capacities for trading, according to the EU regulation – at list 70%. Project of common interest for increasing cross-border capacities are identified in the region and of EU interest.

Energy resources and the availability of energy technologies and capital are the foundation that will determine the speed and structure of changes, which would be the framework for national policies to achieve climate neutrality. Among other things, WB does not have reliable sources of supply of natural gas as a transitional fuel, which could be a temporary substitute for coal, as is a case in some other countries. WB cannot even expect that nuclear power plants will be available to it in the foreseeable future. Natural conditions are not favorable for low carbon hydrogen generation - this will happen sooner in the north and south of the EU. Green technologies - the use of renewable energy sources and energy storage are very capital intensive. On the other side, available capital costs for WB countries are certainly significantly higher than in the EU. These and other challenges, uncertainties and risks in which the energy transition will be implemented in the future, could be solved more easily by cooperation in the region and in Europe, by strenghtening the professional capacities of the responsible national institutions, supported by flexible planning.

---

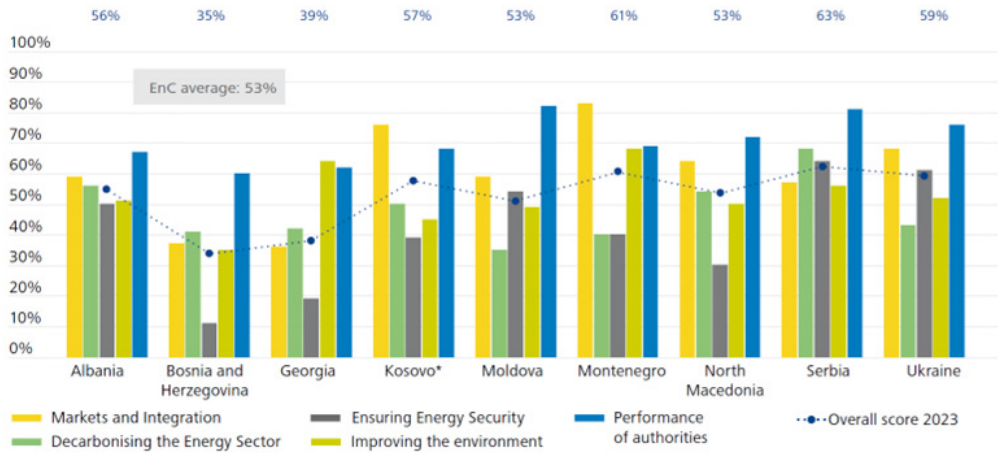
10 North Macedonia; Albania and Bosnia and Hercegovina - with price cap; Kosovo, Montenegro, and Serbia - regulated.

11 Bosnia and Hercegovina with Montenegro and Serbia; North Macedonia with Serbia and Montenegro; Albania with Kosovo.

As per Energy Community Secretariat guidelines, prosumer integration targets for WB6 are covered in the National Climate and Energy Plans (NECPs) with final versions adopted only by Albania and North Macedonia[12]. The National Energy and Climate Plans (NECPs) are plans outlining pathways towards achieving national 2030 energy and climate targets. As an accompanying document to its 2030 renewable energy targets[13], Energy Community Secretariat published in 2020 Policy Guidelines on Integration of Renewables Self-Consumers[14] with recommendations to include monitoring the implementation of prosumer targets in their NECPs. Despite the fact that only Albania and North Macedonia have adopted their final NECPs, all Western Balkan countries, except for Montenegro submitted their draft versions and received the Secretariat's recommendations.

The Energy Community reports that in 2023, among the WB6, Serbia made the most progress in integrating the EU energy legislation while Bosnia and Herzegovina had the least advance. The EnC Secretariat regularly monitors the Western Balkans' progress in transposing and implementing European energy law incorporated by the Energy Community Treaty. Although no Contracting Party was able to improve its overall implementation score during the 2023 reporting period, Serbia emerged as the top performer, followed by Montenegro while Bosnia and Herzegovina's performance was rated as the poorest. The report highlighted Serbia's progress, noting its amended Renewable Energy Law enabling compliant separation of electricity and gas transmission system operators, its first renewable energy auction, timely submission of its draft National Energy and Climate Plan (NECP), and the adoption of long-term strategies for low-emission development and building renovation (EnC, 2024).

Chart 12. Implementation Performance of EU Energy Legislation by EnC Contracting Parties 2023



Source: Energy Community Secretariat, 2023.

12 Energy Community, Governance and National Energy and Climate plans, https://www.energy-community.org/implementation/package/NECP.html

13 https://www.energy-community.org/dam/jcr:421f0dca-1b16-4bb5-af86-067bc35fe073/Decision_02-2022-MC_CEP_2030targets_15122022.pdf

14 https://www.energy-community.org/dam/jcr:7e4760a1-3890-4a7a-a067-d9e16c80ddeb/PG_2020_03_RES.pdf

CHAPTER III - PROSUMER'S POTENTIAL TO INCREASE ENERGY RESILIENCE IN SERBIA: CURRENT CHALLENGES AND POTENTIAL SOLUTIONS

WHAT ARE PROSUMERS AND WHY ARE THEY RELEVANT FOR ENERGY SUPPLY SAFETY?

Prosumers are individuals or legal entities that both produce and consume energy (ergo prosumers), often using renewable sources like solar panels, wind turbines, or bioenergy systems. This model represents a shift from the traditional energy consumption paradigm, where consumers are solely purchasers of electricity from the grid, towards a more decentralized and participatory approach to energy production and consumption.

The relevance of prosumers for energy supply safety can be outlined through several key factors:

- **Promotion of renewable energy sources** – Prosumers play a role in integrating renewable energy into the grid. By generating renewable energy, they contribute to the reduction of greenhouse gas emissions and support the transition towards a more sustainable and low-carbon energy system.
- **Encouragement of energy efficiency** - The prosumer model encourages energy efficiency both in production and consumption. Prosumers are often more conscious of their energy use, adopting energy-saving technologies and practices that reduce overall demand and strain on the grid.[15]
- **Enhanced grid efficiency, flexibility and resilience** - Prosumers support the decentralization of energy production, leading to a more resilient energy system less prone to large-scale failures or blackouts. By generating energy close to where it is consumed, prosumers reduce transmission and distribution losses, enhancing overall grid efficiency. Additionally, their integration into smart grid technologies allows for greater flexibility and responsiveness, enabling the grid to better manage changes in demand and supply, and to stabilize during peak loads. This decentralized approach not only makes the energy system more robust but also more adaptable to varying energy needs.

15 Hu, J. L., & Chuang, M. Y. (2023). The Importance of Energy Prosumers for Affordable and Clean Energy Development: A Review of the Literature from the Viewpoints of Management and Policy. Energies, 16(17), 6270. https://www.mdpi.com/1996-1073/16/17/6270/pdf

TECHNICAL POTENTIAL AND ACTUAL PROSUMER MARKET DEVELOPMENT IN SERBIA

Serbia has a significant potential for solar energy, given its favorable geographical location and climate conditions. In fact, it has even larger potential for solar energy than Germany since it needs 15-20% less panels and area to obtain the same amount of energy. In addition, according to the study from 2022[16], the technically usable solar potential in Serbia is estimated at about 24 GWp[17], of which about half is on roof surfaces. The estimated potential production of electricity from solar capacities is about 30.5 TWh per year which is 78% of our current total gross electricity production In addition, it is estimated that the total area of roofs in Serbia is 600 square kilometers. In fact, lacing rooftop solar panels on only 10% of this area would provide the installed power capacity of 6 GW according to the Ministry of Mining and Energy[18].

However, the pace of prosumer market development is very slow, especially compared to its WB6 peers. From 2021, when the new Law on Renewable energy was introduced, until the end of 2023, around 1.870 households, and only 2 homeowner associations have become prosumers. In fact, household prosumers in Serbia make up for less than 15 MW of solar energy capacities which is only around 0,4% of our planned renewable energy capacities for 2023 (Energy Balance of the RS, 2022). In total, household and industrial prosumers account for less than 37 MW of electricity generation capacities. This contrasts sharply with smaller economies like Albania and North Macedonia, which, by the first half of 2023, had prosumer capacities exceeding 119 MW and 129 MW, respectively[19]. Even Montenegro, with population ten times smaller than Serbia's has managed to achieve more than 1.800 prosumers in less than one year.[20]

16 Đurišić, Ž. and Škrbić B, 2023, Solar and Wind Energy Potential for Strategic Planning of Decarbonisation of Electricity Production in Serbia, University of Belgrade, Faculty of Electrical Engineering, https://doi.ub.kg.ac.rs/wp-content/uploads/2022/12/01-Zeljko-DJurisic_Bojana-Skrbic_Potencijal-energije-sunca-i-vetra-za-stratesko-planiranje-dekarbonizacije.pdf

17 A Gigawatt-Peak (or GWp) is a unit used to describe the rated power output of solar power systems in ideal conditions. As the amount of sunlight varies throughout the day, solar power systems' energy output changes accordingly.

18 Ekapija, 2023, Kako da ugradite solarne panele na krov, proizvodite i prodajete struju – Detaljno objašnjenje nove uredbe o „prosumeru", https://www.ekapija.com/news/3397339/kako-da-ugradite-solarne-panele-na-krov-proizvodite-i-prodajete-struju-detaljno

19 Energy Community, 2023, CBAM readiness tracker, https://www.energy-community.org/dam/jcr:d6e80d5e-9290-4e8b-ac7e-5170ec59808a/EnC%20Tracker%2006_2023_final.pdf

20 Bloomberg Adria, 2023, Kako je mala Crna Gora prestigla Srbiju po solarnim panelima?, https://rs.bloombergadria.com/ekonomija/srbija/29901/kako-je-mala-crna-gora-prestigla-srbiju-po-panelima/news

LEGISLATIVE FRAMEWORK GOVERNING PROSUMERS IN SERBIA

The legal framework governing the status of prosumers, is outlined in the *Energy Law*[21], the *Law on the Use of Renewable Energy Sources*[22], and the accompanying Regulation[23]. These legislations, effective from late April 2021, grant end-users, including households, residential communities, and businesses, the right to generate their own electricity (primarily through the installation of solar panels on buildings) and to feed any excess electricity back into the transmission system operator's grid.

The Energy Law introduces and references the concept of prosumers but does not comprehensively address its role in the electricity market. On the other hand, the Law on the Use of Renewable Energy Sources provides an extensive overview in Chapter IX, titled "Electricity Production from Renewable Sources for Self-Consumption," detailing the rights and responsibilities of electric energy prosumers. Finally, pursuant to Article 59, Paragraph 5 of this Law, the Government of Serbia, in early September 2021, enacted a Regulation that further specifies the prosumer status acquisition process. This includes guidelines for constructing energy facilities owned by individuals and connecting these facilities to the electrical distribution grid, as well as methods of calculating claims and obligations between prosumers and suppliers.

These legislations had its final amendments passed in the March 2023, which limited prosumers' connection capacities[24] to avoid distribution grid overloads.

HOW TO BECOME A HOUSEHOLD PROSUMER IN SERBIA?

The procedure for becoming a prosumer varies for different categories of prosumers: 1) households can install solar panels with installed capacity up to 10,8 kW 2) all other stakeholders (mainly companies) can install solar panels with installed capacity up to 150 kW. In this study, we will focus on the household category (up to 10,8 kW).

To become a prosumer[25], the end customer (household) must first:

1) Meet the necessary prerequisites – The first step for the end customer is find and hire a solar equipment contractor and then calculate the expected costs of installing a solar power plant and its expected effects.

2) Install a solar facility with a production capacity not exceeding the 10,8 kW – The second step involves the customer choosing an adequate solar power plant and then starting the installation process on their property, in collaboration with the hired contractor. An important criterion for selecting an adequate solar plant is that the installed capacity of the prosumer's solar plant cannot exceed the approved installed capacity of the end

---

21 Energy Law ("Official Gazette of RS", numbers 145/2014, 95/2018 – another law, 40/2021, 35/2023 – another law, and 62/2023), https://www.paragraf.rs/propisi/zakon_o_energetici.html

22 Law on the Use of Renewable Energy Sources ("Official Gazette of RS", numbers 40/2021 and 35/2023), https://www.paragraf.rs/propisi/zakon-o-koriscenju-obnovljivih-izvora-energije.html

23 Regulation on Criteria, Conditions, and Calculation Methods for Claims and Obligations Between Prosumers and Suppliers ("Official Gazette of RS", numbers 83/2021 and 74/2022), https://www.pravno-informacioni-sistem.rs/SlGlasnikPortal/eli/rep/sgrs/vlada/uredba/2021/83/1/reg

24 Up to 10.8 kW for households or up to 5 MW for legal entities up to July 2024, when the limit will be lowered to just 150 kW.

25 GiZ Serbia has developed a detailed Guide for Households – How to Become a Prosumer.

customer's existing connection or 10.8kW, whichever is lower. The rulebook[26] that regulates this area in more detail establishes that the procedure for installing a solar panel with an installed power of up to 50 kW is exempt from obtaining any approvals, permits or consents from competent authorities prescribed by regulations on construction of buildings.

3) Adjust the metering point in accordance with the conditions of the Distribution System Operator (DSO) - This step is conducted in collaboration with the DSO. After completing all installation works, the end customer who wishes to become a prosumer sends an email to their local DSO with a Request for metering point adjustment. After the metering point is adjusted, the DSO issues a Notice of metering point adjustment to the end customer.

4) Enter into a full electricity supply contract with net metering[27] - A contract for full electricity supply with net metering is concluded between the prosumer and the selected supplier. The end customer from the household category has the right to guaranteed supply, in accordance with the law governing energy. The guaranteed electricity supplier in Serbia is a branch of the Public Enterprise Elektroprivreda Srbije – EPS Snabdevanje, which holds a license for electricity supply and performs the public service of guaranteed supply based on a contract concluded with the Ministry of Mining and Energy.

5) Register as a prosumer, and starts the operation of the solar power plant - After receiving notification of the signed full supply contract with net metering with the chosen supplier and verifying the submitted documentation, the DSO checks if the plant has been installed in accordance with regulations and connects it. The deadline for connecting the end customer's facility to the distribution system is five days from the date of receipt of contract confirmation by the supplier. By being entered into the Register of customers-producers, the end customer has acquired the status of a prosumer and begins to exercise all their rights and fulfill all obligations arising from the new status.

The main challenge that arises is that the procedures for becoming prosumer are not uniform, transparent and digitalized. The regulation regulated in detail all the necessary procedures and the deadlines are precisely set. However, the parties object that there are large deviations from case to case and that Elektrodistribucija (EDS) has not set up an electronic system that ensures that this procedure is carried out transparently, under clear and uniform conditions throughout the entire territory of the Republic of Serbia. Additionally, EDS' staff is not equally competent across the whole country and there is often a situation where the same laws and by-laws are interpreted completely differently depending on the location, which not only complicates the procedure but also creates a general sense of uncertainty, discouraging potential prosumers from engaging in the process at all. For instance, according to the existing Regulation, Electricity Distribution has a deadline of 5 days to connect a power plant, but in some parts of Serbia, this can take months.

26 Rulebook on special type of buildings and special type of works for which it is not necessary to obtain an act of the competent authority, https://www.paragraf.rs/propisi/pravilnik-posebne-vrste-objekata-radova-za-koje-nije-potrebno-pribavljati-akt.html

27 Net metering is a billing mechanism for net electricity, where the surplus electricity delivered to the grid for one month is deducted from the amount of net electricity for the following billing period.

THE REQUIRED LEVEL OF INVESTMENT AND THE EXPECTED PAYBACK PERIOD

What potential prosumers in Serbia are most interested in are two things: how much will it cost and after how many years will the investment pay off? However, both of these factors largely depend on the characteristics of the household' electricity consumption as well as on the movement of electricity prices. For example, calculations should include the household's needs - what the current electricity consumption is, how much electricity is used during the day (when electricity is more expensive) and how much at night (when it is cheaper). In principle, the rule is as follows: the higher the consumption, the higher the profitability - which means that for small consumers (up to 350 kWh per month) this investment can hardly pay off. Also, even in cases where they consume the same amount of electricity they produced, prosumers can never reduce their bill by 100% given that they will find additional costs on their bills - grid access fee, VAT, excises, etc.

On the other hand, the electricity price in Serbia has increased three times by 8% for households in 2023 alone, which, combined with the cost decrease of solar equipment, has greatly reduced the payback period of solar panels. Additionally, the change in the way VAT and excise duties paid by prosumers are calculated, as well as amendments to the *Law on the Use of Renewable Energy Sources*[28] and the *Decision on the regulated price of electricity for guaranteed supply*[29], have further increased savings in electricity production and shortened the payback period.

For instance, according to a study conducted by GIZ[30], for a household living in a 100m2 property with an annual consumption of 6,000 kWh and a required capacity of 4.9kW, the payback period for prosumer solar energy investment has been reduced from 14 to 10 years. For companies with a consumption of 12,500 kWh per month, a roof size of 600m2, and a required capacity of 121kW and a possible capacity of 100kW, the payback period has been reduced from 10 years to seven years.

Box 1: Solar calculator

The Solar Calculator is an online portal that provides all the necessary information needed by potential prosumers. It only requires basic data input such as geographical location (important for the number of sunshine hours and radiation affecting electricity production), user type (households, residential communities, others), roof area and material it is made of (tile, metal, other), which side the system is mounted on (South, West/East, North), average annual consumption (kWh) and the percentage of consumption in the higher tariff (which applies during the day when the sun shines and panels produce electricity). Based on this information, the Solar Calculator calculates and provides information on aspects essential to become a prosumer: the required and possible capacity of the solar power plant, the necessary investment, the number of years for the investment to pay off, annual and total energy and cost savings, system maintenance costs, and the reduction in CO2 emissions over the life of the panels. In addition, the Solar Calculator's website features a detailed, step-by-step guide on how to become a prosumer, with all the necessary procedures and documentation (currently only for households, while the guide for residential communities and others is in development). Finally, the site also offers a list of contractor firms and a list of banks that provide financing for the construction of solar panels, which potential prosumers can contact.

28 Law on the Use of Renewable Energy Sources ("Official Gazette of RS", numbers 40/2021 and 35/2023), https://www.paragraf.rs/propisi/zakon-o-koriscenju-obnovljivih-izvora-energije.html

29 Decision on the regulated price of electricity for guaranteed supply, https://www.pravno-informacioni-sistem.rs/SlGlasnikPortal/eli/rep/sgrs/drugeorganizacije/odluka/2023/24/1

30 Forbes, 2024, Rok isplativosti ulaganja u solarne panele značajno skraćen, tvrde u GIZ-u, https://forbes.n1info.rs/novac/rok-isplativosti-ulaganja-u-solarne-panele-znacajno-skracen-tvrde-u-giz-u/

SUBSIDIES FOR SOLAR PANEL INSTALLATION

Citizens of Serbia have access to subsidies that can be utilized to more affordably install solar panels or to decrease their payback period. Since 2021, the Ministry of Mining and Energy has been implementing a program called "Energy Rehabilitation of Family Houses and Apartments carried out by local self-government units." They have also included subsidies for the construction of solar power plants and the installation of solar collectors. The municipalities funded 50% of the total price from the contractor's estimate, up to a maximum of 420,000 dinars (€3,584). Subsidies have been available to citizens in 131 (out of a total of 174) local self-government units and, as of October 2023, about 20,000 households have utilized subsidies for various energy efficiency measures (not just for the construction of solar panels).[31] Moreover, from 2023, the amount of funds allocated and the number of household recipients increased thanks to a World Bank loan as part of the five-year "Clean Energy and Energy Efficiency for Citizens" (SURCE) project. The project provides subsidies amounting to $50 million (€46.5 million) for 50,000 households, with incentives covering up to 65% of the investment value, instead of the previous 50%. Local self-government units contribute between 30 to 50% of the allocated funds (the rest is covered by the central government), depending on factors such as the degree of development and the level of air pollution. Public calls for these subsidies are issued by the local self-government units and are published on their websites.[32] It is important to note that, according to the experts interviewed for this study, these subsidies make investing in solar panels cost-effective even for small consumers (up to 350 kW) while for others, it reduces the payback period of the investment by half.

The main issue is in the rules for granting these subsidies. According to the information gathered through interviews with experts, the municipalities themselves conduct tenders for equipment suppliers in which the only criterion is annual turnover, without any requirements related to technical experience, skills, licenses, etc. In order to be able to receive these subsidies, prosumers are obliged to buy equipment from these suppliers. This approach has led to issues, such as a tender-selected company failing to provide and install panels. In addition, this opens up opportunities for malpractice and rigging tenders in favor of companies close to the authorities that lack the necessary expertise and experience in this relatively new field.

KEY CHALLENGES FOR HOUSEHOLD PROSUMERS IN SERBIA

As we have seen, despite the amendements to the legal framework and the provision of subsidies, household prosumer market development in Serbia remains sluggish. Besides inconsistent and non-transparent procedures and inadequate rules for obtaining local subsidies, we have identified several key factors which explain why is this the case:

Households not adequately informed how to install solar panels and use them more effectively. One of the important reasons for the fact that prosumers have not yet taken root in Serbia is that citizens are generally insufficiently informed, first of all, about the advantages of installing solar panels, but also about how to carry out the entire procedure from start to finish in the most efficient way.

---

31 Ministry of Mining and Energy, Subsidies for energy efficiency for citizens in 131 local governments, https://www.mre.gov.rs/vest/1369/subvencije-za-energetsku-efikasnost-za-gradjane-u-131-lokalnoj-samoupravi.php

32 Ministry of Mining and Energy, Project "Clean energy and energy efficiency for citizens" (SURCE), https://www.mre.gov.rs/tekst/sr/2149/projekat-cista-energija-i-energetska-efikasnosti-za-gradjane-surce.php

First and foremost, from a technical perspective, before even starting the process, it is necessary that the roofs on which the panels will be installed are well-maintained, as solar panels have a working life of at least 25 years, and even after that, they continue to function, but with a capacity reduced by 20 percent. Additionally, it's necessary for the panels to be located on the sunlit side of the roof, and that there are no shadows from surrounding buildings. Older houses may require the installation of certain devices within the electrical installations, but the costs are usually not significant.

Besides that, citizens are not adequately informed about the procedure for installing panels and connecting to the grid, the cost of the panels and their installation, which companies are reliable installers of this equipment, etc.

Additionally, using solar energy implies different lifestyle habits. For instance, the consumption logic of prosumers is completely opposite to normal consumers: you should not consume electricity at night when the electricity is cheaper, but at noon, when the production is highest. It's most cost-effective to use the energy that is produced immediately, which is during the day, when there's sunlight. If it's not used then, it must be fed into the grid, and then drawn from it when the panel's production is insufficient, and this involves paying a grid fee, which causes additional financial expenses, thus increasing the final electricity bill. If citizens are not at home during the day, then the solution is to program their washing machine or dishwasher to turn on when the production in the panels is highest.

In addition, prosumers are often not informed about potential mistakes that can be made, which lead to significantly lower profitability of the investment. Perhaps the biggest mistake is oversizing the power of the solar power plant they install, that is, building a larger plant than what they need to cover their consumption. The capacity must be properly determined, otherwise, the investment does not pay off as the citizens expected.

Why is this a mistake? If one considers the consumption of both expensive and cheap electricity, the total capacity that will produce that consumption is obtained. However, due to current regulations, not all of that production can be consumed or charged. The regulation states that a prosumer, besides paying for electricity to EPS like other end consumers, can supply the surplus of produced and unconsumed electricity to EPS Supply, and also withdraw their surplus (while paying a grid fee). However, the calculation is done separately for the costlier tariff (during the day) and the cheaper tariff (at night) over a period of 12 months. For example, if someone consumes 2,000 kWh of expensive electricity and 400 kWh of cheap electricity during the year, there are two possible scenarios: if a solar power plant is installed based on the total consumption that will produce 2,400 kWh, then 2,000 kWh will be consumed, and 400 kWh will be fed into the grid (to the EPS), without any compensation for the prosumer. However, if a plant is installed that will produce 2,000 kWh (which usually happens when there is sunlight, during the day, thus in the costlier tariff) – nothing will be given to EPS for free, and the prosumer will pay separately for those 400 kWh in the cheaper tariff. Therefore, the surplus from the higher tariff cannot cover the consumption in the cheaper tariff and vice versa, and any surplus electricity that the prosumer produces but does not consume, EPS gets for free.

Finally, the many prosumers are not aware that the use of solar energy should not be a replacement for energy efficiency, but rather a complement to it. Therefore, prosumers will not achieve the expected effect without basic energy efficiency measures, which primarily include good insulation (facade, walls, floors, roofs, windows, and doors), an efficient heating and cooling system (such as heat pumps), the use of LED light bulbs, as well as energy-efficient household appliances (refrigerators, dishwashers, washing machines with ENERGY STAR® label), but also changes in electricity consumption habits (active monitoring and optimization of consumption).

No certified equipment installers. At the very first step of becoming a prosumer, households encounter an obstacle, they have to choose a proper equipment installer. Although Serbia, with a directive from 2009, undertook obligation to create a certification system for equipment installers, not yet implemented. On the market there are currently a huge number of companies that do the installation of solar

equipment, often without all the necessary skills and licenses, which can be dangerous. For instance, in the USA, many fires were caused for this reason. Even neighboring Croatia has certified installers and has a website for that, while citizens of Serbia do not have any support or guidelines in this matter.

No study on distribution grid capacities - The Ministry of Mining and Energy, as well as the Electric Power Company of Serbia (EPS), do not know precisely what are the capacities for connecting prosumers to the distribution grid and how much investment is needed to reinforce the grid. However, the assessment of experts we interviewed is that in the next few years, distribution grid capacities will certainly not be an issue, but much of it will depend on the prosumer location. For example, there are some regional centers where demand for solar panel installation is much higher, such as around Kragujevac and Kraljevo, where there is a larger number of residents and the capacities of substations are more occupied, thus requiring greater investments. The current legislation mandates that the electricity distribution is obliged to connect to the grid every household (i.e., capacities up to 10.8 kW) that wishes to become a prosumer, and there is no room for the question of whether this is feasible or not.

Prosumers do not have the same benefits as other end consumers due to different interpretations of the Law by the state-owned utility EPS. Although the definition in the Law states that the „prosumer is the end consumer" that connected the renewable energy plant to his internal installation, they are not equally treated and e.g. are not entitled to a discount of 5% for orderly electricity payment, a discount for rational consumption, and some other perks - as regular end consumers that are not prosumers.

Discrimination of citizens living in multiapartment buildings. As we have already mentioned, there are over 1,800 prosumers in stand-alone houses, and only 2 in residential multiapartment buildings. Besides the physical limitations, such as the size and accessibility of the rooftop and shadowing effects in dense urban areas, the main reason for this is the unequal regulatory treatment. For prosumers living in stand-alone houses, electricity generated from solar panels is used directly for their own consumption, with any excess fed into the grid. However, for prosumers living in multiapartment buildings, regulations prohibit direct line connections from rooftop solar panels to internal installations. Instead, all electricity produced is first delivered to the grid and then is taken from the grid – for one's own consumption, thus paying the grid access fee for all the generated electricity, which is not the case when generated electricity is directly consumed and grid access fee is not charged. This leads to a significant profitability reduction for a prosumer living in multiapartment building compared to a prosumer living in a stand-alone house.

Renewable Energy Communities are recognized by the Law, however, their members are not allowed to become prosumers. Unlike the European Union, where renewable energy communities (e.g. energy cooperatives) have received a special place in the legislation, which gives residential communities certain benefits if they want to become prosumers, in Serbia they operate under the Law on Cooperatives, and are not allowed to become prosumers.

Renewable energy communities are not adequately utilized to promote household prosumer market development. Looking ahead, it's crucial to explore the potential for generating electricity away from where it's used by amending the existing regulatory framework. Such changes would facilitate the generation of power in one location for use in another, effectively enabling a model of remote energy production. This would be particularly beneficial for residents of multiapartment buildings, who could establish renewable energy communities and act as prosumers by producing renewable electricity in a remote location. However, neither the Law on Renewable Energy Sources nor its amendments have provided for renewable energy communities to obtain the status of prosumer but only the status of privileged producers in accordance with the procedure prescribed by the law, i.e., through auctions.

No third-party access to solar panels ownership. The Law on renewable energy sources sets another unnecessary regulatory barrier for households, providing that only the owner of the object on which the solar power plant is installed can become

prosumer. This regulation effectively blocks potential prosumers from entering into contracts with third parties, which enables them, for instance, to lease solar panels from other individuals or businesses in cases when they cannot commit their own resources for such investment. Also, this is not in line with EU Directive on promotion and use of renewable energy sources, which encourages third-party access and development of different business models for installation of rooftop solar panels.

The Distribution System Operator (Elektrodistribucija Srbije) does not have the legal mandate to promote renewables. The rights and duties of the Electricity Distribution Company (DSO) are prescribed by the Law on Energy, and its key responsibility is to take care of the security of supply and the reliability of the grid. However, the Law does not include provisions related to the DSO's obligation to create favourable conditions to integrate a high share of renewable energy into its grid.

No specific tax incentives promoting the prosumer market. Serbia, like most of the EU countries, provide certain incentives for renewable energy productions, such as feed-in-tariffs, direct subsidies, and net billing schemes. However, the adoption of the Law on the Use of Renewable Energy Sources was not accompanied by the revision of existing tax legislation to introduce specific tax incentives for prosumers. In fact, only the Value Added Tax Law[33], at the end of 2022, addressed an aspect concerning renewable energy sources, specifying that the basis for the sale of electrical energy from a supplier to a prosumer should be the compensation amount for the consumed electrical energy.

HOUSEHOLD PROSUMER MARKET DEVELOPMENT - BEST INTERNATIONAL PRACTICES

In this sub-section, we will provide a short review of best international policy practices when it comes to household prosumer market development. These policies can be classified into several types including:

Tax incentives

Financial incentives play a pivotal role in the adoption of prosumer models, effectively lowering the economic barriers that households face when considering renewable energy installations. In many European countries, there are examples of specific tax incentives to promote renewable energy installations and production. For instance, under the Spanish VAT law, the supply of electricity for individual self-consumption is not subject to VAT as it is not considered an economic activity.[34] Even neighboring Croatia has introduced a VAT rate of 0% for the supply and installation of solar panels on private homes, residential buildings, and public structures engaged in activities of public interest, including areas adjacent to such properties.[35] There is another great example across the Atlantic, in the USA: the Inflation reduction act, among other things, enables households to receive a tax credit up to 30% of the cost of installing solar panels on their roofs.[36]

33 Zakon o porezu na dodatnu vrednost, https://www.paragraf.rs/propisi/zakon-o-porezu-na-dodatu-vrednost.html

34 Ezcurra, M. V., & Barroso, C. C. (2020). Tax incentives for photovoltaic power self-consumption: an analysis of the Spanish experience. In Economic Instruments for a Low-carbon Future (pp. 16-31). Edward Elgar Publishing.

35 PWC Tax Summaries – Croatia: Value-added tax. https://taxsummaries.pwc.com/croatia/corporate/other-taxes

36 FACT SHEET: How the Inflation Reduction Act's Tax Incentives Are Ensuring All Americans Benefit from the Growth of the Clean Energy Economy. https://home.treasury.gov/news/press-releases/jy1830

Collective self-consumption – Community energy model

Community energy projects offer a novel way to scale up prosumer participation through collective action and investment. In many countries, the development of community-owned renewable energy cooperatives has enabled individuals to co-invest in renewable energy assets. This collective ownership model not only makes renewable energy more accessible to a wider range of individuals but also fosters a sense of shared responsibility and community involvement in energy production. Once again, Spain provides a leading example: Since 2019, it has introduced a collective self-consumption model where multiple consumers can connect to a single solar panel installation. Additionally, this model permits the installation of photovoltaic panels on neighboring buildings with optimal sun orientation, provided there is a consensus among the occupants of both buildings.

Box 2. Som Energía - a renewable energy cooperative in Spain[37]

Som Energía, a renewable energy cooperative in Spain with over 77,000 members, exemplifies the power of collective prosumer ownership in the renewable energy sector. By paying an initial fee of EUR 100, members are guaranteed access to 100% renewable electricity sourced from the cooperative's own renewable energy plants and supplemented by the wholesale market purchases and green certificates. This setup allows for the sale of excess electricity, with profits either reinvested or returned to members. Furthermore, Som Energía encourages investment in new renewable energy projects through a crowdfunding model, 'Generation kWh', which offers investors kilowatt-hours at production cost for 25 years, enhancing the affordability of renewable energy. Additionally, the cooperative facilitates group purchases of photovoltaic (PV) modules for members wishing to install their own solar panels, reducing costs and simplifying the installation process. This collective approach not only supports the transition to renewable energy but also empowers members through direct participation and shared benefits, including the collective distribution of excess electricity and financial returns on investments.

Simplified Regulatory Processes

The complexity of regulatory processes can be a significant barrier for households interested in becoming prosumers. Acknowledging this, neighboring Romania simplified regulatory procedures in several ways. For instance, the last amendment on the Law on green energy support system enables the natural person prosumers to develop the power sale activity without any registration (however, a certification is required in order to conclude the sale contract). In addition, prosumers are exempt from the obligation to acquire green certificates for the energy they produce for their own consumption.[38] By reducing bureaucratic hurdles and shortening processing times, Romania have made it easier for households to engage in renewable energy production which translated into huge prosumer market development. For instance, only during 2023, Romania installed a record 1 GW of new solar capacity, which represents a 308% surge with almost 100.000 prosumers in total. At the end of 2019 only 303 households, firms, and institutions had such a status.[39]

37 European Environment Agency, Energy prosumers in Europe – Citizen participation in the energy transition, Publications Office of the European Union, 2022, https://data.europa.eu/doi/10.2800/030218

38 Vlasceanu&Partners, Prosumer's legal regime, https://vpartners.ro/prosumers-legal-regime/

39 Balkan Green Energy News, Prosumers in Romania have installed capacity larger than Cernavodă nuclear power plant, https://balkangreenenergynews.com/prosumers-in-romania-have-installed-capacity-larger-than-cernavoda-nuclear-power-plant/#:~:text=Still%2C%20there%20is%20no%20doubt,institutions%20had%20such%20a%20status.

RECOMMENDATIONS TO STREAMLINE THE DEVELOPMENT OF HOUSEHOLD PROSUMERS IN SERBIA

Inform potential prosumers about all the necessary details regarding the prosumer status acquisition. Specialized information services should be established within the state energy companies (primarily EDS and EPS) that will be available to explain to citizens the benefits of becoming prosumers and to guide them through the entire process of installing and maintaining solar panels at any time (e.g. via call centers and online portals with step-by-step text and video guides). In addition, these services should take it upon themselves to organize trainings for prosumers to help them overcome all potential difficulties and so that they know how to recognize and avoid the most common mistakes in the process.

Certify solar panel installers and publish a complete list of certified installers. The Ministry of Mining and Energy should transpose provisions from the 2009 Renewable Energy Directive regarding the certification of solar panel installers so that citizens have a clear list of those who are trained to do the work, who are certified, and who can perform it in a quality manner. To achieve this, it would first be necessary to devise a certification scheme for solar panel installers, followed by amendments to the Energy Law to incorporate this concept into the legal framework. This would lay the groundwork for the enactment of the necessary subordinate legislation, after which the list can be published.

Digitalize the procedure for prosumer status aquisition and standardize the expertise levels of Distribution System Operator (DSO) staff across the entire country. Adopting an electronic system, similar to the unified approach for construction permits, could automate and greatly streamline the process for acquiring this status. In addition, the DSO staff should be provided an adequate training across all of their local branches in order to prepare them for the increased number of prosumer requests for connection to the distribution grid, installation of smart meters, etc.

Conduct an analysis that shows the capacities and how many prosumers can be connected to the distribution grid for the entire territory of Serbia. The Ministry of Mining and Energy should conduct a Hosting Capacity Analysis – a study that estimates the amount of generation that can be added to the electric distribution system at a given time and location under existing grid conditions. This study should form the basis of any further prosumer market planning and policies.

Provide prosumers with the same benefits as other end consumers. Prosumers should have the equal rights as all end consumers - right to discount of 5% for orderly electricity payment as well as a discount for rational consumption of electricity.

Change the rules for awarding local subsidies to give space to credible contractors and prioritize energy-poor households. The conditions for the selection of companies in the following tenders should be tightened - the criteria should not be so broad

to include annual revenue but the focus should be on competence and experience regarding the subject matter i.e. solar panel installation. In addition, priority in receiving subsidies should be given to energy-poor households, which is not currently the practice.

Provide households living in multiapartment buildings with equal treatment as households living in stand-alone houses. Technically, tenants in multiapartment buildings should be given the right to install solar power plants on their roofs and directly connect them to their apartments. Therefore, they would not be forced to pay the grid access fee if they are not producing excess electricity.

Recognize renewable energy communities (energy cooperatives) as legally unique entities and empower them with the right to become prosumer. The Law on the use of renewable energy sources should be amended so that renewable energy communities (energy cooperatives) i.e. its members could become prosumers, and provide incentives to them in the forms of favourable financing for the purchase of equipment, state land for lease at a lower price, lower taxes etc.

Enable third party rights to install solar power plant on the object that is not in their ownership, and become prosumer – based on the agreement with the object owner. The Law on the use of renewable energy source should be amended to enable third-party access to finance and install solar rooftop plants, and lease a power plant to individuals or businesses who are the owners of the property. This practice is widely used in the US and EU.

One of the models can be utilization of ESCO model in promoting residential prosumers. Considering that residential communities i.e. households living in multiapartment buildings have not effectively become prosumers in Serbia, whereas they have emerged as a significant resource in countries with more experience with prosumers (such as the EU countries), it is necessary to explore possible models for their utilization. In this context, the ESCO (Energy Service Company) model presents a potential solution. In Serbia, this model has only recently started being implemented, with existing projects being oriented towards the public and private sectors (businesses), while there have been no investments where the buyers-producers are households and residential communities. The ESCO model entails a company that plans, executes, and finances projects in the field of energy efficiency, or in this case, installing solar panels.

According to the European Parliament and Council Directive 2006/32/EC on energy efficiency[40], an ESCO is a natural or legal person who provides energy services and/or other measures to improve energy efficiency in a facility or user spaces, and takes on a certain degree of financial risk. In this case, residential communities would enter into contracts with ESCO companies for the provision of services for the production or sale of generated electricity. Accordingly, residential communities would pay the ESCO companies either based on the sale of electricity or the savings made by the solar power plant. The advantage of ESCO companies is that they possess the necessary expertise and capital. Investment projects can be with or without the participation of the client, and upon the expiry of the agreed period, the installed equipment becomes the property of the user. Adopting such a model would be necessary considering the weak economic power and credit potential of households, especially residential communities, which have significant potential for solar development.

Legally enable Renewable Energy Communities to become prosumers. Imagine a scenario where a multifamily residential, lacking roof space for solar panels but adjacent to an unused field, could establish a nearby power station to serve its energy needs. Similarly, a weekend home might host a power facility to supply electricity to an urban apartment block. This approach would boost the prosumer market in Serbia by providing incentives for investment in areas with higher returns. This would stimulate the prosumer market in Serbia since it would create an incentive for investing

40 https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32006L0032

in an environment where the profitability is significantly higher. Thefore, we propose reconsidering the eligibility of energy communities for prosumer status, which would also permit individual prosumers to form or join these communities. This change could fill the gap in our legal framework regarding energy cooperatives, aligning with international norms where such entities are acknowledged as prosumers, thus enjoying all associated advantages.

Provide the Distribution System Operator (Electricity Distribution Company) legal mandate to promote the renewables. The Law on Energy should be amended to include the obligation of the Distribution system operator (EDS) to create favorable conditions for high penetration of renewable energy sources connected into distribution grid. By doing that, the EDS would have to increase its investment in the distribution grid every year to support the development of RES.

Introduce specific tax incentives with the aim of promoting the prosumer market development. For instance, policies such as reducing, or abolishing VAT on the supply and installation of solar panels should be considered. Given that they are aimed at increasing the share of renewable energy sources, it should not be difficult to get wide societal support for amending tax laws.

REFERENCES

Balkan Green Energy News (2023), Druga epizoda solarnog podkasta: domaćinstva i firme predali zahteve za priključenje solarnih panela snage 200 MW. https://balkangreenenergynews.com/rs/druga-epizoda-solarnog-podkasta-domacinstva-i-firme-predali-zahteve-za-prikljucenje-solarnih-panela-snage-200-mw/

Balkan Green Energy News (2023), Prva epizoda solarnog podkasta: najteže je prošlo, instalacija solarnih panela će se samo ubrzavati. https://balkangreenenergynews.com/rs/prva-epizoda-solarnog-podkasta-najteze-je-proslo-instalacija-solarnih-panela-ce-se-samo-ubrzavati/

Balkan Green Energy News (2023), Solarni podkast: instaliranje solarnih panela može da smanji račun skoro 50 odsto. https://balkangreenenergynews.com/rs/solarni-podkast-instaliranje-solarnih-panela-moze-da-smanji-racun-skoro-50-odsto/

Balkan Green Energy News (2023), Solarni podkast: Privreda u Srbiji se uhodava u izgradnji solarnih elektrana za svoje potrebe. https://balkangreenenergynews.com/rs/solarni-podkast-privreda-u-srbiji-se-uhodava-u-izgradnji-solarnih-elektrana-za-svoje-potrebe/

Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH (2023), Vodič za domaćinstva:Kako postati kupac – proizvođač.

Energy Community Secretariat (2023), Annual Implementation Report.

Energy Community Secretariat (2023), CBAM Readiness Tracker.

Gallop, P., Gray, E., Nikolovska, E., Mustaţă, A., & Petcu, R. (2021). PEET: The Political Economy of Energy Transition in Southeast Europe-Barriers and Obstacles.

IRENA (2019), Renewable Energy Market Analysis: Southeast Europe. IRENA, Abu Dhabi.

OECD (2022), Clean energy transition in the Western Balkans.

RESET (2023), Chaotic and fake decarbonization of power sectors in the Western Balkans.

Hu, J. L., & Chuang, M. Y. (2023). The Importance of Energy Prosumers for Affordable and Clean Energy Development: A Review of the Literature from the Viewpoints of Management and Policy. Energies, 16(17), 6270.