Serbia

Scaling-up Distributed Solar PV in Serbia: Market Analysis and Policy Recommendations

Toby D. Couture
E3 Analytics

Maja Turkovic
Independent Consultant

E3 Analytics

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SERBIA COUNTRY PROFILE — KEY COUNTRY DATA	
Population (2020)	8,747,936 [1]
GDP per capita (2017)	4,766.00 USD per capita[2]
Electricity consumption per capita (2018)	4.6 MWh/year: 76% of the EU average[3]
Solar resource quality (insolation)[4]	Northeast: 1,200 kWh/m^2/year Southeast: 1,550 kWh/m^2/year Central: 1,400 kWh/m^2/year
Range of current installed costs (reported)	EUR 700 – 1.000/kW
Total annual power consumption (2019)	28 TWh[5]
Average electricity tariffs[6]	Households: EUR 58.46 + taxes Businesses: EUR 76.15 + taxes

This research was supported by the European Climate Foundation (ECF).

1 https://www.worldometers.info/world-population/serbia-population/
2 https://www.worldometers.info/gdp/serbia-gdp/
3 https://www.iea.org/statistics/
4 https://solargis.com/maps-and-gis-data/download/serbia
5 Ministry of Mining and Energy, Energy balance of Republic of Serbia for 2019
6 Serbian Energy Agency, www.aers.rs

1. Introduction

Serbia is set to become an EU Member State, possibly as early as 2025. Once the country joins the EU it will need to adopt the EU Climate Acquis in its entirety, which will result in significant changes in incentives in the power sector. Among other measures, Serbia will need to introduce the EU Emissions Trading Scheme, develop a transparent support scheme for renewables, and adopt medium and long term decarbonisation targets. The EU's long term climate ambition will require complete decarbonisation of the electricity sector before 2050, and as part of the European community, Serbia will need to follow suit. These policy changes are expected to result in a significant shift towards renewables in Serbia's power sector.

In a long term decarbonisation scenario, solar is expected to contribute to Serbia's future electricity mix significantly (REKK, 2018). IRENA (2017) has shown that as the cost of solar PV continues to come down, it is estimated that Serbia will have approximately 7 GW of cost-competitive solar potential by 2030. Currently this potential is not being utilised, as Serbia only has around 11 MW of installed solar capacity.

Since small-scale solar competes with end user electricity prices instead of wholesale electricity prices, solar PV is becoming an attractive investment for some groups of consumers in Serbia already. However, a range of regulatory and legal barriers continue to hold investment back.

In order to help address these barriers, this report contains a number of recommendations on how the current framework can be improved to incentivise investment in solar, even without explicit subsidies or government support. While the report is aimed primarily at policy makers in the country, it may also contain interesting information for potential investors in small and medium-sized solar projects, as it demonstrates that for certain groups of consumers, investing in solar PV is already economic today.

2. Serbia's electricity sector

Market liberalisation

The Serbian electricity sector has undergone significant changes in the past two decades towards a liberalised market, in line with requirements under the Energy Community Treaty. The transformation of the Serbian power sector was initiated in 2005 by unbundling the vertically-integrated national supplier, EPS, into a separate Transmission System Operator (TSO), a vertically-integrated company in charge of electricity generation, wholesale and retail supply of electricity to final customers, and a separate Distribution System Operator (DSO).

Since 2015, the electricity market in Serbia has been fully liberalised: all customers, including individual households, can in principle choose their electricity supplier. However, certain customers (mainly households) retain the ability to opt for the guaranteed supply option, which features electricity prices that are regulated by the Serbian Energy Agency (AERS, i.e. the national energy regulator). All other final customers need to sign an electricity supply contract based on market conditions.

While there were 66 licenced electricity supply entities in Serbia's electricity market at the end of 2018, only 18 such entities were active. Despite the presence of a liberalised electricity market, the historic vertically integrated supplier, EPS, remains the dominant supplier of electricity, providing an estimated 98.4% of the total final consumption sold in the country.

Electricity supply and consumption

The electricity mix of the Serbian Power system in 2019 is shown in Figure 1. The state-owned utility EPS owns 93% of total installed capacity: 4,376MW in thermal power plants and 3.000 MW of hydro power plants. The rest is owned by Independent Power Producers (IPPs): 398 MW of wind, nearly 11 MW of solar PV and 163 MW of others.

FIGURE 1: SERBIA'S INSTALLED ELECTRIC CAPACITY IN 2019 (IN MW)	
Wind	398
Small hydro	102
Large hydro	3000
Biogas	24
Natural gas	35
Thermal	4376
Biomass	2
Solar	11

Source: Ministry of Mining and Energy, Energy balance of Republic of Serbia for 2019

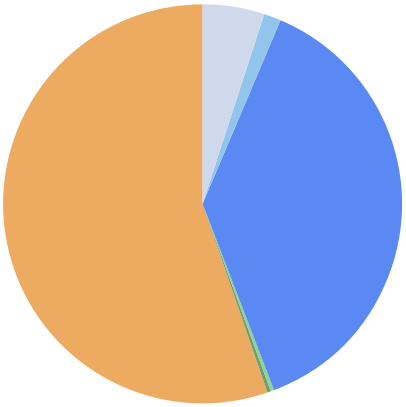
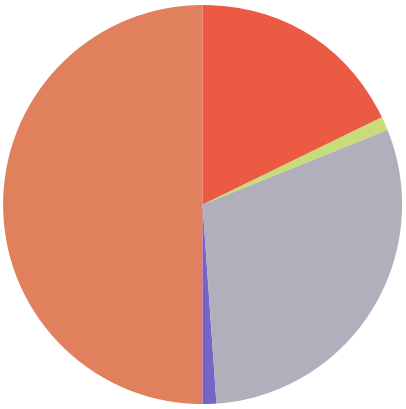


FIGURE 2: SERBIA'S ELECTRICITY DEMAND BY SECTOR (TOTAL = 28 TWH IN 2019)	
Industry	30
Transport	1
Households	50
Commercial	18
Agriculture	1

Source: Ministry of Mining and Energy, Energy balance of Republic of Serbia for 2019



The electricity consumption of final customers amounted to 29.2TWh in 2018. Out of the total power consumption of end consumers, 49.2% was supplied from the open market and 50.8% at regulated prices (the latter relates to households and other small customers connected to 0.4kV), though the share of regulated customers is declining.

Households represented approximately 50% of total electricity demand in the country, with the remaining 50% split between industry (approximately 30%) and the commercial and agricultural sector (approximately 20%). With regard to demand growth, the annual increase in gross electricity demand amounted to approximately 2% p.a.

National renewable energy targets and plans

In order to achieve the Energy Community target of share of renewable energy sources in gross final energy consumption, the government adopted a National Renewable Energy Action Plan (NREAP) describing the policies and measures to achieve a 27% share (in global final energy consumption, or GFEC) in 2020. However, the NREAP was not been updated since 2013. The new target for share of RES in GFEC, proposed by the Energy Community Secretariat, is set at 34% by 2030, but this revised target has not yet been officially adopted by the Serbian Government. At the same time, Serbia has expressed support for national targets instead of Energy Community level targets and has expressed the need for more time to establish robust 2030 targets.

The Serbian Energy Strategy still dominantly leans on the usage of domestic lignite as the main primary source of electricity supply. The current NREAP envisages 1092 MW of new RES by 2020 (aligned with the target of 27% RES in gross final energy consumption). This would represent an increase of over 500 MW from Serbia's current 534 MW of installed capacity. It is anticipated that this will be made up mainly of wind power (500 MW), small hydro, biomass and a small share of solar PV (including both ground-mounted and roof-top installations).

In light of the mismatch between the small role the government envisions for solar PV in Serbia and its actual potential, it is clear that solar power has not yet been given sufficient consideration as a means to diversity the country's electricity mix. In addition, there is currently no public database of customer-sited solar PV installations, as customers with their own onsite generation are currently not required to obtain permits for those installations. As such, they are not visible to DSOs or to government regulators, and therefore the exact solar capacity is unknown. This arguably hinders the government in its efforts to achieve its national renewable energy targets.

Although the government has recently announced it will launch an auction for several large wind power projects, detailed plans or policies to scale-up investment in solar power have not yet been made public.[7]

Solar power

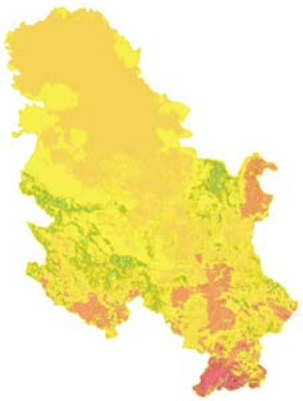
The average intensity of solar radiation is 1,200 kWh/m2/year in northwest Serbia, 1,400 kWh/m2/year in central Serbia and 1,550 kWh/m2/year in southeast Serbia. This means that while Serbia has higher solar potential than most countries in the EU (see Figure 3 below), its utilisation of this potential is currently low.

FIGURE 3: SOLAR RESOURCE MAP OF SERBIA

Long-term average of daily / yearly sum, period 1994–2015

Daily sum	< 3.2	3.3	3.4	3.5	3.6	3.7	3.8
Yearly sum	< 1168	1205	1241	1278	1314	1351	1387

Source: www.solargis.com kWh/kWp



[7] Source: Financial Times (June 17 2020). Serbia plans wind auctions in slow pivot from coal. https://www.ft.com/content/33675e14-9c15-11ea-871b-edeb99a20c6e

Virtually all of the existing PV capacity in Serbia was installed under the country's Feed-in Tariff scheme enacted in 2009. The first quota under the FIT policy was set at 5 MW, which was later increased to 10 MW. The 10 MW quota was broken down into 2 MW for small-scale rooftop systems (under 30 kW), 2 MW for larger rooftop systems (up to 500 kW), and 6 MW for ground-mounted systems. The quota was effectively reached in 2016 and little solar PV development has occurred since. An auction scheme is currently being drafted but has not been adopted yet.

The total current installed solar capacity in Serbia is 10,99 MW, of which 8,82 MW are projects under the FIT scheme.Very little self-consumption has been registered in the country due to the lack of a supportive policy and regulatory environment.

TABLE 1: GRID-CONNECTED SOLAR PV PROJECTS UNDER THE FIT SCHEME

Type	Quota [MW]	Installed capacity [kW]	Number of solar farms	Date Fulfilled
Roof-mounted < 30 kW	2	1,971.6	88	2011–2019
Roof-mounted 30–500 kW	2	1,504.1	11	2015
On the ground	6	5,340.0	8	2014
TOTAL	**10**	**8,815.7**	**107**	**2016**

Source: https://www.mre.gov.rs/doc/registar-110320.html#Sec_Solar

As can be seen from the table above, the 10 MW quota allocated under the FIT policy has not quite been reached, as some projects that received an allocation have not been built within the allotted time. This extra capacity is being re-allocated to other projects.

End user electricity prices

There are essentially two different electricity rate structures in Serbia: 1) **regulated rates** approved by the Serbian Energy Agency, and 2) **open market rates** that fluctuate based on market conditions. The table below provides an overview of the regulated rates in 2018.

TABLE 2: REGULATED ANNUAL PRICES FOR HOUSEHOLD AND COMMERCIAL CUSTOMERS[8]

Regulated Electricity Tariffs by category	Average regulated annual prices for final customers in 2018	
	[RSD/MWh]	[EUR/MWh]
Commercial and others	8910	76.15
Households	6840	58.46

[8] As in many other markets, the exact electricity price that one household or business pays depends on their consumption behaviour (the amount of electricity consumed and time of the day/night). In practice, nobody pays exactly the same electricity price and numbers in the table above are the average values for different consumption categories.

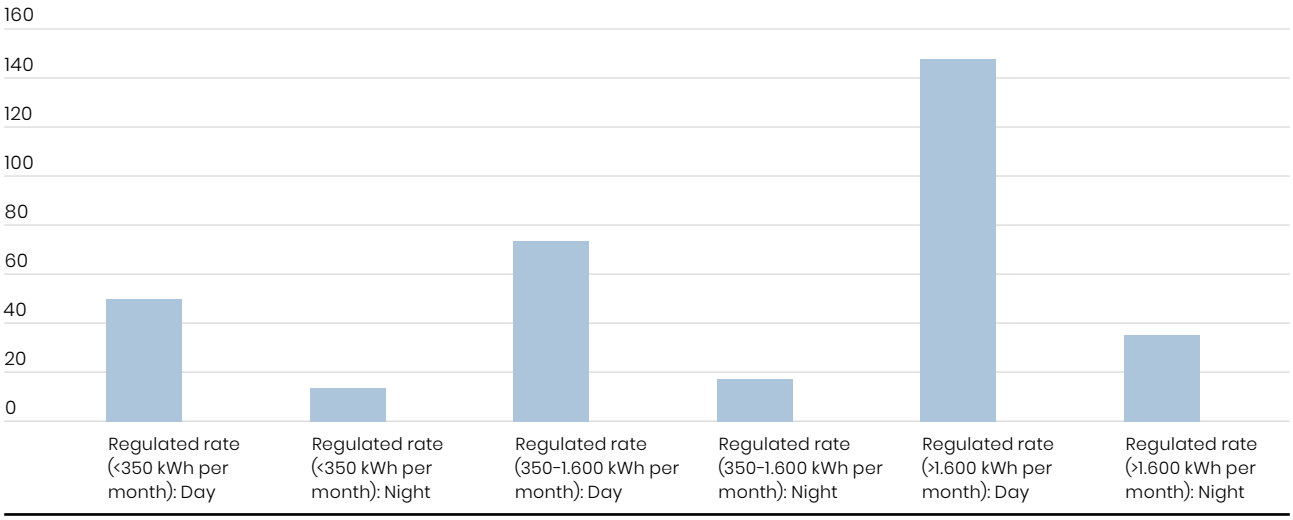
Only households and certain small power customers are allowed to purchase electricity at the regulated rates. In order to qualify, a number of conditions are imposed, including annual income thresholds for households, and the number of employees for small companies. In addition, customers must not have consumed more than 30,000 kWh of electricity in the previous calendar year and all their facilities must be connected to a voltage grid lower than 1 kV.

As a result of these restrictions, the share of total electricity demand that qualifies for the regulated tariffs has shrunk in recent years from 17,221 GWh in 2015 to 14,852 GWh in 2018.

The calculation of the electricity price is subject to a tariff system, which has three zones defined by limits of the monthly consumption, and two tariffs for each zone – one for daily consumption (high tariff) and the other one for night consumption (low tariff).

FIGURE 4: REGULATED ELECTRICITY RATES (2018), PRE-TAX, IN EUR/MWH

Source: Serbian Energy Agency, Annual Report 2018



TEXT BOX 1: IMPACT OF RETAIL RATE ON SOLAR PROSUMERS

Both the structure and the level of the retail electricity price have a significant impact on the attractiveness of customer-sited solar PV projects.

The higher the retail price, the more attractive investments in self-generation technologies like solar PV are. Given that the levelised cost of rooftop solar PV investments is now below EUR 100/MWh in most markets around the world, including in countries like Serbia, retail prices in this range and above are typically considered sufficient to drive investments. In fact, recent analysis of different states across the U.S. show that retail prices are **more** important than solar resource quality in determining where investments in customer-sited solar take place.[1]

In addition to retail prices, however, it is important to consider retail price **structure**: for example, **inclining block rates** (where each additional kWh consumed becomes more expensive, based on a crossing specific thresholds, as is the case in Serbia) tend to make self-consumption investment more attractive, as it is the higher consumption thresholds that are erased first, thereby enabling higher returns. Similarly, the presence of demand charges (which are typically levied on a per-kW basis according to the maximum electrical demand a

given customer reaches over a particular billing cycle) can also make solar PV projects more attractive, particularly when coupled with storage, as storage can guarantee that certain demand thresholds are never reached.

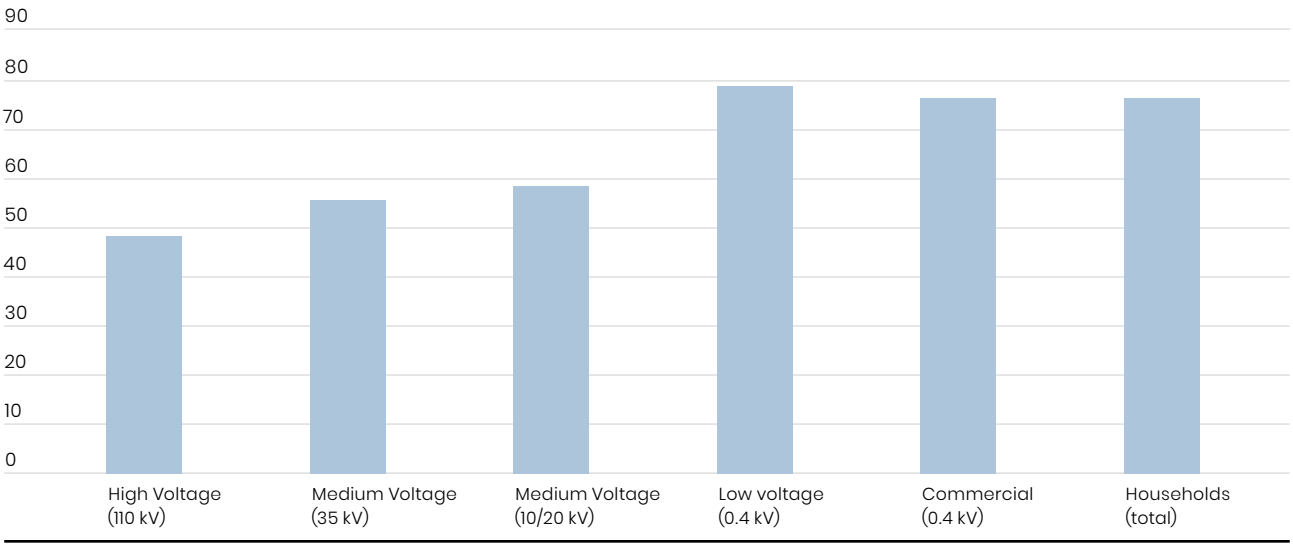
Additionally, factors such as fixed bill charges, taxes, or special subsidy charges, can also make self-consumption more attractive, as they push retail prices up.

[1] https://energyathaas.wordpress.com/2020/02/03/putting-solar-in-all-the-wrong-places/

As highlighted above, since 2015, all end-customers in Serbia can buy electricity on the open market. The customers that buy their power on the open market are subject to market-based pricing, resulting in different prices for households and small businesses that fluctuate over time. The figure below provides an overview of the average yearly prices for end-consumers in Serbia on the open market.

FIGURE 5: AVERAGE OPEN MARKET RATE (2018), PRE-TAX, IN EUR/MWH

Source: Serbian Energy Agency, Annual Report 2018



3. The market for distributed solar PV

The analysis that follows is built upon a combination of both local research, and a workshop that was organised in Belgrade within the context of this project featuring more than 20 key stakeholders in Serbia, including representatives from the Ministry of Energy, the utility sector, the DSO, the regulator, universities, city energy managers, as well as representatives of suppliers and investors. The workshop focused on the regulatory and legal challenges and opportunities with regard to scaling-up distributed solar PV systems in Serbia, with a particular focus on self-consumption. In addition, the workshop helped bring to light some of the technical issues related to grid interconnection, and metering.

The following sections, including the recommendations, are based on findings from the local workshop, and reflect some of the views raised by local stakeholders.

Solar PV revenues and avoided costs for investors

Until recently, all solar PV installations developed in the country were built under the FIT scheme, and the majority were comprised of relatively small rooftop installations (nearly 100 of the country's 107 solar projects consist of rooftop installations below 30 kW). However, as the costs of solar PV systems continue to decline, the attractiveness of developing solar PV systems configured for self-consumption (i.e. for onsite, behind-the-meter use) is starting to grow. The self-consumption of solar PV provides the opportunity for certain customers (notably those paying for the higher cost electricity during the daytime) to reduce their monthly bills and reduce the amount of tax they pay, while improving their energy security.

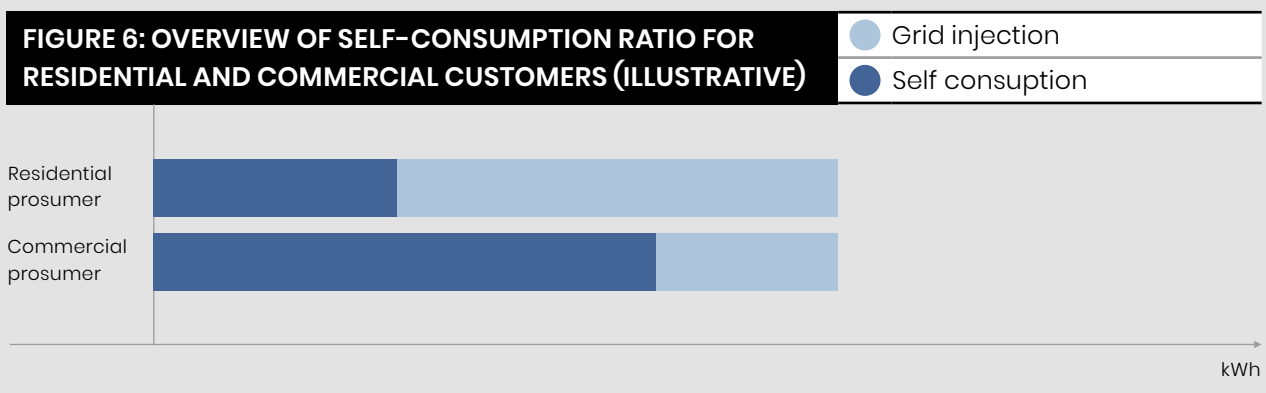
According to stakeholders present at the workshop, **some of the smaller electricity suppliers in Serbia currently buy excess power from PV projects owned by commercial or industrial customers for 42 EUR/MWh, while EPS (the largest national supplier) offers to purchase it for just under 30 EUR/MWh**. In order to be able to sell electricity to Serbia's electricity suppliers, the prosumers need to establish two different legal entities, one to buy the energy from the utility and another to sell it. This creates additional costs and complexity. However, this means that commercial customers engaged in self-consumption are able to receive a cash payment for their net excess generation by selling power directly on the open market.

Considering the current average retail price paid, which in 2018 for households was 58.46 EUR/MWh + VAT, and 76.15 EUR/MWh + VAT for commercial customers, any prosumers in Serbia would have an incentive to maximise their self-consumption, as the rate they pay for power is higher than the rate they receive. For customers that pay above-average prices, the incentive would be even greater. Moreover, given that commercial customers often have a higher self-consumption ratio than residential households (i.e. they can consume more of their own self-generated solar power), **the current market rules in Serbia are more attractive for commercial and industrial prosumers than for individual households** (see Text Box 2).

TEXT BOX 2: UNDERSTANDING PROSUMERS' SELF-CONSUMPTION RATIO

The self-consumption ratio refers to the share of a prosumer's total onsite solar PV generation that it is able, on average, to consume in "real time" in a given month or year. Residential customers that invest in their own solar PV system typically have self-consumption ratios between 20-40%.[1] By contrast, the self-consumption ratio for commercial customers tends to be somewhat higher, between 50-70%, depending on the commercial customer's load profile and the size of the PV system that is installed.[2]

FIGURE 6: OVERVIEW OF SELF-CONSUMPTION RATIO FOR RESIDENTIAL AND COMMERCIAL CUSTOMERS (ILLUSTRATIVE)



In fact, any prosumer can achieve a 100% self-consumption profile simply by installing a smaller solar PV array, thereby ensuring that all (or most) of the real-time power generation can be consumed directly by the building, or facility. This is the case if the size of the PV installation is such that it produces electricity equivalent to the daytime minimum load of the household.
For example, analyses conducted on various commercial customers indicate that a dairy farm with annual electricity demand of 50,000 kWh and a PV system of 30 kW can achieve a self-consumption ratio of roughly 55%. By contrast, for a manufacturing business operating mainly during the daytime with a requirement of 1,000,000 kWh and a PV system of 200 kW, the attainable ratio is approximately 85 percent.[2]

Differences in the self-consumption ratio of different prosumers can have a significant impact on the attractiveness of solar PV investments. For instance, in jurisdictions with relatively high retail prices and weak (or no) policies governing net excess generation, many prosumers simply opt to size their PV systems according to their minimum daytime load. In this way, they can avoid having significant net excess generation. In jurisdictions with more attractive conditions for exporting the power, customers may choose to make greater use of their available roof space and install larger PV systems, exporting more surplus generation to the grid, thereby achieving a lower overall self-consumption ratio.

[1] https://www.sma.de/en/partners/knowledgebase/the-self-consumption-bonus.html
[2] https://www.sma.de/en/partners/knowledgebase/commercial-self-consumption-of-solar-power.html

For commercial and industrial customers in Serbia, self-consumption is starting to become attractive, depending on the investor's time horizon and own discount rate. According to stakeholders during the October 2019 workshop in Belgrade, even with self-consumption ratios of 50%, the payback period for rooftop solar investments for SMEs ranges between 6-8 years (see the sub-section on the ***Cost of Solar PV*** below).

However, tax considerations play an important role: electricity in Serbia is subject to both VAT (at a rate of 20%) as well as an additional excise tax (at a rate of 7.5%). In addition, these taxes are levied not only on the electricity consumed, but also on the other fixed components of the electricity bill, including the contribution to the renewable energy producers, as well as the contribution to support energy efficiency projects. This means that tax considerations play a significant role in determining each customer's final bill (see Text Box 3 for more information on VAT treatment in Serbia).

As a result of these local factors, for certain customers in Serbia, the total electricity rate can surpass EUR 100/MWh. This is the case, for instance, for households or businesses with relatively high electricity consumption (i.e. that fall into the higher consumption brackets), or that consume considerable amounts of power during the daytime. At these levels, investing in onsite solar PV generation starts to become economically attractive. (See Text Box 2 on retail rate structure and self-consumption)

Serbia's VAT regime is regulated by the Law on Value Added Tax (VAT Law), which was last amended in 2018.[9] Serbia's current tax regime as it applies to VAT does not have specific provisions for prosumers, as households are not considered taxable entities. However, by setting up a solar PV system and exporting electricity to the network, prosumers need to register as a separate legal entity that is subject to VAT.

[9] Law on Value Added Tax, Official Gazette of Republic Serbia No: 84/04, 86/04, 61/05, 61/07, 93/12, 108/13, 68/14, 142/14, 83/15, 108/16, 7/2017, and 13/2018.

TEXT BOX 3: PROSUMERS AND THE TREATMENT OF VAT

Broadly speaking, there are four main forms of taxation that are relevant to the taxation authorities, and that should be taken into account:

1. **VAT charged on the equipment** (panels, inverters, wiring, etc.): this continues to be collected unless special exemptions are put in place by the responsible tax authorities, and provides direct tax revenues to the government in year 0.
2. **VAT charged on the operations, maintenance, and insurance costs**: for all service-related aspects, including maintenance, insurance, etc., the government will continue to collect VAT, as applicable, over the life of the asset.
3. **VAT on the exported electricity**: When the prosumer exports electricity, this is typically treated as a "good or service", and is therefore subject to VAT. When the net excess generation is sold to a utility, as a business, the latter are typically able to recover the VAT. If the prosumer is a household, they are typically not eligible to collect VAT, unless they are registered as a VAT-registered legal entity.
4. **VAT charged on the imported (purchased) electricity**: Any taxes that the prosumer pays on their electricity purchases are typically reduced volumetrically by self-consumption. Since taxes are typically levied on the "net" consumption in a given month, or billing cycle, a reduction of purchases from the grid will result in a reduction of the total VAT being paid. This can result in a loss of VAT for the government, particularly over the lifetime of the asset.

From the list above, it is the fourth category of VAT taxation that is arguably the most problematic. However, analysis conducted by the International Energy Agency has indicated that under most cases modelled, the net loss of VAT-related tax revenue is real, but small.[2]
Additionally, if the revenues derived from exporting net excess generation to the grid result in a financial benefit, or profit, then the relevant tax authorities are liable to charge income tax on the associated profit.

[1] https://www.sma.de/en/partners/knowledgebase/the-self-consumption-bonus.html
[2] https://www.sma.de/en/partners/knowledgebase/commercial-self-consumption-of-solar-power.html

Regarding the definition of what constitutes a "chargeable event" in terms of VAT, Serbian law states that "the exchange of goods for other goods or services" is a chargeable event. As such, prosumer transactions are considered admissible for VAT, according to the market value of that electricity.[10] The current VAT rate that applies to the trade of electricity in Serbia is fixed at 20%. Moreover, if a prosumer is deemed to have received a financial benefit from being a prosumer, it is assumed that prosumers will also be liable to pay income tax.

In addition, **the self-consumption ratio remains a hurdle for many potential prosumers in Serbia, in particular households**: While commercial consumers usually exhibit a relatively good correspondence between the energy consumption profile and the onsite renewable generation curve, for residential consumers this is not the case as demand peaks between 6pm and 9pm, which does not coincide well with the peak in solar output. Furthermore, there is currently very little demand-side management, demand response, or decentralised energy storage, which could help customers increase their self-consumption ratio.

[10] Rulebook on the manner of establishing tax base for VAT calculation for trade of Goods and Services, Official Gazette of Republic Serbia, No: 86/15.

Solar PV investment cost

Investors in stand-alone PV systems reported costs for turnkey solutions (including connection to the grid) of roughly 800 EUR/kW. For larger systems this cost goes down to 700 EUR/kW, and for small systems close to 1.000 EUR/kW. Thus, **the range of installed costs for solar PV systems in Serbia is currently between 700 EUR/kW and 1.000 EUR/kW**.

During the workshop, an investor in a 250 kW PV power plant in operation presented calculations for the payback period with and without a Net Metering scheme. The assumptions underlying this analysis included:

- Total investment cost: 800 EUR/kW,
- OPEX costs: 2 EUR/kW/year
- WACC: 7.5%
- Debt:Equity Ratio: 70:30
- Loan tenor: 10 years
- Self-consumption ratio: 50% (with 50% injected into the grid)
- Annual degradation of PV panel output: 1%.
- Starting electricity price: 66 EUR/MWh
- Price obtained for excess power: 42 EUR/MWh.

Without Net Metering, the analysis presented during the workshop found a payback in Serbia of approximately 8 years, and with Net Metering, a payback period of approximately 6 years.

Options for buying and selling net excess generation

The specific pricing conditions available for the sale of net excess generation.

TEXT BOX 4: OPTIONS FOR THE PRICING AND SALE OF NET EXCESS GENERATION

Broadly speaking, there are three different pricing methodologies used to determine the compensation for prosumers' net excess generation:

1. **Compensation in terms of bill credits (i.e. in kWh)** that can be carried over to offset, on a kWh-to-kWh basis, one's electricity consumption in future billing cycles (Net Metering)
2. **Compensation in terms of monetary credits (e.g. 1 kWh = EUR 0.06)** that can be carried over to reduce one's electricity bill in future billing cycles (Net Billing)
3. **Compensation in terms of monetary payment (i.e. EUR cents/kWh)**, resulting in the prosumer receiving both a cheque and a bill at the end of each billing cycle (Net-FIT)

In addition, there is the important issue of how these rates are set. For Net Metering, this is simple: each kWh exported to the grid generates one kWh credit that can be used to offset future consumption. However, **for both Net Billing and Net-FITs, there are additional considerations that need to be taken into account**; in these cases, there are five basic options for determining the price offered for the net excess generation:

1. **linked to the market in real time** (though this would require time-of-use meters for all customers, and is likely to pose an additional barrier for residential and small commercial customers);

2. **linked to the market**, but based on daily, monthly or annual averages;
3. **linked to the energy component of the retail rate**, minus a small fee, or percentage, to cover transaction costs and the supplier's margin (e.g. 10-15%);
4. **Based on some other rate**, such as the supplier's avoided energy costs, that is revised and updated over time;
5. **Based on another formula**, such as the value of solar to the distribution grid, after taking into account time-of-day, the reduction of line losses, the energy and capacity value, etc.

Each of these different options has important implications both for electricity suppliers (i.e. buyers), as well as for prosumers.

Another important consideration for policymakers and regulators is whether different rules, and payment conditions apply for projects of different sizes, for residential vs. commercial customers, for customers connected at different voltage levels, or for customers in different rate categories.

In the U.S., which has the widest variety of Net Metering policies, Net Metering is typically reserved for smaller project sizes under 1 -2 MW.[1] By contrast, Brazil has recently lifted the project size cap on Net Metering projects up to 5 MW.[2] In some cases, different payment arrangements are available for projects of different sizes.

In general, the larger the embedded generation projects become, the more likely it is for such projects to receive some form of **monetary payment** for their net excess generation (i.e. a Net-FIT), in contrast to smaller rooftop systems, which continue to operate predominantly on the basis of bill **credits** (as under Net Metering), or monetary credits (e.g. as under Net Metering). In the interests of keeping self-consumption policies simple and easy to understand both for prosumers and for suppliers, some jurisdictions choose to apply the same compensation rules for all prosumers, regardless of project size or customer rate category.

[1] https://programs.dsireusa.org/system/program
[2] https://www.pv-magazine.com/2018/01/24/brazil-surpasses-175-mw-of-solar-under-net-metering/

4. Barriers to Solar PV in Serbia

Policy and regulation

- **There is a lack of political and strategic commitment for the energy transition in the country.** The electricity sector is heavily dependent on domestic lignite and there is little outward indication of a change in the strategic direction of the electricity sector.
- **However, the recent announcement of a major wind power auction can be seen as a sign that a slight change in strategic direction may already be underway**. Combined with recent solar power auction results from nearby Albania of just under EUR 25/MWh, it is conceivable that the political commitment to renewables and to solar PV in particular will continue to grow in the years ahead.[11]

[11] https://balkangreenenergynews.com/albania-secures-lowest-solar-power-price-in-balkans-in-karavasta-auction/

- **This notwithstanding there is currently no public database of customer-sited solar PV installations**, as customers with their own onsite generation are currently not required to obtain permits for their installations. As such, they are not visible to DSOs or to government regulators. This arguably hinders the government in its efforts to achieve national renewable energy targets.
- **Administrative and regulatory barriers unnecessarily increase project costs**. Moreover, with the rapidly decreasing costs of PV technology, administrative processes account for a large and growing proportion of the total cost of implementing small- and medium-sized solar systems in the country. This negative trend can be addressed by simplifying administrative and permitting procedures, and providing clearer rules for the different types of prosumers in the country.
- **Relatively low electricity prices**. Serbia's low electricity prices, combined with energy poverty and broad public concern over any electricity price increases, contributes to a hesitancy to do anything politically that could increase prices on end-users. This includes a hesitancy to consider any kind of cross-subsidisation between different customer classes.
- **Lack of awareness of the benefits of renewables**. Many key stakeholders in the country remain uninformed, or misinformed, and groups that are quite active in other markets (including the Chambers of Commerce, as in Bosnia and Herzegovina) are largely inactive in Serbia.

Legal considerations

Serbia's current energy law provides a framework for investments in small-scale PV installations: both legal entities and physical persons (up to 30 kW) can be producers and market participants. If the solar power plant has a capacity above 30 kW, the investor is required to register as a legal entity – i.e. a producer of electrical energy. In addition, recent regulations adopted in 2019 enable PV systems up to a capacity of 50 kW to be installed without needing a construction permit. However, the latter only applies for PV systems not connected to the grid. More clarity is needed on the legal status of different prosumers, including with regard to their tax treatment.

Technical parameters and requirements

While there are well established standardised procedures for connecting distributed generation onto the grid (solar PV included), **there are currently no specific regulations or procedures stipulating the technical requirements related to self-consumption in Serbia**.

With regard to self-consumption schemes, according to local stakeholders, all technical requirements that self-generators would be required to meet in Serbia are already provided for by the current rules. Although these rules have been developed mainly for larger generation units, the current regulations do not impose any specific requirements that are not already met by modern micro-generation units such as solar PV systems.

From the perspective of network security and with regard to self-consumption schemes, **there is currently no additional need to introduce further technical requirements for the connection of customer-sited generation to the Serbian power system**.

Metering and billing

There are still no clear rules governing self-consumption. This leads to market uncertainty and discourages investment both from households and from SMEs. Although the government

has participated in a range of studies looking into both Net Metering and Net Billing, the final regulations have not yet been published. In particular, there is still no clear guidance on how the payment for net excess generation will be determined for different customer categories.

In addition, **the self-consumption ratio remains a hurdle for many potential prosumers in Serbia, in particular households**: While commercial consumers usually exhibit a relatively good correspondence between the energy consumption profile and the onsite renewable generation

TEXT BOX 5: ADDITIONAL METERING CONSIDERATIONS

The metering arrangements available (or prescribed by utilities) in a given jurisdiction can have direct impacts on the attractiveness of self-consumption:

1. **In the absence of two-way meters and of clear compensation for the net excess generation**, then PV systems will tend to be dimensioned to cover customers' own consumption at the lowest load level during the day. This may result in relatively small PV systems being installed on large commercial rooftops, and a failure to harness the available rooftop potential.
2. **In situations where two-way meters are used, but no cash compensation is offered, only bill credits** (i.e. under Net Metering), prosumers may choose to maximise their PV system size, particularly if they are paying above-average retail prices. This may lead to significant amounts of net excess generation, above and beyond what utilities expect from individual prosumers.
3. **If there is a two-way meter and prosumers can sell electricity in real time** (i.e. under Net Billing), then prosumers are likely to choose their system size more carefully, aware that their self-consumption ratio and the anticipated export rate will have significant impacts on their profitability; however, the low price at which electricity can be sold may be a barrier and may still result in prosumers opting for smaller system sizes, so that they can avoid having large amounts of net excess generation.

Ultimately, a decision needs to be made on whether Serbia wants to encourage further solar investment and to what extent. In any case, it is clear that even without support there is scope for additional investment among groups paying a high price and with high self-consumption rates.

curve, for residential consumers this is not the case as demand peaks between 6pm and 9pm, which does not coincide well with the peak in solar output. Furthermore, as highlighted previously there is currently very little demand-side management, demand response, or decentralised energy storage, which could help customers increase their self-consumption ratio in Serbia. In addition, as the current target for solar PV is considered to be met, there is no additional support available for solar PV. These circumstances negatively affect the profitability of solar PV investment.

At a technical level, the installation of **smart meters** is increasingly being prioritised in Serbia. Serbia aims to ensure that 80% of electricity connections are equipped with smart meters by the end of 2020. However, an important issue remains: **many of the meters currently being installed in Serbia's distribution system, despite being "smart", often do not have the capability to measure bi-directional power flows**. This means that for any customers who would like to develop a solar system for their own onsite supply, they will be required either to replace their existing meters with newer ones that can measure bi-directional power flows, or to add additional meters, driving up costs.

Balancing responsibilities

Market participants in Serbia in general can address the issue of balancing responsibility in one of the following three ways:

1. By signing a "Balancing Responsibility Agreement", thereby becoming a Balancing Responsible Party (BRP);
2. By transferring their balancing responsibilities to a Balancing Responsible Party;
3. By signing a contract with a supplier. In this case, the participant transfers all its rights and commitments to a guaranteed supplier who is also a Balancing Responsible Party.

For producers under the FIT scheme, there is no balancing responsibility obligation by law; as a result, their balancing responsibility is "transferred" to the guaranteed supplier free of charge (in other words, the transferal of balancing responsibilities is part of the subsidy scheme). Indeed, the current threshold for balancing responsibility in the EU stands at 400 kilowatts.[12] Since most prosumers will be below that threshold, they will be exempt from balancing responsibilities.

However, since self-consumption is not separately regulated under current Serbian legislation, there are no clear provisions governing the balancing responsibilities of prosumers. While there have been some stakeholders in Serbia arguing that prosumers should assume balancing responsibilities, others have argued that this would mean an overly burdensome obligation for many prosumers, particularly smaller prosumers. At the household level, solar production does not align very well with onsite consumption, which can introduce challenges with regard to balancing. As a result, the electricity produced by households would be mostly consumed by other users in the same distribution grid, more specifically users in the region of the same transformer.

Moreover, from a grid operator's standpoint, **balancing does not necessarily require the balancing of the consumption and production of each individual prosumer, but rather the balancing of the system across a particular region** (for example, on one feeder, or transformer). This fact weakens the justification for imposing additional balancing responsibilities on prosumers.

Financing

A number of financial institutions are active in Serbia's renewable energy market, though most are active in supporting the development of larger renewable energy projects, not prosumer-led projects.

The EBRD, KfW and the EIB are all present in Serbia, with the EBRD being most active in the RES sector. EBRD is providing a EUR15 million loan under the Western Balkans Sustainable Energy Financing Facility (WeBSEFF II), which provides credit lines to partner banks in the Western Balkans (Banca Intesa, Erste Bank) for on-lending to businesses and municipalities keen to invest in energy efficiency and small-scale renewable energy projects. Those benefitting from access to this finance are private businesses, ESCOs and local municipalities – specifically for green technology solutions such as lighting upgrades, new production equipment, building insulation, solar PV panels and biomass boilers.

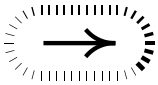
[12] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32019R0943&from=EN

A growing number of domestic commercial banks are active in debt financing of renewable energy projects, often in partnership with multilateral lenders:

- **Banca Intesa** had a KfW line for energy efficiency and renewable energy projects. The loan is granted to SMEs that meet the requirements of the bank. Credit can be used to buy solar systems, reconstruct or expand them. The loan conditions are such that the maximum loan amount is EUR 1,000,000 with a repayment period of up to 8 years.
- **Procredit bank** has a special Green for Growth Fund (GGF)[13] line of credit to support SMEs in implementing energy efficiency improvement and environmentally sustainable projects. ProCredit Bank's standard EE credit line finances solar energy projects that result in minimum energy savings (or CO2 emissions) of 20%. The minimum loan amount for investing in solar systems is EUR 15,000, with a repayment period of 24 to 84 months.
- **Komercijalna banka** has been receiving requests from citizens for approval of subsidised loans for energy efficiency improvement since 2012. The loans were primarily designed to enhance the energy performance of residential buildings and can be used for procurement and installation that include solar systems, solar collectors and solar water heaters. Loans in local currency are granted without equity participation, with a repayment period of up to 60 months, while loans in euros are approved with 30% equity and repayment periods of up to 60 and 120 months.

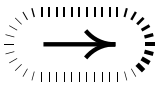
5. Synthesis and recommendations

The following provides an overview of the key findings and recommendations from the research and the local workshop held in Serbia.



A clear and bankable policy framework for prosumers is needed in Serbia.

The economics of self-consumption in Serbia continue to improve, as a growing number of companies and stakeholders throughout the country start to explore the installation of their own solar PV system. And yet, numerous barriers remain. In light of solar PV's tremendous potential in Serbia, it is necessary to create a clear process for prosumers to connect to the grid, while providing legal, financial, and tax-related certainty. Evidence from other jurisdictions around the world such as the U.S., Italy, and China indicate that policy and regulatory clarity can help unlock significant volumes of investment.



A decision needs to be made regarding the type of self-consumption scheme that will be adopted. The regulatory framework should allow prosumers to receive monetary compensation for their net excess generation.

Experience in a growing number of countries around the world signals a move away from

[13] https://www.ggf.lu/about-green-for-growth-fund/

classic Net Metering and toward other self-consumption policies such as **Net Billing** (where a monetary credit is allowed and can be carried over to offset future consumption) as well as **Net-FITs** (where net excess generation is paid for, either at the end of each billing cycle, or at the end of the year).

Net Metering credits all net excess electricity on a one-to-one basis on customers' electricity bill: the transaction is therefore settled in kWh, not in monetary terms. In addition, Net Metering ignores grid and transaction-related costs, making it costlier to utilities, and to other rate payers.

Thus, while a Net Billing approach should be favoured over Net Metering, some challenges remain: Net Billing allows prosumers to receive monetary compensation for their net excess generation, and has less impact on suppliers as well as on other (non-solar) electricity customers. The Net Billing rate can be designed to be lower than the retail rate, providing benefits to electric utilities and even to other non-solar customers by reducing reliance on coal, and lowering market prices during the daytime. **The main challenge with a Net Billing approach, however, is that the monetary compensation provided is still only valuable (i.e. monetisable) if the company or prosumer remains solvent**. If an SME with rooftop solar goes bankrupt, for instance, converting the monetary credits into cash, as well as the project as a whole to an "independent power producer" is likely to prove challenging, particularly if the utility is not cooperative, and if clear legal and administrative arrangements are not in place. Moreover, in terms of mobilizing traditional bank financing (i.e. loans), this remains a major barrier, as banks cannot be certain that the project will be paid off. The lack of clarity around what happens to a customer-sited solar PV system after bankruptcy makes the issuance of loans under such conditions riskier. The presence of clear "market access" for excess prosumer generation, including access to a cash payment at market rates, provides a "worst case scenario" for the bank, and thus, helps de-risk such investments.

As such, in terms of encouraging prosumers in Serbia, a Net-FIT approach should be favoured over Net Billing as a Net-FIT allows prosumers to be paid for the net excess generation at the end of each billing cycle, or calendar year. As highlighted previously, since Serbia already has a form of Net-FIT in place, as commercial customers are already marketing their net excess generation and receiving a cash payment (rather than a monetary credit) for it. What is needed is for this arrangement to be formally recognised, and given a corresponding legal and regulatory framework.

Regarding the compensation rates, there are five basic possibilities. The price for net excess generation can be:

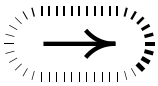
1. **Linked to the market in real time** (though this would require time-of-use meters for all customers, and is likely to pose an additional barrier for residential and small commercial customers);
2. **Linked to the market, but based on daily, monthly or annual averages**;
3. **Linked to the energy component of the retail rate**, minus a small fee, or percentage, to cover transaction costs and the supplier's margin (e.g. 10-15%);
4. **Based on some other rate, such as the supplier's avoided energy costs**, that is revised and updated over time;
5. **Based on another formula, such as the value of solar** to the distribution grid, after taking into account time-of-day, the reduction of line losses, the energy and capacity value, etc.

Each of these different options has important implications both for utilities (i.e. the buyers), as well as for prosumers.

As highlighted above, a pricing formula that allows customers to be **paid** for their net excess generation (rather than simply receiving a bill credit), even if it is established at a relatively low rate such as the market price, can help mobilise financing. One of the key advantages of having access to some market-based rate for net excess generation, versus a Net Metering or Net Billing arrangement where compensation is purely in bill credits or in monetary credits, is that it guarantees a smooth transition to the market in case the company or prosumer moves, or goes out of business. Currently in Serbia, suppliers buy excess power from PV projects owned by commercial and industrial customers for 42 EUR/MWh, while EPS purchases it for less than 30 EUR/MWh. This represents a form of Net-FIT, in that customers can receive a payment for their net excess generation, albeit at a level that is different from the retail rate paid.

However, barriers to becoming a prosumer in Serbia persist. In order to sell surplus electricity, prosumers need to set up two different legal entities: one to buy the power, and the other to sell the net excess generation, creating additional costs and complexity. There are a few ways in which the current market arrangements could be adjusted to improve the overall environment for prosumers in Serbia:

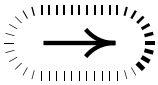
1. By **abolishing the requirement to set up two independent legal entities**, allowing prosumers to exist as a new legal entity; for small prosumers (e.g. households), or for self-consumption projects below 10 kW, for instance, an exemption could be introduced allowing them to receive compensation without needing to set up a separate entity.
2. By **extending the right to obtain a direct payment for net excess generation to all prosumers**, not just commercial and industrial customers;
3. By **providing a formula, or a clearer set of rules, governing the compensation of net excess generation**, that covers all potential prosumer types (residential, commercial, industrial, and institutional) – see Text Box 4 above. The formula applied can be designed to take into account transaction costs, as well as the reduction in distribution system losses, or can be linked directly to the prevailing market prices, either in real time, or based on monthly averages (see below).



Given the desire in Serbia to avoid market distortions and large (real or perceived) subsidies, government officials should consider a Net-FIT based on the following formula: prosumers are provided the right to be paid (whether by their supplier or by a separate off-taker) for their net excess generation on a monthly basis at the average monthly wholesale market rate. This monthly average rate could be published by the regulator, and applied for each billing cycle on a rolling basis.

Such an approach avoids the need for subsidies, and can provide a non-discriminatory basis for prosumer compensation, aligning the prosumer sector directly with the market from the outset. Based on the current wholesale market price trends in the region,[14] and discussions with stakeholders in Serbia, such an approach is likely to prove sufficient to unlock prosumer investments. For households and small business customers, intermediaries such as aggregators may be required in order to minimise transaction costs, as well as the administrative burden.

[14] Monthly wholesale market prices in Serbia in 2019 ranged from EUR 38/MWh to 76/MWh, based on data from ENTSO-E Transparency Platform. See: https://www.entsoe.eu/data/transparency-platform/

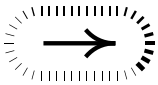


A choice needs to be made with respect to who administers, and settles, the payments for excess generation.

On this question, there are broadly four possibilities:

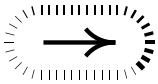
1. **The electricity supplier;**
2. **The distribution system operator (DSO);**
3. **A private intermediary or aggregator;**
4. **A government-backed intermediary, or agency.**

For customers (mainly residential) who continue to rely on the regulated electricity rates, it may be necessary to have a government-backed entity or agency. If policymakers seek to establish consistency and uniformity in the payment rate for net excess generation offered in the market, and to prevent utilities and DSOs from discriminating against such projects, experience in other jurisdictions suggests that having a government-backed intermediary, or agency can help.



No specific balancing obligations should be imposed on individual prosumers.

From a grid operator's standpoint, balancing is more about balancing of the system across a particular region, not for each individual prosumer. Given that most solar PV projects configured for self-consumption are likely to remain relatively small in Serbia (less than 1 MW), there is currently no need to impose individual balancing responsibilities on each prosumer. These balancing responsibilities can be transferred to a Balancing Responsible Party in order to help maintain system stability.

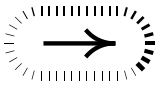


Steps need to be taken to ensure that the gross output of individual solar PV systems can be metered for data tracking and compliance purposes.

Currently the government does not have information about the total electricity produced from RES installed at the customer's premises since the metering infrastructure commonly used only measures net injection into the grid. This applies to many of the newer "smart" meters currently being installed in the country. As a result, the Government does not have access to information on the gross... output from self-consumption systems such as solar PV installations. This creates an important data gap, particularly in light of Serbia's obligations to meet EU-level NREAP and NECP targets.

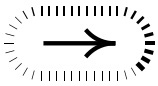
As a result, some stakeholders argued that a second meter is required (control meter) to meter the gross output of the RES installation. Broadly speaking, there are two options: either 1) **the DSO should be obliged to install meters that also allow the metering of bi-directional power flows and the metering of gross output in order to facilitate the future connection of prosumers to the network, or 2) future prosumers should be required to buy and install appropriate metering infrastructure at their own cost**. However, since this additional metering infrastructure adds an additional expense for prosumers, they are unlikely to comply unless the need for such a meter

is embedded in the regulations. A compromise solution could be developed that requires a 50-50 cost split (for instance) between the DSO and the prosumer.[15]



Clarity is needed on the issue of how self-consumption, and net excess generation, are taxed for different categories of prosumers.

Since the current Government of Serbia is reluctant to provide subsidies or other incentives to support renewable energy projects beyond those already provided, adjusting the tax rules should be considered. The Government could consider giving an exemption from the VAT either for the purchase of PV equipment and related installation works, or a special exemption on the personal income of citizens for the cost of purchasing and installing such equipment. Such tax exemptions are commonly used in the United States, as well as in other solar PV markets. Adjusting the rules around VAT and the excise tax could help make solar PV more attractive for households and other small and medium-sized prosumers.



Improving public awareness of the benefits of renewables is necessary to achieving a sustained transformation of the power sector.

A low level of awareness about renewable energy technologies persists within the general public, weakening one of the main drivers of political decision-making in the country. The public in Serbia is generally unaware of the importance of renewables, as well as of the potential financial attractiveness of investing in solar PV. Greater awareness is needed, including among the business community, to push for change.

[15] Under the current regulatory framework, this would likely require that the DSO is provided with the ability to recover this cost from rates.