Bosnia and Herzegovina

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

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BOSNIA AND HERZEGOVINA COUNTRY PROFILE — KEY COUNTRY DATA	
Population	3,286 million (est. 2020)[1]
GDP per capita (2018)	6.065 USD per capita (2018)[2]
Electricity consumption per capita (2018)	4,045 MWh/year[3]
Solar resource quality (insolation)	1,100 – 1,500 kWh/m²/year
Range of current installed costs (reported)	<20 kW: EUR 1.000 – 1.300/kW >20 kW: EUR 600 – 1000/kW
Total annual power consumption (2018)	13,294TWh[4]
Average electricity tariffs	Households: EUR 73/MWh + taxes Businesses*: EUR 90/MWh + taxes

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

* note that rates can exceed EUR 120/MWh for certain commercial and industrial customers
[1] https://www.worldometers.info/world-population/bosnia-and-herzegovina-population/
[2] https://data.worldbank.org/indicator/NY.GDP.PCAP.CD?locations=BA
[3] Project team calculation
[4] Annual report of SERC BiH, https://www.derk.ba/en/godinji-izvjetaji-derk-a

1. Introduction

Bosnia and Herzegovina has applied for membership of the EU. 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 requirements, Bosnia and Herzegovina 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, a requirement that will extend to Bosnia and Herzegovina. These policy changes are expected to result in a significant shift towards renewables in Bosnia and Herzegovina's power sector, which has long remained reliant on coal-fired generation and hydropower.

In a long term decarbonisation scenario, solar is expected to contribute to Bosnia and Herzegovina's future electricity mix significantly.[5] IRENA (2017) has shown that as the cost of solar PV continues to come down, it is estimated that Bosnia and Herzegovina will have approximately 3 GW of cost-effective solar PV potential by 2030. [6] Currently this potential is far from being utilised, as in 2018 the country only had around 18 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 Bosnia and Herzegovina 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 PV projects. 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. Bosnia and Herzegovina's electricity sector

Market liberalisation

Bosnia and Herzegovina has made some progress in unbundling its electricity sector, but the process has not been completed. Bosnia's transmission infrastructure is managed by a state-owned transmission company, "Elektroprijenos BIH", while the system operation function is managed by the Independent System Operator (ISO BIH). BIH is characterised by very a complex and decentralised constitutional organisation. The country is composed of three main administrative entities: the Federation of Bosnia and Herzegovina (FBIH), Republika Srpska, and Brčko District, a municipality in the northeast of the country that has its own municipal electric utility. The generation assets are majority owned by the three public utility companies active in

[5] REKK, 2018. https://rekk.hu/downloads/projects/SEERMAP_CR_BOSNIA_A4_ONLINE.pdf
[6] IRENA, 2017. https://www.irena.org/publications/2017/Jan/Cost-competitive-renewable-power-generation-Potential-across-South-East-Europe

Bosnia and Herzegovina: Elektroprivreda BIH – *EP BIH*, Elektroprivreda Republike Srpske – *ERS* and Elektroprivreda Hrvatske Zajednice Herceg Bosne – *EP HZHB*. These companies retain integrated control of generation, distribution and customer service. BIH also has one municipally owned utility that is responsible for supply and distribution to its over 35.000 customers, Komunalno Brčko. While the retail market is liberalised (meaning customers can choose different suppliers), the market remains largely divided along territorial lines between the main utilities.

Moreover, there is not yet a functioning, real-time power exchange to settle electricity trade within Bosnia: most electricity trading is therefore done bilaterally, based on negotiated contracts, or on regional power exchanges located in neighbouring countries.

While there is no organised power exchange in Bosnia, the country remains a substantial exporter to neighbouring countries, with some estimates suggesting that the country could export roughly 5TWh in 2020 alone, or approximately 40% of the country's current annual power demand.[7] This exported power is traded on neighbouring exchanges such as CROPEX, SEEPEX, and HUPX via the day-ahead or intra-day markets.

Major traders that participate on these regional exchanges include large industries in the country that are connected at 110 kV or 220 kV voltage levels, as well as the country's publicly owned utilities. In addition, there are two privately owned independent power producers (IPP): *TPP Stanari* and Wind Power Plant - *WPP Jelovača* are also major producers. Small privately owned producers including industrial combined heat and power plants (CHP), small hydropower plants (HPP) and solar PV projects operate as IPPs and collectively generate approximately 1 TWh/year (or 8% of national electricity demand).

TABLE 2: BASIC DATA FOR CONSUMERS OF PUBLIC UTILITY COMPANIES IN BIH

	EP BIH	ERS	EP HZHB	Brčko District
Number of consumers	764.742	559.213	193.884	35.574
Installed capacity (MW)	1,682	1,348	860	0
Number of DSOs	5	5	3	1

Source: Annual report SERC BiH, https://www.derk.ba/en/godinji-izvjetaji-derk-a

Approximately 66% of Bosnia's electricity sales occur at regulated rates under the country's "universal supply service" option. Customers deemed eligible for the so-called "universal supply service" option are primarily consumers connected at a 0.4 kV voltage level, which is a category comprised mainly of households and small and medium enterprises, notably those in the services sector. Certain SME customers can also be eligible for universal service, provided they agree to be connected to the grid at a 0.4 kV voltage level.

Electricity supply and consumption

Bosnia and Herzegovina's power mix is mainly comprised of hydropower plants and large thermal coal-fired plants. It remains a significant net exporter of electricity to neighbouring countries, mainly from its coal-fired plants.

[7] Annual report SERC BiH, https://www.derk.ba/en/godinji-izvjetaji-derk-a

Electricity consumption has grown steadily since the mid-1990s, from roughly 6,000 GWh in 1996 up to just over 12,000 GWh per year today. However, due to the recent closure in July 2019 of a major aluminium producer (Aluminij Mostar), electricity demand in the country has declined as of the second half of 2019. The country's Independent System Operator anticipates that demand will decline by over 6% from 12,330 GWh in 2018 to approximately 11,500 GWh in 2020.[8] This will further increase Bosnia and Herzegovina's ability to export power to the region.

The figure below provides an overview of the total generation mix for 2020, including both what is consumed in-country as well as exports. Table 3 below provides a more detailed overview of the electricity consumption in Bosnia and Herzegovina according to the voltage level at which different customers are connected to the grid, including data on the number of customers included at each voltage level.

FIGURE 1: ELECTRICITY GENERATION IN BIH (ESTIMATE FOR 2020)

Coal	10638
Wind Power	260
Small hydro	756
Large hydro	5076
Biogas	7
Solar PV	30

Source: Annual report SERC BiH, https://www.derk.ba/en/godinji-izvjetaji-derk-a

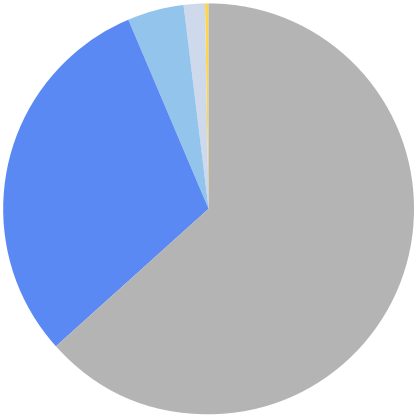
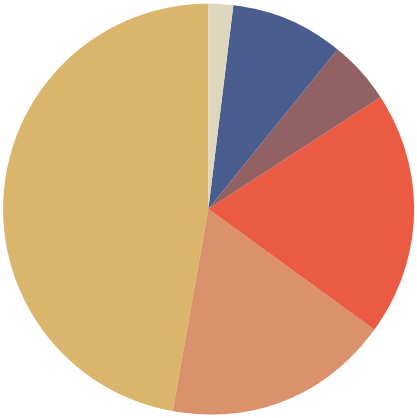


FIGURE 2: ELECTRICITY DEMAND BY CUSTOMER TYPE AND VOLTAGE CONNECTION (%), 2018

110 kV	9
35 kV	5
10 kV	19
Commercial (0,4 kV)	18
Households (0,4 kV)	47
Public Lighting (0,4 kV)	2

Source: Annual report SERC BiH, https://www.derk.ba/en/godinji-izvjetaji-derk-a



National renewable energy targets and plans

The key planning instrument used to reach the set target in the period 2010-2020 is the country's **National Renewable Energy Action Plan** (NREAP BIH), which includes different sub-targets for each of Bosnia's three main administrative entities. The current target for the share of renewable energy sources in Bosnia's Gross Final Energy Consumption (GFEC) in 2020 stands at 40% (including

[8] Source: NOSBIH "Balance of electricity in 2020", internal document

TABLE 3: BASIC DATA FOR ELECTRICITY CONSUMERS SUPPLIED BY BIH'S PUBLICLY-OWNED UTILITIES (2018)

Consumer category	EP BIH	ERS	EP HZHB	Brčko District	Total number	Total consumption (MWh)
110 kV	4	9	4	-	17	906,310
35110 kV	64	37		1	102	484,303
10 kV	883	1,038	218	52	1,191	1,900,124
Commercial (0,4 kV)	64,252	33,778	14,908	3,786	116,724	1,835,063
Households (0,4 kV)	659,079	523,489	177,062	31,301	1,426,931	4,635,063
Public Lighting (0,4 kV)	4,460	862	1,692	-	7,448	181,434
Total	764,884	559,213	193,885	35,574	1,553,413	9,992,567

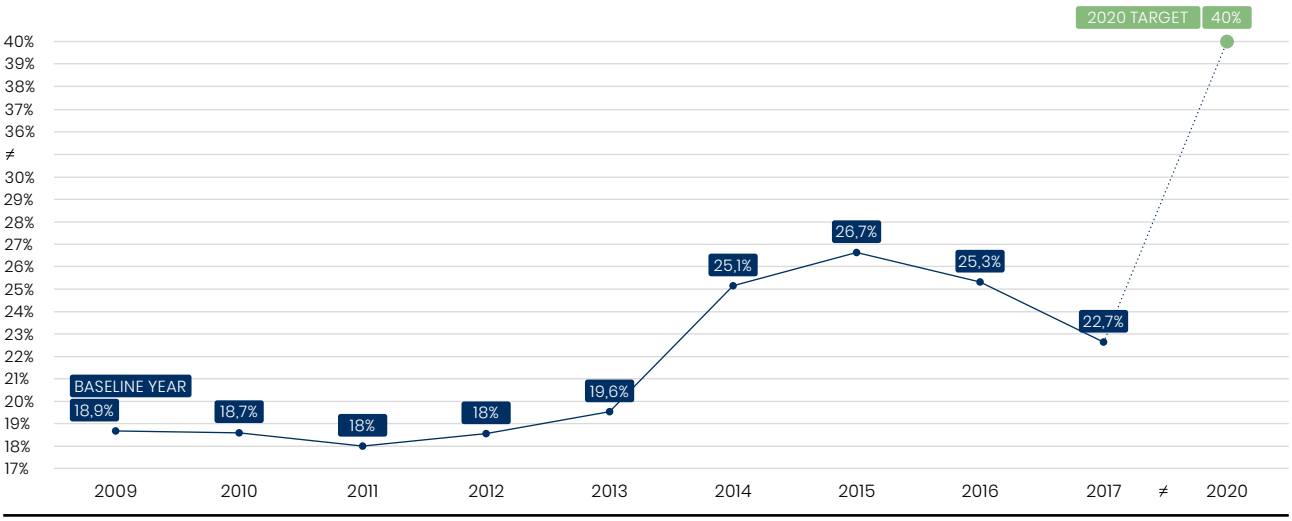
Source: Annual report SERC BiH, https://www.derk.ba/en/godinji-izvjetaji-derk-a

electricity, heating, cooling, and transport).[9] However, due to prolonged inaction, the country is now far short of achieving this target, with a share of RES in its final energy consumption of 25.33% in 2016, falling to 22.7% in 2017. [10]

Due to the high share of hydropower generation in Bosnia and Herzegovina, the country remains heavily dependent on annual variations in hydrometeorological conditions. In recent years, annual electricity generation from hydropower in the country reached 7.12 TWh, while in other years, it was just 3.80 TWh. **As such, annual fluctuations in hydropower output in BIH will continue to have a significant impact on the country's ability to achieve its renewable energy goals on a sustained basis.**

FIGURE 3: FLUCTUATION IN RES SHARE IN FINAL ENERGY CONSUMPTION BIH (2009–2017)

Source: EUROSTAT and Agency for statistics of Bosnia and Herzegovina (BHAS)



9 "National Renewable Energy Action Plan of Bosnia and Herzegovina", https://energy-community.org/implementation/Bosnia_Herzegovina/reporting.html

10 https://ec.europa.eu/neighbourhood-enlargement/sites/near/files/20190529-bosnia-and-herzegovina-analytical-report.pdf and Eurostat 2019.

Currently representatives in BIH are discussing a new process for defining the targets for 2030 with the Energy Community Secretariat (including for carbon emissions, energy efficiency and renewable energy targets). Preliminary proposals indicate that BIH could be expected to increase its RES share from 40% (in 2020) to 48%-55% (in 2030). Considering the already high share of renewable energy sources being used in Bosnia and Herzegovina's heating and cooling sector, due mainly to biomass use for heating, any significant increases in the share of renewables will need to come mainly from the transport and power sectors.

With regard to specific renewable energy policies, the deployment of distributed solar PV has so far been supported primarily by the country's FIT policy. In its most recent Progress Report submitted to the Energy Community,[11] BIH outlines a set of new policies that aim to support distributed solar PV in particular, including prosumers, citizens and energy community projects. The measures outlined include:

1. **Improvement of Administrative Procedures for licensing and permitting** of renewable energy projects (in line with Art. 15 of the EU's Renewable Energy Directive (RED I).
2. **Reform of the country's support schemes** for renewable electricity generation, including the **introduction of a new "market-based" support scheme**.
3. **Introduction of promotional programmes to encourage energy communities** (in line with the EU's Renewable Energy Directive II (RED II).

3. The market for distributed solar PV

Solar power

The total, officially registered solar PV capacity in Bosnia and Herzegovina (BIH) is currently just over 18MW, spread across 190 individual projects, all of which are supported by the country's Feed-in-Tariff (FIT). As the table below shows, the majority of the projects are between 20 kW - 150 kW, as this category received among the most attractive Feed-in Tariff rates. Comparatively few solar PV projects under 20 kW have been developed, although some small and medium-sized enterprises (SMEs) are starting to develop their own solar PV projects for self-consumption. Some of this customer-sited solar PV capacity is not currently monitored and tracked by the various administrative regions, and may therefore not be reflected in national data.

FIGURE 4: SOLAR RESOURCE MAP

Average annual sum (4/2004 – 3/2010)

Source: https://solargis.com/maps-and-gis-data/download/bosnia-and-herzegovina

kWh/kWp

[11] https://energy-community.org/dam/jcr:c0066ecd-40c9-41e8-af35-b30ed28f3562/BiH_EED_AR_072019.pdf

In order to support and promote production of renewable electricity, both the Federation of BIH and the Republika Srpska have introduced Feed-in Tariff policies. Over 60% of the renewable generation supported under the FIT is hydropower, with another 30% accounted for by wind power. Solar PV represents less than 3% of the total.

TABLE 4: GRID-CONNECTED SOLAR PV CAPACITY, IN MW (2013–2018)

	Year	2013.	2014.	2015.	2016.	2017.	2018.
Kapacitet (MW)	Total (MW)	1.41	3.16	8.17	14.12	16.52	18.15
	PV <20 kW	0.05	0.06	0.10	0.19	0.33	0.60
	PV 20-1.000 kW	1.35	3.10	8.07	13.93	16.19	17.55

FIGURE 5: SOLAR PV INSTALLED CAPACITY GROWTH, IN MW (2010–2020)*

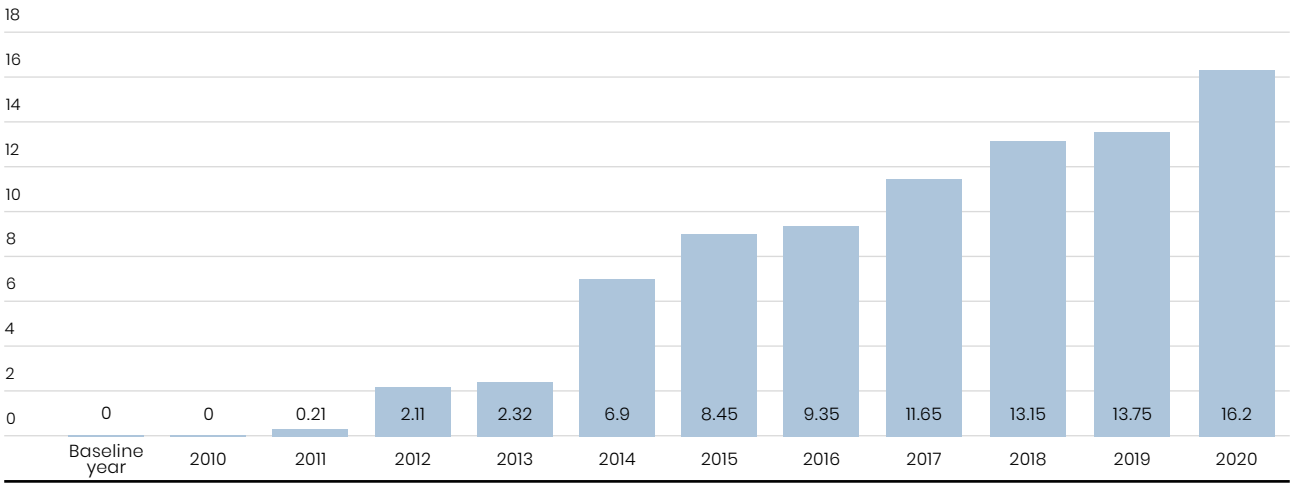
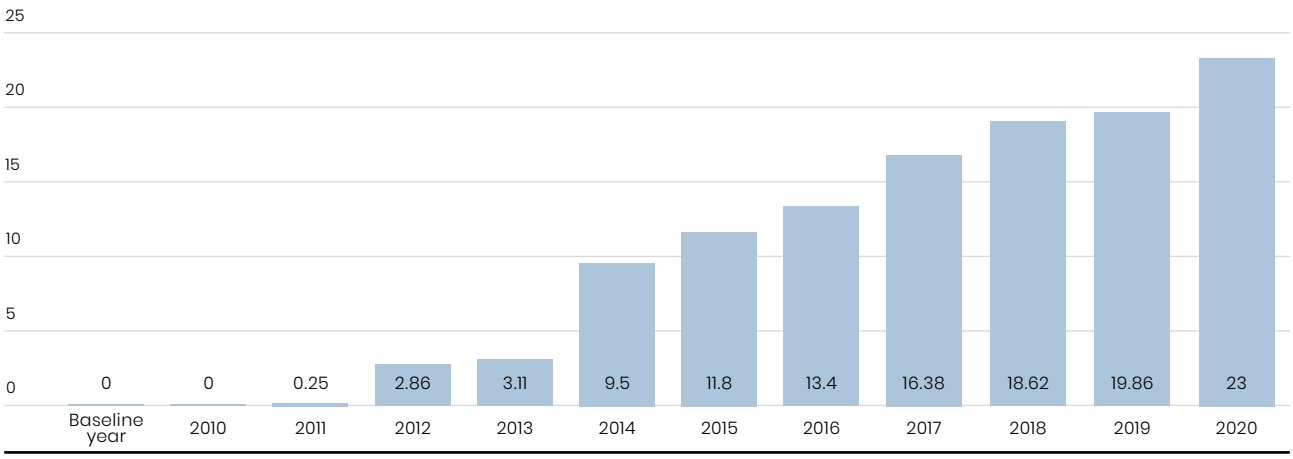


FIGURE 6: SOLAR PV GENERATION, IN GWH (2010–2020)*



* Source: "National Renewable Energy Action Plan of Bosnia and Herzegovina", https://energy-community.org/implementation/Bosnia_Herzegovina/reporting.html

In order to pay for the Feed-in Tariff policy, every electricity consumer in both regions is required to pay a small surcharge on their electricity bill for every kWh consumed. The municipal utility serving Brčko District has not introduced its own FIT policy, and as such, does not have to pay into the renewable energy surcharge.

End user electricity prices

Since power rates are in effect subsidised for customers that benefit from the universal supply tariffs, it is less economically attractive for such customers to invest in customer-sited solar PV projects for self-consumption. The economics are more attractive for other customers, including for commercial and industrial customers. There are approximately 1.300 customers in Bosnia and Herzegovina connected at either 10kV, 35kV, or 110kV. It is for such customers, namely those who do not benefit from subsidised electricity tariffs, for whom investments in customer-sited solar PV projects are particularly attractive in BIH.

Some customers in Bosnia and Herzegovina have electricity meters that do not differentiate between the time of day. These customers (mainly those under the universal service tariffs that receive lower, subsidised electricity prices) pay the same flat tariff for electricity regardless of when it is consumed.

TEXT BOX 1: IMPACT OF THE 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 Bosnia and Herzegovina, 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 Bosnia and Herzegovina) 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] Source: https://energyathaas.wordpress.com/2020/02/03/putting-solar-in-all-the-wrong-places/

Other customers with smart meters pay a **two-tiered tariff structure** with higher tariffs during certain hours of the day, and lower tariffs the rest of the time (e.g. overnight). There is also a distinction between whether customers have, or do not have, **demand charges** (structured in BAM/kW month, based on the maximum demand peak they draw from the network in any given month). Most of the customers with demand charges are industrial and commercial customers.

TABLE 5: OVERVIEW OF THE CURRENT ELECTRICITY RATES (AVERAGE VALUES) FOR DIFFERENT CUSTOMER CATEGORIES, EXCL. VAT (2018) (1 EUR = 1.95583 BAM)

Customer types	BAM/MWh	EUR/MWh
110 kV	95	49
35 kV	104	53
10 kV	119	61
Commercial (0.4 kV)	177	90
Households (0.4 kV)	142	73
Public lighting (0.4 kV)	168	86

Source: Project team calculation base on "Annual report SERC BiH", https://www.derk.ba/en/godinji-izvjetaji-derk-a

When the rates above, notably those for commercial and industrial customers above 10kV, are added to the fixed demand charges they pay (21.5 BAM/kW-month, or EUR 11 per kW per month), the average electricity price that certain commercial and industrial customers pay can exceed EUR 120/MWh, particularly if they are predominantly consuming electricity during the daytime. Indeed, the electricity prices paid by customers above 10kV are almost twice as high as the rates offered to single-tariff households, and over twice as high as smaller commercial customers under 10kV.

TABLE 6: OVERVIEW OF THE TIME-OF-USE TARIFFS AS WELL AS DEMAND CHARGES FOR DIFFERENT CUSTOMER CATEGORIES, EXCL. VAT (2018) (1 EUR = 1.95583 BAM)

	Households with two-tariff meters	Households with one-tariff meters	Commercial <10 kV	Commercial >10 kV
High : 7:00–13:00 16:00–22:00	160.2 BAM / MWh (EUR 81.9 / MWh)	128.2 BAM / MWh (EUR cents 65.6 / MWh)	115.6 BAM / MWh (EUR 59.1 / MWh)	244.9 BAM / MWh (EUR 125.2 / MWh)
Low: 13:00–16:00 22:00–7:00	80.1 BAM / MWh (EUR 41.0 / MWh)		57.8 BAM / MWh (EUR 29.6 / MWh)	122.5 BAM / MWh (EUR 63.6 / MWh)
Demand charges	61		21.5 BAM / kW month (EUR 11 / kW month)	21.5 BAM / kW month (EUR 11 / kW month)

Source: Project team calculation based on https://www.ferk.ba/_en/images/stories/2017/decision_ephzhb_distribution_network_fee_90_2014.pdf

Given that solar PV projects generate electricity during the daytime hours (leaving storage considerations aside), solar PV systems can help offset daytime consumption from the most expensive electricity tariff periods. Combined with solar PV's ability to help reduce demand charges (which can be significantly enhanced by adding customer-sited storage), **the economics of self-consumption for certain customer classes (notably for commercial and industrial customers connected at a voltage level beyond 10kV) in Bosnia and Herzegovina are becoming increasingly attractive.**

By contrast, **the economics of investing in onsite generation are not as attractive for households as they are for SMEs, mainly due to subsidised electricity prices**. According

to EUROSTAT's annual household price report for 2018, Bosnia and Herzegovina is among the countries with the lowest household electricity prices in Europe.

Support policies for solar PV

Bosnia's solar PV market has been driven mainly by the country's Feed-in Tariff policy. The FIT sets out guaranteed purchase prices for different renewable energy technologies. The current FITs for solar PV are presented in Table 7 (for Federation of BIH) and Table 8 (for Republika Srpska).

However, **the country's current FIT policy is scheduled to expire in 2021, creating significant uncertainty for the future of the country's solar PV market**.

Due to Bosnia and Herzegovina's complex and decentralised constitutional structure, the administrative and permitting processes for connecting distributed generation are complicated and time consuming. The procedure is very time-intensive because authorities and jurisdiction are divided among the entities, cantons and municipalities.

TABLE 7: FEED-IN TARIFF LEVELS IN FEDERATION OF BIH (2018)

Federation of BIH	Rated power	BAM/MWh	EUR/MWh
Solar PV	<23 kW	407.1	208.15
	23-150 kW	226.6	115.88
	150 kW-1 MW	182.1	93.12

Source: Feed-in Tariffs from FERK https://www.ferk.ba/_en/ and RERS https://reers.ba/en/

TABLE 8: FEED-IN TARIFF LEVELS IN REPUBLIKA SRPSKA (2018)

Republika Srpska	Rated power	BAM/MWh	EUR/MWh
Rooftop	<50 kW	273,4	139,79
	50-250 kW	234,1	119,69
	250 kW-1 MW	185,6	185,6
Ground-mounted	<250 kW	216,9	110,90

Source: Feed-in Tariffs from FERK https://www.ferk.ba/_en/ and RERS https://reers.ba/en/

The time needed for completion of the distributed generation (DG) connection permitting procedure depends on the location, size and type of technology. Based on developers' experiences, the procedure can last between 1 and 2 years for small and medium-size PV installations (with rated power up to 250 kW). A long list of requested permits, licenses and other documents should be obtained. The most important permits and steps which are required for RE projects are the following:

1. Feasibility study and preliminary design
2. Urban permit
3. Pre-approval of connection and initial connection permit
4. Main project design
5. Energy permit
6. Construction permit

7. Electric power permit and connection contract
8. Use permit
9. License for generation

Each of the above mentioned steps requires additional administrative steps and specific documentation requirements depending on the size and technology (i.e. PV, hydro, wind). Thus, there is little doubt that **the lengthy administrative and permitting processes remain a major barrier for the scale-up of customer-sited renewable energy projects like solar PV**. While a simplified procedure has been specified for PV installations for self-consumption and for PV prosumers, further improvements and simplifications are possible, depending on the region.

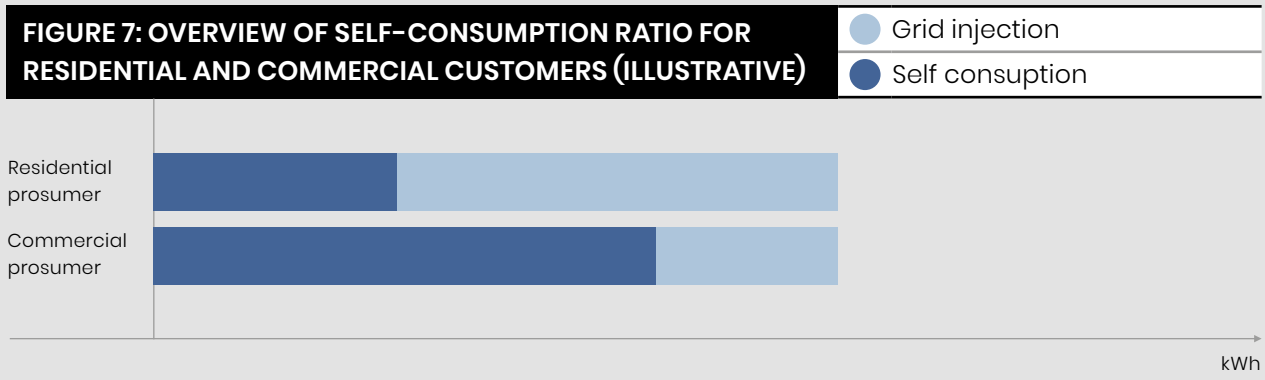
By contrast, according to the current legislation, **producers whose onsite solar PV systems are "behind-the-meter" and do not inject any excess generation into the public grid (i.e. 100% self-consumption) are not obliged to obtain any special licenses**. The presence of lengthy processes is one of the contributing factors leading companies and SMEs to develop onsite projects purely for self-consumption, i.e. without a connection to the local distribution grid, and therefore without the ability to sell excess production.

As a result, however, there is currently no publicly available record of such installations. Even though the number of such installations remains quite small, in the last few years many commercial consumers have shown interest in developing such solar PV installations and a few have already been built.

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 7: 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

Among the installations that have already been developed, some have had difficulties feeding-in their net excess generation to the grid and being compensated for it. In this regard, the need to register as a new legal entity in order to be able to sell their surplus energy is counter-productive.

Government-owned suppliers have an interest in purchasing this surplus electricity directly from prosumers. Currently, such suppliers are able to obtain such surplus electricity at a lower price than the electricity they sell to the regional power exchanges. This enables them to increase their exports to neighbouring electricity markets with higher real-time prices, providing a win-win. **The government could support more local purchasing of the surplus generation from rooftop solar projects by introducing a clearer legal and regulatory framework, including specifically on pricing and tax-related issues**.

There are important differences between the different regions with regard to customer-sited generation like solar PV. **In the Federation of BIH, it is permitted to install PV for self-consumption, but surplus electricity is not allowed to be sold to the grid. Similarly, rules governing customer-sited generation (via a Net Metering scheme) have already been specified in Republika Srpska's most recent Electricity Law**.

TEXT BOX 3: 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. 1kWh = 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 5MW.[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/

Regardless of which approach is chosen, regulators in Bosnia and Herzegovina should ensure that the rate is fair, that it adequately captures the value of distributed generation to the BIH power system, and that it helps to achieving the country's renewable energy targets.

While electricity purchased is taxed at a rate of 17% for VAT, any electricity that is self-generated and consumed onsite would not be taxed. For the tax authorities, this arguably translates into a loss of revenue. However, this ignores the fact that VAT is already collected on the purchase of the solar panels, the inverters, the wiring, etc., as well as on many of the service and operations-related aspects of a solar PV project. As such, any "net" revenue loss (after taking into account such other tax-related gains) from not taxing self-consumed electricity is correspondingly smaller.

Thus far, attempts by local stakeholders to obtain clarity from the Indirect Taxation Authority of BIH regarding how VAT will be treated for solar prosumers have not provided favourable results. During the preparation of the proposal of the Reform of Support Schemes for renewable energy sources in 2019, provisions for a special Net Billing scheme have been formulated for installations of up to 23 kW (in FBIH) and 30 kW (in RS). It has been agreed that for these installations VAT exemption for electricity fed to the grid will be applied. However, this scheme has not yet been implemented.

TEXT BOX 4: 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.energy-community.org/dam/jcr:b73594c1-0e30-48bc-aac1-e8b7ce1478d7/WSEL052017_Muratovi%C4%87_recommendations.pdf
[2] https://nachhaltigwirtschaften.at/resources/iea_pdf/reports/iea_pvps_task1_review_and_analysis_of_pv_self_consumption_policies_2016.pdf

4. Barriers to solar PV in Bosnia and Herzegovina

Future market opportunities for distributed PV in Bosnia and Herzegovina will depend on a range of factors, including:

- **What regulatory framework(s) emerge after the current FIT is discontinued in 2021**;
- **The design of any future regulations or support schemes for prosumers**;

- **The design of any future regulations or support schemes for energy communities**;
- **Future trends of electricity rates in the country**;
- **Future trends of electricity prices on the regional power exchanges**, which will have an impact on nonregulated consumers (medium and large companies connected to medium and high voltages);
- **The marginal costs of electricity production for conventional power plants in BIH**, notably by the publicly owned utilities; there is considerable uncertainty especially after implementation of the planned investments in modernisation of thermal power plants due to developments emerging out of the Large Combustion Plant Directive and the Industrial Emissions Directive (LCPD/IED)[12] as outlined in BIH NERP;
- **The timing of the introduction of carbon pricing** or other means of internalising the external costs of carbon emissions.

Currently a number of barriers to the uptake of PV exist which are discussed in this section.

Policy and regulation

There are a number of barriers to the emergence of a thriving market in customer-sited generation:

- **The major barrier to a faster scale-up of RE in BIH is a lack of strategic commitment from political stakeholders for the energy transition, including a long-standing bias in favour of business-as-usual**. Key BIH stakeholders still stand by conventional power generation technologies (thermal and hydro) and rely on a Business-as-Usual (BAU) paradigm when developing generation expansion plans. This attitude is reflected in several development scenarios in the country's "Framework Energy Strategy of BIH until 2035".[13] In general, BIH still lags behind in fulfilling its obligations resulting from the Third Energy Package, which it is obliged to implement according to the Energy Community's *Acquis Communautaire.* However, in light of recent solar power auction results from nearby Albania of just under EUR 25/MWh, it is likely that the political commitment to renewables and to solar PV in particular will continue to grow in the years ahead.[14]

- **Ongoing delays in restructuring the country's electricity market** continue to hinder the development of renewable energy projects in Bosnia, including with regard to the establishment of intra-day markets within the country that could allow prosumers to sell their net excess generation on the open market.

- **Administrative, regulatory, and permitting barriers and delays unnecessarily increase project costs**. With the rapidly decreasing costs of solar PV, administrative processes account for a growing proportion of total project costs. This can be mitigated by implementing simplified administrative and permitting procedures. High administrative hurdles increase the likelihood that many interested customers, particularly industrial and commercial customers, fail to disclose or register their systems to the authorities, and to the public utility companies in the country. This could have negative impacts both on individual utilities as well as system reliability

[12] See: http://seechangenetwork.org/wp-content/uploads/2013/10/lcpd-web-small.pdf
[13] Source: http://www.mvteo.gov.ba/data/Home/Dokumenti/Energetika/Framework_Energy_Strategy_of_Bosnia_and_Herzegovina_until_2035_ENG_FINAL....pdf
[14] https://balkangreenenergynews.com/albania-secures-lowest-solar-power-price-in-balkans-in-karavasta-auction/

and planning. In light of the improving economics of onsite generation, officials should aim for administrative and permitting procedures that are simple, and easy to implement, particularly for smaller customer-sited systems (e.g. under 250 kW or even 500 kW).

- **Low electricity prices, driven in part by energy subsidies, make investments in distributed solar PV less attractive**. This is especially the case for approximately two thirds of customers still paying regulated rates.

- **Low level of awareness of the benefits of renewables**. Many key stakeholders in the country remain uninformed about the benefits of renewables. This weakens momentum for more advanced policies and regulations targeting the sector.

- **There is lack of clarity around the step-by-step process that different prosumers would have to take in order to develop their projects and connect them to the grid**. More clarity is therefore needed around the compensation level for net excess generation, as well as what legal forms are required for prosumers to export power to the grid and receive payment.

Technical parameters and requirements

The key technical requirements to connect distributed generators (DG) such as solar PV systems to the grid are specified in the current grid codes developed by the country's DSOs as well as in the General Rules for Electrical Energy Delivery, which are approved by the country's regulators.[15] Additional technical requirements are specified in regulations and rules that are specified by the DSOs. These minimum technical requirements for the connection of distributed generation technologies to the distribution grid are primarily related to:

- Rated power of DG;
- Permitted variations of voltage at the Point of Common Coupling (PCC) after connection of DG;
- Level of short circuit currents in local network;
- Network protection settings;
- Voltage control requirements in distribution feeder;
- Power quality at the PCC.

The above requirements are fairly standard across the industry. There are two additional cases in which an additional distribution grid impact study is required:

1. When the distributed generation technology (such as a solar PV system) is connected to the medium-voltage network (i.e. 10, 20 and 35 kV) and has a rated power (Sg) that is larger than 0.1% of the three-phase short circuit power (Sk) at the Point of Common Coupling,
2. When the system is connected to the low-voltage network (i.e. 0.4 kV) and has a rated power (Sg) above 0.67% of the three-phase short circuit power (Sk) at Point of Common Coupling.

The need for additional grid impact studies can significantly slow down project development, and may deter many investors and project developers from developing projects in certain areas. The need for such additional grid impact studies should be revised to ensure that it does not unduly constrain project development.

[15] Source: Source: "General Rules for Electrical Energy Delivery", internal act, EPBiH

Metering and billing

There are still no clear rules governing self-consumption and the compensation for net excess generation. This leads to market uncertainty and discourages investment both from households and from SMEs. Despite many ongoing discussions and working groups in the country, there is still no clear guidance on how the payment for net excess generation is going to be determined, particularly in different regions and utility service areas within the country. In addition, data on gross PV system output are necessary in order to monitor domestic renewable energy development toward the achievement of Bosnia and Herzegovina's national energy and climate targets.

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 maximize 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 Bosnia and Herzegovina 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.

Broadly speaking, there are two options: 1) **the regulations can require all prosumers with customer-sited PV systems to install meters that allow both the metering of bi-directional power flows and the metering of gross output**, or 2) **the regulations could require the Public Utility Companies themselves to adopt metering infrastructure that allows both the metering of bi-directional power flows and the metering of gross output**. However, since this additional metering infrastructure adds an additional cost, either for the prosumer or for the utility, a clear cost-sharing formula or arrangement is needed.

Balancing Responsibilities

A functional competitive national balancing market in BIH was established in 2016. The balancing market is operated by the country's Independent System Operator (ISO BIH) and is a part of the ENTSO-E control block that links Slovenia, Croatia, and Bosnia and Herzegovina together.

Balancing and frequency regulation services are prescribed in the following documents, which are approved by the State Electricity Regulatory Commission of BIH (SERC):

- Grid Code (2019);
- Market Rules (2019);
- Ancillary Services Procedures (2017);
- Rules On Daily Balancing Energy Market Operations (2017).

In BIH designated Balancing Responsible Parties (BRP) purchase balancing services (including reserved power and balancing energy) on the balancing market. According to current regulations, distributed generation units with rated power up to 500 kW (in Republika Srpska) and up to 150 kW (in Federation of BIH) are not responsible for day-ahead planning and balancing of their electricity production. In other words, **prosumers under 500 kW in Republika Srpska and 150 kW in the Federation of BIH are exempt from balancing obligations**. The regulations in Republika Srpska are broadly in line with the regulations emerging in the EU, which currently set an exemption for projects below 400 kW declining to 200 kW for projects connected to the grid after 2026.[16]

Financing Environment

Access to capital remains a major barrier for the development of renewable energy projects in BIH. Many households as well as SMEs find it difficult to access loans to invest in renewables, leaving the market heavily reliant on up front funding, and hence, on the participation of larger companies who can invest in solar projects directly on their balance sheet (rather than by borrowing).

International Financial Institutions (IFIs), namely EIB, EBRD and KfW, have provided loans and technical assistance to renewable energy projects implemented by BIH's publicly-owned utilities. However, such financial and technical support has thus far been limited mainly to wind and hydro power projects.

For instance, KfW has supported construction of the Mesihovina wind power project (50.6 MW, EP HZHB) as well as the Podveležje wind power project (48 MW, EP BIH); meanwhile a further 50MW is planned by EPRS at Hrgud in the south of the country.

In addition, there are a number of credit facilities now available to banks throughout the region, including in BiH, that provide dedicated financing for renewable energy projects:

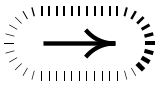
- GEFF is a foreign credit line facility of up to EUR 85 million offered to select financial institutions in the region to enable them to on-lend to residential renewable energy projects such as rooftop solar. Participating institutions include UniCredit Bank, UniCredit Bank Banja Luka, Sparkasse, and Partner.

- WeBSEFF is a credit line facility of up to EUR 135 million that has been made available to select financial institutions in the Western Balkans region to on-lend to businesses as well as municipalities investing in renewable energy projects. Participating institutions include Raiffeisen Bank and UniCredit Bank Mostar.

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

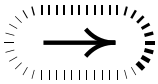
5. Synthesis and Recommendations

Based on research performed during the project implementation and taking into account conclusions from the workshop, a number of important steps need to be taken to accelerate the scale-up of customer-sited solar PV development in BIH. These measures are particularly important in light of the anticipated end of the country's Feed-in Tariff policy in 2021.



Bosnia and Herzegovina should aim to incorporate a specific allocation, or quota, for PV prosumers in the country's forthcoming National Energy and Climate Plan (NECP) 2020.

Such a quota would help provide more clarity to public utilities in Bosnia and Herzegovina, while also providing more clarity to the market as a whole. **The country's publicly-owned power suppliers should be required to incorporate such a "prosumer quota" into their overall planning efforts in order to ensure that customer-sited generation becomes a part of Bosnia and Herzegovina's future energy system.**



A formal decision has to be made regarding the type of self-consumption scheme that will be adopted. In order to encourage prosumer investments, a Net-FIT approach should be favoured.

According to stakeholders present at the workshop, some commercial and industrial customers are already investing in onsite solar PV systems for self-consumption. This strongly suggests that investing in rooftop solar projects is already attractive for customers in certain rate categories in the country. One of the uncertainties that remains in Bosnia and Herzegovina is whether any future policy will be nation-wide, or whether it will be adopted only in certain parts of the country.

Experience in a growing number of countries around the world signals a move away from 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 one 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 provides a "worst case scenario" for the bank, and thus, helps de-risk such investments.

As such, in terms of encouraging prosumers in BIH, a Net-FIT approach should be favoured over Net Billing.

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

- **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);
- **Linked to the market, but based on daily, monthly or annual averages**;
- **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%);
- **Based on some other rate, such as the supplier's avoided energy costs**, that is revised and updated over time;
- **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.

In light of the challenges with regards to allocating subsidies for solar PV projects, and the desire to avoid increasing electricity rates on non-solar customers, the Governments of BIH should consider allowing customers to sell their net excess generation onto the market, either directly, or via intermediaries. This could help improve the economics of rooftop solar projects, and create more decentralised investments in solar PV across the country, particularly among SMEs, which currently pay higher electricity rates.

In order to clarify the policy framework for prosumers in the country, it is necessary to clarify a few key aspects:

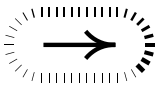
1. **The legal status of prosumers** (is it necessary to establish a separate company to become a prosumer that sells their electricity to one of the public utility companies?);

2. **What pricing conditions for net excess generation are allowed**;

3. A clear **formula or framework governing the compensation of net excess generation**, ideally one that applies across all potential prosumer types (residential, commercial, industrial, and institutional).

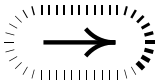
4. **Whether one uniform policy is applied nationwide, in one region of the country (e.g. only in FBiH) or whether utilities will be allowed to design their own** prosumer policies, subject to certain rules and guidelines.

Based on current trends in the country, it is necessary to introduce new regulations governing the emergence of distributed solar PV projects, including clear rules and procedures governing the sale of net excess generation to the grid, specifically in order to create more market certainty for the period after the Feed-in Tariff expires in 2021 (see Text Box 3 for a review of the options).



No specific balancing obligations should be imposed on individual prosumers.

Given that most solar PV projects configured for self-consumption are likely to remain relatively small in Bosnia and Herzegovina (less than 1MW), there is no need to impose individual balancing responsibilities on each prosumer. These balancing responsibilities can be transferred to a Balancing Responsible Party in order to maintain system stability for the foreseeable future.

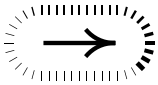


It is necessary to improve the administrative procedures for licensing and permitting of renewable energy projects. In relation to this, steps need to be taken to ensure that the gross output of individual solar PV systems can be metered for data tracking and compliance purposes.

Currently there is a patchwork of permitting and administrative requirements to obtain approval for a customer-sited generation project like rooftop solar PV systems. Local government authorities should streamline these procedures to make it easier for prosumers to get the necessary documents and permits.

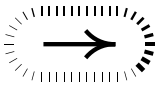
In addition, the procedures should include a legal requirement for all distributed solar PV systems to register with the appropriate authorities, enabling the government to track and monitor the growth of such installations over time. Currently the authorities in Bosnia and Herzegovina do not have information about the total electricity produced from renewable energy projects installed at the customer's premises (such as rooftop solar projects) since the metering infrastructure commonly used only measures net injection into the grid. This creates an important data gap, particularly in light of BIH's obligations to meet EU-level NREAP and NECP targets.

As a result, a second meter may be required (control meter) to meter the gross output of the RES installation. The government should introduce guidelines regarding how any additional costs should be shared between customers and DSOs.



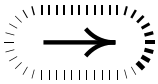
Targeted policies and regulations are needed to encourage energy communities.

Encouraging the growth of energy communities is in line with the EU's Renewable Energy Directive. This could include encouraging partnerships with local municipalities in the country whereby the municipal government could become the proponent for specific community solar projects, e.g. on the rooftops of local government buildings. Such initiatives could also play an important role in raising awareness among businesses and individuals and raise the profile of customer-sited renewables in the country.



Efforts to encourage domestic investments in renewable energy projects in partnership with local companies, or municipal governments, should be explored.

Bosnia and Herzegovina has a substantial diaspora population. Many emigres retain strong ties to Bosnia and Herzegovina, and the country as a whole could benefit by providing investable opportunities in the country into which the diaspora population could invest. With a supportive legal and regulatory framework, customer-sited solar PV projects, including community energy projects, could provide a viable way in which such investments could be mobilised.



Improving public awareness of renewables is paramount to building public and political momentum for more ambitious policies in Bosnia and Herzegovina.

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 Bosnia and Herzegovina is generally unaware of the importance of renewables, and of the many co-benefits that renewable energy development can bring for the country and its citizens. Greater awareness is needed, including among the business community, to push for change.

In particular, **greater media promotion and awareness raising of the importance of solar PV for de-carbonisation of the power sector and for the "democratisation" of the energy transition is needed, notably among the stakeholder groups for whom the economics are currently the most attractive.**


E3 Analytics