REPUBLIC OF SERBIA NET-METERING STUDY
SECOND REPORT: EXAMPLES OF GOOD NET-METERING PRACTICES

ENHANCING CAPACITY FOR LOW EMISSION DEVELOPMENT STRATEGIES (EC-LEDS) PROGRAM

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FOREWORD

RTI International consultants were asked by the U.S. Agency for International Development to perform a study of net-metering in the Republic of Serbia, the purpose of which is to assist Serbia to define and introduce, if feasible, a successful approach to net-metering. In broad terms, the study comprises three reports:

1. First Report: An analysis of the present market structure and legal and regulatory framework with special emphasis on impediments or issues preventing the introduction of net-metering in Serbia.

2. Second Report: A study of examples and models of net-metering practice in other countries, resulting in a report on examples of good practice in countries that have successfully implemented net-metering. This document constitutes this study.

3. Third Report: A proposal for introducing net-metering in Serbia, including a concise set of suggestions on how Serbia may re-shape existing rules to incentivize the introduction of and engagement of investors in net-metering.

This report, *Examples of Good Net-Metering Practices*, is the second report under the net-metering study.
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DEFINITIONS AND ACRONYMS

CEDIS  Crnogorski Elektrodistributivni Sistem of Montenegro
CHP    combined heat and power
DSO    distribution system operator
EC     Energy Commission
EC-LEDS Enhancing Capacity for Low Emission Development Strategies Program
EEG    Erneuerbare Energien Gesetz (Renewable Energy Act of 2014) of Germany
Energy Law The Energy Law “Official Gazette of RS” No. 145/14, enacted on 29 December 2014 by the National Assembly of the Republic of Serbia
ERE    Enti Rregulator i Energjise (Albanian Energy Regulator Authority)
EU     European Union
FiT    feed-in-tariff
FiP    feed-in-premium
GoM    Government of Montenegro
kW     kilowatt
MW     megawatt
NEM 2.0 Net Metering 2.0 program in California
NIT    National Indicative Target
OSHEE  Albanian Electricity Power Distribution System Operator
PV     photovoltaic
Prosumer electricity producer and consumer
Prosumption excess electricity generated by the prosumer and injected into the network
PV     photovoltaic
RE     renewable energy
RES    renewable energy sources
RTI    RTI International
Serbia  Republic of Serbia
SME    small and medium-sized enterprise
US     United States
VAT    value-added tax
EXECUTIVE SUMMARY

Over the last few decades, the world has faced several energy-related challenges. In most cases these challenges have related to securing sufficient energy sources for local populations. One solution to energy security concerns is enabling consumers to secure their own, or a portion of their own, energy requirements. Net-metering is one of the most advantageous options in this regard.

Net-metering is an arrangement that allows consumers who generate their own electricity to deliver unused energy to their local power network and to receive a credit for its value. The main idea behind net-metering is to enable consumers to use the distribution network to store the excess electricity that they produce for use at a later time, while providing the distribution network with local, cheaper and often renewable-sourced electricity that it can deliver to other consumers. This idea has become particularly attractive in recent years because the costs of small-scale renewable energy generation have dropped to levels that are affordable for small-scale investors.

Best practices in other countries indicate that net-metering is eminently workable and provides benefits to end-use customers. The benefits, however, range beyond those to consumers alone. Net-metering can be a significant factor in meeting EU directives and national targets for the introduction of renewable energy sources (RES) electricity. It can also assist in alleviating scarce generation capability and delivery congestion.

Although it has existed for around 25 years, net-metering is still a relatively novel concept around the world. There is no standard model applicable across countries that have adopted it, including those in the EU, and policies towards net-metering vary widely. This presents Serbia with a unique opportunity to develop a model precisely tailored to its own needs. It is important to note that many countries have moved away from the pure net-metering model and instead are adopting a variety of net-billing models, as this approach allows electricity to be valued according to time of use, which is an important issue in the context of Serbian tariff rules.

For Serbia, the main difficulties to overcome in introducing a successful net-metering scheme are the following:

- the relatively high capital cost to Serbians of purchasing and installing a suitable solar rooftop generation system;
- whether or not the savings gained by producing electricity for self-consumption in an environment where electricity is already quite inexpensive will justify this capital cost;
- whether or not the price paid to prosumers for excess electricity supplied into the network will also be sufficient to assist in justifying this cost;
- the categorization of producer-consumers (prosumers) under present law as “entrepreneurs,” which imposes significant cost and compliance obligations that may deter consumers from engaging in net-metering.

The first report in this series—an analysis of the present market structure and legal and regulatory framework examining impediments to the introduction of net-metering in Serbia—indicates that the legal and regulatory framework may be quite simply amended without the need for a significant re-write of existing laws and regulations. The third report, a proposal for introducing net-metering in Serbia and containing a cost-benefit analysis, indicates that the
costs may exceed the benefits without some form of assistance or subsidy to prosumers. These may include assistance with the initial capital outlay (through investment grants), purchase price for excess electricity fed into network (based on the market price of electricity), favorable financing (interest free loans or longer repayment periods), and carbon taxing (allowing the monetization of the carbon dioxide [CO2] emissions reductions, which is currently not the case).

This report focuses on international practices and experiences. Our preliminary suggestions are detailed in section 5. In general terms, we would propose that any model to be introduced in Serbia should be guided by the following principles:

- be as simple as possible;
- enable development of net-metering without creating additional costs to either the prosumer or to those consumers who do not or are not able to participate in a net-metering scheme;
- utilize the experience of those countries that have recently joined the EU and/or have similar backgrounds to the Serbian historical, economic, political, social, etc. experience, especially post-Yugoslav states;
- be compliant with the most recent applicable EU/EC directives and regulations, and with EU recommendations, especially the Third Energy Package, environmental and pro-RES/EE solutions and any other supporting regulations.

In summary, our view is that the most suitable net-metering model for Serbia would be as follows:

1. Self-consumption should be generally permissible. All RES should be allowed as primary energy sources to be used for self-consumption. The construction of a RES facility should be exempted from having to obtain licensing, construction, and other permits if it meets certain criteria.

2. A system of support should be created for the installation of new RES generators that will participate in net-metering. The support could consist of allowing exemptions from value-added taxes (VAT) or other taxes (on the purchase of the necessary equipment or on electricity produced that may not be needed for consumption) and ensuring that the processes of permitting, meter installation, and agreements with the distribution system operator (DSO) and supplier are straightforward and transparent. The types of support that could be adopted should be chosen based on the financial analysis to be completed and discussions with the relevant Serbian authorities.

3. There should be no connection fees or consents necessary should the nominal capacity of the RES be lower than or equal to the load of the existing connection, other than ordinarily applicable for domestic connection to the network. The cost of smart meters should be the responsibility of the DSO. The government has already committed to the installation of smart meters, but the roll-out has not yet been completed. We would suggest that the government accelerate this process, and that prosumers wishing to join the net-metering scheme should have priority in smart meter installation.

4. Technical criteria for connection should be imposed solely by the distribution code. If technical criteria are met, the administrative procedure of approving the status of prosumer should be as simple as possible.

5. The capacity limit could be based either on capacity of the source or on electricity delivered into the network. In any event, the limit should be set at a level that satisfies the prosumer’s needs but discourages them from generating excessive surpluses of electricity and in compliance with the Proposal for the Directive of the European

6. Prosumers should not be required to obtain a license to generate electricity (or for perform any other energy activity), if it is primarily for their own consumption.

7. The injection of excess electricity into the distribution network, should not be treated as the sale of a good but instead as a netting transaction, resulting in a credit against electricity delivered. The alternative view is that injection of excess electricity into the distribution network be treated as tax exempted special transaction. Both of these options are feasible.

8. Until further studies on applicable tariffs are carried out, it is suggested that the Croatian net billing model may hold useful lessons for Serbia. The Croatian model discounts the value of excess electricity purchased from prosumers, making the net-metering arrangement financially attractive to both prosumers and suppliers (as described in more detail in Section 5).
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1 INTRODUCTION

Support for net-metering in technologically advanced, leading economies and countries with high rates of solarity (and generally for small-scale renewable energy (RE) and distributed generation) has been very strong. This support—in the form of the price received for excess electricity delivered to the distribution network, availability of smart meters, and relative simplicity in implementation—has been one factor contributing to the rapid growth in private rooftop solar.

Electricity has historically been generated by utilizing different energy sources, including the following:

- large power plants based on: hydropower, coal, gas or liquid fuels
- sources utilizing advanced technologies such as nuclear energy
- recently, more eco-friendly, new renewable technologies have gained in popularity, such as small hydropower, wind, and solar PV
- biomass.

The energy generation resource and technology development path indicated above has led to challenges emerging in the generation sector, including the following:

- necessity to organize bulky financing and investment
- concentrated sources of pollution
- increasing grid congestion
- progressively exhausting fuel sources and increasing fuel and fuel delivery costs
- temporary or permanent unavailability of certain fuels at certain locations
- lack of supporting infrastructure (like networks, roads, pipelines), cooling water, etc.

Until relatively recently, only large generation units were considered suitable to contribute to securing coverage of electricity needs of societies and businesses. In most cases, smaller units were used mainly as secondary electricity providers, as sources useful for remote consumers, or as backup for large generators only. However, progressively over time, distributed generation has gained much larger attention and recognition as grid supply generators.

The characteristics of different energy sources and the type of technology used, typically impacted the size and location of the generation units. In most cases, generation units were large and located on or close to the primary energy sources, most often away from populated, industrial, or business activity areas.

The economies of scale, size, and location of generators influenced their usual organizational form, which excluded individual persons or small businesses in favor of larger energy companies and governments. Access to larger sources of financing of generation activities also became a norm in this sector.

Increasing need for decentralized electricity generation coupled with recent technology developments (including smart grids) facilitated the possibility of using smaller units as generators producing electricity not only for the owner’s needs, but also for delivering power into the public grids. The new technologies also generated increased interest among smaller
businesses, such as nonprofessional electricity companies, as well as individuals for domestic use.

In some countries, governments facilitate such small-scale energy developments and investment through a number of solutions:

- **Net-metering**, in which a consumer owns its own generation facility (typically fueled by RES) and produces electricity covering at least some of its consumption needs. When a consumer’s electricity generation is higher than its consumption, the surplus may be injected into the electricity network (in most cases, the distribution network). When consumption exceeds generation, electricity is withdrawn from the same network. Such producers/consumers are often called prosumers (producer-consumer). This system, amongst others, was used in the early stages of net-metering adoption across Australia and California.

- **Net-billing**, is a similar system to net-metering and is also applied in some countries. Net billing is currently most commonly used across the EU countries where multi-zone tariff systems are in place. Net-billing applies to instances in which a consumer acts as generator, but there are some important differences from net-metering.
  - The main difference between net-billing and net-metering systems is that with pure net-metering the prosumer pays or is reimbursed proportionally to the prosumer’s net consumption against produced electricity. In most cases reimbursement is an electricity credit during subsequent periods. With net-billing systems, payments are separately calculated for consumed and produced electricity, and the final bill is calculated based on the difference. In short, with pure net-metering, netting is based on volumes of electricity flowing into or from the networks (both direction flows); in net-billing, netting is based on financial flows separated for both directions of electricity flow.

There are also numerous other options developed for the needs of certain countries that very often do not have much in common with the two aforementioned models. These models are often additionally supported by a feed-in-tariff or similar systems coupled with RES generated electricity purchase obligations on suppliers.

Recently in some states in the United States, financial support for net-metering has waned, as realization of some drawbacks and complexity or fairness around pricing has grown, and more traditional forms of generation and delivery have regained popularity.

The main drawback in the way excess electricity has been priced is the impact of net-metering policies on the rates paid by consumers who do not install solar systems. In many cases, utilities compensate net-metering customers for their excess energy at the utility’s full retail rate. This full rate includes both the cost of the energy purchased by the utility (or supplier), but also the cost to maintain and operate the distribution network. The argument now being made is that compensation at this full retail rate amounts to a subsidy for most net-metered customers. A result of this approach has been a lowering of the prices received by prosumers for their net-metered energy. However, the significant benefit that prosumers receive continues to be the production of their own electricity at a much cheaper cost than purchasing it from their utility or supplier (primarily because that electricity is obtained without any additional costs, such as transmission and distribution charges or taxes and in addition, enabling off-setting of their purchases of electricity from the network in high- vs low-tariff zones).
2 TECHNOLOGICAL, LEGAL, AND ECONOMIC FRAMEWORKS FOR NET-METERING

This section discusses the generation technologies that have been most used for net-metering, the metering technologies that are required, EU rules concerning self-consumption, and the commercial and economic aspects of net-metering.

2.1 Generation Technologies Useful for Net-Metering

Various generation technologies are used in net-metering schemes. The most popular encompass solar PV, while wind- and hydro-based generation technologies are also used, although not to the same extent as solar PV. These technologies are discussed in the following sections.

2.1.1 ADVANTAGES OF SOLAR PV FOR NET METERING

Solar PV-based systems are the typical technology of choice for prosumers for several reasons. Among these reasons are ease of installation, very limited or no environmental impact, easier construction and permitting requirements, ever decreasing cost of solar panels—recently as low as €1.5–2/W—for small-scale installations.

Solar PV is particularly suitable for use by SMEs because their daily load profile usually almost perfectly matches the typical generation profile of solar PV panels. Most electricity consumption of a typical SME occurs during the daylight hours, at the main time a solar PV system produces electricity. That way, most of the electricity generated is consumed by the SME. This situation is ideal, because, in most cases, the consumer is able to largely meet its energy needs with electricity it generated. In addition, availability of sunlight is easily predictable in a day-ahead perspective, enabling SMEs that obtain electricity through the power exchanges to further limit their costs (see Figure 1).

Most household use varies from an SME’s. During the day (i.e., when the electricity is generated) household consumption is usually low because householders are typically out of home.
2.1.2 POTENTIAL FOR USING WINDMILL TECHNOLOGY

Although solar PV one of the most promising technologies for covering self-consumption and being used for net-metering, other technologies should not be totally disregarded. For instance, electricity-generating windmills have advanced considerably over the last decade in Europe (especially Austria, Germany, Italy, the Netherlands, Sweden, or the United Kingdom). Despite the overarching trend of enlarging windmills (some of which now reach 6–8 MW worth of capacity), smaller units have also become more efficient and economically viable. Therefore, windmills may constitute another technology used in connection with net-metering, particularly in some windy areas of Serbia.

2.1.3 POTENTIAL FOR USING SMALL HYDROPOWER PLANTS

Small hydropower is a traditional technology that could have significant potential for additional energy generation in the mountainous regions of Serbia. This is mainly due to the number of smaller water flows not used for electricity generation thus far. A standard technology of choice for net-metering in Serbia could be generating facilities with a capacity of a few kW that have little impact on the environment, but at the same time can generate sufficient quantities of electricity to be attractive for small prosumers. In recent years, Albania, for instance, made significant progress in attracting investment in small hydropower plants with a few kW of capacity, capable of delivering electricity to customers in remote areas of the country.

It is also important to mention that there is a high level of technical knowledge in Serbia in the construction of small-scale hydropower, which facilitate the implementation of this technology in the country.
2.2 Metering Technologies

The electromechanical meters used throughout the former Yugoslavia initially enabled bidirectional flow of electricity and rotation of metering disks. This approach enabled an easy introduction of pure net-metering. However, due to problems among utilities related to meter tampering and thefts, bidirectional rotation of meter disks has largely been discontinued. In addition to measuring amounts of net-electricity during the billing period, smart meters provide the possibility of gathering other types of information, like measuring bidirectional electricity flow, measuring delivery/consumption of electricity during different tariff schemes with time-of-use tariffs, adjusting to different metering and billing periods, enabling remote metering and supply management, and directly communicating with the consumer.

These advantages of smart meters over standard mechanical meters are the main reasons that the EU is requiring Member States to install smart meters, so that they will constitute 80% of all meters by 2020. Serbia has accepted this obligation\(^1\).

2.3 EU Rules Concerning Self-Consumption

Promotion of self-consumption in EU countries will be additionally regulated by the current Proposal for a Directive of the European Parliament and of the Council on the promotion of the use of electricity from renewable sources\(^2\) (recast) of 23.02.2017. In Article 21, the proposal introduces a “renewable self-consumer” as being an active customer who consumes and who also may generate, store, and sell renewable electricity which is generated within its premises, including in a multiapartment block. Among others, this proposal provides that the administrative procedures for obtaining such status should not be overly laborious. It also places a threshold concerning the amounts of electricity that can be sold under preferential conditions (an annual 10 MWh for households and 500 MWh for legal persons). In addition, it requires that the price for such sources should reflect the market value of electricity fed from the grid.

For the purpose of this study and in terms of the National Indicative Target (NIT) for Serbia, it is important to emphasize that—according to the Article 7 (previously: Article 5 of the Directive 2009/28/Energy Commission), sub-article 2 of the proposal—when calculating gross final consumption from RES sources, electricity from renewable self-consumers shall be taken into account in the process of establishing the extent of meeting NIT. This is worth stressing, because net metering can help Serbia attain its binding target of RES in its gross final energy consumption, totaling 27% by 2020 (i.e., Serbia’s NIT).

2.4 Commercial and Economic Aspects of Net-Metering

2.4.1 BENEFITS FOR PROSUMERS

There are numerous economic advantages of net-metering for prosumers. By generating their own electricity, the prosumer lowers their energy costs by purchasing less electricity from the network. They also avoid additional delivery-associated charges including:

- network or supplier charges;
- taxes imposed on electricity withdrawn from the network by the state.

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\(^1\) Energy Law of the Republic of Serbia, article 138.
Prosumers may also benefit by receiving income for the excess electricity that they sell to the network. In some countries, prosumers are exempted from paying taxes on this income stream. For instance, in Luxembourg, income from the sale of electricity generated by solar PV systems with a capacity of up to 4 kW is exempted from income tax. Another example is Poland, where a 20% excise tax is levied on the sale of electricity to end-users, but the electricity from RES prosumers is exempt from this tax.

2.4.2 BENEFITS FOR NETWORK COMPANIES

For network companies there are technical advantages such as increased security of supply through distributed generation, and economic benefits such as the decreased need for investment into large-scale electricity generation. Large-scale incumbents in the electricity sector often raise the question of fairness of net-metering compared to net billing, specifically in terms of network charges. At first glance, it may seem unfair that distribution network companies are paid based on netted electricity, because they had to transmit and/or distribute all the electricity fed into the network by a prosumer. Therefore, they are apparently deprived of payment equal to the difference between electricity consumed and netted (namely electricity injected into the network). However, it must be borne in mind that the electricity injected by a prosumer into the network is consumed locally by other, neighboring consumers; at the end of the day, the delivery will be billed to these other consumers. Since the bill will include all other elements, including network charges, the network company is indeed getting paid and does not necessarily have to incur many costs related to such consumption (such as losses from or investment into higher capacity regional networks).

Another problem that traditional distribution companies raise is that net-metering results in an increased need for the local network to be upgraded or expanded to enable it to accept more capacity delivered, which constitutes an additional cost for them. However, net-metered electricity is largely used locally (up to the same transformer station, in most cases). Some studies indicate that net-metering generally has a very positive impact on the limitation of distribution losses. More precisely, distributed self-generation decreases the electricity flows in the networks prior to the transformer to which the prosumer is connected, compared to increased flows caused by additional centralized generation. For instance, according to an EU solar PV parity study loss reduction in certain cases may amount to between 0.25% and 0.75%, depending on the characteristics of the distribution networks.

It is important to note that the customer fixed network charges will remain unchanged, notwithstanding the actual decreased amounts of electricity hauled over longer distances, and still required to be paid by prosumers. These charges are calculated based on a fixed investment cost incurred due to increasing network capacities. Since the capacities will remain broadly unaffected, similarly, fixed network charges should remain unchanged, too.

Even in cases where the network charges are partly or wholly variable, fixed cost is going to be factored into these charges; as such, these costs may not be avoided by end users consuming electricity they generate from RES. Therefore, notwithstanding embedding the prosumers, income of the network companies may remain largely unaffected.

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2 RES Legal, last update 22.07.2016.
3 It is worth noting on this occasion that the excise tax in Serbia amounts to 7.5%.
2.5 Administrative and Authorization Procedures

Complex, time-consuming, and burdensome administrative and authorization procedures still represent an important barrier for the competitiveness of RES projects, specifically small-scale self-consumption projects such as private households or very small businesses. Administrative barriers, in general, involve additional development costs stemming from uncertainty, which have a negative impact on RES projects characterized by higher per-unit capital costs, compared to conventional energy projects.

With rapidly declining RES technology costs, including for small-scale systems, administrative processes are proportionally gaining weight in the overall costs for implementing net-metered RES. Obstacles commonly include:

- administrative procedures related to integration of net-metered installations in spatial and environmental planning;
- network connection and related contractual obligations; and,
- licensing/permitting procedures often required of this type of project.

To facilitate market access for new entrants, in particular SMEs and other small-scale projects, the EU Renewable Energy Directive⁵ obliges Member States to simplify procedures, increase transparency, and ensure coordination among involved authorities in charge of authorization procedures. As stated earlier, this directive may be replaced in the near future with even stricter provisions.

2.6 Network Regulation and Infrastructure

With regard to the electricity network, barriers for small-scale, net-metered RES projects at the local level usually occur in the following two areas:

- Network connection: Poor condition of the (distribution) network and/or capacity saturation; lack of clear rules and responsibilities covering network reinforcement/expansion and connection cost responsibility, lack of transparency and lengthy network connection procedures, and weak or lack of enforcement of net-metered RES producers’ rights.

- Network development: Lack of clear network development plans, lack of rules for the allocation of various costs, and high connection costs in general, especially when related to the obligation of advance payments.

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3 NET-METERING MODELS

Net-metering models around the world comprise numerous characteristics, and each particular model uses various solutions for the consumption. The solutions may differ, for instance, with regard to the way net-energy is metered and balances are calculated, and in relation to metering and billing periods, amounts of netted energy allowed to be injected into the network, pricing models, institutions responsible for administration of the net-metering system, and applicable taxes and levies.

Section 3 of this report focuses on these issues and, where relevant, the different methods of addressing them.

3.1 Types of Energy Metering

The type of energy measurement applied in a net-metering system constitutes a very important element, because it may significantly influence the availability of different billing and payment methods. Energy measurements may also impact the calculation of quantities of electricity produced and therefore the value of the net-metering system to an electricity consumer, which may influence their desire to use the system.

Historically, electromechanical meters were able to measure the electricity flow in one direction only. As such, it was necessary to install two meters working in parallel—one measuring the consumption of the customer and the other measuring the electricity injected into the grid by the consumer. The net-metering amount was then calculated as a simple difference between the two meters. However, in some cases, there were also electromechanical meters that could measure net-electricity only by way of so called “counter-spinning”. These meters were not considered reliable and excluded the possibility of cross-checking for meter tampering or meter faults.

Modern smart meters are capable of eliminating all the aforementioned problems and providing various additional functionalities such as remote reading, testing and management, and providing end-users with online information concerning consumption via laptop or smartphone. Since smart meters are capable of measuring the electricity flows bidirectionally and present their difference (net value) online, they are also ideal for net-metering. This automatic calculation eliminates the need for calculating the net value, which simplifies the billing process as well. Smart meters also acquire data on electricity flows measured in both directions, and this information may be used also for other data collection and important statistical gathering purposes.

3.2 Time-of-Use Tariffs and Net-Metering

Besides differences in technological solutions available for net-metering, there is also an additional factor influencing net-metering solutions related to energy tariff schedules, as applied in a particular country. For householders or SMEs, there are two common tariff solutions: (1) single universal tariff and (2) time-of-use tariffs, where a double-zone tariff is the most common model. The single universal tariff model, which covers a single zone, does not require any specific off-setting measure or financial calculations. The tariff is based on automatic net measurements and a single electricity price. At the end of a measurement period (or at the end of billing period), metered value is obtained by reading net-energy from an automatic meter. The meter measures and acquires data on the energy flows in both directions, which may be used
for statistical and similar purposes (for instance, to establish the level of attainment of NIT). In time-of-use models, consumers are typically charged differently for electricity consumed during peak and off-peak hours. The latter model encompasses automatic net value measurement for each time-of-use electricity tariff and application of different prices of electricity to different time of use zones.

In the context of Serbia, the simple, single-time-zone net-metering may be used for customers using a single-zone tariff. However, it is likely that most customers who decide to use net-metering and solar PV will opt for the two-time-zone tariff to save on electricity bills during night-time consumption. In Serbia, the most common time-of-use tariffs include different prices of electricity during various periods of the day, and the process of netting becomes more complex. The metering agent must keep records, perform calculations, and offset electricity consumption separately for different tariff periods. In such cases, instead of pure net-metering, or its variations, it may be more feasible to use the net-billing model. Net-billing allows for converting electricity into money flows and vice versa and makes it is easier to maintain the settlements since only the financial flows are netted.

### 3.3 Billing Period

Prosumers are very sensitive to the length of a billing period. In most cases, net-metered generation is based on some type of RES being a source of primary energy. RES generation varies (sometimes wildly) during the year depending on weather conditions. With solar PV, there is also an absolute dependence on the period of day when electricity may be generated. Therefore, periods of highest generation and highest consumption rarely match precisely, except in some cases with SMEs. In the case of a household as prosumer with solar PV being the generation source, both consumption and generation almost never match.

Thus, it is more beneficial for a prosumer if the billing period is longer (one year, ideally). This approach allows for most or all surplus electricity generated to be credited to the forthcoming billing periods and consumed at periods when generation is insufficient to cover needs. However, this option needs to be supported by a specific billing mode, with electricity netted every month. In case of surplus consumption, the prosumer is billed for the net electricity consumed using the retail tariff. While in instances where the injected electricity exceeds the consumption, the prosumer does not get paid for that month, but instead the surplus production is transferred into the next billing period. At the end of the year, the accounting is reconciled; if it indicates a surplus of production, the prosumer is reimbursed based on a pre-agreed tariff, applicable feed-in-tariff (FiT), or according to the rules in place in a specific country. If the result of the final calculation is opposite and shows a total net consumption, the prosumer is obliged to pay for the electricity, similar to any other consumer.

At the other end of the spectrum lies a system where the billing/netting periods are short. This system is beneficial to the incumbent electricity operators. In the most extreme cases, there is no carrying forward of surplus electricity production into subsequent periods. Instead, the surplus is lost at the end of a period, and there may not be any reimbursement whatsoever for the surplus of production over the consumption. So, while any surplus should be compensated as early as possible (i.e. ideally, within the next period), because there might remain some excess left that carries forward to the following period (and then to successive following periods), the longer the overall compensation period allowed, the better – because it increases the chance for the prosumer to retain the benefit.

### 3.4 Pricing Excess Electricity

Commonly, different prices may be used for net-metered excess electricity, as follows:
**FiT price:** This pricing is similar to a classic RES support mechanism. The main principle in applying a feed-in-tariff approach is the overarching assumption that prosumers are using RES generation, so a FiT is applied to avoid discrimination between different generators that produce electricity from the same type of RES. In other words, if one group of generators (companies/owners of RES facilities) enjoys a certain price for their electricity, it would be unfair to offer others a different (lower) tariff for the same electricity. Apart from that, in recent years, particularly in the EU, electricity prices have tended to converge, including in cross-border and RES terms. Therefore, there is a steady tendency of converging with the general tariff structures or even abandoning FiTs altogether.

**Wholesale electricity market price:** This approach is used in some regulatory regimes. The price is usually calculated as an average of the wholesale electricity price during a prior defined period (from one week to one year). It may be corrected down with the supplier’s costs of trading on the energy market, taxes, and other surcharges, among others. A very important advantage of this type of excess electricity price is that the wholesale price is directly related to market prices, and it doesn’t require any specific regulatory cost of service studies. Self-consumption schemes that use this method are more market-oriented compared to other systems with regulated prices, because the prices are generally mirroring the day-ahead market.

Using the wholesale price is particularly suitable for net-metering and net-billing schemes. This is because it is the price that the supplier would have to pay to the traditional generator anyway for traditionally produced electricity. Given that, it does not make much difference to the supplier from a financial point of view. On the other hand, the supplier will invoice other consumers (who consumed the electricity delivered by the prosumer) for as much as it paid to the prosumer without having to take on any additional financial risk.

The only additional burden on the supplier is apparently constituted by the need for additional administration of quantities of excess electricity. This cost, however, is paid for indirectly, because the supplier pays wholesale prices to the prosumer (for the excess electricity), while at the same time invoices consumers using a retail price. The difference between these two prices is the supplier’s extra income, which equals the income obtained by purchasing the electricity on the market.

With this method of using the wholesale price, neither network companies nor the state (collecting taxes and levies) are affected. Excess electricity delivered by prosumers appears on bills of other consumers who pay all the applicable network and other costs despite the produced electricity having not traversed the transmission grid and minimally influencing the distribution network.

**Retail price of electricity:** This is the price of electricity invoiced by the supplier, including volumetric network charges, taxes, and levies. The retail price is one of the highest prices for excess electricity applied in self-consumption schemes. It is usually applied in cases where the public policy is to increase self-consumption levels notwithstanding the higher cost (which is a common concern in Australia, for instance). However, usually such systems require some subsidization or concession from the state (for instance, the state’s agreement on refraining from charging the applicable taxes). As mentioned earlier, compensating net-metering customers for their excess energy at the utility’s full retail rate is increasingly seen as a subsidy for net-metered customers.

**Excess electricity is not paid at all (price equals zero):** This approach is not particularly common. The primary reasons for applying this system are as follows:
Not paying anything for excess electricity greatly simplifies the procedures and decreases the burden of self-consumption on the traditional electricity sector incumbents, because any excess electricity received provides a source of income for the distribution or supply company, reducing its cost of purchased electricity. Another reason for introducing this system is to discourage prosumers from generating too much excess electricity, i.e., to increase the level of self-consumption. It appears that the proposed new EU directive mentioned in section 2.3 is taking this direction. Croatia, to some extent, has already implemented this approach, because large electricity production surpluses are penalized by decreasing payments (see the Croatia overview in section 4). When applying this system, there is no need to set up any restrictions on installed capacities.

To not discourage self-consumption completely, this system is usually combined with longer netting timeframes, typically a quarter or a year. Thus, the longer netting timeframe becomes a kind of compensation for lack of payment for excess electricity.

Typically, in countries where retail prices are high, even the prices reduced for network charges, taxes, and levies are high enough to make a self-consumption system viable for prosumers. In cases where prices are low (for instance in many hydro-based electricity systems), it may be necessary for the government to offer some additional incentives to attract the investment. It is important to stress that, in any event, any price lower than the FiT will make the net-metering system cheaper than classical RES FiT-based support systems.

3.5 Net-Metering System Managing Agent

The two most popular options in terms of which entity should be charged with managing the net-metering system are the supplier or the market operator. Engaging the supplier is the most common solution, but efficient only with pure net-metering or net-billing and where the price of excess electricity is lower than or equal to the retail price. In cases were the price of excess-produced electricity differs from the supplier’s (retail) price, excess electricity may become the source of additional income or loss to the supplier, thus increasing risks and unwillingness to engage in the system. Having the supplier be the managing agent also increases the complexity of accounting for variously valued electricity, thus increasing the supplier’s costs.

For these reasons, in cases where the price of surplus electricity is different from the retail price, it is a common approach to use the market operator to perform the role of managing entities. Since market operators deal with a multitude of similar daily operations, it is the most natural solution to engage them for administration of net-metering.
4 INTERNATIONAL PRACTICES

Although it has existed for around 25 years, net-metering is still a relatively novel concept around the world. There is no standard model applicable across those countries that have adopted forms of net-metering, including in the EU, and policies towards net-metering vary widely. This means that Serbia has an excellent opportunity to develop its own model precisely tailored to its own needs.

Since self-consumption often modifies, mixes, or changes completely traditionally occupied positions and responsibilities of incumbent stakeholders in the sector, energy sector authorities very often hesitate to involve themselves in such reforms. Even in cases when they do engage, it is usually done so with precaution. Despite these reservations, net-metering is often welcomed and opens a whole range of new prospects for modern energy sectors. For instance, owing to its generally pro-RE sourcing policies (including enabling prosumers to operate), the share of RES in total electricity production in the EU is estimated to have reached 28.3% in 2015. In the context of developments currently surrounding traditional electricity sectors, different countries keep introducing net-metering in ways that fit best their local circumstances. The available options also depend on technical capabilities such as the metering system applied, the actual electricity sector design, or the financial situation. In sum, there are no pre-established best standards developed, and each country chooses its own way of introducing net-metering.

To facilitate Serbia’s own definition of net-metering system, a review of solutions applied throughout the world is presented in the following sections. These observations should help inform Serbia to develop its own most appropriate model applicable to its own conditions. The experience of countries in the most immediate region, e.g., those of the former Yugoslavia, which have either recently entered the EU, or are on a trajectory to enter the EU within the foreseeable future are particularly insightful for Serbia. Other European nations that have had longer experience with net-metering or other forms of self-consumption are also interesting from the perspective of reviewing the diverse ways that EU countries comply with energy requirements.

The U.S. leads in many energy and net-metering cutting edge areas. However, rapid uptake of net-metering by prosumers has led to some backlash by traditional energy operators, to the extent where some states, after initial trials and tests, decided to halt or significantly alter the idea of net-metering As there is no single solution fitting all U.S. states, and in view of the quite significant differences between the U.S. and Serbia (such as infrastructure quality, regulatory approach, level of regulatory advancement and complexity, history of state control of the energy sector in Serbia, level of prices paid by consumers for electricity in Serbia), the project decided to concentrate on the two most advanced states in terms of net-metering, California and New York. Further, it examines those features (such as valuation of electricity in different time zones), which are also useful in the European context, and are applicable to Serbia to the extent that they are compliant with the EU acquis communautaire and/or the policies of the Energy Community.

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The review includes EU countries (Belgium, Cyprus, France, Germany, Greece, Italy, Spain), the Balkans (Albania, Croatia, Slovenia, Montenegro) and the United States (California, New York).

**General Observations**

Self-consumption is allowed in all countries reviewed. Similarly, there are nearly no prohibitions regarding the possibility of connecting the generator to the electricity delivery system, usually the distribution network. The only restrictions faced are purely technical and deal with influence on technical quality of supply such as voltage variations, flickers, and power exceeding the contracted capacities.

Most countries do not possess and/or do not make publicly available the exact information concerning quantities of self-consumed electricity (both RES and conventional electricity). Where available, the estimates range between less than 1% (Sweden) and up to 11% (Germany). Malta indicates a share of 23% of self-consumed solar PV electricity.

### 4.1 Croatia

**Legal Aspect**

The Croatian Law on RES and combined heat and power (Zakon o obnovljivim izvorima energije i visokoučinkovitoj kogeneraciji, NN 100/15, 123/16, 131/17 – effective since 29.12.2017) defines the term “final consumers with own generation”. Based on that Law, the electricity supplier is obliged to sign a contract to purchase any excess electricity injected into the grid with each consumer that wishes to become a prosumer.

In addition to that, any prosumer should obtain the status of a “privileged generator,” which is granted by the Croatian Energy Regulatory Agency. The conditions that must be met to obtain this status are not complicated and require the following: that the electricity is generated from RES, that the generator is equipped with adequate metering equipment, and that the prosumer obtains a construction permit and presents proof concerning property ownership.

**Technical Aspect**

Prosumers’ capacity in the ‘direction of injection’ shall not exceed the load in the direction of consumption. The maximum power allowed for such generators amounts to 500 kW. The connection point for both the consumption and injection of the electricity must be the same.

There are no restrictions on the type of primary electricity source used for net-metering purposes.

The only requirement concerning metering is that a single meter is in place at the connection point that measures electricity injected into and retrieved from the grid, thus making installation of electronic smart meters obligatory.

**Financial Aspect**

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The billing model defines that a meter separately measures and stores the data on consumed and injected electricity in 15-minute intervals. At the end of the month, the amounts of consumed and injected energy are separately summarized.

The billing process is performed in three steps:

1. **Price of consumed electricity.**

   For single tariff customers, there is a single price for consumed electricity. For double-tariff customers, an average price of consumed electricity is calculated by 1) multiplying the amount of electricity consumed during higher/lower tariff zones by the corresponding tariffs, 2) adding these totals, and 3) dividing that value by the total electricity consumed.

2. **Price of injected electricity.**

   The ratio between consumed and injected electricity for the month is determined, and the price of injected electricity is calculated in one of the two following ways:
   
   - If the amount of consumed electricity is higher than the injected, then the injected electricity is valued at the average price of electricity (i.e. without the network charges, taxes etc.) for that month, multiplied by a coefficient of 0.9.
   
   - If the amount of injected electricity is higher than that consumed, then the value of injected electricity is calculated as above (i.e., 0.9*average electricity price), and further multiplied by the ratio of consumed to injected electricity (i.e., 0.9*average electricity price * electricity consumed/electricity injected). In effect, this leads to deeper discounting of the price of electricity injected. The fact that the calculated value of injected electricity remains the same, leads to the conclusion that the higher the amount of excess electricity, the lower the average calculated price for injected electricity becomes.

3. **Monthly Bill to customers**

   A customer’s monthly bill is calculated as the difference between the value of the consumed electricity (total consumed multiplied by the average price), and the value of injected electricity (total injected multiplied by price calculated in 2. above).

   For example, for single tariff customers, if \( x = \) consumed electricity, \( y = \) injected electricity and \( p = \) average price;
   
   - when \( x > y \), customer is billed \( P = px - 0.9py \)
   
   - when \( y > x \), customer is billed \( P = px - (0.9p(x/y)y) = 0.1px \)

The aforementioned billing method, to our best knowledge, applied exclusively in the Croatian net-metering model. The primary purpose of this methodology is to discourage generation of electricity which drastically exceeds the consumption.

Croatia has deregulated its electricity prices (i.e., all prices, except prices of the public supplier of last resort, are not approved by the regulator). Therefore, the prices used for calculation of the value of injected electricity depend on the actual prices used by each particular supplier in its supply contract. For instance, in case of the public supplier (HEP-Elektra) the price amounts to approximately €0.06–€0.065 €/kWh (depending on the proportion between amounts of electricity consumed in higher- and lower-tariff time zones by a particular consumer). For those
using the flat-rate across the day, the price amounts to €.062/kWh. In addition, there are no exemptions from network charges, taxes, or surcharges for RES for prosumers.

4.2 Slovenia

**Legal Aspect**
In December 2015 Slovenia adopted Decree on self-supply of electricity from RES that regulates a net-metering program. The provisions of the Decree entered into force in January 2016.

The net-metering support scheme is available for households and small businesses. The goal of the policy is not to encourage electricity production for sale but for self-consumption, hence if at the end of the calendar year there was more electricity sent to the grid than acquired, the surplus will not be remunerated.

**Technical Aspect**
This scheme is applied to domestic and small commercial customers with RES electricity installations (solar PV, wind, and hydropower plants) up to 11 kVA for the purposes of self-consumption (with an aim of securing self-sufficiency of households). The annual limit for new capacities is 7 MVA for households and 3 MVA for SMEs. While the limits are set as total capacities for the whole country, government policy is to stimulate household, more than SME, self-consumption. The quantities of electricity consumed from the grid and injected to the grid are settled (netted) on an annual basis.

There are no restrictions regarding technologies applied, which means that all RES installations within the prescribed capacity limits are eligible to participate in net-metering. Installations participating in net-metering are not allowed to benefit from any other support schemes, i.e., FiT and premium tariff support. Further, the legislation in place requires installation of two meters (i.e., one measuring electricity produced by the RES installation and one measuring electricity taken from the grid).

**Financial Aspect**
Prosumers who consume more than they inject over the course of the year (net consumers) pay electricity costs, network charges, and levies only for the difference between withdrawn and injected electricity. The prosumers who in an annual perspective become net producers (i.e., have a surplus) pay no network charges but receive no payment for the annual surplus electricity injected into the grid. Such measures are adopted to encourage and promote installation of new RES generation small-scale units, but also to discourage prosumers from generating amounts of electricity that exceeds their annual electricity consumption.

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4.3 Albania

**Legal Aspect**

Albania long ago established legislation promoting investment in small electricity generation sources, and the country has been quite successful in attracting investment into such sources. In general, a simple authorization is needed for sources of capacity between 500 kW and 1 MW, while a simplified licensing regime applies to capacities of up to 2 MW in solar PV, up to 3 MW in wind, and up to 15 MW in small hydropower.

As a result of this supportive approach, in less than a decade, Albania managed to increase production from small, private generation sources (mainly small hydropower) from nearly zero in 2007 to more than 1.6 TWh in 2017, with privately generated electricity now nearing 36% share in the total of nationally generated electricity. Should this shift have not occurred, Albania would currently face a grave situation concerning the need for greater electricity imports.

Despite this apparent successful policy, on February 2, 2017, the Albanian Parliament adopted Law No 7/2017 On the Promotion of the Use of Energy from Renewable Sources, published in the Official Gazette No 26/2017. This law introduces small-scale net-metering into Albania’s electricity sector, with “net electricity metering schemes” based on bidirectional measurement of flows for SMEs or household customers. The capacity threshold for such net-metered prosumers is up to 500 kW. No authorization or licensing regime applies to such sources, and consumers must only sign a connection agreement with OSHEE, the Albanian Electricity Power Distribution System Operator, (in the case of new connections) and electricity purchase. The contract execution process usually takes approximately 15 business days.

The new law foresees that the surplus of electricity higher than monthly consumption is sold to OSHEE, which is charged with the duty of public service, using the feed-in prices established by Enti Rregullator i Energjise (ERE, Albanian Energy Regulator Authority). Net balancing and billing are performed on a monthly basis, with each unit measuring the flows separately (should there be more than one point of connection).

The Albanian Ministry of Infrastructure and Energy is responsible for approval of a facilitating procedure for connecting small RE projects to the network and most of this secondary legislation is already adopted, or well underway.

**Technical Aspect**

Pursuant to this new legislation, any SME or household consumer may install generating assets comprising solar PV or wind up to a capacity of 500 kW. SMEs or household consumers may use these assets to produce electricity from solar or wind energy to cover their entire or partial electricity needs and may inject any surplus electricity produced into the distribution network. Consumers are required to install, at their own expense, a bidirectional electricity meter and complete the last-mile connection (in case of new installations). In case of a typical small business connection, with a forecast relatively low load, the cost of the whole system would amount to approximately €850, while for the household the cost would be slightly lower.

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At the same time, the network operator in accordance with the network code and supporting regulations approved by ERE, upon request of a prosumer, must propose a priority connection to the point of the network most favorable in terms of connection completion cost and distance. Network operators must also provide any prosumer wishing to be connected to the system with comprehensive information required, which at a minimum includes comprehensive and detailed estimate of costs associated with the connection, detailed timetable describing the process for receiving and processing the request for connection, and any reasonable alternative grid connection points that may be used for the purpose. Should the operator at a later date introduce any amendments, including assigning a different connection point, it will bear the responsibility for covering any resulting additional costs to the prosumer. The network operator shall cover the costs of optimizing, strengthening, and expanding the network upstream (so implicitly, such costs, if any, are added to the commonly paid use-of-network tariffs).

As of now the Operatori I Sistemi te Transmetimit (Albanian Transmission System Operator) has all metering points equipped with smart meters. On the other hand, OSHEE, the DSO, is currently implementing a project financed by the World Bank aimed at updating its metering points with smart meters nationwide. The total number of consumers connected at low voltage totals 1,205,422. This includes 1,047,195 households and 158,227 SME/commercial enterprises. As at the end of 2017, some 129,000 smart meters had been installed. Smart metering is being introduced, commencing with largest customers followed by smaller customers. The project is ongoing, and more meters are being installed. Full implementation of smart metering will create better technical conditions for connecting RES prosumers and will facilitate introduction of the Albanian net-metering scheme.

**Financial Aspect**

Net balancing and billing are conducted on a monthly basis. The surplus electricity exceeding monthly consumption is obligatorily (by the law) purchased by the universal supplier, according to the feed-in prices established by ERE. Currently the prices approved for solar generation are €100/MWh and for wind generation €76/MWh.

Additionally, investment into small-scale generation is supported by convenient loans covering up to 60% of total investment value.

### 4.4 Montenegro

**Legal Aspect**

The Montenegro Energy Law of May 2010 provided for "exchange at the place of connection," which is the equivalent of net-metering. Similar provisions were also included in the Energy Law as of 20 January 2016 (Official Gazette nr. 5/2016). All types of RES and combined heat and power (CHP) schemes are permitted, but the capacity is limited to 50 kW (previously 20 kW). The formulation of Article 96 of the Energy Law, according to which a final customer is “allowed to exchange electricity injected into and taken from the distribution system,” establishes a sort of pure net-metering system.

There is no limit to the amount of electricity produced. The 2010 law clearly defined “year” as a billing period. Under the 2016 law, it is unclear what constitutes an actual billing period, because the new law only defines one month as being a metering period, which is not necessarily the

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same as a billing period. However, since in another part of the 2016 law, "billing month" is mentioned, it may be interpreted to indicate a billing period. This ambiguous phrasing leaves a considerable area for interpretation by various stakeholders and operators, leaving the potential prosumer facing considerable risk, as stakeholders will likely interpret rules according to their best interests.

The following three entities must sign the contract: (1) consumer (prosumer); (2) Crnogorski Elektrodiistributivni Sistem (CEDIS), the DSO; and (3) supplier. The DSO is obliged to sign the contract with a consumer interested to become prosumer and to install a meter enabling separate metering for both directions of electricity flow. Since the EU-imposed obligation related to installation of 80% of smart meters is already almost completed in Montenegro, technically the system will be practically ready to accommodate any interested consumer with regard to the necessary equipment. However, the software installed at CEDIS does not include all components necessary for enabling net-metering, and certain upgrades will have to be completed to enable net-metering to its full extent.

There, however, are certain gaps in Montenegrin legislation preventing from actual efficient operation of the net-metering scheme. For instance, it does not take into account the fact that there is a double-zone, time-of-use tariff and billing system in place (with lower tariffs applied to hours between 23:00 h and 7:00 h). Consequently, it is unclear how the billing should be performed, i.e., each tariff time zone is billed separately, the lower tariff time zone is billed, or a combination of these is applied. Additionally, the law does not regulate the issues concerning the procedure for obtaining the status of a prosumer, a way of calculating the final bill in case of different net-readings in each of the two tariff zones, or a body responsible for disputes resolution or authors content of the contract that the supplier should sign with the prosumer, etc. Further, the other regulations in the country, e.g., farm land protection, create a situation where only roof top installations are preferentially treated, which limits the scope for interest in solar PV.

**Technical Aspect**

Once the system is launched in 2019, every month CEDIS is expected to send information about each prosumer’s electricity consumed from and injected into the distribution grid to the supplier. The supplier will analyze this information, and in cases where the consumption is higher than injection, will invoice the consumer on netted electricity, including all other applicable components of the bill (e.g., network charges, taxes, levies etc.). Conversely, when the injected electricity exceeds that consumed, the supplier will pay the prosumer for surplus electricity (solely for the electricity component). The supplier is also obliged to take balancing responsibility for the prosumer. All technical aspects are stipulated by rules on functioning of the distribution system. These rules do not recognize any specific issues related to net-metering and prosumers, and it may be necessary to introduce some considerable changes and additions to facilitate efficient prosumer connection and operation. In addition, the average FiT in the country is €0.12/kWh (compared to an average end-user tariff of €0.10/kWh), which does not make net-metering particularly attractive.

There is no secondary net-metering legislation in Montenegro that addresses these problematic aspects. These flaws in existing rules and legislation mean that although the apparent possibility of embedding prosumers has existed for over 7 years, there are no practical results visible on the ground yet. Only a total of 15 licenses\(^\text{13}\) have so far been issued for roof top solar PV.

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\(^\text{13}\) Some developers of small systems, fearing the possible consequences of a potential moratorium by GoM on support to the RES, decided to use the "electricity company"-like paths, including obtaining the licenses and status of
projects, totaling 5.4 MW. Most of the projects are still in the early development phases (e.g., obtaining construction permits). There are nine more projects in the regulatory license issuance pipeline; if granted, these will make an additional 5.3 MW. Prosumers are not required to undergo licensing in Montenegro unless they wish to go through the support system managed by the centralized market operator (not the supplier).

The Government of Montenegro (GoM) is considering a moratorium on issuing licenses for preferentially treated RES. These considerations are at play because Montenegro already well exceeds its RES NIT of 33% share (recent GoM estimates indicate already having attained a 41.1% RES share) during 2016. A number of other approved projects are under various development and construction phases, meaning that Montenegro will greatly exceed its RES share once additional new programs commence. However, given the country’s abundance of solarity the GoM maintains that solar PV will not be subject to this moratorium yet.

**Financial Aspect**

Montenegro follows a two-zone tariff system: 07:00–23:00 and 23:00–7:00. Currently the prices approved are: for wind €96/MWh; biomass €123-€137/MWh; rooftop solar €120/MWh; solid waste €90/MWh; gas waste €80/MWh; and small hydropower €68–€104/MWh, depending on the actual capacity of the source.

Price of surplus electricity depends on the proportion between consumption during higher and lower tariff zones.

4.5 Germany

**Legal Aspect**

Germany is somehow specific and different from the other countries discussed thus far, because of its strong industrial sector with numerous factories that produce heat, using different energy sources in which the electricity is a byproduct of the CHP process. Therefore, self-consumption of electricity produced with use of RES technologies (discussed below) includes electricity generated in highly efficient CHP plants. A wide range of exemptions from taxation, levies and network charges apply to these technologies.

The Erneuerbare Energien Gesetz (EEG - Renewable Energy Sources Act), which came into force in 2000, is the engine for the expansion of RE in Germany. The EEG 2014 specified the transition from a FiT scheme to an auction system for most technologies which was completed with the current version EEG 2017. The EEG created the basis for the expansion of RE and made them one of the pillars of German power supply.

**Technical Aspect**

In Germany, self-consumption is in principle supported. Plants with a share of self-consumption are still entitled to receive the regular FiT for the excess electricity they export to the grid. In addition, self-consumed electricity is free from almost all taxes and fees. As electricity retail privileged producers in order to pre-empt the possibility of being left with stranded investment. Gaëtan Masson – IEA PVPS; Jose Ignacio Briano & Maria Jesus Baez – CREARA: IEA – PVPS - Self-consumption policies – 2016 – 2.0.

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prices are more than twice as high in comparison to the FiT for solar plants, self-consumption can be profitable at least if the self-consumed share of electricity is high enough. Since 2014 however, owners of newly installed power plants with a capacity of more than 10 kW are obliged to pay a certain percentage of the “EEG-surcharge” (levy to finance renewable support). Plant owners, not importing any electricity from the network and opting to not receive the FiT for exported electricity, are exempt from this payment. The reason behind the regulation is the argument that network expenses remain stable even if consumers partly use self-generated electricity as peak load does not change.

Financial Aspect

There are several forms of financial support for self-generation of electricity, mainly indirect and varying across regions.

According to legislation in force, all customers pay a specific RES electricity surcharge, which in 2010–2017 increased from €0.0205 to €0.069/kWh.

Until the 2014, the EEG self-generated electricity was exempt from any surcharge. However, the EC expressed concerns about the self-consumption, claiming that because electricity is consumed, it should be subject to the RES surcharge. Following that pronouncement, the EEG 2014 introduced the following rules for self-consumption of electricity:

- Uniform 40% surcharge for all new RES and CHP powerplants, with staggered introduction as follows: 30% surcharge in 2015, 35% surcharge in 2016, and 40% surcharge in 2017
- Small installations with an installed capacity of up to 10 kW remain exempted from paying the EEG surcharge for the first 10 MWh of self-consumed power
- No EEG surcharge for RES and CHP self-consumption from plants existing at the time of 2014 EEG was enacted
- Self-consumption privilege remains in force for all modernizations of existing plants, provided the installed capacity does not increase by more than 30%
- Self-consumption from new conventional installations, which commenced operations after August 2014, is subject to 100% payment of the RES surcharge but remains exempted from network charges and taxes.

A range of dedicated financing programs are in place for investors in RES installations from KfW, state-owned credit bank. There are two models of payment for excess RES electricity. The first model is payment with a defined FiT, while the second model is referred to as “market integration model”, which comprises electricity market prices with added premium, such as feed-in-premiums [FiPs]).

According to the 2014 EEG, metering of self-generated electricity is performed by way of separate measurement of the volumes of generated electricity: (surplus) electricity injected into the grid and electricity taken from the grid.

4.6 France

Legal Aspect

France has introduced a scheme where prosumers connected to the grid may generate, self-consume, and inject excess electricity into the network. There is no net-metering scheme, and surplus electricity is paid based on the applicable FiT or by tender specifications. The value of compensation for solar PV under the FiT scheme varies from €0.0662/kWh to €0.2655/kWh, depending on the size of installation (the bigger the installation, the lower the FiT). Almost all RES electricity is sold through FiT rather than self-consumed because FiT prices are higher than retail ones.

In case of collective self-consumption, generators and consumers must establish a trading relationship via a specific company, a special purpose vehicle. Self-consumption is exempted from taxes, and such installations are also free of network access cost. Recently adopted legislation provides for organizing a tender for prosumers to receive a bonus on self-consumption, but it applies only to systems of 100-500 kW of capacity. The first tender was organized during the second half of 2016.

**Technical Aspect**

Technical distribution code rules currently require installation of two meters, to measure the electricity fed into the grid and consumed from the grid (i.e., in the case of surplus). The process of installing smart meters, which are capable of measuring electricity bidirectional flow, is ongoing, and prosumers are given priority for that roll-out.

**Financial Aspect**

The orders for the specific technologies determine each FiT for a certain source of energy. Currently the prices approved for the different RES are:

- Wind: €ct (cent) 23/kWh for all plants during the first 10 years and then between €ct 5-23 /kWh for the next five years, depending on the overall time of operation per year.

- Solar: The tariff applies to PV installations and plants below a maximum power capacity of 100 kW fixed on buildings. The tariffs depend on the type and the total capacity of the installation, without distinction of the use of the building. Every quarter, the French regulatory authority will publish the changes in tariff levels online for each quarter. The tariffs are published at the following addresses: [www.cre.fr/operateurs/producteurs/obligations-d-achat](http://www.cre.fr/operateurs/producteurs/obligations-d-achat)

- Biogas: plants with a capacity of ≤ 80 kW: €ct 17.5/kWh; plants with a capacity of ≥ 500 kW: €ct 15/kWh and the values for plants between 80 kW and 500 kW are calculated by linear interpolation.

- Hydro: varies between € 80/MWh - €182/MWh depending on the plant’s location and type.

**4.7 Italy**

**Legal Aspect**
Italian RES electricity generators are subject to different options regarding payment method, such as *tariffa onnicomprensiva*, the sale of electricity in the free market or in the market governed by Ritiro Dedicato, the Premium Tariff I or the Tendering Scheme.

The Italian regulator’s estimates indicate that approximately 35% of total production of solar PV plants, 60% of total production of thermal plants, 10% of total production of wind plants, and 25% of total production of hydro plants is consumed through different self-consumption schemes.

The Italian Government subsidizes solar PV plants installed on buildings in the form of subtraction of taxes from the taxation base (equal to 50% of the investment costs, up to a maximum cost of €96,000). No network charges are applicable to self-consumed electricity from installations below 20 kW.

**Technical Aspect**

Legislation provides for obligatory metering through two meters. One meter measures only the generated electricity; the other meter measures electricity injected into and withdrawn from the grid. Self-consumption is then calculated using an appropriate algorithm. The national regulatory authority’s defining rules to calculate self-consumption.

Net-metering currently applies to prosumers with RES plants up to 500 kW or high efficiency CHP plants up to 200 kW. Previously, these limits were significantly lower (20 kW–200 kW) until 2015. The net-metering rule also applies to hybrid generators, to the extent that the non-RES energy share in generation portfolio is lower than 5%.

Another specific feature of Italian system is that electricity must be supplied to and received from the same connection point, with exemption of smaller municipalities (less than 20,000 inhabitants) and the Defense Ministry, which may use different connection points to supply and receive electricity.

**Financial Aspect**

Self-consumption system in Italy is based on economic compensation model, called Scambio sul posto. It is a form of net-billing based on market price of electricity (energy quota) and cost of network services, i.e., network charges (service quota). The system functions in that electricity withdrawn from the grid is first bought by each final customer from a supplier. Then Gestore dei Servizi Energetici S.p.A, a power services operator, pays the generator a fee equal to the market value of electricity injected into the grid (market value of electricity withdrawn from the grid), increased by the network charges and general system charges. The balance of these operations is calculated once a year.

### 4.8 Spain

**Legal Aspect**

Spain created its own model of self-consumption, which relates to solar PV generation. The model applied is neither net-metering nor net-billing.

The Real Decreto RD 413/2014 was approved to regulate the specific compensation regime or premium tariff, aiming at supporting RE plants. The Real Decretos 359/2017 and 650/2017 set

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each one a call for the allocation of the specific compensation regime for new RE plants located in the mainland electricity system.

In 2015 Real Decreto 900/2015 was approved, establishing charges on existing and new self-consumption RES plants, both on capacity and generation levels. According to RD 900/2015 these are not taxes or compensation for utility losses, but contributions to overall system costs. Self-consumption installations under 10 kW and plants located not on the Spanish mainland will be spared the generation charge but will still be subject to a fixed charge per kW of capacity.

**Technical Aspect**

All prosumers are obliged to install two bidirectional meters to measure all energies fluctuating from, to, and within prosumers installation. This requirement, however, is necessitated solely because of the quite complicated system of different electricity taxes in Spain.

**Financial Aspect**

The generation of electricity from RES was promoted through a price regulation system. Plant operators could choose between a FiT and a bonus, which is paid on top of the electricity price achieved in the wholesale market.

Prosumers are divided into two groups, depending on installed capacity. Installed capacity limit for the first group amounts to 100 kW. Prosumers are allowed to produce electricity and inject excess electricity into the grid, but injected electricity is not paid for. The only benefit for these prosumers derives from self-consumed electricity (which is net of all charges, taxes, etc.). The excess injected into the grid benefits the distribution company. Prosumers of this type (size) are households and small commercial consumers. In Spanish circumstances (number of sunny days and usual working hours), such prosumers self-consume between 33% and 41% of generated electricity. Taking into account the fact that they are not being paid for the injected electricity, this group of prosumers apparently benefit from only approximately one third (on average) of their generated electricity. Thus, the main benefit to this group’s consumers is avoidance of a relatively high retail price of electricity, which they otherwise would have to pay (€0.24/kWh). The savings from decreased consumption of electricity from the grid may be sufficiently high to attract the investment. The average cost of installation of a small solar PV system in Spain amounts to €2,070/kWp.

The second group of prosumers consists of those whose installed capacity exceeds 100 kW. They are treated as any other electricity producers, i.e., they may sell the excess electricity at wholesale price. They also have to pay the grid-access charge for generators and generator taxes like any other producer. This group includes commercial and industrial consumers (consumption of 20–500 MWh/year), whose tariffs mean lower electricity prices (€0.12–0.16 /kWh). However, because of the much larger solar PV assets they normally install, prosumers in this group report lower installation costs, amounting to €1,260/kWp. These prosumers also self-consume a significantly higher part of the generated electricity. In Spanish conditions, consumption ranges between 41% up to 75%. An additional benefit for these prosumers (noting that they sell electricity using the market price) is that they are mainly equipped with solar PV installations that produce most of the electricity during daily hours, allowing them to obtain significantly higher prices than the average daily price (base price) on the electricity market.

Additionally, both groups of prosumers are obliged to pay a specific backup charge based on self-consumed electricity (known as a “sun tax”). Only installations lower than 10 kW and some geographically specific territories are exempted from this tax. Most households belong to this tax-exempted group because of the usually low capacity of installed facilities.
4.9 Greece

**Legal Aspect**

A net-metering scheme in Greece has been in place since 2015. As of January 2015 (implemented May 2015), net-metering was introduced for systems up to 500 kW. Electricity generated but not consumed—i.e., injected into the network—is counter-balanced (netted) with the electricity consumed from the network on an annual basis under a 25-year long contractual agreement with the supplier. Any excess of injected electricity above consumption is not reimbursed.

**Technical Aspect**

Self-consumed electricity is not measured separately. Rather, one meter measures electricity consumed from the grid and electricity injected into the grid; in the case of the smart meter, it automatically calculates netted electricity.

Exemptions from regulated charges such as the RES levy and network charges are foreseen for the electricity produced by all RES systems. RES installations not supported through FiT or FiP are supported through the system of guarantees of origin.

**Financial Aspect**

Primarily, the electricity produced by an installation or plant is offset with self-consumed energy. Any surplus electricity is fed into the grid without any obligation for remuneration. Apart from that, PV installed on public buildings in the context of the EU-funded programs can receive up to 20% of the value of the total annual electricity production.

4.10 Cyprus

**Legal Aspect**

The net-metering scheme in Cyprus applies to natural and legal persons producing electricity from solar PV plants. Since 2017, biomass and biogas plants are also eligible.

**Technical Aspect**

Households and municipal solar PV systems of a capacity below 3 kW are eligible for the net-metering scheme and receive the retail price plus a subsidy of €900 per kW (maximum €2,700 per installation) under the “Support Scheme for solar PV and Biomass/Biogas 2017.” An Administrative Committee allocates funds from the Special Fund for RES and Energy Efficiency to eligible projects. Self-consumers are obliged to install three meters, measuring all data regarding flows including reactive power.

**Financial Aspect**

The budget of the special fund is provided by the state (through an assigned annual budget) and is mainly paid for by end-consumers (through electricity bill charges that include a special tax on electricity consumption). Selection of eligible persons is based to a large extent on income and socio-economic criteria. Successful applicants after constructing a facility may continue operation under a new net-metering scheme or stay under the previous regime.

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21 CEER Status Review on RES Support Schemes EU 11.04.2017str.25, 57-63
RES Legal EU - Georgios Maroulis – Cyprus net-metering.
Net-metering in Cyprus is based on a classical model. The electricity offsetting is carried out once every two months for each calendar year by Electricity Authority of Cyprus or by any other electricity supplier with which the consumer has a contract. Any surplus is transferred within the following two months while any deficit is invoiced. The final account (measurement of April–May) of the calendar year closes the final settlement so that electricity surplus cannot be carried over from one calendar year to the next.

4.11 Belgium

**Legal Aspect**

Self-consumption is allowed in Belgium. In Flanders and Wallonia, the net-metering scheme is applied only to facilities below 10 kW. There are no capacity restrictions in Brussels region, but the remuneration model is different for capacities above 10 kW.

**Technical Aspect**

RE installations are equipped with two different meters: a bi-directional meter and a “green meter” measuring the electricity produced by the RE plant.

**Financial Aspect**

Although all schemes applied can be defined as net-metering, there are significant differences in regulation for residential vs commercial and industrial prosumers. The main differences exist in relation to remuneration for excess electricity. Excess electricity price for the residential sector amounts to retail price, while commercial and industrial consumers have to find a counterpart consumer and sign a power purchase agreement to be paid for the excess electricity they produce. This model includes time-of-use tariffs, which constitute an additional advantage for prosumers, particularly solar PV installation owners.

Net-metering credit timeframe amounts to one year. In Brussels and Wallonia, green certificates apply as an addition to RES-generated electricity, but this system is fading out.

4.12 California

**Legal Aspect**

California has one of the most mature systems of net metering, which has been in place in some form for more than two decades. The current system of net-metering in California was established by the Decision Adopting Successor to Net Energy Metering Tariff (issued on February 5, 2016, by the Californian Public Utility Commission). During the early stages of net-metering system development in California (1996 onwards), the limit for introducing new prosumers was established at 5% of aggregate customer peak demand in the state. As that aim was forecast to have been exceeded around 2015, the California Public Utilities Commission created a next-generation program known as “Net Metering 2.0” (NEM 2.0). It maintained the relatively high prices payable for excess electricity; however it removed the principle of a full retail price payment (i.e., removed from the reimbursement/payment system all other charges – such as network, supplier and the likes applicable to residential customers).

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23 Decision Adopting Successor to Net Energy Metering Tariff–Resolution E-4665, (issued on February 5, 2016, by the Californian Public Utility Commission.)
**Technical Aspect**

Eligible technologies under the current system include solar PV, wind, fuel cells, and biogas. Capacity limits are 1 kW–1 MW for individual installations.

**Financial Aspect**

California first applied the classical net-metering model. Depending on the electricity balance of the customer at any moment, the meter runs forward or backward; at the end of the month, it presents the pure net-metered amount of electricity. The responsible distribution company reads prosumers’ meters each month and issues a monthly statement indicating the net amount of electricity consumed or injected into the grid during that particular billing period.

If the net amount is positive (consumption higher than generation), the prosumer is charged for its consumption. If it is negative (generation higher than consumption), the netted amount of electricity is rolled over to the next month as a credit for further consumption. Once a year, a final clearing is completed where in the case of net surplus prosumer is allowed to choose whether he wants to roll that electricity credit into the next year or to be paid using a special utility tariff, equal to the retail price of that utility.

The payment is very attractive to consumers to install solar PV panels and become prosumers. Most prosumers in California begin with smaller systems and increase capacity over time until attaining the generation levels which more or less cover their yearly consumption.

Since 2009, California has allowed virtual net-metering for multi-family affordable housing units and municipalities, in which groups can share self-generated electricity as well as the revenues from net-metering and have different connection points for inflows and outflows with the network. Additionally, there is an option of “Self-Generation–Bill Credit Transfer,” which enables prosumers to transfer excess credits to another user’s account.

NEM 2.0 introduced the time-of-use electricity prices. That system is still undergoing some developments and tweaks, but the main feature is that the electricity’s value changes depending on the time when it is generated. Since electricity is more expensive in the late afternoons and early evenings, the value of excess electricity generated during that time is particularly valuable. The term "value" instead of a "price" is intentionally used in this context because it is the value of surplus electricity generated that is treated as a credit against the consumption during the following billing period. NEM 2.0 also introduced the rule according to which new consumers have to pay for the full cost of connecting to the grid, which was not the case under the previous system where part of the connection cost was subsidized.

Finally, NEM 2.0 allowed for payment of non-bypassable charges by prosumers. These are some of the typically “fixed” charges that are spread over the “per-kilowatt hour” charges, which are normally incorporated into the retail electricity prices. Previously, prosumers were exempted from payment of these. NEM 2.0 imposed the obligation of paying them in respect of electricity consumed from the grid.

**4.13 New York**

**Legal Aspect**

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24 New York State; Department of Public Service: Recommendations for Harmonizing Distributed Generation Interconnection Practices, final report, October 2017 New York State; Department of Public Service: Interconnection of Distributed Generation in New York State, Final report, September 2015.
The first net-metering law in New York was enacted in 1997. Originally, the law applied solely to residential solar systems up to 10 kW capacity. It was further developed and expanded over time in order to include other forms of electricity generation. Today practically all technologies are allowed to be used in net-metering, including solar, wind, biomass, fuel cells, CHP/cogeneration, anaerobic digestion, and micro-CHP-turbines. A support system was also made also available for commercial, industrial, nonprofit organizations, the agricultural sector, residential, schools, and local, state, and federal government facilities. As a result of these reforms, New York currently is one of the most advanced states in the US in the development of net-metering.

**Technical Aspect**

Supported capacities are limited by various capacity thresholds, including the following:

- 2 MW for nonresidential solar or wind
- 500 kW for agricultural wind or biogas
- 25 kW for residential solar or wind
- 10 kW for residential micro-CHP and fuel cells.

In 2013, some variations to the (until then) unlimited support were introduced regarding different technologies. Aggregate capacities for solar PV, agricultural biogas, and residential micro-CHP were limited to 3%, while for fuel cells to 0.3% of the share in the utility’s overall consumption during a reference year (2005). Despite these shares not seeming particularly impressive, taking into account the shares of these technologies and their relatively low level of development, the remaining margin for further development under the net-metering system remained relatively high. Thus, new rules and limits were introduced to prevent disturbances to the operation of incumbent electricity market operators and to prepare them for future development of net-metering.

However, in 2017, the New York Public Service Commission, under the ongoing “Reforming our Energy Vision” initiative introduced changes to both the existing distribution network code, regulatory rules, and net-metering regulation to facilitate a higher level of penetration of the electricity sector by low-scale net-metering. One of the most important changes meant abolishing previous limits concerning shares of net-metered electricity in total demand.

**Financial Aspect**

The net-metering model in New York comprises crediting surplus generation to the prosumer’s next bill (so called Satellite account) at the retail rate. The billing period is limited to one year except for nonresidential wind and solar and residential micro-CHP and fuel cells, where excess electricity can be carried over to the following billing periods without time limits.

Table 1 provides a concise overview of Balkan countries and US states that are most relevant to the Serbian context or provide leading edge practices in net metering.
<table>
<thead>
<tr>
<th>Aspect</th>
<th>California, US</th>
<th>New York, US</th>
<th>Croatia</th>
<th>Slovenia</th>
<th>Montenegro</th>
<th>Albania</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capacity limits</td>
<td>1 kW–1 MW for individual installation.</td>
<td>2 MW for non-residential solar or wind; 500 kW for agricultural wind or biogas; 25 kW for residential solar or wind; 10 kW for residential micro-CHP and fuel cells.</td>
<td>&lt; 500 kW but, in any case – must be lower than the load in the direction of consumption.</td>
<td>&lt; 11 kW</td>
<td>&lt; 50 kW</td>
<td>&lt; 500 kW</td>
</tr>
<tr>
<td>Type of tariff system</td>
<td>Depending on the supplier, usually three to four zones, typically 8:00-14:00; 14:00-20(22):00; 20(22):00-8:00. There are also differences between working days and weekends, as well as winter and summer periods.</td>
<td>Depends on supplier and type of consumption (residential/business), typically 8:00-24:00 and 24:00-8:00 or 8:00-22:00 and 22:00-8:00. Single rate system is also applied, depending on the choice of a customer.</td>
<td>Two zones: 07:00–23:00 and 23:00–7:00.</td>
<td>Two zones: 07:00–23:00 and 23:00–7:00.</td>
<td>Two zones: 07:00–23:00 and 23:00–7:00.</td>
<td>Two zones.</td>
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<tr>
<td>Applicable FIT/prices</td>
<td>Approved by California Public Utilities Commission, but varies by market and utility. For</td>
<td>FIT program sets 20-year contracts for projects for nonresidential solar</td>
<td>Current information as of 2016: Solar: €270/MWh; Small hydropower: €130/MWh</td>
<td>FiT was in use only until 2016 and a tendering system thereafter.</td>
<td>Wind: €96/MWh; Biomass: €123-€137/MWh; Rooftop solar: €120/MWh</td>
<td>Solar: €100/MWh; Wind: €76/MWh.</td>
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<tr>
<td>Aspect</td>
<td>California, US</td>
<td>New York, US</td>
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<td>example, solar in LA (LADWP) varies between 0.13-0.18 $/kWh, in Glendale (GWP) 0.066-0.079 $/kWh.</td>
<td>PV projects ranging from 50 kW to 20 MW. The FIT rate is currently set at $0.22/kWh.</td>
<td>Wind: €100/MWh; Biomass: €170/MWh; Biogas: €172/MWh; Landfill gas: €59/MWh.</td>
<td>The average support for RES electricity in 2016 amounted to €138.5/MWh, mainly because of numerous micro-instalations.</td>
<td>Solid waste: €90/MWh; Gas waste: €80/MWh; Small hydropower: €68–€104/MWh, depending on the actual capacity of the source.</td>
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<tr>
<td>Price of surplus electricity</td>
<td>Surplus is credited for future use.</td>
<td>For most types of systems, customer net excess generation (NEG) is calculated based on utility's retail rate. Solar panel systems up to 25 kW: ~ 0.13 $/kWh. Surplus is not paid in cash, but credited for future use.</td>
<td>Injected electricity is discounted by a factor of 0.9 times average retail price (currently €62 per MWh for flat-rate tariff, and €60–€65 per MWh depending on consumption during higher and lower tariff zones for dual-tariff). Price is further discounted by a factor of consumed/injected amount if there is surplus injection.</td>
<td>Surpluses are not reimbursable.</td>
<td>Feed in price depending upon the applied generation technology. Between €76 (wind) and €100 (solar) per MWh.</td>
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<tr>
<td>Managing agent</td>
<td>Supplier</td>
<td>Supplier</td>
<td>Supplier</td>
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<td>Supplier</td>
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<tr>
<td>Type of metering used</td>
<td>Bi-directional smart metering.</td>
<td>Bi-directional smart metering.</td>
<td>Bi-directional smart metering with 15-minutes measurement period.</td>
<td>Two meters separate for each direction of power flows.</td>
<td>Bi-directional smart metering.</td>
<td>Bi-directional smart metering.</td>
</tr>
<tr>
<td>Who covers the connection cost</td>
<td>Customer (75 $ - cost of technical review).</td>
<td>Customer.</td>
<td>Prosumer: last mile only + meter.</td>
<td>DSO.</td>
<td>DSO for existing consumers turning into prosumers/consumer for new connections.</td>
<td>Prosumer, last mile only + meter.</td>
</tr>
<tr>
<td>Aspect</td>
<td>California, US</td>
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<tr>
<td>Pros – advantages of the model, advisable for application in Serbia</td>
<td>• All types of technologies allowed; • Supplier is the managing agent; • Bi-directional smart metering; • Monthly metering and netting, with annual billing.</td>
<td>• All types of technologies allowed; • Supplier is the managing agent; • Bi-directional smart metering; • Monthly metering and netting, with annual billing; • Surplus is transferred to subsequent periods.</td>
<td>• Low capacity limits; • All types of technologies allowed; • Supplier is the managing agent; • Bi-directional smart metering; • Monthly metering and netting, with annual billing; • Surplus is transferred to subsequent periods.</td>
<td>• Low capacity limits; • All types of technologies allowed; • Supplier is the managing agent; • Forfeiture of chronic excesses; • Connection cost covered by DSO.</td>
<td>• Low capacity limits; • All types of technologies allowed; • Supplier is the managing agent; • Bi-directional smart metering; • Price of surplus based on suppliers’ price; • Connection cost covered by DSO.</td>
<td>• Supplier is the managing agent; • Bi-directional smart metering.</td>
</tr>
<tr>
<td>Cons – disadvantages in terms of application in Serbia</td>
<td>• Very high capacity limits; • Full retail rate is the price payable for surplus electricity; • Prosumer pays the connection cost.</td>
<td>• Very high capacity limits; • Prosumer pays the connection cost.</td>
<td>• Type of metering with 15 min. metering period is quite advanced and costly – as such may not be applicable for Serbia and increased cost will be discouraging; • Prosumer pays the connection cost.</td>
<td>• Metering model with two meters applied.</td>
<td>• Monthly billing.</td>
<td>• High capacity limits; • Restriction on technologies allowed; • Too high price (feed-in); • Prosumer pays the connection cost; • Monthly billing.</td>
</tr>
</tbody>
</table>

Source: Own research.
4.14 Summary of International Practices with Net-Metering

The comparison of net-metering systems above illustrates that there is no standard model applicable across regions that have adopted it. Net-metering policies vary widely, though some trends and key decision-points are discernible.

Looking at all pros and cons of different models applied throughout the world, it has to be stated that there is no single model meeting all the possible conditions applicable in Serbia. Instead, it is advisable to seek a composition of best solutions from different models.

Simple net-metering is disadvantageous due to the fact that it does not recognize different values of electricity generated and consumed during days and nights. Application of net-billing helps to avoid that problem.

Annual, as opposed to monthly, billing allows for compensation of seasonal changes in generation and consumption levels.

It is apparent that, for single tariff customers, the best solution should be a single price for electricity generated, tied to that applicable to the tariff for consumption. In actual fact though, this would prove to be a highly impractical solution. This is because the practice from other countries indicates that it is quite rare for single tariff customers to be interested in investment in net-metering. Rather, such customers would firstly change their distribution arrangements to a two-tariff system and then opt for net-metering.

Locations that have had lengthy experiences with self-consumption, including France, Germany and Spain in the EU and California and New York in the US have had to evolve their frameworks as more prosumers joined the networks. In these more mature frameworks, there are often distinctions in how prosumers are treated, depending on the type of RES, generating capacity, age of system (older systems are typically grandfathered under old rules), among others. In countries where FiTs were once popular, such as Germany, there has been a reduction in the value of the FiTs and restrictions on new RES connections into the networks. Novel arrangements such as collective self-consumption and virtual net-metering were introduced. While these arrangements offer many benefits, they may not be workable in Serbia at this stage. This is because of the lack of regulations and rules concerning disbursement of potential common revenues derived from net-metering, and the relative underdevelopment of the financial system and general hesitation of local banks to issue loans to multi-apartment associations.

Locations that have more recent experience with introducing net-metering tend to treat all RES equally, allowing them to feed into the network. Many have moved towards net billing over net-metering, in order to value electricity at time of use. Learning from other regions where there has been pushback due to rapid growth of net-metering, these countries try to balance the attractiveness of the practice to prosumers with the needs of suppliers. Croatia created an elegant and sophisticated approach by discounting the value of surplus electricity injected into the grid. A modified version of the Croatian model could be a good base for creation of a net-metering model applicable for Serbia.

Serbia will benefit more from the experiences and examples of developments in net-metering in its most immediate neighborhood, including countries of former Yugoslavia, countries that have recently acceded to the EU, and countries that are working to align with the EU acquis and EC process). In this context, our suggestion is that Serbia consider the experience of Croatia. The main reasons for this are as follows:
1. It is one of two former Yugoslav states, the other being Slovenia, which have entered the EU thus far;

2. Croatia is a much more recent entrant (July 2013) than Slovenia (May 2004). Because of this and the fact that Serbia is awaiting entry into the EU, the Croatian experience is more relevant for Serbia;

3. Croatia is a country coming from very similar historical, language, economic, social, banking, fiscal, etc. background as Serbia;

4. Since both Serbia and Croatia were parts of former Yugoslavia, common technical regulations and requirements used to apply in both countries. Such regulations, for instance, encompassed types of metering systems, network design, technical standards applied, connection rules and standards, etc. This results in a very similar electricity infrastructure existing in both countries (especially at the back-bone levels), making the Croatian example very much suitable for application in similar regulatory frameworks – such as in Serbia;

5. The main feature of net-metering encompasses allowing the electricity consumer to enter the role of electricity producer (generator - prosumer). But, at the same time discouraging the consumer from switching predominantly into the role of a generator. Avoiding such switching of roles is most efficiently achievable by discouraging the generation of excessive surpluses of electricity. In the case of Croatia, that intention is strengthened by the application of a correction factor to the value of generated electricity (i.e. the injected electricity is multiplied by a factor of 0.9 and an additional factor equaling the ratio between injected and consumed electricity in case of surplus generation);

6. Croatia has a similar level as Serbia of centralization of authorities at all levels (which is different from the U.S., or from Germany and Poland, which all have considerably powerful states and regional and local authorities);

7. The Croatian model constitutes an updated version of the Slovenian model, which was developed much earlier than the Croatian one;

8. This model is sufficiently simple and easy to understand compared with those used across the EU countries. This would enable smoother application – perfectly fitting the relatively underdeveloped financial markets in Serbia, with banks hesitating to issue loans to households, and the financial sector lacking the specialised RES/EE supporting funds, etc.
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5 PRELIMINARY SUGGESTIONS

A suitable net-metering model would ideally be as simple as possible and enable development of net-metering without creating additional costs to the prosumer or to those who do not participate in a net-metering scheme.

The following preliminary suggestions set out criteria that in our view (having not yet had the opportunity to discuss our findings with Serbian stakeholders) could form the basis of a suitable net-metering model for Serbia:

1. Self-consumption should be permissible. All RES should be allowed as primary energy sources. The construction of a facility that enables self-consumption should be exempted from having to obtain a construction permit if satisfying certain criteria, such as height above the roof (clearance) for solar PV, combination of height and wings diameter in the case of wind turbine, and power for the other RES (but might still meet standard consents applicable to homeowners performing alterations or additions). It is noted that RES other than wind and solar PV (which are subject to a cap) are currently entitled in Serbia to receive valid FiTs that provide benefits to the prosumer in the form of significantly higher purchase prices. The applicability or otherwise of these FiTs to prosumers would need to be examined.

2. A system of support would likely need to be created for the installation of new RES generators to be included in net-metering. Such support could include allowing exemptions from VAT or other taxes (on the purchase of the necessary equipment or on excess electricity produced) and ensuring that the processes of permitting, meter installation, and concluding agreements with the DSO and supplier are straightforward and transparent. Tax exemptions on electricity produced may not be necessary because Serbia presently exempts any activity with annual revenue less than €65,000 (~$73,000). It may be more expensive to collect these taxes than to waive them. Further financial analysis and discussion with Serbian authorities is needed to define the types of support that would be most beneficial and feasible.

3. There should be no connection fees or consents necessary where the nominal capacity of the RES is lower than or equal to the load of the existing connection (other than those ordinarily applicable for domestic connection to the network). The cost of smart meters should be paid for by the DSO. The government has already committed to installation, and should speed up this process and ensure that purchased smart meters are capable of measuring bidirectional electricity flows and present their difference (net value) online. A threshold may need to be established so that the prosumer may not request a change in their meter more frequently within a set period (e.g., a minimum 8 or so years), unless the prosumer is willing to bear the cost. We would also suggest that prosumers entering the net-metering scheme have priority in smart meter installation. Apart from avoiding additional, and quite meaningful, costs to end users, meters should be less expensive if purchased by the DSO in bulk and in advance. The DSO should be able to negotiate better pricing and finance terms. Another advantage is that buying in bulk upfront assures the purchaser it obtains meters with the same technical characteristics (particularly communication protocols), which enables the option not only to read the meters remotely, but to apply and remotely control the other options that smart metering offers. If purchasing is delayed – meters are replaced one-by-one – it is unlikely that all the above-mentioned conditions will be met.
4. Technical criteria for connection should be contained solely in the distribution code. If technical criteria are met, the administrative procedure of approving the status of prosumer should be as simple as possible. Recognizing that a prosumer’s generation plant has little impact on the network, it would be advisable to shorten and simplify the procedure from that applicable to generation projects seeking to sell output through the network.

The capacity limit could be based either on capacity of the source or on electricity delivered into the network. The limit should be set at a level that discourages the prosumer from generating excessive surpluses of electricity. The Proposal for the Directive of the European Parliament and of the Council on the promotion of the use of energy from renewable sources (recast) of 23.02.2017, which is very likely to become a formally binding directive shortly, leaves no options on this matter. Article 21 of the proposal states that consumers that feed up to 10 MWh into the network are not considered to be energy suppliers. In Serbia, a prosumer with installed capacity of 11 kW will not exceed the 10 MWh threshold, and thus will be in compliance with the Proposal for the Directive. For households it should be a maximum of 10 MWh annually, while for legal entities permitted quantities amount to 500 MWh annually. There is also limited risk of elevated cost of the scheme where the price of electricity delivered into the network is set at a level that discourages the prosumer from generating excessive surpluses of electricity.

5. Prosumers should not be required to obtain a license for performing an energy activity (which is the case under Serbia’s Energy Law). The rationale for this suggestion centers on that fact that prosumers are intended to consume, not produce electricity.

6. The injection of excess electricity into the distribution network should not be treated as selling of a good, but instead should be treated as a netting transaction, resulting in a credit for electricity delivered. An alternative view is that injection of excess electricity into the distribution network should be treated as a tax exempted special transaction. Taxation law stipulates that VAT is to be paid on any transaction at the moment of physical delivery or billing, whichever happens first. If electricity delivery to the network is considered the sale of the good, it is taxable; in that case, a formal tax exemption would need to be granted. If delivery is not considered a sale, it is not taxable. Both options are feasible, but the second option may be simpler and less costly. If a tax exemption is granted, accounting for the correct quantities may be required, which is an additional complication and cost.

7. It is noted that, in general, countries have moved away from the net-metering model and instead a variety of net billing-models are being adopted. Amongst the reasons for this is that it allows for electricity to be valued based on its time of use, which is an important issue in the context of tariff rules in Serbia. Until further studies on applicable tariffs have been carried out, it is suggested that the Croatian net billing model may hold valuable lessons for Serbia as it discounts the value of excess electricity purchased from prosumers, making the net-metering arrangement financially attractive to suppliers yet still attractive to prosumers. This model encourages engagement in self-generation by providing pricing directly tied to the actual supply prices while securing the supplier’s interest in the system by providing them with a discounted value for excess electricity and limiting the attractiveness of overproduction by the prosumer. In Croatia, prices are closely related to the actual cost of purchasing electricity by the supplier, which may be similar in Serbia.