DEVELOPMENT OF SMALL-SCALE RENEWABLE ENERGY SOURCES IN BULGARIA

LEGISLATIVE AND ADMINISTRATIVE CHALLENGES

CENTER FOR
THE STUDY OF
DEMOCRACY

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This report explores the potential and the obstacles before the decentralization of electricity supply in Bulgaria. With the ongoing phase-out of the first generation of state-support measures to developing renewables, Bulgarian policy-makers have been late to define new ways to foster the decarbonisation of the electricity system while maintaining security of supply. A low-hanging fruit would be the exploitation of Bulgaria's enormous potential for decentralised generation of electricity through renewable energy sources. Unlocking it would contribute to a national energy revolution, which would also be the cheapest and most fiscally neutral way to increase the share of renewables in the electricity system. But decentralisiation and democratisation of the power supply requires complex and disciplined policy development and implementation and will continue to face system inertia and opposition from the incumbents. There is also the need to overcome significant administrative and financial burden for the installation of new small-scale renewable electricity plants, which have reduced the investment incentives for households and small enterprises.

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LIST OF ABBREVIATIONS

CHP	Combined Heat and Power
DSO	Distribution System Operator
ERSA	Energy from Renewable Sources Act
ESO	Electricity System Operator EAD
EWRC	Energy and Water Regulatory Commission
FiT	Feed-in Tariff
HPP	Hydro Power Plant
ktoe	Tonnes of Oil Equivalent
LUPA	Land Use Planning Act
NPP	Nuclear Power Plant
NREAP	Bulgarian National Renewable Energy Action Plan
PV	Photovoltaic
RES	Renewable Energy Sources
SEDA	Sustainable Energy Development Agency
SEERMAP	South East Europe Electricity Roadmap
TYNDP	Ten-Year Network Development Plan

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1. INTRODUCTION: DECENTRALISATION – A SUSTAINABLE PATH TO DECARBONISATION IN BULGARIA

The European Union's Energy Union Framework Strategy laid out on 25 February 2015 aims at a citizens-oriented energy transition. Resting on five pillars (Energy security, solidarity and trust; A fully integrated European energy market; Energy efficiency contributing to moderation of demand; Decarbonising the economy; and Research, innovation and competitiveness),[1] it targets to ease the delivery of the EU energy-climate objectives: reduce EU territorial greenhouse gas emissions (by 20 % by 2020, and by 40 % by 2030), increase the share of energy coming from renewable sources (to 20 % by 2020 and to 27 % by 2030), and improve energy efficiency (by 20 % by 2020, by 27 % by 2030).

Those general EU objectives are largely supported by the EU public opinion. According to a special Eurobarometer survey published in 2017 79 % (-2 % from 2015) of the Europeans surveyed agree with the statement that "fighting climate change and using energy more efficiently can boost the economy and jobs in the EU". This element is particularly crucial at a moment where many EU Member States face protracted unemployment. Meanwhile, 90 % of the surveyed Europeans were in favour of national governments setting renewable energy targets and 92 % supported similar national targets for energy efficiency, with 79 % agreeing that "more public financial support should be given to the transition to clean energies even if it means subsidies to fossil fuels should be reduced". Democratic legitimacy and public acceptance/support however need further efforts to understand and include all stakeholders in the governance of the energy transition; as well as ensuring that public policies are in line with citizens' preferences.

The EU has identified that the development of energy transition policies will depend on the following prerequisites and assumptions:

- Energy cultures and energy systems differ across Europe. This means that there are different challenges and opportunities with respect to low carbon energy transition. Pathways to successful transitions will also differ. To understand this requires comparative research.
- A successful Energy Union via decarbonisation and decentralization of the economy will be based on public engagement and participation.
- Socio-economic incentives including regulatory and organizational structures should be employed for achieving social acceptance and public participation of consumers and prosumers.

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[1] COM/2015/080 final Communication from the Commission to the European Parliament, the Council, the European Economic And Social Committee, the Committee of the Regions and the European Investment Bank A Framework Strategy for a Resilient Energy Union with a Forward-Looking Climate Change Policy.

- Socialisation of new renewable and energy efficient technologies through innovative public discussion among stakeholders and the general public.
- A comparative study on the interactions between individual energy preferences and governance policies.

With the launch of the Winter Package of energy transition legislative proposals at the end of 2016,[2] the EU has opened a new chapter towards a more practical transition from a centralized power system based on fossil fuels and nuclear power, as well as large-scale generation facilities from renewable energy sources, to the decentralization of electricity supply relying on small-scale RES and Combined Heat and Power (CHP) units. The ultimate aim of the Energy Union is to empower consumers to become producers themselves and/or through smarter demand response management.

Despite the ongoing changes, consumers including households, businesses and industry, still cannot fully benefit from the transformations as they face imperfect information, rising network fees and additional surcharges, limited retail and wholesale market competition (especially in CEE), insufficient support for demand-driven mechanisms and regulatory and investment gaps in decentralizing supply on a large scale.[3] The EU would aim to support new opportunities for local communities to not only become self-sufficient (decreasing the consumption from the grid), but to also trade the produced surplus energy. This is an area, in which Bulgaria lags considerably behind, which the report aims to tackle.

Decentralized power generation or distributed generation (DG) describes small-scale generation capacities that are connected to the distribution network or end user (medium and low voltage: 110kV and lower) where the energy source is often renewable (wind, solar, biomass, biogas, hydro, geothermal or ocean-based) and available locally. Decentralization of power generation fosters the empowerment of people, businesses and communities, whereby they can play the role of active producers and consumers rather than passive consumers only. The term 'prosumers' refers to the entities- people, communities and businesses that both generate and consume electricity. A non-exhaustive list[4] of the types of prosumers features: residential prosumers;[5] community/ cooperative energy;[6] commercial prosumers[7] and public prosumers.[8]

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2 COM(2016) 860 final Communication From the Commission to the European Parliament, the Council, the European Economic and Social Committee, the Committee of the Regions and the European Investment Bank: Clean Energy For All Europeans.

3 Com (2015) 339. Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: *Delivering a New Deal for Energy Consumers*.

4 European Parliament, *Briefing:Electricity 'Prosumers'*, November 2016, retrieved from: http://www.europarl.europa.eu/RegData/etudes/BRIE/2016/593518/EPRS_BRI(2016)593518_EN.pdf

5 Citizens who produce electricity on their property, mainly by installing solar PV panels on their rooftops or through micro combined heat and power(micro-CHP).

6 Citizen- led renewable energy cooperatives ('Res Coops'), housing associations, foundations, charities, which are not commercial actors, but produce energy meant for self- consumption, mainly by solar PV panels and wind turbines.

7 SMEs, department stores, office buildings, industry and other business entities whose main business activity is not electricity production, but which self-consume the electricity they produce, mainly with rooftop PV panels and CHP, leading to significant cost savings.

8 Schools, hospitals and other public institutions that self-generate electricity.

The decentralization is linked to the ongoing process of market liberalization and deregulation. Member-states, especially in Eastern Europe, have been reluctant to open up their retail markets as governments have been unable to introduce better social safety nets to protect the large groups of energy poor, instead relying on keeping regulated prices artificially low. At the same time long term contracts and entrenched business – political dependencies have prevented the introduction of free and fair competition. Protecting energy vulnerable households through regulating prices has proven more and more difficult to manage in Bulgaria, as subsidized electricity prices have undermined central heating and vice-versa. At the same time the Bulgarian protests from 2013 that helped bring down the then Bulgarian government are a proof and a lesson that transitioning from regulated, centrally planned, large-scale supply-based system towards liberalised, democratised and decentralised, prosumer focused energy if not handled properly could spell serious social instability and could hurt the political prospects for the new system. Such governance gaps are also non-productive as they limit the incentives for improvements in energy efficiency, demonize renewable energy technologies and pervert rational energy choices.

Nonetheless, the decentralisation of power supply could lead to several improvements of the whole energy system. A rise in the number of autonomous households, which do not depend on the grid, will reduce transformation, transmission and distribution losses, which can reach above 40 % of the total generation.[9] Self-consumption could also diminish the frequency and impact of damages on the grid. In addition, the transmission system operator (TSO) would be able to achieve cost reductions associated with a smaller need for balancing and a more efficient plan for switching on and off generation facilities during peak demand periods. In the context of Bulgaria, DG can also be a powerful tool to reduce energy poverty.

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9 2016 Statistics on the Complete Energy Balance from the EUROSTAT.

2. BULGARIAN RENEWABLE ENERGY AND CLIMATE POLICY – AT A GLANCE

According to the National Inventory Report,[10] emissions from the energy sector are the main source of greenhouse gases (GHG) in Bulgaria. In 2015, the energy sector was responsible for 74.2 % of national total GHG emissions. The main source of emissions in the energy sector has been combustion of solid fuels (61.7 % of the emissions from fuel combustion in 2015), followed by liquid fuels with 26.4 % and gaseous fuels with 11.1 %. Bulgaria has committed to follow the United Nations Framework Convention on Climate Change (UNFCCC) in Rio de Janeiro in 1992 and to contribute to the achievement of the joint EU-wide emission reduction target of 20 % below the 1990 level by 2020. Also, Bulgaria would implement the United Nations Climate Change Conference (COP 21) decisions together with the rest of the EU members.

Even if most of Bulgaria's emissions are related to the energy sector, still, most of the energy policy efforts are related to the preservation of lignite-fired power plants and the construction of a new nuclear plant, while RES integration has lagged behind following the short-lived green energy investment peak of 2011 – 2012.

In Bulgaria, electricity from renewable energy sources has been supported since 2007 through a preferential feed-in tariff scheme. Other options for support were considered as well – for instance "tradable green certificates" market similar to the one operating in Romania. The lack of a developed electricity market as well as the lack of an operating power exchange until early 2016 has made this option impossible, leaving Bulgaria with a FiT model, which proved not to be well constructed and managed. Renewable energy is also given guaranteed access to transmission and distribution networks with a priority dispatch. Indeed on paper, it resulted in more RES being built but bad governance has resulted in concentration of RES power in few suppliers, rather than decentralization of production.

Bulgaria is on track to reach its renewable energy target for 2020. Bulgaria also met the 2013/2014 and 2015/2016 intermediate goals as set under the Renewable Energy Directive of the EU. The 2016 share of renewable energy sources in the gross final energy consumption stands at 18.8 %, well above the 16 % target.[11]The Bulgarian National Renewable Energy Action Plan (NREAP)[12] – the main document to ensure the achievement

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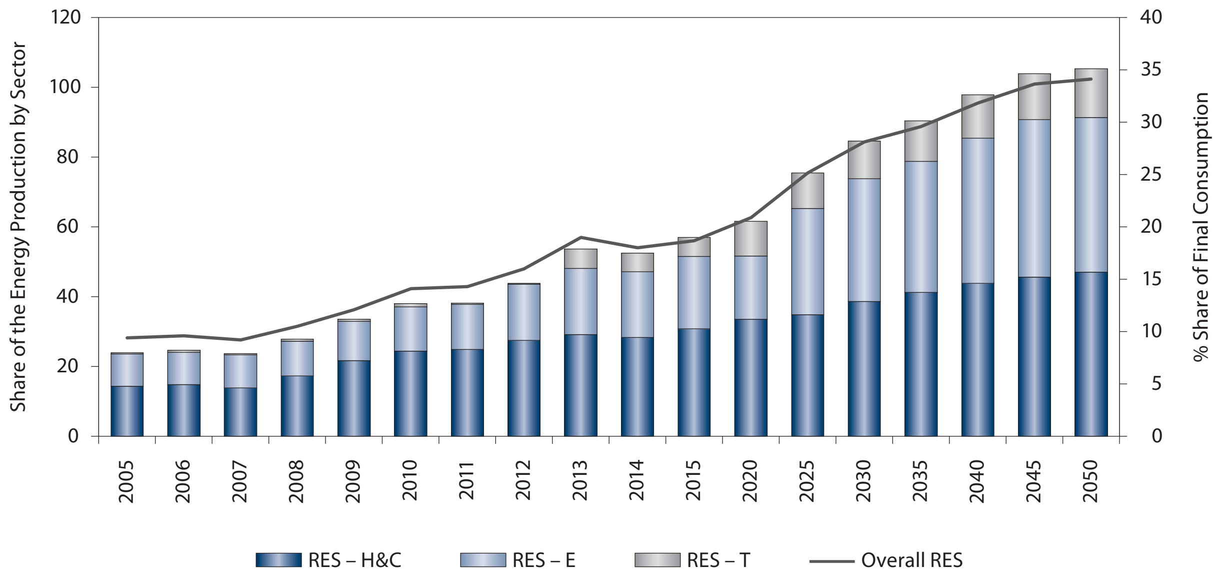
[10] Ministry of Environment and Water (2017) National Inventory Report 2017. Greenhouse Gas Emissions in Bulgaria 1998 – 2015.

[11] https://www.statista.com/statistics/747958/share-renewable-energy-electricity-consumption-bulgaria/

[12] Ministry of Energy. (2010). National Renewable Energy Action Plan (NREAP). It was designed to cover the 2010 – 2020 period. No new renewable energy plan for the 2020 – 2030 period has been developed yet.

of the national RES targets – includes 38 planned measures to promote RES and provides estimated trajectories for both the shares of renewable energy consumption in heating and cooling, electricity, and transport, as well as the development of renewable energy capacities until 2020. The support measures have been designed in such a way as to benefit large-scale renewable energy facilities, and hence large investors or very often well-connected policy-makers that had captured regulatory and licensing institutions to receive light-speed construction permits and preferential connection to the grid.

FIGURE 1. SHARE OF ENERGY PRODUCTION FROM RENEWABLE ENERGY SOURCES BY SECTOR AND IN THE FINAL ENERGY CONSUMPTION (%)



Source: *National Statistical Institute; Projections from the PRIMES Model.*[13]

Almost 80 % (991 ktoe) of the Renewables balance sheet for 2016 is occupied by "Wood, wood wastes and vegetable wastes". Of these, 758 ktoe (or 60 % of the total RES) are consumed in the Households sector – meaning a large portion of the Renewable Energy Sources (RES) target is met through burning firewood with low efficiency[14]. In addition to the 3300 MW hydro power generation capacity and the almost 2000 MW of solar photovoltaic (PV) and wind facilities, the share of renewables in the electricity sector had reached almost 21 % of the total and on track to fulfil the RES-Electricity (RES-E) 2020 target of 21.3 %. Even before the 2009 – 2013 massive expansion of solar and

[13] The PRIMES model is an EU energy system model which simulates energy consumption and the energy supply system. It is a partial equilibrium modelling system that simulates an energy market equilibrium in the European Union and each of its Member States. This includes consistent EU carbon price trajectories.

[14] NSI (2017) Energy Balance Sheets 2016, http://www.nsi.bg/en/content/16006/%D0%BF%D1%83%D0%B1%D0%BB%D0%B8%D0%BA%D0%B0%D1%86%D0%B8%D1%8F/energy-balance-sheets-2016

wind capacity, close to one-quarter of the power generation capacity was held by the hydro-power sector.

The NREAP includes only one measure related to distributed RES, which is directed toward investors, end users, and planning authorities and had to be implemented after 2011. Its purpose was to "promote the use of individual renewable energy systems as a reliable way of achieving the low-carbon targets at low public costs". According to this measure, individual systems should be encouraged through additional incentives such as less cumbersome administrative procedures for energy facilities generating electricity from renewable sources of up to 30 kW installed capacity on roofs and faзade structures of buildings and on land within urban areas. The measure also stipulates that a support scheme should be implemented "for the construction of roof and faзade photovoltaic systems on private, public and industrial buildings, including a simplified administrative procedure for legalization and connection to the distribution network". The estimate for the total contribution needed from each renewable energy technology in Bulgaria to meet the binding 2020 targets and the indicative interim trajectory for the shares of energy from renewable resources in heating and cooling 2010 – 2020 however did not discern between large and small RES capacities.

The main national support scheme for renewable energy has been based on long-term contracts for the mandatory purchase of electricity produced from wind, solar, small-hydro and biogas facilities under subsidized feed-in tariffs in combination with grants from the EU Regional and Rural Development Plans. The support scheme however benefited large-scale renewable energy facilities instead of small distributed generation.

Almost 90 % of all RES generation capacity was installed between 2010 and 2012 leading to sharp increase in final user tariffs in the middle of the economic recession, and which resulted in a popular backlash caused compounded mainly by the widespread energy poverty. The development of the Bulgarian RES policy was also subject of corruption practices and was accompanied byto poor administrative capacity (and corrupt practices) that ultimately led to a Feed-in Tariff (FiT) scheme way beyond the prevalent market costs in Europe. As a result, the financial state of the Bulgarian state-owned public power supplier NEK deteriorated as it has been responsible for purchasing all renewable energy generation under long-term contracts.

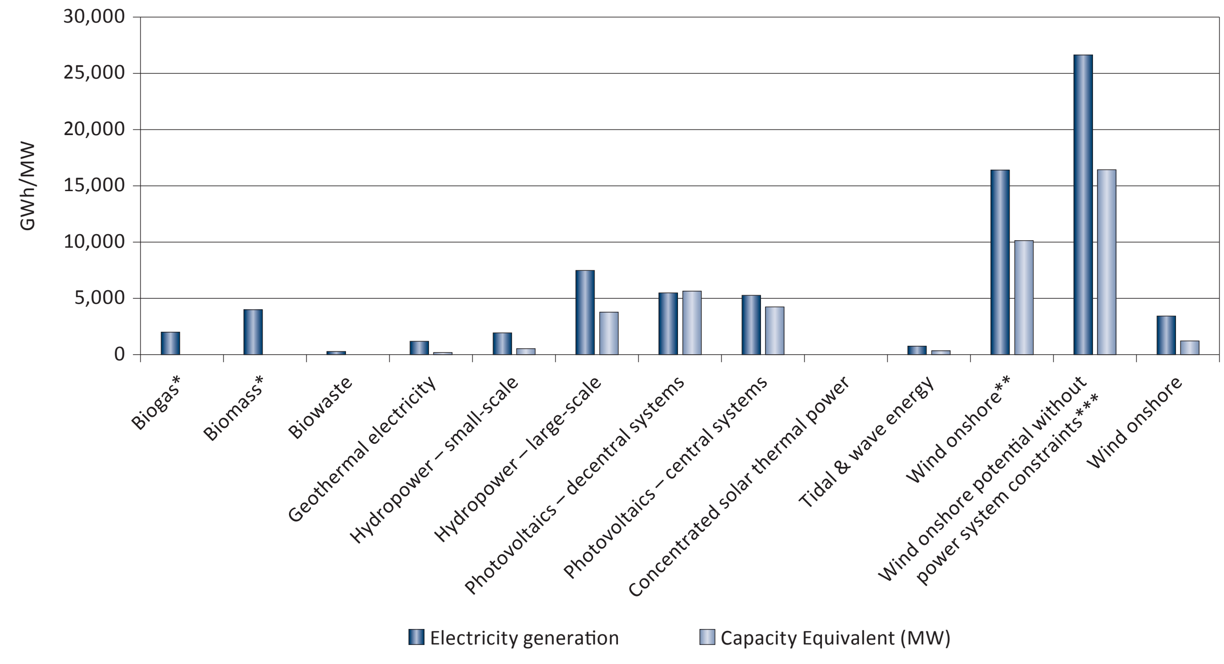
As a result of the popular backlash and the worsening financial position of state-owned energy companies, in 2015 the existing FiT scheme was suspended and is yet to be replaced by a new policy for the period until 2030. Meanwhile, the Energy and Water Regulatory Commission (EWRC) has set an annual limit on the amount of hours wind and solar generation could be purchased at preferential FiTs. The generation limit for small-scale roof-top PV systems has been set to 1,261 hours per annum. RES-E producers are also subject to full balancing responsibility, which leads to additional costs for the generating capacities. The right to priority connection was abolished by amendments to the Energy from Renewable Sources Act (ERSA). Now, plant operators are only entitled to non-discriminatory access, meaning that their statute is no different to other electricity producers from the grid's point of view. The preferential statute has been one of the support measures for potential investors in RES, but now this incentive is not available. Unlike many other EU member-states, the ERSA has failed to launch renewable energy auction schemes that would align feed-in-tariffs closer to market benchmark levels and the falling levelised cost of electricity (LCOE).

3. EXISTING RES PROJECTS AND POTENTIAL FOR DEVELOPMENT

If Bulgaria is to achieve the ambitious EU 2050 goal of close to 100 % electricity generation from zero-carbon energy sources, the country's enormous potential for small-scale renewable energy facilities needs to be unlocked. This would come into clash with entrenched powerful lobbies for the existing coal and nuclear power plants, as well as from the gas industry in the country.

Bulgaria has a long-term potential capacity for decentralized PV-based power generation of more than 5.6 GW (see Figure 5 below), which would produce up to 5.4 TWh per annum or one-eighth of the current power consumption in the country.[15] The results are based on the theoretical

FIGURE 2. LONG-TERM (2050) REALIZABLE POTENTIAL FOR RES-ELECTRICITY TECHNOLOGY



* *for biomass and biogas the expressed electricity generation potential serves only as a rough indication, reflecting rule-of-thumb preallocation to different uses (heat, electricity, transport) of the underlying potential for bioenergy feedstock.*

** *potential used in Green-X modelling, based on GIS modelling with consideration of technical (power system) constraints and of land use limitations.*

*** *potential based on GIS modelling without consideration of technical (power system) constraints but with land use limitations.*

Source: *Green-X model for the South East Europe Electricity Roadmap (SEERMAP).*

[15] According to the adapted version of the Green-X model of the future development of the main renewable energy technologies, created by the Technical University of Vienna.

solar potential in the country, which is expressed in about 2,150 annual solar hours and 1,517 kWh/m2 of average annual solar radiation, and the technological change and diffusion expectations for PVs. The solar potential is a bit higher for the South Central and Southeastern regions in Bulgaria with the biggest gains expected in the solar thermal field, which is already the most widespread use of decentralized PV installations in the country.

However, this forecast is too optimistic and does not account enough for the current administrative capacity and the legal and regulatory framework for self-producing generating capacities. The current legislation and regulatory practice does not attain its goal to provide adequate support for households and small consumers to invest in renewables. All efforts until now have been directed toward attracting large investors, which are no longer showing much interest in the market as the FiT scheme was withdrawn and additional tax and administrative burden was placed on the sector. The scepticism about the prospect of decentralized RES-based power generation is reflected in the Ten-Year Network Development Plan (TYNDP) of the Electricity System Operator EAD (ESO), the Bulgarian independent transmission operator, for the period 2017 – 2026. The plan forecasts a total of 1,119 MW of new RES capacities installed in the next decade.[16] The specific figures are presented below.

TABLE 1. EXISTING AND FUTURE RES CAPACITY PROJECTIONS

RES Type	2016	2017 – 2026	2026 Total
HPPs (without PSHPPs)	2,337 MW	29 MW	2,366 MW
Wind	701 MW	545	1,246 MW
Photovoltaics	1,041 MW	495	1,536 MW
Biomass and biogas	66 MW	50 MW	116 MW
Total RES	4,145 MW	1,119 MW	5,264 MW

Source: *ESO (2017) TYNDP 2017 – 2026.*

These would add up to the increase of conventional capacities – 200 MW added to the NPP Kozloduy after a modernisation project, and an expected 187 MW capacity in heating and industrial combined heat and power (CHP) plants. According to the TYNDP, the share of RES-E in the gross electricity production will rise from 15.10 % in 2017 to 18.26 % in 2026 or from 5,88 TWh to 7,38 TWh in absolute terms. The TYNDP also notes that additional efficiency measures to reduce final consumption may increase the actual share of RES-E in the system. The increased non-HPP (e.g. non-dispatchable) RES capacities of over

[16] ESO (2017) Ten-Year Network Development Plan 2017 – 2026.

2.7 GW in 2026 would also add to the balancing costs of ESO – from gas-fired power plants, from pumped-storage HPP, or from demand response. Even this small increase in renewable energy capacity in electricity generation could prove not to materialise because the TYNDP forecasts are based on applications for the installation of new RES capacity dating back to 2012 when high preferential FiTs were still the dominant form of subsidy. Many of the investors have not withdrawn their applications yet despite not having proceeded with completing their renewable projects. Hence, the ESO has calculated them as part of the future outlook for the grid.

According to the official Guarantees of Origin Registry of the Sustainable Energy Development Agency (SEDA) for 2017,[17] the 10 largest wind parks have a combined capacity of 379 MW or more than 50 % of all wind capacities in Bulgaria. The 10 largest PV parks have a total capacity of 223 MW or more than 20 % of the total PV capacity in the country. The three largest PV parks respectively have capacities of 50 MW, 50 MW, and 29 MW. The largest wind capacities are in North-Eastern Bulgaria and most of the PV capacities are in South-Eastern Bulgaria. This clearly shows that the largest winners of the current policies have been utility-scale RES producers.

Table 2. Large wind and photovoltaic producers

Type	Size	Number	Total Capacity
Wind	>3 MW	63	568 MW
Photovoltaic	>3 MW	109	646 MW

Source: *SEDA (2017) Guarantees of Origin Registry.*

While other countries like Germany, where the largest 10 PV power plants have a total capacity of about 1 GW compared to the total installed capacity of over 38 GW (or a mere 2.5 %), did not encourage the construction of large PV parks on arable land after 2010, Bulgaria did not manage to switch the focus of its PV investors from utility-scale PV to small-scale RES power capacities. Currently, over 98 % of Germany's 1.5 million PV power plants are connected to the decentralized low-voltage grid and PV plants of over 1 MW installed capacity account for only 15 % of the total PV capacity in Germany.[18]

In Bulgaria, small-scale RES installations (i.e. below 30 kW) are a rarity. A total of just 929 PV installations below 30 kW have been added to the distribution grid since 2006 with the majority of plants added to the grid in the 2011 – 2013 period. Since then the number of new

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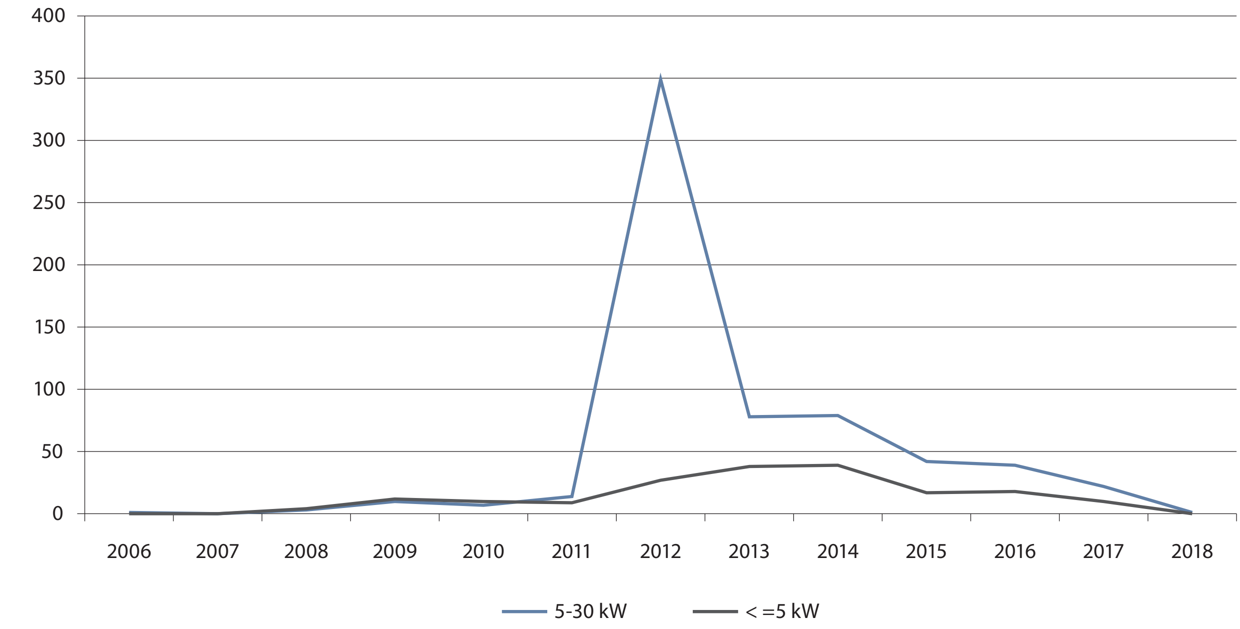
[17] SEDA (2018) Guarantees of Origin Register, https://seea.government.bg/bg/registers/register-garancii

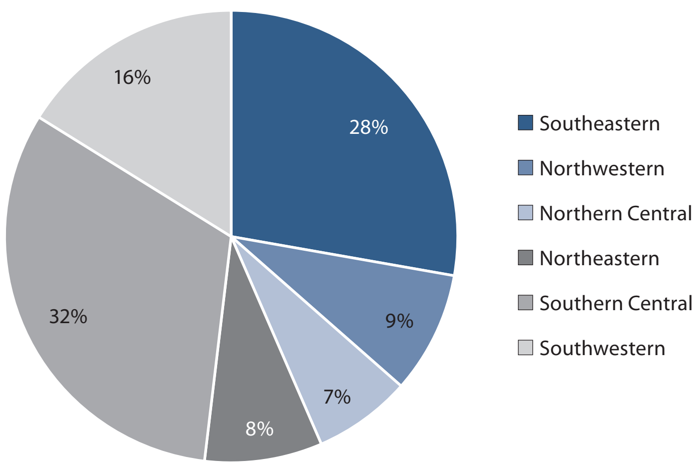
[18] Fraunhofer ISE (2018) Recent Facts about Photovoltaics in Germany.

FIGURE 3. NUMBER OF INSTALLED NEW RES INSTALLATIONS WITH CAPACITY OF BELOW 30 kW



Source: *Sustainable Energy Development Agency (SEDA).*

FIGURE 4. NUMBER OF NEW PV CAPACITIES BY REGION UNDER 30 KW BY REGION 2006 – 2017



Source: *Sustainable Energy Development Agency (SEDA).*

installations has declined amid a strong public backlash against green energy and the removal of support schemes for large-scale renewable power plants. This decreased the investment appetite even for small-scale capacity, which are still receiving preferential FiTs, albeit at lower levels. In 2017, just 32 facilities have been added to the grid, with the expectation that 2018 the number will fall to below 10. The total generating capacity of small-scale RES (almost entirely roof-top or small-scale farmland PV installations) is 19,52 MW or barely 1.4 % of the total wind and solar capacity in the country. Zooming in on the geographic allocation of new small-scale installations, predictably more than half of all installations are located in Southern Central and Southeastern regions of the country, where the solar potential is the biggest.

The opportunities for decentralization of the power supply in Bulgaria should be viewed in the context of energy poverty and governance gaps in the country. Bulgaria faces critical issues in energy affordability: in 2010 over a third of the households report being unable to afford keeping their homes adequately warm, and roughly 60 % of the Bulgarian households have used wood for cooking and heating – a criterion for defining a household as energy poor.[19] Bulgaria is also a EU leader in terms of the share of households that have defaulted on their utility bills, despite the fact that Bulgaria's pricing policy is devised around keeping electricity prices artificially low. In addition, the data from the 2011 census showed that nearly 54 % of the inhabited dwellings in the country use wood and coal as a main heating source, while in villages, the respective share is 95.2 %. This is not only inefficient considering the limited insulation and outdated furnaces used but has been contributing to dangerously high levels of air pollution in urbanised areas.

The limited reach of certain types of networked energy infrastructures (particularly gas) means that, in addition to affordability issues, energy deprivation is also predicated upon the spatial and technical limitations associated with switching towards more affordable fuel sources in households. Some parts of the population have had no option other than using wood and coal for heating. In Bulgaria, switching towards this source of energy has clear positive income dimension. Subsidized household electricity prices have made Bulgarians in big cities overly reliant on electricity for heating. Hence, changes in electricity prices have had a disproportionately negative effect on energy poverty of households. A decentralised power generation system could partially solve this dilemma by allowing households and SMEs to move away from coal and wood, while not choosing the lesser evil, namely dependence on the central grid for electricity supply. If financial and administrative obstacles are removed, investing in self-production facilities could become much more attractive even to vulnerable groups. The latter could benefit from special financial support from the government in the form of subsidized loans or innovative financial mechanisms involving the pooling of many communities in energy cooperatives.

[19] CSD, 2014, Energy Sector Governance and Energy (In)Security in Bulgaria, Center for the Study of Democracy, Sofia.

4. PROSUMPTION AND DECENTRALISATION POLICIES IN THE EU – COMPARATIVE PERSPECTIVE OF GOOD PRACTICES

The International energy Agency (IEA) distinguishes four drivers or respectively barriers of prosumer growth, namely economic, behavioral, technological and national policy framework. Analysis of the economic drivers features the cost of PV systems, electricity prices and self-consumption ratio among others. Non-financial factors such as environmental protection considerations and achieving higher autonomy are considered to be key behavioral drivers. New developments for PV, electric vehicles, storage, demand response and energy efficiency represent the technological aspect. Specific national conditions are defined by PV rooftop availability, building-owner structure, grid conditions, administrative capacity and quality of governance.

Although there has been no clear definition of prosumption in EU energy legislation yet, some aspects are already covered by the provisions for small-scale electricity producers in the Energy Efficiency Directive, the Renewable Energy Directive and the Guidelines on State Aid. For example, the Renewable Energy Directive requires priority grid access for renewable electricity, with a provision for small scale capacities that need to be less burdensome regarding administrative and regulatory procedures and the Energy Performance of Buildings Directive indirectly creates demand for prosumption by setting targets for zero-energy buildings (by 2021). The European Parliament has also called for the recognition of the important and changing role of consumers in the transition to a clean and decentralized energy sector. The 2016 Communication on "Clean Energy for all Europeans" the EC further emphasizes on the need for legislation to reflect the shift of role from consumers to prosumers.

The same year, the European Commission (EC) published a study on residential prosumers with the goal to identify policy and economic drivers and respective legislation barriers. Results show that most Member States have tried to create a dual legislative framework for prosumption – one for self-consumption only and one for allowing sale of electricity back to the grid. The International Energy Agency (IEA) defines a small-scale RES-based generation facility with a capacity of up to 10 kW, which is also what EU research shows to be the most prevalent form of residential power installations.[20] For example, in the UK the average capacity of PV installations is 3.5 KW, which could produce more than 60 % of the annual household consumption (at 90 % utilization). The EU has adopted a three-tier approach for defining renewables-generating capacity: residential capacity is set at a maximum of 10 KW, commercial

[20] IEA 2014.

from 10-250 KW, and industrial more than 250 KW installed capacity.[21] This distinction is necessary due to the different price structures, self-consumption levels and thus, researchers call for separate actions in the different domains.

Usually, self- consumption is profitable when the time of consumption matches the time of production (given the costs related to renewable energy storage deployment). Commercial prosumers achieve higher rates of self- consumption than residential ones, because they generate their power at the time of consumption (during the day), for some business the rate reaches 50-80 %, while some commercial and manufacturing buildings self-consume 75-100 % of the electricity they produce. This has a direct impact on energy bills and lowering peak system demand. In contrast, PV residential prosumers usually consume up to 30 % of the generated power, which means that the rest could be sold to the grid leading potentially to power system imbalances.[22] This speaks of the need to foster the uptake of storage systems, introduce blockchain technology to allow for trading among prosumers, bring production close to consumption or change consumption behaviors.

Renewable Energy Cooperatives

One of the most financially efficient ways of decentralizing the power system has been the spread of renewable energy cooperatives around Europe. Renewable energy cooperatives emerged as a new successful business model in the power sector that is currently developing under a favorable national policy framework most notably in Germany and Denmark. Their example could be used for policy guidelines in the case of Bulgaria, where individual household-based RES-based power generation would be prohibitively expensive to most people. Cooperatives allow citizens to develop joint ownership and participation in renewable energy projects, hence sharing the financial and environmental benefits from these projects.

The popularity of renewable energy cooperatives in Denmark and Germany could be explained by the generous support for such initiatives and the countries' tradition with communal energy projects.[23] Germany exhibits a long history of self-consumption, albeit fossil-fuel based, where about 7 % of the total electricity demand is met by industrial self-consumption, generated in most part by Combined Heat and Power (CHP) plants.[24] German citizens started to install roof-mounted PV and small wind turbines as early as the 1990s. With the first Renewable Energy Act (EEG) introduced in 2000, feed-in-tariffs (FiTs) for a 20-year period were set so as to foster market uptake. Energy cooperatives (Energie-Genossenschaften) emerged as a model enabling citizens to build larger

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[21] EC, *Study on "Residential Prosumers in the European Energy Union"*, May 2017, https://ec.europa.eu/commission/sites/beta-political/files/study-residential-prosumers-energy-union_en.pdf

[22] EP. *Briefing. Electricity prosumers*. 2016. http://www.europarl.europa.eu/RegData/etudes/BRIE/2016/593518/EPRS_BRI(2016)593518_EN.pdf

[23] www.rescoop.eu

[24] Eurostat Database. (2018). Data for 2016 in the Supply, Transformation and Consumption of Electricity – Annual Data Section.

scale installations, such as solar parks. In 2012 citizen-owned electricity generation through rooftop PV, larger scale installations owned by energy cooperatives (incl. citizens in the broader sense)[25] contributed to 46 % of the installed renewable energy capacity of 72.9 GW.[26] Furthermore, more than 90 percent of Germany's wind parks are operated by small project developing companies and public initiatives.[27]

The majority of German energy cooperatives (75 %) finance renewables projects via so-called cooperative banks (38 % with subsidies, 19 % with loans from other banks and 14 % from other sources). Cooperative banks not only provide loans, but also offer consulting, marketing and insurance services to renewable projects. Also, the energy cooperatives in Germany focus on regional value added by using local/regional resources, craftsmen and benefit from trade tax income.[28] Crowdfunding has also become a way to finance projects with several crowdfunding platforms focused on energy cooperatives. One of them raised more than 1.2 million euros in its first year, with an average investment of 1,252 euros by 1,000 individuals and accepting investments starting from as low as 25 Euro. In 2014, 92 % of the members of energy cooperatives in Germany were private individuals.[29] 86 % of the energy cooperatives in Germany generate electricity, 19 % operate a district heating network and 1 % operate local power distribution networks.[30] They have an average minimum participation of EUR 652 per member and a total average participation of EUR 3'652.

A study on renewable energy cooperatives in Germany reveals more details about the structure of energy communities and cooperatives. In 2012, 80 % of energy cooperatives had capital of less than EUR 2 million and just a few over EUR 5 million,[31] with stable equity ratios between 31-100 % for over 60 % of the analyzed cooperatives. Concerning the social structure, in the same year, half of the energy cooperatives had between 3 and 100 members, and 30 % had between 100 and 200 members. Most of these members were men aged 35 and older (88 %), university graduates (51 %) who earn EUR 2'500 or more per month (compared to 11.5 % earning less than EUR 1'500 per month). Energy cooperatives in Germany are run in a democratic way with each member having one vote regardless of the investment size. 96 % believe they are well informed on operational and organization issues.

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25 A broader definition of citizens' energy also includes shares held in public and private companies generating renewable power, including 'Municipal utilities'. (CLEW)

26 (https://www.cleanenergywire.org/factsheets/citizens-participation-energiewende figures on citizen ownership)

27 https://www.cleanenergywire.org/dossiers/onshore-wind-power-germany

28 https://www.dgrv.de/en/services/energycooperatives/energycoopsfinancewithlocalcoopbanks.html

29 Source: Figure: Membership structure of energy cooperatives. Source: Federal Office for Energy Cooperatives, DGRV, 2014. (https://www.cleanenergywire.org/factsheets/citizens-participation-energiewende)

30 Energy cooperatives Results of the DGRV-Survey (at December31, 2015), 2016, DGRV https://www.dgrv.de/weben.nsf/2a1a6cd05dbb01c0c1256e2f005612d1/e7b7b885ccf6c6e8c1257e84004f9047/$FILE/Survey_Energy_Cooperations_2015.pdf

31 Munich Personal RePEc Archive. Research Perspectives on Renewable Energy Cooperatives in Germany: Empirical Insights and Theoretical Lenses https://mpra.ub.uni-muenchen.de/55931/1/MPRA_paper_55931.pdf

In Denmark, energy cooperatives date back to the 1980s when the first wind power plants were built by citizen-led associations. Now a total of 20 % of all wind-based power plants are operated by cooperatives.[32] Even small-scale district heating units are still largely organized through cooperatives. Photovoltaic cooperatives have begun emerging in Denmark since 2012 on the back of supportive net-metering rules and a preferential feed-in tariff for households and cooperatives selling electricity back to the grid. PV projects have become increasingly more attractive to households and cooperatives as the excessive construction of windmills has been met with social resistance due to the decline of returns from wind-based power plants and the territorial capacity to build new facilities. There are four main forms of community-based RES projects in Denmark including:

- General partnerships between individual members, which jointly take investment and production decisions. Every member, no matter how many shares in the project he/she has, has one vote.
- Municipal ownership, in which municipalities set up a private company to operate wind turbines either alone or in partnership with a local utility.
- Community foundations, established by local businesses or industrial associations, with the goal of reinvesting profits from the electricity supply for community benefit.
- Shared ownership, in which private developers have to either offer 20 % of the shares of the project to local residents or sell part of the project, for example one wind turbine, to community organizations.

Best practices in decentralization support measures

There are three main ways, in which EU member-states are supporting power market decentralization and prosumption patterns: prosumers can feed electricity to the grid for free, prosumers are offered a reduction in their energy bills for the electricity they feed into the grid, or prosumers are paid for the electricity fed into grid by utilities[33]. Again, Germany, the UK and Denmark have been leading by example by offering some of the most effective regulatory frameworks for promoting citizen-led renewable energy technologies.

Germany

Germany has developed a wide portfolio of supporting mechanisms for renewable energy, including low-interest loans, premium feed-in tariffs, utility bills surcharges, etc.[34] In addition, the Act on Granting Priority to Renewable Energy Sources (EEG) obliges the grid operators to give priority access to renewable capacities, expand the grid if necessary to

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32 Information on the Development of Communal-based Energy in Denmark, Community Power (Co-Power) project accessed at http://www.communitypower.eu/en/denmark.html

33 For example, Germany and the UK offer prosumer remuneration, while Denmark and the Netherlands offer compensation of energy bills (eg. net metering) based on the electricity fed into grid.

34 Summary of supoprt schemes, http://www.res-legal.eu/search-by-country/germany/tools-list/c/germany/s/res-e/t/promotion/sum/136/lpid/135/

accommodate the new facility and purchase the generated electricity with priority.[35] Renewable energy plant operators (may or may not own the plant) in Germany are entitled by law to grid connection with priority over conventional power plants, with the point of connection being either the closest grid or the one that can provide better technical and economic feasibility (even if this means grid expansion). Plant operators carry the cost for grid connection to the closest point and for installing smart meters. The DSO can assign a different connection point than the closest one, but would then bear the associated costs. Each DSO can set its own procedure for grid connection. The grid operator has to provide grid access to a plant even if this demands grid expansion or optimization (when this is assessed as economically reasonable).[36]

A preferential feed-in tariff is applicable to all renewable capacities (wind, solar, hydro, geothermal, biogas, biomass) under 100 KW and usually set for a 20-year period. The grid operator pays the plant operator fixed sum per kWh. In addition, a Tenant Electricity Surcharge has been introduced for prosumers, which applies only for solar PV rooftop installations and covers the self- consumption of residential power plants up to 100 KW, while the above described FiT covers the electricity sold back to the grid. The Tenant Electricity Surcharge depends on the installed capacity and is EUR ct 8.5 lower than the feed-in tariff or EUR ct 3.81 per kWh for capacities less than 10 MW.

The FiT for residential PV installations depends on the size of the installed capacity and the energy source, (e.g. roofs, facades, noise barriers) but it varies between EUR ct 8.91 – 12.70 per kWh. Commercial prosumer growth has been impacted negatively in 2014 after the introduction of the Tenant Electricity Surcharge (which gives less benefits for self-consumption compared to feeding into the grid) applied to self-consumed PV electricity, in this way putting a temporary break on the growth of commercial prosumers.[37]

United Kingdom

In the UK more than half of the installed renewable capacity is either residential or community owned with households or household alliances dominating the sector. Electricity generation from renewable energy sources is supported through several mechanisms: a feed-in tariff, Contracts for Difference (CfD) scheme, a quota system and tax regulation mechanism. Renewable capacities are connected to the grid under the principle of non-discrimination and the grid operator is

[35] http://www.res-legal.eu/search-by-country/germany/summary/c/germany/s/res-e/sum/136/lpid/135/

[36] Plant operators, which feed electricity to low and medium-voltage grids apply for "grid system connection request". The DSO has eight weeks to issue timetable, cost estimate, technical reqirements, etc. The DSO then assigns a connection point and makes an offer to the plant operator. Then, the plant is connected to the grid and can start feeding in electricity. A signed agreement between the DSO and the plant operator is optional.

[37] IEA. Tapping the Potential of Commercial Prosumers. DRIVERS ANDPOLICY OPTIONS (RE-COM-PROSUMERS) http://iea-retd.org/wp-content/uploads/2016/08/RE-COM-PROSUMERS-Report.pdf

obliged to expand grid capacity if this is necessary to accommodate for all the renewable energy produced by a plant, but is not obliged to give priority access to the grid.[38] Renewable energy plants (wind, solar, hydro) with a capacity of up to 5MW (and above 50KW) are eligible for the FiT (ROO FIT Large installations),[39] which is defined in accordance to the category of installed capacity, position in deployment caps and technology.

Tariffs are adjusted on an annual basis, in accordance with the Retail Prices Index. Deployment caps have been set since February 2016 and their goal is to limit capacities that are eligible for a particular tariff in a given period.[40] The Renewables Obligation (RO) is a quota mechanism, which ensures a certain proportion of energy delivered by electricity suppliers is renewable and is applicable for capacities above 5MW (plant operators with capacities between 50 kW and 5MW could choose either of the two schemes). This scheme is closed down for all new capacities since March 31, 2017 (the intention to do so is communicated in 2011 and the Contracts for Difference Scheme replaces the RO for larger capacities).

CfDs are contracts between the renewable plant operator and Low Carbon Contracts Company (LCCC), wholly owned by the UK Government, and function based on the “market price” and a pre-agreed “strike” price. They support renewable energy by providing predictable revenue streams in the long-term and are currently UK’s main instrument to incentivize investments. Payments are made both ways- when the market price is below the ‘strike’ price, the LCCC pays the plant operator the difference and when the market price exceeds the ‘strike’ price, the operator pays the amount of the difference to the LCCC. The scheme is funded by the Supplier Obligation, while operational costs of the LCCC are funded through the Operational Costs Levy for applicable for all UK suppliers.[41] Plant operators have to participate in an Allocation round (so far there have been two- in October 2014 and April 2017). Starting from April 2017 the CfD scheme is the only support scheme for all new renewable power plants over 5MW.

In addition, small capacities under 50KW (wind and solar) take part in the micro-generation certification scheme (MCS) and are exempt from the described provisions for larger capacities.[42] MCS applies to small installations solar PV and wind with a capacity of 50kW or less and all micro combined heat and power (CHP) installations.[43]

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38 http://www.res-legal.eu/search-by-country/united-kingdom/tools-list/c/united-kingdom/s/res-e/t/gridaccess/sum/204/lpid/203/

39 https://www.ofgem.gov.uk/environmental-programmes/fit/applicants/roo-fit-large-installations

40 4 Tariff periods per year for renewables and 2 for micro CHP.

41 https://www.emrsettlement.co.uk/about-emr/contracts-for-difference/

42 http://www.res-legal.eu/search-by-country/united-kingdom/single/s/res-e/t/promotion/aid/feed-in-tariff-5/lastp/203/

43 Microgeneration Certification Scheme: Small installations https://www.ofgem.gov.uk/environmental-programmes/fit/applicants/microgeneration-certification-scheme-mcs-small-installations

Denmark

Denmark aims to meet 50 % of its electricity demand from RES in 2030 and be a 'low carbon' society by 2050.[44] Grid operators have to connect renewable capacities under the principle of non- discrimination (with no priority given to RES) and although they need to expand capacity under certain circumstances, plant operators are not entitled to it.[45] Through the Law on Promotion of Renewable Energy, the Premium tariff supports electricity generation from renewable sources (wind, solar, biogas, biomass, hydro) in Denmark. Regarding solar PV installations, since 2016, only installations with a capacity of less than 500KW are eligible for the tariff, including commonly owned PV with or without self-consumption and household installations connected to self-consumption, with an approximate value of the tariff equal to 10ct per kW/h in 2017.[46] Those who consume all or part of the electricity they generate, are (partially) exempt from the Public Service Obligation (PSO) charge, introduced in support of RES. Loan guarantees and feasibility study support are provided by Energinet.dk (independent public enterprise owned by the Danish Ministry of Climate and Energy owns, operates and develops the transmission systems for electricity and natural gas in Denmark) to associations and local initiatives for wind power generation, with a total budget of 10 million Euro and a maximum project guarantee of EUR 67'000.

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44 IEA. 2017. Energy Policies of IEA Countries. Denmark http://www.iea.org/publications/freepublications/publication/EnergyPoliciesofIEACountriesDenmark2017Review.pdf

45 http://www.res-legal.eu/search-by-country/denmark/tools-list/c/denmark/s/res-e/t/gridaccess/sum/95/lpid/96/

46 http://www.res-legal.eu/search-by-country/denmark/single/s/res-e/t/promotion/aid/premium-tariff-law-on-the-promotion-of-renewable-energy/lastp/96/

5. LEGAL AND REGULATORY FRAMEWORK FOR SMALL RES IN BULGARIA

Bulgaria has some of the most burdensome procedures among the EU countries, when it comes to the installation and exploitation of small PV capacities, particularly regarding grid access and system operation. The unpredictability of policies, regulations and incentives in the sector is another key obstacle for people to invest in new capacities, which according to the statistics are declining steeply. To illustrate, in the past there have been instances when the Electricity System Operator decided to limit generation from renewable energy plants to 40-60 % of their capacity in the hours between 10am and 5pm (on the grounds of maintaining grid stability), in this way influencing significantly the economics of PV projects.

The incentives (currently the as feed-in-tariff for capacities under 30KW) are not sufficient to compensate for the limited funding for PV projects and lack of financing mechanisms, such as grants, loans for green energy, etc. Foreign investment in the sector has also been impacted negatively by the severe unpredictability of policies and incentives. Characterized by high upfront costs (but low operational costs) and a relatively long payback period, PV capacities need a more predictable environment to thrive. Bulgaria's support scheme for new capacities under 30KW from 2020 on is unclear yet and some of the key strategic documents such as the National Energy and Climate Plan (NECP) are still in the making, leaving many questions about the future development of the country's energy policy.

The legislative framework governing small-scale RES-based electricity generation depends on several interdependent legislations, ordinances and strategy papers. The most important pillars of the Bulgarian energy policy consist of:

- The Energy Act;
- The Energy from Renewable Sources Act;
- The Energy Strategy of the Republic of Bulgaria till 2020;
- The National Action Plan for the Energy from Renewable Sources.

During the 2008 – 2009 period state incentives for the development and exploitation of new renewable energy sources were adopted without the existence of an adequate regulatory framework. In 2011 – 2012, the government responded to the booming interest in the renewables' investment with administrative and regulatory limitations instead of removing incentives. The latter created the ideal environment for corruption to thrive. All this resulted in BGN 700 million (~EUR 358 million) of unpaid debts by the regulated market electricity provider to renewables producers, and the blocking of further renewables investments after

2014. Even though the boom in renewables in Bulgaria has helped the government achieve its EU commitment to have 16 % of final energy consumption coming from renewable energy by 2020, the country has paid a high price as it has destroyed public trust and the image of renewables among ordinary Bulgarians.[47]

Stakeholder analysis

There are many stakeholders, defining the success or failure of small RES capacities in the residential sector. The stakeholder analysis would look deeper into the roles of each of them:

a) The National Parliament, responsible for the national legislation:

– The National Parliament adopted the first version of the Renewable Energy Support Act (RESA) in May 2011. The RESA implemented the requirements of Directive 2009/28/EC of the European Parliament and of the Council on the promotion of the use of energy from renewable sources. The RESA has been amended several times since then. Additional conditions regarding the governance of renewable energy have been implemented in the national legislative framework – the Energy Strategy of Bulgaria until 2020 (adopted in June 2011), the Energy Act, etc. Most recently in May 2018, the Bulgarian parliament passed an overarching amendment to the Energy Law obliging all renewable power producers with capacity of at least 4 MW to sell all of their power production on IBEX at a "premium tariff" determined on a bi-annual level by the Bulgarian energy regulator. Since the latter is below the price agreed in the long-term purchase contract, the companies would be receiving a compensatory premium, in effect the difference between the market price and the contract price.

b) The sectoral ministries (of energy, public works, etc.), responsible for the secondary legislation:

– The Ministry of Energy and the Ministry of Environment and Water is responsible for implementing the national energy policy of Bulgaria. The Ministry of Energy is also the sole shareholder in some of the largest energy companies in Bulgaria joined under the Bulgarian Energy Holding (BEH). The shareholdings of BEH include 100 % ownership in, among others: the National Electricity Company (NEK) – the public supplier of electricity and the owner of the largest hydro capacities in Bulgaria; NPP Kozloduy – the only nuclear power plant in the country; TPP Maritsa East 2 – the largest lignite power plant in Bulgaria; Maritsa East Mines – the largest lignite mine in the country; Electricity System Operator – the TSO, owner of the high-voltage transmission network; Bulgartransgaz – the TSO, owner of the high-pressure national gas transmission system; Bulgargaz – the public supplier for natural gas; etc. Until recently, NEK was responsible for purchasing all of the renewable energy-based generation including it in the regulated energy market mix. Since NEK is selling electricity

[47] CSD (2014) Energy Sector Governance and Energy (In)security in Bulgaria.

on the regulated market at prices below the purchasing price, this has contributed to an enormous tariff deficit, which has reached over EUR 125 million in 2014. In order to stabilise NEK's financial health, the government led by the energy ministry introduced an energy sustainability fund (ESF), which collects the social responsibility tax (SRT) (i.e. the green and CHP surcharge) paid by all final consumers, the CO_2 emission revenues and a 5 % revenue tax imposed on power producers and transmission system operators. The ESF now directly compensates the difference between the regulated market price charged by NEK and the power purchase price including the one based on the preferential feed-in tariffs for renewables and CHPs.

c) The national energy regulatory authority, responsible for specific sectoral documents (e.g. rules for energy trading, for the balancing market, etc.):

– The Energy and Water Regulatory Commission (EWRC) is the institution responsible for the governance of the energy sector, including RES. The EWRC has 9 members and an administration for the 4 sectors it regulates: electricity, natural gas, heating, and water & sewerage services. Inter alia, its powers include the setting up of incentives for development of electricity networks, which have to accommodate "generation from different scale from RES and distributed generation." Also, the EWRC is responsible for the fair redistribution of the additional costs incurred by the FiT support scheme to all consumers connected to the transmission and distribution grids. Every year by 30 June, the regulator determines the level of the FiT by a capacity category for all renewable-based generation facilities with a long-term contract. The EWRC also adopts secondary legislation related to the governance of the RES sector, including ordinances for the connection and dispatching of RES.

d) The Sustainable Energy Development Agency (SEDA)

– The SEDA is responsible for the governance of the renewable energy producers in relation to the certification of the renewable energy volumes and the management of a special register for all renewable energy certificates. It is also responsible for the oversight of the Bulgarian NREAP. Its powers are defined by the Renewable Energy Support Act (RESA). The SEDA is also responsible for the implementation of national energy efficiency policy according to the national legislation.

e) The state-owned TSO for electricity and the privately-owned DSOs, responsible for grid connections;

– Electricity System Operator EAD (ESO) is the state-owned TSO, owner of the transmission grid (high voltage lines from 110 kV to 400 kV, plus substation, metering infrastructure, etc.). The company is responsible for the grid connection of producers, including RES, with capacity of over 5 MW. It is also responsible for the dispatching of the national transmission grid and responsible for keeping the balance between electricity generation and demand. ESO has to prepare a Ten-Year Network Development Plan (TYNDP) every two years, in which it forecasts the installation of new renewable energy facilities.

- Distribution System Operators (DSOs) are private companies, with regional monopoly ownership over the national distribution grids (medium and low voltage lines – from 110 kV to 0.4 kV, including substations and transformer stations, metering infrastructure, etc.). There are currently 4 licensed companies operating the distribution grids: CEZ Razpredelenie Bulgaria – responsible for Western Bulgaria's grid; Elektrorazpredelenie Yug, part of EVN Bulgaria, responsible for the South-Eastern part of Bulgaria; Elektrorazpredelenie Sever, part of Energo-Pro Varna holding, responsible for the North-Eastern part of Bulgaria; and Electricity Distribution Company Zlatni Pyasatsi, responsible for the distribution grid in a seaside resort in North-Eastern Bulgaria. The DSOs submit in the first quarter of each year a prediction about the renewable energy capacity that is expected to be added to the grid through the year. ESO then aggregates the new capacity forecast and submits it to the energy regulator for approval. Small-scale renewables (below 30 kW) are not included in the forecast. Since 2015, the ESO has consistently forecast 0 MW of new renewables capacity to be added to the grid. This is reflected in the largely stagnant generation profile of wind and solar facilities but is somewhat strange considering the rapid increase (albeit from a low level) of power generation from biomass.

Even if all 4 of the DSOs are regulated by the same institution – the EWRC, their processes for connection of distributed energy sources, as well as their administrative procedures, may differ and lead to different practices. For instance, while the validity of the approvals for connection of one of the DSOs is valid for one year, another DSO has a rule, that approvals are valid for 6 months only. The fees required during the connection approval process are different and so are the needed steps in terms of coordination with other authorities (other grid operators, the municipality, etc.).

f) Other national and local authorities:

- The municipal administrations are responsible for several key procedures, related to the installation of new small RES capacities. These procedures include land use, building permits, architectural and technical plans. The municipal administrations are also overseeing the connection of rooftop solar and other small distributed RES capacities by working together with DSOs on approvals and safety requirements. For example, the final grid connection contract is not possible to be issued by the DSO without a building permit for the PV installation. There is a different set of administrative procedures in different municipalities. In some municipalities procedures are more complicated due to the opinions of the environmental/health administration on the assumed damaging impact of the system on people/birds. To some extent this problem is due to ignorance and a lack of adequate knowledge about PVs. Some municipalities require the plans to contain exact specifications of the provided equipment (like brand and electricity parameters of the provided modules), which creates unnecessary administrative burden.

– Cadastre services – Usually, a proof of ownership is needed along with an up-to-date property plan of the location where a distributed RES is going to be installed. The property plan should not be older than 6 months. The cadastre is far from perfect and still a large territory of Bulgaria – more than 60 %, is not covered by its services.

g) Civil society

The general public has been quite neutral toward the RES sector, at least in the first years of its development after the adoption of the first RES law in 2007. There were no objections toward the high FiTs defined by the EWRC at least until the investment boom in RES in 2011 and 2012. Media have also been generally neutral in this period and presented the new RES technologies as a way for decarbonizing the economy, without objecting to the associated costs.

All this changed when the political agenda had to accommodate to the quick rise of RES capacities, which had to be subsidized through end-user costs. The EWRC has been cross-subsidizing the prices for residential consumers through higher prices for the local industry. As an exporting market, the Bulgarian electricity sector was also cross-subsidized by the foreign markets. The price increases in the electricity sector and the low average income of the Bulgarian households eventually led to mass protests against the incumbent electricity suppliers, which escalated in protests against the government and its resignation in the beginning of 2013. Media outlets are also quite aware of their readers' and viewers' attitudes. Thus, the electricity sector occupies the first-page headlines only if there are increases in the end-user prices. One of the narratives, which were presented by nationalist parties and accepted by many citizens, was that subsidised RES, together with other subsidised producers, are the reason for the high prices.

One could claim, that residential energy consumers are technology agnostic. There is no bias toward any of their energy options – be it nuclear, coal, gas, or renewables. Households are still most concerned about their energy costs and are considering energy options not based on carbon footprint, but mainly according to the associated costs. Their "choice" to use electricity from the grid is natural, considering that regulated prices are still low and subsidised, especially when compared to the distributed RES options. Their attitude may be inclined toward support for small RES, including in their homes, if the proper incentives are in place together with affordable financial options.

Barriers to development of small-scale RES

In principle, the legislative framework in Bulgaria does not distinguish between the different producers of electricity from RES, and there are no specific provisions for prosumers or energy cooperatives. Although some exemptions or simplified procedures exist for small installations of less than 30kW in buildings that are already connected to the network, the administrative process for small-scale installations remains cumbersome and more adequate for industrial producers.[48] The construction of small rooftop PV systems on residential buildings in Bulgaria is hampered by numerous complicated procedures. The construction of such installations is not possible only by notification, but involves obtaining a Building Permit. This procedure entails the need for a supervision company to monitor the construction of the PV system, as well as complimentary architectural, electrical, static and other designs subject to special approval by the municipal administration. The Land Use Planning Act (LUPA) however has been amended to allow for a simplified procedure for solar capacities less than 30 kW. According to the changes from 2011, a building permit is not required for installing RES capacities under 30 kW, including when those are built on existing structures.[49]

An amendment to the ERSA from April 2012 implemented more formal simplified regime for building small PVs on rooftops and similar locations by reducing the number of procedures, relevant to large and mid-scale ground-mounted PV plants. The simplified procedure is applicable to capacities up to 30 kW on residential buildings, capacities up to 200 kW on industrial/storage buildings, small HPPs with capacity up to 1.5 MW, and biomass up to 500 kW (for biomass and agricultural waste) and up to 1.5 MW (for biomass which is at least 60 % manure).[50] According to the legislative changes, the procedures should not last more than 2 months, but in practice it takes over 4 months because of several controversial provisions. One example is a transitional provision of the ERSA that allows DSOs to reschedule the grid connection of larger scale PV plants after 2016 if they contribute to potential destabilisation of power grids. DSOs have been also trying to apply the same method also for the small residential PV segment.[51]

An adopted Ordinance under the ERSA provides an opportunity for the DSO to reject connection of the RES installation to the grid[52] if a) there is no technical availability to connect the producer in the asked timeframe, or b) when the connection of this producer would lead to the deterioration of the supplies for other consumers due to lack of [grid] capacities. This contradicts the preferential status for connection of residential installations provided by the ERSA legislation itself. The DSO sometimes refuses to purchase the full amount of electricity from rooftop PV plants, motivating that first the PV plant should cover first the demand of the dwelling itself and then, the rest of the electricity

48 European Commission (2017) Study on Residential Prosumers in the European Energy Union, part of the Third Report on the State of the Energy Union.

49 Ministry of Regional Development and Public Works (2017), Land Use Planning Act, Art. 147, http://www.mrrb.government.bg/bg/zakon-za-ustrojstvo-na-teritoriyata-zut/

50 SEDA (2015) Energy from Renewable Sources Act, Art. 24, http://www.seea.government.bg/documents/ZEVI.pdf

51 PV Grid (2014) Bulgaria: Small Scale Residential PV, http://www.pvgrid.eu/database/pvgrid/bulgaria/national-profile-2/residential-systems/2272/small-scale-residential-pv-1.html

52 Ministry of Energy (2014) Ordinance 6 on Connecting Electricity Producers and Consumers to the Electricity Transmission and Distribution Grids (Naredba 6), Art. 11

will be purchased. "Own needs" are mistakenly interpreted as the electricity need of the entire building on which roof the PV plant is. This problem is usually resolved by registering a legal entity, as then, "own needs" are interpreted as the needs of the particular household only.[53] In addition, the standardized contracts and the business attitude toward small RES differ between the various DSOs (CEZ Razpredelenie Bulgaria, Elektrorazpredelenie Yug – EVN, and Elektrorazpredelenie Sever – Energo-Pro). Some of them do not indicate the connection point in their preliminary official evaluation, on the basis of which all licensing procedures for the construction of the system are carried out.

Also, administrative procedures are not consistent among different municipalities. In some municipalities procedures are more complicated or more expensive, which leads to cost overruns or to significant time delays that diminish the incentive of households to start the investment in the first place. Municipalities are responsible for managing the construction permitting process governed by the LUPA. This part of the whole investment cycle takes the longest time to complete – roughly 150 days. In addition, permitting deadlines are not always kept due to lack of administrative capacity but also as result from corruption pressure from municipal officials. Moreover, many urban areas do not have an applied street regulation, which makes it difficult to locate residential and electrical infrastructure that needs to be upgraded to allow the installation of the renewable capacity. Municipalities neither have the budget nor the staff to conduct all the necessary procedures to place urban areas under a full regulated status.

Regulatory Framework for Prosumption

There is no special legislative framework for prosumption or for decentralised power generation. The only difference between the rules for the installation of new RES-based electricity capacity is related to the size of the facility. Power plants below 30 kWp are the only RES plants that are still eligible to receive fixed preferential feed-in tariffs if connected to the grid. The lack of a differential approach towards the integration of small-scale RES, in practice, means that the administrative burden for households and small businesses is much greater of a barrier than for an energy company investing in a large-scale capacity. Even if a household wishes to install a renewable-based facility only for self-consumption, the barriers are similar to the one faced by industrial-scale producers. The introduction of a fast-track procedure for small-scale RES, or even a one stop-shop institution speeding the overcoming of administrative hurdles by prosumers is critical if the country could take advantage of its enormous potential for decentralised power generation.

The regulatory framework for the installation of RES is not limited to the national legislation governing the renewable energy sector but encompasses all the different administrative, regulatory and municipal normative acts such as ordinances and procedural regulations. The

[53] Ministry of Energy (2014) Ordinance 6 on Connecting Electricity Producers and Consumers to the Electricity Transmission and Distribution Grids (Naredba 6).

bureaucratic process of installing a small-scale RES facility reminds more of a civil construction project, rather than the deployment of a new energy technology. The installation of a solar panel, a wind mill or a biogas generator has to take place on *regulated* land, which means that the legal designated use of the territory, where the facility would be installed, cannot be changed. In effect, this constraints small-scale RES investors from using agricultural and forest lands.

The bulk of administrative procedures concerning the process of micro-RES installation are governed by the Law on Energy from Renewable Sources (LERS), Ordinance No.6 (more specifically chapter 5 on RES) and the Land use planning act (LUPA). LERS governs the socio-economic relations related to the production and consumption of electricity, heating and cooling from the renewable energy sources. It is where one can find the main elements of the state support mechanisms for new RES-based generation facilities. Ordinance No. 6 (as mandated by Art. 116 from the Law on Energy) lists the administrative steps to connect a power-generating facility to the grid, and the LLUP governs the construction phase of the investment process. Special by-laws govern some of the specific tasks during the installation of the RES facility and during its exploitation.

Administrative Procedures

Before an investor and prosumer could even start the process of installing a renewable energy facility, the distribution system operators (DSOs) annually submit a forecast to the Transmission System Operator (TSO) for the amount of renewable energy capacity that would be added to the distribution grid in the following 12 months (on a regional and different voltage basis). The TSO then has two months to approve the DSO submissions and submit a separate annual forecast to the energy minister and the energy regulator (EWRC) for the new RES capacity added to the DSO and TSO grids over the next year. The energy ministry sends a reasoned opinion for the TSO proposal to the regulator, which has until 30 June to publish online the renewable capacities approved for connection to the grid (again on a regional and different voltage basis). In fact, this means that the DSOs could limit the future amount of renewable capacity installed to the grid already before any grid connection applications are submitted. The DSO/TSO forecast for new RES installations does not include facilities below 30 kW.

Once a household or a business decides to invest in a small-scale power plant, the following main administrative steps, governed by Ordinance No. 6, need to be cleared before the exploitation of the new plant begins:

1. DSO Application- request for assessment

- All physical or legal persons, wishing to construct a facility for generation of electricity from renewable energy sources (up to 5 MW) or to increase the capacity of an already existing plant, submit an application to the respective DSO (based on the region) for connection to the grid- request for assessment. The application costs around EUR 35 and has to be supplemented by a number of documents including proof of ownership, approved construction project by the municipal architect, certificate showing the real estate is on regulated land, and detailed technical specifications of the power plant. In case, the DSO requires information or documents that have not been provided with the application, the applicant has 14 days to provide the latter. Then the DSO has 14 more days to decide whether the application is fully completed. The applicant has 30 more days to provide the needed documentation. After this period, the application is considered invalid.

- The DSO has 30 business days to review all the documentation and issue a motivated opinion on the acceptability of the project (in case the point of grid connection coincides with that of the metering device), it takes 15 days to review the application. The DSO refuses all applications after the limit of the forecast annual capacity of renewable energy facilities in the region has been reached without considering them.
- When the DSO's opinion shows the application was eligible, it evaluates the conditions and the way to connect the facility to the grid in a 30-day period. If the DSO needs to consult the TSO on the conditions for the connection to the grid, the respective period for a reasoned opinion doubles. If the new plant requires moving existing electricity infrastructure (which becomes clear during the assessment phase) the producer is responsible both financially and for executing the works.

2. Request for a contract

- The person that has received a positive opinion from the DSO on the eligibility of the application, can submit a request for a contract with the DSO for the connection of the facility to the grid, providing an assessment from an electrical engineer in accordance with Category 6 construction (LUPA) and a building permits.
- The DSO has 30 days to prepare a contract, (which is accompanied with the issue of an invoice for advanced payment, which in the case of small-scale RES facilities of below 5 MW, is EUR 12,500 per MW (a facility with capacity of 30 kW, for example, would then pay EUR 375). The advance payment (to be paid within 7 business days) is part of the costs for connecting incurred by the DSO to connect the facility to the grid.) and 30 more days after the contract is signed to elaborate a detailed design plan on grid connection. The DSO has to finish all works and installations related to the grid connection no longer than 30 days after the filing of a notification by the investor for the formal completion of the installation. The notification is accompanied by technical documents certifying main technical and safety parameters of the power-generating facility and the construction stages together with technical drawings. The DSO has 7 days to assess the compatibility with legislative acts (in case the notification does not contain all needed information, the investor has 7 more days to provide it to the DSO, the application is cancelled if it takes longer than 7 days).

- When the declaration is validated by the DSO, within a 7-day period, the DSO and the producer coordinate a date for technical testing of the facility, which cannot happen later than 14 days after the approval of the declaration. The producer, the person responsible for the installation and the DSO sign a protocol on compatibility.

3. Connection to the grid

- Grid connection is allowed upon:
  - Declaration for acceptance of the General terms for grid access of the respective DSO
  - Copy of a contract for the purchase of electricity produced
- The electricity producer pays the DSO for connecting the facility to the grid according to the terms and in the time framework, determined by the grid connection agreement.
- Even if one chooses the trading arm of the owner of the DSO connecting the new facility, the producer would have to supply the retail company with the whole project documentation, which would then be reviewed in full contributing to further delays in the final grid connection process. The DSO also sends a written request to the energy regulator, EWRC, for determining the feed-in tariff (FiT) for the RES facility below 30 kWp although such procedure is not necessary. The amount of the FiTs by capacity categories are already decided by the energy regulator for the annual regulatory period starting from 1 July.

TABLE 3. ADMINISTRATIVE PROCESS FOR CONNECTING A SMALL-SCALE RES INSTALLATION BELOW 30 KW[54]

Stage	Timeframe (business days)	Cost
1. DSO evaluation of the conditions of grid connection and eligibility approval[55]	30-45 days	EUR 35-50
2. Installation company prepares eligibility opinions from an electrical engineer	7 days	EUR 25 (depending on the DSO) for evaluation of the opinions
3. Approval of the construction project and issue of a construction permit by the municipality	7-14 days	Fee is determined by municipalities on the basis of Category 6 construction, may vary
4. Construction of the RES facility	7-14 days	A 5-kW photovoltaic installation costs between EUR 5,000 and 7,000; investment in a 30-kW facility could reach above EUR 25,000

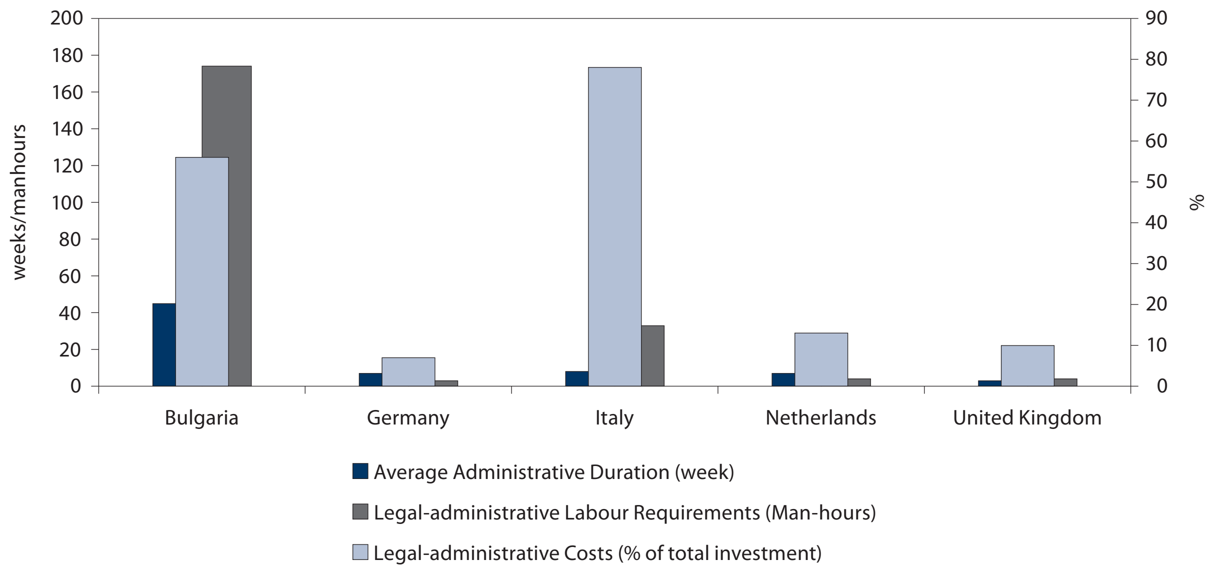
[54] Ordinance No. 6 from ESRA, DSO information bulletins online, online offers of renewable energy installation companies.

[55] Following an application filed in person in the respective DSO. DSO issues framework on grid connection. Preliminary contract application to be filed in DSO no later than 6 months after the latter is issued (Tax in accordance with Ordinance № 1/18.03.2013 г.)

TABLE 3. ADMINISTRATIVE PROCESS FOR CONNECTING A SMALL-SCALE RES INSTALLATION BELOW 30 kW (CONTINUED)

Stage	Timeframe (business days)	Cost
End of administrative and construction process for self-consumption; steps below for prosumption		
5. Final grid connection agreement with the DSO	7-30 days	N/A
6. Connection to the grid and 72-hour testing period	7 days (with the application and scheduling process)	EUR 25 for testing Up to EUR 375 for connection
7. Power purchase and balancing agreement with the DSO	7 days	N/A
Total	72-126 days	EUR 7,000-8,000 for PV below 5 kW EUR 27,000-28,000 for PV of 30 kW

FIGURE 5. COMPARATIVE ADMINISTRATIVE BURDEN IN FOUR EU MEMBER STATES



PV Financing Project – Database on Administrative Costs and Barriers for EU member-states

Following the overview of the complicated administrative procedure for installation of a small-scale renewable capacity, it is valuable to see how the Bulgarian situation compares to the most successful examples of the spread of decentralized renewables-based power systems. From Figure 5, one can easily see that potential Bulgarian prosumers face enormous legal administrative challenges during the investment process. According to a cross-European study from 2014, on average Bulgarian households would need around 40 weeks to install a new renewables facility and spend more than 170 man-hours of time commitment. Since then, legislative changes in the renewable energy law and the LUPA simplifying the administrative procedures and removing some of the consultative steps including the ones involving the energy regulator, have reduced the duration of the process to around 20-25 weeks. However, this is still much longer than what is necessary in Western European countries. Small-scale RES facilities are connected to the grid within 10 weeks in Germany, Italy, the Netherlands and the UK. Correspondingly, more than 50 % of the total investment costs in Bulgaria are devoted to the administrative process, which is overtaken just by Italy with 78 %. In most Northwestern European countries including the selected case studies, administrative costs range between 10 and 20 %, which together with the much more competitive market for PV construction and supplier companies contribute to a much more enabling environment for the uptake of off-grid solutions despite an overall smaller technical potential.

In order to foster small scale renewable installations and reduce the administrative periods, two reforms were undertaken regarding plants of 30 kW or lower installed capacity. First, many of the administrative steps involving the issue of construction permits have been largely removed by categorizing small PV installations as Category 6 construction in the LUPA. These projects are processed without appraisal of the investment plan and include less steps for approval. Second, small-scale renewable facilities no longer require the conclusion of apreliminary contract with the DSO,, again reducing the procedure.

Exploitation, Auditing and Taxation:
The Administrative Red-Tape following Connection

The cumbersome 5-month procedure for the construction of a small-scale RES installation even when it is a rooftop facility used largely for self-consumption, is followed by an equally complicated process for exploiting the facility and trading with the DSOs. Firstly, the prosuming household or business needs to pay for the installation of a smart metering device, which sends power generation data in real time to the DSO. The prosumer has to then enter in an agreement with a special balancing group (SBG), which in the case of the smallest installation, is led by the DSO itself. The SBG plays the role of balancing the differences between generated and consumed electricity according to a generation timetable approved in the agreement. The timetable is submitted by the prosuming entity in advance for a period of one year. In case of an imbalance (no matter whether above or below the forecast), the prosumer pays a small penalty of up to several euros. Estimating generation and sales to the grid is almost impossible especially if the main purpose of the generating facility is self-consumption, which means that smaller producers would likely pay around EUR 10 per annum for covering imbalance costs.

Once the renewable facility is connected to the grid, the owner has to apply to the Sustainable Energy Development Agency (SEDA) to be granted a guarantee of origin (GoI) certificate. This is again a slow administrative procedure, which requires the sending of a number of documents including invoices for the sold electricity, geospatial information for the facility including a detailed, certified design scheme, a trade measurement protocol and a certified copy for the exploitation of the facility. The whole procedure costs around EUR 10. In addition, the prosumer has to apply for the issue of a new GoI every time the facility generates at least 1 MWh of electricity, which means several times per annum. Without the certificate, the DSO is not obliged to pay the prosumer a preferential feed-in tariff set by the energy regulator each year. The procedure envisions that each GoI should be received in person, which creates an additional logistical obstacle for prosumers, especially when the facility serves for self-consumption only. In addition, the prosumer has to submit a quarterly and an annual report for the actual generated electricity during this period.

On top of the administrative and balancing costs of servicing a small-scale renewable-energy facility, a 5 % revenue tax is levied on all producers of electricity, which is paid monthly to the Energy Sustainability Fund (ESF). The revenue tax, which was introduced in 2015 in attempt to close the tariff deficit in the wholesale regulated market supplier, does not exclude the payment of a 10 % corporate tax.

Table 4. Investment Costs and Revenues

In Euro	5 kW	30 kW
Equipment Costs	5000	25000
Administrative Costs	500	500
Total preliminary costs	5500	25500
Preferential FiT (EUR/MWh)	138,9	118,2
Net specific output per annum (hours)	1261	1261
Average output per annum (MW)	6,3	37,83
Revenue from Power Sales	875,07	4471,506
Revenue tax – 5%	43,8	223,6
Access fee to the grid	23	141,11
Balancing costs	126	756,6
Profit before taxes corporate tax	682,3	3350,2
Corporate tax – 10%	68,23	335,02
Net Profit	614,08	3015,20
Period for Return of Investment (years)	9,0	8,5

Source: *Survey of offers from renewable energy construction companies; EWRC; Ordinance 6.*

Paradoxically, if accumulated, all the taxes and administrative fees paid by prosumers for the registration, installation and exploitation of a micro-scale energy facility could potentially exceed the net income (after subtracting the electricity for self-consumption) from selling power back to the DSO. This limits the incentive for households and small businesses to invest even in the less expensive PV rooftop installation, not to mention larger and more sophisticated facilities. If one adds the initial investment in building the facility and the time spent in an administrative maze of procedures, it is easy to understand why Bulgaria's vast renewable energy potential has not been fulfilled yet.

6. THE MAIN FACTORS HINDERING SMALL RES DEVELOPMENT

The main factors hindering the development of small RES capacities may be summarized in several categories: economic, legislative and governance. While some of the obstacles affect the costs related to such investments, other variables influence the expected benefits, mainly through the lack of incentives or the distortion of energy economic fundamentals. There are no measures to encourage the creation of energy communities at municipal level or other schemes to encourage inclusive market development. There are also no legal provisions for supporting the development of renewable energy communities and cooperatives at municipal level in general.

One of the key barriers has been the lack of consistency of the energy legislative framework. The law on renewable energy is often changing without much public discussion or anticipatory measures to consult with investors. The arbitrary introduction of fees such as an access fee or a 5 % revenue tax have diminished the ability of prosumers to establish their project financing structure and calculate accurately an expected rate of return. There is also significant insecurity about how the renewable energy market will develop. Although preferential feed-in tariffs are due to be phased out by the early 2020s, the Bulgarian government has failed to define a new renewables support policy in the framework of the National Energy and Climate Plan (NECP).

In addition, the national legislation and the local administrative procedures still do not make a distinctive difference between investments in small rooftop solar modules and the construction of an industrial-scale PV park. The lack of “one-stop shops” at municipalities to process all the necessary documentation for the installation of a new facility lead to high additional administrative costs and make the investment too time-consuming. In addition, DSOs themselves do not have an incentive to add new decentralised power generation capacity. First, they may have to invest in their own grid or in installing smart meters across the board to accommodate smaller RES. However, the needed investments may not be approved by the energy regulator due to its insistence on preserving final power prices low. Second, if the small RES producer is “behind the meter” this would mean lower sales for the incumbent supplier and lower revenues for the DSO, which would also have a detrimental effect on prices for other consumers. Eventually, the DSOs may fall into a “Utility Death Spiral”, when the “defection” of one user from the grid leads to higher prices for the remaining consumers and thus incentivizes them to “defect” as well.[56]

[56] Rocky Mountain Institute (2014) The Economics of Grid Defection.

For rooftop PV investors the default option is to use the facility as a behind-the-meter source of diminishing its own consumption, while selling the excess generation of electricity back to the grid. Some households and businesses prefer the "self-consumption" option as it is "invisible" for the electricity distribution company making the administrative procedure for connecting to the grid less cumbersome.

The DSOs may even refuse the connection of a small RES-producer or to require additional unnecessary investments in the infrastructure, which make the RES investment unattractive. Some of the extreme examples show that DSOs may require applicants for small RES connection to pay for the upgrade of the local distribution grid, even for small capacities under 30 kWp, and these investments may be new cable lines, poles, or even transformer stations. Obviously, such additional costs make the investment in a small RES quite unlikely and incentivize households and small businesses to continue purchasing energy from the grid.[57] One of the reasons is that there are many rural areas with a low number of inhabitants, where investment in the grid is needed, but is not always economically viable for the DSOs. Also, the investment costs for DSOs need to be approved by the Regulator, which is usually reluctant due to the effect these cost approvals have on the estimate of the final price for consumers. By shrinking the approved return of return of DSOs, the energy regulator is able to maintain the price for households at artificially low prices.

Even if investors would like to trade with the DSO, this remains very difficult. The Bulgarian legislation does not include specific net metering rules, which allows network operators to impose arbitrary administrative requirements for small-scale facilities. According to the energy law, investors could use electricity storage systems if they are in the immediate vicinity of the generation facility. The specific legislation that needs to be changed in order to allow for net metering options is Ordinance 6 on Connecting Electricity Producers and Consumers to the Electricity Transmission and Distribution Grids[58]. In order for net metering to be successful, the option for self-production of energy should be more lucrative than the consumption from the regulated market, where prices are still below the full costs of the service.

There are also no legal provisions about energy communities at municipal level or energy cooperatives. The lack of standardized approach for approving new facilities does not give any incentives to small investors to take the risk, which has meant that the decentralisation of electricity generation relies on the ambition of a few enthusiasts. In Bulgaria, the Cooperatives Acts defines the regulatory framework for all cooperatives, including energy ones. For rooftop PV installations, the Law on the condominium ownership management needs to be applied too. Some

[57] The complaints from small RES producers against the DSOs are managed by the EWRC, which has to supervise the contractual procedures and could issue binding decisions regarding the received complaints within two months of the receipt of the complaints. The decisions of the regulator themselves could be appealed at the regional administrative courts, where timelines could be quite long – about 1-2 years for a single decision.

[58] Ministry of Energy (2014) Ordinance 6 on Connecting Electricity Producers and Consumers to the Electricity Transmission and Distribution Grids (Naredba 6).

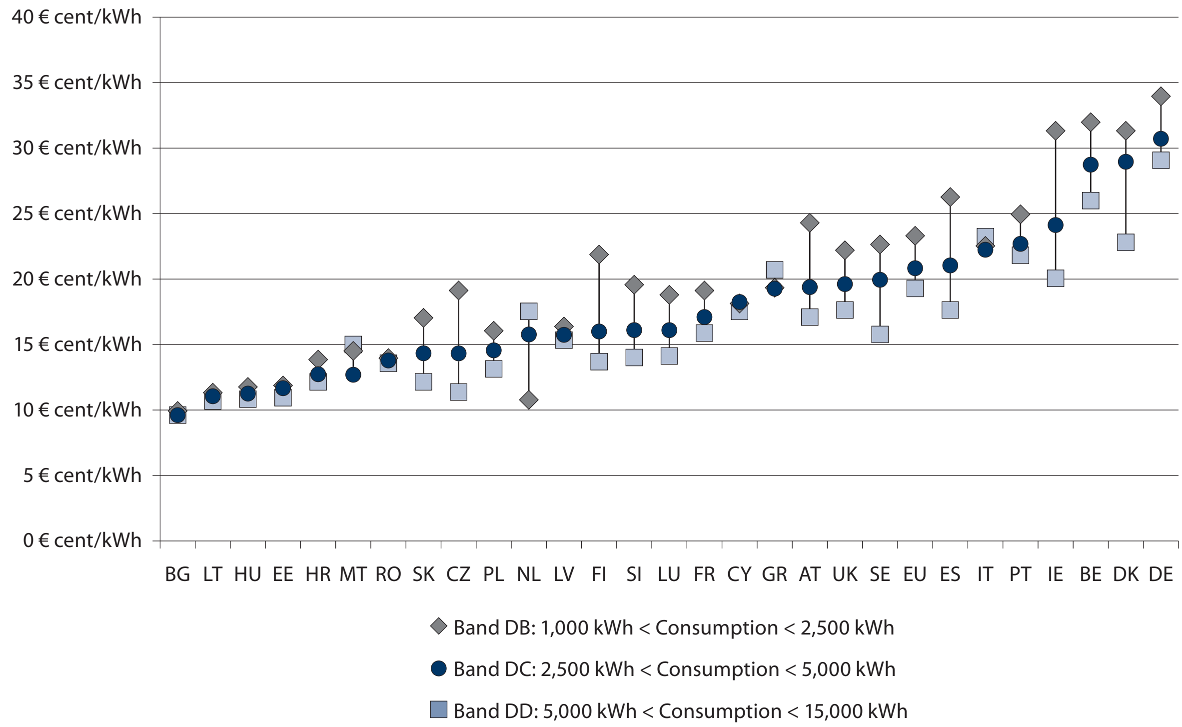
of the enabling factors for energy cooperatives apart from the regulatory environment include national networks, brochures and information campaigns on setting up and operating cooperatives, financing mechanisms, tax incentives, information on respective experts and others. In Bulgaria, a general framework to incentivize investment in energy cooperatives needs to be elaborated, featuring the above described measures.

Probably the most serious factor affecting the business case for small rooftop solar or other distributed RES generation is the widespread energy poverty in Bulgaria. Close to 40 % of households face difficulties in paying their electricity bills, which has made it politically impossible for the government to accept an increase of power prices by the regulator. The power tariffs hike of 2012 led to mass street protests in early 2013 leading to the toppling of the cabinet. As shown in Figure 6, EU data show that household retail electricity prices (including all taxes) in Bulgaria are the lowest in the European Union and about 2.5 to 3 times less than prices in the most expensive markets (e.g. Germany, Denmark, and Belgium). Although the prices at purchasing power standard (PPS) are closer to the EU average, they still distort consumer energy choices especially for middle and high-income households, who are more likely to invest in off-the-grid solutions. Bulgaria is one of the few countries in the EU, where industrial prices are higher than household prices, which distorts the market making energy supply a social rather than an economic activity tightly controlled by the state. Energy poverty should be the priority not of the energy ministry but of that of social policy. Meanwhile, subsidies for energy poor households are not targeting a transformation of consumption patterns, i.e. incentivising energy efficiency or investment in self-sufficiency but represent cash transfers to cover directly utility bills or even worse the purchase of air-polluting coal and wood.

The Bulgarian government has embarked on a program for the full liberalisation of the power market, in which the regulated market is gradually phased out. Currently, it makes up between 45-48 % of all electricity demand in the country. The government has agreed to a World Bank proposal to gradually increase household power tariffs by around 5 % per annum for the next five years. The World Bank also suggests the gradual elimination of the single-buyer model led by NEK, which sells electricity to the DSOs at fixed regulated tariffs. The idea is that within the next five years only the most vulnerable households would receive a "social" tariff, while subsidies for the rest would be gradually eliminated. With the increase of power prices, households would have a bigger incentive to see alternative options to satisfy their electricity consumption.

The general macroeconomic framework in Bulgaria does not provide an enabling environment for energy investments. The weighted average cost of capital (WACC) is much higher than in other countries due to the political risk, the lack of regulatory consistency and the small size of the market. Also, local banks are more conservative than their peers in other EU countries requiring higher collateral and interest rates. Currently, there are also no public financial instruments to support the development of smaller RES capacities.

FIGURE 6. ESTIMATED HOUSEHOLD RETAIL ELECTRICITY PRICES, DECEMBER 2017 –ALL TAXES INCLUDED



Source: *European Commission (2018) Quarterly Report on European Electricity Markets, Volume 10 (issue 4; fourth quarter of 2017), based on Eurostat, DG ENER.*

7. CONCLUSION AND POLICY RECOMMENDATIONS

Even if Bulgaria is over-achieving its RES-goal for 2020, there are some frustrating details. The investment in large RES projects practically stopped after 2012 (with the exception of some biomass plants) and the statistics show, that large part of the RES in the final energy consumption comes from biomass, burned by households. The development of small RES, close to consumption, has not taken off and without proper incentives could not be improved. Meanwhile, the 2030 targets on a EU level are now set at 32 % share of RES in the energy mix, and the current approach of Bulgaria could not ensure the achievements of the new goals for the period until 2030.

The national plan for development of RES has proposed only one measure for improving the incentives of small distributed RES, but its implementation in the legislative basis and the administrative procedures is not successful. Even if small capacities under 30 kW were promised alleviated process, the reality is that important stakeholders such as distribution grid companies and local authorities are intentionally or unintentionally hindering this process.

The potential for small RES is large, according to data from the SEERMAP project and its Green-X model. Small-scale rooftop panels for instance could reach up to 5.47 GW or 13 % of the overall installed renewable energy capacity in the country. These projections could never materialize if there is no improvement in the current administrative capacity and the legal and regulatory framework for self-production generating capacities.

One of the overarching legal challenges is that the laws do not distinguish between small and large RES producers, thus giving advantage to multi-million investments in utility-scale RES capacities. There are no specific provisions in the national legislation for prosumers or energy cooperatives. Projects build on arable land even have an advantage, as they do not have to fulfil some of the administrative procedures related to the modification of existing buildings when rooftop projects have to be implemented.

In addition to the administrative and legal factors, hindering small RES development, one could add the general macroeconomic environment. The economics of small RES investments is negatively affected by the existing cross-subsidies in the regulated electricity sector, which still make consumption from the grid way more attractive than the investment in own generation.

The development of small RES in Bulgaria may be improved, if the following policy recommendations are considered:

- Amending the legislation in order to allow and promote installation of small RES at end consumers' locations through one-stop shops and diminished administrative burden;

- Reducing to a minimum the amount of administrative steps that are related to permitting procedures in order to decrease unfounded delays and grid connection denials.
- Creation of one-stop shops at municipalities for streamlining all administrative procedures and minimising logistical and coordination delays related to permitting.
- Development of special programs for subsidised construction of small-scale RES facilities in attempt to decrease the dependence of households on energy subsidies.
- Changing the regulatory cost model for the distribution grids so that the prices for access to the grid are not dependent on the quantity consumed;
- Removing all the remaining cross-subsidies in the electricity sector in order to send the right price signals to all market participants;
- Reconsidering large-scale, government-sponsored energy projects and comparing the expected costs for the final consumers with the costs of electricity produced from small RES;
- Simplifying the procedures for introducing net-metering possibilities for small-scale RES and prevent DSOs from arbitrary changing the administrative procedures for trading excess electricity with the grid.
- Changing the focus of the RES policies from electricity-only to heating and cooling as well – with the proper incentives for end users to consider such option;
- Streamlining administrative procedures at local municipal level through national guidelines;
- Increasing the regulatory monitoring and control toward the DSOs in order to allow for less rejections of small RES connections;
- Ensuring the inclusion of all RES in a transparent, non-discriminatory national electricity market.
- RES capacity increases would depend on de-risking the investment environment for private actors by removing arbitrary taxes on revenues and easing the issuing of operational and construction licenses.

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