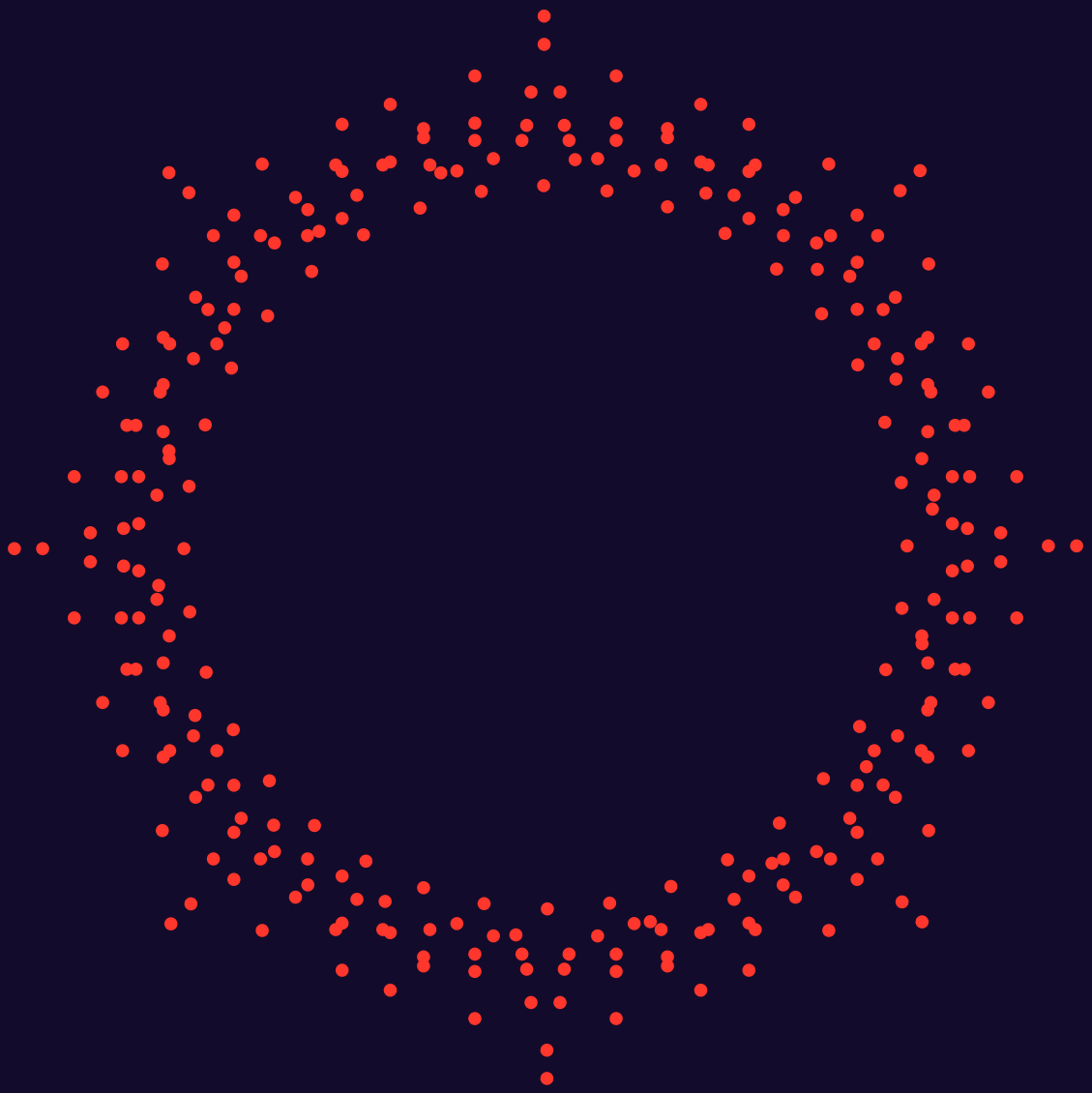
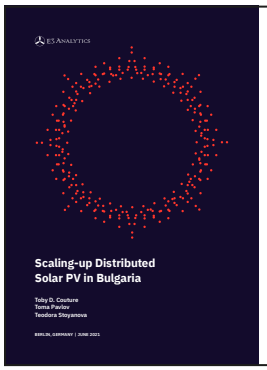
E3 Analytics



Scaling-up Distributed Solar PV in Bulgaria

Toby D. Couture
Toma Pavlov
Teodora Stoyanova

BERLIN, GERMANY | JUNE 2021



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KEY COUNTRY DATA

BULGARIA	
Population (2020)[1]	6,942,142
GDP per capita at market prices (2019)[2]	EUR 8,680.00 per capita
Electricity consumption per capita (2018)[3] Electricity consumption per capita in the households sector (2018)[4]	4.45 MW per capita: 76% of the EU average 1.55 MWh per capita: 98% of the EU average
Solar resource quality (global horizontal irradiation)[5]	North: 1,350 kWh/m²/year Southwest: 1,500 kWh/m²/year Central: 1,450 kWh/m²/year
Range of current installed costs (reported)	EUR 550 – 850 per kW
Primary energy consumption (2018)[6] Final energy consumption (2018)[7] Total net electricity consumption (2019)[8]	18.4 Mtoe 9.9 Mtoe 34 TWh
Average electricity tariffs (2019)[9]	Households: EUR 0.0798 kWh + taxes Non-households: EUR 0.0858 kWh + taxes

1 https://www.nsi.bg/en/content/6727/population-projections-sex-and-age
2 https://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=nama_10_pc&lang=en
3 https://ec.europa.eu/eurostat/statistics-explained/index.php/Electricity_and_heat_statistics#Consumption_of_electricity_per_capita_in_the_households_sector
4 https://ec.europa.eu/eurostat/statistics-explained/index.php/Electricity_and_heat_statistics#Consumption_of_electricity_per_capita_in_the_households_sector
5 https://solargis.com/maps-and-gis-data/download/bulgaria
6 https://ec.europa.eu/energy/data-analysis/energy-statistical-pocketbook_en
7 Ibid
8 https://www.nsi.bg/
9 https://ec.europa.eu/eurostat/statistics-explained/index.php/Electricity_price_statistics

KEY INSIGHTS

The overall trajectory of energy policy in Bulgaria continues to rely heavily on high-cost, large-scale technologies and projects, including expanding the role of natural gas, and doubling down on nuclear power. In the process, the overall policy environment is downplaying the role of more sustainable and cost-competitive technologies like solar PV. This approach risks saddling the country with outdated infrastructure as well as an increasingly uncompetitive energy system.

It is now economic for commercial and industrial customers in Bulgaria to invest in solar PV projects, without subsidies and without government incentives. As a result, the market for distributed solar PV in Bulgaria is starting to grow. Remarkably, the growth of the market is occurring despite the lack of a clear policy and regulatory framework, and in spite of the presence of many administrative and tax-related barriers.

Most distributed solar PV projects currently being built in Bulgaria are being configured purely for self-consumption; in other words, they are not connected to the grid, and are being used strictly to reduce the customer's electricity bill. A further consequence of this is that **solar PV installations are being under-dimensioned in order to avoid surplus generation** (and therefore, in order to avoid needing a grid connection). Taken together, these factors hold the country's solar market back from realizing its full potential.

The authorities in Bulgaria need to take steps to systematically reduce barriers, fees, and surcharges on small and medium-sized solar PV systems, make it easier to connect to the grid and export the surplus electricity, and create a comprehensive policy and regulatory environment to catalyse investments. This can be done by implementing a clear legal and regulatory framework for prosumers in line with the EU's RED II Directive, and making strategic use of EU funds, including through the European Green Deal.

1. INTRODUCTION

Bulgaria is poised for significant transformations of its energy system in the coming decades leading up to 2050. Among the major drivers for this are the rapidly decreasing costs of renewable energy sources, a sustained rise in electricity prices, the need to reduce the energy and carbon intensity of the country's economy, and bottom-up market forces. In addition, the 2018 Directive on the promotion of the use of energy from renewable sources (RED II) combined with the European Green Deal are fuelling a fundamental re-think of energy and infrastructure investments across the EU.

This report provides an in-depth look at the market for distributed solar PV for both households and businesses (i.e. residential and commercial prosumers) in Bulgaria. **Prosumers are defined as individuals or companies who use their own solar PV system to meet a portion of their electricity needs.** As this report will show, however, there are several different kinds of prosumers, some who use solar PV strictly to meet onsite loads without the ability to export

surplus to the grid (referred to here as projects engaged in "pure" self-consumption), and those who configure their systems to allow exports (referred to here as traditional prosumers).

With the transposition of the RED II Directive, Bulgaria is required to adopt a range of new regulatory provisions aimed at providing legal and policy certainty for the sector.[10] In particular, RED II enshrines the right of households and businesses to install their own onsite renewable energy supply, and establishes a range of clear guidelines regarding the regulation of the sector. In the process, it is expected that the transposition of the RED II Directive into local law will improve the business case for investing in customer-sited solar PV projects in particular. Since the details of local laws and regulations are still being developed, it is hoped that this report can help shed light on some of the key options available.

2. OVERVIEW OF THE ELECTRICITY SECTOR

The electricity sector in Bulgaria was state-owned for much of the second half of the 20th century, including for several years after 1989 during the transition to a market economy. While efforts to liberalize the market and introduce competition started in the early 2000s, the state continues to play a major role in the energy sector, and it retains an ownership stake in a significant share (roughly 60%) of the power generation business. In addition, while electricity prices for business and industrial consumers have been liberalized, prices for households continue to be regulated, and are kept artificially low.

As part of the electricity market liberalization process, Bulgaria introduced an electricity exchange in 2014, the Independent Bulgarian Energy Exchange (IBEX), making it one of the last countries in the EU to do so.[11,12] The legal framework governing the IBEX operations has been subject to improvements and revisions throughout the years. Some of the most important regulations implemented in 2018 and 2019 included the elimination of the "single buyer" role of the Bulgarian National Electricity Company, and the inclusion of producers of 1 MW and above on the free market. Centralized trading via the IBEX was also introduced.

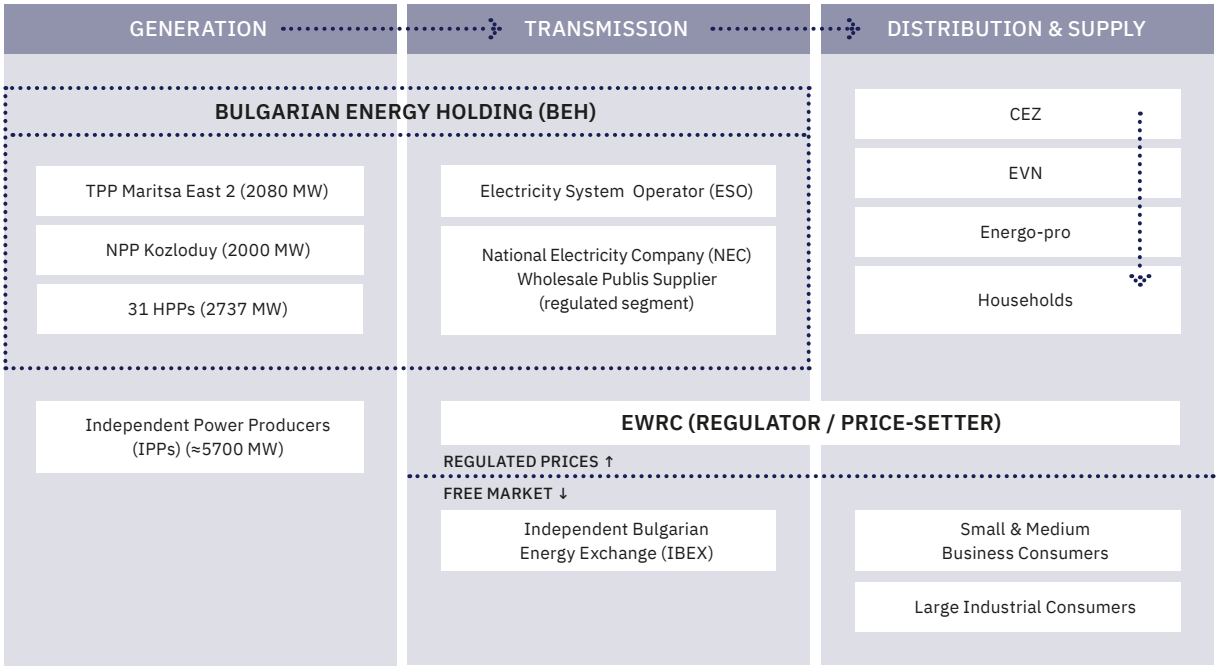
An overview of the current structure of the electricity market is illustrated by Figure 1 below. In addition to owning a substantial share of power generation through subsidiaries, the state-owned Bulgarian Energy Holding (BEH) also owns the high voltage transmission grid. The distribution network and retail supply, by contrast, are privately-run.

[10] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L_.2018.328.01.0082.01.ENG&toc=OJ:L:2018:328:TOC

[11] https://cms.law/en/bgr/publication/bulgaria-the-drive-for-full-liberalization-of-the-energy-market-and-the-upcoming-changes

[12] The Independent Bulgarian energy exchange (IBEX) was initially established as a subsidiary of the Bulgarian Energy Holding (BEH) company, the former state-owned monopoly supplier. However, due to the fact that BEH also owns some of the largest power plants in the country, the European Commission raised the issue of potential conflict of interests and the Bulgarian government transferred the ownership to the Bulgarian Stock Exchange, which is now the sole owner of the power exchange. https://www.oecd.org/corporate/ca/Corporate-Governance-of-SOEs-in-Bulgaria.pdf

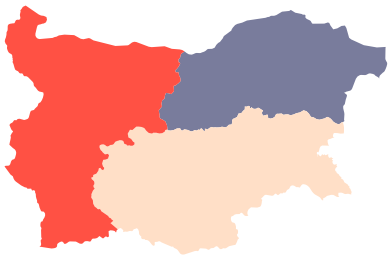
FIGURE 1: HIGH-LEVEL STRUCTURE OF THE BULGARIAN ELETRICITY MARKET



Note: Amounts in MWs denote approximate installed capacity.[13]

FIGURE 2

OVERVIEW OF THE SERVICE AREAS OF THE THREE MAIN DSOS IN BULGARIA[14]



The country is divided into three main regions, each of which is managed by a different distribution system operator (DSO) with a regional monopoly.

As the map shows, there are currently three main DSOs active in the market:[15]

1. **CEZ Razpredelenie Bulgaria**, part of CEZ Bulgaria (currently in the process of selling its business in Bulgaria) – responsible for the capital Sofia and the western part of the country;
2. **Elektrorazpredelenie Yug**, part of EVN Bulgaria – responsible for the southeastern part of the country; and
3. **Elektrorazpredelenie Sever**, part of Energo-Pro Varna holding – responsible for Varna and the northeastern region;

CEZ has the biggest market share with 40% (or 2.043.566 clients), followed by EVN with 37% (1.899.531 clients) and ENERGO-PRO with 23% (1.165.052 clients).[16]

[13] Adapted from Ivanov (2019): https://www.sciencedirect.com/science/article/abs/pii/S2210422417301454

[14] http://dobrich24.com/novina/infokampaniq-za-smqna-na-dostavchika-na-tok-v-dobrich-na-24-noemvri-ot-10-chasa/6383

[15] There is also Electricity Distribution Company Zlatni Pyasatsi, which is responsible for the distribution grid in a seaside resort in northeastern Bulgaria, though its share of the market is negligible.

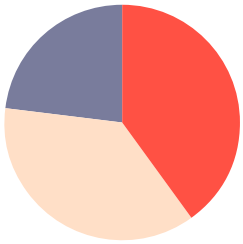
[16] See: https://www.dker.bg/uploads/2020/report_EC_2020_EN.pdf. The distribution system operators provide electricity to households who are part of the so-called regulated market, which refers to households whose electricity prices are set by the Energy and Water Regulatory Commission (EWRC). However, starting October 1, 2020, small and medium business consumers are required to purchase their electricity on the open market at market-determined prices. The full liberalization of the electricity market is expected to occur by 2025, at which point electricity prices for households will also be exposed to market prices.

The total number of electricity customers in Bulgaria is approximately 5.1 million.[17] Out of this, 4.5 million (or approximately 90%) are individual household customers, while the remaining 600.000 are non-household customers. However, in terms of demand, commercial and industrial customers make up almost two-thirds of total power demand (see Figure 3 below).

FIGURE 3: MARKET SHARE OF THE THREE MAIN DSOS BY NUMBER OF CLIENTS

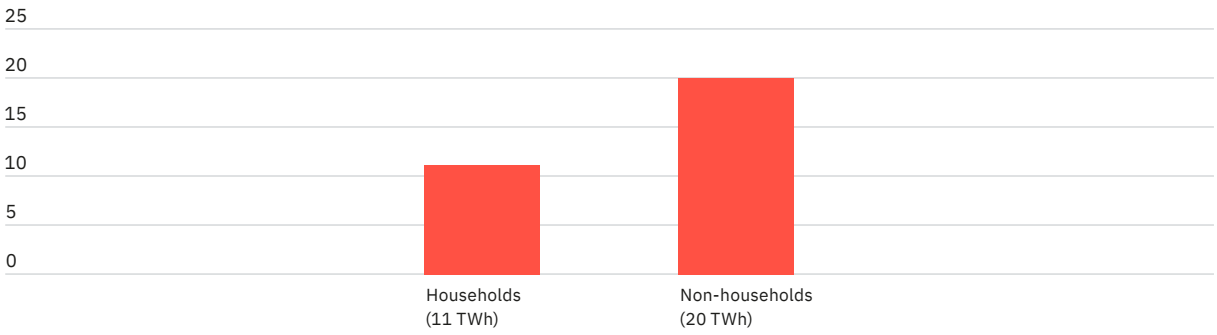
CEZ	40
EVN	37
Energo-pro	23

Source: Energy and Water Regulatory Commission



Based on the 2018 annual report from the Ministry of Energy, the total final electricity demand for households is 11 TWh, while the total final electricity demand for non-household customers (commercial and industrial) is 20 TWh.[18]

FIGURE 4: FINAL ELECTRICITY DEMAND IN 2018 (IN TWH)



Source: Ministry of Energy

Electricity Mix

Bulgaria has a relatively diverse electricity mix that consists of both conventional power plants, as well as renewables. The largest share of the electricity supply comes from lignite coal power plants (40%), followed by the only nuclear power plant in the country (36%) and renewables (19%). Natural gas currently has a small share at approximately 4% of the total mix. Historically, Bulgaria has relied considerably on hydropower, including several pumped-storage plants that work in tandem with the baseload nuclear and lignite coal power plants. (see Figure 6).

[17] https://www.dker.bg/uploads/2019/Doklad_do_EK_2019_BG.pdf
[18] https://me.government.bg/files/useruploads/files/buletinenergy2018-04.06.2019-finish.pdf

FIGURE 5: NET ELECTRICITY GENERATION BY POWER PLANT TYPE IN GWH			
	Lignite coal	16718	40%
	Nuclear	15291	36%
	Renewables	8204	19%
	Gas	1544	4%
	Black coal	246	1%
Source: ESO (2018)[19]			

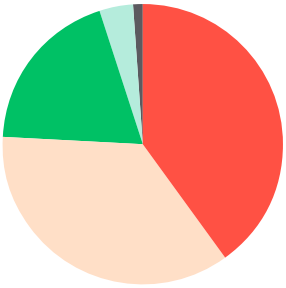
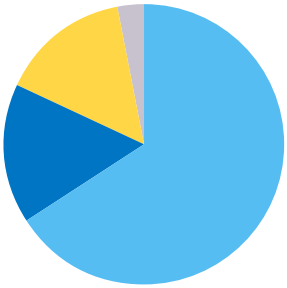


FIGURE 6: NET ELECTRICITY GENERATION FROM RENEWABLES IN GWH			
	Hydro	5392	66%
	Wind	1316	16%
	Solar PV	1239	15%
	Biomass	257	3%
Source: ESO (2018)			



Electricity Rates

Bulgaria currently has the lowest household electricity prices in the EU.[20] Due to the lower average household income compared to the rest of the EU,[21] however, fully 30% of Bulgarian households reported in 2018 being unable to pay their utility bills on time — the second highest rate in the EU.[22]

For commercial and industrial consumers (defined as medium-sized consumers with an annual consumption between 500 MWh and 2 000 MWh), prices have increased more significantly. While prices for households increased 17% between 2009 and 2019, prices for commercial customers have experienced a 36% increase over the same period (see Figure 7 below). At the beginning of 2016, there was a spike in the electricity prices for industry, which is attributed to the launch of the day-ahead market at the power exchange.

By contrast, prices for large industry are on average lower than the rest of the EU, as well as lower than prices currently seen in both Croatia and Romania (Figure 8 below). On the basis of this, it is clear that investing in solar PV for customer's own onsite use is most attractive for small and medium-sized commercial and industrial customers in the country.

[19] Note that we have used 2018 data for the time being, because there are some significant discrepancies in the 2019 data available.

[20] See: https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Electricity_price_statistics

[21] https://ec.europa.eu/eurostat/documents/2995521/10826603/8-07052020-AP-EN.pdf/2c418ef5-7307-5217-43a6-4bd063bf7f44

[22] https://ec.europa.eu/eurostat/web/products-eurostat-news/-/DDN-20200120-1

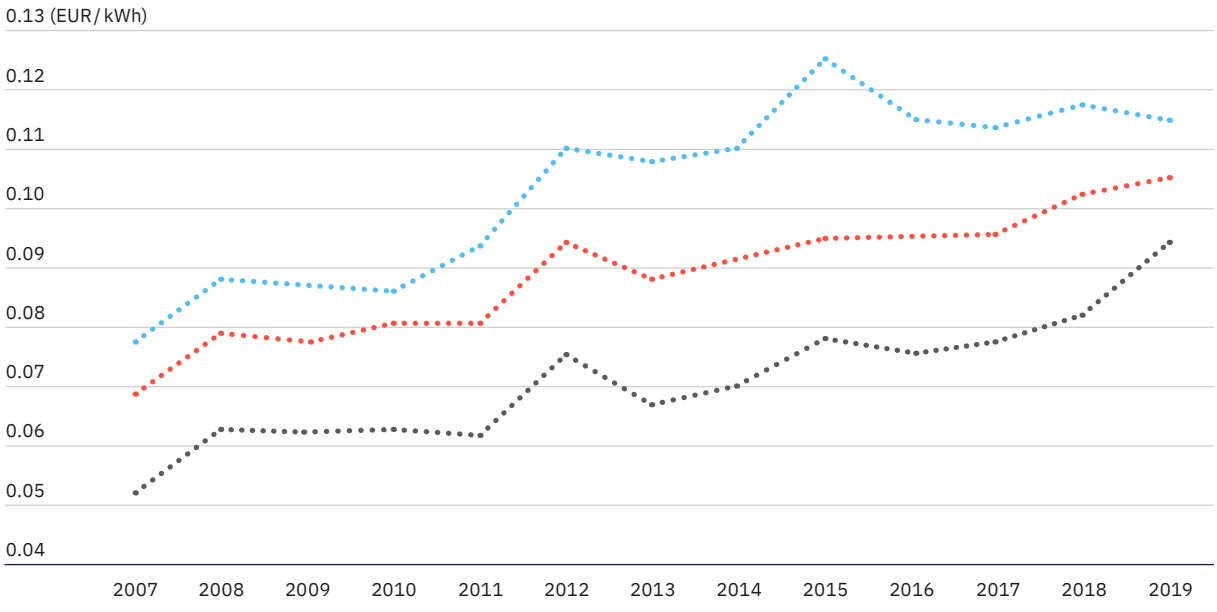
WHY IS INVESTING IN SOLAR PV CURRENTLY MORE ATTRACTIVE FOR BUSINESSES THAN FOR HOUSEHOLDS?	In addition to paying higher electricity prices than other customer classes in Bulgaria, they also benefit from better economies of scale than small projects developed by households, and better alignment of the load profile with the solar PV output, which leads to a better self-consumption ratio.

TABLE 1: ELECTRICITY RATES FOR HOUSEHOLD, COMMERCIAL AND INDUSTRIAL CONSUMERS (2019)

Consumer Type	Rate (EUR/kWh)	Rate (BGN/kWh)
Households	0.10	0.19
Industry (annual consumption between 20 MWh and 500 MWh)	0.11	0.22
Industry (annual consumption between 500 and 2 000 MWh)	0.10	0.20
Industry (2 000 and 70 000 MWh)	0.09	0.18

Source: Eurostat (2020). Note: Prices include all taxes and levies.

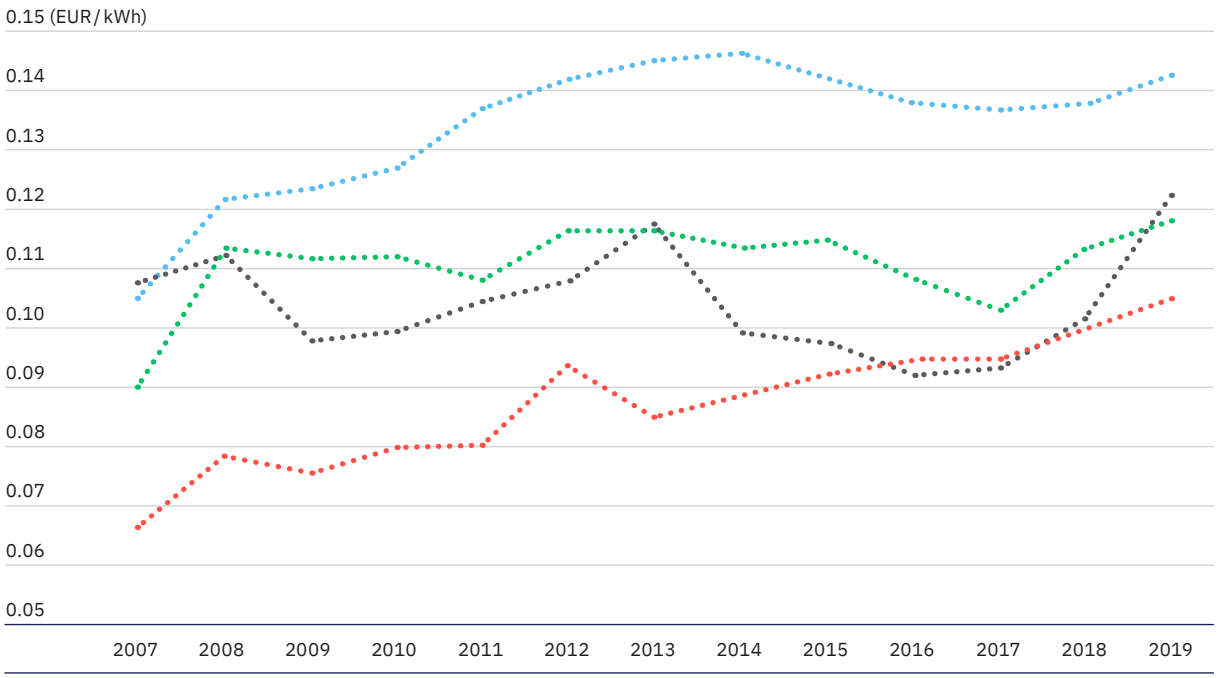
FIGURE 7: ELECTRICITY PRICES FOR INDUSTRY CONSUMERS IN EUR/KWH (2007—2019, Q2)



Source: Eurostat (2020)[23] Note: prices include all taxes and levies.

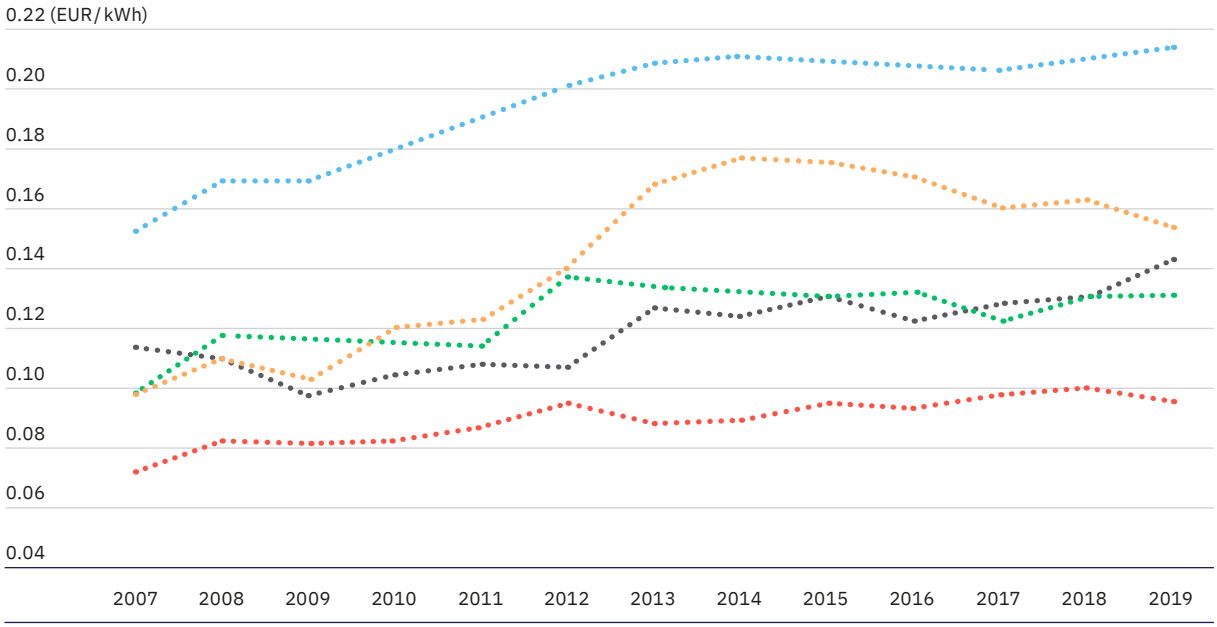
[23] https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Electricity_price_statistics

FIGURE 8: ELECTRICITY PRICES FOR INDUSTRY CONSUMERS IN EUR/KWH (2007—2019, Q2)



Source: Eurostat (2020) Note: prices include all taxes and levies. Industry consumers are defined as medium-sized consumers with an annual consumption between 500 MWh and 2 000 MWh.

FIGURE 9: ELECTRICITY PRICES FOR HOUSEHOLD CONSUMERS IN EUR/KWH (2007—2019, Q2)

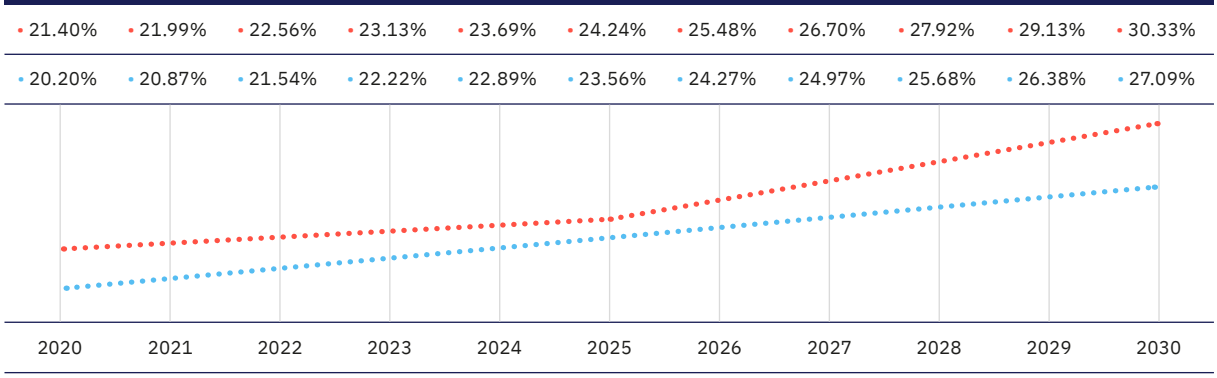


Source: Eurostat (2020) Note: prices include all taxes and levies. Household consumers are defined as medium-sized consumers with an annual consumption between 2 500 kWh and 5 000 kWh.

3. BULGARIA'S RENEWABLE ENERGY TARGETS

Driven by a surge of renewable energy development triggered by the country's feed-in tariff policy, Bulgaria met its 2020 RES target of 16% at the end of 2013, when the RES share in gross final energy consumption reached 18.9%. Between 2013 and 2019, the overall RES share has increased only by 2.7% to reach 21.6% in 2019. More recently, Bulgaria's National Energy and Climate Plan (NECP) for the period 2021-2030 sets an overall RES target of 27% in gross final consumption of energy in 2030. With regard to the electricity sector, the 2019 share stood at 23.5% while the 2030 RES target is set at 30%.[24]

FIGURE 10: RES TRAJECTORIES IN GROSS FINAL ENERGY CONSUMPTION UNTIL 2030



Source: NECP (2020) Note: the actual 2020 levels are likely to be higher than the projections made in the NECP for the same year.

TEXTBOX 1: THE RISE AND FALL OF FEED-IN TARIFFS IN BULGARIA

The market for renewables in Bulgaria took off in 2007 with the adoption of a law on renewable energy sources. The subsequent introduction of feed-in tariffs drew a large number of foreign and domestic investors.[1] This happened at a time when investment opportunities and support schemes in other European markets were shrinking due in part to the repercussions of the 2008-09 financial crisis. Partly as a result, in 2011, Bulgaria was ranked second among the top ten emerging markets for renewable energy.[2] In fact, nearly 90% of all non-large hydro RES generation capacity was installed between 2010 and 2012 and Bulgaria quickly reached its 2020 RES target.[3]

The rapid deployment of renewable energy projects (which had a significantly higher per-kWh cost at the time) led to a need to increase in rates on electricity consumers and caused a backlash in 2013.[4] The backlash was further compounded by the relatively high rate of energy poverty in the country. The electricity system operator also struggled with accommodating the connection of all new renewable installations. In addition, the National Electricity Company (NEC) became heavily indebted to the distribution system operators, which served as central off-takers responsible for paying out the feed-in tariffs to RES producers.

[24] https://www.nsi.bg/en/content/5062/electricity-generated-renewable-sources-share-gross-electricity-consumption

As a result of this complex interplay of factors, feed-in tariffs in Bulgaria were discontinued for most project sizes by 2013 and further curtailment measures for RES producers were introduced, disincentivizing further investment. Already in September 2012, the Regulator introduced a retroactive grid access fee for all RES producers, a fee that in some cases represented as much as 39% of individual projects' feed-in tariff revenues.[5] In 2014, a further retroactive fee was imposed directly on the revenues of solar PV and wind farms, reducing the feed-in tariffs by a further 20%. A further measure that was introduced in 2015 is a cap on the number of hours for which FIT projects are eligible to receive the FIT payment; beyond this number of hours, projects were left either to sell their surplus electricity on the exchange, or to self-consume it. This rule also applies for existing contracts concluded under the old conditions, which means that it was applied retroactively to older FIT contracts.

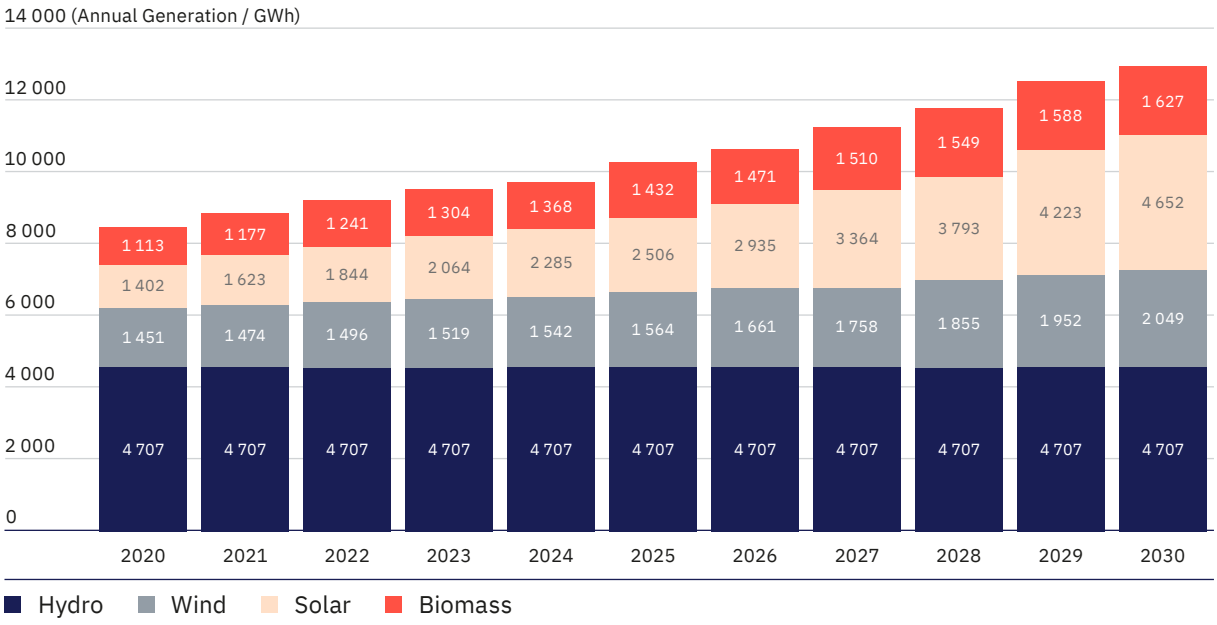
In a decision from 2018, the Supreme Administrative Court sided with one producer with an old contract who complained against the imposed production cap.[6] A number of other retroactive measures have also been challenged in court on the basis that they represented a violation of the non-discriminatory principle and of the country's constitution. An agreement was reached with all energy producers in 2015 that they would contribute 5% of their monthly revenues to a newly-established Fund for the Security of the Energy Supply, as a measure for alleviating the financial deficit in the sector that had built up in the electricity system.

Following the rapid expansion of renewables in the period from 2008 to 2013, the investment framework for renewables in Bulgaria came to be characterized by high regulatory uncertainty. The 2019 overall RES share in gross final energy consumption stood at 21.6%, which is only 2.7% higher than the 2013 share. From a regulatory standpoint, the situation for existing RES producers has become more stable in recent years. In the last major reform from 2018, existing long-term PPAs were converted to feed-in-premium agreements, as producers above 1 MW were required to sell their electricity on the free market. Feed-in tariffs remain in place but eligibility is limited to projects up to 30kW in size. The current feed-in tariffs are updated every year starting July 1st by the Energy and Water Regulatory Commission; for projects up to 5 kWp the current FIT level is EUR 121.72/MWh while for projects above 5 kWp and under 30 kWp it stands at EUR 101.37/MWh.[7]

1 http://eprints.whiterose.ac.uk/128625/1/Justusetal2018_Bulgaria_reviewed.pdf
2 https://www.cms-lawnow.com/publications/2019/11/cms-renewables-energy-guide-2019
3 http://old.csd.bg/artShow.php?id=18293
4 https://csd.bg/fileadmin/user_upload/publications_library/files/2018_07/DECENTRALISATION_ENG.pdf
5 https://www.bluelink.net/novini/istoriya-na-spora-mezhdu-proizvoditelite-na-ekoenergiya-i-darzhavata.html
6 https://www.capital.bg/politika_i_ikonomika/bulgaria/2018/10/01/3318439_vei_mogat_da_tursiat_kompensacii_za_neizkupeniia/
7 https://www.dker.bg/uploads/reshenia/2020/res_c_27_20.pdf

According to Bulgaria's NECP, the annual production of electricity from renewable energy sources is projected to increase from the current 8.673 GWh to 13.035 GWh in 2030. To achieve this, solar PV generation is projected to increase the most — more than three-fold over the course of the next ten years. By contrast, biomass and wind generation are only projected to increase slightly, while hydro is expected to remain at its current level.

FIGURE 11: GROSS PRODUCTION OF ELECTRICITY FROM RE BY TECHNOLOGY 2020—2030 (IN GWH)



Source: NECP

Table 2 below provides an overview of the forecast for the installed capacities of renewable energy technologies in Bulgaria.

TABLE 2: PROJECTED RES INSTALLED CAPACITIES BY POWER PLANT TYPE, 2020—2050 (IN MW)

Year	Solar	Wind	Biomass-waste	Hydro (pumped hydro excluded)
2020	1.042	699	80	2.508
2021	1.191	709	114	2.508
2022	1.339	719	149	2.508
2023	1.488	729	184	2.508
2024	1.636	739	219	2.508
2025	1.785	749	253	2.508
2026	2.071	788	263	2.508
2027	2.357	828	273	2.508
2028	2.643	868	282	2.508
2029	2.930	908	292	2.508
2030	3.216	948	302	2.508
2035	3.216	948	306	2.508
2040	3.216	1.811	309	2.508
2045	3.277	2.723	371	2.508
2050	4.555	4.500	335	2.508

Source: NECP (2020)

THERE ARE TWO SALIENT ASPECTS TO BULGARIA'S CURRENT NECP:

The current NECP continues to present a view of an energy transition in which **nuclear power and natural gas play a central role**. The envisioned expansion of nuclear capacity, as well as the government investment of over EUR 1 billion in a new gas pipeline, further underscore this view.

The government's view for the deployment of renewable energy capacities is heavily back-loaded, with almost 40% of the total solar PV target and nearly 50% of the total wind target by 2050 scheduled to be connected to the grid in 2045-50.

Given that solar and wind are already cost-competitive with existing generation sources today, these two aspects are difficult to reconcile with existing market realities, and economic fundamentals.

4. DISTRIBUTED SOLAR PV IN BULGARIA: STATUS AND FUTURE PROSPECTS

Despite the policy and investment uncertainty generated by the frequent retroactive changes made to its feed-in tariff policy, the market for distributed solar PV in Bulgaria has succeeded in surviving over the course of the last 14 years since Bulgaria's accession to the EU. There are approximately 2.273 solar installations with installed capacity of up to 1 MW that are connected to the grid.[25] In terms of the overall market for distributed PV, current estimates suggest that Bulgaria has over 30 active companies in the solar sector.[26] Moreover, there are signs that the market for customer-sited installations in Bulgaria is starting to pick up pace.

It is important to differentiate between four types of solar PV projects in Bulgaria:

1 **Feed-in tariff projects**, in which 100% of the electricity generated is fed into the grid under a long-term contract. Individual project size is capped at 30 kW. This category captures the majority of current solar PV projects in the country. As of 2018, legacy FiT projects of above 30 kW have been transitioned to feed-in premiums.

2 **Pure self-consumption projects**, in which the solar PV system is configured strictly to serve onsite demand, without being configured with the ability to export surplus generation to the grid. As a result, such projects tend to be dimensioned in order to ensure that all (or nearly all) solar power generated by the facilities can be consumed directly by the customer onsite, without exporting any surplus to the grid. Since such projects do not inject power into the grid, they register mainly as a reduction of demand on the network, making them hard to monitor. Interviews conducted as part of this analysis indicate clearly that the number of these pure self-consumption projects has been growing considerably over the past three years, notably in the enterprise sector (SMEs and larger companies). This finding is also corroborated by recent articles and round tables.[27, 28, 29]

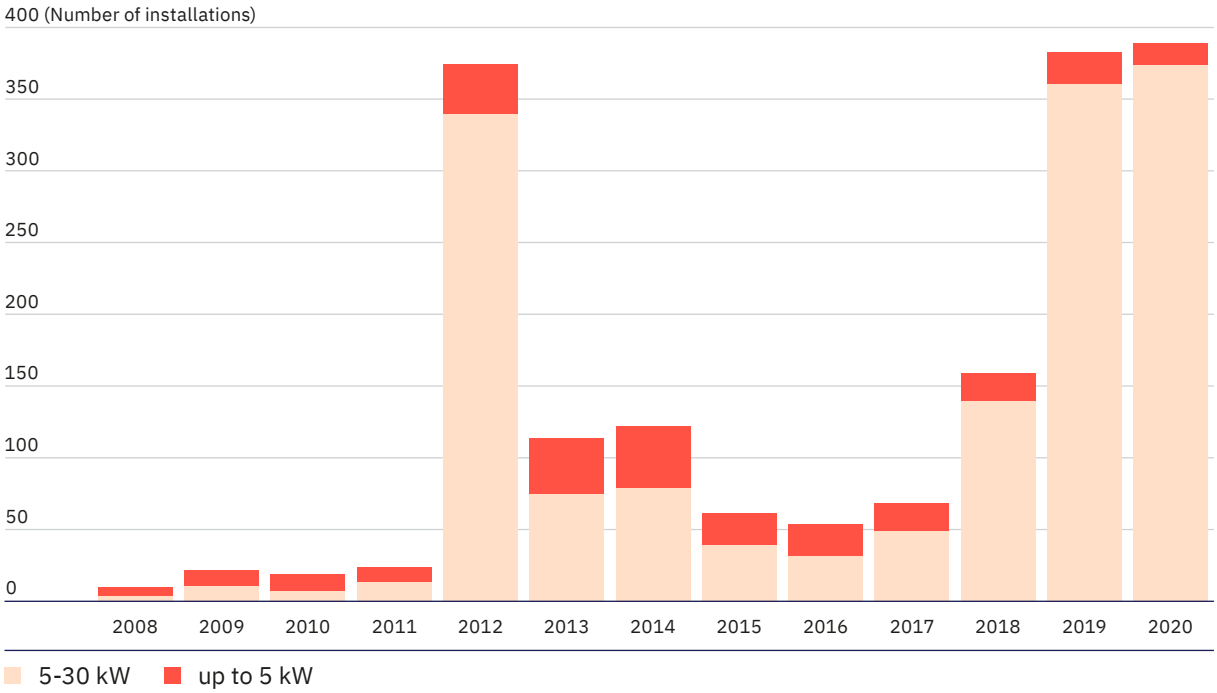
[25] https://portal.seea.government.bg/bg/ByProducerAndEnergyObject
[26] http://www.bsa.bg/about-us/chlenove/
[27] https://www.mediapool.bg/firmi-pravyat-sobstveni-vei-za-da-se-spasyavat-ot-energiyna-zavisimost-news315564.html
[28] https://www.capital.bg/biznes/energetika/2020/09/18/4115294_biznesut_prevkljuchva_na_sluncheva_energiia/
[29] https://www.facebook.com/events/315736192892667/

3 **Prosumer projects**, in which individuals or companies use their own customer-sited solar PV system to meet a portion of their onsite needs, and export the rest to the grid. Such "true" prosumer projects are still rare in Bulgaria, due to the additional costs and administrative complexities required in order to connect to the grid and export surplus power.

4 **Merchant projects**, in which a developer secures the rights to land and the necessary permits and develops a solar PV project in order to sell the output either via bilateral contracts (such as corporate PPAs) or directly on the open market (i.e. on the power exchange). While they did not exist until the recent past, such projects are starting to be developed in Bulgaria, as the recently announced 400-MW solar project by Enery Development Trakia Solar Ltd. shows; such ventures are likely to consist mainly of larger project sizes (100 MW and above).[30]

The first category (i.e. Feed-in Tariff projects) represents the bulk of the distributed solar PV market in Bulgaria. According to the Sustainable Energy Development Agency (SEDA), a total of 1.777 small solar PV installations with up to 30 kW of installed capacity have been connected to the grid between 2008 and 2020 (see Figure 12 below).[31] Their cumulative installed capacity amounts to 43 MW. While there are only 240 large solar PV installations with capacity of 1 MW and above, the bulk of which were deployed in 2012, their cumulative installed capacity is 905 MW. The cumulative installed capacity of all solar PV installations connected to the grid is 1.100 MW through 2020.[32]

FIGURE 12: NUMBER OF NEW SOLAR PV INSTALLATIONS WITH UP TO 30 KWP OF INSTALLED CAPACITY



Source: Sustainable Energy Development Agency (2020)

30 https://renewablesnow.com/news/enery-bg-1-to-build-400-mw-solar-park-in-bulgarias-haskovo-local-govt-712191/
31 https://portal.seea.government.bg/bg/ByProducerAndEnergyObject
32 https://bnr.bg/post/101432693/do-2024-godina-oshte-700-mw-vatarni1-600-mw-solarni-i-219-mw-moshtnosti-ot-biomasa

In a sign of decreasing technological costs and a more stable regulatory environment, since 2017, there has been a noticeable increase in the number of new small solar PV installations being developed. In 2019 and 2020, over 380 new installations of up to 30 kW have been connected to the grid, surpassing the number of projects installed in the six-year period between 2013 and 2018.

Despite benefiting from a higher FIT payment level, the share of solar PV installations of up to 5 kW remains very small, due partly to limited disposable income of household customers, and the fact that small installations are not exempt from many of the fees, taxes, and surcharges imposed on larger installations.[33]

With regards to solar PV installations that are configured purely for self-consumption and are not connected to the distribution system, there are no official data available. However, developers note the increasing investment interest of SMEs and larger firms in such projects since 2018 – which coincides with the requirement for such customers to move to market-based prices, instead of the regulated prices they previously enjoyed.

In fact, evidence gathered from a series of interviews with developers and key market actors indicate that **it is now more cost-effective for certain electricity customers in Bulgaria to meet a portion of their own needs with onsite solar than to continue buying all of their electricity from the Bulgarian power exchange.** It is this shift in the economics of customer-sited solar that is responsible for the growing interest among industries and SMEs to invest in distributed PV projects.[34]

According to data from two of the three DSOs, by the end of 2020, **there were approximately 118 "pure self-consumption" installations with cumulative installed capacity of 9 MW**. At the end of 2020, all three DSOs reported and that there were a further 120 installations in the pipeline with a combined installed capacity of 12 MW.[35]

One of the already realized projects is that of the multinational wholesale chain METRO Cash and Carry, which, in 2019, started equipping some of its stores in Bulgaria with rooftop solar PV installations entirely for self-consumption.[36] In a similar example, the mid-sized textile company Delta Textile in the town of Ruse has invested in a 195 kWp rooftop solar PV installation that was deployed in 2020.[37] **Interviews with such commercial customers suggest that they expect a pay-back time of five to seven years** under the market conditions and installed costs that prevailed in 2019-2020.

[33] This includes an imbalance penalty for any deviations from a pre-agreed production schedule, a grid access fee, a 5% revenue tax, as well as a 10% corporate tax. Note that in late 2020, Bulgaria's Parliament introduced a change to the current energy law allowing for an exemption from the 5% tax on revenues for RES projects developed after January 2021. Projects that benefit from the FIT, however, will still have to pay the fee as before. The change is expected to be adopted in early 2021. See: https://www.capital.bg/biznes/energetika/2020/10/24/4130766_otpada_edna_ot_golemite_prechki_za_novi_vei_moshtnosti/

[34] While solar PV projects are much more common in the private sector, there have been also some examples of projects in the public sector. Local authorities in several towns and cities in Bulgaria have equipped public buildings, including schools and kindergartens, with rooftop solar PV systems for self-consumption as part of renovation works aimed at increasing energy efficiency. Importantly, in almost all of the cases, the projects have been co-funded by the EU. https://news.bg/education/montirat-solarni-paneli-na-5-stolichni-uchilishta-i-detski-gradini.html

[35] https://www.mediapool.bg/firmi-pravyat-sobstveni-vei-za-da-se-spasyavat-ot-energiyna-zavisimost-news315564.html

[36] https://balkangreenenergynews.com/metro-bulgaria-equipping-supermarket-roofs-with-solar-power-plants/

[37] https://renewablesnow.com/news/bulgarias-cez-esco-to-build-195-kwp-solar-plant-for-delta-textile-bulgaria-674753/

Among the key factors driving the preference for purely self-consumption projects is that if a producer chooses to both consume and sell electricity (i.e. true prosumer), the price for the so-called "surplus power" depends on the offer of an electricity trader. Interviews with local stakeholders indicate that the price for such surplus generation is currently in the EUR 30-50 MWh range, which is below the average market price on the power exchange. Another important factor is the administrative burden, including costs, associated with the export even of very small amounts of surplus power to the grid, making this option unfavorable for many investors.

Market Insight: ESCOs emerge as unlikely allies in the development of distributed PV projects

Allies are emerging from unexpected places: the parent companies of two of the three Distribution System Operators (DSOs) in Bulgaria have set up subsidiary companies to engage in providing energy savings solutions, which in recent years has included the development of customer-sited solar PV systems. Both CEZ ESCO Bulgaria and ENERGO-PRO Energy Services are offering turn-key services to both public and private companies to install rooftop and other customer-sited solar PV projects in the country. As of early 2021, CEZ ESCO Bulgaria had already completed more than 20 projects and it had 25 more in the pipeline, while ENERGO-PRO Energy Services had completed more than 10 such projects.[38,39]

The increasing involvement of companies linked to the DSOs and their subsidiaries in the DPV market in Bulgaria has been driven in part by the EU's Energy Efficiency Directive.[40] The Directive introduces an obligation on individual Member States to reduce their energy consumption by a certain level by 2020, and by 2030. For Bulgaria, the reduction targets are 20% and 27% respectively.

In Bulgaria, the responsibility to achieve these targets has been largely devolved onto DSOs. In response, **the DSOs (through their subsidiary ESCO companies) have honed in on the potential of customer-sited solar PV projects as a tool to help reduce demand from the network, and hence, to help comply with the Energy Efficiency Directive. This has turned them into active drivers of the distributed PV market**. However, given the market power that DSOs have in the electricity system, certain stakeholders interviewed for this analysis expressed concern that the emergence of these subsidiary companies is creating an unequal playing field and could even serve to inhibit the growth of the distributed solar sector in the medium- to long-term, as DSOs are in a privileged market position as de facto gatekeepers of the distribution grid.

[38] https://www.mediapool.bg/firmi-pravyat-sobstveni-vei-za-da-se-spasyavat-ot-energiyna-zavisimost-news315564.html

[39] Both companies offer alternative financing methods; CEZ ESCO Bulgaria, for instance, offers an option for deferred payment of the investment. The contract period is usually 60 months with an initial installment of 20% of the investment costs. The remaining amount is spread across the period of the contract with a certain minimum price increase. In an optimal scenario, the monthly lease payment is designed to be on par with the actual savings on electricity bill. See: https://www.capital.bg/biznes/energetika/2020/09/18/4115294_biznesut_prevkljuchva_na_sluncheva_energiia/

[40] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv%3AOJ.L_.2018.328.01.0210.01.ENG

STEPS TO CONNECT TO THE GRID

The procedure for applying to connect a renewable energy installation to the grid involves three main steps:[41]

1. Initial Assessment by DSO

In the first step, project proponents need to submit an application to their respective DSO for an assessment. Depending on the DSO, the fee is ca. EUR 50. The DSO then has 30 calendar days to evaluate the application and provide an opinion.

2. Request a Contract

After receiving a positive response from the DSO, proponents can submit a request for entering into a contract with the DSO for the connection of the installation to the distribution grid. Supplementary documents including the assessment of an electrical engineer are required, drawings, calculations and instructions in accordance with the Land Use Planning Act (LUPA). The DSO draws a legal contract within 14-30 days after the request, depending on the DSO. An advance payment of approximately EUR 2.500 per MW of installed capacity is then required. Upon receiving the payment, the DSO has 30 days to complete works related to the grid connection of the installation.

3. Connect to the Grid

Upon completion of the engineering works by the DSO, the final step is the physical connection of the installation to the grid. After the connection is established, there is a 72-hour testing period. The entire administrative and construction process related to the connection of the installation to the distribution grid takes between 3 and 6 months, depending on the DSO and the time local authorities take to issue the relevant permits.

Balancing Responsibilities

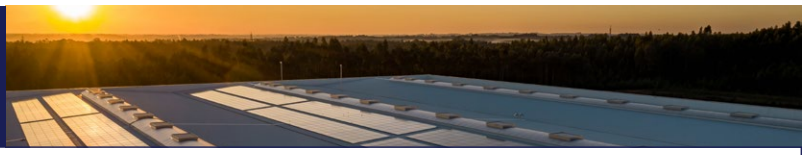
An important prerequisite for the fast deployment of small-scale RES projects is fair treatment with regard to the allocation of balancing responsibilities. The main challenge is to find the most appropriate way to allocate the responsibilities for balancing the grid between prosumers (including energy communities) and the distribution system operators. Balancing costs refer to the costs that the local or regional system operator need to incur in order to make up for deviations in the balance of supply and demand for electricity. The topic of balancing responsibilities has emerged as a contentious area in many countries, with utilities and DSOs seeking to offload the costs of balancing onto smaller producers, including small and medium-scale prosumers.

In Bulgaria, all electricity producers (including small ones) have to enter in an agreement with a balancing group. In the case of the small solar PV installations, this is the DSO itself. The DSO balances the differences between generated and consumed electricity according to a generation timetable approved in the agreement. According to the procedures currently in place in Bulgaria, the production timetable has to be submitted by the producer in advance, typically for a period of one year. In case of deviations from the schedule, the producer is required to pay an imbalance penalty. Estimating generation and consumption is nearly impossible for small- and medium-sized solar PV projects and is associated with high administrative burden, especially if the main purpose of the generating activity is self-consumption. The penalty for deviations in forecasts depends on the day-

[41] Information on the procedure is available on the webpages of the three distribution system operators (DSOs). For example, CEZ's is here: https://www.cez-rp.bg/bg/za-klienta/prisuedinyavane-na-vei-proizvoditel (in Bulgarian) and https://www.cez-rp.bg/en/customer-service/res-connection (in English)

ahead price on the power exchange.[42] For small installations, it adds up to roughly EUR 20-30 per year, depending on the precise configuration of the system.

TEXTBOX 2: SMEs AND LARGE INDUSTRY ACTORS INVESTING IN SOLAR PV PLANTS



The case of Megahim (prosumer)

At the beginning of 2020, Megahim, a medium-sized company in the paints and coatings industry, invested in a 112 kWp rooftop solar PV plant.[1] The company, based in the northeast city of Ruse, employs around 150 people, and specializes in the production of paints and coatings for facades, interior walls, metal and wooden structures.

At the end of 2019, Energo-Pro Energy Services, a subsidiary of the power utility Energo-Pro, approached Megahim with an offer to construct a rooftop solar PV plant that would reduce the company's grid electricity consumption. Since 2018, Megahim has had to purchase its electricity on the free market, where prices are significantly higher than on the regulated segment.[2] Furthermore, in the first half of 2019, industrial consumers and business associations complained from the soaring prices of electricity on the free market, which had spiked to levels higher than most major European markets.

In order to shield itself from the volatile market prices and utilize renewable energy sources, Megahim decided to make its own investment, without subsidies and without the benefit of a clear policy and regulatory framework, in a rooftop solar PV plant. Interviews with the operator indicate an expected payback period of 4 to 5 years. Completed in May 2020, the plant consists of 334 polycrystalline solar panels of 335 Wp each and two solar inverters of 50 kW each on a 700 sq m rooftop space.[3] With an installed capacity of 112 kWp and expected annual production of 136 MWh, Megahim hopes the plant would be able to meet at least half of the company's energy demand. In addition to self-consumption, the plant is also connected to the grid, allowing excess electricity during off-peak times to be exported back to the grid under a contract with Energo-Pro Energy Services.

The case of Aurubis Bulgaria (pure self-consumption)

In July 2020, the Bulgarian energy solutions provider CEZ ESCO, a subsidiary of the power utility CEZ, signed a contract with the local unit of the Hamburg-based copper producer Aurubis, for the construction of a 10 MW solar PV plant.[4] Once operational, the solar PV plant will be the biggest installation configured entirely for self-consumption in Bulgaria. This is also one of the biggest solar PV plants to be constructed in Bulgaria in recent years. With the solar PV plant, Aurubis Bulgaria will save some 11.700 MWh per year from grid electricity consumption (sufficient for approx. 12.000 households), which will cover an average of 2.5% of the electricity needs of its smelter facility. The plant is expected to become operational within 18 months.

1 https://www.energo-pro-energyservices.bg/bg/energijna-efektivnost/realizirani-proekti-za-energijna-efektivnost/fotovoltaichna-elektrocentrala-111-89-k-wp-gr-ruse

2 https://www.mediapool.bg/na-borsata-za-tok-dvoino-po-visoki-ot-es-tseni-i-vzaimni-obvineniya-news295255.html

3 https://tinyurl.com/y57qdnrb

4 https://www.capital.bg/biznes/kompanii/2020/07/29/4096911_chez_i_aurubis_shte_izgradiat_nai-golemiia_solaren/

42 https://www.capital.bg/politika_i_ikonomika/bulgaria/2018/01/03/3106529_cenata_na_balansirashtata_energiia_se_obvurzva_s/

Major barriers to DPV in Bulgaria

1 Policy and regulatory barriers
The lack of clear pricing conditions for surplus generation, combined with the imposition of numerous fees, taxes, and surcharges on owners/developers of distributed solar PV projects significantly constrains the growth of the market.

2 Administrative burden
The procedure to connect an installation to the distribution grid in Bulgaria is similar regardless of the size of the installation. This represents a high burden for smaller installations, and drives projects to configure their systems for pure self-consumption, making them harder to monitor, and control.

3 Customs Agency
Under Bulgaria's current legislation, electricity is considered an excise good, creating an obligation for prosumers who wish to export a share of their generation to the grid to pay excise tax. As such, prosumers in Bulgaria are obliged to apply for a registration of their plants with the Customs Agency prior to deploying the plant. Once registered, an excise tax of EUR 1 per self-consumed MWh is incurred, based on reports that producers are required to submit to the Agency every month.[43]

Stakeholders interviewed for this analysis indicated that it took them over two months to register the plant with the local Customs Agency. One recurring obstacle turned out to be the smart meter, which does not display the amount of energy produced on the device itself, instead feeding the real-time data to a near-by computer. Upon inspection of the plant, the Customs Agency did not approve the smart meter, citing the potential for the measurements to have been tampered with. As a result, the producer was required to install an additional meter (at their own cost) in order to measure the amount of electricity generated and self-consumed onsite.

4 Access to finance
Currently only one bank offers individual households a designated loan product for the purchase and deployment of a 3 kW autonomous rooftop solar PV installation with a 5,8 kWh Li-ion battery. The loan conditions are fixed and include EUR 7,825 for financing with a 2,5% annual interest rate over an 8-year period. Importantly, the customer cannot choose the firm that installs the system and the technical specifications are also fixed. The same bank also offers commercial loans for "green investments" that can include solar PV installations.[44] The exact conditions, however, vary by customer.

5 Legal issues
The major legal issue is the lack of a clear legal definition of prosumers, including their rights and obligations. With the transposition and the implementation of the Renewable Energy Directive (RED II, 2018/2001) and the Electricity Market Directive (EMD, 2019/944), prosumers are expected to be defined in the Bulgarian legislation by the end of 2021.

[43] https://www.capital.bg/biznes/energetika/2021/03/05/4182008_za_slunchev_tok_triabva_da_registrirate_danuchen_sklad/

[44] https://www.procreditbank.bg/bg/za-firmi/biznes-krediti/kredit-zelena-investicija

6 Socio-economic barriers

In addition to the policy and regulatory barriers, a range of socio-economic factors further hamper the investment in distributed solar PV systems in Bulgaria. Despite the fact that GDP per capita has grown fivefold between 2000 and 2019 and reached EUR 8,860 at the end of 2019, Bulgaria remains the poorest country in the EU with GDP per capita in terms of purchasing power that is half the EU average and approximately one third of that of the leading EU Member States. Furthermore, some 2.3 million people, or 32% of the Bulgarian population, are at risk of poverty or social exclusion, one of the highest rates in the EU.[45]

Barriers notwithstanding, there have been some positive regulatory changes for the sector in recent years.

Positive Developments in Bulgaria's Policy and Regulatory Environment

From an administrative perspective, amendments to the Spatial Development Act in 2019 removed the requirement for rooftop and façade solar PVs up to 1 MW to have an approved investment plan in order to obtain a building permit. Furthermore, such installations do not require a formal commissioning if they are not connected to the grid.

From January 2021, producers with new installations of above 30 kW that are connected to the grid no longer have to pay a 5% levy on their revenues from the sale of electricity. The levy was originally introduced on FIT projects in 2015 as a measure to fund the Energy System Security Fund.[46]

Finally, as part of the upcoming transposition of the RED II directive, the NECP envisions legislative changes aimed at creating a stronger legal framework for prosumers and energy communities in particular.[47] However, the transposition with an original deadline of June 2021 is going to be delayed due to the parliamentary snap elections in July 2021 and the negotiations leading up to the formation of a new government.

Synthesis

Most owners/developers of customer-sited solar PV projects in Bulgaria are currently focusing on pure self-consumption rather than connecting their systems to the grid. However, this approach has a number of drawbacks:

- Under-dimensioning of installations
- Fewer economies of scale
- Less displacement of carbon-intensive generation from Bulgaria's existing generation mix, and less low-carbon electricity being generated overall

[45] https://ec.europa.eu/eurostat/statistics-explained/index.php/People_at_risk_of_poverty_or_social_exclusion#:~:text=In%202017%2C%20112.8%20million%20people,after%20social%20transfers%20in%202017.

[46] https://www.parliament.bg/bg/bills/ID/163432

[47] Another important strategic document in Bulgaria is the Strategy for Sustainable Energy Development of Bulgaria until 2030 with a Horizon of 2050 (henceforth simply "the Energy Strategy"). The Energy Strategy is a key political document with legal and regulatory importance that sets the mid- and long-term vision for the development of the energy sector in the next decade. For more information, see: https://www.parliament.bg/bg/parliamentarycommittees/members/2579/documents

- Since such "pure self-consumption" systems cannot be effectively monitored, the renewable electricity they generate cannot be effectively integrated into the government's renewable energy supply statistics, undermining Bulgaria's efforts to comply with the EU's renewable energy targets

With a better policy and regulatory framework, prosumers could contribute their surplus generation at a cost that is comparable, if not even **below**, the current generation cost of the leading utilities in Bulgaria, thereby helping Bulgaria accelerate its energy transition. Moreover, the surplus generation would quite likely be lower than prevailing daytime wholesale electricity market prices, which currently range between EUR 50 and EUR 80/MWh; this indicates that surplus generation from prosumers could even help **reduce** daytime electricity prices on the wholesale market, providing benefits to other electricity consumers, including other companies and industries that do not have their own solar PV installation.

5. RECOMMENDATIONS AND FUTURE PATHWAYS

As highlighted above, the market for distributed solar PV in Bulgaria is starting to gain momentum, particularly for medium and large-sized companies and industries. A combination of factors including increasingly low-cost solar PV, rising electricity prices, and increasingly liberalized electricity prices are combining to make solar PV an attractive way for companies to reduce their energy bills.

In order to create a bankable policy and regulatory framework for small- and medium-sized solar PV projects, Bulgaria should consider the following measures:

1. **A comprehensive policy framework for prosumers is needed in Bulgaria**, one that is aligned with the EU's RED-II Directive, and creates policy and regulatory certainty for the sector. This includes the implementation of clear grid-connection procedures, clear rules with regard to tax treatment, **a one-stop-shop** for all renewable energy applications.

2. Bulgaria needs to introduce regulations establishing **fair pricing conditions for surplus generation**. In this regard, Bulgaria can draw insights from the recent discussion around **Surplus Power Tariffs**, which would provide a simple, LCOE-based price for the purchase of surplus electricity output that is exported to the grid.[49] As there are currently no solar PV auction prices that could provide a market-based benchmark, another alternative would be to award prosumers the average wholesale market prices, calculated on a monthly basis.

3. In its new legislation, **Bulgaria should establish legal clarity on the definition and the status of prosumers, as well as on the definition of key terms like net metering, net billing, and virtual net metering**.

[48] http://www.ibex.bg/en/

[49] See:https://proseu.eu/sites/default/files/PROSEU_Surplus%20Power%20Tariffs%20-%20Position%20Paper%20%28short%20version%29_2021-02-25.pdf

4 **Bulgaria should establish a public registry of certified solar PV installers** similar to those found in other markets around the world. Installers applying to be on the list would have to pay a fee to help offset the costs of certification.

5 **Efforts should be made to simplify grid connection procedures for small systems such that grid authorizations can be made via simple notification**, provided the installation is done by a certified installer.

6 **Bulgaria should waive the excise tax on small solar PV projects in particular.** Currently, the excise tax poses an unnecessary administrative burden, notably due to the requirement to file monthly reports.

7 Bulgaria should introduce financing instruments to improve access to finance, specifically in order to help lower and middle-income households, as well as small and medium-sized businesses, to overcome the upfront costs barrier. This could involve a special renewable energy credit facility providing preferential loan terms for grid-connected prosumer projects. Such low-interest loans could be administered through Bulgaria's development bank, the BDB, as well as through private banks.[50]

8 In combination with the credit facility mentioned above, **Bulgaria should develop and implement its own 100.000 solar roofs program**, drawing on successful experiences in Germany in the early 2000s,[51] and more recently in Austria.[52] Such an initiative could be done in conjunction with a nationwide awareness-raising campaign. Such initiatives can ensure that local households and businesses become part of the energy transition, rather than passive observers.

9 **Bulgaria should ensure that public and EU funds are channelled to support investments in distributed** solar PV installations on public buildings and on middle and low-income housing in particular. The Government's draft National Recovery Plan[53] outlines investment in solar PV systems as a priority. Focusing such efforts on middle and low-income housing can help ensure that solar PV does not come to be seen as an option only for the wealthiest households, while helping reduce energy costs for the poorest households.

50 https://bbr.bg/en/
51 https://www.eclareon.com/sites/default/files/presentation_solar_guidelines_mnre_round_table_20032012.pdf
52 https://ec.europa.eu/jrc/sites/jrcsh/files/kjna29938enn_1.pdf
53 https://www.nextgeneration.bg/14

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