EU Market Outlook

For Solar Power

2020 - 2024

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Foreword

Welcome to SolarPower Europe's EU Market Outlook for Solar Power 2020–2024.

The solar PV sector is no stranger to positive surprises – in recent years this has included surpassing expectations in terms of steep cost reduction, flexibility, user-friendliness, manifold applications, and its rapid growth rate. However, the latest entry in this list has been a really big surprise: newly installed solar power in the European Union increased by 11% to 18.2 GW in 2020! Not only did demand for solar PV systems in the EU grow over the course of a year that was defined by the COVID-19 pandemic, it increased by double digits to a level that marks the second-best ever in EU solar history. There was not a single analyst who forecasted such a positive outcome six month ago, especially considering the fear of a 'second wave' haunting Europe this autumn and winter.

As the association representing the European solar sector, we are deeply relieved about this encouraging development of our industry that is the most job-intensive among all power generation sources. With that said, the growth seen in 2020 is 12% less than projected in our previous market outlook, from 2019. We anticipate that it will take until 2022 before demand for solar PV systems will have compensated the delays in deployment caused by COVID-19, meaning we have lost precious time in our race against climate change.

The European solar sector appreciates the efforts of the European Commission setting ambitious carbon reduction targets, towards climate neutrality via its Green Deal, and through the tools offered in its Next Generation EU recovery plan that tie over one third of financial support for member states to climate-related expenditures. This offers many opportunities to foster rapid solar growth in Europe. Our policy recommendations in this document were developed together with our members, in particular national solar associations, to help policymakers in EU member states identify the many programmes on offer, and establish the most efficient incentive mechanisms to boost solar as the lowest cost and most effective power generation technology to manage the clean energy transition.

More commitment for solar on the EU member state level should remain a high priority. While most member states are increasingly seeing total solar capacities grow and have acknowledged solar in their National Energy and Climate Plans (NECPs) to meet 2030 EU targets, most of these deployment levels are still not ambitious enough. The average 19.8 GW/year solar growth projected in the NECPs for the next decade is close to the volume the EU has installed during its most severe economic crisis. Moreover, we are seeing market leaders, such as Germany, putting regulatory obstacles in the way of solar that make investments much more difficult, and thus slow down long-term growth. This is not the way forward! As we have shown for Paris Agreement-compatible scenarios modelled in our recent 100% Renewable Europe report, the volume of solar that the EU must install is at least 2.5 times higher than the expected NECP totals by 2030. To enable Europe's citizens, corporates, and financing institutions to embrace the lowest-cost and most versatile power generation technology, even more enthusiastically after the COVID-19 crisis, EU member states must provide optimal policy frameworks for solar to continue to surprise us positively in the future.

SolarPower Europe, together with its national association and corporate members, looks forward to working with policy stakeholders to enable solar to deliver on its immense potential to meet the EU's 2030 targets, provide the maximum benefit for Europe's climate, and contribute significantly to the Green Deal.

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Thanks to our Sponsor Members:

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Methodology: SolarPower Europe's five-year forecast consists of Low, Medium and High Scenarios. The Medium scenario anticipates the most likely development given the current state of play of the market. The Low Scenario forecast is based on the assumption that policymakers halt solar support and other issues arise, including interest rate hikes and severe financial crisis situations. Conversely, the High Scenario forecasts the best optimal case in which policy support, financial conditions and other factors are enhanced.

Segmentation is based on the following system size: Residential (<10 kW); Commercial (<250 kW); Industrial (<1000 kW); Utility-scale (>1000 kW, ground-mounted). SolarPower Europe's methodology includes only grid-connected systems. Installed capacity is always expressed in DC, unless otherwise stated.

All figures are based on SolarPower Europe's best knowledge at the time of publication.

Executive summary

Solar PV power in the European Union has shown strong resilience in 2020 despite Coronavirus negatively impacting everyone's life in many aspects. Surprisingly, demand for solar power technology in the European Union did not decrease but rather increased notably in 2020. EU members states installed 18.2 GW of solar power capacity in 2020, an 11% improvement over the 16.2 GW deployed in the previous year. While this is less than what we forecasted in last year's EU Market Outlook, it is significantly higher than our estimate in an adjusted post-outbreak forecast in late spring. 2020 was the second-best year ever for solar in the EU, only topped by 2011, when 21.4 GW was installed.

Germany installed 4.8 GW, enough to become again the largest solar market in Europe, a position it held for most of the time in the last 20 years. The other Top 5 include the Netherlands (2.8 GW); last year's market leader Spain (2.6 GW); Poland, which more than doubled annual solar deployment (2.2 GW); and France (0.9 GW). Like last year, we have invited national associations to write detailed country profiles for the leading EU markets (see p. 44).

In total, the European Union's Top 5 solar markets were responsible for 74% of the 2020 installed capacity in the region compared to a 5% points higher share (79%) in 2019. That means, even though the contribution of the other 22 EU member states remains rather small, it is notably rising. And when taking into account that the Top 5 solar markets represent about 57% of the EU's population and 61% of its GDP, their share is not that prevalent anymore.

The broadening acknowledgment of solar PV's benefits can be also observed in another trend: in 2020, 22 of the 27 EU member states installed more solar than the year before, compared to 21 out of 28 in 2019. All this has resulted in the European Union increasing the cumulative installed solar power capacity by 15% to 137.2 GW by end of 2020.

The surprisingly positive 2020 for the EU solar sector will be followed by 4 years characterised by even stronger demand. Our Medium Scenario now forecasts additions of 22.4 GW in 2021, which means 5% higher demand than forecasted last year. For the following 2 years, we are even more upbeat, now projecting 27.4 in 2022 and 30.8 GW in 2023, translating into 15% and 18% higher deployments than in our EMO 2019. And in 2024, SolarPower Europe sees demand cross the 35 GW level, bringing total installed solar PV capacity to 253 GW.

There are many good reasons for solar's recent positive developments and optimistic outlook in the European Union beyond its unique versatility and constantly improving cost leadership – and that is policy support in Brussels and many other EU capitals, creating the right market framework conditions for any type of the manifold possible solar applications.

The Key Policy Files that SolarPower Europe is intensively working on are briefly summarised in Chapter 2 (see p. 22), showing the crucial topics under discussion to speed up solar growth, including ambitions for the Clean Energy Package 2.0, how to tackle the gap on carbon pricing, initiatives to tap Europe's gigantic solar roof potential, and constraints of the power grid. In our Policy Recommendations (see p. 6), we explain how member states can boost solar by utilising the European Commission's economic recovery plan. Applying these means correctly is a unique opportunity to invest into solar as the most job creating and flexible renewable energy source to accelerate the clean energy transition. This is because the member states' National Energy & Climate Plans (NECPs) outlining their strategies to meet the 2030 EU targets do take solar into consideration but need to do much more, as our analysis in Chapter 3 shows (see p. 30).

Policy recommendations

Next Generation EU – Solar Powering the European Economic Recovery

The coronavirus pandemic didn't spare the solar power sector. Whereas COVID-19 slowed the very steep growth curve observed over the past 2 years, the European solar industry has demonstrated a very strong resilience. While growth levels are still 12% lower compared to our expectations before the crisis, we now see an 11% increase in deployment of solar projects across the EU in 2020 with only 5 out of 27 EU Member States installing less capacity than in the previous year. SolarPower Europe anticipates a return to normality in 2022, with the speed depending heavily on the economic recovery and stimulus packages.

The EU's recovery plan, *Next Generation EU* is an unprecedented and ambitious investment plan which aims to mitigate the impact of the COVID-19 pandemic by accelerating Europe's green and digital transition, creating new opportunities for industrial growth and job creation at the service of Europe's climate-neutrality ambition. The solar industry, as the most sustainable and job creating energy source, appears as a perfect candidate to contribute to this challenging transition.

The core of the so called *Next Generation EU* plan is the EUR 672.5 billion Recovery and Resilience Facility (RRF). The RRF will provide financial support for Member States which can be directly injected in their economies, under the form of grants, loans or state guarantees. Investments covered by the RRF must be aligned with the objectives of the European Green Deal, with up to 37% of the total funding exclusively earmarked for climate-related expenditures. At the time of writing, the European Council and the European Parliament were negotiating the details of the RRF, with a view to reach a final agreement by end of 2020.

In order to access RRF funds, Member States will have to submit their "national recovery and resilience plans" to the European Commission, detailing the measures and sectors targeted and demonstrating the contribution to the achievement of Europe's energy and climate objectives. **The Commission has strongly encouraged Member States to concentrate their investments in 6 flagship initiatives, 4 of which are directly relevant to the solar sector:**

- **Power up**: by 2025, build and integrate 200 GW of RES by 2030, support the installation of 6 GW of electrolyser capacity and the production and transportation of 1 million tonnes of hydrogen (H_2).
- **Renovate**: by 2025, contribute to doubling the renovation rate and fostering deep renovations.
- **Recharge and refuel**: by 2025, deploy at least 1 million charging points and 500 H_2 refuelling stations deployed.
- **Reskill and upskill**: by 2025, ensure 70% of Europeans of working age have basic digital skills, that 4 in 5 Vocational Education and Training (VET) graduates are employed and that 3 in 5 VET graduates benefit from in job training.

The Recovery & Resilience Plans are therefore a unique opportunity for Member States to invest into solar and boost the clean energy transition, enable sustainable growth and create green jobs. Investments into solar create the most jobs per million dollars of capital investment.[1] Utility-scale solar investments combine job creation with very low costs for greenhouse gas emission abatement, whereas investments into rooftop solar can be implemented within a short timeframe. Furthermore, investing into solar will contribute to increase the competitiveness of EU industry: Solar power's Levelised Cost of Electricity is already competitive against industrial and wholesale electricity prices across Europe today (see Fig. 1, p. 9).

1 IEA (2020). *Sustainable Recovery*.

To make solar a core pillar of Europe's green Recovery & Resilience plans, Solar Power Europe together with its members developed 6 key recommendations for EU Member States:

1. **Boost utility-scale solar and storage** – Relevant flagship initiative: Power up

   Member States should allocate funds to finance additional renewable energy tenders, including tenders for hybrid renewable energy projects that combine solar with utility-scale Battery Energy Storage Systems (BESS). In combination with additional tenders, recovery funds should be used to accelerate permitting procedures, a key bottleneck to deploy utility-scale solar.

   Other cost-effective ways to leverage private investments with Recovery and Resilience Funds is to use these to provide public support for renewable energy Power Purchase Agreements (PPAs) or to de-risk finance for projects through budget guarantees, as detailed in Japan's recovery plan.[2]

2. **Roll out solar-rooftop and storage programmes** – Relevant flagship initiatives: Power up, Renovate

   Up to 90% of Europe's roof surfaces remains unused, while the potential contribution to Europe's energy transition could be significant – the Moderate Scenario of SolarPower Europe's *100% Renewable Europe* report models 570 GW of rooftop PV capacity deployed already by 2030, a massive leap from the 90 GW installed today. To make the most of Europe's solar rooftop potential and provide a short-term boost to jobs, Member States should design solar mandates for all new and existing buildings with suitable rooftops. Solar mandates should be coupled with targeted support schemes to citizens and businesses that wish to install on-site solar and storage that can be funded with Recovery and Resilience funds. Such measures will also contribute to creating new job opportunities for EU citizens.

3. **Promote electrification, deploy BESS, and invest in smart grids** – Relevant flagship initiatives: Power up, Renovate and Recharge and refuel

   Electrification has great potential to boost the European Green recovery. Only for electrical contractors, more than 270,000 jobs could be created in the building sector, and 112,000 jobs in e-mobility.[3] Member States should use Recovery & Resilience funds to promote renewable-based electrification of energy end-uses, such as buildings, heat, transport, and industry. For example, the German recovery plan announced in early July offers incentives to deploy electric cars and fleets, next to additional recharging infrastructure and battery manufacturing. This resulted in a 221% growth for newly registered BEVs in Q3/2020 year on year, and a market share of 4.8% or even 20.1%, when all e-based varieties are included.[4]

   Furthermore, Member States should prioritise investments into the integration of BESS and smart grid projects that unlock distributed flexibility resources in the energy system. Spain's recovery plan set a very good example in this regard, planning to allocate investments to deploy transmission and distribution level smart grids with a view to integrate additional shares of renewable energy.

2 Taiyang News (2020). *Renewables Find Mention in COVID-19 Economic Stimulus Package Of Japanese Government; Up To $1 Billion To Support Corporate Renewable PPAs Under Commitment To RE100.*

3 According to electrical contractors' association EuropeOn.

4 Strategy& (2020). *Wachsendes Angebot elektrisiert die Kunden: Zulassungen von E-Autos legen in Deutschland um 168% zu.*

Policy recommendations / continued

4. **Support the European solar manufacturing sector** - Relevant flagship initiative: Power up

Recovery funds should support the domestic research and innovation on solar PV emerging technologies and facilitate the development of new manufacturing projects in Europe, strengthening Europe's long-term energy security and ensuring European innovations lead to job creation and economic growth in Europe.

To support the development of innovative solar manufacturing pan-European projects, SolarPower Europe launched the Solar Manufacturing Accelerator which successfully presented ten leading PV manufacturing projects in July 2020.

5. **Reconvert former coal and industrial sites with solar**

Member States should seek to support the reconversion of former coal and industrial sites into hubs for innovative solar applications. Supporting the development of utility-scale solar, floating solar, biodiverse solar and agricultural photovoltaics coupled with BESS creates new growth ecosystems in areas affected by the clean energy transition.

6. **Finance training & re-skilling programs**

Solar creates more jobs than any other energy source.[5] By boosting the deployment of solar, Member States will drive job creation for workers across a very wide range of experiences and backgrounds.

National Recovery & Resilience Plans should support job creation in solar by providing fiscal and administrative incentives for companies looking to expand their workforce. In addition to this, recovery plans should be used to launch large-scale training programmes to provide the necessary skills to deploy the infrastructure needed to achieve the clean energy transition. Specifically, recovery funds should be used to fund the re-skilling of fossil fuel workers.

5 IRENA (2020). *Renewable Energy Jobs Continue Growth to 11.5 Million Worldwide.*

1 EU solar markets 2020


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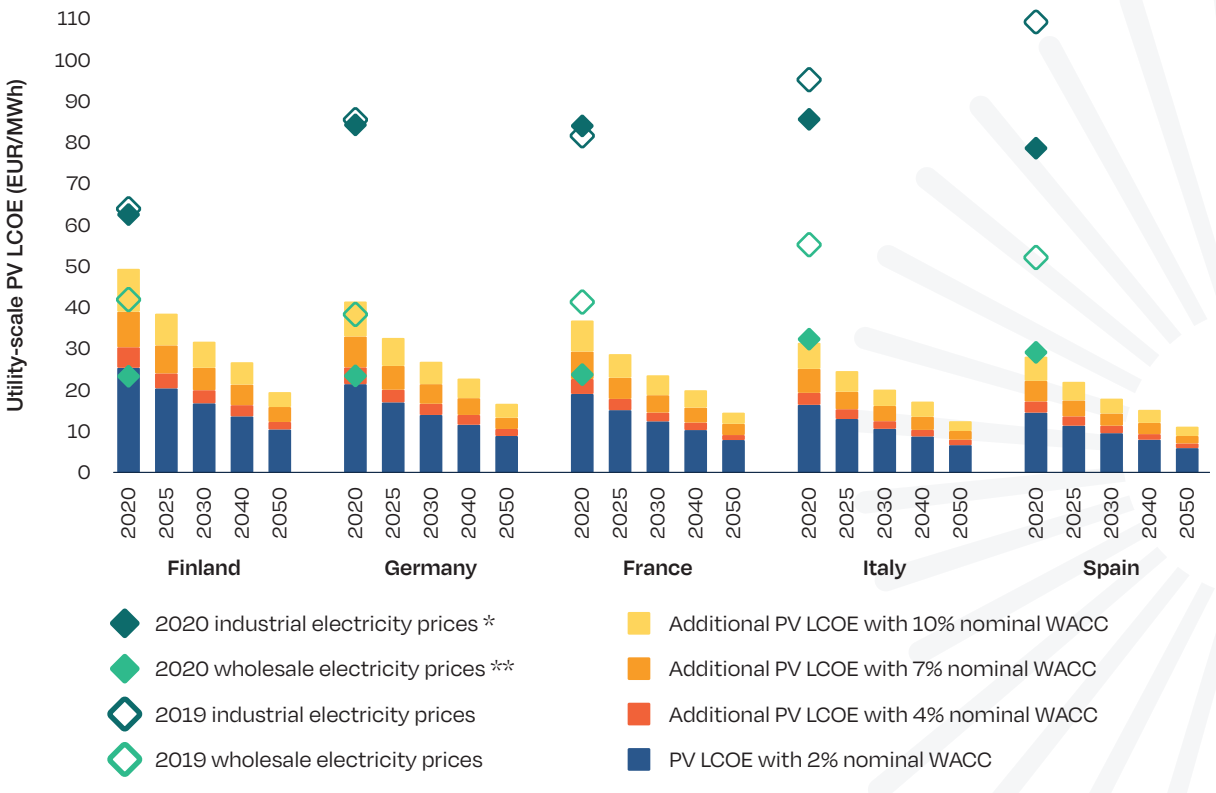
Solar power in the European Union has shown strong resilience in 2020 despite Coronavirus negatively impacting everyone's lives in many ways. While the solar industry has successfully worked on further reducing costs for solar power generation, commercial power plant developers and operators have been dealing with unexpected competition in 2020. Due to lower economic activities, industrial and wholesale electricity prices dropped dramatically across the Continent (see Fig. 1).

FIGURE 1 PV LEVELISED COST OF ELECTRICITY (LCOE) IN FIVE EU LOCATIONS, 2020-2050



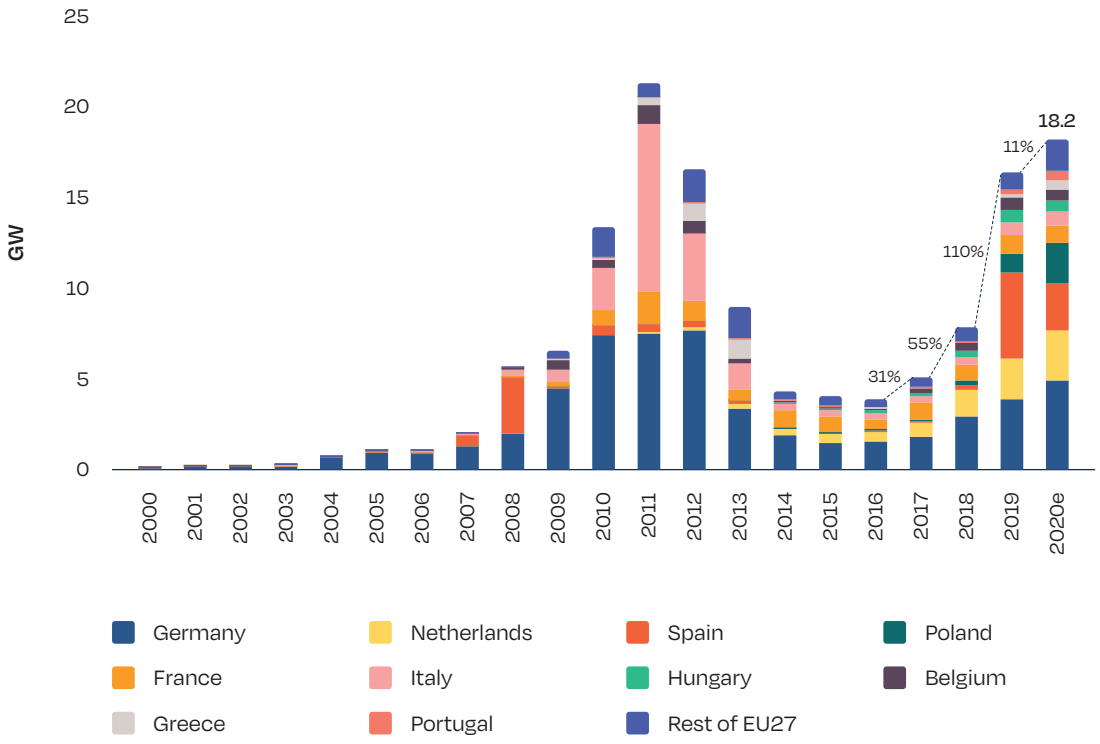
*: H1 2020 average national price for medium-size industrial consumers (without taxes).
**: H1 2020 average national price for wholesale baseload electricity.
SOURCE: European Commission (2020); Eurostat (2020); ETIP PV (2020).

1 EU solar markets 2020 / continued

In 2019, large-scale solar power plants easily outcompeted both industrial and wholesale electricity prices in southern and northern Europe in basically any interest rate environment. Only a few months later, the business case for large scale solar was different, requiring much better financing conditions to beat wholesale power prices. But this and other challenges brought upon the European solar sector through Coronavirus have had less impact than anticipated.

Surprisingly, demand for solar power technology in the European Union did not decrease but rather increased notably in 2020. EU members states installed 18.2 GW in 2020 – that's an 11% improvement over the 16.2 GW deployed in the previous year (see. Fig.2). This makes 2020 the second-best year ever for solar in the EU, only topped by 2011, when 21.4 GW was installed. The number is about 12% less than what we had forecasted in last year's Medium Scenario of the EU Market Outlook, but higher than in our Global Market Outlook published in June, when we had strongly revised the number downwards after the first Coronavirus wave (see Box 1, p. 14).

FIGURE 2 EU27 ANNUAL SOLAR PV INSTALLED CAPACITY 2000-2020

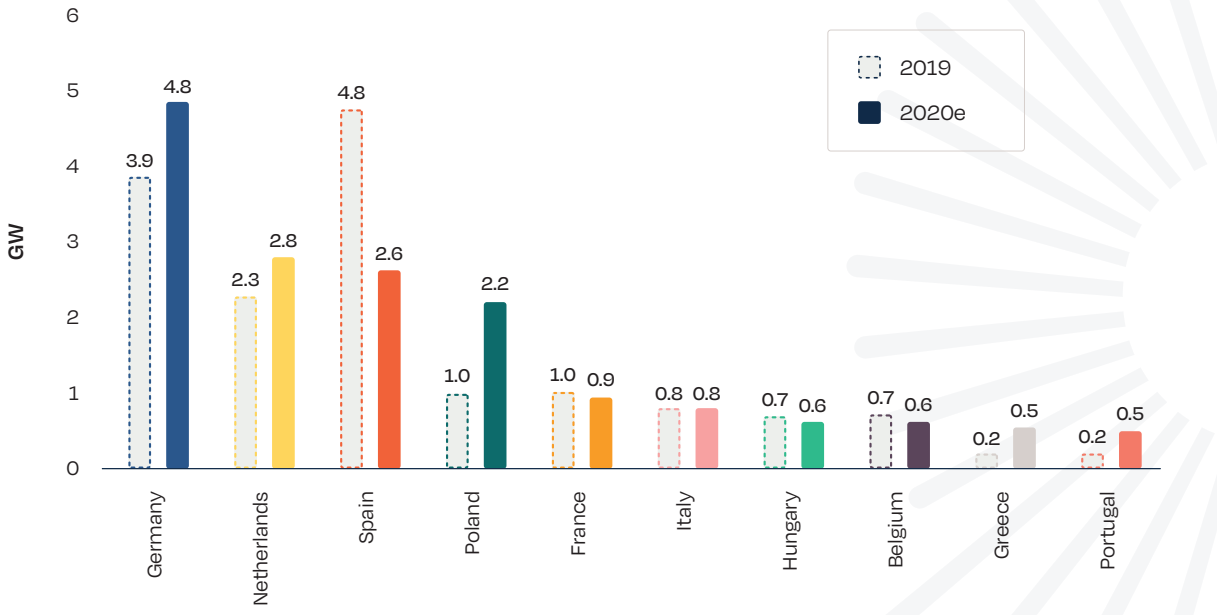


1.1. Top 5 EU solar markets 2020

Germany is again the largest solar market in Europe, a position it held for most of the time over the last 20 years, interrupted only six times, once by Italy, twice by Spain and three times by the UK. After a consolidation phase following the first full feed-in tariff based European solar boom, the Continent's largest economy's solar sector has been experiencing a second boost as of 2018. This is due to a combination of self-consumption with attractive feed-in premiums for medium- to large-scale commercial systems ranging from 40 kW to 750 kW. It is also due to auctions for systems up to 10 MW and a tried and tested regulatory scheme on the one the hand and solar's steadily improving cost competitiveness on the other hand. After a first small subsidy-free system of 8.8 MW was installed in 2019, several more powerful ones have followed in 2020, with the country's largest solar power plant, a 187 MW utility-scale system starting to feed its first electricity into the grid in November while still being under construction. These developments have enabled Europe's dominant solar market to grow by around 1 GW per year for the last 3 years, reaching 4.8 GW in 2020, 25% more than last year, and 74% higher than the second largest European market.

Europe's new No. 2 in 2020 is likely **the Netherlands**, which moved up one rank, after installing an estimated 2.8 GW, a 23% rise compared to 2.3 GW installed in 2019. The biggest market segment in 2020 again was commercial rooftops, which increased their share to nearly 50%. The residential market, though in absolute terms stable, saw its portion shrink by about 10% points down to nearly 30%. The market segment of ground-mounted systems remained at around 20%, with the largest PV plant so far, a 110 MW in Groningen province, becoming operational this year. There is an increasing interest in multifunctional use of space, like floating solar or solar carports, with the largest solar panel carport of 35 MW having recently started construction. The main two drivers for solar in the Netherlands continue to be net metering for the residential and small business segments, while the commercial and utility-scale markets rely on the SDE+ tendering scheme, where solar has to compete with other renewable energy sources (and as of 2021 with CCS and energy saving projects).

FIGURE 3 EU27 TOP 10 SOLAR PV MARKETS, 2019-2020



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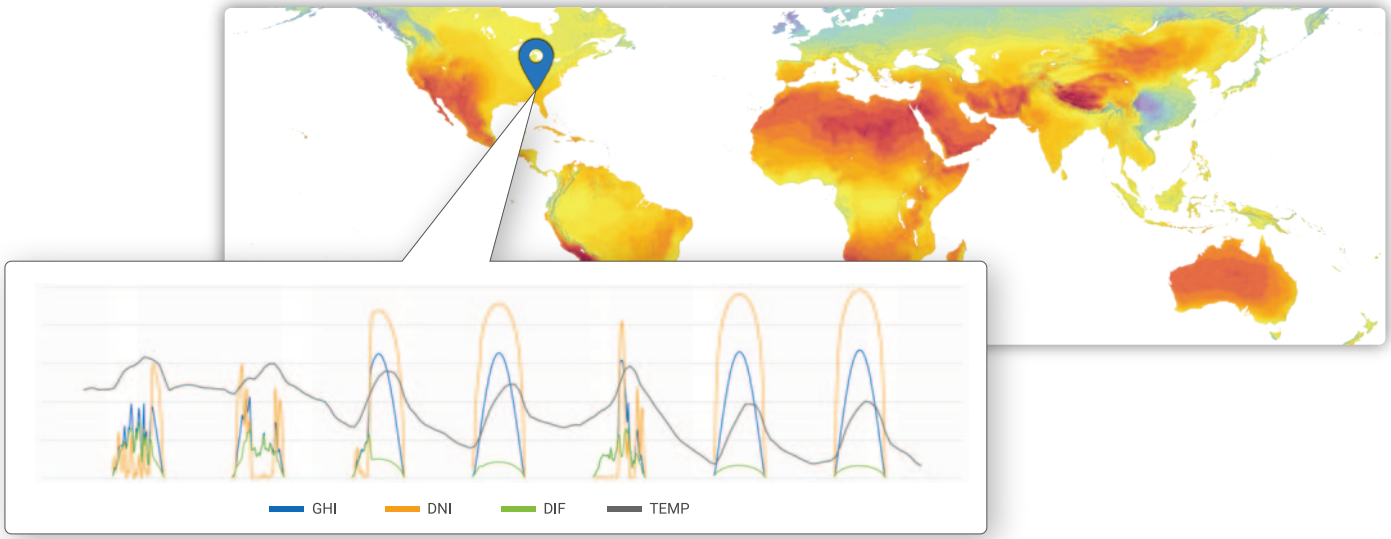

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Spain's time on Europe's solar throne lasted only one year. The southern European country dropped to rank 3 with an estimated newly installed capacity of around 2.6 GW, down 45% from around 4.8 GW last year. Nearly 4 GW of the 4.2 GW ground-mounted power plant capacity installed in 2019 mostly stemmed from two tenders in 2017. But in 2020 there were no new volumes from additional tenders to be deployed. Instead, nearly 1.5 GW of the 2020 installations came from PPA based systems out of a 100 GW+ pipeline under development in Spain. This makes the country probably the world's largest market for subsidy-free solar, while showing at the same time that grid constraints can dramatically slow down the installation pace for solar power plants. The self-consumption rooftop market grew less than originally anticipated due to COVID-19, which has hit Spain extraordinarily hard and has resulted in a dire economic situation where many SMEs have been delaying or even abandoning their solar project plans. The residential segment was not impacted that negatively, as fiscal incentives of some municipalities apparently had effects on households' investment decisions pro solar.

The biggest surprise on the EU's solar map is again **Poland**, the EU's coal bridge head, where hard and lignite coal represent nearly 75% of power demand in 2019. Poland not only exceeded the annually installed solar GW-scale for the first time, it is also expected to have jumped directly to the second floor in 2020, adding 2.2 GW (our number is between the estimates of PV Poland's figure of 1.85 GW and Stowarzyszenie PV's figure of 2.3 GW). This positive solar development follows on the previous year's scoop, when Poland's PV market grew almost four-fold to 972 MW. The backbone for the continued strong growth of solar in Poland is self-consumption founded on a favourable policy net-metering/feed-in framework for prosumers. Most Polish solar systems are smaller than 1 MW, with the bulk installed in the micro-generation segment (under 50 kW), adding up to around 350,000 systems by end of 2020. Beyond net metering and FiTs, Poland offers further financial incentives, including reduced VAT and income taxes, and low-interest loans. The micro-generation segment is complemented by an annually held RES auction scheme launched in 2016 and a newly developing PPA segment that just saw the first few systems being installed.

France fell back one place, now ranking fifth among the EU's top PV markets. It installed an estimated 945 MW in 2020, 7% down from 1,021 MW in 2019. In Q3/2020, France reached the threshold of 10 GW total solar capacity. This is 2 years late according to the original plan, which requires nearly 10 GW more to meet its 20 GW target by end of 2023, and needs over three times more to reach the its goal of 44 GW by 2028. For years, France's installations have been hovering close to the 1 GW level, with long administrative procedures and challenging grid connection processes hindering developers to speed up installations. Moreover, investors have been irritated by a government bill to retroactively cut feed-in tariffs for existing solar power plants, passed by the Parliament but later rejected by the Senate in fall 2020.

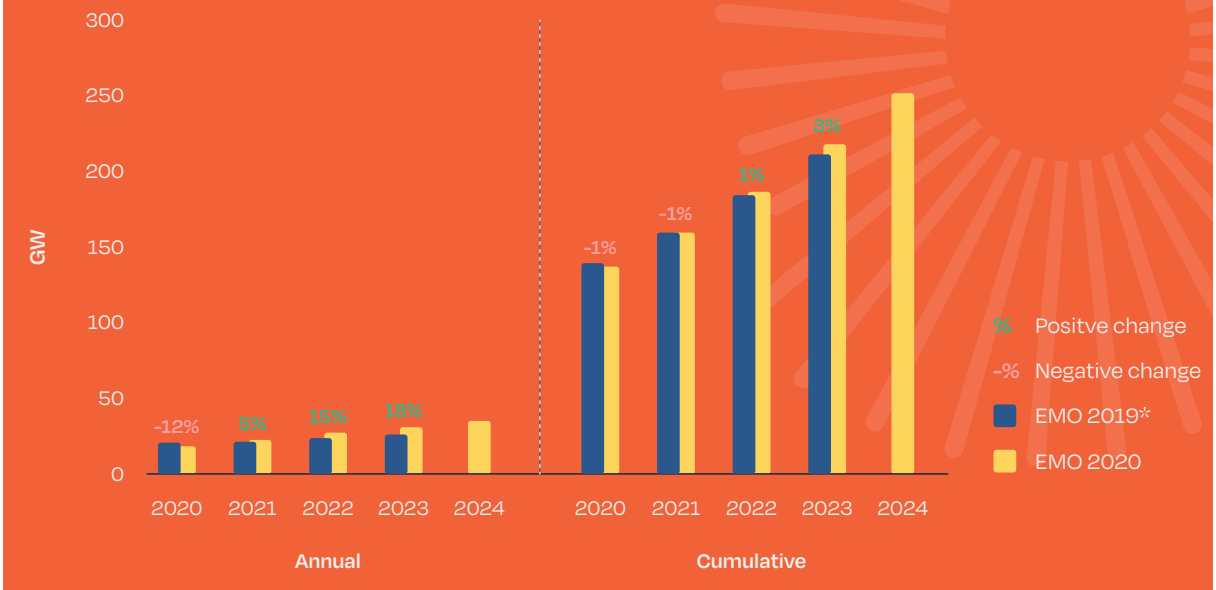
In total, the European Union's Top 5 solar markets were responsible for 74% of the 2020 installed capacity in the region compared to a 5% points higher share (79%) in 2019. When looking at the Top 10, the share increases to 90% based on a combined capacity of 16.4 GW, which is 1 GW more the group added compared to 2019 (15.4 GW). For the Top 10 the trend is similar to the Top 5. Their total share in newly installed EU solar capacity declined, in this case by nearly 4% points from 94% in 2019. That means, even though the contribution of the other 24 or 17 EU member states remains rather small, it is notably rising. Furthermore, when taking into account that the Top 5 solar markets represent about 57% of the EU's population and 61% of its GDP, its share is not that prevalent anymore.

It seems the time has come as the vast majority of EU member states has been jumping on the solar train directed by a few pioneers. In 2020, 22 of the 27 EU member states installed more solar than the year before. Despite COVID-19, this is more than in the previous year, when 21 out of 28 EU members experienced solar market growth. This development is supported by analysis of the members states' National Energy Climate Plans indicates, which indicate growing awareness and increasing solar activities in most of the countries (see Chapter 3).

Box 1: Looking back and forth

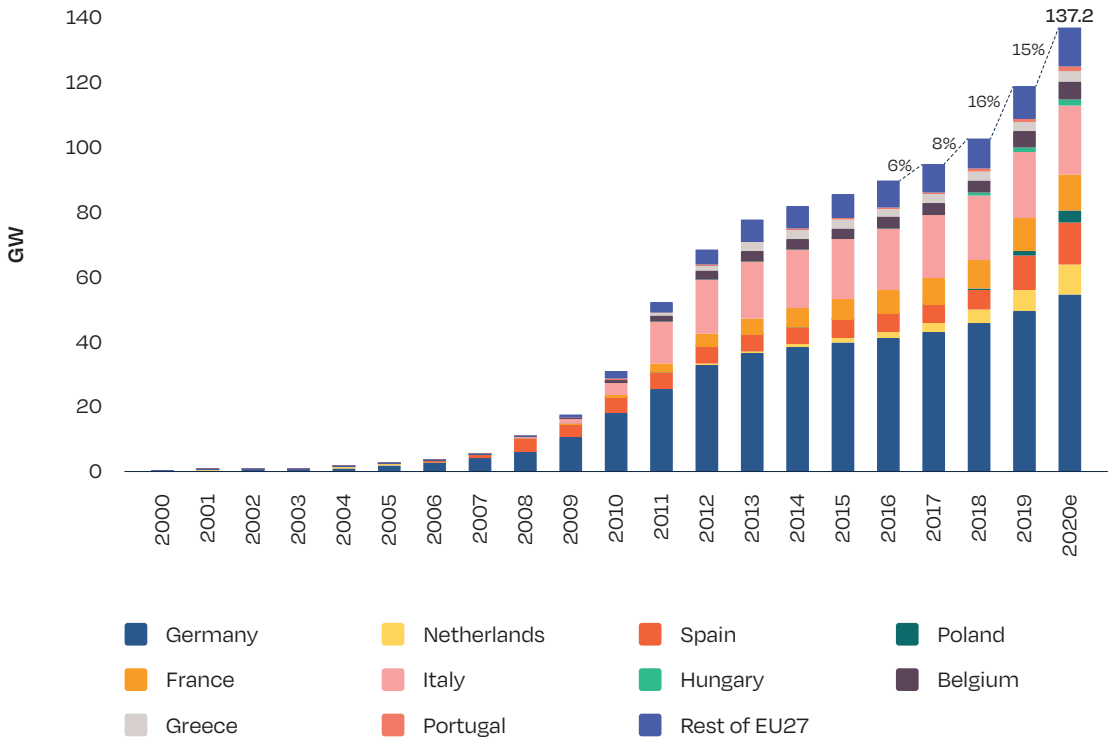
When we published our previous EU Market Outlook in December 2019, Europe's solar world was in order. After the market had more than doubled in 2019, the European Union appeared well prepared for another year of growth. Our Medium Scenario assumed 26% growth to 20.6 GW for 2020, the final year to meet the 2020 climate targets. It also assumed a year to take a breath in 2021 with a 4% growth, before demand was anticipated to get back to low two-digit levels, with 11% and 10% in 2022 and 2023, respectively, as the next climate- relevant EU objectives were far off, in 2030. The advent of COVID-19 has changed everything. After the first heavy wave hit Europe, we changed our model for the Global Market Outlook published in June, then expecting an 18% year-on-year collapse in our Medium Scenario, while the High Scenario still offered hope of reaching 18.6 GW. Solar has been rather lucky and walked the High Scenario path. The second quarter results from several leading EU markets turned out much better than feared, in particular for Germany, which kept its DIY shops open and handymen working in spring. In September, we adjusted our main case assumption significantly upward to -10%. But even that was too pessimistic. The attractiveness of flexible, low-cost solar power made the technology very resilient to the virus, finally turning the tide, again resulting in another growth year, with 18.2 GW and a resulting remarkable plus 11%. While this is still 12% less than originally anticipated in our EMO 2019, no analyst had expected such an outcome in late spring. With several European Green Deal tools integrated in the Recovery Package, and the momentum for the lowest cost, versatile green power only getting stronger, we have significantly upped our growth expectations for the next 4 years. Our Medium Scenario now forecasts 22.4 GW in 2021, which means 5% higher demand than forecasted last year. For 2022 and 2023 we are even more upbeat, now projecting 15% and 18% higher deployments than in our EMO 2019. Still, the new growth outlook has to be taken into perspective. A close look at the cumulative installed capacity reveals that COVID-19 impacts will delay market growth by 2 years. As it stands now, it will take until 2022, before total installed solar power capacities will reach the level, we forecasted in our EMO 2019.

FIGURE 4 COMPARISON MEDIUM SCENARIO EMO 2019 VS 2020



*: Values have been adjusted by subtracting the UK values to allow comparison.

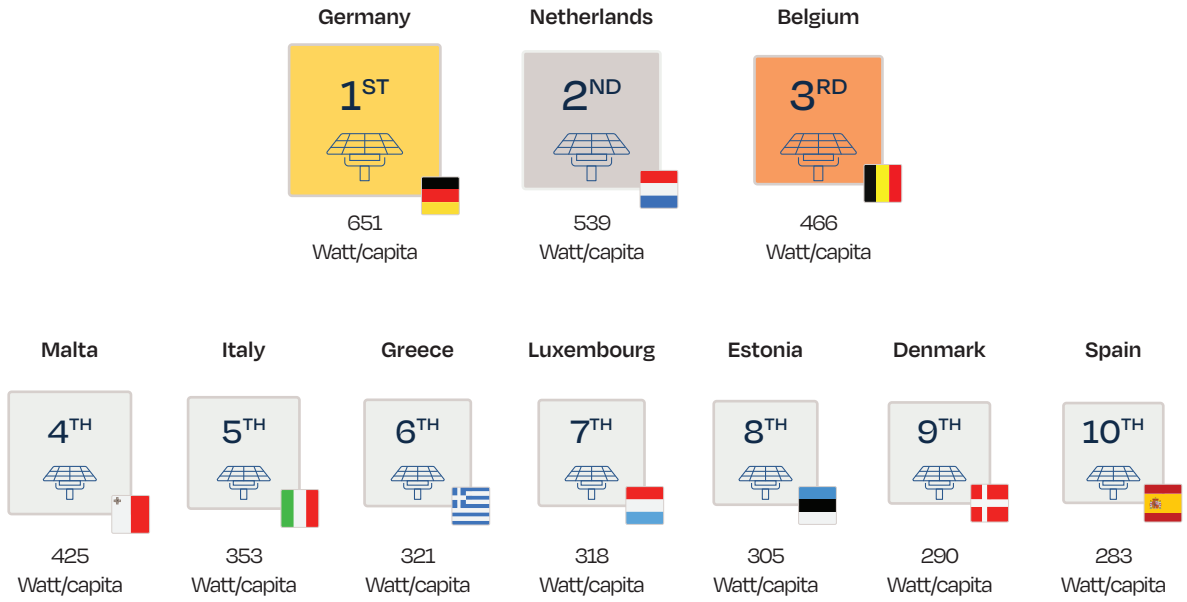
FIGURE 5 EU27 CUMULATIVE SOLAR PV INSTALLED CAPACITY 2000-2020



The EU-27 member states' cumulative installed solar capacity ranking in 2020 has remained basically the same (see Fig. 5). Germany keeps the major share, operating the largest capacity of solar power plants in the European Union, with 54.6 GW of total installed capacity. Germany's distance from the far off second place is getting even larger, as Italy's solar fleet, which added only around 0.8 GW, now consist of 21.3 GW. One major difference in our ranking is due to Brexit, which means that last year's No. 3, the UK, is not listed anymore. Instead, Spain takes over the third rank in the EU with 13.2 GW, which is still a few hundred MW behind the UK. While one two-digit GW market was lost, another one has come up. By the end of 2020, France is estimated to generate solar electricity from 10.9 GW. The only other EU market about to touch the two-digit GW level in 2021 is the Netherlands with a 2020 year-end cumulative solar capacity of 9.2 GW. All Top 10 EU markets operate over 1 GW of solar power capacity, with Belgium above the 5 GW level, Poland, Greece and Hungary in the 2-4 GW range, and the smallest one, Portugal now estimated to own 1.4 GW. Other GW-level EU solar fleets are generating power in Austria, Bulgaria, Czech Republic, Romania and Sweden, with the latter exceeding the GW threshold for the first time in 2020.

While Germany lost a little of its cumulative market share, reaching 40%, down from 42% in 2019, as well as Italy, now at 16%, down from 17%, the European Union's two largest operators of solar power generation assets together claim a total share of 56% from 75.9 GW in 2020 compared to 59% and 70.3 GW in 2019. The share of the Top 5 cumulative markets reached 80%, the Top 10 accounted for 92%.

FIGURE 6 EU27 TOP 10 COUNTRIES SOLAR CAPACITY PER CAPITA 2019



SOURCE: United Nations (2020).

Solar per capita

The EU country with the largest population, Germany continues to rank highest for another comparison of total installed solar capacity, though in this regard its lead is much less prevalent. Germany has more solar installed per capita (651 W) than any other Union peer. But the Netherlands has been catching up very quickly on this metric, coming close with 539 W/capita, after each citizen installed an average of 384 W in 2019. All other Top 10 EU solar markets have per capita installed capacities between 466 W (Belgium) and 283 W (Spain).

In summary, solar in the European Union has proved much more resilient to the Coronavirus than anticipated in the late spring. The newly installed capacity in 2020 is less than forecasted in last year's EU Market Outlook, but demand has grown by 11% to 18.2 GW, and the cumulative installed capacity increased by 15% to 137.2 GW. In terms of watt per capita, two member states, Germany and the Netherlands, are now having the equivalent of at least one of the new large size 500 W solar panels installed for each citizen.

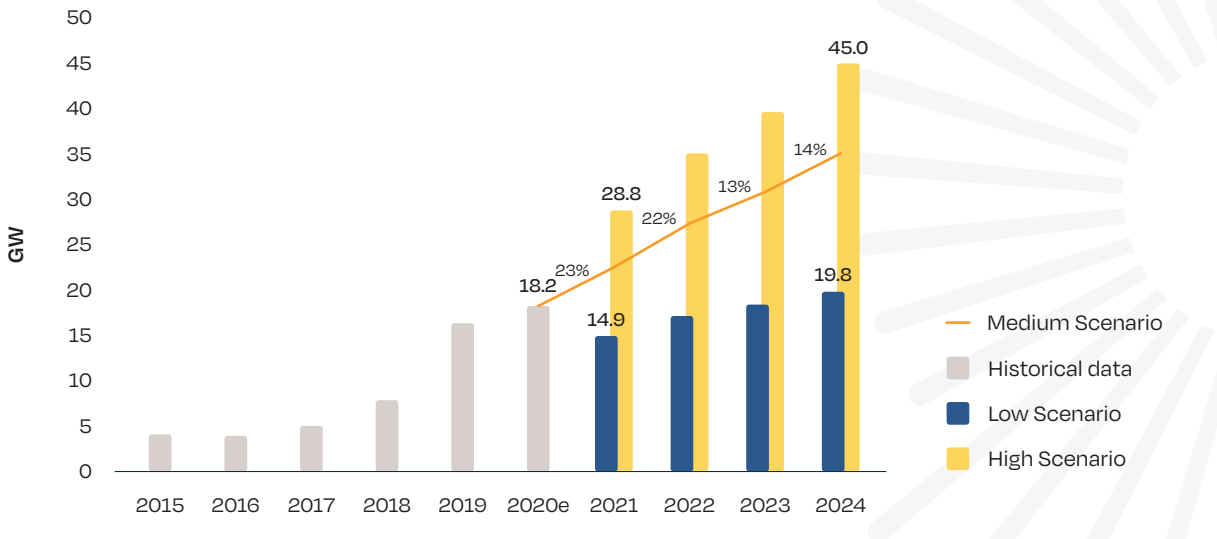
1.2. EU solar market prospects 2021-2024

A surprisingly positive 2020 for the EU solar sector will be followed by 4 years characterised by even stronger demands in our Medium Scenario (see Fig. 7). After demand improved by 11% in 2020, we expect a 23% boost for 2021. Installations are expected to reach 22.4 GW, which would mean an all-time high for the European Union, beating the decade old 21.3 GW record from 2011. Market growth will not slow down in 2022, when new annual additions are supposed to reach 27.4 GW. Though the growth rate will slightly decrease to 13% in 2023 and 14% in 2024, both years are anticipated to see solar deployment above the 30 GW level, with 30.8 GW in 2023 and 35.1 GW in 2024.

SolarPower Europe's growth assumptions are much higher than the targets formulated by EU members states in their National Energy and Climate Plans (see Chapter 3). But with drivers for solar in Europe only getting stronger, the foundation is laid for further rapid growth in the coming years, among other reasons, because:

- Solar's cost reduction continues. US investment bank Lazard's latest edition of its annual Levelized Cost of Energy Report 2020 showed a 7% year-on-year decrease to an average of 0.04 USD/kWh for utility-scale solar, which is lower than for any other power source;
- Solar increasingly wins in cost-based technology neutral energy tenders, such as in France, Spain, Denmark, and multiple times in Germany;
- Its low cost has also created a business case for subsidy-free solar systems, with the number of corporates opting for solar to source their power quickly augmenting;
- Solar's versatility is unmatched, enabling various multi-purpose applications that meet quickly increasing interest now that solar is cost competitive. Examples include rooftop solar for carparks allowing direct EV charging or floating solar and Agri-PV that promise owners of water/land areas to enter energy production while benefiting from further advantages as solar panels offer shading facilities, which reduces evaporation in water reservoirs;
- Various EU policy initiatives in the context of the EU Green Deal striving for carbon neutrality and the Recovery Packages will directly or indirectly boost solar, as discussed in our Chapter on Key Policy Files for Solar (see p. 22).

FIGURE 7 EU27 ANNUAL SOLAR PV MARKET SCENARIOS 2021-2024



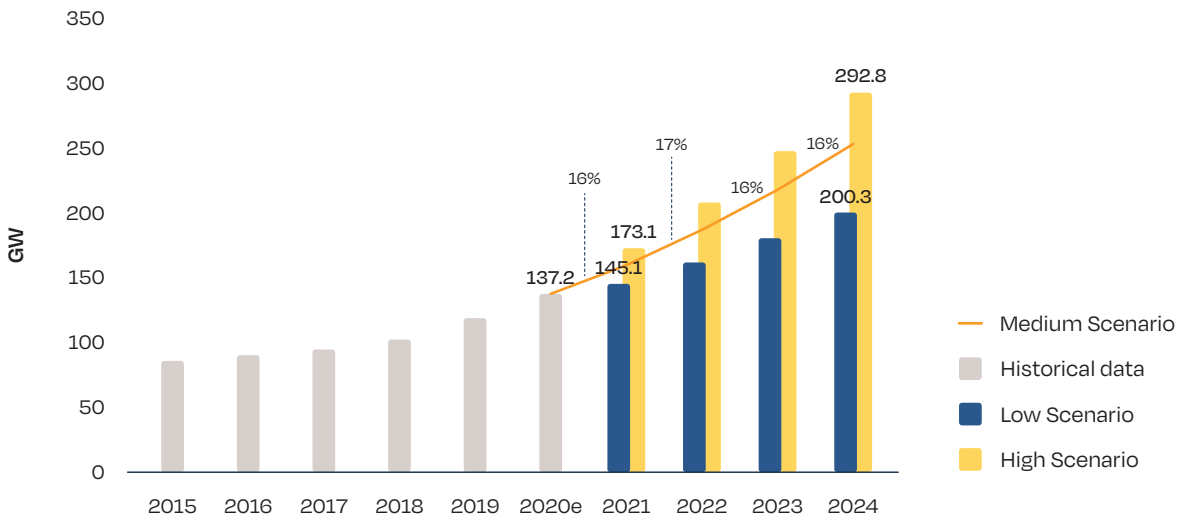
The next 4 years of our Medium Scenario can be divided into 2 phases. In a catch-up phase we will see solar projects being built after they were originally delayed or even cancelled due to COVID-19 but are offered new opportunities primarily through incentives from economic stimulus funds. This 20% plus growth phase will be trailed by a more moderate phase, involving a 13-14% growth period in 2023/24. Demand in those 2 years will be driven mostly by customers attracted to solar's very flexible potential to reduce their energy expenses and improve sustainability. This will involve even more energy companies, investors and corporates as well as residential prosumers, while member states will have implemented the necessary framework conditions to push and pull renewables in order to meet their 2030 EU climate targets.

The Low Scenario, on the other hand, anticipates dwindling demand in 2021 to a volume of 14.9 GW, growing only to 19.8 GW in 2023. This scenario was modelled on major EU markets slashing solar support and implementing policies that would disable key business models. Such an outcome is close to impossible when even COVID-19 had only limited impact on solar demand in the EU, and when observing current solar activities and policy discussions, where the climate crisis is very high on many decision-makers' agendas, even though certain activities are indeed counter-productive, like retroactive cuts in France or various proposals for Germany's EEG 2021 revision (see p. 45).

The High Scenario projects 28.8 GW already in 2021 and up to 45 GW new solar additions in 2024, which sounds also very improbable from today's view. But solar has rather often surprised everyone positively in the past, including in 2020. Our High Scenario assumes solar turns into a big beneficiary of the Green Deal and Recovery Packages, assumes no import taxes for solar products, no prohibitive taxes or fees on self- consumption/storage, no obstacles to subsidy-free solar PPAs, or any other barriers that could slow down flexible and distributed solar power.

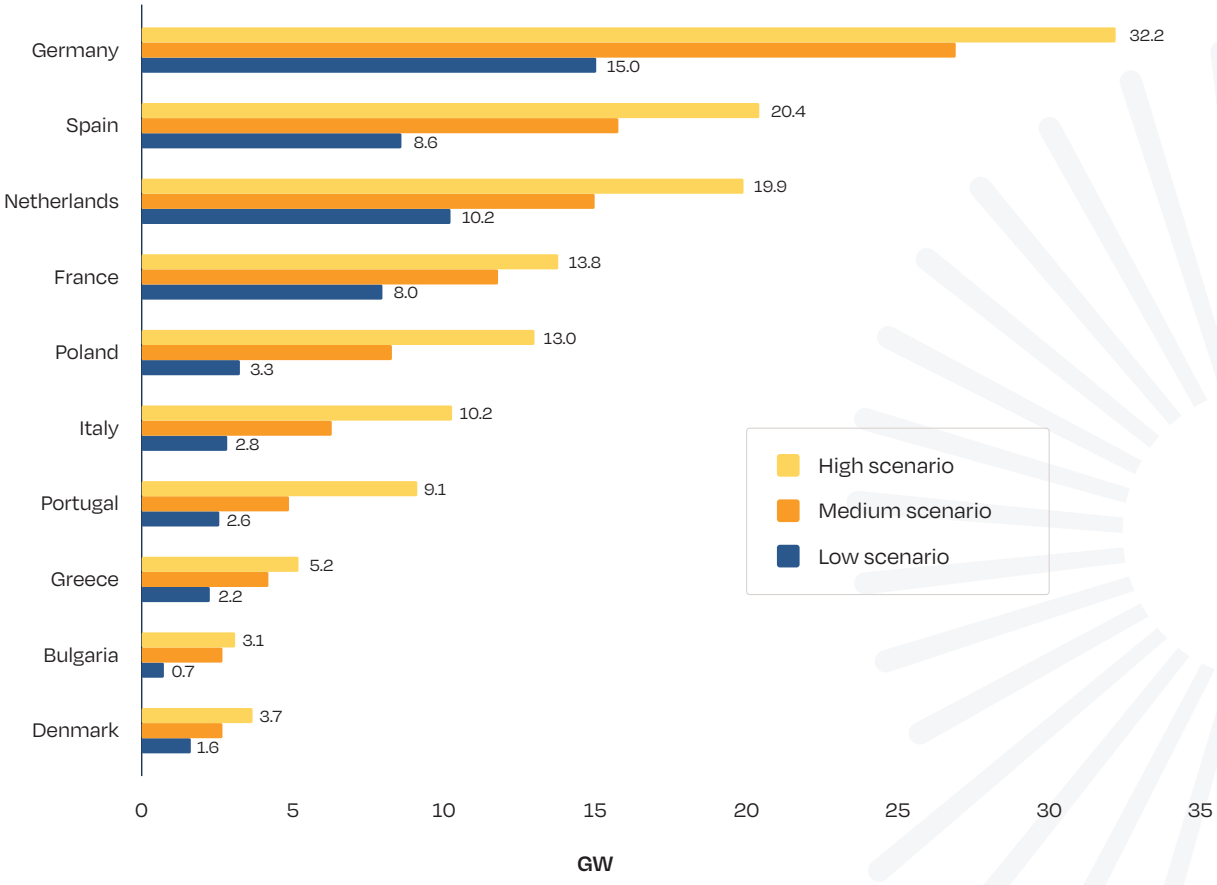
The cumulative PV market scenarios from 2021 to 2024 show constant, two-digit annual growth rates that are a little higher than in our previous EU Market Outlook. The Medium Scenario now forecasts 16-17% growth rates compared to 13-16% levels last year, adding around 115.5 GW to reach 252.9 GW end of 2024, from 137.2 GW today (see Fig. 8). With annual PV deployments anticipated to be higher as of 2021, it will take until 2022 for the market to fully catch up with pre-COVID-19 assumed market volumes (see Box 1, p. 14). The High Scenario sees the EU reaching 292.8 GW in 2024, but even our Low Scenario assumes the EU will add over 60 GW to operate a 200.3 GW solar capacity by the end of 2024.

FIGURE 8 EU27 TOTAL SOLAR PV MARKET SCENARIOS 2021-2024



In line with our general very positive EU Market Outlook, we are more upbeat on the solar developments of the largest 10 EU markets (see Fig. 9). For most of these markets, the 4-year installation forecasts from 2021 to 2024 (listed in the order of the Medium Scenario assumptions) expect more power additions than in the previous outlook. We now anticipate **Germany** to be the largest market for the coming years in all 3 scenarios, despite the uncertainties along the EEG 2021 revision, which contains several provisions that will make life much harder for solar investors. The most severe is the implementation of tenders for rooftop systems as of 500 kW, incrementally going down to 100 kW. Still, the momentum for solar in Germany is expected to stay strong, also backed by the fast ascent of PPA-based systems. It is most likely Spain will add the second most solar capacity, closely followed by **the Netherlands**. While Spain has a huge PPA project development pipeline, grid constraints remain a major obstacle. Although a new auction calendar was published, it will take time before these power plants will be built, so that self-consumption rooftop systems will become a stronger pillar over the coming years. Solar in the Netherlands is supposed to keep thriving on a broad incentive scheme landscape, which will enable the country to defend its third rank. That is, unless **France** or **Italy** who both have major solar growth plans finally overcome their bureaucratic hurdles to tap the huge potential available in these spacious and sunny European countries. We see also a lot of solar growth opportunities for Europe's latest shooting star **Poland**, now part of the Top 5 markets for the next 4 years. Notable additions in the Top 10 list are Bulgaria and Denmark. In Bulgaria, recent regulatory

FIGURE 9 EU27 TOP 10 SOLAR PV MARKETS ADDITIONS 2021-2024



changes for the C&I sector have triggered many companies to look into solar self-consumption systems. Moreover, the utility-scale solar sector is finally seeing renewed interest after the brief 2011-12 FiT boom on expectations of rising wholesale prices and a coal phaseout after 2025. With very little solar traction in **Bulgaria** in the last few years, our model shows a large spread from the Medium to the Low Scenario. After auctions have opened the field for ground-mount solar in **Denmark** and proving its competitive cost when outcompeting wind in recent technology neutral tenders, a strong trend to PPA-based systems is arising, with announcements for several 100+ MW solar power plants. There is high likelihood, Denmark will be among the Top 10 markets adding the largest solar volumes in the European Union over the next four years.

Our analysis sees the Top 10 EU solar markets install 98.5 GW from 2021 until 2024 in the most probably Medium Scenario, 55.1 in a Low Scenario and 130.7 GW in the High Scenario.

The fundamentals of our EU solar weather forecast have not changed. We will again see a very sunny business environment for solar power in the coming years, with only few clouds limiting the sun from shining bright everywhere in the region (see Fig. 10). For just 3 of the Top 15 solar markets, we see clouds on the

FIGURE 10 EU27 TOP SOLAR PV MARKETS PROSPECTS

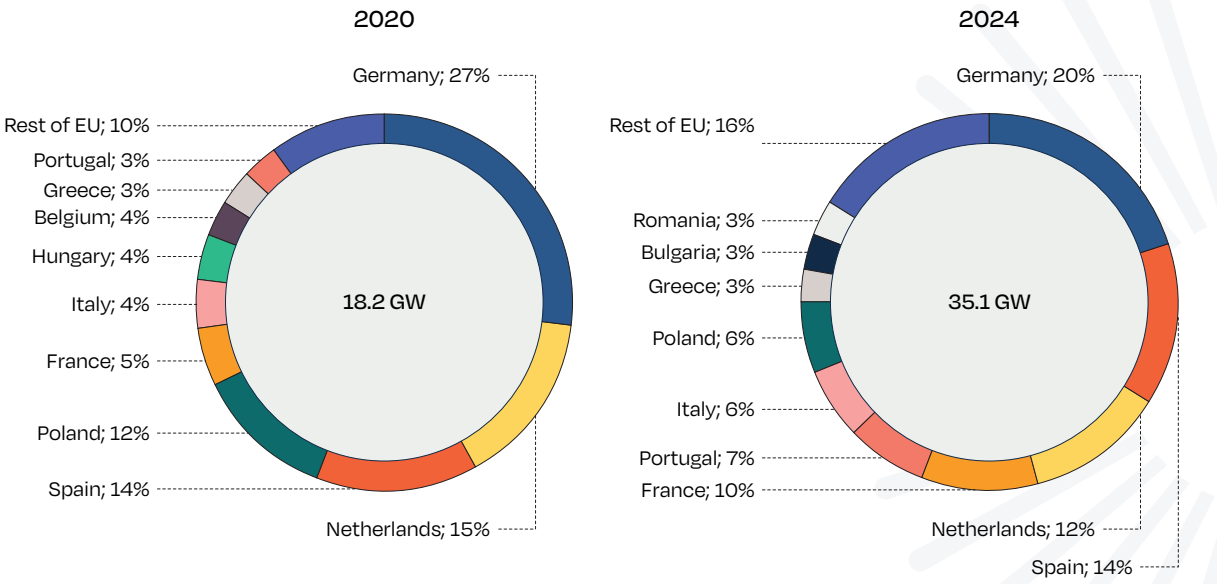
Country	**2020** Total capacity (GW)	**By 2024** Total capacity medium scenario (GW)	**2021-2024** New capacity (GW)	**2021-2024** Compound annual growth rate (%)	Political support prospects
Germany	54.6	81.5	26.9	11%	
Spain	13.3	29.0	15.8	22%	
Netherlands	9.2	24.2	15.0	27%	
France	10.9	22.7	11.8	20%	
Poland	3.6	11.9	8.3	35%	
Italy	21.3	27.6	6.3	7%	
Portugal	1.4	6.3	4.9	46%	
Greece	3.4	7.6	4.2	23%	
Bulgaria	1.1	3.8	2.7	35%	
Denmark	1.7	4.4	2.7	27%	
Belgium	5.4	8.0	2.6	10%	
Hungary	2.1	4.4	2.3	21%	
Sweden	1.2	3.4	2.2	30%	
Austria	2.0	4.0	2.0	19%	
Romania	1.4	3.3	1.9	24%	

horizon (Germany, Italy, Belgium), the rest is supposed to enjoy truly sunny weather. The choice might seem odd at first glance, but these are the EU member states with the lowest growth expectations (Italy 7%, Belgium 10% and Germany 11% CAGR). Nearly all others are expected to boost demand by over 20%. Indeed, Germany will continue to dominate Europe's solar sector by far. We anticipate the country will reach 81.5 GW of its 98 GW Climate Law target for 2030 already in 2024. But Germany, which met its 2020 climate goals only with the help of COVID-19 impacting its economy, is about to pass a revised EEG 2021 law that puts several obstacles in the way for its solar sector, which has just recently recovered from a several year-long market slump (for details, see feature on Germany, p. 45). Italy, despite its ambitious goals for solar, 51 GW by 2030, has seen little progress. A tax incentive as part of the Economic Stimulus for small solar and storage systems somewhat helped, but the long-awaited auctions, which were technology neutral tenders, turned out to be disappointing for solar so far. Different schemes in Belgium's regions make it difficult for solar investors. The country does not have a federal auction plan for the entire country, the NECP targets are unambitious, among other reasons.

Again, while there are a number of things that need improvement, as outlined in our chapters on key policy files for solar (see p. 22) and NECP assessment (see p. 30), in general the outlook for solar is very bright in the European Union, in particular when taking into account that the regions has been hit very hard by Coronavirus. We expect the largest 15 EU solar markets to add 109.6 GW in the coming 4 years based on our most probable Medium Scenario, compared to 81.6 GW in the previous EMO 4-year forecast.

In 2024, the EU solar market is projected to be nearly twice as large as today, 35.1 GW vs. 18.2 GW, with Germany still leading the region, but at a smaller share of 20% compared to 2020, and ahead of Holland and Spain, just in reversed order (see Fig. 11). In the next 4 years, demand will further diversify to smaller countries. The Top 10 market share will decrease to 84%, from 90% today.

FIGURE 11 EU27 SHARES OF TOP 10 SOLAR MARKETS IN 2020 AND 2024



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It has been a big year for energy and climate policies, following the announcement in November 2019 that the EU would commit to achieving climate neutrality by 2050, and convert these climate ambitions into a new growth strategy for Europe: *the European Green Deal*.

Following this, key initiatives have been rolled out in 2020, starting with the publication of a European Industrial Strategy in March, the publication of an Energy System Integration Strategy and Hydrogen Strategy in July, and the publication of a European Renovation Wave in October. More critical initiatives are on the way: in December 2020, the European Commission will propose a new framework for EU electricity grids (TEN-E) and review the Clean Energy Package legislation to cope with new ambitions with a view to propose a "Fit for 55 Package" in June 2021.

How can solar companies navigate in this legislative jungle?

SolarPower Europe has cleared the way and summed up the Top 10 policy trends for solar in Europe.

1. Clean Energy Package 2.0: reviewing ambitions for 2030

In September 2020, **the European Commission proposed to increase the 2030 GHG emissions target from at least 40% to at least 55%.** The Commission has updated its Climate Law Regulation proposal from March to include the new 2030 target, in addition to the climate neutrality target by 2050. The Climate Law is due to be negotiated between EU Member States and the European Parliament, with the former not yet settled on a specific figure, and the latter supporting an even greater ambition of 60% GHG emissions reductions by 2030.

Regardless of the final GHG target, increased climate ambition will require an upwards review of **both renewable energy and energy efficiency ambitions.** Already overshot by more than 1% according to the NECPs, the 2030 target for renewable energy in final energy demand will have to increase from the current 32%, to between 38% and 40% according to the European Commission. **Reaching at least 40% of renewable energy penetration by 2030 will be necessary to put Europe on track to achieve a renewables-based energy system, according to SolarPower Europe's 100% Renewable Europe study.**

The Commission intends to achieve increased climate and energy ambitions through a set of legislative initiatives under **the Fit for 55 Package**, which is due to be presented in June 2021 and will include **proposals to revise the Renewable Energy Directive (RED II) and the Energy Efficiency Directive (EED)**, in addition to new policies to revamp carbon emissions rules in the EU. By December 2020, the Commission will **propose a review of the Energy Performance of Buildings Directive**

(EPBD), which will include additional provisions relevant to on-site solar and storage.

In addition to introducing higher renewable energy targets, **the review of RED II will seek to introduce new measures to reflect the European Green Deal's objective, as well as new elements stemming from the Energy System Integration Strategy.**

This Fit for 55 Package is an opportunity to go beyond Clean Energy Package legislation and further unlock the growth of solar in Europe. This can help accelerate the implementation of EU energy and climate legislation, by introducing a stronger governance system to steer the implementation of NECPs, and allowing targeted improvements to the Renewable Energy Directive. In particular:

- Increasing the EU binding 2030 renewables target to at least 40%;
- Enhancing the EU framework for Guarantees of Origins (GOs), increasing the transparency and granularity of the information contained in GOs, and adapting the certification system to the uptake of renewables-based hydrogen;
- Further simplifying administrative procedures for solar installations, notably by introducing European-level guidelines on permitting for utility-scale solar installations and exempting rooftop PV installations from construction permits;
- Improving the prosumer framework, by clarifying the regulatory framework for joint self-consumption schemes and developing dedicated incentives for C&I systems;
- Accelerating the deployment of renewable electricity in the transport and heating sectors.

Beyond higher energy efficiency ambition, **the revision of the EED will seek to overcome the 3% ambition gap** between Member States' national contributions and existing 2030 energy efficiency targets. The Commission plans to focus its efforts on reducing energy consumption in buildings, notably through the Renovation Wave Strategy, which aims to achieve a 60% reduction in building energy consumption. The renewables-based electrification of buildings could reduce primary energy demand by more than 22% by 2030, and 39% by 2050.[6]

2. Bridging the gap on carbon pricing

Increasing the EU's 2030 GHG emissions reduction target from 40% to at least 55% means that EU policymakers need to reinforce decarbonisation action across all economic sectors. The **EU Emission Trading Scheme (ETS)**, one of the central pillars for decarbonisation, is set to undergo a revision to recalibrate its strength accordingly:

- **Tightening and strengthening the mechanisms that determine the ETS stringency,** such as the Linear Reduction Factor and the Market Stability Reserve, will ensure that higher carbon prices are in place in the sectors within the ETS scope, including in the power sector. A higher carbon price on electricity will foster the deployment of renewables at the expense of fossil-based generation.
- An extension of the ETS to other sectors that are currently outside of the scope is currently under consideration. What is crucial is to have some form of carbon pricing in all the sectors – and the ETS is one of the tools to deliver this. Therefore, **we support the inclusion of those sectors for which no carbon pricing is in place today**, notably the shipping sector. By contrast, we identify **several fundamental challenges to the direct inclusion of road transport** into the ETS, and we recommend a **detailed assessment of the impacts of the inclusion of buildings** – especially due to unintended distributional effects on poorer households, the overlay of other decarbonisation policies, and the low effectiveness of current carbon prices.

In parallel to revising the ETS, the Commission intends to propose a **Carbon Border Adjustment Mechanism in 2021**, to target the carbon leakage issue, which is increasingly relevant as the ETS price rises. The current Commission policy options lack adequate information on tool design and application to assess the impacts on the solar industry, however, it is clear that **along the solar PV value chain there will be ambivalent impacts, which could result in lowered EU competitiveness** at the global level. To avoid this, it is key to look at options strengthening the instruments already applied within the EU, while using soft measures to encourage climate action from trade partners.

6 SolarPower Europe (2020). *100% Renewable Europe.*

3. Grid modernisation: building the energy transition's hardware

The increased penetration of variable renewables in the European energy mix to at least 40%, largely driven by decentralised solar capacities, and the high level of electrification of end-uses to around 60%, will deeply change the structure of the energy system by 2030. The limited grid capacity is already becoming a concern, especially in member states that have seen rapid growth of solar installations in the last few years, such as the Netherlands, Spain, and Portugal.

Rather than facing the risk of future bottlenecks in the connection of new projects, a comprehensive modernisation of grid planning, including for grid connection and operation is needed at EU level, with a particular focus on distribution grids where most of the solar projects and electrified end-uses will connect. New technologies, such as advanced inverters or smart power plant controllers, will support the grid integration of solar. Two aspects in particular can be highlighted:

First, the electrification of the European economy calls for important investments into power grid development: EUR 59 billion annually in the next decade according to the European Commission, almost triple the amount invested annually between 2011 and 2020. Such investments should also support the roll-out of smart technologies, which can optimise grid operation and unlock new sources of flexibility.

- **The Next Generation EU fund put forward by the Commission to support the recovery of Europe is an opportunity to speed up the green and digital transition,** with EUR 20 billion in *InvestEU* earmarked for sustainable infrastructure.
- In addition, **the upcoming revision of the TEN-E Regulation,** which defines the procedures for interconnection projects to benefit from the CEF-E fund, is an opportunity to accelerate the smart, interconnection of European power grids: it will be critical to prohibit the funding of new fossil fuel infrastructure and reinforce the sustainability criterion in the selection process of Projects of Common Interest.

Second, the future energy system will require an increasing availability of flexibility resources. From utility-scale batteries to domestic storage, and renewable-based hydrogen, solar electricity can be stored for later use, taking pressure off the grid when demand is high. Thanks to appropriate market and price signals, households or electric vehicles loads can be aggregated and provide flexibility by encouraging consumption when electricity is cheapest and in low demand. In that regard, the development of a new network code on demand-side flexibility will be critical

Assemini PV park, 23 MW. Cagliari, Italy. © ENI

to providing EU-level minimum design principles for local flexibility markets and facilitate the implementation of the Clean Energy Package.

4. Solar roofs in the spotlight

Achieving climate-neutrality requires additional action across all key sectors of the economy. The European building stock, which currently represents approximately 36% of the EU's GHG emissions, has struggled to efficiently decarbonise itself over the past decade. **Emissions from the building sector are still higher than in 2014**[7] with the rate of new energy renovation in the EU stuck at about 1% of the EU building stock per year.

As the EU strives to overcome these bottlenecks, **a new momentum is growing towards rooftop solar installations**, with a demonstrated impact on achieving the decarbonisation and reduction of energy demand of EU buildings.

On-site solar on buildings in the EU could generate between 680 TWh and 1,300 TWh.[8] This represents significant untapped potential for solar market growth and for job creation. In 2019, 9.4 GW of rooftop solar were deployed, with the total installed capacity across the residential, commercial and industrial rooftop market segments reaching 81 GW.

In September 2020, the **European Commission unveiled the Renovation Wave strategy, which aims to reduce building emissions by 60% by 2030**, through doubling the rate of energy renovation in Europe, and should trigger the renovation of 35 million building units by 2030. According to the Commission's estimates, reaching these objectives would require an additional annual investment of around EUR 90 billion.

The Renovation Wave promotes **an integrated approach to building renovation, acknowledging the contribution of on-site renewable solutions and rooftop solar in particular** to achieve higher energy efficiency requirements, and secure affordable electricity supply for vulnerable consumers. The start of the Renovation Wave also marked the official launch of the **New European Bauhaus**, that aims to combine good design with sustainability, a great opportunity for innovative technologies such as Building Integrated PV, and aims to establish at least 5 Bauhaus projects by the end of 2022.

In this complex political landscape, three initiatives will be key to unlocking the potential of on-site solar in buildings:

- The proposal, as part of the revision of the Renewable Energy Directive, to introduce **minimum requirements for renewable energy in buildings.**
- The commitment to **map existing challenges encountered by BIPV products in the EU and to address by BIPV**, such as facilitating mutual recognition of national certification schemes and insurance schemes.
- As part of the revision of the General Block Exemption Regulation and the Energy and Environmental Aid Guidelines (EEAG), **the Commission will clarify the scope of State Aid for renewable energy installations for self-consumption.**

5. Digitalisation, cybersecurity and interoperability: the glue to foster energy system integration

As part of the European Green Deal, the Commission presented a strategy for Energy System Integration on 8 July 2020. An effective, smart, and well-coordinated integration of the energy system will be crucial if we are to decarbonise our economy by 2050 in a cost-effective manner, and transform our energy system to become more secure, resilient, and competitive for the future.

The European energy system is going through increasing decentralisation and decarbonisation processes, and digitalisation is the key enabler for a successful integration of the energy system. Digitalisation allows devices to work more efficiently and to unlock opportunities for actors across the value chain (i.e., consumers, prosumers, retailers, traders, producers, network operators), providing them with new solutions and revenue opportunities. As a result of an increase of distributed and connected smart devices, the EU must strengthen two key pillars:

- **Cybersecurity**: Distributed smart devices, like residential solar panels or EV charging stations, have direct connections to internet servers of the equipment manufacturer. Some servers may control hundreds of thousands if not millions of

7 EEA (2020). *EEA greenhouse gas - data viewer.*

8 Huld et al. (2020). *The Rooftop Potential for PV Systems in the European Union to deliver the Paris Agreement.*

devices. An increase in digitalised components pose new and unique challenges from a cybersecurity perspective, becoming a potential target for hackers. **The Directive on Security of Network and Information Systems (NIS Directive) provides the regulatory framework to build security across sectors** that are vital for the economy and society, where a cyberattack could disrupt an essential service, such as energy and digital infrastructure. The Commission will adopt Delegated Acts in the form of network codes on cybersecurity to provide indications on minimum requirements to guarantee data security of smart meters. The adoption of the network codes should not be later than 2023.

- **Interoperability:** The roll-out of smart devices goes hand-in-hand with the development of EU-wide interoperability principles and transparency procedures for safely sharing data between systems or components, and for protecting such data. The Commission is working on an **Implementing Act on data interoperability on metering and consumption data**, as well as on the data required for customer switching, demand response and other services, including also self-generation of renewable electricity. The Commission expects to have the first acts on metering and consumption data adopted by end of 2021.

6. Solar to Hydrogen: unlocking solar's potential beyond power

The direct electrification of our economies and massive uptake of renewables and solar by 2030 will be the primary driver to achieve climate neutrality by 2050. As the most versatile and competitive electricity source globally, solar energy will be a key pillar of this transition. According to SolarPower Europe's 100% Renewable Europe study, more than

12,000 TWh of solar electricity could be generated by 2050, supplying more than 60% of Europe's future energy demand and driving the successful decarbonisation of key sectors of the economy, such as heating and road transport.

But there are other energy uses that could be too expensive to fully electrify or have other technical challenges. These are the so-called "hard-to-abate" sectors such as chemicals, parts of heavy industry, long-haul heavy-duty road transport, aviation, and shipping. **In these sectors, renewable hydrogen will play a key role, and opens a significant market opportunity for solar in Europe.**

Hydrogen produced via electrolysis powered by solar electricity has zero GHG emissions. When made in Europe, it reduces the EU's energy dependency on third countries and when produced by grid-connected renewables it offers a real form of sector coupling between the power sector and other economic sectors. Investment in renewable hydrogen has significant potential in terms of jobs and growth creation.

On 8 July 2020, the European Commission published its European Hydrogen Strategy, laying down ambitious targets for the deployment of renewable-based hydrogen in Europe with the objective of becoming the global leader in this field.

By 2030, the EU committed to installing at least **40 GW** of renewable hydrogen electrolysers **in the EU** and **40 GW** of renewable hydrogen electrolysers **outside the EU**, to produce up to 10 million tonnes of renewable hydrogen supporting the decarbonisation of EU heavy industries. The EU also committed to invest up to EUR 220-340 billion to scale up and connect an additional 80-120 GW of solar and wind energy production capacity by 2030.

How can we get there and what is needed?

In November 2020, SolarPower Europe teamed up with key partners, including Wind Europe and Breakthrough Energy, to create the Renewable Hydrogen Coalition, with the aim of accelerating the uptake of renewable-based hydrogen solutions and securing the right policy framework.

Becoming a global leader in renewable hydrogen requires bold commitments. To replicate Europe's "renewables success story", the EU Hydrogen Strategy must strive to **accelerate renewables deployment, scale up the production of electrolysers "made in Europe," and support technological breakthroughs** increasing the efficiency and competitiveness of renewable hydrogen solutions. Sound and comprehensive infrastructure planning is also critical, with a view to prioritise the modernisation of EU electricity grids and streamline investments into hydrogen infrastructure with a prime focus on the local production and use of renewable-based hydrogen.

7. Sustainability and circularity: solar products under scrutiny

In the context of increased climate ambition and the transition to a renewables-based energy system, the EU is stepping up its game on the sustainability front.

With the launch of the Circular Economy Action Plan (CEAP) in March 2020, the Commission outlined a dense legislative agenda, with measures aimed at strengthening the policy framework for sustainable products and promoting circularity across their lifecycle. Among these, the CEAP identifies the need to revise the Ecodesign Directive to encompass a broader range of sustainability aspects, and to develop a harmonised methodology for substantiating green claims. As a sector already under the Ecodesign scope, **SolarPower Europe supports a stronger and wider Ecodesign framework and cross-sectoral coherence in sustainability assessments.** The latter is a crucial step for the comparison of different power generation sources and of activities across different sectors.

With **Ecodesign and Energy Label rules for solar PV modules, inverters, and systems** expected to enter into force as of 2023, the Commission is going forward with the definition of sustainability criteria, parameters, and metrics to strengthen the sustainability of the solar sector, and establish new standards on quality, recycling, and product efficiency. As the lead stakeholder on this file, SolarPower Europe, in collaboration with other PV organisations, is finalising an Expert Input Paper with the industry's recommendations for appropriate sustainability criteria.

Another important upcoming legislative development to monitor is the **revision of the European Battery Directive**, which will take place in 2021. The new regulation will largely focus on strengthening sustainable features of batteries for e-mobility and

stationary storage. It will contain provisions to ensure ethical and transparent sourcing of raw materials, rules and information requirements on carbon footprint, as well as battery performance obligations. Moreover, the new regulation aims to improve the end-of-life management of batteries, by supporting increased battery recyclability and circularity, as well as second-life applications for EV batteries.

8. Rethinking the role of State Aid

State aid has been instrumental to improve the cost-competitiveness of solar and kick-start the solar PV market in Europe. In 2020, utility-scale solar installations are competitive with fossil fuels in most countries and subsidy-free solar PPAs develop at a fast pace throughout Europe. The future energy and environment state frameworks must adapt to the maturing solar market yet also address new challenges such as the support of innovative solar technologies (AgriPV, floating solar, BIPV), storage, and renewable hydrogen.

On top of this, and in a much wider perspective, the EU is shifting towards a new approach to competition policy and State aid, as Europe needs to significantly accelerate its green transition to reach climate neutrality, ensure the fast and large-scale deployment of key technologies such as renewable hydrogen, and support the uptake of European Clean Energy Champions.

In that context, the Executive Vice-President for Competition Margrethe Vestager launched in October 2020 a call for contributions of stakeholders on **the compatibility of European Competition policy with the European Green Deal**, touching on the three main pillars of competition policy – State aid control, anti-trust rules, and merger control. This consultation, closed in November 2020, is to be followed by a conference on the same topic in the first quarter of 2021. At this occasion, SolarPower Europe has reaffirmed the successful role of the EU competition policy in allowing the most innovative and cost-efficient green technologies to emerge, and has stressed the need to evaluate the environmental benefits of projects based on a robust 'environmental benefit' criterion.

In parallel, the European Commission is reviewing **its State aid guidelines for energy and environmental protection (EEAG)**, which provides the framework for its assessment of national support schemes for renewables. The current text, published in 2014, has been prolonged until the end of 2021, and should then be replaced by a revised set of guidelines. **This revision is first and foremost an opportunity to adapt the State aid framework to the Clean Energy Package provisions**, including on preserved technology-specific auctions or feed-in tariffs for small-scale projects, retroactive changes, prosumer frameworks or capacity remuneration mechanisms. But it also opens the possibility to re-adapt the EU framework on competitive bidding processes, in particular by excluding small-scale renewables, and adapting Feed-in Premiums and Contracts-for-Difference schemes to increasingly competitive and low-cost auctions. **It explores the idea of combining price-based tenders with additional criteria in line with the objectives of the European Green Deal, such as carbon footprint, flexibility, or innovative land uses.** Finally, it seeks to provide guidelines for future support mechanisms for renewable hydrogen, including in the form of Carbon Contracts for Difference.

9. An EU Industrial Strategy for Solar: reshoring a strong industrial value chain and supporting exports of solar goods and services

By 2050, solar energy is expected to become Europe's prime energy source, with the potential of supplying more than 60% of Europe's total energy demand. The strategic importance of solar to deliver on climate neutrality, combined with strong growth of the EU domestic demand for solar products (+100% in 2019) has triggered a new momentum to support PV manufacturing in Europe. The European innovation leadership in developing cutting-edge solar PV technologies is a solid basis to develop manufacturing activities – from wafers, to new cell concepts and modules, as well as inverters and other important parts of solar systems – and lead to a new wave of industrial investments.

The European Commission presented in March 2020 a **new Industrial Strategy**, with the aim of supporting the uptake of EU industrial champions in clean energy

technologies, in line with the European Green Deal. The strategy promotes the uptake of industrial alliances, following the blueprint of the European Battery Alliance launched in 2019, and the Clean Hydrogen and Critical Raw Materials Alliances launched in 2020. The European Commission acknowledges that there is a "basis for re-establishing a strong European photovoltaic supply chain". The review of the strategy in the first quarter of 2021, in light of the COVID-19 crisis, should allow the creation of new alliances, including renewable energies.

In fact, the industry has already taken action: SolarPower Europe set up the **Solar Manufacturing Accelerator** in May 2020, gathering major players from the solar manufacturing and research sector. In July 2020, the Accelerator selected and presented ten major solar PV industrial projects.

In parallel, the untapped potential for solar generation in emerging markets offers a massive economic opportunity for both partner countries and European solar businesses. **Green Deal Diplomacy** could drive global cooperation on climate change, exporting European know-how in renewables to lead a global green recovery after COVID-19. The EU already has a remarkable portfolio of international development cooperation instruments aimed at capacity building, policy advice, and development finance, which will be revised and enhanced as part of the next Multiannual Financial Framework (2021-2027) and the Neighbourhood, Development, and International Cooperation Instrument (NDICI).[9] The *renewAfrica* initiative is also aimed at supporting this process.

At the same time, the European Commission increasingly considers international trade and investment agreements an essential complement to traditional development cooperation instruments to accelerate the global energy transition. The Commission has launched **a comprehensive review of its trade policy**, responding to a variety of new global challenges including the climate crisis and COVID-19. It also supports a swift adoption of a new **International Procurement Instrument** (IPI), which would allow action to be taken against restrictive or discriminatory measures in third markets (for example solar tender requirements). Finally, it seeks to improve coordination around **Export Credits Agencies** (ECAs) in the European Single Market.

10. Financing gets greener

One of the aims of the European Green Deal is to create a conducive policy framework to transition to sustainability. The topic is of importance for solar: to provide a long-term signal to direct financial and capital flows to green investments, the Commission has announced it will mobilise over EUR 1 trillion of private and public investments towards climate-friendly assets over the next decade.

The Sustainable Finance Strategy and the EU Taxonomy are crucial tools to steer investment into sustainable and green investments that are fit for the future. Moreover, in line with the political ambition behind the European Green Deal, the European Investment Bank (EIB) decided to increase the level of climate and environment commitment, with the goal of becoming the "European Climate Bank".

- The Commission will develop a **Delegated Act on climate change mitigation and adaptation under the Taxonomy Regulation**, where investments into solar systems are considered the perfect fit to decarbonise the energy system. The Commission will also adopt a Delegated Act by June 2021 specifying the information that companies subject to the **Non-financial Reporting Directive** will have to disclose on how, and to what extent, their activities align with those considered environmentally sustainable in the Taxonomy.
- **The EIB Group published the Climate Bank Roadmap 2021-2025** in November 2020, setting out how the Bank intends to deliver on an increased commitment towards the climate and environment. The Bank will work with Member States to develop tailored instruments to support the roll out of renewable hydrogen, including potential support schemes such as carbon contracts for difference (CfD) to stimulate industries to switch from fossil-based to clean hydrogen. With the Roadmap, the Bank has also taken a step in the right direction by adopting a higher cost of carbon, reflecting the best available evidence on the cost of meeting the temperature targets in the Paris Agreement and setting Europe on the right path to be decarbonised by 2050.

9 See more information on this in SolarPower Europe's Global Market Outlook 2020-2024, Box 1 on *"European support instruments and initiatives for solar project development in Africa"*.

3 Assessment of the National Energy and Climate Plans

Solar PV energy holds immense potential for the future European energy mix, driven by falling costs (reaching USD 4 cents/kWh in 2019 according to Lazard) and scalability on rooftops, carports, water surfaces, and many other innovative applications. It is now widely acknowledged that solar, together with wind, will significantly grow in the coming decade: the IEA forecasts that solar will be the first electricity capacity installed in Europe by 2025[10], and SolarPower Europe's European Market Outlook projects double-digit growth of the annual total solar market over the same period of time.

EU member states' National Energy and Climate Plans (NECPs), created through the Clean Energy Package, can facilitate a cost-effective deployment of solar by providing clear investment perspectives and enabling frameworks, which benefit all Europeans and can ensure a fast and green recovery. The cost-efficient deployment of solar projects in Europe is still hampered by several barriers. First, the high cost of finance (representing up to half of project costs in some EU countries) due to the persistence of regulatory uncertainty and the lack of visibility of national policies. Further, lengthy and complex permitting procedures, as well as a lack of available grid capacity, have slowed down the installation of new solar projects even in some of Europe's most promising markets. Removing these barriers could unlock up to half a million jobs by 2030 – up from 100,000 jobs in 2018 – particularly in SMEs active in the rooftop PV sector, while triggering new manufacturing activities in the value chain.

The final NECPs show an improved yet mixed picture for solar. The final plans pledge 198 GW of additional solar PV capacity by 2030, meaning 19.8 GW of newly installed capacities per year (from 2021 to 2030). This average annual volume of installations is significantly below SolarPower Europe's estimated market developments of 252.9 GW under a business-as-usual Medium Scenario until 2024. While the final NECPs have clear improvements in regulatory frameworks compared to the draft plans published in 2019, no plan shows a perfect picture across all dimensions that would be the base for our High Scenario of 38.9 GW on average, reaching 292.8 GW by 2024.

SolarPower Europe has conducted a detailed assessment of the 27 NECPs across seven different areas that are key for solar deployment: solar targets, auctions, administrative procedures, prosumers, power purchase agreements, flexibility and storage, and grid integration. This chapter provides a cross-cutting analysis of each of these categories, and a country-by-country assessment of solar targets and key challenges.

For information on the methodology and the full NECP assessment, please check SolarPower Europe's *interactive NECP EU Solar Map*.

Solar targets

Across NECPs, there are differences in quality and amount of information in regards to solar targets. On a positive note, nearly all countries clearly indicate the solar target for 2030, with Latvia being the only

10 IEA (2020): *World Energy Outlook 2020.*

notable exception. Moreover, numerous plans indicate intermediate trajectories in terms of yearly capacity targets, or post-2030 targets. Targets are usually expressed in terms of GW of PV capacity or TWh of PV electricity generation. However, with the exception of a handful of countries, plans do not include targets disaggregated by system size, or distributed versus utility-scale installations.

Using the Watt per capita ratio[11] in 2030 as a parameter to assess member states' solar ambitions, the picture across the EU looks rather scattered. Alongside a number of top performers (Luxembourg, the Netherlands, Denmark, Germany) that have set a solar target resulting in over 1,000 W/capita by 2030, a significant number of countries have set low ambition targets that would result in a W/capita ratio even below the EU average in 2020 (around 300). With an expected EU-wide Watt per capita ratio of 758 by 2030, most of NECP solar targets imply a Watt per capita ratio below the expected EU average.

Looking at the aggregated solar targets, a total new capacity amounting to 198 GW is set to be installed across the bloc by 2030. In cumulative terms, 2030 solar targets amount to 335 GW, which is in line with a low ambition scenario whereby solar potential is not fully harnessed. By comparison, SolarPower Europe's recent 100% Renewable Europe study projects that at least 850 GW PV have to be installed in the EU by 2030 to meet the less ambitious 2.0°C Paris Agreement target in 2050. All in all, as Europe is revising its 2030 renewable energy target upwards from 32% today to 38-40%, low-cost solar will have to support much more ambitious national renewable energy pledges in order to put Europe on track for its climate-neutrality objective.

Auctions

To some extent, NECPs include information about the current and future plans for solar and renewable tenders at the national level. A few top performers (Germany, Italy, Portugal) tick all the boxes for presence of information on auctions, including details on schedules, volumes and design, or they define renewable energy auctions as the prime means to reach the NECP targets. By contrast, on the other end of the spectrum, nine countries do not include any information about solar auctions. However, the majority of plans are somewhere in the middle. Several countries refer to a process of auction design that is currently underway and therefore contains limited details on timing and volumes.

FIGURE NECP 1 SOLAR TARGETS

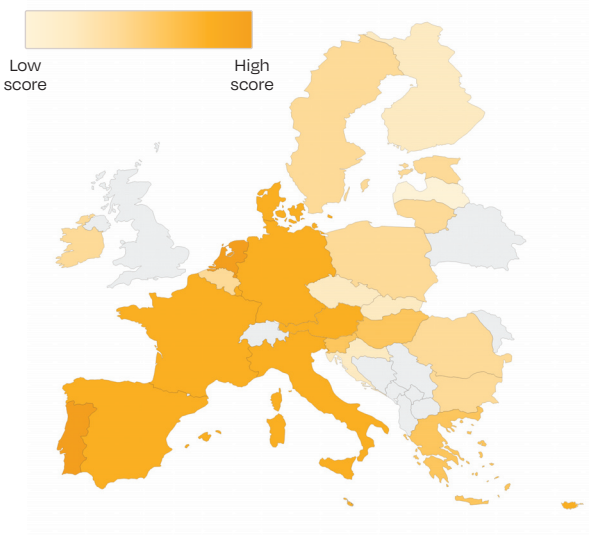
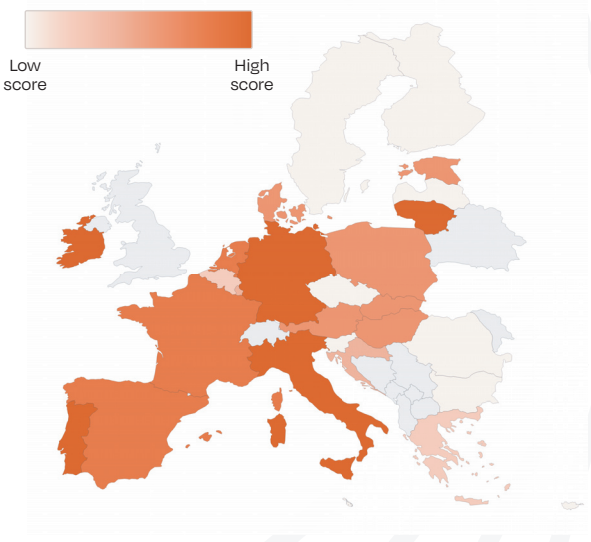


FIGURE NECP 2 AUCTIONS



11 The W/capita ratio is calculated based on expected installed PV capacity in GW and the expected number of inhabitants in a given year.

3 Assessment of the National Energy and Climate Plans

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Administrative procedures

The NECPs lack clarity on the measures aimed at improving administrative processes, with several plans including very little information to no information. Several plans do not clearly state how they will implement the Clean Energy Package one-contact-point system for the permit-granting procedure (Article 16 of the Renewable Energy Directive). In general, plans fail to tackle the growing challenge of administrative procedures, across all dimensions: the complexity of permit-granting processes, often involving several layers of regional authorities; the lack of measures to facilitate access to land, such as energy zoning or facilitated environmental permits; and the adaptation of procedures for revamped or repowered projects. In addition, the challenge of access to land for the development of new solar projects is not addressed in the plans.

Prosumers

Overall, the NECPs show a general development of prosumer schemes, even though the details of support schemes remain unclear in many countries. Fourteen countries have developed a specific prosumer target or trajectory. Many plans provide positive enabling frameworks, including measures to improve information and capacity-building of consumers, and dedicated financing schemes. In particular, three best performers (France, Italy, Luxembourg) present clear objectives or trajectories for prosumer development, have a detailed prosumer scheme and a related enabling framework, and allow collective self-consumption beyond the borders of a building. Collective self-consumption provisions, on the other hand, are not present in most plans.

Power Purchase Agreements

Despite some improvements compared to the draft plans, the NECPs still do not include details on enabling regulatory frameworks for PPAs and the measures taken to remove barriers to the development of such contracts. Nineteen plans do not include any evaluation of the current situation for PPAs with regard to the potential, or the regulatory barriers, nor propose

FIGURE NECP 3 ADMINISTRATIVE PROCEDURES

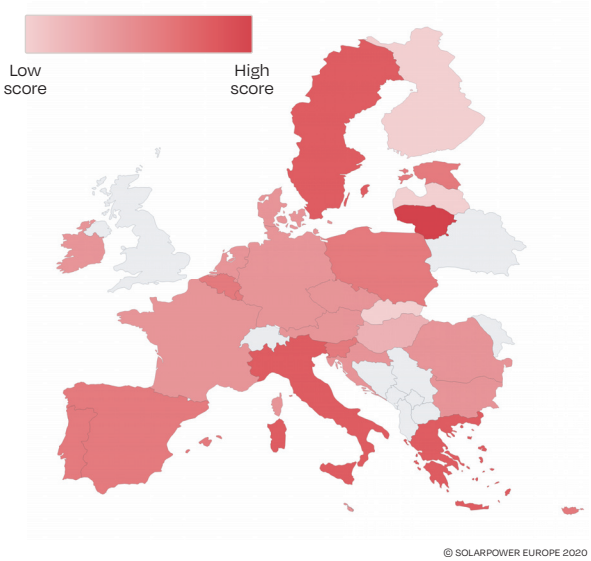
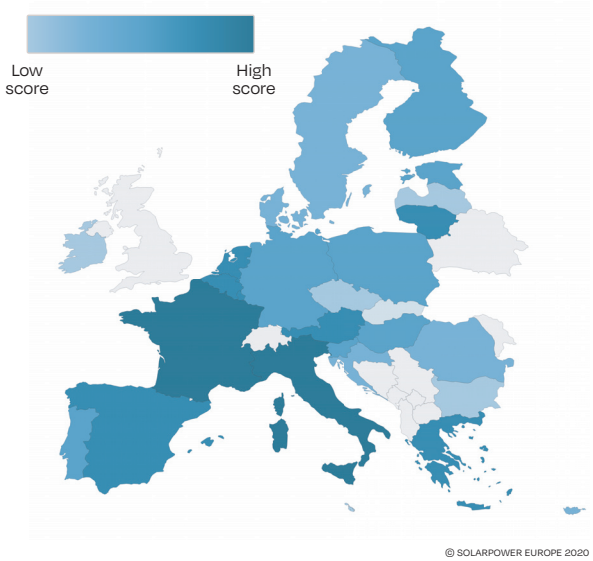


FIGURE NECP 4 PROSUMERS



enabling measures. A few plans stand out from the rest with measures to incentivise PPAs and the identification of existing barriers.

Flexibility and storage

All NECPs include at least some general reference to measures addressing flexibility in the energy system, and the majority refer to actions to implement flexibility provisions from the Clean Energy Package. On the other hand, assessing the current status of storage capacity or demand-side response available for system flexibility is not a common practice. A handful of best-performing countries include exhaustive information on actions to enhance system flexibility, including specific measures and objectives to promote battery storage and demand-side response. However, several NECPs do not make specific reference to battery storage and address the flexibility issue at a general level.

Grid integration

NECPs in general do not provide information on preparing grids for a large-scale integration of renewables. Mostly, they focus on transmission network and interconnections, while the forecast growth of medium- and low-voltage connected devices and prosumers requires more attention to the development of distribution grids as well as smart grid technologies. The reasons are the focus of NECPs, from the Governance Regulation, on developing interconnection and high voltage grids, and, in certain countries, a low ambition for the development of renewables.

FIGURE NECP 5 POWER PURCHASE AGREEMENTS

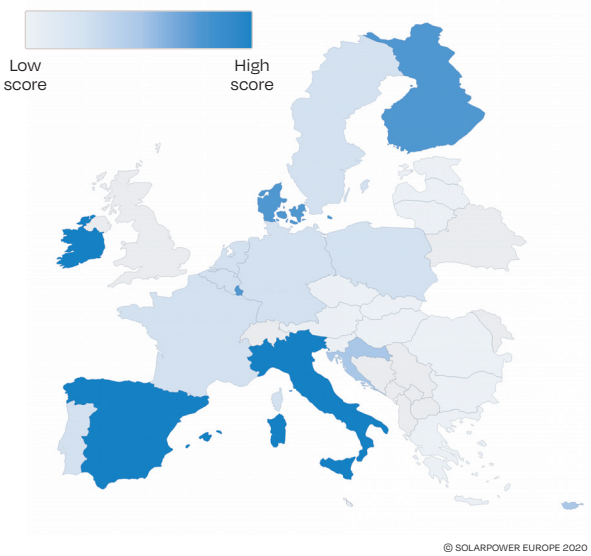


FIGURE NECP 6 FLEXIBILITY AND STORAGE

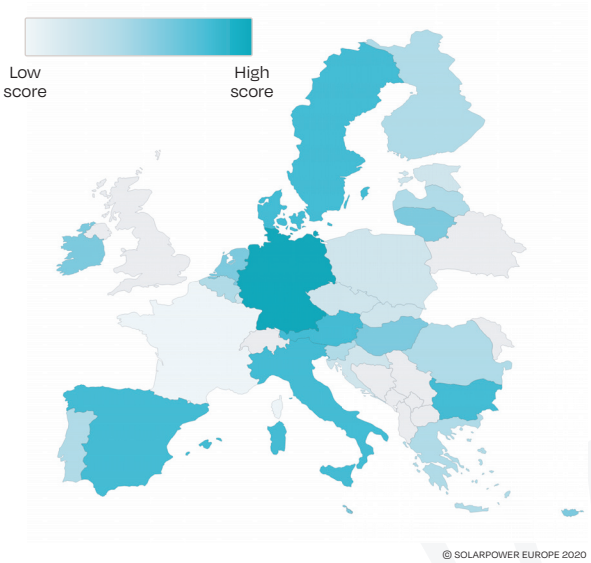
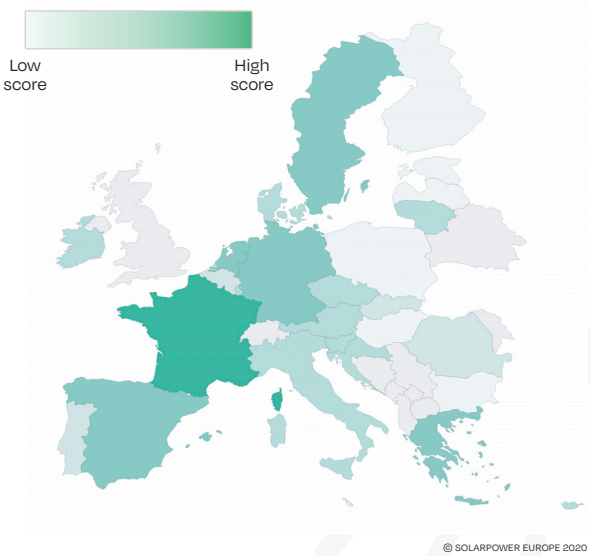


FIGURE NECP 7 GRID INTEGRATION



3 Assessment of the National Energy and Climate Plans

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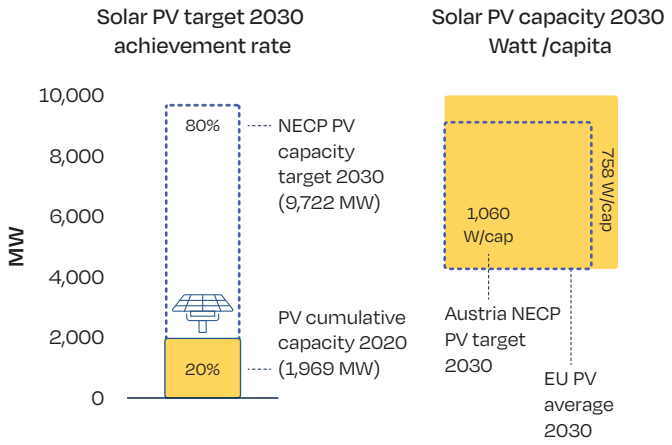
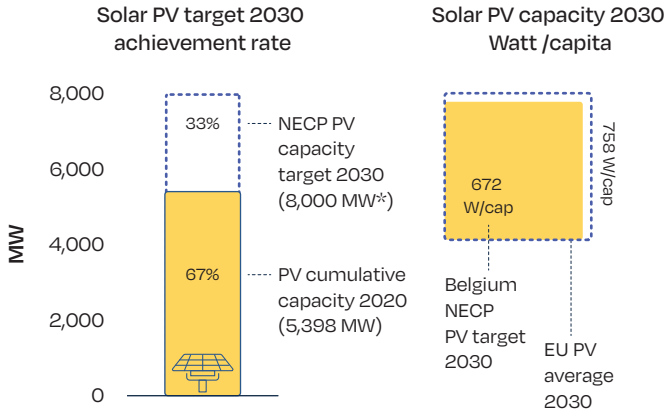
NECP AUSTRIA



Key challenges:

- **Administrative procedures.** In spite of the very ambitious and comprehensive Austrian solar rooftop programme, the Austrian NECP lacks a proper evaluation of the administrative challenges and ambition in remedy measures, in particular for larger-scale PV.
- **Prosumers.** Austria has set up an ambitious 1 million prosumers programme, revised upwards since 2018, accompanied with a comprehensive set of support measures. The implementation of that programme will be critical, as challenges remains for C&I rooftop PV and that the collective selfconsumption provisions remain difficult to implement.
- **Grid integration.** The NECP identifies the right upcoming challenges stemming from PV integration to the grid and puts forward remedy measures. Monitoring the implementation of such measures will be necessary.

NECP BELGIUM

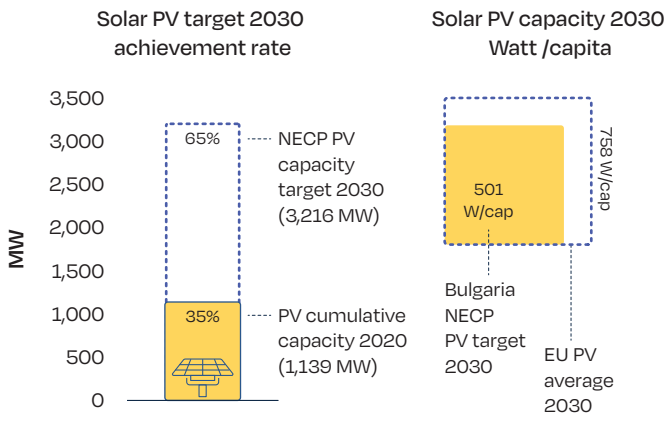


*: Average between low and high targets.

Key challenges:

- **PV target.** The solar target should be more ambitious in a country with high potential like Belgium. The study "Towards 100% renewable energy in 2050" shows that the potential in Belgium on well-oriented rooftops and ground-mounted PV on maximum 10% of the territory is 170 GW, compared to the 8 GW target in the Belgian NECP.
- **Administrative procedures.** The fragmentation of the Belgian plan is most apparent with regard to solar auctions, where no overall auction plan at federal level targets solar. While Wallonia includes information on auction design, but no details on volumes and schedules, no information is available for the Flemish counterpart.
- **Grid integration and flexibility.** The plan does not assess the importance of modernising the distribution grid, despite the high share of prosumers. In addition, the plan has mixed quality in the flexibility frameworks, with the two regions at times focusing on different aspects and the federal level adding an additional layer of complexity. Lastly, the transition from net-metering schemes to prosumer schemes valuing demand-side flexibility, already advanced in Flanders, should be closely monitored.

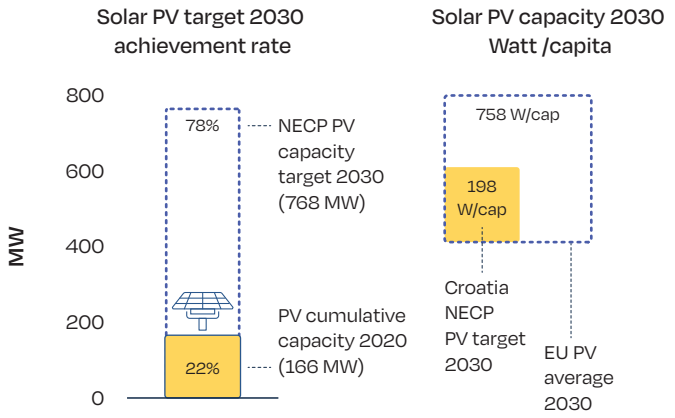
NECP BULGARIA



Key challenges:

- **PV target.** Bulgaria's solar target remains low as PV will only account for 2.6% of electricity in 2040. Yet Bulgaria benefits from high irradiation rates, notably in the south of the country, and has an important solar potential, which is not reflected in the current target..
- **Auctions.** The current support schemes for solar in Bulgaria focus on PPA and prosumers and there is no auction system for utility-scale PV. Introducing an auction system could provide incentives and unlock the immense solar potential in Bulgaria, one of the highest in Europe.
- **Administrative procedures.** The plan mentions measures to simplify administrative procedures, but these measures are significantly lacking ambition.

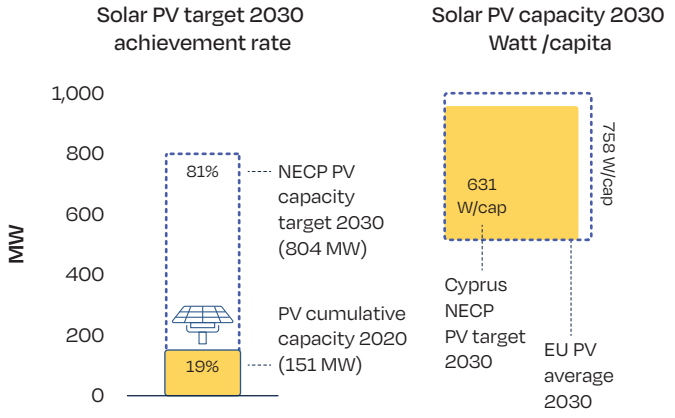
NECP CROATIA



Key challenges:

- **PV target.** Croatia has shown an important willingness to support solar development. Yet, although the plan includes extensive information, including year-by-year installed capacity, the PV capacity target is at the conservative end of the spectrum, with only 600 MW of new additions over 10 years.
- **Auctions.** The NECP mentions the existence of an auction plan over the next three-years. The publication and the implementation of such a plan will be critical to drive the growth of solar in Croatia.
- **Prosumers.** Croatia has set itself a target of development a 300 MW capacity of prosumers by 2030, driven by a tax exemption of self-consumed electricity and direct marketing, accompanied with an ambitious programme for PV in buildings. A further regulatory review should set a framework for active customers and renewable energy communities.

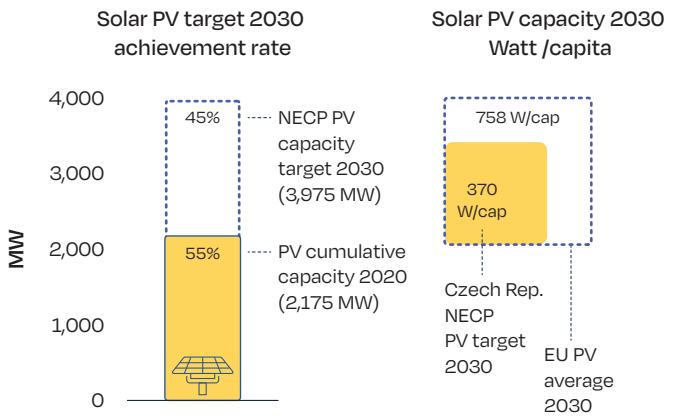
NECP CYPRUS



Key challenges:

- **PV target.** Even though the Cyprus plan described solar as a key technology for RES deployment, the solar target does not grasp the full solar potential of Cyprus, which has one of the best solar irradiances in Europe, and could further support the renewable energy target of the country.
- **Auctions.** The plan does not include any details on the future solar auctions to deploy the targeted solar capacities, such as the design or the schedule.
- **Prosumers.** The plan lacks details on the future support schemes, as Europe will phase out net-metering in 2024, nor does it provide enabling frameworks such as financing support or building code measures.

NECP CZECH REPUBLIC



Key challenges:

- **PV target.** The NECP outlines in detail, on a year-by-year basis, projected solar developments in the country, giving a good visibility to investors. However, considering the solar potential, the PV target appears underwhelming. The present government mainly relies on small-scale rooftop PV development.
- **Auctions.** Utility-scale solar is not eligible for support in the national auctions. The current political rhetoric is largely against new large-scale solar power and damages investor confidence.
- **Prosumers.** Although the plan aims to develop a clear vision for self-consumers with detailed objectives and related support measures, the Czech government has announced plans to introduce retroactive changes on the level of support schemes. If introduced, such changes could significantly endanger the development of solar PV in the country.

3 Assessment of the National Energy and Climate Plans

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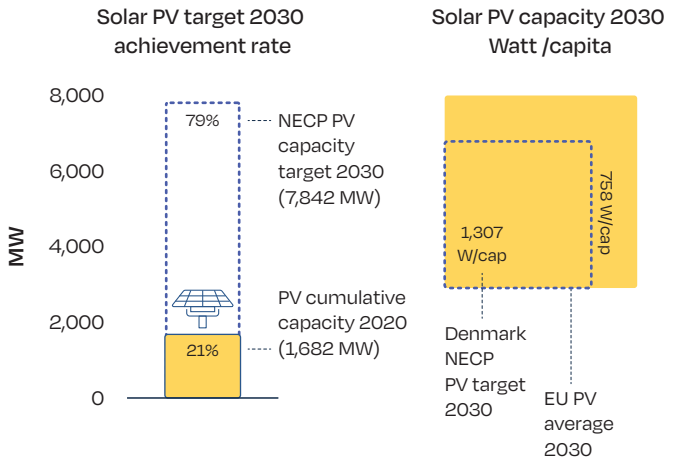
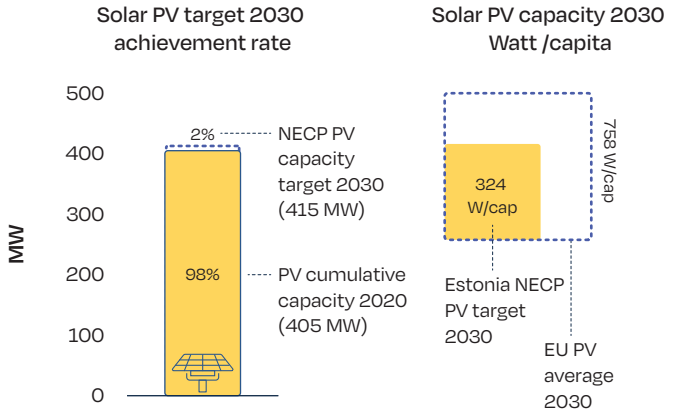
NECP DENMARK



Key challenges:

- **Prosumers.** Denmark has made important efforts to have a better understanding of the opportunities and barriers of prosumers. However, the incentives for prosumers are relatively low and self-consumption is not booming in Denmark. In addition, the plan does not detail how the Clean Energy Package provisions on collective self-consumption will be implemented.
- **Grid development.** Denmark has developed a vision for the future of its grid, integrating the growth of renewable energies, although a timely implementation of the plan is urgently needed. Many utility-scale PV projects are already blocked from grid connection due to a lack of grid capacity and have a low visibility regarding the timeline to overcome these constraints.
- **Administrative procedures.** The country has taken measures that should simplify the connection of solar PV projects, in particular through a simplified grid connection procedure for solar PV self-consumption. The implementation of the CEP provisions on the simplification of administrative procedures should further facilitate the development of new projects.

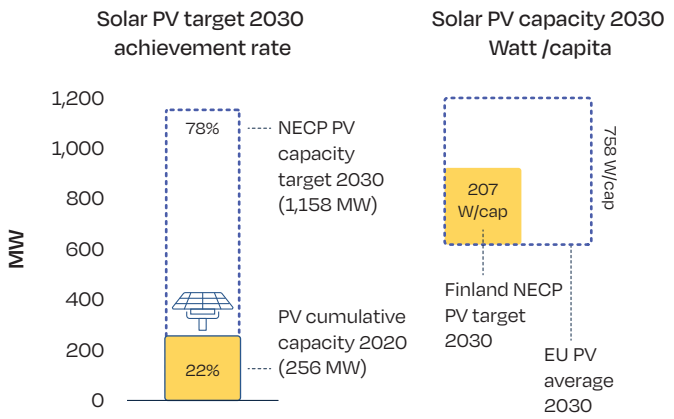
NECP ESTONIA



Key challenges:

- **PV target.** Despite ambitious RES targets and detailed trajectories for solar capacity and generation, the solar ambition remains very low, as the country has already reached the 2030 PV capacity target set out in the plan. The solar target should be increased further.
- **Administrative procedures.** Estonia has created a manual of proceedings for project developers and has taken steps to identify, with local authorities, suitable areas for the development of solar projects, which is a significant best practice. As part of the implementation of the RED II, measures to further simplify administrative procedures and introducing a one-contact-point system should further facilitate the deployment of new solar projects.
- **Prosumers.** The development of solar prosumers is a clear objective of the Estonian energy policy and the plan includes an estimated potential for new and renovated buildings. The country already proposes financing support for prosumers, but the development of support frameworks for individual and collective self-consumers will be critical to develop the market.

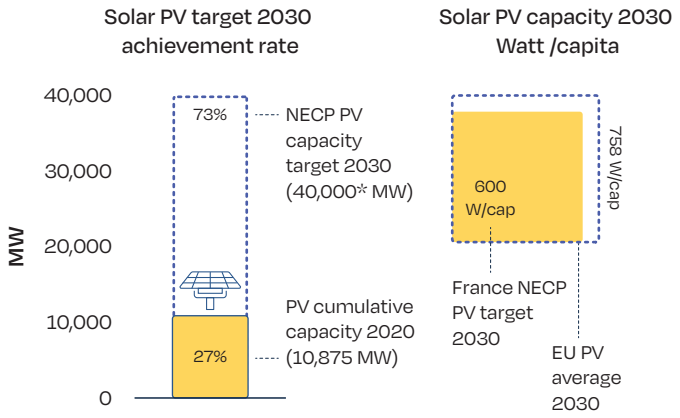
NECP FINLAND



Key challenges:

- **PV target.** The Finnish solar target results into just about 900 MW of solar installed over ten years, much below its potential. The ambition should be raised, including through the setting of solar auctions.
- **Prosumers.** The Finnish government has commissioned a study on self-consumption and its barriers. On that basis and as part of the implementation of the RED II, the government should introduce or improve the support framework for solar PV prosumers.
- **Administrative procedures.** The plan does not contain information on current or future measures taken to simplify administrative procedures. The implementation of the RED II in that regard, in particular for prosumers, will be important for facilitating the development of new projects.

NECP FRANCE

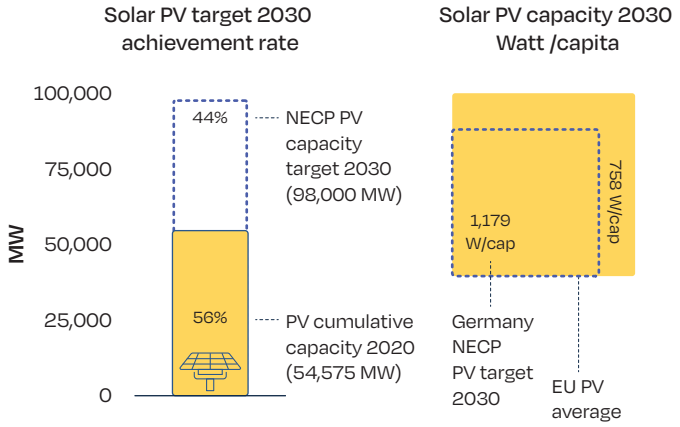


*: Average between low and high targets for 2028, rounded up to 40 GW.

Key challenges:

- **Auctions.** The French NECP details the planned schedule for auctions in the next years. France is at the moment revising its tender design, including its CO_2 selection criterion. It should enshrine into law the announced threshold of 500 kW for tenders, which should boost the prosumer market.
- **Prosumers.** France has an ambitious prosumer programme with 14.5 to 19 GW of rooftop PV by 2030. Yet, the government's proposal to retroactively change the support level for solar projects commissioned prior to 2011 could undermine investors' confidence in that market.
- **Administrative procedures.** Solar project developers in France are facing long administrative procedures, due to rising issues in accessing land, in particular agricultural land. They also face too challenging grid connection processes. The plan does not provide details regarding these two topics.

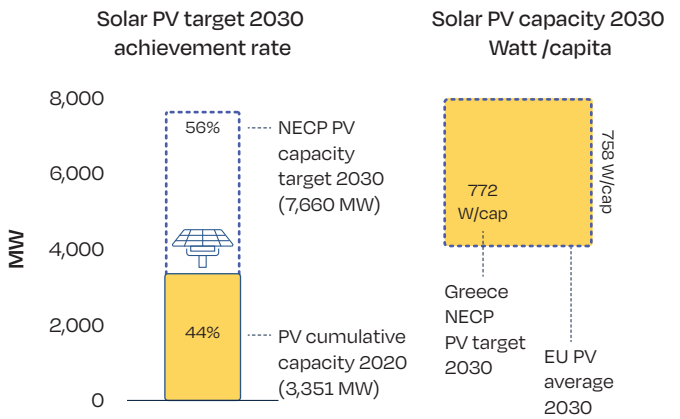
NECP GERMANY



Key challenges:

- **Auctions.** The plan provides detailed information for future auction schedules in Germany. Yet, as part of the current EEG revision, the government proposed to lower the tender threshold to 100 kW from 2025 from the current 750 kW. This has raised important concerns about the high pressure and the lack of development of new projects in the commercial and industrial segment, building on the lessons of the French tendering scheme.
- **Prosumers.** Despite being a pioneer when it comes to solar rooftop PV, the framework for prosumers could be improved. Solar projects above 10 kW do not have access to a full tax exemption on the self-consumed electricity, limiting investor incentives. In addition, the national collective self-consumption scheme has shown considerable limits.
- **Flexibility and storage.** Solar and storage prosumers face red tape and have to acquire a costly metering system when becoming active consumers and providing flexibility services.

NECP GREECE



Key challenges:

- **Auctions.** The plan makes general references to the development of special and common tender procedures. However, the plan has no information on auction pipeline and schedule, while it envisions a strong reliance on subsidy-free projects.
- **Support schemes.** Despite the NECP ambition, the government is envisaging creating a new tax on RES producers' revenues, that would lower the revenues of solar projects. Such a measure could slow down the solar PV development trajectory to 7.7 GW in 2030.
- **Prosumers.** With a 1 GW objective by 2030, solar PV prosumers are a priority for Greece. Yet the plan does not detail which support framework will replace the current net-metering schemes.

3 Assessment of the National Energy and Climate Plans

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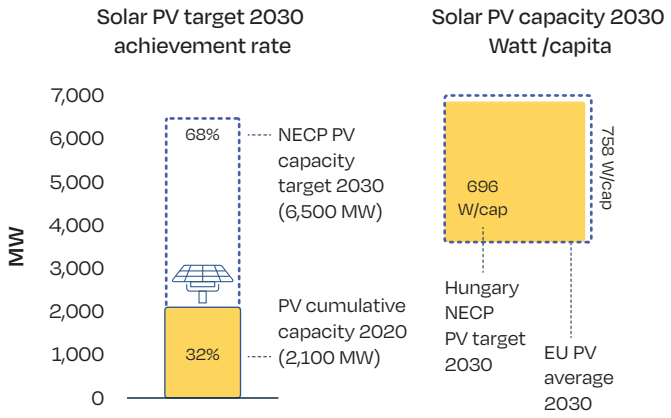
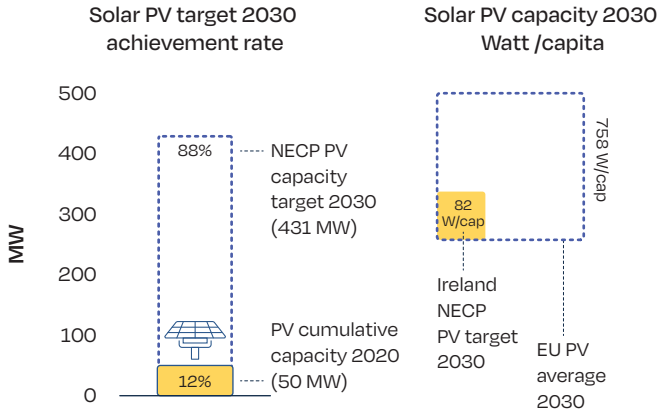
NECP HUNGARY



Key challenges:

- **Prosumers.** The plan proposes a specific target for the development of prosumers as well as a comprehensive set of enabling measures. However, it does not provide a lot of details on the precise support schemes for prosumers, and in particular for residential prosumers for whom the net-metering scheme will have to be phased out in 2024.
- **Administrative procedures.** The plan should develop the amount of information existing on administrative measures, and in particular identify the one-contact-point system foreseen in the RED II.
- **Grid development.** While utility-scale PV developers face increasing difficulties to find grid connection agreements, the plan does not contain any measure related to grid investment, in particular distribution grid, and grid modernisation through the deployment of smart grid technologies.

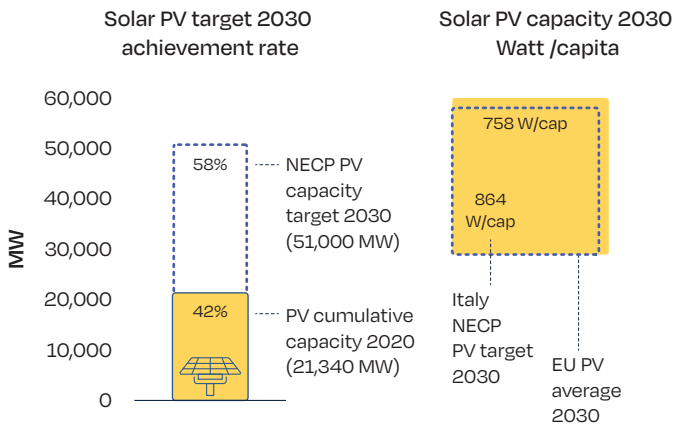
NECP IRELAND



Key challenges:

- **PV target.** Counterintuitively, Ireland's additional measures scenario assumes a much lower PV deployment than the existing measures scenario, with a 431 MW target in 2030. With only 380 MW added through 2030, the country's expected solar capacity per capita is among the lowest in the EU.
- **Administrative procedures.** The plan mentions that measures are being established but does not discuss these measures in detail. Further measures should be put in place to ease the administrative burden, which can create heavy barriers to investments in renewable projects. Furthermore, the need for standardised local administrative requirements and fees, which currently differ widely depending on local authorities, should be addressed.
- **Prosumers.** The plan includes a support scheme for prosumers, but it does not include provisions for collective self-consumption and information on the share of prosumers. Additional support measures should be set for small-scale rooftop solar, in addition to the foreseen tenders of the Renewable Electricity Support Scheme.

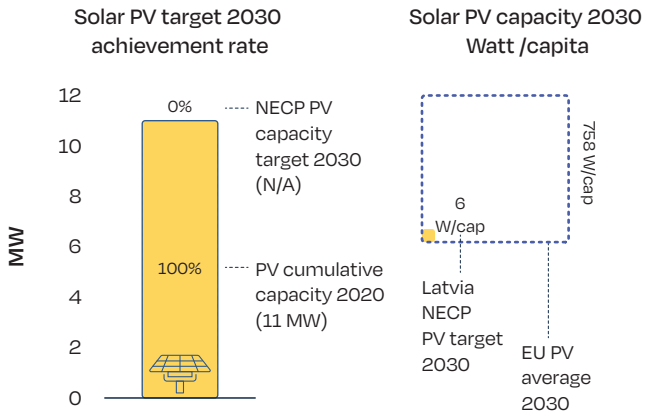
NECP ITALY



Key challenges:

- **PV target.** The solar target is high, more than doubling the current capacity and amounting new additions of 30 GW. However, the trajectory could be higher: the average growth by 2025 is just 1 GW/year until 2025 and the 2030 potential is an underestimation.
- **Administrative procedures.** The plan provides a detailed analysis of the challenges and proposes a series of related actions. Administrative procedures remain complex in Italy, because regional authorities are involved in permitting processes. The implementation of the measures, in particular those aimed at facilitating access to agricultural land, will be key.
- **Grid development.** The Italian plan contains detailed information on the upcoming challenges, including a quantification of the required investments, but does not give a clear vision on measures that will be taken. Monitoring the implementation of the proposed regulatory changes will be critical.

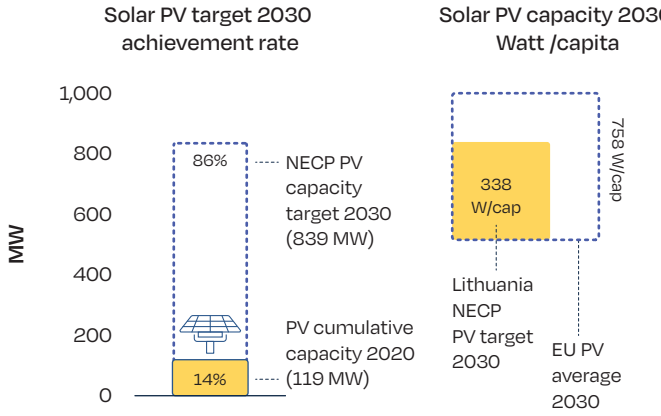
NECP LATVIA



Key challenges:

- **PV target.** The Latvian NECP has set an ambitious target for the development of renewables. Yet, there is no plan nor target or auctions for the installation of solar. This does not give investors enough visibility for their investments.
- **Prosumers.** A specific plan should be set to encourage prosumers, based on support schemes, tax exemptions, and the development of collective self-consumption.
- **Administrative procedures.** The plan does not assess possible difficulties that could be encountered by PV project developers, nor does it propose remedy measures or measures to implement the Clean Energy Package.

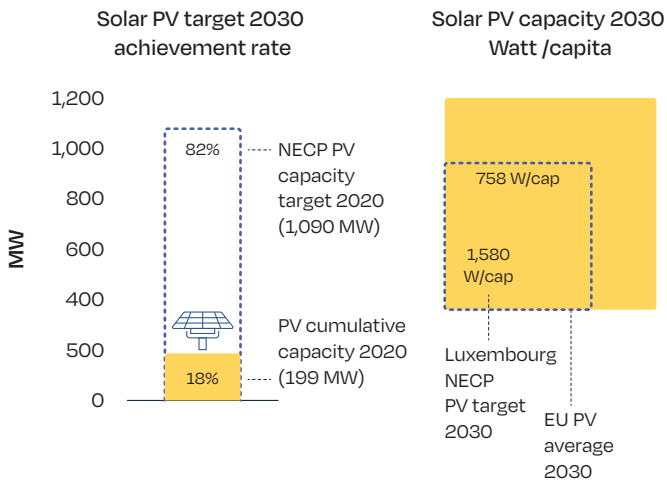
NECP LITHUANIA



Key challenges:

- **PV target.** The Lithuanian solar capacity target expected for 2030 is somewhat unclear in the plan. If the target is about 840 MW, it is a relevant growth compared to current levels, although in absolute terms more ambition could be possible, as the resulting installation levels would be still lower than the EU average.
- **Prosumers.** Lithuania has developed a complete vision for the development of solar prosumer, with clear objectives and a comprehensive set of measures to support their development. It is crucial, however, that this plan is followed up and implemented smoothly to foster distributed PV deployment.
- **PPAs.** While the plan includes extensive information on different measures supporting PV deployment, a framework for Power Purchase Agreements still needs to be developed.

NECP LUXEMBOURG



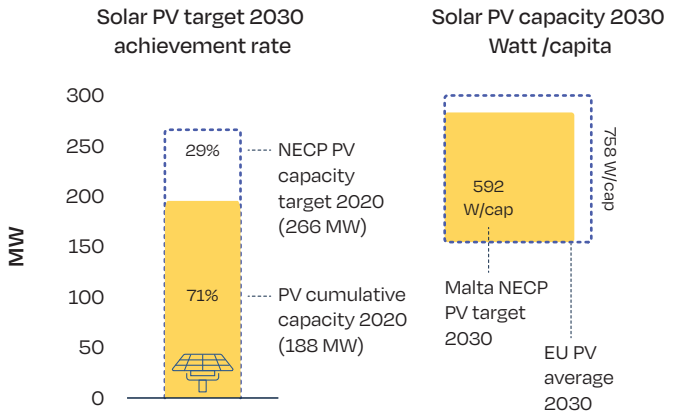
Key challenges:

- **Auctions.** The NECP indicates that the new multiannual plan for tenders will be published, with tendered volumes subsequently increased each year. However, details of the volume and designs are not included.
- **Prosumers.** The plan shows very good provisions for solar prosumers and is developing several interesting incentives. In particular, the proposed measures will tackle the different barriers to self-consumption, from public incentives, to awareness raising and financing. The self-consumption schemes need to now be fully implemented in the national law.
- **Administrative procedures.** The plan contains interesting measures to simplify the administrative procedures linked to the support schemes and the financing schemes for prosumers. This however needs to be completed by the set-up of a clear "one-contact-point", which should simplify the development of solar projects.

3 Assessment of the National Energy and Climate Plans

/ continued

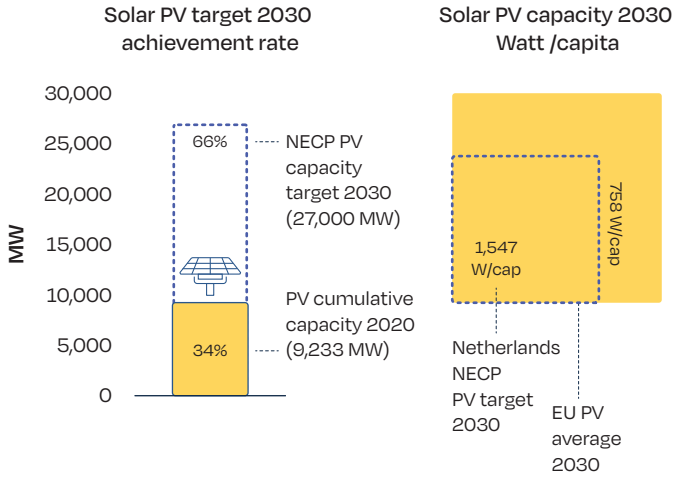
NECP MALTA



Key challenges:

- **PV target.** The trajectory of solar capacity remains low due to several factors such as physical and spatial limitations, resource availability, cost of land and other issues. As a result, only 78 MW are planned to be installed over the next ten years. In addition, no information on auctions is available.
- **Prosumers.** The plan proposes measures to incentivise the development of self-consumption. Yet, it does not include a proposal to transpose the Clean Energy Package with regard to collective self-consumption. In addition, the NECP could give increased visibility to developing prosumer schemes by quantifying the potential or setting a target for the development of prosumers.
- **Administrative procedures.** While specific provisions to facilitate the administrative proceedings for self-consumption and distributed renewables are included, and it is mentioned that the country is preparing the implementation of the Clean Energy Package, the plan should contain more detailed measures or procedures set up to implement CEP provisions, and at least a better assessment of the situation.

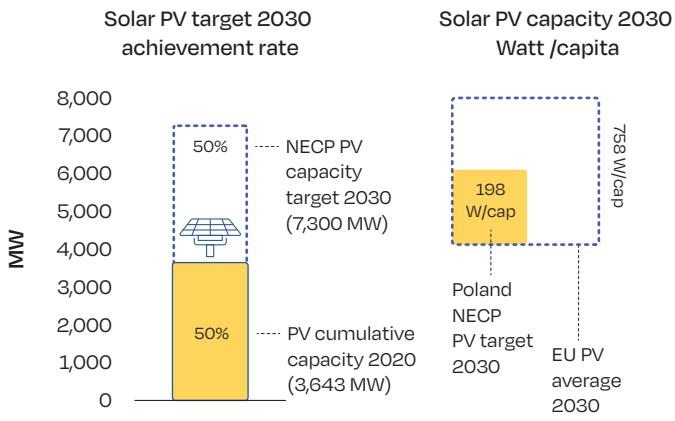
NECP THE NETHERLANDS



Key challenges:

- **Prosumers.** The plan contains a clear objective for prosumer shares (10 TWh by 2030) and identifies the related challenges. While it specifies information on the gradual phase-out of the current net metering scheme, it does not contain information on the future support scheme set to be adopted by the parliament.
- **Flexibility and storage.** The implementation of the CEP is set out in detail and includes references to dynamic pricing, aggregation, market access and fair reward for flexibility. However, no specific objectives or support schemes are planned for storage and demand-side response. Yet, a national consultation has been opened on taking up flexibility and storage techniques in the SDE++ scheme.
- **Grid integration.** New solar projects are facing a significant lack of grid capacity. The plan does contain elements related to the reinforcement of the internal and regional grid but lacks clarity on the policy actions to increase the penetration of renewable energies in the distribution grid.

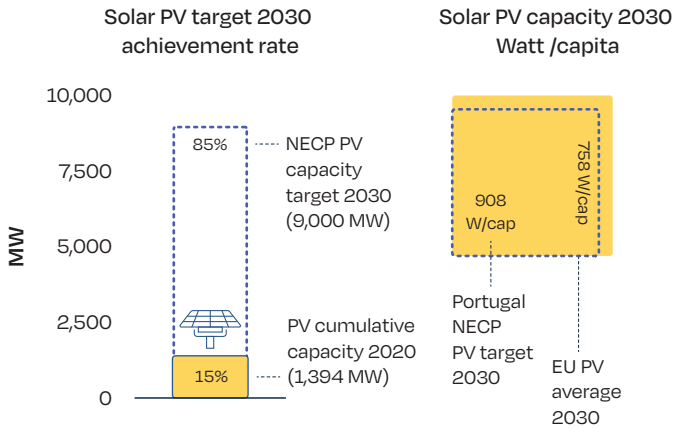
NECP POLAND



Key challenges:

- **PV target.** Solar PV is booming in Poland. It doubled its solar PV capacity in 2019 and the government has shown a clear will to develop solar. Yet, the current objective of 7.3 GW by 2030 would represent 3.7 GW of net solar additions in 10 years, a low ambition compared to current annual additions.
- **Auctions.** Poland has announced new auctions under the 2019 renewable energy law in Poland. Despite the government engagement in publishing a 3-year auction schedule, such a schedule is not detailed in the plan, which fails to provide visibility to investors.
- **PPAs.** Poland has an important potential for PPAs, with to date 7 projects of 112 MW concluded. Yet, the plan does not address the existing barriers to PPAs, such as the regulatory requirements for direct energy supply or the EU-ETS costs exemption for energy-intensives using PPAs.

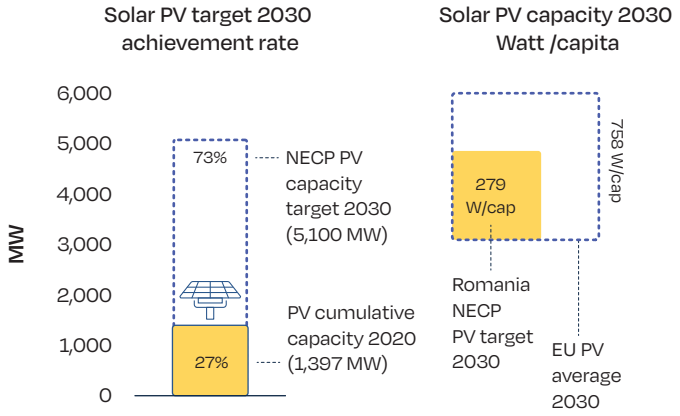
NECP PORTUGAL



Key challenges:

- **Auctions.** The solar market in Portugal has significantly developed, driven by successful auctions in 2020. However, the plan does not detail the auction schedule in the coming years, nor the volumes.
- **PPAs.** The draft NECP does not contain any elements on Power Purchase Agreements. Since Portugal presents a high potential for developing subsidy-free PPA projects and since a number of PPAs have been developed in the country, it is important that the final NECP at least assesses this development and the existing barriers to PPAs.
- **Grid development.** The plan includes measures taken to reinforce the interconnection capacity and the national transmission infrastructure, but it does not address the main bottlenecks for solar development. These are the low establishment of HV and MV transmission lines between cities or the distribution network development, which need to be addressed. In addition, the plan does not contain measures related to the digitalisation of the electricity system.

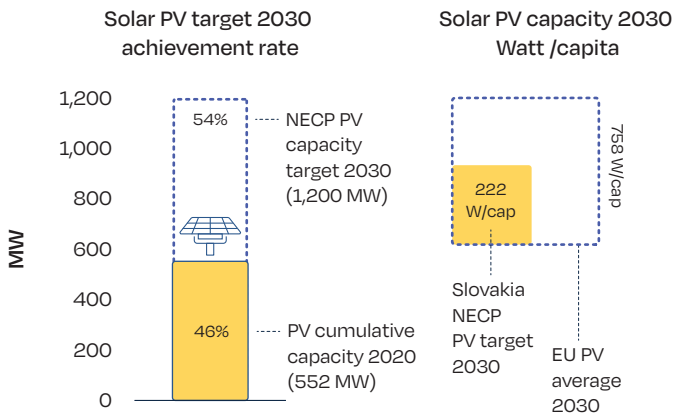
NECP ROMANIA



Key challenges:

- **PV target.** The target anticipates a 3.7 GW growth over 10 years, which is more than double the cumulative installed capacity in the country. However, these targets do not fully reflect the potential for Solar development in Romania, which is one of the highest in Europe. According to the current target, in 2030 the country would have a limited solar penetration compared to its more ambitious peers.
- **Auctions.** The support for RES through auctions is only mentioned implicitly, whereas details on volumes, schedules and design for renewable and solar tenders are absent.
- **Prosumers.** Positive elements are included in the final Romanian plan for prosumer support schemes. At the same time, the plan should be more ambitious on prosumer development.

NECP SLOVAKIA



Key challenges:

- **PV target.** Both the overall ambition for RES deployment and the solar PV contribution remain low. The plan could be updated with more accurate information, as the goals and trajectories are inadequate and rely on outdated data. Though the PV target has increased significantly compared to the previous NECP draft, with 648 MW of new capacity installed through 2030, solar ambition remains limited.
- **Auctions.** The plan outlines general information about RES auctions, but not specifically for solar. Moreover, the indicated capacity of auction schemes appears low.
- **Prosumers.** The Slovakian plan does assess the prosumer capacity in the country. However, it does not give details on the support schemes that will be developed to incentivise self-consumption, including collective self-consumption.

3 Assessment of the National Energy and Climate Plans

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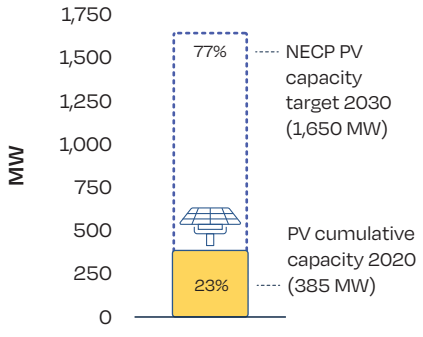
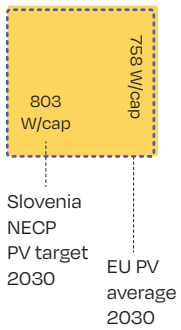
NECP SLOVENIA

Solar PV target 2030 achievement rate



Solar PV capacity 2030 Watt /capita

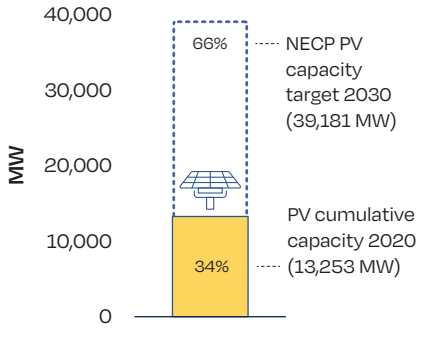


Key challenges:

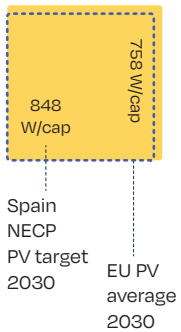
- **Auctions.** The NECP does not include information on auction design, volume and schedule. This poses a significant challenge to PV project development in the medium term.
- **Prosumers.** Objectives set out in the plan include improving the role of active consumers and providing financial support for prosumers. However, it is important that these objectives are enshrined into law and accompanied by developed regulatory frameworks, such as collective self-consumption. In addition, there are concerns about the long-term stability of the regulatory framework which are harming the investment environment.
- **Administrative procedures.** The plan contains interesting proposals to simplify administrative procedures, whose implementation should be closely monitored. However, the list of measures should be completed. The administrative procedures are still very extensive, comprehensive, and difficult to understand. In addition, there is no specific contact point for the permit granting procedure, which could significantly ease processes.

NECP SPAIN

Solar PV target 2030 achievement rate



Solar PV capacity 2030 Watt /capita

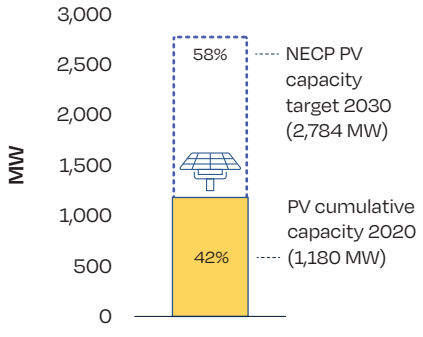


Key challenges:

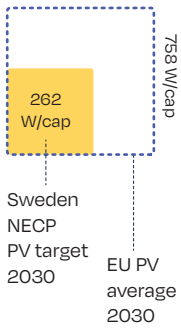
- **Administrative procedures.** The plan has identified administrative procedures as a bottleneck of renewables' deployment. Access to land is a particular challenge for solar PV developers. The recent Royal Decree Law 23/2020 should further clarify and simplify the administrative authorization procedure for production facilities.
- **PPAs.** Spain has conducted an in-depth analysis of the potential and opportunities for PPAs, as well as the barriers to PPA development. It proposes sound measures that will support the development of PPAs. The development and implementation of such measures will be critical.
- **Grid development.** New projects are challenged in Spain by a scarce grid capacity. The plan puts forward a series of measures, including new grid development procedures, investments in digitalisation of the grid, new grid connection rules based on peak grid capacity, increased transparency of available grid connection capacity and location. It also created a new target for storage development (6 GW, including 2.5 GW for battery storage).

NECP SWEDEN

Solar PV target 2030 achievement rate



Solar PV capacity 2030 Watt /capita



Key challenges:

- **PV target.** The plan shows relatively low ambition for solar energy before 2030 with 1.6 GW of newly installed solar capacity and a resulting low value of PV penetration by 2030. However, a higher ambition of solar capacity is shown post-2030 with more than 7 GW installed capacity.
- **Auctions.** The plan does not include any information on the future auction schedule, volume and design. Providing more visibility to investors here will be critical.
- **Prosumers.** Sweden has a comprehensive prosumer programme, including an investment subsidy for prosumer solar and storage. However, the plan lacks information regarding the size of current support schemes. The system limit of 255 kW for exemption from energy tax on the self-consumed electricity will be increased to 500 kW and could support the development of industrial PV applications.

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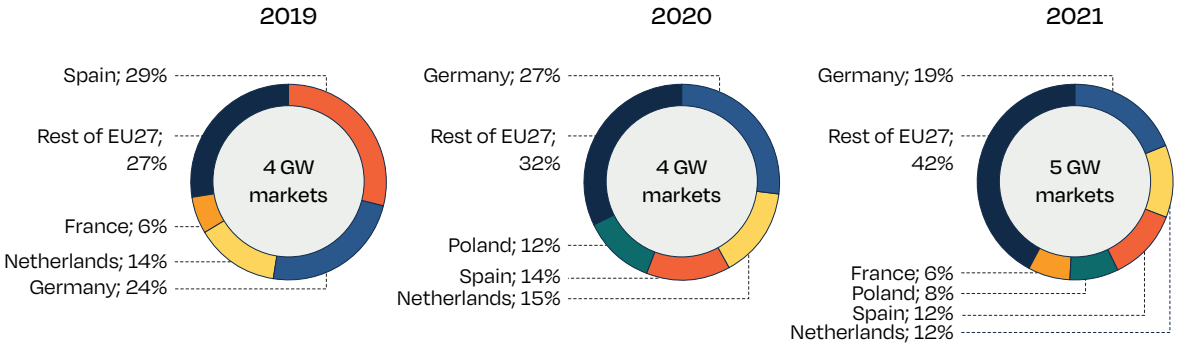
44 MW, Budel, the Netherlands. © SolarCentury

In 2020, four EU solar markets installed more than 1 GW of solar – Spain, Germany, the Netherlands and Poland. While the number has remained unchanged from last year, partly due to the impact of COVID-19 on EU solar markets, the order and composition of the largest markets has changed. Germany and the Netherlands have gained the first and second position respectively, whereas Spain dropped to rank 3. The latest market to enter the GW-scale is Poland, while one country, France, installed less than the year before and less than 1 GW. For 2021, we expect France, which was the fifth largest solar market in the European Union in 2020, to expand that group again.

For this chapter, we have invited national solar/renewables associations from our members representing this year's Top 5 EU solar markets to provide their local expert views on their home countries (which, however, sometimes differ from our estimates that are based on several sources). For those countries for which we did not receive contributions from national solar associations, we have written the overviews based on our SolarPower Europe research.

1.	**GERMANY** SolarPower Europe	SolarPower Europe
2.	**THE NETHERLANDS** Holland Solar	Holland Solar
3.	**SPAIN** Unión Española Fotovoltaica (UNEF)	UNEF
4.	**POLAND** Polish Society for Photovoltaics (PV Poland)	PV POLSKA
5.	**FRANCE** Syndicat des Énergies Renouvelables (SER)	SYNDICAT DES ÉNERGIES RENOUVELABLES

FIGURE 12 EU27 GW-SCALE SOLAR MARKETS 2019 - 2021



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1. Germany

New legislation might put long term solar growth at risk

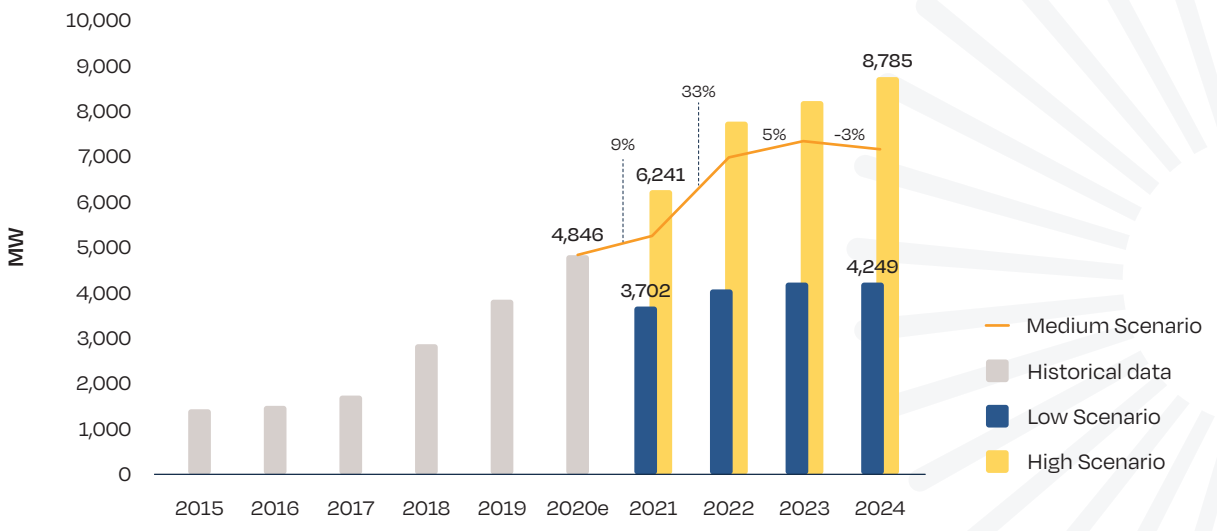
Overview of PV developments

In 2020, Germany regained its role as the largest European PV market by overtaking Spain. A steep growth trajectory starting in 2018 with 2.9 GW installed (+1.1 GW YoY) continued steadily in 2019 (3.9 GW, +1.0 GW net increase) and is estimated to reach 4.8 GW in 2020 (+0.9 GW net). Today, Europe's largest economy not only has the largest operating PV fleet in the EU (54.6 GW); the country with the European Union's largest population also has the highest ratio of solar capacity per capita – 0.65 kW per inhabitant. Leaving behind uncertainties around the 52 GW cap issue that characterised last year's policy debate, a government agreement in July lifted the cap and set a new target of 98 GW by 2030 (which the EEG 2021 draft slightly extends to 100 GW). The future outlook seems promising, with 7 GW year-on-year foreseen no later than 2022. However, some aspects in the revision of the EEG 2021 law, which passed in the first reading of the Parliament but has two further readings pending at the time of editorial deadline, leave room for substantial concern.

Solar PV Targets

Contrary to previous expectations, it seems that Germany will ultimately reach its climate and energy targets for 2020. Due to the effects of the COVID-19 crisis, carbon emissions in transport and energy have decreased significantly in 2020. This was considered implausible a year ago. Looking at the 2030 horizon, a new 98 GW solar target in the NECP and a 65% RES target in gross electricity consumption set the pace for the transition from nuclear and coal. They are scheduled to be fully phased out by 2023 and 2038 respectively. Notably, the 2030 solar target means average additions of 4.3 GW PV per annum, a level below this year's installations. Besides setting targets, the German NECP outlines a good policy framework for solar growth.

FIGURE GW1 GERMANY ANNUAL SOLAR PV MARKET SCENARIOS 2021-2024



Drivers for solar growth

Up until now, three types of tenders were held for large-scale solar in the past years: regular solar tenders for projects between 750 kW to 10 MW, special tenders for projects of the same size, and mixed wind and solar tenders. Regular tenders took place three times a year with a volume of 2 x 150 MW, 1 x 175 MW and 2 x 500 MW. These tenders are technology specific. To support the achievement of its renewable energy targets, in 2018 the government coalition agreed to organise extra tenders over 3 years, accounting for a total solar capacity of 4 GW (2019: 1 GW; 2020: 1.4 GW; 2021: 1.6 GW), in addition to the regular tenders. Moreover, the technology-neutral tenders awarded in 2020 repeated the pattern of last year, with solar winning all the auctioned capacity.

On top of these three tender types, in September 2020 the first technology-neutral innovation tender took place, allocating nearly all of its 650 MW capacity to solar projects. The next round with 500 MW will take place in 2021. According to the EEG 2021, the annual volume is planned to be increased by 50 MW, resulting in 850 MW to be tendered in 2028, which the Economy Ministry expects to be shared equally between wind and solar. The results will be taken into account for the acknowledgeable annual tender volumes that will range between 1.6 and 1.9 GW.

The self-consumption regime will be fundamentally changed with the passing of the new EEG law. Crucially, starting from 2021 large rooftop systems above 500 kW will also transition from feed-in premium schemes to auctions. The planned tendered capacity, however, will be significantly lower than the current installation levels of this segment, resulting in an annual gap of 75%. It is expected that a decrease in the threshold even in tenders of systems as small as 100 kW by 2025 will negatively impact commercial and industrial installations.

Despite changes through the EEG revision, that will require costly smart monitoring equipment also for very small systems, the residential rooftop segment is expected to continue its path upwards in the medium term. High retail electricity prices, the availability of low-cost PV systems and the expected financial support stemming out of the Recovery and Resilience Plan create good conditions for an increased uptake of small-scale PV. In addition, the analysis from SolarPower Europe's European Market Outlook for Residential Battery Storage 2020-2024 shows a thriving residential BESS segment, with high growth prospects and a strong attachment rate to home PV systems. This could lead to further growth for solar.

Next to capacity installed through the self-consumption regime and auctions, PPA-based

Gound-mounted PV park in Germany.

© Shutterstock/Peteri

projects are a third pillar of solar development. Large-scale merchant solar is an emerging trend in the German market. For example, EnBW's 187 MW subsidy-free solar park is the largest PV plant in the country and started operations in late 2020, while several other PPA projects grid-connected this year. As utilities, large investment funds and private investors are very active in this segment, we anticipate the PPA market to grow strongly in the coming years.

Challenges

The EEG draft law contains provisions that pose significant challenges to PV development, which might prevent solar from reaching a 10 GW level, which German Solar Association BSW considers essential for Germany to reach its 2030 targets.

As previously described, lowering the capacity threshold for PV systems falling within the auction scheme severely hinders the potential of large commercial rooftops, which constitute one of the most dynamic solar segments. A low-capacity threshold for auctions is inefficient and, as we have seen in other EU countries that were lagging behind their solar targets, the trend is to raise the threshold rather than to reduce it.

In contrast with the direction outlined in the EU Clean Energy Package, the new German law poses numerous administrative hurdles to self-consumption. These hurdles include the obligation to install smart meters and remote controls on all systems from 30 kW down to PV installations as small as 1 kW.

There are around 10 GW of PV systems that are reaching 20 years of age and that will exit the EEG support scheme by 2030. Therefore, it would have been important to lift market barriers in order to allow these systems to continue their operations without disproportionate burdens. However, the EEG 2021 includes EEG surcharges on self-consumed electricity. On the plus side, until 2027, such systems up to 100 kW will receive a guaranteed feed-in price depending on market price minus a marketing fee.

The feed-in tariff-based remuneration scheme remains based on the so called "breathing cap". The rates increase or decrease depending on whether annual installations are above or below certain thresholds, set up as yearly expansion targets. In light of greater climate ambition, these targets need to be increased considerably, otherwise the feed-in premiums decrease too fast.

Finally, permitting procedures for large-scale projects shall be reviewed in order to avoid a shortage of suitable locations for cost-competitive PV generation. PV applications with minimal land use impact, such as Agri-PV and floating solar should particularly be encouraged.

Despite these challenges, SolarPower Europe anticipates continued growth for the next 3 years, with much of the recently increased tender capacities to come online (see Fig. GW1). In 2024, the already flattened growth curve is supposed to turn negative as a consequence of the adverse market circumstances created through the EEG 2021.

Authors: *Raffaele Rossi* and *Michael Schmela,*
SolarPower Europe

2. The Netherlands

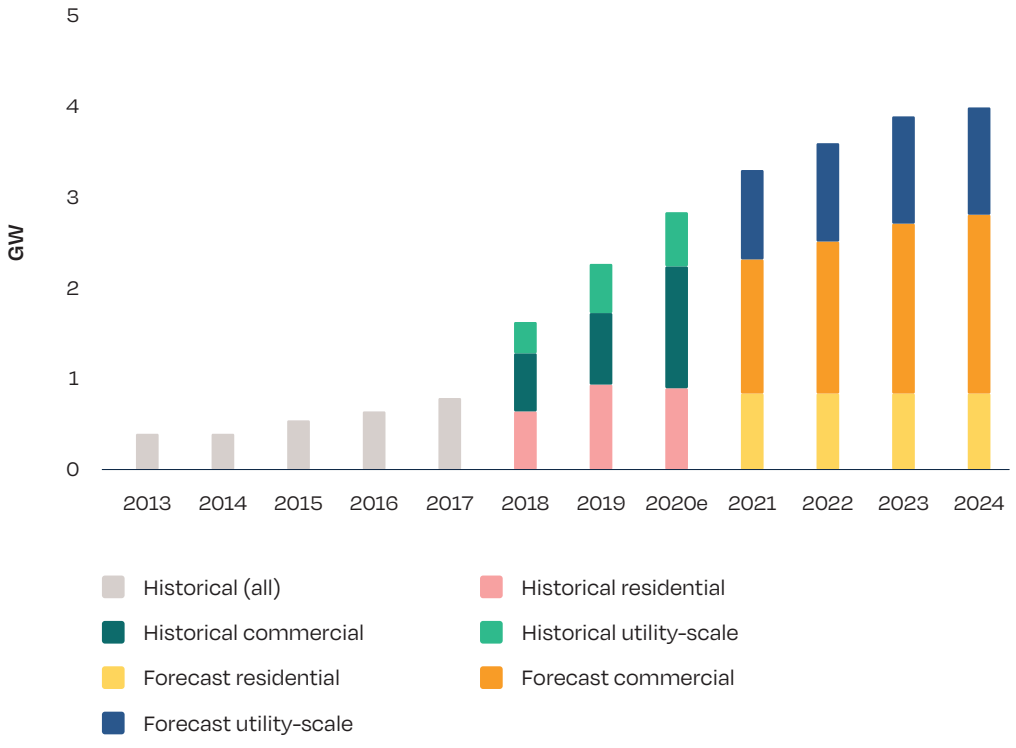
Large 12 GW project pipeline, but solar must now compete with CCS projects in tenders

With an expected added capacity of almost 3 GW in 2020 and a project pipeline with SDE+ subsidy-awarded projects of 12 GW, the market looks quite sunny despite the COVID-19 crisis. The pipeline includes both rooftop commercial and ground-mounted projects, with rooftop making up the lion's share. The main challenge is now to ensure the completion of all projects. In general, approximately 70% of the projects reach closure, including timely grid connections. Many favourable project development areas in the Netherlands are experiencing grid congestion, which means no new projects can be connected to the grid in the near future. In 2021, the Dutch solar market will grow again and is expected to reach 3.5 GW in 2021 and 4 GW in 2024 (see Fig. GW2).

Many system-size records in 2019

In September 2020, a 110 MW solar park was completed in Vlagtwedde, in the province of Groningen in the north of the country. The construction of a larger solar park of 147 MW will soon begin in the province Flevoland. An increasing number of floating solar projects were also completed in 2020, mostly situated on sandpits and water deposits. There is an increasing interest in multifunctional use of space, like solar carports. Recently the contruction of 35 MWp solar panel carport started on a festival site in Dronten. Currently, the country's largest rooftop project, installed on a warehouse in Venlo, has a capacity of 18 MW.

FIGURE GW2 NETHERLANDS SOLAR PV MARKET SCENARIOS 2021-2024, BY HOLLAND SOLAR



SOURCE: Holland Solar.

The biggest market segment in 2020 was the commercial rooftop market, with a share of almost 50% (1.2-1.4 GW). The residential market had a share of nearly 30% (0.8-1 GW). Finally, the market for ground-mounted and floating solar PV accounted for more than 20% (0.5-0.7 GW). These estimates are calculated, based on data for the completion of 2020 projects as far as this was available.

While its relative market share has decreased, the residential market has remained stable in absolute terms. It is expected to stabilise at a level of at least 800 MW per year. Residential solar is an important market segment for the Netherlands. Although small, it helps create awareness and support for the energy transition among citizens, leading to greater acceptance of the spatial consequences and other consequences that come with introducing solar and wind energy into the energy mix.

Dutch policy/RE targets

The Netherlands will not meet its EU 2020 targets from national sources, which would require renewable energy to account for 14% of the country's total energy mix. Instead, it will be at only 10.7-11.2%. This will be compensated with a statistical transfer, i.e. a reservation of 58 PJ of Danish wind volume. However, there is an impressive pipeline of projects both in solar and wind, both offshore and onshore. The Energy Agreement's 16% renewable energy target for 2023 is therefore projected to be achieved, with 16.6%.

Concept Regional Energy Strategies

As agreed in the Climate Agreement, clusters of municipalities published their concept Regional Energy Strategies with plans for wind and solar capacity. These strategies must sum up to 42 TWh production for solar and onshore wind electricity in the year 2030. The concept shows that the ambitions of local authorities will easily sum up to this amount. Also, the concept strategies show that rooftop solar systems are strongly favoured over ground-mounted solar and onshore wind turbines. The expected ground-mounted capacity will have to be developed with 50% local ownership. After feasibility checks, like a grid capacity check, the strategies will be finalised by March 1st ,2021. Local spatial planning and permitting procedures will be based on these Regional Energy Strategies. The expectation is that local policies become more dominant for the solar sector.

In order to meet local requirements, a code of conduct on how to best integrate solar with the natural and social environment has been established with the support of many NGOs and stakeholders, like Holland Solar.

Drivers for solar growth

The residential solar market is driven by net-metering. There is no limitation or charge for net-delivery. A new law proposal is now in concluding phase in the Dutch Parliament. If the law passes, from 2023, the right to use net-metering will gradually decrease, with 9% every year, up until 2031, when net-metering will no longer exist in the Netherlands. This degressive path is based on a seven-year payback time for the prosumer, assuming 30% self-consumption and an optimal situation. Besides net-metering, small businesses with solar system connections up to 3*80 A are offered a fiscal advantage in their profit tax. In 2021, an extra investment subsidy for SMEs and social real estate owners will be launched in order to incentivise extra rooftop solar.

Up until now, the Netherland's commercial and utility-scale market was driven by the SDE+ tendering scheme, where solar had to compete with other renewable energy sources. In this scheme a different maximum capacity was on offer, depending on technology (wind, biomass, solar), size, and application (ground-mounted, rooftop, floating). In 2019, there were two subsidy rounds in the spring and autumn, with a budget of EUR 5 billion each. The projects were required to have minimum sizes of at least 15 kW, with no maximum size specified. In the spring of 2020, the last round of EUR 4 billion in the current format was held. The SDE funds are collected by a surcharge on the consumer and commercial electricity prices (ODE).

As of autumn 2020, it was agreed that the SDE scheme which will remain in place until 2025, will be broadened in scope, to include energy saving projects and CCS. The ranking in the amended scheme (now called SDE++) will be based on Euros per kT CO_2 avoided. The maximum SDE++ contribution will be lowered every year. This will also depend on the reference price of energy based on fossil fuels. However, the expectation is that solar energy projects can be developed without any incentives based on PPA contracts by 2025 at the latest. Utility-scale solar is estimated to reach grid-parity around 2023, depending on the development of electricity prices.

Future market development

Holland Solar, the Dutch Solar Energy Association, is positive about the market development for the next four years, as can be seen in our forecast (see graph). The market is divided into two parts: (1) the residential and small businesses market (both < 3*80 A), and (2) the commercial and utility-scale market. Commercial-scale includes large rooftop projects, while utility-scale covers solar parks. Our forecast was more or less confirmed by a recent publication from Wood Mackenzie. Wood Mackenzie estimated a growth of 12.9 GW in the next five years, which is equal to an average newly installed capacity of 2.58 GW per year.

Challenges

One of the main challenges for solar in the Netherlands is securing timely grid connections. In several areas, there is simply a lack of grid capacity. Additional reserve capacity will be put into general use by the grid operators. Cable pooling which combines solar and wind project will be legally accepted and maximum grid capacity per installation will be reduced to below 70% of installed panel capacity.

Another challenge the country faces is the availability of land, especially for utility-scale projects, as well as social acceptance when it comes to using agricultural land for solar energy projects. Government policy is to prefer rooftops over fields for solar installations. In 2021 this topic will be part of the political debate in the elections and coalition formation.

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27.4 MW, Bomhofsplas, the Netherlands.

3. Spain

Walking the good path

The year **2019 was the best year in history for photovoltaic energy in Spain.** A new record of installed capacity was established both in utility-scale, with 4,201 MW_{DC} of new capacity, and in self-consumption, with 550 MW_{DC}. As a result, Spain was the leading market in Europe, for the first time since 2008, and the sixth largest solar market in the world.

For 2020, we were not expecting another record year, but **we predicted that the market would keep a solid pace** due to a wide portfolio of projects under development. The estimates of new capacity that we foresaw at UNEF for 2020 (pre-COVID-19) were in the order of 2-3 GW_{DC} for utility-scale.

With the outbreak of the COVID-19 pandemic, plants under development were the first to see the impacts, experiencing delays due to logistical problems in the import of components and in their administrative procedures. However, with the end of the year in sight, we can be confident that this activity resisted the impact of the pandemic much better than other sectors did. **According to data from the end of October, the addition of PV capacity in utility-scale plants in 2020 is 1,450 MW_{DC}.**

It has to be remarked that, in the absence of auctions, all this new capacity has been driven by the **PPAs/merchant** segment. This is a **historical achievement: in Europe, this is the first time that this amount of capacity is connected to the grid without being included in any kind of public program with subsidies or auctions.** It is a good sign and shows the degree of competitiveness that PV technology has achieved in the Spanish market.

In Spain, the solar PV PPAs have been thriving for the last few years. Many companies from different sectors (banking, telecom, food processing, pharmaceutical, etc.) are willing to contract renewables and reduce their energy costs.

For **self-consumption** the situation is somewhat different. Despite the good figures in 2019, the full potential had not yet been reached; we expected **720 MW_{DC} of new solar rooftop capacity for 2020.** However, it is unlikely that this sector resists COVID-19 as strong as the utility-scale. In Spain, SMEs install most of the rooftop capacity. These companies, in anticipation of the economic crisis, may prefer to save the funds for later, delaying or cancelling their self-consumption projects. But in the residential sector the year is faring better than expected. The drivers are fiscal advantages in certain municipalities and mobility restrictions from the pandemic, which mean people improve their savings and are more willing to invest.

Cabrera Solar Complex, 200 MW. Alcalá de Guadaíra (Seville), Spain.

Drivers for solar growth

Despite this year of uncertainty, we have to remind ourselves that the sun still shines in the sky. The Spanish National Energy and Climate Plan (NECP) was approved this year with a target for 2030 of 74% of renewable electricity generation and of 39.2 GW of PV capacity. From around 10 GW_{DC} today, this means that **new PV capacity** will have to be around **2.8 GW every year** in the next decade to meet the NECP goals.

In this regard, the Spanish government has just approved the Royal Decree 960/2020 with a **new remuneration scheme for renewables**, based on a fixed price per generated energy, that will be awarded through **auctions**. The aim of the government is to hold an auction for 3 GW of new renewable capacity before end-2020, of which at least 1 GW would be assigned to PV.

The government is also developing the **National Self-Consumption Strategy**. This will define policies that put the **citizen at the center of the energy transition**, promoting formulas, such as the **energy communities**. The Strategy will also evaluate the potential for self-consumption in the country and set targets of installed capacity by 2030.

The Spanish climate change law is also on track. After a parliamentary consultation process, the government will negotiate with the different parties to find the needed support for its approval, expected before 2021.

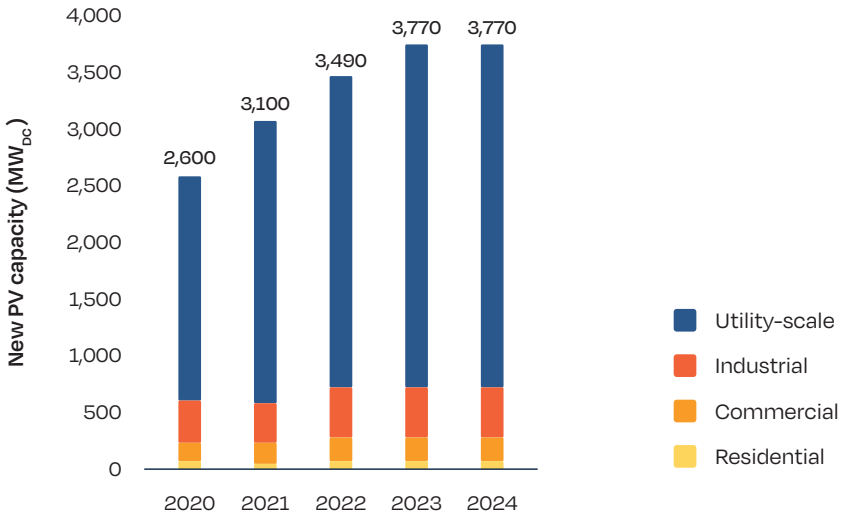
Another driver for the PV sector will be the **Recovery, Transformation and Resilience Plan**, aimed to modernise the Spanish economy and create growth after the COVID-19 crisis. The plan, designed for the **next three years**, is built on **10 driving policies**, one of which is the **Energy transition**.

Challenges

The ambitious PV targets set in the NECP reflect the potential for a country like Spain and its solar resources, and address the **persistent challenges of PV deployment in Spain**. These include the terms of the administrative authorisations and the network access procedure.

Regarding authorisations, the GW size utility-scale market in Spain puts pressure on public entities, especially at the regional level, that struggle and at times fail to meet legal deadlines. Self-consumption

FIGURE GW3 SPAIN ANNUAL SOLAR PV MARKET SCENARIOS 2020-2024, BY UNEF



SOURCE: UNEF.

also sees long authorisation processes at the local level, as many municipalities still require a construction work license to install PV systems. The central administration is not an exception, also showing slow response times in the procedures managed by the Ministry.

The different administrations (central, regional and local) shall put efforts into reducing their terms through **digitalisation**. They should also review their contracting framework, to have the **agility to hire new personnel** and substitute sick leaves and retirements.

In addition, the design of the authorisation process itself must be reviewed. As it is now defined, the previous steps are a requirement for the next ones, creating **bottlenecks** all along the process. A higher degree of **simultaneity** should be introduced so the developers can advance in parallel avoiding getting trapped by a particular question that is being delayed.

Regarding **the network access**, the existing procedure (dating back to year 2000) has been criticised due to its long terms, its lack of transparency and the presence of asymmetric information. A new Royal Decree of access and connection is expected before end-2020. This should solve these issues and ensure that capacity is assigned to projects with greater development.

Conclusions

Spain is on a good path, but still has to overcome certain challenges to optimise performance. Particularly, Spain has **to strengthen its industrial PV sector**, which should grow significantly following the massive capacity deployment in the next years.

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4. Poland

All set for continued strong growth

Overview of solar PV developments

2020 was undeniably a very successful year for the photovoltaic industry in Poland, both in terms of installed capacity and overall market development. After years of low rates of PV connections, installed capacity reached 838 MW in 2019. However, the real boom came in 2020, when about 1,850 MW (1,675 MW between October 2019 to October 2020) were installed, increasing the total operating PV capacity to about 3,150 MW (see Fig. GW4). It has been reported that about 1,000 people are directly employed in the production of PV system components and 5,000 people are active in the installation sector.

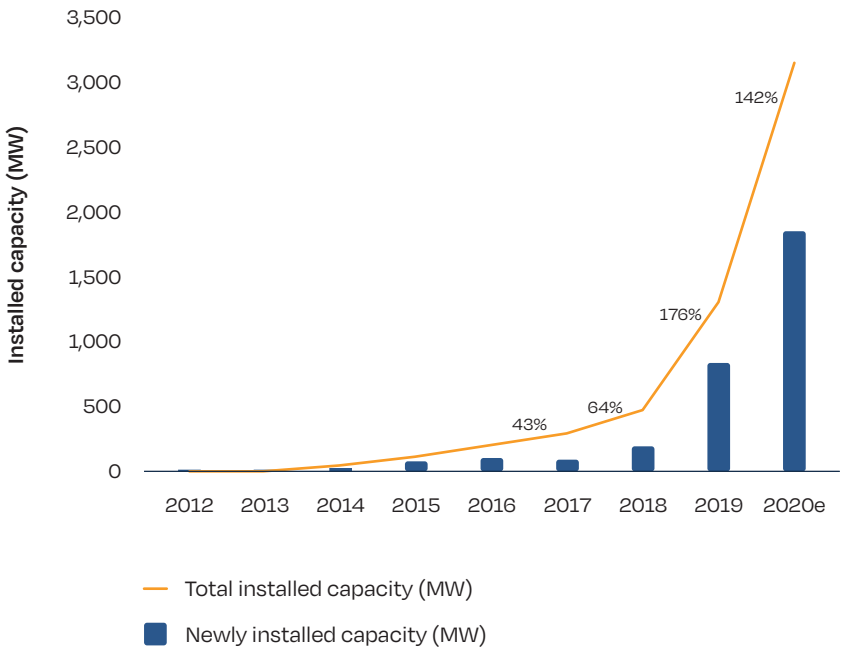
At the end of 2019 about 155,000 micro-installations with a total capacity of 833 MW had been registered, by the end of 2020, these number increased to 350,000 systems with an average power of 6.5 kW, now totalling 2,300 MW expected to be grid connected. This steep growth shows the increased attractiveness of photovoltaic micro-installations.

TABLE 1 POLAND PV SYSTEM SEGMENTATION BY THE END OF 2019, BY PV POLAND

POWER RANGE (MW)	INSTALLED POWER (MW)
< 0.05	833.0
0.05 - 0.25	23.0
0.25 - 0.5	25.9
0.5 - 0.75	31.2
0.75-1	343.9
> 1	43.3
Total	1,300

As shown in Table 1, by the end of 2019, a PV capacity totalling 478 MW belonged to systems above 50 kW. Systems with nominal power of 1 MW or just below are the largest contributors across these segments. The Energy Regulatory Office lists 307 installations with nominal power in the range of 0.95 - 1 MW, while only 27 systems with a nominal power above 1 MW and with a total capacity of 43.3 MW are registered. The largest listed system has a capacity of 2,138 MW.

FIGURE GW4 POLAND SOLAR PV MARKET 2013-2020, BY PV POLAND



SOURCE: PV Poland.

Drivers for solar growth

This substantial increase in PV capacity is mainly due to a favourable self-consumption scheme for prosumers, which balances out across the year the energy that was delivered to the grid and those purchased from the grid. A discount mechanism allows prosumers to exchange the energy surplus fed into the grid with free electricity in times of purchase from the grid at specific ratios. The size of the discount depends on the system size: 0.8 for systems below 10 kW, 0.7 for systems between 10 kW and 50 kW and 0.6 for small and medium-size enterprises. DSOs have the obligation to purchase energy from these micro-installations. The expansion of the definition of prosumers to include SMEs has encouraged this segment to generate renewable electricity for their own energy needs.

Public support is also granted through tenders, in which winners are guaranteed the purchase of their produced energy at a certain price for a 15-year period. A reference energy price is set for groups of various sizes and for different renewable technologies. PV systems are in the same basket as onshore wind farms. In an auction in December 2019, 900 MW were awarded at prices ranging from 57.2 to 72.5 EUR/MWh with project completion deadlines on the 30 June 2021.

After a series of regulatory changes, today solar installations enjoy a VAT reduction. Both rooftop and ground-mounted systems below 50 kW benefit from an 8% VAT instead of 23%. Additional support to solar is granted through cost reductions via a reduced income tax; preferential loans and subsides set up through the National Fund for Environmental Protection and Water Management; bank loans with low interest rates.

Outlook

The current state of solar in Poland indicates that it has finally becoming a relevant market at the global scale. Falling renewable energy costs, the changing role of coal and new business models in the energy sector – including micro-sources and distributed energy sources – are just some of the trends that will shape the solar market in Poland. All these factors contribute to increasing the societal awareness to environmental issues and improve people's support to the transition to renewables. These factors also strengthen the voice of society in making strategic decisions on energy infrastructure and increase citizen participation through a stronger development of local distributed PV sources. It is estimated that in 2024 there will be 9 to 11 GW installed throughout the country.

In April 2020, the Ministry of Climate appointed a Panel for the Development of Renewable Energy Industry and Benefits for the Polish Economy. The Ministry of Climate emphasizes that the goal of the Polish government is to build a strong European zero-emission industry, a long-term challenge to help diversify the energy mix and thereby improve supply security. In September 2020, the government and PV industry representatives signed an agreement on the development of solar in the country. In the Polish NECP, PV is highlighted as one of the key technologies to reach the EU RES goal and its dynamic development is one of the strategic projects of Poland's Energy Policy by 2040.

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2 MW, Biskupiec, Poland.
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5. France

Ambitious targets, quite some way to go

Overview of solar PV developments

In 2020, France crossed the symbolic threshold of 10 GW of solar power connected. With 283 MW connected during the third quarter of the year, the solar fleet now amounts to 10.2 GW. Over the last 12 months, 827 MW have been grid connected. However, the COVID-19 crisis resulted in some delays in connection procedures. This led to a slightly lower installed capacity than what was expected, given the previous years, especially for the second quarter (243 MW in Q2/2019, 179 MW in Q2/2020).

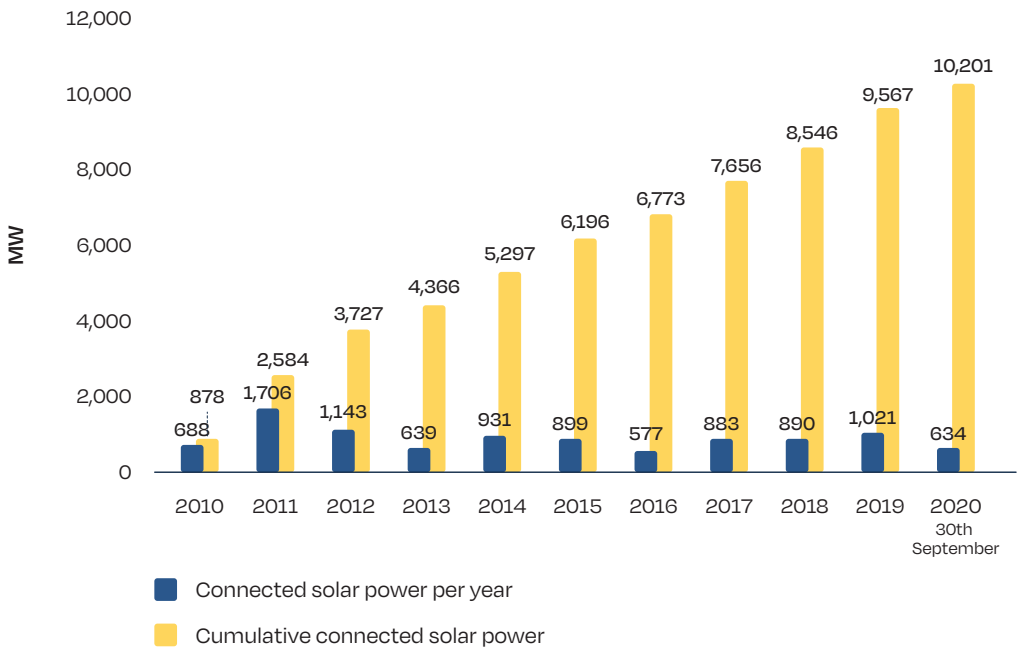
With 4.46 TWh produced between July and September 2020, the sector beat its record from the previous quarter (4.43 TWh). Production is up 4.9% compared to the third quarter of 2019. The coverage rate of electricity consumption by solar energy is therefore 4.6% for this quarter (2.9% over the last 12 months).

Solar PV targets in France

The 2015 Energy Transition for a Green Growth law set ambitious goals for 2030, confirmed in the Climate & Energy Law adopted last year. These objectives have been implemented for each technology through the Multi-Annual Energy Programme (MAEP). This defines clear trajectories and volumetric objectives for the coming 10 years. The MAEP objective for the end of 2023, an operating solar fleet of 20.1 GW, has currently been reached by 50%.

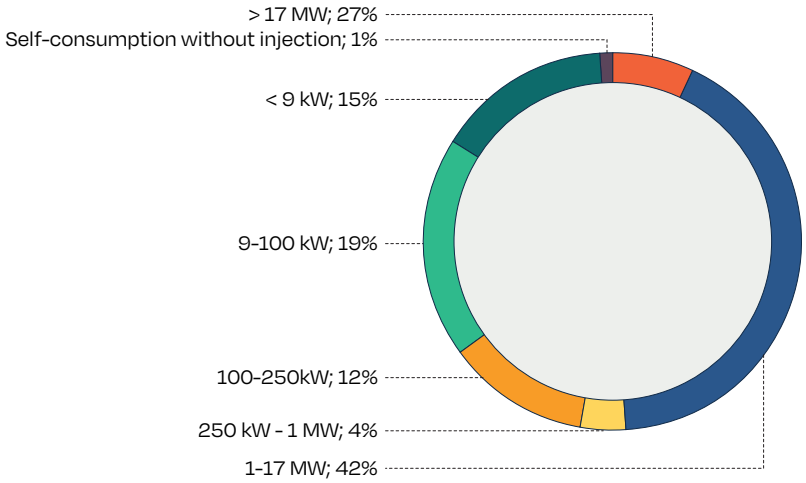
A revised version of the first MAEP, adopted this spring, confirmed the willingness to strongly accelerate the development of the solar park in France. The new targets presented for 2028 lie between 35.1 GW and 44 GW in cumulative capacity. These targets imply that the annual market needs to rise to 2 GW/year between now and 2023, and then to 4 GW/year between 2023 and 2028. This means between 330 and 400 km² of PV area will be installed in France for ground-mounted and between 150 and 200 km² for rooftop installations. Solar power is therefore positioned as one of the most important contributors to the French energy transition.

FIGURE GW 5.1 FRANCE ANNUAL AND CUMULATIVE SOLAR PV CAPACITY 2020-2020, BY SER



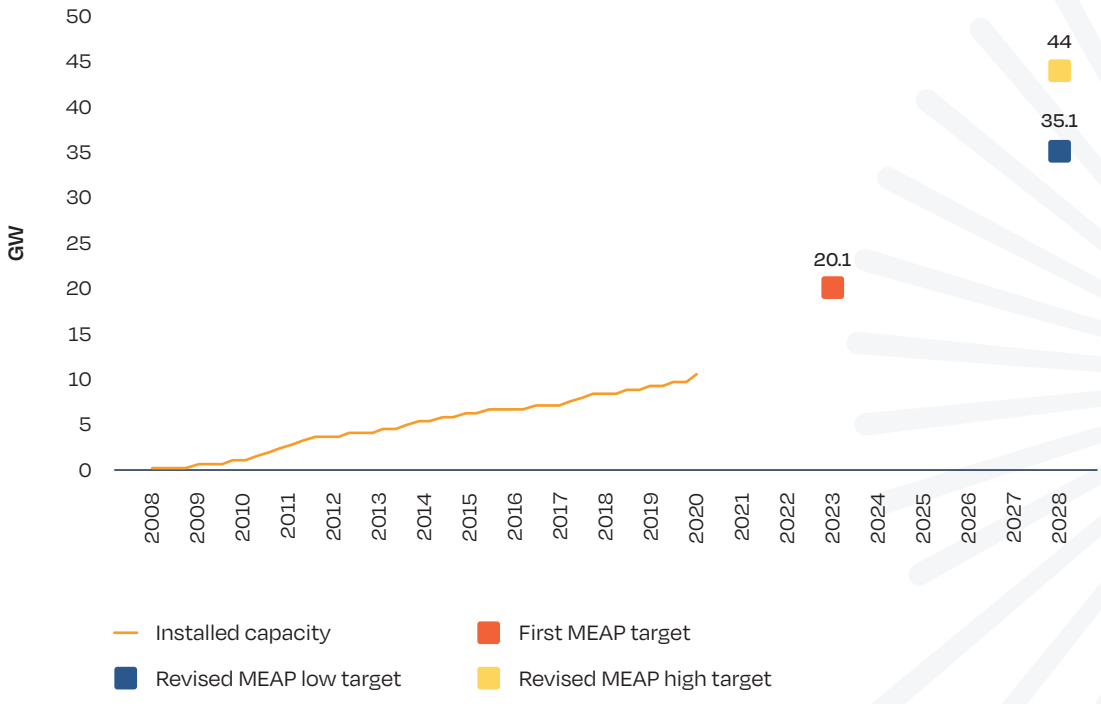
SOURCE: SER.

FIGURE GW 5.2 FRANCE CUMULATIVE SOLAR PV GRID CONNECTED CAPACITY Q2 2020, BY SER



SOURCE: SER.

FIGURE GW 5.3 FRANCE MULTI-ANNUAL ENERGY PROGRAMME SOLAR PV TARGETS, BY SER



SOURCE: SER.

Drivers for solar growth

Calls for tenders are the main driver for achieving these targets, with 2.9 GW scheduled every year. Two-thirds of these tenders will be ground-mounted installations. The remaining third will be attributed via calls for rooftop installations.

For many years, the French renewable energy association (SER) advocated that projects for rooftop installations below 500 kW be exempt from tendering procedures and eligible to a feed in tariff (FIT), in line with the current State Aid Guidelines. This year, the French Government finally agreed to move forward on this topic, and work is currently ongoing regarding the concrete implementation of this change. This should make things easier for this market segment, where projects were previously limited by the tendering procedure.

Additionally, the self-consumption market, for which a dedicated framework has been put in place, is increasing quickly but still represents a small installed capacity. In Q3/2020, 85,714 installations were self-consuming, representing 360.82 MW.

Challenges

Reaching an ambitious target of 44 GW of solar power in France by 2028, compared to the 10 GW currently installed, requires regulatory changes in order to help all market segments grow.

First and foremost, one needs to widen the perimeter of eligible land in calls for tenders for ground mounted projects. Given the 2028 MEAP target and given that the distribution of major projects remains constant, we can expect almost half of solar power to be installed on the ground, representing 17 GW, i.e. approximatively 18,000 to 27,000 hectares. Therefore, a general reflection on land use is necessary to take into account the real impact of PV projects on soils and to facilitate their development. In addition, innovative PV projects with especially low land use impacts, such as Agri-PV and floating solar, should be encouraged.

Moreover, the development of photovoltaic projects is tightly regulated. Some administrative procedures and architectural planning issues have to be clarified and simplified. Some local services may have an

Dynamic shades Agri-PV system, viticulture. © SUN'AGRI

Agri-PV greenhouse. © AMARENCO

ambiguous and debatable interpretation of the framework in place. This can sometime go beyond current regulatory rules, for example regarding fire protection rules. Administrative deadlines also need to be shortened.

As part of the Finance Bill for 2021, the French Government tabled an amendment aimed at renegotiating the prices of solar power contracts signed between 2006 and 2010. This amendment targets PV installations of more than 250 kW, which received levels of support that the Government believes will lead to an excessive profitability. This would affect around 1,050 contracts in total. The exact implementation of this provision will have to be specified in a Council of State decree. The amendment was adopted by the French National Assembly on November 13 but rejected by the Senate two weeks later. The examination of the text is still ongoing.

France promotes a low carbon footprint solar PV industry. The carbon criteria in the call for tenders is seen as a fundamental pillar of an industrial strategy which should go hand in hand with the market development. The development of the French industry's innovation capacities and technological breakthroughs, thanks to the work of strong R&D centers (INES, IPVF, etc.), will also improve competitiveness.

Finally, as mentioned above, self-consumption is still a small market for PV solar energy. The support mechanisms for self-consumption projects need to be adapted so as to enhance the value of all electricity produced, self-consumed and injected into the grid. This needs to occur at levels that allow the projects to be financially secured. Opening up self-consumption without penalising consumers, who are not always able to consume all of their production, is also a way forward.

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