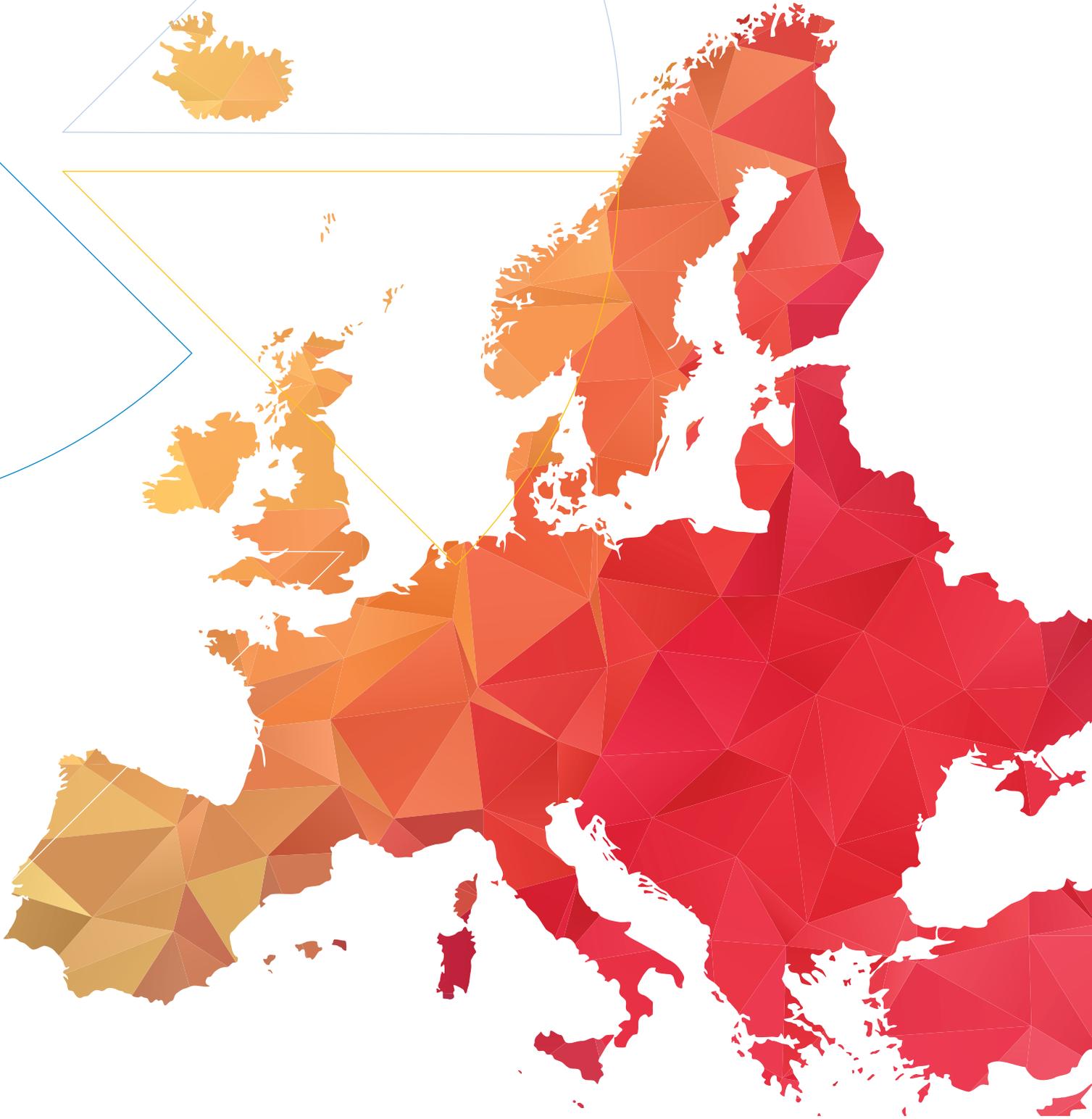


# European Market Outlook

## For Residential Battery Storage

2020–2024



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# FOREWORD

Welcome to SolarPower Europe's first European Market Outlook on Residential Battery Storage.

One of the key elements of the EU Clean Energy Package, adopted in 2019, is the creation of “new rules that make it easier for individuals to produce, store or sell their own energy, and strengthen consumer rights with more transparency on bills, and greater choice flexibility.” The core idea is to “place the consumer at the centre of the clean energy transition with new electricity market design rules to empower energy consumers to play an active role in driving the energy transition and to fully benefit from a less centralised, and more digitalised and sustainable energy system.”

This new 5-year outlook from SolarPower Europe, which will be published on an annual basis, tracks how the market for residential battery energy storage systems (BESS), one of the fundamental tools for energy prosumers, develops in Europe.

These devices are instrumental for citizens that want to personally contribute to Europe's energy transition, enabling them to utilise solar power even when the sun doesn't shine, and in consequence, also use much more of their home-made clean electricity at the point of generation. But battery storage not only serves individuals to green their power consumption and lower costs at home, it is also beneficial for the renewable energy-based power system serving society as a whole. Residential batteries, individual or aggregated, can provide flexibility, firmness, and balancing services, helping to stabilise electric grids in the new energy world based on variable power sources.

Our market research shows strong growth for home batteries in Europe. In 2019, a total of 745 MWh battery capacity from 96,000 systems was installed, representing a 57% year-on-year growth. However, over 90% of this capacity was added in only 5 countries (Germany, Italy, UK, Austria, Switzerland), of which one alone (Germany) was responsible for two thirds of the entire installation volume last year.

While the evolution of home storage is closely related to the development of residential solar markets in Europe, it also shows that leading markets with strong demand for small-scale PV, like the Netherlands, have no pull effects on battery usage at all. Here, full net metering support schemes that disincentivise self-consumption are leaving BESS out of the equation. The European experience also demonstrates that funding schemes have helped and continue to support people in leading markets to opt for storage solutions.

The good news is that power generated and self-consumed at home from solar and storage already beats retail power in countries with high retail electricity prices. With retail power prices trending upwards, and solar and storage continuing its cost reduction path, this green power solution is only increasing its economical attractiveness. In Germany, for example, battery attachment rates in today's residential solar market are over 90%.

Now, there needs to be strong efforts to quickly expand the momentum that can be seen in a few pioneering markets across Europe. With European Green Deal instruments, such as Next Generation EU Funds, and national recovery plans from the negative effects of COVID-19, there is a big toolbox available. Moreover, the various Clean Energy Package directives provide the manual with the right policy frameworks that only need to be implemented and executed appropriately to overcome existing barriers, such as double taxation.

We expect the residential storage market to grow slightly in 2020, as the major markets have been mostly using the right tools, and have even included financial support for the strategically important battery segment in their recovery packages, as is the case in Italy.

Although we assume low two-digit growth rates from 2021–2024, increasing capacities to around 7 GWh and about 1 million homes (from 2 GWh and 270,000 systems at the end of 2019) growth needs to dramatically accelerate to an unprecedented level. Our study, *100% Renewable Europe*, conducted with Finland's LUT University, modelled the needs for 1,600 GWh distributed BESS by 2050, when electricity storage will be the backbone of our energy system, covering up to 24% of European power demand. If European citizens are truly enabled to actively contribute and become the heart of the energy transition, this is entirely possible.

*Enjoy reading our European Market Outlook on Residential Battery Storage.*



WALBURGA  
HEMETSBERGER  
CEO, SOLARPOWER  
EUROPE



MICHAEL SCHMELA  
EXECUTIVE ADVISOR,  
SOLARPOWER  
EUROPE



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**Project manager:** Michael Schmela, SolarPower Europe.

**Authors:** Pierre d'Halluin, Raffaele Rossi & Michael Schmela, SolarPower Europe.

**Market intelligence:** Pierre d'Halluin, Omar Hatoum, Raffaele Rossi & Michael Schmela, SolarPower Europe.

**Text editing:** Lukas Clark-Memler, SolarPower Europe.

**External contributors:** EuPD Research; PV Austria (AT); EDORA & ODE (BE); AKU-BAT & Solární Asociace (CZ); European Energy (DK); Fortum (FI); Enerplan (FR); BVES & BSW-Solar (DE); HELAPCO (EL); Anie Rinnovabili & Italia Solare (IT); Energy Storage NL & Holland Solar (NL); PV POLAND (PL); APESF & APREN (PT); UNEF (ES); Svensk Solenergi & Energimyndigheten (SE); Swissolar (CH); STA (UK).

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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 and storage 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.

Residential solar and storage systems are defined as installations with a capacity below 10 kW<sub>PV</sub> / 10 kWh<sub>BESS</sub>. SolarPower Europe's methodology includes only grid-connected systems. Installed PV capacity is always expressed in DC.

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# POLICY RECOMMENDATIONS

**1. Actively promote a smooth and sound implementation of the provisions of the Clean Energy Package in all member states** and support them in transposing provisions into national legislation. In particular, it is paramount that the articles related to storage and prosumers are adequately implemented to remove market distortions and to create a level playing field for Battery Energy Storage Systems (BESS). This especially holds for the “active customer” framework with residential storage for which member states need to find simple forms of energy market participation for small scale customers. Thus far, National Energy and Climate Plans (NECPs) have included activities to promote flexibility and BESS only to a limited extent.<sup>1</sup> Current discussions on changing the policy frameworks in certain member states, such as Germany and Austria, are going against the direction indicated in the Clean Energy Package. It should be required to add in all NECPs explicit measures to support BESS deployment, and to steer national policy discussion towards the objectives of the Clean Energy Package.

**2. Leverage Next Generation EU funds to enhance and prioritise BESS deployment.** With 37% of Next Generation EU funds allocated to fulfilling the objectives of the European Green Deal, significant funding opportunities are available to promote distributed storage as a key enabler of the energy transition:

**a. National Recovery and Resilience Plans** should include financing for distributed storage support measures, such as direct and indirect subsidy schemes. These measures should be supported by

additional policy tools, such as solar mandates coupled with storage and dynamic tariffs;

**b. Flagship initiatives** by the EU Commission, such as the Renovation Wave, should also prioritise distributed BESS as a key cost-effective tool to improve energy efficiency in buildings;

**c. InvestEU strategic European investment window** should recognise BESS as a separate strategic value chain for the energy transition – for strengthening the EU industrial base and for job creation. It should be supported through the establishment of industrial ecosystems that cover the whole value chain: from the provision of raw materials, through cell and battery manufacturing, to installation and sale at the local level.

**3. Acknowledge the pivotal role of distributed BESS in the energy transition.** In a 100% renewable energy system, electricity storage becomes crucial in providing an uninterrupted energy supply, backing up to 24% of European electricity demand. In order to do so, distributed BESS installed capacity need to surge to 900 GWh by 2030 and 1,600 GWh by 2050, an immense growth from the level installed today.<sup>2</sup> European and national policymakers should recognise this huge potential and promote distributed storage in their energy and climate plans.

**4. Modernise the grid for storage to fulfil its full potential in providing flexibility to the energy system.** Increasing focus is needed on strengthening the distribution grid level and for the rollout of smart meters. Network operators and policymakers should give more prominence to the role of distributed RES throughout all phases of grid planning processes.

<sup>1</sup> SolarPower Europe's analysis of the final National Energy and Climate Plans.

<sup>2</sup> SolarPower Europe & LUT University (2020): *100% Renewable Europe: How To Make Europe's Energy System Climate-Neutral Before 2050*.

# POLICY RECOMMENDATIONS / CONTINUED

## Policies to support distributed BESS

When looking at the energy transition and the decarbonisation of the EU economy, BESS will play a pivotal role in a renewable-based power system. By providing flexibility and fast balancing services, BESS technologies provide all the conditions that are vital for maximising the integration of high shares of variable renewable energy sources (VRES), as well as the grid integration of electric transport.

From a power system perspective, BESS technologies bring significant benefits, including:

- Injecting and absorbing electricity extremely fast (<50 ms), with higher accuracy than conventional generators, to provide power system reliability services;
- Improving short-term variability, fostering the penetration of higher shares of renewables in the power system;
- Eliminating production and load peaks, reducing network costs and investments needs;
- Making solar fully dispatchable, optimising the supply of solar energy in line with the power system needs;

- Storing solar electricity when prices are low, using it when prices are high, allowing energy prices to stabilise;
- Rebooting grid operations in the event of power outage.

The provisions included in the Clean Energy Package, specifically in the Market Design Regulation 2019/943 and Market Design Directive 2019/944, constitute a solid basis for BESS. Opening up new markets for storage – such as frequency response, energy shifting, reactive power, balancing – strongly support its business case, especially if properly matched with the possibility of stacking several services and removing financial disincentives to simultaneously store renewable energy and provide flexibility services to the grid.

On top of setting up a strong legislative framework enabling BESS technologies to deploy their full potential, there are additional measures that can be taken by policymakers to speed up their uptake. The following list outlines different ways that governments can support BESS integration to enhance renewable deployment while creating a more flexible and reliable grid.

### a. Direct financial incentives for end consumers

The fastest and most direct way to support the deployment of residential storage are cash subsidies based on the kWh of the storage system, where PV customers are incentivised to add a BESS to their PV systems through a lump-sum payment subsidy that reduces the upfront costs of the installation. This boosts self-consumption shares for households and helps grid stability in areas with a high penetration of distributed PV. In this manner, the direct financial incentive can be compensated by a reduction of the overall network charges. Flat subsidies (e.g. EUR 2,000 per BESS) have proven ineffective because they incentivise adding BESS with sub-optimal energy capacity, whereas incentive programs composed of a fixed fraction plus an additional variable fraction based on energy content (kWh), or solely on the variable fraction, have been more successful. Several direct BESS incentive programs are found at regional level across EU countries, including Germany, Italy, Austria, and Belgium. Regional support programs in place today tend to have funding allocated on a year-by-year basis, reducing market certainty over the medium term. Clear visibility of the duration of the incentive program would be highly beneficial to investors. Moreover, appropriate funding should be allocated to the support program, especially if it is designed with a first come, first served criterion.

**EASE OF IMPLEMENTATION:** ★★ ★  
**IMPACT ON STORAGE:** ★★ ★  
**EXAMPLE POLICIES:** GERMANY, ITALY, AUSTRIA, BELGIUM

**EXAMPLE POLICY:** GERMAN FEDERAL STATES (10 OUT OF 16) SUPPORT STORAGE THROUGH DIRECT UPFRONT SUBSIDIES, TYPICALLY WITH ENERGY CONTENT-BASED INCENTIVES RANGING BETWEEN EUR 200–300 PER KWH.

**b. Tax Depreciation for Storage Installations**

Storage can also be incentivised through a depreciation mechanism within a citizen’s yearly income or corporate tax statement. By qualifying storage as a favourable technology with tax advantages, commercial and private users can deduct the investment of a battery from their tax obligations by a certain percentage of their income or corporate tax. This minimises administrative work for the government and the house owner because no separate grant application system is required. At the same time, the indirect impact through tax alleviations might lower consumer visibility of the grant (and, therefore, might be less effective than direct subsidies).

<b>EASE OF IMPLEMENTATION:</b> ★★★★★	<b>EXAMPLE POLICY:</b> ITALY OFFERS THE OPTION TO DEDUCT 50% (E.G. EUR 4,000) OF THE BESS VALUE FROM THE ANNUAL TAX INCIDENCE. THE NETHERLANDS ALLOWS BUSINESSES TO DEPRECIATE THE INVESTMENT OVER THREE YEARS.
<b>IMPACT ON STORAGE:</b> ★★★★★	
<b>EXAMPLE POLICIES:</b> ITALY (DETRAZIONE FISCALE), NETHERLANDS (ENERGY INVESTMENT DEDUCTION)	

**c. Integrated Building Renovations and Efficiency Standards**

States can offer grants for private and commercial customers to carry out integrated renovations to decarbonise buildings. Alongside energy efficiency improvements and the deployment of on-site renewables, BESS technologies are cost-effective solutions that deliver high energy efficiency and increase self-consumption rates and should be therefore included in the scope of these policies. Such measures should also be implemented along minimum efficiency standards for buildings to drive the upgrade of buildings with low energy performance. Given the complexity around efficiency metrics, this policy could need a longer timeframe – the medium-term horizon – to be implemented.

<b>EASE OF IMPLEMENTATION:</b> ★☆☆☆☆	<b>EXAMPLE POLICY:</b> ITALY HAS COMBINED A RENOVATION STIMULUS WITH THE OPTION TO DEDUCT PV & STORAGE BY 110% FROM THE ANNUAL TAX BILL (I.E. PV & STORAGE COMES FOR FREE ONCE A HOUSE RECEIVES AN EFFICIENCY RENOVATION).
<b>IMPACT ON STORAGE:</b> ★★★★★	
<b>EXAMPLE POLICIES:</b> ITALY, SCOTLAND	

**d. Solar Mandates coupled with storage**

Instead of incentivising efficiency measures, solar mandates make PV installations mandatory on every roof. The measure can either include retrofitting old roofs or only future constructions. It is paramount to take into account the grid integration effects of a large-scale deployment of PV installations, e.g. in residential areas. One option to match this capacity growth with appropriate system flexibility is by adding the possibility to have part of the mandated requirement met with BESS capacity. This would ensure that generated electricity is used at a later stage while the grid is kept balanced during the times of high production and low consumption.

<b>EASE OF IMPLEMENTATION:</b> ★☆☆☆☆	<b>EXAMPLE POLICY:</b> CALIFORNIA’S SOLAR MANDATE HAS COME INTO EFFECT IN EARLY 2020 AND REQUIRES ALL RESIDENTIAL BUILDINGS (LOWER THAN THREE STORIES) TO ADD ENOUGH PV TO, ON AVERAGE, OFFSET THE ANNUAL AVERAGE ENERGY DEMAND OF THE HOUSEHOLD. THE POLICY OFFERS THE POSSIBILITY TO TRADE IN OBLIGATORY PV “CREDITS” THROUGH “STORAGE” CREDITS.
<b>IMPACT ON STORAGE:</b> ★★★★★	
<b>EXAMPLE POLICIES:</b> USA (CALIFORNIA), GERMANY (BADEN-WÜRTTEMBERG)	

## e. Tax Exemptions to Prosumers

Although they do not provide a direct incentive to storage, an additional set of measures to take into account as support policies to battery storage are indirect incentives in the form of support schemes to prosumers, such as exemption from charges, fees, and taxes on the self-consumed electricity. These measures encourage prosumers to maximise their self-consumption ratio, thereby incentivising investment into storage. By extension, measures strengthening the prosumer business case, such as enabling citizen energy communities on a local level and supporting the right to self-consume, are often also beneficial to battery storage.

The Renewable Energy Directive provides for an exemption from charges and fees on self-consumed electricity for prosumers with a PV capacity below 30 kW. The provision must be transposed into national law by 1 July 2021, but tax, charges, or fee exemptions already exist in many Member States. The implementation of this policy has a medium level of complexity, considering that it might require a minimum level of advanced metering system. The 30 kW threshold limits the self-consumption incentives to residential and small commercial systems, although in implementing this provision in their national law, Member States could set a higher value and extend the benefit to larger distributed systems. It should be noted that the current discussions in Europe (e.g. Spain, Belgium, Netherlands) to increase the fixed, capacity-based share in the grid tariff lowers the business case for prosumers based on grid fee exemption.

**EASE OF IMPLEMENTATION:** ★★☆☆

**IMPACT ON STORAGE:** ★★☆☆

**EXAMPLE POLICIES:** FRANCE, SWEDEN, GERMANY, SPAIN, ITALY

**EXAMPLE POLICY:** IN FRANCE, SELF-CONSUMED ELECTRICITY IS EXEMPTED FROM TAXES UP TO 1 MW FOR SYSTEMS THAT INJECT ELECTRICITY IN THE GRID, AND UP TO 240 GWH/YEAR WHEN ELECTRICITY IS FULLY CONSUMED ON SITE. IN SWEDEN, PROSUMERS WITH SYSTEMS BELOW 500 KW ARE EXEMPTED FROM THE ENERGY TAX ON SELF-CONSUMED ELECTRICITY.

## f. Time-of-use tariffs

An additional indirect incentive to BESS is constituted by time-of-use (ToU) tariffs, which incentivise consumers to adapt their electricity demand in response to time-varying electricity prices. Such tariffs are meant to reflect the actual cost of electricity at the time it is being consumed. With electricity prices varying throughout the day and between the working days and the weekend, end customers are therefore exposed to cost-reflective price signals and are nudged to adjust their demand profile in order to reduce their energy bills. The use of ToU tariffs creates a more flexible and reliable grid. If energy prices from the wholesale market and dynamic network charges are handed down to the end-customer, BESS are able to react to these prices. The battery will charge and store energy during low prices (high generation, low demand). During high prices (low generation, high demand), BESS can either supply the household or even sell the energy back to the system if energy arbitrage is allowed. In a landscape of more and more liberalised EU electricity markets, ToU tariffs benefit from the increased competition among retailers while acting as a driver for innovative business models. Extensive smart meter rollout and network surveillance technology is a necessary precondition for such types of tariff structure, and should be incentivised by governments. Further, along with the Clean Energy Package, member states need to avoid disproportionate administrative and technical procedures (e.g. extensive metering obligations) to participate with ToU tariffs.

**EASE OF IMPLEMENTATION:** ★★☆☆

**IMPACT ON STORAGE:** ★★☆☆

**EXAMPLE POLICIES:** FINLAND, UK

**EXAMPLE POLICY:** IN FINLAND, ALL CUSTOMERS CAN OPT FOR DYNAMIC TARIFF PRICES FOR ELECTRICITY, WHOSE HOURLY COST IS DETERMINED THE DAY AHEAD BASED ON WHOLESALE MARKET PRICES. CUSTOMERS PAY TO THE RETAILER A MONTHLY FIXED FEE PLUS THE HOURLY PRICES FOR ELECTRICITY CONSUMPTION.

# EXECUTIVE SUMMARY

SolarPower Europe's first European Market Outlook on Residential Battery Storage 2020–2024 shows an emerging technology sector with high prospects that builds on a strong initial growth phase. Last year, 745 MWh from 96,000 systems were installed, representing a 57% annual growth rate. The foundation for the European residential BESS sector was laid by a handful of countries, where a large residential solar market already exists – namely Germany, Italy, UK, Austria, and Switzerland. These Top 5 markets absorbed over 90% of all BESS installations in 2019 and are also responsible for a similar level of the nearly 2 GWh of operating residential storage capacity in Europe so far.

There are two main drivers for homeowners investing in solar and storage: emotions and economics. The move away from full feed-in tariffs to self-consumption has enabled homeowners to consume their green power product themselves, and with batteries this is possible to a larger extent providing a high degree of power independence. While power from solar rooftop systems has already been much cheaper than retail electricity in most European markets for several years, battery storage's rapid cost improvements are now enabling solar and storage to beat grid power as well in an increasing number of European countries. Different incentive schemes have been helping customers in their decision-making to add batteries when buying solar systems.

2020 is expected to see only 9% in market growth. The main reason is the COVID-19 pandemic that has been negatively impacting demand for solar & storage in several European countries, although this would be much less than feared due to the resilience of the German market, and solar & storage financial support from economic stimulus packages in other key markets, such as Italy and Switzerland.

According to our Mid-Scenario, by 2021, the yearly growth rate is expected to be in the two-digit range again, catching up after the COVID-19 slowdown, and boosted by recovery packages. This scenario anticipates implementation of the EU Clean Energy Package prosumer provisions over the next few years, eliminating many of the barriers standing in the way between the customer and a battery storage system for their home. Overall, our most likely scenario expects the 1 GWh storage capacity addition threshold to be reached in 2022, which corresponds to approximately 140,000 new systems installed per year.

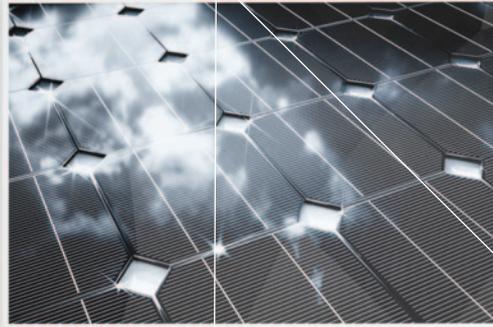
Our 5-year residential battery storage outlook anticipates for the most-likely Medium Scenario that capacities will be 7.2 GWh in 2024. But under optimal conditions, Europe's prosumers could operate a battery fleet as large as 9 GWh by the end of 2024, compared to 5.6 GWh in the Low Scenario.

For the coming years, there will be only one clear leader in the field of residential energy storage: Europe's largest economy, Germany, will be the unchallenged Number 1, followed by Italy by some distance. With strong government support, Austria will overtake the UK, where both residential solar and storage now fully rely on market forces. With solar supported by COVID-19 recovery funds, home storage in Switzerland is expected to be the fifth largest European market until 2024. As the cost of storage is quickly decreasing and backed by national and regional policy initiatives, private prosumers in several other European markets will increasingly embrace solar and stationary batteries as well.

However, in order to accelerate battery storage market growth in Europe to the levels required to meet the EU's ambitious energy transition targets, we need a toolbox of different instruments – from acknowledgment of the potential of distributed BESS, policy frameworks, the right support mechanisms, to making grids fit for batteries (see Policy Recommendations on p. 5).

# 1 ENERGY STORAGE

## INTRODUCTION



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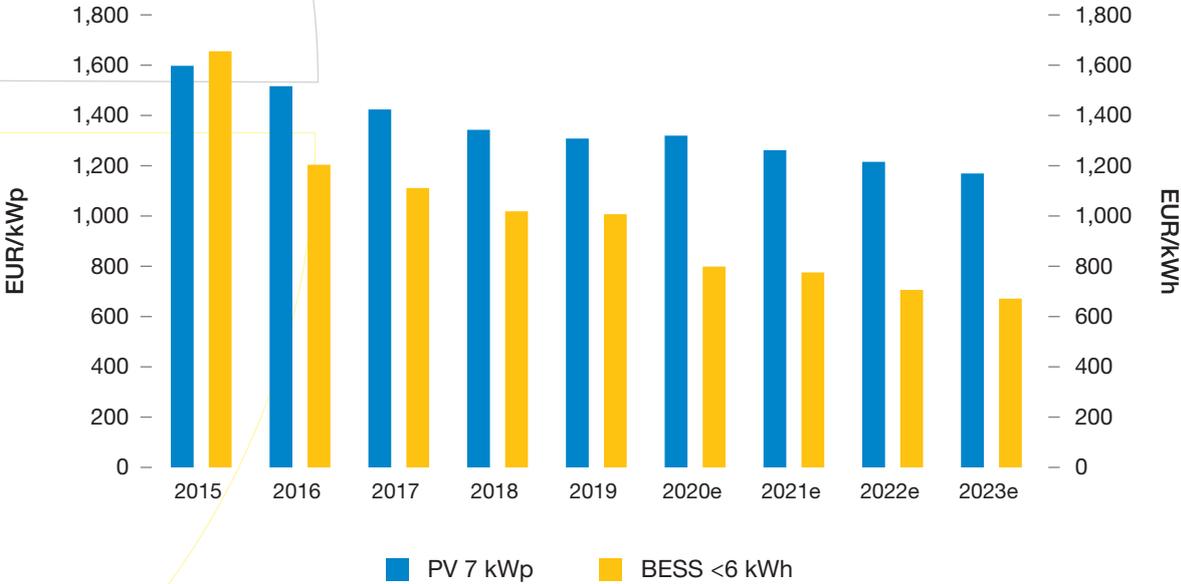
Battery storage for homes has become very popular in a number of European countries. In the leading markets, storage attachment to residential solar systems is over 90%. That has several motivations, which can be all grouped under two main drivers: **emotions** and **economics**.

The move away from full feed-in tariffs to self-consumption has enabled homeowners to consume their green power product themselves, and with batteries this is possible to a larger extent and at the time of their choice. Solar and storage provides a certain degree of power independency, while prosumers can still enjoy the benefits and long-time appreciated safety of the public/investor-owned distribution grids.

Kick-started with subsidies, the rapid and continuing decrease of cost and prices for solar systems and, in recent years, also battery energy storage systems have made these two technologies increasingly attractive to homeowners.

In Germany, Europe's largest solar & storage market by far, between 2015–2019, prices have fallen by around 18% for small solar systems and nearly 40% for home storage solutions (see Fig. 1.1). For the next few years until 2023, a further 10% price decrease is expected for the well-established residential solar systems market, and a steeper 33% reduction for the much younger BESS segment.

FIGURE 1.1 SURVEY OF RESIDENTIAL SOLAR AND STORAGE PRICES IN GERMANY, 2015-2023



Source: EuPD Research (2020).

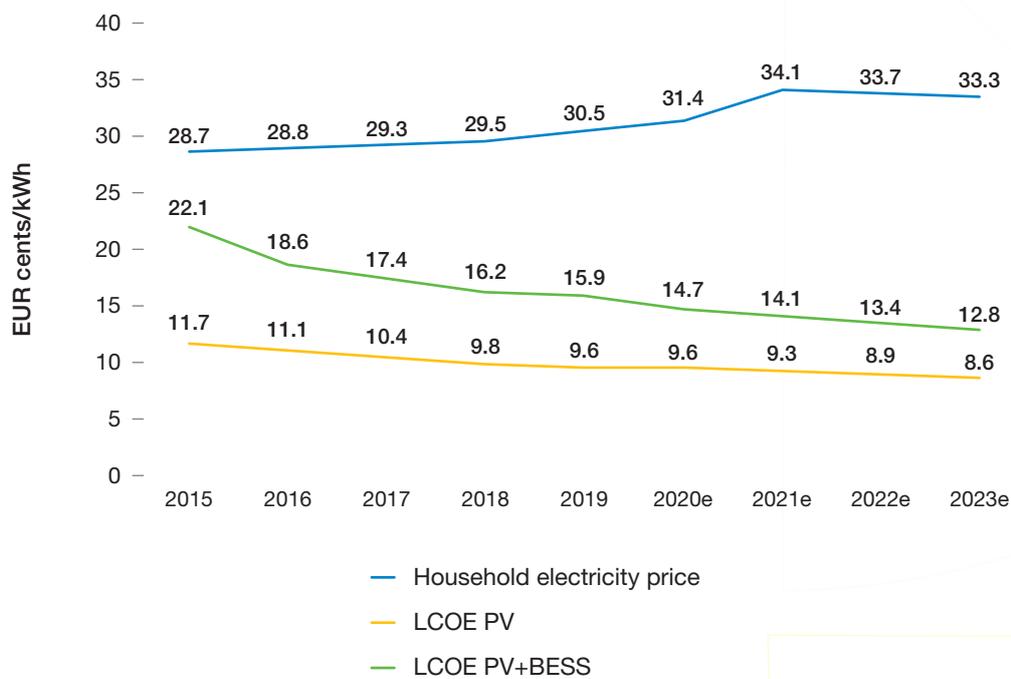
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The spread between increasing retail power prices, on the one hand, and solar and storage power prices, on the other, is widening, making the promise of solar and storage even more appealing at a time when national support schemes for pure residential solar systems in Europe are tendentially being phased out.

While power from solar rooftop systems has already been much cheaper than retail electricity in most European markets for several years, battery storage’s rapid cost improvements are now enabling solar plus storage to beat grid power as well in an increasing number of European countries. In Germany, best-in-class solar plus storage systems reach LCOEs of 14.7 EUR cents/kWh today, which is nearly half of the typical electricity price, one of the highest in Europe (see Fig. 1.2).

# 1 INTRODUCTION / CONTINUED

FIGURE 1.2 COMPARISON OF HOUSEHOLD ELECTRICITY PRICES AND COST OF SOLAR AND STORAGE IN GERMANY



Note: Household electricity prices for consumption Band Dc with annual consumption between 2,500 and 5,000 kWh.  
Source: EuPD Research (2020).

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With electricity prices generally continuing an upwards trend not only in Germany but across Europe, plus the continually reducing costs for storage systems, the economics for residential solar and storage are only improving. Bloomberg NEF forecasts a 7% per year decrease in the capital cost for residential energy storage system for the coming years.

Altogether, these drivers will eventually lead residential solar and storage systems to grid parity on the entire European continent, and the faster national policy frameworks are adapted in accordance with EU directives to enable solar and storage to play out its competitive advantages.

 BATTERY SYSTEM



# 2

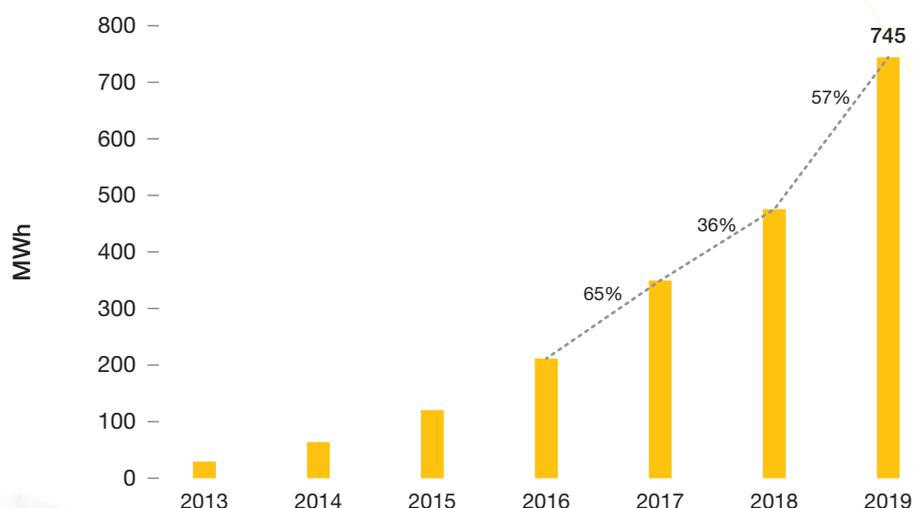
## RESIDENTIAL SOLAR & STORAGE MARKETS IN EUROPE TODAY

Since the beginning of the residential battery energy storage business in Europe, the trajectory has only gone in one direction: up! The starting point for the technology in Europe was pushed in Germany, where home storage started to gain traction in 2013, after the feed-in tariff law for solar systems was changed from full FiTs, to a model supporting self-consumption in combination with premium FiTs for excess power.

In subsequent years, Italy and UK, two other leading solar markets at later points in time with a notable volume of installed residential solar system capacity, saw first deployments of BESS while growth continued in Germany.

Up until 2017, Germany, Italy, and the UK remained the primary markets with 90% of overall installations. At that time, the total residential storage capacity installed in Europe accounted for 350 MWh, and approximately 2% of all residential solar PV systems across Europe were coupled with a battery. In the following years Austria, France, and Switzerland also saw growing deployment of home battery storage systems. In 2018, 65,500 residential BESS systems were commissioned across Europe, with a total capacity of 505 MWh, while doubling of demand for solar systems in 2019 pulled residential storage installations as well: last year, additions grew by 57% to 745 MWh (see Fig. 2.1).

FIGURE 2.1 EUROPE RESIDENTIAL BESS ANNUAL MARKET 2013-2019

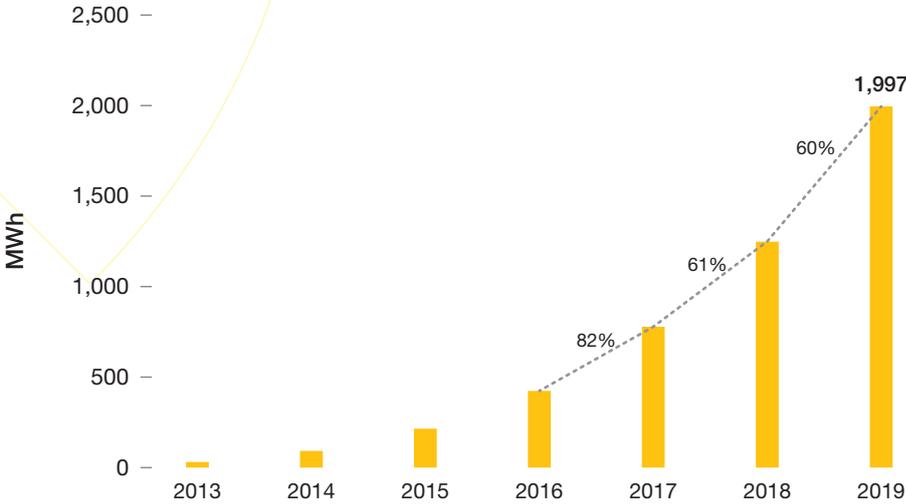


This strong growth has led to a total installed residential storage capacity of nearly 2 GWh by the end of 2019 (see Fig. 2.2). Taking residential BESS into perspective with its solar peer, it accounted for approximately 7% of the total residential PV systems in operation in Europe. Even though the attachment share is rising, the untapped market potential for BESS is gigantic, especially when taking into account that over 90% of European buildings are still without solar systems.

**The Top 5 European Residential Storage Markets**

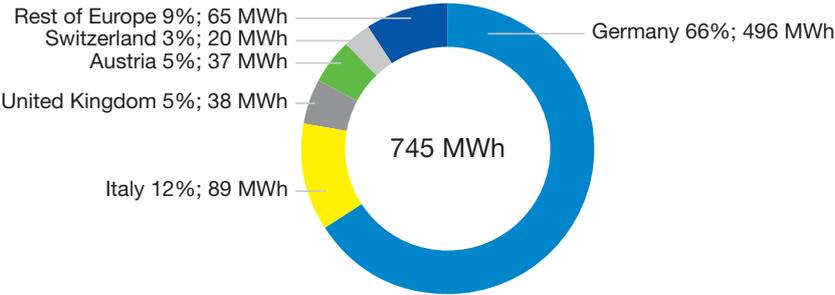
Stationary battery storage for European homes today is driven by a handful of pioneers. As in solar, Germany is the largest single BESS market in Europe by far, responsible for two of three units installed in homes in 2019. While the 4 next biggest markets – Italy, UK, Austria, and Switzerland – added 25% of the residential BESS capacity in 2019, all other countries shared a mere 9% of the market volume of 745 MWh (see Fig. 2.3).

FIGURE 2.2 EUROPE RESIDENTIAL BESS CUMULATIVE MARKET 2013-2019



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FIGURE 2.3 EUROPE TOP 5 RESIDENTIAL BESS MARKETS 2019



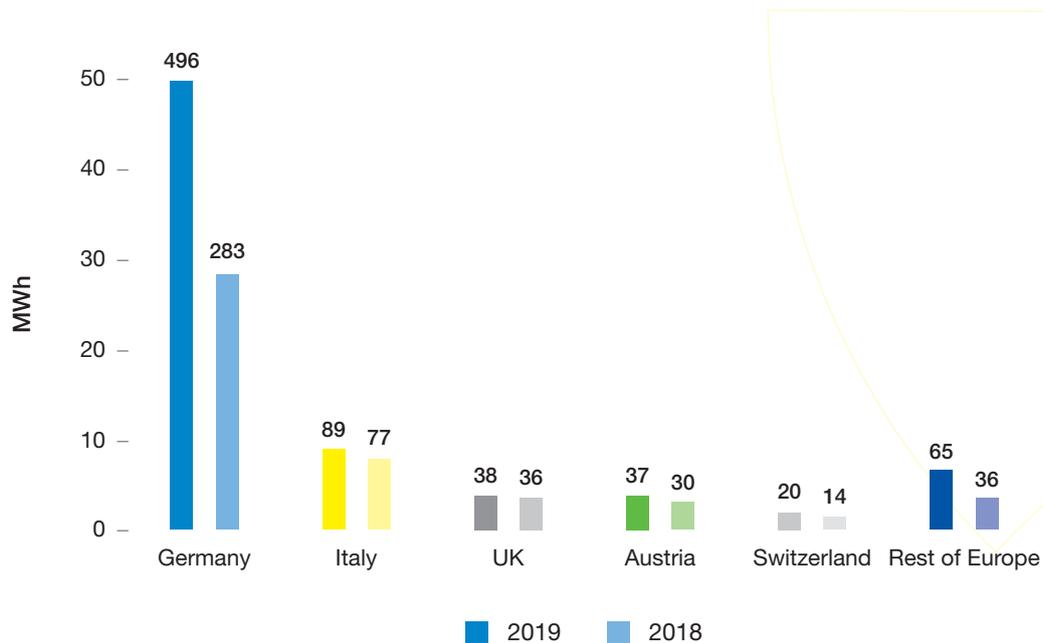
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## 2 RESIDENTIAL SOLAR & STORAGE MARKETS IN EUROPE TODAY / CONTINUED

Germany remains the undisputed leader in Europe in installations of both residential solar PV and residential battery storage systems last year (see Fig. 2.4). In 2019, 63,000 residential BESS were commissioned, with a total capacity of around 496 MWh. This resulted in a 75% annual growth in residential storage capacity in comparison with 2018. This rate was surprisingly higher than in previous years, ranging between 26% in 2018 and 65% in 2017, although the KfW financial support mechanism had expired in 2018. But nearly two thirds of German states have been offering support schemes for residential storage systems. Moreover, the economics of solar and storage is compelling, and with interest rates at historically low levels plus the absolute investment sum rather low, Germans opted for solar and storage packages, resulting in attachment rates of over 90%.

Generous subsidies allowed the Italian market to quickly develop and become the second largest market for residential BESS in 2016. In 2019, about 9,000 residential BESS were commissioned in the country, with an overall additional capacity of around 90 MWh. This corresponds to a 16% growth in comparison to the 77 MWh installed in 2018. The Italian home battery market has been driven and maintains its attractiveness by strong public support schemes. The national fiscal incentive for small-scale solar PV, a tax credit covering 50% of the CAPEX for any homeowner installing a PV system, has been extended to residential BESS in early 2018. In addition, the region of Veneto offered financial grants to promote the coupling of a battery with residential PV systems in 2019, while Lombardy is still continuing this type of support. In late 2019, Friuli Venezia Giulia started paying subsidies for home batteries and solar.

FIGURE 2.4 EUROPE TOP 5 RESIDENTIAL BESS MARKETS 2018-2019



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**In the UK, the third European core home storage market after Germany and Italy, residential BESS has only seen little growth in 2019, limited by the low residential solar PV market.** In 2019, 5,000 residential BESS, equal to around 38 MWh were commissioned across the country, while 36 MWh were registered in 2018, resulting in a 6% growth in additional capacity. The residential solar PV market slowed down dramatically from 2016–2018, following the drastic reduction of feed-in rates in the UK rooftop solar PV programme. After completely closing the PV rooftop and the Smart Export Guarantee regulation in 2019, both residential solar and storage now rely solely on free market forces. Energy retailers are now entitled to provide prosumers with specific tariff structures and have the possibility to include battery storage in their equations.

**Austria has developed into as a big player in the European residential storage sector over the last few years.** With about 37 MWh of residential storage capacity commissioned last year (corresponding to around 5,500 individual systems), the residential BESS market saw a 23% growth rate compared to 2018. In September 2018, the Austrian Government published its #Mission2030 programme, which identified 12 flagship projects for decarbonising Austria's energy system. One of them aims at 100,000 rooftop PV systems and small-scale storage installations. To support this ambitious target, an investment subsidy scheme for small-scale solar that was launched in 2017 was extended to cover battery storage in 2018 and renewed again in 2019.

**In France, the low retail electricity price of around 0.18 EUR/kWh is still a major barrier to the residential battery business take-off.** Although the EU's second largest economy has over 300,000 residential solar PV installations across the country, the home storage segment is still small. The storage capacity installed in 2019 stagnated compared to 2018, resulting in only 3,500 new systems for an overall capacity of around 14 MWh. Residential BESS in France is still at an early stage where the small group of technology-aware customers is opting for low-capacity batteries.

The situation in **Switzerland** was similar to France in 2019. Even though the market saw a 43% increase in new residential storage capacity additions to around 20 MWh equal to 2,500 units, up from 14 MWh or about 1,500 units in 2018, demand remained limited partly due to the low electricity price of 0.20 EUR/kWh when compared to market leader Germany. However, the high average income in Switzerland, as well as the high penetration of battery technologies among the country's PV installers, resulted in a storage attachment rate of 25% of new sales, which means that 1 in 4 solar system buyers also opted for a battery.

**In total, the Top 5 European residential storage markets were responsible for over 90% of the 2019 installed capacity in the region.**

**In the remaining European countries, the residential battery storage market remains at an early stage of development, or is even non-existent as of today.** While the rest of Europe added 65 MWh in 2019, up from 36 MWh the year before, it is still less than the additions in Europe's second largest market, Italy. In countries with very large residential solar PV markets, like the Netherlands and Belgium, the net-metering solar incentive schemes have done the opposite of what they did for PV – instead blocking the creation of a residential BESS market. In the Nordics, where residential solar PV has just started to emerge as decreasing costs have reached levels that make the technology also attractive in less sunny countries, a large potential for the development of storage remains untapped (with the exception of Sweden, which has offered attractive subsidies for both residential solar and storage). Blessed by high irradiation, Spain, as one of Europe's solar pioneers, is about to enter the battery storage map as well. As of 2019, home owners are now also eligible to invest in solar and battery systems. On the other hand, most eastern European countries continue to have low retail electricity prices and lack subsidies for batteries.

Overall, the cumulative residential storage capacity installed in Europe reached 2 GWh from 270,000 systems by the end of 2019, registering a 59% growth over 2018.

## 2 RESIDENTIAL SOLAR & STORAGE MARKETS IN EUROPE TODAY / CONTINUED

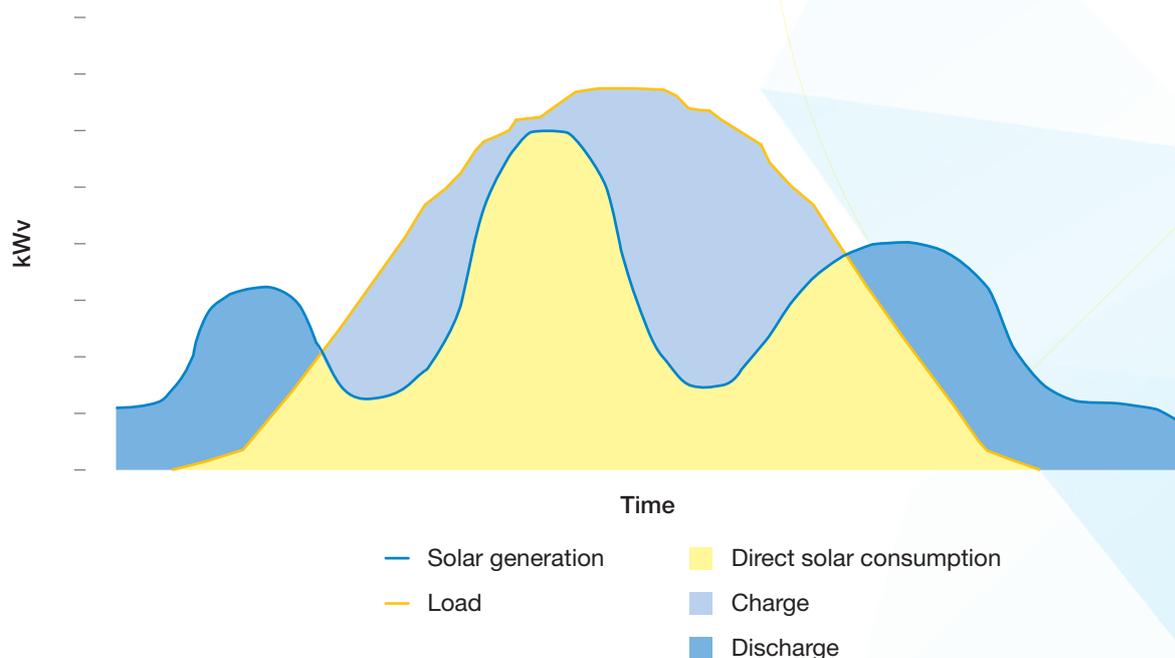
### BOX 2 THE BENEFITS OF A RESIDENTIAL SOLAR & STORAGE IN LIGHT OF DIFFERENT REGULATIONS TO EXPORT ELECTRICITY TO THE GRIDS IN EUROPE

The primary value of coupling a residential solar PV system with a BESS is to optimise the local use of the energy produced. Small-scale solar PV is attractive because it allows homeowners to produce their own clean and cheap electricity. Moreover, thanks to various state support schemes, this investment often ends-up being highly valuable and offering an interesting return rate. However, a home equipped with solar PV panels self-consumes only between 20–35% of the electricity generated, the remaining much larger share is being exported to the grid. This is due to the fact that the solar PV system’s peak production is reached around midday, whereas the home load is high either in the morning or in the evening, outside of work-time hours. A residential BESS, allowing to store excess electricity produced during the day in order to consume it at night, increases

the self-consumption rate of the installation up to between 60–90%. Therefore, the coupling of solar and storage at a residential level lead to an improvement of the incumbent homes self-sufficiency (i.e. the share of their load that is covered by electricity produced from their PV panels).

In addition to the emotional value of being less dependent on the grid, a better self-sufficiency allows for substantial savings on the electricity bill. This economic value of increasing the proportion of energy consumed on-site depends – alongside the retail electricity cost and the cost components – on the compensation for excess electricity exported to the grid. This could be based on the wholesale rate at which an energy retailer would usually buy a kWh of electricity, but many governments have implemented support mechanisms for small-scale PV that often still consist of premium feed-in tariffs (see Table 2.1, p. 20). Therefore, the gap between the import and export power rates for household prosumers vary dramatically depending on the country and thus have different impacts on the direct economic value of self-consumption.

FIGURE 2.5 SOLAR PLUS STORAGE GENERATION PATTERN



Source: Solar Power Europe (2018): *Unleashing the potential of Solar & Storage*.

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3 Lightsource, Good Energy and Foresight Group (2015): *The Decentralised Energy Transition*.

## VARIOUS MECHANISMS FOR ELECTRICITY EXPORTED TO THE GRID BY RESIDENTIAL PROSUMERS

- **Feed-in tariff/premium.** Launched for the first time in Europe by the German Renewable Energy Act (EEG) in 2000, feed-in tariffs (FITs) consists of a fixed rate, set at a national level by the government, at which any individual with an eligible renewable energy plant can sell the electricity produced locally to the grid. FITs are usually contracted for a defined time period from the plant's commissioning (typically 20 years) and depend on the plant technology and size. During the first steps of their implementation, FITs were often very high to incentivise large investments in renewable energy generation. However, in the countries where they are still in force, the rates for solar PV plants have been steadily decreased in accordance with the falling price of the technology - and the growing gap with the retail electricity price is creating value for residential BESS. Feed-in premium (FIP) schemes follow the same rationale, but rather than a fixed tariff, generators are paid a fixed or variable premium in addition to the market price.
- 2. **Net-metering.** In this scheme, every kWh exported to the grid by a prosumer from his electricity generation plant would be deducted from his electricity bill. Therefore, the grid plays the role of an unlimited virtual storage, which allows to use at night electricity that has been produced during the day. This mechanism is a very strong support mechanism for decentralised renewable electricity generation, but it prevents any development of the decentralised electricity storage market. It can be structured as full net-metering or partial net-metering, whereby only a percentage of the electricity exported to the grid is deducted from the electricity bill.
- 3. **Net-billing.** In this scheme, similarly to net-metering, generators are compensated by the energy fed into the grid with an equivalent reduction on the electricity bill. However, under the net-billing scheme, the compensation amounts to the actual electricity price at time of injection. In other words, the final electricity bill is the result of the difference between the value of electricity consumed and the value of the electricity fed into the grid.
- 4. **Market-based mechanism.** In more liberalised energy markets, governments do not subsidise decentralised renewable electricity generation plants anymore. Instead, energy retailers are entitled to provide prosumers with specific buy/sell contracts, which include a financial compensation for any kWh exported by their clients to the grid. This mechanism offers more flexibility for energy retailers to create innovative tariffs structures, for instance including the benefits of coupled solar and storage installations at a residential level, but only if the policy framework conditions are set right.

Obviously, countries can implement power export regulations in very different ways (as long as they adhere to European guidelines), but the four types listed in the table are the common basis. As the competitiveness of renewables only improves, the EU's power markets increasingly evolve towards market-based mechanisms and the progressive phase-out of overly generous incentives for green electricity fed into the grid as it was known in the past. The Clean Energy Package includes provisions not to have new net-metering mechanisms past 2023, while at the same time several European countries that still use this incentive scheme have plans to phase it out (see Table 2.1, p. 20). This move will shape the role of prosumers across the EU and support the development of residential BESS as homeowners will have to increase self-consumption rates of their

residential solar PV installations if they want to make the most out of it.

The economic value of increased self-consumption is still the only incentive for residential BESS in most European countries. However, the flexibility it provides and the smart energy management tools that often come together with it offer many perspectives for innovative solar and storage business cases. With the opening of the capacity and flexibility markets to decentralized assets there is also a potential for **aggregation** of different services and Virtual Power Plants (VPP) to unlock new revenue streams for residential batteries. In addition, **collective self-consumption**, energy communities and peer-to-peer trading are new trends that are worth looking at as they will enable a better use of decentralised assets and potentially involve electricity storage.

## 2 RESIDENTIAL SOLAR & STORAGE MARKETS IN EUROPE TODAY / CONTINUED

TABLE 2.1 OVERALL FRAMEWORK FOR PROSUMER ELECTRICITY EXPORT IN SELECTED EUROPEAN COUNTRIES

COUNTRY	REGULATION TYPE	RETAIL ELECTRICITY RATE 2019 (EUR/KWH)	AVERAGE POWER EXPORT RATE FOR RESIDENTIAL PV SYSTEMS 2019 (EUR/KWH)	COMMENTS	FUTURE EVOLUTION
Austria	Feed-in tariff	0.2034	0.0767	13-years duration contracts, available for PV systems with a capacity between 5 and 200 kW, the rate is updated yearly on a downward trend.	The government is currently discussing the revision of the FiT scheme.
Belgium	Full net-metering	0.2839	/	Available for PV systems below 10 kW; a green certificates system is established in the whole country.	Phased out in Flanders, Wallonia to retain it for now; the government is planning to introduce in 2022 capacity tariffs, injection taxes and dynamic price contracts.
Czech Republic	Market-based	0.1748	n.a.	Most energy retailers offer buy/sell contracts options for prosumers.	No changes planned.
Denmark	Market-based	0.2984	/	The previous net-metering scheme in place for residential systems has been substituted with a remuneration based on market price excluding balancing costs. New installations can choose among different remuneration options.	No changes planned.
Finland	Market-based	0.1734	0.04	Most energy retailers offer buy/sell contract options for prosumers; the export rate is typically equal to the wholesale electricity price minus a commission added by the retailer.	A net-billing scheme based on the hourly spot market is currently under assessment.
France	Feed-in tariff	0.1778	0.1	20-years duration contracts, available for PV systems below 100 kW.	No changes planned.
Germany	Feed-in tariff	0.3088	0.11	20-years duration contracts, opened to PV systems below 10 kW; the FIT is regularly mostly decreased depending on newly installed capacities.	The government is currently discussing the revision of the FiT scheme.
Greece	Full net-metering	0.1595	/		No changes planned.
Hungary	Full net-metering	0.112	/	Available for PV systems below 50 kW.	No changes planned.
Ireland	No mandatory compensation	0.2423	0	Prosumers exporting excess electricity to the grid are not compensated.	Irish government committed to implement a feed-in tariff mechanism by 2021 at the latest.

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COUNTRY	REGULATION TYPE	RETAIL ELECTRICITY RATE (EUR/KWH)	AVERAGE POWER EXPORT RATE FOR RESIDENTIAL PV SYSTEMS (EUR/KWH)	COMMENTS	FUTURE EVOLUTION
Italy	Net-billing	0.2301	0.21	Net-billing only covers parts of the charges and duties that are included in the retail electricity price. The government recently introduced a new self-consumption tariff for Citizen Energy Communities, which is not compatible with the net-billing scheme.	Net billing to be phased out by 2025.
Netherlands	Full net-metering	0.2067	/	Available to PV systems below 15 kW.	Will be phased out starting from 2023.
Norway	Net-billing	0.1867	0.052	Excess electricity is sold at the wholesale electricity rate, based on the hourly spot market.	No changes planned.
Poland	Partial net-metering	0.1343	0.11	Prosumers are compensated for excess electricity exported to the grid at 80% of the rate at which they buy electricity from it.	No changes planned.
Portugal	Net-billing	0.215	0.048	The surplus of production injected to the grid is bought by the energy supplier at a rate which amounts at 90% of the wholesale electricity price on the hourly spot market.	No changes planned.
Romania	Partial net-metering	0.1358	0.047	Excess electricity is sold at a fixed yearly rate, which is equal to the average wholesale electricity price in the Day-Ahead market of the previous year.	No changes planned.
Slovenia	Full net-metering	0.1634	/	Available for PV systems up to 11 kW.	No changes planned.
Spain	Net-Billing	0.2403	n.a.	Excess electricity is sold at the wholesale electricity rate, based on the hourly spot market.	No changes planned.
Sweden	Feed-in premium	0.2058	0.058	Prosumers get a tax rebate of 0.058 EUR/kWh fed into the grid. The tax credit system can be seen as a feed-in premium for the excess electricity, but it does not offer a guaranteed remuneration over a specific period.	The government is considering a tax deduction for private individuals purchasing a BESS, starting from January 2021, set to substitute the current direct subsidy scheme.
Switzerland	Market-based	0.184	0.05	Energy retailers may offer buy/sell contract options for prosumers.	No changes planned.
United Kingdom	Market-based	0.2122	0.041	Energy retailers may offer buy/sell contract options for prosumers.	No changes planned.



# 3

## RESIDENTIAL SOLAR & STORAGE MARKETS IN EUROPE TOMORROW

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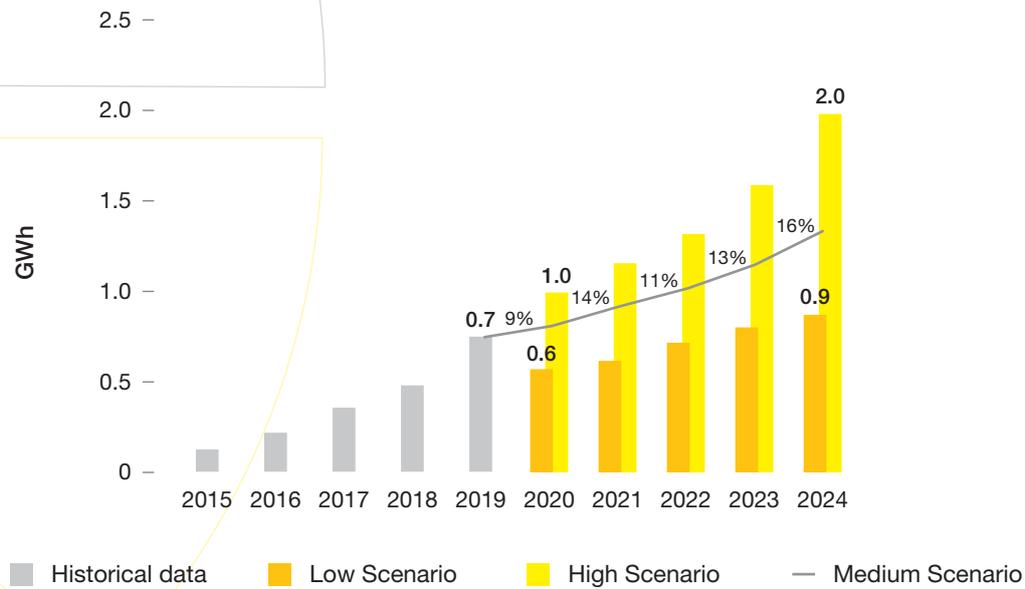
The residential BESS market in Europe will continue to grow strongly in the coming years (see Fig. 3.1). After residential storage capacity additions soared by 57% to 745 MWh from around 100,000 systems in 2019, this year's installation volume is expected to grow much slower, at 9%. The main reason is the COVID-19 pandemic that has been negatively impacting demand for solar & storage in several European countries, although this slower rate is less than feared so far due to the resilience of the German market (for details, see p. 29).

However, according to our **Mid-Scenario**, the yearly growth rate is expected to be in the two-digit range again at 14% in 2021, catching up after the COVID-19 slowdown and boosted by recovery packages, then slowing down to an 11% growth rate in 2022, before it moves up again to a growth level of 13% in 2023 and 16% in 2024. This scenario anticipates implementation of the EU Clean Energy Package prosumer provisions over the next few years, eliminating many of the barriers standing in the way between the customer and a battery storage system for their home. Overall, our most likely scenario expects that the 1 GWh storage capacity addition threshold should be reached in 2022, which corresponds to approximately 140,000 new systems installed per year.

Our **Low Scenario** anticipates a 23% demand drop to a level resulting in additions of 0.6 GWh in 2020. This seems unlikely when looking at the market influence COVID-19 had on activities in the first 8 months of the year. Although infection numbers have been going up in September again, indicating a second wave that might be aggravated in the upcoming flu season, governments will still try to avoid any severe lockdowns and continue to implement recovery packages. While demand for rooftop solar and storage might be negatively impacted again, it will not fully collapse. Besides the virus, negative boundary conditions of policy frameworks still present in several EU members states might take longer to implement than foreseen. In that case, the Low Scenario forecasts additions of only 0.6 GWh in 2021, 0.7 GWh in 2022, 0.8 GWh in 2023, and 0.9 GWh in 2024.

On the other hand, our **High Scenario** forecasts up to 1 GWh of home storage additions in 2020, which is optimistic but not impossible, when taking into consideration that Europe's largest residential solar and storage market has proven to be very resilient against COVID-19, and recovery schemes like the national tax incentives for solar & storage in Italy are starting to show positive results. This scenario also anticipates that the EU directives' positive prosumer provisions are implemented quickly, and that a faster and stronger development of the EV market also triggers residential storage demand. If all of this came to fruition, the market could grow twice as fast as estimated in the Medium Scenario, increasing to 1.2 GWh in 2021, 1.3 GWh in 2022, 1.6 GWh in 2023, and reaching 2 GWh in 2024.

FIGURE 3.1 EUROPE RESIDENTIAL BESS ANNUAL SCENARIOS 2020 - 2024



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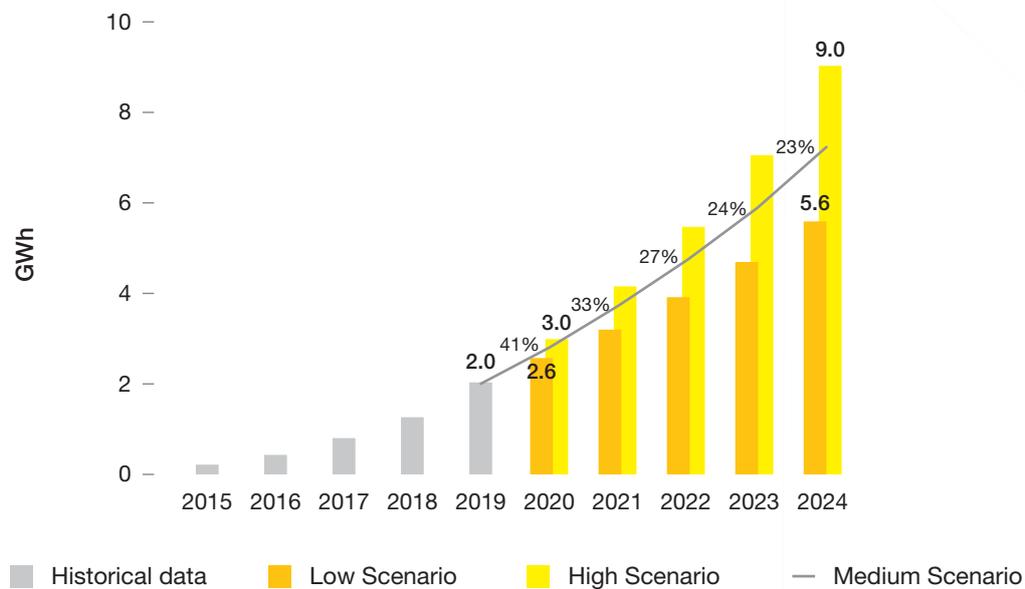
When looking at total installed residential battery storage capacities, our European Market Outlook 2020-2024 shows strong two-digit growth rates over the coming years (see Fig. 3.2). As this market segment is still in an early stage, the cumulative growth rate in 2020 is expected to be notably high (41%) – with the total capacity increasing to 2.8 GWh from 2 GWh last year –

despite the anticipated stagnation in annual growth in 2020. Our first 5-year residential battery storage outlook anticipates for our most-likely Medium Scenario that capacities will reach 7.2 GWh in 2024. But under optimal conditions, Europe’s prosumers could operate a battery fleet as large as 9 GWh by the end of 2024, compared to 5.6 GWh in the Low Scenario.



### 3 RESIDENTIAL SOLAR & STORAGE MARKETS IN EUROPE TOMORROW / CONTINUED

FIGURE 3.2 EUROPE RESIDENTIAL BESS CUMULATIVE SCENARIOS 2020 - 2024



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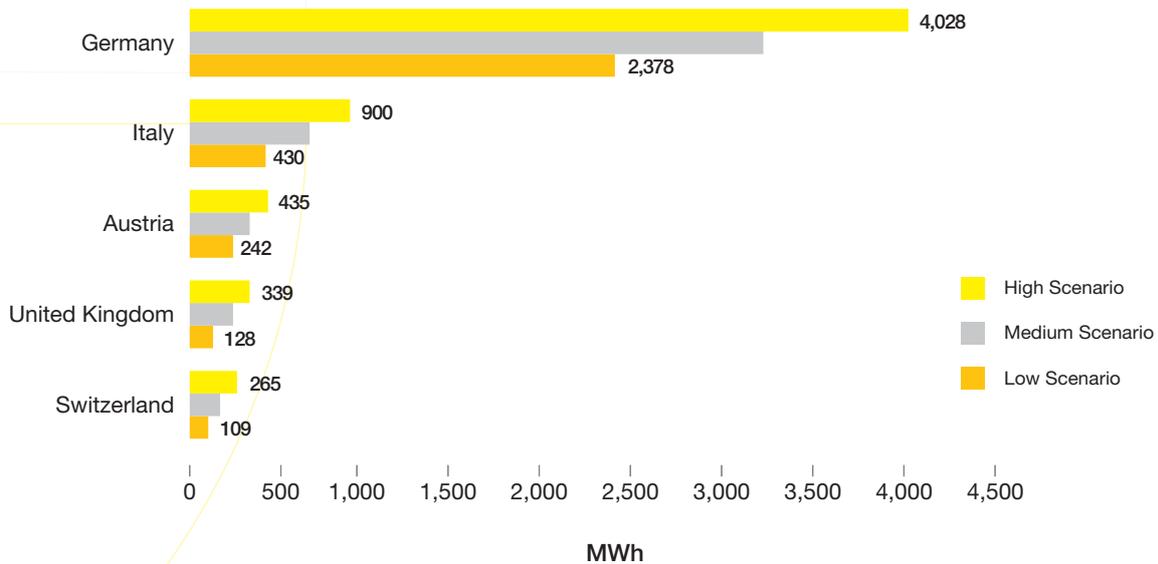
#### Local Developments

For the coming years, there will be only one clear leader in the field of residential energy storage: Europe's largest economy Germany will be the unchallenged No. 1, followed by Italy with some distance (see Fig. 3.3). With strong governmental support, Austria will overtake the UK, where both residential solar and storage now fully rely on the market forces. With solar supported by COVID-19 recovery funds, home storage in Switzerland is expected to be the fifth largest European market until 2024. However, the cost of storage is quickly decreasing and, backed by national and regional policy initiatives, private prosumers in other European markets will increasingly embrace solar and stationary batteries. Noteworthy emerging markets are Spain, Ireland, Czech Republic, and Sweden thanks to favourable policy frameworks and support schemes.

In **Germany**, the residential BESS market is expected to follow the development of the residential solar PV installations, with an attachment rate for new systems having already reached over 90% today. We expect another surge towards battery storage as of 2023, when a substantial number of households equipped with

solar panels will start phasing out of their EEG Feed-in tariffs contracts (whose durations are 20 years from the year of commissioning). Indeed, according to a recent EuPD Research survey, 58% of German PV owners are considering retrofitting their systems with a battery after the expiration of their FiT contract. EuPD sees a retrofit potential of over 200,000 systems until 2030. However, the potential is much larger – only 10% of all home PV systems were coupled with a battery by end of 2019. In total, we estimate 3.2 GWh of residential battery capacity additions from 2020 to 2024 in our Medium Scenario. But with a strong momentum for solar in Germany, which recently dropped its 52 GW total solar installation cap for a new target of 100 GW by 2030, and a strong recent increase in EV sales initiated through a Corona stimulus package, demand could be much higher, reaching up to 4 GWh, according to our High Scenario. As the first draft for the EEG 2021 currently under discussion contained proposals for expensive monitoring technology to push back self-consumption, there is also a chance that residential storage might face new barriers, which is included in our Low Scenario, expecting new installations of 2.4 GWh.

FIGURE 3.3 EUROPE TOP 20 MARKETS RESIDENTIAL BESS ADDITIONS 2020-2024



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The development of the **Italian** residential storage market looks bright for the next few years. First of all, there is a new tax incentive scheme as part of the COVID-19 recovery programme valid until the end of next year. Then, there are several regions that already have and further that are considering implementing subsidies for residential solar/storage, all of which provides good reason to anticipate continuous growth for residential solar PV plus storage installations across the country. However, as both the VAT rebate and the regional grants are dependent on annual renewal, there is a chance of sudden market changes. Our market estimates range from 900 MWh of newly installed home battery capacity in the High Scenario, 671 MWh in the Medium Scenario to 430 MWh in the Low Scenario by 2024.

Though comparatively small when it comes to its population of 8.9 million, **Austria's** residential storage is large. The country's investment subsidy for residential solar and storage systems has been renewed recently for the period 2020-2023, with an overall budget of 24 million EUR per year (of which 12 million EUR will be specifically dedicated to storage systems). Further growth is also backed by financial incentives from the national and state governments on the one hand as well as driven by the rising spread between the retail

electricity rate and the subsidised feed-in tariff. In our Medium Scenario, the number additional residential storage capacity commissioned there every year will go from 39 MWh in 2020 to 81 MWh in 2024, an overall growth of 110% over the period. As the Austrian government is working on a 1 million solar roofs programme by 2030, there is a good chance more storage capacity will be installed in the coming years than in a business as usual scenario; our High Scenario anticipates 435 MWh of new capacity until 2024, that's 98 MWh more than for the Medium Scenario.

In the **UK**, after two years of consolidation phasing-out its original solar feed-in tariff scheme, the residential PV market seems to have started recovering and is expected to gain traction starting from 2021, driving growth in residential BESS installations as well. Under the new Smart Export Guarantee (SEG) scheme, some electricity retailers have started to offer tariff structures optimised for energy storage systems owners that strongly improve the business case for coupled solar and storage systems. Though the incomplete smart-meter rollout is still a barrier, as many customers cannot enjoy smart electricity tariffs yet, these new retail electricity contracts are paving the way to a stable unsubsidised growth that is supposed to speed up as

### 3 RESIDENTIAL SOLAR & STORAGE MARKETS IN EUROPE TOMORROW / CONTINUED

storage costs continue its way downwards. The Medium Scenario foresees additions of 247 MWh until 2024, with upside potential towards 339 MWh and a Low Scenario of 128 MWh based on a hard Brexit and its negative economic consequences.

The European country with the fifth largest residential storage capacity additions will be **Switzerland**. The residential solar and storage market is expected to grow also during the 'Corona-year', as the non-EU member's government already in April had given green light for a recovery stimulus related 2-digit million cash infusion into the solar sector to shorten the waiting line for solar subsidies. We expect a short uptick in 2020/21 also for solar as the market will continue its positive growth trend for the coming years. According to the Medium Scenario, we anticipate capacity additions of 168 MWh until 2024 and 48 MWh in that year alone.

In **France** no dramatic change is likely to occur within the next four years – the interest for residential storage remains low, even though we anticipate – on a low level – a doubling of annual installations to 31 MWh in 2024 in our Medium Scenario. The same goes with the **Netherlands**, though for different reasons. Here, the government recently announced that the net-metering regulation for residential PV systems, as the main barrier for true self-consumption and batteries, would remain in force until 2023. In **Belgium**, on the other hand, the net-metering scheme will be removed in Flanders by 2021, while it seems it will remain in Wallonia for the time being. The battery support scheme available in Flanders has been prolonged for 2021, but due to its small budget it is expected to have limited effects on market growth. Belgium is planning to introduce in 2022 capacity tariffs, injection taxes and dynamic price contracts, which would encourage prosumers to invest in residential storage systems.

Europe's largest solar market in 2019, **Spain**, is another potential residential storage growth market to keep on the radar. While Spain reached Europe's No. 1 spot through large-scale solar systems, several positive developments for rooftop PV are likely to drive a boom in residential solar and storage systems as well, though basically starting from nil. With an average retail

electricity price being high and still rising as well as a new regulation for self-consumption that enables the use of residential storage systems, the residential BESS market is expected to emerge quickly.

High on the list of Europe's emerging residential storage markets are **Ireland** and **Czech Republic**, where new policy frameworks support the growth in residential solar and storage markets. The outlook is promising, where good regulations still have to be implemented in order to tap the full potential of home batteries and smart home energy management. In the Czech Republic, alongside the new Energy Act that is being prepared and will come into force after 2022, the current Energy Act is being updated and should enter into force in the beginning of 2021, opening the market for battery storage. In addition, stand-alone batteries should be permitted to provide flexibility services starting January 2021. In Ireland, on top of a new support scheme for prosumers provides financial incentives to micro-generation, actions are being taken for prosumers to be eligible to sell their electricity into the grid.

In all other European countries, no major regulatory changes are on the horizon that could propel residential solar and storage installations to larger markets in the short term. There, it looks like demand will remain limited to early adopters unless administrations set clear signals to kick off the residential solar and storage market.

However, the ambitious climate targets set by the European Green Deal, and several other tools from the European Commission, such as the Renovation Wave that will support rooftop solar, as well as the rising acknowledgement that small-scale batteries are key to enable higher shares of decentralised solar generation, support an optimistic outlook for the European residential solar and storage market. In our Medium Scenario, we expect the cumulative residential storage capacity installed across Europe to reach **3.7 GWh in 2021, 4.7 GWh in 2022, 5.9 GWh in 2023, and 7.2 GWh in 2024**. Well-designed regulations for prosumers and an improvement of smart-metering infrastructure without burdening households are now required in many countries in order to reach the full potential of this promising technology.

# 4

## THE TOP 4 EU RESIDENTIAL BATTERY STORAGE MARKETS

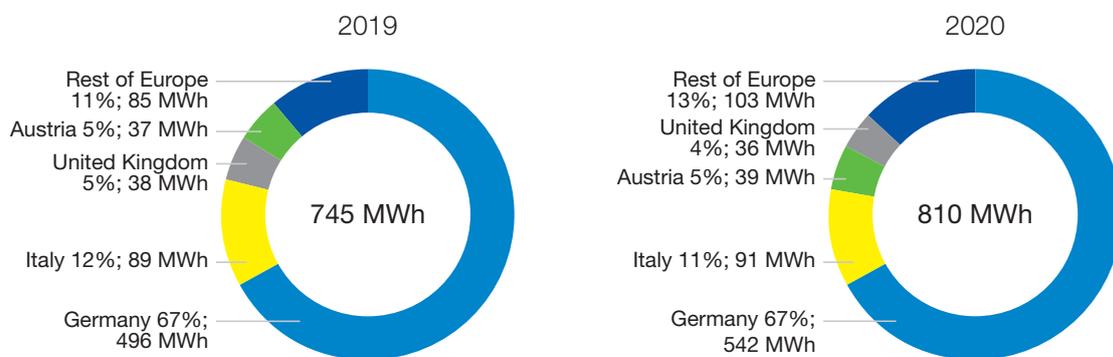


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In 2019, the four largest European residential battery storage markets – Germany, Italy, UK, and Austria – together installed 660 MWh of residential BESS.

That is 89% of the total 745 MWh that was installed in that year in Europe. While the Top 4 countries are expected to be the same this year, the order has changed, with Austria overtaking the UK. The share of this group will slightly decrease but remain dominant at 87% in 2020 (see Fig. 4.1).

FIGURE 4.1 TOP 4 MARKETS 2019-2020



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In this chapter, we provide a detailed background on the evolution of battery storage in Europe's leading four markets, with Germany leading the group having installed 1.3 GWh by the end of 2019, more than twice as much as the other three combined (see Fig. 4.1). One key to the success of residential and solar in these four countries are policy frameworks that enable self-consumption of solar power generated at home, or in other words, no support for full net metering. In most of these markets, direct subsidies and/or tax incentives have been available.

## 4 THE TOP 4 EU RESIDENTIAL BATTERY STORAGE MARKETS / CONTINUED

TABLE 4.1 SUMMARY TABLE OF THE MAIN RESIDENTIAL BESS MARKETS

COUNTRY	GERMANY	ITALY	UNITED KINGDOM	AUSTRIA
Cumulative residential BESS capacity 2019 (MWh)	1,328	243	143	120
Cumulative residential PV capacity 2019 (MW)	7,214	3,950	2,352	772
Cumulative residential BESS attachment rate 2019 (%)	17%	4%	6%	16%
Retail electricity price for residential customers 2019 (EUR/kWh)	0.3088	0.2301	0.2122	0.2034
Overarching framework for prosumer electricity export	Feed-in tariff	Net-billing	Market-based	Feed-in tariff
Average export rate for residential PV systems 2019 (EUR/kWh)	0.11	0.21	0.041	0.0767
Authorisation to self-consume	✓	✓	✓	✓
Energy arbitrage possible	X	X	✓	X
Aggregation and grid services possible	Pilots ongoing	Pilots ongoing	✓	X
Financial support schemes	Several regional support mechanisms (about 2/3 of states).	50% fiscal rebate; 110% depreciation alongside energy efficiency improvements; regional grants for storage in Lombardy and Friuli Venezia Giulia.	No	Federal investment grant; some regional support mechanisms.
Remaining barriers	Double charging for BESS connected to the grid, poor smart-metering infrastructure.	Political uncertainty on the various support schemes, net-metering.	Incomplete smart-metering infrastructure, lengthy DSO approval processes.	Poor smart-metering infrastructure.

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## GERMANY

Germany is by far the leading European market for residential BESS systems. The first residential solar and storage installations were registered in 2013, using a support mechanism launched by the federal investment bank KfW. Since then, over 170,000 units have been registered in the country. Surprisingly, despite the end of the KfW subsidy in 2018, the additional residential storage capacity installed in 2019 reached almost 500 MWh, growing by 75% in comparison with the previous year. However, there were still BESS subsidies available in about two-thirds of German states.

In our Medium Scenario, for 2020, we expect 9% growth, despite the effects of COVID-19 (see Fig. 4.2). The factors are twofold: in spring, there was a rush for solar systems as people feared the 52 GW installation cap might be reached before a follow-up regulation could be implemented. This did not happen; the Renewable Energy Law (EEG) solar target was lifted to 100 GW in time. In the summer, the first draft of the country's upcoming feed-in tariff law revision, EEG 2021, was leaked, showing several barriers for self-consumption and residential storage, which should lead to second run on solar & storage in 2020. While 2021 and 2022 are supposed to be years of lower growth, a new surge is expected from 2023 onward due to the mass retrofitting of older PV systems with expiring FiT contracts. We foresee 2-digit growth rates again as of 2022, leading to additional residential storage capacity of 612 MWh, in 2023 to 689 MWh, and in 2024 to 805 MWh from 103,000 new systems.

### Residential solar and storage market in Germany

Germany has historically been the European leader for solar PV deployment. Following the EEG, which came into force in April 2000, the federal government launched strong support schemes for decentralised solar PV generation, which led to an outstanding growth in the market during the decade 2000–2010. A feed-in tariff was set, allowing households equipped with solar to sell their electricity to energy retailers at a subsidised rate, for a duration of 20-years from the commissioning of the plant.

The 1 million rooftop solar PV systems threshold was reached in 2012, raising concerns for the pressure of those decentralised generation assets put on grid operators' shoulders. In 2013, the public investment bank KfW, which was already in charge of subsidised loan in favour of small-scale PV, started a support scheme to stimulate the installation of local stationary storage systems in conjunction with solar systems below 30 kW. The scheme consisted of a low-interest loan as well as a grant on the repayment. The overall budget was EUR 25 million for the period 2013–2015 and was then renewed with EUR 10 million for the period 2016–2018.

In parallel, FiTs for small-scale PV and the retail electricity price for household consumers followed radically opposite curves. Germany's ambitious Energy Transition targets, including the will to shut down all nuclear plants by 2022, caused a surge in retail electricity prices through higher taxation. This has resulted in Germany having one of the highest electricity prices for households in mainland Europe. Starting from 2009, the EEG FiT for PV systems below 10 kW, was decreased monthly at a higher rate, going from 0.43 EUR/kWh at the end of 2009 to 0.24 EUR/kWh in early 2012. This decision was a consequence of the fall in PV module prices. As of then, the rate was regularly adapted in order to follow the industry cost trends to keep returns at appropriate levels and trigger self-consumption. Today, the FiT for solar PV installations up to 10 kW is around 0.09 EUR/kWh. This gap between the import and export rate for electricity is an incentive for PV systems owners to invest in BESS that increase their self-sufficiency.

The increasing attractiveness of self-consumption has provided a huge boost to the residential BESS industry in Germany. Many local companies started to offer their own solutions as the market size quickly expanded from 4,500 units commissioned in 2013 to more than 36,000 additions in 2018. In terms of capacity, around 30 MWh were added in 2013 and about 280 MWh in 2018. Though the KfW did not renew its support scheme in 2019, the market has steepened its growth, adding 63,000 new residential BESS year-on-year.

## 4 THE TOP 4 EU RESIDENTIAL BATTERY STORAGE MARKETS / CONTINUED

### Improving economics for residential storage but still several barriers

The business case for residential stationary storage in Germany is still limited to self-consumption. With the retail electricity rate for households being about 0.30 EUR/kWh for many years now, and the feed-in tariff offered by the EEG continuing to go down steadily on a monthly basis, the value for increasing self-consumption is high. Furthermore, PV systems may export only up to 60% of their electricity production on the EEG feed-in tariff, incentivising homeowners willing to install higher capacity PV systems to invest in a coupled BESS.

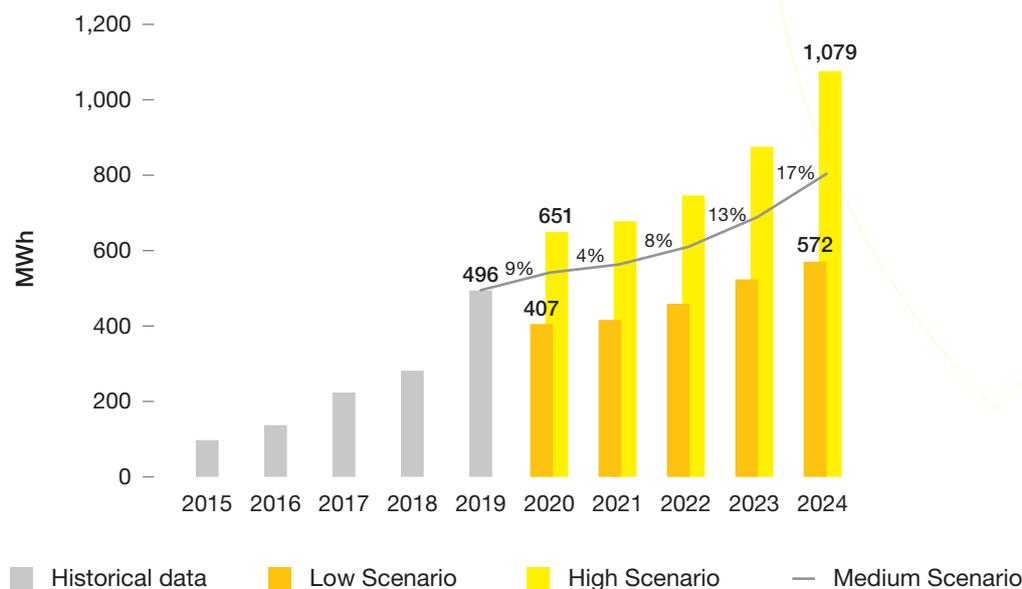
Until recently, stationary storage connected to the grid were subject to double taxation when charging power from the grid and then exporting it again. Following the European directive on the subject, the federal government amended the law, theoretically allowing residential BESS to be exempted from this double charging, but the process is rather complex.

There has been little progress toward stacking services from stationary storage. Moreover, the smart-meters infrastructure is still barely developed in the country and almost inexistent at the low-voltage level. In this context, even though static time-of-use tariffs with lower rates at off-peak times are available, more dynamic and cost-reflective tariff structures remain very limited.

### Prospects

A big shift is expected to occur in the German market with the numerous PV plants that will start phasing-out of their 20-years long EEG FiT contracts as of 2020. Almost 60% of homeowners equipped with solar PV plan to retrofit their systems with storage after the expiration of their feed-in tariff. From 2023 onward, this will start having a huge impact on the market growth, because it is from the year 2003 that the residential solar PV capacity addition was above 100 MW.

FIGURE 4.2 GERMANY RESIDENTIAL BESS ANNUAL SCENARIOS 2020 - 2024



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Although subsidies are only available on the regional level today – and will support growth in that segment also in the coming years, Germany’s NECP mentions that the government has the intention to support investments into energy storage technology again, but without providing details.

Other drivers are the COVID-19 recovery funds to support electric vehicles, which has induced a steep increase in demand for clean cars that will also result in more sales of solar and battery systems as those new owners who do not already own solar and storage will likely look into that option to power their cars with green electricity and save on high retail electricity prices.

While there are certain risks for the development of residential storage in Germany - the first draft of the new EEG 2021 contained provisions for expensive monitoring technology to push back self-consumption, the general attitude towards solar is rather positive throughout all parties.

Many pilots (various SINTEG C/sells research projects) are currently ongoing in Germany in order to determine what kind of mechanisms could help tap the potential of local, low-voltage flexibility assets, which could unleash further revenue streams for residential BESS.

Overall, German is expected to remain the largest residential storage market in Europe by far in the coming years. Our Medium Scenario estimates additions of 3.2 GWh from 410,000 new systems and a CAGR rate of 28% until 2024.



## 4 THE TOP 4 EU RESIDENTIAL BATTERY STORAGE MARKETS / CONTINUED

### ITALY

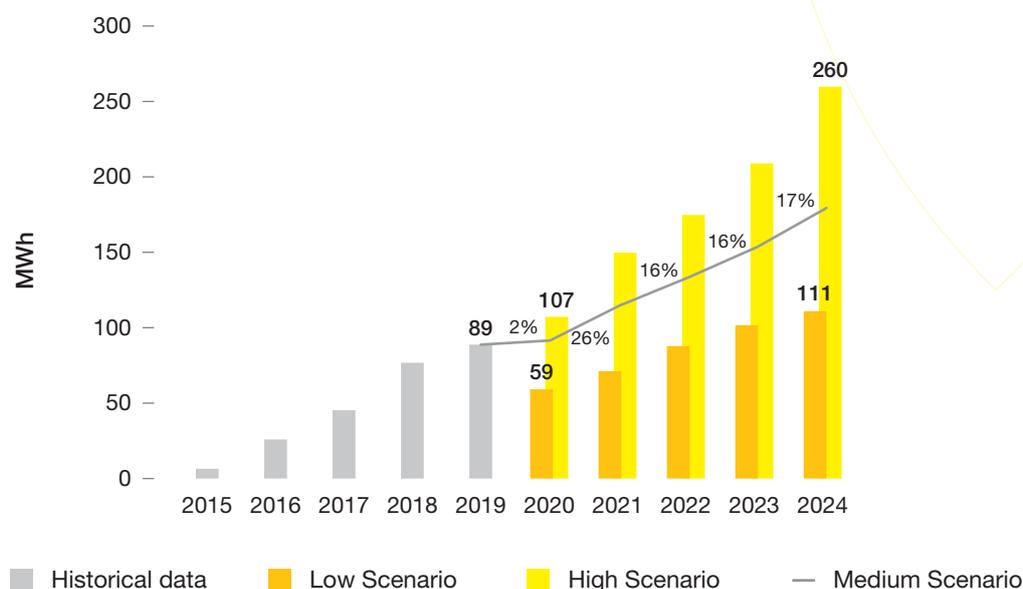
The residential BESS sector has been surging in Italy thanks to strong public subsidies. The first residential coupled solar and storage installations in the country were registered from 2015, and the sector kick-started in 2016 following the launch of a financial grants scheme in the Lombardy region. The extension to BESS of the 50% tax credit offered to homeowners purchasing residential solar PV systems, as well as the regional subsidy created by the Veneto region following the Lombardy model led to further growth from 2018 onward. Overall, 26,000 units have been registered in the country, with a cumulative storage capacity of 260 MWh. In 2019, the additional residential storage capacity installed reached 89 MWh, growing by 16% in comparison with 2018. We would have expected strong two-digit growth in 2020 as well, but with Italy hit very hard by the Coronavirus in the spring, our Medium Scenario foresees demand to improve only by around 2% to 91 MWh (see Fig. 4.3). This growth level is made possible by the solar/storage recovery measures quickly passed by Italy's government; without it, the country's BESS market would have shrunk in 2020.

### Residential solar and storage market in Italy

Unlike in several other solar markets, the residential segment was the motor of the Italian solar sector in recent years, responsible for an average share of 35% among total installed PV capacity in the last 4 years. This has led to a cumulative capacity of over 3.9 GWh and slightly more than 900,000 homes.

The residential PV market in Italy took off between 2005 and 2013, following the five Conto Energia decrees, setting a subsidised feed-in tariff for small-scale solar generation. Between 600,000 and 700,000 homes have been equipped during this period, and still benefit from the scheme as the FiT incentive was granted for 20 years from the commissioning of the system. Residential solar installations went down after 2013, fluctuating around 200 MW installed per year since then. The Italian energy authority GSE offers a net billing scheme called Scambio sul Posto for any PV system below 500 kW. Under this scheme, on a yearly basis prosumers subtract the value of electricity fed into the grid to the bill of electricity consumed. A typical residential customer with a consumption of 3,000 kWh per year would save 0.21 EUR/kWh exported to the grid.

FIGURE 4.3 ITALY RESIDENTIAL BESS ANNUAL SCENARIO 2020 - 2024



The government also provides a huge incentive for the installation of small-scale PV generation assets in the form of a 10-years long tax credit covering 50% of the investment cost. Typically, someone spending EUR 10,000 for a PV system would benefit of a EUR 500 tax rebate per year during the next 10 years.

The residential BESS market in Italy really emerged starting from 2016, when the Lombardy region decided a new incentive specifically for small-scale storage. The dedicated budget was EUR 2 million first and was then renewed every year since, each time amounting to EUR 3–4 million.

Moreover, in 2018, the 50% fiscal incentive for the installation of residential PV systems was extended to small-scale BESS, all systems installed simultaneously or after the commissioning of the solar system being eligible. This decision boosted significantly the residential BESS market and, by the end of 2019, approximately 24,000 systems were registered in the country, corresponding to an overall storage capacity of 243 MWh. The tax agency decided in May 2019 to make the 50% fiscal credit unavailable for storage systems retrofitted to PV plants that are still subsidised through the old Conto Energia scheme. However, the Parliament stepped back on that decision, and the 50% fiscal credit has been reintroduced since mid-July 2020 with more favourable conditions on receivables transfer.

In mid-2019, Veneto region also launched an incentive program for residential BESS and Lombardia renewed it for one more year. While the incentive scheme in Veneto has not been renewed, the Friuli Venezia Giulia region also decided to launch a grant for residential storage, with a budget of EUR 200,000.

### **Economics for residential electricity storage in Italy**

The only application for residential BESS in Italy currently is to improve the self-consumption rate of small-scale PV plants. Batteries installed by households cannot charge nor export from the grid but only from the coupled solar PV system, which makes it impossible to use storage for other business models such as energy arbitrage. The current framework for self-consumption under the Scambio sul Posto net billing scheme also provides a barrier to the storage business case, since prosumers get a remuneration for the electricity they feed into the grid.

The retail electricity rate oscillated between 0.20 and 0.25 EUR/kWh during the last decade. Italy was one of the pioneers in the rollout of smart meters, but it did not translate into many innovative electricity offers for residential customers. Static time-of-use pricing contracts, with a lower rate at night and during off-peak periods are widely available and often chosen by PV owners. However, dynamic time-of-use tariffs are inexistent yet.

The main driver for the purchase of BESS by homeowners equipped with PV are the very generous incentives offered by the government and the regions. Thanks to those, Italy is by far the most attractive European country for small-scale solar plus storage systems regarding payback time. The 50% tax relief drastically eases the investment in a residential BESS and the additional independence it provides in comparison to PV appeals many customers.

### **Prospects**

With the energy efficiency incentive to deduct investments into PV and storage by 110% from the annual tax bill offered as part of the Coronavirus recovery measures until the end of 2021, installations in 2020 might be actually around 107 MWh according to our High Scenario, which would be around 20% higher than anticipated in our Medium Scenario.

However, as the fiscal incentive, the regional grants and the Scambio Sul Posto schemes have to be confirmed every year, there is systemic uncertainty in the outlook for subsequent years.

On the other hand, some positive signs allow for optimism. In early December 2019, the Friuli region decided to launch a grant for residential storage, with a budget of EUR 200,000. Other regions could follow the move in the coming years, pushing up the national market.

In this context, we anticipate a 2021 demand uptick following the 'Corona-year' consolidation, resulting in 115 MWh of new installations and a 26% annual growth, to be followed by low two-digit growth rates – ranging between 16 and 17% – for the coming years to 2024.

## 4 THE TOP 4 EU RESIDENTIAL BATTERY STORAGE MARKETS / CONTINUED

### UNITED KINGDOM

The residential BESS market started to gain traction in the UK in 2016. Overall, approximately 23,000 units have been installed in the country so far, with a cumulative storage capacity of 260 MWh. In 2019, the country added 38 MWh residential storage capacity, growing by less than 1% in comparison to the 36 MWh set up in 2018. Our Medium Scenario anticipates slightly decreasing demand for 2020, with the SEG regulation countering some of the effects of COVID-19 that had hit the UK very hard in the spring. In 2021, post COVID, and again driven by SEG, the residential storage market growth is expected to come back strong – increasing by 35% to 48 MWh.

#### Residential solar and storage market in the UK

The small-scale solar PV segment in the UK has long been supported by a very generous governmental subsidy. From April 2010, a homeowner installing solar panels on its rooftop had the possibility to be compensated for every kWh generated, whether it was consumed on site or exported to the grid. In addition, an extra-payment was granted for every kWh exported. Those subsidies were contracted for a duration of 20 years from the date of commissioning.

Thanks to this scheme, the residential solar PV market saw a steady growth since 2010, with more than 150 MW installed every year and a peak at 560 MW of additional capacity in 2015. In 2017 and 2018, the new residential PV capacity installed fell below 100 MW subsequently to the sharp decrease of the generation premium rate.

The government subsidy support scheme closed to new applicants on 31 March 2019. Prosumers now have to subscribe a specific contract with their retailer to be compensated for the excess electricity they may export to the grid, following the Smart Export Guarantee regulation. Despite the fall in new residential solar installations in 2017 and 2018, the market was on the rise again in 2019 – but that was due to the installation rush in the three months of the year before the FIT scheme was closed on 1. April 2019. An additional residential solar capacity of 125 MW was commissioned, accounting for approximately 45,000 households.

In parallel, the UK's residential battery market emerged around 2015 thanks to falling installation costs and a rising gap between the electricity retail price and the

export rate. Another driver was the emergence of new tariffs structure that encouraged time-of-use optimisation (see below).

Since 2015, BESS demand has seen moderate but consistent growth, mostly coming from new solar PV installations installed concurrently with a battery storage. This has happened although no specific support mechanism for storage systems have been introduced, and the economics for the end consumer remain weak. The cumulative installed base reached about 20,000 systems and a total storage capacity of 143 MWh end of 2019.

#### Economics of residential electricity storage in the UK

In the UK, the electricity price for households has historically been rather low compared to Mainland Europe. However, it has also risen steadily for a decade, from 0.14 EUR/kWh in early 2010 to 0.19 EUR/kWh in 2015 and around 0.22 EUR/kWh in 2019, creating an improving argument for households to go solar plus storage to gain more independence from the electricity grid.

Network charges for electricity retailers integrate time components that are often reflected in the final consumers' bills through time-of-use dependent rates. The Distribution Use of System (DUoS) charges compensate for the distribution network costs - and their rates vary depending on three time bands reflecting the variation of power demand during the day. The Transmission Network Use of System (TNUoS) charges compensate for the transmission network costs - and are based on the share of demand during TSO's peak load periods. This way, and due to the liberalised retail electricity market, utilities are encouraged to offer Time-of-use contracts to their customers, where the final price of electricity depends on the time when it is consumed.

Ofgem, the UK energy regulator, is regularly assessing new network tariff structures to take advantage of smart energy management at a residential level. Moreover, the taxation on electricity for households being quite low, bill components provide clear price signals to encourage consumers to optimise their electricity consumption. Hence, the smart-meter rollout still has to be boosted in order to empower residential customers. But the original plan to have about 80% of households equipped with smart-meters in 2020, was delayed – the new target is 85% by 2024.

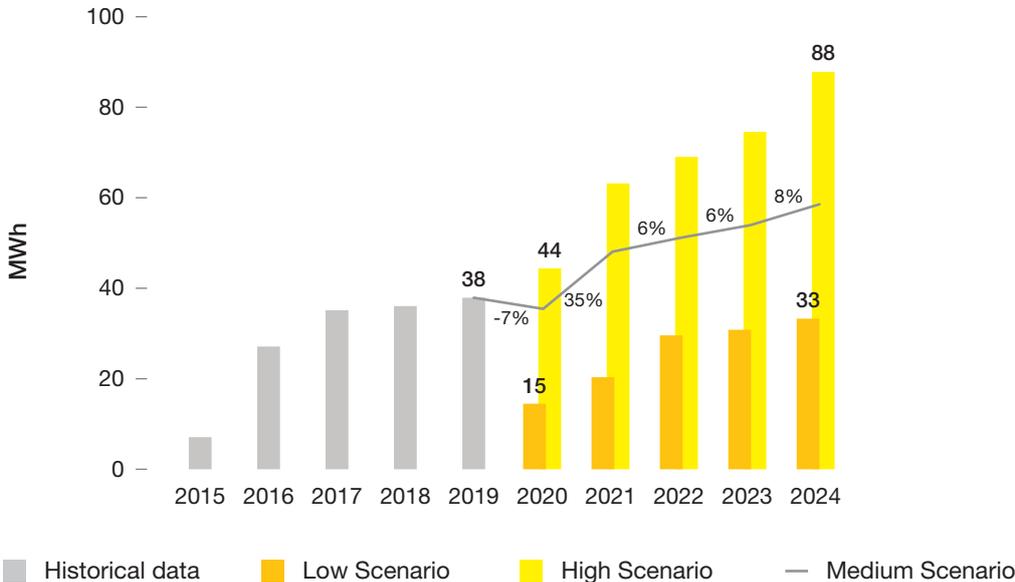
This evolution toward more cost-reflective retail electricity rates has gone a new step forward with the Smart Export Guarantee, which entered in force from 1. January 2020. Under this new regulation, every energy retailer will have to offer her own contract to buy any exported electricity from an eligible small-scale generation system. SEG contracts may have fixed price or they may include some elements of “smartness” and dynamic variations. Suppliers are also allowed to include energy storage within their offer. If so, they have to decide which kind of power they wish to compensate for, whether being “green” electricity coming from the customers’ PV systems or “grey” electricity that comes from the grid and has been stored before being exported.

Overall, the UK retail electricity market is at a high stage of liberalisation, with suppliers being free to design their own tariff structures, both for import and export rates. This already allows decentralised generation and storage assets owners to make big savings by smartly managing their energy use. The efforts should now focus on the smart-meter rollout, in order to make time-of-use tariffs more accessible.

Now, that the government FIT scheme has been phased out, the economics for both residential solar and storage are much more difficult to estimate as it strongly depends on the retailer considered. At the start of 2021, 14 suppliers have offered Smart Export Guarantee contracts, the export rate within those contracts is now offered at a level of up to 0.08 GBP/kWh (0.087 EUR/kWh), making it valuable to increase self-consumption as much as possible with a residential BESS.

In addition, value could be tapped from energy arbitrage. Home batteries enable prosumers to manage smartly their energy use and production, storing electricity from the grid when it is cheap and exporting it back at a time where the export rate is higher. Some SEG contracts are specifically designed for consumers equipped with both solar PV and storage, optimising the house load to the benefits of the supplier and the end-consumer. The new SEG regulation provides retailers with the option to offer Time-of-use pricing contracts to their customers, which in turn can improve the economics of coupled solar and storage installations. With further decrease in the battery prices, the purchase of a solar rooftop and a home battery could soon make economic sense even in the absence of any governmental subsidy.

FIGURE 4.4 UK RESIDENTIAL BESS ANNUAL SCENARIOS 2020 - 2024



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## 4 THE TOP 4 EU RESIDENTIAL BATTERY STORAGE MARKETS / CONTINUED

### Prospects

In the UK, a major shift has occurred this year after the end of the FIT scheme and the beginning of the SEG regulation, marking the transition from a subsidy-driven home solar and storage market to a non-subsidy driven period. Residential PV installation levels decreased after the end of the FIT regime, hampering the installation rates of residential BESS as well. With no specific support scheme and the likely transition period needed for new SEG offers to reach their maturity, no large uptake should occur in subsequent years. This is why, in our Medium Scenario, we expect a stable rise in the number of home battery systems installed every year, with the yearly growth rate settling down as the market gets bigger in size. We estimate the additional

residential storage capacity to go from 48 MWh in 2021 (6,500 units, 35% growth compared to 2020) to 58 MWh in 2024 (7,900 units, 8% growth compared to 2023).

If there is no ongoing assessment about any support scheme for residential storage, the political uncertainty remains high in the UK these days. The impact that Brexit – hard or soft – will have on both the retail electricity price and the taxation of solar PV and battery technologies is difficult to gauge. In contrast, the success of pilot projects experimenting the value of battery aggregation for grid services and/or collective self-consumption might lead to additional upside in the future. With so many unknowns, the spread between our Low and High Scenario in 2024 is large, ranging between 33–88 MWh of new storage capacity.



## AUSTRIA

The residential BESS market in Austria began to get traction as early as 2015, and was accelerated by an investment grant to kick-start the technology that was launched at the federal level in 2018. Overall, 18,000 units have been commissioned so far across the country, with an overall capacity of 120 MWh by the end of 2019. In that year, 37 MWh of residential storage capacity were added, corresponding to a 23% year-on-year growth. The recent renewal of the investment grant by the federal government was another important support element for the market to see further solid growth in subsequent years after 2020, which has been negatively impacted by COVID-19. Our Medium Scenario foresees residential storage capacity additions of 39 MWh, corresponding to a low 4% annual growth rate. However, as in several other residential storage markets, we expect a strong post-COVID comeback in 2021 and beyond.

### Residential solar and storage market in Austria

The Austrian federal government set a new regulatory framework for renewable energy in 2012 by adopting the “Ökostromnovelle” (Green Electricity Act). Among others, a generous subsidy for small-scale PV plants was allowed. It consisted of a one-time financial grant for installations below 5 kW and a 13-years FIT for systems between 5–200 kW. Those two schemes are still in force and are renewed every year on a downward trend, in accordance with the decrease in PV system prices. This helped the residential solar PV market take off and the additional capacity commissioned every year in this segment varied around 50 MW between 2013 and 2017.

In 2017, a nation-wide investment subsidy for small-scale PV systems (located on rooftops and sealed areas) was passed for the years 2018 and 2019 in coherence with the government’s more ambitious renewable targets. The scheme, backed by an annual EUR 9 million budget, offered financial support covering up to 30% of the investment costs. This new program led to a dramatic growth in the sector, from 50 MW commissioned in 2017 to 88 MW in 2018 and 130 MW in 2019.

Concurrently, a specific budget of EUR 6 million per year was dedicated to support the investment in any storage systems installed with the subsidised PV systems. Overall, the financial support for the solar and storage systems could cover up to 45% of the total investment costs. While approximately 3,500 residential BESS were

registered in 2017 (24 MWh), the sector experienced steady growth with 4,500 units installed in 2018 (30 MWh, 25% growth) and about 5,500 in 2019 (37 MWh, 23% growth). The total residential storage capacity in service across the country is estimated to be 120 MWh by end of 2019.

Next to the federal support scheme there are also regional incentives available for both small-scale solar PV and attached storage systems.

### Economics of residential electricity storage in Austria

Residential BESS sector in Austria is mainly driven by the citizen’s ambitions to improve energy self-sufficiency. The retail electricity rate for household customers was rather stable during the last decade, oscillating around 0.20 EUR/kWh. By contrast, the feed-in tariffs for small-scale PV was progressively reduced, reaching 0.077 EUR/kWh for the year 2019. This move supported the value for coupling rooftop PV systems with BESS as it enables a higher self-consumption rate for the solar system.

While nearly all traditional regional retailers offer static Time-of-use tariffs, with specific rates for peak and off-peak times, more dynamic pricing contracts are scarce. In addition, the smart-meter penetration barely reached 17% of households end of 2019. In this context, almost no energy retailer is in the position of offering specific tariff structures to homeowners equipped with solar and storage systems, limiting the potential benefits of energy arbitrage.

Overall, the economics for coupling BESS to residential rooftop PV systems still has room for improvement in Austria. But the many sorts of incentives available support the investment rationale for customers striving for more independence from the grid and looking to produce their own green power.

### Prospects

The federal government of Austria has the ambitious objective of covering 100% of total national electricity consumption with renewable energy sources by 2030. A draft for the new EAG law just introduced for discussion by the country’s Energy Ministry includes several positive solar provisions, with the central pillar being a 1 million solar roofs programme – a 10-fold increase from the 2018 target of 100,000 roof-mounted PV systems.

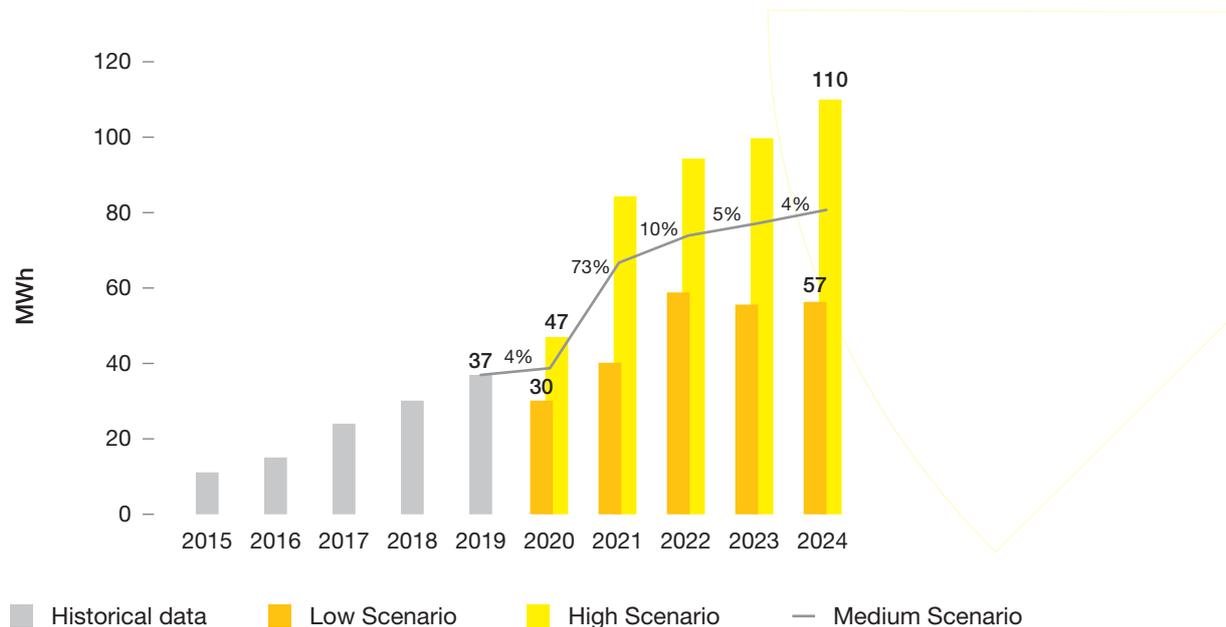
## 4 THE TOP 4 EU RESIDENTIAL BATTERY STORAGE MARKETS / CONTINUED

As a concrete measure, the investment subsidy for both small-scale solar PV and BESS was renewed in September 2019 for the years 2020–2023. A total budget of EUR 24 million for solar PV and EUR 12 million for storage will be granted by the federal government every year. This alone should sustain a stable growth of the residential BESS market. It remains to be seen what exactly the new EAG will bring, but the draft outlines expiration of taxes on self-produced and consumed power for small systems.

With the smart-meter rollout expected to be completed by the end of 2021, there will be potential for more innovative electricity contracts, enabling end-customers to unlock the full potential of their BESS. There are also regions currently assessing more stringent building regulations that would make integrating solar PV for new homes compulsory.

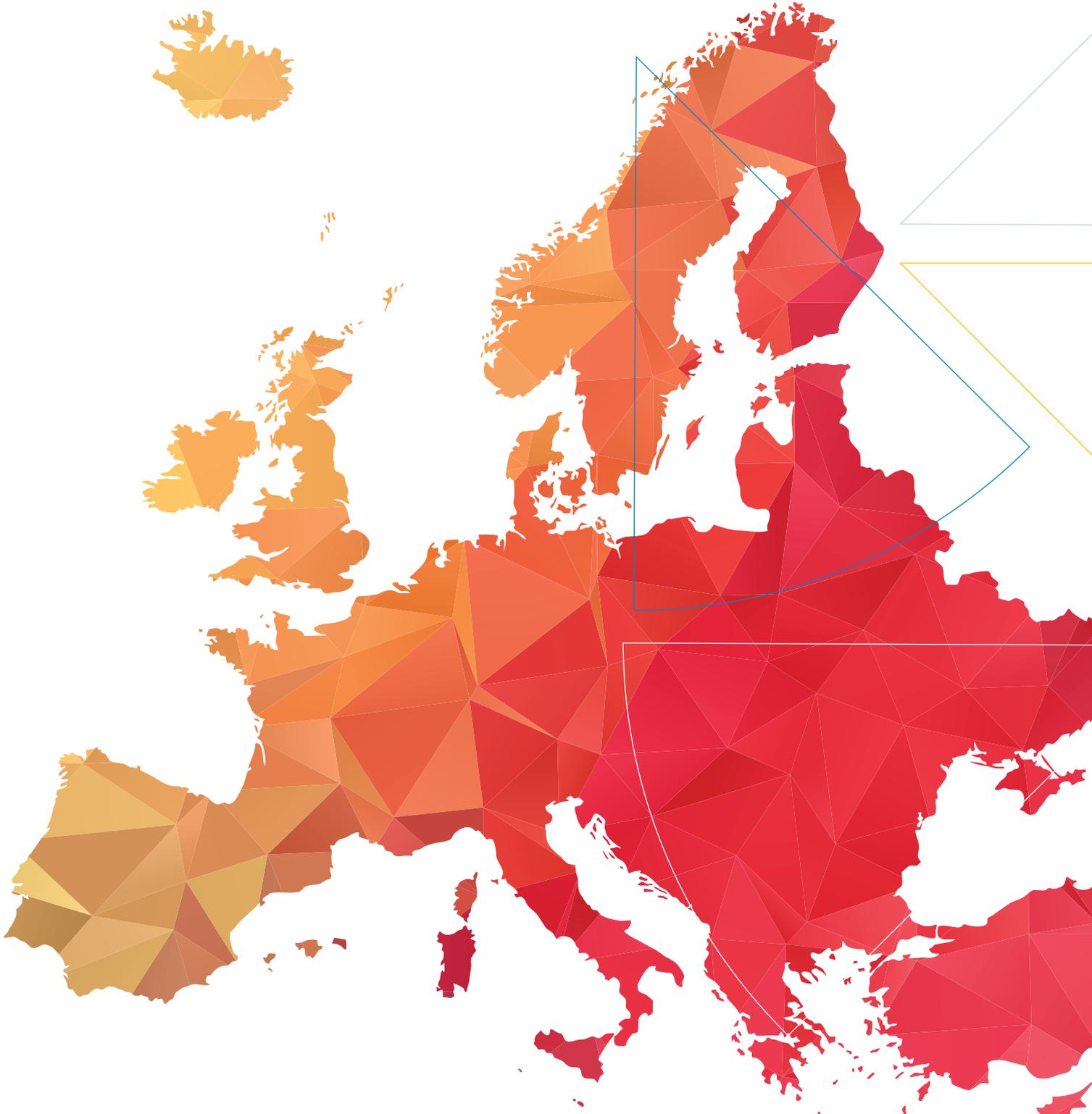
We assume in our Medium Scenario demand to more than double to 11,700 in 2024, from 5,600 in 2020, and translating into a capacity growth to 81 MWh from 39 MWh. While growth is expected to slow to around 5% in 2023 and 2024, this is based on the expiration of the current solar and storage funding. When taking into consideration the solar and storage provisions in the new EAG, the potential is much higher. Our High Scenario for 2024 estimates new capacities of 110 MWh, a 36% growth over the Medium Scenario forecasts. In any case, with all of these positive developments, we see Austria becoming a new core market for residential solar and storage in the short and medium term in Europe, entering the Top 3 already this year, and leaving the UK behind.

FIGURE 4.5 AUSTRIA RESIDENTIAL BESS ANNUAL SCENARIOS 2020 - 2024



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**SolarPower Europe**  
Rue d'Arlon 69-71, 1040 Brussels, Belgium  
T +32 2 709 55 20 / F +32 2 725 32 50  
info@solarpowereurope.org / [www.solarpowereurope.org](http://www.solarpowereurope.org)



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