



European Market Outlook

For Residential Battery Storage
2021–2025

SolarPower
Europe

Join 250+ SolarPower Europe members



Influence



Intelligence



Network



Discounts



Visibility



**SolarPower
Europe**

SolarPower Europe – Leading the Energy Transition

SolarPower Europe is a member-led association that aims to ensure that more energy is generated by solar than any other energy source by 2030.

www.solarpowereurope.org

Foreword

Welcome to our European Market Outlook for Residential Battery Storage 2021–2025.

Solar & battery storage is probably the greatest couple in the energy transition – they truly bring out the best in each other. While solar shows larger versatility and increasingly lower cost than any other power generation technology, battery energy storage systems (BESS) are important partners to extend the reach of solar into periods when the sun doesn't shine or just simply to make the energy system more flexible. This affection is true for all PV power applications – large-scale and distributed solar. BESS is only growing more attractive for solar, as the steep learning curve of batteries has resulted in cost levels which make this duo's economics more and more interesting to PV power generators, in particular in the residential segment, which is the scope of this report.

Indeed, the growth numbers speak for themselves. In 2020, around 140,000 household battery systems with a combined storage capacity over 1 GWh were installed in Europe, which contains two landmark numbers – for the first time, over 100,000 systems were added in one year, and for the first time, the annual GWh-scale was reached. The total residential battery storage market grew by 54% to over 3 GWh of installed capacity by the end of 2020.

However, the bulk demand for residential batteries in Europe was shouldered only by a handful of countries. Germany alone was responsible for 70% of newly installed storage capacity, and the share of the Top 5 markets together (Germany, Italy, UK, Austria, Switzerland) reached 93% in 2020; that's even higher than the year before. Our 5-year market outlook sees the same dynamic in the future – the identical Top 5 will hold an 88% share, even while the market volume is expected to grow over fourfold to 12.8 GWh in 2025.

The message from this picture is clear – as a key tool to complement flexible solar, battery storage needs much higher attention from energy policy makers across Europe. When the 2030 National Energy Climate Plans (NECPs) will be revised, the gigantic potential of battery storage has to be acknowledged. This has to happen alongside higher targets for solar, which have to be significantly increased – we are talking about a factor of around 2.5X to comply with the 1.5°C Paris Agreement.

In fact, the EU Clean Energy Package already provides many very helpful provisions to remove barriers to a Europe-wide storage roll-out. Unfortunately, only a few EU members states have implemented these prosumer and self-consumption friendly guidelines into national legislation. Those who did, enable citizens to become less dependent from rising energy prices, and allow companies to create business models based on the large toolkit offered by battery storage technology, such as aggregation, peer-to-peer, ancillary services. Unlocking these features would also facilitate better grid planning and ensure the distribution grids are fit for a renewables-based energy system.

While battery storage is a natural fit to residential solar, policy frameworks that are missing or are counterproductive to self-consumption, like net metering in the Netherlands, can have disastrous effects on the evolution of a battery storage market, even if the rooftop solar segment is thriving. As the German example shows, an established solar rooftop market in an environment of high retail power prices does not need direct subsidies for battery storage anymore. In the country, battery attachment rates for new PV systems are 60%. However, to kick-start the battery storage segment under adverse conditions, like in many eastern European countries, initial support schemes will help, as they did in at the outset of Germany's market development.. A very successful support programme was implemented in Italy last year, and extended until 2023. The tax credit for efficiency measures, which includes solar & storage, financed from a COVID-19 recovery fund has strongly accelerated the application of BESS in Europe's second largest market.

Like residential solar, the market for battery storage will continue its upward path; the crucial question is how fast will it grow? In this regard, it's of utmost importance that the upcoming EU Battery Regulation does not burden storage technology manufacturers and investors. Appropriate regulations for improved sustainability and safety performance of batteries are very welcome and important, but a battery framework must avoid any distortive market effects. Ultimately, many European countries soon need to create a 'Happy Ending' for the most promising couple of the energy transition, in order to enable Europe to meet its climate targets for 2030 and beyond.



WALBURGA HEMETSBERGER
CEO, SolarPower Europe



MICHAEL SCHMELA
Executive Advisor,
SolarPower Europe



RAFFAELE ROSSI
Solar & Storage
Workstream Coordinator,
SolarPower Europe

Thanks to our Sponsor Members:



Table of contents

Foreword	3
Executive summary	5
Policy recommendations	6
1 Introduction	7
2 Residential solar & storage markets in Europe today	10
3 Residential solar & storage markets in Europe tomorrow	17
4 Top 4 European battery storage market	22
4.1. Germany	24
4.2. Italy	27
4.3. United Kingdom	29
4.4. Austria	32



Project lead: Michael Schmela, SolarPower Europe.

Project manager: Raffaele Rossi, SolarPower Europe.

Authors: Gabriele Caccia, Christophe Lits, Raffaele Rossi & Michael Schmela, SolarPower Europe.

Text editing: Bethany Meban, SolarPower Europe.

External contributors: EuPD Research; PV Austria (AT); EDORA & ODE (BE); AKU-BAT & Solární Asociace (CZ); BSW-Solar (DE); European Energy (DK); Syndicat des énergies renouvelables (FR); HELAPCO (GR); MANAP (HU); OIE Hrvatska (HR); ISEA (IR); Anie Rinnovabili & Elettricità Futura (IT); Energy Storage NL & Holland Solar (NL); APREN (PT); UNEF (ES); Svensk Solenergi (SE); Swissolar (CH); Solar Energy UK (UK).

Contact: info@solarpowereurope.org.

Please cite as: SolarPower Europe (2021): *European Market Outlook for Residential Battery Storage 2021-2025*.

Published: November 2021.

ISBN: 9789464444285.

Design: Onehemisphere, Sweden, contact@onehemisphere.se.

Methodology: SolarPower Europe's five-year forecast consists of Low, Medium and High scenarios. The Medium Scenario anticipates the most likely development given the current state of play of the market. The Low Scenario forecast is based on the assumption that policymakers halt solar 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 PV capacity below 10 kW. SolarPower Europe's methodology includes only grid-connected systems. Installed PV capacity is always expressed in DC.

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

Disclaimer: This report has been prepared by SolarPower Europe. It is being furnished to the recipients for general information only. Nothing in it should be interpreted as an offer or recommendation of any products, services or financial products. This report does not constitute technical, investment, legal, tax or any other advice. Recipients should consult with their own technical, financial, legal, tax or other advisors as needed. This report is based on sources believed to be accurate. However, SolarPower Europe does not warrant the accuracy or completeness of any information contained in this report. SolarPower Europe assumes no obligation to update any information contained herein. SolarPower Europe will not be held liable for any direct or indirect damage incurred by the use of the information provided and will not provide any indemnities. Unless otherwise stated, the copyright and other intellectual property rights of market intelligence data and resources provided are owned by SolarPower Europe.

Executive summary

The strong growth path of residential battery energy storage systems (BESS) across Europe continued in 2020 with a 44% year-on-year increase in annual installed capacity. In spite of the COVID-19 health crisis, for the first time the European BESS market reached the landmark GWh scale, totalling 1,072 MWh of storage capacity installed in a single year. With about 140,000 battery systems installed in 2020, this was also the first time in which more than 100,000 battery units were installed in a year.

While the increase in the annual BESS market has been very steep, the growth in cumulative installed storage capacity is even more pronounced. The residential BESS fleet jumped from less than 2 GWh in 2019 to over 3 GWh in 2020, with a 54% year-on-year increase. Total storage capacity has grown 14 times its size, compared to just five years ago.

Although more and more national markets are looking at solar & storage as a means to decrease dependency from volatile electricity prices and make better use of self-produced green energy, the deployment of this technology is still largely driven by a handful of leading countries. Germany, the European powerhouse in both residential solar PV and residential battery storage systems, constitutes 70% of the total European home storage market. The great performance of the domestic PV market in 2020 and a high attachment rate with battery storage led to a large increase of the BESS market, which stood at 749 MWh, a 51% increase from the year before. In Italy, the introduction of a strong fiscal incentive for solar & storage, in addition to the already existing support schemes, resulted in a yearly 44% market growth with 94 MWh installed. Different market conditions allowed the remaining top 5 countries to grow in the two-digit range – including the availability of prosumer-friendly electricity tariffs in the UK, and government incentives and supportive

policy frameworks in Austria and Switzerland. Taken together, the five largest markets represent 93% of total European installations.

Our five-year market outlook foresees that the European residential BESS market will continue its upward path, as many European countries see the first tangible results of the recovery packages and other measures put in place to relaunch the economy in the aftermath of the COVID-19 health crisis. We expect 1.37 GWh of home storage capacity to be installed in 2021, up 28% from 2020 levels. In our Medium Scenario, the market will grow to 2.51 GWh by 2025, up 134% compared to 2020.

Strong growth rates can also be seen when looking at total installed capacity scenarios. In our Medium Scenario, we expect the cumulative residential storage capacity installed across Europe to reach 4.4 GWh in 2021 and 12.8 GWh in 2025, with annual growth rates consistently above 20% for all the intervening years. Under optimal conditions, Europe's residential prosumers could operate a battery fleet as large as 14.6 GWh by the end of 2025, compared to 10.2 GWh in the most pessimistic scenario.

The report delves into the specific features of the top 4 largest European markets, which will continue to provide the strongest push for home batteries across the continent. In our five-year analysis, Germany is poised to remain the undisputed leader in the field of residential storage, followed by Italy by some distance. These, together with other two leading markets UK and Austria, will still constitute the top 4 markets in 2025, according to our Medium Scenario. At the same time, as the cost of storage quickly decreases, and enjoys backing from national and regional policy initiatives, private prosumers in several other European markets will increasingly embrace solar and stationary batteries as well.



Policy recommendations

1. **Acknowledge the paramount role of battery storage in the energy transition.** Electricity storage is a crucial component for the transition towards a climate-neutral European Union by 2050, where high penetration of variable renewable energy sources, like wind and solar, needs to be complemented by flexibility solutions providing uninterrupted energy supply – and among storage technologies, batteries are key. In order to sustain a 100% renewable energy system in Europe, distributed battery capacity needs to grow widely from the level installed today and reach 1,600 GWh by 2050.¹ In any case, to reach a climate-neutral EU by 2050, an appropriate recognition of the role of batteries, together with a review of technical and cost developments of storage technologies, needs to be reflected in EU long-term planning and energy system modelling. At the same time, national policymakers must recognise this huge potential and give more prominence to distributed storage in the revision of their National Energy and Climate Plans.
2. **Establish enabling frameworks for prosumers and self-consumption in members states in accordance with EU legislation.** While the deadline for implementing the provisions of the Clean Energy Package in member states has passed, few countries have moved forward towards transposing them in their national legislations. It is paramount to promote smooth and comprehensive implementation of the Clean Energy Package in all member states – in particular, the articles related to storage and prosumers, in order to remove market distortions and create a level playing field for batteries. This would enable peer-to-peer and aggregation business models, as well as the possibility to provide ancillary services and access new revenue streams. Unlocking the storage potential of EU buildings will be crucial to ensure the achievement of
- the Fit for 55 Package. In this regard, the upcoming revision of the Energy Performance of Buildings Directive must ensure the EU's Renovation Wave drives the uptake of on-site solar & storage.
3. **Develop a future-proof EU Battery Regulation.** In the forthcoming triilogue negotiations regarding the draft EU Battery Regulation, policymakers shall ensure a balanced battery market in line with EU climate neutrality ambitions. The regulation needs to support the competitiveness of strategic industrial sectors, with provisions that enable an improved sustainability and safety performance, without putting excessive burdens on manufacturers and discouraging investments. It is crucial to implement a timely and appropriate framework for battery requirements, covering key issues such as carbon footprint, recycled content, performance and durability, and due diligence. However, any framework for battery requirements should avoid distortive effects on markets and evaluate trade and competition impacts of the proposed measures.
4. **Better integrate distributed energy resource potential throughout all phases of grid planning.** Power grids, in particular at distribution level, need to be reinforced and modernised, in order to accommodate the uptake of distributed solar & storage and to better value its flexibility potential. To this end, participative and regular grid planning exercises must be conducted at transmission and distribution level and system operators must provide transparency on current and future system needs. In addition, system operators must consider alternatives to grid reinforcements, such as distributed flexibility solutions, when planning the grid, and must be appropriately incentivised.

¹ SolarPower Europe & LUT University (2020): *100% Renewable Europe: How To Make Europe's Energy System Climate-Neutral Before 2050*.

1

Introduction



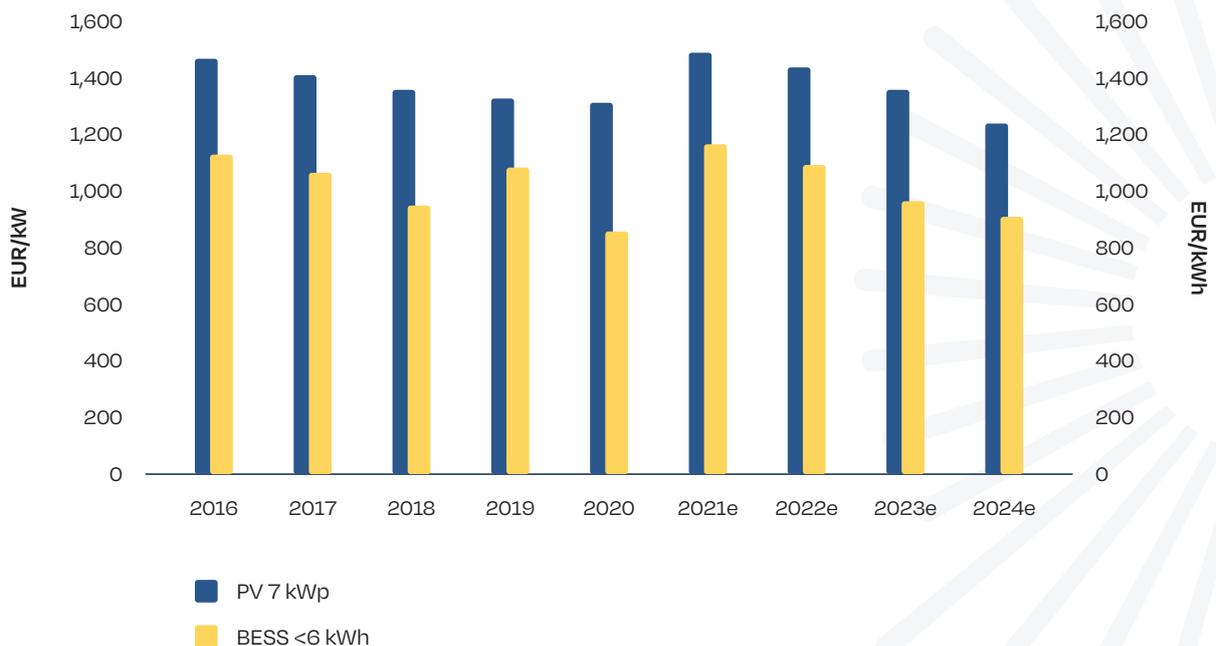
In 2020, while Europe experienced the effects of a severe health crisis and harsh lockdown measures were enforced in several member states, households looked with increased interest at residential solar & storage solutions as a means to lower carbon footprint, reduce electricity bills and increase energy independency.

Kick-started with incentive schemes, the rapid and continuing decrease of costs and prices for solar PV systems and, in recent years, Battery Energy Storage

Systems (BESS), have made these two technologies increasingly attractive to homeowners.

In Europe largest solar & storage market Germany, prices have fallen by 11% for small solar systems and 24% for home storage solutions between 2016–2020 (see Fig. 1.1). Despite a rise in prices taking place in 2021 due to post-lockdown global trade and economic conditions, a decreasing trend in the price of both applications is expected to continue as supply chains adapt.

FIGURE 1.1 SURVEY OF RESIDENTIAL SOLAR & STORAGE PRICES IN GERMANY, 2016–2024



Source: EUPD Research 2021.

© SOLARPOWER EUROPE 2021

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

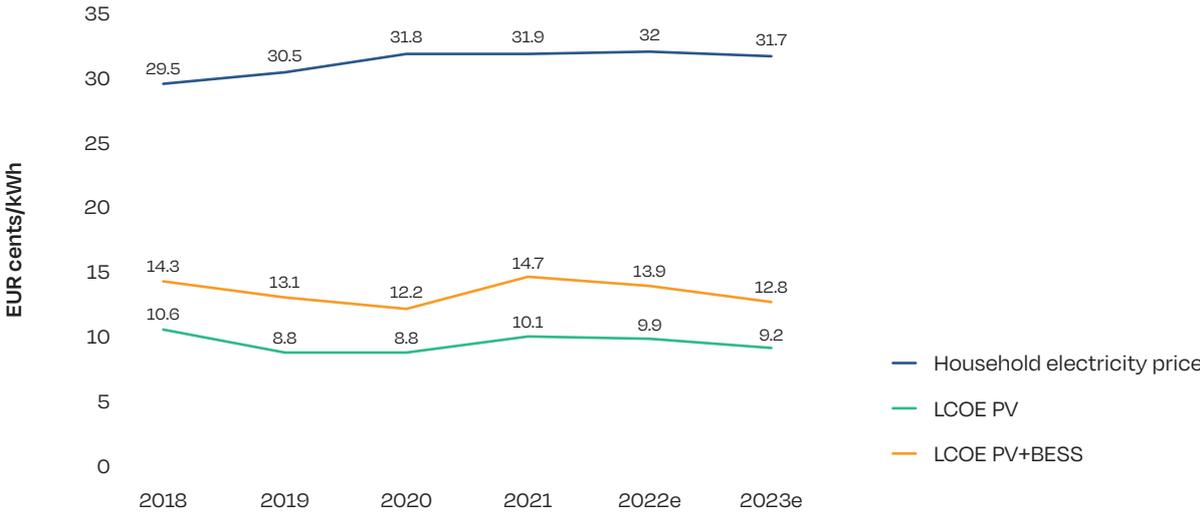
While power from solar rooftop systems has already been much cheaper than retail electricity in most European markets for several years, now battery storage’s rapid cost improvements is also now enabling solar & storage to beat grid power in an increasing number of European countries. In Germany, best-in-class solar & storage systems reached Levelised Cost of Electricity (LCOEs) of 12.2 Euro cents/kWh last year, which is nearly a third of the typical electricity price, one of the starkest differences in European electricity costs (see Fig. 1.2).

The energy prices crisis that Europe is experiencing at the moment this report is drafted exacerbates the need to be less dependent on retail power price

volatility. While retail electricity prices are expected to remain high in the medium term, the economics for residential solar & storage will continue to improve. A short-term issue has been a strong uptick in PV component prices in recent months, resulting in the temporarily increase of LCOEs of both standalone solar and solar & storage. However, as the component price crisis is addressed, the downward path in solar & storage costs is expected to continue as of the second half in 2022. Following a 13% year-by-year decrease in lithium-ion battery pack prices in 2020, in the same year Bloomberg NEF forecasted a further 58% price reduction by 2030.

Altogether, these drivers will eventually bring residential solar & storage systems to grid parity on the entire European continent, while policy frameworks are improved to enable the full unlocking of solar & storage potential. This will go hand in hand with the further rollout of smart meters, making new dynamic pricing tariffs available and thus providing a further driver for the uptake of storage technologies.

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



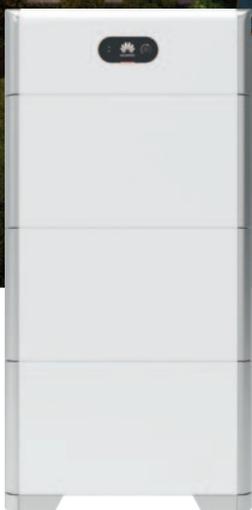
Source: EUPD Research 2021.

© SOLARPOWER EUROPE 2021

Smarter Energy for a Better Life

With Huawei FusionSolar Residential Smart PV Solution

- Up to 30% more solar energy generated with optimizers
- 24h green energy with Smart String Energy Storage System (ESS)

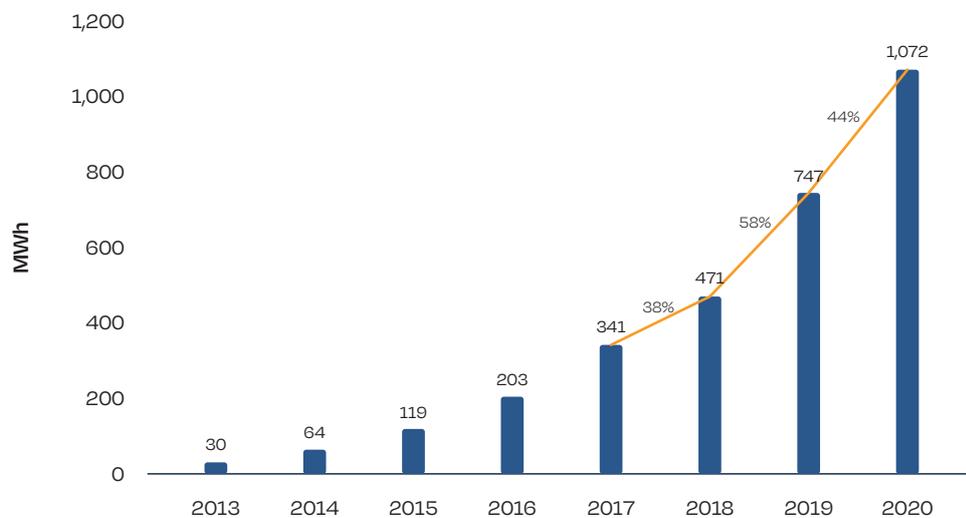




Our first edition of the European Market Outlook For Residential Battery Storage, which was launched last year, depicted a rapidly growing home storage market across the continent. In 2019, Europe installed 747 MWh of new residential storage capacity, a 58% annual increase from the 471 MWh added the previous year.

The strong growth path continued in 2020, with a 44% year-on-year increase in annual installed capacity. For the first time, the European residential battery market reached the landmark GWh scale, totalling 1,072 MWh of storage capacity installed (Figure 2.1). This is equivalent to about 140,000 battery systems installed in 2020 compared to the 99,000 installed in 2019. In other words, not only the GWh milestone was reached – also, for the first time, more than 100,000 battery units were installed in one single year.

FIGURE 2.1 EUROPE RESIDENTIAL BESS ANNUAL MARKET 2013-2020



© SOLARPOWER EUROPE 2021

This steep growth trajectory is even more impressive looking back at the market just a few years back, when the residential solar PV market was struggling to gain pace and poor investment conditions made solar & storage attractive to a limited number of customers. In 2015, only five years before these milestones were reached, less than 18,000 home battery systems had been installed, totalling 119 MWh. The market has grown eightfold since then.

Back in 2015, the European continent was basically relying on a handful of BESS pioneer markets. Germany, the country where home storage started first gaining traction and which is still today the largest market, had switched from a full Feed-in Tariff (FIT) scheme to a model supporting self-consumption in combination with a premium for excess power. Home battery markets started to emerge in a few other countries – Italy, the United Kingdom, and Austria, with hardly any capacity installed in the rest of Europe. Today, battery technologies are an established reality in more and more European countries. The early adopters have been joined by many other countries, even though the home storage story there is just at the beginning.

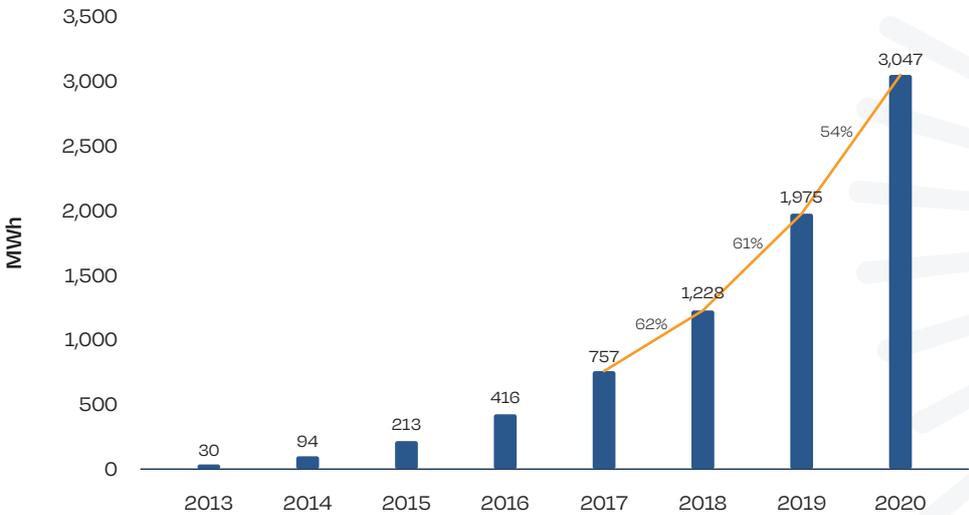
The home storage growth path in Europe turned out to be significantly higher than what we forecasted one

year ago, when the first edition of the European Market Outlook for Residential Battery Storage was published. Back then, we assumed the market would grow 9% to about 800 MWh. The positive evolution of the market conditions slightly exceeded even our most optimistic expectations – our High Scenario anticipated about 1,000 MWh of annually installed capacity. This yearly review of our model takes into account this strong improvement.

While the increase in the annual market has been very steep, the growth in cumulative installed storage capacity is even more pronounced. The residential BESS fleet jumped from less than 2 GWh in 2019 to over 3 GWh in 2020, with a 54% year-on-year increase (see Fig. 2.2). Such high growth in cumulative capacity gives an even better perspective of the speed of adoption of BESS technologies. Total storage capacity has grown 14 times its size, compared to just five years ago.

Taking residential BESS into perspective with its solar peer, it accounted for approximately 8% of the total residential PV systems in operation in Europe. Even though the attachment rate is rising, the untapped market potential for BESS remains huge, especially when taking into account that over 90% of European buildings are still without solar systems.

FIGURE 2.2 EUROPE RESIDENTIAL BESS CUMULATIVE MARKET 2013-2020



© SOLARPPOWER EUROPE 2021

2 Residential solar and storage markets in Europe today

/ continued

The Top 5 European Residential Storage Markets

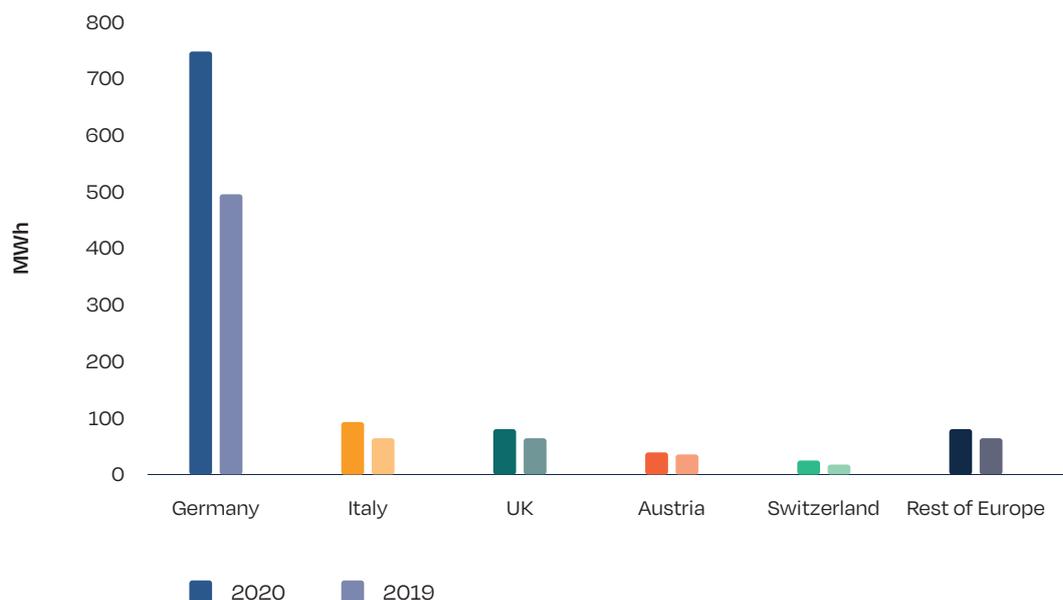
Germany remains the leading European country in installations of both residential solar PV and residential battery storage systems (see Fig. 2.3). In 2020, over 90,000 residential BESS were installed in the country, for a total new capacity of about 750 MWh. The central role of Germany in the European home storage market cannot be underestimated. Not only is it the country currently providing the great majority of the total European annually installed capacity, with a 70% share; its predominance is growing, up 2% absolute compared to the previous year. The annual installed capacity in Germany in 2020 is higher than total European installed capacity in 2019.

The German annual BESS market has grown 51% from 2019, when it installed 496 MWh. This growth is mainly due to a surge of residential PV systems installations, which in 2020 accounted for over 1 GW of annual capacity, the country's best performance ever for the small rooftop segment. The growth rate of BESS installed per annum continues to increase steadily, despite the end of the nation-wide financial

support mechanism from the German Development Bank (KfW) in 2018. On the other hand, a few German states continue to offer support schemes for residential storage systems, although some of these regional schemes are changing or running out of money. The attachment rate with residential solar remains high, with about 60% of new home PV systems coming together with a battery.

Italy retained and consolidated the #2 position thanks to strong public support schemes. In 2020, an additional capacity of 94 MWh was installed in the country, corresponding to a 44% growth in comparison to the previous year. The Italian residential BESS market has been driven and continues to maintain its attractiveness thanks to appealing subsidy schemes. In addition to the already existing 50% tax credit for small-scale solar PV and residential BESS (*Ecobonus*), a new fiscal incentive, the *Superbonus 110%*, was introduced as part of the COVID-19 national recovery program. This highly beneficial tax credit scheme allows homeowners to deduct up to 110% of the expenses related to home energy efficiency work, which comprise also PV and

FIGURE 2.3 EUROPE TOP 5 RESIDENTIAL BESS MARKETS 2019-2020



© SOLARPOWER EUROPE 2021

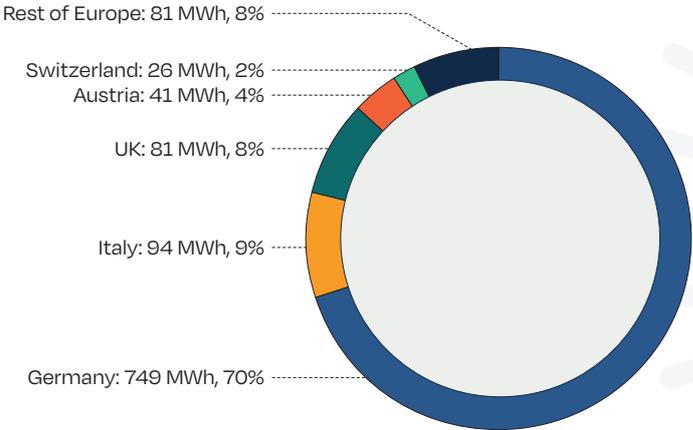
BESS systems installations. By contrast, the financial grants for solar & storage offered by some regions as Lombardia, Veneto and Friuli Venezia Giulia were not renewed in 2020.

The United Kingdom, the third European core home storage market, is also experiencing notable growth without subsidies. About 11,000 residential BESS units, corresponding to around 81 MWh, were commissioned in 2020 across the country, resulting in a 25% increase year-by-year compared to the 65 MWh registered in 2019. Despite a relatively high attachment rate with residential PV systems, the market remains limited by the rather small volume of home PV capacity installed. Residential solar still suffers from the drastic reduction of feed-in rates in the UK rooftop solar programme. After completely closing the PV rooftop FIT scheme in 2019, both residential solar and battery storage now rely basically on free market forces. However, with the introduction of the Smart Export Guarantee regulation in January 2020, prosumers are being offered specific tariff structures by energy retailers to reward the export of renewable electricity to the grid, which provides an incentive to adopt battery storage solutions.

The Austrian market remains a relevant European BESS market amidst continued low two-digit expansion. With 41 MWh of residential storage capacity installed in 2020 from around 6,000 individual systems, the market grew 10% compared to 2019. The 100,000 rooftop PV target from the Mission2030 programme has been upscaled to a 1 million rooftop PV systems target as per the country's National Energy and Climate Plan. To support this ambitious target, an investment subsidy scheme for small-scale solar that was launched in 2017 was extended in 2018 to also cover battery storage, and then renewed again in 2019 for the following 3 years.

Despite low retail electricity prices, Switzerland has seen large growth during the last year, backed by favourable policies. Thanks to the government's efforts to push solar PV development through attractive funding schemes, storage installations experienced high growth rates. In 2020, an additional capacity of 26 MWh was installed, corresponding to a 39% increase from 2019, when a capacity of 18 MWh was added. The country's high average income and the good awareness of battery technologies among PV installers acted as key drivers for residential solar & storage.

FIGURE 2.4 EUROPE TOP 5 RESIDENTIAL BESS MARKETS 2020



© SOLARPPOWER EUROPE 2021

2 Residential solar and storage markets in Europe today

/ continued

In total, the Top 5 European residential storage markets were responsible for 93% of the 2020 installed capacity in the region. In all other European countries, the residential battery storage market remains at an early stage of development or is even non-existent as of today. These rest of Europe countries added 81 MWh in 2020, 25% more than the 65 MWh installed the year before; but the 81 MWh total installed in 2020 by over 30 countries only equals the additions of Europe's third largest market, the UK.

In France, the low retail electricity price of 0.196 EUR/kWh registered in H2/2020 proved to be a major barrier to the take-off of the residential battery business – in comparison, retail electricity prices in Germany stood at 0.3 EUR/kWh. Although the EU's second biggest economy has more than 400,000 residential solar PV installations across the country, the home storage segment is still very small. The storage capacity installed during 2020 amounted to about 4,000 units for an overall additional capacity of 15 MWh, which is a small raise compared to 2019 levels. Overall, the residential BESS market in France is still in a nascent phase, where a small group of technology-aware customers is opting for low-capacity batteries.

In the Netherlands and Belgium, countries with large residential solar PV markets, net-metering solar incentive schemes constitute the main disincentive for the uptake of battery storage. As both markets are slowly transitioning out of their net-metering schemes, the business case for solar & storage is poised to improve accordingly. In Sweden, continued growth in the residential PV sector is driven and supported by subsidies for residential solar & storage. Spain, which is one of Europe's solar pioneers, blessed by optimum weather conditions and boosted by a new incentive package for both solar and storage, has also entered the battery storage map and will play a more prominent role in the future as the rate of residential PV installations grows. Most eastern European countries on the other hand continue to have low retail electricity prices and still lack appealing investment frameworks for batteries, with the exception of the Czech Republic, which saw a significant number of installed home storage systems in 2020. In the rest of European countries, no noteworthy pro-storage developments took place.



© Udo Kroener/Shutterstock

Box 1. Small Commercial Solar & Storage

We have seen how the field of residential BESS is growing very rapidly in Europe and especially in countries like Germany and Italy, where a series of favourable conditions and policy measures from national governments are increasing the interest of prosumers to couple their PV systems with a home storage battery. Many factors such as increasing electricity retail rates, declining storage technology costs, and a constant decline of grid export tariffs, are making the overall economics of batteries more and more convenient for those households who decide to benefit from several storage applications.

But apart from the residential storage segment – those batteries coupled with a PV system smaller than 10 kW and with a storage capacity generally lower than 20 kWh – there is another niche that is slowly gaining traction across the biggest European markets. It is what we define as the “small commercial” segment, that refers to BESS paired with PV systems between 10 and 100 kW and with a storage capacity comprised from 20-30 kWh to 200 kWh. As the name suggests, the users of these bigger batteries are generally medium-size businesses or entities like small manufacturing activities, shopping malls, office buildings or small energy communities. The small commercial segment is not too different from residential households in terms of the battery usage applications, which in most cases are linked to support an already existing rooftop PV system.

Business cases

From a broader perspective, energy storage systems offer a wide range of applications and services that create remarkable value streams for the energy grid. There are several services that BESS can provide to the electricity system, depending on the level at which the battery is installed – if behind the meter, at the distribution level, or at the transmission level. In this section, we focus on behind-the-meter customer services, which are beneficial to end-users such as residential households, and commercial or small industrial businesses.

Although the segment is still at a very early stage of development, some business cases are already emerging:

- **Increased solar energy consumption.** As it happens for residential customers, a common use case for small commercials is to couple battery storage

with a solar PV system to increase the consumption share of solar energy. In this way, the excess clean energy during the day is stored into the battery device and is discharged later in the evening when the sun is not shining anymore. By maximising self-consumption, the business can save on the lower amount of expensive electricity purchased from the grid and by not selling solar power back to the grid at a low grid export tariff. This business case is more appealing in countries with high electricity tariffs and where there are no net-metering or net-billing schemes. In doing so, it is possible to reduce the electricity bill by becoming less dependent from the grid during costly peak hours and therefore improving the overall PV system economics. In addition to this, using a higher share of green electricity in its operation allows a business to brand itself as a sustainable company to its clients. This business case is viable for businesses that can benefit from excess solar power stored during the day by using it later in the evening or in night-time hours.

- **Demand charges reduction.** An important use case for small businesses is a reduction of demand charges, whereby the energy storage device is used to manage the power load of the company to avoid expensive demand charges during periods of the day when prices and electricity usage are higher. This is done by keeping the load “under control” below a certain threshold by charging the battery either with excess renewable energy coming from the rooftop PV system, or during off-peak periods when energy prices are lower. Then, the battery is discharged during on-peak periods when costs are higher. In this manner, the stored energy is used to reduce and shift the energy amount drawn during peak times, thereby providing significant savings on the electricity bill. In addition, by shaping the load profile in a more distributed manner, it is also possible to smooth the fluctuations of the intermittent energy output to improve reliability and achieve better overall performances. This use case is particularly convenient when the policy framework includes some form of dynamic pricing or time-of-use tariffs, which incentivise end-users to adapt their electricity demand in response to time-varying electricity prices. With increased volatility in power prices across Europe, this feature can prove critical to avoid relying on the grid when electricity becomes very expensive.

2 Residential solar and storage markets in Europe today

/ continued

Box 1. Small Commercial Solar & Storage *Continued*

- **Less interconnection costs.** Another common use case for small commercials is using battery storage to reduce interconnection costs: these are all the costs related to the connection, metering, transmission, distribution and administration incurred by the electric utility for the installation and maintenance of the system. By reducing the utility grid connection size, the business is able to unlock lower fixed costs or energy rates, as the consumption of electricity stored in the battery reduces the dependence on the grid. This results in the possibility to shift to a lower and cheaper contracted connection capacity with the distribution system operator. This use case is attractive in countries where fixed costs are a significant part of the total electricity tariff.
- **Backup Power.** As for households, energy storage devices can provide backup power to businesses in case of a grid failure event. If paired with a local generator, the battery can come into action within the range of a few seconds to compensate for the power outage and avoiding the shutdown of business operations. This service can offer significant savings to a commercial activity, especially for a manufacturing firm where an unexpected blackout that causes the interruption of production lines could bring significant losses. This feature is particularly relevant in regions where

the electricity grid is weak and unreliable and storage allows for a higher degree of independence.

- **Other services.** There are several other services that small commercial BESS might provide in addition to the above-mentioned applications at “customer” level. Further additional value streams can also be generated at distribution and transmission level for network and system operators. For example, **energy arbitrage, frequency regulation, voltage support and spin/non-spin reserve** are a series of **ancillary services** provided by users of the grid to support the transmission system operator (TSO). For distributed system operators (DSOs), the main services that could be provided are transmission and distribution deferrals, which refer to the delay or avoidance of expensive investments and upgrades of the electricity grid thanks to the support of storage systems in critical areas.

In Europe there are still many barriers and market regulations that need improvement to enable businesses to access DSO/TSO value streams. The biggest obstacle for the small commercial segment is represented by the storage devices' small size, as the majority of these services typically apply to larger battery systems like front-of-the meter and utility-scale. Thus, for the moment, it is still not possible to consider these use case applications for the evaluation and the economics of a profitable business case, but potential to be unlocked in the future is very large.



© sonnen

3

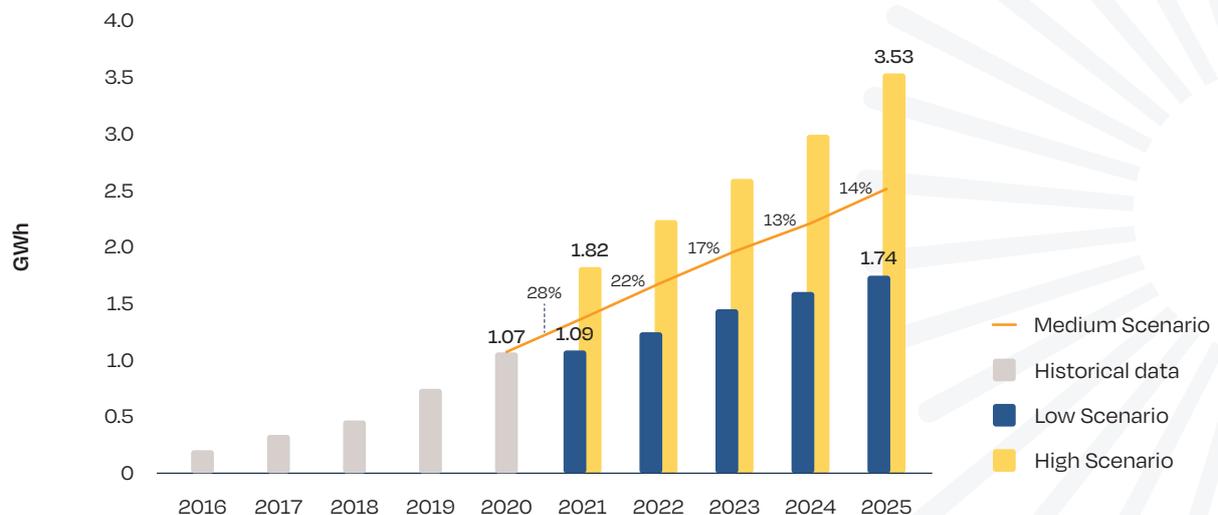
Residential solar and storage markets in Europe tomorrow



The residential BESS market will continue its strong growth over the next years. After last year's sustained growth despite the COVID-19 pandemic, and against more pessimistic initial expectations, we expect the European residential BESS market to maintain its upward path, as many European countries see the first tangible results of the recovery packages and other measures put in place to back their economies. After the European residential battery market surpassed the GWh level for the first time in 2020, with 1.1 GWh of storage capacity installed resulting in a 44% growth, our Medium Scenario expects 1.37 GWh to be installed in

2021, up 28% from 2020 levels (Figure 3.1). We revised upwards our growth projections compared to last year's analysis, primarily due to the improved market conditions in the two leading markets, Germany and Italy. In our previous market outlook's most-likely Medium Scenario, we had expected to reach the GWh milestone only in 2022. Similarly, the 1.37 GWh volume we now anticipate for 2021 is higher than last year's Medium Scenario projection for 2024. Following a steep two-digit growth trajectory, our revised Medium Scenario forecasts 1.67 GWh in 2022, 1.96 GWh in 2023, 2.21 GWh in 2024 and 2.51 GWh in 2025.

FIGURE 3.1 EUROPE RESIDENTIAL BESS ANNUAL SCENARIOS 2021-2025



© SOLARPPOWER EUROPE 2021

3 Residential solar and storage markets in Europe tomorrow /

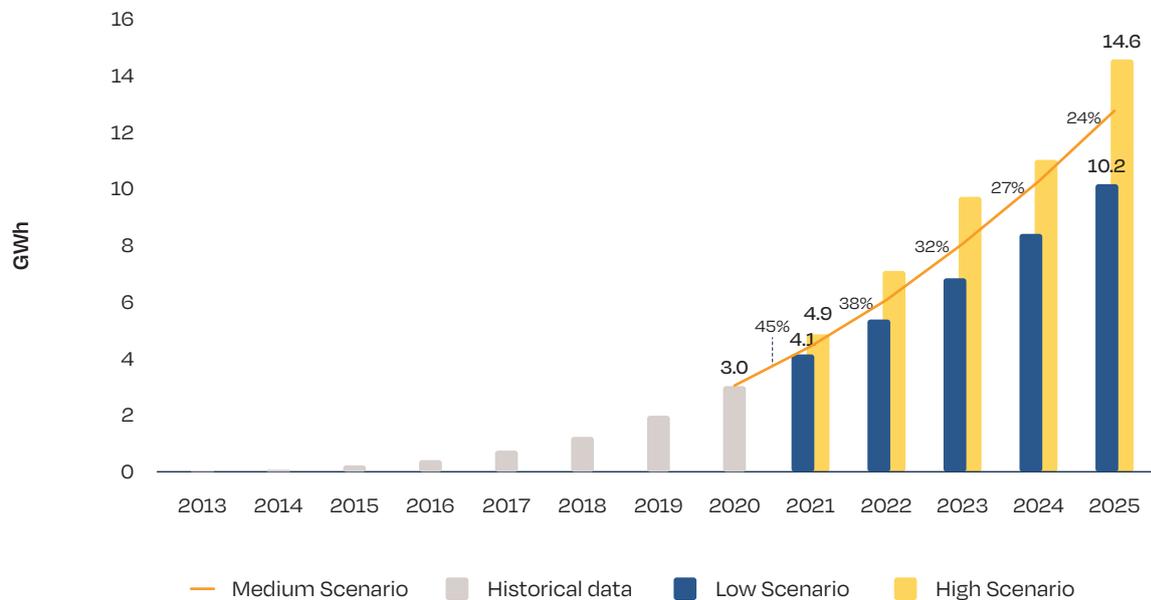
continued

As a result of improved market conditions, the Low Scenario has also been revised upwards significantly. Considering the increasing recognition of the role of distributed solar & storage in the European energy transition, it appears very unlikely that the deployment of these technologies would stop anytime soon. Still, our Low Scenario, which anticipates worsened trade conditions, new COVID-related restrictions and other negative market impacts, foresees a stagnating market in 2021, with 1.09 GWh of storage capacity installed. By contrast, further advancement in EU member states' ambition towards renewable energy and decarbonisation goals, paired with improved policy frameworks and other positive effects on markets could lead to 1.82 GWh of installed capacity in 2021, as anticipated in the High Scenario. At the moment, such optimism seems unjustified, but storage, like solar did several times in the past, could provide unexpected positive surprises. By 2025, the

European home storage market could be as small as 1.74 GWh or as large as 3.53 GWh, according to our Low and High Scenarios.

When looking at total installed residential battery storage capacities, our European Market Outlook 2021–2025 shows very high growth rates over the coming years (Figure 3.2). As a market segment still in an early growth phase, last year's 54% annual growth will be followed by a 45% increase in 2021. In our Medium Scenario, we expect the cumulative residential storage capacity installed across Europe to reach 4.4 GWh in 2021, 6.1 GWh in 2022, 8.0 GWh in 2023, 10.3 GWh in 2024 and 12.8 GWh in 2025. Associated growth rates are consistently above 20% for all the interested years. Under optimal conditions, Europe's residential prosumers could operate a battery fleet as large as 14.6 GWh by the end of 2025, compared to 10.2 GWh in the Low Scenario.

FIGURE 3.2 EUROPE RESIDENTIAL BESS CUMULATIVE SCENARIOS 2021-2025



© SOLARPOWER EUROPE 2021

Local Developments

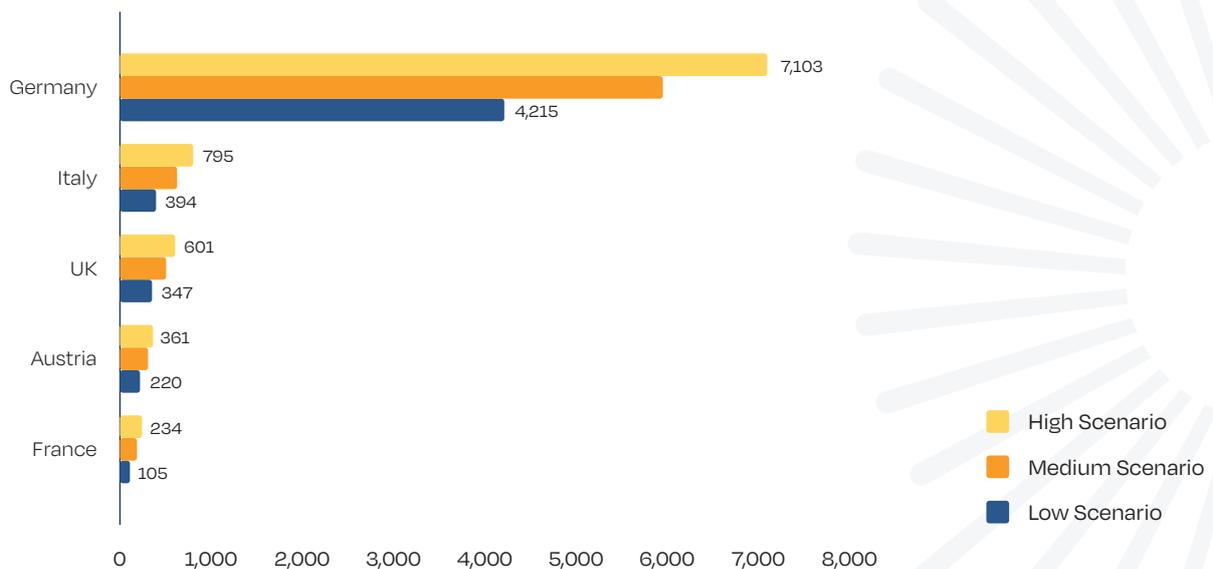
Over the next years, Germany will continue to be the undisputed leader in the field of residential energy storage, led by a strong development of the residential solar PV segment and a high battery attachment rate. The biggest European economy will continue to be followed by Italy, where very attractive government incentives, triggered by the necessity to recover quickly from the COVID-19 pandemic, will make the market grow significantly. While in the UK the market will continue to surge thanks to cost-reflective network tariff restructuring, favourable government measures for solar & storage will ensure a steady market expansion also in Austria and Switzerland. In general, with decreasing technology cost of BESS and supportive national policy initiatives, many private prosumers in other emerging European markets such as Spain, Ireland, Czech Republic and Sweden will be more attracted by PV and battery systems as well.

In Germany, the residential storage market is expected to follow the development of the residential solar PV installations, which are forecast to grow steadily between 2021 and 2025. Thanks to an

average attachment rate of about 60% for new systems, the battery market will also grow considerably. In addition to this, we expect a growing number of BESS to be installed on already existing residential PV systems. Starting in 2021, households equipped with solar panels under the renewables feed-in law EEG introduced in 2000 will see the phase out of their 20-year FIT contracts. According to an EuPD Research survey, 58% of German PV owners are considering retrofitting their systems with a battery after the expiration of their EEG contract. EuPD sees a retrofit potential of over 200,000 systems until 2030. However, the potential is much larger – only 20% of all home PV systems were coupled with a battery by end of 2020.

Overall, we estimate 5.95 GWh of residential battery capacity additions from 2021 to 2025 in our Medium Scenario. But, if we consider the robust solar growth in Germany (which last year abandoned its 52 GW total solar installation cap for a new target of 100 GW by 2030), the significant EV sales increase triggered by the COVID-19 stimulus packages and participation of the Green Party in the new government coalition, demand could be even higher, reaching 7.10 GWh

FIGURE 3.3 EUROPE TOP 5 MARKETS RESIDENTIAL BESS ADDITIONS 2021-2025



© SOLARPOWER EUROPE 2021

3 Residential solar and storage markets in Europe tomorrow /

continued

based on our High Scenario. On the other hand, delays in the actual implementation of the recovery packages, and issues with the current EEG, where quickly decreasing feed-in premiums in consequence of strong demand have been making investments in small solar much less attractive as product prices increased, are posing barriers for the residential storage development if not fixed. This is represented by our Low Scenario, expecting new installations for 4.22 GWh. However, a new German government coalition without Conservatives is likely to push developments towards our High Scenario. In any case, Germany will continue playing in a different league than any other European country when it comes to residential battery deployment.

The development of the Italian residential storage market looks very promising for the coming years as well. The Superbonus 110% support scheme, now extended until 2023, will continue to drive the BESS market upwards. Our Medium Scenario forecasts a total of 625 MWh home battery capacity additions, compared to 394 MWh in the Low Scenario and 795 MWh in the High Scenario between the period 2021-2025. Under the Medium Scenario, 2025 is the year when the BESS fleet in Italy will exceed 1 GWh in total capacity.

In the United Kingdom the residential PV market is on the rise after the stagnation that followed the termination of the FIT scheme. Battery storage installations will follow the same trend, supported by the market liberalisation allowing retailers to offer innovative network tariffs structures to their customers. Though the slow pace of smart meter rollout remains an important 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 storage costs decrease continues. The Medium Scenario foresees additions of 500 MWh until 2025, with upside potential up to 601 MWh and a Low Scenario of 347 MWh based on hard economic consequences of Brexit.

Austria will remain in the club of the top 5 residential storage markets in Europe despite the country's comparatively rather small population of 8.9 million. The revision of the national solar target to 11 TWh by 2030 and the 1 million rooftop PV systems target under the Mission2030 programme will play a key role in determining the country's ambition towards

distributed solar & storage. In addition to the country's investment subsidy for residential solar & storage valid until 2023 and other regional incentives, further growth is driven by the increasing spread between the retail electricity price and the subsidised feed-in tariff price. Our Medium Scenario anticipates that residential BESS capacity installed per year will grow from 56 MWh in 2021 to 84 MWh in 2025, a 50% increase over the whole period. Considering total additions between 2021-2025, in our Medium Scenario we forecast 304 MWh of new capacity, which is 85 MWh higher than the Low Scenario and 57 MWh lower than the High Scenario.

The European country with the fifth largest residential storage capacity additions will be France, taking the position away from Switzerland. Solar energy in France is poised to grow consistently in the outlook period, thanks to improved policy conditions. Despite the low electricity prices in the country and a low attachment rate between solar & storage, our forecast expects between 105 and 234 MWh installed between 2021-2025, with the Medium Scenario at 178 MWh.

In Switzerland, which is now out of the top 5 markets, residential storage will follow a similar pattern to its neighbour Austria. The home solar & storage market continues to grow despite the COVID-19 health crisis, as the government approved a sizeable recovery package that includes incentives to solar. This support scheme, renewed in 2021, comes together with an improvement of the bureaucratic procedures for solar installations.

In the Netherlands no major changes are bound to happen in the near future. Here, the net-metering regulation for residential PV systems is still the most important barrier for self-consumption through batteries and will remain fully in force until 2023. In Belgium, on the other hand, the net-metering scheme was removed in Flanders, raising households' interest for self-consumption with storage, while in Wallonia the net-metering will stay in place until 2023. 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. Also, 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.

Spain, which is one of the largest solar markets in Europe, has a big potential for residential storage growth. Together with the strong deployment of large solar-scale systems occurred in the past years, the residential installations for both PV and storage systems are now expected to increase too. First, the sun tax was abolished in 2019, enabling investments in distributed solar, and in July 2021, the Spanish government introduced a big incentive scheme for PV self-consumption and storage until 2023, as part of the national recovery plan. Considering the average retail electricity price being high (and still rising) and this new favourable national incentive package, the residential Spanish BESS market is expected to emerge quickly.

Other minor residential storage markets to keep an eye on are Ireland and the Czech Republic. Despite the very early stage of both markets, the future outlook seems quite promising as the governments are working to implement new favourable regulations that will drive the development of residential batteries and smart home energy management systems in the future. In Ireland, a new support scheme on micro-

generation (Clean Export Guarantee) is currently under development to allow prosumers to sell their electricity to the grid. In the Czech Republic, amendments of the Energy Act initiated last year are currently under discussion in the parliament; which, if passed, would open the market for battery storage. In addition, stand-alone batteries and small aggregated renewables and storage have been allowed to provide flexibility services starting from January 2021.

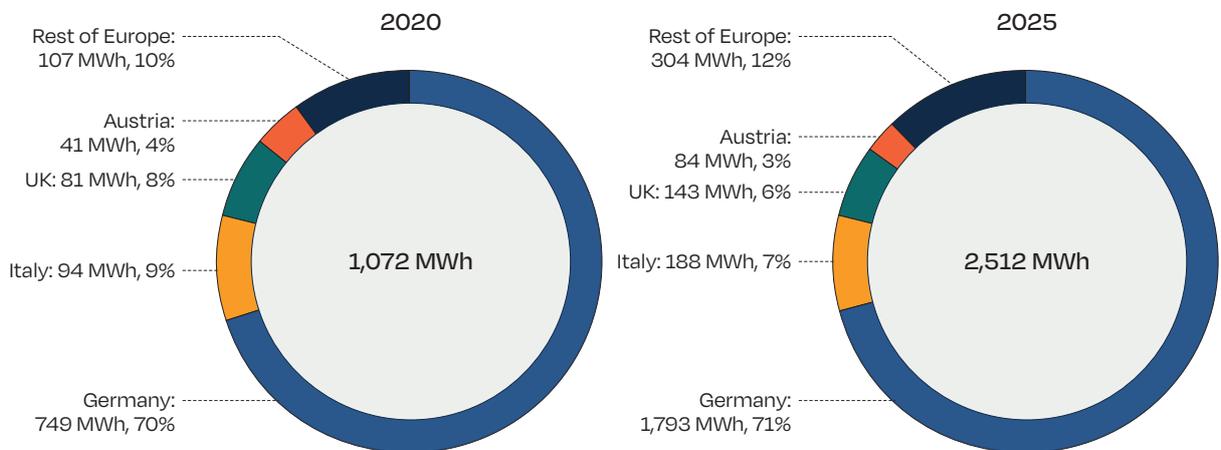
In all other European countries, no major regulatory changes are on the horizon that could propel residential solar and storage installations to larger markets in the short term. There, it looks like demand will remain limited to early adopters unless administrations will set clear signals to kick off the residential solar & storage market. However, the climate targets set by the European Green Deal and several other initiatives from the European Commission, such as the Renovation Wave, as well as the rising acknowledgement that small-scale batteries are key to enable higher shares of decentralised solar generation, all support an optimistic outlook for the European residential solar & storage market.



In 2020, the four largest European residential battery storage markets – Germany, Italy, the UK and Austria – together installed 965 MWh of residential storage capacity. That is 90% of the total 1,072 MWh that was installed in that year in Europe. By 2025, we do expect annual capacity to grow significantly, but the main players will not change. The current top 4 markets will remain the largest contributors of storage installations in Europe, although their aggregate annual capacity share, which amounts to 2,208 MWh, will marginally decrease to 88% of the total 2,512 MWh we anticipate for that year (Figure 4.1).

In this chapter, we provide a detailed background on the evolution of battery storage in Europe’s four most prominent markets, with Germany leading the group having installed over 3 GWh by the end of 2020, more than three times as much as the other three combined (Table 4.1). One key to the success of residential solar & storage in these four countries are policy frameworks that enable self-consumption of solar power generated at home. In most of these markets, direct subsidies and/or tax incentives have been available.

FIGURE 4.1 TOP 4 MARKETS IN 2020 & 2025



© SOLARPOWER EUROPE 2021

TABLE 4.1. OVERVIEW OF THE TOP 4 RESIDENTIAL BESS MARKETS

	GERMANY 	ITALY 	UK 	AUSTRIA 
Cumulative residential BESS capacity 2020 (MWh)	2,077	272	272	161
Cumulative residential PV capacity 2020 (MW)	8,375	4,141	2,402	927
Cumulative residential BESS-PV attachment rate 2020 (%)	20%	5%	9%	15%
Retail electricity price for residential customers 2020 (EUR/kWh)	0.303	0.219	0.220	0.214
Overarching framework for prosumer electricity export	Feed-in tariff/ feed-in premium	Net-billing	Market based	Feed-in-tariff
Average grid export tariff for residential PV systems 2020 (EUR/kWh)	0.091	0.21	0.06	0.077
Authorisation to self-consume	Yes	Yes	Yes	Yes
Energy arbitrage possible	Yes	No	Yes, with some time-of-use tariffs	No
Aggregation and grid services possible	Partially	Pilots ongoing	Yes	No
Financial support schemes	Some regional support mechanisms	50% fiscal rebate; 110% depreciation alongside energy efficiency improvements	No	Federal investment grant; some regional support mechanisms
Remaining barriers	Double changing of grid remuneration; poor smart meter infrastructure; no dynamic time-of-use tariffs	Limited timeframe of current depreciation scheme; net-billing; no dynamic time-of-use tariffs	Incomplete smart metering infrastructure; lengthy DSO approval processes	No standardised IT communication to enable arbitrage or aggregation; limited smart metering infrastructure (but plans to reach 95% by end of 2024)

4 The TOP 4 EU residential battery storage markets / continued

4.1. Germany

Germany confirms itself as the leading European country 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 270,000 total units have been registered in the country. The growth of storage continued after 2018, when the subsidy from KfW came to an end and only BESS subsidy schemes at state level were left. In 2020, the additional capacity installed was 749 MWh, which is 51% higher compared to the one installed in 2019.

In our Medium Scenario, we expect a 26% growth for new storage installations in 2021, since the main driver, the residential solar PV market, has continued to develop at the similarly outstanding levels as it did during 2020 (Figure 4.2). Moreover, the new Renewable Energy Law (EEG) 2021 includes some positive amendments like the surcharge exemption on self-consumption for PV systems from 10–30 kW, extending the provision for systems up to 10 kW. This makes small commercial solar systems more attractive, leading also to bigger storage sizes. Additionally, starting from 2021 older PV systems with

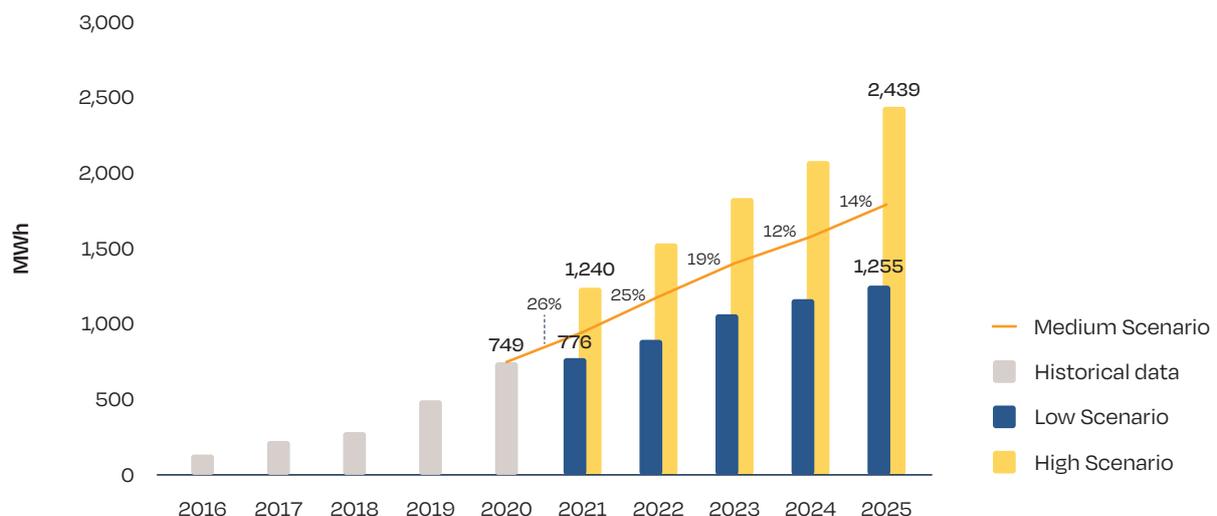
expiring FIT contracts will make battery retrofitting a more and more relevant share of total installations.

In our Medium Scenario, we forecast a similarly high 2-digit growth rate for 2022 (+25%) as the year before – with an additional residential storage capacity of 1,181 MWh. In the years 2023 to 2025, our forecast assumes installations of 1,402, 1,577 and 1,793 MWh respectively, for a total additional number of 880,000 units for the period 2021–2025. This means that by the end of our outlook period, the German home BESS fleet would comprise over 1 million batteries.

Residential solar & 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.

FIGURE 4.2 GERMANY RESIDENTIAL BESS ANNUAL SCENARIOS 2021-2025



© SOLARPOWER EUROPE 2021

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, 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 25 million EUR for the period 2013–2015 and was then renewed with 10 million EUR 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 the world. 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 0.07 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.

Over the years, the increasing attractiveness of solar 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 90,000 additions in 2020. In terms of capacity, around 30 MWh were added in 2013 compared to 749 MWh in 2020.

Economics for residential storage in Germany

The business case for residential stationary storage in Germany is still primarily associated to self-consumption. With the retail electricity rate for households being constantly high at around

0.30 EUR/kWh for years, and even increasing to about 0.31 EUR/kWh this year, and the feed-in premium offered by the EEG accelerating its decrease (over the course of 2021 the premium dropped by 1 Euro cent to 7 Euro cent, due to strong demand), 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 remains somewhat complex. The Energy Industry Act passed in June 2021 also opened the possibility for multi-use applications for behind-the-meter storage.

Moreover, in regards to the smart meter rollout, the 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 limited.

Prospects

The German storage market is expected to continue on a high 2-digit growth rate also in 2021 and 2022 (+26% and +25% respectively), mainly led by the strong residential solar development. A further increase in the Medium term will derive from the numerous PV systems that will start phasing out of their 20-year long FIT contracts. About 60% of homeowners equipped with solar PV plan to retrofit their systems with storage after the expiration of their feed-in tariff. Additionally, several federal states across the country have decided to make the installation of solar PV systems mandatory on private roofs. An example is Berlin, where the senate of the German capital has introduced in June 2021 a new law that makes compulsory for the majority of new buildings – including residential buildings – to install a PV or a solar thermal installations on the roof, starting from 2023. The solar law will be also valid for existing buildings if the roof is fundamentally renovated. Other federal states moving in the same direction are

4 The TOP 4 EU residential battery storage markets / continued

Bremen, Hamburg, Schleswig-Holstein, and Baden-Württemberg, with the last one's legislation requiring buildings to include solar installations as of May 2022.

It seems unlikely we will see the introduction of new storage subsidy schemes at federal level – it will rather be the renewal of the current regional subsidies to support further market growth across the country. Additional market drivers will continue to be the effects of the COVID-19 recovery stimulus initiated last year, which has pushed the demand for electric vehicles, which is leading in turn into a bigger interest for solar & storage systems. Households who do not own a PV or a storage system yet will be attracted by the possibility to save money on their bill against the high Germany electricity prices and be an active part of the sustainable transition by charging their cars with green and cheaper energy.

The new EEG Law 2021 amended in January has brought some positive changes for prosumers, among

which raising the tax exemption threshold for solar PV systems from 10 kW up to 30 kW. Moreover, among the new amendments there are easier procedures to retrofit post-EEG solar systems.

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, Germany is expected to remain the biggest and most developed residential storage market in Europe over the next years. Our Medium Scenario estimates new additions of 5.95 GWh for 880,000 new units between 2021 and 2025. However, with the Green party joining the new government coalition a much higher 2030 solar installation target is expected to be announced soon, which would lean solar & storage growth rather toward our High Scenario of 7.1 GWh of new installations.



© sonnen

4.2. Italy

The residential BESS market in Italy has been, and in the next few years, will continue to be driven by attractive public subsidies. The first residential solar & storage installations in the country were registered in 2015. Since then, the sector started to grow rapidly following financial schemes available in the regions of Lombardy and Veneto and the extension to batteries of the 50% tax credit for the purchasing of a residential PV system. Last year's introduction of the new Superbonus 110% incentive scheme provides the most significant boost to the market – and will continue do so over the next two years. In total, almost 40,000 units have been registered in the country, with a cumulative storage capacity of 272 MWh. In 2020, the additional residential storage capacity installed reached 94 MWh, growing 44% in comparison to 2019. Despite Italy being hit very hard by the pandemic, the market did not shrink, registering a growth beyond initial expectations, which is also thanks to the introduction of this big new fiscal incentive in mid-2020.

Residential solar & storage market in Italy

Unlike in several other solar markets, the residential segment was the main driver of the Italian solar sector in recent years, with an average share of 37% among total installed PV capacity in the last 5 years. This has led to a cumulative capacity of 4.1 GW and 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 (*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.

The government also provides an incentive for the installation of small-scale PV generation assets in the

form of a 10-year long tax credit covering 50% of the investment cost. Typically, a household spending 10,000 EUR for a PV system would benefit from a 500 EUR tax rebate per year during the next 10 years.

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

In 2018, the 10-year tax incentive for the installation of residential PV covering 50% of the upfront investment cost were extended to small-scale BESS. All systems installed simultaneously or after the commissioning of the PV system were eligible. In mid-2019, Veneto launched an incentive program for residential BESS and Lombardia renewed it for one more year. While the incentive scheme in Veneto was not renewed, the Friuli Venezia Giulia region also decided to launch a grant for residential storage, with a budget of 200,000 EUR. From 2020, however, none of the regions have renewed their financial subsidies for solar & storage.

In July 2020, as part of the COVID-19 national recovery plan, the government introduced the aforementioned Superbonus 110%, important significant measures to encourage energy efficiency interventions in residential buildings. The measure gives the possibility to obtain a tax credit of 110% for the expenses occurred from July 2020 until 2023, to be spread over a 5-year period in five annual instalments of equal amount. In order to obtain the credit, the law makes an important differentiation between “leading” (*trainanti*) and “towed” (*trainati*) improvements. The former concern thermal insulation, winter air conditioning systems and seismic risk reduction works; while the latter include the installation of grid-connected PV systems, battery storage, EV charging infrastructure, and other energy efficiency measures. Therefore, in order to benefit from the Superbonus, the PV and the storage systems must be installed in conjunction with one of the main interventions and the overall investments made must lead to an improvement of the building's energy efficiency rating. In the case of ineligibility for the Superbonus, it is still possible to obtain the 10-year 50% tax credit already in place for the installation of small-scale PV generation assets and BESS.

4 The TOP 4 EU residential battery storage markets / continued

Economics for residential storage in Italy

The only application for residential BESS in Italy currently is to improve the self-consumption rate of small-scale PV plants. Household batteries cannot charge from nor feed to the grid, but can only interact with the co-located 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.

In the last decade, the Italian retail electricity rate has oscillated between 0.20 and 0.25 EUR/kWh. 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.

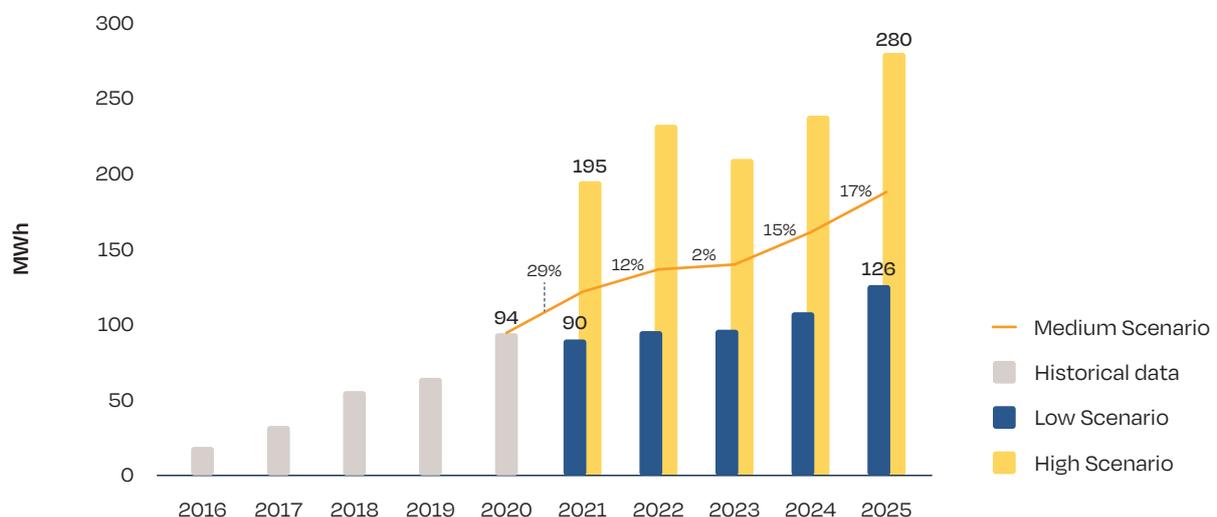
The main drivers for the purchase of BESS by homeowners equipped with PV remain the very generous incentives currently offered. Thanks to those, Italy is by far the most attractive European country for small-scale solar & storage systems regarding payback time. The 110% or 50% tax reliefs

drastically eases the investment in a residential BESS, and the additional independence it provides together with a PV appeals many customers.

Prospects

Thanks to the large incentives provided through the Superbonus 110%, we expect a strong growth of battery installations in Italy. According to our Medium Scenario, 122 MWh will be installed until the end of 2021, for a total of 16,500 batteries (Figure 4.3). This is equal to a 29% growth compared to 2020 installed capacity. We anticipate a significant increase also in 2022, with an annual market of 137 MWh and a 12% year-on-year growth. However, there is a possibility that the market will be much larger than that, provided that there are no significant obstacles to access the Superbonus. The more optimistic end of our outlook foresees 195 MWh in 2021 and 232 MWh in 2022. With the end of the incentive scheme in 2023, our expectation is that the market will take a break that year, and to regain traction through 2025 as residential PV installations continue growing. The Medium Scenario anticipates the Italian home storage market to reach 188 MWh in 2025. Throughout the period 2021-2025, our market estimates forecast a total of 625 MWh home battery capacity additions in the Medium Scenario. Under this scenario, 2025 is the year when the BESS fleet in Italy will exceed 1 GWh in total capacity.

FIGURE 4.3 ITALY RESIDENTIAL BESS ANNUAL SCENARIOS 2021-2025



© SOLARPOWER EUROPE 2021

4.3. United Kingdom

The UK residential BESS market has been active since 2016. Overall, approximately 37,000 units have been installed in the country so far, with a total cumulative storage capacity of 272 MWh. During 2020, the country installed 81 MWh of residential storage capacity, which represents a 26% increase if compared with the figures added in the previous year that amounted to about 9,000 units. The UK storage market is actually larger than previously assessed, not too far from Italy and confirming itself as a market with a solid base despite the absence of any support scheme. Even with the COVID-19 pandemic did not have a slowdown effect on the BESS market, which has continued its growth trajectory in line with the previous years. We expect 2021 to be another positive year, with 93 MWh installed according to our Medium Scenario and a 14% growth, as the lessening of health crisis measures will bring a further raise of both residential solar and BESS installations.

Residential solar & storage market in the UK

The small-scale solar PV segment in the UK was supported for a number of years by a generous government subsidy. From April 2010, a homeowner installing solar PV 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 to 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.

After the slight market recovery started again in 2019, the solar growth trend continued also in 2020, with circa 50 MW of new residential PV installations, leading to a cumulative amount of 2.4 GW installed at the end of the year.

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 important driver was the emergence of new tariffs structure that encouraged time-of-use optimisation. 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 even if no specific support mechanism for storage systems have been introduced, and the economics for the end consumer remain less favourable than in other markets. In 2020, around 11,000 residential BESS have been installed, accounting for about 40% of the new residential solar PV systems and a corresponding storage capacity of 81 MWh.

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 2020, improving market conditions for households to look at solar & storage as a means towards 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. In addition, the Transmission Network Use of System (TNUoS) charges compensate for the transmission network costs, and are based on the share of demand during TSO 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.

4 The TOP 4 EU residential battery storage markets / continued

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 (SEG), which entered in force from 1 January 2020. Under this new regulation, every energy retailer has to offer its 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 for households.

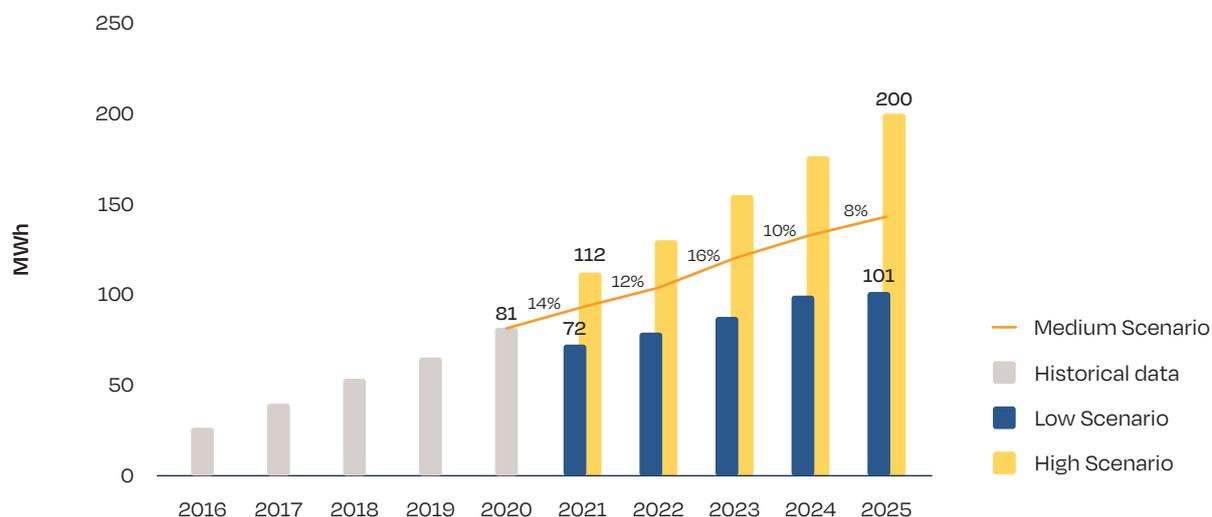
Without a government FIT scheme, the economics for residential solar & storage are much more difficult to estimate as the remuneration strongly depends on the retailer considered. At the beginning of 2021, 14 suppliers offered Smart Export Guarantee contracts, with the export rate within those contracts 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



© Tesla

FIGURE 4.4 UK RESIDENTIAL BESS ANNUAL SCENARIOS 2021-2025



© SOLARPOWER EUROPE 2021

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 solar & 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.

Prospects

With no specific government incentive, and the likely transition period still needed for new SEG offers to reach their full maturity, we do not expect major changes in the direction the UK home storage market will take over the next five years. Our Medium Scenario foresees a stable growth in the number of BESS installed every year, increasing from 81 MWh in 2020 to 93 in 2021 (+14%) and 145 MWh in 2025 (+75% over five years). Under the Medium Scenario, the UK will have a home storage fleet of 365 MWh in 2021 and 865 MWh in 2025.

An additional driver of the market could be represented by a change in residential buildings regulation in England and Wales, where new homes will be required to include a rooftop PV system in order to achieve a better level of energy efficiency. This in

turn, could lead to a higher number of households interested in the purchasing of a BESS that can benefit from an optimised time-of-use tariff.

Also, the new nation-wide half hourly metering plan for the domestic retail market expected to be completed within 4-5 years will ensure a better penetration of new time-of-use tariffs and products that will reward end-consumers for using energy in a more flexible way. This will also improve the overall economics of solar & storage, making the combination more attractive for prosumers.

If there is no ongoing assessment about any support scheme for residential storage, the political uncertainty remains high in the UK these days. The long-term impact that Brexit will have on both the retail electricity price and the taxation of solar PV and battery technologies is still difficult to forecast.

In contrast, the success of the many pilot projects experimenting the value of battery aggregation for grid services and/or collective self-consumption will lead to additional upside in the future.

With so many unknowns, the spread between our Low and High Scenario in 2025 is large, ranging between 101 MWh and 200 MWh of new storage capacity.

4 The TOP 4 EU residential battery storage markets / continued

4.4. Austria

The residential battery storage market in Austria started to get traction as early as 2015, and was accelerated by an investment grant to kick-start the technology launched in 2018 at the federal level. Overall, about 24,000 units have been installed so far across the country, with a total capacity of 161 MWh by the end of 2020. Last year, 41 MWh from 6,000 units of residential storage capacity were added, corresponding to a 10% increase compared to 2019. The renewal of the investment grant by the federal government for the period 2020-2023 has been an important support element for storage to ensure a solid recovery in the aftermath of the health crisis, which caused a slowdown in the installation of home batteries. Our Medium Scenario for 2021 forecasts residential storage capacity additions of 56 MWh, corresponding to a strong 37% annual growth rate. We expect sustained growth at least until 2023, as long as the investment grant for storage is available.

Residential solar & 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-year 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 9 million EUR budget, offered financial support covering up to 30% of the investment costs. Concurrently, a specific budget of 6 million EUR per year was dedicated to support the investment in any storage systems installed with the subsidised PV systems. Overall, the financial support for solar & storage systems could cover up to 45% of the total investment costs. In addition to the federal support scheme, there are also

regional incentives available for both small-scale solar PV and attached storage systems.

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), about 5,500 in 2019 (37 MWh, 23% growth) and 6,000 in 2020 (41 MWh, 10% growth). The total residential storage capacity in service across the country is estimated to be 161 MWh by the end of 2020.

Economics of residential electricity storage in Austria

The residential BESS sector in Austria is mainly driven by homeowners' desire to improve their 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 were progressively reduced, reaching 0.077 EUR/kWh for the year 2020. The spread increase between the two raised the value of coupling rooftop PV systems with batteries. Nearly all the traditional retailers in the country already offer static time-of-use tariffs with specific rates for peak and off-peak times. Furthermore, the national smart meter rollout is progressing quite fast and should be completed in 2022. This is enabling more retailers to also provide dynamic pricing contracts, with special tariff structures for households equipped with solar & storage systems. Overall, the economics for coupling batteries to residential rooftop PV systems has still room for improvement in Austria, but the various incentives available support the investment rationale for customers striving for more independence from the grid and looking to self-consume their own green power.

Prospects

The federal government of Austria has the ambitious plan of covering 100% of total national electricity consumption with renewable energy sources by 2030. At the core of this goal lies the ambitious 1 million rooftop programme, which implies a tenfold increase from the 2018 target of 100,000 roof-mounted PV systems.

Moreover, the Renewable Expansion Act (EAG) introduced in July 2021 aims to add 27 TWh of electricity from renewable energies, from which

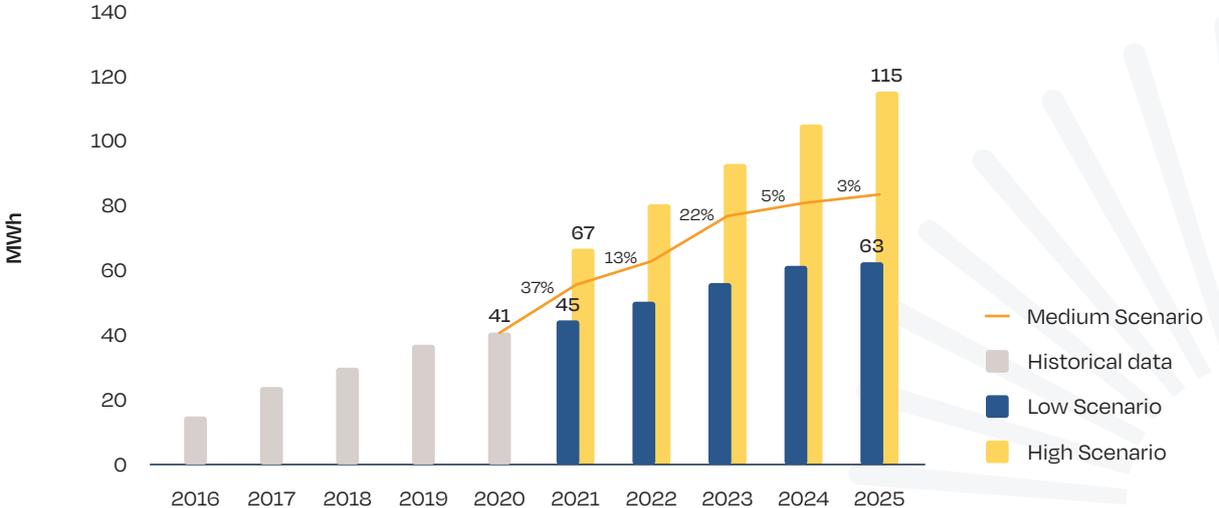
11 TWh of solar PV. It also brings many other interesting policy changes, among which two funding systems. One taking the form of a market premium for PV electricity to be fed into the grid– which still requires notification from the European Commission – or via an investment grant for solar & storage systems, which could start by the end of 2021. The EAG also facilitates grid access with flat-rate costs and the creation of energy communities.

The investment subsidy for both small-scale solar PV and BESS that was renewed for the period 2020–2023 should sustain a stable growth for the residential BESS market. A total budget of 24 million EUR for solar PV and 12 million EUR for storage is allocated by the federal government each year.

With the smart meter rollout expected to be terminated in 2024, there will be potential for more innovative electricity contracts, enabling end-customers to unlock to a larger extent the potential of their storage systems. Certain Austrian regions are also currently assessing more stringent building regulations that would make integrating solar PV for new homes compulsory.

We assume in our Medium Scenario demand to increase from 56 MWh in 2021 to 84 MWh in 2025 (Figure 4.5). This equals to a 37% year-on-year growth in 2021 and a 105% growth over the five-year period. After three strong years, growth is expected to slow down after 2023, due to the expiration of the current subsidy scheme. By 2025, a 521 MWh home battery fleet will be operating in the country, compared to 161 MWh installed at the end of 2020.

FIGURE 4.5 AUSTRIA RESIDENTIAL BESS ANNUAL SCENARIOS 2021-2025



© SOLARPOWER EUROPE 2021



SolarPower
Europe



SolarPower
Europe

SolarPower Europe - Leading the Energy Transition
Rond-Point Robert Schuman 3, 1040 Brussels, Belgium
T +32 2 709 55 20 / F +32 2 725 32 50
info@solarpowereurope.org / www.solarpowereurope.org



ISBN NUMBER 9789464444285