

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.

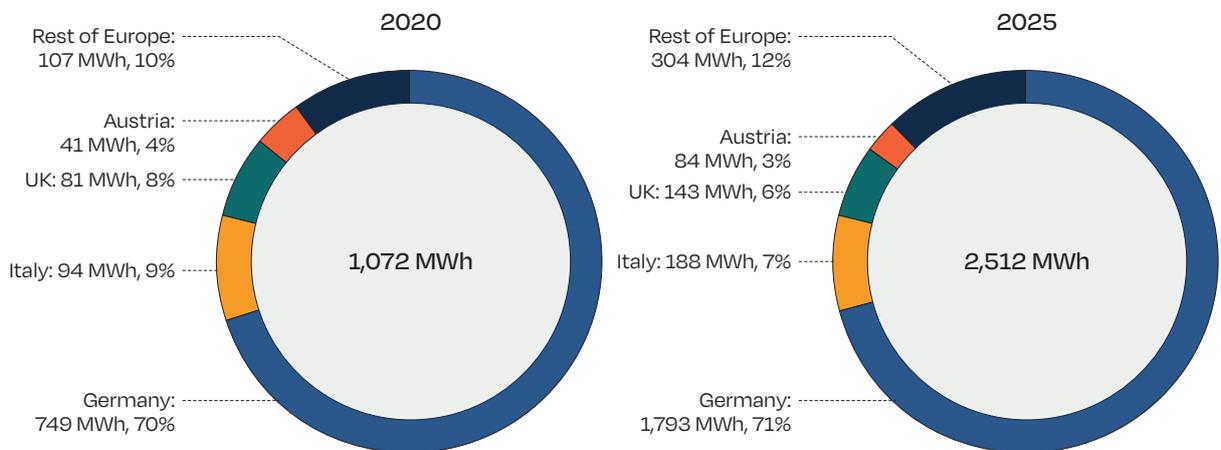
In all other European countries, no major regulatory changes are on the horizon that could propel residential solar and storage installations to larger markets in the short term. There, it looks like demand will remain limited to early adopters unless administrations will set clear signals to kick off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



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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

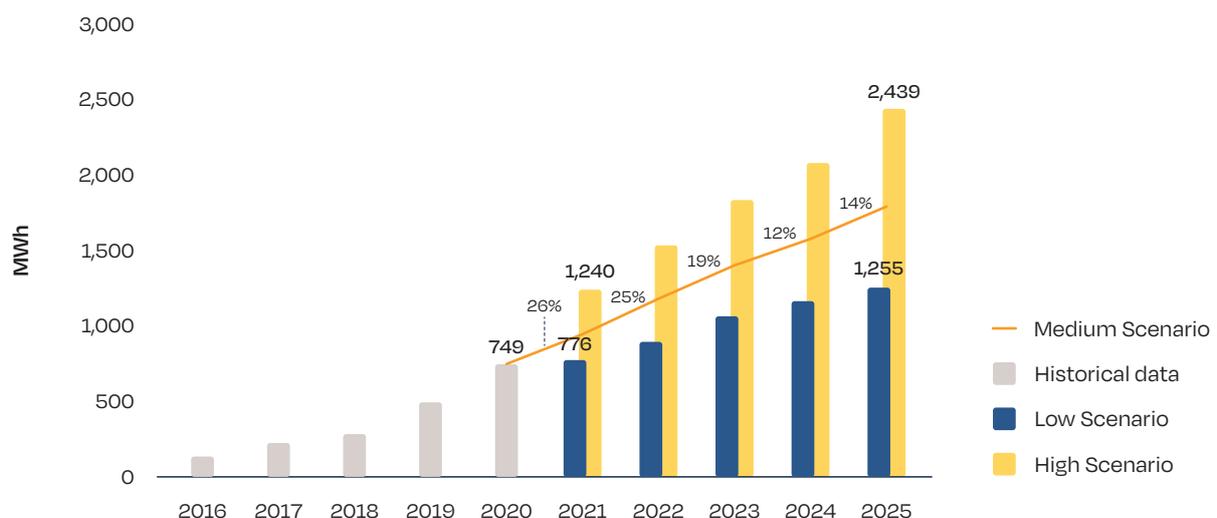
expiring FIT contracts will make battery retrofitting a more and more relevant share of total installations.

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



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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