

Is the German utility-scale energy storage market set to take off?

Germany | Germany's early lead among Europe's battery storage adopters is now long gone. But with the urgency to deploy renewable energy compounded by the need for greater energy independence, some industry players and experts see change coming on the horizon, Cameron Murray writes.

As by far Europe's largest economy, the German market is usually on the radar of businesses in any fast-growing and internationalising sector. But when it comes to large-scale front-of-meter battery storage projects, its deployment figures for 2021 lagged far behind the UK, Ireland and France.

The residential sector has conversely always been very strong, as homeowners increasingly seek to back up their home PV systems. But just 32MW of utility-scale (1MW-plus) projects were installed in the country in 2021, according to a recent report by a group of RWTH Aachen University-based and spinout organisations. However, the situation is starting to change, one of its authors tells *PV Tech Power*.

"The large-scale market is gaining traction, with different drivers from previous years. You have big Innovation Tenders for co-located sites, you have many industrial sites installing MW-plus systems and you also have the Grid Boosters which will provide a huge boost to the market," says Jan Figgner, head of grid integration and storage system analysis at ISEA RWTH Aachen University.

People see the German market now as 'boiling' and want to be there early, adds Florian Mayr, partner at clean energy finance and strategy consultancy Apricum.

Two companies which were part of the start of the energy storage boom in the UK, investor Gore Street Capital and renewables developer Anesco, entered the German market in quarter one 2022. In June, Swiss Life Asset Managers, which has US\$290 billion of investments, joined them when it acquired a platform with a 220MW BESS pipeline.

But this bullishness isn't necessarily widely shared. Claus Urbanke, head of wind and solar Germany for Norwegian hydro-power company Statkraft, says that the short-term storage needs of the market are limited and that Statkraft does not currently see a commercial case for standalone battery energy storage, although it is

participating in the Innovation Tenders from federal network operator Bundesnetzagentur for co-location, explained later.

Jorg Blaurock, partner at 3Energie Consulting which produces annual reports on the storage sector for national storage association BVES, agrees to an extent. He says that Germany does not need any more energy storage for grid stability as its needs are already well served by existing assets and interconnection with other countries, and that the main driver is opportunities in the wholesale energy market capitalising on increased volatility.

Where are we today?

One big reason why the German battery energy storage market has not taken off yet is because of a relatively small grid frequency services market, typically the first driver for battery storage because of its stable revenue guarantees. This relates to Germany's greater array of options for grid flexibility, including numerous interconnectors to other national grids.

Value stacking is also more difficult due to unfavourable regulatory conditions. This stems from the existing regulatory definitions for storage assets being inadequate according to BVES, although should change going forward after new definitions were brought into German law in May 2022.

Frequency containment reserve (FCR) is the main ancillary service for batteries to play in, but the 550-600MW market is close to saturation with around 600MW of utility-scale battery energy storage installed at the time of writing, according to project developer ECO STOR.

FCR will soon be replaced by aFRR, which will help make the service more international amongst Europe's interconnected markets, although will not on its own increase the size of the market, points out Statkraft's Urbanke.

"There was a short time when these (short duration storage) projects were commercially viable in primary reserve (FCR), but since this is such a small segment



A 4.5MWh BESS using Audi EV batteries brought online by RWE in January 2022.

Credit: RWE

of the market which got exploited quickly, this opportunity doesn't exist anymore," he says.

The period he refers to is around 2018 when nearly 200MW of utility-scale battery storage was installed according to Delta-EE, a record year for the sector. But the market slowed substantially in 2020 and 2021 as FCR was increasingly saturated.

The largest operational battery storage system in Germany today is the Lausitz Battery Energy Storage System at 60MW/52MWh, attached to a coal plant operated by power plant operator and utility LEAG. LEAG, RWE and other large utilities have been the main players installing large systems to-date, says Lars Fallant, COO of project developer Tricera Energy.

These are market-driven projects, he adds, capitalising on grid frequency services and trading opportunities. These, plus the Innovation Tenders incentivising co-located storage projects and a handful of massive 'Grid Booster' storage tenders are the main drivers of the market going forward, according to all the sources we interviewed.

'Ukraine has amplified the drivers': ancillary services and short-term trading

Along with the rest of the European Union, Germany recently upped its renewable energy targets for 2030 to reduce reliance more quickly on Russian fossil fuels after its

Credit: Smart Power.



invasion of Ukraine. Energy storage will be needed to integrate those new resources onto the grid.

"The invasion amplified the existing factors driving the storage market, especially for big industrial sites and other renewable energy installations as everyone knows now we need independence from Russian gas. And those renewable energy assets will need batteries," says Figgner.

To achieve a renewable mix of 80% by 2030, the new target, Germany will need 84GWh of additional energy storage, all batteries, according to the Fraunhofer Institute for Solar Energy Systems.

As more renewable resources come onto the grid, this will increase market volatility which in turn creates an opportunity for battery storage to capitalise in short-term trading markets. Delta-EE anticipates that this ramp-up in storage will start in 2025 although the numbers it is expecting are still far below what is needed. It expects around 450MW of additions in 2025 growing (with a dip in 2026) to around 800MW in 2030.

The Smareg 4 project in Eisenach, Germany, developed by Smart Power and recently acquired by BCP Battery

But even before any ramp-up of renewable resource deployment happens - it's still early days - the existing revenue opportunities for storage have increased substantially, says Georg Gallmetzer, managing director of ECO STOR. And that is despite a revenue source that has historically made up half of the value stack for big batteries no longer being available for projects being commissioned after 2022.

He says that the prices in the auxiliary (ancillary) service markets and spreads in short-term trading have multiplied so much recently that the business model is stronger than last year, even with a 30% increase in material costs due to supply chain constraints (lithium-ion batteries, transformers, concrete and building work etc).

Fallant partially agrees: "The frequency response and energy trading markets have increased recently, but most owners go for frequency response because it ages the battery less quickly because of shallower cycling. But the outlook is that batteries will do more energy trading, although no one knows exactly where the prices will go."

Gallmetzer agrees that most systems focus on frequency response because of the less heavy cycling. But heavy cycling activities like energy trading will increasingly deliver higher profits and investor returns over time, he claims.

Because growth in energy storage will never keep up with growth in renewables, according to Gallmetzer, opportunities for storage in trading and grid services will

continue to increase until the 2030s or 2040s when batteries may eventually begin to cannibalise their revenue opportunities.

Innovation Tenders

Another driver of the storage market is the Innovation Tender mentioned earlier, which was first brought in for renewable generation but recent ones for projects that combine two different clean energy resources will see the first winning sites commissioned in 2023. All the winners from the tenders in May and August 2021 were solar-plus-storage projects.

Winning projects get an additional fixed market premium per kWh of energy provided to offset technology investment costs. Statkraft is deploying a 20MW solar, 7MW lithium-ion storage project through the tender and will participate in others.

"The storage project for the Innovation Tender will effectively be a peak shaver function for the PV plant because, and this is due to the way the tender is designed, you can only inject the storage system with kilowatt-hours which are produced by the PV plant. So, every day you would inject the cheapest hours and then you would dispatch to the grid during the most expensive hours when the plant doesn't produce any more, so typically during the evening," Urbanke said.

But, he added, the requirement for storage to only charge from the generation asset was not the most optimal solution.

Fallant agreed, saying it was a "...big disadvantage as the usability of the battery



Credit: TESVOLT.

German ESS maker TESVOLT mainly targets the C&I market. Behind-the-meter residential and commercial continue to outshine the utility-scale segment.

storage is very limited for this application". Nonetheless, these tenders have been called a bright spot in the relatively subdued German market.

Grid Boosters

Two of Germany's big four transmission grid operators, TenneT and TransnetBW, have announced plans to launch 'Grid Booster' ('Netzbooster' in German) projects in which large battery storage systems will be installed at vulnerable locations on the grid.

The aim of these is to reduce redispatch costs and defer some of the mass of new cable investments the country needs to integrate new renewable energy resources. In general, Germany's renewable generation is in the windy north while consumer needs are in the more densely populated south.

Batteries can help mitigate the issues in ensuring the smooth shift of energy across the country by, for example, being placed at both ends of a grid congestion point, acting as a virtual power line.

According to the latest announcements, Transnet's will be 250MW while TenneT is planning two of 100MW each (all one-hour systems). They are set to be commissioned in 2025 although project development tenders or firm dates have not yet been announced.

Figgenger expects these tenders to happen in 2023 and points out that although they are few in number, they will significantly boost the utility-scale storage market. If they went online today, they would increase the size of the utility-scale battery storage market by two-thirds in one swoop.

Looking forward

"Why do you think Germany doesn't have 100-200MW projects like the UK, and when do you think it will?" was a question put to the PV Tech Power team by a German delegate at Intersolar Munich in May this year, to which the short answer was 'very soon'.

Gallmetzer says the move to larger projects has simply needed investors to try smaller projects first, to get experience in the sector before scaling up. Siemens and Fluence announced plans to build a 100MW/200MWh battery in Wunsiedel although have not given a delivery date. RWE expects a 72MW project to come online in late 2022 while ECO STOR will build a 100MW/200MWh system for commissioning in 2024.

Gallmetzer tells PV Tech Power that the main limitation for Germany achieving its storage deployment targets is not finance, nor materials, nor grid access.

"The actual limitation of growth of the German storage market is the number of teams and players on the market and their output capability for developing and deploying large-scale storage projects," he says.

"I think with the existing players we could get to 30-50GWh by 2030, but not 100GWh. But even with 40-45% renewable share today batteries see a tremendous profit opportunity on the short term (trading) markets."

The entry of international investors and developers like Gore Street Capital and Anesco should help here but the expected shortfall based on ECO STOR and Delta-EE's numbers seems insurmountable by battery storage alone.

Some of that shortfall could be made up for by green hydrogen, which we hear the energy community in Germany is very bullish on, although this is mostly focusing on using it as feedstock for industry. A second use will be for transportation and then lastly using it for power-to-gas-to-power electricity energy storage will be considered, although the economics of this don't yet stack up.

Germany is so bullish on the technology that buyers of energy storage solutions (ESS) do not even consider flow batteries as an option for medium-to-long duration solutions, according to one provider who was speaking anonymously.

New definition for energy storage

In recent news, the German parliament amended several laws relating to energy and the electricity grid which officially recognised energy storage as a resource where the "final use of electrical energy is postponed to a later point in time than when it was generated" (a direct translation).

This may finally mark the end of energy storage assets being treated as a generating resource when discharging and a consumer of electricity when charging, although the immediate effect is negligible or unclear.

The significance of it is that future regulations can be formulated to be much more friendly to energy storage. Until now, sources have described Germany's regulatory framework for storage as unfavourable, complex and full of hurdles and insecurity, as rules were always defined for traditional energy assets.



Tricera Energy exhibiting at Intersolar / ees Europe in Munich in May 2022.

Credit: Cameron Murray / Solar Media

But Gallmetzer says it is difficult to evaluate the significance of the move because of the complexity of the topic and the fact its contents may change as it passes through the Bundesrat.

Residential, commercial & industrial to continue dominating the market, but to what extent?

All reports providing forward forecasts on the German energy storage market estimate that the residential and commercial & industrial (C&I) sectors will continue to account for the vast majority of storage deployments.

Blaurock says that one driver of households and businesses wanting to become energy-independent is the negative reputation that big energy groups have developed, due to windfall profits whilst energy prices have been high.

Another is that solar energy is relatively cheap, and regulators have simplified the process for installing on-site solar resources, which has in turn helped the associated on-site energy storage market to kick on.

Although it's to be expected, BESS developers say that the utility-scale storage market's future growth is being underestimated. This is both because of difficulties in forecasting the opportunities in energy trading several years down the line, and an under-reporting of planned projects.

Conclusion

It's clear that Germany's need for energy storage is likely to grow substantially as more renewable resources are integrated into the grid. Whether there is enough capital, grid access and development capacity to deliver the quantity of utility-scale projects is far from certain, however.

Unless we start to see a lot more project developers enter the market, the sector is likely to continue to be driven by small-scale projects purchased by homes and businesses and may fall well short of the sorts of figures industry actors claim are needed. ■