1H 2025 Energy Storage Market Outlook

April 30, 2025

BloombergNEF

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Section 1. Executive summary

14.7%

Energy storage market's compound annual growth rate in gigawatt-hours from 2025 to 2035

94GW/ 247GWh

BNEF's estimate for global energy storage additions in 2025

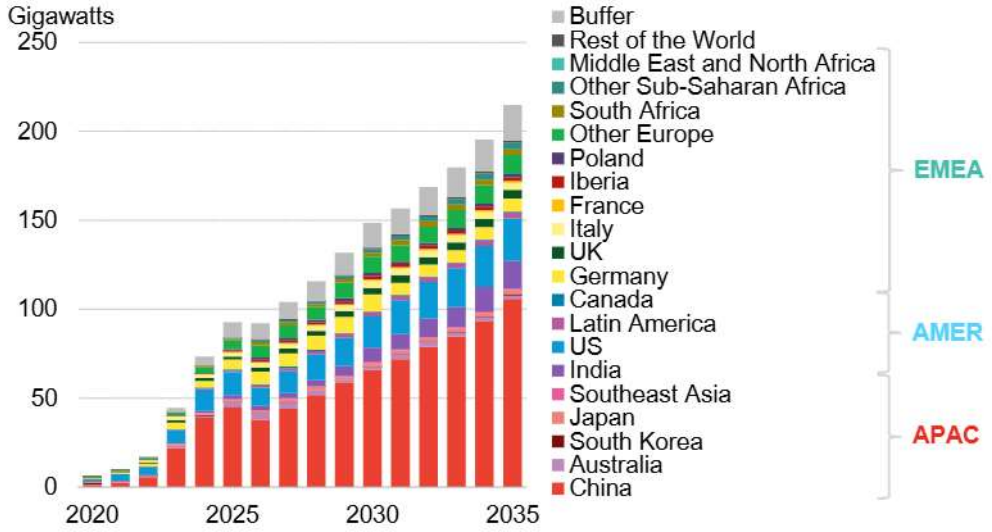
8

Number of markets where gigawatt-hour scale energy storage projects have been commissioned or entered financial close since the start of 2024

The global energy storage market is poised for another record year in 2025 despite policy changes and uncertainty in the US and China, the two largest markets. BloombergNEF expects additions to grow 35% this year, with China continuing to lead thanks to regional co-location mandates. Globally, the utility-scale segment is the main growth driver through the forecast period, with gigawatt-hour projects online or under construction in every continent.

- BNEF tracked 74 gigawatts (GW) or 181 gigawatt-hours (GWh) of global energy storage additions in 2024 (excluding pumped hydro), nearly doubling in gigawatt-hours from 2023. A new record for annual additions of 94GW/247GWh will be set in 2025, followed by a compound annual growth rate (CAGR) of 14.7%, with annual additions reaching 220GW/972GWh in 2035.
- Cumulatively, energy storage adds 1.6 terawatts (TW)/6.1 terawatt-hours (TWh) of new capacity from 2025 to 2035, compared to 9.4TW and 2.1TW of new solar and wind. Global wind and solar markets have respective CAGRs of 6.6% and 3.6% in the same period.
- Energy storage project development is increasingly driven by the utility-scale segment, with mandates and targeted auction schemes driving gigawatt-hour projects in more markets. Since 2024, gigawatt-hour projects have been commissioned in Saudi Arabia, the US and China, and entered construction in Australia, the Netherlands, Chile, Canada and the UK.

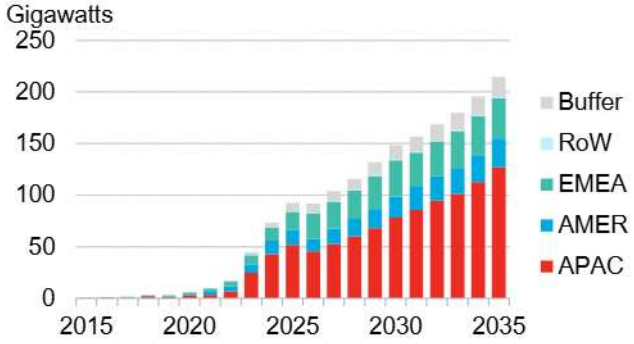
Figure 1: Global gross energy storage additions by market



Source: BloombergNEF. Note: Buffer is an estimated that is not explicitly allocated to any specific application. EMEA is Europe, the Middle East and Africa. AMER is the Americas. APAC is Asia Pacific.

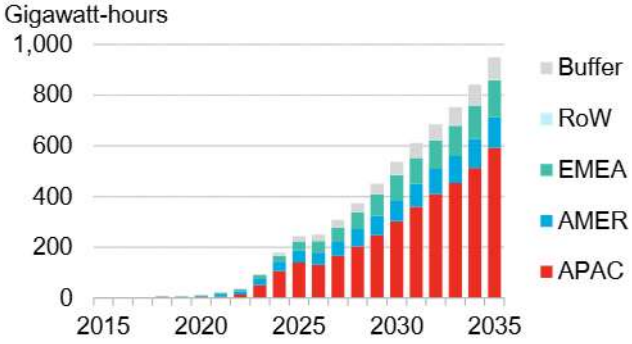
- The residential market has been more mixed, cooling slightly in Europe but rising in markets like California due to policy changes. Commercial battery deployments overtake residential build by 2030 in this outlook, thanks to updated assumptions on attachment rates, which we calculate as the percentage of solar installations that pair with a battery.
- Lithium iron phosphate (LFP) batteries peak at a record 92% gigawatt-hour market share in 2027, pushing out the use of nickel-based battery chemistries, which have a market share of just 1% by 2035. Sodium-ion plays a smaller role than in our previous outlooks, as low LFP battery prices have made it less competitive. BNEF attributes 8% of additions in 2035 to a mix of undefined technologies installed for longer-duration energy storage projects (LDES). LDES may be met by other non-lithium energy storage technologies.
- The **Asia-Pacific (APAC)** region maintains its leadership through the forecast period, with its share of annual gigawatt-hour additions growing slightly to 61% in 2035 from 59% in 2024 (Figure 2). China accounts for most of this, driven in the near term by mandates to pair utility-scale wind and solar projects with energy storage. The market will change as the new policy requires wind and solar payment mechanisms to move toward more market-based structures, but BNEF still expects strong demand for batteries. Growth in India provides an additional boost in this outlook due to increased utility and federal procurement, adding to Australia and Japan's auctions that encourage investment in energy storage to provide clean firm capacity. Cumulative deployment for APAC reaches 965GW/3,723GWh in 2035.
- **Europe, Middle East, and Africa (EMEA)**'s share of annual additions on a gigawatt-hour basis rises to 17% by 2035, from 14% in 2024. The utility-scale market is scaling quicker than expected and will become the largest segment in the region from 2026, thanks to targeted support schemes across Europe, and a sharp ramp up in utility procurement in the Middle East and Africa. EMEA reaches 421GW/1,203GWh cumulatively by the end of 2035.
- The **Americas (AMER)** share of annual installations falls to 12% in 2035, from 21% on a gigawatt-bour basis in 2024. Activity is still led by the US, despite a drop in expectations as higher tariffs on imports drive battery prices up and slow build. Canada, Brazil and Chile are the next largest markets, adding similar amounts of capacity by 2035, mostly in the utility-scale segment. By 2035, the AMER region reaches 256W/999GWh cumulatively, adding just about a terawatt-hour to global capacity.

Figure 2: Annual global energy storage installations by region based on power output



Source: BloombergNEF. Note: RoW is Rest of World. EMEA is Europe, the Middle East and Africa. AMER is the Americas. APAC is Asia Pacific.

Figure 3: Annual global energy storage installations by region based on energy capacity



Source: BloombergNEF. Note: RoW is Rest of World. EMEA is Europe, the Middle East and Africa. AMER is the Americas. APAC is Asia Pacific.

- Our global **buffer** addresses uncertainties such as markets where we lack visibility and where more ambitious policies may develop that we haven't predicted. For historical capacity, BNEF has based the buffer on battery shipment analysis, where gaps in historical and near-term battery demand were identified. BNEF analysis assumed 5.1GWh in 2023 and 12.0GWh in 2024, which is 10% and 15%, respectively, of the GWh demand outside China in each of these years (excluding buffers). BNEF added a 10% buffer based on global forecast gigawatt-hour capacity each year after that from 2025 to 2035.
- *(Selected numbers for Germany, UK, Iberia (Spain) and North Europe were corrected on September 16, 2025.)*

Section 2. Global outlook

Globally, cumulative capacity reaches 1,808GW/6,527GWh at the end of 2035, nearly 18 times the capacity at the end of 2024 (164GW/370GWh). Mainland China (hereafter referred to as China) leads with 45% of cumulative installed capacity by 2035 on a gigawatt basis, followed by 13% in the US. Other leading markets include Germany, India, Italy, the UK, Australia and South Africa (Figure 4 and Figure 5).

Figure 4: Region ranking based on cumulative energy storage capacity by power output

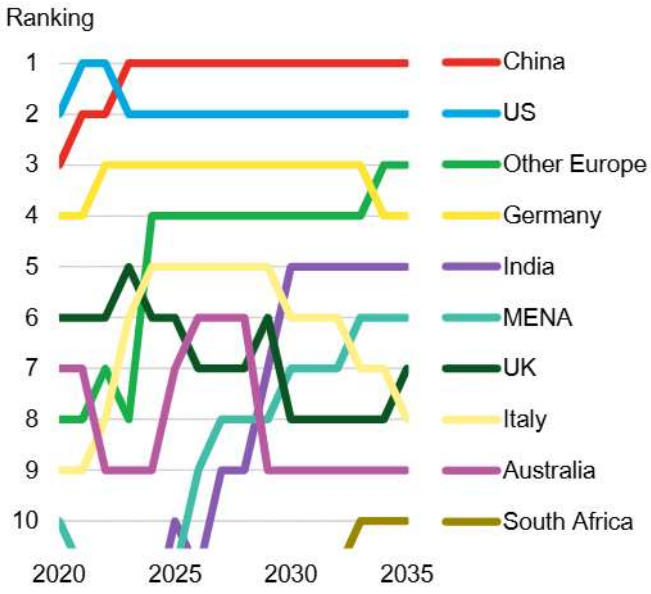
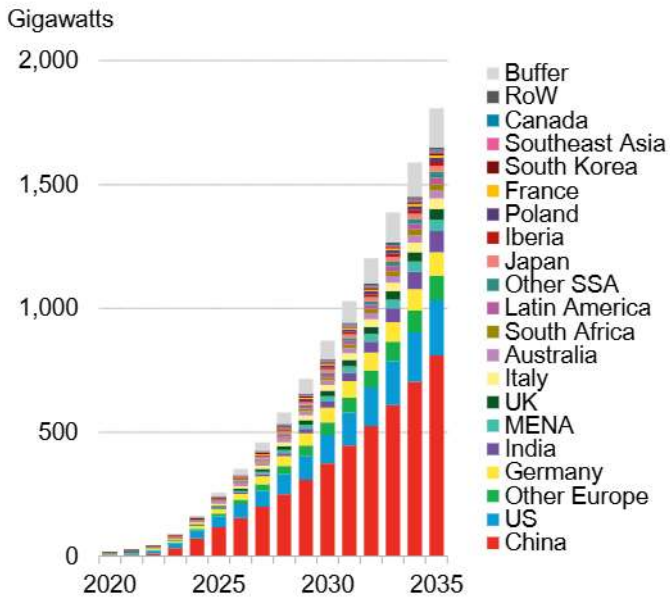


Figure 5: Global gross cumulative energy storage capacity by power output and key markets



Source: BloombergNEF. Note: BNEF orders countries according to their region group. 'Other Europe' includes Czech Republic, Hungary, Slovenia, Slovakia, Denmark, Estonia, Finland, Lithuania, Latvia, Norway, Sweden, Bulgaria, Cyprus, Greece, Croatia, Malta, Romania, Austria, Belgium, Ireland, Luxembourg, Netherlands, Switzerland. Buffer is an estimate that is not explicitly allocated to any specific application. SSA is Sub-Saharan Africa. MENA is Middle East and North Africa. RoW is Rest of World.

China, the world's largest energy storage market (ranked here in gigawatt terms), added 39GW/99GWh in 2024, up 113% in gigawatt-hours relative to 2023. Cumulative capacity reaches 809GW/3,174GWh in 2035, driven mainly by rapidly growing solar and wind build. Despite changes toward more market-based payment structures for solar and wind projects, near-term build is still driven by energy storage mandates across regions in China.

The US is the second-largest market throughout our forecast period. In 2024, the US added 12GW/34GWh, up 61% from 2023 additions in gigawatt-hour terms. BNEF expects 13GW/42GWh of additions in 2025, a reduction from our previous forecast due to the negative impact of tariffs on build. US reaches 223GW/875GWh cumulatively in 2035. This is down from our previous forecast mainly due to the impact of tariffs.

Other European countries (excluding Germany, Italy, Spain, Portugal, France, the UK and Poland) combine as the third-largest region by 2035. Combined additions totaled 3.2GW/5.1GWh in 2024, jumping to 4.9GW/8.5GWh in 2025. Cumulative capacity across the region reaches 100GW/260GWh by the end of 2035, with deployments spurred by European Union-approved

support schemes in the Netherlands, Czech Republic, Lithuania, Hungary, Greece, Finland, Slovenia, Slovakia and Bulgaria. Deployments also continue to be spurred by uptake of residential batteries in Switzerland, Austria, Belgium and Sweden.

Germany drops to the fourth-largest market by 2035 from third in our last outlook. Germany added 4.0GW/6.5GWh in 2024, grows to 5.7GW/9.8GWh in 2025, and reaches 95GW/230GWh cumulatively by the end of 2035, slightly down from our previous forecast. Co-location of residential solar with batteries continues to be the norm in Germany, with over 82% of residential solar installations pairing with batteries in 2024. Utility-scale solar projects also continue to co-locate with batteries thanks to Germany's innovation auction. We expect high rates of co-location will continue across all segments through our forecast period, driving battery build as Germany targets 215GW of solar by 2030.

India is set to become the fifth-largest market by 2030, remaining so until 2035. BNEF tracked 0.85GW/1.5GWh of additions in 2024, marking India's first year with over a gigawatt-hour of installations. The market grows to 2.0GW/2.5GW in 2025 as utilities continue to drive solar photovoltaic plus battery and standalone projects in "complex" clean power auctions seeking firm capacity. Cumulative capacity reaches 85GW/348GWh in 2035, with the utility-scale segment driving the market.

The **Middle East and North Africa** is now the sixth-largest region by 2035. It had a remarkable growth year in 2024, adding 953MW/1,984MWh of energy storage. The pipeline of projects is strong, driven by utilities seeking firm capacity. We expect 1.5GW/3.2GWh of additions in 2025. By 2035, cumulative capacity reaches 46GW/157GWh, with deployments led by ambitious national targets across Saudi Arabia, the United Arab Emirates, Egypt and Israel.

The **UK** rises to the seventh-largest market by 2035, from eighth in our previous outlook. The UK added 1.4GW/2.6GWh in 2024 with an additional 1.6GW/3.1GWh expected in 2025. Additions continue to grow throughout the decade, thanks to the pipeline of projects contracted via the UK capacity market. By 2035, cumulative capacity reaches 43GW/122GWh, higher than our previous forecast for 39GW/113GWh, as we observed higher attachment rates, at 60%, in the residential solar and battery market, driving up our forecast for that segment.

Italy drops to eighth by 2035. Italy added 2.0GW/5.3GWh in 2024, nearly double our previous expectations, as utility-scale projects came online quicker than expected. In 2025, the market grows to 2.2GW/5.7GWh. The utility-scale segment has now overtaken residential as the largest in the country, thanks to the pipeline of projects from the capacity market. The utility-scale market will be further boosted by targeted auctions to procure energy storage, with the EU-approved €17.7 billion ($19.5 billion) support scheme looking to contract projects up until 2033. By the end of 2035, Italy reaches a cumulative 43GW/147GWh.

Australia remains the ninth-largest market by 2035. Australia added 865MW/2592MWh in 2024 and is forecast to add 3.0GW/9.1GWh in 2025. The federal government has a 9GW target for new clean storage capacity by 2030, which will drive uptake of utility-scale batteries over the next few years. After 2030, state government targets, looming coal plant retirements, and sustained uptake of small-scale solar systems will support battery installations in Australia. Cumulative capacity reaches 30GW/84GWh by 2035, up from our previous forecast of 27GW/67GWh.

South Africa, broken out as a stand-alone market for the first time, rises steadily to 10th-largest by the end of 2035. South Africa added 827MW/1641MWh in 2024, thanks to the completing of the first gigawatt-hour scale project in the country. The existing pipeline of projects will help drive a further 945MW/1,885MWh in 2025. Utility-scale deployment rises through the forecast period as

utility Eskom continues to contract projects that can serve as firm capacity when coal plants close. By 2035, cumulative capacity reaches 27GW/87GWh.

Updates from 2H 2024 Energy Storage Market Outlook

From BNEF's 2H 2024 Energy Storage Market Outlook, the most notable updates to this edition applying to global capacity numbers include:

- **New markets split out:** Energy storage forecasts are now available at a country level for Poland, Spain, Portugal and South Africa.
- **High tariff forecast scenario for the US:** Our base-case forecast for the US assumes a 54% tariff on Chinese imports (based on April 2 tariffs), though they were increased to 145% by President Donald Trump as of April 9. Based on the higher tariffs, we produced an energy storage build scenario for if Chinese imports persist. US annual energy storage additions could fall between 51%-74% in gigawatt-hour terms lower than our base case between 2025 and 2027. We may revise our base-case forecast depending on tariff negotiations in the coming months.
- **Shipment and buffer:** We updated our shipment analysis to reflect imports throughout 2023 and 2024 to update estimates for the 2024 buffer. The update led to the 2024 buffer going to 12.0GWh from 8.3GWh.
- **Transmission and distribution:** We updated build for this segment for most markets globally based on regional analyst estimates, rather than mainly relying on our transmission and distribution energy storage modeling. By 2030, this leads to 18GW/60GWh of energy storage capacity for transmission (up from 17GW/59GWh) and 7.6GW/28GWh for distribution (down in gigawatt-hour terms from 8GW/30GWh). For our outlook from 2030 to 2035 we maintained the outputs from our transmission and distribution energy storage model. For more on our methodology, see *A.5 Transmission and distribution forecast*.

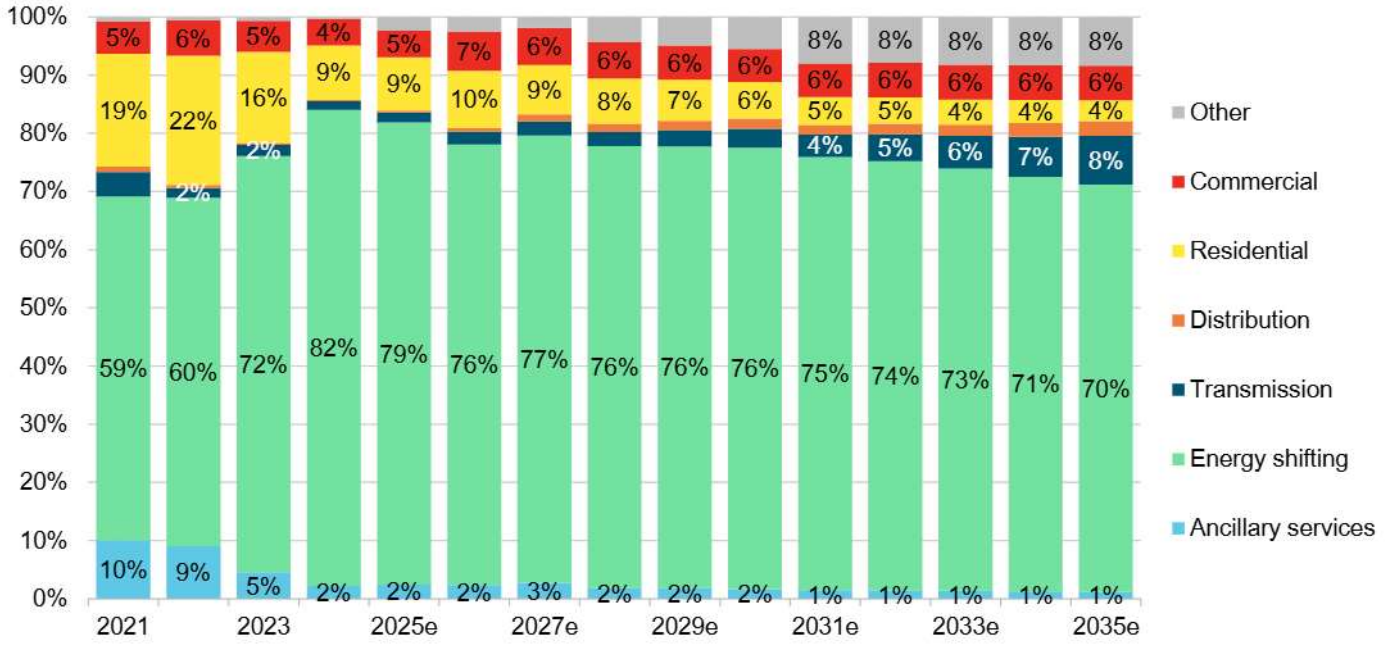
Regional-specific changes are explained in the regional sections throughout the report.

2.1. Applications

Energy shifting continues to be the primary use case for energy storage. The residential storage market share dropped significantly in 2024 after rising in 2022, as impacts of the energy crisis in Europe cool down and reduce demand for home energy installations (Figure 6). Strong growth in the utility-scale segment in China, as well as newly emerging markets in Europe like Italy, pushed the share of capacity installed for energy shifting to a record high in 2024.

Although energy storage capacity has been added for ancillary services in many new markets, we expect this application to retain a smaller portion of deployments. The commercial segment now overtakes residential just after 2030, as the growth in government support and business adoption raises our expectation for attachment to commercial solar. Transmission and distribution remain marginal applications through to 2030, with growth potential through 2035, especially in China.

Figure 6: Application mix of energy storage projects deployed annually based on energy capacity



Source: BloombergNEF. Note: Excludes pumped hydro projects. Includes 'Other' application category and excludes global buffer. At a project level, if multiple applications are selected, the capacity is divided equally among them. Energy shifting refers to capacity built for renewable integration, power price arbitrage and/or providing reliable capacity to meet peak system demand. For definitions see Appendix 0.

Energy shifting accounted for 82% of total energy storage deployments (referring to gigawatt-hours in this section) in 2024. It remains the largest driver of storage capacity through to 2035. The significant rise in share between 2022 and 2024 is mainly attributed to regional mandates in China that require wind or solar projects to pair with energy storage. Projects categorized under our energy shifting application refer to the use of energy storage for renewable integration, price arbitrage and capacity services. Ambitious clean energy goals and energy storage targets, and the larger role energy storage is taking in capacity markets, will help keep energy shifting as the dominant application.

Ancillary services account for 2% of deployments in 2024, declining to just 1% by 2035. Ancillary services have sometimes been the first market that batteries enter. Batteries can nearly instantaneously ramp up and down, lending them a technical advantage over other resources competing to provide ancillary services. In 2024, projects still came online for ancillary services in Nordic markets like Sweden and Finland, adding to demand in India, Japan, and the state of Texas in the US. The UK also announced a new ancillary service that boosted battery revenues in late 2024. Despite these market movements, ancillary services remain a niche market that do not scale compared to the larger opportunity for energy shifting in power markets.

The **residential** market made up 9% of all energy storage deployments in 2024, but drops to 4% by 2035. Germany remains the largest residential storage market with over 80% of customers adopting batteries with rooftop solar. The US, the second-largest market in 2035, is boosted by California, which lowered solar export payment rates and default time-of-use tariffs that encourage faster battery adoption among residential customers. Other key markets are Australia and European countries like Italy, Belgium, Austria, the Czech Republic and Sweden.

The **commercial** segment accounted for only 4% of total deployments globally in 2024 and is expected to grow modestly to 6% in 2035 as funding and interest in this segment increase in key markets. The largest market by 2035 is China by a distance, but demand is also strong in Sub-Saharan Africa and India, where weak grids help drive battery uptake as storage costs decline. Demand in the near term is also boosted in this outlook, thanks to targeted subsidies for commercial batteries in countries like Greece, Hungary and Bulgaria.

Transmission and **distribution** remain marginal applications through to 2030, but then transmission grows in the 2030s primarily as China picks up additions. Our analysis suggests that energy storage as a replacement for grids becomes a more significant segment after 2030 as battery prices fall and opportunities emerge for storage as grid infrastructure.

Section 3. Technology

3.1. Battery technology outlook

Lithium iron phosphate (LFP) remains the prevalent lithium-ion battery chemistry in the stationary energy storage market. Chinese battery makers, which specialize in LFP production, continue to benefit from the growth of the Chinese domestic market and aggressive overseas expansion.

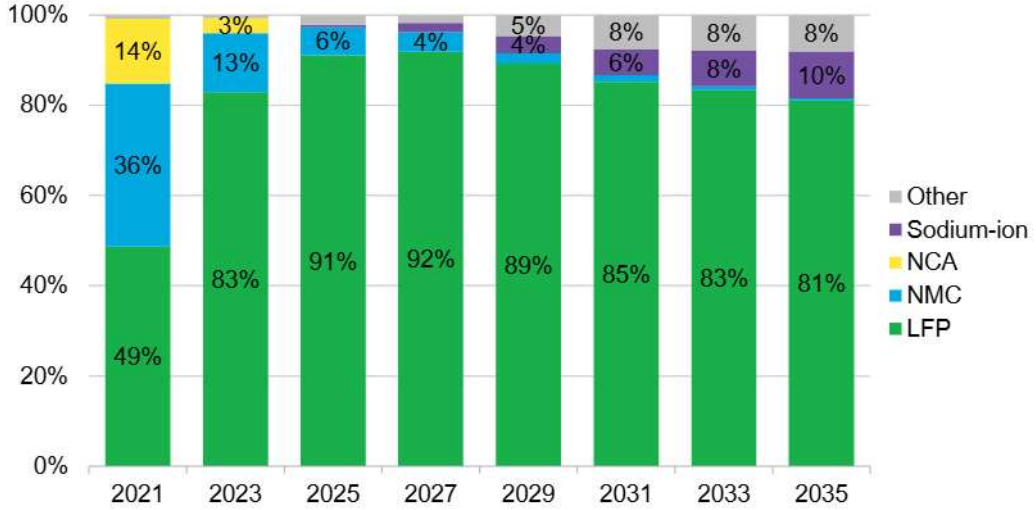
Most major battery makers, such as CATL, BYD, EVE Energy, CALB and Hithium, develop products specifically for the energy storage market, driving a continued deviation from the electric vehicle chemistry mix, which features a larger proportion of nickel-based lithium-ion battery chemistries. Compared to LFP, nickel-based chemistries such as nickel manganese cobalt oxide (NMC) and nickel cobalt aluminum oxide (NCA) are more energy dense, allowing automakers to offer lighter and longer-range electric vehicles.

The energy storage market is dominated by LFP because it is cheaper, safer, and better suited to energy shifting applications

We expect LFP to remain the dominant chemistry for energy storage from now to 2035 (Figure 7), largely due to lower cost and higher cycle life compared to nickel-based lithium-ion battery chemistries. LFP's lower energy density is less of a concern for the energy storage sector: weight and space are not as important for stationary systems, though bigger cell sizes have led to pack and system-level energy density improvements.

Our expectation for sodium-ion batteries has cooled, as activity in China is less imminent due to the increasingly low prices of LFP batteries.

Figure 7: Stationary storage technology mix outlook based on gigawatt-hours



Source: BloombergNEF. Note: "Other' represents capacity built for 'Other' applications in BNEF's Energy Storage Market Outlook, which include long-duration energy storage (LDES). Within LDES, energy storage technologies other than lithium-ion and sodium-ion batteries will play a role, BNEF has not forecast a further breakdown due to uncertainty around commercial scale-up across the many technologies in that group. NCA, NMC and LFP refer to lithium-ion battery chemistries. NCA is lithium nickel cobalt aluminum oxide, NMC is lithium nickel manganese cobalt oxide and LFP is lithium iron phosphate.

LFP's growing market share continues to be driven by aggressive scale-up in manufacturing capacity led by Chinese battery makers. Battery makers outside China, many of which historically specialized in nickel-based lithium-ion batteries, are also scaling up manufacturing of energy storage system (ESS) products using LFP. Major examples include South Korea-based LG Energy Solution and Samsung SDI as well as Japan-based Panasonic. As a result, the market share for NMC and NCA drops to 2% by 2029, from a combined 50% in 2021.[1]

BNEF separates capacity as 'other in the technology mix outlook to address capacity being built under 'other' applications in BNEF's energy storage 2035 forecast, which includes long-duration energy storage (LDES). Within LDES, energy storage technologies other than lithium-ion and sodium-ion batteries will play a role, including other technologies like thermal, mechanical and chemical storage solutions. BNEF has not forecast a further breakdown due to uncertainty around commercial scale-up across the many technologies in that group.

LFP

Major technology trends in LFP batteries include ever larger prismatic cells for energy storage coming to market, allowing for more energy storage capacity per unit. Standardized 5MWh 20-feet containers using 300 ampere-hours (Ah) or larger cells became the standard offered product for 2024, a 34% increase from 3.72MWh previously using cells around 280Ah. Next-generation products are already being designed with even larger cell and system capacities, as the trend has continued into 2025 with 587Ah cells and respective systems reported to come into mass production by CATL, Hithium, and CRRC Zhushou with deliveries in 3Q and 4Q 2025. Many cell manufacturers such as EVE, CALT and REPT have now announced cells over 600Ah.

System integration efficiency can improve with larger cells, as fewer connectors are needed, and more capacity per rack and container can be achieved. However, mass commercialization of larger systems usually takes time when transitioning to larger cells as systems need to be redesigned, with engineering and production taking many months. AC (alternating current) components (power conversion systems) also need to be adapted to new DC (direct current)-side designs. That said, some companies have managed to move to larger cells within the course of a year. These newer products usually launched in China often take six months or so to be available overseas as they need to undergo new product certification requirements in respective markets.

NMC

NMC batteries have lost market share due to their higher cost. NMC is also less favored for energy storage as it degrades at a faster rate than LFP. NMC remains in the energy storage mix in a handful of markets and applications. In Japan and South Korea, where battery manufacturers specialize in nickel-based chemistries, we assume a share of manufacturing will meet energy storage demand domestically and can continue to supply diminishing NMC demand overseas out to 2035, though globally BNEF expects NMC deployments to have peaked at 15GWh in 2024 and decline to 4.7GWh by 2035.

In the US, we also assume NMC may feature in utility-scale projects until at least 2027. Even though the shift toward LFP is clear, 2024 saw large shipments of NMC batteries for energy storage. The impact of very high tariffs on imports from China, where the vast majority of LFP is manufactured, will reduce demand for energy storage in general in the US, but make any NMC available from outside China more viable.

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[1] See *BNEF Energy Storage Tier 1 List 1Q 2025* for more on energy storage providers (web | terminal).

We expect NMC to continue featuring in residential and commercial applications globally, though LFP will still dominate in this segment. There is existing manufacturing capacity for NMC that we assume will continue serving that segment out to 2035. The residential energy storage market is less price sensitive, and providers are more likely to be able to offer competitive products even with the higher costs for NMC cells. Additionally, the higher density of NMC may provide some competitive advantage in the much smaller end of the residential energy storage market, where size and weight are more carefully considered.

Sodium-ion

Based on company announcements, BNEF expects sodium-ion batteries to start volume manufacturing for stationary energy storage this year.

Initial deployment of new generation products will continue to be in China: in July 2024, a 50MW/100MWh sodium-ion project came online in Hubei, China, becoming the first in the world at this scale. The Chinese government has been promoting the development of national standards for sodium-ion battery products to accelerate commercialization and market adoption and has also seen the most significant announcements of sodium-ion battery cell production.

Despite this, expectations among manufacturers have cooled as LFP prices continue to trend downward, leading to a reduction in our expectations for sodium-ion to scale.

3.2. Long-duration energy storage

As the demand for grid reliability and decarbonization rises, long-duration energy storage (LDES) is gaining significant attention from governments, utilities, and investors. Many regions are recognizing the critical role of LDES in achieving their long-term climate goals and are introducing supportive policies and mechanisms. In 2024, the adoption of LDES technologies accelerated, with China leading. Beyond China, pilot projects and early commercial deployments are also progressing steadily across other regions. Below we highlight some LDES market updates since the last outlook.

Definition of long-duration energy storage (LDES)

There is no universal definition for long-duration energy storage. The US Department of Energy defines LDES as storage with a duration of more than 10 hours. In China, energy storage of four hours or longer is considered LDES. We refer to technologies that can extend duration by at least six hours as LDES or take market-specific definitions if these are set. Pumped hydro and lithium-ion batteries are excluded from the analysis below. For more research on the topic see: *2024 Global Long-Duration Energy Storage Update* (web | terminal).

Market updates

Australia: In February 2025, the state government of New South Wales awarded Long-Term Energy Service Agreements (LTESAs) to 225MW/1,800MWh of long-duration lithium-ion battery projects. These agreements are an indicator of growth of payment appetite for longer-duration energy storage capacity. More may come in as part of the federal Labor government's expanded Capacity Investment Scheme (CIS), which hosts a series of tenders every six months (between 2024 and 2027) to secure 23GW of new renewable capacity and 9GW of new clean storage by 2030. These LTESAs provide generators with an option to sell their electricity at an agreed minimum price.

South Korea: The government finalized its 11th Basic Plan for Electricity Supply and Demand (BPE) after nine months of deadlock, providing clarity on energy. According to the 11th BPE from the Ministry of Trade, Industry, and Energy, the country needs 23GW of long-duration energy storage by 2038.

Canada: Ontario's Independent Electricity System Operator (IESO) will soon kick off its Long-Term 2 (LT2) procurement seeking 1.6GW of capacity for energy storage and non-storage facilities. The first window of procurement seeks 600MW of capacity with a required minimum system duration of eight hours, encouraging non-battery energy storage systems to participate in the process. Contracted projects will be able to secure 20-year capacity payments from IESO. The remaining windows will support new energy storage built in 2030-2033. The registration deadline for the first window is August 21, 2025. Its result is scheduled to be announced at the end of March 2026.

UK: In April 2025, the UK opened the first application window for its scheme to support the development of long-duration energy storage projects, defined in its document as at least six hours. The scheme will look to contract the first batch of projects by the second quarter of 2026, targeting pumped hydro and other technologies such as flow batteries, liquid air, and compressed air energy storage.

Further reading on LDES research:

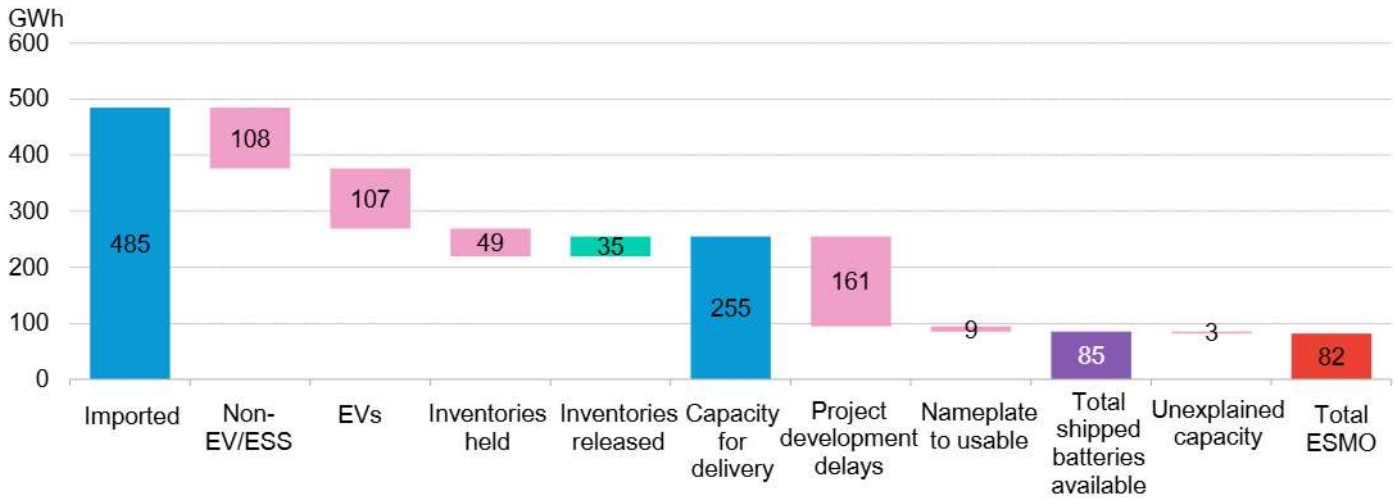
- *2024 Global Long-Duration Energy Storage Update* (web | terminal)
- *2024 Long-Duration Energy Storage Cost Survey* (web | terminal)
- *Flow Batteries Sit at Cusp of Rapid Growth in China* (web | terminal)
- *Long-Duration Storage: Opportunities and Barriers* (web | terminal)
- *Beyond Lithium-Ion: Long-Duration Storage Technologies* (web | terminal)
- *BNEF Energy Storage Project Database* (web | terminal)

Section 4. Battery shipments

Total quantities of batteries exported from China and Korea into other markets is an indicator that often differs from annual installed capacity that BNEF tracks in its energy storage outlooks. BNEF has been using battery trade flow data to investigate where it reveals gaps at a regional level and to inform global capacity buffers. For raw data on battery imports, clients can use the *Battery Supply Chain Trade Flows Data Tool* (web). Below, we translate that data in comparable battery capacity and apply assumptions to explain what it indicates about the stationary energy storage market.

Data on battery shipments for energy storage is often two to three times more than BNEF's expected annual battery demand for energy storage deployments for any given year[2]. However, that value cannot explain that year's deployments since these batteries may not be operational the year they are imported. To supply 2024 battery demand, for example, we calculated 485GWh of batteries were exported from China and Korea, but only 85GWh was deployed as stationary storage (outside China) last year. Major factors impacting differences, quantified based on our analysis, are in Figure 8.

Figure 8: Batteries exported from China and South Korea to meet 2024 stationary energy storage demand outside China



Source: BloombergNEF. Note: Exports taken from Sinoimex data, converted to gigawatt-hours based on $ per kilowatt-hour pack price assumptions. Excludes China domestic demand, assuming that is entirely met by domestic supply. Analysis looks only at batteries exported from China and Korea, not factoring in locally manufactured batteries in non-China and Korea markets. EVs are electric vehicles. ESS are energy storage systems. ESMO refers to this report. Full assumptions in Appendix 0.

In more detail, these factors are:

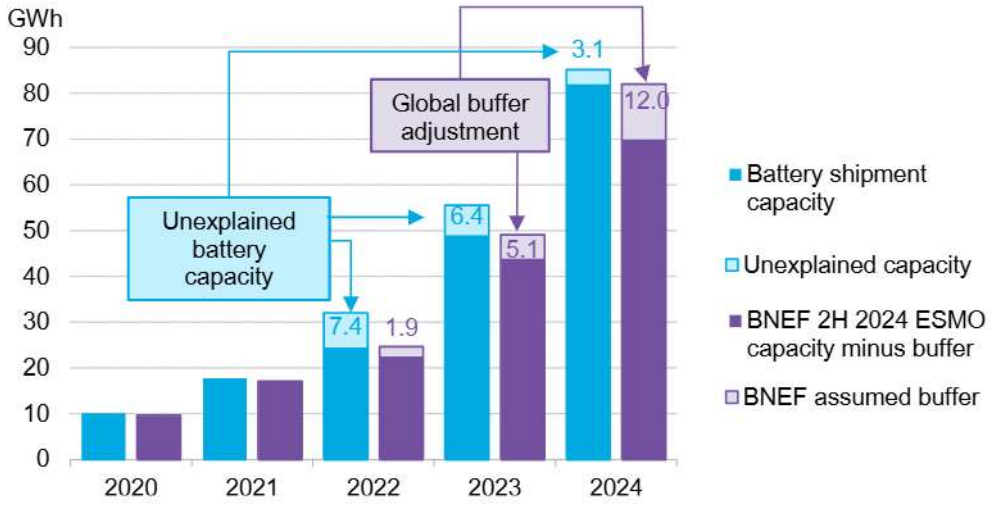
- **Non-stationary energy storage battery demand:** BNEF Energy Storage Market Outlooks do not cover all battery segments (such as electric vehicles, consumer electronics and other segments such as data centers, UPS and portable batteries). BNEF calculated that these amount to roughly 215GWh in 2024 (108GWh for non-EV/ESS segments and 107GWh for EVs).

[2] SNE Research reports 301GWh of batteries were shipped for ESS in 2024, compared to BNEF"s 181GWh ESS deployments for that year.

- **Inventories:** Inventories have been playing a major role in company supply chain strategies as the industry has grown substantially to supply a larger and higher number of projects, while learning from experience from post-pandemic supply chain disruptions and growing localization efforts. In 2024, we estimate battery inventories are still growing at least 14GWh net (49GWh held from when initially shipped, 35GWh released back into the market from previous period). Inventories for ESS batteries started to grow in 2025 as companies rushed to import batteries ahead of tariffs ratcheting up for non-EV lithium-ion batteries, which will go up to 25% in 2026, from 7.5% today, though additional unexpected tariffs have severely halted the import strategy for the rest of 2025 since additional tariffs have suddenly increased to 145% as of April 9. See *Trump's China Tariffs Send Battery Cost Back to 2023* (web | terminal) and *US-Made Batteries Are Pricey But Developers Want Them* (web | terminal).
- **Commissioning delays:** After batteries are imported, a time lag to commissioning can be expected. Based on industry insight, we maintained the 12-month assumption for most markets globally, and 18 months for the US where projects can have longer lead times.
- **Nameplate and usable capacity:** Battery manufacturers will report output based on nameplate capacity, but when a system is installed and commissioned it is typically reported by the energy storage project owner, developer and grid operator based on usable capacity, which is what BNEF reports. BNEF assumed this to be a 10% difference, though this can vary significantly between projects given different tolerances around necessary redundancy. For more, see *Energy Storage System Cost Survey 2024* (web | terminal).

After considering these factors, shipped battery capacity in 2020 and 2021 correlated very closely with BNEF's tracked capacity. For 2022 and 2023, BNEF added global buffers assuming we missed capacity due to tracking visibility. We assumed 5.1GWh in 2023 and 12.0GWh in 2024, 10% and 15%, respectively, of the GWh demand outside China in each of these years (excluding buffers).

Figure 9: Batteries exported from China and South Korea with assumed discounts and delays versus BNEF energy storage demand outside China



Source: BloombergNEF. Note: Battery shipment capacity is based on battery exports from China and South Korea (using Sinoimex data) and discounting for factors such as non-ESS battery segments, inventories, delays to commissioning and nameplate to usable capacity adjustment. Full assumptions in Appendix 0.

We left the remaining battery capacity in 2022 to 2024 as 'unexplained capacity'. Unexplained capacity was equivalent to 30% (7.4GWh) of 2022 battery demand, 13% (6.4GWh) of 2023 battery demand and 4% (3.1GWh) of 2024 battery demand BNEF tracked outside China, including buffers (Figure 9). This difference could be a result of us underestimating factors listed above. We suspect inventories and non-ESS battery demand may have been even higher than our estimates. Holding more inventories is a common strategy to deal with supply chain uncertainties in a rising tariff environment (if expected) and has been more common since the pandemic.

We did not include China battery production or domestic demand, as we chose to calculate batteries physically available in non-Chinese markets through imports. For context, China produced 260GWh of batteries for stationary storage in 2024 according to the Ministry of Industry and Information Technology (MIIT), compared to our total global installed base of 181GWh in 2024. China production in 2024 is still higher but more in line with what we expect will be installed globally in 2025 (247GWh). For additional information on shipment methodology, see Appendix 0.

Section 5. Asia Pacific

The Asia-Pacific region added 43GW/107GWh in 2024, more than doubling 2023 installs. BNEF expects 2025 to reach another record at 52GW/139GWh, with China driving the market (Figure 10, Figure 11). Regional mandates to pair utility-scale solar and wind with batteries will keep spurring additions in China, as major policy changes transition solar and wind toward market-based payment structures. India is quickly growing to become the next largest market in the region, as utilities contract gigawatt-scale solar photovoltaic plus battery projects. Australia, South Korea and Japan are also growing thanks to targeted auctions. Cumulative capacity in the region reaches 443GW/1,392GWh by 2030 and 965GW/3,723GWh by 2035. Build continues to be driven by the utility-scale segments, especially in China (Figure 12, Figure 13).

Figure 10: APAC's annual energy storage additions by market

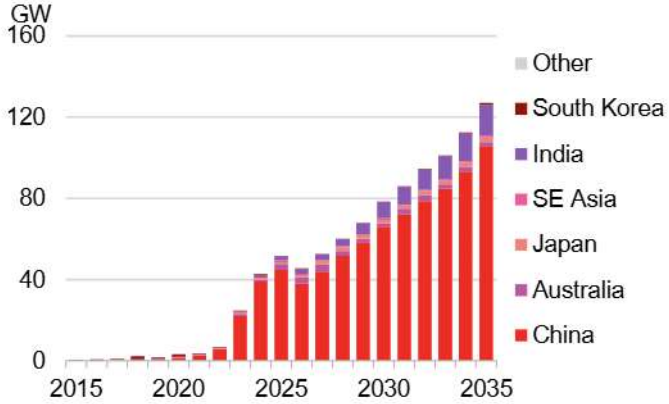


Figure 11: APAC's cumulative energy storage capacity by market

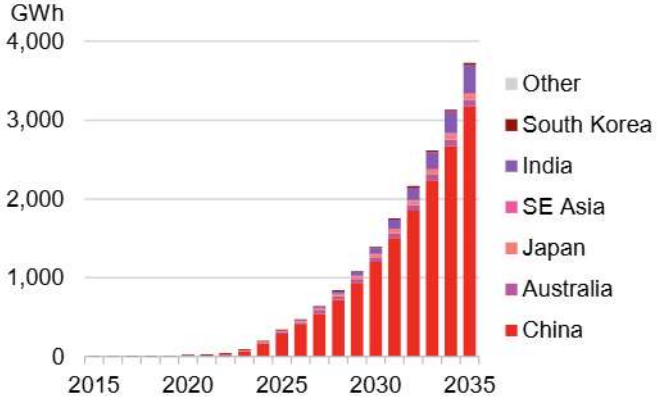


Figure 12: APAC's annual energy storage additions by application

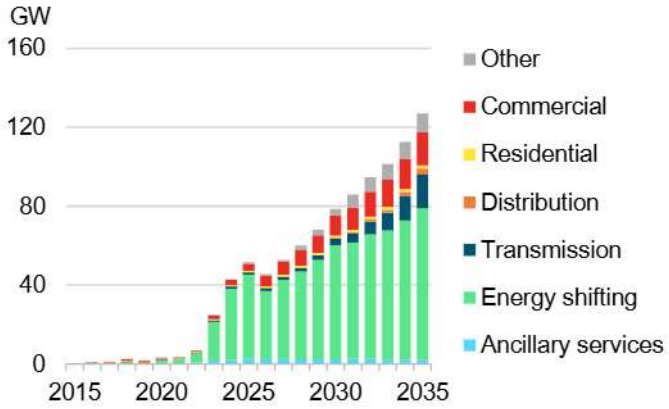
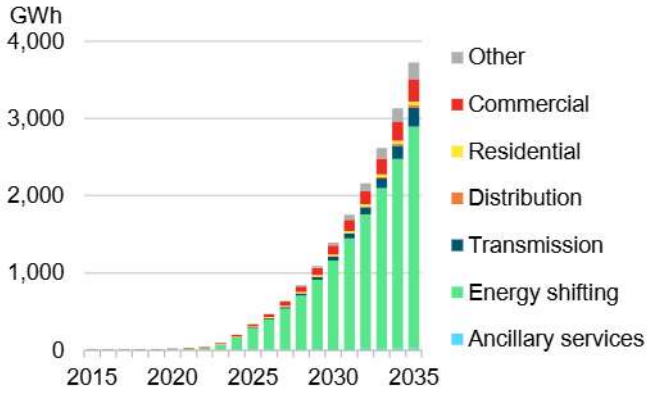


Figure 13: APAC's cumulative energy storage capacity by application



Source: BloombergNEF. Note: SE Asia is Southeast Asia.

5.1. China

BNEF expects energy storage additions in China to hit a record 45GW/123GWh in 2025 (Figure 14, Figure 15). In gigawatt terms, this is 49% higher than expected in our previous outlook and a 15% jump compared to 2024 additions. Energy shifting dominates capacity additions, making up 86% in gigawatt terms, driven by remaining provincial mandates that indicate a minimum ratio of energy storage relative to solar or wind.

Since the previous outlook, BNEF has raised forecasts for wind and utility-scale solar in 2025 by 29% and 24%, respectively. Despite a new policy easing some mandates in certain regions, mandates have grown across the country, further boosting storage deployment (see section *New policy changes and energy storage deployment*).

From a supply perspective, looking at six top energy storage developers, around 62.8GWh of energy storage systems were tendered between October 2024 and March 2025, which accounts for about 51% of our expected installation capacity for 2025. Most of these systems will be operational in 2025 and some in 2026. This includes around 19GWh from PowerChina, 17GWh from China Huadian, 12GWh from CNNC Huineng and Xinhua Power, 10.5GWh from China General Nuclear Power Group, and 4.3GWh from China Huaneng.

Figure 14: China's annual energy storage build

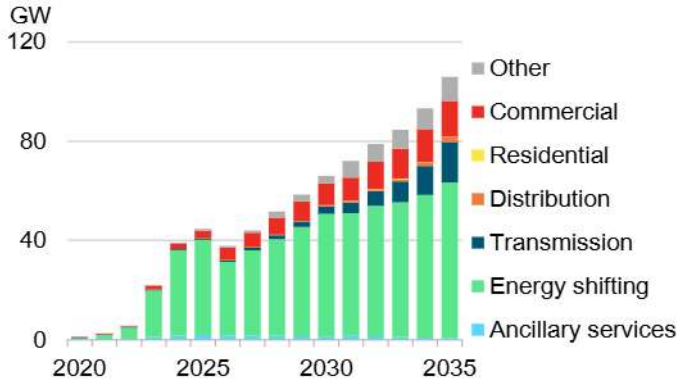
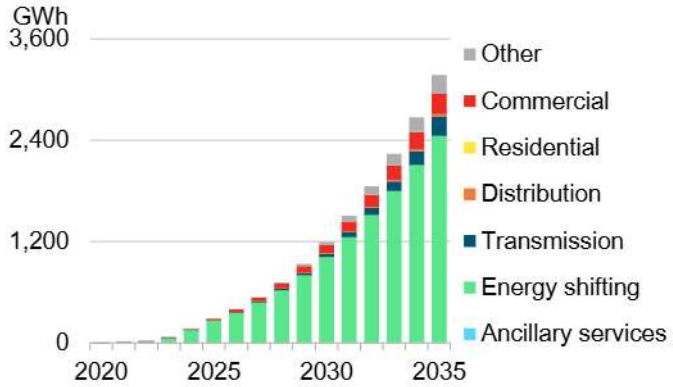


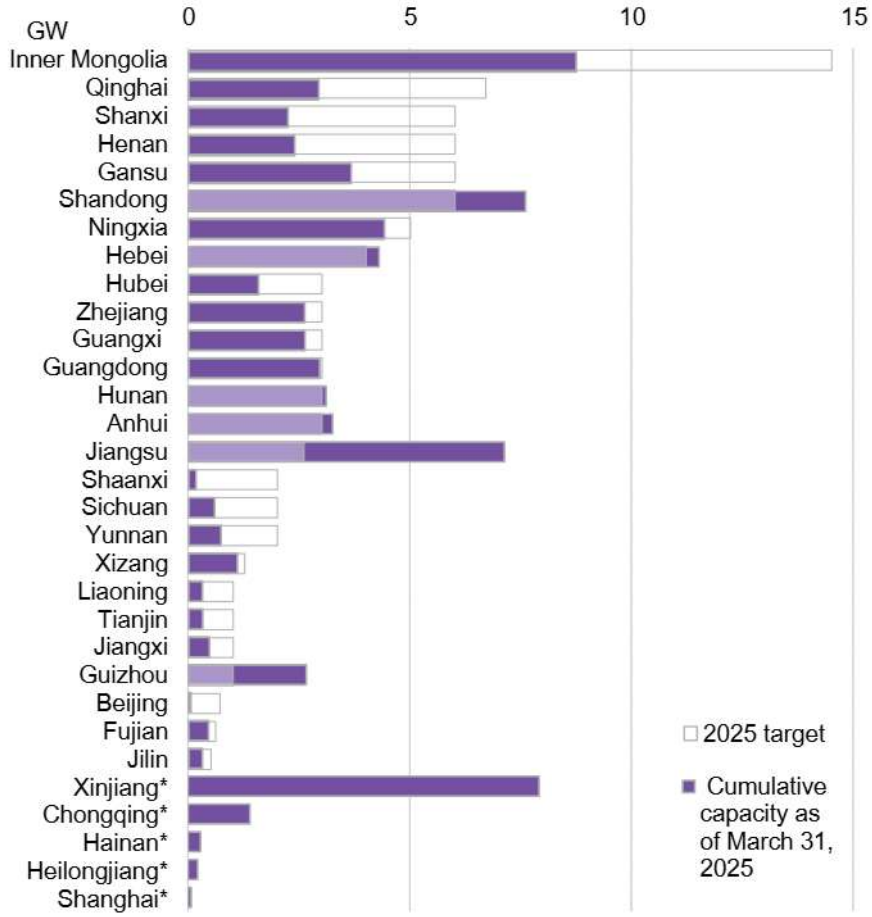
Figure 15: China's cumulative energy storage capacity



Source: BloombergNEF

As of March 2025, 76.9GW of energy storage projects were built in China (Figure 14), according to BNEF's database. Of that capacity, 67.0GW was built in 26 regions that have deployment targets, which collectively amount to 87.9GW by the end of 2025. Among the six provinces that have already achieved their targets, Jiangsu and Guizhou have exceeded theirs by 174% and 166%, respectively. Despite the lack of economics, the mandates continue to drive the deployment of energy storage even after targets have been met. And though there is no target, Xinjiang ranks second in the country in terms of installed capacity in gigawatt terms, thanks to its strong solar and wind build.

Figure 16: China's 2025 local energy storage deployment targets and cumulative capacity as of March 2025



Source: BloombergNEF. Note: Asterisks indicate regions with no targets identified. Data updated as of March 31, 2025.

Mandates will continue to drive energy storage build in the near term despite policy changes that may shift markets away from mandates over time

We expect the mandates will continue to drive energy storage build in the near term due to a lack of an effective market mechanism incentivizing energy storage development. This is despite policy changes that may shift markets away from mandates over time (see next sub-section). As of February 2025, 30 of 31 provinces, municipalities and autonomous regions in mainland China had mandates (Figure 17, Figure 18). Weighted by actual utility solar and wind build in each province in 2024 (including regions without storage mandates), the national average mandated ratio is currently 14.2% for solar and 13.3% for wind, slightly higher compared to the 11.6% for solar and 12.2% for wind in August 2024 when there were 29 regions with mandates.

Figure 17: Mainland China's provincial requirements of energy storage capacity to solar projects' capacity (%)

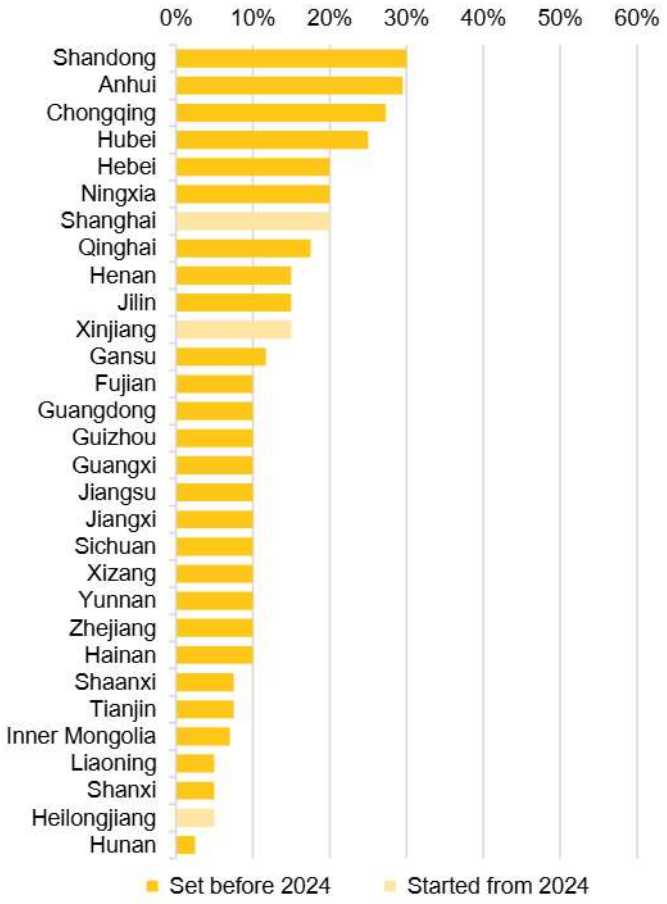
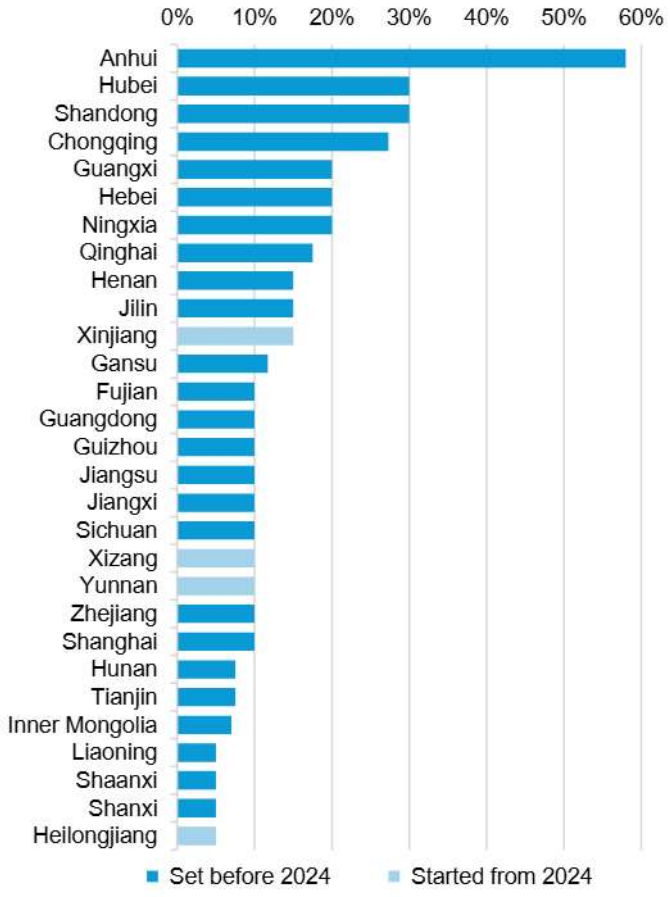


Figure 18: Mainland China's provincial requirements of energy storage capacity to wind projects' capacity (%)



Source: BloombergNEF. Note: Within the same province, the required ratio can vary by location. Charts show the provincial-level average ratios. BNEF assumes policies from 2021 continue to be effective when there are no subsequent updates. If there are updates, BNEF has applied the latest data. Data updated as of February 2025.

We expect business models to evolve as economic opportunities for batteries open in most provinces starting around 2028, aided by China's power market reform. Compared to our previous outlook, we increased total energy storage installations between 2026 to 2027 by 13% in gigawatt terms. That mainly aligns with the latest BNEF wind and utility solar forecasts, which increased 10% for this period. Additionally, power market development promoted by a new policy may enable new opportunities; see section below.

Annual build falls 15% to 38GW/112GWh in 2026 and then bounces back, rising 16% to 44GW/140GWh in 2027. Total wind and utility-scale solar build in China will drop 3% in 2026 and then grow 5% in 2027. It will take time for the market to adjust from the shift from policy-driven build toward an economic market. For example, some regions may cancel mandates in advance.

Cumulative energy storage capacity reaches 810GW/3,174GWh in 2035, about 11 times the capacity in gigawatt-terms at the end of 2024. This is 10% higher compared to our previous outlook to again align with the latest BNEF solar and wind forecasts, which increased 7% for this period, to a cumulative capacity of 6,992GW by 2035.

New policy changes and energy storage deployment

In February 2025, China introduced a new national policy that mandates 100% of wind and solar generation be traded in the wholesale market from 2025, shifting from the current feed-in premium tariffs and toward a Contract for Difference (CfD) scheme that would significantly change the way renewables get built in China. The policy provides the general framework of a new price settlement mechanism for renewables, leaving local governments to define their own implementation details by the end of 2025. See *China's CfD Scheme No Panacea for Renewables Developers* (web | terminal) for details.

An increasing amount of wind and solar in the spot market may lead to larger price fluctuations and increase the peak-to-valley price gap. This could drive some economic build of energy storage, assuming market prices are volatile enough and the market design allows price arbitrage opportunities. As the policy encourages renewable energy projects to secure higher prices in the spot market, solar and wind project operators may be encouraged to develop storage assets to have more flexibility to discharge when prices are high.

Meanwhile, the policy emphasized that a paired energy storage asset shall not be a prerequisite for the permitting, commissioning or grid connection of renewable energy projects, which may ease some mandates. The reason given was to stop unreasonable cost allocation to the renewables, meaning the development of energy storage should not burden further wind and solar development, in a move that could ease mandates in certain regions.

That said, the policy is not calling for a stop to mandates, as they can still be applied at other stages of development and in various forms, such as in competitive auctions for the development rights of solar and wind projects. After the policy announcement, new mandates were still released from provincial governments such as Yunnan and Guizhou. See section above on the policy's impact to energy storage deployment from 2025 to 2027.

Details of the upcoming local implementation will determine whether the expectations are reliable and will determine how much the shift in deployment drivers from mandates to economics will affect energy storage. It is uncertain to what extent the policy can speed up local power market development. We cannot yet rule out the possibility that some local governments might be prompted to stop all mandate tools before the appearance of adequate economics.

The policy will impact wind and solar project build and generation and therefore energy storage demand. BNEF has not updated the solar and wind forecasts to reflect the impact of this policy and will subsequently be reviewing the impact on forecasts as regions release their local plans over the coming months.

5.2. Australia

BNEF expects energy storage additions in Australia to climb to a record 3.0GW/9.0GWh in 2025 driven primarily by utility-scale batteries. Cumulative energy storage capacity reaches 18.4GW/51.3GWh by 2030, and 30.4GW/84.3GWh by 2035, roughly nine times larger than the installed capacity at the end of 2024 in gigawatt terms.

Figure 19: Australia's annual energy storage additions

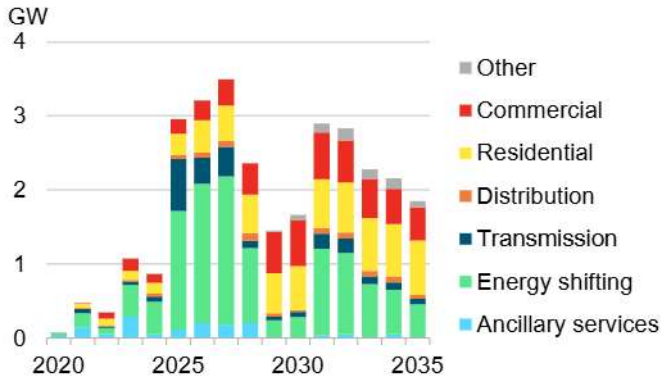
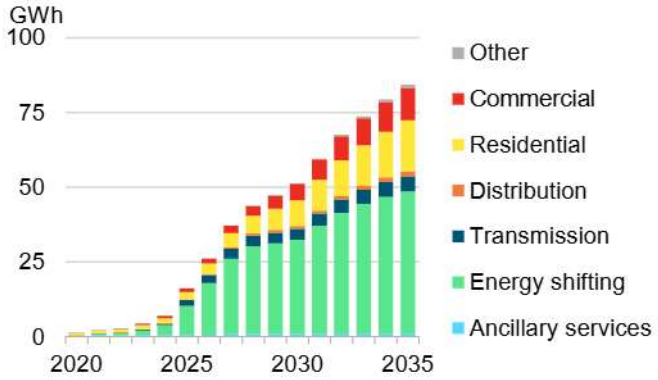


Figure 20: Australia's cumulative energy storage capacity



Source: BloombergNEF

Utility-scale

Australia is on the cusp of a utility-scale battery boom, driven by a combination of sustained elevated power market volatility, supportive government policies, and looming coal power plant retirements. BNEF expects 2025 to be a record year for utility-scale battery additions, with 2.5GW/8.0GWh of new capacity forecast to come online.

Many of the newer projects under construction are both bigger and have a longer duration than those commissioned before 2024. Last year, France-headquartered renewable developer Neoen SA's 219MW/877MWh Collie Stage 1 battery in Western Australia became Australia's first four-hour duration battery to come online. Synergy Ltd., Western Australia's state-owned utility, is building its own four-hour duration battery in Kwinana, due to fully commission this year. Batteries in Western Australia are being built to soak up cheap renewable supply (particularly from rooftop solar) during the midday hours to discharge during the early mornings and evenings, when renewable output declines.

Australia's utilities that operate in its eastern and south-eastern states are also building two- to four-hour duration batteries as they seek to pivot their portfolios away from coal and toward low-carbon alternatives. In New South Wales, AGL Energy Ltd. is building a 500MW/1,000MWh battery at the site of its now-retired Liddell coal plant, due online next year, while Origin Energy Ltd. has plans to install 700MW/2,800MWh of battery capacity at the site of its Eraring coal plant – to be built across three stages by 2027. In Victoria, EnergyAustralia Pty. has secured financing on a 350MW/1,140MWh battery at the site of its Yallourn coal plant, due for commissioning in 2026.

Historically, Australia's big utilities shied away from outright ownership of utility-scale batteries, put off by high upfront costs and uncertain market revenue potential. Instead, they preferred to sign lease agreements which allowed them to operate the asset to earn revenue from competitive markets at the expense of an agreed fee to the battery owner. This trend appears to be changing as costs have declined, revenue potential has improved, and business models have evolved.

Batteries are benefiting from sustained wholesale power market volatility

The rapid rise of renewable energy generation is reshaping Australia's power markets. An ever-growing fleet of wind and solar assets suppresses spot prices when they generate in abundance; conversely, more expensive dispatchable generators ramp up their output and push up spot prices when wind and solar output is low – exacerbating intraday volatility. Across 2024, average intraday arbitrage – the difference between the lowest and highest average price – ranged from A$88.04/MWh in Tasmania to A$538.88/MWh in Queensland. This was a significant increase from 2023, when arbitrage ranged from A$41.80/MWh in Tasmania to A$373.28/MWh in Queensland.

Figure 21: Average half-hourly power prices in Australia's National Electricity Market

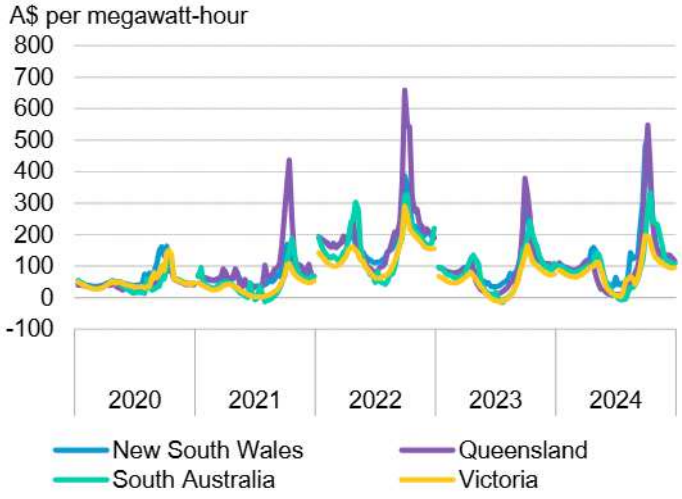
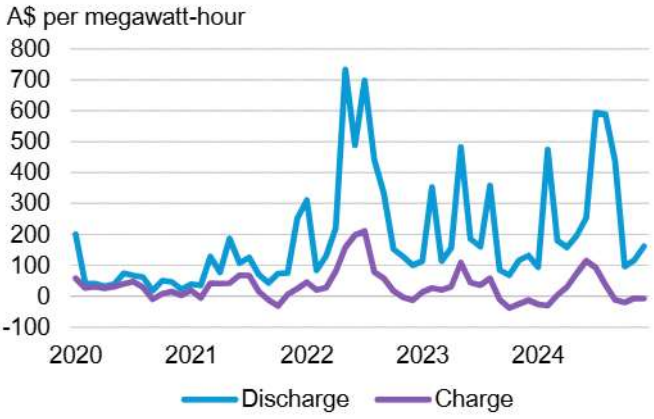


Figure 22: Monthly realized power prices for utility-scale batteries in South Australia



Source: Australian Energy Market Operator, BloombergNEF.

These growing arbitraging opportunities are proving lucrative to batteries, as reflected by their realized discharging prices and charging costs. BNEF expects arbitrage in the NEM to remain elevated over the short to medium term as more renewables enter the grid, further suppressing midday power prices. The looming retirement of Australia's coal plants could reduce dispatchable capacity in the market, further stoking volatility.

Further reading:

- *1H 2025 Australia Market Outlook* (web | terminal)
- *2025 Australia Energy Storage Update: Drivers of Uptake* (web | terminal)
- *Australia's Long Duration Batteries Need More Volatility* (web | terminal)
- *Australia's Big Coal Generators Pivot Toward Batteries* (web | terminal)

Government support and looming coal retirements will sustain battery uptake

In November 2023, the federal Labor government expanded its Capacity Investment Scheme (CIS) – a series of tenders held every six months between 2024 and 2027 – to secure 23GW of new renewable capacity and 9GW of new clean storage capacity by 2030. The scheme aims to incentivize uptake by reducing revenue uncertainty – a longstanding impediment to project bankability.

Successful applicants of CIS tenders will be offered some form of long-term revenue underwriting agreement. A standard CIS agreement is structured such that if a project exceeds its revenue ceiling, the project owner pays the government a percentage of the profits. On the flip side, if a project underperforms relative to its net revenue floor, the government pays the owner a share of the shortfall. In some cases, successful projects may be awarded underwriting agreements that differ in structure to a standard CIS contract.

Akaysha Energy's four-hour 415MW Orana battery, AGL Energy's two-hour 500MW Liddell battery, and Iberdrola Australia's two-hour 65MW Smithfield battery were among the winners of the CIS tender in New South Wales in November 2023. The projects were awarded Long-Term Energy Service Agreements (LTESAs) by the New South Wales government, which provides generators an option to sell their electricity at an agreed minimum price. These revenue-underwriting instruments can also help improve the economics of expensive long-duration projects – in February 2025, the state government awarded LTESAs to 225MW/1,800MWh of long-duration lithium-ion battery projects.

In December 2023, the federal government opened a CIS tender for 600MW of four-hour equivalent storage capacity in South Australia and Victoria. EnergyAustralia's four-hour 50MW Hallett battery in South Australia and four-hour 350MW Wooreen battery in Victoria (to be built at the site of its Yallourn coal plant) were among the 995MW/3,626MWh worth of capacity awarded CIS contracts in this tender round.

As of March 2025, just under 2,300MW of standalone battery capacity has either been awarded a CIS agreement or LTESA in Australia. The results of a CIS tender for 2,000MWh of clean storage capacity in Western Australia are expected soon.

Beyond 2030, further uptake of rooftop solar, state-level targets, and more coal capacity closures will continue to drive utility-scale battery installations in Australia. BNEF forecasts that rooftop solar uptake could increase 76% to 46GW in 2035, from 26GW in 2024. Demand for batteries to shift supply from midday hours, when solar generates at its peak, to other hours of the day will continue to grow.

BNEF also forecasts that around 70% of Australia's currently operating coal capacity will retire by 2035, driven by challenging economics and state targets to increase renewable energy penetration. The state of Victoria, where nearly 5GW of coal capacity is expected to retire over the next decade, has a target to install 6.3GW of batteries by 2035, not limited to utility-scale projects. The government of Western Australia has committed to closing all state-owned coal plants by 2030 and is looking to batteries to shoulder some of the burden of replacing them.

However, the extent to which government support and coal retirements will drive uptake of utility-scale batteries could depend on the results of the upcoming federal election, due to take place on May 3, 2025. A win for the opposition Liberal-National Coalition could threaten the extent of support on offer from programs like the CIS and shift the focus away from renewables and batteries toward coal plant life extensions and nuclear power.

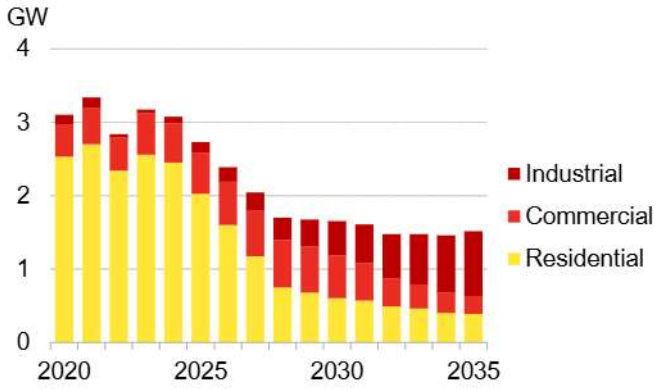
Further reading:

- *Australia's Ambitious But Ambiguous Clean Power Policies* (web | terminal)
- *Australia: 10 Things to Watch in 2025* (web | terminal)
- *2023 Australian Coal Update: Drivers of Retirement* (web | terminal)
- *2023 Australian Coal Update: Detailed Plant Analysis* (web | terminal)

Residential and commercial

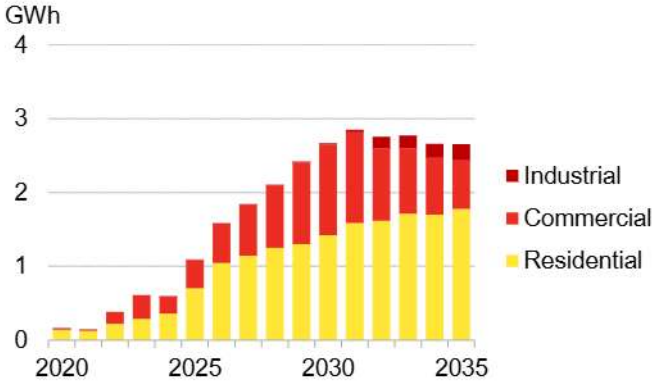
Australia installed 589MWh of behind-the-meter (BTM) storage capacity in 2024, a slight decrease from the year prior, but a record for residential uptake. This brings total installed capacity to 3GWh. BNEF expects a near doubling in annual installations in 2025 to 1.1GWh – albeit from a low base. An additional 9.1GWh of capacity is expected to be installed in the next five years, and another 16.4GWh over 2030-35, taking total capacity to more than 28GWh by 2035.

Figure 23: Historical and forecast annual small-scale solar additions in Australia



Source: BloombergNEF, Australian Energy Market Operator.

Figure 24: Historical and forecast annual small-scale energy storage additions in Australia



Although Australia's mighty fleet of rooftop solar systems means there is a large potential market for batteries, stubbornly high small-scale storage costs and the lack of government support have held back uptake. Upfront prices for BTM batteries have risen over the past four years in Australia. An average residential battery now costs $842 per kilowatt-hour, compared to $654/kWh in 2021.

However, BTM battery installations are steadily increasing on the back of improved technology offerings and greater government incentives like New South Wales' household battery subsidy and various interest free loan offerings by state governments. Additionally, as solar feed-in tariffs fall and more customers are steered toward time-of-use tariffs, batteries are likely to become more popular to maximize value from small-scale solar systems.

Further reading:

- *2025 Australia Behind-the-Meter Update* (web | terminal)
- *1H 2025 Australia Market Outlook* (web | terminal)

5.3. Japan

Japan added 0.8GW/2.2GWh of projects in 2024, 7% lower than our estimates in gigawatt terms, as some of the utility scale projects didn't come online as we had anticipated. For 2025, the market will be roughly comparable, at 0.9 GW/ 2.2GWh, with utility-scale projects accounting for 38%.

Japan's energy storage market is expected to reach 23GW/72GWh cumulatively in 2035 – a more than fivefold jump compared with cumulative installations in 2024. The forecast is up 2% in gigawatt terms, mainly due to slight adjustments in our residential and commercial battery storage forecast. Falling battery costs, subsidies for both small-scale and utility scale battery projects as well as lucrative capacity payments will drive the installations of projects until 2035.

Figure 25: Japan's annual energy storage additions

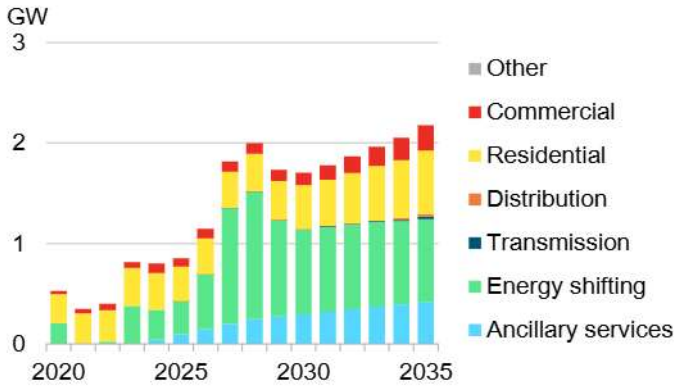
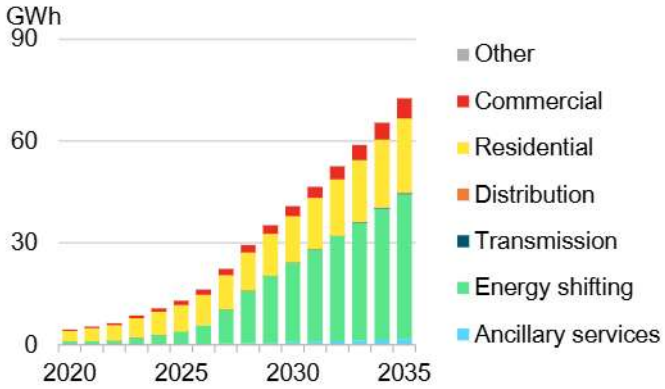


Figure 26: Japan's cumulative energy storage capacity



Source: BloombergNEF

Utility-scale

We expect Japan to install 0.3GW/0.8GWh of utility-scale projects in 2025. Japan utility-scale additions grow, especially after 2027 when energy storage projects in the long-term decarbonization auction come online, reaching a cumulative 6.4GW/23GWh in 2030.

Second long-term decarbonization auction results are expected in second quarter

Japan held its second long-term decarbonization auction in January 2025, where 1.5GW of energy storage was on offer for bidding. The result of the auction will be announced in the second quarter of 2025. BNEF expects that the auction will attract more participants, giving rise to strong competition, due to the high cap prices.

Subsidy programs will continue

The federal government is expected to continue its subsidy program for utility scale energy storage as the Ministry of Economy, Trade, and Industry (METI) requested an annual budget of ¥15 billion ($106 million) for FY2025. The previous year's program covered half of the project costs. Subsidies are key for utility-scale projects participating as a merchant business model to be economically viable. For more, see *2025 Japan Energy Storage Economics: A Balancing Game* (web | terminal).

Bumpy ancillary services market helps batteries gain higher revenues

Japan's ancillary service market launched new segments such as I, II-1, and II-2 in April 2024. For the first half of fiscal year 2024 (April 2024 to March 2025), battery projects benefited from higher ancillary services prices across segments. These new segments set a shorter continuous runtime and faster reaction speed, rewarding batteries' capability better than the current segments. In April, battery energy storage earned higher revenues than most other technologies in all segments. The average contracted price for battery energy storage projects in the III-2 segment was ¥344/kWh in April-September 2024 – more than 40 times higher than the average, due to the lack of competition in the market.

Japan's METI is considering implementation of a simultaneous market which integrates kWh and ΔkW markets, that is the wholesale and the ancillary services markets. Another proposed feature is a three-part offer system in which power generators submit bids based on three components: startup costs, minimum output costs and incremental cost curves. The exact design of the market, including if and when such a market will be introduced, is under discussion in a government committee.

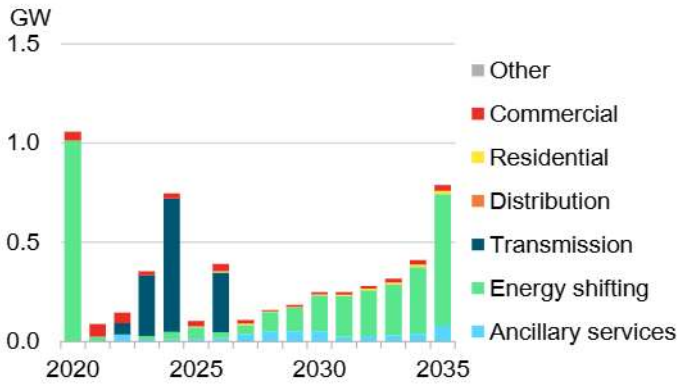
Residential and commercial

The residential sector will also see a steady increase in installations, reaching a cumulative 7.4GW/21.7GWh in 2035. We expect stable deployment to continue because of government subsidies for the adoption of battery storage systems along with solar panels. By 2035, the commercial sector sees a more than fivefold increase in annual installations due to increased local government support for commercial energy storage. Japan reaches 2.0GW/5.8GWh cumulatively in terms of commercial batteries in 2035.

5.4. South Korea

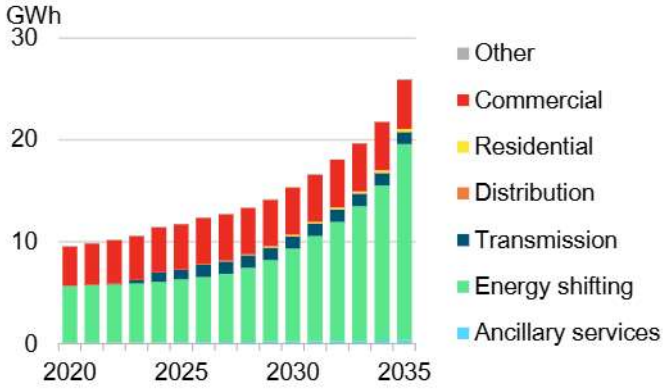
South Korea added 709MW/818MWh of energy storage projects in 2024. For the past few years, state-owned utility Kepco's transmission deferral energy storage projects have been leading new build. BNEF expects 105MW/312MWh of energy storage capacity to be installed in 2025, driven primarily by energy shifting.

Figure 27: South Korea's annual energy storage additions



Source: BloombergNEF

Figure 28: South Korea's cumulative energy storage capacity



Utility-scale

Projects awarded during the first energy storage capacity auction are expected to come on line this year, driving energy shifting storage build. Korea East-West Power consortium's 35MW/140MWh project east of Jeju island is set to come online in March. Another project awarded in west Jeju, Korea Southern Power's 23MW/92MWh, kicked off construction and is set to come online in November. Launched in November 2023 to curb increasing renewables curtailment on Jeju island, the auction was one of the instruments South Korea is experimenting with to reform its power market.

Finalized energy roadmap puts a green light to energy storage

Energy storage is expected to play a key role in helping South Korea's fossil fuel-centric power system accommodate more variable renewables. The 11th Basic Plan for Electricity Supply and Demand (BPE), finalized after nine months of deadlock, provided clarity on energy storage as it lays out a plan to resume the auction in the first half of 2025.

South Korea released an Energy Storage System (ESS) Strategy in October 2023 to reclaim its past success as one of the largest markets in terms of installations. A series of fires since 2017 severely dented the country's standing in the global storage market.

According to the 11th BPE from the Ministry of Trade, Industry, and Energy, the country needs 23GW of long-duration energy storage by 2038. This target is just outside our forecast period and will be reflected in our outlook once the ministry provides more clarity around potential long-duration energy storage auction dates.

Further reading:

- *Korea's Energy Plan to Be Fleeting Amid Political Turmoil: React* (web | terminal)

5.5. India

BNEF estimates that energy storage additions in India totaled 0.9GW/1.5GWh in 2024, in line with expectations from our previous outlook. This year is likely to be a milestone at 2GW/2.4GWh added, up 62% in gigawatt-hour terms from last year (Figure 29). Cumulative energy storage capacity reaches 25GW/77GWh by 2030, about 12% higher than our previous forecast in gigawatt-hour terms as we expect more capacity in 2026 and 2027 from projects resulting from clean power auctions to come online. By 2035, cumulative capacity reaches 85GW/347GWh (Figure 30).

India's energy storage market continues to grow on the back of tenders by local utilities and federal agencies. Several new tenders have been announced since our previous outlook, adding to the pipeline of projects BNEF expects online ahead of 2030 and increasing our near-term expectations.

India's clean power auctions crossed a significant milestone in 2024, as gigawatt volumes breached the half-century mark, with auctioning agencies awarding a record 59GW (AC). Complex auctions, which require a combination of renewables and storage for delivering firmer clean power, drove the rise in volumes at 37GW, which includes auctions that fall into peak power, round-the-clock and load-matching categories which may support energy storage build. In addition, India's agencies conducted 10 energy storage auctions through 2024. Most mandate two hours of storage while some require longer durations. Developers are likely to use pumped

storage projects for tenders requiring more than four hours of storage, while batteries are preferred for under four hours.

In April, Gujarat utility Gujarat Urja Vikas Nigam (GUVNL) awarded 1GWh of contracts for stand-alone batteries. In March, the National Hydroelectric Power Corp. (NHPC) announced a tender for 1.2GW of solar with at least 4.8Wh of energy storage, with projects expected to be delivered in 2028. NHPC also announced another tender for 125MW/500MWh of energy storage to be built in Kerala. Another large utility, Karnataka Power Transmission, awarded 350MW/700MWh in April 2025 as part of an existing tender for 1GWh of batteries.

Figure 29: India's annual energy storage additions

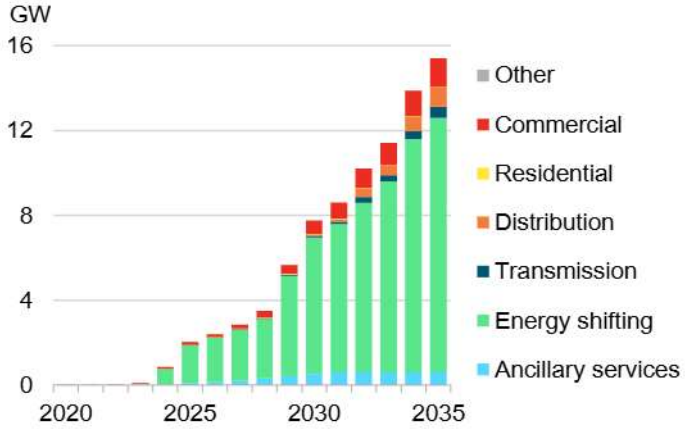
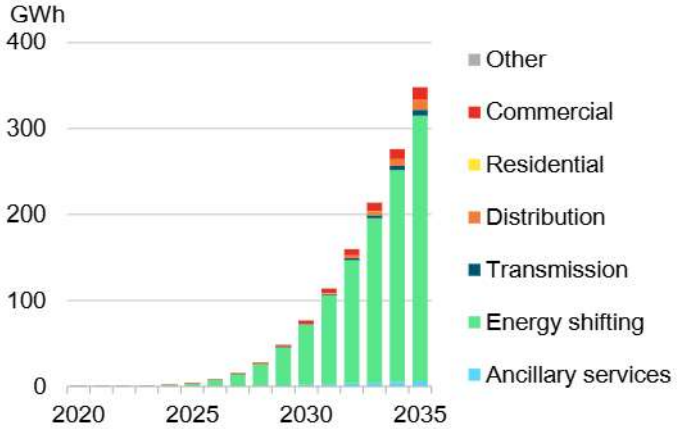


Figure 30: India's cumulative energy storage capacity



Source: BloombergNEF

Winning project developers receive long-term contracts that reduce project risk and are typically chosen via competitive auctions, pushing bids and potential project returns down. The market as a result is growing rapidly but may not be hugely profitable for developers. Tariffs at energy storage auctions for unsubsidized projects in 2024 dropped to a third of those quoted in 2022. In 2022, two-hour batteries had tariffs of 13.0-13.4 million rupees ($153,000-158,000) per MW per year. SECI's second tranche in September 2024 had average tariffs of 4.6 million rupees/MW/year, recording a 66% drop over two years. NTPC's and Gujarat's auctions in 2H 2024 showed a sharp reduction of tariffs to 2.7-2.8 million rupees/MW/year as these projects will receive viability gap funding of up to 40% of the battery energy storage system (BESS) capital expenditure.

Further reading:

- *India Clean Energy Bids and Tariffs 2024* (web | terminal)
- *India's Billion Dollars in Subsidies to Spur Battery Build* (web | terminal)
- *Contract Delays Hold Up $8 Billion of Clean Power in India* (web | terminal)

5.6. Southeast Asia

BNEF estimates that 408MW/538MWh of energy storage capacity was added in Southeast Asia last year, 24% higher than in 2023 (Figure 31, Figure 33). Additions are expected to nearly quadruple in gigawatt-hour terms to 929MW/1,984MWh in 2025. Cumulative energy storage capacity reaches 5.0GW/10GWh by 2030 and 8.4GW/19GWh by 2035 (Figure 32, Figure 34). We have maintained our forecast from the last outlook.

The buildout of battery-based energy storage in the region has ramped up in the last three years and should grow substantially as countries begin firming supportive policies for batteries at grid-level and for behind-the-meter applications. In 2025, BNEF expects nearly 1GW of energy storage additions as utility-scale projects come online in Indonesia and the Philippines. BNEF also tracked a jump in the imports of lithium-ion batteries to the region in 2024, particularly to Malaysia and Thailand. It is not clear how much of those batteries will be installed as behind-the-meter energy storage systems in the coming year, as opposed to being used for electric vehicles. We have allocated additional capacity to our global buffer to reflect this uncertainty.

Figure 31: Southeast Asia's annual energy storage additions by application

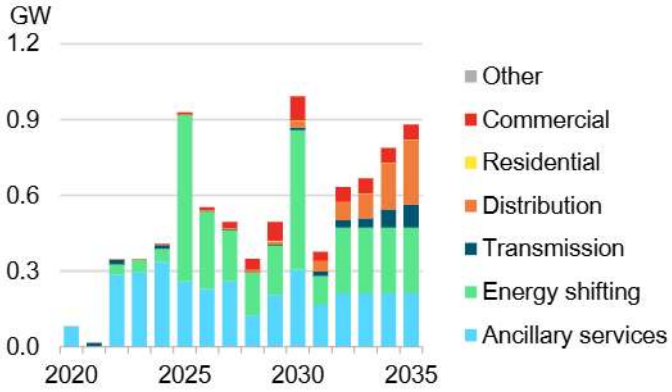


Figure 32: Southeast Asia's cumulative energy storage capacity by application

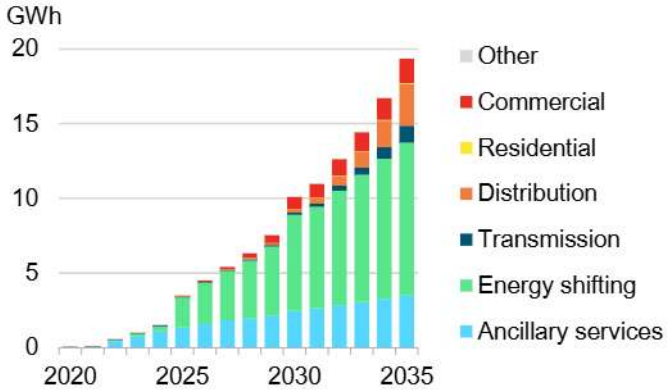


Figure 33: Southeast Asia's annual energy storage additions by country

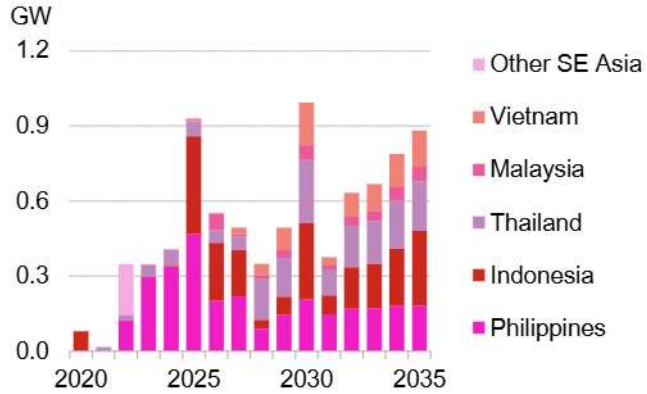
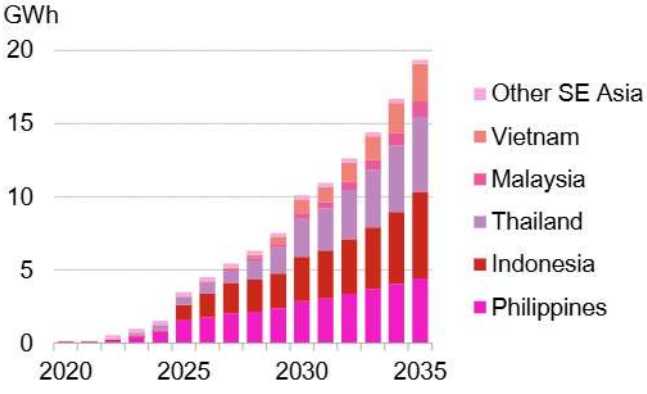


Figure 34: Southeast Asia's cumulative energy storage capacity by country



Source: BloombergNEF

The **Philippines** will hold its second renewable energy auction for the year in July, featuring solar capacity paired with battery energy storage for the first time. While lower-cost projects like ground-mounted solar remain the priority, the government is also aiming to procure more

expensive power from floating solar and solar projects paired with storage to optimize land use and improve grid reliability. These projects must be paired with a four-hour battery energy storage system of at least 20% of the solar project's capacity. Therefore, at least 220MW/880MWh of battery storage systems will also be auctioned alongside 1.1GW of solar power. The Department of Energy on March 11 released an auction notice and guidelines related to the country's fourth Green Energy Auction (GEA-4), due to be conducted in July. For more, see *Philippine Power Auction Features Floating Solar, Storage* (web | terminal).

Vietnam's Ministry of Industry and Trade released a draft report on February 4 for public comments that included proposed revisions to the Power Development Plan (PDP) VIII, which outlines Vietnam's electricity capacity additions by 2030 and 2050. The amendments suggest increasing capacity additions for all renewable technologies and energy storage, except for offshore wind. The draft outlines 12.6GW of energy storage between 2025 and 2030 (including pumped hydro and batteries). See *Vietnam Turns to Large-Scale Solar for Renewables Growth* (web | terminal).

Malaysia has allowed commercial and industrial (C&I) power consumers to meet their electricity demand through direct power purchase agreements (PPAs) with third-party renewable energy suppliers from March 2025. This move could be a boon for solar and energy storage system developers, whose pool of potential customers will be widened significantly. See *Malaysia Expands Corporates' Access to Clean Power* (web | terminal).

Section 6. Americas

The Americas region added a record 13GW/37GWh in 2024, up 64% from 2023 in gigawatt-hour terms. Growth slows in 2025 as the US market faces new tariffs leading to project delays (Figure 35, Figure 36). The US will still lead regionally, at 87% of gigawatt-hour deployments, reaching 223GW/874GWh of energy storage deployments by 2035 as utilities execute on energy storage targets and clean energy goals. Still, that is 10% less than our previous outlook and could be 51%-74% lower in gigawatt-hour terms between 2025 and 2027 if a worse-case 145% tariff scenario sustains. Some of the slowdown in the US is compensated by growth in Latin America, which added 788MW/2,826MWh in 2024 and will see battery auctions in Brazil and Argentina this year. By 2035, cumulative capacity in Latin America reaches 26GW/92GWh.

Figure 35: AMER's annual energy storage additions by market

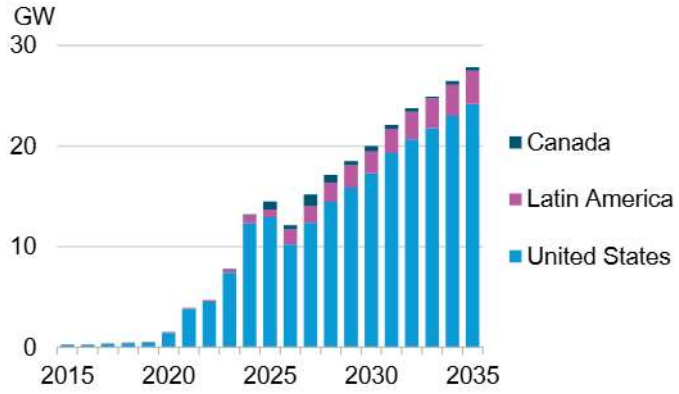


Figure 36: AMER's cumulative energy storage capacity by market

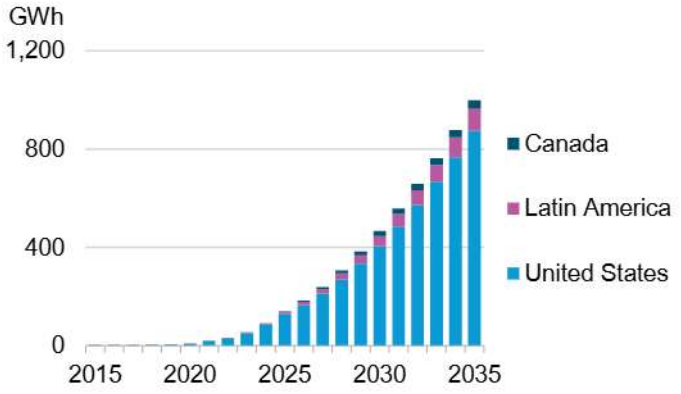


Figure 37: AMER's annual energy storage additions by application

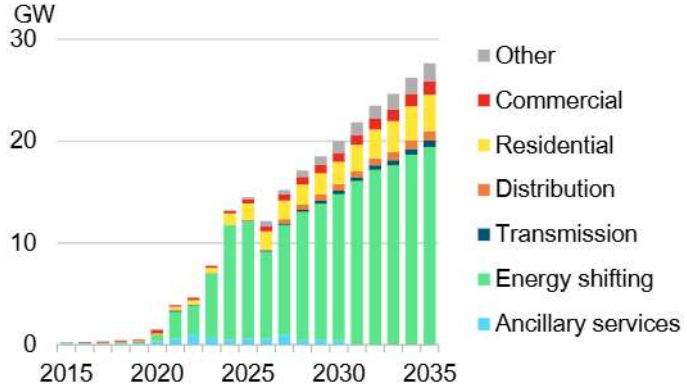
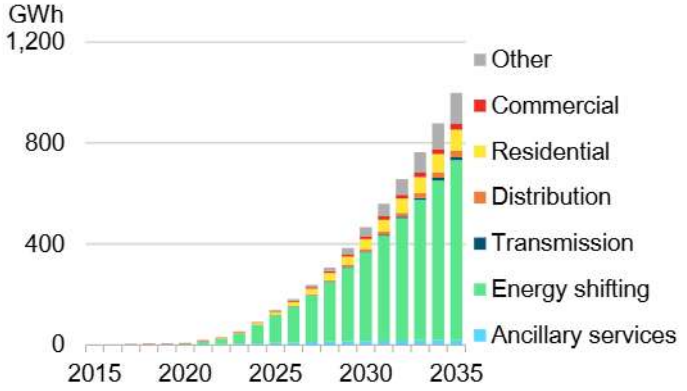


Figure 38: AMER's cumulative capacity by application



Source: BloombergNEF

6.1. US

Annual energy storage additions in the US reached 12.3GW/34.5GWh in 2024 – up 59% year-on-year in gigawatt-hours, on the back of falling costs and strong demand. However, growth is set to stagnate in 2025 before a collapse in 2026, assuming new import tariffs on Chinese goods imposed by the Trump administration remain high and continued policy uncertainty slows project development. The US battery energy storage market is vulnerable to changes in tariffs on Chinese imports as the country heavily relies on China's supply chains.

BNEF expects annual new build to reach 12.9GW/42.2GWh in 2025, 12% lower in gigawatt-hour terms than our previous forecast. The current forecast is based on a 54% tariff, due to the timing of the forecast update. However, tariffs were raised to 145% on all goods from China as of April 8, in addition to specific tariffs impacting lithium-ion batteries.

Despite higher costs and policy uncertainty, new additions in 2025 are supported by a rush to complete late-stage projects before an additional scheduled tariff hike under Section 301 which increases to 25% starting in 2026, from 7.5% today. Annual additions plummet in 2026 due to higher import tariffs and higher-than-expected system costs driven by the tariff hikes. Annual installations drop 13% in gigawatt-hours to 10.2GW/36.7GWh in 2026.

The market slowly picks up after 2026 due to future cost reduction, a shift of supply chains to Southeast Asia and domestic production due to tariffs, and continued demand growth given load growth and utilities' interest in sourcing energy storage. Market players will adapt to the higher-cost environment over time. Still, any escalations in the trade war between China and the US could discourage new investment and further slow uptake.

Our cumulative capacity forecast reaches 115GW/405GWh in 2030 and 223GW/875GWh in 2035, assuming the Investment Tax Credit remains. Cumulative capacity for 2030 and 2035 is 16% and 10% lower than our previous forecast due to slower uptake across all the segments. We lowered the cumulative capacity of utility-scale projects in 2030 and 2035 by 14% and 7% in gigawatt-hours from our previous forecast. Similarly, the cumulative capacity of residential and commercial energy storage in 2030 and 2035 dropped by 17% and 23% in gigawatt-hours due to higher import tariffs and slower uptake of these segments than our previous forecasts.

Figure 39: US annual new energy storage build, assuming 54% import tariff on China

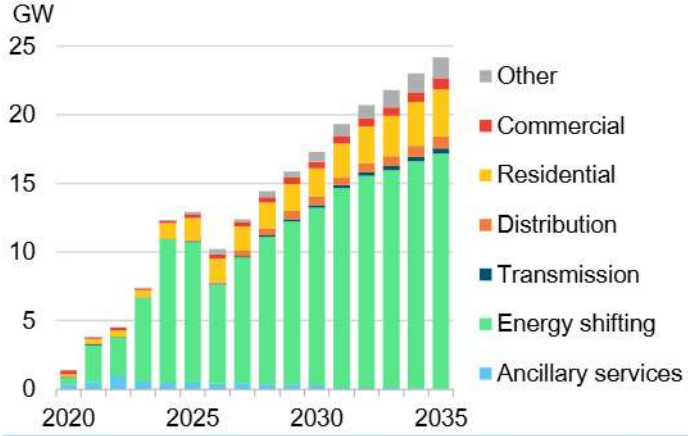


Figure 40: US cumulative energy storage capacity, assuming 54% import tariff on China

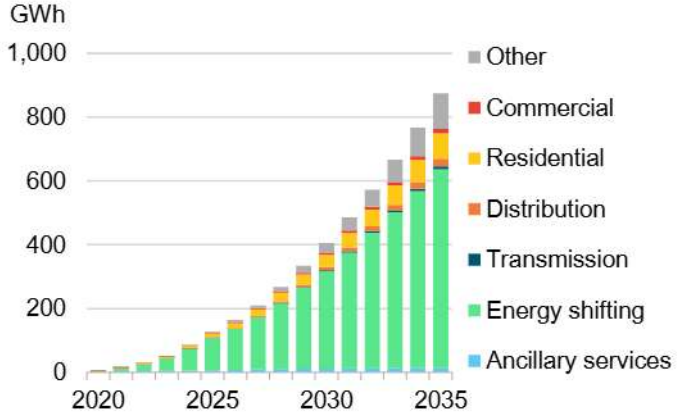
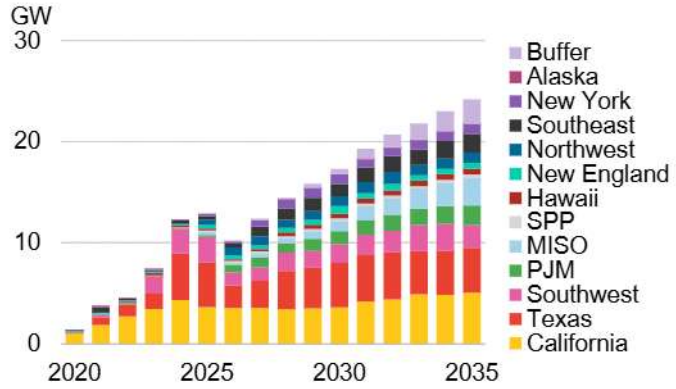
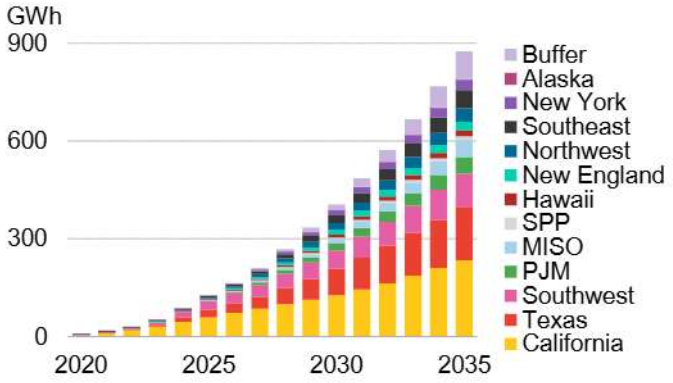


Figure 41: US annual new energy storage build by region, assuming 54% import tariff on China



Source: BloombergNEF

Figure 42: US cumulative energy storage capacity by region, assuming 54% import tariff on China



The two largest markets, the Electric Reliability Council of Texas (Ercot) and California, dominated installations in 2024. These two markets accounted for 65% of installations in gigawatt-hours in 2024. Ercot added 4.6GW/8.0GWh in 2024 and surpassed California for the first time in gigawatt terms. The Southwest is also quickly catching up with the two top due to regional utilities procuring energy storage capacity to accommodate high solar penetration. The region added 2.4GW/9.3GWh last year, up 50% in gigawatt-hours compared to 2023.

These three markets accounted for 92% of nationwide installations in 2024. Asset owners and operators in these regions have signed tolling agreements or asset leasing deals. This business model removes some development hurdles for both parties and supports the uptake of energy storage deployment. See *Energy Storage Tolling: A Primer* (web | terminal) for more details.

Trump's reciprocal tariffs to pause growth

The US energy storage market is feeling the pain from higher import tariffs on goods from China, Canada, and Mexico, with President Donald Trump hiking import tariffs since he returned to the White House this year (Table 1).

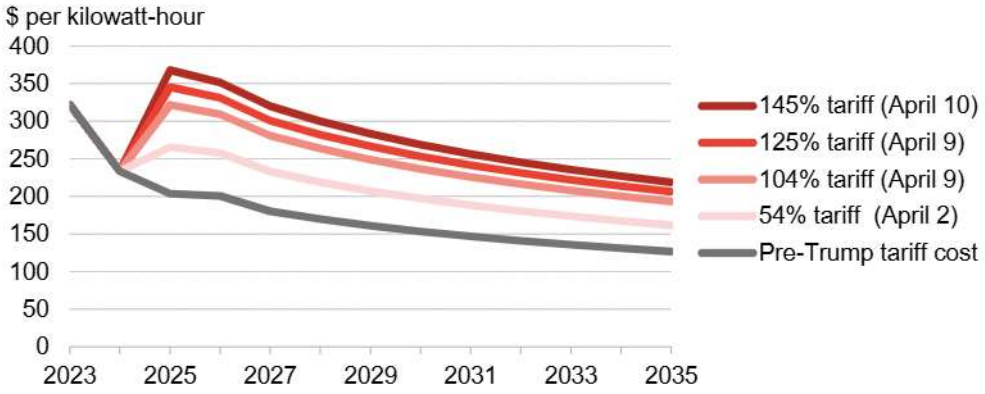
Table 1: Import tariffs on non-electric vehicle batteries from China

Tariff type	In 2025	After 2025
IEEPA tariff (in effect: March 4, 2025)	20%	20%
+ Reciprocal tariff (in effect: April 2, 2025)	+34% (54% in total)	+34% (54% in total)
+ Reciprocal tariff (in effect: April 9, 2025)	+50% (104% in total)	+50% (104% in total)
+ Reciprocal tariff (in effect: April 9, 2025)	+21% (125% in total)	+21% (125% in total)
+ Reciprocal tariff (in effect: April 10, 2025)	+20% (145% in total)	+20% (145% in total)
Section 301 tariff	7.5%	25%
Base import tariff	3.4%	3.4%
Total	**155.9%**	**173.4%**

Source: BloombergNEF. Note: IEEPA stands for the International Emergency Economic Powers Act. Dates for reciprocal tariffs indicate announcement dates.

The April tariff timeline is such that Trump announced additional 34% tariffs on April 2, which are added to 20% tariffs under the International Emergency Economic Powers Act (IEEPA), raising the total to 54% (excluding Section 301 and base import tariffs). BNEF analysis shows that with blanket 54% import tariffs, four-hour turnkey system costs rise 30% in 2025 (to $266/kWh) compared to without the new administration's new tariffs (Figure 43). With higher-than-expected costs, supply contracts are being renegotiated, projects are being delayed and canceled in the worst case.

Figure 43: Cost outlook for US four-hour turnkey battery energy storage systems by tariff on Chinese imports



Source: BloombergNEF. Note: Charts show costs of four-hour turnkey systems, which include all project equipment (DC-side battery system, power conversion system and related installation) excluding engineering, procurement, and construction (EPC) and grid connection. Applies sweeping tariffs to battery rack and inverters from China and 25% tariffs to transformers from Canada and Mexico. Includes Section 301 tariffs of 7.5% for 2023-2025, 25% after 2025 and a general import tariff for lithium-ion batteries. Pricing based on usable capacity. Dates for reciprocal tariffs indicate announcement dates.

An escalation of the US-China trade war increases battery storage system costs further. Sweeping tariffs were raised to 104% on April 9, 125% on the same day and 145% on April 10. Our analysis shows that four-hour turnkey system costs are now higher than 2023 cost levels based on a sweeping 145% tariff. With a much higher tariff on imports from China, other Asian markets like South Korea, Japan and Southeast Asia could export batteries to the US despite additional import tariffs on these Asian countries. See *Trump's 104% China Tariffs Send Battery Cost Back to 2023* (web | terminal) for more details.

These tariffs will also increase production costs of US-made batteries as the US still needs to import battery materials, including graphite, from China for domestic battery production. See *'Reciprocal' Tariffs Spell Chaos for Clean Energy Markets: React* (web | terminal) and *Battery Metals Monthly: Things to Watch in 2025* (web | terminal) for more details.

If 145% tariffs on Chinese imports remain, we expect annual energy storage additions in the US to fall to 6.1GW/19.8GWh in 2025, 2.6GW/9.4GWh in 2026 and 6.0GW/22.2GWh in 2027 – 51-74% lower in gigawatt-hour terms than our base case in those years, which assume a 54% tariff. With such high tariffs on Chinese imports, we expect the US battery storage market to shift away from China's supply chain and rely on imports from South Korea and Southeast Asia, as well as domestic production, though this will take a couple of years to ramp up. We may revise our base-case forecast depending on tariff negotiations in the coming months.

Figure 44: Annual US energy storage additions based on power output, assuming 145% import tariff on China

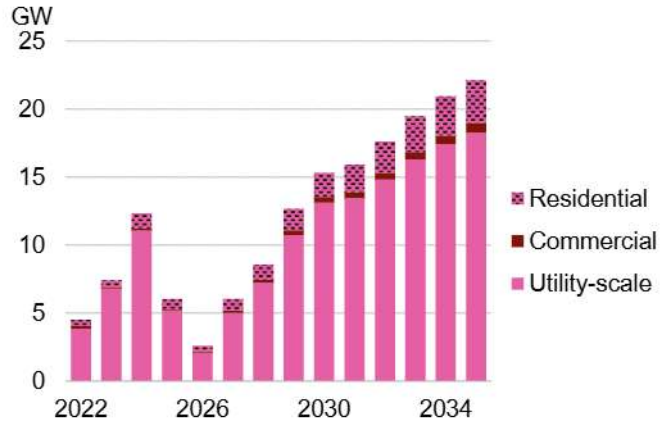
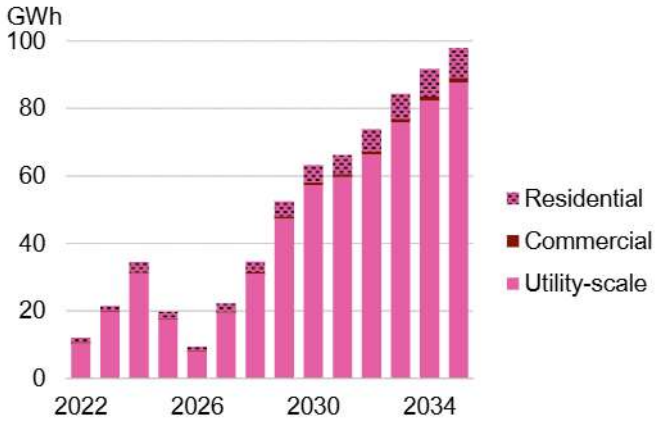


Figure 45: Annual US energy storage additions based on energy capacity, assuming 145% import tariffs on China



Source: BloombergNEF

Energy storage system costs could be even higher if the US decides to impose antidumping and countervailing duties on battery anode imports from China. The US International Trade Commission and Department of Commerce are currently investigating the case of China's antidumping practice in the US. If a proposed 916% antidumping duty is implemented, the manufacturing cost for a lithium nickel manganese cobalt oxide (NMC) 811 cell could increase 51%, according to BNEF's analysis. See *US Weighs 916% Duty on Chinese Graphite Used in Batteries* (web | terminal) for more details.

Domestic content bonus updates

Just ahead of Trump's inauguration in January, the US Department of Treasury issued an update of the domestic content rule under Investment Tax Credit (ITC), which awards projects an additional 10% bonus if they qualify. The update clarified that battery cells, which are the most important part of the stack of equipment that qualifies whether a project meets domestic content requirement, can only contribute to local content if US-made.

This narrows the strategy of using battery cells manufactured overseas and raises the hurdle for projects to qualify for the credits. Regardless, the qualification of projects for domestic content will be limited by local battery cell manufacturing capacity, set to ramp up modestly in coming years. See *US Raises Requirement for Local Energy Storage Incentives* (web | terminal) and *US-Made Batteries Are Pricey But Some Developers Want Them* (web | terminal) for more details.

Illinois mulls an energy storage target while Virginia fails to expand existing one

No state has added or updated energy storage targets since the last market outlook, though the Illinois legislature is working on a bill (HB3758 and SB2497) setting a 15GW energy storage deployment target for 2035 and mandating that the Illinois Power Agency conduct competitive solicitations to procure energy storage. The bill also includes a provision on virtual power plant (VPP) programs and aims to require large electric utilities to propose an initial tariff for VPP programs. Last year, the state failed to pass legislation calling for a statewide 8.5GW procurement by 2050 (HB5856 and SB3959).

In contrast, Virginia failed to increase its energy storage deployment target and mandate for utilities such as Appalachian Power and Dominion Energy this year. The bill (HB2537) passed both houses, but Republican Governor Glenn Youngkin removed the entire section on the target when reviewing the bill. The bill could have required Dominion Energy to procure at least 5,220MW of short-duration energy storage by 2045 and 3,480MW of long-duration energy storage by 2045, adding to an existing 3.1GW target by 2035.

Table 2: US state energy storage targets

State	Year announced	Legislation/regulation	Target
California	2010 2016	AB2514 AB2868	1,825MW by 2020 (1,325MW utility-scale storage and 500MW of distributed storage)
Oregon	2015	HB2913	Portland General Electric and Pacific Power to each install at least 5MWh by 2020 up to 1% of 2014 peak load
Nevada	2017	SB204	100MW by 2020, 1,000MW by 2030
New Jersey	2018	Clean Energy Act	2,000MW by 2030
Massachusetts	2017	HB4857	1,000 MWh by 2025
Virginia	2020	HB1526	3,100MW by 2035
Connecticut	2021	SB952	300MW by 2024, 650MW by 2027, and 1,000MW by 2030
Maine	2021	SP213	300MW by 2024, 400MW by 2030
Maryland	2023	HB910	750MW by 2027, 1,500MW by 2030 and 3,000MW by 2033
New York	2021, 2022	Case 18-E-0130	1,500MW by 2025, 6,000MW by 2030
Michigan	2023	HB4256	2,500MW by 2030
Rhode Island	2024	H7811	90MW by 2026, 195MW by 2028, and 600MW by 2033
Illinois (under review)	2025	HB3758 SB2497	15,000MW by 2035

Source: BloombergNEF

Ercot (Texas)

Within the US, the Ercot region added the most capacity last year, overtaking California for the first time. Additions more than tripled to 4.7GW/9.9GWh in 2024. A combination of the expectation of high price volatility, shorter development timelines, and anticipated load growth supports high installation in the market. Despite those expectations, power price volatility eased in 2024 and prices of ancillary service dropped due to market saturation by battery storage.

The market is set to maintain a high installation volume in 2025 before a hiccup in 2026 and 2027. This assumes most projects this year already have equipment underway based on project status reported by the US Energy Information Administration. Since most projects in Ercot rely on merchant revenues, we expect higher import tariffs to significantly hamper the market in 2026 and 2027 as projects fail to pencil out economically with more expensive equipment. Still, load growth and the demand for co-located projects with solar should support growth after 2027.

Cumulative capacity reaches 29.8GW/80.4GWh in 2030 and 52.2GW/164.0GWh in 2035, 9% and 16% higher in gigawatt-hours than in our previous forecast, respectively, due to our more bullish view on the long-term deployment due to near-term load growth driven by data centers and electrification. As market saturation leads to falling ancillary service prices, we expect Ercot to

deploy longer-duration energy storage projects, eyeing energy arbitrage and co-location with solar projects over time. See *US Data Center Market Outlook: The Age of AI* (web | terminal) for more details.

Figure 46: Ercot's annual new energy storage build

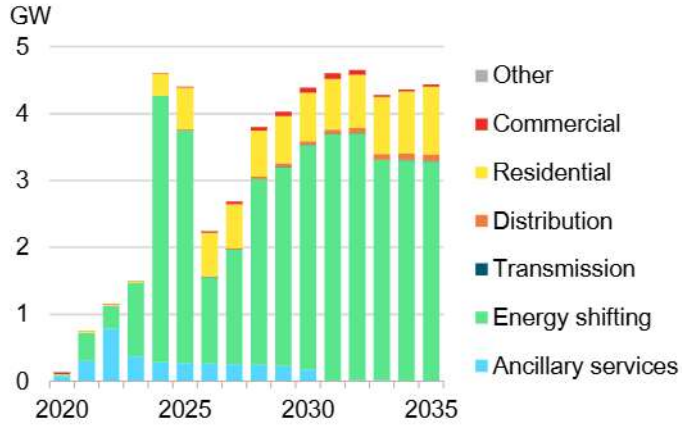
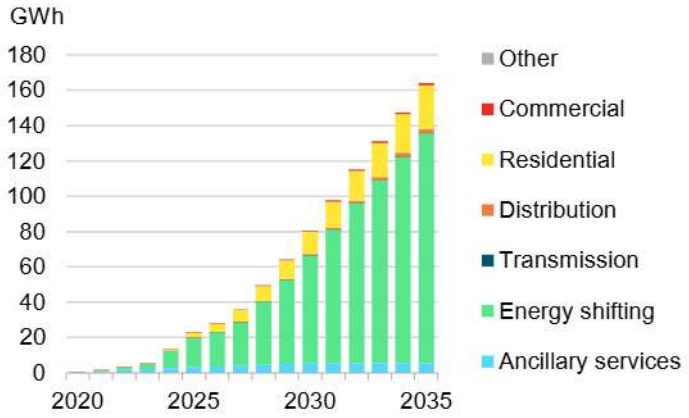


Figure 47: Ercot's cumulative energy storage capacity



Source: BloombergNEF

Despite the market's record-high annual additions, power price volatility was limited last year. The average daily max-min power spread was $93/MWh in 2024 – 30% and 59% lower than the spread in 2022 and 2023, respectively. Still, the market has already seen a big price spike in 2025. The real-time power price in one Ercot load zone, managed by the Lower Colorado River Authority (LCRA), surged to $1,936/MWh between 8 a.m. and 9 a.m. on February 18, driven by high power demand due to cold weather. See *US Power Weekly* series (web | terminal) for more details.

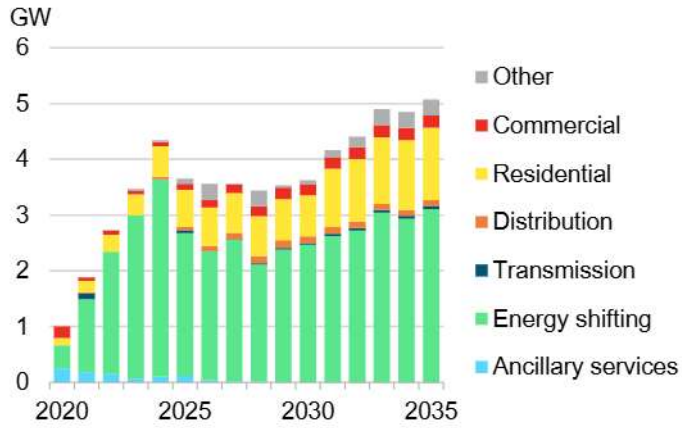
In December 2025, Ercot will launch a long-discussed real-time ancillary service market by implementing Real-Time Co-Optimization (RTC). Currently, Ercot only has a day-ahead ancillary service market. The objective of RTC is to dispatch power plants more effectively to procure energy and ancillary services. With this change, optimization will be even more complex for asset owners as they need to consider price spreads between real-time and day-ahead markets for ancillary services for their operation.

California

California fell to second-largest in 2024 in terms of annual gigawatts installed, adding 4.3GW/14.4GWh – 22% lower in gigawatt terms than our forecasts due to the delay of a couple of projects including AES's 240MW/960MWh Rexford 1 project (web). Additions are set to stagnate in the near term due to increased system costs from tariffs.

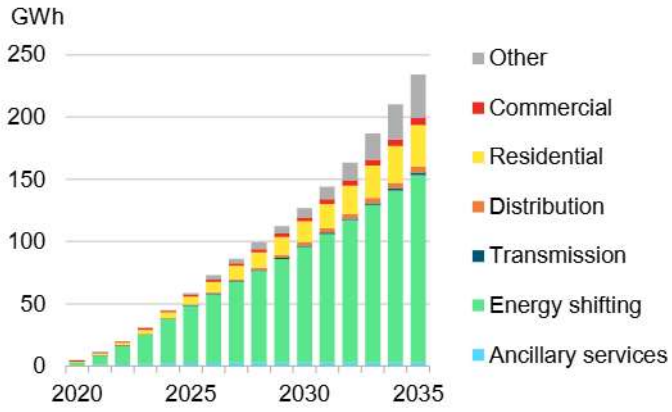
BNEF expects installations to fall 4% in gigawatt-hour terms in 2025 as market players pause their projects in the pipeline as they wait to see further policy development. Cumulative capacity reaches 35.5GW/126.9GWh in 2030 and 58.9GW/234.2GWh in 2035 – 11% and 1% lower than our previous forecast due to slower near-term deployment.

Figure 48: California's annual new energy storage build



Source: BloombergNEF

Figure 49: California's cumulative energy storage capacity



In October 2024, the Federal Energy Regulatory Commission (FERC) approved changes to California Independent System Operator (Caiso)'s interconnection processes. Caiso expects new rules to help it manage interconnection applications more efficiently and reduce timelines, as they would require a more robust set of documentation to prove project progress when submitting an initial application. However, from a developer perspective, development timelines including interconnection might not change much as they will need to spend more time on other development work to ensure project viability before submitting applications.

Caiso will also implement a new zonal cluster system depending on the availability of transmission capacity for interconnections: deliverable zones and merchant zones. Merchant zones cover areas with less than 50MW of available transmission capacity. In the merchant zones, interconnection costs will likely be higher as project owners need to pay for grid upgrades for their interconnections. In addition, when application volume exceeds available capacity, Caiso will determine which projects can connect by using a new weighted score system that takes account of project viability, system need and commercial interest. Still, there is a concern among stakeholders that one of these metrics – commercial interest – could favor certain groups such as load serving entities over independent power producers and developers.

Southwest

The Southwest has quickly ramped up energy storage additions since 2023. Annual additions jumped to 2.4GW/9.3GWh in 2024 – 28% year-on-year growth in gigawatt-hours. A few 200MW- to 300MW-sized battery storage projects in Arizona contributed to the all-time high installation. One of these projects was Orsted's 300MW/1,200MWh Eleven Mile Solar Center project (web), the largest project in the state to date. It powers Meta's data center with a 402MW solar project.

BNEF expects annual installations to grow 8% on a gigawatt-hour basis to 2.5GW/10.0GWh in 2025 as projects from regional utilities' energy storage procurements come online. These utilities are set to deploy more energy storage projects post 2025 based on their integrated resource plans (IRPs). Cumulative capacity reaches 14.9GW/57.3GWh in 2030, 6% lower in gigawatt-hours than in our previous outlook, adjusted downward to account for the near-term tariff impact. Still, we expect the market to keep deploying more energy storage projects in the long term due to utilities' strong interest in energy storage procurement. Cumulative deployment is

26.6GW/100.9GWh in 2035, 3% higher in gigawatt-hours than our previous forecast due to our bullish long-term view.

Figure 50: Southwest's annual new energy storage build

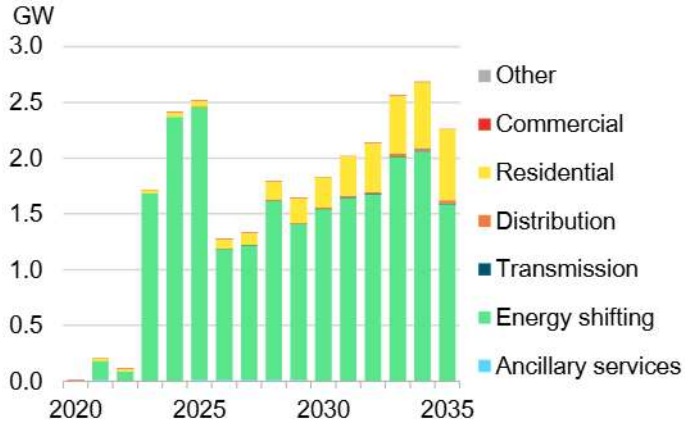
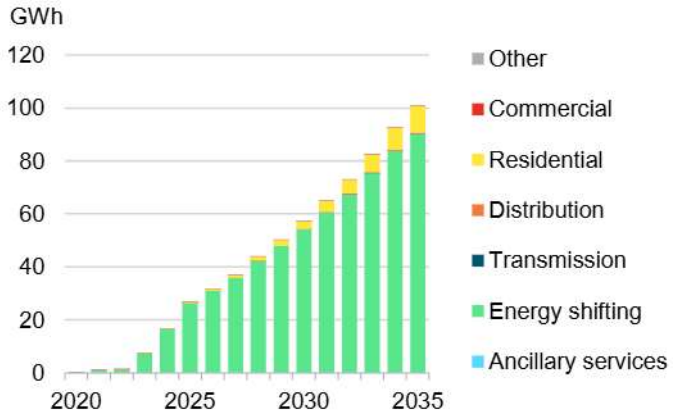


Figure 51: Southwest's cumulative energy storage capacity



Source: BloombergNEF

MISO and SPP

The Midwest, which encompasses the Midcontinent Independent System Operator (MISO) and Southwest Power Pool (SPP), installed 67MW/156MWh of energy storage in 2024, most of which was in the MISO territory. BNEF expects installations in the region to jump to 0.5GW/1.8GWh in 2025 based on projects in the pipeline and utilities' IRPs.

Even with a near-term slowdown in 2026 resulting from higher tariffs, we have significantly raised energy storage estimates in the region to 2035, especially in MISO. MISO is set to see a surge of new solar development over the next decade, which should boost demand for energy storage. Additionally, the interest in new development in MISO is growing in utilities' IRPs and Michigan's state target. For instance, DTE Energy in Michigan issued a request-for-proposal for new 450MW standalone energy storage projects in March to meet its 2,950MW energy storage target by 2042. Cumulatively, MISO's 2035 capacity is almost double our previous forecast. Cumulative capacity in the whole Midwest region reaches 4.7GW/18.4GWh in 2030 and 16.1GW/63.4GWh in 2035.

Figure 52: MISO's annual new energy storage build

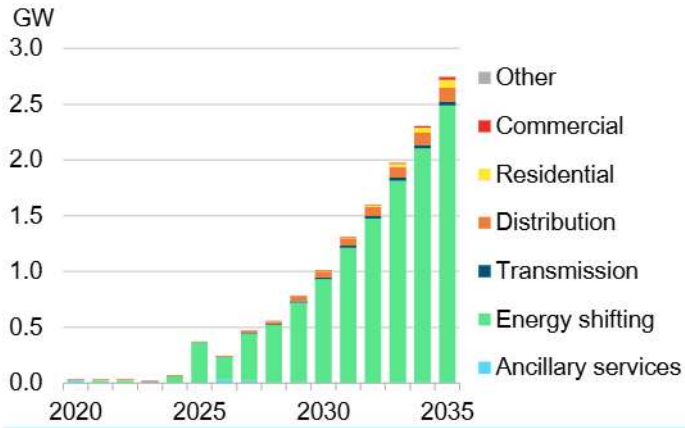


Figure 53: MISO's cumulative energy storage capacity

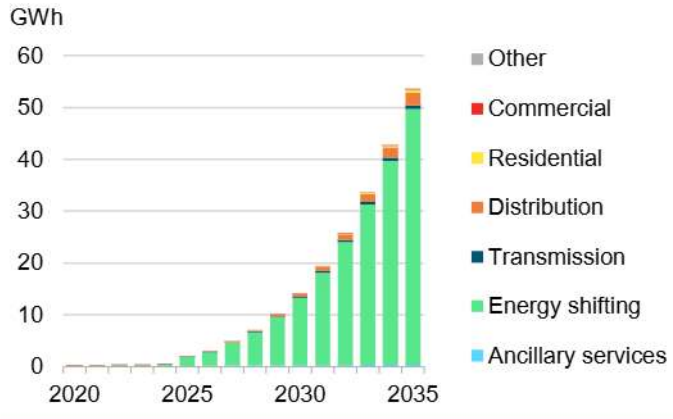
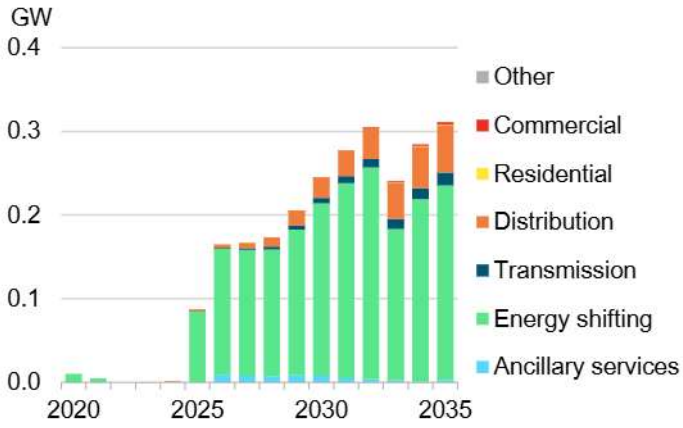
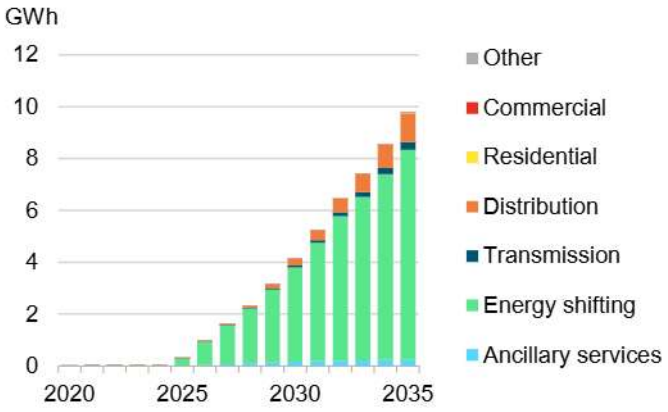


Figure 54: SPP's annual new energy storage build



Source: BloombergNEF

Figure 55: SPP's cumulative energy storage capacity

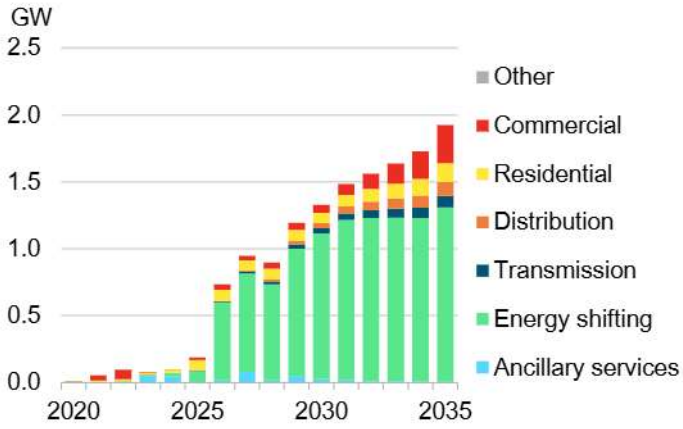


PJM

In the PJM Interconnection, the regional grid that manages electricity in 13 states and Washington DC in eastern US , last year only saw 98MW/174MWh added, slightly lower than the deployment in 2023 and 85% lower in gigawatt-hours than our expectation, as many planned projects did not get built. BNEF expects annual deployment in 2025 to double but remain small, though quadrupling in 2026 as a large volume of projects in the pipeline is scheduled to come online. This is still less than what would be expected without the tariff as projects get delayed.

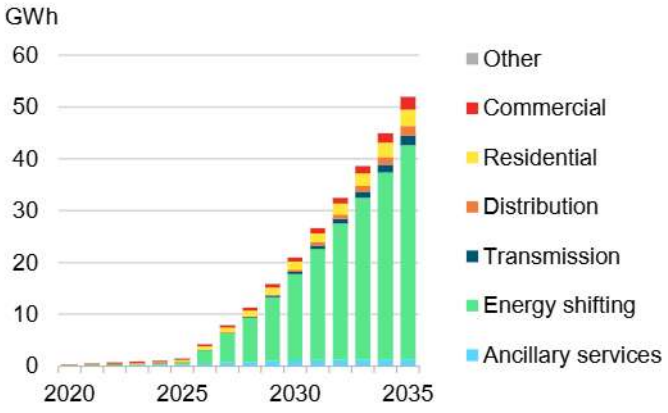
Further projects might experience delays or cancellations depending on how tariffs evolve. However, some of these might experience delays or cancellations due to the tariff impact. Cumulative capacity reaches 6.0GW/20.9GWh in 2030 and 14.4GW/51.9GWh in 2035, 37% and 33% down in gigawatt-hours, respectively, due to tariff impacts and the region's slower near-term uptake compared with our previous expectation.

Figure 56: PJM's annual new energy storage build



Source: BloombergNEF

Figure 57: PJM's cumulative energy storage capacity



PJM is still gaining attention from some developers due to extremely high prices in a capacity auction last year, which cleared at $444.26-$466.35/MW-day in Baltimore Gas & Electric (BGE) and Dominion Virginia Powe (DOM) zones and $269.92/MW-day in the rest of the regional

transmission organization (RTO) zone. The cleared price in the rest of RTO saw a ninefold increase from the previous year's auction, due to lack of power supply capacity. This caused a lot of backlash from different stakeholders including state governors.

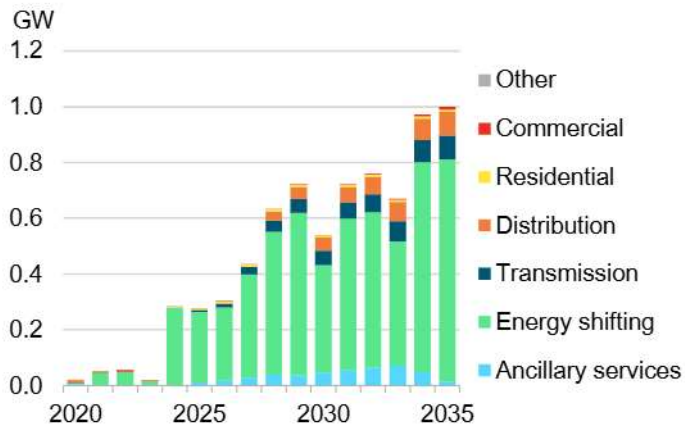
To avoid extreme prices in the future, PJM proposed a $325/MW-day price cap and $175/MW-day price floor in its auctions for power delivery in 2026-2027 and 2027-2028 to the Federal Energy Regulatory Commission (FERC). FERC's final decision is still pending but many stakeholders including ratepayer advocates have been opposing the plan due to high price floors and caps. The next capacity auction will take place in July. Separately, FERC will also host a conference in June to discuss effectiveness of capacity auctions given the latest PJM auction result (web | terminal).

Separately, **New Jersey** state is mulling incentives for front-of-meter and behind-the-meter energy storage systems to meet its 2GW deployment target. In November 2024, the NJ Board of Public Utilities issued a draft on incentive programs. For grid-connected systems, the state considers annual competitive solicitations to award upfront subsidies starting in 2025. The regulator also proposed upfront subsidies of $150-300/kWh for behind-the-meter systems and an additional $50-100/kWh bonus for systems locating in certain areas, depending on system size. These will be huge upfront subsidies that cover a quarter to a third of residential energy storage costs and could kickstart behind-the-meter battery deployments in the state. See *2025 US Residential Solar Market Update: Down But Not Out* (web | terminal) for more details on US residential storage costs.

Southeast (excluding Florida)

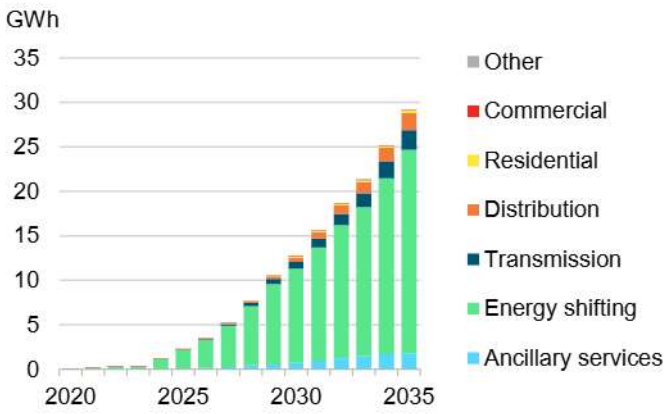
The Southeast installed 285MW/867MWh of energy storage in 2024 – 21% fewer megawatt-hours than our expectation due to some utility-scale projects being delayed and almost no additions for the commercial segment. BNEF expects the region to add 277MW/1,101MWh in 2025. Utility contracts including with Georgia Power and Duke Energy support these near-term additions. Duke Energy is replacing its 1.1GW Allen Steam coal-fired power plant with two battery energy storage projects including a 50MW/200MWh system due in 2025 and another 167MW/668MWh system due in 2027. Cumulative capacity reaches 0.5GW/2.1GWh in 2030 and 1.0GW/4.0GWh in 2035, 39% and 36% down in gigawatt-hours, respectively, reflecting slower uptake of utility-scale than our previous forecast.

Figure 58: Southeast's annual new energy storage build



Source: BloombergNEF

Figure 59: Southeast's cumulative energy storage capacity



Florida

Florida added 21MW/58MWh of energy storage in 2024, 41% lower on a megawatt-hour basis than our expectation as no utility-scale projects came online last year. Installations remain small, at 77MW/199MWh in 2025 and 78MW/228MWh in 2026. Despite the near-term tariff impacts, we increased our post-2026 installations based on IRPs of utilities such as Florida Power & Light, which aims to install over 4GW of battery energy storage by 2033. Annual additions reach 500MW/1,917MWh in 2027 and maintain high installations from 2028 to 2035. Cumulative capacity gets to 3.1GW/10.6GWh in 2030 and 7.0GW/26.0GWh in 2035, 5% and 30% higher in gigawatt-hours than our previous forecast, respectively.

Figure 60: Florida's annual new energy storage build

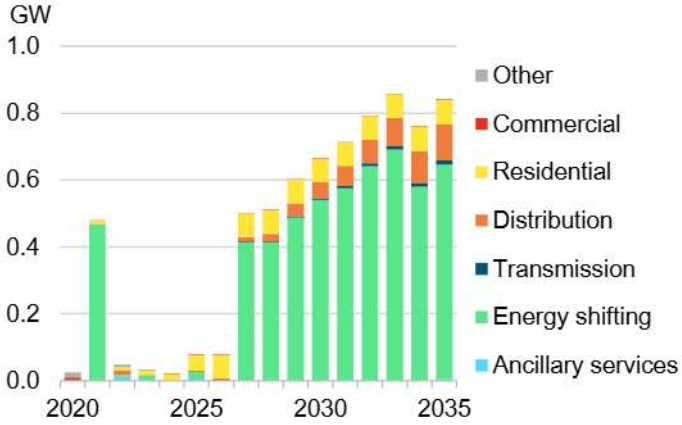
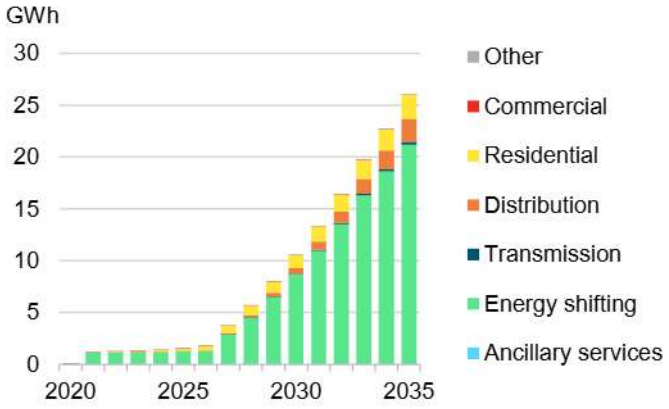


Figure 61: Florida's cumulative energy storage capacity



Source: BloombergNEF

Northwest

The Northwest is set to see an influx of energy storage projects starting this year. The region's energy storage deployment has been limited to date given its abundant hydro resources providing flexibility to the power region. Only 82MW/320MWh was installed in 2024 – almost no change from 2023 and 71% lower than our expectation as many projects did not come online.

Still, BNEF expects annual installations to jump to 0.5GW/2.0GWh in 2025 and reach a gigawatt scale in 2026 and onward, even after accounting for project delays from higher tariffs. The region has many projects in the pipeline, and utilities such as Puget Sound Energy and PacifiCorp are also leading the procurement based on their IRPs. Cumulative capacity reaches 5.1GW/20.1GWh in 2030 and 10.5GW/41.5GWh in 2035, 6% and 21% lower in gigawatt-hours compared to the previous forecast, respectively due to negative impacts of tariffs and slower near-term uptake.

Figure 62: Northwest's annual new energy storage build

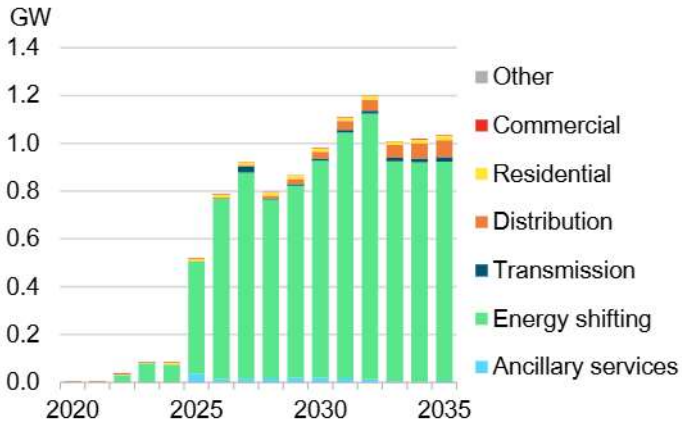
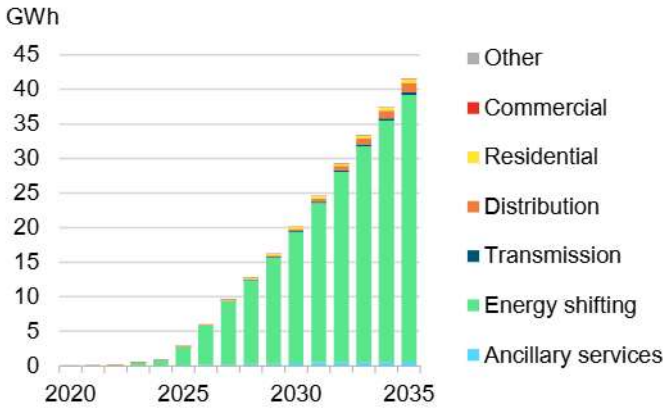


Figure 63: Northwest's cumulative energy storage capacity



Source: BloombergNEF

New York

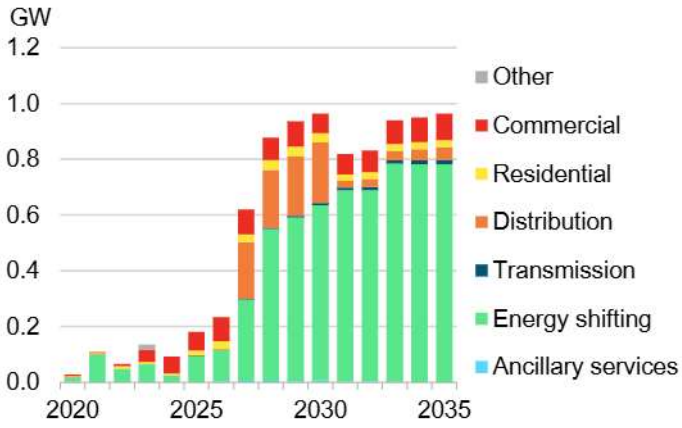
New York is set to add several hundred megawatts annually in a few years as it launches annual solicitations. Energy storage development activities have been limited in the state despite its 6GW target. New York added 92MW/197MWh in 2024, 31% lower on a megawatt-hour basis than our previous expectation as 30% of small-scale capacity in our expectation did not get built. Annual additions remain small, increasing modestly to 181MW/569MWh in 2025.

Starting in 2027, however, installations jump to more than 800MW. Growth beyond 2026 is driven by New York State's new annual solicitations for energy storage projects of 5MW or larger. The state recently approved the Bulk Energy Storage Implementation Plan, which includes hosting 1GW of solicitations annually between 2025 and 2027, leading to higher installations over 2028-2030.

The solicitations will deploy a two-way Contract-for-Difference scheme, called the Index Storage Credit (ISC) Mechanism, with a 15-year contract for lithium-ion battery storage and a 25-year contract for non-lithium-ion energy storage. The first solicitation will start in June. Bid prices will account for 60% of the solicitation's judging criteria. Non-pricing factors such as project viability (such as levels of permitting, interconnection processes and stakeholder engagement), system needs (such as benefits to the grid), and societal/economic benefits (such as benefits to local communities) account for the remaining 40%.

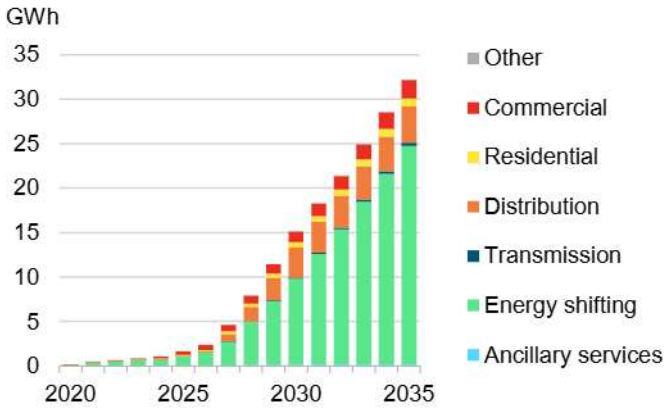
Despite the plan's approval, BNEF still thinks New York may miss its 6GW deployment target by 2030, though this depends on the success of annual solicitations. Cumulative capacity reaches 4.3GW/15.2GWh in 2030, 18% lower in gigawatt-hour terms than our previous forecast. This is because we assume about 60% of the capacity on offer in the solicitations to be contracted as looming policy uncertainty and higher costs could discourage participation in the solicitations. Cumulative capacity in 2035 is 8.8GW/32.2GWh, 7% higher in gigawatt-hours than our previous estimate, due to our bullish view on uptake beyond 2026 driven by the ISC mechanism.

Figure 64: New York's annual new energy storage build



Source: BloombergNEF

Figure 65: New York's cumulative energy storage capacity

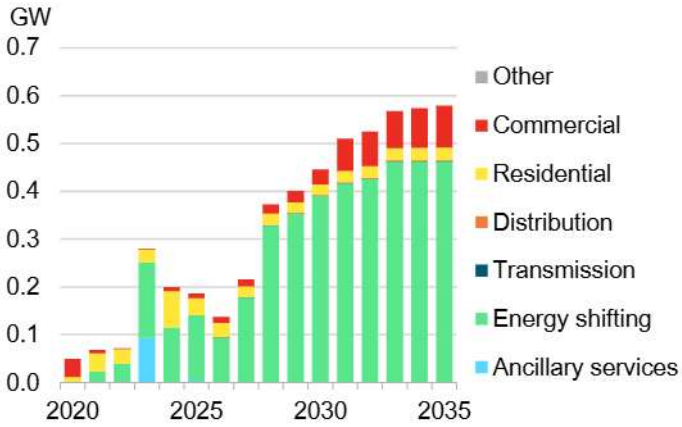


In January, utilities Con Edison and Orange & Rockland Utilities hosted a request-for-proposal of the utility dispatch right control program, or tolling agreements, for energy storage projects. They aim to procure at least 310MW of energy storage resources by awarding a 15-year contract. Contracted projects must come online by December 31, 2030. The deadline for bid applications was at the end of February. The result is scheduled to come out at the end of July. See *Energy Storage Tolling: A Primer* (web | terminal) for more details on tolls.

Hawaii

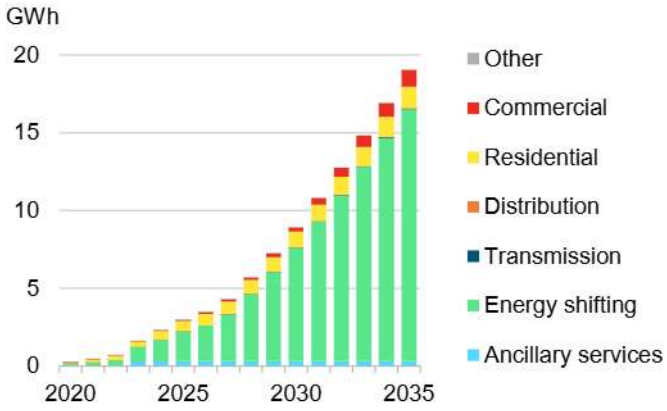
Hawaii installed 200MW/690MWh of energy storage projects in 2024, 29% less in megawatt-hours than our expectation, as only half of utility-scale projects expected in our previous forecast came online. BNEF expects Hawaii to add 187MW/675MWh in 2025, 129% more in megawatt-hours than our previous outlook as those delayed projects come online. High solar penetration and utilities' IRPs drive new installations. Cumulative capacity reaches 2.5GW/8.9GWh in 2030 and 5.3GW/19.0GWh in 2035 – 24% and 19% lower in gigawatt-hour terms than our previous forecast, reflecting the negative impact of tariffs on build.

Figure 66: Hawaii's annual new energy storage build



Source: BloombergNEF

Figure 67: Hawaii's cumulative energy storage capacity



New England

Energy storage deployment in New England has been slow. The region built only 74MW/223MWh of energy storage in 2024, 73% less in gigawatt-hours than our expectation as most of the utility-scale projects didn't come online. Still, BNEF expects the region to install 357MW/753MWh in 2025 – more than tripling storage capacity.

Utilities' interest in energy storage supports the uptake, but we have lowered our forecast for the region due to the slow uptake and lack of projects in the pipeline. We expect the region to reach 3.3GW/15.5GWh by 2030 and 6.0GW/25.6GWh by 2035 cumulatively, 10% and 28% down in gigawatt-hours compared to our previous forecast, respectively, due to the slower near-term uptake and negative impacts of tariffs. Storage capacity is temporarily set to jump over 2028-2030 because of Massachusetts' legislated long-duration energy storage target. The state calls for 750MW of energy storage with durations of 10 to 24 hours by 2030. We assumed 12 hours for the duration of these energy storage projects in our forecast.

Figure 68: New England's annual new energy storage build

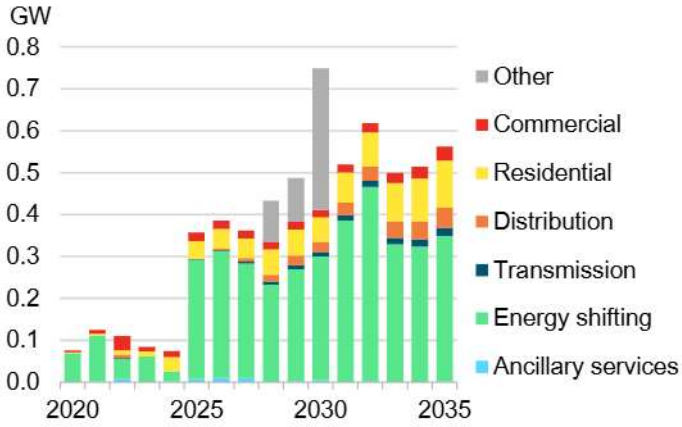
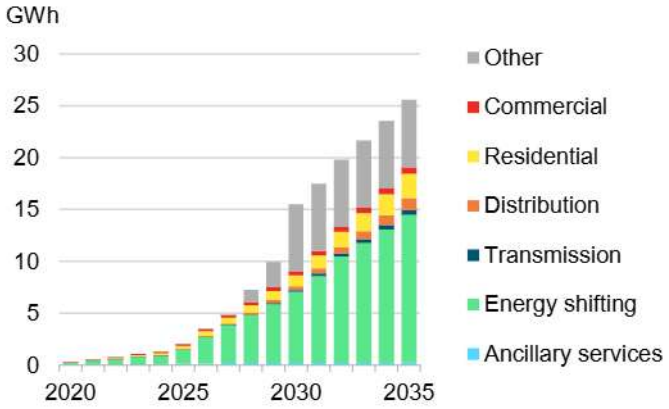


Figure 69: New England's cumulative energy storage capacity



Source: BloombergNEF

6.2. Canada

Canada installed 110MW/186MWh of energy storage in 2024, 69% lower in megawatt-hours than our expectation due to fewer installations across all segments. Starting in 2025, the market is set to take off as large-scale projects contracted in past capacity procurement processes in Ontario's Independent Electricity System Operator (IESO) come online. BNEF expects annual additions to range between 430MW/1,513MWh and 1,183MW/4,181MWh over 2025-2028, most of which are utility-scale projects. IESO's ongoing procurement will support new energy storage projects including long-duration energy storage starting in 2029 as the new process requires energy storage systems of eight-hour duration or longer.

Figure 70: Canada's annual new energy storage build

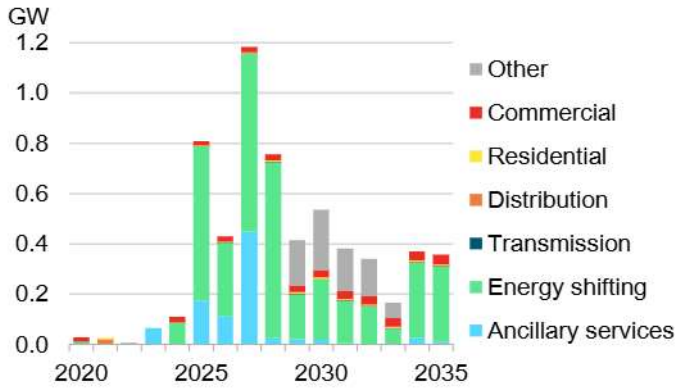
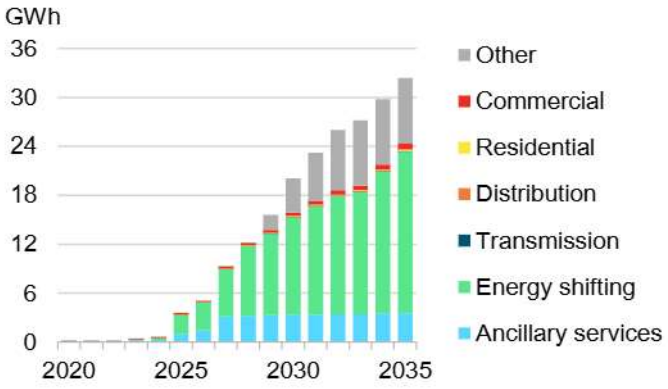


Figure 71: Canada's cumulative energy storage capacity



Source: BloombergNEF

Ontario's smaller capacity procurement windows to steadily support uptake around 2030

Ontario's IESO will soon kick off its Long-Term 2 (LT2) procurement seeking 1.6GW of capacity for energy storage and non-storage facilities. Contracted projects will be able to secure 20-year capacity payments from IESO. Unlike the previous procurement processes such as LT1 and Expedited LT1, IESO has divided the procurement into four small windows and has started procurement for the first one this year (Table 3). The registration deadline for the first window is August 21, 2025. Its result is scheduled to be announced at the end of March 2026. The first window seeks 600MW of capacity and requires contracted projects to come online by May 1, 2030. The required minimum system duration is eight hours, encouraging non-battery energy storage systems to participate in the process. The remaining windows will support new energy storage built in 2030-2033.

Table 3: Independent Electricity System Operator's capacity procurement processes

LT2 procurement windows	Target capacity	Targeted deadline for commercial operations date (COD)
Window 1	600MW	May 1, 2030
Window 2	400MW	May 1, 2031
Window 3	300MW	May 1, 2032
Window 4	300MW	May 1, 2033

Source: Independent Electricity System Operator

Ontario's power market to shift to locational pricing

IESO will implement locational marginal pricing for its electricity market starting May 1, 2025. Since the market previously used a single and unconstrained power price, this change has a big impact on its electricity market as market players now need to consider grid constraints and locational power prices for their projects. That said, this change might have limited impact on energy storage in the near term since many energy storage projects in Ontario eye IESO's capacity procurement processes awarding long-term payments. In the long term, more projects could explore merchant opportunities without IESO's procurement processes, shaping the market.

6.3. Latin America

Battery energy storage deployment is set to take off in Latin America. Argentina and Brazil are planning their first standalone battery auctions this year, marking a major shift in the policy environment. Mexico and Colombia both have also advanced plans for batteries in their respective energy plans, with Mexico expected to require new renewable projects to install batteries while Colombia assesses regulation for batteries in its power market.

Energy storage additions in the region hit 788MW/2,826MWh in 2024, a bit higher than expectations primarily due to Chile additions. This was nearly double 2023 additions in gigawatt-hour terms. This year, capacity additions may fall slightly in megawatts but grow in megawatt-hours to 768MW/3,187MWh. Cumulative energy storage capacity reaches 12GW/41GWh by 2030 and 26GW/92GWh by 2035, roughly 20 times larger than the gigawatt-hour installed capacity at the end of 2024. Growth is primarily in the utility-scale segment, as renewable penetration across Latin America grows strongly. We also see strong growth in the commercial segment in Brazil, as uptake of batteries across businesses rises.

Figure 72: Latin America's annual energy storage additions

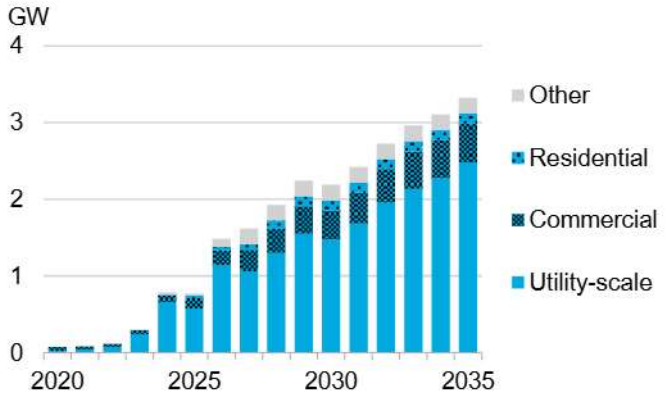


Figure 73: Latin America's cumulative energy storage capacity

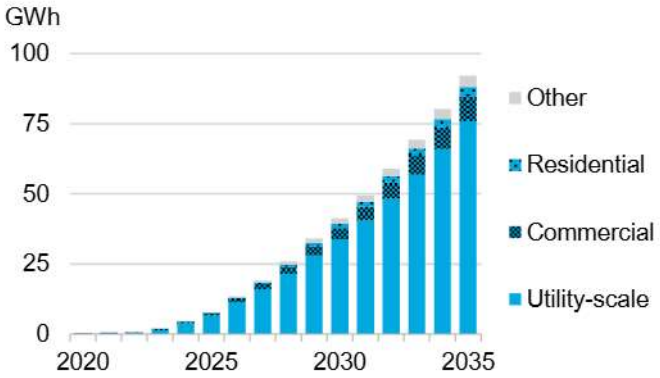


Figure 74: Latin America's annual energy storage additions by market

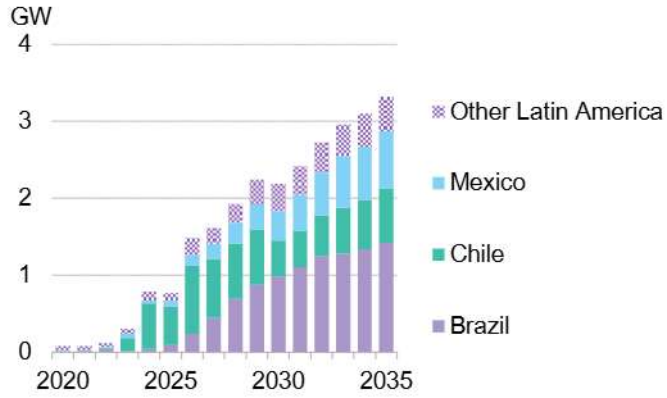
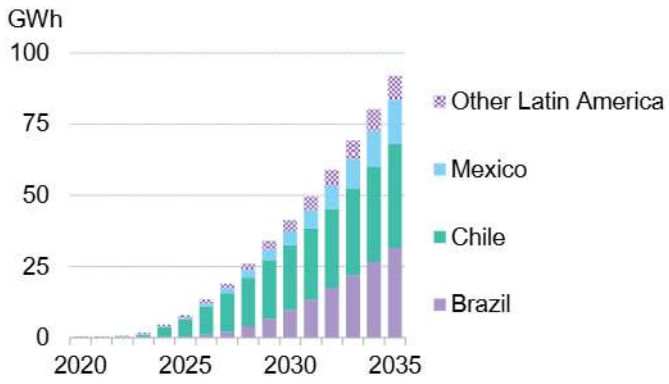


Figure 75: Latin America's cumulative energy storage capacity by market



Source: BloombergNEF

Brazil

Energy storage is still in its early stages in Brazil, but a turning point for the technology could be close. BNEF expects around 90MW/208MWh in new build additions by 2025, doubling to 236MW/597MWh in 2026. Cumulative energy storage capacity reaches 10GW/32GWh in 2035, from less than a gigawatt at the end of 2024.

Residential, commercial and microgrid (represented in the "other") applications are poised for growth in the short term, tied to synergies with Brazil's growing distributed generation sector and opportunities to replace oil generation in isolated regions not connected to the transmission grid.

However, Brazil's biggest growth driver is energy shifting. The country is planning a **capacity auction** specifically for batteries, which is likely in the second half of 2025. Preliminary rules outline that projects should have a minimum 30MW capacity, four hours of duration and be operational by July 2029, awarding a 10-year contract. There is no information yet about the total capacity expected to be awarded through the auction.

Projects aimed at energy shifting will drive most growth this decade, both from the capacity auction and from storage projects co-located to wind and solar assets, aiming to **mitigate renewable generators' losses caused by forced curtailment,** an issue that was particularly acute in 2024. For more, see *2H 2024 Latin America Clean Energy Market Outlook* (web | terminal).

Figure 76: Brazil's new build power capacity, by application

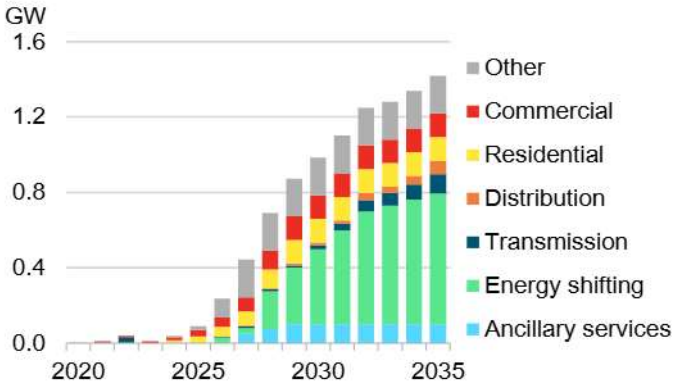
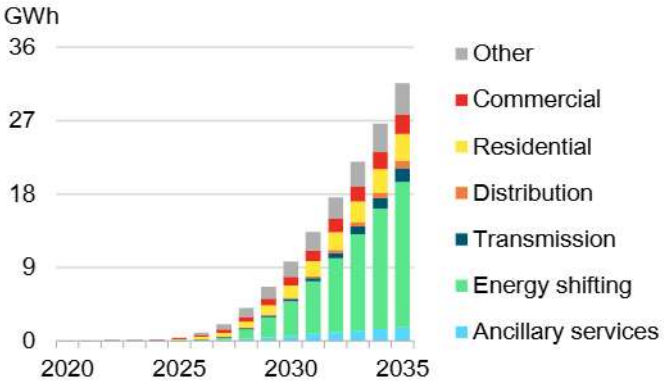


Figure 77: Brazil's cumulative energy capacity, by application



Source: BloombergNEF

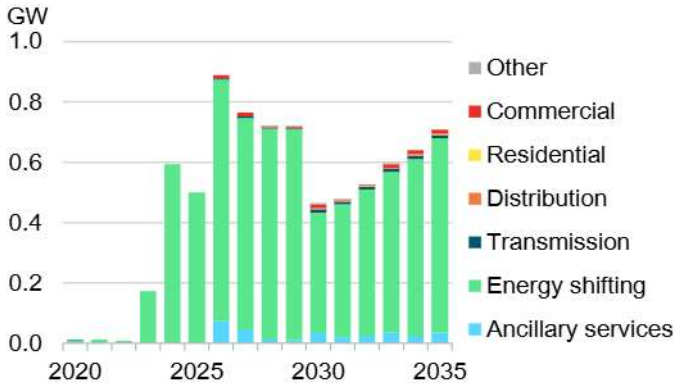
Chile

Chile added almost 600MW/2,400MWh of energy storage assets in 2024, a bit above our expectation in the previous outlook. In gigawatt-hour terms, this is 180% growth compared to 2023 additions. BNEF expects additions to remain stable, at around 500MW/2,500MWh in 2025.

Battery demand is driven by opportunities for energy storage projects to capture power price arbitrage, receive capacity payments and reduce financial losses from solar and wind projects due to increasing curtailment rates. Solar and wind assets faced severe transmission bottlenecks in 2024, which led to 18% and 12% curtailment rates, respectively, up from 10% and 8% the previous year. The critical state of transmission capacity encourages renewable developers to couple energy storage assets with their existing and new wind and solar projects.

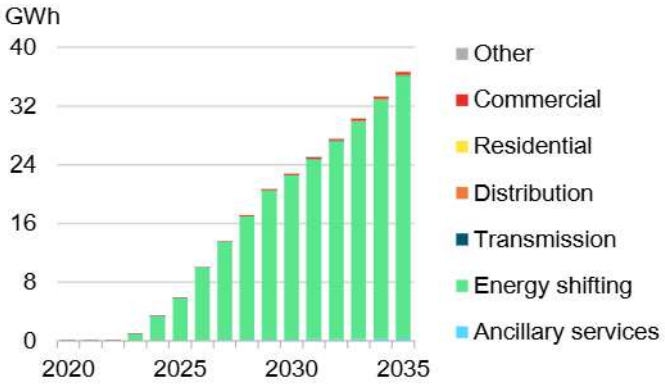
Cumulative energy storage capacity reaches 4.8GW/22.6GWh by 2030, about 25% higher in gigawatt-hour terms compared to our previous forecast. By 2035, cumulative energy storage capacity reaches 7.7GW/36.2GWh, roughly 11 times installed capacity at the end of 2024.

Figure 78: Chile's annual new energy storage build



Source: BloombergNEF

Figure 79: Chile's cumulative energy storage capacity

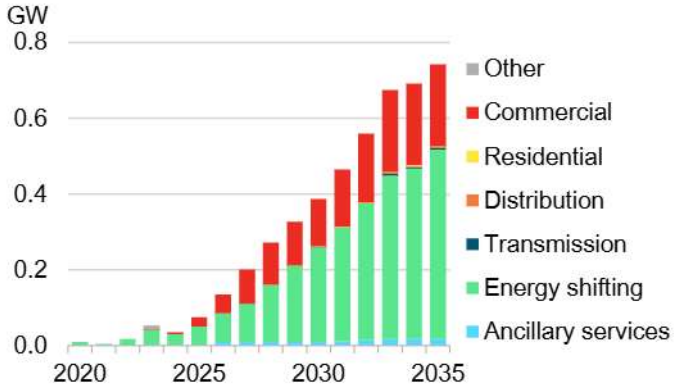


Mexico

Mexico has increased its energy storage ambitions in 2025, with Jorge Islas, undersecretary for planning and energy transition announcing that batteries be built at new renewable project at 30% of the renewable project's capacity. There are no further details on how or if renewables projects would be compensated for the added costs of the batteries. Such mandates have been the main driver of energy storage demand in China and are also being implemented in India.

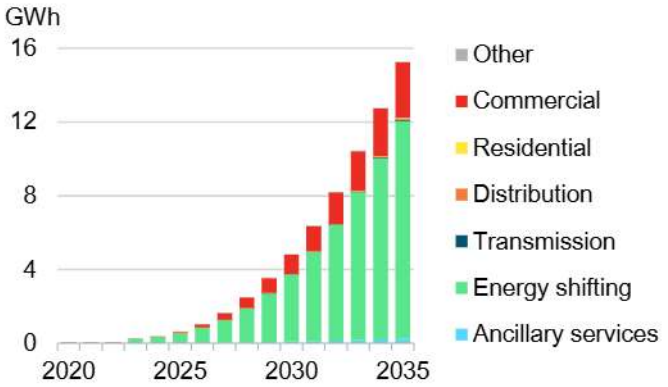
Additionally, in Mexico's new National Electricity System Strengthening and Expansion Plan 2025-2030 released in February 2025, the government outlined five energy storage projects totaling 574MW to be commissioned by the end of 2027. A second phase of the plan (which is still in development) plans for another 741MW of battery storage projects between 2027-30. BNEF expects that Mexico could reach 1.5GW/4.8GWh of cumulative battery storage by 2030 if those projects come online on the expected date.

Figure 80: Mexico's annual energy storage additions by application



Source: BloombergNEF

Figure 81: Mexico's cumulative energy storage capacity by application



Colombia

Colombian's Mining and Energy Planning Unit (UPME) is currently analyzing and proposing regulation changes to foster more deployment of storage assets in the country. UPME reports that the country currently lacks regulations that allow storage assets to participate in the ancillary services market and arbitrage. The document with proposal changes was submitted for public consultation and feedback from the market until April 27.

Colombia was the first country in Latin America to hold a large-scale energy storage tender, back in 2021. The government planned the storage system to reinforce the transmission infrastructure of northern Colombia's Atlantico Department. The project, a 45MW/45MWh storage system, was initially scheduled to be commissioned in 2023, but is currently facing the risk of never becoming operational as the project developer claims it may be financially unfeasible. By end-2024, Colombia had only three operational energy storage systems totaling 9MW/7.4MWh.

Argentina

Argentinian market administrator CAMMESA announced on February 17 that it will hold a 500MW storage tender for projects with four-hour duration. It will be developed in the Buenos Aires Metropolitan Area. Project size can range between 10-150MW. Contracts will be signed in US dollars. The process will take place on May 19 and results will be revealed on June 27.

Section 7. Europe, Middle East, and Africa

The Europe, Middle East and Africa (EMEA) region added 13.5GW/24.9GWh in 2024, a 55% increase in gigawatt-hours from 2023 but 8% less than we had anticipated (Figure 82, Figure 84). The slower growth was due to a cooling residential market in Spain, Germany and Italy, as well as lower confidence in utility-scale battery revenues in the UK. Growth far exceeded expectations in the Middle East and Africa, with gigawatt-hour scale projects coming online in Saudi Arabia and South Africa. Cumulative capacity reaches 222GW/509GWh by the end of 2030 and 429GW/1,226GWh by 2035 (Figure 83, Figure 85). Growth will be driven by targeted auction schemes across the region, with the utility-scale segment overtaking the residential segment as the largest in 2026.

Figure 82: EMEA's annual energy storage additions by region or country

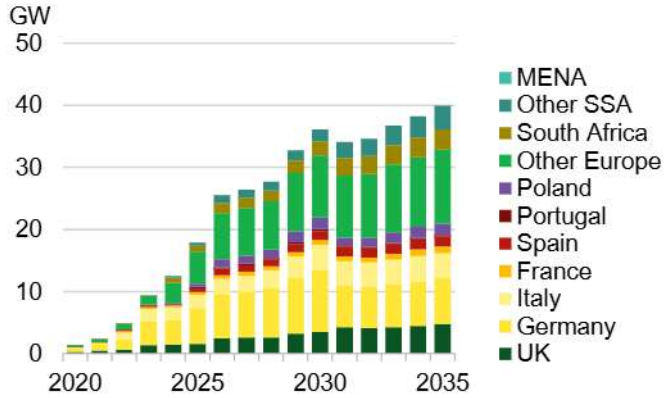


Figure 83: EMEA's cumulative energy storage capacity by region or country

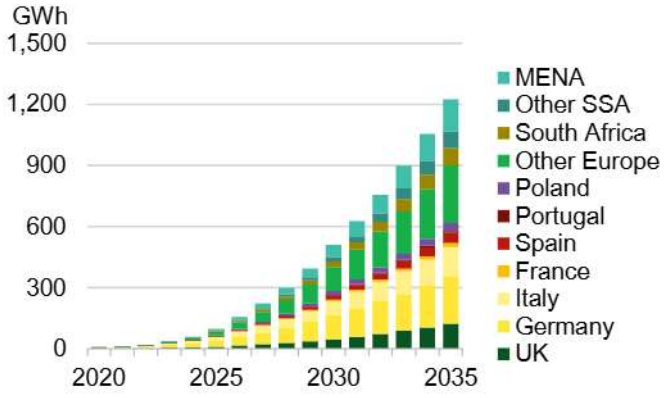


Figure 84: EMEA's annual energy storage additions by application

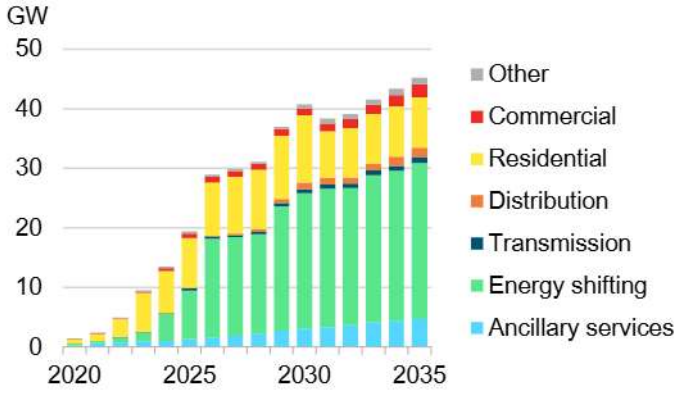
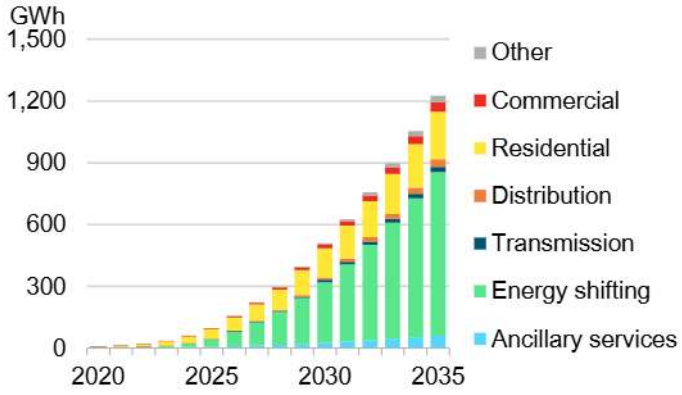


Figure 85: EMEA's cumulative energy storage capacity by application



Source: BloombergNEF. Note: MENA is Middle East and North Africa. SSA is Sub-Saharan Africa.

7.1. European policy updates

In Europe, governments are moving on from simply providing direct grants or capex subsidies and instead are increasingly using mechanisms like two-way contracts for difference. This allows governments to ensure that they only help developers manage their downside risk and prevents funds from going toward projects that would be otherwise profitable (Table 4).

Table 4: Energy storage targets and support schemes in Europe since 2024

Market	Targeted support schemes for energy storage
Austria	• €75 million approved in September 2024 for systems over 1MWh • €35 million approved in April 2024 for systems between 4kWh and 50kWh • €17.9 million approved in June 2024 for systems between 51kWh and 1MWh
Belgium	• No EU-approved targeted scheme, but batteries can win long-term contracts in the capacity market
Bulgaria	• €339 million approved in March 2024, targeting 1.4GW of renewables plus 350MW of storage – contracted 3.1GW of renewables plus 1.2GW of storage in November 2024 instead • €589 million approved in June 2024, targeting 3GWh – contracted nearly 10GWh in April 2025 instead
Croatia	• €500 million approved in April 2024
Cyprus	• €35 million approved in February 2025, targeting 150MW/350MWh of co-located energy storage
Czechia	• €279 million approved in March 2025, targeting 1.5GWh of energy storage – to be contracted by December 2025
Germany	• Innovation auctions are held twice a year – awarded 587MW of PV plus storage in October 2024 round, targeting 486MW in May 2025 round
Greece	• €341 million approved in September 2022, targeting 1GW of energy storage by 2026 – contracted 900MW instead: first round contracted 411MW in 2023, second round 300MW in 2024 and final round 189MW in March 2025. • €1 billion approved in April 2024, directly awarded to two renewable plus storage projects by 2025
Hungary	• €1.1 billion approved in June 2023, targeting 800MW/1,600MWh – contracted 440MW in April 2024
Ireland	• No EU-approved targeted scheme, but batteries can win long-term contracts in the capacity market
Italy	• €17.7 billion approved in December 2023, targeting 9GW/71GWh by 2033 – first round scheduled for September 2025, targeting 10GWh by 2028
Lithuania	• €180 million approved in October 2024, targeting 1.2GWh of energy storage – first round accepting applications until June 2025, targeting 800MWh by 2028
Netherlands	• €417 million approved in October 2023, targeting renewable plus storage projects – first round allocated €100 million in April 2024
Poland	• €1.2 billion approved in October 2024, targeting at least 5.4GWh of energy storage – first round opened in April 2025, taking applications until May 2025
Portugal	• €100 million approved in August 2024, targeting 500MW by 2025
Romania	• €103 million approved in March 2023, targeting 240MW/480MWh – contracted to projects totaling 130MWh in October 2024 • €150 million approved in November 2024, targeting co-located energy storage
UK	• No targeted scheme, but batteries can win long-term contracts in the capacity market

Source: European Commission, BloombergNEF. Note: Green shading indicates changes since 2H 2024.

7.2. Germany

Germany added 4.0GW/6.5GWh of battery storage capacity in 2024, down from an expected 4.4GW/7.1GWh. Installations in the residential segment came in at 3.4GW/5.4GWh, short of our expected 3.9GW/6.3GWh, as the rooftop PV and battery market generally cooled in 2024. In the utility-scale segment, 460MW/920MWh was added, beating our expectations of 350MW/660MWh.

BNEF expects Germany to add 5.7GW/9.8GWh of battery storage capacity in 2025. The rooftop PV and storage market is expected to bounce back, driving 4.6GW/7.8GWh of residential battery installations. The utility-scale market is also expected to grow in 2025, adding 1.0GW/1.8GWh of batteries.

Cumulative energy storage capacity reaches 59GW/121GWh by 2030, down from our previous forecast for 64GW/115GWh as we reduced duration assumptions for residential batteries in line with average system sizes we are seeing in the market. Cumulative energy storage capacity reaches 95GW/230GWh by 2035, slightly up in gigawatt-hour terms compared to our previous outlook. This capacity splits almost evenly across two main segments, with 31GW/105GWh in the utility-scale segment and 60GW/115GWh in the residential segment, with a remaining 3GW/9GWh installed in the commercial segment.

Figure 86: Germany's annual energy storage additions

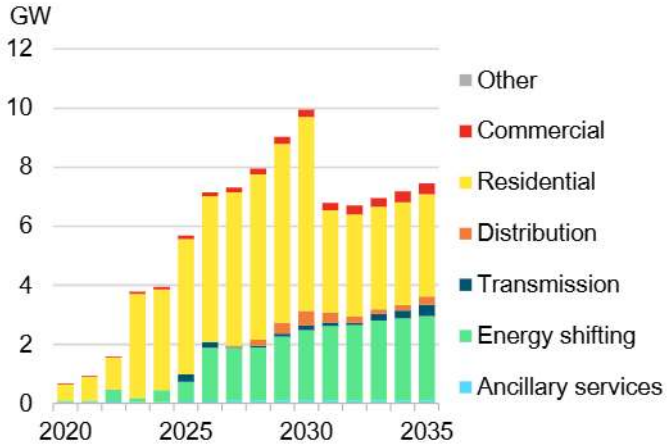
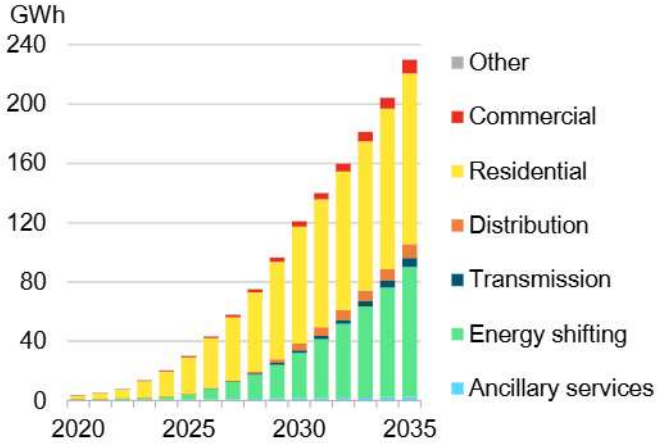


Figure 87: Germany's cumulative energy storage capacity



Source: BloombergNEF

Residential

Germany installed 566,000 residential battery systems (between 1kW and 30kW), paired to 451,000 residential solar systems in 2024. The attachment rate of batteries to solar remains high, at 82%, translating to 3.4GW/5.4GWh of residential batteries installed.

Residential PV and storage growth in Germany slows after 2030 as solar targets are met

We expect uptake to accelerate in the years leading to 2030, when BNEF's residential solar forecast totals 88GW, informed by Germany's ambitious target for 215GW of solar PV in all segments by 2030. Residential battery installations drop after 2030, in line with expectations for residential solar in Germany to slow after targets are met.

Commercial

BNEF tracked 89MW/186MWh of commercial battery systems installed in 2024. This includes projects between 20kW and 1MW that are not owned by individuals and represents a 14% increase from 2023 installations. Until 2035, this segment remains marginal at 2.9GW/9.0GWh of cumulative capacity.

Utility-scale

BNEF tracked 460MW/920MWh of utility-scale battery systems installed in 2024 as projects from Germany's innovation auctions continued to drive the segment. As the auctions require at least a 25% solar-to-storage (MW) ratio and a two-hour storage duration, the average duration of projects commissioned in Germany came in just above two hours in 2024.

Outside the innovation auction, which mainly drives smaller co-located projects, large utilities and investors like Vattenfall, Verbund and RWE are planning to drive up their investment in energy storage projects. High solar penetration in Germany creates opportunities for both co-located solar-plus-storage and stand-alone storage projects looking to capture power price arbitrage opportunities driven by low or even negative daytime solar prices. By 2035, cumulative utility-scale capacity reaches 31GW/105GWh.

(Germany's annual energy storage additions in 2024 and cumulative capacity in 2035 for residential, commercial and utility-scale were corrected on September 16, 2025.)

Further reading:

- *Europe Energy Storage Market Overview 2024* (web | terminal)

7.3. UK

The UK added 1.4GW/2.6GWh of battery storage capacity in 2024, slightly up in gigawatt-hour terms from an expected 1.5GW/2.4GWh. Installations in the residential segment came in at 361MW/578MWh, up significantly from the 187MW/300MWh we expected in our last outlook, primarily as attachment rates to rooftop PV rose faster in 2024 than we predicted. Installations in the utility-scale segment came in at 1.1GW/2.0GWh, a little less than our expectations (1.3GW/2.1GWh) as investors delayed projects given lower market revenues in 2024.

BNEF expects the UK to add 1.6GW/3.1GWh of battery storage capacity in 2025, with both the utility-scale and small-scale segments experiencing modest growth. Cumulative energy storage capacity reaches 21GW/47GWh by 2030, up 3% in gigawatt-hour terms from our previous forecast. We expect a higher uptake of batteries in the residential segment, though this is slightly offset by reduced expectations in the commercial segment.

Cumulative energy storage capacity reaches 43GW/122GWh by 2035, up 8% in gigawatt-hour terms compared to our previous outlook. This is broken down as 36GW/104GWh of batteries in the utility-scale segment and 5.4GW/11GWh of batteries across the residential and commercial segments. The remaining capacity, 1.4GW/7GWh, we attribute to projects that will be driven by the UK's long-duration energy storage scheme, which we tracked as an application in the "other" category and may include non-lithium energy storage projects.

Figure 88: UK annual energy storage additions

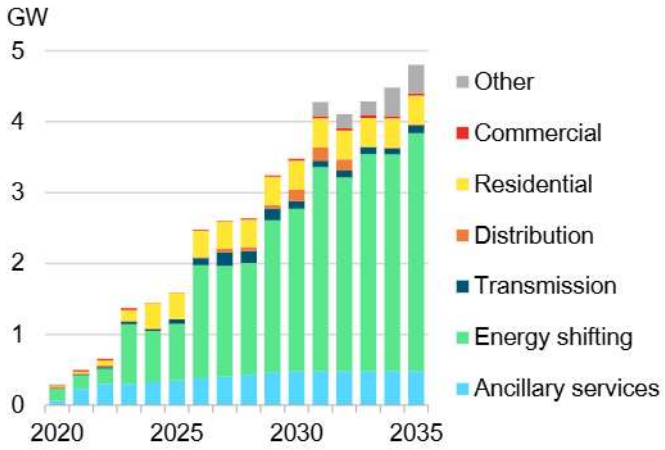
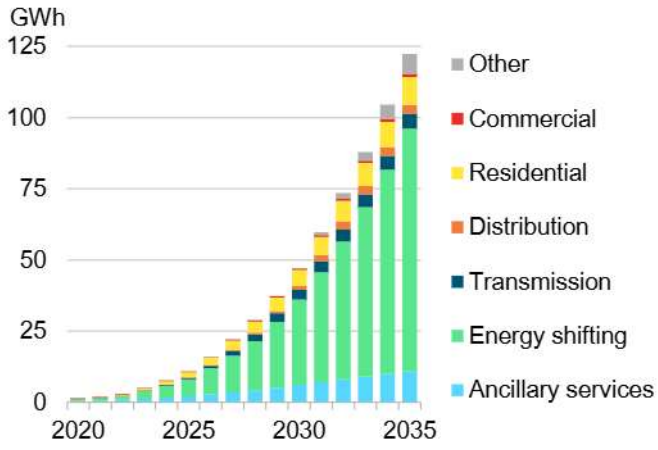


Figure 89: UK cumulative energy storage capacity



Source: BloombergNEF

Utility-scale

BNEF tracked 1.1GW/2.0GWh of utility-scale capacity installed in the UK in 2024, with an average project size of 70MW and project duration of 1.9 hours. This was well short of our previous forecast, as developers stepped back from building new projects because of lower market revenues.

The move toward arbitrage continues

The UK market is moving toward longer-duration projects, with 2024 the first year when more than half of projects commissioned had durations of two hours or more. This trend is part of a shift in revenues for energy storage projects, as value in the previously lucrative frequency response market is shrinking, and developers are gearing up for participation in wholesale energy markets.

Additionally, the UK's capacity market for securing backup supplies of electricity cleared close to an all-time high in March 2025. New battery projects broke auction records, with 6GW of new battery capacity securing contracts in this auction, more than the 5.7GW seen last year. Of these, some had durations of as long as eight hours, tying in with the UK's plan to build out its long-duration storage capacity. Besides that, a 50MW six-hour compressed air storage project also secured a contract, the first of its kind in the UK.

Energy storage market revenues will continue to depend on arbitrage and capacity payments in 2025, despite a slight uptick in ancillary service revenues following the announcement of the new Quick Reserve launched in November 2024. The new service is not expected to withstand saturation for long as it added less than 500MW of new battery demand to the market. Focus among developers will continue to be on optimizing batteries for participation in energy markets, securing capacity market contracts and managing risk.

Further reading:

- *Batteries and Older Gas Plants Win in UK Power Auction* (web | terminal)
- *Europe Energy Storage Market Overview 2024* (web | terminal)

Long-duration energy storage sets a launch date

In April 2025, the UK opened the first application window for its program to support the development of long-duration energy storage projects, defined in its document as at least six hours. The initiative will look to contract the first batch of projects by 2Q 2026, targeting pumped hydro and other technologies such as flow batteries, liquid air, and compressed air energy storage. Our forecast accounts for this capacity coming online after 2030, with a cumulative 7GWh by 2035 (average of five-hour duration projects) tagged as an "other" application.

(UK's annual utility-scale energy storage additions in 2024 was corrected on September 16, 2025.)

7.4. Italy

Italy added 2.0GW/5.3GWh of battery storage capacity in 2024, up 27% in gigawatt-hour terms from an expected 1.8GW/4.2GWh. The utility-scale segment added 1.0GW/3.6GWh, more than tripling our expectations as projects contracted via the capacity market came online quicker than expected. This growth was offset by the residential segment, which added 1.0GW/1.6GWh, falling short of 1.5GW/3.0GWh we anticipated, as rooftop PV demand fell.

BNEF expects Italy to add 2.2GW/5.7GWh of battery storage capacity in 2025, with both the utility-scale and small-scale segments experiencing modest growth. Cumulative energy storage capacity reaches 23GW/66GWh by 2030, down 2% in gigawatt-hour terms from our previous forecast. We expect a slower uptake of batteries in the residential segment as the rooftop PV market generally cools due to removal of subsidies.

Cumulative energy storage capacity reaches 43GW/147GWh by 2035, down 1% in gigawatt-hour terms compared to our previous outlook. This is broken down as 26GW/99GWh of batteries in the utility-scale segment and 15GW/31GWh of batteries across the residential and commercial segments. The remaining capacity, 1.8GW/18GWh, is driven by Italy's demand for longer-duration energy storage tracked as an "other" application, and may support non-lithium energy storage deployments.

Figure 90: Italy's annual energy storage additions

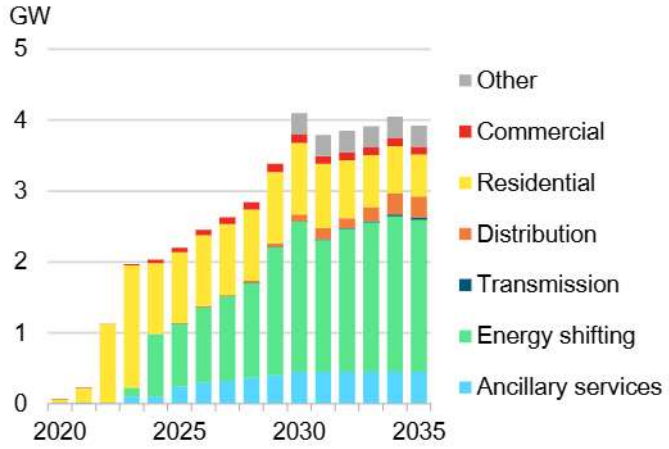
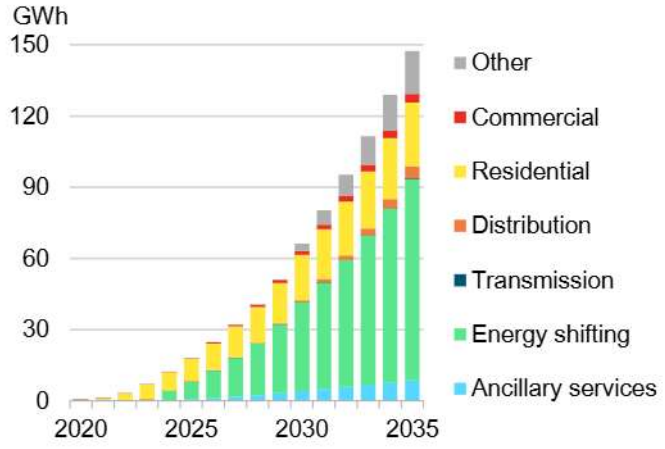


Figure 91: Italy's cumulative energy storage capacity



Source: BloombergNEF

Utility-scale

Build exceeds expectations

The utility-scale segment had a strong year in 2024, after years of projects in the pipeline being delayed, and is now the largest segment in Italy. Over 980MW/3,620MWh of capacity came online, most of which were initially contracted for Italy's Fast Reserve and Capacity Market auctions in 2020. Most of the commissioned capacity was driven by Enel's portfolio of projects won in the first two capacity auctions, as they continue to hold majority market share in the region.

MACSE auction scheme date set

The MACSE auction scheme is scheduled to be held in September 2025, with projects expected to come online as early as 2028. Developers are expected to confirm their desire to participate by June 2025.

The first auction will look to procure 10GWh of energy storage capacity, driving the market even further before the end of the decade. Terna, the Italian grid operator, has outlined specifics around the regional split for this demand, with 7GWh of capacity required in South Italy and Calabria, 3GWh in Center-South of Italy, as much as 1GWh in Sardinia, and 1.5GWh in Sicily.

Unlike Europe's first targeted energy storage auction held in Greece, the MACSE auction will not limit developers by requiring them to bid for a fully fixed-revenue contract. Instead, MACSE presents a novel proposition: it allows developers to decide what proportion of capacity they want to receive fixed revenues for and what proportion they want to be merchant.

Further reading:

- *Europe Energy Storage Market Overview 2024* (web | terminal)

Residential

Utility-scale segment has now surpassed the residential segment in Italy

The growing investment in the utility-scale segment means that residential segment is no longer the largest in Italy, despite adding 1.0GW/1.6GWh in 2024 as expected. The residential segment is also forecast to maintain higher levels of additions through are forecast period than previously expected: while Italy's Superbonus scheme, initially introduced to subsidize home energy installations, is being phased out, BNEF observed that attachment rates held at 80% in 2024. Our latest forecast now considers that attachment rates hold through to 2035. Cumulative residential capacity is estimated to reach 14GW/27GWh by 2035, up from our previous forecast for 10GW/20GWh.

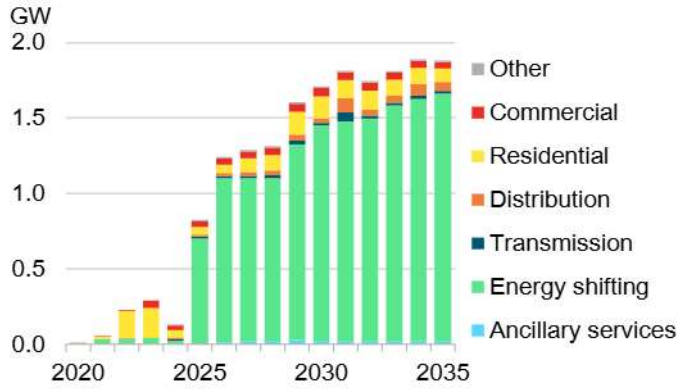
7.5. Iberia

Iberia added 133MW/223MWh of energy storage in 2024, down 85% in gigawatt-hour terms from expected additions in our previous outlook. Iberia is expected to add 825MW/1,582Wh in 2025, more than seven times the year before. The utility-scale segment drives most of the growth with projects contracted from PV-plus-storage auctions expected to start coming online.

Cumulative energy storage capacity reaches 8.7GW/22GWh in 2030, up 4% in gigawatt-hour terms from our previous forecast thanks to better-than-expected performance in the utility-scale segment. Cumulative energy storage capacity grows further to 18GW/58GWh by 2035, but this is slightly down from our previous forecast for 18GW/61GWh. While we are more bullish on the

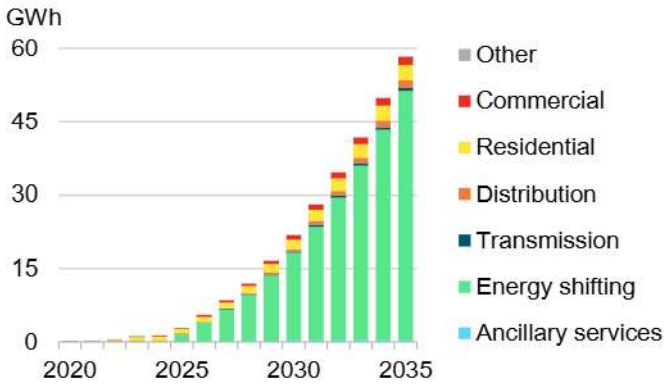
utility-scale segment, the forecast is brought down by slower residential and commercial battery expectations.

Figure 92: Iberia's annual energy storage additions



Source: BloombergNEF

Figure 93: Iberia's cumulative energy storage capacity



Spain: capacity auctions coming up

In December 2024, Spain's Ministry for the Ecological Transition and the Demographic Challenge (MITECO) launched a consultation regarding a capacity mechanism, which is now expected to launch in 2026. Discussions around the capacity market in Spain came into focus over the past year as nuclear phase out is considered, potentially triggering demand for firm capacity, which batteries and other energy storage technologies can provide. This, in combination with the launch of a capacity market, would drive an upward revision to our forecast if confirmed.

The capacity market will add to existing subsidy auctions that are supporting stand-alone storage projects in Spain, with nearly 3GWh of batteries already expected online before 2028.

Utility-scale

In September 2024, MITECO published results for its first tender for innovative energy storage projects. Initially announced in July 2023, the tender sought to contract projects of 4 to 4.5 hours in duration.

The tender awarded €167 million in capex subsidies to 46 projects totaling 881MW/3,590MWh. Of this amount, €150 million will go to 35 battery projects totaling 757MW/3GWh, while the remaining funds allocated awarded to thermal storage projects. Awarded projects are expected to be deployed before the end of 2026 (Table 5).

Table 5: Details for Spain's €280 million energy storage aid announced in July 2023

Technology	Funding	Results
Battery energy storage	€150 million	757MW/3GWh
Thermal energy storage	€30 million	124MW/590MWh
Pumped hydro energy storage	€100 million	Results yet to be announced

Source: BloombergNEF, Ministry for the Ecological Transition and the Demographic Challenge (MITECO).

Residential and commercial

BNEF tracked 25MW/41MWh of **residential** battery additions in 2024, pairing with around 361MW of residential solar, based on our *1Q 2025 PV Market Outlook* (web | terminal). Additions in this segment were significantly down from previous expectations, and we have lowered our forecast as we observed that the rooftop solar market in Spain was not growing as quickly in 2024 as in previous years, responsible for lower expectations for residential batteries in the region.

For Otovo, an installer of residential solar and batteries, for example, the lack of growth in the Spanish market last year, triggered a strategy review. The company reported a drop in attachment rates in Spain. BNEF reduced our assumed attachment rate to 10% for 2024, though our forecast assumes that attachment rates in Spain gradually rise from 2027 onwards, reaching 20% by 2030.

In the **commercial** segment, BNEF estimates that 26MW/56MWh of commercial batteries were added in 2024. We raised our assumed attachment rate in this segment to 5% in 2024 in line with reports from solar association Unión Española Fotovoltaica (UNEF). Despite this rise in assumed attachment rates, we now have a lower commercial battery uptake due to the drop in annual commercial solar installations to 1.06GW in 2024 from 1.57GW in 2023 and 2.05GW in 2022, as well as a drop in the commercial solar forecast through to 2035.

(Iberia's annual energy storage additions in 2024 and 2025, cumulative capacity in 2030 and 2035, and Spain's residential and commercial annual energy storage additions and attachment rates forecast out to 2030 were corrected on September 16, 2025.)

7.6. France

France added an estimated 353MW/452MWh of battery storage in 2024, up 21% in gigawatt-hour terms from our previous forecast thanks to a change in our assumptions for the commercial segment, where we now assume a 2% attachment rate. BNEF expects France to add 471MW/604MWh in 2025, with growth driven by a handful of developers pushing projects forward in the utility-scale segment.

Cumulative energy storage capacity reaches 5.2GW/8.3GWh by 2030, up 32% from our previous forecast. France is considering setting an energy storage target that could call for as much as 6GW by 2030. By 2035, cumulative energy storage capacity reaches 9.8GW/20GWh, up 21% from our previous forecast. The potential announcement of a target could also impact installations in the following years.

Figure 94: France's annual energy storage additions

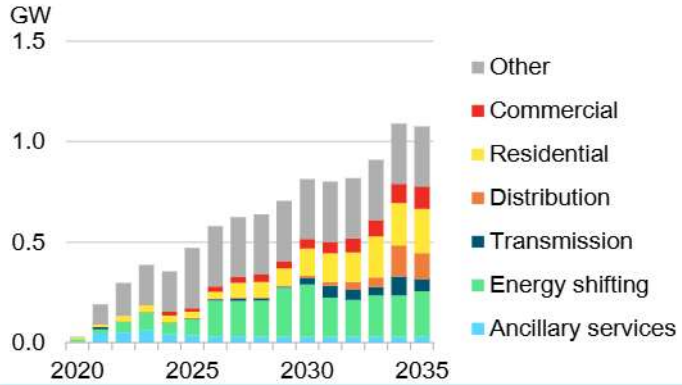
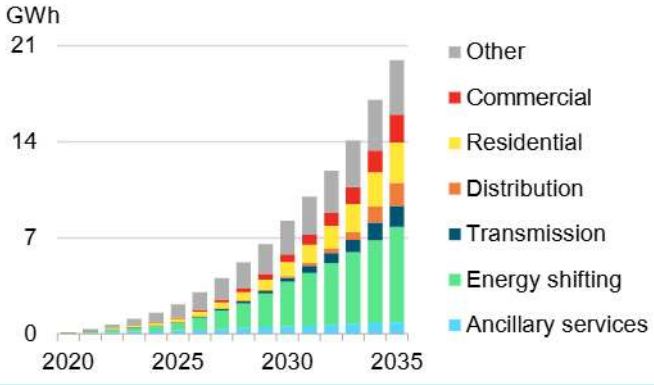


Figure 95: France's cumulative energy storage capacity



Source: BloombergNEF. Note: 'Other' in France applies primarily to electric vehicle charging energy storage installations.

Residential

BNEF estimates that France added around 34MW/55MWh of residential batteries in 2024, in line with previous expectations. In 2023, Enphase reported that roughly 8% of residential solar systems in France were paired with batteries, and we have held this assumption for 2024. This attachment rate is low compared to other markets in Europe, as cheap residential electricity combined with a lack of available subsidies makes pairing residential batteries with solar relatively unattractive in France.

7.7. Poland

This is the first time we have analyzed data for Poland separate from the rest of East Europe to give more visibility given the significant growth expected in the coming years. Poland added 269MW/438MWh of energy storage in 2024. The residential segment was the largest, with more people choosing to attach batteries to rooftop PV installations following a change in the scheme for solar export payments.

BNEF expects 538MW/1002MWh of energy storage additions in 2025, with the utility-scale segment growing to surpass the residential market. Cumulative energy storage capacity reaches 8.4GW/19GWh by 2030. The utility-scale segment continues to grow thanks to both the capacity market and targeted energy storage auctions. By 2035, cumulative energy storage capacity reaches 16GW/40GWh.

Figure 96: Poland's annual energy storage additions

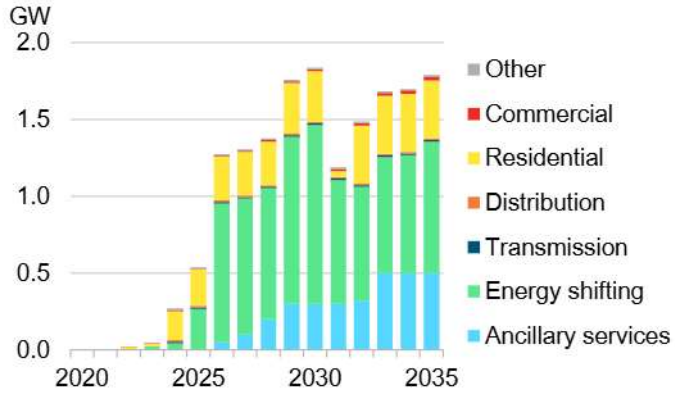
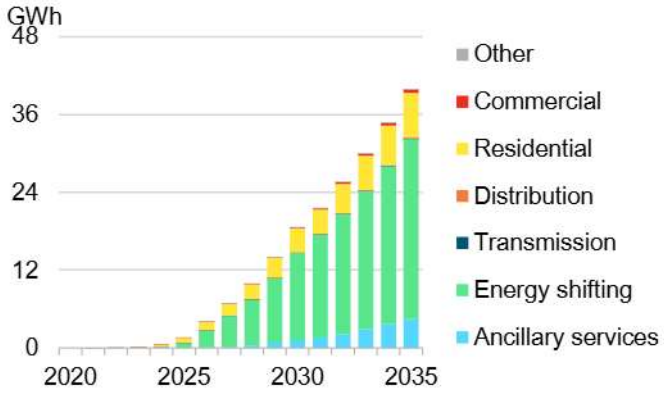


Figure 97: Poland's cumulative energy storage capacity



Source: BloombergNEF

Utility-scale

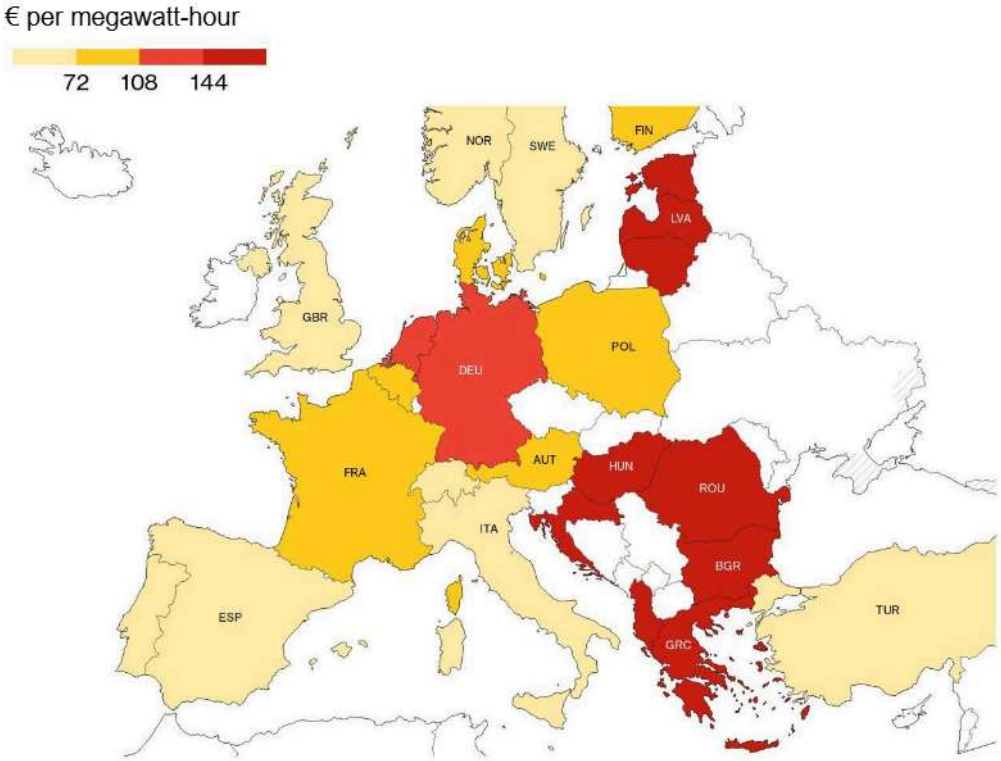
Poland is targeting 4.7GW of utility-scale batteries by 2030, with funding support already approved for at least 1.35GW/5.4GWh of projects by 2028. The Polish capacity market is also helping to support projects, and batteries won the most contracts out of all new-build fossil fuel and clean technologies in the last Polish capacity market auction. As battery prices come down and the need to phase out coal looms, we expect further growth in the utility-scale battery market.

7.8. Rest of Europe

BNEF estimates that energy storage capacity additions across the rest of Europe in 2024 came in at 3.2GW/5.1GWh. Additions are expected to rise in 2025 to 4.9GW/8.5GWh, with activity picking up in South and East Europe. Cumulative energy storage capacity reaches 50GW/110GWh by 2030, up 18% in gigawatt-hour terms compared to our previous forecast. By 2035, cumulative capacity reaches 100GW/260GWh, growing roughly 26 times compared to installed capacity at the end of 2024.

The near-term rise is mostly driven by the utility-scale segment, as rising power price spreads and lower battery costs increase demand for energy storage projects. Power price spreads alone are now enough to underpin energy storage projects in Southern and Eastern European markets like Hungary, Bulgaria, Greece and Romania, as well as in the Baltic states Latvia, Estonia and Lithuania. Governments are also ramping up support for energy storage in these markets to help smooth the transition.

Figure 98: Min-max power price spreads across Europe in 2024



Source: BloombergNEF

North Europe

The North Europe region (Norway, Sweden, Finland, Denmark, Latvia, Estonia, Lithuania) added 0.8GW/1.2GWh in 2024, nearly double our previous outlook in gigawatt-hour terms and a 117% jump in gigawatt-hours compared to 2023 (Figure 99). Cumulative energy storage capacity reaches 7.4GW/14.8GWh by 2030, in line with our previous forecast, and 15GW/39GWh by 2035, roughly 43 times larger than installed capacity at the end of 2023 (Figure 100).

Figure 99: North Europe's annual energy storage additions

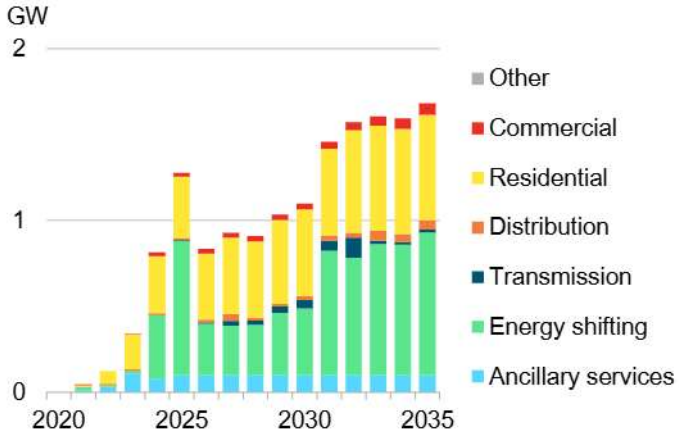
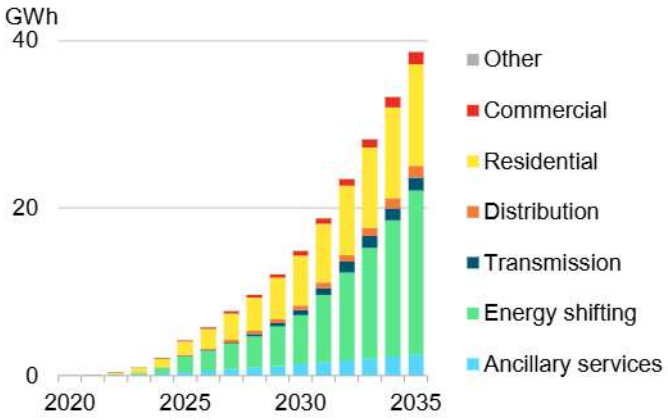


Figure 100: North Europe's cumulative energy storage capacity



Source: BloombergNEF

Residential

In **Sweden**, we estimate that 317MW/507MWh of residential battery capacity was added in 2024. Roughly 260MW of residential solar was added in the first half of 2024, according to Swedish solar association Svensk Solenergi. We observed an attachment rate of 40% in 2024, up from 32% in 2023, and this drives our final estimate.

Installations in the rest of North Europe bring the final 2024 tally to 333MW/533MWh, up from our previous expectation for 245MW/477MWh due to the increase in our observed attachment rate.

Utility-scale

Sweden and **Finland** continue to drive deployments of utility-scale projects, with the former leading deployments in 2024. Projects in the region have mostly targeted the regional Nordic frequency market which was yet to saturate in 2024 and came in at an average of 1.4 hours of duration.

We expect activity to slow down in Sweden as the frequency opportunity saturates, but continue to grow in Finland, where power price volatility is higher and presents an alternative business case. Finland should also represent further opportunities later in the decade, as the need to phase-out coal plants drives demand for energy storage as a source of firm capacity.

(North Europe's annual energy storage additions in 2024 and cumulative capacity in 2030 and 2035 were corrected on September 16, 2025.)

South Europe

BNEF estimates that the South Europe region (Bulgaria, Croatia, Greece, Hungary, Romania, Cyprus, Malta) added 444MW/778MWh in 2024, up 146% from our previous outlook as projects came online quickly in Bulgaria and Romania (Figure 101). Cumulative energy storage capacity reaches 15GW/37GWh by 2030, up 64% from our previous forecast following the announcement of additional initiatives to procure energy storage projects. By 2035, cumulative capacity reaches 29GW/82GWh, down 7% from our previous outlook due to changes in our behind-the-meter build assumptions (Figure 102).

Figure 101: South Europe's annual energy storage additions

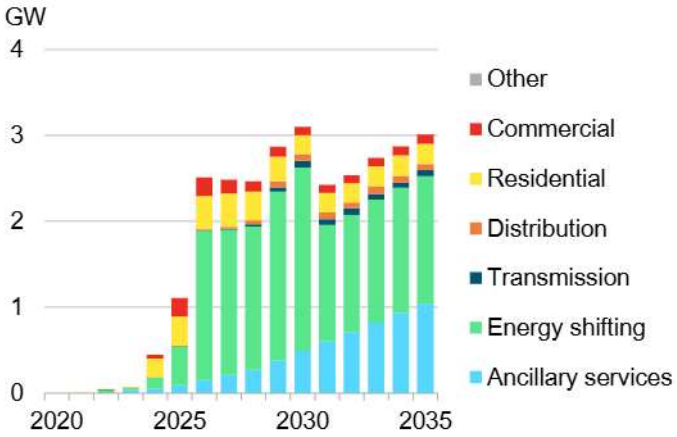
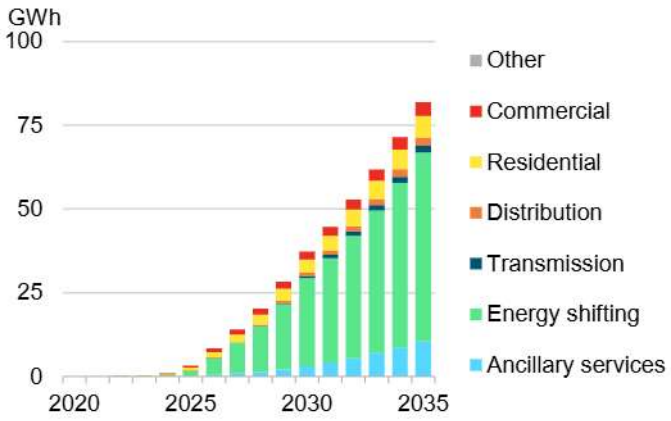


Figure 102: South Europe's cumulative energy storage capacity



Source: BloombergNEF

Utility-scale

In addition to rising power price spreads, lower battery prices are improving the viability of arbitrage-based projects. With the improvement, power price spreads alone are now enough to underpin projects in markets like **Greece, Bulgaria** and **Romania**. However, despite sufficient price volatility, developers are slow to build without revenue certainty, so government support continues to ramp up and targeted energy storage auction schemes are now in force across these markets.

In **Greece**, the third round of the energy storage auction scheme that began in 2023 concluded in early 2025, contracting 189MW of batteries instead of the targeted 200MW. Greece will no longer hold subsidy auctions for energy storage and is instead moving to a model where grid connection capacity is tendered, and developers are expected to push forward with merchant projects.

We expect other markets to move in this direction following their initial auctions, as governments observing high levels of volatility in their markets aim to reduce how much they need to support projects that could be profitable without subsidies.

West Europe

The West Europe region (Austria, Belgium, Ireland, Netherlands, Switzerland, Luxembourg) added 1.4GW/2.2GWh of energy storage in 2024, 3% lower than our previous expectation (Figure 103). Cumulative energy storage capacity reaches 20GW/42GWh by 2030, up 4% from our previous forecast, and 38GW/100GWh by 2035, down 7% from our previous forecast due to changes in our residential attachment rate assumptions (Figure 104).

Figure 103: West Europe's annual energy storage additions

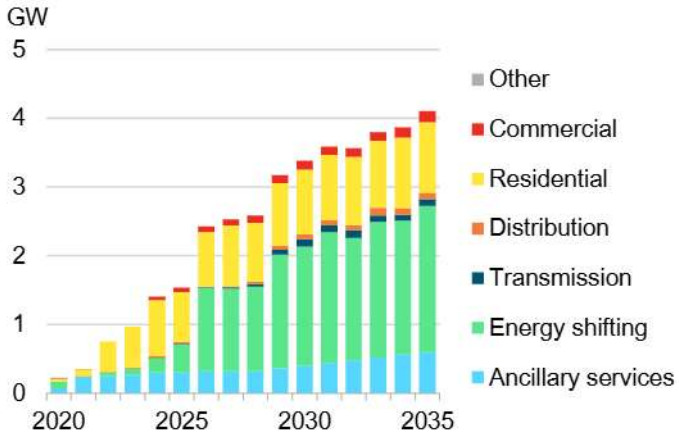
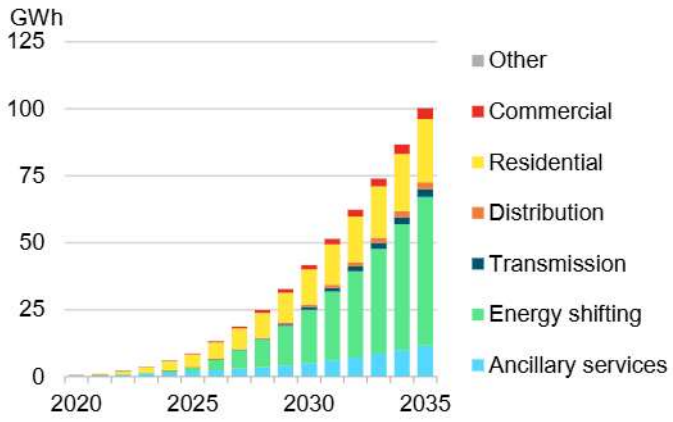


Figure 104: West Europe's cumulative energy storage capacity



Source: BloombergNEF

Residential

BNEF estimates that **Austria, Switzerland**, and **Belgium** added just over 1GWh of residential battery capacity in 2024, amounting to roughly 70% of residential battery capacity tracked in the whole region. We observed attachment rates of 60% in Austria and 40% in Belgium and Switzerland. In the **Netherlands**, observed attachment rates also rose slightly to 10% as solar export payments are on the decline and consumers are looking for ways to maximize their solar self-consumption.

Utility-scale

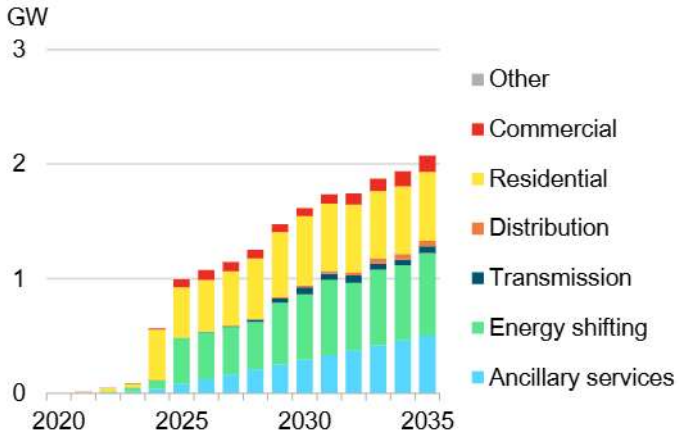
Project development increasingly relies on further development of capacity markets and arbitrage opportunities in wholesale power markets. This combination is successfully driving projects in **Belgium** and **Ireland**. In Belgium, BNEF tracked and estimates at least 50MW/200MWh of additions in 2024, with another 1.2GW/4.4GWh of projects under construction or past financial close. In Ireland, BNEF tracked and estimates at least 150MW/300MWh of 2024 capacity additions, with another 433MW/866MWh under construction or past financial close. We expect projects under construction or past financial close to come online by 2026 or earlier.

We are also seeing an increase in ambition in the **Netherlands**, despite the absence of a capacity market. Developers are considering large-scale projects to help manage grid congestion in the country, with Lion Storage's 350MW/1,400MWh Mufasa project reaching financial close in February and expected online by 2026.

East Europe

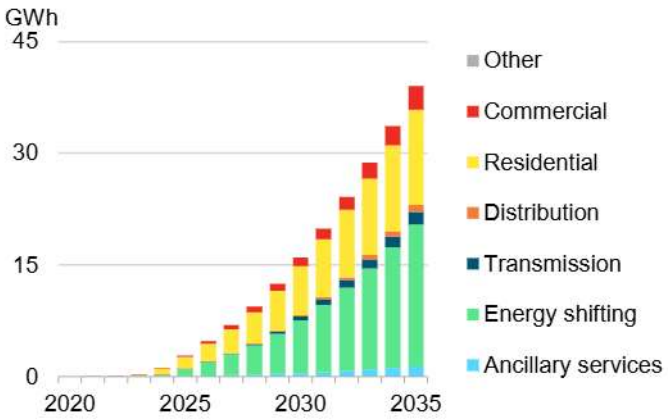
East Europe (Hungary, Czech Republic, Slovakia, Slovenia, Ukraine) is on track to add 565MW/899MWh in 2024, with a strong upward revision to account behind-the-meter growth in Czech Republic (Figure 105). Cumulative energy storage capacity reaches 8.2GW/15.9GWh by 2030 and 18GW/39GWh by 2035, roughly 190 times larger than installed capacity at the end of 2023 (Figure 106).

Figure 105: East Europe's annual energy storage additions



Source: BloombergNEF

Figure 106: East Europe's cumulative energy storage capacity



Utility-scale

Rising power price spreads and lower battery prices have improved the viability of arbitrage-based projects. With the improvement, power price spreads alone are now enough in markets like **Hungary**. Despite sufficient power price volatility, however, developers are slow to build without revenue certainty, so government support continues to ramp up, with targeted energy storage auction schemes now in force in **Hungary**, **Poland**, **Slovenia** and **Slovakia**.

Adding to these schemes above, **Czech Republic** approved €279 million in March 2025 to support 1.5GWh of energy storage projects. Contracts will be awarded before December 2025, and the projects could come online by 2028 or earlier. **Serbia** also made progress toward some of its first utility-scale projects, tendering 1GW of solar co-located with 400MWh of energy storage capacity in late 2024. Developers have now sent forward the first grid connection requests for energy storage projects in the country as of February 2025.

7.9. Middle East and North Africa

BNEF estimates that energy storage additions in the Middle East and North Africa region (MENA) hit 953MW/1984MWh in 2024, mostly driven by the commissioning of the 1.3GWh Red Sea energy storage project in Saudi Arabia. In 2025, BNEF expects 2.8GW/6.5GWh of energy storage additions, with activity driven by utilities stepping up plans to procure energy storage capacity.

Cumulative energy storage capacity reaches 22GW/58GWh by 2030, up 169% from our previous forecast as we have become more bullish given that utilities aggressively ramping up their ambitions to procure energy storage capacity. By 2035, cumulative energy storage capacity reaches 46GW/157GWh, up 88% from our previous outlook.

Figure 107: MENA's annual energy storage additions

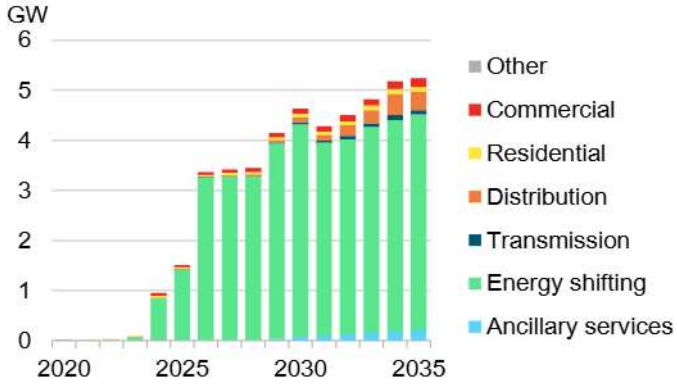
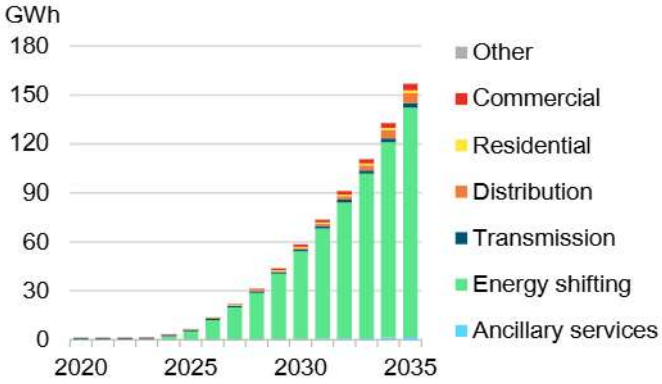


Figure 108: MENA's cumulative energy storage capacity



Source: BloombergNEF

Project activity in the region is mostly dominated by national utilities, which are increasingly tendering a mix of stand-alone and co-located energy storage projects.

In **Saudi Arabia**, the SE Bishal 2GWh project was commissioned in early 2025, and several gigawatt-hour scale projects expected to follow in the coming year. Active developers are now a mix of regional players like Acwa Power and Masdar, as well as international utilities like EDF. This has led us to raise our forecasts, with a sharp increase in expectations for projects deployed from now to 2030.

In **Israel**, projects continue to come online on the back of utility-driven tenders for co-located solar and storage projects, with developer Enlight continuing to lead deployment of projects.

Utility-scale activity is also picking up in other markets including **Egypt** and **the UAE**. As battery prices come down and demand from the US is slowing, we expect battery manufacturers to step up their attempts to deliver projects to the region, driving uptake through the end of the decade.

7.10. Sub-Saharan Africa

South Africa

This is the first time we have analyzed South Africa separately from rest of the Sub-Saharan Africa region to give more visibility given the significant growth expectation in coming years. BNEF tracked 827MW/1,641MWh of energy storage additions in the country in 2024. Additions were mainly driven by the deployment of the 225MW/1,140GWh Kenhardt energy storage project. BNEF expects 945MW/1,885MWh of energy storage additions in 2025, with the utility-scale segment once again driving additions with projects contracted by utility Eskom coming online.

Cumulative energy storage capacity reaches 11GW/27GWh by 2030 and 27GW/87GWh by 2035. The utility-scale segment continues to grow as Eskom contracts energy storage capacity to serve as firm capacity with coal plants retiring.

BNEF also tracked a large amount of lithium-ion battery imports in 2023 and 2024. These battery imports exceed the demand we have observed for the utility-scale segment and are likely for behind-the-meter energy storage installations. As we have not been able to directly track or estimate how much of this capacity was installed in this segment, we have allocated additional capacity to our global buffer for now.

Figure 109: South Africa's annual energy storage additions

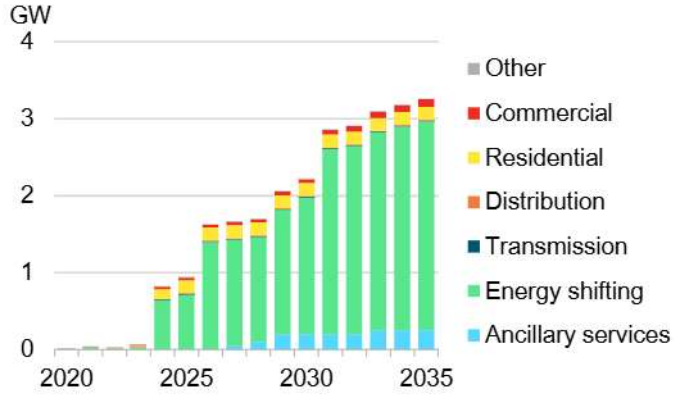
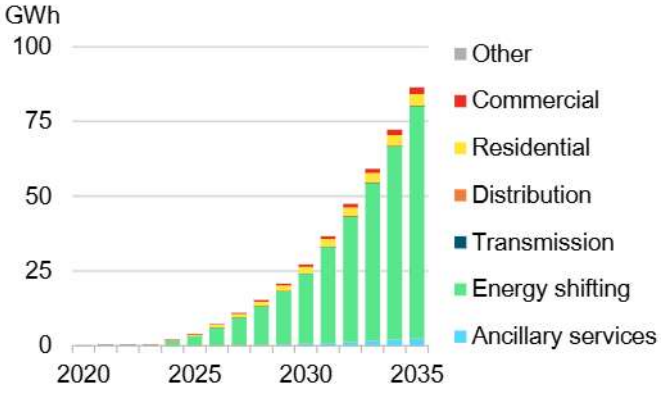


Figure 110: South Africa's cumulative energy storage capacity



Source: BloombergNEF

Rest of Sub-Saharan Africa

BNEF expects energy storage additions in the rest of Sub-Saharan Africa (SSA) to hit 242MW/498MWh in 2024, with a handful of utility-scale projects in Senegal, Gambia, Mali, Mozambique and Chad driving the market. In 2025, BNEF expects 522MW/1,100MWh of energy storage additions, with contracted utility-scale projects expected to come online in Mauritius, Zambia, Somalia and Cameroon.

Cumulative energy storage capacity reaches 8.4GW/22GWh by 2030 and 24GW/83GWh by 2035 as demand continues to grow across all segments. As battery prices come down, we expect a higher proportion of solar systems installed across the region to pair with energy storage systems.

For this forecast, we have applied our updated expectations on attachment rates to each market in the region. These attachment rates are higher than in Europe later in the decade, as challenges with grid reliability and outages across the region mean that batteries are key for reliability of

power supply. This drives our expectations for energy storage demand in markets like Nigeria that are already installing large amounts of behind-the-meter solar.

Figure 111: SSA (excluding South Africa) annual energy storage additions

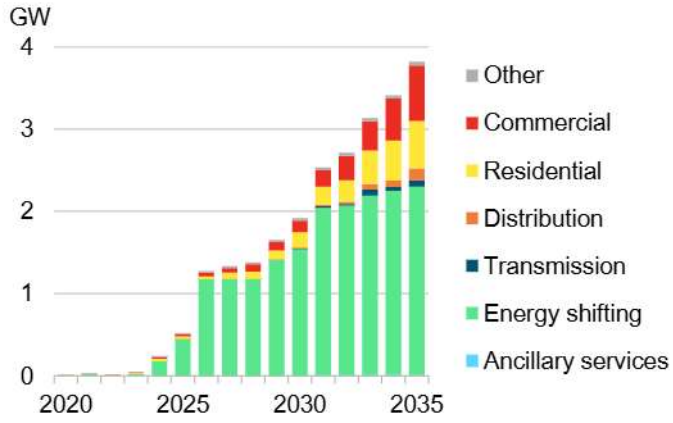
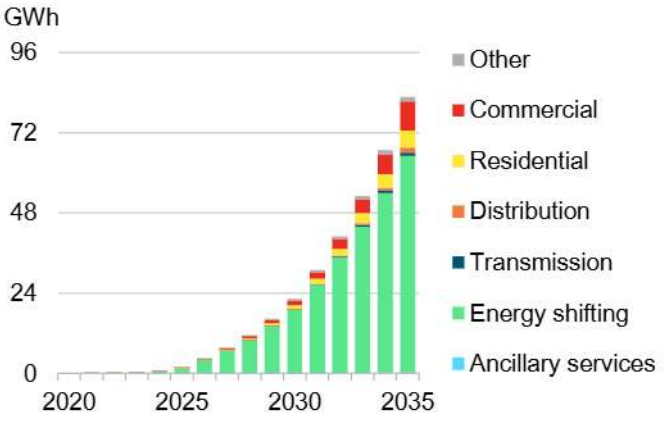


Figure 112: SSA (excluding South Africa) cumulative energy storage capacity



Source: BloombergNEF

Section 8. Methodology

A.1. Coverage

This Energy Storage Market Outlook is a forecast of the global stationary energy storage market from 2025 to 2030. A total of 33 countries and regions are covered (Table 6), which includes 45 unique markets, territories or country groupings that are aggregated into highlighted areas. We show some country results in aggregate, such as Europe – South, Europe – West, Europe – East, Europe – North, Other Latin America, Middle East and North Africa, and Sub-Saharan Africa. In this outlook, Poland, Portugal, Spain and South Africa got country-level forecasts for the first time.

Table 6: Energy Storage Market Outlook regional coverage

Country/sub-regional grouping	Region	Markets included
Canada	AMER	
US	AMER	Alaska, California, ERCOT, Florida, Hawaii, MISO, New England, New York, Northwest, PJM, Southeast, Southwest, SPP
Mexico	AMER	
Brazil	AMER	
Chile	AMER	
Other Latin America	AMER	Argentina, Venezuela, Belize, Bolivia, Colombia, Costa Rica, Ecuador, El Salvador, Guatemala, Honduras, Nicaragua, Panama, Paraguay, Peru, Uruguay
UK	EMEA	
Germany	EMEA	
France	EMEA	
Italy	EMEA	
Poland	EMEA	
Portugal	EMEA	
Spain	EMEA	
Europe – East	EMEA	Hungary, Czech Republic, Slovakia, Slovenia, Ukraine
Europe – North	EMEA	Norway, Sweden, Finland, Denmark, Latvia, Estonia, Lithuania
Europe – South	EMEA	Bulgaria, Croatia, Greece, Hungary, Romania, Cyprus, Malta
Europe – West	EMEA	Austria, Belgium, Netherlands, Switzerland, Luxembourg
Turkey	EMEA	
South Africa	EMEA	
Sub-Saharan Africa	EMEA	Angola, Benin, Botswana, Burkina Faso, Central African Republic, Chad, Congo, Côte d'Ivoire, Djibouti, Equatorial Guinea, Ethiopia, Gabon, Gambia, Ghana, Guinea, Kenya, Liberia, Madagascar, Malawi, Mali, Mauritania, Mauritius, Mozambique, Namibia, Niger, Nigeria, Rwanda, Senegal, Seychelles, Sierra Leone, Somalia, South Africa, Swaziland, Tanzania, Togo, Uganda, Zambia, Zimbabwe
Middle East and North Africa	EMEA	Egypt, Israel, Jordan, Algeria, Bahrain, Iran, Iraq, Kuwait, Lebanon, Libya, Morocco, Oman, Qatar, Saudi Arabia, Tunisia, Turkey, United Arab Emirates, Yemen

Country/sub-regional grouping	Region	Markets included
Australia	APAC	
China	APAC	
India	APAC	
Japan	APAC	
South Korea	APAC	
Indonesia	APAC	
Malaysia	APAC	
Thailand	APAC	
Philippines	APAC	
Vietnam	APAC	
Other SE Asia	APAC	
Rest of World		All other markets

Source: BloombergNEF. Note: Blue indicates regions that were analyzed separately for the first time in 1H 2025 Energy Storage Market Outlook.

A.2. Outlook comparison

This Energy Storage Outlook builds upon the *2H 2024 Energy Storage Market Outlook* (web | terminal). This forecast considers the existing project pipeline[3], current market activity, climate targets and related policy framework, planned auctions, company announcements and analyst judgment. We also use BNEF wind and solar forecasts[4] as guidelines to estimate renewable-plus-storage capacity and *New Energy Outlook* scenarios – the Economic Transition Scenario and Net Zero Scenario – to understand bounds of capacity build (web | terminal).

Comparison to 2H 2024 Energy Storage Market Outlook

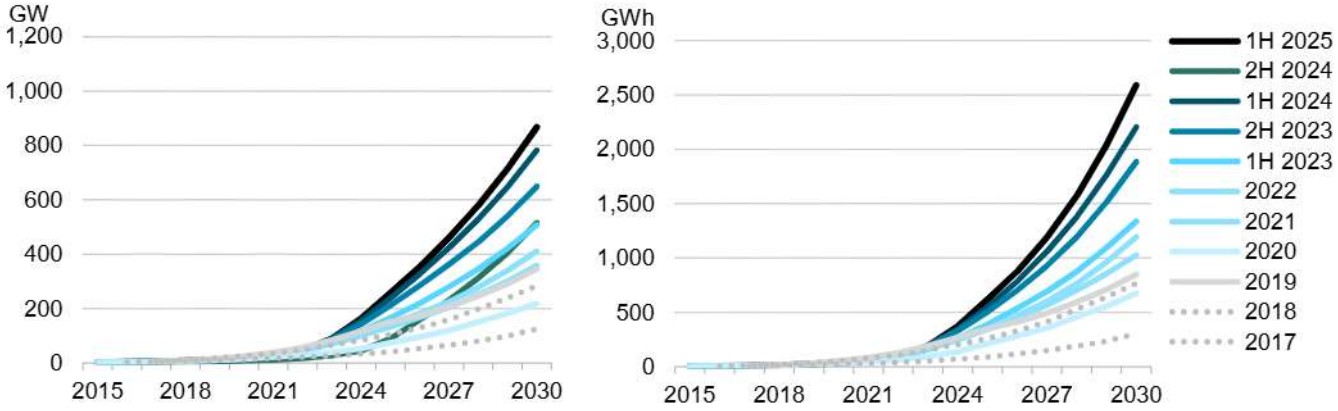
Our *2H 2024 Energy Storage Market Outlook* (web | terminal) suggested that global cumulative capacity could hit 790GW/2,300GWh by 2030 (Figure 113). In this report, we estimate that global cumulative energy storage capacity reaches 869GW/2,590GWh, or 8% higher in gigawatt-hour terms (and 10% more in gigawatt terms) compared with the previous outlook.

Despite us lowering the US forecast due to the impact of tariffs and localization policies, we have raised global numbers in gigawatt-hour terms due to higher expectations in China, the Middle East and North Africa, and Sub-Saharan Africa. For a summary of updates on the outlook see *Updates from 2H 2024 Energy Storage Market Outlook*.

[3] For more on existing project pipeline, see BNEF's proprietary *Energy Storage Project Database*, which tracks energy storage project development by country and application.

[4] For more on renewable outlooks, see *1Q 2025 Global PV Market Outlook* (web | terminal) and *Global Wind Market Outlook* (web | terminal).

Figure 113: Comparison of historical Energy Storage Outlooks – cumulative capacity



Source: BloombergNEF. Note: Charts compare long-term outlooks. All data are in the accompanying dataset.

Historical forecast accuracy

BNEF has been producing global energy storage forecasts since 2014. Here we compare our historical forecasts with the cumulative global build in 2024 (164GW/370GWh). We significantly underestimated the 2024 energy storage market size in our 2020-2022 forecasts; in our 2020 forecast in particular we heavily discounted forecasts to account for the pandemic, overestimating its negative impact on build.

Table 7: BNEF's historical forecasts of global energy storage capacity in 2024 versus actual capacity

Forecast year	Cumulative installation forecast in 2024	Difference in power capacity output	Difference in energy capacity output
2024 (actuals)	**164GW/370GWh**	**-**	**-**
2024 (2H)	159GW/359GWh	-3%	-3%
2024 (1H)	157GW/344GWh	-5%	-7%
2023	143GW/329GWh	-14%	-13%
2022	106GW/249GWh	-54%	-48%
2021	100GW/248GWh	-64%	-49%
2020	53GW/136GWh	-209%	-171%
2019	118GW/269GWh	-39%	-38%
2018	84GW/202GWh	-96%	-83%
2017	34GW/69GWh	-263%	-436%

Source: BloombergNEF

A.3. Applications

The outlook aggregates five main applications for energy storage, which are energy shifting, customer-sited storage (both residential and commercial), transmission and distribution (T&D) and ancillary services and other/unknown, as well as a buffer. In this iteration of the energy storage market outlook, we made notable updates to the methodology that affect three application groups: grid replacement, buffer and other/unknown (Table 8).

Table 8: Energy storage applications

Sub-category		Description
Energy shifting		Mostly involves using utility-scale energy storage to perform arbitrage and provide reliable capacity to meet peak system demand.
Ancillary services		Using energy storage to provide operating reserves (frequency regulation, contingency spinning and others) through absorption or injection of short bursts of power. This is often procured by the system operator in the form of frequency regulation or reserves.
Grid replacement	Transmission	Energy storage can be installed at specific locations on the grid to better utilize existing transmission and distribution assets or defer reinforcement investment. For instance, storage assets can be located at grid congestion points and perform as "virtual power lines". They can also be used to provide an instantaneous response during peaking hours when an existing substation is overloaded.
	Distribution	
Customer-sited	Residential	Integrated at household (low voltage) and at commercial or industrial facilities (low/medium voltage). They can offer peak shaving (reducing peak demand in kW) and time-of-use optimization (shifting consumption of kWh from expensive peak time to less-expensive off-peak time). When combined with solar, can be used to increase the rate of self-consumption and serve as backup energy. We consider solar-plus-storage for both residential and C&I segments. We additionally consider standalone batteries to mitigate demand charges in the C&I segment.
	Commercial and industrial	
Other		Includes applications which are not covered in the major applications listed above, such as microgrids, virtual power plants (VPPs), EV charging and technology testing projects. We also include projects without an announced application type in this category and as of November 2024, included long-duration energy storage capacity for Canada, Italy, China, US, UK in this category.
Buffer		Capacity is an estimate/headroom that is not explicitly allocated to any specific application.

Source: BloombergNEF. Note: Commercial and industrial (C&I) has been grouped together in this report and labeled 'commercial.'

A.4. Battery shipment analysis methodology

For our battery shipment analysis, BNEF used only batteries exported from China and South Korea, two of the major battery exporters for ESS. Data used was based on monetary monthly values from Sinoimex for batteries under the HTC Code 8507.60, which is for lithium-ion batteries. This data can be accessed from the *Battery Supply Chain Trade Flows Data Tool* (web).

For the US, we were able to use data from the US International Trade Commission to segment out EV batteries more accurately from non-EV battery imports (HTC Codes 8507.60.0010 and 8507.50.0020, respectively). Export data is available at a country level, which allowed us to adjust some assumptions at a regional level (we only applied a different assumption for the US in this iteration).

Table 9: Battery shipment analysis assumptions

Factor	Assumptions by year					BNEF context
	2020	2021	2022	2023	2024	
Battery prices ($/kWh)	150	141	151	145	125	Based on volume weighted battery pack prices *BNEF's 2024 Lithium-ion Battery Price Survey* (web | terminal). 2020-2022 prices were not adjusted for 2023 inflation, though they are in real 2022 dollars. Prices for 2023 and 2024 were updated from the last outlook to reflect higher average prices for batteries outside of China (to approximate prices closer to non-China prices).
Nameplate to usable capacity ratio	10%	10%	10%	10%	10%	Energy storage projects will have more battery capacity than the expected usable capacity that is designed. Battery suppliers do this to assure enough energy storage capacity to consider depth of discharge, expected degradation and redundancy. BNEF assumed 10%, but varies by project.
Delay to commissioning (months)	12	12	12	12	12	We assume that batteries take about 12 months from the time they enter import ports to the time they are commissioned. In the US, we assumed an 18-month delay (as projects have experienced delays at different parts of the project development timeline).
Inventories	0%	10%	30%	30%	30%	Since the pandemic and especially with the ramp-up of battery cell manufacturing in China, companies have increasingly been importing batteries without necessarily a specific order or project delivery contracted, given growing demand.
Inventories delay (months)	12	12	12	12	12	This is the assumed time it takes for inventories to translate to capacity available for deployment. System integrators/providers may stockpile for future delivery, residential storage distributors may have over-estimated market capacity and have more inventories than they had planned for.
EV imports (% of GWh)	65%	80%	80%	90%	80%	Except for the US, where data for EV battery imports have a separate import code, we have estimated the share of exports of battery capacity for EVs.
Non-EV and non-ESS battery capacity (GWh baseline for consumer electronics)	6,085	7,795	11,271	8,678	8,678	Capacity calculated assuming a baseline of imports each year is for non-EV and non-ESS batteries. Assumes 2018 imports are the baseline and we applied the growth rate of consumer electronics battery output in China between 2019 and 2024 as the assumed growth rate for non-EV/ESS batteries overseas. Assumed 2024 demand remained flat.

Source: BloombergNEF

A.5. Transmission and distribution forecast

Our model estimates battery storage systems are used for preventing network congestion, and deferring transmission and distribution grid upgrades for at least 10 years. In 2024, we updated our model to reflect falling battery and energy storage system prices. Although wire solutions are typically more cost-effective than batteries used only as grid assets and excluded from energy markets, the aggressive decline in battery prices this past year increases the economic build-out of storage capacity as grid investment deferral.

Transmission and distribution-level services

We estimated the total opportunity for transmission and distribution-level services from energy storage based on the amount of network investments over the period of an economic analysis. We start with global investment in grid reinforcements, estimate the portion of this investment where energy storage projects could be competitive and then approximate an uptake trajectory based on a qualitative assessment of country-level conditions.

Increasing levels of distributed energy resources (DERs) and changing demand patterns on the grid are creating new network constraints. During periods of high output from DERs, networks can experience congestion and low voltages. During periods of low output from DERs and low power consumption, such as overnight, networks can experience high voltages. Energy storage applications can help address these issues as well as several other constraints (Table 10). Our analysis focuses on the prevention of network congestion as we feel this will be the dominant driver of T&D storage applications.

Table 10: Use cases and outlook for transmission and distribution storage applications

Use case	Description
Prevent network congestion	Delay or mitigate the need to replace network element that is expected to overload by offloading it during high load conditions
Provide voltage control	Mitigate over- and under-voltage by injecting/absorbing either active or reactive power into the grid
Black-start the grid	Restore power to an islanded system after a blackout
Reduce energy losses	Reduce power transfers through a network element to lower losses
Improve power quality	Balance loading on each phase of a power line to reduce harmonics, lower neutral current and balance phase voltages
Reduce reverse power flows	Reduce or eliminate reverse power flows on a feeder or distribution network, mitigating the need for upgrades

Source: BloombergNEF. Note: Row in green highlights the use case reviewed for this report.

The overall calculation for T&D energy storage capacity consists of five steps outlined below.

Step 1 – Calculate grid investment for each market

In the *New Energy Outlook Grids 2024* publication we look at total grid investment globally through to 2050, according to our *2024 Power Grid Investment Outlook* (web | terminal). The capital required to reinforce systems and connect renewables to networks grows over time, reaching an estimated $483 billion by 2030, up from $326 billion in 2023 shared between T&D grids.

Energy storage, along with other distributed energy resources, can be used to defer or offset larger investments in T&D. Additions to T&D infrastructure are rarely incremental and will instead

involve adding anywhere from 25% to 50% more capacity to a given site. To capture the "lumpiness" of wire solutions, we assumed that a battery project for transmission grid deferral is 25% smaller than the comparable grid upgrade capacity. The case for energy storage to defer grid investments depends on various factors such as the cost of the T&D installation, the peak to average demand ratio, the demand growth rate at the site, and whether energy storage can also be used to provide other services.

Step 2 – Apply a total addressable market size factor

To determine the potential market share for energy storage projects, we defined a typical grid and battery project for both T&D applications. For simplicity, we only consider the case of addressing network congestion. We assume that a series of grid elements are under-rated, and a utility must decide between two alternatives based on cost alone.

Table 11: Cost of reference projects to determine energy storage market share

Voltage	Project alternative	Project scope	Mean cost estimate ($ million, real 2024)	
			2024	2050
Transmission	Grid	230kV 50-kilometer transmission line, associated switchgear and auxiliary equipment	57	57
		Cost of project delivery time being five years longer (with approximated interest costs)	3	3
	Battery	113MW/450MWh battery project connected at 230kV with substation and grid connection	185	127
Distribution	Grid	35kV distribution line, 35kV transformer, associated switchgear and auxiliary equipment	3.9	3.9
	Battery	10MW/40MWh battery project connected at 200kV system	12.1	8.3

Source: BloombergNEF. Note: Grid costs are based on typical values. BNEF assumes 230kV power lines cost on average $1.4 million per kilometer, and 35kV power lines cost $0.30 million per km. The average cost estimate is based on both overhead and underground cables. The remaining costs are for substation equipment. Battery costs are based on global benchmark costs.

Actual projects can vary a great deal based on site-specific factors. In some cases, there may be additional substation upgrades required or the required power line may be longer. To capture this uncertainty, we assume that both grid and battery project costs are normally distributed with 90% of the project costs contained within ±33% of the value stated in Figure 115.[5]

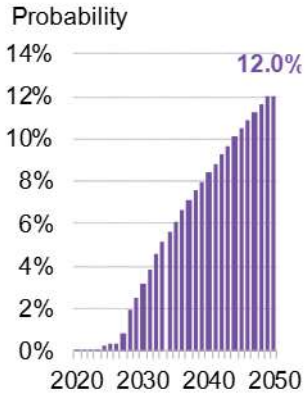
Over time, energy storage projects become more competitive relative to grid projects due to falling battery costs. There are also indications that the cost of building new power lines is rising due to longer permitting processes, higher engineering standards and lower public acceptance. For this analysis, we kept the cost of constructing new power lines constant as the cost rise seen over the past five years is not significantly greater than general inflation.

Storage projects for network upgrade deferral are often justified by their faster deployment. We have assumed that it takes on average five years longer to construct a transmission grid project than a battery project. We accounted for this difference in deployment time by increasing the grid project cost by 5%, which approximately reflects five years of paying a 2% interest on a loan for half of the project cost. With the costs of these two projects sorted, we then calculated the likelihood that a given battery project would cost less than its grid project alternative in each year.

[5] Commonly referred to as a P90 estimate.

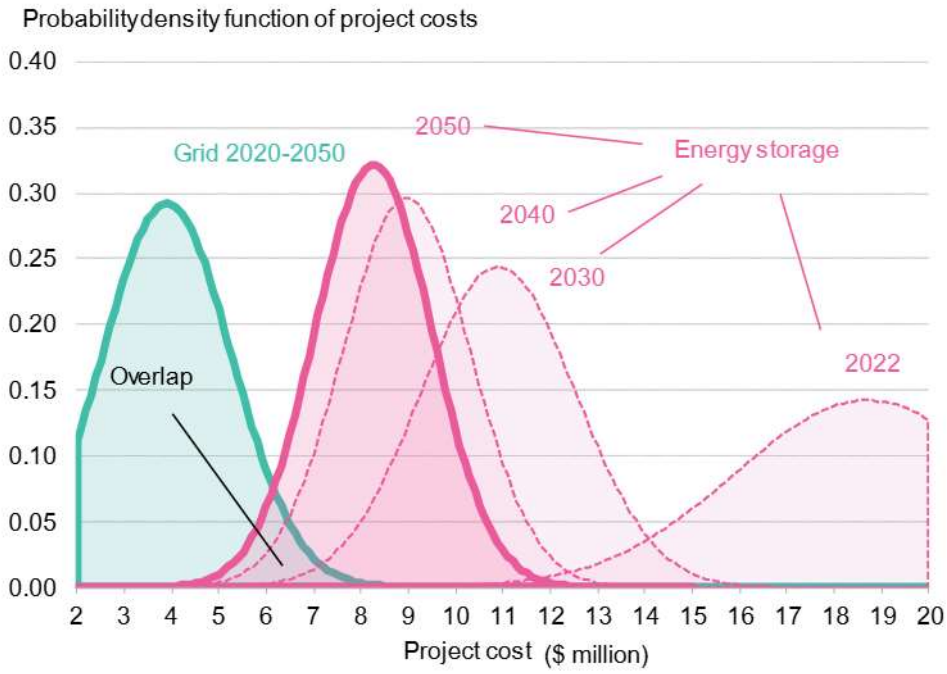
As battery prices fall, the range of cost estimates gradually approaches the cost of the grid alternative until they eventually overlap (Figure 115).

Figure 114: Probability battery project costs less than grid transmission project



Source: BloombergNEF

Figure 115: Cost profiles of competing grid and battery distribution alternatives



Source: BloombergNEF. Note: The width of the energy storage profiles changes to maintain a +/- 15% P90 cost estimate. Area under each probability density function totals to 1.00.

We find that by 2050 the likelihood an energy storage alternative is cheaper than a traditional grid project is 12% for transmission projects and 12.3% for distribution projects (Figure 114, **Error! Reference source not found.**), up significantly due to lower battery costs. These figures represent the portion of grid reinforcement costs that could be replaced by battery projects. We multiply these percentages by the amount of network reinforcements to obtain the potential market size for distribution and transmission battery projects, respectively.

Step 3 – Apply a country-specific adoption curve

Finally, these market sizes are adjusted for each country based on analysts' assessments of the regulatory frameworks in their markets to see if an alternative to traditional network reinforcement would be permitted and properly remunerated by the regulator. A more favorable regulatory environment results in a more rapid uptake of energy storage. The regulatory environment differs for transmission and distribution storage.

The scoring framework to determine this uptake level evaluates the following metrics, where a higher number of positive answers translates to a faster adoption curve for transmission and distribution storage:

1. Does regulation in the country/region allow for transmission/distribution storage projects?
2. Does the country/region already have transmission/distribution storage projects?
3. Are there transmission/distribution project permitting issues/delays in the country/region?
4. Is the grid very sparse in the country/region?
5. Is there known congestion in the country/region?

6. Is there a regulatory requirement to look at non-wire alternatives in the country's/region's long-term grid plans?
7. Are there financial incentives to consider non-wire alternatives?
8. Are utilities in the country/region innovative?
9. *For distribution grid storage only: Does the country/region have a local flexibility market(s)?*
10. *For distribution grid storage only: Does the country/region expect high deployment of fast and ultrafast electric vehicle chargers before 2030?*

Step 4 – Convert to GW and GWh from US dollars

Using a battery cost, we convert to a capacity of battery storage projects that would be deployed. The cost in 2024 is $254/kWh and 2050 is $133/kWh. We also compare the near-term results with the T&D storage projects in our energy storage project database. We take the greater number between our forecast and the projects in our database.

Step 5 – Subtract cannibalization

Our model accounts for the potential cannibalization effect that behind-the-meter storage assets could have on total energy storage build. A portion of behind-the-meter storage assets will be available to the grid through a combination of tools and mechanisms such as virtual power plants or time-of-use pricing. Optimized dispatch of these assets could help alleviate grid constraints that would otherwise warrant utility-scale development.

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