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# FORESIGHT 20/20: ENERGY STORAGE

## Eligibility transitions to opportunity

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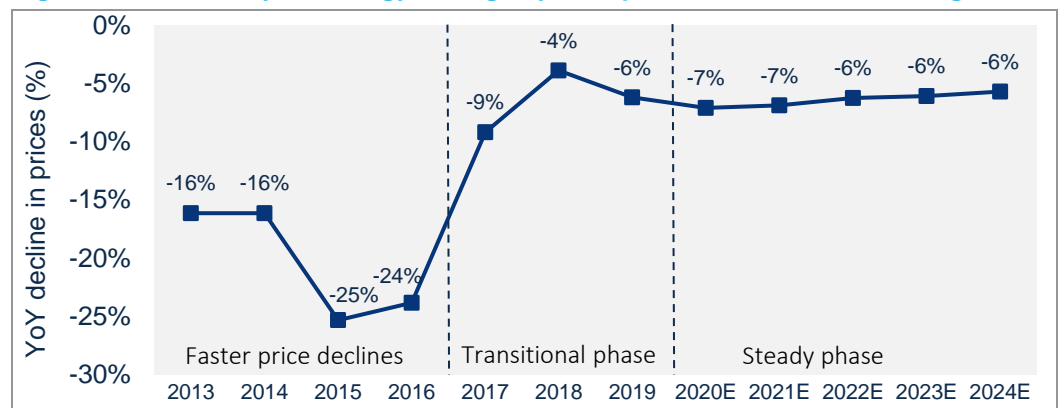
# FORESIGHT 20/20: ENERGY STORAGE

In the Foresight 20/20 series Wood Mackenzie’s analysts outline what the next decade will bring for their technologies and markets. One of the few certainties of the Energy Transition is that its advance will not be a straight-line. This series aims to highlight the underlying trends that will shape the coming decade and the gamechangers and risks that could, if they materialize, move the market. But before we move ahead, let us look back.

## Defining a decade: energy storage’s road to recognition and eligibility

The year 2020 begins with an energy storage industry transitioning from its infancy into true scale, and the past ten years paint a picture of these first bold but unsteady steps as the industry and policymakers still work to fully understand and value the technology. The first scattered pilot programs of the early decade transitioned quickly to hundreds of MWs deployed for ancillary services, driven by massive 15-25% annual lithium-ion system price declines. Short-duration systems of 15 to 30-minute durations proliferated worldwide, and demonstrated the technical capabilities of the industry.

**Figure 1 Year-over-year energy storage system price declines, 2013 through 2024**



Source: Wood Mackenzie

Plummeting costs opened the door for the industry, but through most of the decade projects were limited to short-duration (and thus relatively cheaper) deployments on the order of 20-30 minutes in duration. This began to change in the last years of the decade, as declining prices and direct policy support rapidly made longer duration (on the order of one to four hours) systems economical.

The decade belonged still to ancillary services, however, the lowest-hanging fruit of the storage tree, as supply constraints and questions of safety and eligibility softened and

delayed the expected surge. The decade ends with the first hints of true scale and potential beyond ancillary services, with the annual market eclipsing 1 GW in 2018 driven by a surge in deployments following favorable policies and economics in South Korea, China, Australia, and the UK, among many more. The decade closes as policymakers worldwide grapple with the complex question of how to put a value on energy storage and how to ensure this value can be captured.

### Future focused: eligibility gives way to opportunity

Costs have fallen, direct incentives and clean energy targets are proliferating, and competitive markets and vertically-integrated electricity providers are beginning to recognize the potential and unique nature of energy storage. The starting gun has sounded for the global storage market, which is set to grow from approximately 4 GW of annual deployments in 2019 to more than 15 GW in 2024.

In the next decade the already consolidating web of manufacturers, developers, investors, and integrators will compete for their slice of this burgeoning industry, carving out mature supply chains and driving down costs. As they do continued policy and regulatory efforts will be key to driving upside in the market, particularly aggressive clean energy goals and direct carve-outs for energy storage based on newly-recognized value. Further clarity on value streams will be needed to drive transitions towards investability for non-subsidized and more market-exposed systems in the mid to long-term.

Quantifying the full opportunity for the industry is complicated by these ongoing efforts and the industry's continued innovation in technologies and business models. Value propositions including aggregation of behind-the-meter resources, difficult to quantify flexibility and resiliency services, and renewable shifting will take center stage as players look beyond ancillary services. The first success stories for these emerging strategies are already being written – Sunrun has aggregated solar-plus-storage in ISO-NE's organized capacity market and developers in Australia are confronting renewables curtailment to name just two – with more to come as these strategy pioneers chart new paths that fast followers will help map.

Expect the next three to five years to continue the aggressive pursuit of groundbreaking projects and market share that defined strategies in the previous decade as first movers look to make good on the bold promises, and perhaps gambles, staked out as industry interest surged. The end of the decade will benefit from stabilizing supply chains and mature and experienced players, but with even more potential for disruption from new technologies and policies.

## Growth gamechanger: energy storage's 0-to-60 acceleration hits gamechangers almost too fast to mark

The energy storage industry is in the enviable position of juggling growth gamechangers from multiple directions. Plunging costs drove speculation in the first scaled markets, but as price declines enter a steadier rate further recognition of storage's value, rather than cost, will be the key factor in determining growth. Consider these five stories, all of which highlight a different way storage's value is being recognized.

- 1) **Offsetting corporate emissions:** when Google announced a partnership with NV Energy for significant solar-plus-storage investment to power data centers they were not just breaking new ground in a key market, they were pioneering a new way corporations value renewables. Rather than simply offset consumed electricity Google seeks to time-match consumption with availability, and that requires storage. If this catches on among other climate-forward corporations the upside could be massive, and recent news from Daimler in Germany that they would procure renewables in real-time shows that this trend may become global.
- 2) **Promoting economic potential:** In 2019 the European Commission launched a €10 billion innovation fund targeting low-carbon technologies along with energy storage. The U.S. Dept. of Energy's Energy Storage Grand Challenge, a potential 'Sunshot for Storage', represents the U.S. federal government's largest-scale action to date as well, recognizing the technology's potential as a new industry in the United States. With millions behind the technology globally, these innovation efforts have potential to encourage alternatives to lithium-ion and potentially shift the market.
- 3) **Behind-the-meter (BTM) resiliency:** bill management has been a key driver for BTM applications globally, including in Australia, South Korea, Japan, and the Philippines. Now, following the deadly and costly wildfires in California in recent years regulators and policymakers there are seeking every lever they can to mitigate risks to the public. One such lever is the Self-Generation Incentive Program (SGIP), which will redirect 63%, or half a billion dollars, of its budget towards projects enhancing critical facility resiliency.
- 4) **Hedging the energy transition:** Oil major Total and automaker Opel announced a collaboration on EV cell manufacturing, potentially investing as much as \$5.5 billion into up to 47 GWh of manufacturing capacity. Total, already investing in stationary storage applications, and Opel clearly see batteries as a key element of the future, and the increasing convergence of electric vehicles and the energy industry. Europe continues to thus position itself as a global manufacturer through the European Battery Alliance, and other oil majors are also active in the space, with Shell's M&A activity alone diversifying the giant into solar, storage, and EVs.
- 5) **Reshaping the finance world:** Massive investment from international development entities, such as the World Bank and the Asian Development Fund, have already begun remaking the relationship between finance and cleantech,

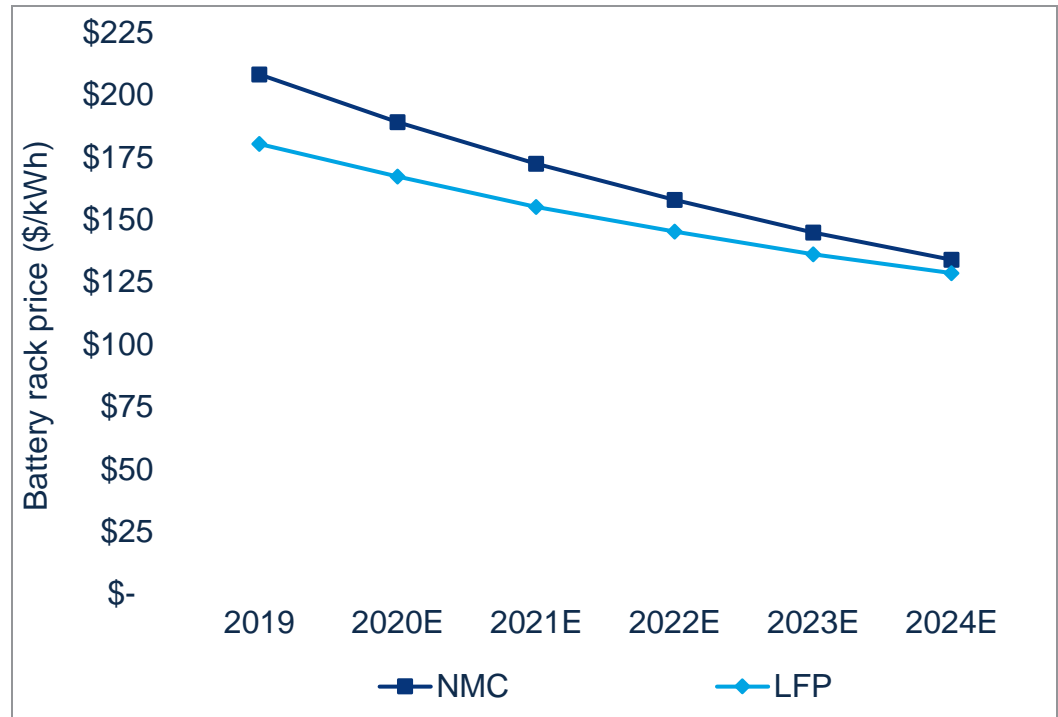
and this is quickly moving into the private sector. Blackrock's seismic announcement that they anticipate a "fundamental reshaping of finance", ending investment in thermal coal and redesigning its investment strategy to put sustainability front and center, rocked the entire energy industry. Storage has emerged as a potential center of mass for this new focus on sustainability, with significant investment from a new multi-billion renewable energy fund set to flow into the storage space.

Any one of these stories highlighting new value corporations, communities, states, nations, and investors are recognizing in storage would have made banner headlines in 2015, but it turns out that all five major announcements occurred in *January 2020 alone*. The decade is only a month old and already five year-defining shifts have occurred. Thus to categorize a "growth gamechanger" seems both premature and yet redundant for a market that is changing so rapidly so quickly. Expect the accelerator to remain flush with the floor, and for that momentum to drive the entire energy transition to new speeds.

### Gray swan risk: supply chain constraints could tap the breaks

While the momentum behind the storage industry has continued to build the past several years have been marked by delays caused by safety concerns, the inevitable logistical hiccups that occur when transitioning from pilot to scale, and uncertain market participation rules, among many others. The most significant of these may wind up being the supply chain shortages and commodity dynamics which compressed the market for 2018 and 2019, driving many planned deployments into the next decade, and forcing a renewed look at alternative suppliers, particularly the Chinese lithium-iron phosphate (LFP) battery vendors.

Figure 1 Lithium-ion battery rack price forecast, LFP vs. NMC



Source: Wood Mackenzie

The supply chain question exists for any nascent industry, but the energy storage market has the benefit and complication of overlapping supply chains with the EV and consumer electronics industries. This has the spectacular benefit of piggy-backing learning curves for lithium-ion batteries, but it also ties the industry more closely to the research, development, and innovation goals of these other parallel spaces which, in the case of the focus on weight and energy density, may not converge with stationary storage goals.

Risks in the supply chain became evident late in the last decade as policies in South Korea drove deployments to that market, sucking the oxygen out of other international markets. Uncertainty goes even further up the chain, encouraging vendors to pursue alternative chemistries or push towards low-cobalt systems. The market has signaled a renewed focus on innovation in the space, but it remains a key source of risk as deployments are set to scale up exponentially.

Securing adequate supply to meet growing demand is an immense challenge, and while vendors are scaling up with support from the energy and automotive industry, it is not immediately clear that supply can meet surging demand, particularly given the dramatic upsides possible amidst the accelerated energy transition. Complications in key commodity availability, delays in manufacturing scale-ups, and the gradually diverging priorities of the EV and stationary energy storage space could all throw sand in the gears,

though there is significant potential for upside through second-life and battery recycling programs which will emerge into scale over the next 5-10 years.

As the decade progresses and further incentives, direct or indirect, accelerate the energy storage market the dynamic of the industry “pushing” stakeholders to recognize the technology for its potential will quickly flip. Stakeholders are already “pulling” rather than being pushed, turning to storage aggressively rather than being forced to consider it. The timing and speed of this push / pull shift, and the speed with which the industry can react, will define its potential. In our 2030 hindsight piece will we be remarking on an industry that was able to scale to its potential, or one that was held back by not planning far enough ahead?

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