Developer Perspectives on Today's Energy Storage Markets

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In 2023, the world added an impressive 45 gigawatts/97 gigawatt-hours of energy storage capacity, nearly tripling year-on-year growth, with the majority driven by battery storage installations. The global energy storage market is projected to continue its rapid expansion in 2024, adding over 100 gigawatt-hours of capacity, primarily from the United States and China. In the United States, battery storage capacity on the grid has grown tenfold to 16,000 megawatts, with expectations to double again this year, led by significant growth in Texas, California and Arizona.

A distinguished panel of energy storage developers convened at the 2024 Infocast Energy Storage Finance & Investment Summit in San Diego to discuss the current market dynamics and future trajectory of energy storage. The following is an edited transcript of their discussion.

Panelists

- **Anna Astretsova, Vice President of Finance, GridStor**
  GridStor has over 2 gigawatts of early-stage energy storage projects sited primarily across the western United States, backed by Goldman Sachs Asset Management's Horizon Energy Storage Fund.
- **Amir Barnir, Vice President, US – Network Infrastructure, Zenobē Americas Inc.**
  Zenobē has 750 megawatts of battery storage assets in operation or construction globally and more than 2.5 gigawatts of late-stage development projects, with Mr. Barnir focusing on energy storage in the United States.
- **Spencer Li, Vice President, Project and Corporate Finance, Avantus**
  Avantus is a leading renewable energy developer, with a pipeline of more than 30 gigawatts (GWdc) of solar and 94 gigawatt hours (GWh) of energy storage projects across the western United States.
- **Laura Pagliarulo, Chief Executive Officer, SolaREIT**
  SolaREIT specializes in providing innovative and accretive financing solutions to developers for the real estate under solar and storage projects, with hundreds of millions in assets under management across the United States.
- **David Stripling, Director of Origination, Ormat Energy Storage**
  Ormat Energy Storage manages a diverse portfolio of 600 megawatts of utility-scale storage projects across high-growth markets in the United States, with a focus on renewable integration.

Moderator

- **Shellka Arora-Cox, Partner, Pillsbury Winthrop Shaw Pittman LLP**

Outlook and Trajectory

Shellka Arora-Cox: Mr. Barnir, given the substantial developments in the energy storage sector, do you believe we are on track to achieve the projected growth in 2024 within the U.S. market?

Amir Barnir: Yes, I am confident that 2024 will be a landmark year for energy storage in the U.S. The industry has been building towards this for some time, and the momentum has only intensified since the passage of the Inflation Reduction Act (IRA) two years ago. The IRA has effectively unlocked significant investment, facilitating the rapid proliferation of storage projects across the country. Until recently, distributed generation markets were confined to states like Massachusetts and California, but we are now witnessing a nationwide expansion, with developers embracing the complexity of these projects and finding innovative ways to navigate various offtake structures.

Arora-Cox: Where do you anticipate this growth will be most pronounced—standalone storage, solar-plus-storage, behind-the-meter installations, or across all these segments?

Laura Pagliarulo: The most significant growth will likely occur in front-of-the-meter installations. Last year, 75% of storage deployments were concentrated in Texas and California. At SolaREIT, we are exploring opportunities in a broader range of states, including Idaho, Montana, New York and Massachusetts. These regions present multiple use cases for storage, with front-of-the-meter installations continuing to dominate due to their scale and impact on grid stability.

David Stripling: Behind-the-meter installations are expected to lag in the near term as we observe a much larger volume of front-of-the-meter storage assets being deployed, especially in key markets like California, where regulatory drivers, such as resource adequacy requirements, are pushing adoption forward regardless of tariff implications. The impact of tariffs on 2024 commercial operation dates appears minimal, as most projects have advanced to stages where such delays are unlikely.

Location Considerations

Arora-Cox: Standalone storage is clearly leading the charge, but site selection is becoming increasingly challenging as land availability diminishes and the grid becomes more saturated. How do you approach site selection for battery storage installations in such a rapidly evolving market?

Spencer Li: Site selection is absolutely critical, particularly in markets with high price volatility where the potential for capturing revenue is greatest. In California, where the most lucrative sites have largely been developed, we are now delving deeper into secondary locations. Running sophisticated financial models to analyze and forecast revenues is essential. California's regulatory environment also requires careful navigation. There are pockets of NIMBY (Not In My Backyard) sentiment, which must be balanced with more supportive YIMBY (Yes In My Backyard) communities. Local and state permitting regimes must be managed adeptly to expedite project timelines and secure necessary approvals.

Anna Astretsova: I agree with Spencer's assessment. In the solar and wind sectors, project success often hinges on managing interconnection costs, land prices, and ensuring market volatility works in your favor. However, densely populated areas, where opposition to development is more pronounced, necessitate proactive engagement with local stakeholders. Establishing a strong reputation and ensuring projects are perceived as safe and beneficial to the community are crucial factors in overcoming permitting challenges.

Market Dynamics in Texas, California and New York

Arora-Cox: Given the distinct market dynamics in Texas and California, how would you characterize the utility-scale battery storage installations in these two states?

Barnir: California and Texas exemplify two very different market environments, each fostering growth for distinct reasons. California's expansion is policy-driven, with a strong emphasis on resource adequacy. Projects that successfully secure grid interconnection and permits are highly valued, reflecting the scarcity of such opportunities. In Texas, growth is driven by the market's rapid pace, where quicker grid connections and shorter project timelines create compelling business cases despite the inherent risks associated with such speed. The ability to build a 300-megawatt site in 24 months and secure an offtake contract demonstrates the agility and opportunity within the ERCOT market.

Stripling: Site selection in ERCOT involves a careful balance between revenue potential and cost factors, particularly when deciding whether to position projects adjacent to load or generation. In Texas, land and interconnection costs are relatively lower than in California, but the speculative nature of future energy price volatility requires meticulous planning. It is likely that load-adjacent locations will have more durable volatility and are better locations for battery storage projects. Conversely, in California, where costs can be prohibitive, projects require rigorous financial scrutiny to ensure they meet hurdle rates. The interconnection costs in California can be egregious, and land prices can exert **significant pressure on project economics, demanding a careful synthesis of these elements to achieve success.**

Pagliarulo: Texas is rapidly reaching saturation, with diminishing returns on new developments. On the other hand, New York offers a contrasting landscape. Projects in New York tend to be smaller, but they benefit from regulatory certainty and established programs, providing a reliable revenue stream. The challenge, however, lies in the interconnection queue, where the capacity currently in line significantly exceeds the available space in the state's programs. In markets like New York, developers are navigating these challenges to position themselves effectively for future opportunities.

Interconnection Challenges

Arora-Cox: Interconnection remains a significant challenge, with more than 2,600 gigawatts of generating and storage capacity currently queued for interconnection—more than twice the total installed capacity on the grid. How do you expect FERC Order No. 2023 to address these challenges, particularly in markets like California where additional reforms are also being considered?

Barnir: FERC Order No. 2023 is a critical reform that the industry has needed for some time, aimed at addressing the severe backlog in interconnection queues. However, its effectiveness will depend on how well Independent System Operators (ISOs) manage the anticipated surge in project applications. In regions like the East Coast, where interconnection queues have been stalled for years, we expect a tenfold increase in projects, which could overwhelm the system despite the reforms. The policies mandated by FERC Order No. 2023 are already in place in several markets, but the implementation will require ISOs to make adjustments to their processes.

Li: In California, the interconnection process is particularly cumbersome, with some projects facing delays until 2030, even under the best-case scenario. The reforms introduced by FERC Order No. 2023 are intended to streamline the process, but the backlog is so severe that even with these changes, progress may be slow. Developers with projects in the CAISO queue likely need to consider alternative strategies for monetizing their positions.

Astretsova: The reforms will undoubtedly introduce new layers of complexity and cost, particularly for early-stage projects. Requirements such as site control and substantial financial deposits increase the risks for developers, making it essential for the banking sector to provide support during the pre-NTP (Notice to Proceed) phase. These reforms are likely to lead to a more selective market, where only well-capitalized developers with strong credit will be able to advance their projects. The industry must adapt to these changes and find innovative financing solutions to manage these increased risks effectively.

Financing Considerations

Arora-Cox: Ms. Astretsova, in light of rising interest rates, how is the financing landscape for energy storage projects evolving, and what challenges and opportunities are developers facing?

Astretsova: Investor interest in energy storage remains robust, particularly as the sector continues to demonstrate its potential for significant returns. We are seeing the development of structures to support partially contracted or even fully merchant projects. The financial incentives introduced by the IRA have enhanced liquidity, making storage projects more attractive to investors. However, the current interest rate environment necessitates a more strategic approach to financing. Developers are increasingly looking at hybrid structures that combine traditional debt with equity and tax equity financing. The industry is working to monetize the depreciation fees. Once the market figures that out, we would anticipate traditional tax equity structures. The introduction of tax equity has been particularly transformative, enabling projects that were previously considered too risky to secure necessary funding.

Barnir: Tax equity has indeed been a game-changer, especially for standalone energy storage projects. The financing landscape has evolved rapidly, with tax equity now playing a central role in enabling these projects. When debt was cheap, developers were willing to take bigger risks. However, with interest rates on the rise, developers must be more cautious, focusing on securing long-term contracts to mitigate risks. The shift toward contract revenue rather than relying solely on merchant revenues is a prudent strategy in the current environment, ensuring that projects remain financially viable even as debt becomes more expensive.

Pagliarulo: The debt markets are still adjusting to the unique risks associated with energy storage, much like they did with solar projects 15 years ago. The perceived risks versus the real risks need to be better understood by lenders. As a result, only the most robust projects with well-structured risk profiles will secure financing. We are seeing an increasing focus on securing high-quality sites with strong interconnection points, which are likely to retain their value over the long term, making them sound investments even in a challenging financing environment.

Future Outlook

Arora-Cox: Looking ahead, how do you see the risk-return profile evolving in markets like Texas over the next five to seven years as more assets are deployed and market conditions change?

Astretsova: The energy storage market is poised for continued growth, driven by the increasing frequency of extreme weather events, which create volatility and drive revenue for storage projects. The future remains uncertain, but the need for storage will only intensify as renewable energy generation increases. The balance between storage capacity and market volatility will dictate the trajectory of future returns. Markets like Texas are well-positioned to see continued growth, despite the inherent risks, due to the state's unique market dynamics and the ongoing expansion of renewable energy sources.

Pagliarulo: In Texas, the value of high-quality sites with strong interconnection points will remain high, even as the market evolves. These assets are likely to retain their value over the long term, making them sound investments. The ability to connect to the grid efficiently and secure high-voltage interconnection points will continue to be critical factors in the success of storage projects in the region.

Arora-Cox: Finally, how are you adapting procurement strategies in response to tariffs on lithium and non-lithium batteries, and how is this shaping the market?

Stripling: The industry is still assessing the full impact of recent tariffs on the supply chain. While domestic production of lithium batteries is expected to increase significantly by 2030, there may be a mid-term shortage, requiring developers to carefully manage procurement strategies. The Biden administration's carrot-and-stick approach has already led to 15 announcements of domestic battery production within a year of the IRA's passage, but it remains to be seen whether this production will come online quickly enough to meet demand. Developers may need to secure supplies early or explore alternative technologies to mitigate potential tariff impacts.

Pagliarulo: The industry's experience with solar tariffs provides valuable lessons for navigating the current landscape, but energy storage presents its own unique challenges. The combination of domestic production incentives and tariffs on imports will shape the market, necessitating strategic planning and flexibility from developers. In some cases, this may mean negotiating new terms with suppliers or seeking alternative sources of components to avoid potential bottlenecks and ensure projects remain on track.

Arora-Cox: With that, I'll open the floor to questions.

Audience Question: How are developers responding to the recent increase in tariffs, which are set to reach 25% by 2026 for products sourced from China?

Astretsova: The industry is actively seeking to secure supplies before the tariffs fully take effect. Safe harboring, a strategy familiar from the solar sector, is likely to play a role, although the short shelf life of batteries presents challenges. The differential between projects with domestic content and those relying on imports will become a decisive factor in project viability. The demand for domestically produced components is expected to surge, driven by the need to avoid substantial tariff impacts.

Barnir: Safe harboring for batteries is complex due to degradation in capacity over time. Unlike solar panels, which can be stored for extended periods, batteries have a limited window for storage before warranties kick in and energy capacity begins to degrade. This limits the potential for safe harboring, making it a strategy of last resort rather than a primary approach. Developers will need to carefully weigh the risks and benefits of safe harboring against the potential impact of tariffs on project timelines and costs.

Audience Question: What is the current focus of storage development technology—solely on lithium-ion, or are other technologies being considered?

Stripling: Lithium-ion technology remains the dominant choice for energy storage due to its cost-effectiveness and suitability for the current grid requirements. However, alternative technologies such as flow batteries and compressed air storage are being explored, particularly as the market evolves and the demand for longer-duration storage increases. While these technologies hold promise, they are still in the early stages of development and require further de-risking before they can compete with lithium-ion on a large scale.

Arora-Cox: Thank you to all our panelists for an engaging and insightful discussion.