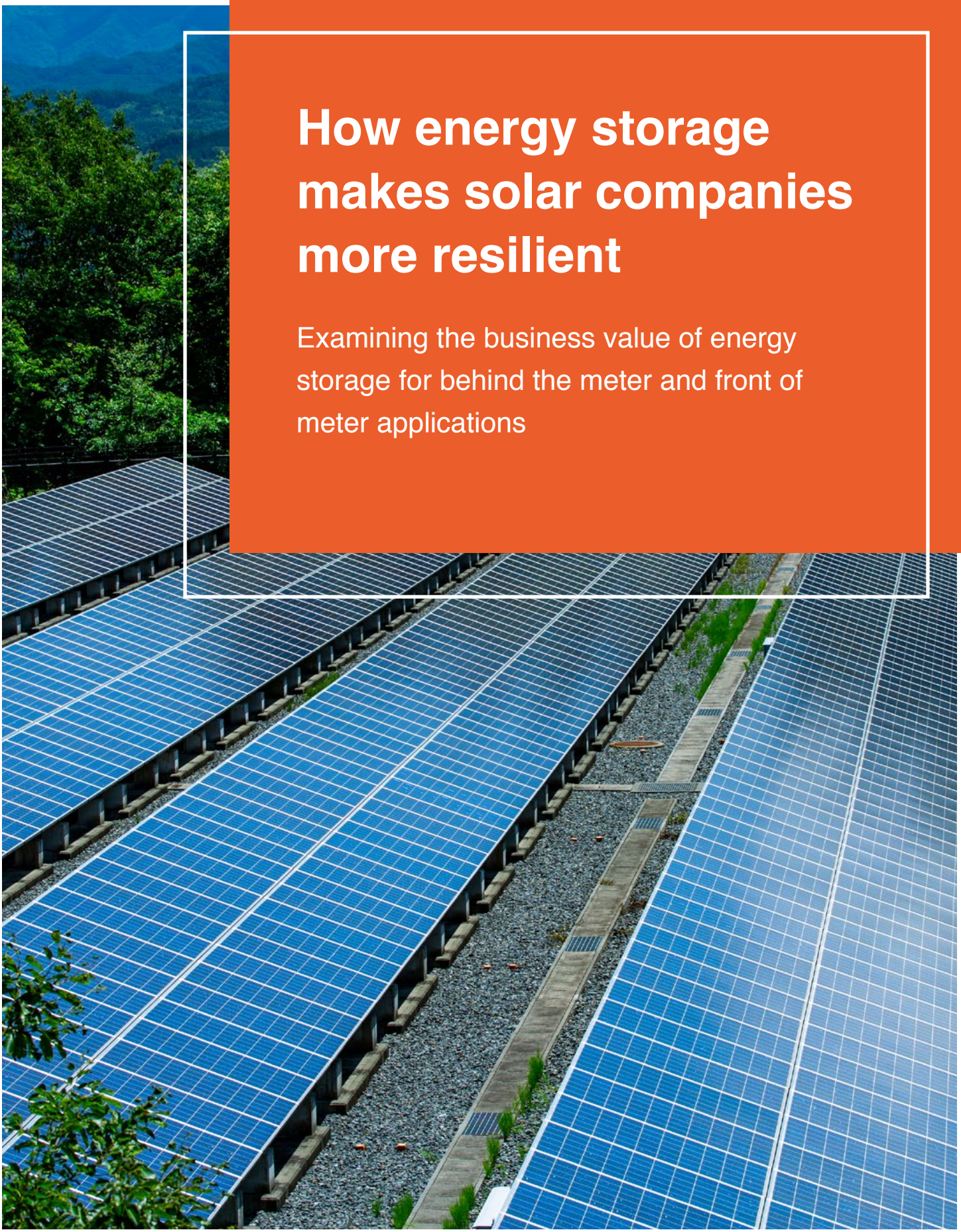
How energy storage makes solar companies more resilient

Examining the business value of energy storage for behind the meter and front of meter applications



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Executive summary

It's been a challenging year

2020 has been a challenging year for everyone, and the solar industry is no exception. Since COVID-19 forced lockdowns and halted normal life in March, more than 620,000 U.S. clean energy workers have lost their jobs.[1] That's 18.5% of the industry's workforce, and more than double the number of clean energy jobs created since 2017.

On the brighter side, 2020 was also the year that renewables production in the U.S. surpassed coal production for the first time in over 130 years.[2] There's reason to believe the solar industry will recover. Before March, clean energy generation had grown 10.4% since 2015, making it one of the fastest-growing employment sectors in the U.S. economy.

How solar companies can enhance resilience with energy storage

Full recovery from the current recession will likely take years, with Wood Mackenzie and SEIA projecting that distributed solar installations won't approach pre-COVID projections until 2023, as shown in Figure 1.[3]

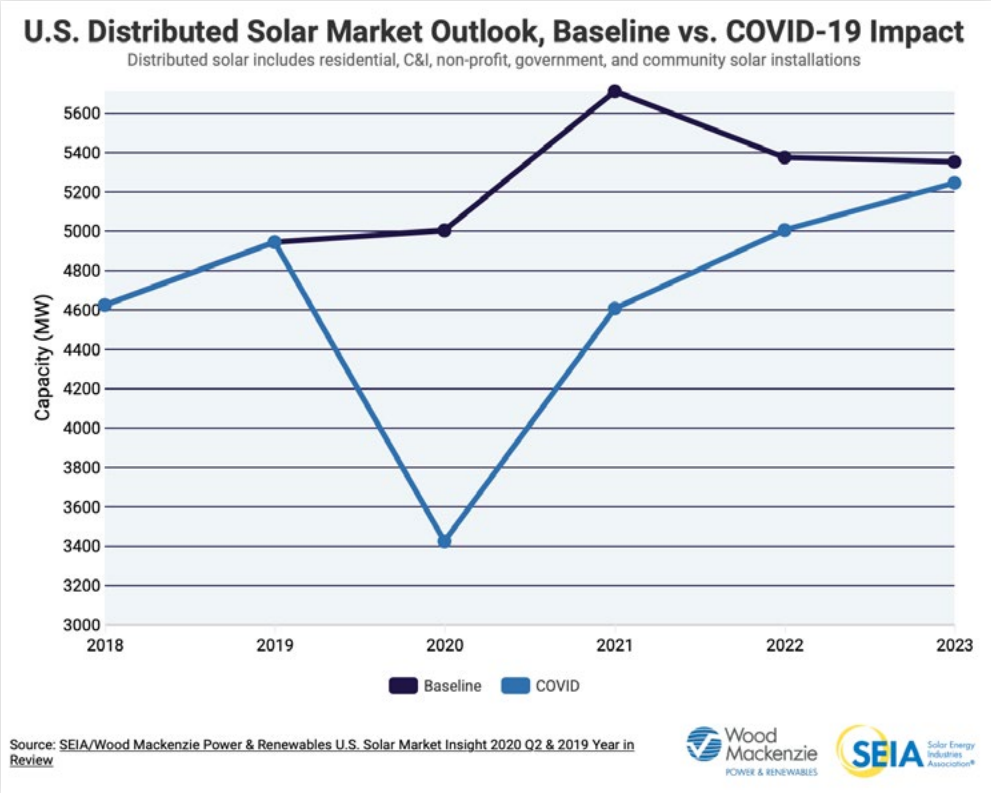

Figure 1. Source: SEIA/Wood Mackenzie Power & Renewables U.S. Solar Market Insight 2020 Q2 & 2019 Year in Review.

1. Bates, Michael. (Jun 17, 2020). "COVID-19 continues to devastate clean energy jobs." Solar Industry Mag. https://solarindustrymag.com/covid-19-continues-to-devastate-clean-energy-jobs
2. Milman, Oliver. (Jun 3, 2020). "Renewables surpass coal in US energy generation for first time in 130 years." The Guardian. https://www.theguardian.com/environment/2020/jun/03/renewables-surpass-coal-us-energy-generation-130-years
3. U.S. solar market insight. (Jun 11, 2020). SEIA. SEIA/Wood Mackenzie Power & Renewables U.S. Solar Market Insight 2020 Q2 & 2019 Year in Review

Solar companies can take steps today to bolster their business. In this economy, it's more important than ever to reap more value from projects, enhance competitiveness, and win more deals. Building energy storage capabilities and growing your team's understanding of storage applications is critical.

Solar companies that add storage to their projects improve project margins, deliver differentiated and competitive offerings, and enhance the resilience of their business so they can weather the ups and downs of the 'solarcoaster.' Based on real-world deployments by Stem partners, we find that developers can increase their revenue by 50% and improve gross profit by up to 2x with the addition of storage.

Yet in many ways, energy storage projects are more complicated than solar. They require sophisticated software to operate storage systems, customized system sizing, modeling and design, and adherence to strict codes of permitting, interconnection, and operation.

This ebook offers a primer on energy storage for behind the meter (BTM) and front of meter (FTM) applications, so you can position your company to take advantage of energy storage. It discusses the key revenue streams that energy storage allows BTM and FTM projects to capture, and outlines keys to success with integrating energy storage into your offerings.

For more on how to integrate energy storage into your solar business — and to become Stem Certified — enroll in Stem University for free at **stem.com/stem-university**.

Commercial behind the meter applications

Commercial BTM energy storage systems paired with distributed solar are uniquely able to deliver numerous services to commercial energy users as well as utilities and ISOs. These services include energy savings and demand charge savings for customers, revenue generation through demand response and wholesale market participation, backup power solutions for customers, and lower emissions for a reduced carbon footprint.

5 ways AI-driven energy storage adds value to BTM solar projects

1. CAPTURE MORE INCENTIVE DOLLARS

Solar + storage investments are particularly attractive now because of two federal tax incentives: An Investment Tax Credit (ITC) and Modified Accelerated Cost Recovery System (MACRS) depreciation deduction.

Battery systems charged by renewable energy 75% of the time annually qualify for the five-year MACRS schedule, which is equal to more than 20% reduction in capital costs. And they are eligible for the ITC, which is currently 26% for systems charged by solar but declines to 10% by 2022 and stays at 10% (for non-residential systems) from then on. While these guidelines apply to storage systems installed concurrently with solar, the National Renewables Energy Laboratory (NREL) states storage added to an existing renewable energy system would also be eligible, provided that the solar and energy storage are in close proximity and under common ownership.[4]

2. ADDRESS TIME-VARIABLE RATES AND DEMAND CHARGES

In part because of increased solar penetration in places like California and Hawaii and the way this has affected the balance between supply and demand on the grid, utilities are changing or eliminating net metering, while putting increased emphasis on time-of-use rates and demand charges. For an average commercial energy user today, more than 50% of energy spend is based not on *how much* energy you use, but *when* you use it.

Solar energy alone does not address the most expensive demand peaks, which now with new rate structures often occur in the late afternoon when solar production drops. By employing both solar and energy storage, customers can reduce not only energy charges, but also demand charges that occur when solar output goes down, as shown in Figure 2.

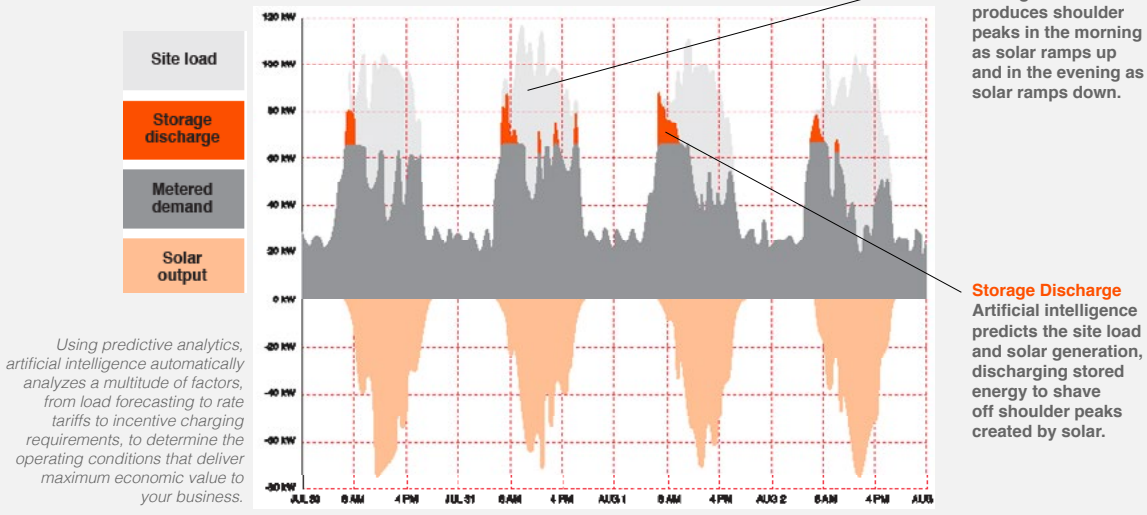

Figure 2 shows how energy storage reduces peak demand during times when solar production is low. Source: Stem, Inc.

4. National Renewable Energy Laboratory. "Federal tax incentives for solar." Fehttps://www.nrel.gov/docs/fy18osti/70384.pdf

3. FUTURE-PROOF YOUR PROJECTS

Historically, customer demand focused exclusively on standalone solar. Today, most customers are looking to include energy storage in new solar projects and retrofit existing solar projects to add it. This is happening not because energy storage is trendy but because it makes solar projects more adaptable to changing electricity markets and policies, and consequently more valuable.

Over the lifetime of a typical solar project, your customers will face between five to eight rate changes, with each one potentially impacting the economics of solar. While these changes can diminish solar project economics, they also incentivize developers to pair solar with energy storage.[5] With Stem's intelligent energy storage, solar becomes a flexible asset and its generation can be used when it's most valuable. Stem's advanced Artificial Intelligence (AI) operates storage systems and reprograms algorithms as rates, incentive structures, and policies change.

4. PARTICIPATE IN WHOLESALE MARKETS AND DEMAND RESPONSE

Increasing grid congestion, high renewables penetration in many areas, and decommissioning of nuclear and coal power plants are driving new utility and ISO programs such as demand response and wholesale market participation. Solar + storage projects can participate in these new revenue-generating programs to add substantial project value.

Stem customers have achieved 10% or more added savings by contributing power to the grid through demand response and wholesale market participation. AI is an essential tool for turning solar and storage systems into dispatchable assets that can participate in energy markets.

5. GIVE YOUR CUSTOMERS A BACKUP POWER SOLUTION

The increasing frequency of deadly wildfires, severe storms, and power shutoffs is elevating the need for companies to build a resilience strategy. Barely a week goes by without businesses facing some sort of power-related downtime.

Diesel-fueled generators, long favored for back-up power, produce heavy emissions that counter companies' sustainability goals. Additionally, generators do not automatically switch on when power fails. During the precious few minutes while they fire up, critical systems fail, then reboot, causing disruptions in daily operations and often safety hazards.

With the right combination of technologies – specifically solar + storage – businesses can make significant strides in ensuring continuity and reducing losses associated with outages. These combined systems act as self-sufficient microgrids, generating energy and powering critical loads until utility service is restored. In today's crisis, solar developers with storage offerings could help a variety of essential businesses – like hospitals, food distribution facilities and pharmacies – continue to serve critical needs during power outages.

Electricity is now our lifeline.

COVID-19 could exacerbate the impacts of severe weather events, power shutoffs and other power-related downtime.

As Peggy Noonan recently pointed out in the Wall Street Journal: *"Everything works—and will continue to work—as long as we have electricity. It's what keeps the lights on, the oxygen flowing, the information going. Everything is the grid, the grid, the grid."*[6]

5. Trabish, Herman K. (Dec 19, 2019). "Tax credit, net metering declines strike distributed solar, but falling costs, storage offer new hope." Utility Dive. https://www.utilitydive.com/news/tax-credit-net-metering-declines-strike-distributed-solar-but-falling-cos/569098/
6. Noonan, Peggy. (Mar 19, 2020). "We need time to absorb all this." Wall Street Journal. https://www.wsj.com/articles/we-need-time-to-absorb-all-this-11584661302

Partner Spotlight:

SunGreen Systems Partners with Stem to Deliver Higher Value Solar + Storage Solutions

SunGreen Solar provides solar, LEDs, and cool roofs to help customers cut down on expensive power from utilities. Like all solar businesses, they are impacted by changing policies and time-of-use rates. The company found that adding storage helped them future-proof their projects and design a stronger offering for customers.

"A solar + storage strategy enables our customers to maximize their savings and protects the value of their investment in solar, even as the utility industry continues to experience major shifts," said Alex Deeter, Sales and Marketing Engineer at SunGreen Systems. "Storage is also a huge competitive differentiator for us. It enables us to expand our offerings and reach a broader market."

SunGreen's Stem-powered solar + storage strategy has led to accelerated uptake by customers. The company closed three solar + storage projects in the first three months after formalizing the partnership. Project payback for customers has improved by 6 to 12 months compared to standalone solar projects, while the increased customer savings has resulted in higher SunGreen revenues.

EXAMPLE SUNGREEN SYSTEMS + STEM PROJECT:

Manufacturing Facility in Fontana, CA

- Storage system size: 1554 kW / 3108 kWH
- PV system size: 771 kW
- PV + Storage annual savings: $340,000

"Our customers are increasingly sophisticated, and they understand the value of a solar + storage strategy. We needed a storage partner that was easy for us to work with and that allowed us to present a single, comprehensive proposal with obvious benefits for customers. Stem has been ideal."

-Alex Deeter, Sales and Marketing Engineer, SunG reen Systems

Front of meter applications

These are exciting times for FTM, or grid-scale, solar + storage projects. FTM markets are continuing to expand for storage – and in turn, increasing opportunities for storage to maximize value for FTM solar projects.

As the first storage provider to successfully launch a virtual power plant (VPP) and integrate it into California wholesale markets, Stem brings market-leading expertise and insight to help developers realize successful projects.

5 ways AI-driven energy storage adds value to FTM solar projects

1. MAXIMIZES MARKET REVENUES AND OPTIMIZES BIDDING STRATEGY

Effective market participation depends on reliable, real-time communication with market operators and trading partners. After submitting an optimized bid, Athena dispatches assets in response to market signals and shares verified performance data with market operators so asset owners can receive payments.

Bidding successfully into organized electricity markets is a multi-dimensional task that demands advanced software. Athena's optimization engine generates multiple data forecasts and then overlays economic and operational constraints to produce energy bids that are optimized for any given moment in time. This exercise is crucial to project returns, as high bids risk non-selection while low bids leave money on the table.

2. AUTOMATES PROGRAM MANAGEMENT AND COMPLIANCE

Market rules and contract requirements can change many times over a project's lifetime, significantly altering how the asset generates revenue. Stem's expert team continuously updates Athena with the latest information on incentives, compliance requirements, and tariffs so that projects can accommodate even drastic changes in operating regimes. In other words, Athena "future-proofs" projects against changes both anticipated and unforeseen.

3. ENABLES OPTIMAL DESIGN

Designing successful projects requires sophisticated analysis. Athena's optimization algorithms, combined with Stem's project evaluation tools and market expertise, incorporate thousands of data points – including hourly solar production and market price forecasts as well as details about site operation, market structures, and financial inputs – to simulate how a project would perform throughout its lifetime. The result is a comprehensive picture of project economics that helps developers identify the most promising projects and then structure them to maximize value.

4. SUPPORTS FINANCING AND BANKABILITY

Athena supports successful project financing efforts with unparalleled insight into how projects are likely to perform plus the ability to constantly adapt to changing conditions. Athena can operate projects to meet a variety of different financial targets – such as the desired rate of return, the relative cost and value of CAPEX vs. OPEX, residual values, and risk profiles – ensuring that projects have the financial profile necessary to receive funding.

5. ENHANCES STORAGE LIFECYCLE VALUE

The value of maximizing battery performance over the project lifecycle speaks for itself. Leveraging insights gained from more than 14 million runtime hours, Athena actively manages battery state-of-charge (SOC), cycling, and other operational factors to extend performance and delay degradation – sometimes well beyond initial manufacturer estimates – to the benefit of program and warranty compliance and overall project value.

Partner Spotlight:

Syncarpha Capital Uses Athena to Optimize Wholesale Market Participation

Location | Massachusetts

Sites | 5

Total storage portfolio size | 28.2 MWh

Applications | MA SMART and wholesale market participation

> *"Stem's AI acumen and project operation experience makes them an ideal storage partner for Syncarpha Capital as we build our newest solar fleet in Massachusetts. Stem's AI-based project operation experience since 2012, and experience with storage co-sited with solar since 2014, creates a highly reliable partnership platform with Syncarpha's long utility-scale solar and wholesale market experience."*
>
> -Cliff Chapman, CEO, Syncarpha

Syncarpha Capital, LLC is a leading investment company that develops, owns and operates distributed photovoltaic (PV) solar and energy storage systems across North America.

In 2019, Syncarpha contracted with Stem to build 28.2 megawatt-hours (MWh) of large-scale storage projects co-sited with solar in Massachusetts. Stem is now providing AI-driven energy storage at the first of five sites. The project is the first solar + storage independent power producer site and generates nearly 5 MW peak solar power during the day.

All five distribution grid-connected sites across Massachusetts will be developed and owned by Syncarpha Capital. The systems will be connected to just over 28 megawatts (MW) of solar and will receive partial support from the Solar Massachusetts Renewable Target (SMART) Program, a state initiative that promotes cost-effective solar development with customer-facing and grid service benefits.

The systems will be managed by the Stem AI platform, Athena, which enables Syncarpha to participate in the New England Independent System Operator (ISO)-managed wholesale markets while complying with SMART and federal Investment Tax Credit requirements. Moreover, Stem's AI platform enables the sites to participate in wholesale and retail service revenues.

Keys to success with energy storage

While the scale and location of FTM and BTM projects may differ, the core challenge is the same: optimizing multiple, variable storage value streams using advanced software.

Mastering each of these areas takes a village. Stem is a 170-person company that is devoted to this work. Building out these capabilities takes years, and by working with Stem, you can outsource this expertise to us.

Here are the key areas of expertise needed to succeed with storage.

1. ANALYTICS, SIZING AND PROJECT DESIGN

Determining whether energy storage will pencil for any given project is handled best by an experienced storage partner, who can help developers quickly understand the market landscape, value streams available, and costs required for a given project.

At Stem, we analyze projects across markets, taking into account every possible value stream and product requirement. Then we help developers estimate the payback period, and run simulations to determine system size (or capacity) to deliver those value streams while minimizing cost of capital. If the developer is interested in an alternative financing vehicle, we can provide new financing options, along with pricing, sales, and contracting support.

Another aspect of the project which Stem supports is project design. It is critical during this phase to work with a partner experienced in storage design and familiar with fire code and UL requirements, which differ substantially from solar requirements. Prior to interconnection application submission and Authority Having Jurisdiction (AHJ) permit submission, Stem helps with system selection, design, site layout, and configuration.

2. SUPPLY CHAIN MANAGEMENT

Managing supply chain for energy storage projects is a complex process. For 10 years, Stem has been dedicating resources towards managing large supply contracts with hardware vendors - a process that requires deep relationships, non-stop vendor negotiation, and ongoing attention to get the highest quality products at the best value. A maturing industry has brought many competitive vendors into this space, giving developers more choice and access to better products but also creating a more crowded and differentiated vendor landscape. Where five years ago there were three primary vendors to choose from, today there are dozens! In the last six months alone, Stem engaged more than 30 hardware vendors and integrators.

Each hardware supplier has a different chemistry and unique capabilities, which complicates the process of picking out the best product for your projects. For instance, if you are doing solar clipping and solar shifting, you may want a different type of product than if you are doing market participation and frequency regulation. As a storage partner, Stem can help you determine the best product in the market for your project's specific requirements.

Stem will also ensure all the necessary requirements are in place for technical, warranty, operation and maintenance, commercial terms, performance, and degradation specifications. Our supply agreements typically range between 100 to 200 pages, including finely-tuned details that can have a major impact on the bottom line of the project. Having a dedicated resource with years of experience executing large energy storage supply agreements is critical. If you don't have the know-how to negotiate these types of major contracts, it creates a

high-risk situation for your organization — especially when you consider liquidated damages associated with performance, capacity, and performance guarantees.

3. PERMITTING, INTERCONNECTION, AND DEPLOYMENT

So you have an energy storage project scoped, the economics penciled, the project designed, and a supply agreement in place. The next area of expertise required is permitting and interconnection.

Permitting is done through the local AHJ, the city planner in charge of approving the project. The AHJ will ensure the appropriate safety requirements are in place including fire code rules, UL certification, and third-party lab tests on equipment. It is helpful to work with a storage expert that has preliminary plan sets and templatized design layouts that already have those requirements built in. Battery suppliers do not include this service in their agreements. Stem has a documentation library of preconfigured designs that meet the permitting requirements across different markets. With over 1,000 projects operating across more than 75 jurisdictions, we have more experience permitting and deploying projects than any other storage service provider. We leverage our documentation database to speed up the permitting process and give your project a running start.

Now how hard can it be to build a storage system if you're a solar developer? It can't be that different, right? Well, there are ~70 different Original Equipment Manufacturer (OEM) specific construction requirements and 20 commissioning and provisioning requirements. Each vendor has checklists outlining what has to be done before you can commission the system. Stem maintains the most comprehensive resource library of installation procedures, templates, checklists, training tools, OEM data sheets and O&M manuals in the industry. We help our partners jump the learning curve and mitigate risk.

Scheduling is another consideration. Most developers have a detailed schedule for solar, but often have less understanding of the schedule for storage. Having an experienced storage project manager is important for being able to integrate the storage schedule with the solar schedule. That resource will also oversee and support onsite construction. They manage site preparation, positioning, coordination with supply chain, onsite offloading, wireway and battery cables, AC conductor installation, and commissioning.

4. OPERATION AND AI EXPERTISE

Energy storage operation is far more complex than operating solar. Solar produces power when the sun shines. Battery storage gives you the ability to determine when that power gets stored, and when it gets used. The level of management required is why energy storage controls software is so important. Storage relies on advanced software and analytics to perform real-time decision-making, so that the battery will charge and deploy power at the most opportune times. An intelligent control system is necessary for realizing the full value of a storage asset through value stacking.

In addition to value stacking, advanced software is also critical for keeping the battery healthy so its lifecycle is maximized. It is responsible for controlling the state of charge of the battery, the number of times it cycles, the pace at which it charges and discharges, at what state-of-charge the system should rest, temperature management, and degradation tracking. These factors influence the lifecycle of the battery, so they are critical for maximizing project revenues over time. Continuous software upgrades are also important for program compliance, system performance, warranty compliance, and overall customer satisfaction. Batteries do not come out of the box from suppliers with this software in place, making it critical to work with a storage service provider with energy storage optimization software expertise.

In addition to advanced software, you should have an experienced team available to develop market participation strategies for your storage assets. Markets suitable for storage already exist in New England, New York, and California and will soon open up in other states as a result of FERC Order 841, which was issued in 2018 and directs grid operators to remove barriers to the participation of storage in wholesale markets. Wholesale markets add significant economic value to storage, so developers benefit from working with a storage service partner who can provide guidance on wholesale market participation strategies, along with software that can manage participation and get updated when markets change.

Naturally, an AI is only as good as the team standing behind it. For years, Stem has pioneered storage in markets across North America and successfully advocated for policies and incentives that reward storage for the values it provides to customers and the grid. With nearly 10 years' experience as an operator of storage projects, Stem currently provides services and solutions to partners at more than 1,000 sites across nine states and three countries.

5. EXPERIENCE

Energy storage adds significant value to storage projects, but it's a whole different ball game than solar. Many project developers realize the complexity once they get into the process, at which point they may step back to determine how to resource these projects. For some, that means hiring the expertise in house; for others it means working with a storage service partner that brings the necessary expertise to the table. Either way, having deep expertise in energy storage across each functional group is absolutely critical for succeeding with energy storage projects.

Stem has been in the energy storage business for more than a decade, and has more storage deployments than any other competitor. Stem's storage assets under management total more than 790 MWh. Stem's well-known market leadership in California was recently affirmed by the California Solar & Storage Association (CALSSA), which found that Stem's 2019 C&I installations, totaling roughly 27 MW across the state, were roughly three times larger than our nearest competitor.[7]

7. Stem. (Jun 15, 2020). "Stem named top California commercial energy storage installer." https://www.stem.com/stem-named-top-california-commercial-energy-storage-installer/

It’s easy to work with Stem

Energy storage is complex. Partnering with Stem is the easiest way to take advantage of energy storage benefits.

Developed cooperatively with our solar partners, Stem’s Partner Program offers a comprehensive set of educational and training tools to successfully model, sell, and install Stem-integrated storage solutions.

Become a Stem partner and gain access to these and many more benefits:

One benefit that Stem offers for free to all solar partners is access to Stem University, Stem’s online education portal. These courses are designed to provide hands-on business and technical training for sales professionals, sales analysts, project managers, and installers. Stem University gives you the power to identify and address customer needs, creating mutually beneficial deals with added value for everyone involved.

	stem Premier Partner	stem Certified Partner	stem Authorized Partner
Buys Stem ESS Solution from	Stem Direct	Distributor	Distributor
Stem University Library	✓	✓	✓
Proposal Support	✓	✓	✓
Stem Training Certification	✓	✓	
Stem Lead Program	✓	✓	
Exclusive Training Access	✓	✓	
Stem Direct Sales/ PM Support	✓		
Stem MDF Program	✓		
Early Offering Program	✓		
Volume-Based Pricing	✓		

To access Stem University and become an expert in energy storage, visit stem.com/stem-university. You’ll get immediate access to the courses for free.

Interested in speaking with a Stem representative to get more information about the Stem Partner Program? Visit www.stem.com/become-a-partner