CPower
The Bridge To Energy's Future

# CREATING VALUE WITH BEHIND-THE-METER STORAGE

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# BATTERIES INCLUDED

With the number of both site level and grid level use cases for energy storage (ES) and the associated potential value streams increasing – while at the same time costs for ES systems continue to drop, we can start to understand the basis for high ES deployment growth rates. There are a variety of energy storage solution types currently in use – hydro, thermal, inertial – but chemical, what's commonly referred to as battery energy storage and more specifically lithium ion battery storage, is currently driving the intensifying energy storage adoption curve.

These battery assets offer an attractive mix of operational flexibility, responsiveness, energy density, and rapidly decreasing costs. Flexibility is key: a battery energy management system's flexibility and its ability to generate a combination of revenues and/or cost avoidance of value streams allow battery storage projects to become economically viable in an increasing number of situations, energy markets, and geographies.

## ENERGY MARKET VALUE STREAMS

Let's consider the spectrum of potential energy market value streams that a battery energy management system can support. The first category is On Bill savings. Depending on location (and this category definitely depends on location), savings are predominately derived from some mix of demand charge management savings, system level coincidence peak management, and/or energy arbitrage. Second, there is what I'll refer to as the "Off Bill" value stream. These are external revenue streams or sources. This starts with the independent system operators' (ISO) capacity programs, and includes utility level capacity programs, ancillary services like reserves and frequency regulation, non-wire alternative utility programs, and anticipated "flexibility services" programs which are expected to require faster acting and more granular capacity services.

Finally, there are energy storage financial incentives, which can occur at the state and/or federal level. Many states have established renewable generation energy storage targets and mandates. To support these initiatives, states like California, Massachusetts, and New York have created incentive programs to provide funds to support either standalone energy storage or energy storage paired with renewables. On the federal level, incentives have typically taken the form of a tax incentive. If your storage asset is being deployed with a qualifying asset such as solar, this would present an opportunity for the storage portion of the project to also qualify for the incentive.

One important point to mention when discussing energy market-based financial benefits: They can vary significantly, and not unlike the real estate market, are very much driven by location. Sites that operate in states who offer a combination of open energy markets, aggressive renewable generation and storage goals or mandates, and some meaningful opportunity to reduce transmission and distribution demand-related costs can benefit from these states' attractive economic propositions.

# SUPPLY AND DEMAND

That's the economic side of things. Now let's look at the supply side. Who's involved in this value equation, and how do they benefit? Well, the first (and sometimes overlooked) beneficiary of ES flexibility is the grid itself. As the mix of distributed generation and storage resources continues to evolve, these operators are beginning to envision and seek new demand-side products that offer the ability to shift demand more rapidly, and at increasingly granular levels. Energy storage is well positioned to support the grid operators' needs of today and anticipated future flexibility requirements.


Let's flip this and look at the demand side now. Who on this side of the equation can benefit from the financial incentives that utility and grid operators may provide in return for the services energy storage may supply?

It all starts with a utility account. In the demand-side world, you have to have one, and you have to have the rights to manage that account. But there's more. You have to decide which ISO and/or utility programs the account will participate or enroll in. And, you also have to decide what demand-related actions and commitments will be made on behalf of the account.

This means you have to have the ability to vary the account's demand for grid-supplied power, which is measured at the utility meter. And that's where energy storage assets come into play. A storage asset can deliver (or consume) a variable range capacity (up to its rated output size) for a duration that is governed based upon its energy capacity rating and current state of charge.

In short, you need both the enrollment rights to the utility account and control of the energy storage asset's capacity rights in order to benefit.

Two types of parties have emerged that typically control both of these sets of rights. The first, no surprise, is the utility account holder themselves. This is applicable in cases when they choose to purchase and own an ES asset. As you might expect, they apply the proceeds from energy storage system operations to offset the purchase and operations costs. But additionally, the utility account holder may use the proceeds to fund future distributed energy resources (DER) and/or energy efficiency projects. And often they leverage the incoming grid services revenue (usually delivered in the form of checks or electronic funds transfer, as opposed to an on-bill credit) to increase the visibility of the value that the ES project and its champion(s) are creating for the organization.

The other group is third party owner-operators / investors. They own the ES asset, but contract to provide attributes from the ES asset to the host site in return for the certain utility account enrollment rights. The third party owner (TPO) utilizes these rights to generate market revenues, and they often combine these market revenues with some form of service or lease payment from the host site to offset their ESS investment cost over time. The more value streams the TPO/Investor can recognize, the more opportunities they have to: Reach their targeted rate of return objectives; offer more attractive service/lease payments to the host site; and/or, improve the project's overall profitability.

## RESILIENCY AND SUSTAINABILITY

While there is always an economic component serving to drive and justify a project, it may not be the only driving factor. Depending on the host site's energy goals and objectives, the facility may look to leverage the flexibility of the battery energy storage system (BESS) to also support energy resilience and/or sustainability objectives.

Batteries can be effective in providing some degree of electrical power resiliency in the event of a grid supply outage. Often there can be more cost-effective ways to provide long duration, full facility backup power. But if your facility's goals include delivering power continuity to a specific set of critical systems for a defined period of time (typically measured in hours, not in days), and/or you simply want to enable existing renewable generation to be able to power your facility during a grid outage, battery supported resiliency may make sense.

As for sustainability, that term can take on a lot of meanings, but there are a couple of ways ES may be leveraged to support a facility's sustainability initiatives. Emissions reductions could be facilitated by feeding facility demand from storage during those times when higher emitting generation assets may be called into service by the grid, for example, during Demand Response events or other times of grid stress. Another sustainability play for ES may be shifting energy generated from renewable sources to times when facility demand is still present, but renewable generation is unavailable.

When looking to capture the total economic picture for BESS investment, we need to consider all three value streams:

- Energy Markets Value, derived from on-bill cost avoidance, grid services, and State & Federal incentives
- Resiliency Value, which may be derived from cost avoidances like:
  - a retailer being able to stay open and continue to sell their products and/or services
  - keeping a manufacturing plant producing products and avoiding costly downtime shut down and set-up costs
  - preventing inventory spoilage for items that require refrigeration
- Sustainability Value, which may be driven from:
  - load shifting and energy arbitrage related to stored renewably generated power
  - tracking the emissions offsets generated by the ES system and benchmarking against what it might cost to achieve these emission reductions by other means

## PLANNING FOR SUCCESS

If we want to put all this into practice, where do we start? We start with a plan. We build an accurate project financial plan/proforma that accurately identifies the various equipment, interconnection, installation, and operational costs. It must accurately consider all the various value streams your system is expected to generate. Along with that, we must develop an operational strategy that generates enough value to offset investment and cost of capital.

Oh, and one last thing. We have to ensure the plan can be executed.

Putting a solid plan together takes a lot of work, but so too does working the plan. There are a lot of steps to successfully executing your ES investment plan, but some of the more important include:

- Have the metering, controls, and reporting infrastructure needed to comply with regulatory requirements
- Ensure you have the necessary energy markets access, and things like the ability to place market bids, and receive bid acknowledgments, etc.
- Have a method to forecast market conditions and anticipated market values
- Have the means to weigh the trade-offs of seasonal, day-ahead, and near real-time asset allocation strategies
- Ultimately, be able to take action, and do so in ways that align with the energy objectives and obligations of the facility

From grid scale to residential rooftop solar, battery energy storage systems hold the promise of a decentralized, decarbonized, and digitized energy future. They offer operational flexibility, encourage deploying renewable assets, provide financial benefits to owners and third parties alike, and promote both grid stability and customer sustainability. Planning and operating a battery energy storage system isn't simple – the future never is – but it has the potential to pay substantial dividends for years to come.

# CASE STUDY

UMASS AMHERST

The University of Massachusetts, Amherst (UMA) has pioneered sustainability programs in every facet of campus life. In 2017, UMA launched an on-campus solar project featuring 15,000 photovoltaic panels generating 5.5 MW (DC) of clean, green power.

As the project neared completion, A recent comprehensive study of energy storage, undertaken as part of Massachusetts's Energy Storage initiative, recommended that the state pursue 600 MWs of advanced energy storage by 2025. For UMA, this gave them the impetus to explore on-site storage opportunities to complement its own evolving suite of sustainability initiatives.

An initial recommendation by the battery development team of a two-hour battery would have worked well enough under the current scenario, but it would have quickly proven inadequate for the rapidly transforming energy landscape and its longer, shifting demand peaks. Competitive Energy Services (CES), UMA's long-time energy consultants who worked on the 5.5 MW solar project, recommended a four-hour battery to accommodate future changes and advance UMA's sustainability objectives.

The redesigned battery project came with a daunting price tag – $2.4 million. To offset the additional capitalization needed, UMA and CES applied for a grant from the Massachusetts Advancing Commonwealth Energy Storage, or ACES, program. UMA was awarded one of 26 grants, which paid for nearly one-half of the project's initial costs. Capitalization concerns thus addressed, UMA and CES pursued a smaller but faster ROI. This brought the conversation around to asset monetization and another long-time associate in UMA's energy sustainability efforts: CPower Energy Management.

UMA and CES understood that they already had the resources in hand with CPower to recoup their investment and improve their ROI on the battery system. Working with CPower, they undertook a thorough analysis of the battery's integration with and impact on grid demand. From there, CPower, UMA, and CES designed a comprehensive demand-side energy management plan that would optimize participation on multiple revenue-generating programs, a process called "value stacking." By stacking the various available programs, UMA was able to monetize their battery asset through multiple revenue streams, greatly enhancing its value to the university community.

UMA's 1.3 MW, 5.2 MWh storage battery gives it an incredible amount of flexibility in how and when it dispatches the battery in response to grid events. It can dispatch 1 MW for four hours, reduce it to 500kw for eight hours, or ramp it to its maximum 1.3 MW for three hours of dispatch. The additional power permits it to accommodate longer event windows, and even choose how much or how little of that window to fill (depending on the demand management program).

Because the various programs' established peaks do not always line up, UMA can choose its own hours that take best advantage of all available programs, thus maximizing the cost reduction and monetization potential. In terms of grid reliability, UMA helps reduce what needs to be built in the future to meet the university's, state's, and region's growing and changing peak needs.

The 1.3 MW battery recommended by CES and monetized by CPower was fully commissioned and handed over to UMA in the second quarter of 2019. Since then, it has created more than $200,000 in value over the summer. By participating in the EverSource Daily Dispatch demand management program, UMA projects an annual revenue benefit of $234,000 in this one utility program alone.

Over ten years, the revenue from one single utility demand response program will provide an essentially full return on investment. Additionally, the battery has shown the capability to provide a powerful boost to the university's load-shedding program performance. During an event called by Connected Solutions on August 19th, 2019, the battery contributed 1192 kw on top of the university's shed load of 2823 kw for a total of more than 4 MW.

Battery storage on-site at UMASS Amherst

## About the Author

Rob Windle directs his energies to expanding the proliferation and monetization of distributed energy resources (DERs) such as decentralized generation and energy storage. DERs allow energy consumers to generate financial cost offsets and revenue benefits from increased energy markets participation, while leveraging existing and planned systems infrastructure and assets. He has over 20 years' experience in business strategy, new product development, direct and channel sales management and development across the Energy, Enterprise Software, and Automation industries. Mr. Windle is a Certified Energy Manager and served as a board member of the Technology Association of Georgia's Smart Energy Solutions group. He received his Bachelors degree in Engineering from the University of Cincinnati.