stem

Clean Energy Solutions for Electric Cooperatives

How to maximize solar, storage, and EV charging benefits for co-ops and their members

November 2023

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Introduction

The progressive utilization of renewable energy in electric cooperatives continues to rise, bringing significant benefits to their members. Recent years have seen a marked acceleration in this trend due to an increase in incentives to subsidize clean energy investments coupled with an appreciable decline in costs associated with solar photovoltaics (PV), battery energy storage systems (BESS), and electric vehicle (EV) charging infrastructure.

Wood Mackenzie, a global research and consultancy group, expects between 211 GW and 760 GWh of cumulative battery storage capacity will be available in the U.S. by 2032[1] – this should support the 24 different states and the District of Columbia that have adopted specific targets for greenhouse gas emissions.[2]

Introducing massive quantities of solar, storage, and EV to the grid presents a unique set of opportunities and challenges, with the technology differing significantly from traditional power generators such as natural gas and coal.

Specifically, storage is increasingly crucial for co-ops and their members. The prevailing choice for large-scale storage systems currently in use is lithium-ion technology. Developers favor lithium-ion for its cost-effectiveness, high-cycle efficiency, fast response times, and flexibility during critical operating hours. They offer various benefits, including utility bill optimization, resilience, grid stabilization, load shifting, and renewable energy integration. These functions are essential for a cooperative's grid operating in a safe, secure, and reliable fashion.

The following eBook details clean energy use cases featuring solar, storage, and EV charging, an overview of new opportunities from federal incentives, and a selection of co-op projects showcasing diverse grid applications.

[1] "Global Energy Storage Forecasts," Wood Mackenzie, accessed July 11, 2023, https://sisense.woodmac.com/app/main/dashboards/5ab88d747801f7b81e0001a5
[2] "State Climate Policy Maps," Center for Climate and Energy Solutions, accessed October 16, 2023, https://www.c2es.org/content/state-climate-policy

Clean Energy Solutions

Use cases for electric cooperatives

Battery energy storage technology plays a crucial role in optimizing the usage of renewable energy sources, allowing for the capture and storage of generated power for use when needed, such as during peak demand periods or power outages. From powering commercial buildings and supporting grid operations to facilitating solar and EV charging, energy storage presents diverse and transformative use cases in today's energy landscape.

Utility Bill Optimization

Battery energy storage can discharge during peak demand hours, helping members and distribution cooperatives significantly reduce costs by avoiding expensive demand charges. This use case is also referred to as “coincident peak mitigation” (or “management”).

Resilience and backup power

“Energy resilience” refers to reducing or eliminating power outages by installing battery energy storage for backup power at substations or member sites, often combined with solar PV. With U.S. outages growing in frequency and duration, resilience has become an increasingly compelling use case for energy storage. Plus, energy storage can be located close to the load center, eliminating the need for transmission and distribution lines where most failures occur.

Renewable energy integration

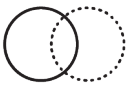
Battery energy storage is the primary solution for integrating variable renewable resources like solar and wind into the grid. As a firming resource, storage can smooth renewable output and solve for any differences in forecasted vs. actual supply (e.g., due to changing weather conditions).
In recent years, it has become increasingly common to pair battery storage with solar PV (both large-scale and distributed solar) to “time-shift” solar generation to the late afternoon and evening hours, when it is often more valuable. Storage can also capture solar oversupply that would be otherwise “clipped,” enabling larger and more efficient solar projects.

Grid stabilization

Battery energy storage can provide ancillary services such as frequency regulation (up or down), spinning and non-spinning reserves, voltage support, and black start. A key advantage of energy storage in these applications is its near-instantaneous availability.

Transmission and distribution (T&D) deferral

Battery energy storage installed at any point on the electricity grid – transmission, distribution, or member sites – can help co-ops defer T&D infrastructure investments. In this case, the battery is a “non-wires alternative” (NWA).



Wholesale market participation

Battery energy storage is the primary solution for integrating variable renewable resources like solar and wind into the grid. As a firming resource, storage can smooth renewable output and solve for any differences in forecasted vs. actual supply (e.g., due to changing weather conditions).

Fleet electrification with EV charging

As businesses move to electrify truck fleets, there are many questions about how to manage the load requirements across sites. Co-ops can prepare to meet the needs of members and key accounts as load shape changes with both utility-scale and customer-sited energy storage. Doing so will help co-ops to maintain resilience and adequately serve members, while also helping these large energy users optimize their energy spend.

How Parties Collaborate to Deliver Clean Energy Projects for Cooperatives

Various key roles are required to deliver successful clean energy projects with storage for co-ops, as described below. Because storage is often paired with solar, that configuration is assumed throughout.

Electric cooperative

Ultimate decision maker and client. Selects projects based on prospective benefits to members and in response to member priorities and needs. Flexibility to either directly own the project or execute a PPA with a third-party owner to receive the project's benefits.

Developer

Leverages solar, storage, and EV charging infrastructure deployment expertise to generate project ideas customized to a co-op's specific goals and needs. Oversees project execution and often provides solar and storage services to the co-op. In some cases, the co-op may serve as its own developer.

Energy storage provider

Contributes storage-specific design, procurement, deployment, and operational expertise to extract maximum value from the project. Designs optimal BESS in collaboration with the developer and co-op, and operates it with the co-op.

EV fleet owners

Forecasts load profiles for EV fleets so co-ops can manage accurate load requirements across sites.

Financier

Provides project financing to the developer.

Engineering, procurement, and construction firm (EPC)

Installs the project. Many developers also serve as EPCs.

The relationship between the co-op, developer, and energy storage provider is especially important, as they will continue to collaborate over the lifetime of the project. Later in this eBook, see four Project Highlights of solar plus storage projects Stem is currently supporting to help co-ops capture energy storage value streams tailored to their specific circumstances and needs.

New Opportunities from Federal Incentives

Various federal tax incentives, including direct pay incentives and the Grid Resilience and Innovation Partnerships (GRIP) program, are now accessible to many organizations. At Stem, our clean energy and policy professionals have scrutinized the bill to understand its implications on the economics of energy projects. We briefly summarize how the these policies can benefit clean energy projects here and recommend viewing our related webinar on demand.[3]

Direct Pay Options

The Inflation Reduction Act (IRA) permits direct pay options for co-ops. Cooperatives can deploy clean energy projects and receive direct cash payments when directly owning projects. This creates an expanded opportunity for cooperatives to own projects rather than execute a power purchase agreement (PPA) given this new ability for nonprofit and public entities to monetize tax credits without having any tax liability.

Who is Eligible for Direct Pay Options

Projects smaller than one megawatt AC qualify for full direct pay. Conversely, from 2024 onwards, projects larger than one megawatt must adhere to specific domestic content requirements to remain eligible for full direct payment.[4]

Grid Resilience and Innovation Partnerships (GRIP) Program

Under the Department of Energy's jurisdiction per the Infrastructure Investment and Jobs Act, the Grid Resilience and Innovation Partnerships (GRIP) Program intends to invest over $10 billion from FY22-FY26 for upgrading grid technology and infrastructure. This major initiative complements other schemes like the USDA New ERA and PACE Programs, and the tax incentives under the IRA, aligning towards a sustainable future. Co-ops can use the resources and funding provided by GRIP to foster clean energy projects and bolster their grid infrastructure. The GRIP program offers co-ops a unique opportunity to enhance their power grids, assuring reliable electricity supply during challenging weather conditions and safeguarding their infrastructure.[5]

Who is eligible for the GRIP Program

Designed to enable entities involved in power generation and distribution, the GRIP program welcomes applications from utilities, energy companies, non-profit organizations, state and local governments, and Indian Tribes, through the Tribal Consortium for BIL Section 40101(d).

A 501(c)12 not-for-profit organization, such as an electrical cooperative, may be eligible for the Smart Grid Grants Program under GRIP. They typically operate without a profit incentive and collectively generate and transmit power to serve their communities.[6, 7]

[3] "What the Inflation Reduction Act Means for your Clean Energy Project," Stem, accessed August 17, 2022, https://www.stem.com/webinar-what-the-inflation-reduction-act-means-for-your-clean-energy-project

[4] "Are You Ready for the Largest Clean Energy and Climate Investment in US History?" Stem, accessed August 17, 2022, https://www.stem.com/stems-inflation-reduction-act-insights-mike-alter

[5] "How MUNIs can get a GRIP on energy storage," Stem, accessed August 2, 2023. https://www.stem.com/how-munis-can-get-a-grip-on-energy-storage

[6] "Frequently Asked Questions on the Grid Resilience and Innovation Partnerships (GRIP) Program," Grid Deployment Office, access October 16, 2023, https://www.energy.gov/gdo/frequently-asked-questions-grid-resilience-and-innovation-partnerships-grip-program

[7] "Request for Information on the Grid Resilience and Innovation Partnerships Program (DEFOA-0002827)," National Rural Electric Cooperative Association (NRECA), accessed October 14, 2022, https://www.cooperative.com/programs-services/government-relations/regulatory-issues/Documents/NRECA%20GRIP%20RFI%20Comments%20Final%2010.14.2022.pdf

7 Best Practices for Realizing Successful Clean Energy Projects for Co-ops

Always looking for innovative ways to serve their members and reduce costs, many co-ops are increasingly turning to energy storage. As battery costs continue to decline and wholesale transmission and capacity charges increase, many co-ops find energy storage an effective way of delivering savings to their members.

Stem has assembled the following best practices to help co-ops maximize member benefits from energy storage. These recommendations extend across the design, deployment, and operational phases (Fig. 1). They are based on over a decade of experience spearheading hundreds of successful projects for a wide range of clients, including businesses, project developers, independent power producers, and co-ops.

Design	Deploy	Operate
1. Configure optimal BESS solution	3. Develop a clear project financial and operating model	5. Prioritize seamless BESS integration and operating visibility
2. Determine revenue streams	4. Minimize BESS procurement risks	6. Ensure warranty and ITC compliance
		7. Optimize BESS operations

Fig. 1. 7 best practices for realizing successful co-op clean energy projects

1. Identify proper location, interconnection, and sizing of BESS

Reducing demand charges via coincident peak (CP) management may be the primary use case distribution co-ops are interested in today. Demand charges for distribution co-ops are calculated in many ways, and tariff structures vary. When considering cost-effective energy storage, it is important to understand not only the mechanism by which peak rates are set but also the characteristics of the peak and the amount of energy needed to shoulder expected peaks. Because batteries deliver a finite amount of energy, selecting one with the right duration (MW / MWh ratio) in an adequate site location and interconnection area for your needs is essential to balancing BESS size with its costs and benefits.

2. Consider multiple value streams

Battery energy storage can provide several value streams beyond coincident peak management. A "value stream" is simply the ability to realize economic value from the energy storage use cases described above, at any point over a project's lifetime. Near-term value streams for co-ops may also include resilience or grid stabilization services. Note that the size of the battery does not necessarily need to increase to realize additional value streams; rather, the software that operates the battery must be capable of realizing secondary value streams without compromising the primary one (see No. 7, "Optimize storage operations"). The more value the software captures, the more value co-op members will receive.

3. Develop a clear financial and operating model for the project

It's essential to understand the financial benefits that the energy storage facility will provide over time. This requires modeling avoided costs and revenues from all current and future value streams, including any "value stacking" that may occur to extract more value from the battery. For projects owned and operated by third parties to the utility, prospective lenders often require detailed forecasts of the project's long-term value over the contract term.

4. Minimize BESS procurement risks

Battery purchasing contracts are complex and can affect the asset's long-term value; consequently, Terms and Conditions (T&Cs) must be reviewed and negotiated carefully. Buyer protection mechanisms include availability guarantees (to ensure battery availability during coincident peak events and assign fault if not), capacity guarantees (to ensure battery performance over the full duration of a long-term contract); and delivery of liquidated damages (to protect the buyer from financial harm in the event of a delay). An expert storage partner with significant contractual expertise and buying power can aid efforts to reallocate risk back onto battery OEMs.

5. Prioritize seamless BESS integration and operating visibility

Although energy storage may be a new technology for many co-ops, it doesn't have to be a black box. Utility operators should be able to dispatch the BESS, view the operating status in real-time, and easily report on system performance. Experienced storage partners can provide simple, standardized integrations based on SCADA/DNP3 protocols that most utilities already use. Web-based user interfaces are additional tools to improve visibility and understanding of BESS operations.

6. Ensure compliance with operating constraints

As with the other operational best practices, compliance is accomplished by smart storage software. For example, there may be requirements to charge a BESS directly from co-located solar (this was particularly relevant under old ITC rules), so the software must be able to avoid grid charging, where necessary. The software must also ensure the battery is operated within warranty throughput specifications, which are typically based on charge and discharge cycles, average resting state of charge (rSOC) and other parameters as appropriate in order to preserve asset health. The software's ability to adhere to these parameters and document performance over time protects the asset from undue operational degradation and supports the co-op in any warranty claims.

7. Optimize storage operations to get the most value from the BESS

A battery's ability to realize economic benefits for co-op members is wholly dependent on the software that operates it. Ultimately, the value a battery creates will be determined by thousands of decisions made by the software – including when to charge and discharge, at what rate (in MW) and for how long – based on terabytes of data over a 10- to 20-year timeframe. Consequently, energy storage providers should be scrutinized for the excellence of their software and the real-world results it has achieved for customers.

Project Highlights

Mohave Electric Cooperative

Arizona

Battery Energy Storage System Size: 15 MW / 60 MWh

Use Cases: Solar Plus Storage, Renewable Energy Integration, 24/7 Monitoring, Solar Forecasting, and Advanced Modeling

Solar PV System: 23.27 MW_{DC}

Commercial Operation Date: Late 2023

Mohave Electric Cooperative (MEC) is a not-for-profit distribution cooperative serving 36,700 members in Arizona committed to supplying safe, reliable, affordable electricity, and excellent customer service.

Stem worked in tandem with EDPR NA Distributed Generation (EDPR NA DG) and Prometheus Power to develop MEC's first solar and storage facility. Stem will operate and monitor the energy storage system 24/7 via Athena®, which enables MEC to interface with the battery, schedule it for dispatches, operate 24/7, and dispatch on command into high demand time periods. Athena's PowerTrack application will also be used for solar forecasting and advanced modeling to help streamline solar optimization for added value for MEC and its members.

Holy Cross Energy

Glenwood Springs, CO

Battery Energy Storage System Size: 5 MW / 15 MWh

Use Cases: Solar Plus Storage, Renewable Energy Integration, Coincident Peak Mitigation

Solar PV System: 5 MW

Commercial Operation Date: Early 2022

Holy Cross Energy (HCE), which serves more than 44,500 members across 5 western Colorado counties, has set a goal to deliver 100% clean energy by 2030. It partnered with Stem and Ameresco, an independent energy solutions provider, for its project consisting of a 5MW solar facility paired with a 5MW / 15MWh BESS.

This battery primarily reduces HCE's coincident peak charges. But the co-op already has a significant number of renewables online, and at times it risks oversupply; consequently, the battery is also used to capture oversupply that otherwise would have been curtailed. By providing direct bill savings to the co-op while enabling higher penetration of low-cost renewable energy, the battery reduces costs for co-op members while facilitating the achievement of clean energy goals.

Stem provides the project's turnkey smart storage solution - including battery hardware and Athena® platform - and operates the BESS in collaboration with HCE.

Ozarks Electric Cooperative

Arkansas

Battery Energy Storage System Size: 7 MW / 14 MWh

Use Cases: Solar Plus Storage, Renewable Energy Integration, Coincident Peak Mitigation

Solar PV System: 2.7 MW

Commercial Operation Date: Summer 2021

Ozarks Electric Cooperative, which serves more than 70,000 members in northwest Arkansas and northeast Oklahoma, collaborated with Stem and Today's Power Inc., a developer partner in Stem's Partner Program, for its project consisting of a 2.7MW solar park, paired with a 7MW / 14MWh BESS.

While the project aims to provide savings to Ozarks Electric Cooperative members over the 20-year contract term, the battery's primary use in this project is to reduce wholesale demand charges for co-op members.
Stem provides the user interface to allow Ozarks Electric Cooperative to coordinate the charge and discharge signals and schedules for the BESS, to discharge the battery into system peaks. Additionally, Stem provides performance reporting of the system and ensures its availability for dispatch signals from the co-op.

Cape & Vineyard Electric Cooperative

Oak Bluffs, MA

Battery Energy Storage System Size: 58 kW / 232 kWh

Use Cases: Resilience & Backup Power, Renewable Energy Integration, MA SMART Incentive Management, Solar plus Storage

Solar PV System: 272 kW

Commercial Operation Date: Fall 2021

The Cape & Vineyard Electric Cooperative (CVEC) currently serves two dozen municipalities in southeastern Massachusetts. For this project, it has partnered with Stem and Greenskies Clean Energy to install a 272kW solar PV system paired with a 58kW / 232kWh BESS at an elementary school on Martha's Vineyard. The solar PV is part of a portfolio of projects that doubled CVEC's existing renewables capacity and helped lower costs for members.

In addition to providing the turnkey storage solution, Stem's Athena® platform operates the solar asset in compliance with the solar ITC and an important state incentive, the Solar Massachusetts Renewable Target (SMART) program. In a grid outage, the battery also provides the school with backup power for up to four hours.

About Stem, Inc.

Stem (NYSE: STEM) is a global leader in AI-driven clean energy solutions and services.

Stem (NYSE: STEM) provides clean energy solutions and services that maximize the economic, environmental, and resiliency value of energy assets and portfolios. Stem's leading AI-driven enterprise software platform, Athena® enables organizations to deploy and unlock value from clean energy assets at scale. Powerful applications, including AlsoEnergy's PowerTrack, simplify and optimize asset management and connect an ecosystem of owners, developers, assets, and markets. Stem also offers integrated partner solutions that improve returns across energy projects, including storage, solar, and EV fleet charging.

For more information, visit www.stem.com.

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