NON-WIRES ALTERNATIVE CASE STUDY:

Boothbay, Maine

CONVERGENT

The Challenge

In a 2008 rate case filing with the Maine Public Utilities Commission (MPUC), Central Maine Power (CMP) proposed a $1.5 billion transmission upgrade for the state involving the refurbishment of over 300 miles of transmission lines and high voltage substations.

The goal of this refurbishment was to help address reliability concerns resulting from forecasted increases in peak load conditions on the grid. GridSolar intervened, contending that these load forecasts were too high and did not warrant the proposed, costly solution. In a settlement, MPUC agreed to allow GridSolar to develop Non-Wires Alternatives (NWAs) in two locations rather than the traditional transmission solution.

One of those locations, Boothbay, is located on a peninsula in the mid-coast of Maine. Boothbay Harbor, the adjacent community, is a small, charming, coastal town with a population of just over 2,000 people, that experiences a major tourism surge in the summertime, increasing electrical demand and causing the single, 34.5 kV radial wire feeding the peninsula to overheat and sag. The cost of replacing this transmission feeder was estimated at $18+ million and was projected to take several years to permit and complete. GridSolar selected Convergent Energy + Power (Convergent) to develop the first energy storage NWA for utility infrastructure as an alternative to this costly, time-consuming transmission upgrade.

The Solution

Convergent's 0.5 MW / 3 MWh system is comprised of three 40' Energy Storage Modules and one 20' Power Control module.

Convergent designed, engineered, and commissioned a 0.5 MW / 3 MWh energy storage asset in Boothbay, Maine in April, 2015 in response to Central Maine Power's proposed transmission line upgrade. The energy storage facility was located adjacent to the radial 34.5 KV sub-transmission line that feeds the Boothbay peninsula and connected to a local substation that serves the load pocket of the peninsula. Locating the energy storage facility close to the Boothbay Harbor load pocket enabled Convergent to alleviate 500 kW of strain on the upstream feeder during peak summer loads.

Convergent's energy storage facility represented the most significant component in Grid Solar's multi-pronged solution, which included behind the meter demand reductions, energy efficiency measures, diesel generation and energy storage.

The contract was designed as a 10-year term but incorporated flexibility for the utility. The storage asset was permitted, designed, constructed and placed in service within 10 months of contract execution.

The Technology

PROJECT SPECS
0.5 MW for 6 hours

PROJECT COST
~$3 M

TECHNOLOGY
Advanced Pb-Acid batteries; Lockheed Martin integrated

PERFORMANCE SPECS
During the peak summer months of May, June, July and August, Convergent's NWA energy storage asset was on-call to provide voltage support to the Boothbay region from 9:00am to 9:00pm, with a contractually guaranteed response time of less than five minutes. Outside of these summer months, the NWA asset was available to operate with a minimum of 24-hours' notice from Central Maine Power.

The system was integrated and warranted by Lockheed Martin, using over 1,800 VRLA batteries from C&D Technologies.

Convergent selected Lockheed Martin as the systems integrator for the energy storage system. Lockheed engineered, procured and delivered a modular system consisting of three 40' energy storage modules (ESMs) and one 20' power control system (PCS) module. All four of these containment modules were equipped with robust heating and cooling systems, fire suppression systems, isolation breakers, and communication equipment capable of on site and remote monitoring and responding to changes in temperature, humidity, string voltages and gas accumulation.

Valve-regulated lead acid batteries were chosen as the most cost-effective solution available at the time. Convergent procured these batteries from C&D Technologies, who provided over 1,800 batteries with a comprehensive performance guarantee for the duration of the contract. Each ESM contained over 600 individual batteries, capable of providing 1 MWh of energy at 600V DC.

The power supplied by the batteries was routed underground to the PCS, which contained five grid-tied Princeton Power bi-directional power inverters, each capable of inverting and/or rectifying 100 kW. These inverters are fully synchronized with the grid power supply, enabling the system to rapidly charge or discharge power onto the grid in accordance with the needs of Central Maine Power.

Control and monitoring of the energy storage system was provided by Lockheed Martin's proprietary energy storage management software. This software enables Convergent to interface with the energy storage facility locally via a control panel located inside the PCS module or remotely, via Convergent's Network Operations Center (NOC) in New York.

The Results

Convergent's NWA energy storage asset in Boothbay, Maine was utilized by Central Maine Power for three consecutive summers, providing on-demand power during summer peaks and preventing further deterioration to the constrained upstream transmission feeders and substations.

Convergent's energy storage facility provided this much-needed relief to the transmission system far earlier than what was possible with a traditional feeder replacement and did so in only 10 months from contract execution to commissioning. Furthermore, Convergent's energy storage system maintained 100% uptime during peak summer months, validating the reliability and responsiveness of energy storage as a utility resource.

Convergent's $3 million facility successfully helped CMP ratepayers avoid an $18+ million transmission feeder upgrade that would have ultimately proven unnecessary.

The Takeaways

Convergent's Boothbay energy storage system was the first NWA application of battery-based storage for utility infrastructure in the United States, and it set the standard for projects throughout North America. What was a novel concept in 2015 - using an energy storage solution to defer transmission and distribution system upgrades - is now commonplace.

The success of Convergent's trailblazing energy storage facility is demonstrated in:

- **Cost Savings**
  The ratepayers of Maine avoided an $18+ million investment in transmission and distribution upgrades with a cost of only $3 million for the energy storage system over the life of the pay-for-performance contract.
- **Avoided Infrastructure Damage**
  The Convergent solution prevented further deterioration to previously restricted upstream transmission feeders and substations by providing instantaneous on-demand power during summer peaks.
- **Rapid Deployment**
  The Convergent energy storage facility was completed in a fraction of the time required for the proposed transmission feeder upgrade with a deployment time of only 10 months from contract execution to commissioning.
- **Reliability**
  This energy storage power asset demonstrated reliability on par with the installation of a new transmission line with 100% uptime during peak summer months and immediate dispatch capability.

These benefits are greatly enhanced when considered in the context of the Boothbay Peninsula's uncertain load growth. Central Maine Power's ratepayers invested in a cost-effective, reliable, and rapidly deployed energy infrastructure alternative, resulting in millions of dollars of savings and greatly extending the life of the existing power infrastructure and avoided investing in a costly, multi-year investment to accommodate a load growth projection that did not materialize.

About Convergent

Convergent Energy + Power (Convergent) is the leading independent developer of energy storage solutions in North America. Powered by results, Convergent manages all aspects of the energy storage asset development cycle to help customers navigate an increasingly expensive, decentralized, and renewable-driven energy landscape. Convergent deploys state-of-the-art technology to significantly lower commercial and industrial customers' electricity bills and provide utilities with cost-effective grid solutions. With over 120 MWs and 240 MWhs of projects in operation, construction, or under contract, Convergent is also the largest independent operator of energy storage in North America. For more information, visit **convergentep.com** or follow us on **LinkedIn** or **Twitter**.

Convergent was an excellent company to deal with. We would be thrilled to work with them again. The pricing that they offered was the best in the market at the time, the service that they provided was excellent, and they were very transparent and easy to work with. Ultimately, it was a very successful collaboration.

–RICH SILKMAN
Founder of GridSolar

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