CASE STUDY

Grid-scale battery energy storage system

A first-of-kind project in Alberta !

BBA.CA

Innovation

Revolutionizing the power landscape

WindCharger is Alberta's first grid-scale, battery energy storage system (BESS) and is charged by renewable energy. Located southeast of Calgary, it captures and stores the energy generated at the 66 MW Summerview II wind farm and then later discharges that clean power to the grid.

BBA provided all the studies, designs, commissioning and interconnection services required to make the project a success for TransAlta Renewables, one of Canada's leading renewable independent power producers. With a nameplate capacity of 10MW, a total energy storage capability of 20MWh and 2-hour charge time, the facility officially began its commercial operations in October 2020.

Overcoming intermittency for a greener future

WindCharger supplies emission-free power to the provincial grid during times of peak demand or low wind conditions. In doing so, it compensates for the intermittent nature of wind power and makes the grid more reliable. Its massive lithium-ion battery packs effectively balance power supply and demand issues. All these advantages make a large-scale shift to renewable energy foreseeable, which will be fundamental for helping Alberta and Canada meet their respective climate change targets.

> By successfully demonstrating the use of utility-scale BESS for renewables, WindCharger is paving the way for more widespread use of green power generation. In this sense, the project is truly groundbreaking and very significant for the future of all Canadians. However, like any innovative undertaking, it required a significant amount of planning, creativity and diligence to execute.

Innovation

A first-of-kind project in Alberta

WindCharger was the first major energy-storage project to be connected to the Alberta grid using Tesla's Megapack technology. These novel aspects, in addition to the project's magnitude and need to connect to an existing facility, resulted in numerous technical and commercial challenges for BBA, the client and the province's power grid operator.

To prepare for the challenge, BBA put together a highly skilled team of experts, drawing from its Electrical, Civil & Structural, and Automation departments. Relying on rigorous communication and coordination procedures, the team successfully delivered:

- Feasibility and electrical studies
- Recommendation of modular lithium-ion battery technology offering optimal storage density
- Detailed engineering for all project stages
- Electrical equipment design, specifications, integrated controls and protections, commissioning and WECC testing
- Designs for the foundation, piles and structure for the indoor equipment
- Control logic definition and implementation
- Telecom network design and integration
- Data concentrator and screen page configuration

Complexity

There's no easy path to success, especially when you're mapping new territory. Since WindCharger was the first facility of its kind in Alberta, specific requirements for BESS-to-grid connections were still under development. This created interesting challenges for BBA's engineers, who fulfilled the roles of system designers and technical consultants for the first-time integration of energy storage in the Alberta Electric System Operator (AESO) connection process.

New grid connectivity framework

The AESO is responsible for making sure generators connect to the province's transmission system in a safe, reliable and consistent manner. BBA worked very closely with the AESO and Tesla, the battery system manufacturer, to find solutions that would meet existing requirements, while also proposing approaches to suit BESS equipment. BBA's team facilitated conversations between stakeholders and provided valuable technical expertise to support the AESO to develop a new framework. BBA's next challenge was to produce designs that would comply with the new, as-yet-untested framework. With no playbook to refer to, the engineers faced challenges to devise feasible and compliant solutions. WindCharger served as a test case for the new framework, helping to validate it and providing valuable lessons learned.

Countering constraints with flexibility

When the project was in the functional specification stage, the AESO released its short-term market implementation requirements. BBA responded with adaptability and ingenuity to ensure design compliance and make the project a success. From start to finish, the interconnection process was completed in approximately 21 months, a major accomplishment given the extent of the technical unknowns.

Social and/or Economic Benefits

Connecting Albertans to a brighter future

Decarbonization is happening now and being defined collectively. Companies have an important role to play in accelerating the creation of this new energy world, a world that is more equitable, both socially and environmentally. With global energy consumption constantly increasing, it's important to invest in renewable sources to make them more reliable, affordable and sustainable. Unquestionably, the WindCharger project has helped advance Alberta's requirements for energy storage connections and enriched the expertise of the local engineers working for and with the regulator. Looking ahead, these combined gains will make it easier for renewable power generators to develop new BESS facilities. The result will be a greener energy grid that delivers the reliability that end users need. This is particularly significant for Alberta. With limited opportunities to develop additional hydropower, the province needs to expand its reliance on wind and solar if it wants to transition away from fossil fuels. In addition to supporting the fight against climate change, this green energy shift will help protect Albertan individuals and businesses from the volatility of fossil fuel prices.

Delivering concrete economic benefits

WindCharger has already left its mark on the local economy. With a total capital cost of $14.5 million, the project has injected several million into Alberta, providing valuable opportunities for workers and businesses during the construction phase.

Environmental Benefits

Hitting essential environmental targets

According to the Government of Alberta, electricity generation currently accounts for 18% of Alberta's greenhouse gas emissions, which explains the continued focus on increasing electricity generation from renewable energy sources.

Since renewables like wind and solar power don't produce the equivalent of GHGs, these sources are significantly more environmentally friendly than fossil fuels like coal or natural gas.

By transitioning to more emission-free power, Alberta hopes to limit the impacts of climate change, which include more frequent droughts, floods and forest fires.

The WindCharger project has provided invaluable lessons learned and informed important regulatory developments for energy storage facility interconnections.

This new level of clarity is meaningful because it will enable other Albertan generators to supply the grid in a consistent manner that eliminates concerns about intermittent supply.

A multiplying effect

Considering that Southern Alberta is home to some of the best onshore wind resources in the world, the potential is tremendous. Once nearby generators levelize their output with similar BESS technologies, Alberta will be positioned to meet its clean energy goals without compromising the reliability of its grid.

As for WindCharger, the facility is already making a difference. It allows up to 10MW of clean energy to be discharged in during peak demand or low-wind periods. Its powerful batteries can hold enough capacity to power the equivalent of all the homes in nearby Pincher Creek for 90 minutes.

Meeting Client's Needs

TransAlta Renewables's goal was to develop a first-of-kind utility-scale BESS facility for its Summerview II wind farm in Alberta. Recognizing that the project interconnection would be challenging, the client sought a dedicated partner with in-depth electrical knowledge and sufficiently broad expertise to cover all aspects of project. They needed a partner that would be able to skillfully coordinate and consult with the technology manufacturer, construction contractor and the AESO.

BBA's multidisciplinary team rose to the occasion by delivering all the required work packages—including the feasibility study, recommended technologies and detailed engineering—and then providing support for the commissioning and the facility's interconnection to the grid. The firm's engineers were actively engaged on site—troubleshooting as needed, acting as an extension of the client's team at all times, and seeing the projects through to completion.

Summary of BBA's value:

- On time and on budget delivery of detailed engineering
- Timely adjustments in response to the expanded project scope
- High constructability, operability and process safety standards
- Interconnection completed in 21 months
- Zero safety incidents
- Zero workplace COVID-19 cases

TransAlta now has a fully operational and profitable energy storage facility that allows its Summerview II wind farm to provide stable power to the provincial grid.

"TransAlta thanks its project partner BBA Engineering for helping us meet the challenge of building and operating Alberta's first utility-scale lithium-ion battery energy storage facility fueled by 100% wind generation."

Dan Martin, P. Eng., PMP
Manager, Capital Projects
TRANSALTA CORPORATION

APPENDIX 1

About BBA

BBA has been providing a wide range of consulting engineering services for over 40 years. Today, its engineering, environmental and commissioning experts team up to quickly and accurately pinpoint the needs of industrial and institutional clients. The firm's expertise is recognized in the Energy and Natural Resources industry. With 16 offices in Canada and internationally (Chile), offering clients local support and field presence, BBA is recognized for providing some of the industry's most innovative, sustainable and reliable engineering solutions.

Energy

Mining and metals

Biofuels, oils and gas

Industrial and manufacturing

pharmaceuticals, agri-foods, wood and forestry, pulp and paper

Fostering ingenuity
to better value nature.

BBA.CA