NON-CONFIDENTIAL
FINAL OUTCOMES REPORT

ERA Project ID:	R0161349
Project Name:	Chappice Lake Solar & Storage Project
Recipient Contact:	Jake Jones, Director of Project Operations
ERA Project Advisor:	Susan Carlisle, Project Specialist, Clean Technology
Start Date:	September 27, 2021
Completion Date:	August 25, 2023
Total Project Budget:	$45,334,821
ERA funds received:	$10,000,000
Project Description:	The Chappice Lake Solar Storage project includes a 22.1MWdc/13.9MWac PV installation paired with a first-of-kind 2.9MWac/8.3MWh vanadium flow battery (VFB) supplied by Invinity Energy Systems (“Invinity”).

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1 EXECUTIVE SUMMARY

This Non-Confidential Final Report (the "Report") fulfills the requirements set forth in the Contribution Agreement between Elemental Energy Renewables Inc. ("EERI", "Elemental Energy") and Emissions Reductions Alberta ("ERA"); subsequently assigned to Chappice Lake Limited Partnership ("Chappice Lake LP")

ERA contributed CA$10M of grant funding to complete the development, construction and commissioning of the Chappice Lake Solar and Storage Facility (the "Project").

The Project's mechanical completion was achieved on July 20, 2023, plant commissioning commenced on April 16, 2023, and completed final testing and commissioning on August 25, 2023.

The project is expected to generate approximately 37,600MWh annually, enough clean electricity to power the equivalent of approximately 5,000 homes each year. This amount of solar electricity results in reducing carbon emissions by approximately 19,900 tCO2e /year and 15,000 in the first year of operations. Over the span of the Project's 35-year life, emissions reductions of over 500,000 tCO2e will be achieved.

The Project created significant local and provincial employment as well as opportunities for technical skill development and capacity-building in a rapidly growing industry. It will produce emission-free electricity for sale into the Alberta Electric System Operator ("AESO") electricity pool for the duration of its expected 35-year life.

Project innovations and achievements include:

- Installation of the first utility scale vanadium flow battery DC-connected to a solar generation facility in Alberta
- Utilization of the first machine learning battery dispatch software system in Alberta
- Provision of additional grid support via optional voltage control mode and volt-var control mode
- Provision of supplementary ramping control of a renewable generator by use of a battery
- Highest and best use of project lands that would otherwise have been grid constrained, including maximizing installed solar capacity and generation.

The proactive and transparent dissemination of project learnings throughout project construction and commissioning has greatly improved the industry's understanding of how to effectively and responsibly develop solar energy projects with battery storage in the province.

In conclusion, the Project has paved the way for the expansion of Alberta's utility scale solar industry.

2 PROJECT DESCRIPTION

2.1 Introduction

This Report meets the requirements of ERA, as set out in the Contribution Agreement. This specifically includes a concise summary of what the Project has achieved, conclusions and recommendations for further fields of research, and the status and performance of the project in terms of process, output, outcomes, and impact measures. The Report also delineates all Project Technology developed during the project.

2.2 Project Background

The Chappice Lake Solar Storage project includes a 22.1MW direct current (dc)/13.9MW alternating current (ac) photovoltaic (PV) installation paired with a first-of-kind 2.9MWac/8.3MWh vanadium flow battery (VFB) supplied by Invinity Energy Systems ("Invinity"). The addition of DC-connected batteries allowed the Project to maximize the use of a grid-constrained site by increasing the solar capacity from 16.7MWdc to 22.1MWdc, and therefore take advantage of economies of scale related to a larger project with significant fixed costs for interconnection.

The battery system is contained within a secured, thermally controlled, storage building and consists of 38 Invinity VS3-022 battery modules. The PV system consists of 40,675 Longi LR5-72HBD-545 solar panels mounted on ATI DuraTrack HZ v3 single-axis tracker racking system. The overall system is expected to generate approximately 37.6 GWh/yr, degrading at 0.4% each year of operation.

The primary advantage of VFB technology over conventional battery storage technologies is that the material used to store energy does not degrade, either through charge/discharge cycling or over time. Unlike lithium-ion batteries which degrade with each cycle, there is no state-change during charge or discharge of a VFB, meaning that none of the charge-carrying capacity of the electrolyte is consumed during operation.

Unlike traditional batteries, such as lithium-ion or lead-acid, the VFB charge and discharge reactions take place in a completely liquid state in a water-based electrolyte. This avoids processes which reduce the power and energy capacity of lithium-ion batteries every time they are used, resulting in little to no degradation of energy capacity for VFB, even over decades of heavy duty use and unlimited cycling. This makes the electrolyte a non-degrading asset capable of unlimited cycling with zero capacity loss over its lifetime (25-years). At end-of-life, the electrolyte can be recovered and reused or recycled, offsetting battery decommissioning costs and reducing the environmental costs of energy storage. The safe and stable chemistry of the all-vanadium electrolyte also poses no fire or explosion risk.

2.3 Project Objectives

a) To design, construct, finance, build and operate a DC-connected dispatchable PV facility with a vanadium flow battery (VFB).

b) To manage the battery dispatch (charge and discharge) via an automated process involving Calgary-based Arcus Power Corp's ("Arcus") proprietary machine learning algorithms.

c) Use project as a template for a DC connected PV-VFB flow battery configuration that can be deployed at new projects in Alberta and across Canada via meeting technology success metrics and transparent knowledge dissemination.

2.4 Performance & Success Metrics Identified in the Contribution Agreement

The results of the technology success metrics identified in the Contribution Agreement are as follows:

Success Metric	Project Target	Achievements to date
Battery System Availability	>90%	Will be determined after the third full year of operations.
Battery Round Trip Efficiency (DC incl. auxiliaries)	70%	74.8%
Battery Response Time	<1s	The system is not able to measure response time and therefore this success metric cannot be assessed.
% Clipped Energy Capture	90%	Will be determined after the third full year of operations.
% DG Credit CPD Revenue Capture	80%	Will be determined after the third full year of operations. The Alberta Utilities Commission will phase out DCG Credits by the end of 2025 (Decision 26090-D01-2021). Therefore, the battery dispatch prioritization will not be governed by CPD capture and will instead be focused on arbitrage opportunities.
PV Net Capacity Factor (%)	26%	Will be determined after the third full year of operations.
PV System Availability	98%	Will be determined after the third full year of operations.

2.5 Project Changes

On April 8, 2022, the ERA and EERI entered into an Assignment and Assumption agreement to assign the Contribution Agreement to Chappice Lake LP. Chappice Lake LP is 75% owned by EERI and 25% owned by Cold Lake First Nations.

2.6 Technology Risks

The project team identified potential risks associated with the performance of the technology when submitting the ERA Shovel Ready grant application in April 2021. Since then, Invinity's VFB technology and the VS3-022 product installed at the Project has been deployed and is operational across several projects in the United Kingdom ranging in scale from a 1 MWh behind-the-meter installation to a 5 MWh project providing ancillary services to the UK's National Grid.

In Q4 2022, Invinity completed its bankability report with an independent Engineering Consultant (DNV) that carried out comprehensive performance tests (evaluating response time, power, capacity, round trip efficiency and the ability to perform back-to-back cycles) on units located at Invinity's manufacturing facility in Scotland, UK and reviewed operating data from existing projects.

The performance of Invinity's VFB modules at operational projects and the results from Invinity's bankability report have significantly mitigated the risks associated with meeting the technical performance criteria and delivering the expected decarbonization, air quality and commercial benefits that were previously modelled.

The long term (25-year) performance of Invinity's VS3-022 product remains a risk as no Invinity VS3-022 modules have been operational for that period.

With extreme and extended periods of cold weather at the Chappice Lake site, it was necessary to enclose the VFBs in an insulated warehouse designed to maintain an internal ambient temperature above ~5ºC when the external ambient temperature is below -20ºC. Consideration needed to be given to ensuring temperatures within the warehouse do not rise significantly during the summer and increase the internal VFB electrolyte temperature beyond ~45ºC which may reduce the performance of the project.

The Battery Energy Storage System (BESS) dispatch control utilizes machine learning algorithms that incorporate the site solar generation forecasts, AESO system load forecasts, Alberta-specific weather forecasts (primarily temperature and wind speed), and real-time project data (battery state of charge, electrolyte temperatures, etc.) to maximize net revenue. The model takes into consideration expected charging that will occur via capture of clipping energy. This model, by virtue of the machine learning component, will learn to better predict market prices and to adjust the dispatch based on relative probabilities of predicted market pricing (e.g., prioritize dispatch at lower pricing with higher probability over higher pricing at lower probability). The model will also adapt over longer periods of time to change in the Alberta Electricity Market, including changes in loads, generation and transmission inter-ties with other jurisdictions. This will allow the battery dispatch control to adapt to future change in the market. With such a model, there is always performance risk, which Elemental Energy will be monitoring over the life of the facility.

3 OUTCOMES AND LEARNINGS

3.1 Experimental Procedures/Methodology

Vanadium flow batteries are delivered in a neutral state, with no charge and no voltage available at the battery terminals. This presents significant safety advantages during transportation and installation. When fully installed, the first step of the VFB commissioning procedure is to carry out an "initial charge", that will bring the batteries into their normal operational state, with voltage available at the batteries' terminals. Most inverters available on the market would not operate if there is no voltage available at the battery terminals. The inverters are not capable of creating a voltage on the battery terminals to start the initial charge. This is the case with the SMA Medium Voltage Power Skid (MVPS), that includes an SMA inverter and a transformer. To address this issue, Invinity has developed a proprietary method for working around this inverter limitation, thus allowing the combined battery-inverter system to initiate the initial charge. This method was successfully demonstrated for the first time during the commissioning of the Chappice Lake project and will be reused by Invinity for further projects in Australia and North America.

The environmentally controlled shed that the batteries are housed in represents the first large scale indoor installation of Invinity's VFB. The shed has heaters to allow the batteries to function during extreme cold temperatures as can be experienced in Alberta. This is Invinity's first installation in cold climates and required detailed calculations and design for the heating system. To minimize electrical demand charges at night, the shed utilizes an experimental smart heating control that attempts to maximize heat generation during solar generation hours, in attempt to minimize heating during non-solar hours. The smart control also utilizes the heat generated from the batteries in order to minimize heating costs.

3.2 Battery Technology Development

Invinity's products are standardized, factory-built vanadium flow batteries that are produced in high volumes for consistency, reliability, and quality. Prior to the Chappice Lake project, the first orders for Invinity's VS3-022 product were in 2020 with deliveries in October 2021 to the UK.

The VS3-022 product that has been deployed at other projects is the same product that has been installed at the Chappice Lake project with the core technology at the heart of the unit (the cell stacks and the vanadium electrolyte) being identical with Invinity focusing on corporate and manufacturing development through optimization of the supply chain and manufacturing to reduce costs while improving quality and performance.

Invinity completed an extensive audit process by leading global assurance provider SAI-Global in 2021 and 2022 certifying Invinity as compliant with ISO standards for Quality Management (ISO 9001), Environmental Management (ISO 14001) and Health & Safety Management (ISO 45001) becoming one of the only flow battery manufacturers worldwide to hold all three standards.

With a stable core technology, Invinity's product team focused on improving Invinity's controls (to reduce cost, lead time and supply chain risk with previous hardware providers) and on implementing a comprehensive data analytics and reporting platform. Invinity's analytics suite monitors almost 180 datapoints for the VFBs at the individual battery module level and up to the performance of the inverter bank level (collection of VFB modules connected to individual inverters).

In June 2023, Invinity expanded its manufacturing capacity in Vancouver increasing manufacturing capacity to 200 MWh of vanadium flow batteries per year. Increasing project sizes such as the Chappice Lake project has allowed Invinity to strategically invest in Invinity's Canadian manufacturing base.

The new facility in Vancouver has allowed Invinity to further scale up production in line with increasing sales with the 38 x VS3-022 units manufactured for the Chappice Lake project being some of the first modules manufactured and tested at the new facility. The new facility included an overhead crane that allows units to be safely and efficiently loaded and unloaded which significantly reduces time and cost associated with product delivery, providing easier access for transportation of standard 20-ft ISO containers, and enabling a higher number of deliveries per day. Invinity's manufacturing team established a formal and repeatable assembly approach that allowed Invinity to assemble the VS3-022 units at a rate of 1 per day, a rate which had not been achieved previously. Invinity has since further increased the rate of assembly building on the success of this project.

3.3 Installation and Commissioning

Due to the batteries being located in an indoor warehouse, it was not practical to use a crane to place each battery on site. The batteries are double stacked at Chappice Lake similar to other projects previously completed by Invinity. However, for all these previous projects, a crane was used to put the batteries in position on the foundations and lift the stacked batteries on top of the ones that are at ground level. The lifting option selected for the Chappice Lake project was to use a 25-ton rated forklift. This was proved to be a successful method for handling the batteries from the delivery truck outside of the shed, to their final location inside. Lifting the stacked units was also done successfully with the forklift.

The project experienced delays in the pile installation due to challenging geotechnical conditions, as well as battery delivery delays and delays for other electrical equipment, due to supply chain constraints. The project was able to source alternatives, with minimal impacts to budget and schedule.

Commissioning of a complex energy system came with a number of technical challenges. The project team was able to resolve all commissioning issues encountered. As the first project of this configuration, and Elemental Energy's first energy storage project, optimization and control process improvements have been extensive and are expected to be ongoing for an extended period.

3.4 Overall Project Achievements

The Project has achieved the first successful integration of DC-connected flow batteries to a utility scale solar project. A custom Power Plant Controller (PPC) was required to manage the flow of power to and from: the grid, solar project and batteries. The PPC required considerable effort to maximize the battery benefits while respecting the interconnection limits. This included control of the solar generation and battery, as well as incorporation of the Arcus battery dispatch. Smart control was added to the PPC to ensure all available solar clipping energy is captured when solar production exceeds the grid limit of 13.9MW. The clipping feature also functions when the solar production ramp rate is limited by the AESO ramp limits or if the project is curtailed by AESO.

Other ancillary benefits and achievements include:

- The first successful use of machine learning battery dispatch in Alberta, which is custom to the Alberta energy market.

- Provision of additional grid support via optional voltage control mode and volt-var control mode
- Provision of supplementary ramping control of a renewable generator by use of a battery
- Highest and best use of project lands that would otherwise have been grid constrained, including maximizing installed solar capacity
- Successful design and implementation of a smart HVAC controller designed to minimize electrical demand charges by maximizing use of heat generated from the BESS and maximizing electrical heating during solar hours subject to energy prices
- Installation of the first utility scale vanadium flow battery DC-connected to a solar generation facility in Alberta
- Utilization of the first machine learning battery dispatch software as a service in Alberta
- Highest and best use of project lands that would otherwise have been grid constrained, including maximizing installed solar capacity and generation.

3.5 Lessons Learned

Invinity has incorporated lessons learned on the VS3-022 product (that was deployed for this project) during manufacturing and installation/commissioning into the development of its next generation product. The next generation product is designed for higher efficiency, reduced capital cost and improved integration for distributed grid scale projects similar in size to this project or larger.

The VS3-022 product is comprised of three core components, the cell stacks (where the electron transfer takes place for charge and discharge reactions), the electrolyte (which stores electricity) and the balance of plant (hoses, pumps, fuses). During manufacturing, Invinity identified potential sources of human error in the final assembly process on existing hose clamps. These were changed to automotive style quick connectors that would significantly minimize potential leaks due to incorrect assembly.

The product contains internal DC/DC converters to increase the voltage from each cell stack from roughly 50V to between 1,000 – 1,500V for integration with commercially available solar and battery inverters. While enabling simpler integration for small projects (<500kW) with individual units, the DC/DC converters are an expensive component of the battery and can be a source of reliability issues. Invinity's next generation system architecture has been updated to remove the need for internal DC/DC converters by connecting modules in series. This significantly reduces cost and increases both efficiency and reliability but reduces flexibility in how the VFBs are arrayed together to deliver the full system capacity for larger multi-MW projects.

Due to the site location in Alberta, a battery shed was constructed to house the batteries and minimize the exposure to extreme cold temperatures. The warehouse is able to maintain the internal ambient temperature above 5C during -40C ambient temperatures, ensuring the batteries are able to deliver their full rated specification during an extended cold weather period. During commissioning, the project team struggled to reduce the electrolyte temperature to within its optimal temperature operating range. Invinity has redesigned the thermal management system in the next generation product by embedding ductwork within the electrolyte tanks to improve heat transfer and cooling. This will improve the product's ability to maintain electrolyte temperature within the desired range with a smaller temperature differential between the electrolyte and the surrounding air.

In addition to lessons associated with the experimental procedures and methodologies, and technology development above, the Project realized a number of lessons that will be incorporated into future projects, including:

- Temporary province-wide and regional grid constraints on renewable energy projects can be partially mitigated by adding energy storage and this will become more prevalent as more renewables are added to the grid;
- In the appropriate geotechnical conditions, pile foundations are a more economical solution for batteries than concrete foundations;
- Stacking of the batteries significantly reduced the shed size and costs;
- Ramp down power control on renewable energy projects, and the associated benefits to the grid (e.g. Voltage support), can be incorporated into projects that include storage and these directly benefit the renewable generator as it reduces the potential for being tripped off-line;
- Clipping energy captured by batteries under system operator ramp-up constraints can be substantial and analysis of this benefit will help inform future evaluation of storage paired with renewables;
- First attempts at scaling installation by a BESS supplier will likely result in new discoveries of BESS control issues that need to be resolved;
- First attempts at pairing a particular BESS supplier with a particular inverter supplier will likely result in control and integration challenges that require involvement of both suppliers to resolve, and automation of the controls in order to minimize manual operator intervention requires significant thought, observation and adjustment;
- Scope delineation including engineering, supply and control, between BESS supplier and the engineers/contractors responsible for integration are important in the successful delivery of projects and the early involvement of all parties is key to achieving the best outcome;
- Minimizing demand charges is a material objective and requires significant effort in the automation of various processes, including inverter control and heating control if BESS are located in a temperature-controlled building.

Learnings from the Project are expected to continue through at the first several years of operation.

4 COMMERCIALIZATION

The Project significantly advances the commercialization of Invinity's VFB by allowing Invinity to scale its operations in Canada. The Invinity VS3-022 product is a standardized and factory-built product that has been deployed in its current form since 2021 with no significant technological developments or changes to the technology readiness level over the course of the Project. The Chappice Lake project is the first time a full Invinity VFB project with large numbers of modules has been integrated with SMA's DC-coupled solar and storage solution. Invinity had completed preliminary integration testing at SMA's test facilities in Kassel, Germany previously as part of a similar project using the same architecture, however the test was conducted with a smaller number of individual units. Preparation work was undertaken to align software communication using Modbus TCP/IP protocol between the SMA inverter and the Flow Battery Energy Storage Manager (FBESM).

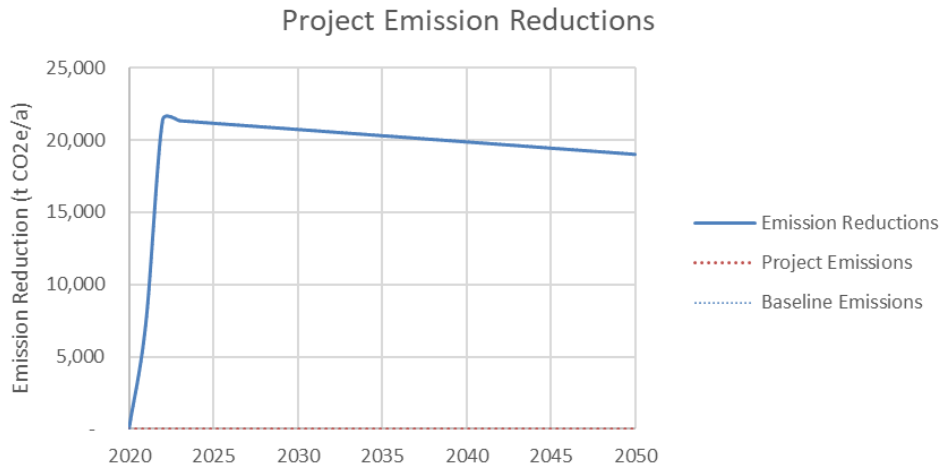
The Project also created the opportunity for Arcus to develop a custom machine learning model specific for battery dispatch in the Alberta Energy Market. The model is unique, as it requires incorporation of both energy pricing forecasts as well as project specific solar generation forecasts and battery characteristics including power, energy and efficiency. The creation of the model paves the way for deployment on future renewable-paired batteries, independent of battery storage technology.

Elemental Energy is in the process of utilizing the learnings on the Project during the design, construction and commissioning stages, as well as preliminary operating results, to assess future renewable-paired battery storage opportunities. Elemental Energy is currently performing financial analysis of potential battery storage on Elemental Energy's existing and future renewable energy projects, both in Alberta and other jurisdictions. With increasing renewables penetration, the business case for batteries is expected to improve over time. Much as the Brooks Solar Project, as the first utility scale solar project in Alberta, paved the way for rapid expansion of solar in Alberta, this Project is expected to pave the way for significant penetration of energy storage paired with all renewables.

5 ENVIRONMENTAL BENEFITS

5.1 Emissions Reductions Impact

The Project will reduce GHG emission in Alberta by displacing grid electricity. The project will create approximately 19,600 tCO2e of emission reductions annually with the first emission reductions occurring in 2023. The project, over its lifetime, will generate more than 500,000 tCO2e of emission reductions. Our market analysis, assuming a market adoption start date of 2024, with a maximum penetration of 10% of the solar market and 30% of the solar-storage market, could result in 1 MtCO2e of emission reductions by 2035 and over 7 MtCO2e of emission reductions by 2050.



The Project is expected to have a minimum of a 35-year operating life, resulting in long-term emissions reductions. Solar panels experience performance degradation over time to the tune of between 0.3% and 0.5% of capacity per year. Taking into account a first full year expected production in 2024 of 29,151MWh, an annual average degradation of 0.4% and a 35-year life, the Project is expected to produce a total of approximately 500,000MWh over its life.

In summary, the Project on its own is expected to reduce GHG emissions by 500,000 tCO2e over its life. Based on the $10M contribution from ERA, this amounts to a contribution of $20/tCO2. This is 70% less than the 2023 federal carbon tax rate ($65/tCO2), and nearly 90% less than the federal carbon tax currently proposed in 2030 ($170/tCO2). Beyond the Chappice Lake Project, the ERA funding could lead to broader market reductions of 7 Mt CO2e of emission reductions by 2050.

The table below sets out the expected annual generation and emissions reductions.

Year	Baseline Emissions @Year (tCO2e)	Project Emissions @Year (tCO2e)	Estimated Annual Production (if applicable)	Units of Production	Emissions Reduction @Year (tCO2e)
2022					
2023	9,216	64	16,283	Mw Hr	9,152
2024	15,512	145	29,830	Mw Hr	15,366
2025	19,445	145	36,689	Mw Hr	19,300
2026	19,366	145	36,539	Mw Hr	19,221
2027	19,286	145	36,388	Mw Hr	19,141
2028	19,206	145	36,238	Mw Hr	19,061
2029	19,127	145	36,088	Mw Hr	18,982
2030	19,047	145	35,938	Mw Hr	18,902
2031	18,967	145	35,787	Mw Hr	18,822
2032	18,888	145	35,637	Mw Hr	18,743
2033	15,437	145	35,487	Mw Hr	15,292
2034	12,039	145	35,336	Mw Hr	11,894
2035	11,988	145	35,186	Mw Hr	11,843
2036	11,937	145	35,036	Mw Hr	11,792
2037	11,885	145	34,885	Mw Hr	11,740
2038	11,834	145	34,735	Mw Hr	11,689
2039	11,783	145	34,585	Mw Hr	11,638
2040	11,732	145	34,435	Mw Hr	11,587
2041	11,681	145	34,284	Mw Hr	11,536
2042	11,629	145	34,134	Mw Hr	11,484
2043	11,578	145	33,984	Mw Hr	11,433
2044	11,527	145	33,833	Mw Hr	11,382
2045	11,476	145	33,683	Mw Hr	11,331
2046	11,425	145	33,533	Mw Hr	11,280
2050	11,220	145	32,932	Mw Hr	11,075

5.2 Other Environmental Impacts

In addition to GHG benefits, the Chappice Lake Solar-Storage project has several additional distinct environmental benefits. The use of VFB's provide a high re-usability, recyclability, and long asset life that will result in a lower environmental footprint and reduced levels of waste compared to a lithium-ion project with associated cell replacement and end of life disposal requirements for which recycling options are not currently widely available. In Invinity's VFB the electrolyte fluid does not degrade nor

require replacement, while the housing and other parts require maintenance and end of life disposal but are made of components the significant majority of which (by weight) are fully recyclable.

While solar PV projects are land intensive and result in a reduction of agricultural farmland and some impacts in habitat reduction, Elemental plans to maintain agricultural use by grazing approximately 200 sheep at the site in operations. Grazing sheep at a solar project helps by (i) reducing the emissions and costs associated with mowing, (ii) vegetation management with improved soil health and less weeds without the need for herbicides, (iii) provides food for sheep.

This Project and the future roll out of solar & storage projects will bring significant air quality benefits to Alberta as the project displaces emissions intensive fossil fuel based generators, including coal and natural gas. Although coal has now been mostly phased out from Alberta's electricity system and air quality impacts of natural gas facilities are far lower, dispatchable renewable energy facilities have zero emissions resulting in net air quality improvements.

The Project will lead to an increase in chemical handling as the vanadium-based electrolyte is deployed to the site. The electrolyte is a fluid mixture of vanadium dissolved in a mixture of water and sulfuric acid, a similar concentration to traditional lead-acid batteries. Invinity has significantly mitigated the risk of environmental contamination through several design measures. Invinity VFB projects are made up of several 20-ft containers, with 6 x modules within each container and the electrolyte distributed across twelve tanks. These tanks are stored within a secondary containment layer which is sized to accommodate 130% of the electrolyte liquid volume which is then housed within a 20-ft shipping. Finally Invinity transfers the electrolyte to and from the VFBs only within its own facilities, minimizing the risk of any spills and resulting containment at the project site.

6 ECONOMIC AND SOCIAL IMPACTS

6.1 Description of Projected Economic Impacts in Alberta

The Project resulted in substantial direct and indirect economic development for the local community and province of Alberta.

Of the over 15,382 direct labour hours required to construct the project, more than 70% were attributable to workers from Cypress County and the Province of Alberta. A total of 53 full time jobs were created during construction. These figures exclude the significant hours and cost of third-party technical consultants, legal counsel, lender employees, and members of the owner's team.

Key contractors that worked on the project:

- miEnergy
- WSP Engineering
- Invinity Energy Systems

In addition to the economic impact of construction, the project also generates long-term economic impacts through operations. A Calgary-based solar service provider, SkyFire Energy, has been contracted to provide long-term operations and maintenance service for the solar facility and the batteries. One full time job has been created during operations. This company also subcontracts certain task to local labour, further creating local economic investment. Cypress County benefits from annual property tax from the Project, which will amount to several million dollars over the course of the Project's life.

Through both construction and operations, Project participants have had the ability to substantial expand their capacity and transferable skill base. Individual labourers are now amongst the most experienced solar and battery storage installation professionals in the province and western Canada, positioning them favorably for long-term employment opportunities as the solar sector expands rapidly.

The Project required 10 full time staff for a period of 12 – 14 weeks to assemble and test the final systems of the Invinity VFBs before they were transported to site. The Project required 16 full time staff in Vancouver for stack production and assembly.

Contractors involved in the operation of the project have become certified by both SMA for the inverters and Invinity Energy Systems for the BESS, allowing them to expand their service offering to the growing solar industry.

The addition of storage to a grid-constrained solar project not only made the project viable, thereby adding a new source of property tax revenue to the Province and the County, but it also allowed the solar facility to be constructed with a larger DC-capacity, which caused the property tax revenue to increase.

The direct and indirect economic impacts of the construction and operation of the Project are truly substantial. This impact will only continue to grow as the solar industry expands in Alberta and additional opportunities are created, in part a result of the success of the Project.

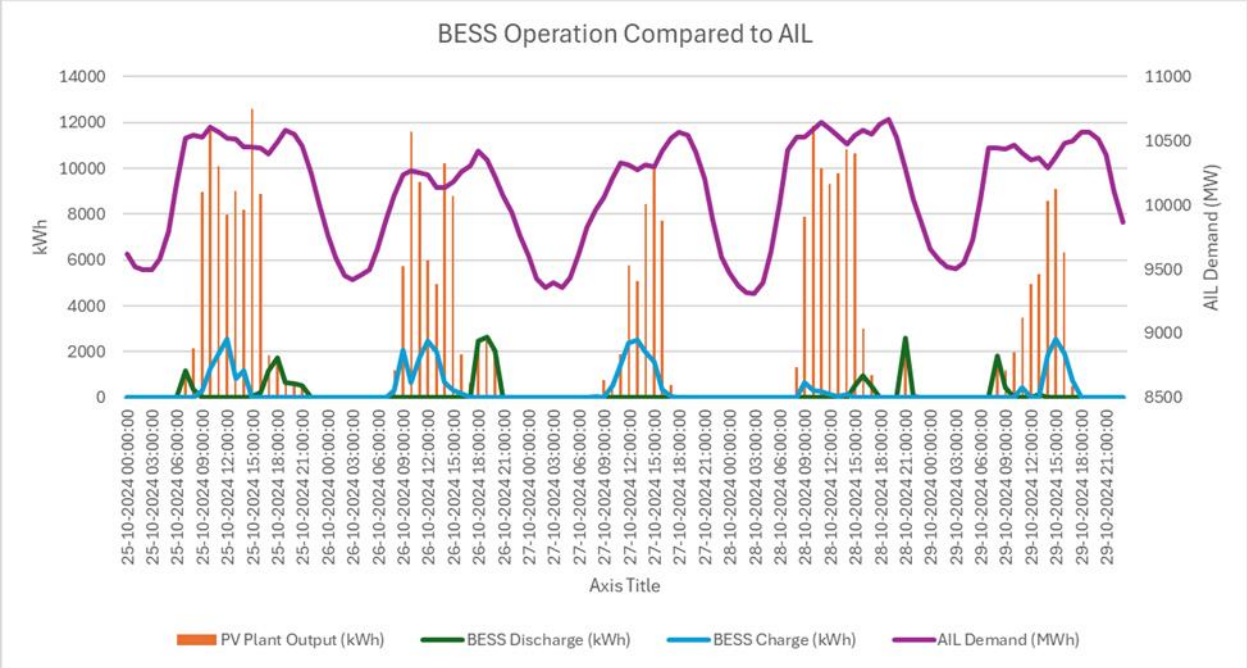
By becoming an early adopter of VFB technology, Alberta will benefit in several ways:

- By rapidly integrating renewables and storage systems Alberta can become a leader in exporting technology and innovative intellectual property associated with hardware (like Invinity's VFB technology), smart grid solutions, and intelligent dispatch solutions (such as Arcus' technology).
- Becoming an emerging clean energy leader will help diversify the Albertan economy towards an energy leader which includes conventional and emerging renewable energy technology.
- Projects such as Chappice Lake also make significant contributions to local tax revenues – the Project is expected to contribute over $5M to Cypress County over the Project life.
- With Alberta's relatively carbon intensive grid, and deregulated market structure which enables the implementation of innovative commercial market-based technology solutions, the province is well positioned to be a globally competitive leader in the ongoing clean energy transition.

6.2 Description of Projected Electrical Grid Impacts in Alberta

The DC-coupling of a battery to a solar facility, and the automated dispatch of the battery via machine learning algorithm, provides the following benefits to the Alberta electric grid:

- Increased renewable generation on the Alberta grid, resulting in reduced energy cost to customers and reduced carbon intensity of the Alberta grid;
- Improved ramping control of renewables, via battery dispatch, for improved grid stability;
- Improved reactive power control provides additional stability to the grid; and
- Dispatchability of energy stored from renewables allows more renewable energy to supply the grid when solar generation has tapered and demand is higher, as illustrated below.



6.3 Description of Increased Innovation Capacity

The Project resulted in the following increases in innovation capacity in the Province of Alberta:

- Increased knowledge of the handling and installation of Vanadium Flow Batteries for skilled trades workers.
- Development of an Alberta-specific battery dispatch model for utility solar paired with DC-connected batteries, utilizing machine learning, by Alberta-based Arcus Power Corp.
- Increased knowledge of the use case and economic benefits of DC-connected batteries with utility scale solar.
- Increased knowledge for WSP engineers based on Alberta for SCADA programming and Power Plant Control related to BESS dispatch and optimization.
- Increased knowledge of thermal performance of the Invinity SVB, including thermal management in a controlled environment (indoor) in cold climates and identification of potential improvements to the cooling system of the VS3-022 units.
- Increased optimization of demand management for BESS shed heating through smart heating controls.

6.4 Impact on Local Communities, Underserved Communities, and/or Indigenous Groups

Participation in the Project will benefit our partner and co-owner, Cold Lake First Nations in several ways. First, long-term project revenues will supplement the Nation's administration. The existing federal government funding model, under the Indian Act System, does not provide adequate funding for First

Nations communities to deliver services to members that are on par with those services provided off-reserve. Revenues from this Project partnership will augment the CLFN's own source revenue and assist the community in the areas of healthcare, housing and reserve infrastructure, among others, to enhance overall community well-being.

In addition to revenue generation, CLFN will benefit from this Project through capacity development of its members, business entities and its administration. By developing capacity in this sector, through knowledge transfer and real-world experience, CLFN will become better positioned to grow a portfolio of renewable energy assets - and reap the maximum benefit from those assets - to strengthen the long-term financial security of the Nation. This will have compounding impacts on employment and revenue generation for CLFN.

For years, CLFN has been active in Alberta's oil and gas economy but recognizes a need to diversify its businesses. Community member employment and CLFN-owned company contracting opportunities as well as growth in renewable energy industry acumen and project development experience are the essential building blocks for CLFN to accomplish this goal.

The Project is on lands leased from a local farmer who was seeking to diversify his revenues and ensure long-term sustainability of his farming operations. His young family lives close to the Project and were pleased to see the Project move forward to construction and operations.

6.5 Equity, Diversity, and Inclusion

Elemental has established meaningful relationships with First Nations based on respect and recognition of their inherent treaty and aboriginal rights and interest. Elemental has built a close relationship with the Cold Lake First Nations (Co-owner and Partner in the Project), as well as First Nations in other provinces, including Cowessess First Nation in Saskatchewan and the Sipekne'katik First Nation in Nova Scotia.

During the construction of the project, MiEnergy (EPC Contractor) employment rates of underrepresented groups was: 7.6% women, 0.34% of gender diverse, 22.4% youth, 9% racialized and 13.8% indigenous.

Elemental's Director of Corporate Finance & Operations, Tania Ontiveros, attended the annual Equity, Diversity and Inclusion workshop facilitated by the Canadian Centre for Diversity and Inclusion in September 2021 and provided training to all Elemental's employees in November 2021. In addition, on February 25, 2022, she attended the "Advancing EDI in the Future Electricity Sector Workforce" workshop facilitated by NRCAN.

On April 12, 2023, Elemental team members attended the workshop "Reducing Inequity in the Transition to Clean Electricity" sponsored by NRCAN. Elemental is committed to continuously informing and educating our staff in our internal B Corporation learning sessions, team announcements, and employee onboarding.

Through the B Corporation Certification, Elemental has developed a matrix that measures equity, diversity and inclusion progress across the company. Elemental's culturally diverse team includes 36% women. Elemental's goal is to have a gender-balanced team with 50% women and 50% men by end of 2024. Two Elemental employees are from Latin America and 1 from Asia. In addition, Elemental provides internship and co-op opportunities for university students and supports local networking events such as Women in Renewable Energy (WiRE). The WiRE events are organized with the main purpose of advancing the role and recognition of women in the energy sector. During calendar year 2022, Elemental's Director or

Corporate Finance and Operations, Tania Ontiveros, organized two Women in Renewable Energy (WiRE) in-person events. One of the events was sponsor by Elemental. Tania has been the Chapter Lead in Vancouver for WiRE for the past 6 years.

The WiRE Chapter in Vancouver partnered with Women in Sustainable Energy (WISE) on June 8, 2023, to host an event that provided an opportunity for women to connect with women mentors in clean tech, renewable energy, hydrogen, and other industries. Elemental provided a sponsorship for this event. More than 100 people attended the event. Men and other underrepresented groups also attended the event.

Through our community benefit fund, Relay Education provides renewable energy workshops to kids in elementary school and high school on an annual basis on the different communities where our projects are located. During 2021/2022 we provided workshops to 895 students in the provinces of Alberta, Nova Scotia and Newfoundland and we expect to provide workshops for more than 1,000 students in 2023. In addition, the fund will benefit associations that provide support to the community with fee assistance programs, counselling, etc.

7 SCIENTIFIC ACHIEVEMENTS

The Invinity VS3-022 product has a number of patents, is a standardized and factory-built product that has been deployed in its current form since 2021 with no significant technological developments. The Chappice Lake project is the first time a full Invinity VFB project with large numbers of modules has been integrated with SMA's DC-coupled solar and storage solution. Invinity had completed preliminary integration testing at SMA's test facilities in Kassel, Germany previously as part of a similar project using the same architecture, however the test was conducted with a smaller number of individual units. Preparation work was undertaken to align software communication using Modbus TCP/IP protocol between the SMA inverter and the Flow Battery Energy Storage Manager (FBESM).

The BESS dispatch control is the first project in Alberta to manage the charging and discharging of a DC-connected BESS paired with solar. The Arcus model was created for this Project, while the intellectual property is retained by Arcus, and takes into consideration both macro-level inputs such as Alberta load forecasts based on weather and diurnal patterns, as well as project-specific inputs such as solar generation forecasts, grid constraints and battery status.

8 OVERALL CONCLUSIONS

While early in the evaluation of the Project outcomes, the Project has achieved its primary objectives of:

- Installing and commissioning the first DC-connected flow battery paired with a utility scale solar project.
- Creating and implementing the first Alberta battery dispatch model for a renewable-paired battery.

The target outcome for Round Trip Efficiency ("RTE") on the batteries was 70%, while the achieved RTE was 74.8%. The remaining target outcomes require an extended operating period and will be compiled after the third year of operations.

9 NEXT STEPS

Elemental is working with Invinity to explore future opportunities for energy storage in Alberta. The expansion of energy storage will facilitate future renewable growth within the province. Elemental

Energy's current pipeline for late-stage development projects is being assessed for energy storage opportunities to improve overall project economics and protect the investments against future changes in the energy market. Additional opportunities for battery storage exist on some of Elemental Energy's existing operating projects which were constructed to be battery-ready. The opportunities are being assessed financially and Elemental Energy is making plans to submit permit applications.

10 COMMUNICATION PLAN

Summary of Key Knowledge Sharing Activities

The Project partners utilized a wide range of communications tools and tactics across multiple channels to share knowledge about the project. The approach of disseminating difference messages across multiple channels was chosen to achieve maximum impact with a range of audiences including the wider energy industry, both in Canada and internationally, the local community and key stakeholders in Alberta and across western Canada and policy makers at both a state and federal level. The communications plan was executed through close collaboration between Elemental Energy's senior management and Invinity's Marketing and Communications team. Communications initiatives which have already been delivered by the project include:

- Presentations at multiple trade shows including RE+, North America's largest clean energy event.
- Press coverage of the project in both local and international press outlet.
- Multiple factory open days, attended by a wide range of stakeholders at Invinity's facility in Vancouver, BC – including a visit from Minister Wilkinson, who used the opportunity to launch Canada's Clean Energy Strategy.
- Online publication of case studies.
- Creation of several promotional videos prior to installation and during construction.

Plan for Communicating Information about Project & Results

As the project moves into its operating phase, the project partners expect to continue to communicate information about the project results and operation. It is expected that certain key metrics from the project such as total kWh throughput and total emissions reduced will be published in due course along with more general operating datasets which demonstrate how the technology is being used to achieve the desired outcomes and deliverables. This is a strategy that the project partners have used previously with other projects, and it has proven to be an effective means of communicating project results.

On September 21, 2023, the grand opening event took place at the project site, with participation from all partners. This has resulted in further press coverage for the project, along with supporting the creation of so-called "ever-green" materials such as video footage, interviews and photos which can be used repeatedly in the future to support knowledge-sharing activities in the long term.