CASE STUDY

300 MW Henvey Inlet Wind Project

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The 300 MW Henvey Inlet Wind Energy Centre (HIWEC) is the largest single-phase wind project in Ontario, as well as the largest First Nation wind partnership project in Canada. The undertaking was led jointly by Pattern Canada and Nigig Power Corporation, a wholly-owned subsidiary of Henvey Inlet First Nation, where BBA was selected by CER, the general contractor for the project. BBA was chosen for the design and commissioning thanks to our proven ability to deliver renewable energy facilities on time and on budget, with minimal environmental impact.

BBA overcame complex design challenges—largely attributable to challenging soil conditions, sensitive environmental areas, and harsh commissioning conditions—to successfully complete the wind farm, which is effectively composed of two separate facilities, one on each side of an inlet that stretches from Lake Huron into Henvey Inlet Reserve No. 2.

The 300 MW wind energy facility includes 87 turbines spread over a 20,000-hectare area, two 230 kV substations interconnected to the IESO-controlled grid and 110 kilometres of 34.5 kV underground collectors. Today, the facility generates $10 million annually for the Band and clean energy for 100,000 homes across the province.

A landmark project

PROJECT OBJECTIVES, SOLUTIONS AND ACHIEVEMENTS

With thoughtful designs and carefully planned work methods, BBA contributed directly to the project's acceptance by the local community and its successful completion within the strict environmental parameters established by the HIFN Band. To do so, BBA had to plan site work in advance and tailor its designs to ensure minimal disturbance of sensitive areas.

More specifically, we made a tremendous effort to minimize the width of cable trenches and ensure that wind turbine grounding grids would not encroach on environmentally restricted areas. Although these imperatives were further complicated by cost, schedule, soil and weather constraints, our engineers succeeded in finding solutions that satisfied all established criteria. Ultimately, we delivered designs for 173 different trench segments and 25 cable crossings.

POWERING THE FUTURE OF A FIRST NATION

Henvey Inlet First Nation (HIFN), a community with 200 on-reserve residents located some 90 kilometres south of Sudbury, sought to build a wind farm that would turn strong gusts into clean energy. Their vision was to own and operate a facility that would support the Band's future development by providing emission-free electricity and sustainable revenues from the sale of power to the province. However, the HIFN community still needed to be convinced that the development would not come at the expense of the biodiversity and traditional sites located within their Reserve. In order to gain social acceptance, the HIFN Band developed a rigorous environmental program—one that Band Councillor Pat Brennan would later qualify as: **"the Cadillac of environmental [stewardship]"— for all contractors to adhere to.**[1]

Without assurance that all criteria would be met, the Band would not issue a permit and the project would not get the go-ahead. BBA's engineers were therefore tasked with designing and commissioning a facility that would meet all safety criteria while remaining cost-effective and environmentally responsible, two essential project targets.

THE LARGEST SINGLE-PHASE WIND PROJECT IN ONTARIO

300 MW
of wind energy

110 KM
of 34.5 kV buried collectors

Two
230 kVM
substations

[1] CTV News, Canada's largest First Nation wind farm begins operation, accessed on November 25, 2020

LEVEL OF COMPLEXITY AND PROJECT CHALLENGES

WORKING AGAINST THE ELEMENTS TO ENSURE ON-TIME PROJECT DELIVERY

A key project objective was on-time delivery, as any delay in getting the facility up and running would cause a significant loss of revenue for Pattern and the Henvey Inlet First Nation community. However, in the summer of 2018, a wildfire tore through the Parry Sound area, forcing the project site to shut down. The ensuing delay—coupled with the need to complete construction before the onset of winter—resulted in a condensed schedule for various work packages.

BBA's rigorous approach to electrical design, project management and commissioning contributed directly to the project's timely delivery. As expected, **many geographical issues—such as the presence of large boulders and a high water table—became evident during the trench-blasting and cable-laying phase, often forcing our team to produce new construction designs within less than 24 hours** to prevent costly delays associated with idling construction teams and equipment and to ensure phase completion.

We later performed the commissioning during winter, despite harsh climate conditions, in order to keep the project on schedule. Our team rose to the challenge by paying careful attention to risk management, through strategies such as assigning the design engineers to the commissioning phase, remaining attentive to HSE issues, and ensuring clear and continuous communication with the environmental and construction teams.

TACKLING A ROCK-HARD CHALLENGE

Henvey Inlet First Nation Reserve No. 2 is located on the northeast shore of the Georgian Bay and sits within the Canadian Shield, over a very hard granite substrate known for its high thermal and electrical resistivity. The geological conditions posed a substantial challenge for BBA's engineers, as any miscalculation could cause the medium-voltage electrical cables to fail under normal operating conditions. Cables heat up when carrying current, but surrounding rock such as granite can make heat dissipation difficult.

Theoretically, this risk can be mitigated by using different materials for the backfill, or by cutting wider trenches so that cable separation can be increased. However, since these alternatives come at increased financial and environmental costs, BBA's engineers were therefore tasked with finding viable designs that would meet all safety criteria while remaining cost-effective and environmentally responsible, two essential project targets.

LEVEL OF COMPLEXITY AND PROJECT CHALLENGES

Since the project required approximately 65 kilometres of trenching, any small increases in trench blasting or backfill expenses could result in millions of dollars in additional expenditures. **From a human-scale perspective, the reduction in displaced soil may not seem like a dramatic improvement, but multiplied over more than 65 kilometres, it results in substantially less blasting.** This means fewer emissions, less noise to affect wildlife, less damage to natural ecosystems and lower expenditures on backfill.

Balancing the different variables—cable separations, backfill material characteristics, trench width—required numerous rounds of calculations, as the team weighed the relative benefits of modifying each variable. This iterative process was repeated for each unique segment that made up the 110-kilometre collector system and for the cable crossings within it.

COUNTERING THE WINTER COLD

Since the commissioning phase was scheduled for the winter months, climate also posed a risk. With temperatures plunging to an average low of -20°C in January, weather conditions threatened to damage the commissioning team's electronics-based testing equipment. It also increased health and safety risks for our personnel.

To complicate matters, the area was carpeted with 13 feet of snow in 2019, piling up to a record high that no one could have foreseen. BBA prepared tents and frost-fighters to protect equipment—and personnel—from freezing. Our workers wore winter-type PPE, but the biting cold and heavy snowfall still forced us to work quickly. To work safely and effectively, our team used elevated platforms, which increased the risk of error for everyone involved. **Stringent HSE reviews helped keep the team aware of potential hazards and promoted a strong safety culture—one that helped us complete the project with zero losttime injuries.**

KEY OBJECTIVES

- Protect biodiversity and traditional lands
- Develop cost-effective designs with minimal environmental impact
- Deliver on time and on budget while ensuring reliability and team's safety

MAIN CHALLENGES

- High soil resistivity
- Limited or no access to certain areas
- Wildfire and record snowfall
- Need for overnight design iterations

TECHNICAL EXCELLENCE AND INNOVATION

AN ITERATIVE DESIGN PROCESS TO WEIGH ALL OPTIONS

Iterations were also needed to design the grounding grids for the two substations and 87 wind turbines. While granite bedrock is an excellent material for anchoring wind turbines, it is a poor electrical conductor and therefore complicates the grounding of structures. BBA had to search for suitable grounding grid locations and ensure that they did not fall within environmentally protected zones.

THE PROCESS INVOLVED:

1. Surveying all accessible areas
2. Identifying locations that were sufficiently large and had visual indications of low electrical resistivity soils
3. Verifying with the environmental team that selected areas were not sensitive
4. Measuring the soil resistivity
5. Developing computer models to determine whether adding a remote grid at that location was technically and economically feasible

A SINGLE TEAM TO REDUCE PROJECT RISK

Risk management is a key component of any project. For the Henvey Inlet Wind Farm development, BBA mitigated risk by assigning the same team to both the design and commissioning phases. Moreover, the same individuals remained on site for the duration of the commissioning phase.

By eliminating the need for inter-team knowledge transfer, we reduced the risk of error in the commissioning phase, which was already high due to severe weather conditions. The project was completed with no lost time due to injury—a major point of pride for our project manager and the entire team. The decision also helped save on time, further benefitting BBA, the client and the community.

A VAST UNDERTAKING

87
wind turbines

20,000
hectare site

173
unique trench segments with 25 cable crossings

TECHNICAL EXCELLENCE AND INNOVATION

A UNIQUE APPROACH THAT ENRICHES THE ENGINEERING PRACTICE

Assigning the same engineers to both the design and commissioning phases may not be a common practice, but it's one that BBA believes leads to better project outcomes and more well-rounded professionals. When engineers get to see their designs take shape and verify their operations first-hand, they gain valuable experience and enriched expertise.

It's a gratifying process that drives a commitment to excellence. And in the end, all of society benefits when it can rely on qualified engineers who bring deep and far-reaching knowledge to infrastructure projects. BBA firmly believes that this work method will benefit future projects across Ontario and Canada.

CONTRIBUTION TO ECONOMIC, SOCIAL & ENVIRONMENTAL QUALITY OF LIFE

TRULY SUSTAINABLE

The Henvey Inlet Wind Farm project is an example of sustainable development in its truest sense. Already, it is providing significant social, environmental and economic benefits that are sure to last well into the future. This includes significant and reliable revenue for the Band—estimated at $10 million annually—and clean energy for 100,000 homes across the province of Ontario.

ENVIRONMENTAL BENEFITS

Renewable energy projects like the wind farm at Henvey Inlet First Nation Reserve No. 2 are helping Ontario meet its power demands while simultaneously reducing the impact on our environment caused by climate change. Wind energy generates electricity without emitting air pollutants, particulate matter or waste of any kind. Generating 300 megawatts of power from Henvey Inlet Wind instead of from coal contributes to cleaner air and conserves water resources. In fact, every year, this facility saves: 851,000 metric tonnes of carbon dioxide, 4,100 tonnes of sulphur dioxide and 1,200 tonnes of nitrogen oxides.

GENERATES ENOUGH CLEAN ENERGY FOR

100,000
homes

$10 million
annual net proceeds for the Henvey Inlet First Nation

770,000
tonnes of CO_2 saved compared with coal

Source: https://henveyinletwind.com/

CONTRIBUTION TO ECONOMIC, SOCIAL & ENVIRONMENTAL QUALITY OF LIFE

SOCIAL AND ECONOMIC BENEFITS

The social and economic benefits of this project are fundamentally intertwined. By providing a diverse range of well-paid employment and contractual opportunities, the project increases the community's overall wealth and financial stability.

Having a source of reliable revenue and emissions-free energy within their territory also gives the Band the chance to move forward with other development initiatives, such as expanding health and education services. They can now confidently envision building additional infrastructure for their community, knowing they will have the power and capital needed to make these objectives a reality.

The Henvey Inlet Wind Energy Centre helps make the First Nation richer and more self-sufficient. When local youth and young adults can foresee a bright future for themselves on their land, the benefits become immeasurable.

"Now that construction is complete, we can begin to look forward to economic independence as a community. Our youth will see an even brighter future from expanding health and education services along with increased infrastructure."

- Greg Newton,
  CEO of Nigig Power Corporation
  Press Release: Oct. 15, 2019

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.

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