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FORT SEVERN SOLAR PROJECT

**CANADIAN CONSULTING ENGINEER
AWARDS 2020**

Prepared by: Hedgehog Technologies

PROJECT SUMMARY

Fort Severn First Nation is striving to reduce its dependency on diesel-generated energy as a way to protect its traditional territory which it shares with Ontario's last remaining polar bear population.

Since the 1990s, Fort Severn has explored alternative energy sources but have not found the right project manager to realize their vision. Three years ago, a young chief named Paul Burke was elected with a promise to restart the halted 300-kW solar project and hired Hedgehog Technologies as the project manager.

Chief Paul Burke and Council provided the leadership and persistence to turn the community's vision into action. Hedgehog Technologies transformed its vision into a project plan and executed it despite the challenges of climate, geography, and technology.



COMPLEXITY

Fort Severn First Nation, the traditional territory of the Wasaho Cree Nation, is located close to the mouth of the Severn River that spills into Hudson Bay. Fort Severn First Nations are strengthened by their deep-rooted Cree culture and relationship with the polar bear, caribou, sturgeon, and other wildlife in the lowlands. The community relies on diesel generators to power their infrastructure but without an all-season road, isolation and extreme weather conditions can make it difficult to access essential goods. Depending on the season, the route to deliver supplies switches between winter ice roads, barges, or air cargo. Each alternative has a narrow window of availability.

Fort Severn First Nation and Hedgehog Technologies overcame a significant challenge that required an electrical house (e-house) to be positioned near the solar array. Fort Severn First Nation acquired a large crane to perform the operation which they stored in Moosonee, Ontario. Then Hedgehog planned to load the crane onto a barge and transport it across James Bay to the project site. At the time, James Bay faced an unusual buildup of ice which meant the barge wasn't authorized to leave the port for an entire year. Hedgehog had to shift towards a high-risk contingency plan: digging a trench to make the flatbed truck sit at ground-level before dragging the e-house to the target location using two existing excavators.

Due to the orientation of the solar array, the structure had to be pulled sideways which increased the risk of tipping. This plan required extensive calculations, modeling, and coordination which became critical to the project for two reasons:

1. Damaging the e-house would pose significant delays in the project timeline.
2. Purchasing a new e-house would exceed the already constrained budget.

Hedgehog contracted Igloo Innovations to perform an analysis of the e-house to ensure its safe delivery. The study highlighted whether the lift points and surrounding structure could withstand the lateral loads from dragging it into position. Then a finite element analysis (FEA) determined how the pull, friction, and ambient temperature would affect the structure and provide insight into the static and dynamic load types, pull force, max stress, and safety factor. On the day of the move, a blizzard reached Fort Severn which added another layer of complexity in regards to worker safety and execution.

Hedgehog and the general contractor team at Bower Electric proceeded with the plan and successfully installed the e-house without incident.

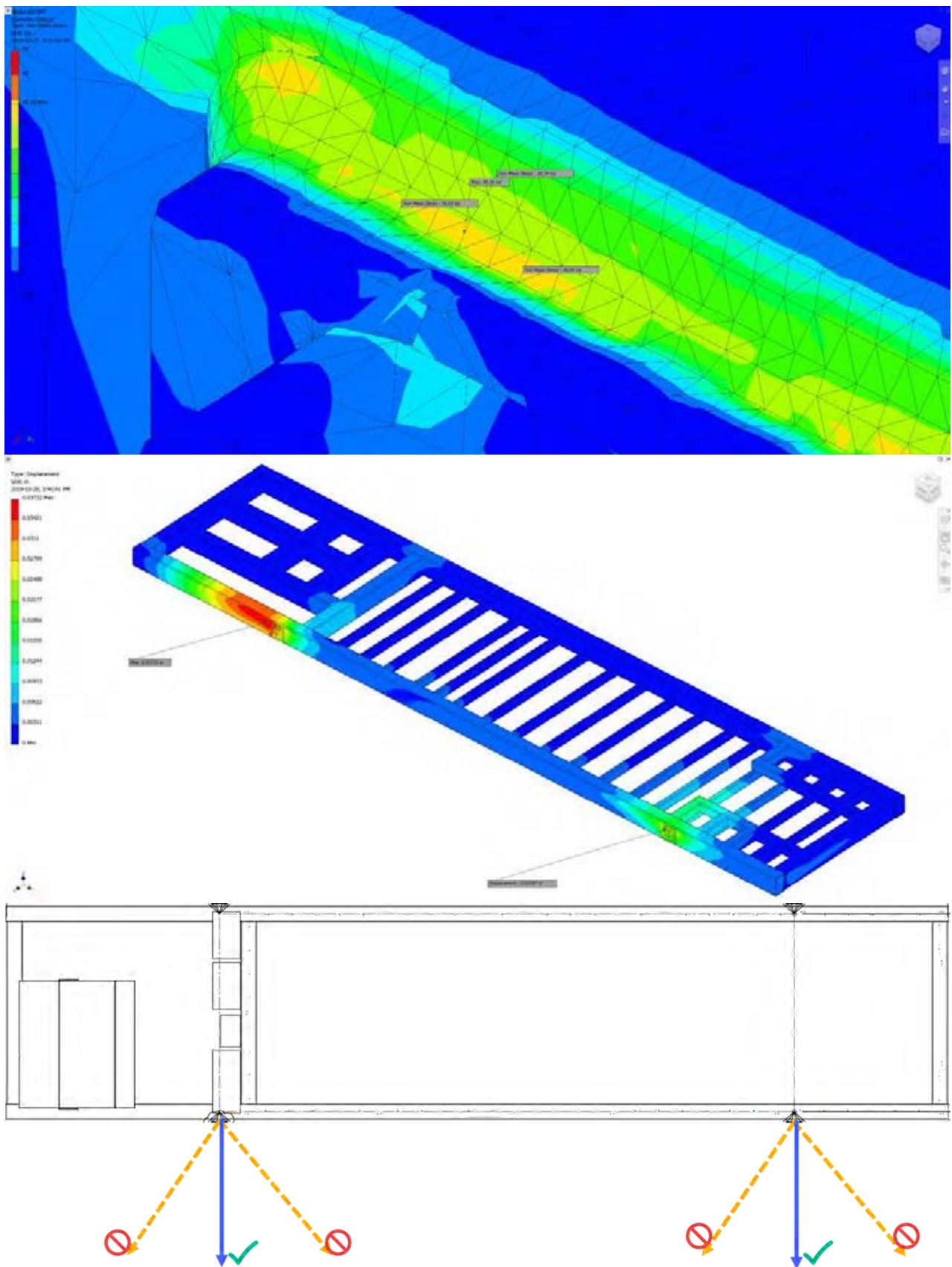


FIGURE 1: E-house structural analysis.



FIGURE 2: E-House stored on a flatbed truck.



FIGURE 3: E-house dragging technique.

MEETING CLIENTS' NEEDS



In 2016, after an extensive tendering process, Fort Severn First Nations hired a qualified subcontractor to manage the complex solar project. With the remote placement of the community and their seasonal weather challenges, the project was underestimated and exceeded the budget before the subcontractor had to be replaced.

Dr. Michael Wrinch, Principal of Hedgehog Technologies, visited Fort Severn and worked with the chief and the local community to understand their unique culture and project challenges. Being a project management professional with experience in remote environments, he understood the entire scope of the project and how to deliver it within the new budget which was funded by multiple sources.

The stakeholders of this project include the following organizations:

- Fort Severn First Nation
- Northern Ontario Heritage Fund Corporation (NOHFC)
- Indigenous Services Canada (ISC)
- National Research Council of Canada (NRC)
- Independent Electricity System Operator

Chief Burke directed Hedgehog to update the designs to meet the new conditions of the project. Then produce calculations and studies such as the annual power generation projections and protective device coordination to ensure the solar array didn't cause disruption to the local utility's operations.

Hedgehog was mandated by Chief and Council to play a key advisory role in negotiating the connection agreement and power purchase agreement. With the dedication of all parties involved, the once stagnant project (which had been considered abandoned a few years ago) suddenly had a plan to make it a reality.

A large green modular building is being transported on a flatbed trailer pulled by a truck. The scene is set in a snowy, overcast environment. The building has a corrugated metal exterior and a small arched window. The truck's front end, including the headlights and a yellow safety chain, is visible in the foreground. The ground is covered in a layer of snow.

PROJECT INNOVATION

Innovation often arises when there are uncertain weather conditions. A prime example is dragging the e-house into position using two excavators. While the dragging method isn't revolutionary, it's not common to perform a lateral pull with a structure that is not designed for lifting.

Hedgehog understood the risk factors from extensive calculations and modeling. The data provided key insights into visibility, temperature changes, lift angles, load shifts, and structural weak points. With the comprehensive analysis, the excavators were able to successfully drag the e-house into position during a blizzard—even with the arrival of curious polar bears!

Another unique aspect of the project is the community involvement throughout the planning phase since Hedgehog Technologies joined. The community had been excluded from previous teams which ultimately led to past failures. Chief Paul Burke and Hedgehog brought the community together to hear opinions, involve residents in the supervised building of panels, create training initiatives such as the Solar Install Training Program, and provide general education on maintaining the new solar array.

The goal is to build independence within the community to sustainably manage their energy needs while empowering the people to be part of the solution.



ENVIRONMENTAL BENEFITS

"IT WAS CRITICAL THAT WE DISPLACE DIRTY FOSSIL FUELS WITH CLEAN ENERGY TO PROTECT THE TWO REMAINING POLAR BEAR POPULATIONS IN ONTARIO'S FAR NORTH." — PAUL BURKE, CHIEF OF FSN

There are currently 170 remote indigenous settlements across Canada (NRCAN) that operate on diesel fuel. This 300-kW solar installation will reduce GHG emissions from the extraction, production, and transportation of diesel fuel to Fort Severn.

The reduction of diesel consumption will lower the amount of fuel needed to travel across winter roads, barge, or air cargo. This limits the risk of spillage which would destroy polar bear denning areas along the Severn River. Previously, a barge ship containing food supplies for Fort Severn sunk during its route through James Bay. While the loss of food negatively impacted the community, greater damage could have been sustained to the ecosystem had the barge been transporting barrels of diesel at the time. An environmental disaster would push the polar bear in Ontario's Far North to the brink of extinction from the devastating effects on the territory and food chain.

With a new system for clean energy production, Fort Severn will encourage low carbon emissions to save about 123,140 liters of diesel per year which equals about 62 vehicles off the street. The project will allow the Fort Severn First Nations to align closer with their cultural vision.



SOCIAL/ECONOMIC BENEFITS

"HEDGEHOG WORKED CLOSELY WITH COMMUNITY MEMBERS WHOM THEY TRAINED TO BECOME THEIR EMPLOYEES AND RAISED AWARENESS OF THE MANY CHALLENGES WE WOULD FACE." — PAUL BURKE, CHIEF OF FSN

Fort Severn's vision for self-sufficiency required Hedgehog to facilitate training programs for the community. This included teaching the locals how to perform routine maintenance and operating the control systems in order to restart the solar array in the event of a problem. Having the ability to independently manage their supply of energy with the flexibility to adapt to extreme changes in weather conditions offers a sustainable advantage to the remote town.

Fort Severn is also reducing its diesel consumption by roughly 123,140 liters which are about \$307,850 worth of savings annually. The project also supports its economic development through job creation associated with operating the solar array and performing maintenance. These economic drivers are important to the growth of Fort Severn.



FIGURE 4: Bower Electric installing solar panels.



FIGURE 5: Drone footage of Fort Severn solar project.



FORT SEVERN SOLAR PROJECT

Fort Severn First Nations
Project Owner

Hedgehog Technologies
Project Managers

Bower Electric Co.
Contractors

Igloo Innovations Inc.
Structural Advisors

