

April 2022



# FORT SEVERN FIRST NATION SOLAR ARRAY



*PREPARED BY*  
Hedgehog Technologies

*PREPARED FOR*  
Canadian Consulting Engineer Awards

Category: Natural Resources,  
Mining, Industry, Energy



## INTRODUCTION

As protectors of the declining polar bear population in Northern Ontario, The Fort Severn First Nation (FSFN) have a vision for renewable energy to power the community.

The FSFN wanted to complete a 300-kW solar array to offset the remote community's energy demand. Hedgehog Technologies led the project management, engineering, and coordination of logistics.

In collaboration with Chief Paul Burke, community training programs were developed to support Fort Severn in maintaining the project after completion.

## STAKEHOLDERS







## COMPLEXITY

Fort Severn is located close to the mouth of the Severn River that spills into Hudson Bay. The Fort Severn First Nation relies on diesel generators to power their infrastructure but without an all-season road, extreme weather conditions can make it difficult to access essential goods. The supply route shifts between ice road, barge, or air cargo depending on the season.

With the added complexity of the COVID-19 pandemic, logistics played a defining role in the outcome of this project. Any miscalculations, shifting weather patterns, or replacement components made the budget vulnerable to the rising costs within the supply chain.

For example, In the Spring of 2020, a large crane was scheduled for shipment by barge across James Bay. The goal was to position an electrical house (e-house) near the solar installation. With an unusual build-up of ice from the winter season, the barge was denied clearance to leave the port until the following year. Hedgehog devised a contingency plan to use local excavators and pull the e-house into position. Any damage sustained to the structure would have been expensive to replace and delayed the project indefinitely.

Hedgehog performed a finite element analysis (FEA) to determine how temperature and friction could affect the e-house. It was important to understand how the structural weak points could withstand a lateral pull motion. On the day of installation, a blizzard reached Fort Severn. Hedgehog and the contractors at Bower Electric proceeded to drag the e-house to its destination through the snowy terrain.

# FIGURE 1

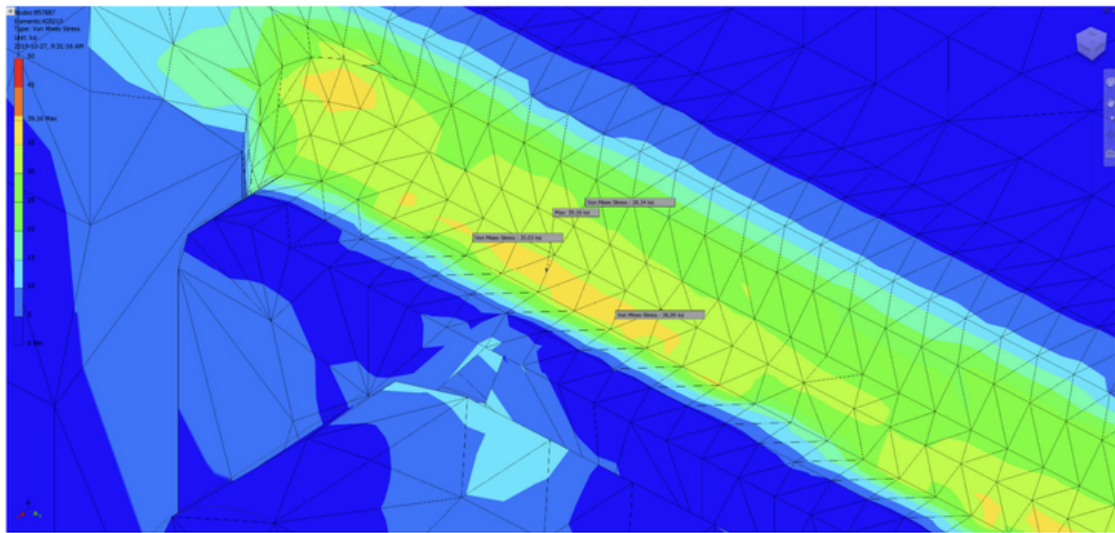


Figure 10 - Stress, Pt B closeup (max probed 36.09 ksi)

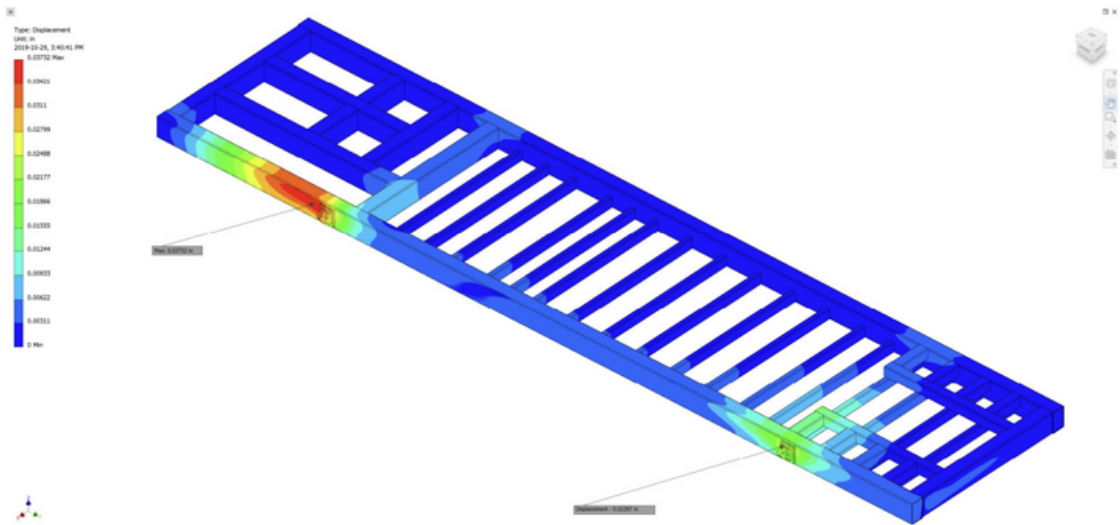


Image: E-House structural analysis

## FIGURE 2



*Image: E-house installation during a blizzard*



*Image: Solar panel installation team*





In 2016, Fort Severn First Nations hired a contractor to manage the solar project. Given the remote placement of the community, complexity, and seasonal weather challenges, the project was underestimated and exceeded the budget and the subcontractor had to be replaced.

Dr. Michael Wrinch, P.Eng., principal engineer at Hedgehog Technologies, visited Fort Severn to meet with the Chief to learn about the unique aspects of Fort Severn culture, the foreseeable challenges, and how to revive the project within budget.

The nature of this project involved several key stakeholders:

- Fort Severn First Nation (FSFN)
- Hydro One Remote Communities
- Electric Safety Authority of Ontario
- Northern Ontario Heritage Fund Corporation (NOHFC)
- Indigenous Services Canada (ISC)
- National Research Council of Canada (NRC)
- Independent Electricity System Operator (IESO)

Working with the above parties, Hedgehog applied a risk-based project management approach to complete the deliverables. This included providing studies such as a projection of annual power generation and protective device coordination which ensures the solar array does not create disruptions to the local utility. Negotiations for the connection and power purchasing agreements were also championed by Hedgehog, the Chief, and Council. Through the dedication of each party, the once abandoned project became a reality.



## INNOVATION PT.1

For a remote First Nation community, the transition to solar energy is a forward-thinking step in the direction of sustainability. Unique projects such as renewable energy systems in remote regions are challenging to manage due to location, harsh weather conditions, availability of resources, and communication. To navigate this, Hedgehog adopted an innovative project management strategy that combined Agile and risk-based project management.

Agile Risk Management is an innovative approach to the typical resource-based project plan. A standard project will have sequential steps that are interdependent whereas Agile uses a standard list of objectives in conjunction with a project risk register that is updated regularly. This allows for Agile 'sprints' to address the higher risk activities and re-order its prioritization in real-time.

The risks were quantified as:

High risk: results in a failed project including technical, financial, or indefinite delays.

Medium risk: causes significant delays or costly remediation actions.

Low risk: considered non-contentious and does not change the project direction.

The Agile Risk Management style of project planning enabled the team to react to unpredictable events such as severe weather impacts, the COVID-19 pandemic, equipment failure, and major design modifications while remaining on schedule and within budget.





## INNOVATION PT.2

Solar power goes beyond saving money, it represents a paradigm shift in the way Fort Severn First Nation is moving from the fossil fuel economy. Fort Severn has become a blueprint for other Indigenous communities to follow.

This project is proof that renewable energy can operate on microgrids for which a First Nation community can independently manage their own energy needs. By using advanced technology, Fort Severn First Nation improved their ancestral connection to the ecosystem while forging strong partnerships that were required to make this project successful.

The final step was developing an operations and maintenance program that included training, manuals, and operational procedures. The community energy champion was trained as the local operator who oversees repairs with the support of Hedgehog.

Fort Severn First Nation showed determination and perseverance in the face of extreme weather, logistical challenges, and a global pandemic that jeopardized public safety. The methods and technologies used in this project are a testament to the innovation that allowed this project to be completed in a timely manner.





## ENVIRONMENT

Fort Severn shares the wetlands of Hudson Bay with an at-risk polar bear species. Climate change is a major factor that is affecting the lifestyle of the FSN who depend on trapping, fishing, and hunting to thrive. The community considers such wildlife as an important part of the ecosystem and takes pride in protecting the polar bear dens during mating season.

The completion of a solar array provides Fort Severn with sustainable energy while offsetting its dependence on diesel generators. It is expected to displace up to 400,000 liters of diesel on an annual basis factoring in the additional cost of transporting barrels using cargo planes, ice roads, or barge ships during season changes.

Previously, a barge containing food supplies for Fort Severn sank on its route through James Bay. While the loss of food negatively impacted the community, it had the potential to be an environmental catastrophe had it been filled with barrels of fuel.

The Fort Severn First Nation took an innovative approach to reduce its greenhouse gas emissions through solar energy. Now Chief Paul Burke wants to empower other remote First Nation communities across Canada to do the same.



## ECONOMIC ADVANTAGE

In collaboration with Chief Paul Burke, Hedgehog developed community training programs to teach the local residents how to maintain and repair the solar array. Through this initiative, new economic opportunities have emerged in Fort Severn.

An example is a young electrician named Owen Miles who was designated by the Chief as community energy champion to oversee the solar project after completion. These economic drivers are important to Fort Severn's economy and future.

The solar array is expected to generate savings between \$250,000 to \$350,000 annually depending on the amount of available sunlight. Chief Paul Burke recognizes that the cost savings will provide more control over finances and he plans to invest this into the development of new homes across Fort Severn.





**FORT SEVERN FIRST NATION**  
Project Owner

**HEDGEHOG TECHNOLOGIES**  
Project Manager/Electrical Engineering

**BOWER ELECTRIC CO.**  
Contractors