Coral Harbour Solar Project

Energy Yield Assessment

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greencat Renewables

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Table of Contents

1 Introduction

1.1 Project Overview

Northern Energy Capital retained Green Cat Renewables Corporation (GCR) to conduct an Energy Yield Assessment (EYA) for the Coral Harbour Solar Project (the Project). The proposed solar photovoltaic (PV) project requires approximately 6.5 acres of land and is located approximately 11km from the town of Coral Harbour and 1.5km from the Coral Harbour airport in Nunavut, Canada. The Project will consist of approximately 2,000 fixed-tilt solar modules with a total generation capacity of 0.96 MW_{AC}.

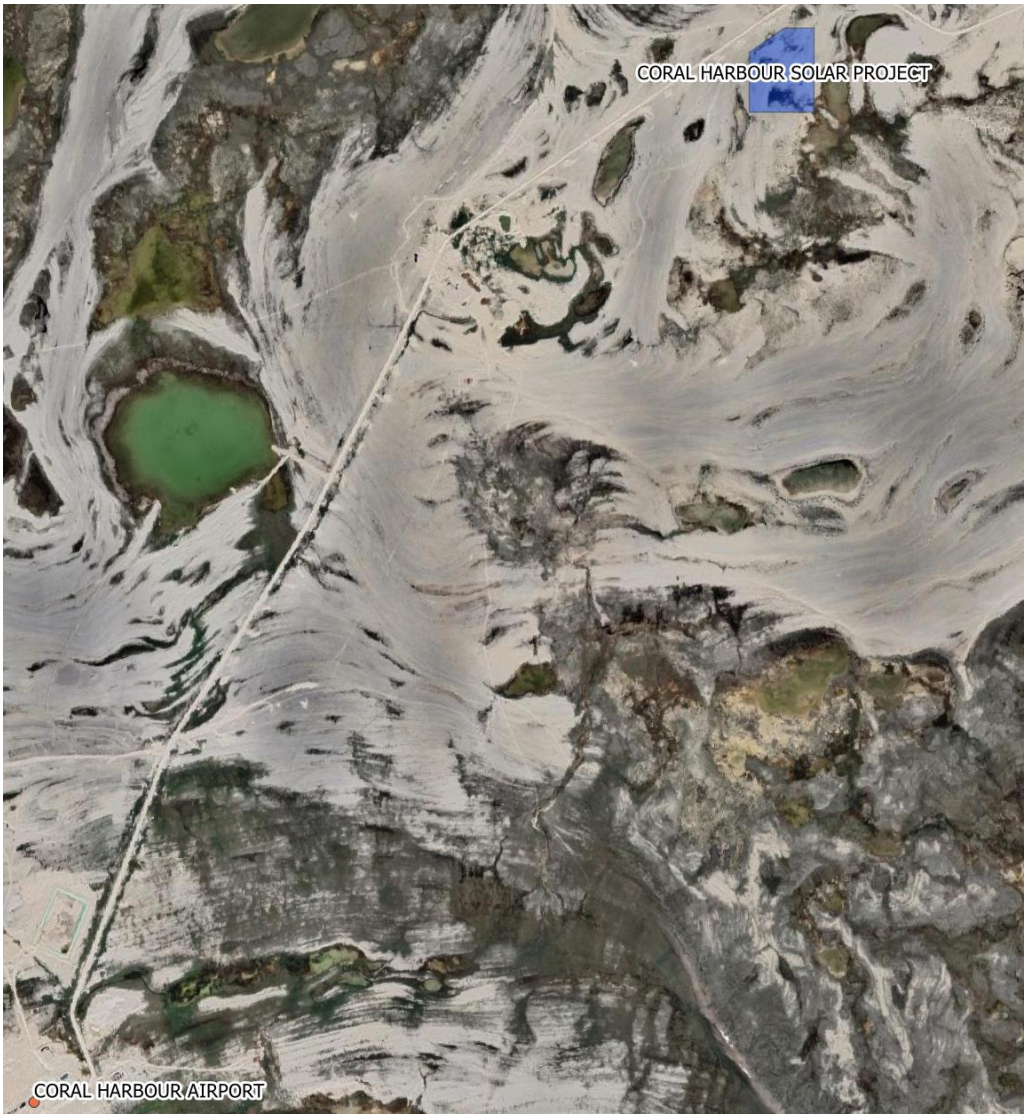

Figure 1-1: Coral Harbour Solar Project Site and Location

2 Assessment Methodology

2.1 Modelling Software

The energy generation was modelled in PVsyst 7.2 simulation software. PVsyst is considered the solar industry's preferred software simulation tool for bankable energy yield analyses.

2.2 Irradiance

Irradiance levels used within this assessment have been obtained from the Meteonorm 8.0 database. Meteonorm is a solar irradiance database developed by Meteotest. It was first released in 1985 and is widely used throughout the solar energy industry for assessing irradiance to inform energy yield production from solar farms throughout the world.

The Meteonorm irradiance figures are based on a combination of measured and modelled irradiance. The horizontal irradiance is converted to the in-plane irradiance within PVsyst using the Perez Model.

2.3 Assumptions

In September 2020, GCR prepared a technology comparison review for Northern Energy Capital that assessed various solar layout options to determine which option had the highest annual energy yield. It was determined that the fixed tilt system with 20m spacing and 45° tilt angle was the most optimal design.[1] Using the parameters defined in this report and typical design assumptions of similar solar projects, an energy yield assessment was conducted.

The array configuration modelled within the Energy Yield Assessment is shown in Table 2-1.

Table 2-1: Array Configuration

Parameter	Value	Description
Axis Tracking	None (Fixed Tilt)	Modules are mounted on fixed tilt racking
PV Module	Longi LR5-72HBD-540M Bifacial	Manufacturer and Model
PV Module Capacity	540W	Module Capacity at Standard Test Conditions
Inverter	Sungrow SG350HX	Manufacturer and Model
Inverter Rating (Max)	352kVA	Inverter Rating at Standard Test conditions
Inverter Rating (Nominal)	320 kVA	Inverter Rating at 40°C
Panel Azimuth	180° (Due South)	Azimuthal position measured from true north
Panel Tilt	45°	Tilt angle of the module measured from vertical
Panels on Vertical	2	Number of panels per table on the vertical axis
Panels on Horizontal	12	Number of panels per table on the horizontal axis
Panels per Table	24	Number of panels per table

[1] Coral Harbour - Technology Comparison Analysis (Sept. 2020)

Parameter	Value	Description
Inter Row Spacing	20m	Center to center distance between table rows
Inter Table Spacing	0.25m	Distance between tables
Minimum Module Height Above Ground	0.6m[2]	Approximate height at the bottom of the array
Maximum Module Height Above Ground	3.79m	Approximate height at the top of the array
Albedo	Varies Monthly[3]	Fraction of global incident radiation reflected by the ground

2.4 Site Layout

A site layout was created using the assumptions above as a basis of design. The layout can be seen in Figure 2-1 below. This layout was used to create a shading profile in PVsyst that calculated the energy losses due to shading.

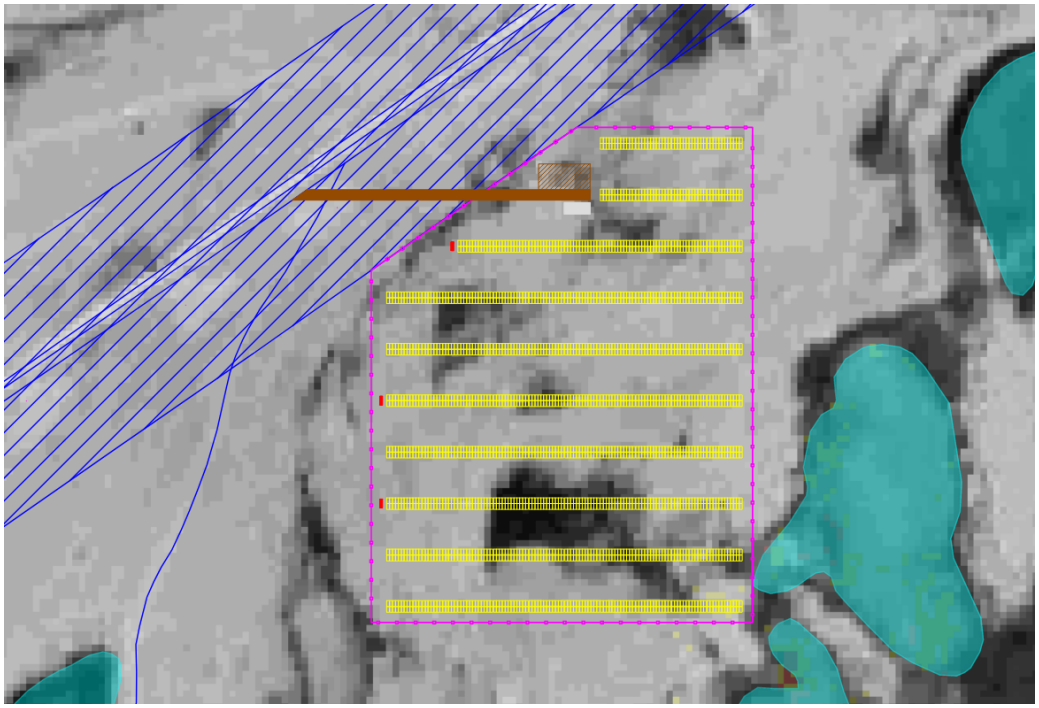

Figure 2-1: Coral Harbour Solar Project Site Layout

[2] Average snow depth in 2020 was approximately 0.5m. An additional 0.1m has been added to minimize the effects of accumulated snow on energy yield
[3] Monthly albedo values derived from snow on ground data provided by the Government of Canada and typical PVsyst albedo values

3 Results

The results of the energy yield assessment are given in Table 3-1. The full PVsyst report can be found in Appendix A.

Table 3-1: PVsyst Energy Yield Assessment Results

Parameter	Value	Comment
Average Annual Global Horizontal Irradiance	1030 kWh/m^2	Meteonorm 8.0 database figure.
Near Shadings: Irradiance Loss	-4.95%	Includes for inter-row shading.,
IAM Factor	-1.90%	Includes for irradiance reaching PV cell's surface.
Soiling Loss Factor	-2.71%	Includes for soiling losses.
Ground Reflection Gain	2.45%	Includes for gains from ground reflection losses.
Bifacial Annual Global Incident Radiation on Ground	708 kWh/m^2	Determined in PVsyst based on the ground cover ratio.
Global Irradiance on Rear Side	15.68% (216 kWh/m^2)	Overall irradiance exposure on the rear side of the modules. Includes for rear shading losses of ground reflection losses (albedo specified), total diffuse irradiance and the rear side view factor.
Annual Array Nominal Energy at STC	1,709 MWh	Energy theoretically available at the module surface
Annual Array Virtual Energy at MPP	1,667 MWh	PVsyst calculation. Accounts for losses on the DC side prior to the inverter.
Annual AC energy at Inverter Output	1,626 MWh	PVsyst calculation. Energy available at the inverter output (accounting for inverter losses)., prior to accounting for the distance between the inverter, transformer, and connection point.
Annual Energy to Grid	**1,596 MWh**	Energy available for grid export. This figure is representative of a raw energy yield and does not account for scheduled downtime and grid availability or degradation.

4 Conclusion

The proposed site has been assessed to determine the theoretical energy yield of the Project. It was determined that the site could feasibly accommodate a PV array of approximately 1.115 MWp. The potential energy yield of the Project is 1,596 MWh per year.

Appendix A – PVsyst Report

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