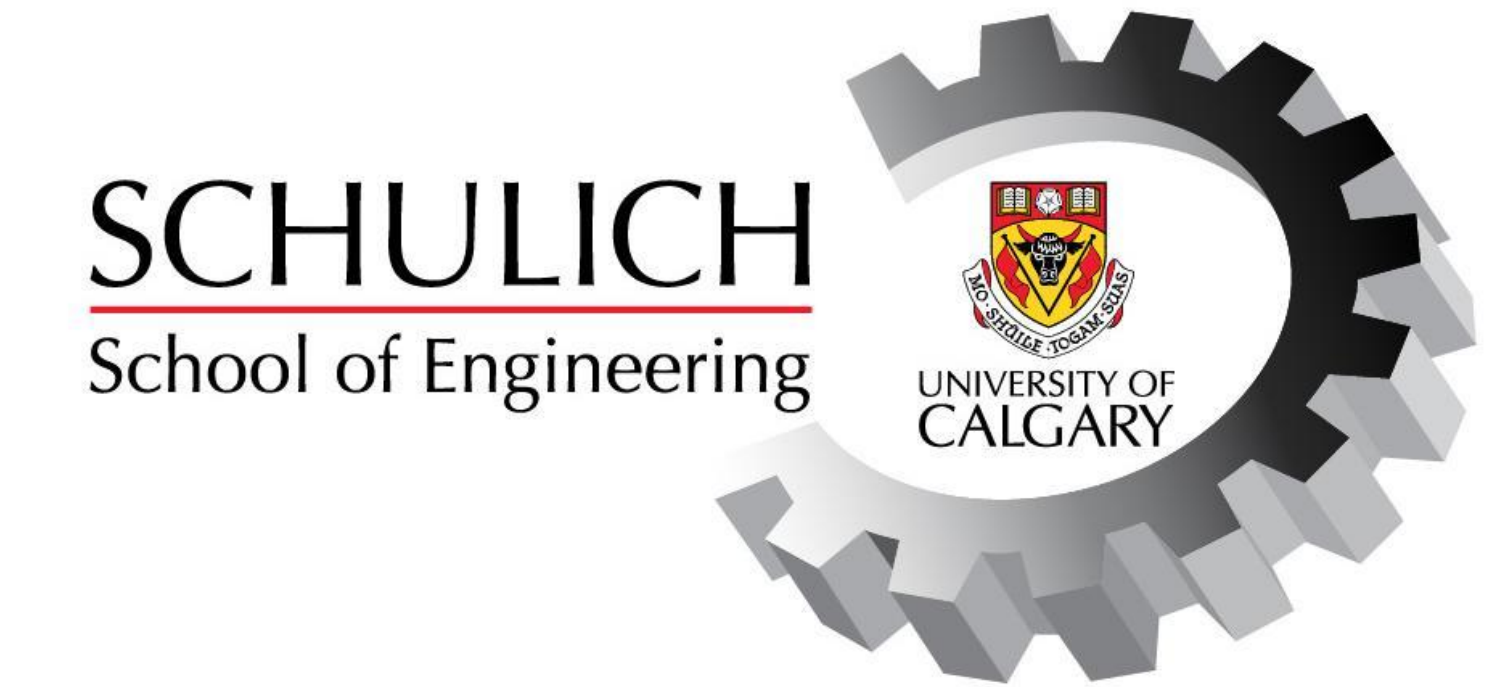


Algae Deterrent Pump System

Schulich School of Engineering, University of Calgary



Problem

Background

The facultated lagoon at the Tsuut'ina Nation receives water from 7 surrounding buildings.

Volume: 14200 m³
Max Depth: 2.5 m

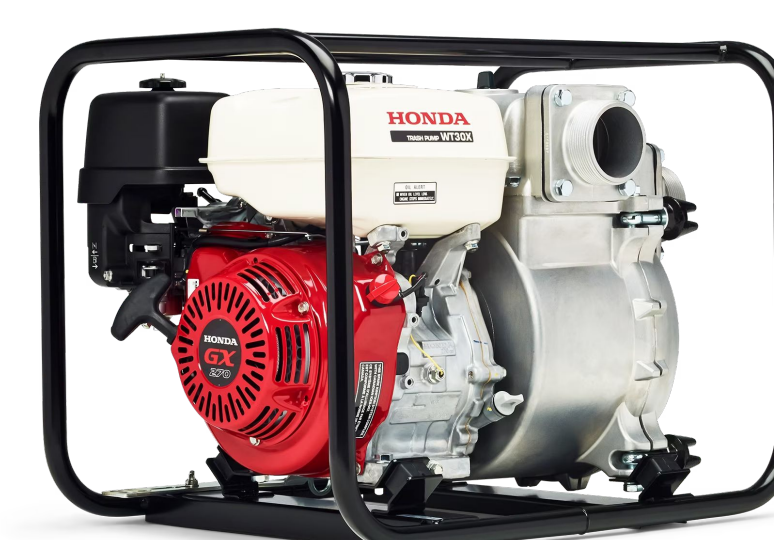


There is no power available on nearby or on site.

Problem Statement

Excessive filamentous algae in the Tsuut'ina Nation lagoon affects water quality and discharge.

Current Solution



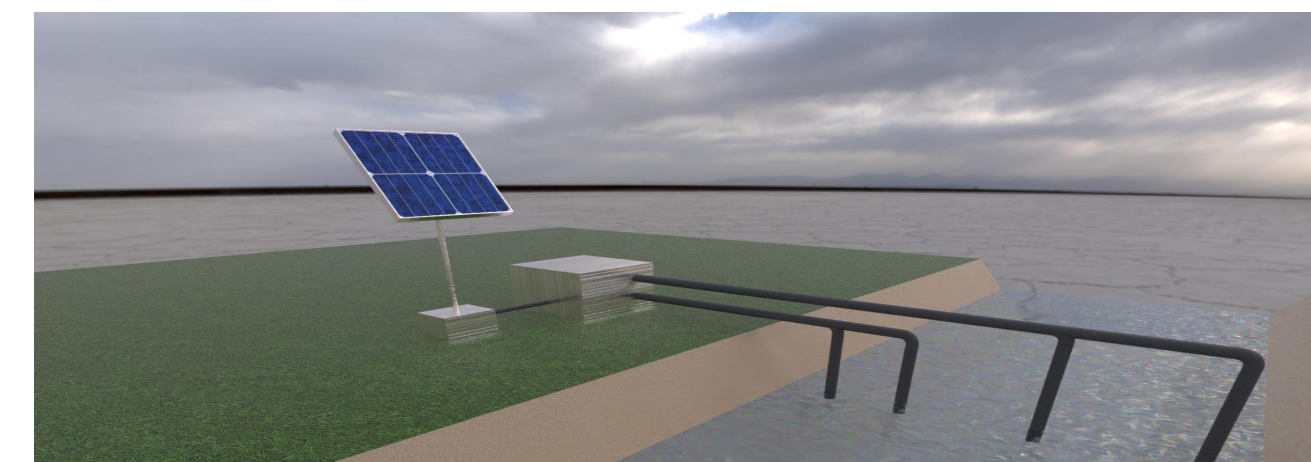
Manual gas powered Honda trash pump with 20 L/s flow rate

Objectives

- Design an autonomous high-volume pump system for large-scale lagoons that utilizes renewable energy
- Reduce algae growth and enhance wastewater quality by circulating water
- Perform CFD modelling, develop a detailed BOM, comprehensive design methodology and a small-scale prototype

Solution and Methodology

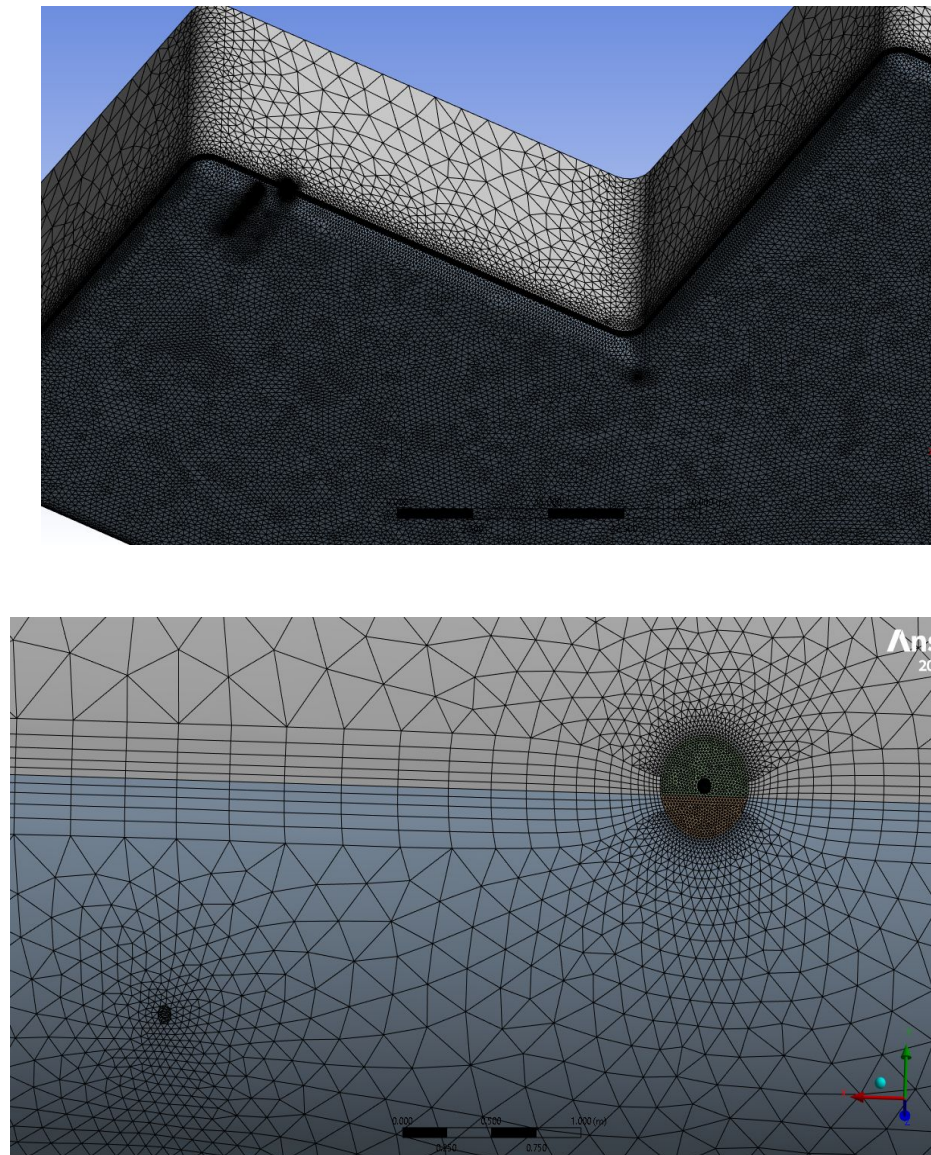
Solar Panel-Powered Solution with Battery Back-up



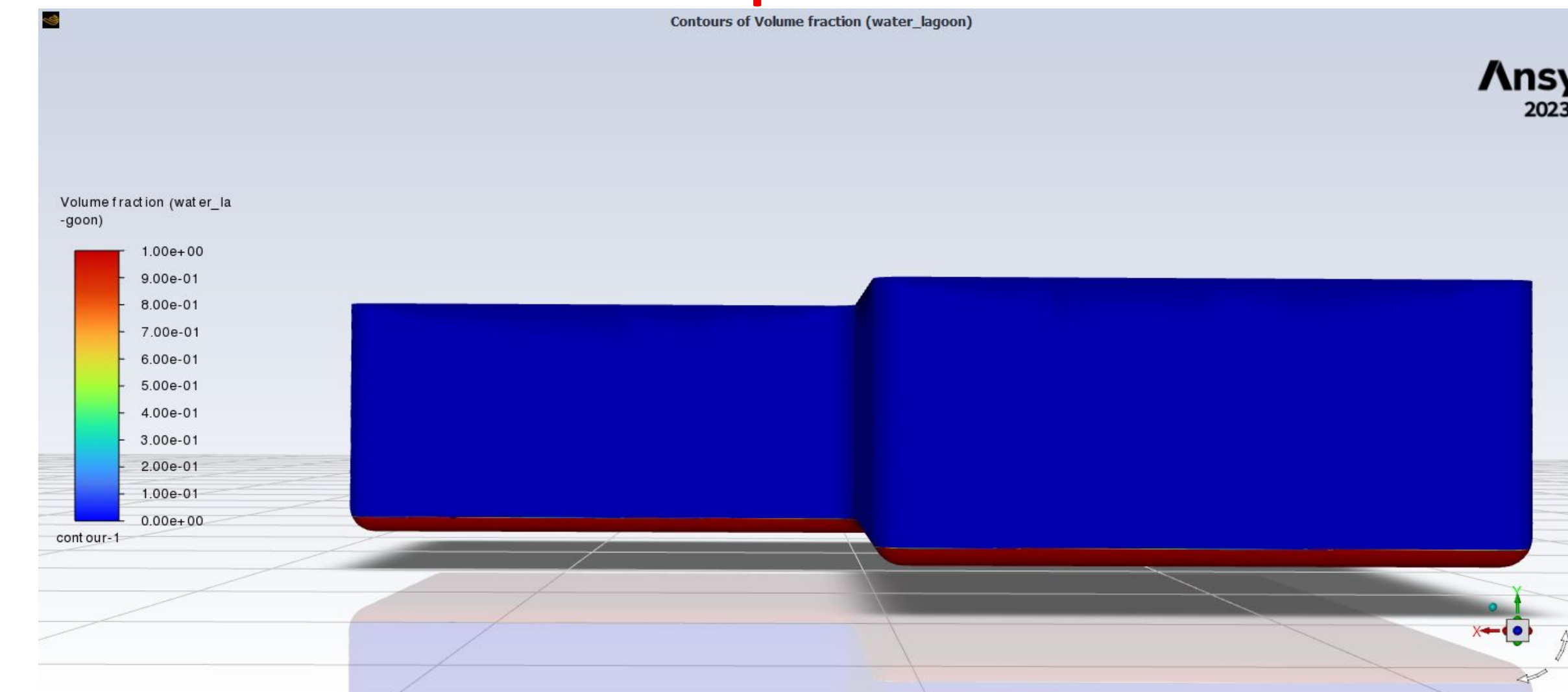
Solar power operated pump system to mitigate the algae problem in the entirety of the lagoon. Involves the solar panels, charge controller, battery bank, inverter, timer, and a centrifugal pump.

CFD Modelling

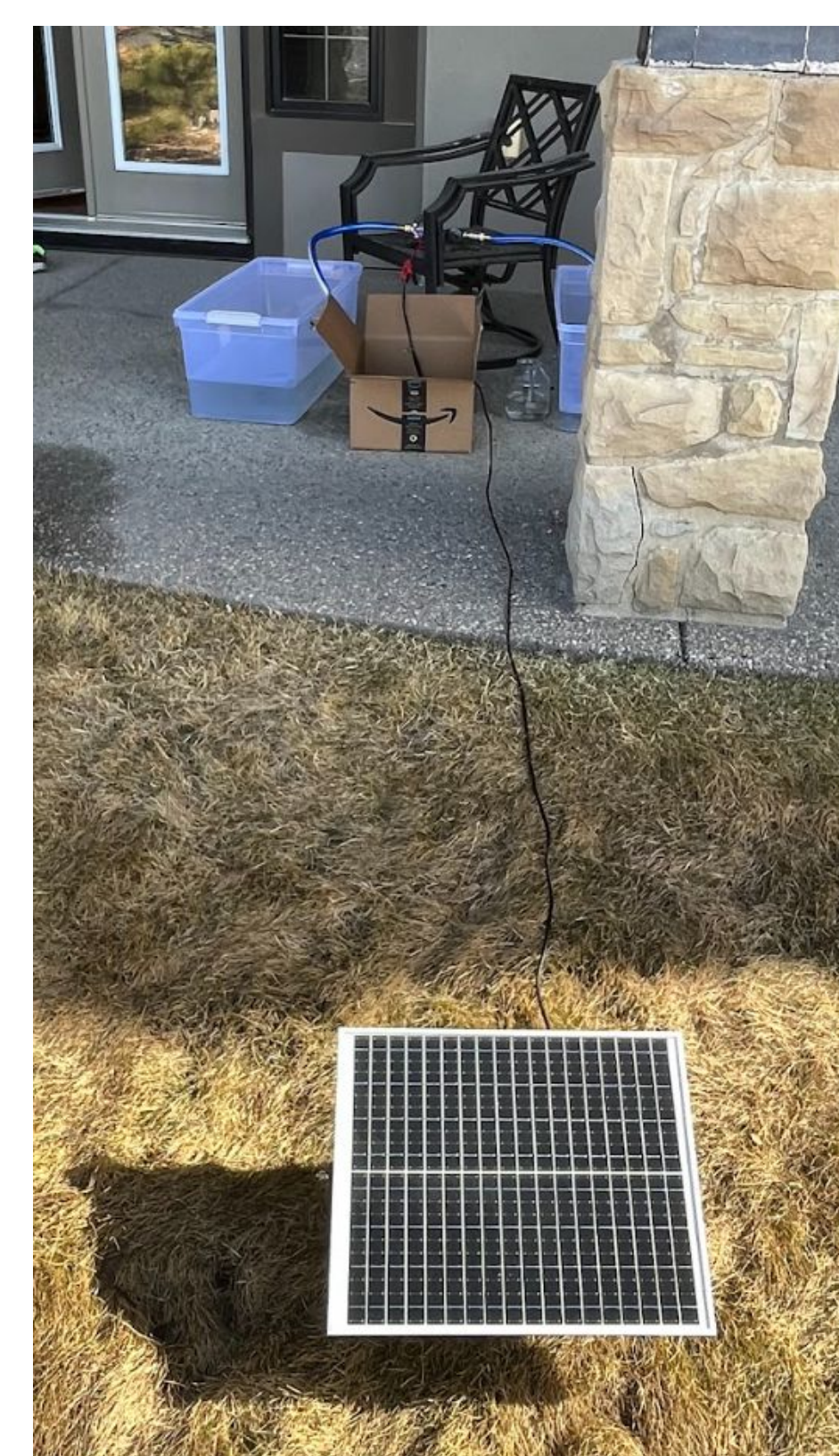
Meshing



Setup

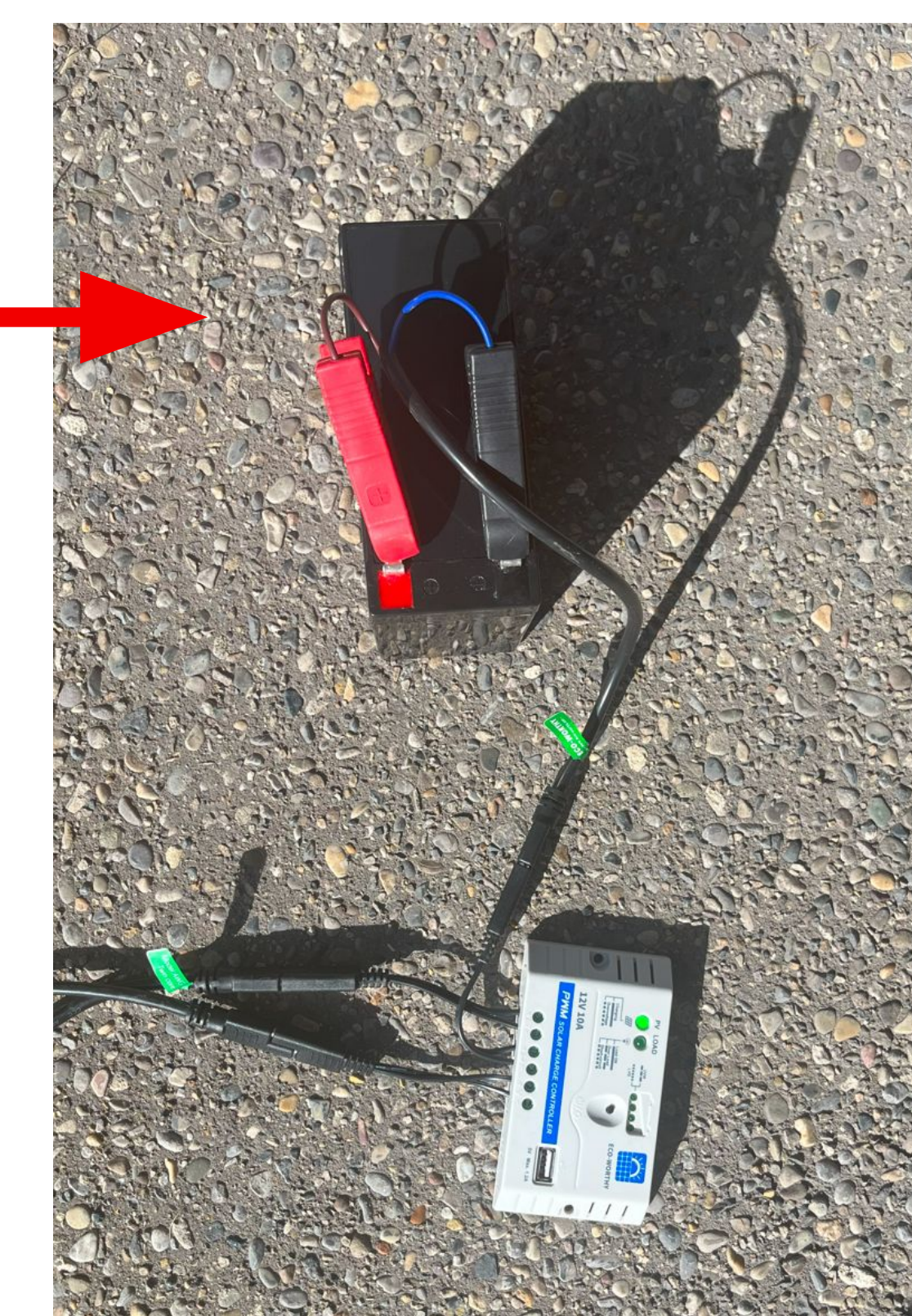


Prototype and Testing



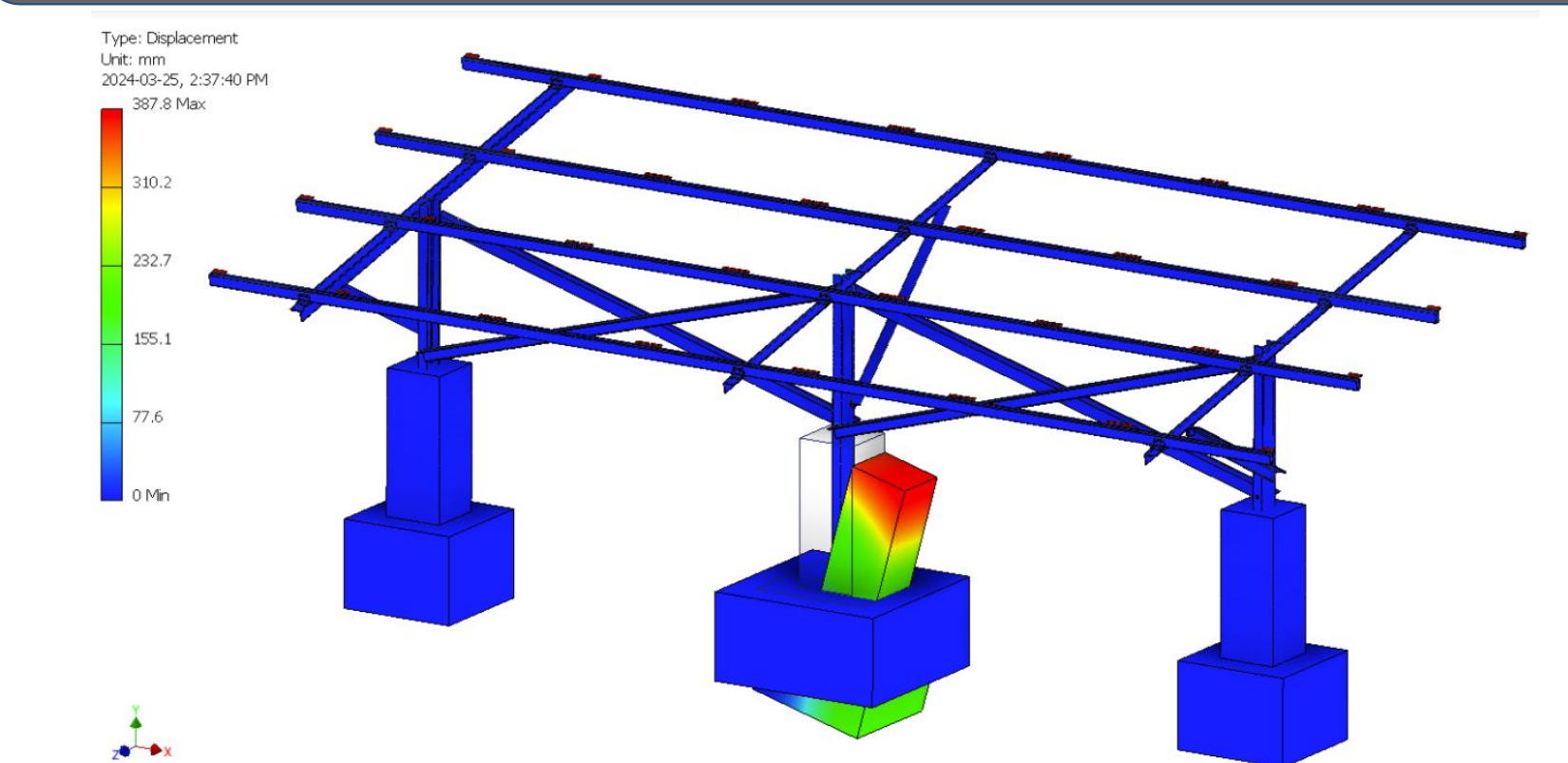
The left bucket is after the system ran

The battery was charged using the solar panel

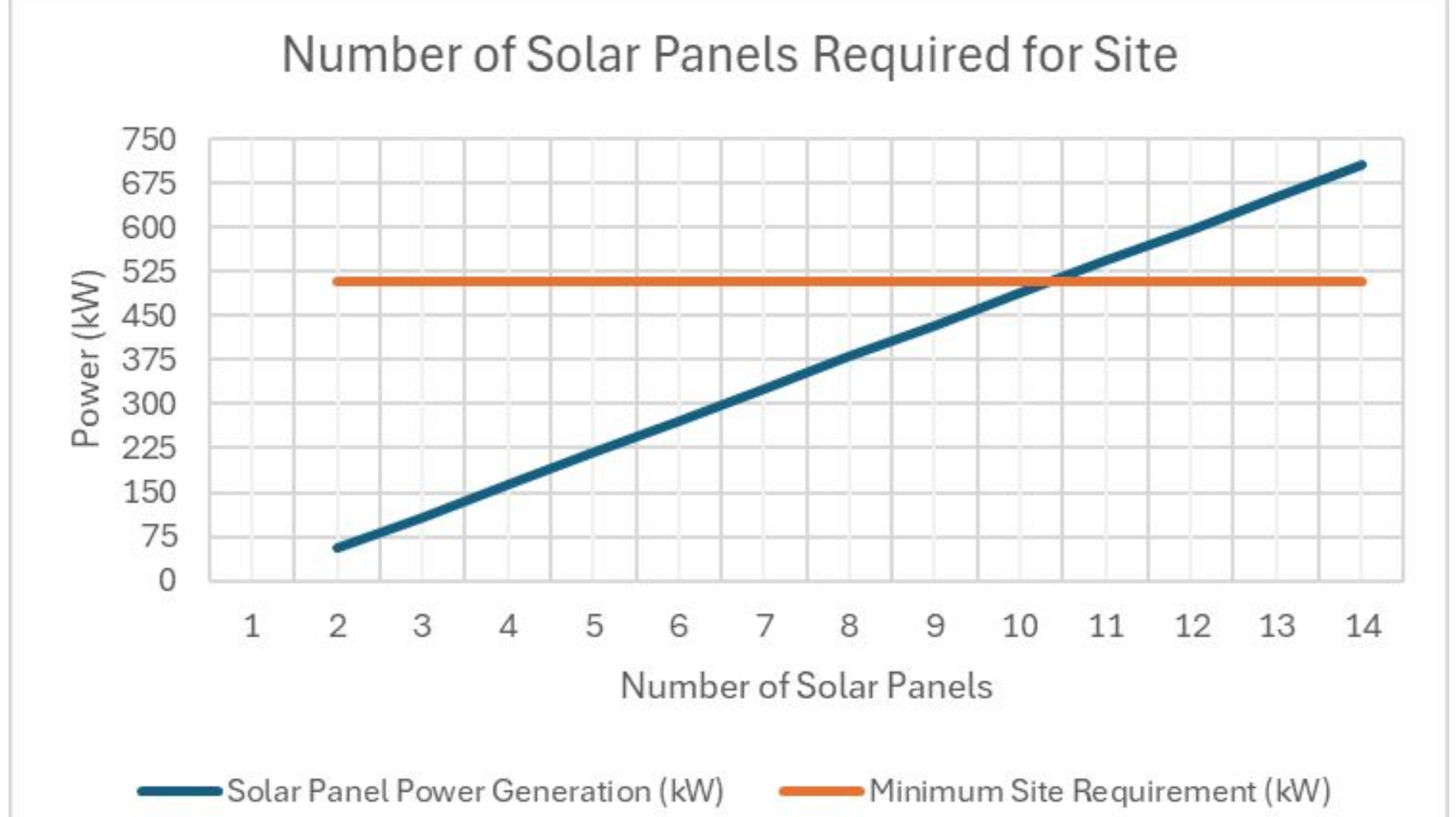


Result

FEA Structural Analysis



Minimum Panel Requirement

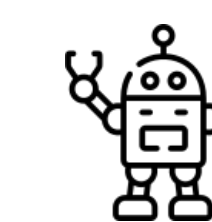


Value



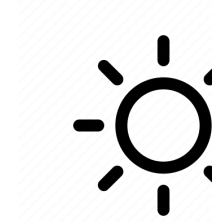
Algae Control

Deter algae growth



Autonomous Operation

Reduce workload and increase efficiency



Renewable Energy

Power system with Renewable Energy



Economical Effectiveness

Use Off-The-Shelf materials effectively



Scalable Solution

Communities can execute simple solutions



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Anita Malekian



Mackenzie Wallich