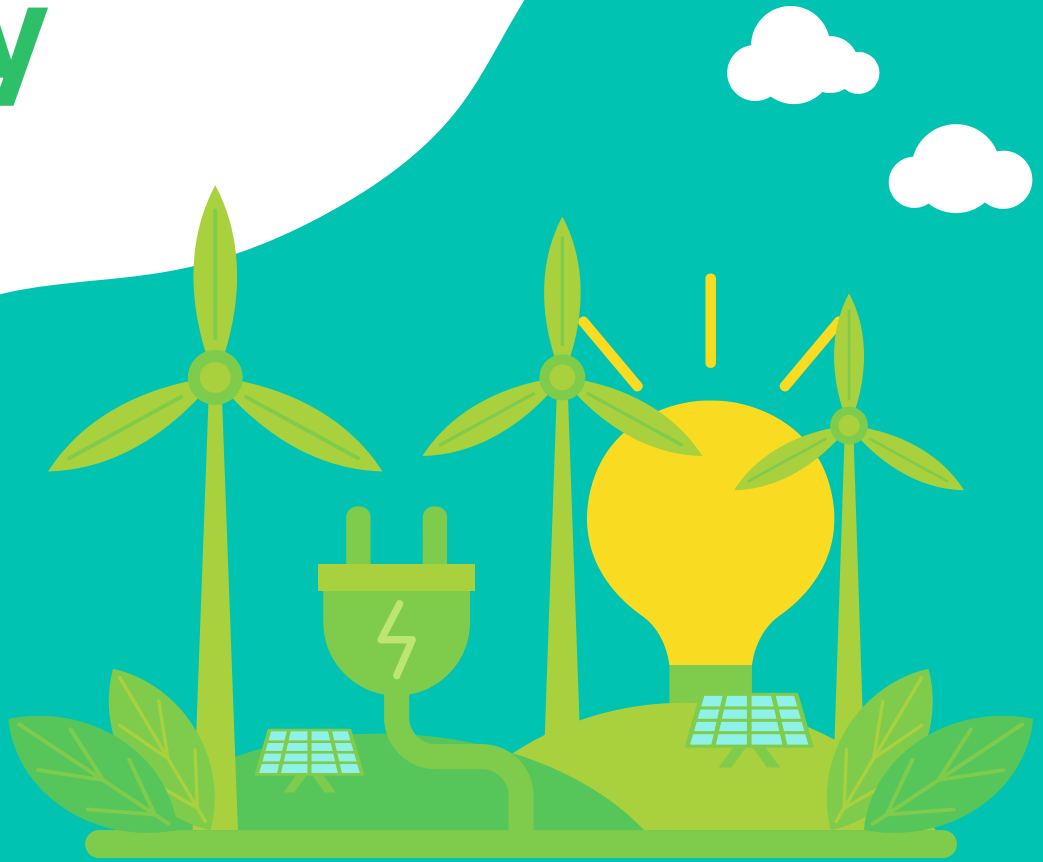
Project Day 2022

April 9, 2022



Team SolarSize
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Team SolarSize

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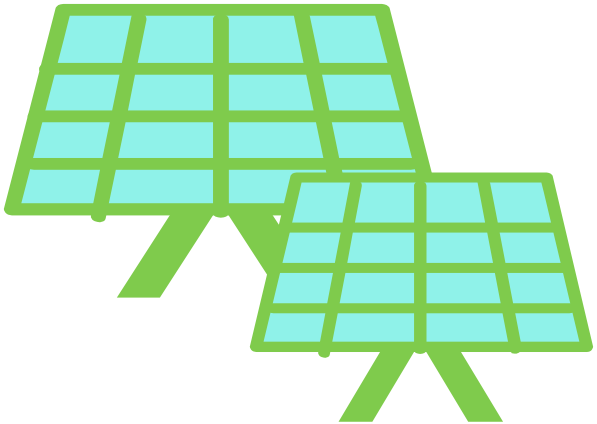
Front-End Development
Server Management

Karlee
Front-End Development
Documentation Management

Kaden
Back-End Development
Solar Model

About This Project



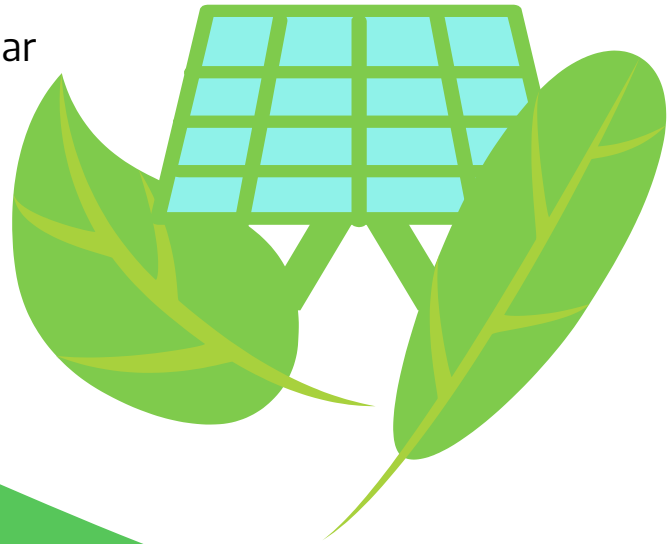
- A tool that utilizes building consumption metrics and solar intensity data to calculate accurate ROIs
- Helps to determine over/under generation windows and size solar generation solutions accordingly

The Application

- Web application
- User-friendly form which considers:
  - Location
  - Regular consumption data
  - Multiple panel types
  - Financial factors
- Built-in knowledgebase and information
- Suggests optimal solar panel setup
- Graphs
  - Regular consumption vs. solar power generation
  - Value resulting from full-credit generation vs. overgeneration
  - Annual cash flows
- Calculations
  - Total return on investment
  - Estimated kWh of solar power generated

Our Why?

- Fossil fuels are the primary source of energy in Canada
- Solar energy is renewable and sustainable
    - Alternative for fossil fuels
- Persuade more people and businesses to install solar generation solutions



The Problem

How do you choose the best panel?

How many panels should you use?

How much return will you get?

Architecture

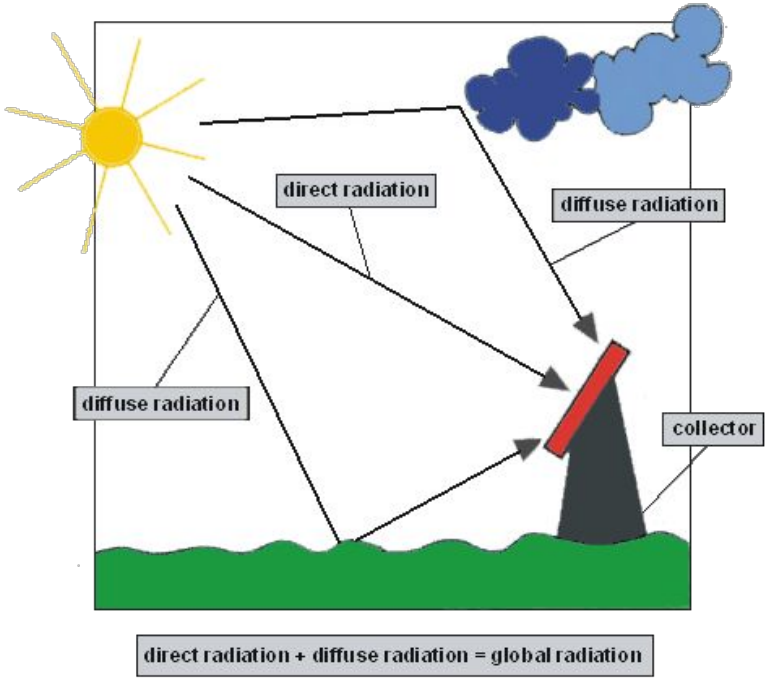
Frontend

Backend

Data

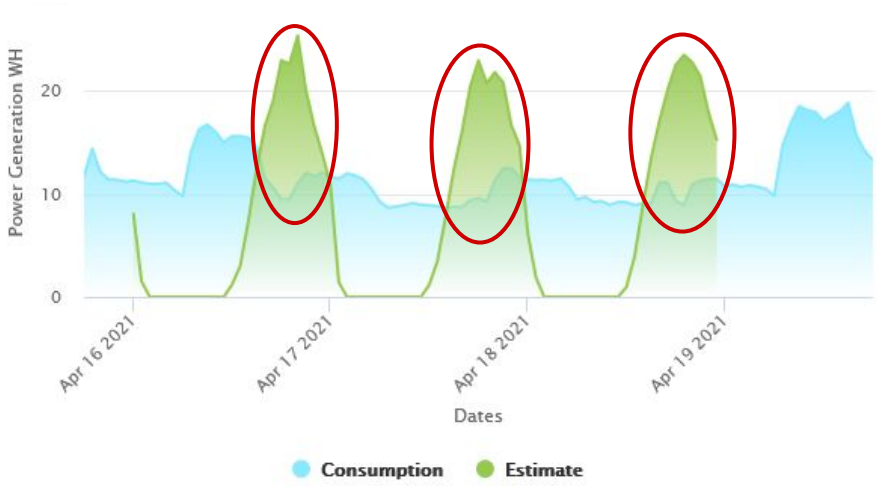
Solar Model

- Calculates estimated power output
- NASA POWER provides global solar irradiation data
- Python converts the global data to direct and diffuse components which are used in the calculations



Overgeneration

- Production of solar energy beyond consumption needs
- SaskPower only provides half-credit (7.5¢/kWh) for overgeneration
- This makes overgeneration inherently less valuable, but not valueless



Inputs

Location

Panel Options

Grants

Analysis Dates

Cost of kWh

Roof Area

Loan Rate

Consumption Data

Return on Investment

- 20 year analysis
- Calculates breakdown of solar power installation:
  - Capital Cost
  - Maintenance Cost
  - Loan Interest
  - Full-credit Value
  - Overgeneration Value
- Determines which setup provides the best financial return

Capital Cost:

$46,927.00

Savings Earned:

$156,921.00

ROI and Annual Cash Flow Analysis Calculations

$$Capital\,Cost = (System\,KW \cdot \frac{Cost}{KW\,Installed}) + Interconnection\,Study\,Fee + Bidirectional\,Meter - Grants$$

$$Balance\,Remaining(end\,of\,1st\,year) = Capital\,Cost + Loan\,Interest - Amount\,Saved$$

$$BalanceRemaining(2nd\,year\,and\,on) = Balance\,Remaining + Loan\,Interest - Amount\,Saved$$

$$Amount\,Saved = (Full\,Credit\,Power \cdot Value\,of\,Full\,Credit) + (Overgeneration\,Power \cdot Value\,of\,Overgeneration) - Maintenance\,Costs$$

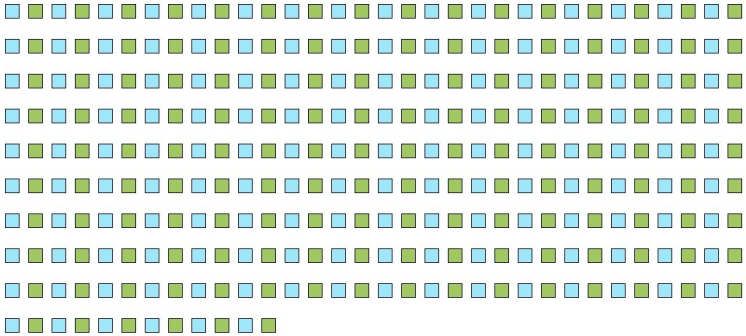
Optimal Solar Panel Installation

The optimal panel setup is:

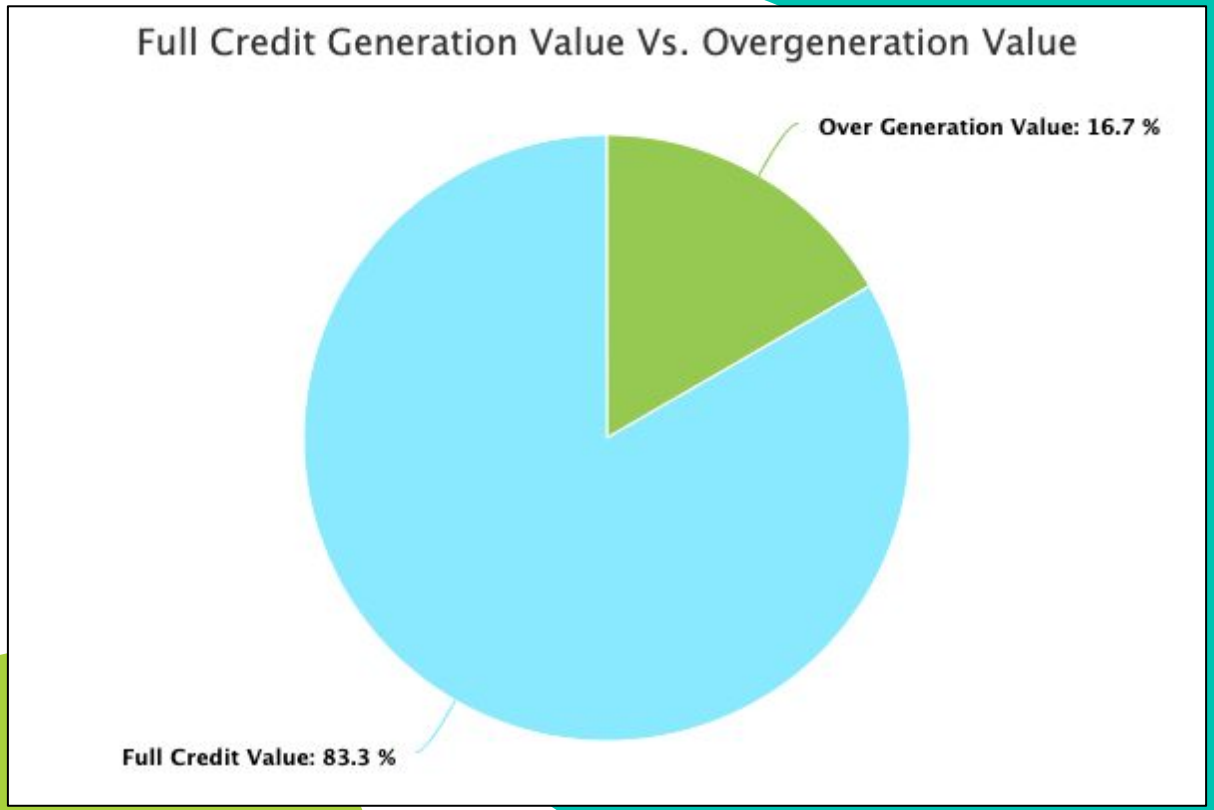
237 310W Black Frame 60 cell Mono-PERC 35mm T4 CANADIAN MADEs

Angled at

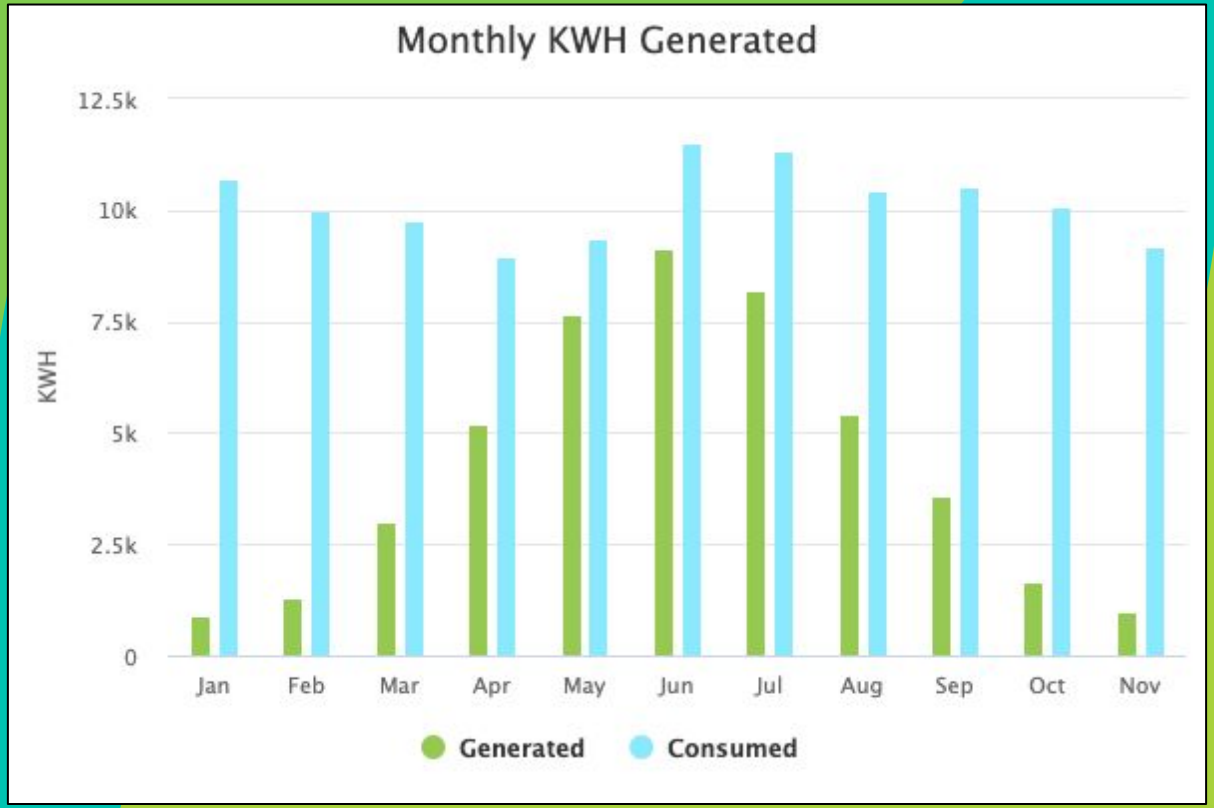
49.6°



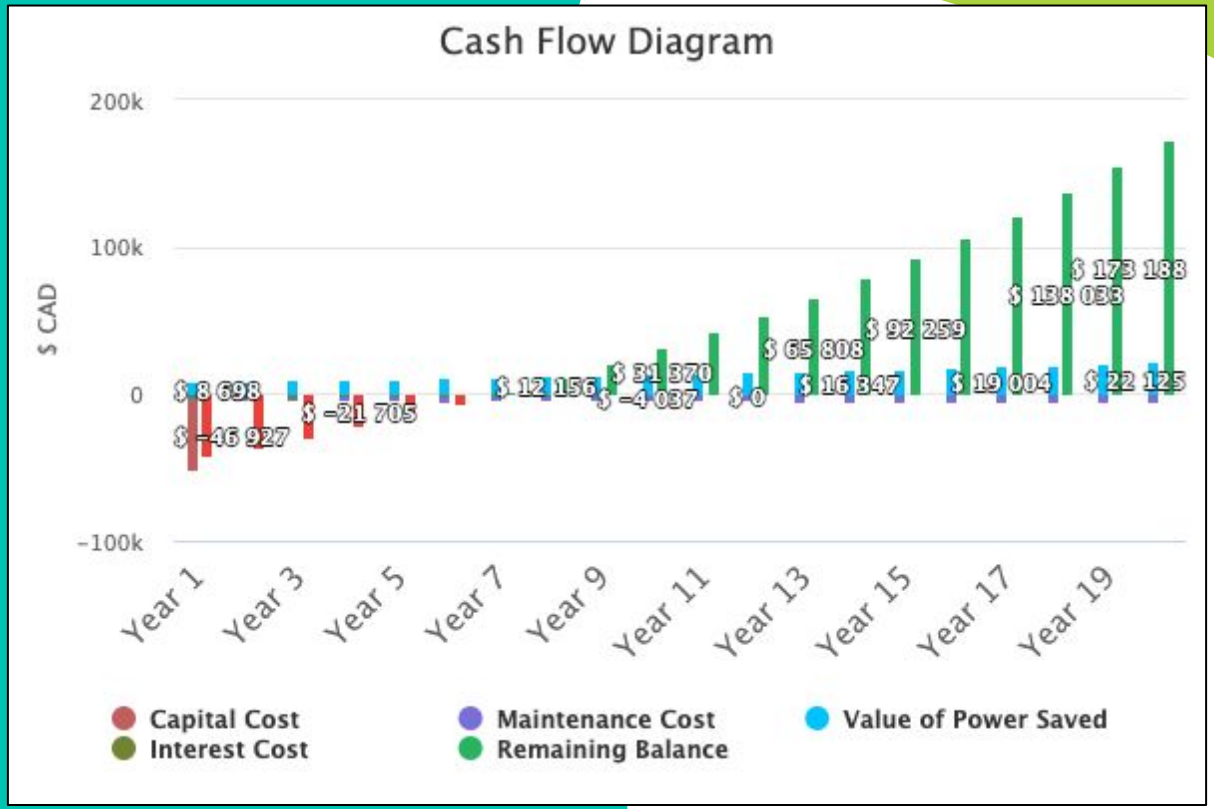
Full Credit Value Vs. Overgeneration Value



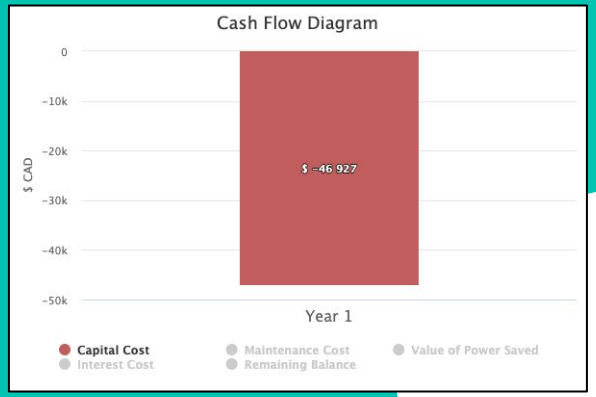
Monthly kWh Generated

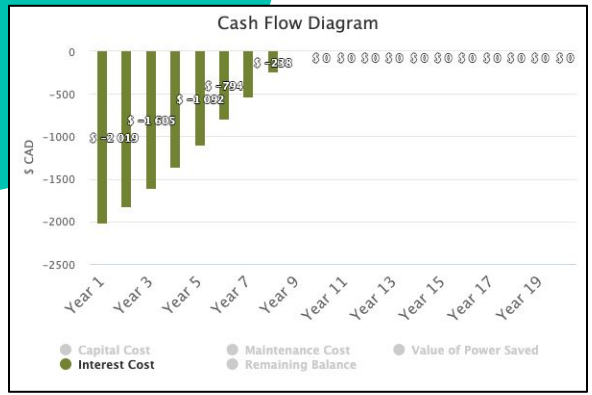


Cash Flows


Cash Flow Diagram
200k
100k
0
-100k
$ CAD
$ 8 698
$ -46 927
$ -21 705
$ 12 156
$ 31 370
$ -4 037
$ 0
$ 65 808
$ 16 347
$ 92 259
$ 19 004
$ 138 033
$ 173 188
$ 22 125
Year 1
Year 3
Year 5
Year 7
Year 9
Year 11
Year 13
Year 15
Year 17
Year 19
Capital Cost
Interest Cost
Maintenance Cost
Remaining Balance
Value of Power Saved

Cash Flows


Cash Flow Diagram
$ CAD
0
-10k
-20k
-30k
-40k
-50k
$ -46 927
Year 1
Capital Cost
Interest Cost
Maintenance Cost
Remaining Balance
Value of Power Saved


Cash Flow Diagram
$ CAD
0
-500
-1000
-1500
-2000
-2500
$ -2 019
$ -1 605
$ -1 092
$ -784
$ -236
$ 0 $ 0 $ 0 $ 0 $ 0 $ 0 $ 0 $ 0 $ 0 $ 0 $ 0 $ 0 $ 0
Year 1
Year 3
Year 5
Year 7
Year 9
Year 11
Year 13
Year 15
Year 17
Year 19
Capital Cost
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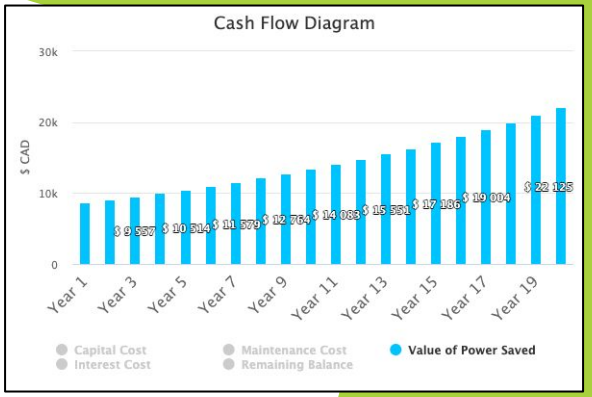
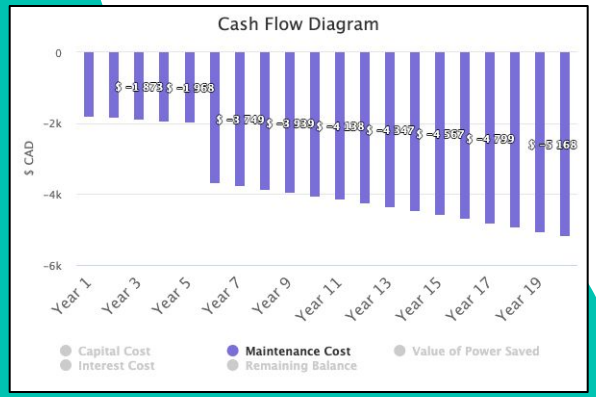
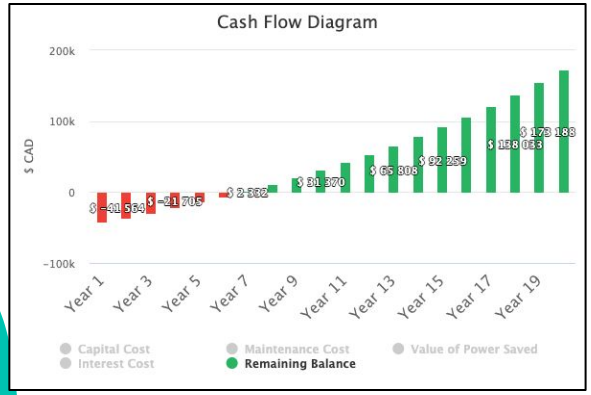
Value of Power Saved

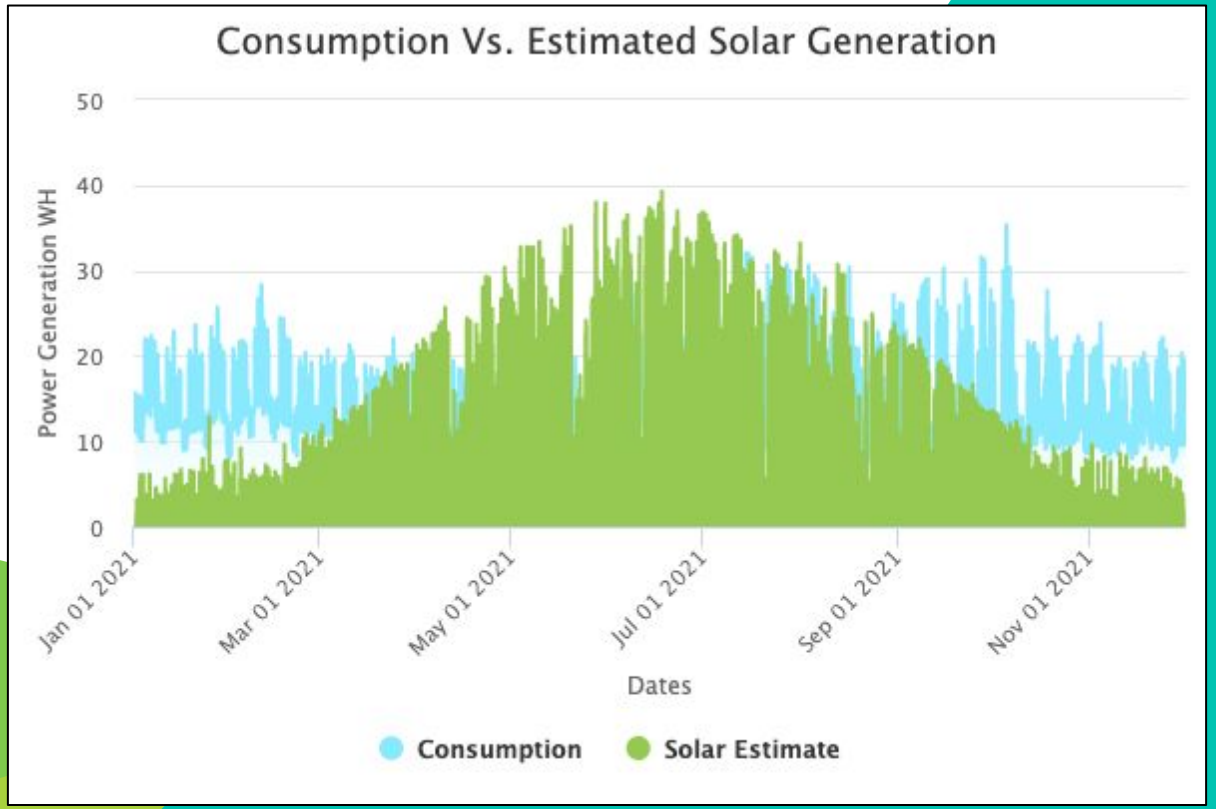

Cash Flow Diagram
$ CAD
30k
20k
10k
0
$ 9 537
$ 10 514
$ 11 379
$ 12 764
$ 14 088
$ 15 351
$ 17 186
$ 19 004
$ 22 126
Year 1
Year 3
Year 5
Year 7
Year 9
Year 11
Year 13
Year 15
Year 17
Year 19
Capital Cost
Interest Cost
Maintenance Cost
Remaining Balance
Value of Power Saved


Cash Flow Diagram
$ CAD
0
-2k
-4k
-6k
$ -1 873
$ -1 968
$ -3 749
$ -3 939
$ -4 138
$ -4 347
$ -4 567
$ -4 799
$ -5 168
Year 1
Year 3
Year 5
Year 7
Year 9
Year 11
Year 13
Year 15
Year 17
Year 19
Capital Cost
Interest Cost
Maintenance Cost
Remaining Balance
Value of Power Saved


Cash Flow Diagram
$ CAD
200k
100k
0
-100k
$ -41 564
$ -41 705
$ -2 332
$ 31 370
$ 65 808
$ 92 259
$ 158 083
$ 178 188
Year 1
Year 3
Year 5
Year 7
Year 9
Year 11
Year 13
Year 15
Year 17
Year 19
Capital Cost
Interest Cost
Maintenance Cost
Remaining Balance
Value of Power Saved

Yearly Savings/Balance

Consumption Vs. Solar Generation



Future Iterations

01 Solar Power Installation Comparisons — 20 of Panel A VS. 30 of Panel B

02 User Accounts — Client Access

03 Saving Locations and Related Data — Client Locations

Acknowledgements

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- Project Advisor: Dr. Timothy Maciag
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- Project Idea: Greenwave Innovations

Questions and Comments