

# Northern Alberta Institute of Technology



## Alternative Energy Program

Solar Photovoltaic Reference Array Report, Edmonton - March 31, 2017

## Goals

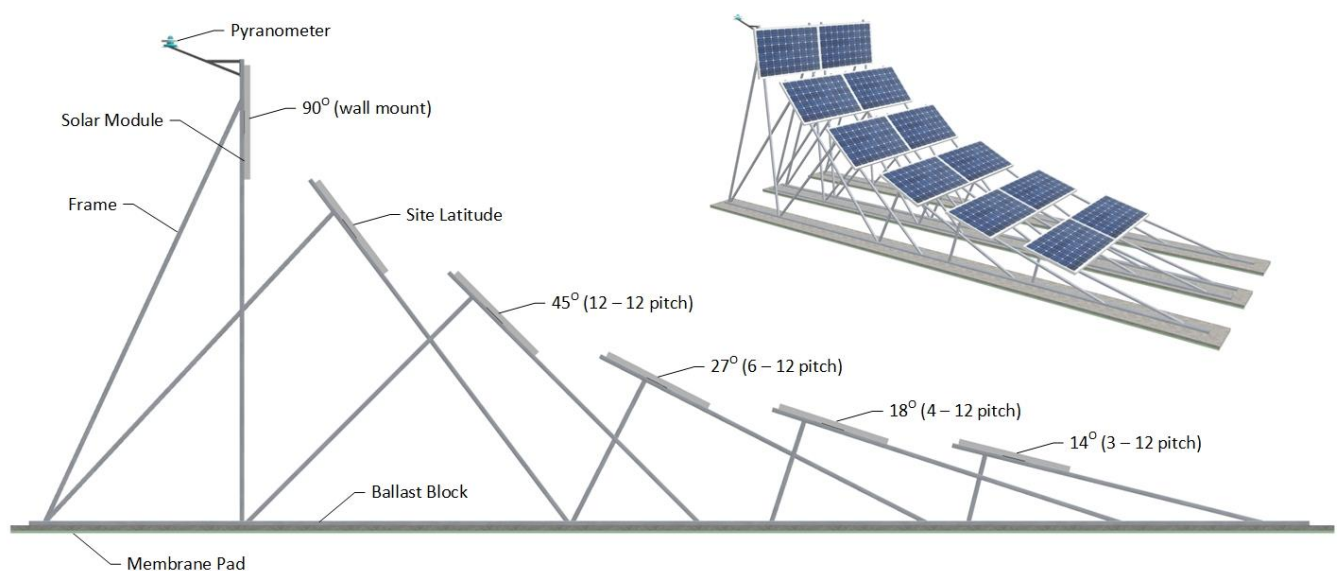
- Provide solar energy system educators, installers and adopters with real world regional performance data.
- Improve system design and economic modeling accuracy.

## Methodology

- Track individual module performance on as many of the most common installation angles as is possible. Roof pitches of 3/12, 4/12, 6/12 and 12/12 as well as ground installations based on site latitude and wall mounting at 90° were chosen.

## Design

- Pairs of Conergy P-230PA solar modules with Enphase M215 microinverters are mounted at 14°, 18°, 27°, 45°, 53° and 90°. One side or column acts as an unmaintained control while the other column has the snow removed for comparison.
- Aside from cloud cover the solar array is continuously shade free.
- Azimuth or facing direction is optimized for Canada, due south.
- Energy generated is delivered directly to the electrical grid.

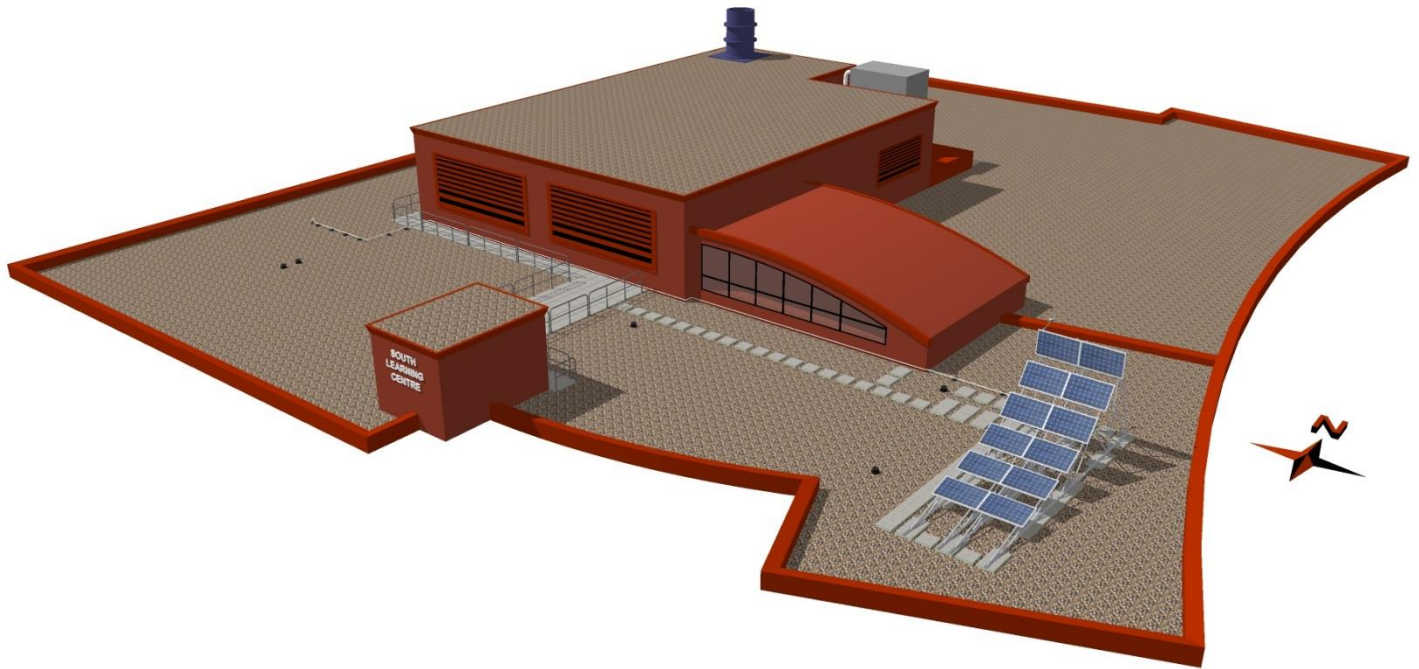


## Project Contacts

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## Installation

- NAIT's South Learning Centre located at 11762 – 106 Street, Edmonton, Alberta.
- Site latitude, 53°.
- Oriented true south.
- Commissioned May 06, 2012.

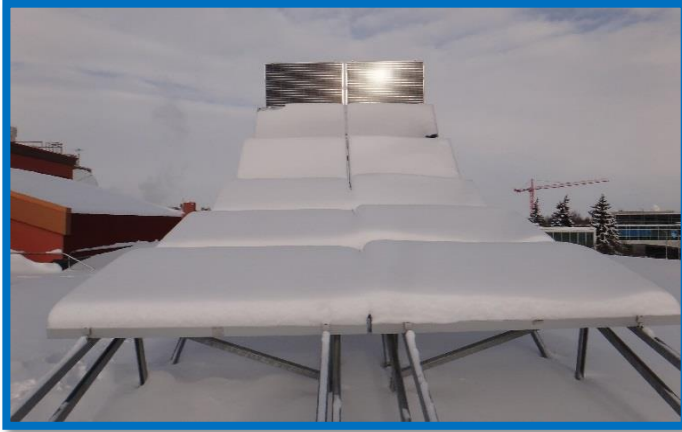


## Project Participants

- Concept – Solar Energy Society of Alberta, Howell Mayhew Engineering.
- Sponsors – City of Edmonton, NAIT, Alberta Innovates Tech Futures, Howell Mayhew Engineering, Great Canadian Solar.
- Project Management – Howell Mayhew Engineering, NAIT Alternative Energy Program.
- Structural Design – Andy Smith.
- Electrical Design – Howell Mayhew Engineering.
- Array Design – NAIT Alternative Energy Program.
- Array Installation – Great Canadian Solar.
- Pyranometer and Logger Installation – NAIT Alternative Energy Program.
- Site Commissioning – Howell Mayhew Engineering.
- Site Maintenance – NAIT Alternative Energy Program.
- Data Management – NAIT Alternative Energy Program.
- Reporting – Jackson Belley, Christian Brown (Alternative Energy Technologists).

## Maintenance

- Snow is removed from the left or west column of modules only.
- Snow on the right or east column must not be disturbed allowing the modules to clear naturally.
- Snow clearing happens immediately after any snowfall or before sunrise the following morning.
- Pre and post cleaning photographs of the Edmonton array are taken to provide further insight into snow and wind dynamics.
- During the five year study Edmonton's array required an average of 20.4 snow clearings per winter.

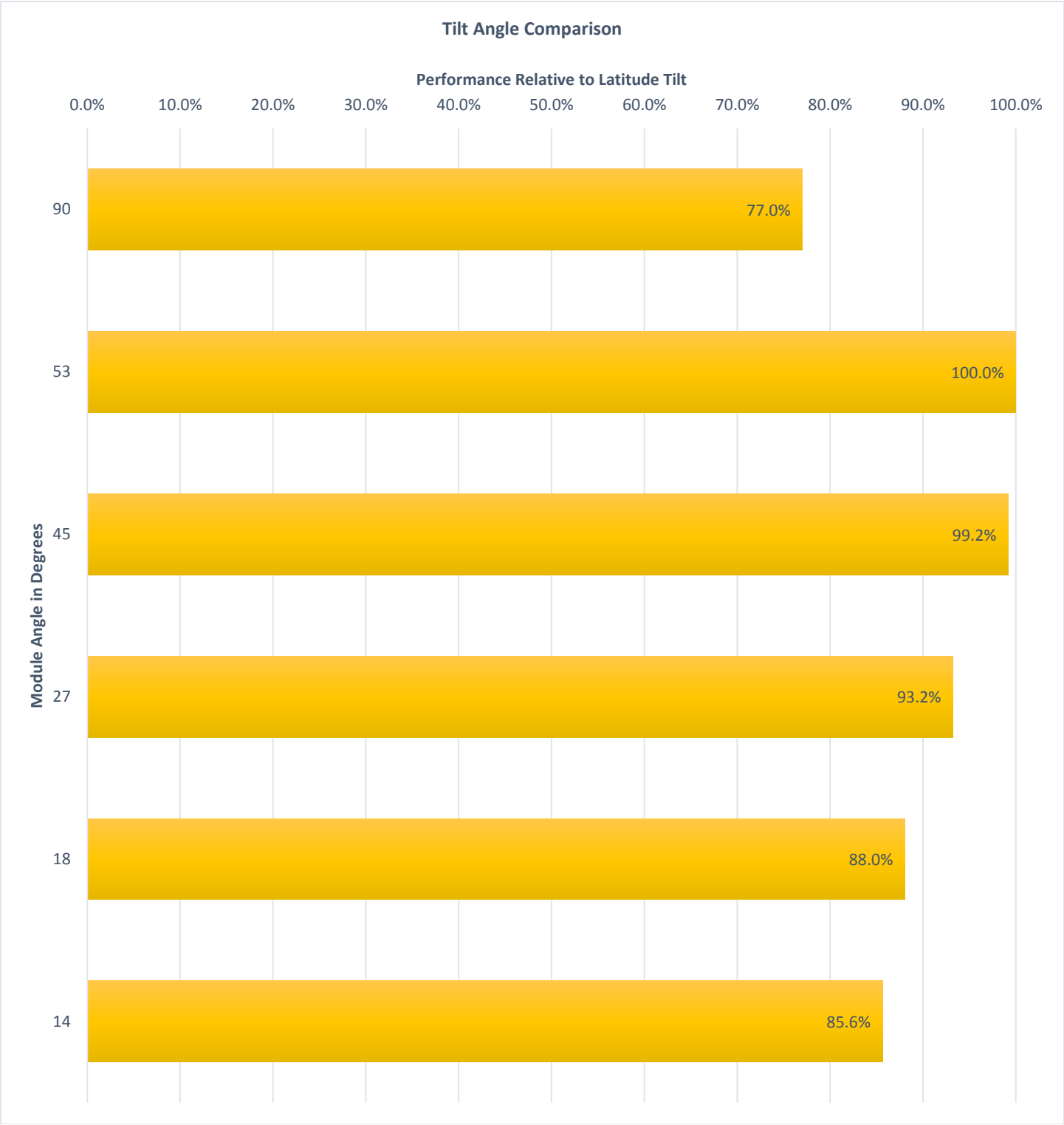


## Data Collection

- Microinverters generate a snapshot of the system status every five minutes.
- Every five minute record is an average of the previous five minute's performance data and contains a Timestamp, AC Voltage, DC Voltage, DC Current, Inverter Temperature and AC Energy in Watts.
- All data points are zeroed if no power is detected from the module.
- A record for each module and inverter combination is collected once per week and contains a full dataset for the previous week.
- Seven day records for each inverter are stored as CSV files for analysis.

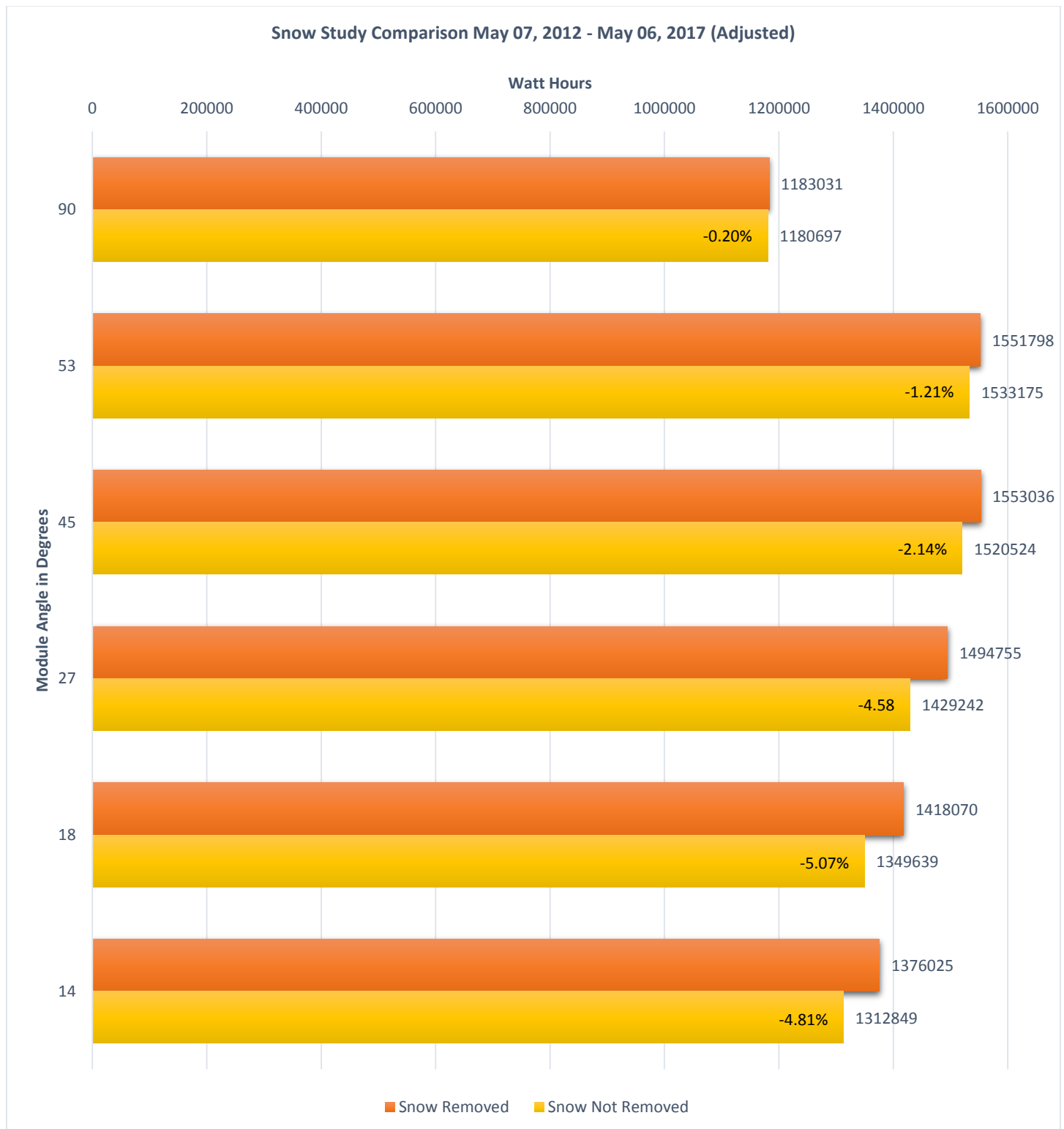
Result: Tilt Angle Comparison

- The following graph shows the production relationship between different tilt angles using the highest producing angle (53°) as baseline.
- Only data from the snow side of the array was used here.



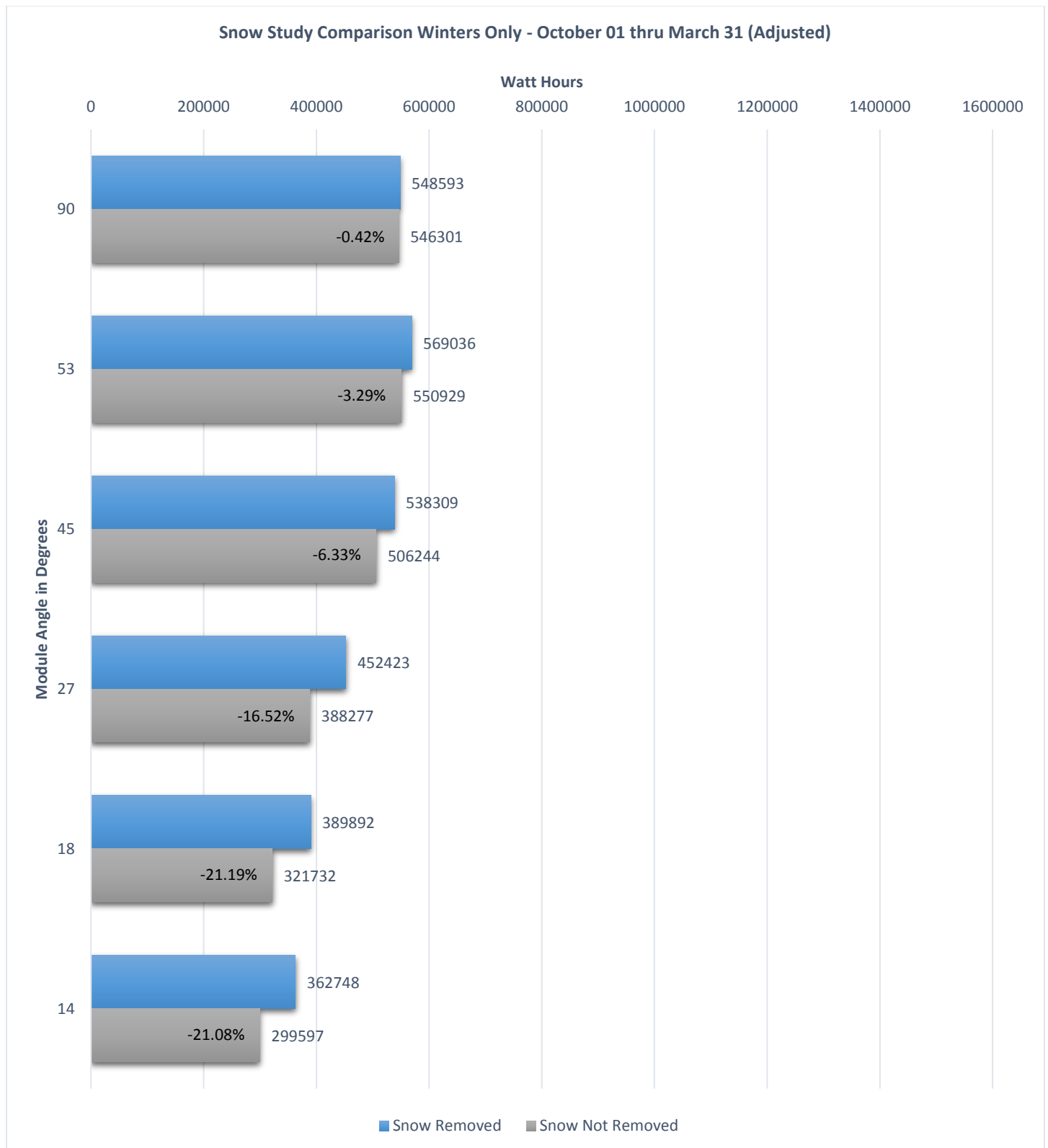
## Result: Snow Impact

- Here we see the impact of removing snow from the modules versus leaving the modules to clear naturally.



## Result: Snow Impact, Winter Only

- The following shows the effect of clearing during snow months only (October 1<sup>st</sup> to March 31<sup>st</sup>, 2012 to 2016).



## Result: Monthly Comparison

- Shows total production by month in watt hours for the duration of the five year study.

