

Northern Alberta Institute of Technology



Alternative Energy Program

Solar Photovoltaic Reference Array Report – March 31, 2016

Goals

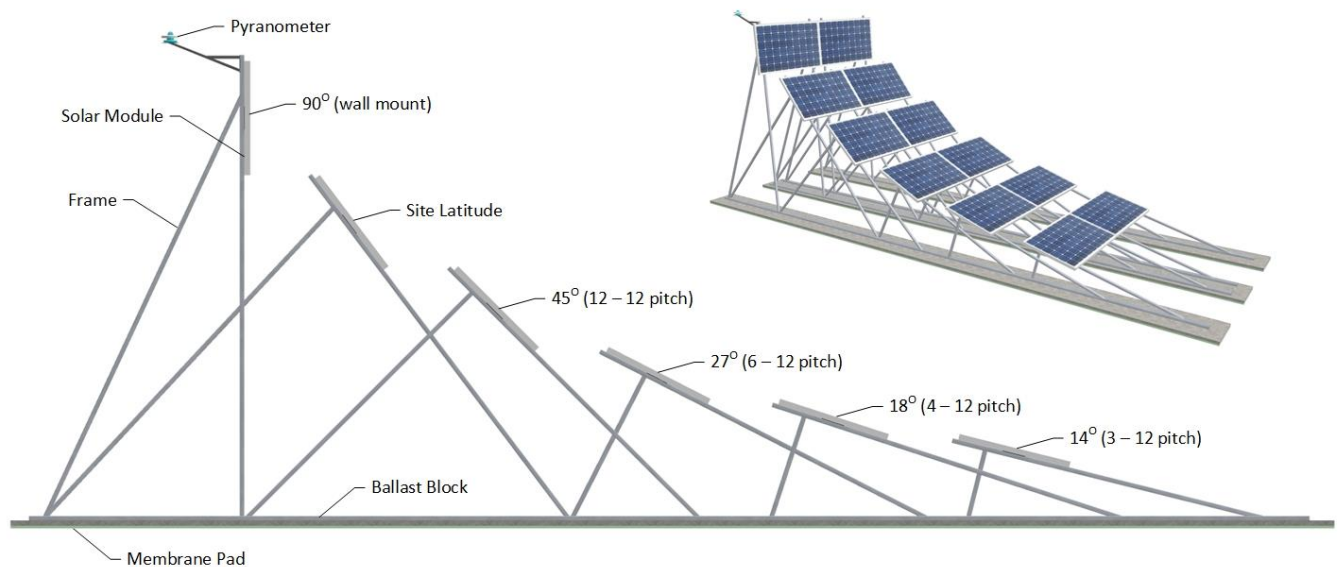
- Provide solar energy system educators, installers and adopters with real world regional performance data.
- Improve system design and economic modeling accuracy.

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.
- Study the impact of snow on overall performance for a term of, not less than, five years.
- Make findings available to any and all interested parties.

Design

- Pairs of Conergy P-230PA solar modules with Enphase M215 microinverters are mounted at 14°, 18°, 27°, 45°, 53° (Edmonton) 55° (Grande Prairie) 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.

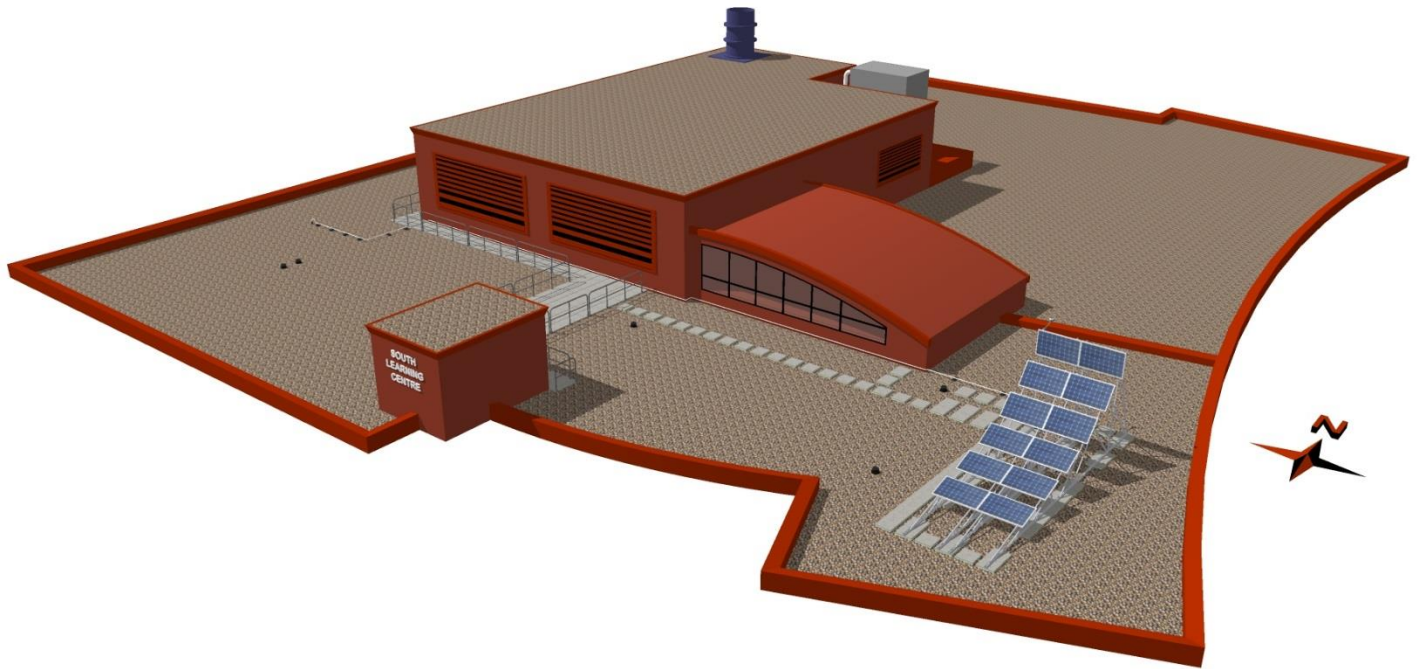


Project Contacts

- Dr. Jim Sandercock – NAIT Alternative Energy Program – jsanderc@nait.ca
- Tim Matthews – NAIT Alternative Energy Program – tmatthew@nait.ca

Installation One

- The first site selected was atop NAIT's South Learning Centre located at 11762 – 106 Street, Edmonton, Alberta.
- Site latitude, 53°.
- Ballast mounted.
- Commissioned April 1, 2012.

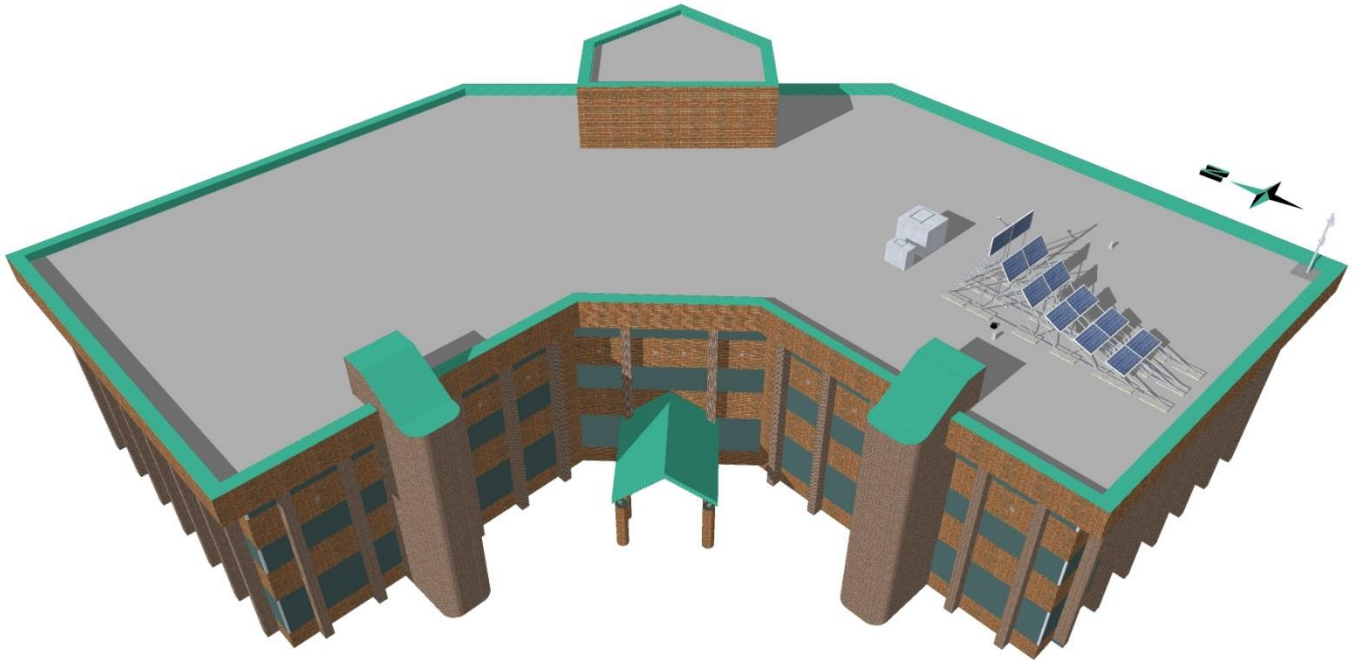


Edmonton Project Participants

- 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 – NAIT Alternative Energy Program, City of Edmonton.

Installation Two

- The second site selected was atop City Hall located at 10205 - 98 Street, Grande Prairie, Alberta.
- Site latitude, 55°.
- Ballast mounted.
- Commissioned May 24, 2013. Snow maintenance commenced September 1, 2015.

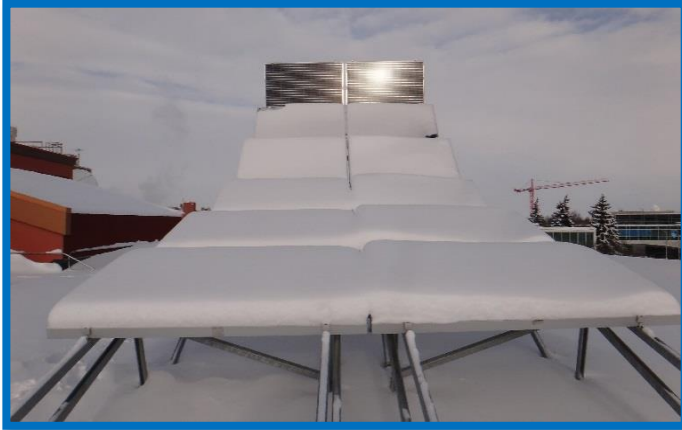


Grande Prairie Project Participants

- Concept – Solar Energy Society of Alberta, Howell Mayhew Engineering.
- Sponsors – The Alberta Real Estate Foundation, NAIT, City of Grande Prairie.
- Project Management – NAIT Alternative Energy Program.
- Structural Design – Andy Smith.
- Electrical Design – Great Canadian Solar, NAIT Alternative Energy Program.
- Array Design – NAIT Alternative Energy Program.
- Array Installation – Great Canadian Solar, NAIT Alternative Energy Program.
- Pyranometer and Logger Installation – Campbell Scientific.
- Site Commissioning – Howell Mayhew Engineering.
- Site Maintenance – Grande Prairie City Hall Staff.
- Data Management – NAIT Alternative Energy Program.
- Reporting – NAIT Alternative Energy Program.

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 first four years of study Edmonton's array has needed an average of 24 snow clearings per winter.



Data Collection

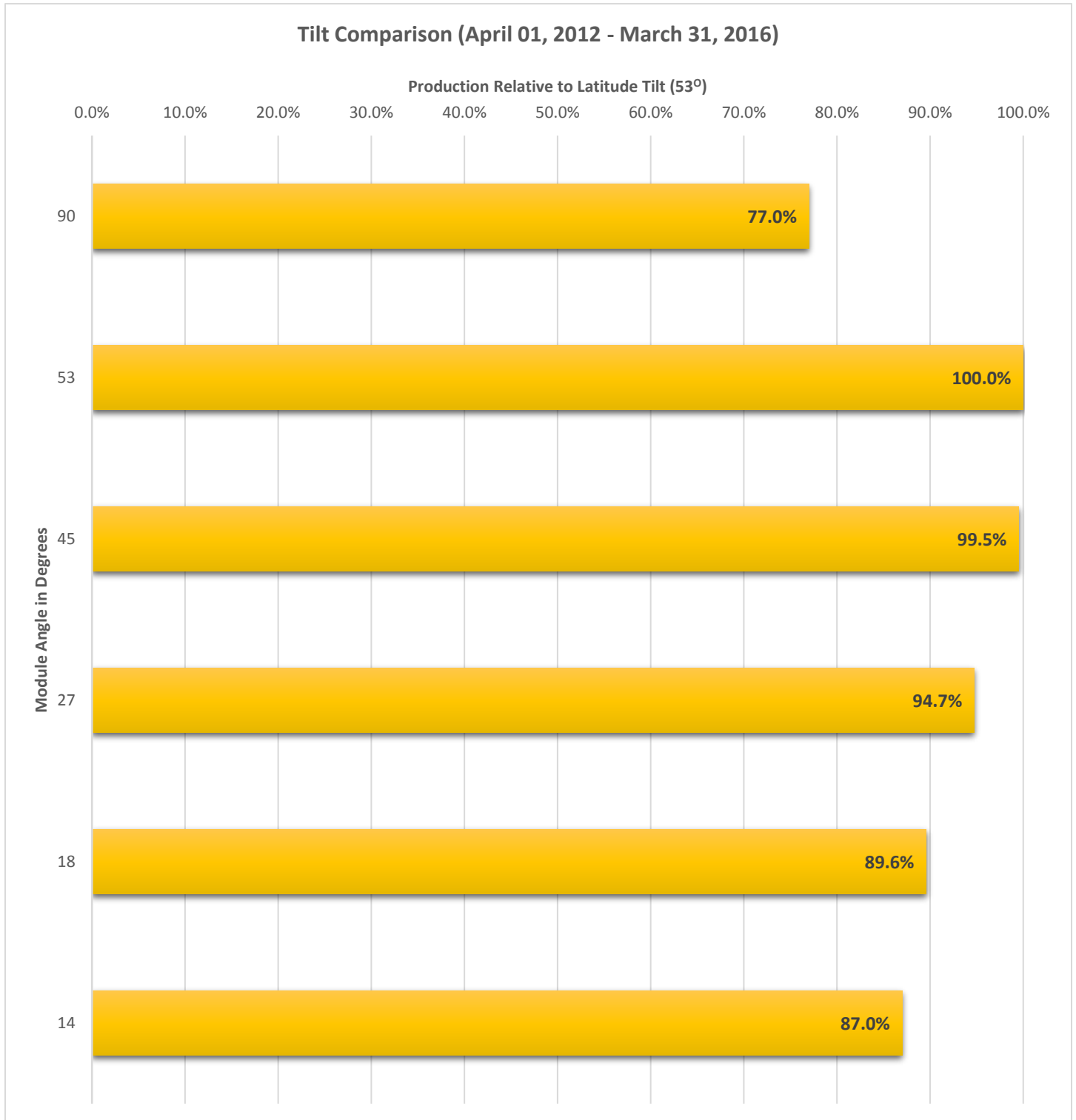
- Microinverters generate a snapshot of the system status every five minutes.
- Every five minute record contains the Timestamp, AC Voltage, DC Voltage, DC Current, Inverter Temperature and Power Production.
- All data points are zeroed if no power is detected from the module.
- A record for each module 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.

Data Requests

- Requests for data should be submitted attention Tim Matthews tmatthew@nait.ca and must include the array of interest (Edmonton or Grande Prairie), date range required, your name, e-mail address and organization.

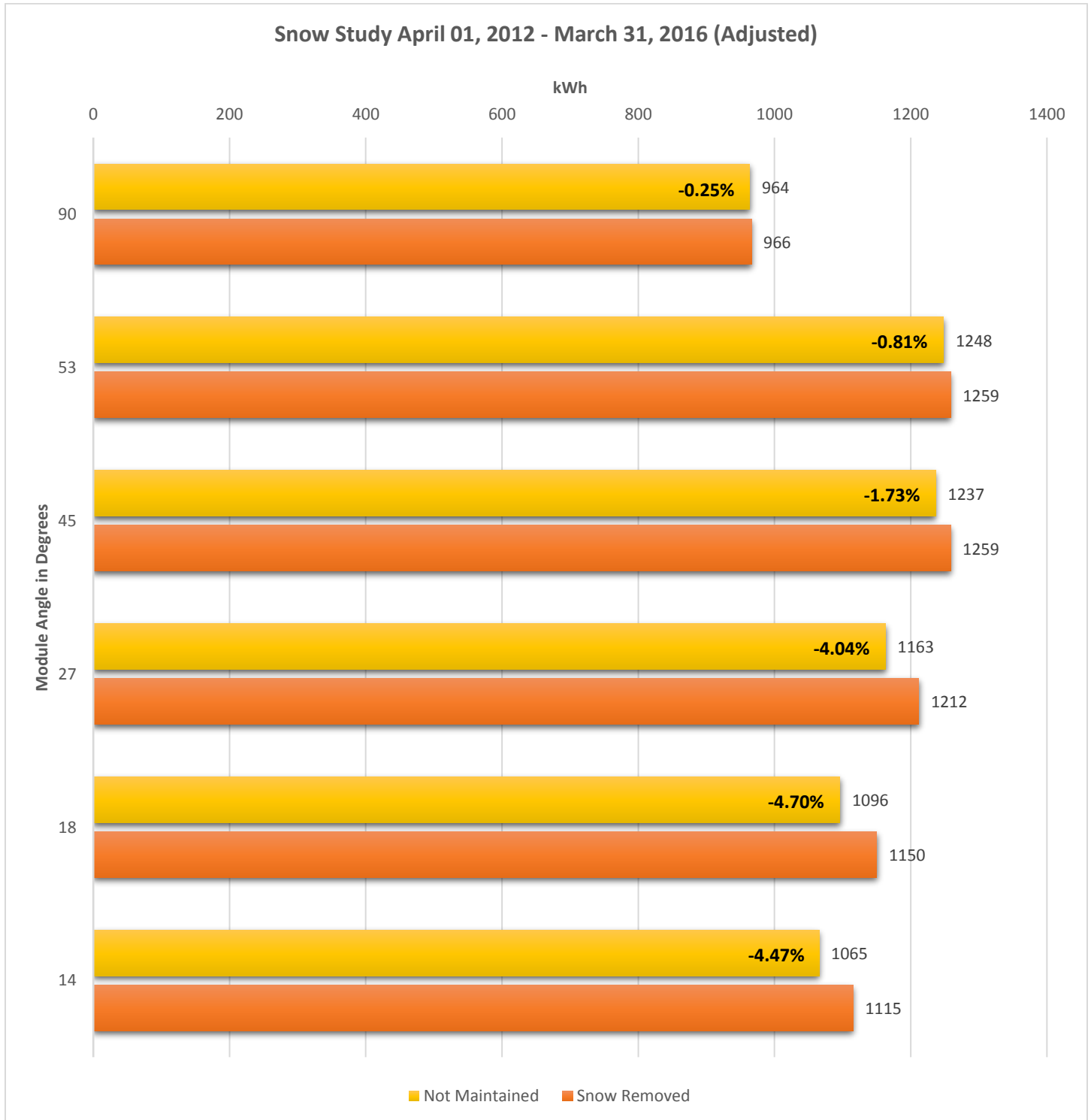
Reports: Tilt Angle Comparison (Edmonton)

- The following graph shows the production relationship between the different tilt angles using the highest producing angle (53°) as the baseline.
- Data from each set of left and right modules was combined for this report.



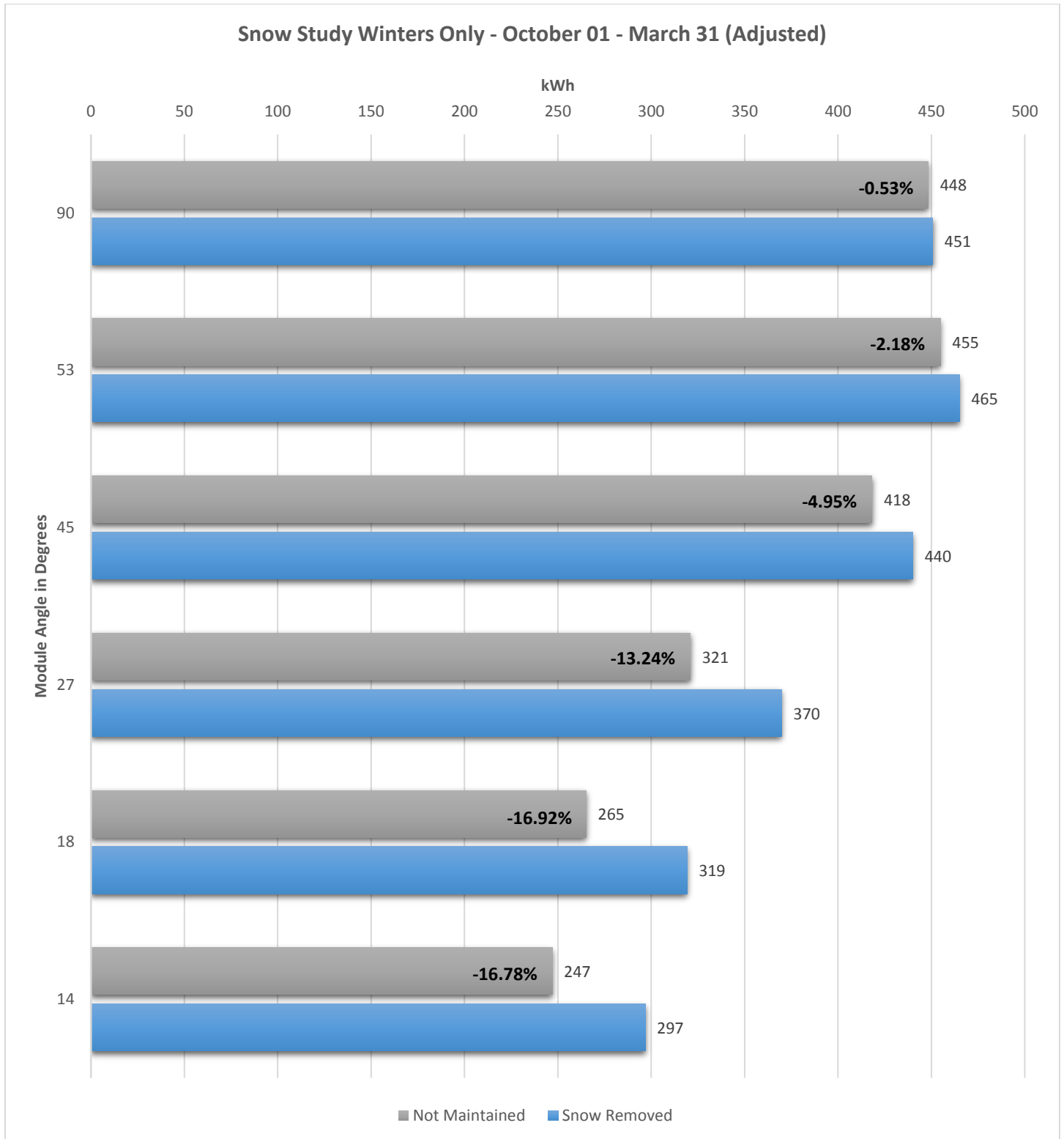
Reports: Snow Impact (Edmonton)

- Here we see the impact of removing snow from the modules versus leaving the modules to clear naturally.
- Only variances created by snow cover are shown. Variances resulting from manufacturing tolerances have been removed from the results.



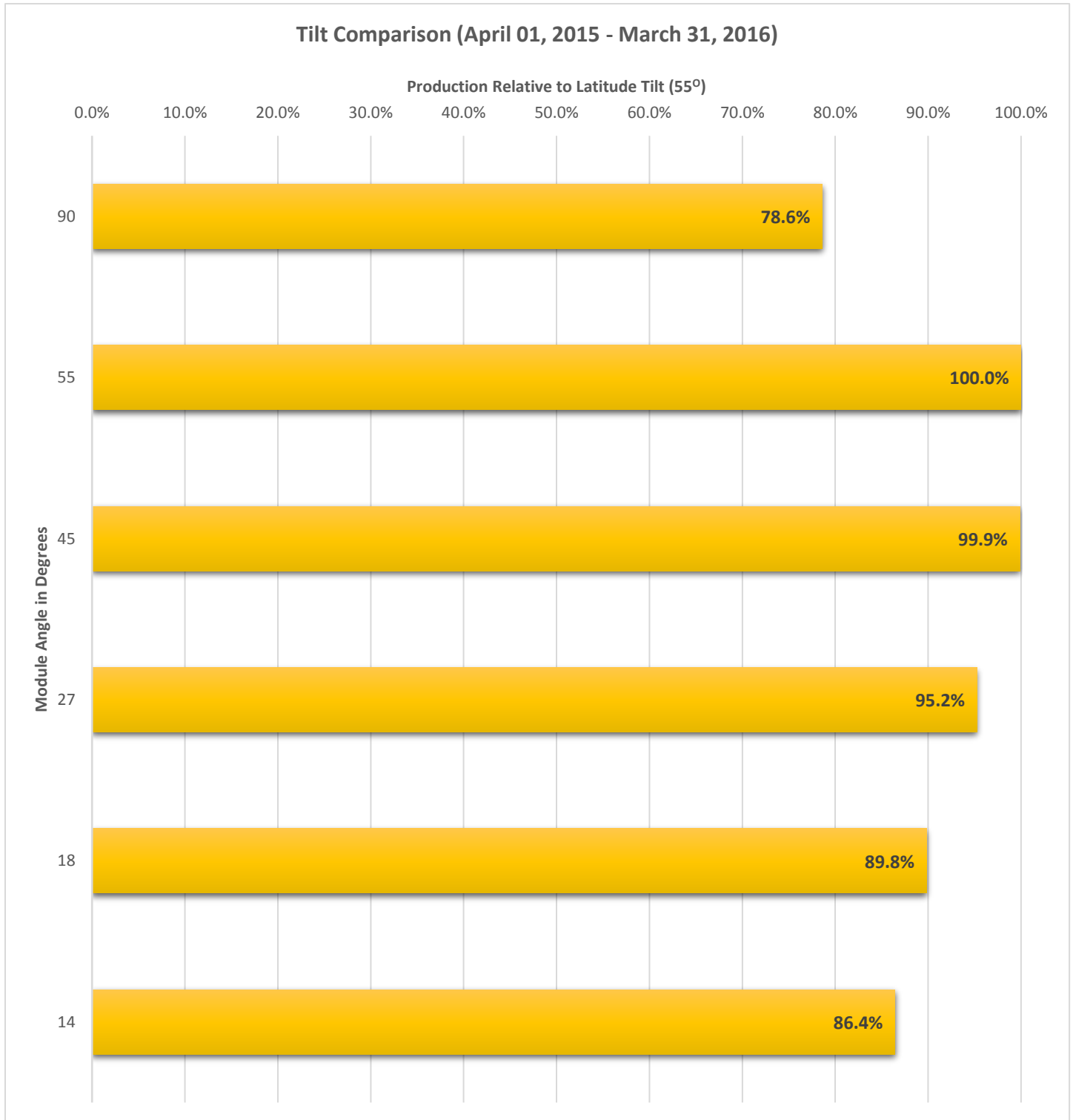
Reports: Snow Impact, Winter Only (Edmonton)

- The following shows the effect of clearing during Edmonton’s snow months only.
- Data was compiled from October 1st to March 31st, 2012 to 2016.



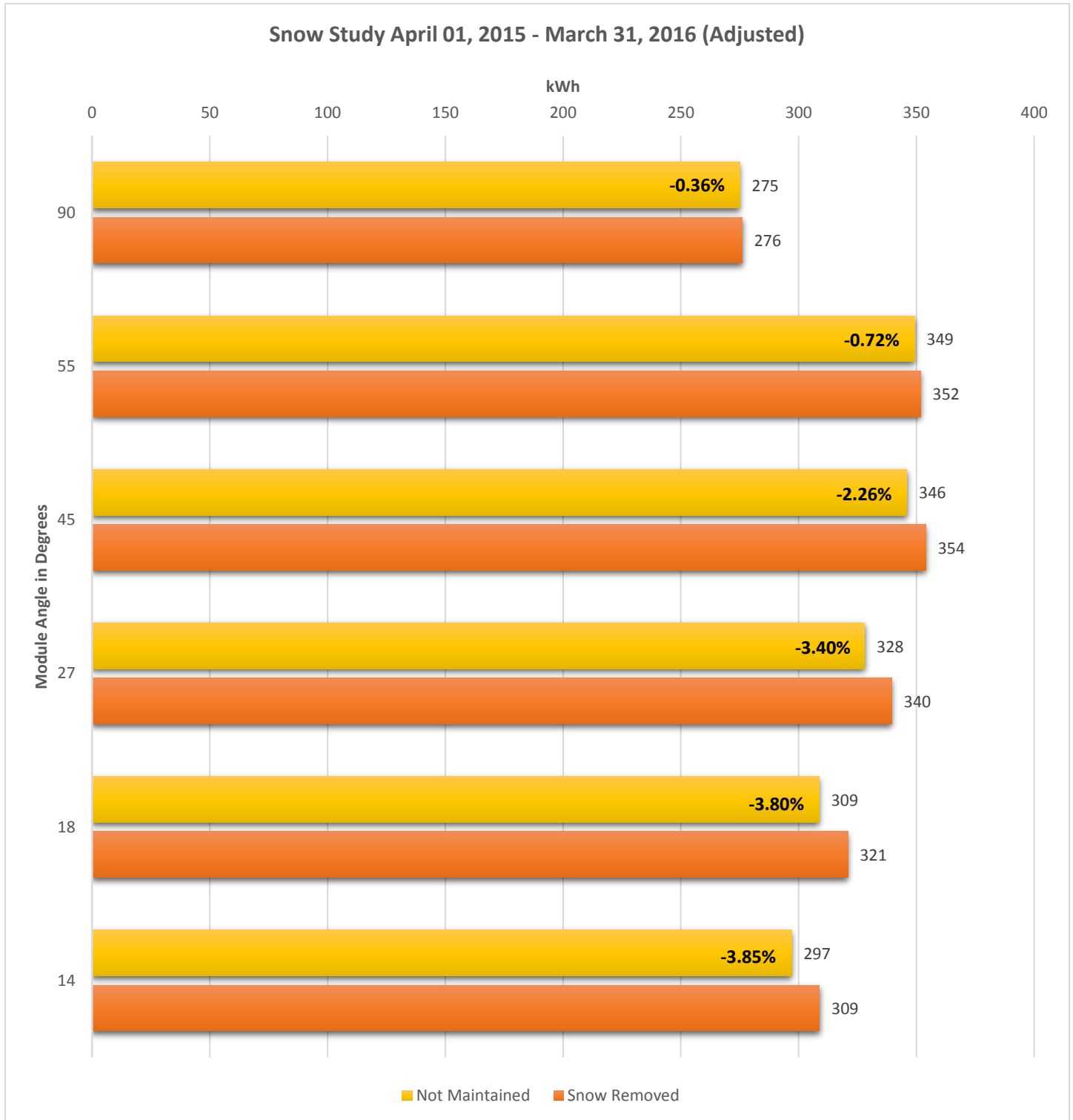
Reports: Tilt Angle Comparison (Grande Prairie)

- The following graph shows the production relationship between the different tilt angles using the highest producing angle (55°) as the baseline.
- Data from each set of left and right modules was combined for this report.



Reports: Snow Impact (Grande Prairie)

- Here we see the impact of removing snow from the modules versus leaving the modules to clear naturally.
- Only variances created by snow cover are shown. Variances resulting from manufacturing tolerances have been removed from the results.



Reports: Snow Impact, Winter Only (Grande Prairie)

- The following shows the effect of clearing during Grande Prairie’s snow months only.
- Data was compiled from October 1, 2015 to March 31, 2016.

