Northern Alberta Institute of Technology

Alternative Energy Program

Solar Photovoltaic Reference Array Report – March 07, 2015

Goals

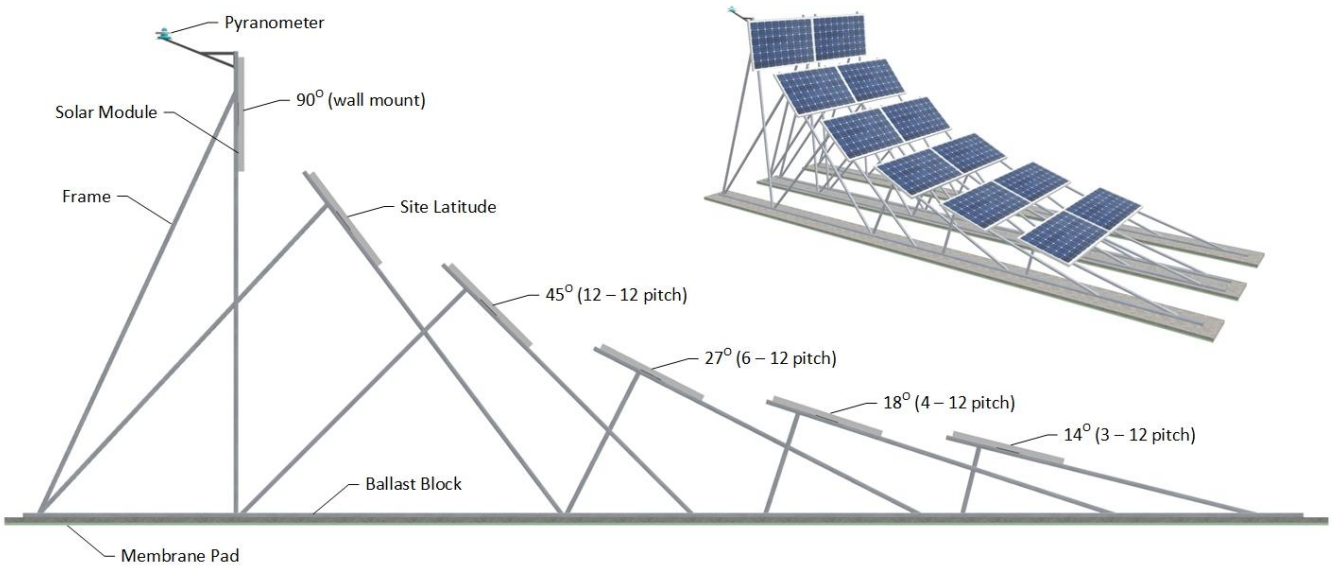
- Provide solar energy system educators, installers and adopters with real world regional performance data.
- Improve system design and economic modeling accuracy.

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^{O} 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

- To meet research objectives the array has been configured using pairs of modules arranged at the preselected mounting angles. 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.

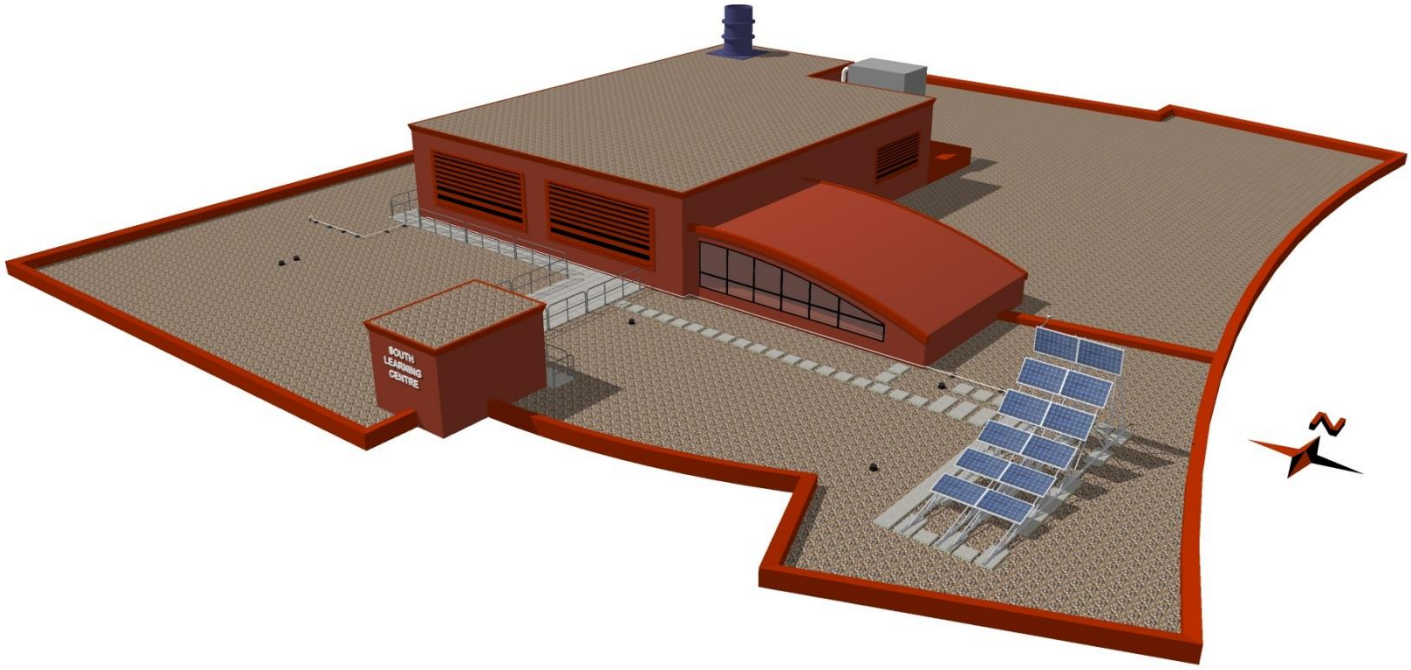


Project Contacts

- 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^{O}.
- Ballast mounted.
- Commissioned April 1, 2012.

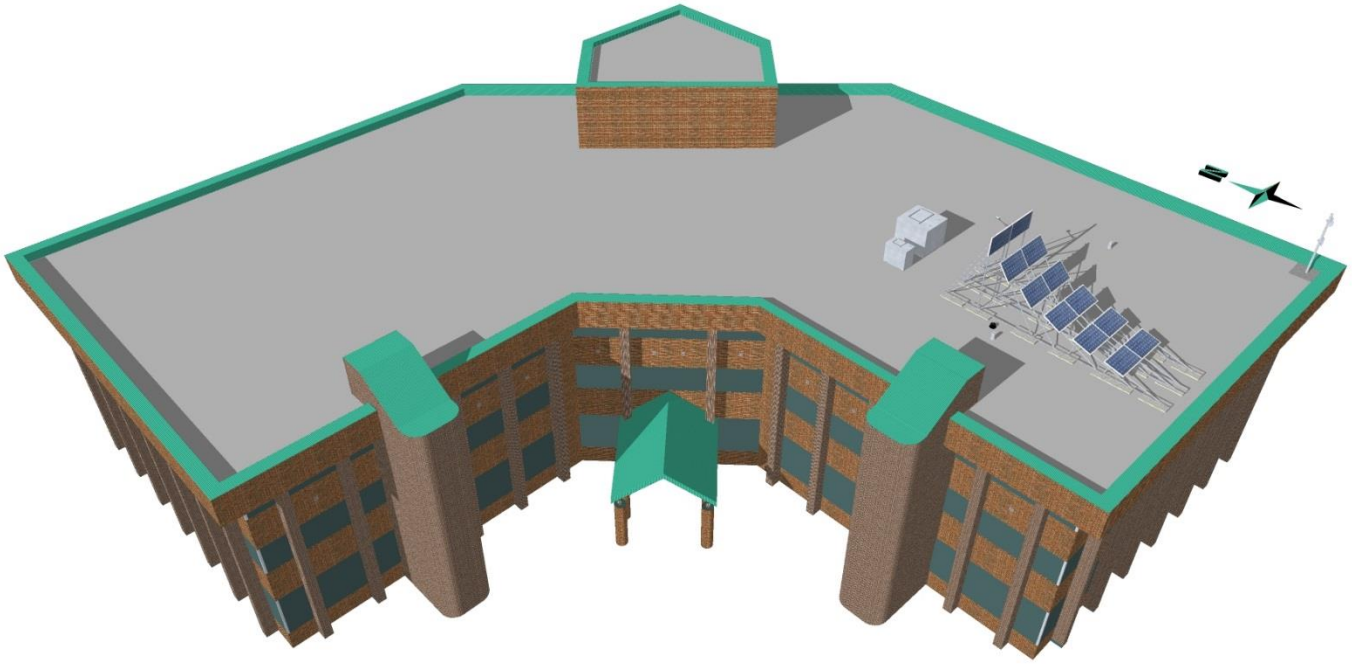


Edmonton Project Participants

- Concept – Solar Energy Society of Alberta, Howell Mayhew Engineering.
- Sponsors – The 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, The City of Edmonton.

Installation Two

- The second site selected was atop City Hall located at 10205 - 98 Street, Grande Prairie, Alberta.
- Site latitude, 55^{O}.
- Ballast mounted.
- Commissioned May 24, 2013. Snow maintenance commences January 1, 2014.



Grande Prairie Project Participants

- Concept – Solar Energy Society of Alberta, Howell Mayhew Engineering.
- Sponsors – The Alberta Real Estate Foundation, NAIT, The 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.
- Whenever possible maintenance occurs immediately after any snowfall or before sunrise the following morning.
- Pre and post maintenance photographs of the Edmonton array are taken to provide further insight into snow and wind dynamics.
- Edmonton's array has required an average of 24 snow clearings per winter to date.

Data Collection

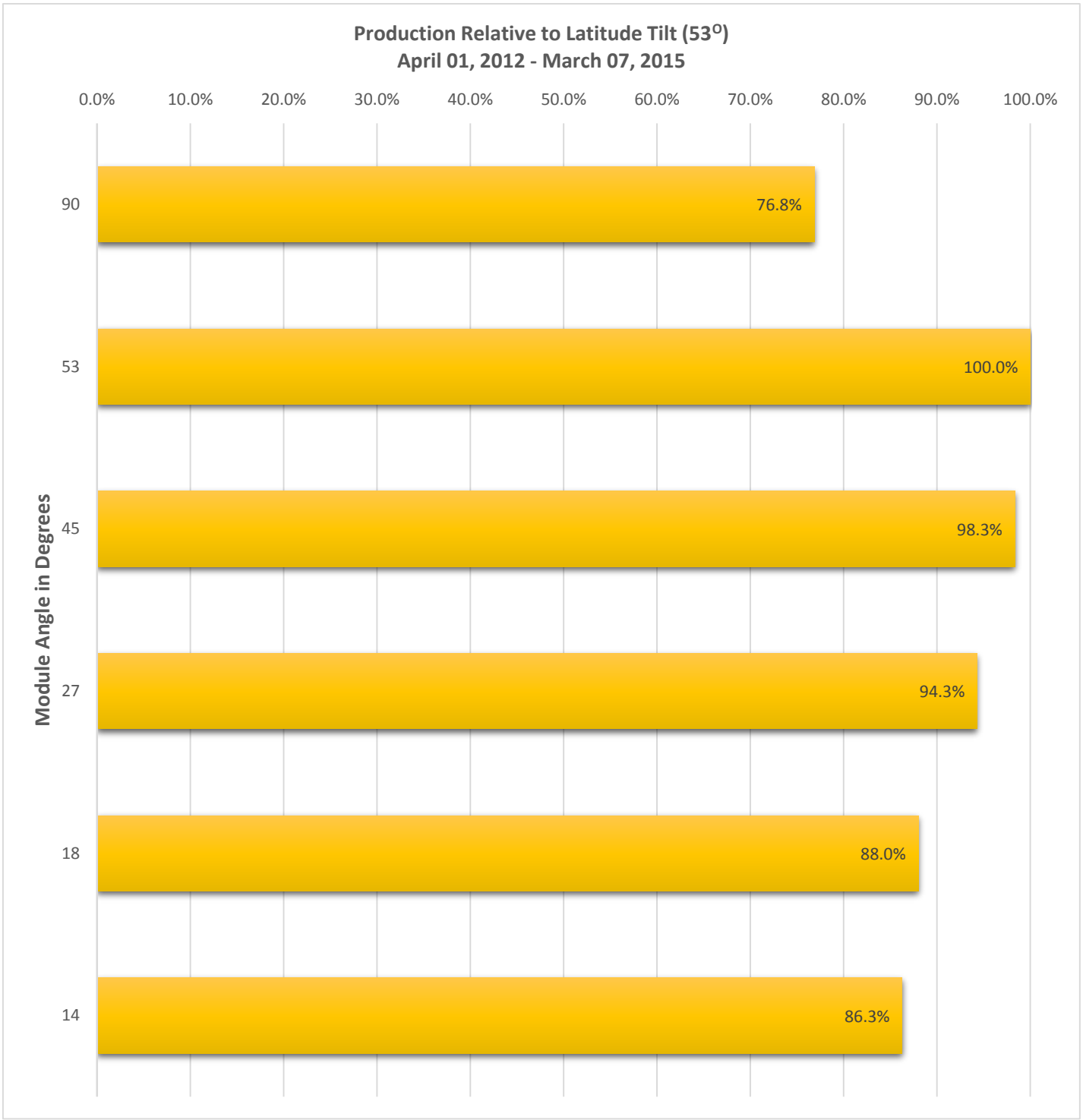
- Microinverters generate a snapshot of the system status every five minutes.
- Every five minute record contains the Timestamp, AC Voltage, DC Voltage, DC Current, Inverter Temperature and Power Production.
- All data points are zeroed if no power is detected from the module.
- A record for each module and inverter combination is collected once a week and contains a full dataset for the previous week.
- Seven day records for each inverter are stored as *.csv files for analysis.
- Data from the Grande Prairie site will begin to be published after two complete winter cycles.

Data Requests

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

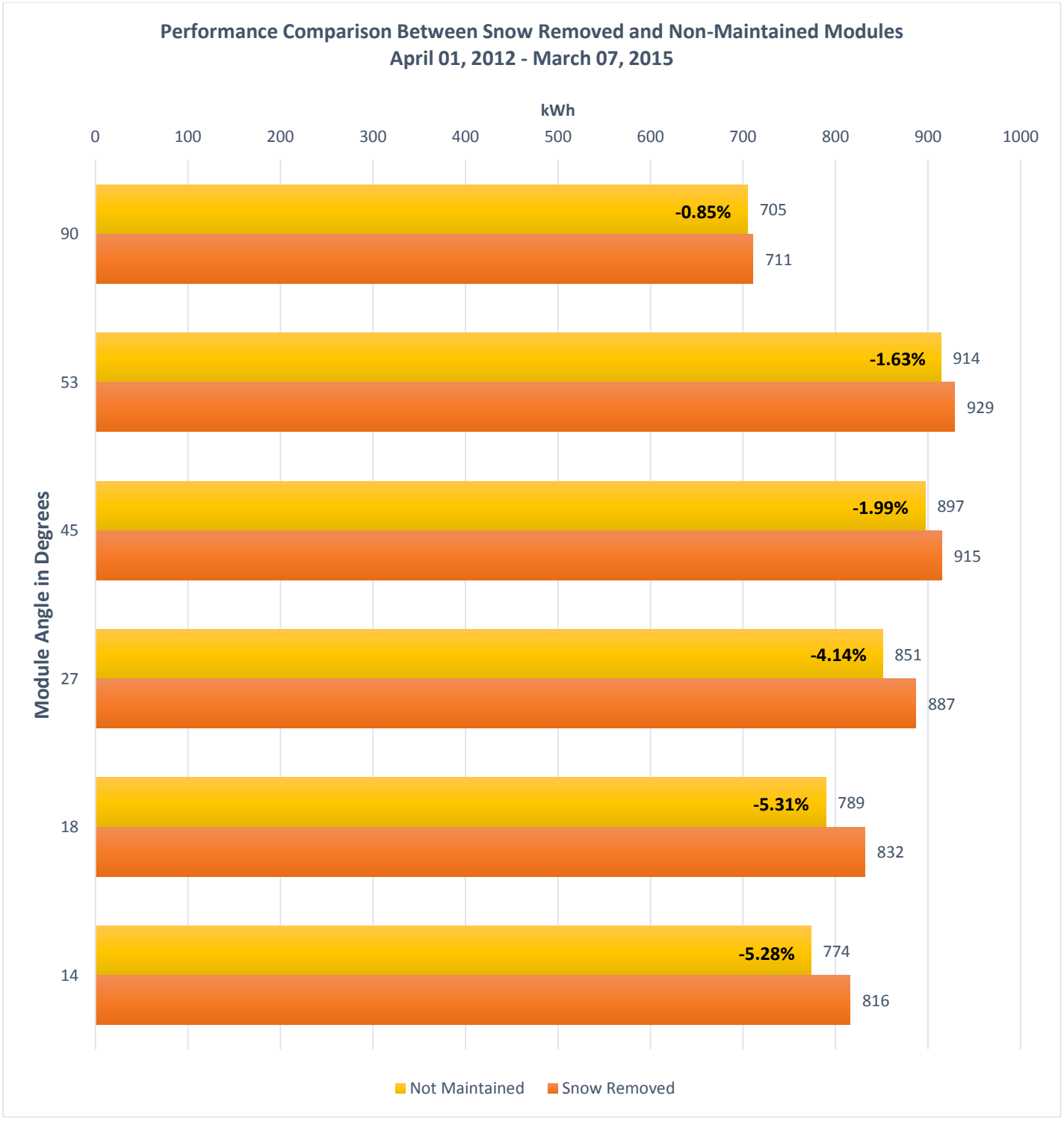
Reports: Tilt Angle Comparison (Edmonton)

- The following graph shows the production relationship among the different tilt angles using the highest producing angle (53^{O}) 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.
- To limit the variances displayed to those produced by snow accumulation manufacturing variances between left and right module/inverter sets have been normalized using non-snow month or summertime data.



Reports: Snow Impact, Winter Only (Edmonton)

- The following shows the effect of clearing during Edmonton's snow months only.
- Data was compiled from October 01, 2012 to March 31, 2013 and October 01, 2013 to March 31, 2014.