

Energy Production Comparison of Four Representative Solar Cell Technologies: mc-Si, a-Si, CIGS and OPV

Dr. Richard Childers/Konarka

Elsa Kam-Lum/Total S.A.

NREL Reliability Workshop, February 2011

- This report summarizes the work from an initial scoping study at Konarka to compare energy production of four different PV technologies. Representative, commercially obtained PV panels from four types of solar technologies, mono-crystalline Si, a-Si, CIGS and OPV exposed to Boston Area (42° Latitude) outdoor conditions were monitored for daily energy production during August to November 2010. The OPV panel surpassed the energy production of mc-Si, a-Si and CIGS panels in watt-hrs per nameplate watt every day on all 4 months monitored.
- Comparison of the daily results are presented for the 4 month period (August to November 2010).

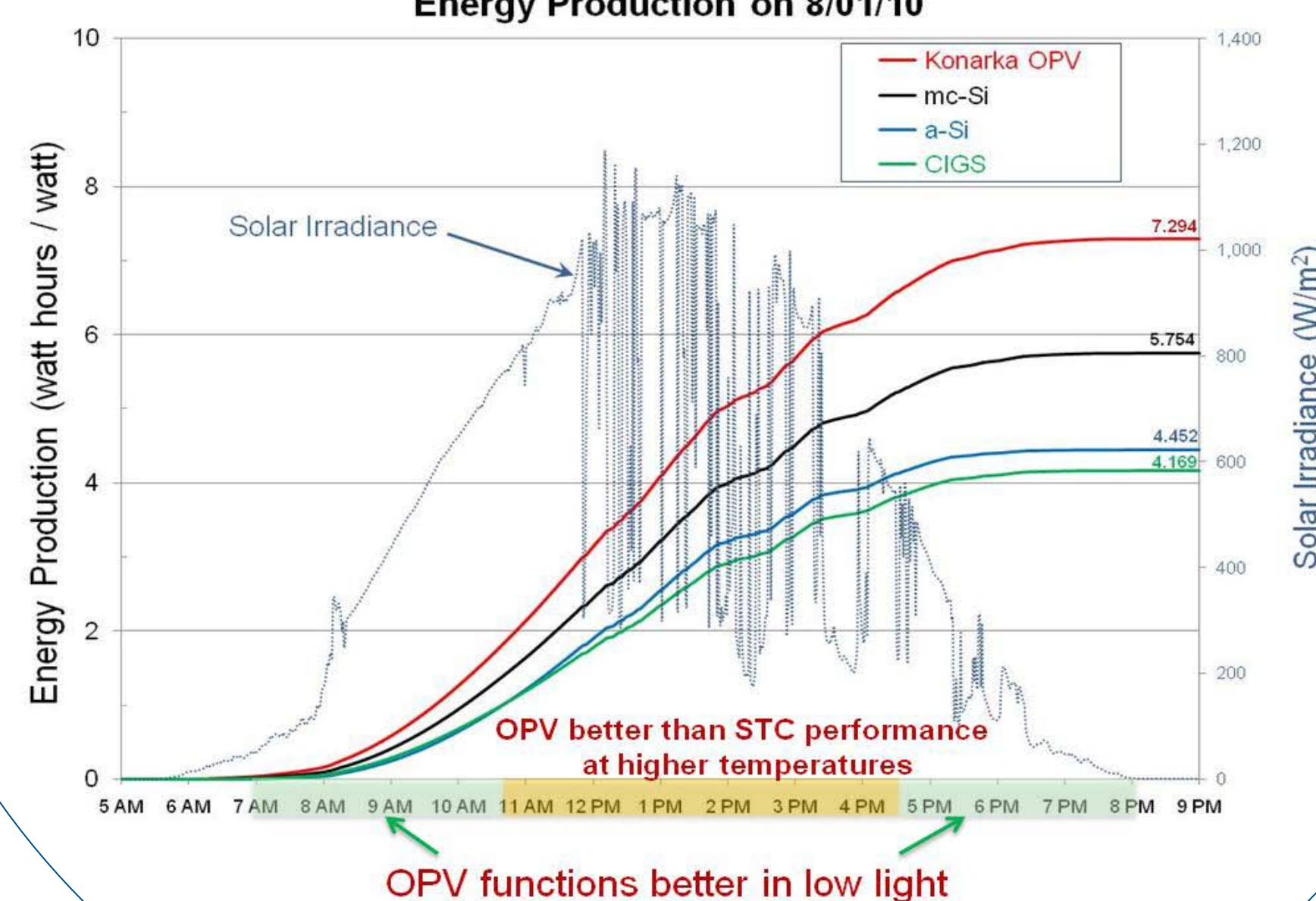
Methodology

- Test Vehicles: PV test panels acquired commercially
- Test location: Konarka Headquarters - Boston, MA area
- Panels Orientation: due South tilted at 42° off horizontal (at latitude)
- Measurements:
 - Parameters: voltage, current, temperature and irradiance
 - Frequency: data acquired and stored every 1 minute from 5am to 9pm, every day over the 4 months reported.
- Data Acquisition Equipment:
 - digital voltage and current meters
 - microprocessor controlled maximum power point tracking (50 msec response time) for each panel under test
 - ambient and OPV panel temperatures measured with type K thermocouples
 - Eppley Model PSP pyranometer to measure solar irradiance

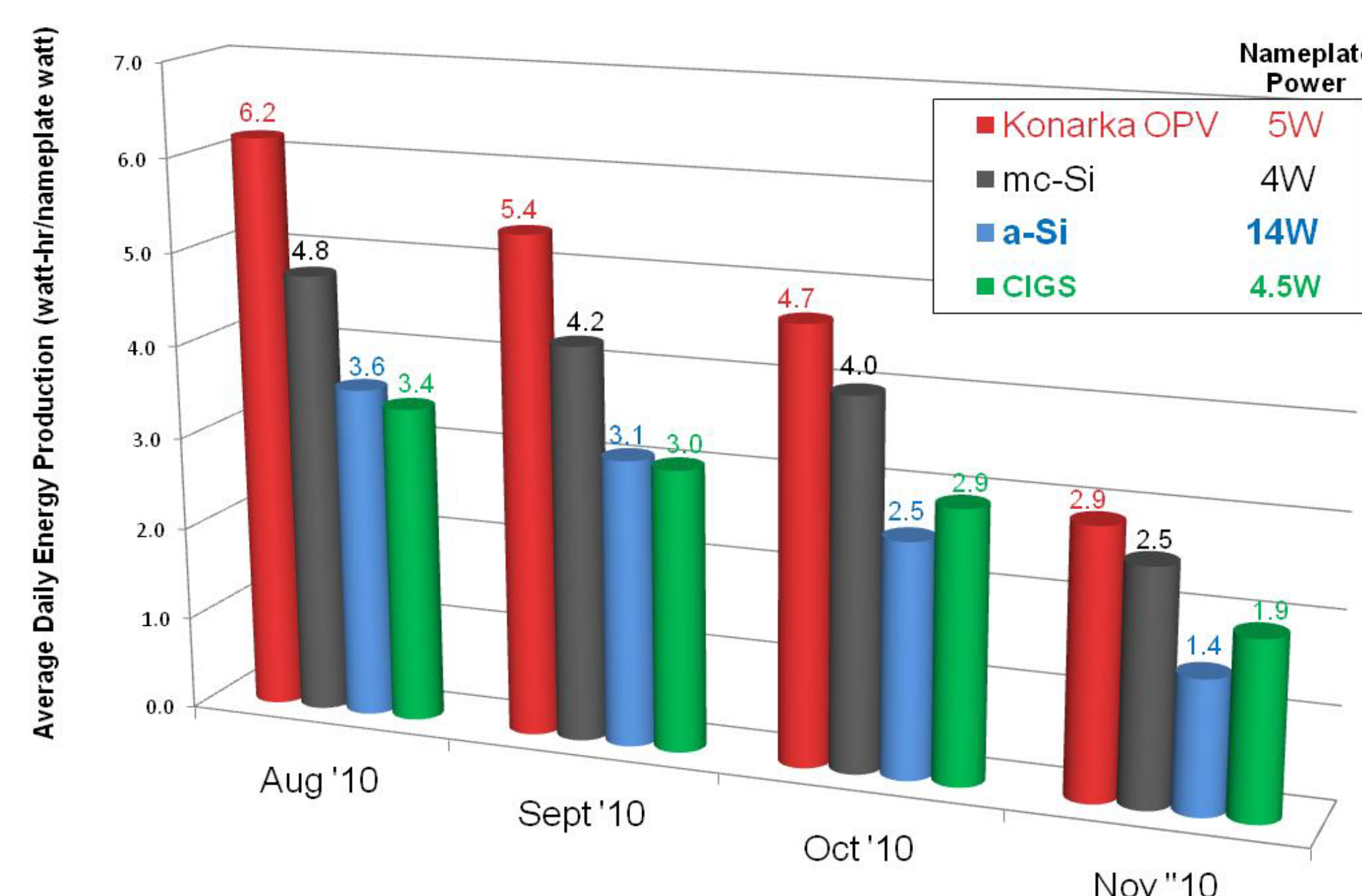
Outdoor Measurements, Boston, MA area, USA

First Day Results

Over 25% more energy collected by OPV panel compared to c-Si, a-Si and CIGS
Energy Production on 8/01/10



Average Daily Normalized Energy Production by Month



ENERGY PRODUCTION (in watt-hr)
POWER (Panel rating in watt)

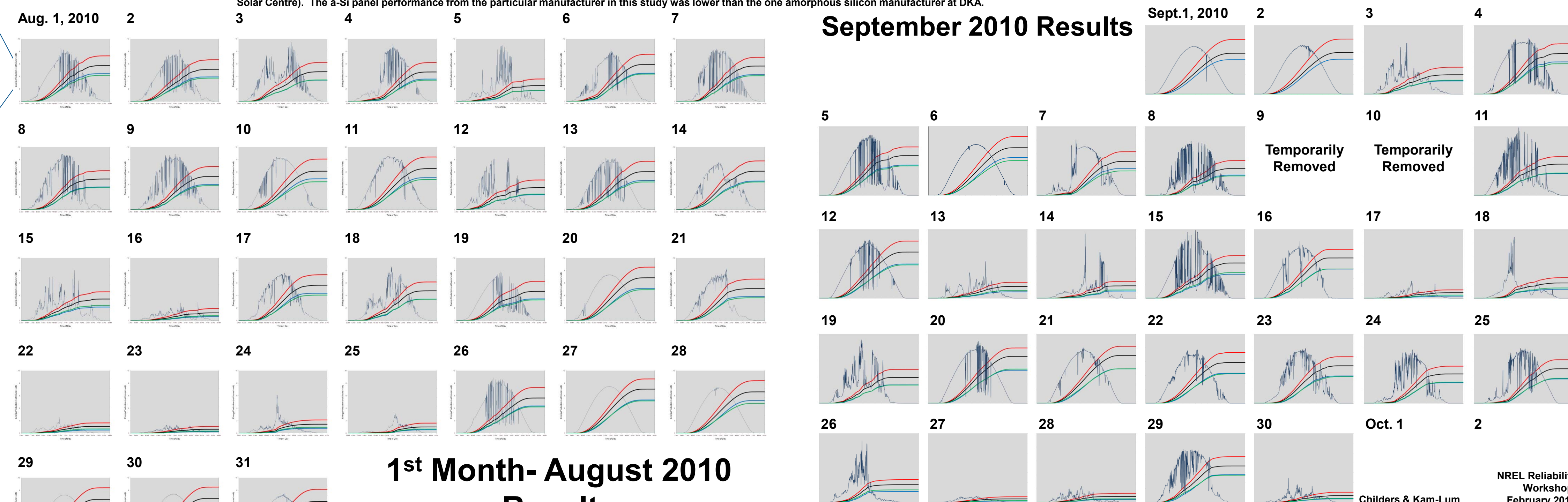
Highest for Konarka OPV

Childers & Kam-Lum

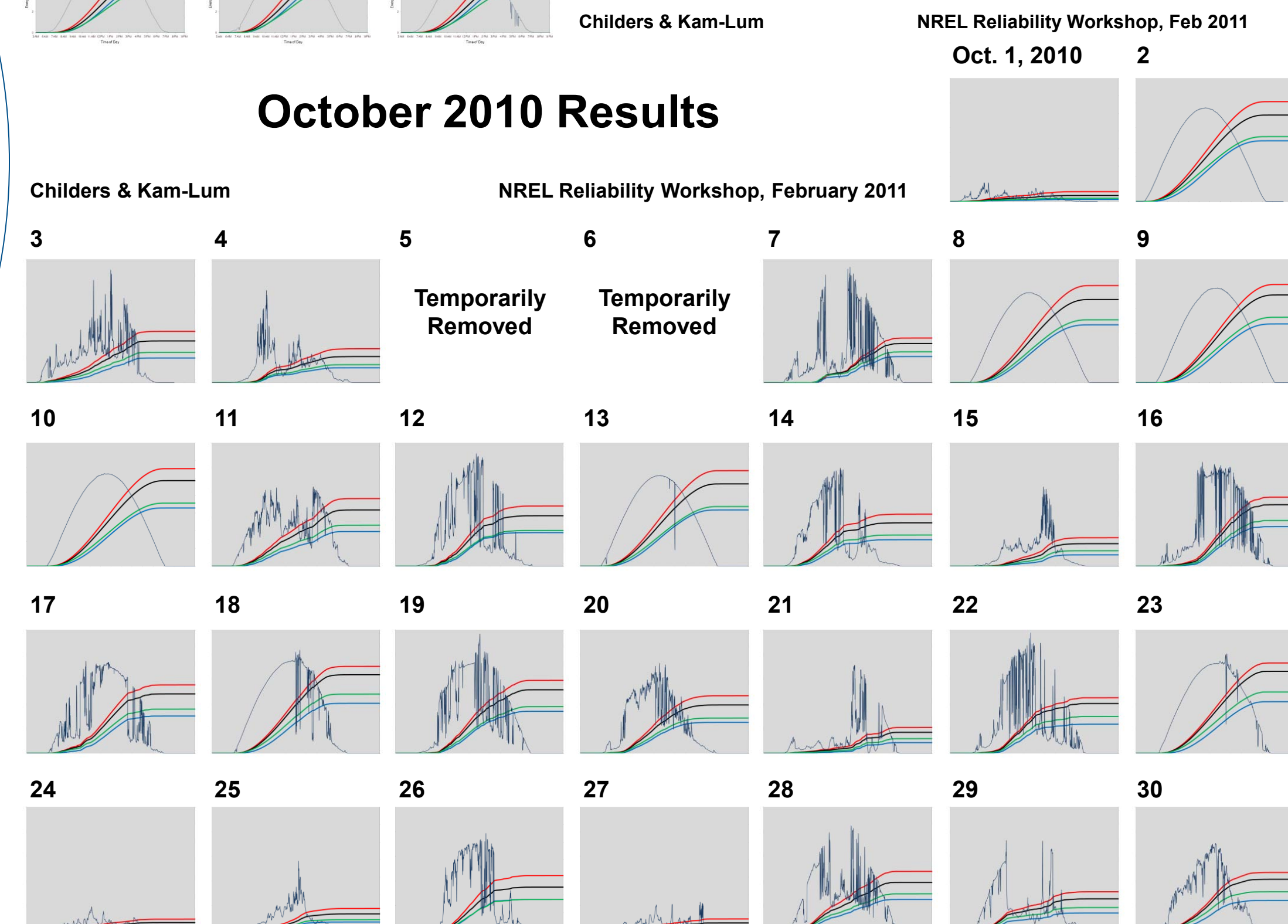
NREL Reliability Workshop, February 2011

Note: The daily average normalized energy production (watt-hr/watt_{nameplate}) obtained in this study in August (month closest for irradiation & ambient temp to DKA 23 40°S latitude) for mc-Si and CIGS is within the range in industry reports from same type technology panels at DKA (Desert Knowledge Australia, Solar Centre). The a-Si panel performance from the particular manufacturer in this study was lower than the one amorphous silicon manufacturer at DKA.

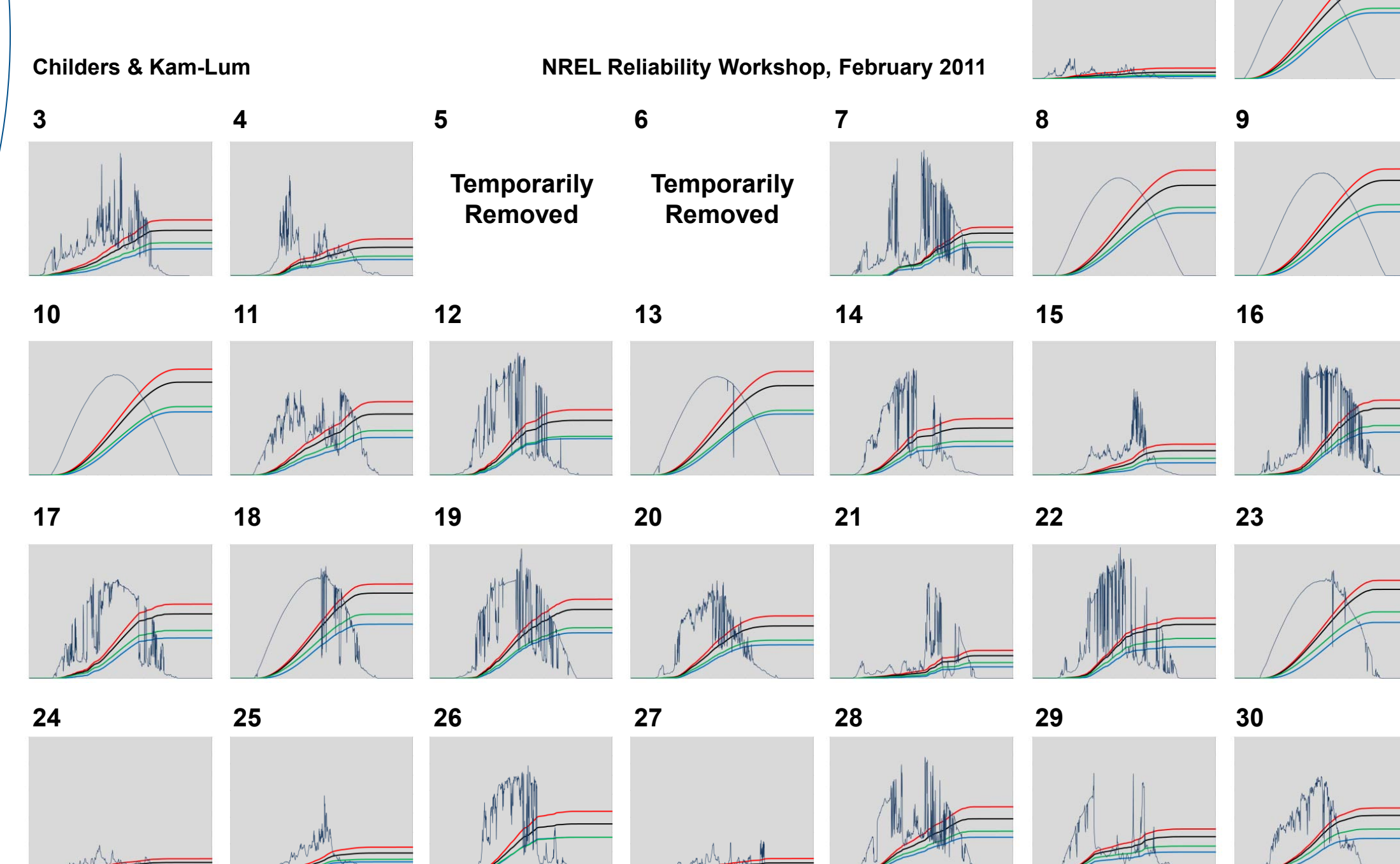
September 2010 Results



1st Month- August 2010 Results

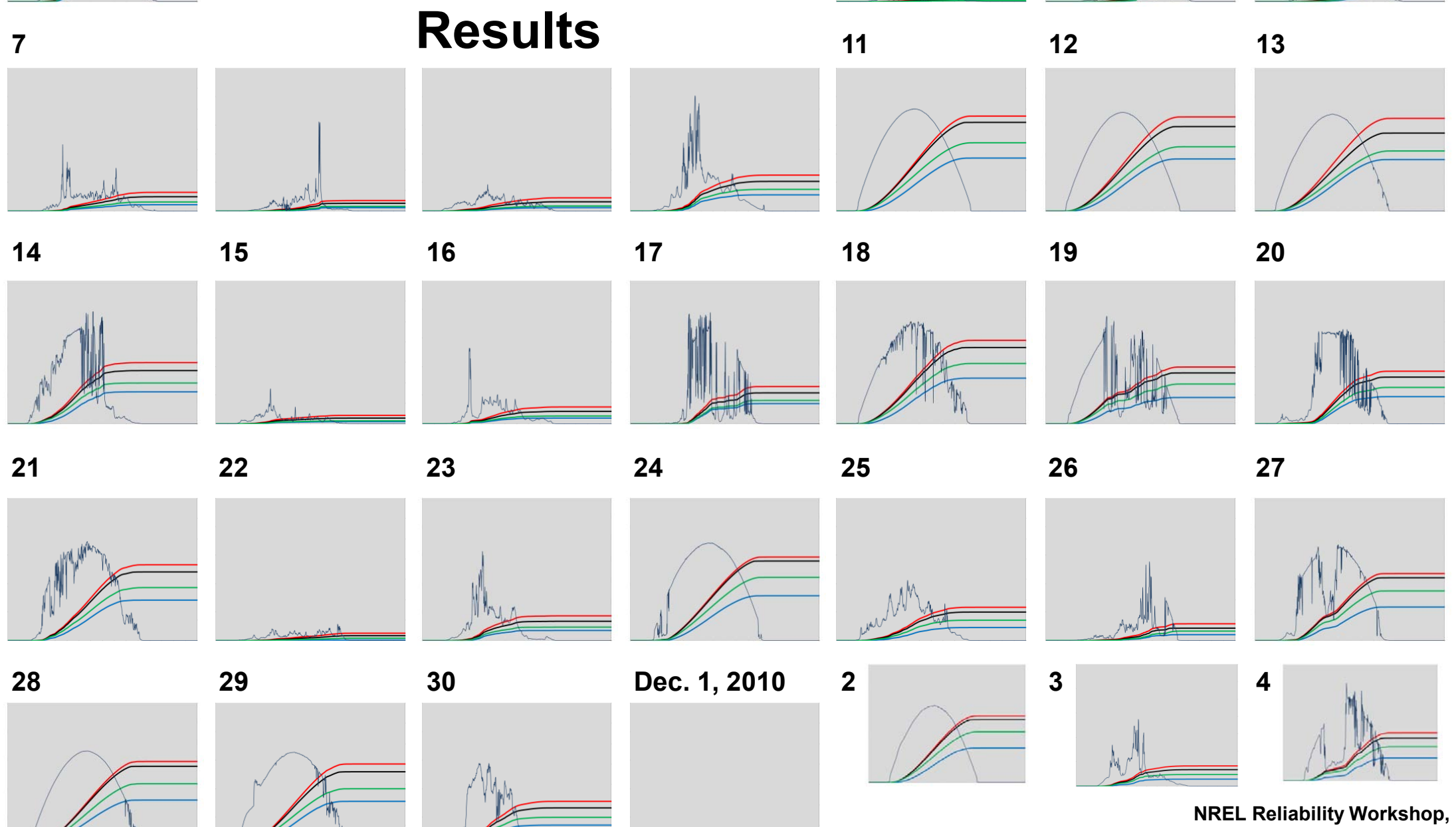


October 2010 Results



System Maintenance

November 2010 Results



Conclusions & Recommendations

- The OPV panel energy production surpassed the energy production of mono-crystalline Si, a-Si and CIGS commercially obtained panels every day during the 4 months of monitoring.
- Decreasing energy production was observed for all panels over the four months. This is believed due to each technology's particular temperature coefficient properties and decreasing ambient temperature and irradiance between August to November at 42° latitude. Corresponding ambient temperature and irradiance data is being compiled.
- The daily average normalized energy production (watt-hr/watt_{nameplate}) obtained in this study during August for mc-Si and CIGS is within the range in industry reports from same type technology panels at DKA (Desert Knowledge Australia, Solar Centre).
- This was a scoping study of energy production of four different solar photovoltaic technologies from commercially available panels when exposed to outdoor conditions at 42° latitude. A more in-depth study adding other PV technologies not included in this study, with more manufacturers and larger number of samples and longer duration is recommended.

Contact:
Richard Childers/Konarka
rchilders@konarka.com
Elsa Kam-Lum/Total S.A.
ekam-lum@konarka.com

This poster presentation does not contain proprietary or confidential information

Konarka – converting light to power – anywhere



TOTAL