

# Solar Power in Rural Alaska

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ALASKA ENERGY AUTHORITY



SAFE,  
RELIABLE, &  
AFFORDABLE  
ENERGY  
SOLUTIONS

REDUCING THE COST OF ENERGY IN ALASKA

# Outline

- Introduction to the Alaska Energy Authority
- Planned Kotzebue Electric Solar PV Project
- Update on Eagle Solar PV Project
- Rural Solar Points to Ponder



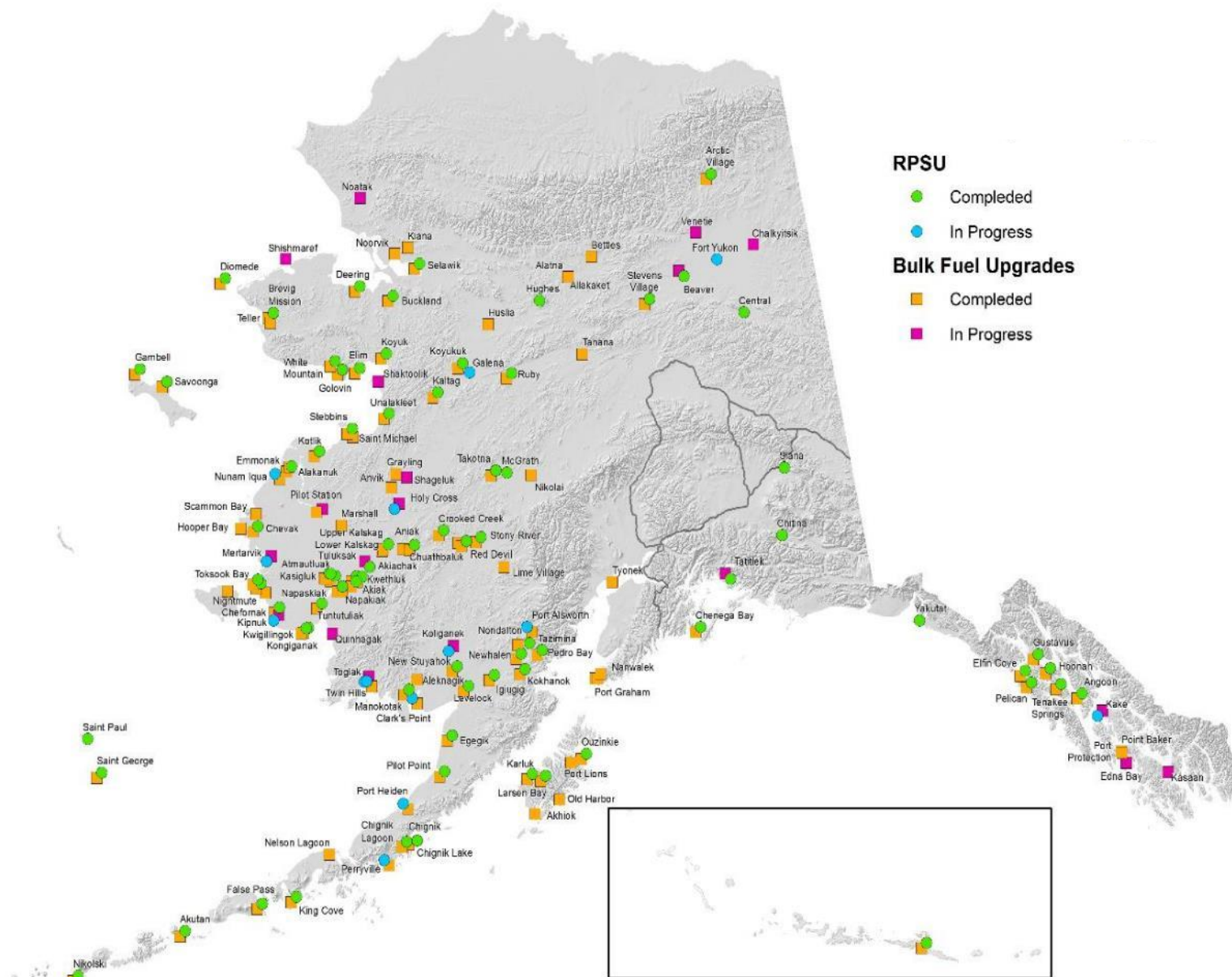


AEA's mission is to reduce the cost of energy in Alaska



# Bulk Fuel and Rural Power System Upgrades

2000-2016



# Kotzebue Electric Association Solar PV Project

- 576kW (***largest in rural Alaska***, second largest in Alaska)
- Power generation: 700,000 kWh/year
- 14% Capacity Factor
- 2020 Construction with local and regional labor
- General Contractor: Alaska Native Renewable Industries LLC
- 1,440 LG 400W bifacial solar panels
- 720 SolarEdge P850 Power Optimizers
- Eight 67kW 3-phase inverters
- 880 APA Titan ground screws for the racking system
- To be integrated with KEA's diesel/wind/battery system





# Eagle, Alaska

AP&T provides power and communication services to the residents of Eagle and Eagle Village

Yukon River

NORTH

Seasonal highway

Project Site

Airport

Short construction seasons  
Highway closure Oct-Apr





# Project Site



School

Heat loop between powerplant and school

Maintenance Building

Powerplant

3 Diesel Generators – 125kW to 175kW  
Average daily load is 80kW [70-90kW]

Fuel Tanks



# Pad Construction



Before



Clearing

Construction activities commenced in June 2014



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Pad Completed



Excavator used for pad construction

1000 yards  
of gravel  
used to level  
and elevate  
pad acquired  
from local sight

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# Pole Installation



Eight 8" Sch 80 steel poles on 18' spacing  
buried 8' deep with concrete footings and  
structural steel stabilizing beams  
Construction was delayed and work on pad was  
completed in August 2014

Deeper excavation delayed by frost



Buried conduits  
between poles and  
powerplant

Trenches and holes  
were excavated using  
back hoe, excavator and  
Ditch Witch



# Array Installation

12 modules per string  
Module weight – 42lbs each  
Mount weight – 150lbs  
Total weight - 650lbs



Zoom boom with assembly lifting frame ,  
machine had to be trailered in from Tok

12 Modules assembled onto a  
DPW TPM12 module mount  
Special equipment required to  
Install/ maintain the module  
assemblies



Weather was fair during installation and  
the arrays were assembled, installed and  
commissioned in just over a week in mid May 2015  
The installation of the balance of PV system  
electrical devices was completed in 2014.





# Performance



Has been as expected based on the PVWatts calculator provided by NREL

[<http://pvwatts.nrel.gov/pvwatts.php>]

| Period |           | Actual Generation kWh | Calculated by PVWatts, kWh |
|--------|-----------|-----------------------|----------------------------|
| 2015   | June      | 3810                  | 3239                       |
|        | July      | 3037                  | 3212                       |
|        | August    | 2442                  | 2781                       |
|        | September | 1805                  | 2268*                      |
|        | October   | 1062                  | 1344*                      |
|        | November  | 399                   | 910*                       |
|        | December  | 54                    | 480*                       |
| 2016   | January   | 78                    | 840*                       |
|        | February  | 948                   | 1700*                      |
|        | March     | 2409                  | 2718*                      |
|        | April     |                       | 3203                       |
|        | May       |                       | 3490                       |

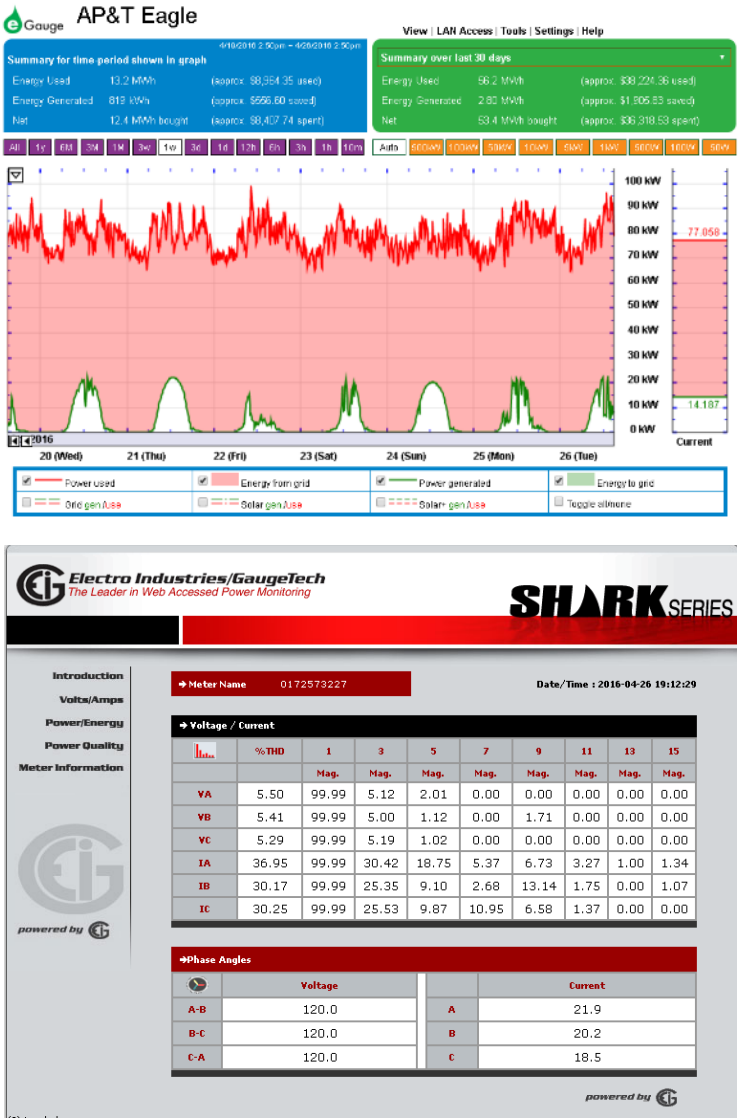
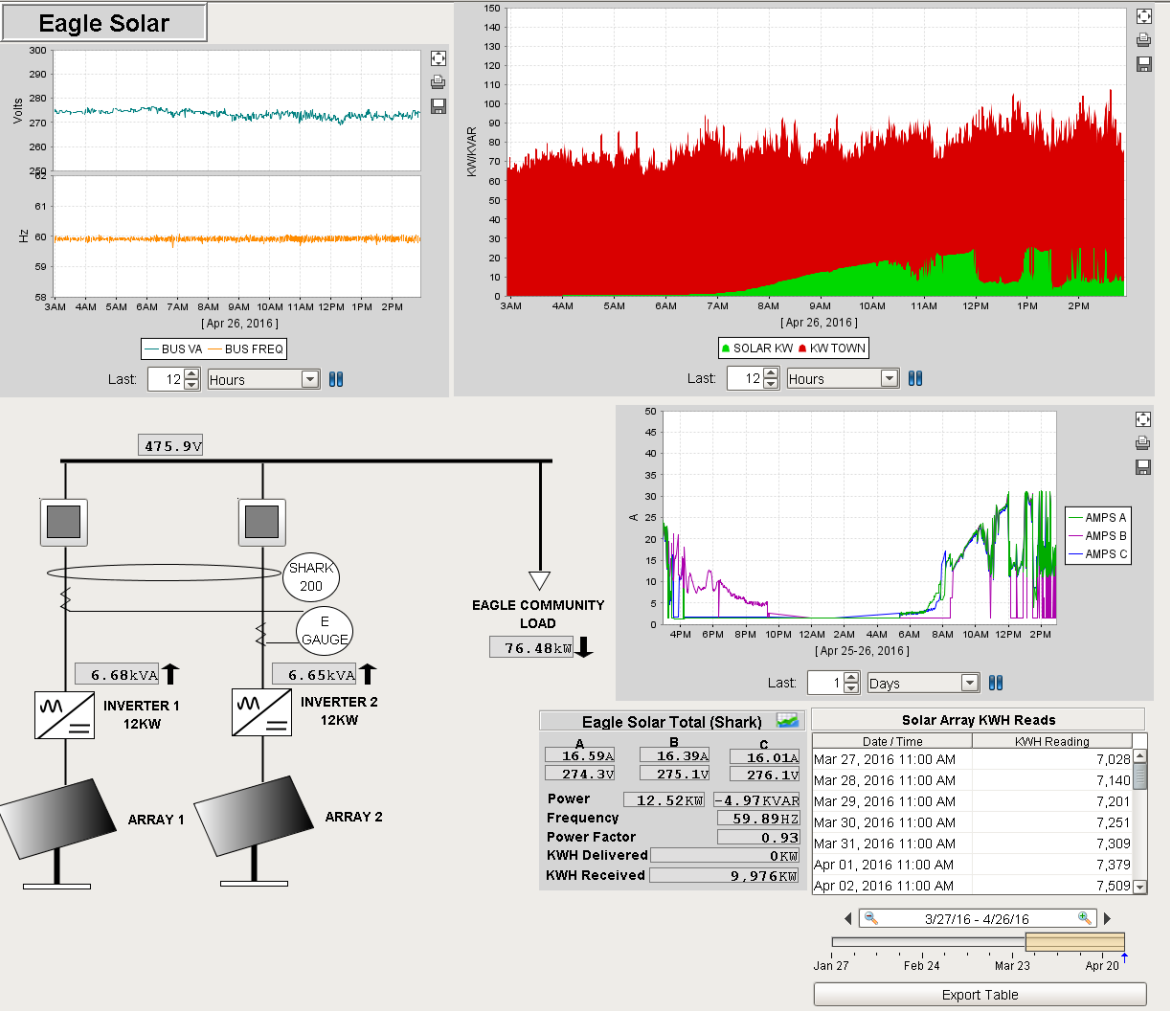
Output was reduced due to wild fire haze for several weeks

We believe the poor performance between September and March is partially due to the shading from hills south of Eagle. PVWatts assumes the horizon to provide shade not the local geography.



\*Indicates that value is calculated using a 65° tilt angle, all other values use 45°

# Remote Monitoring



eGauge window showing PV system performance

Shark window showing power quality data, e.g., system harmonics

SCADA window showing powerplant electrical conditions, solar contribution to town load, Shark meter data, instantaneous PV performance.



# Features



Fully automated PV electrical system.  
SCADA system.  
Fiber optic link between powerplant and the company server.  
Remote access of the SCADA system, eGauge and the Shark meter.

## Operation & Maintenance

O&M has been minimal since the solar system was commissioned amounting to only about 20 hours for snow removal and adjusting the tilt of the arrays

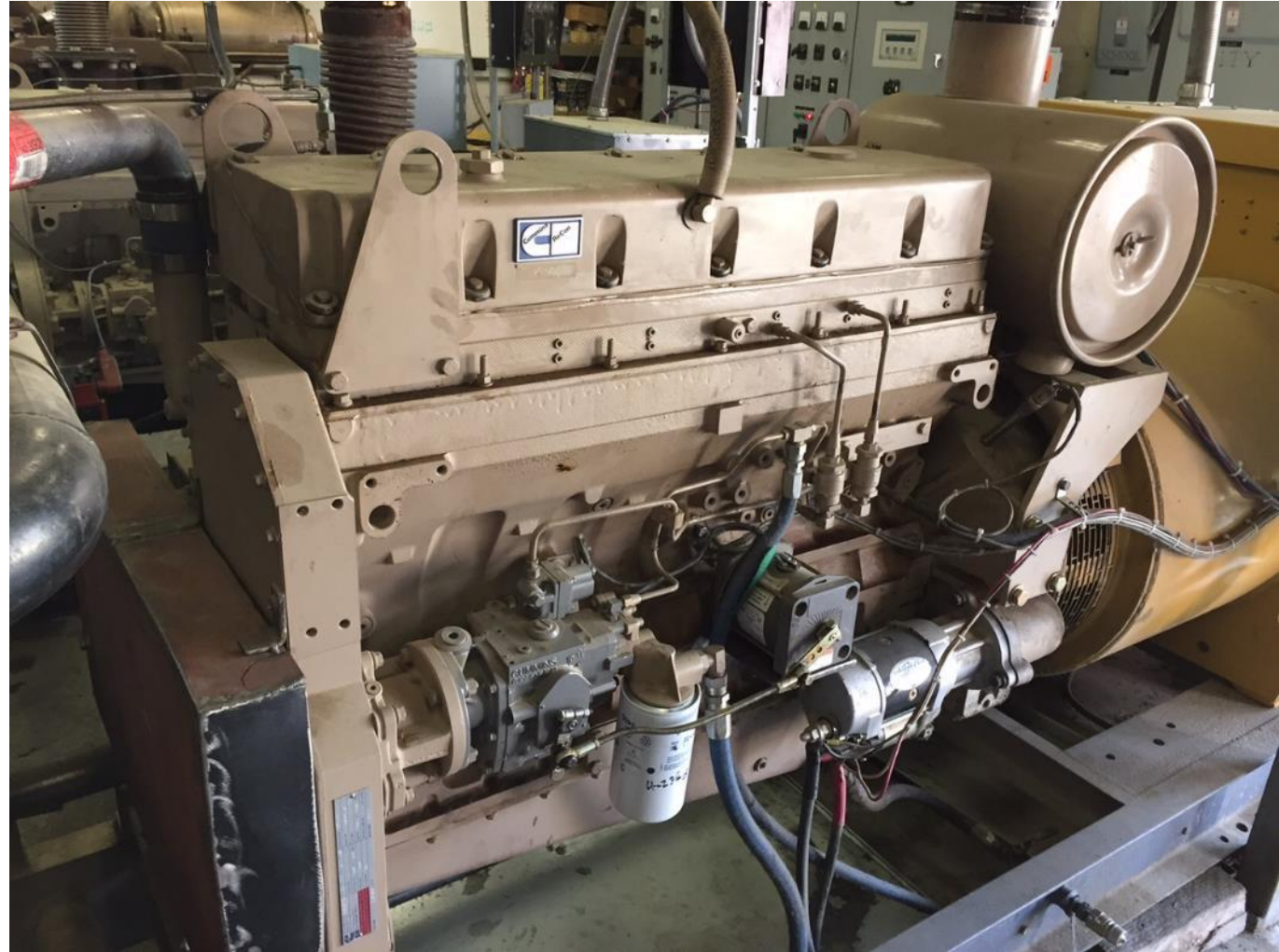
## Issues

The inverters frequently shutdown and restart due to minor frequency and voltage excursions that are typical occurrences in a small isolated electrical system. This is an automatic process but impacts the overall performance of the PV system. We are working with the manufacturer to determine if it will be possible to adjust the range of the voltage and frequency trip settings.



# Eagle Powerhouse Info

- Two 175kW Cummins L10 gensets
- One 180kW John Deere 6101
- Heat recovery to the school
- Average load in May: 86kW (PCE)
- Peak load in May: 111kW (PCE)
- Minimum load in May: 50-60kW (est.)





# Eagle Solar PV Project

- Installed in May 2015
- 24kW of PV
- 97kW average load
- \$261k cost
- 25,048 solar kWh in FY19
- 1,898 gallons of diesel saved
- \$5.3k annual savings at \$2.81/gallon (FY19)
- 3% of total fuel use saved
- Minimal O&M required



# Points to Ponder in Rural Solar PV Planning

- Fire Marshal review required?
- Design and construction comply with electric code?
- Coordinate with the utility (see AVEC's Cogeneration Application)
  - Safety
  - Interconnection standards
  - Insurance
  - Inspection
  - Appropriate meter!
  - Rates
- Consider three phase balance
- Ensure transformers are appropriate
- Consider and understand effects on electric rates (PCE, Net Metering, etc...)
- Include impacts on heat recovery and diesel efficiency in economic analysis







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