NORTH WEST REC

Your Touchstone Energy® Cooperative

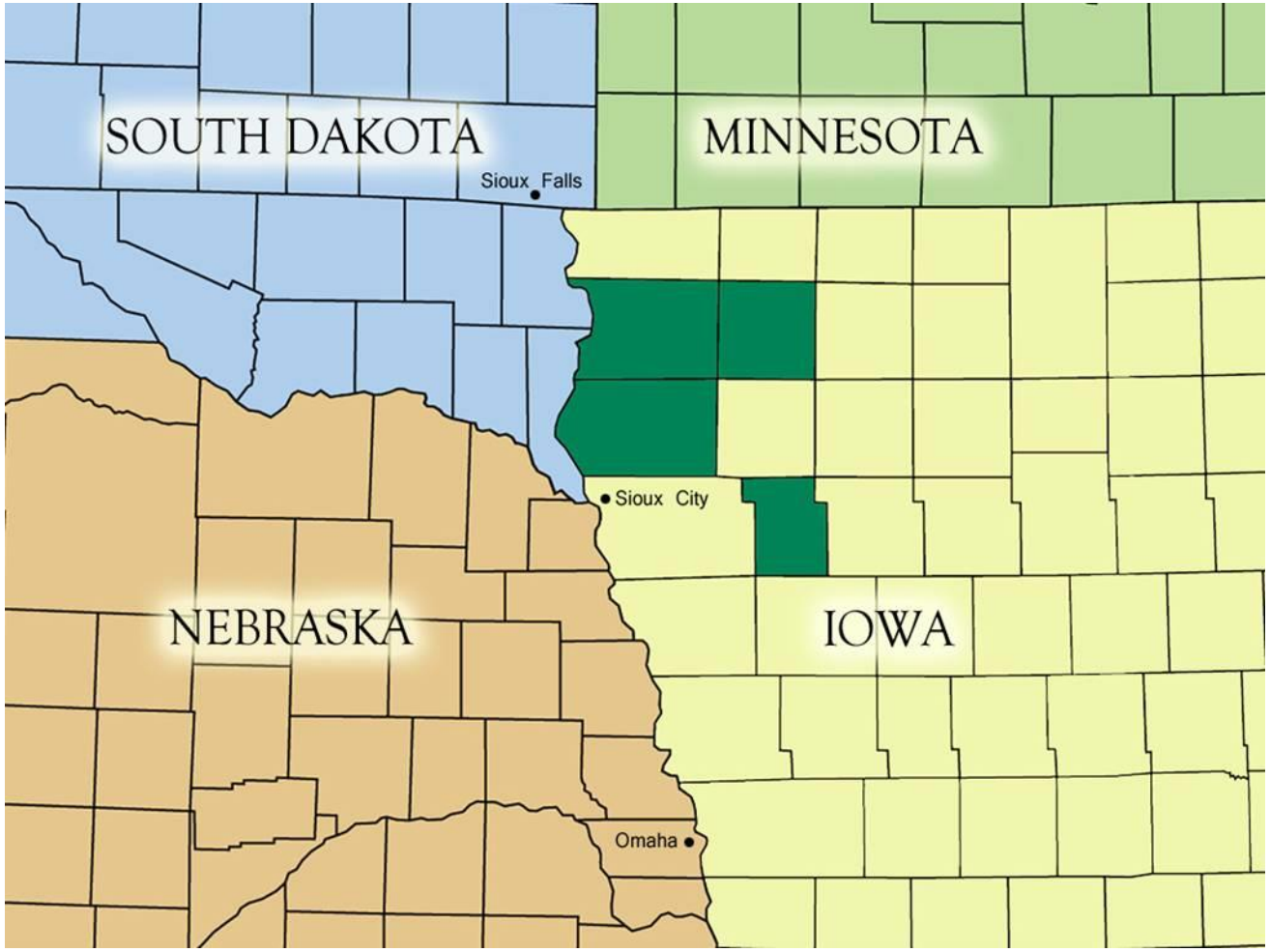
SOLAR DEMONSTRATION PROJECT

September 2, 2015

USDA Solar Energy Conference

NORTH WEST REC

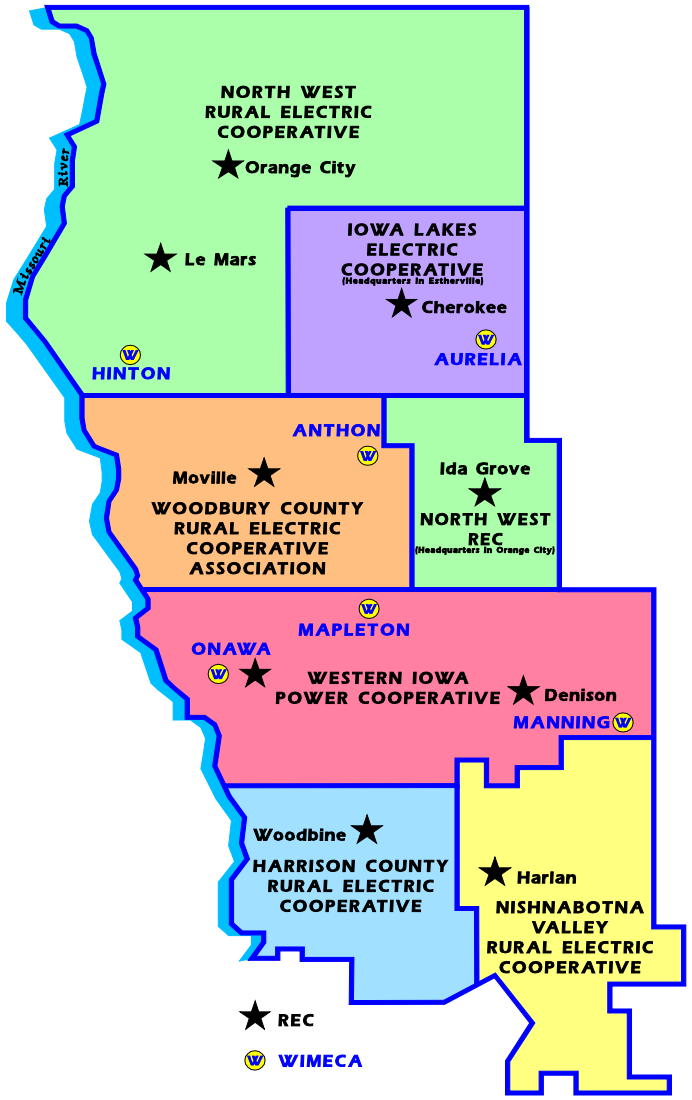
Your Touchstone Energy® Cooperative



- Member owned electric Cooperative
- 9,700 meters
- 3,700 miles of electric line
- Members are primarily in Sioux, O'Brien, Plymouth & Ida counties

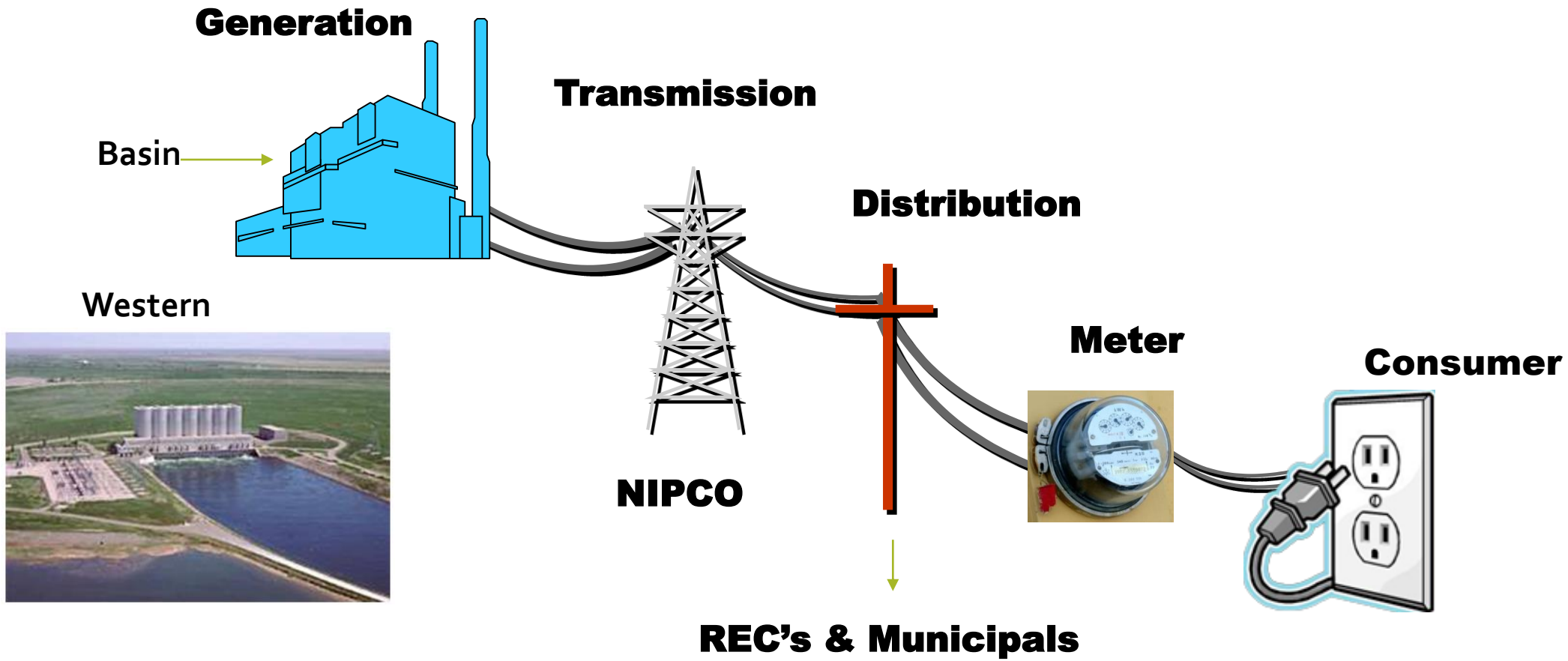

Headquarters in Orange City
District Offices in Le Mars & Ida Grove
Service Center in Primghar

NIPCO Is Wholesale Power Supplier



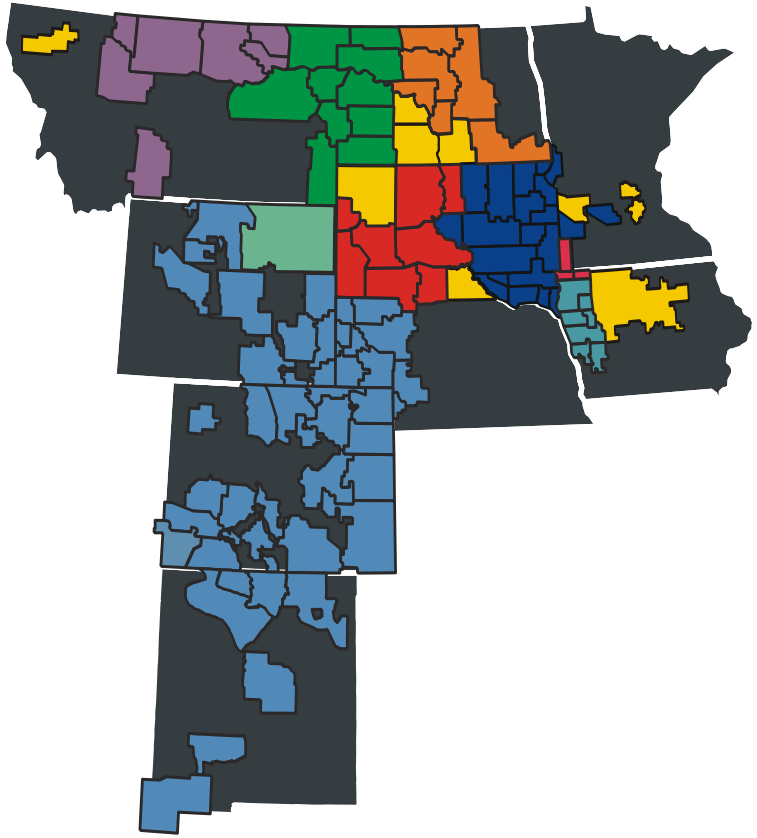
- NWREC one of NIPCO's 7 distribution cooperative members
- We have an "all requirements" contract with NIPCO

Cooperative Power Supply Network



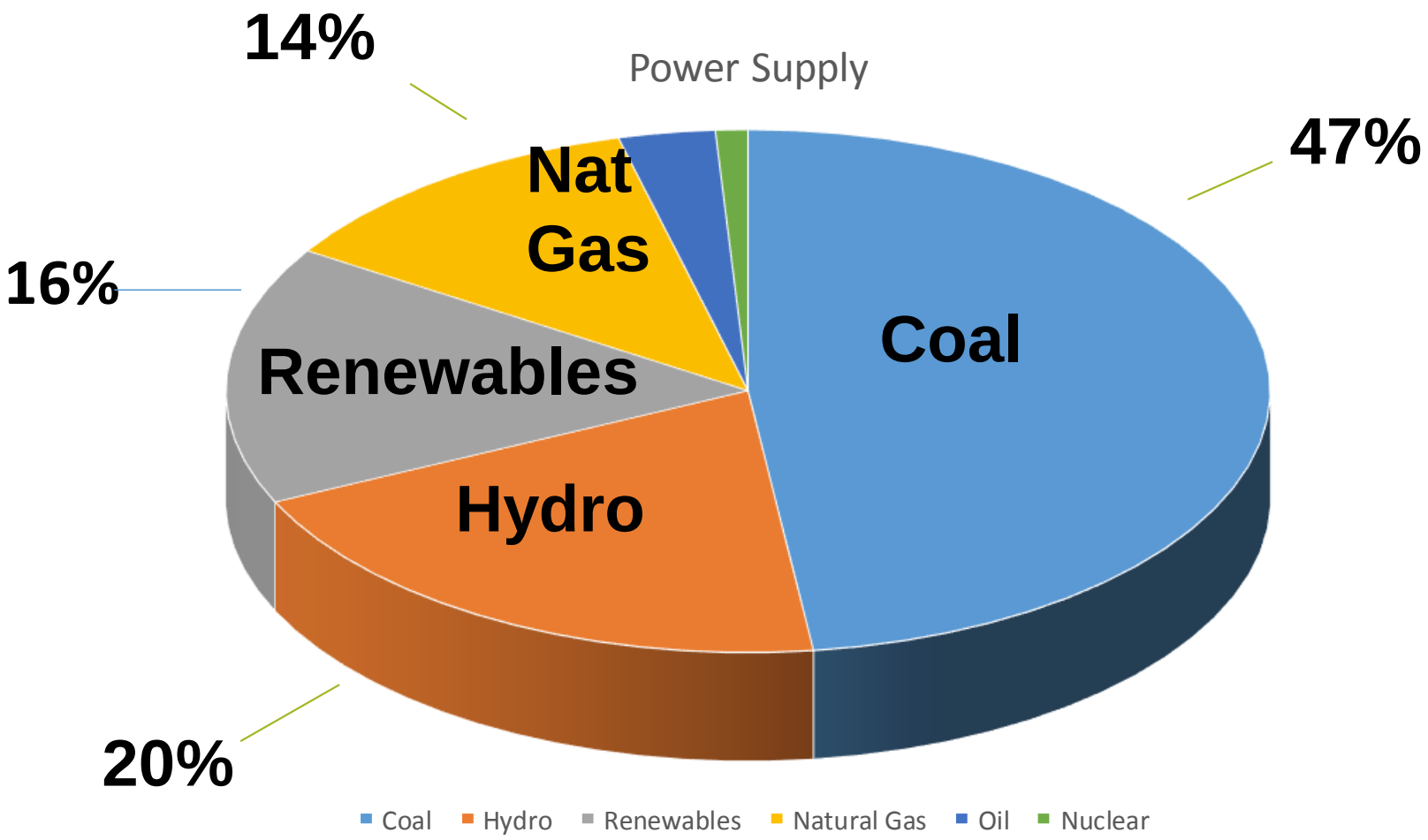
Power Supply . . .

Basin Electric – 80%



Hydro Generation is 20%

Power Supply Portfolio



NWREC's Solar Demonstration Project . . .

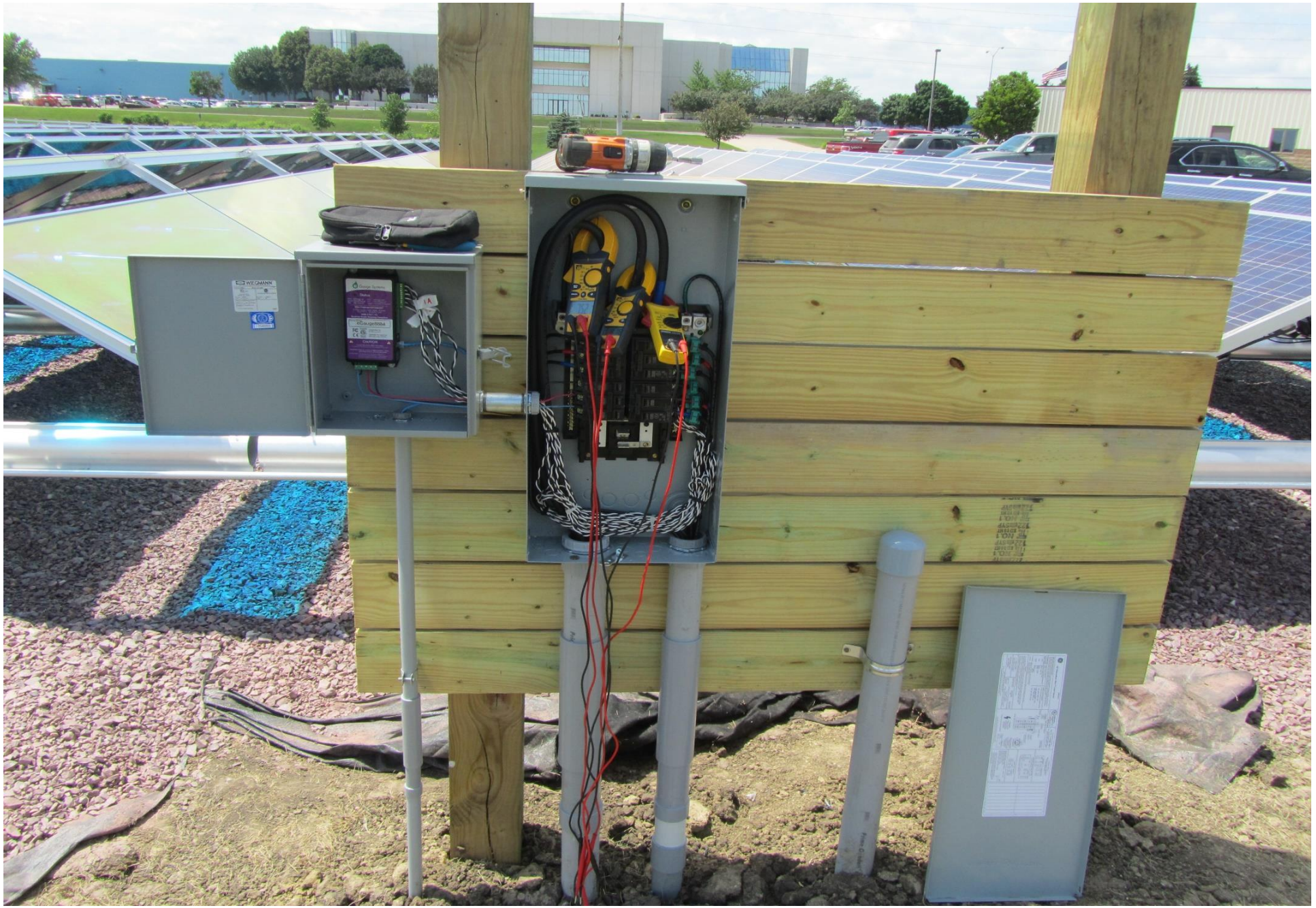
- **Through our strategic planning process, we continue to look at new energy & technology developments**
- **In the Fall of 2013, we were seeing an increase in discussion about renewable energy and specifically solar generation**
- **Our Statewide had formed a Distributed Generation Task force**
- **Our Board decided to do a demonstration project and to try to learn more about solar with the goal of sharing what we learn with our members, legislators, schools and others**

- Our employees installed the solar array
- It is on the south side of our Orange City headquarters property
- Used local licensed electrician for wiring
- Safety is our highest priority


Altec


- There are 96 solar panels
- Each panel is 410 watts
- 39.36 kW DC (34 kW AC)


The tenK system uses smart reflectors to maximize the energy produced


WEGMANN

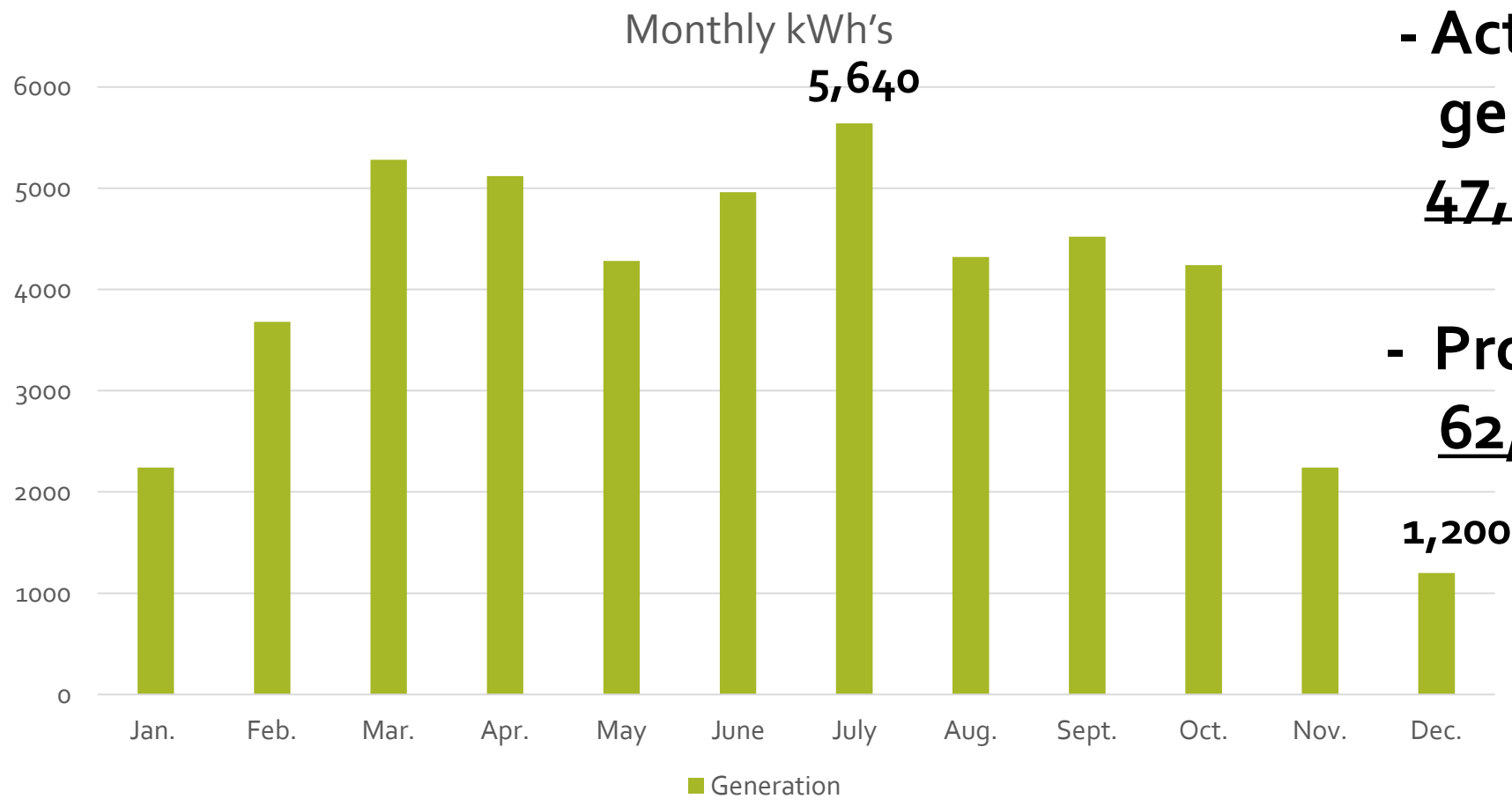

FIRE
EXTINGUISHER
DO NOT BLOCK
FIRE
EXTINGUISHER
DO NOT BLOCK
DANGER
ARC FLASH & SHOCK HAZARD


Solar
Demonstration
Project
NORTH WEST REC


North West REC 1505 Albany Pla
Solar array foot print is approximately 5,000 s.f.

What have we learned?

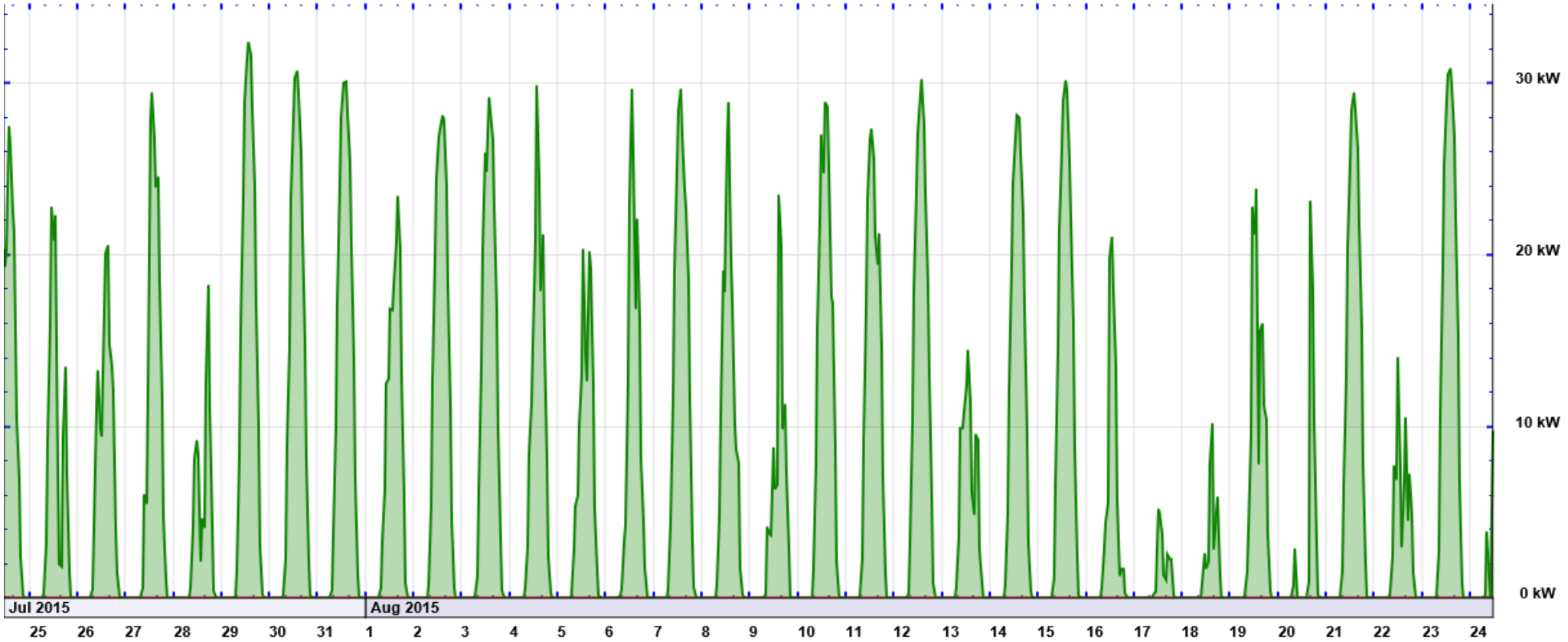
One of the Questions We Had – "How Much Does Solar Generation Change Monthly?"



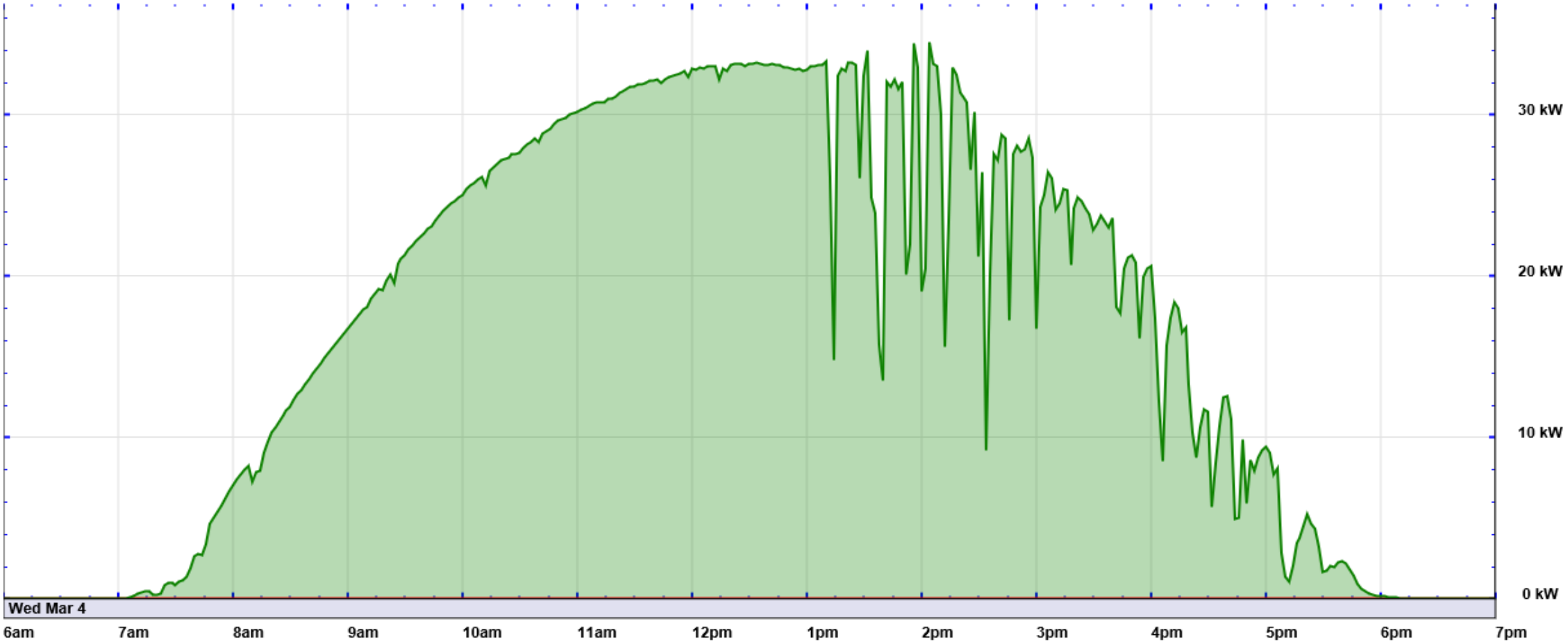
- **Actual first year generation <u>47,720 kWh's</u>**

- **Projected was <u>62,282 kWh's</u>**

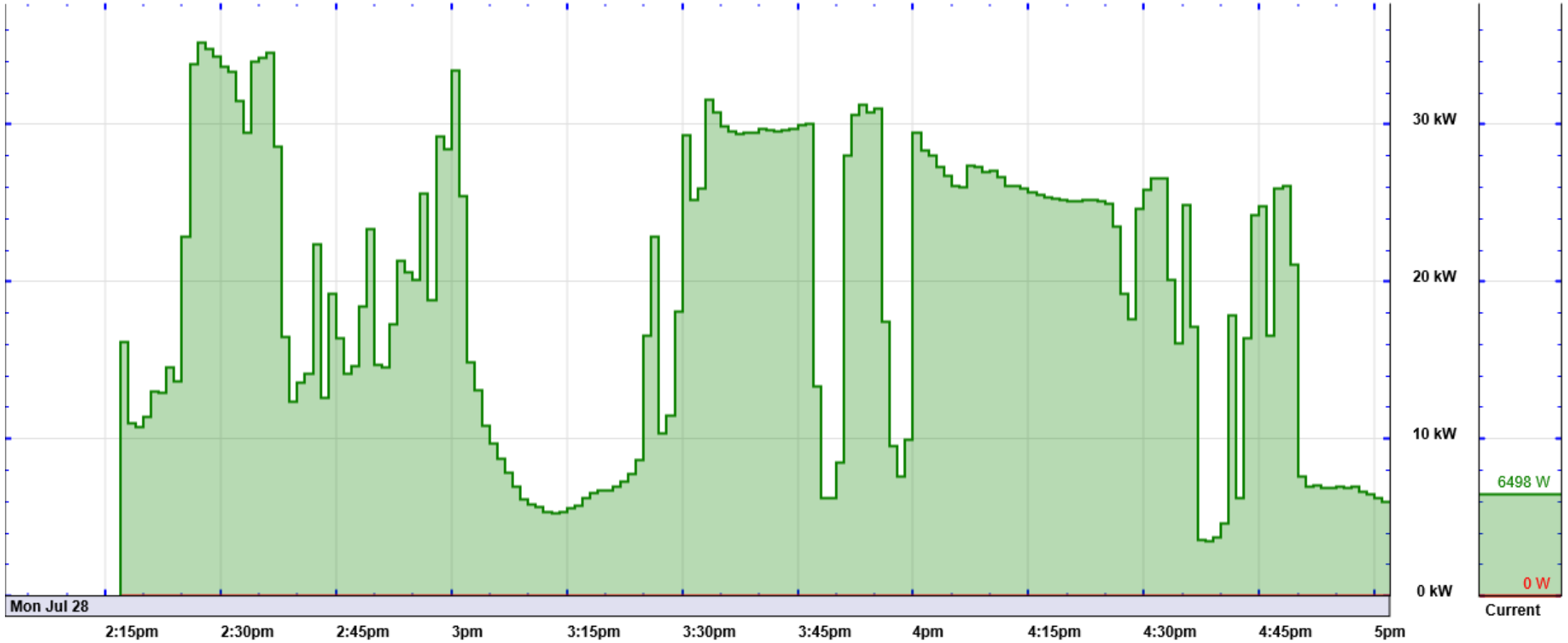
A Related Question – "What is the impact of clouds & snow?"



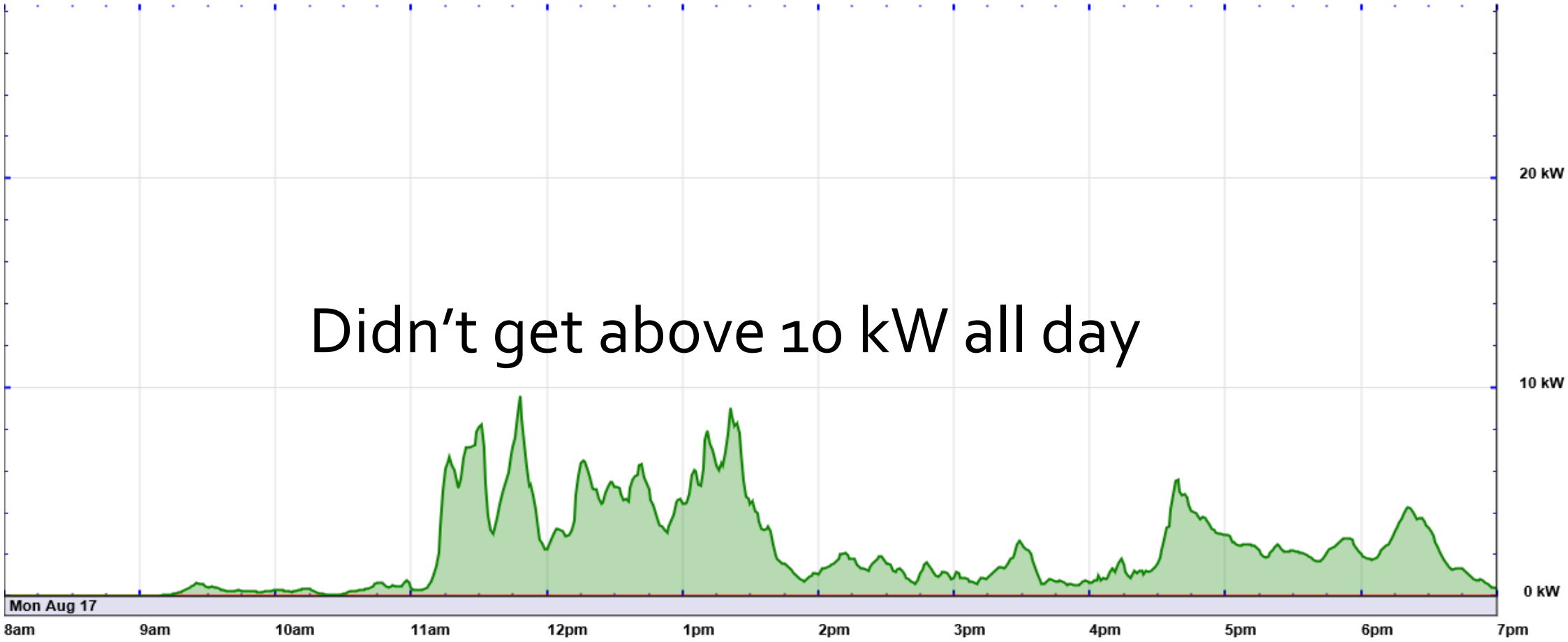
Mostly Sunny Winter Day



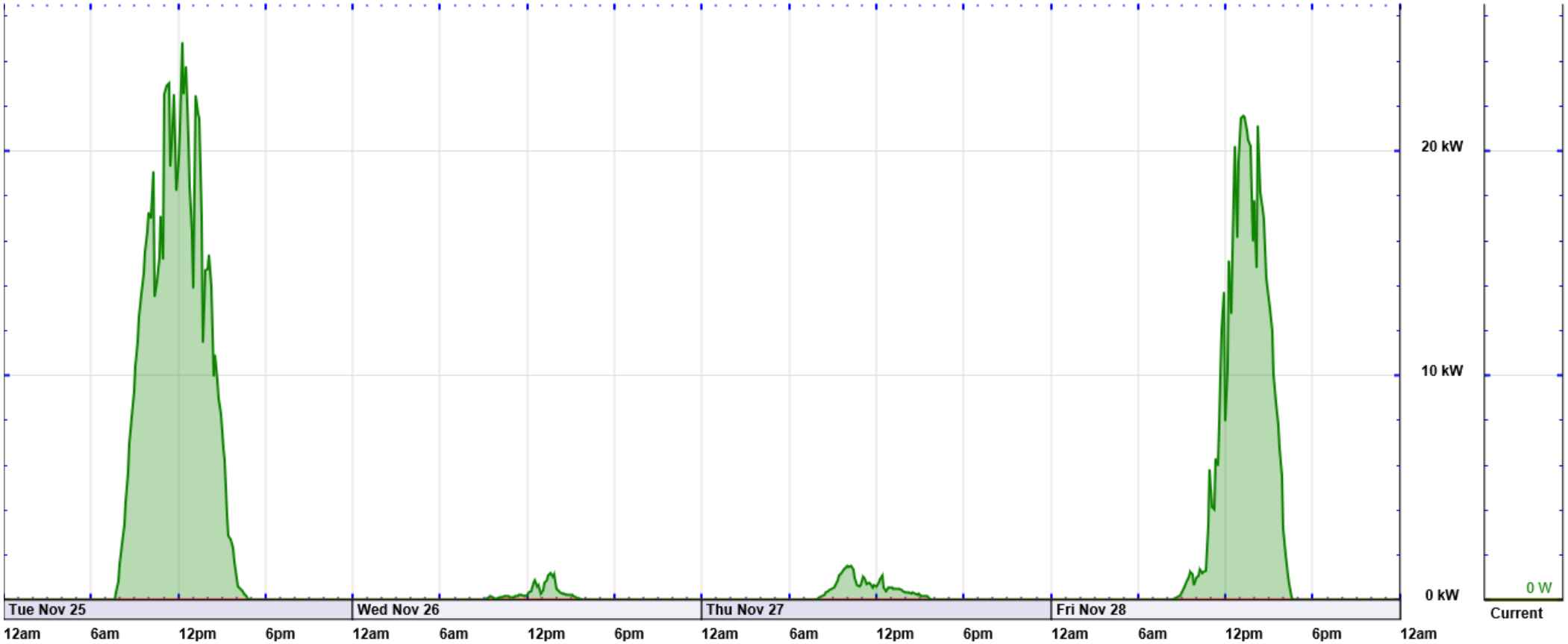
Partly Cloudy Summer Afternoon



Mostly Cloudy Day



Impact on generation from snow . . .



Another Question – "Does Solar Generation match up or "coincide" with our system peak demand?"

- We are a winter peaking system, but we have peak demand usage & billings every month
- Our monthly system peak demand is the highest half hour of kW demand usage

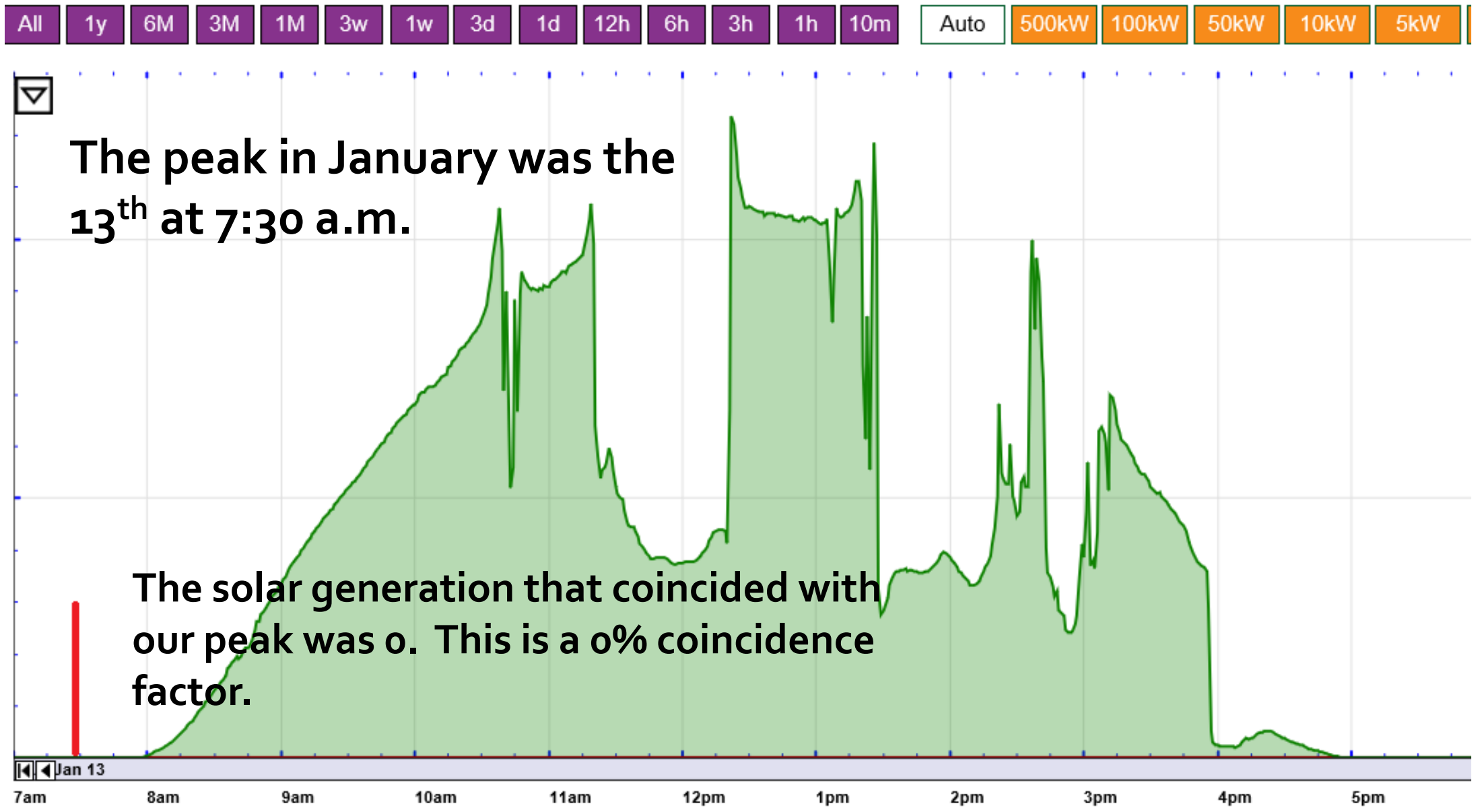
When Does the Peak Occur?

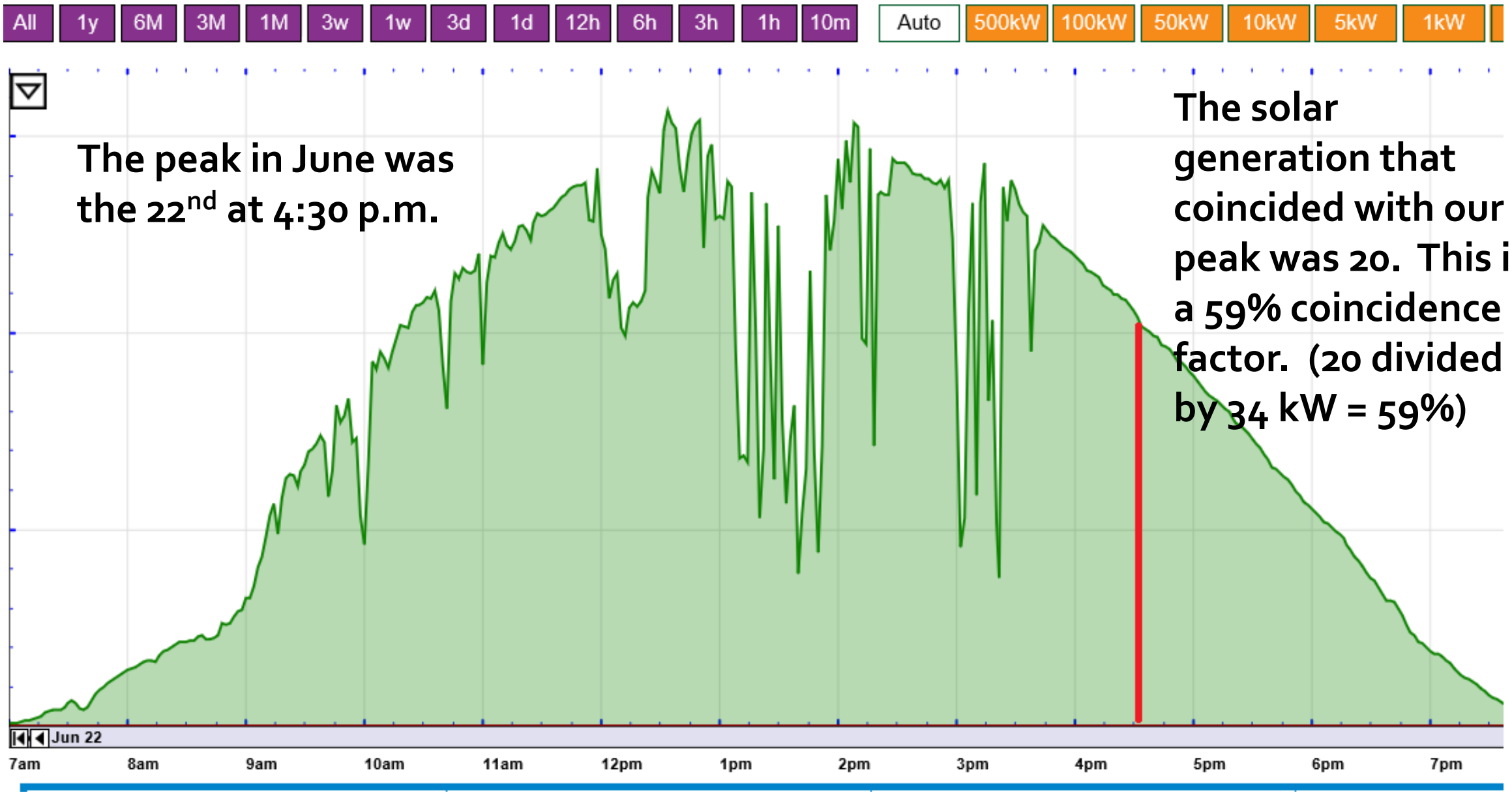
Summer Time

Between 4:30 p.m. and 7:30 p.m.

Winter Time

Between 6:00 a.m. and 9:00 a.m.


All
1y
6M
3M
1M
3w
1w
3d
1d
12h
6h
3h
1h
10m
Auto
500kW
100kW
50kW
10kW
5kW
The peak in January was the 13th at 7:30 a.m.
The solar generation that coincided with our peak was 0. This is a 0% coincidence factor.
Jan 13
7am
8am
9am
10am
11am
12pm
1pm
2pm
3pm
4pm
5pm

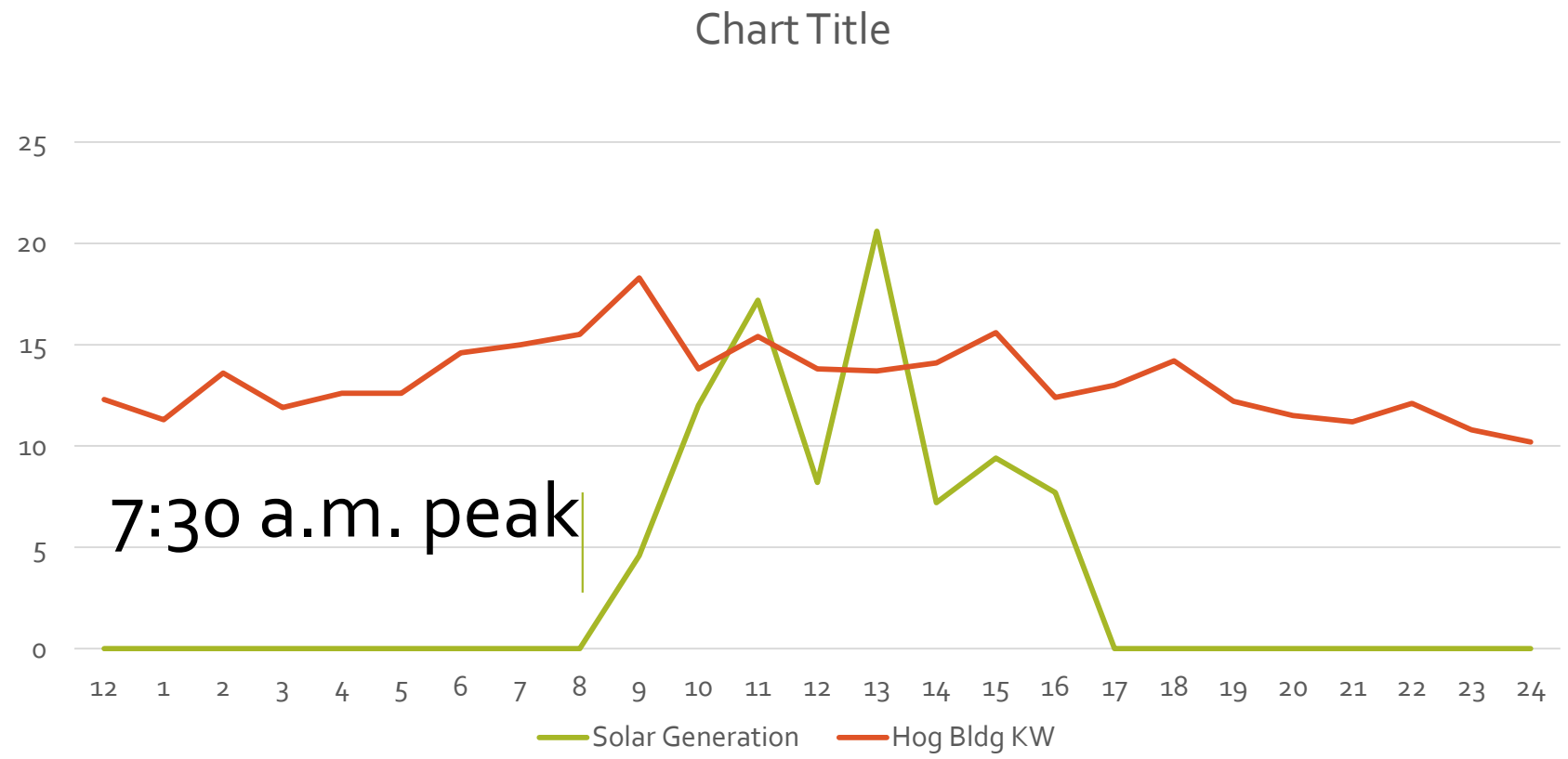

All
1y
6M
3M
1M
3w
1w
3d
1d
12h
6h
3h
1h
10m
Auto
500kW
100kW
50kW
10kW
5kW
1kW
The peak in June was the 22nd at 4:30 p.m.
The solar generation that coincided with our peak was 20. This is a 59% coincidence factor. (20 divided by 34 kW = 59%)
Jun 22
7am
8am
9am
10am
11am
12pm
1pm
2pm
3pm
4pm
5pm
6pm
7pm

Monthly Coincidence or "On Peak" Factors . . .

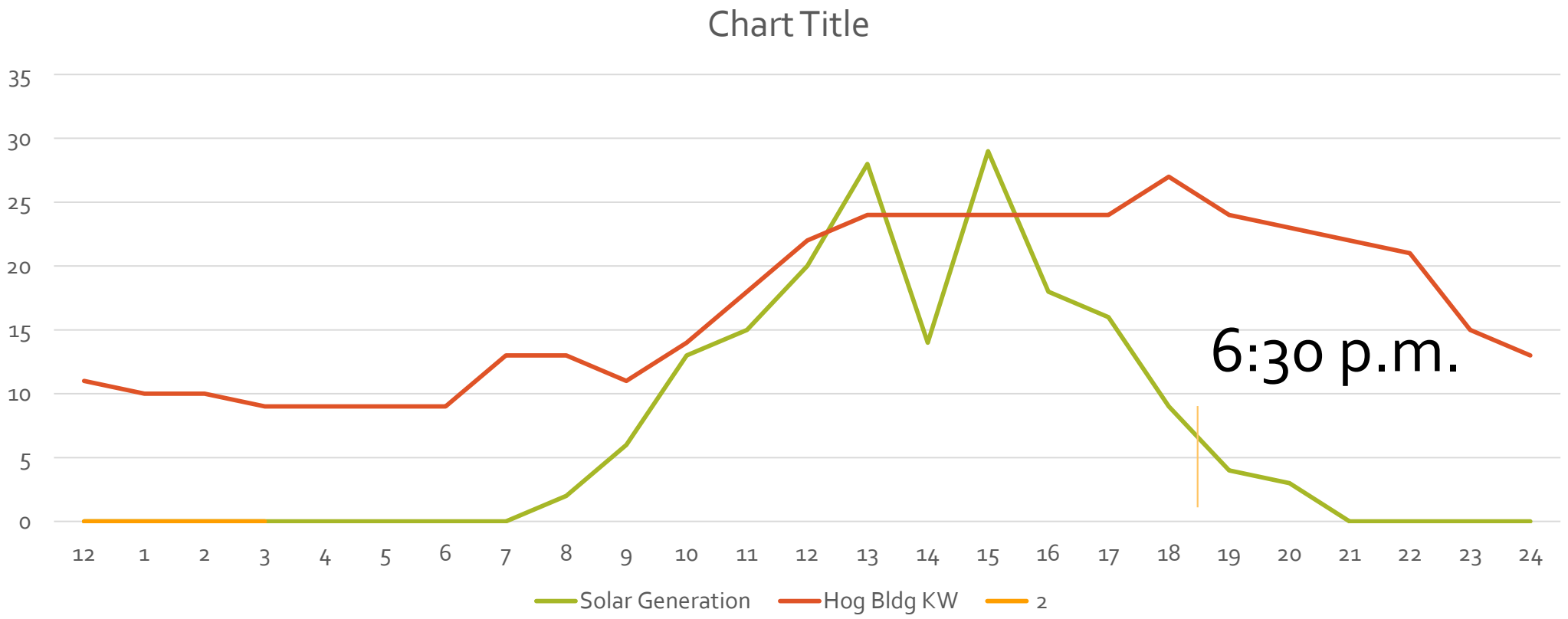
- January 0%
- February 0%
- March 0%
- April 9% (3 kW)
- May 76% (26 kW)
- June 59% (20 kW)
- July 76% (26 kW)
- Aug. 45% (15 kW)
- Sept. 16% (5 kW)
- Oct. 0%
- Nov. 0%
- Dec. 0%

95 kW for Year

Solar Generation & Hog Building kW on a January day



Solar Generation & Hog Building KW on a summer day



Two Key Factors We Review . . .
Annual Capacity & Coincidence Factors

Capacity Factor

- Ratio of actual output to potential output over a period of time
- Maximum output of kWh's or energy – 34 kW X 8,760 = 297,840 kWh's
- Actual generation – 47,720 kWh's
- 47,720 divided by 297,840 =

16% Capacity Factor

Coincidence Factor

- Peak demand generation during NWREC's peak (coincides with . . .)
- 34 kW times 12 months = 408 kW
- Actual kW generated during our peak – 95 kW
- 95 kW divided by 408 =

23% Coincidence Factor

Why is this important for us?

- **There is a long & detailed answer that gets into demand and energy metering and billing and I don't have time in my portion of the presentation for that**
- **The short answer is that if the highest or peak solar generation coincides with our highest or peak system demand, it is nearly 4 times more valuable to us and our power supplier**
- **For example, in the months when there is no solar generation on our peak (Winter morning peaking months), we only avoid 2.6 cents per kWh on our power costs. If there was 100% solar generation on our peak (100% generation – 34 kW in this example - coinciding with our peak), we would avoid nearly 14 cents per kWh. In this case, the solar generation would be over 4 times more valuable to us and our power supplier.**

Maintenance issues?

While we have not had major maintenance issues, we did have to replace some panels & inverters recently that were not working properly.

Summary . . .

- We are using what we have learned to develop and modify our renewable energy programs.
- We want to make sure that our programs are workable for the Cooperative & our members so that they can be sustainable.
- We are pleased to work with any of our members who are interested in installing renewable energy and interconnecting with our system. We will net meter up to 50 kW but sized according to the load.
- Rob and Lee are here also and we would be happy to visit with you about our net metering policy and interconnection agreement.

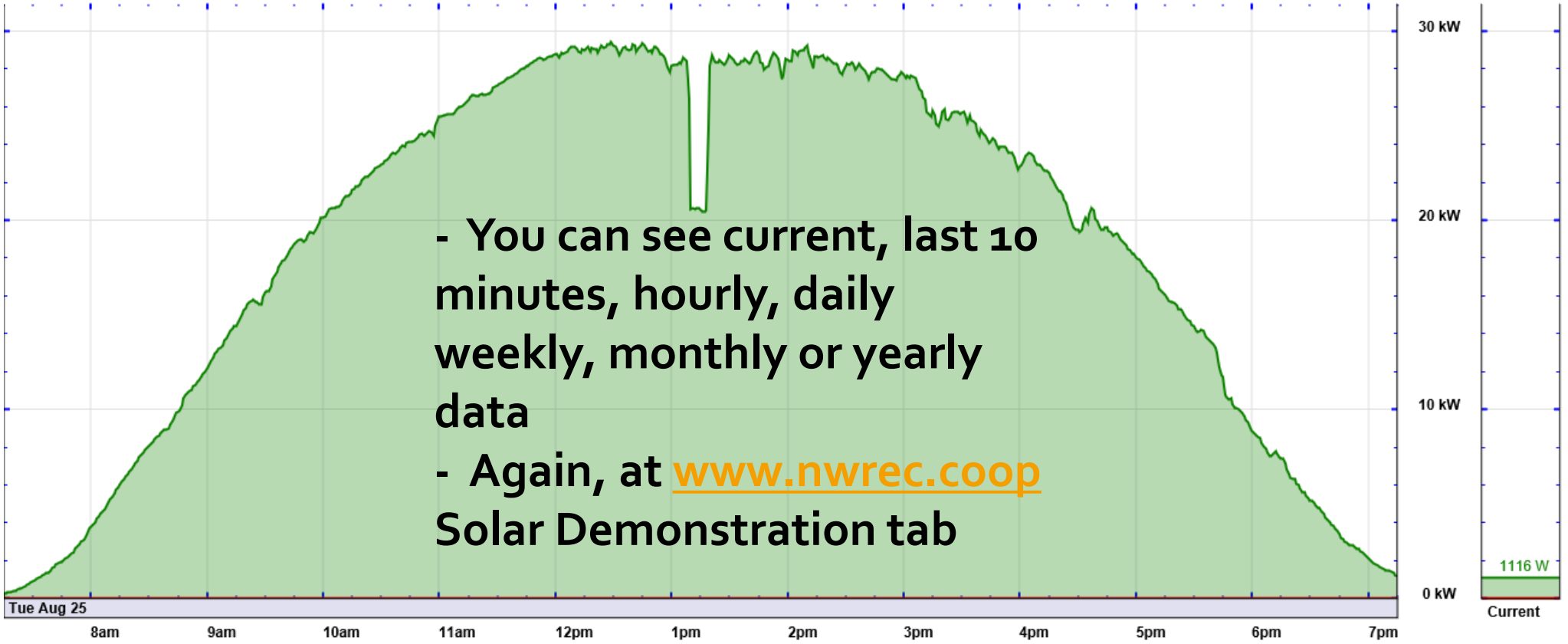
Summary . . .

- We have learned a lot through this demonstration project and look forward to gaining additional insights in the second year of operation.
- We have not pursued any battery storage options in connection with this project, but as this technology improves and becomes more cost effective, it could have the potential of greatly enhancing the integration of solar generation with utility distributed generation programs.

Summary . . .

- For additional information on our our solar demonstration project , please check our web site at www.nwrec.coop

You can also see our solar generation in real time on our web site . . .



- You can see current, last 10 minutes, hourly, daily weekly, monthly or yearly data
- Again, at www.nwrec.coop Solar Demonstration tab

Thank You