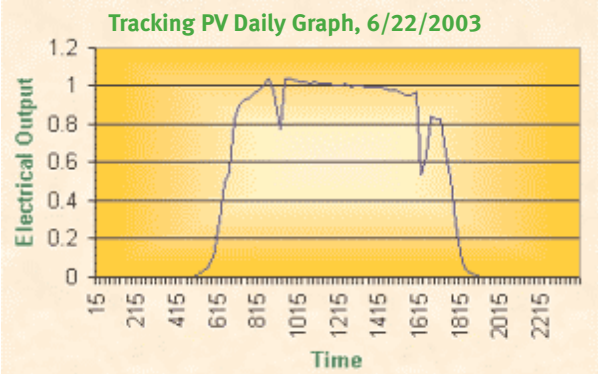
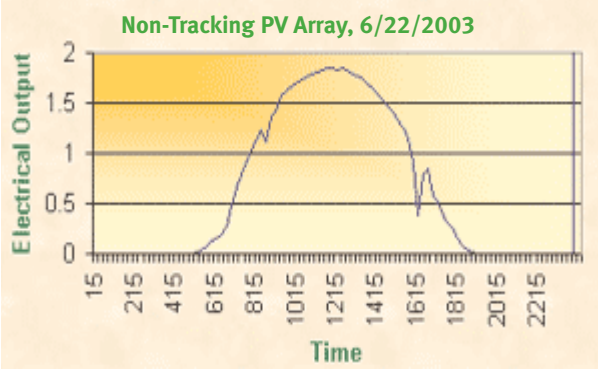
What we learned from our solar energy projects

Dual-axis tracking systems produce about 30% more electricity than fixed panels.





The dual-axis tracker "makes the day longer and sunnier." It always faces the sun at the ideal tilt angle (high tilt in the winter and low tilt in the summer) and azimuth (east to west). This allows the system to produce about 30% more energy! Fixed panel arrays are perfectly positioned for a short time each year. The system owner must pick the best tilt angle and azimuth.

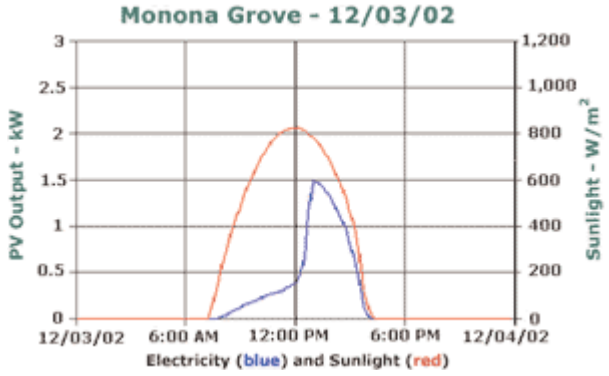
Panels at a 25˚ tilt angle produce about 5% more electricity than panels tilted at 45˚.

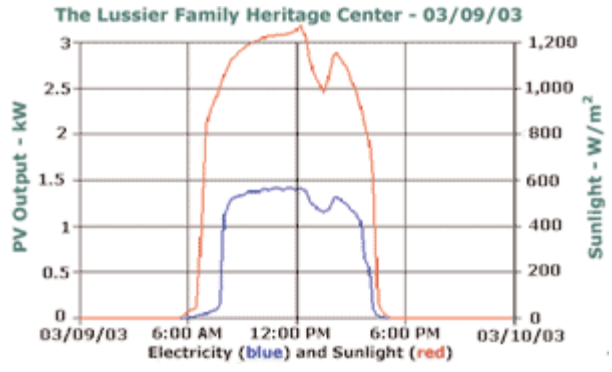
This can be explained by the old farmer's adage to "Make hay while the sun shines." The 25˚ tilt arrays slightly outperform the 45˚ tilt over the course of a year because they are better optimized for the longer, sunnier summer days.

Snow can help or hurt system performance.

Snow cover on fixed angle panels causes the systems to lose several days of production. The snow generally melts off when temperatures reach 32 degrees or greater.

The tracking array sheds snow because it is at a steeper tilt due to the winter sun being low in the sky. Snow cover on the ground can serve as a "reflector" for the sun and actually increase the output of our pole-mounted tracking arrays.





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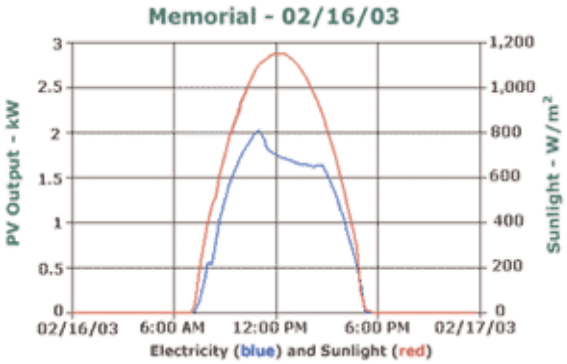
Monitoring can identify design, equipment or site problems.

Most solar PV systems have been installed without a comprehensive monitoring system. Monitoring helps identify design and equipment problems. Each of our systems has, at a minimum, a utility-grade electrical meter that is read every month. Most of our systems also record weather and solar information.

- Monitoring helped us to detect that one solar system was performing poorly compared to our other systems. The culprit was a large transformer that remained energized throughout the night. Transformers continue to consume energy even when power is not flowing through them. We installed a relay to de-energize the transformer each night and re-energize it in the morning. It is now controlled by a photo-eye and only operates during daytime hours. As a result, we have cut our parasitic losses by more than 80%.
- In another case, we found an equipment problem with a new German-made inverter. It was brought to the U.S. market with the same output rating as in Germany. U.S. laws are more restrictive about operating temperatures. To comply, the inverter manufacturer de-rated the program on units for sale in the U.S. It produces less energy when it gets hot. On sunny days, with a nice curve of sunshine, our electrical output curve had a nasty notch around noon. The notch lasted several hours while output was reduced. The manufacturer provided us with cooling fans to keep the inverters within required parameters. The inverter company now does not recommend installing their inverter in closed, indoor spaces without the fan. Real-time data monitoring helped us find the notch in the system output.



MGE continues to monitor system performance. Check it out at www.mge.com/solar.