

Santiam Valley Ranch Solar Photovoltaic (PV) Project, 2013

Kathy Bridges & Ken Dunder

In 2011, we contacted OSU Energy Efficiency Center offering Rural Energy Assessments. We received our Assessment Report (No. 1028) on July 25, 2011. Our goals were to:

- (1) to install a photovoltaic array on the building roof to provide up to 70.4% of the farm's energy consumption and reduce CO2 emissions associated with electrical generation; and
- (2) expanding operations to allow tilapia fish growth in water temperatures ranging between 82-86°F in indoor heated tanks.

Recommendations from OSU Energy Efficiency Center was to install a photovoltaic array and a solar thermal array on the large barn roof. We thank Mikhail Jones, Lead Analyst and Joe Junker, Principal Auditor, for their excellent 58-page report and suggestions.

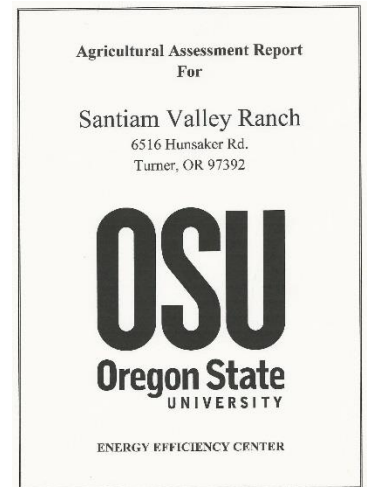
The total cost for the evaluation and report was \$370, which included an Energy Efficiency Assessment for a single facility, and approximately four hours assessment time on-site. The program was funded by USDA, Rural Development Program for agricultural producers or eligible small rural businesses and located in a rural area.

Based on recommendations noted above, in 2012 we applied for grants and loans to begin implementing "Phase 1" of our long-term goal to expand our aquaculture facility.

In January of 2012, we contacted Solar Ki, LLC, an Energy Trust of Oregon certified consultant and designer for solar electric systems. In February and March of 2012, we met with Laura Uhler, Owner of Solar Ki. She provided information for a grid-tie electric design and installation for a 20,400 Watt system. The total estimated cost from Solar Ki was \$79,900; the completed cost was \$82,843.30.

At the time Mikhail Jones visited the farm in 2011, the wind turbine had not yet been raised. By the time Laura Uhler visited the farm, the shadow of the wind turbine negated the possibility of installing the PV system on the large barn. The decision was made to install the PV system on top of two other barns (equipment and horse barns). The large barn roof would be reserved for the future solar thermal array.

Based on Laura Uhler extensive solar electric system proposal and bid, we worked together to apply for grants and loans to achieve our mutual goal. Laura received commitment from Energy Trust of Oregon for \$20,400 in incentive grants.¹ We also received agreement from PGE for net



Ken and Laura Uhler, Owner, Solar Ki, LLC

¹ EnergyTrust of Oregon provide Oregon residents or businesses who use PGE or Pacific Power & Light and who chose to pursue renewable energy an incentive, and which is based on total cost of the system. Similar incentives are available from other utility vendors.

metering and interconnection service for the electrical system.² Lastly, we received approval from Marion County that installation of the PV system is a permitted use and is exempted from permits since installation would be on an agricultural building. With this preliminary information assembled, we ventured forward, applying for two grants from USDA and Oregon Department of Energy.

On March 22, 2012, we applied to USDA Rural Development for a REAP (Rural Energy for America Program) grant. Our request was for \$19,975. On May 24, seventeen projects were funded statewide; our project was awarded \$10,351.

On March 29, 2012, we applied to Oregon Department of Energy for a RED (Renewable Energy Development) grant. On November 29, 2012, three projects were funded statewide; our project was awarded \$27,965.

Financing of the project must be paid up-front. Energy Trust of Oregon's payment will go to the contractor, Solar Ki, LLC, upon completion and inspection by ETO. To put this project into reality, a second mortgage was made with NW Preferred Federal Credit Union, Stayton, to finance the remaining costs of the project.

After approval of the ODE grant in November, the project began in December of 2012. We purchased Fronius solar panels which were delivered to the farm in early January, 2013. The balance of the materials were delivered in early February. On January 23, Solar Ki's structural and electrical engineer visited the farm and finalized the design. Based on feedback from the structural engineer, Solar Ki's subcontractors did internal structural work on both barns to reinforce the roofs. Simultaneously, we replaced the most of the exterior roofs on both of the barns.



Interior of horse barn. 2X4's added lengthwise on the barn roof.



Interior of equipment barn. 2X6's added widthwise on the barn roof (above and right).

² Net metering allows the consumer of energy to work with the utility to interconnect with the electric distribution system. It allows the consumer to use energy created by the utility when needed, while also allows the consumer to provide surplus energy generated by the consumer to go into the electric distribution system. When receiving federal and/or State grant assistance, surplus energy generated by the consumer is "donated" back to the electrical grid. If one pays for the system outright, consumers can sell their surplus energy to the grid.

Repairs on the exterior roofs of both of the barns was quite substantial. For the equipment barn, half of the metal roof was torn off (and was later used on the horse barn). OSB was applied, then covered with Tyvek, and interlocking metal roofing was installed.



Equipment barn: right side of roof was removed and interlocking metal roofing was installed.



Our son, Luke Fitzpatrick, helped with all aspects of the project. Luke and Ken install OSB board and soffits.



Our roofing crew was complete with Phil Wessel, who also assisted.



The roof on the horse barn had many leaks which had to be replaced before the PV system could be installed. The metal roof was torn off. OSB was applied, then the roof was covered with Tyvek. The roof of the barn was extended beyond the exterior walls by adding 12" soffits (to reduce water damage to exterior plywood siding). Additionally, the roof was extended on the gables, again to reduce water damage. The metal roof from the equipment barn was cut to fit the length of the horse barn roof and installed. When this metal was used up, the metal from the horse barn was lengthened by cutting and adding extensions from the unused metal roof.



Horse barn: The metal roof was removed. Ken, Luke and Phil installed OSB board and extended the roof, allowing soffits and gable. Tyvek was added. Metal roof taken from the equipment barn was moved and installed onto the horse barn. The balance of the metal roof from the horse barn was reused and extended with add-ons to accommodate the added width of the roof.



...and Luke screwed the metal roof; overlapping shorten pieces with the old metal roof.



Ken and Phil hand up the metal roofing to Luke...



The PV system was installed on March 12-14 on the two roofs. Simultaneously, electricians upgraded the wire from the main panel to the horse barn, upgraded the panel in the equipment barn, and installed the new dual meter bases for the two PV systems. On March 19, PGE installed a new transformer and hooked up the PV systems into the net-metering system. It was discovered that the inverter in the equipment barn was not working correctly. Repairs were ordered by Solar Ki and installed on April 8th, putting the entire system up-and-running.



Laura's crew installed Unirac SolarMount racks on the roof.



Everyone is getting excited as solar modules are unpacked and prepared for installation.



Laura and her crew prepare solar modules for mounting on the roof racks.



Completed installation on the horse barn. 7920 W system, with ample room provided to maintain and clean the solar panels.



Electricians install Fronius inverter and AC/DC disconnect and 400/320A 200 dual feed service to PGE..



Solar Ki's crew install Unirac SolarMount racks onto the equipment barn.



Solar modules are installed and electrical lines are hooked up linking the modules and Fronius inverter.



12,480 W system installed, again allowing space for maintenance and cleaning of the solar modules.



Dreaming of a world with solar power.....



Check out the old meter and new inverter and meter base in the equipment barn.



Our utility system capable of generating up to 40.4 kW system using wind and solar energy. According to PGE, the system will reduce our household carbon dioxide emissions by 36,441 pounds per year. And best of all, we are not dependent on using non-renewable coal for our power source..



Ken with PGE meter.



Laura Uhler doing final solar access reports for both systems.

The other side of the horse barn roof was also replaced, again due to leaking. Again, soffits and gables were added. Used metal roof from the horse barn was lengthened and installed and a few new metal panels were purchased to complete the job on April 15, 2013.



Ken, Luke and a friend from Lebanon, Steve Alexander, worked to install the final metal roof on the north side of the



Total project cost was \$82,843.30 of which \$20,400 provided by Energy Trust of Oregon, \$10,351 provided by USDA-REAP, \$27,965 provided by ODE-RED, and \$24,127.30 provided by Santiam Valley Ranch, with additional potential for 30% federal tax credits.

Improvements from this project include:

- 20.4 kW solar photovoltaic system, which when combined with the 20 kW wind turbine system, should negate our PGE bill of approximately \$250-300 per month for our business meter
- Continue with our goal to become energy independent
- New roofs on two barns, one of which had to be re-roofed anyway
- Improved structural re-enforcements in two barns
- Extensive upgrade to our 50 year old, archaic electrical meter in the equipment barn
- Moving closer to our reality of expanding our aquaculture facility in a manner that works with our planet
- Promoting a self-sustaining lifestyle
- Getting ready for an electric vehicle with power from our own wind turbine and solar PV system
- And just feeling good about life!

