Final Technical Report for DOE/EERE

Project Title: Christmas Valley Renewable Energy Assessment

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Project Objective

In partnership with the Oregon Military Department, the Department of Energy used the award to assess and evaluate renewable resources in a 2,622-acre location in Lake County, central Oregon, leading to future development of up to 200 MW of solar electricity.

Background

The Oregon Military Department (Military) acquired a large parcel of land located in south central Oregon. The land was previously owned by the US Air Force and developed for an Over-the-Horizon Backscatter Radar Transmitter Facility, located about 10 miles east of the town of Christmas Valley. The Military is investigating a number of uses for the site, including Research and Development (R&D) laboratory, emergency response, military operations, developing renewable energy and related educational programs. One of the key potential uses would be for a large scale solar photovoltaic power plant. This is an attractive use because the site has excellent solar exposure; an existing strong electrical interconnection to the power grid; and a secure location at a moderate cost per acre.

The project objectives include:

1. Site evaluation
2. Research and Development (R&D) facility analysis
3. Utility interconnection studies and agreements
4. Additional on-site renewable energy resources analysis
5. Community education, outreach and mitigation
6. Renewable energy and emergency readiness training program for veterans

Tasks Narrative

Phase 1 Task 1: Site Evaluation

Oregon Military Department (Military) awarded a design-build contract with Randolph Construction Services of Pasco, Washington to design and install the rooftop solar system on Sector 4, 5, and 6 buildings at the Christmas Valley former backscatter radar site. Oregon Military Department has now dubbed the project as *Project Horizon Solar Installation*. Installation is complete, and the project was energized in January 2012. Cost savings realized during the construction phase allowed Military to install additional panels as well as establish a small training module. The training module is not connected directly to the remainder of the rooftop array and can be dismantled without affecting performance, permitting the future training program to work directly on panel installation.

It is important to note that funds under this grant did not support hardware or labor costs.[1] Task 1 activities funded construction and design documents, support services to prepare the site, and decommissioning plans.

Because the buildings are not currently occupied, there is next to zero on-site electric load. The Military Department and local utility Mid-State Electric Cooperative decided to enter into a power purchase agreement (PPA) until the buildings are in use and the net metering benefits could be realized.

Shown above: Christmas Valley rooftop solar.
The rooftop array's performance can be remotely monitored here:
http://live.deckmonitoring.com/?id=christmas_valley

[1] Labor and hardware for the rooftop project is funded through a pass-through grant with EECBG funds dedicated to the Department under formula from the American Recovery and Reinvestment Act (ARRA).

Military was pleased to support local industries that offer a top-quality products. The solar project at Christmas Valley supports Oregon's own manufacturing base. Installed panels are Sunmodule SW 235 poly/version 2.0 and 2.5 frame from SolarWorld, a Hillsboro company. The inverters were made by PV Powered in Bend, Oregon.

No solar projects have been developed on the 300 acre site to date. While the Military Department has a substantial feasibility study on solar development at the Christmas Valley site, it has not taken the final step of translating those feasibility criteria into criteria and framework for an RFP. Also given the rate of change in solar project costs the feasibility assessment is now out of date. At the time of the final technical report it is estimated that a project of up to 40 megawatts could be developed utilizing single axis trackers on the 300 acre site at a cost of 40million to 60 million dollars.

Two additional items of note:

- *Site analysis.* The Military Department hired a geotechnical firm, Carlson Geotechnical, to provide a soil report. The report will be included as an attachment to any future RFP.

- *State legislation exempted a large solar facility at Christmas Valley from siting laws.* House Bill 2820 exempted any potential future large solar facility at Christmas Valley from Energy Facility Siting Council (EFSC) jurisdiction. From the bill [italics indicate new statutory language]:[2]

  > (b) "Energy facility" does not include a hydroelectric facility *or an energy facility under*
  > *paragraph (a)(A)(iii) or (D) of this subsection that is established on the site of a decommissioned United States Air Force facility that has adequate transmission capacity to serve the energy facility.*

Phase 1 Task 2: Research and Development (R&D) Facility
(Oregon Institute of Technology AKA Oregon Tech)

Oregon Tech and the University of Oregon's Solar Radiation Monitoring Laboratory (SRML) published two reports exploring the possibility of establishing an environmental monitoring station at Christmas Valley, including research-grade solar radiation and meteorological observation capabilities. (See Attachment 2.)

[2] http://www.leg.state.or.us/13reg/measpdf/hb2800.dir/hb2820.en.pdf

Other research activities on site

The Dartmouth College Physics Department has a lease from OMD to operate a remote sensing facility at Christmas Valley. The facility consists of 2 HF radar antennas that monitor the circulation of plasma in the ionosphere at sub-polar latitudes, focusing on response to geomagnetic storms and other space weather phenomena. Dartmouth is occupying the southern-most portion of the 326-acre parcel that OMD acquired in 2009.

The project is part of an NSF-funded research program called SuperDARN.
http://engineering.dartmouth.edu/superdarn/index.html

OIT investigated the possibility of cooperating with Dartmouth on deployment of a research-grade solar radiation and meteorology monitoring station at Christmas Valley, particularly sharing of power and internet infrastructure. As part of the roof-top solar project, OMD and Dartmouth cooperated with a local vendor to upgrade internet service to the Christmas Valley site for both groups of users. It appears that Dartmouth has an agreement with MEC to provide power to its radar facility, a development that in part prompted MEC to extend its 24.9 kV distribution network to the site.

Phase 1 Task 3: Utility Interconnection Study
(Oregon Military Department)

Military pursued two interconnection agreements for a ground-mount array: one with Mid-State Electric Cooperative, the local electrical utility, and another with Bonneville Power Administration (BPA) for the full scale solar facility. BPA continues to be engaged in Christmas Valley interconnection options, most directly in cooperation with Mid-State on a line-loss cost study on the project.

Phase 1 Task 4: Study Potential for Additional On-site Renewable Energy Resources
(Oregon Tech)

Consultant Steve Anderson (Evergreen Engineering) completed a feasibility assessment that will provide strategic guidance to Military in the development of utility-scale solar at the site. (See Attachment 3.)

Oregon Tech has produced two additional studies – renewable resource assessments at Christmas Valley for biomass, geothermal, and concentrating solar thermal applications; and a feasibility analysis of research, development, training, and education (RDT&E) opportunities on site (pursuant to Task 2). These studies were completed in 2012 and provided as attachments in the quarterly reports.

Phase 1 Task 5 and Phase 2 Task 1: Community Education, Outreach and Mitigation (Oregon Department of Energy)

In Q4 2013, Rabe Consulting oversaw the installation of a touchscreen display in the Lake County Chamber of Commerce (pictured at right) and wayside signs at three locations: Quartz Mountain, Silver Lake, and Paisley. Silver Lake and Quartz Mountain – the Forest Service installations – are pictured below.

The Department an agreement with Lake County Resources Initiative (LCRI, www.lcri.org), a local non-profit, to take ownership and long-term maintenance responsibility for the wayside signs and Lakeview kiosk. The Department and LCRI executed this conveyance in October 2013. We are grateful to LCRI for their willingness to take on this responsibility with no financial support.

In accordance with the Lake County/Christmas Valley Communications and Outreach strategy and timeline, the Oregon Department of Energy initiated a solar workshop to educate Christmas Valley residents about solar generally. Solar Oregon completed three months of outreach to new and existing contacts in Christmas Valley, OR prior to the delivery of a Basics of Solar Workshop on November 19, 2011. This outreach resulted in a high turnout (31 residents) of very engaged and enthusiastic home and business owners.

The topics covered in the presentation were:

- Home energy use, weatherization and energy efficiency techniques
- Mid-State Electric Cooperative and Lake County assistance programs
- Solar resource in Oregon
- Solar installations in Oregon
- Available solar technologies
- PV (on and off-grid)
- Solar water heating
- Passive solar design
- Net metering and interconnection policies in Mid-State Electric Coop
- Available tax credits, incentives, and loan programs
- Available technical training for solar electric

Phase 2 Task 2: Veterans Training

The Military Department worked with Treasure Valley Community College (TVCC) to develop a solar training curriculum. The program was being developed with a priority on training veterans on the installation and maintenance of solar power. The curriculum was planned as a two-part course; starting with online classes teaching the theories and fundamentals of solar power. The students will then travel to the Christmas Valley facility for a 1-2 week hands-on course utilizing the micro-inverter system installed for educational use. The course is ready to be converted to an online curriculum.

A site visit was conducted at Christmas Valley in December, 2012 to look at the suitability of the existing facilities to support hands on solar training. The building with the micro-inverter solar system has an administrative area that could be made to support on-site classes. There is a functional kitchen/break area already in place. The only construction required would have been to secure access to the roof and a catwalk around the solar array to facilitate hands-on training.

In 2013 additional considerations resulted in the Oregon Military Department cancelling plans to develop a classroom at the Christmas Valley site. The reasons were twofold: One, the site is too remote to make student travel and facility supply and maintenance cost effective. Two, Treasure Valley Community College developed a new training program and hands on solar training facility at the Oregon National Guard Armory in Ontario. This facility is immediately adjacent to the community college and the National Guard Armory and is therefore better suited to the need of the Military department than the remote site in Christmas Valley.

Lessons Learned

This project provided the Oregon Military Department with important experience regarding on site energy production and the need to communicate with the local electric utility before the

project is started. The rooftop solar installations were completed without a proper agreement from Central Electric Coop to purchase the surplus energy. The result was a solar energy project that initially provided no financial benefit to the Military Department. The system operated for more than a year before an agreement was made with Central Electric Coop.

Successes

This project provided the Oregon Military Department with experience in solar energy systems. This experience has already led Military to consider solar projects on many other sites outside of Christmas Valley.

The education and outreach tasks were highly effective. Christmas Valley is a remote and sparsely populated region in Central Oregon. Many residents who were initially skeptical of solar energy projects have become advocates for future projects.

This project also resulted in lasting partnerships between Oregon Department of Energy, Oregon Military Department, Oregon Tech, Lake County Resources Initiative and many local contractors, residents and other stakeholders. These relationships will help to facilitate future renewable energy projects in Christmas Valley and throughout Lake County and Oregon. Pictured to the right are representatives from multiple state agencies, the governor's office and local contractors visiting the site in 2011.