

INFRASTRUCTURE

Solar highways

Oregon Department of Transportation travels a long road to power highway lights with renewable energy.

By John Ochwat



Oregon Department of Transportation chose a site south of Portland at the junction of two freeways, which offered good southern exposure for the 540-foot-long array of solar panels.

It's not often that innovation comes from watching television. But don't tell that to Allison Hamilton, a project director with the Oregon Department of Transportation (ODOT). While watching a NOVA special on PBS about solar power, she noticed solar panels on the German Autobahn. The sight of them made her sit up, turn to her husband, and ask, "If they can do that there, why can't we do it here?"

PROJECT DETAILS

Owner

Oregon Department of Transportation

Project Manager

Moyano Leadership Group

Design

Advanced Energy Systems

Contractor

Aadland Evans Constructors, Inc.

Nineteen months after the light bulb went on over Hamilton's head, ODOT commissioned the nation's first solar highway project on Dec. 19, 2008, putting renewable energy into the grid to power lights on Interstate 5. By all measures, the 104-kilowatt solar array located at a freeway interchange 15 miles south of Portland is a success. Even so, the project showed some of the bumps on the long road that will exist until renewable energy is widely adopted on U.S. freeways.

Footing the bill

Despite its northerly latitude, Oregon had a good political climate for a solar project. In 2007, the Oregon Legislature drafted policies for the state of Oregon to arrest its growth of greenhouse gasses. At about the same time, Oregon Governor Ted Kulongoski directed state agencies to meet their electrical needs with 100 percent renewable resources.

When Hamilton went into the office to start researching her idea, she found the support was there. But that wasn't nearly enough. "I looked into the cost, and it was very expensive," she said. "The ability to use state highway funds to buy solar panels didn't look like it was going anywhere. Everyone at ODOT thought it sounded like a good idea, I just couldn't spend any of our money."

Hamilton's next step was to start networking, which led her to an analyst for the Oregon Department of Energy (ODOE).

Together they completed a request for information and posted it to the ODOT website. Sun Edison helped explain the third-party financing, then a consultant who previously worked as a director of ODOE helped develop the demo project and form a much bigger picture of the solar highway program. The consultant also helped get appointments with executives at Portland General Electric (PGE), the local power utility. "It took a year to hammer out details with PGE," Hamilton said. "But they have been a marvelous partner ever since."

The \$1.28 million project would not have been possible without federal and state tax credits, which give solar developers incentives for building solar projects. The Oregon Business Energy Tax Credit covered 50 percent of the cost, and a federal tax credit covered 30 percent more and offered accelerated depreciation for the solar panel owners. Accelerated depreciation lets project owners recoup the entire depreciation allowance in the first year through reduced taxes, instead of a five-year period. The Energy Trust of Oregon provided a grant of \$175,000 from a fund paid by PGE and PacificCorp electric utility customers to fund conservation programs and promote reusable energy.

Even with the financing in place, there were two further challenges. Since states aren't taxed, states need a tax equity partner they can work with. The partner typically provides an amount of money equivalent to the credit and the tax credit is "passed through" to them. In the solar highway project, the partner was U.S. Bank.

The second challenge was the Dec. 31, 2009, expiration of the 30-percent federal tax credit, which put pressure on the contractors to get the job finished and commissioned before the end of the calendar year.

Financing was only one hurdle during the project. Another was getting the blessing of the Federal Highway Administration (FHWA). "To use freeway right of way, we needed FHWA's approval," Hamilton said. "ODOT doesn't do anything without their agreement." After several meetings with experts and attorneys, and discussions that reached all the way to the U.S. Department of Transportation in Washington, D.C., Hamilton said, "the FHWA came back and said, 'We think this has a lot of value, let's make sure we do it right.'"

Hamilton also reached out to Ted Aadland, CEO of Aadland-Evans Constructors, Inc. She and Aadland had lunch and discussed the project, and Aadland ended up forming SolarWay, a solar energy EPC (engineer/procure/construct) consortium consisting of four Oregon firms. Aadland Evans would serve as the general contractor, Moyano Leadership Group in Salem would act as the group's project manager and design leader, and Advanced Energy Systems of Eugene would be the designer and installer. Good Company of Eugene did public outreach to help market the project and consulted about sustainability.

"The team was formed to be turnkey, able to deliver from concept through delivery," Aadland said. "We took a value-based investment approach, and Oregon was very much a part of it. That included the materials, too. The solar panels came from SolarWorld, a company in Hillsboro, Ore., and the inverter was manufactured by PV Powered in Bend, Ore."

A place in the sun

Picking a spot for the project was no simple matter. The panels had to be out of the clear zone, the area where errant vehicles could travel (off the edge of the pavement). It had to be in PGE's jurisdiction, and it had to be connected to an ODOT electricity load to meet net-metering requirements. It had to be in an area that wouldn't be improved in the foreseeable future (in this case, 20 years) so that the panels wouldn't have to be moved or removed. The final site is at the junction two freeways south of Portland, which offered good southern exposure for the 540-foot-long array of solar panels.



Workers install solar panels as part of the Oregon Department of Transportation Solar Highway Demonstration Project.

However, once SolarWay located the best southern exposure, there was one further hitch: a tree. The tree, a large Douglas Fir, created enough shadowing to affect the panels' solar gain, and since the tree couldn't be cut down, they had to move the panels a little to the northeast of where they really wanted to put the site.

Expiration of the 30-percent federal tax credit meant the project had to be delivered on a tight timeline. SolarWay received its notice to proceed in September 2008, and the project was commissioned on Dec. 19 — 12 days before the credit expired.

It took a public-private partnership to bring all the pieces together. "We're bringing in our knowledge of what it costs to get things built," Aadland said. "We share that knowledge with public entities about how to drive down costs, shorten schedules. So there's a synergy that really works to make it a good investment."

Since going live in late 2008, the panels have provided 112,000 kWh of annual power production, which is 28 percent of the interchange's total power use.

Clouds on the horizon

While 28 percent is a start, it's a long way from the more than 47 million kWh of electricity needed every year to run

Oregon's signals, illumination, buildings, ramp metering, and more. Last year, the Oregon Transportation Commission approved three more solar projects, including adding another 150 kW to the demonstration site, installing 1.3 megawatts at a rest area in Wilsonville, Ore., and installing 3 megawatts at an ODOT maintenance storage facility in West Linn, Ore. "We want to put together a GIS-based survey to identify sites around the state, then rank them for potential for solar highway development," Hamilton said. "The goal is an inventory of sites to choose from so we can turn to a solar developer and say, 'Are you interested?' If terms meet, then we can move ahead."



Artist's conception shows a solar array installed next to a highway to provide power for lighting.

Oregon isn't the only state with solar ambitions. Hamilton said ODOT has been contacted by people from nine to 10 countries and 16 or 17 states wanting more information about the solar highway project, and other states are developing programs based on it. "Technically, it's a breeze," Hamilton said. But she and others argue that this is one project where the challenge isn't the technology, which is proven, or even the desire to implement highway solar systems, as the interest in the Oregon program proves. The challenges include cost, which is still quite high. Aadland Evans President Don Irwin points out that a 230-Watt solar panel costs roughly \$450. "That's equivalent [power for] four 60-Watt light bulbs, and it only works when the sun is out."

For companies bidding on projects and groups wanting to implement them, it's not as simple as giving it to the lowest bidder. "The harder part is figuring out how the financing works and dealing with power companies because they need to buy power," Aadland said. "It's more complicated than people realize."

With a patchwork of varying state grant and loan programs and a shifting set of federal incentives, a key component is finding people who can pull together the financing and navigate the maze of regulations (including those of utilities and departments of transportation) to make the deal come together. The regulatory framework and financing framework will continue to evolve, Hamilton said. "But in this business climate, it's hard to find tax equity partners."

Nonetheless, the system sits at the side of the freeway and is expected to save 2,900 tons of CO₂ emissions over the course of its lifetime. It may take a while for the United States to work through the issues to implement solar highway programs, but in the meantime, 146,000 vehicles go by the panels every day. And as Hamilton noted, "That's a lot of visibility."

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