Little Cooperative Builds Big Project

California utility works with one of its members, capturing heat from the earth to produce power

By Pam Blair

In the middle of Lake County, Oregon, sits the quiet community of Paisley, population 250, home to cattle ranches, hay fields and a U.S. Forest Service office.

It also is home to a 3-megawatt geothermal plant developed by the local 4,500-member rural electric cooperative.

Like those who formed Surprise Valley Electrification Corp. in the 1930s, the project required dogged determination.

"There are so many details," says Lynn Culp, member service manager for SVE, based in Alturas, California. "I thought that within a year and a half we could have something going."

After about five years of development, the 40-foot cooling tower is in place, along with the condenser unit, the vaporizer, the turbine, a new substation and transmission line, two production wells, one injection well, two cooling wells, integrated controls and miles of insulated pipe connecting the system.

On June 9, the plant generated electricity and synchronized to the electrical grid for the first time. A number of tasks must be completed before the plant begins commercial operation.

Details of a power contract are still being negotiated with Pacific Power and the Bonneville Power Administration.

"I'm told that geothermal development typically takes 10 years from discovery of a resource to production, so we are ahead of that schedule," says Culp, who got involved in the project in late 2008. "These are not easy projects. If it was easy, everyone would be doing it."

As SVE's ad hoc project manager, Culp got a master's degree-level education in all things geothermal as he immersed himself in every step of development.

"You got to find the experts," Culp says. "You think you are smart enough to figure things out, but it is very complicated. It took a year to understand the language and all of the state regulations.

"There is no way we could have done it on our own. You must facilitate—bring the right people together to keep the project moving forward."

The geothermal resource was discovered when a ranching family, the Colahans, tapped into hot water when they drilled an irrigation well in 1980.

The water was so hot—235 degrees—that it had to sit in a cooling pond before being applied to the alfalfa crop.

While the Colahans used the water, the thermal energy was wasted. After a study in 2008 recommended development of the small geothermal resource, the Colahans approached SVE.

"Our vision was to sell this renewable energy for a number of years and then have this resource available to us when we needed it," Culp says. "But nobody is looking for green power right now."

It does not help that California requires 75 percent of energy generated to satisfy the state's renewable portfolio standard to be produced in California.

"This is our first rodeo," Culp admits. "Lots of things are unknown and unseen. You have to understand markets change,

Colorado TBC crew members work on the cooling tower at the Surprise Valley Electrification Corp. geothermal plant in Paisley, Oregon.

Photos by Lynn Culp, Surprise Valley Electrification Corp.

and you cannot foresee what that means."

One of the unknowns was the scope of the project. When work started in 2009, the plan was to use the Colahans' well and drill an injection well, resulting in a 1.5-MW resource. But reworking the existing well was problematic, so another well was drilled. When it did not produce as expected, yet another well was drilled.

"The project became twice the size as originally proposed," Culp says. "The pipeline more than tripled in size."

The system's nameplate generation is 3.7 MW, but it will produce 3.1 MW. Part of that will be used to run the plant, resulting in an output of 2.4 MW.

Costs increased 75 percent—from $12 million to $21 million. The project was feasible for SVE thanks to a federal grant, state business tax credit and a 1.25-percent clean renewable energy bond.

"We have increased the equity of our system from $25 million to around $50 million," Culp says. "It was a substantial undertaking for such a small cooperative."

As the project grew in scope, management faced a tough decision: Walk away from a substantial investment or keep their eyes on the prize and trudge ahead.

"Co-ops are made up of strong-willed people," General Manager Brad Kresge explains. "We were committed to seeing this project through. The benefits are not going to be seen right away, but in the generations to come. We are looking down the road. Who knows what the power supply situation holds in the future?"

Above, steam rises from hot water underground through a well at the Paisley geothermal plant. Top, TBC workers unload the condenser unit, which was built in modules on a skid by Turbine Air System in Texas. TBC assembled the plant in Oregon.

The estimated payback is 20 years.

"When you look at a project every day, you don't necessarily see its significance," Kresge says. "But this is really a remarkable accomplishment." ■

Technology Opens Way for Cooler Temperatures

Geothermal power development used to be viable only for resources with temperatures of 300 F or higher. Newer binary systems—such as the one used by Surprise Valley Electrification Corp. in Paisley—allow for development of resources between 200 and 300 F.

Since 2006, Chena Hot Springs near Fairbanks, Alaska, has produced electricity at 165 F. U.S. Geothermal's $41 million Raft River Power Plant in Idaho operates at around 275 F.

They are a few of the more than 100 geothermal projects now in development in Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, North Dakota, Oregon, Utah and Washington.

The Pacific Rim volcanoes make the West rich in geothermal resources.

"One of the benefits of geothermal energy is that it is available 24 hours a day, 365 days a year," says Lynn Culp, member service manager for SVE.

Unlike wind and solar—which are intermittent and unpredictable—geothermal is a baseload renewable source of electricity. It does not have the price volatility or environmental impacts of fossil fuels. The technology is modular, making it relatively easy to install and tie into the power grid.

At the Paisley plant, the geothermal fluid heats a refrigerant. Because the fluid never leaves the piping system, it is a closed system. Heat from the geothermal fluid causes the refrigerant to vaporize and turn the turbine, generating electricity. The geothermal fluid is injected back into the reservoir and the refrigerant is condensed through a cooling tower and cycled back through the system. Some of the water goes to an irrigation pond.

The spent geothermal fluid coming out of the power plant still contains heat energy that can be used for other purposes, such as aquaculture and greenhouse farming.