CANBY'S GEOTHERMAL LAUNDROMAT

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ABSTRACT

A small community cooperative installs a non-coin operated Laundromat to save money and upgrade equipment. Retrofitted gas-fired 55-lb industrial laundry dryers receive energy from a geothermal district heating system to dry domestic laundry.

PROJECT BACKGROUND

I'SOT, Inc., a non-profit 501 (c) (3) religious organization drilled a 2100 foot geothermal well with the assistance of a DOE grant in 2000. A district heating system was installed in 2003 with the help of a materials-only grant from the CEC and NREL Phase I&II grants that funded permitting, engineering, installation, and monitoring of the project for a 24 month period.

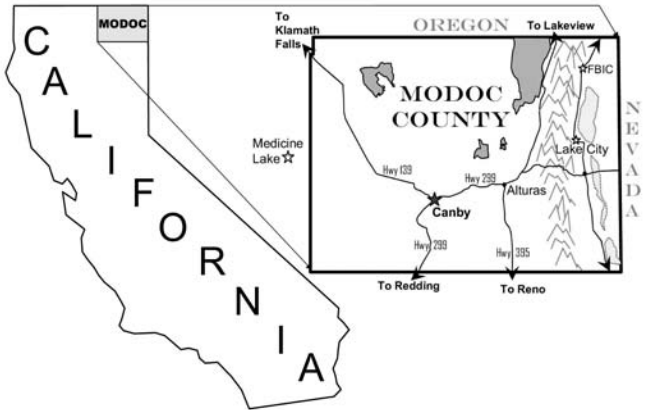

Figure 1: Project Location

The project overcame significant obstacles including:

- Drilling 2,000 feet of clay/tuff formations.
- Low resource flow of 37 gpm with a 250 ft drawdown
- Mercury and arsenic concentrations in excess of EPA standards
- Delayed environmental permitting

Granulated activated carbon was found to be effective for removing mercury, allowing discharge to a local river under an NPDES discharge permit. Average annual discharge to the Pit River since 2004 has been 14.6 gpm.

Today, the district heating system heats approximately 63,000 ft^2 of residential and commercial structures including a 30 ft. x 96 ft. greenhouse. The net 2008 project savings for propane and electricity was approximately $52,500 after all pumping, maintenance and permitting costs were subtracted.

In 2008, the Canby Geothermal Development Project was selected for funding by the California Energy Commission to create the first completely sustainable net-zero energy community in California by fully cascading the use of a geothermal resource and 1) producing green electrical power for California rate payers; and 2) creating up to 120 jobs by implementing geothermal direct-use applications, including greenhouse and aquaculture operations. These long-term goals (3-10 years) will be made possible by drilling a 4,000-ft. geothermal production well, and flow testing it into a current producing well for long-term productivity and power producing potential. A 2,900 ft. pipeline will be installed to connect the currently producing ISO-1 well and newly drilled ISO-2 to discontinue geothermal discharge to a local river while increasing capacity of a district heating system.

A CO-OP LAUNDRY

Historically, the community families in Canby have had a co-op laundry for 40 years and the energy to take care of that need has been propane to heat water for the washers and dry clothes. The five year average propane usage for this task is about 7,050 gallons per year. Figure 2 & 3 show washers and dryers that have been used by community members.

Figure 2: Decommissioned 14 lb. Commercial Washers

Figure 3: Decommissioned Commercial 30 lb. Gas Dryers

Figure 4: New Canby Community Laundromat Location

Typically, I'SOT would buy used laundry equipment from a Laundromat that was upgrading. For many years, inexpensive equipment and the low cost of propane made it a viable way of doing large amounts of domestic laundry. However, in the last few years, propane has more than doubled; going from a 20-year area low of $.80 per gallon to over $2.40 per gallon. Combined with the increased maintenance cost to operate the old machines, I'SOT, Inc. chose to buy all new high efficiency washer/extractors and 55lb gas industrial dryers at an approximate cost of $35,000 and locate them at a new building on the district heating system. Brian Brown Engineering, responsible for the design of the I'SOT geothermal district heating system, drew up the mechanical plans for the building including the retrofitted dryers.

The first equipment selection was the washers. Maytag 21 lb commercial on-premises laundry washer-extractor were selected as they use less than half of the water the old top loading 14 lb washers and extracts that water with 307 g's of force. The first task is to remove excess water from the laundry before requiring the dryers to finish the job. A 50 lb. soft mount washer/extractor was also purchased to handle sleeping bags and large comforters.

Figure 5: New High Efficiency 21 lb Washers

The second equipment selection was the dryers. The relative humidity in Canby for most of the year averages about 15%, so we looked for a dryer with the largest cubic foot per minute (cfm) rating. Figure 6 shows the new dryers. The old 30 lb Loadstar propane dryers moved about 400 cfm of Canby's dry air and had a discharge temperature between 180°-200°F, which was a safety hazard with old kitchen towels.

The selected 55 lb Dexter gas dryers are rated at 910 cfm. After pressure drop going through the filters and coils, the project engineer expected 830 cfm of air flow. Design also required a 140°F airside discharge and 4 gallons per minute (gpm) supply water temperature of 150°F.

Figure 6: New Retrofitted 55 lb. Dryers

THE RETROFIT

After removing the gas unit from the dryer, it was obvious that a larger opening would need to be made to allow the maximum air flow through the coil and rotating drum. Figure 8 shows the small original opening and how much larger it needed to be. A plenum was then mounted over the enlarged opening with a hot water coil as shown in Figure 9. A control valve was installed on the return header which is connected to a controller in the buildings mechanical room. This in turn is monitored by the district heating system's DAS software. The retrofit per dryer averaged about $1,800 including the coil, plenum, control valve, fittings and copper supply and return lines. This cost is largely dependent on the price of copper which has been extremely volatile in the last few years. This equipment was purchased in June 2008. The simple payback for the new equipment and dryer retrofits is under 3 years considering cost of machines ($35,000), retrofits ($9,000), and the current price of propane ($2.33/gal) at an average usage of 7,050 gallons per year.

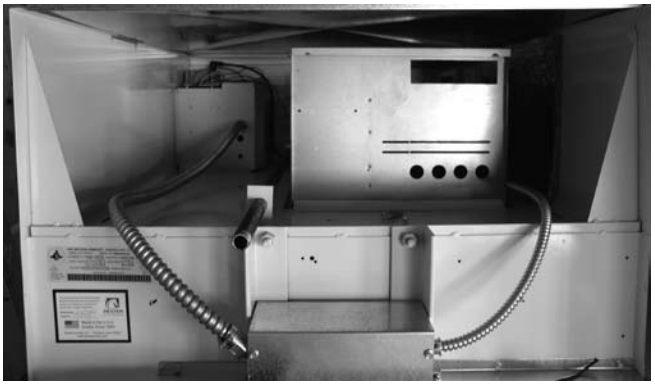

Figure 7: Gas dryer before retrofit

Figure 8: Target Size of New Opening

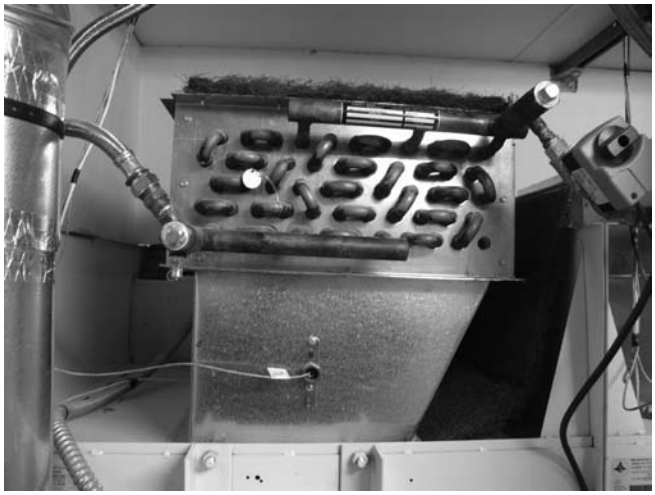

Figure 9: Completed Dryer Retrofit

DRYER PERFORMANCE

Figure 10 below shows dryer and district heating system performance. The upper dialog box shows overall system conditions and the lower dialog box shows the retrofitted dryer performance. Design supply water temperature is 150°F and is manually set to meet that requirement. The supply air temp to the dryers exceeds the design temperature of 140°F. Temperature probes are placed both after the hot water coil and the exhaust duct to monitor dryness of the laundry. If the exhaust temperature exceeds the exhaust temperature set point (EXT T SP), the control valve would close and limit energy to that dryer. At this time, the EXT T SP is set so that drying is maximized. The following year was spent "tweeking" dryer and system parameters to minimize the amount of energy that is sent to the Pit River. Before the dryers were installed, system controls would limit supply loop temperature according to outside temperature, which varies between winter and summer. Typical loop temperature in the winter is between 145°F and 160°F. During the summer, supply loop temperature hovers around 130-135°F. Coordination between users and the system manager will attempt to find the "sweet spot" so that a balance can be struck between drying time and use of the geothermal resource.

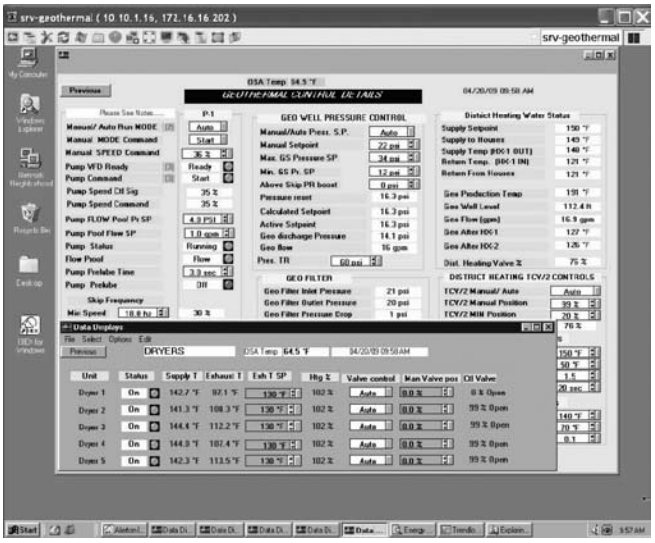

Figure 10: Data Acquisition Screen for Dryers and District Heating System

- The laundry facility has been in use for one month at this writing, so only preliminary observations can be made.
- Users report that drying time is longer with the retrofitted dryers than with the old propane ones but are able to stay within the scheduled time of 1.5 to 2 hours, which is dependent on family size.
- Since the drying temperature is cooler, the laundry is less wrinkled, so less ironing is needed.
- While the dryers were retrofitted with a hot water coil, the dryers "brain" still thinks it is a gas machine. Error codes occasionally come up on the dryers' readout because sensors detect lower drying temperatures with respect to time.

CONCLUSION

The only wrinkle after retrofitting the gas dryers was the error messages that occur because of the hard-wired programming expectations of the dryer's controller. That controller expects higher temperatures than the loop temperature of 150°F can provide. The Canby Geothermal Project's future plans to drill another geothermal well may provide the extra energy needed to satisfy the controller's temperature requirements.

The geothermal savings expected in 2009 for the Canby Geothermal Project is expected to increase from 2008 because 7,050 gallons of propane per year were used to dry clothes in the old dryers. If the cost of propane in 2009 averages only $2.25 per gallon, an additional $15,900 would be saved not counting electrical costs associated with the high efficiency washers. The overall 2009 savings from the project would be estimated to be around $68,500. A subsequent paper on this very new project addition will evaluate the data generated from the project's DAS.