

Facilities Reforestation Tech Tips

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Modern Systems Cut Energy Use 80 Percent at the Coeur d'Alene Nursery

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Forest Service nurseries supply planting stock, process seed, and provide seedling testing services for the Forest Service and other Federal agencies. These services help sustain, rehabilitate, and improve forests on public lands.

Unfortunately, nursery operations are energy intensive. The Coeur d'Alene Nursery in northern Idaho cut energy usage an astonishing 80 percent when it modernized the refrigeration, lighting, and heating, ventilation, and air conditioning (HVAC) systems. The nursery used third-party financing, a power company financial incentive, and a design-build contract to accomplish the work with comparatively little capital outlay. This tech tip explains how the nursery did it.

A Valuable Resource

The Coeur d'Alene Nursery (figure 1) was built in 1962 and is administered by the Idaho Panhandle National Forests. It is the only Forest Service nursery in the Northern Region. This year, the nursery expects to ship 5 million tree seedlings to the Northern, Rocky Mountain, Intermountain, and Pacific Northwest Regions. The nursery maintains 130 acres of irrigated seedbeds that can produce 16 million bareroot seedlings annually and 17 greenhouses that can grow 4 million containerized seedlings annually. Production includes native softwood timber species and a wide range of native trees, shrubs, grasses, and flowers.

Buildings at the nursery include a 3,300-square-foot office building, eight 22-foot-wide by 96-foot-long and seven 30-foot-wide by 96-foot-long greenhouses, a 160-foot-wide by 230-foot-

Highlights...

- The Coeur d'Alene Nursery was relying on outmoded systems to provide refrigeration, lighting, and heating, ventilation, and air conditioning.
- The Bonneville Power Administration provided a \$250,000 incentive and arranged a 10-year loan to replace the failing systems and reduce energy costs dramatically.
- Other Forest Service units may be able to realize similar energy savings and take advantage of nontraditional funding sources.

long shelter house, and twelve tree coolers with almost 21,000 square feet of refrigerated space. The coolers are nearly 13 feet high, so their combined volume is around 273,000 cubic feet. That's a lot of space to cool!



Figure 1—An aerial perspective of the Coeur d'Alene Nursery is painted on the entry wall.



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Mechanical systems include 30- and 40-horsepower, submersible pumps for greenhouse irrigation and domestic water, two 100-horsepower deep-well turbine pumps for irrigation, and 12 water heaters.

The nursery also has a 20-year-old, 250-kilowatt backup electrical generator for the greenhouses.

An Assessment Leads to Action

In recent years, the deferred maintenance list at the Coeur d'Alene Nursery grew as funding failed to keep up with maintenance needs. Part of the problem was that the original design of the nursery's freon-based refrigeration system was inefficient. High energy costs were crippling the nursery's operating budget.

In 2001, nursery manager Joseph Myers requested emergency repairs to keep the refrigeration system operational and prevent a catastrophic loss of seedlings. The Northern Region provided \$60,000 in construction funds to repair the most pressing problems. The repairs, designed by Air Trane of Coeur d'Alene, ID, kept the nursery operational for the next year, but increased energy consumption. The fans were working harder than they were designed to work. Repairs wouldn't have kept the system going for long and the Forest Service's Capital Improvement Project process could not solve the problem quickly enough to prevent the system's possible failure. Idaho Panhandle National Forests engineer Ervin Brooks knew a quick permanent solution was needed and contacted the facilities group in the Northern Regional Office.

Jane Kipp, an architect in the Northern Regional Office's facilities group, contacted the Bonneville Power Administration (BPA), which supplies electricity throughout the Pacific Northwest. The BPA has numerous programs to promote energy conservation and was immediately interested in surveying the nursery, one of the largest energy consumers in Coeur d'Alene. You can learn more about BPA's energy conservation programs at <http://www.bpa.gov/corporate/>.

BPA energy manager Micah Haman visited the nursery and identified the following items that could be addressed as part of an overall energy reduction project:

- Lighting
- Water conservation
- Heating
- Refrigeration
- Building envelope (everything that separates the building's contents from the environment)
- Long-term service contract

The BPA recommended contacting the Forest Service's Pacific Northwest Region engineering staff because they had recently completed a \$1.3 million retrofit at a nursery in Rogue River, OR. The Rogue River project was funded by the Forest Service while the Coeur d'Alene project required innovative third-party financing and included a \$250,000 incentive from the BPA.

Luahn Simms, the Pacific Northwest regional mechanical engineer, engaged Cascade Energy Engineering in Portland, OR, to study the nursery refrigeration system. She used that information to prepare a prospectus for the refrigeration renovation. Based on the finished prospectus and report, the BPA wrote a task order that itemized the work. It included the terms and schedule of payment for a loan to finance the upgrade costs that exceeded the cooperative funding available through the Forest Service and the BPA. Idaho Panhandle National Forests grants and agreements specialist Robyn Frank was instrumental in implementing the agreements between the BPA and the Forest Service. The Northern Region engineering and contracting staff used the task order to issue a design/build contract to Cisneros Construction of Portland for \$2,680,438. The contract was overseen by Scott Vandegrift, central zone engineer for the Idaho Panhandle National Forests, who served as the contracting officer's representative.

The contract included complete replacement of the tree cooler refrigeration system with an ammonia-to-glycol chiller system. The chiller system includes screw compressors with variable speed drives that reduce power usage when cooling demands are lower (figure 2). Compact, efficient evaporators inside the cooler rooms (figure 3) replaced the large, power-hungry evapo-

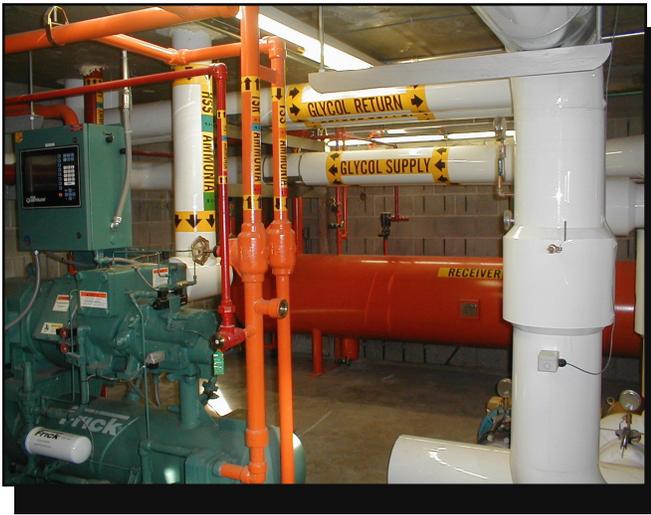


Figure 2—The compressor room at the Coeur d’Alene Nursery contains the new main ammonia-to-glycol chiller system equipment, including the screw compressors and glycol pumps.

rators and big fans that used to push air through undersized plenums into the cooler rooms. The chiller is monitored and controlled by a computer, which maximizes system efficiency with the help of variable frequency drives on equipment motors



Figure 3—New, efficient evaporators inside each cooler room at the Coeur d’Alene Nursery replaced large, power-hungry evaporators located outside the cooler walls.

(figure 4). “Waste” warm water produced by the system’s condenser (figure 5) is used to defrost the evaporator coils.

The nursery remained open during construction. The contractor closely coordinated all utility disruptions to comply with strict constraints on the timing of the disruptions. The contract required all construction to be completed while the tree coolers



Figure 4—This variable frequency drive controls the speed of the motors on the evaporators inside the cooler rooms at the Coeur d’Alene Nursery.



Figure 5—The condenser for the new refrigeration system also provides a warm water source for defrosting the cooler room evaporators at the Coeur d’Alene Nursery.

were not being used. To protect the millions of dollars worth of seed stock at the nursery, all seed freezers operated throughout the project.

The project was substantially complete and all tree coolers were operational in November 2004. The project was commissioned in March 2005.

The refrigeration contract didn’t address all the energy reduction opportunities identified in the BPA energy report. The nursery space lighting was reviewed and upgraded under a BPA contract with Northwest Edison, Inc. Lighting retrofit work