Facilities
Reforestation
Tech Tips

United States Department of Agriculture
Forest Service
Technology & Development Program
August 2006
7300/2400 0673–2326–MTDC

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

Jane A. Kipp, Architect, Northern Region, and Kathleen Snodgrass, Project Leader

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.

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.

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-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.

For additional information, contact: *Kathleen Snodgrass, project leader; USDA Forest Service, MTDC; 5785 Hwy. 10 West; Missoula, MT 59808–9361. Phone: 406–329–3922; fax: 406–329–3719; e-mail: ksnodgrass@fs.fed.us*

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.

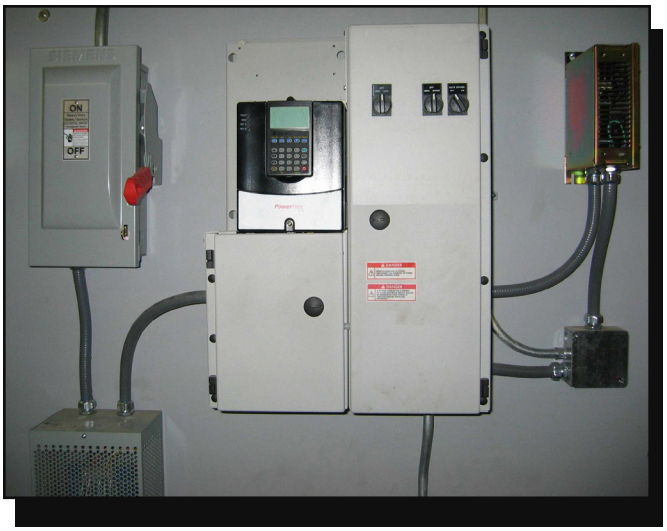

Figure 4—This variable frequency drive controls the speed of the motors on the evaporators inside the cooler rooms at the Coeur d'Alene Nursery.

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

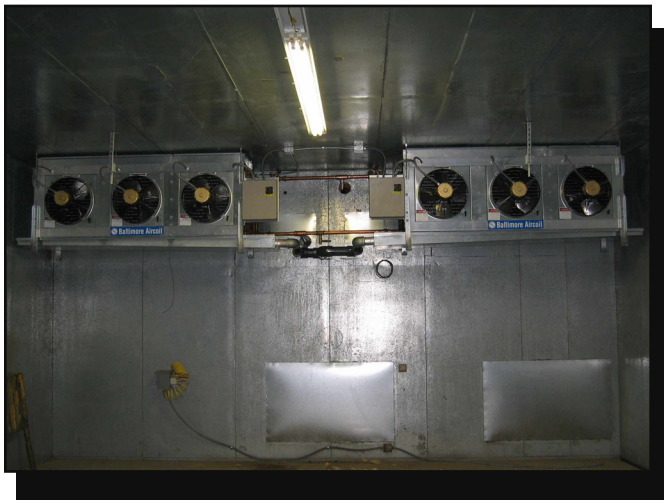

Figure 3—New, efficient evaporators inside each cooler room at the Coeur d'Alene Nursery replaced large, power-hungry evaporators located outside the cooler walls.

(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 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

included replacing the existing florescent ballasts and replacing all the fluorescent tubes with more efficient, low-mercury, T32 fluorescent tubes (figure 6). Besides improving energy efficiency, this upgrade eliminated a PCB (polychlorinated biphenyl) hazard from the old ballasts. Replacement of water heaters and HVAC upgrades will be accomplished later through other agreements with the BPA.

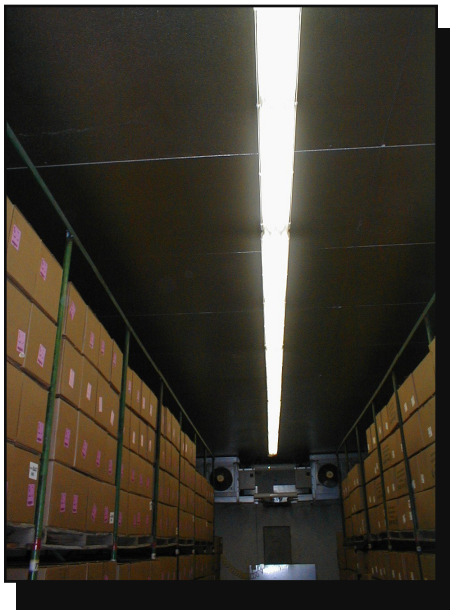

Figure 6—The new light fixtures in this packing shed at the Coeur d'Alene Nursery are far more energy efficient and contain far less toxic material than the old fixtures.

Conservation Saves Money, Time, and Energy

The Coeur d'Alene Nursery refrigeration project has dramatically reduced energy usage and eliminated many of the deferred maintenance issues that plagued the nursery for years.

The nursery now uses about 380,000 kilowatt hours of energy each year. The verification report commissioned after construction states that the nursery will save about 1.8 million kilowatt hours annually, an 80-percent reduction from the historic average of 2.1-million kilowatt hours. The water heater replacements have not yet been installed, but should reduce the nursery's energy use even more.

The project also solved ongoing maintenance problems with lighting, heating, refrigeration, and electric motors that had strained budgets and threatened system failure that could have brought nursery operations to a halt.

Because of the relative simplicity of the new system, the nursery manager has decided not to enter into a long-term service contract yet.

Energy savings have reduced the nursery's indirect costs and have substantially contributed to reducing energy use and costs as required by Forest Service policy and Federal regulations. Because the nursery is spending less on operating and maintenance costs, it will not need to increase the cost of nursery stock as frequently, and those increases will be smaller.

Because the new equipment is so much more compact, an area once occupied by the massive cooler evaporators now provides extra storage space—an unanticipated bonus.

Improvements Aren't Free

This project cost more than was available through cooperative funding by the BPA and the Forest Service. A loan arranged through the BPA must be repaid in annual installments of around $208,700 over 10 years. Energy costs have been reduced about $82,000 per year. The annual $60,000 to $100,000 cost of repairs has been eliminated. The cost reductions for energy and repairs aren't quite enough to make the loan payments, but they come close.

A capital investment project would have paid for the work without a loan, but it could not have been implemented as quickly. Even if the Northern Region had been able to divert capital investment funding rapidly to the nursery, other important maintenance work throughout the region would have had to be postponed for years—not a desirable outcome, considering the region's deferred maintenance backlog. Alternative financing through the BPA was the best solution in this case.

Future Conservation Possibilities

The nursery manager is pleased with the success of the energy conservation project. He would like to make the nursery operation even more efficient and sustainable by installing a biomass heating and energy generation system. Such a system would allow the nursery to reduce its energy purchases dramatically, and might allow the nursery to sell surplus energy, reducing its indirect costs. The manager also is considering other measures, such as water conservation in the irrigation system, which would save energy as well as water because the system's pumps wouldn't need to run as long.

Other Financing Methods

The Coeur d'Alene Nursery project clearly demonstrates that Forest Service personnel can accomplish needed energy conservation without going through the capital investment process.

In addition to the method used at the nursery, Utility Energy Services Contracts (UESCs) can help finance energy upgrades. A UESC is an agreement between a Federal agency and its utility company that applies cost savings generated by energy efficiency improvements to pay for the work. You can find out more about UESCs at *http://www1.eere.energy.gov/femp/financing/uescs.html.* An example UESC between the Forest Service and Southern California Edison is available to Forest Service and Bureau of Land Management employees on their internal computer networks at *http://fsweb.wo.fs.fed.us/eng/programs/facilities/sus_green/excontra.htm.*

Super Energy Savings Performance Contracts (Super ESPCs) are similar to UESCs, but use "umbrella" contracts arranged by the Federal Energy Management Program to allow agencies to undertake numerous projects without having to negotiate a separate agreement for each project. You can learn more about Super ESPCs at *http://www1.eere.energy.gov/femp/financing/superespcs.html.*

Some States offer incentives or bundled financing for energy efficiency projects. You can check out what's available in your State at *http://www1.eere.energy.gov/femp/program/utility/utilityman_energymanage.html.*

Will It Work For You?

If you're not sure whether your facilities have potential for energy savings, consider having an energy audit or retrocommissioning performed on your building.

You may be able to obtain a free energy audit through one of the State or Federal programs. A Web site detailing the programs is available to Forest Service and Bureau of Land Management employees on their internal computer networks at *http://fsweb.wo.fs.fed.us/eng/programs/facilities/sus_green/audit.htm.*

Retrocommissioning carefully examines existing systems and makes adjustments and modifications to optimize them. Such evaluations may be cost effective for larger buildings (30,000 square feet or more) or for a campus of several buildings. You can learn more about retrocommissioning at *http://www.fypower.org/bpg/module.html?b=offices&m=Commissioning.*

Acknowledgments

The authors would like to thank the following people for their assistance reviewing this tech tip:

Gary Kees, mechanical engineer, MTDC
Joseph Myers, Coeur d'Alene Nursery manager, Idaho Panhandle National Forests
Scott Vandegrift, central zone engineer, Idaho Panhandle National Forests

About the Authors

Jane A. Kipp, AIA, has worked as an architect in Northern Region Engineering since 1991. Before that, she had worked as an architect and design engineer for a variety of public and private employers. She graduated from the University of Arizona in 1980 with a bachelor's degree in architecture.

Kathleen Snodgrass came to MTDC as a project leader in 2001 from the Nez Perce National Forest, where she had been the facilities architect for about 7 years. She had worked in facilities, landscape architecture, land line, and general engineering on the Nez Perce National Forest for about 10 years and had spent about 10 years in highway design and construction with the Idaho Division of Highways. She graduated from Washington State University in 1974 with a bachelor's degree in architectural studies.

Library Card

Kipp, Jane; Snodgrass, Kathleen. 2006. Modern systems cut energy use 80 percent at the Coeur d'Alene Nursery. Tech Tip. 0673–2326–MTDC. Missoula, MT: U.S. Department of Agriculture Forest Service, Missoula Technology and Development Center. 6 p.

The Coeur d'Alene Nursery in northern Idaho modernized its refrigeration, lighting, and heating, ventilation, and air conditioning systems to cut energy usage by an astonishing 80 percent. 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.

Keywords: agreements, air conditioning, Bonneville Power Administration, BPA, electricity, energy audits, energy conservation, energy efficiency, Energy Savings Performance Contracts, financing, heating, HVAC, incentives, lighting, nurseries, pumps, refrigeration, retrocommissioning, Super ESPC, tree coolers, UESC, Utility Energy Services Contracts, ventilation

---

Single copies of this document may be ordered from:

USDA Forest Service, MTDC
5785 Hwy. 10 West
Missoula, MT 59808–9361
Phone: 406–329–3978
Fax: 406–329–3719
E-mail: *wo_mtdc_pubs@fs.fed.us*

Electronic copies of MTDC's documents are available on the Internet at: *http://www.fs.fed.us/eng/t-d.php.*

For additional information about energy use reduction, contact Kathleen Snodgrass at MTDC.

Phone: 406–329–3922
Fax: 406–329–3719
E-mail: *ksnodgrass@fs.fed.us*

Forest Service and Bureau of Land Management employees can search a more complete collection of MTDC's documents, videos, and CDs on their internal computer networks at: *http://fsweb.mtdc.wo.fs.fed.us/search/.*