Improvements for Energy Conservation at the Coeur d'Alene Nursery

Aram Eramian

Aram Eramian is Horticulturist/Bareroot Forester, USDA Forest Service Coeur d'Alene Nursery, 3600 Nursery Road, Coeur d'Alene, ID 83814; Tel: 208.765.7372; E-mail: aeramian@us.fed.us.

Eramian, A. 2009. Improvements for energy conservation at the Coeur d'Alene Nursery. In: Dumroese, R.K.; Riley, L.E., tech. coords. 2009. National Proceedings: Forest and Conservation Nursery Associations—2008. Proc. RMRS-P-58. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station: 10–12. Online: http://www.fs.fed.us/rm/pubs/rmrs_p058.html.

Abstract: In 2002, the USDA Forest Service Coeur d'Alene Nursery in Idaho began to evaluate ways to reduce energy consumption in lighting, refrigeration, and heating and cooling of facility workspace. The primary factor leading up to this was the inefficiency of the nursery's Freon®-based refrigeration system. Energy costs and maintenance of the system were becoming a larger portion of the nursery's operating budget. Through the Bonneville Power Administration (BPA), the nursery used third-party financing, financial incentives, and a design-build contract to accomplish the work with very little capital outlay. Energy consumption has been substantially reduced as a result of the system improvements.

Keywords: water conservation, lighting systems, heating systems

Coeur d'Alene Nursery

The USDA Forest Service Coeur d'Alene Nursery in Idaho was built in 1962 and is administered by the Idaho Panhandle National Forest. The nursery provides plant material in the form of native conifer, shrub, forb, and grass seedlings for reforestation and restoration work within the Northern Region. The nursery maintains 53 ha (130 ac) of seedbeds that can produce 16 million bareroot seedlings, and 17 greenhouses that can grow 4 million container seedlings annually. The nursery will ship approximately 5 million tree seedlings this year to customers in the Northern Region.

Buildings at the nursery include a 306 m^2 (3,300 ft^2) office building, 2,750 m^2 (29,580 ft^2) of additional heated work areas, eight 7 m (22 ft) by 29 m (96 ft) and seven 9 m (30 ft) by 29 m (96 ft) greenhouses, approximately 6,320 m^2 (68,000 ft^2) of shelter house growing space, and 1,950 m^2 (21,000 ft^2) of refrigerated space for seedling cold storage.

Conservation Possibilities

In 2001, maintenance needs (costs) exceeded existing funding levels for refrigeration, lighting, and other mechanical systems. The nursery manager sought financial help from the Region for cooler maintenance. Work was done on the existing refrigeration system to keep it operational, but it was a short-term solution. In 2002, the refrigeration system continued to degrade to the point it was no longer reliable. The work that was done in 2001 increased power consumption rather than reducing it. The nursery manager went back to the Region for assistance with a permanent solution for the coolers. The architect in the Regional Office had been working on energy conservation programs and contacted the Bonneville Power Administration (BPA) to see if any programs were available that could fund some of the maintenance work at the nursery. The BPA was interested in surveying the nursery site because of the amount of power being used annually. In December 2002, a BPA energy manager came to the nursery and conducted a site evaluation. His review identified five areas where improvements could be made to conserve energy: lighting, water conservation, heating, refrigeration, and the building envelope.

Lighting

The nursery space lighting was upgraded under a contract and was funded by an incentive program through BPA. The contractor came to the nursery in the spring of 2003 and assessed the existing interior and exterior lighting systems and developed recommendations for retrofit to more efficient fixtures. Existing fluorescent ballasts and tubes were replaced in the summer and fall of 2003 with more efficient, low-mercury T32 tubes. The replacement of the old fluorescent ballasts also eliminated a polychlorinated biphenyl (PCB) hazard at the facility. In two locations, motion sensors were installed to the

light fixtures to efficiently manage power consumption. In the past, lights were continually left on in these locations long after work was completed. Exterior lighting fixtures on buildings were converted from mercury vapor to high-pressure sodium. The retrofit of the lighting system reduced energy consumption to a point where it was noticed by the local utility provider. BPA estimates predicted we would save 200,000 kWh, or US$ 8,850 per year.

Water Conservation

The primary 300-horsepower deep-well turbine pump was evaluated for energy conservation improvements. It was determined, however, that the cost of a variable-frequency drive (VFD) would be very expensive. The breakeven point would have occurred 45 years into the future based on current use rates. Evaluation of past irrigation practices and pump performance curves for the existing pump determined that the system was not being run at optimal levels. Irrigation practices and schedules have been changed to run within optimal pump performance, reducing pump operation hours and thus saving additional energy.

Heating

Heating and cooling systems in office areas have been targeted for upgrading, but at this point have not been completed. Existing electric baseboard heaters and through-the-wall air conditioners will be replaced with heat pumps. BPA estimated the cost savings will be US$ 4,710, or 80,000 kWh per year with this conversion.

Refrigeration

The existing Freon®-based (R401-A) refrigeration system was evaluated by an energy engineering firm in the fall of 2002. The information gathered was used to prepare a prospectus and report for the refrigeration system renovation. The BPA used the report to write a task order that the Northern Region of the Forest Service used to issue a design and build contract in 2003. The terms and schedule of payments for the third party loan that was used to finance the project were included in the task order. Contract design reviews and acceptance of the plans took place in the latter part of 2003.

The demolition of the old system and construction of the new system began in the spring/summer of 2004 after all seedlings for that year were shipped to the field. The contractor was to replace the existing Freon®-based system with an ammonia-to-glycol chiller system. The chiller system included screw compressors equipped with variable frequency drives that reduce power consumption when demand is low. Compact, efficient evaporators were installed inside each of the cooler rooms. All systems are monitored and controlled by a computer, which maximizes system efficiency with the help of variable frequency drives on equipment motors. Warm water produced by the system's condenser is used to defrost the evaporator coils in the cooler rooms, hallways, and loading dock. Construction work on the cooler system was completed in November 2004 in time for storage of fall-lifted bareroot and container seedlings.

Other Items

Water Heaters—Currently 12 electric water heaters are in use in various buildings at the nursery. BPA recommended replacement of these with direct "tankless" water heaters as the older ones fail. No replacements have been made to date. BPA estimates that we would save an additional US$ 509, or 6,400 kWh per year.

Programmable Thermostats—Five programmable thermostats were purchased and installed on existing heaters in various work areas. This has provided more efficient use of the existing heaters by heating work areas only on days that people are scheduled to be working. This has eliminated heaters being left on overnight and on weekends during the peak heating season, saving additional energy. BPA estimated US$ 500 per year in savings with the retrofit.

Payoff of Energy Conservation Efforts

The nursery uses an average of 1.16 million kWh of energy per year since the completion of the lighting and tree cooler renovations. The nursery's historic average energy usage prior to the energy saving improvements was 2.1 million kWh. The largest realized cost savings was the renovation of the tree seedling coolers. Because the main electric meter tracks usage for the entire site, smaller energy conservation work, like replacing thermostats, insulating cracks and holes in building envelops, and turning lights off in areas not being occupied, could not be tracked directly to determine the energy savings. Overall, the measures have reduced energy consumption by about 0.94 million kWh annually since 2005 (fig. 1). In monetary terms at current utility rates, this equates to a cost savings of approximately US$ 56,000 per year. In addition, annual maintenance costs of between US$ 60,000 and US$ 100,000 have been eliminated. An additional 80,000 kWh in energy savings will be gained annually when the heat and cooling renovations for office work areas are completed.

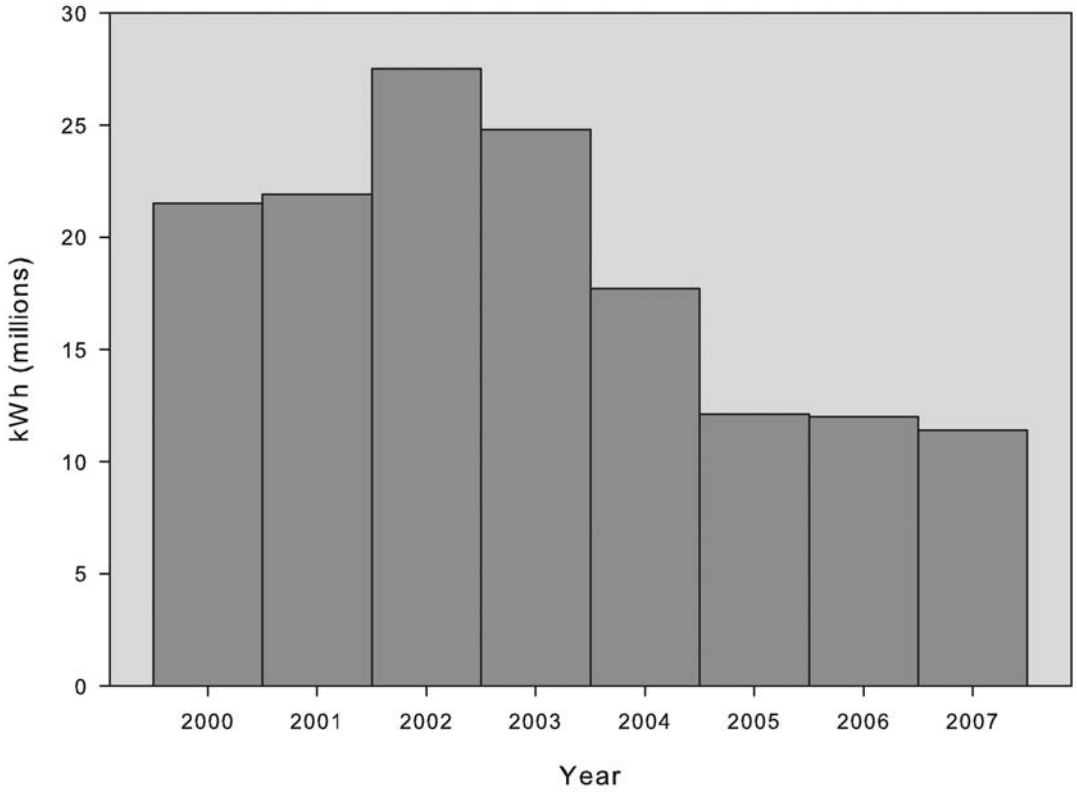

Figure 1. Annual kWh usage for the USDA Forest Service Coeur d'Alene Nursery from 2000 to 2007.

The content of this paper reflects the views of the authors, who are responsible for the facts and accuracy of the information presented herein.