

## **Case Study: Sustainable Campus Initiative for Energy Research and Development**

Oak Ridge National Laboratory (ORNL) is the Department of Energy's largest science and energy laboratory, and is a leader in energy efficiency, renewable energy, and in research and development of areas of energy supply such as clean fossil and nuclear energy. ORNL is nearing the completion of the largest modernization program in its 65-year history. Since 2002 ORNL has constructed more than 1.2 million square feet of state-of-the-art and efficient office, laboratory, and support facilities, at a cost of approximately \$350 million dollars. Sustainable campus design and development formed the basis of the campus modernization.

There are four core principles that we used to shape the design and development of the new campus. These included:

- An open campus that emphasizes natural landscapes and incorporates existing water features such as a three acre pond
- Sustainable design for buildings, based upon Leadership in Energy and Environmental Design (LEED) principles
- Flexible structure that anticipates future campus growth
- Programmatic centers of excellence integrated into the wider campus

In all cases the goal was to minimize environmental impact and reduce the use of non-renewable resources. The resulting transformation of the ORNL campus was dramatic: a parking lot formerly used by 1000 cars each day along with deteriorating structures gave way to 13 new buildings, including six in the new east campus, which is the only fully LEED-certified campus in Tennessee and in the Department of Energy complex nationwide. Of these six buildings the newest, which we call the Multiprogram Research Facility, earned the LEED Gold certification while the other five buildings are certified LEED silver.

A unique combination of federal, state, and private funds made this 21<sup>st</sup> century campus a reality within 5 years. The Department of Energy built several of the new LEED silver buildings, including the new ORNL Conference and Visitor Center complex. The State of Tennessee built the Joint Institute for Computational Sciences and the Joint Institute for Biological Sciences buildings, also to LEED Silver standards. Keenan Development Corp (KDA) built the privately funded buildings, assuring LEED silver or gold certification. An important partner in all this was the architectural and engineering firm Heery International, as were the host of local, private subcontractors willing to build to LEED standards. Finally, an ongoing, strong relationship continues with Johnson Controls, who installed the building automation system in these new buildings.

The results of this initiative are dramatic. The new buildings are, on average, 54% more energy efficient per square foot than the structures they replaced, and water consumption has dropped approximately 14 million gallons per year. Yet there have been other benefits to building with efficiency and sustainability in mind. This new, sustainable campus has been instrumental in the recruitment of world-class talent for the Laboratory's mission. It was also used to leverage other science and technology

capabilities at ORNL to win major new research programs in bioenergy, nanoscience, and high-performance computing. Homegrown technologies such as hybrid solar lighting, advances in building and roofing materials, and heat-reflective paints have been tested or deployed on the campus. The commitment to sustainability that has guided ORNL's modernization effort has become an integrated principle of the Laboratory's facilities management program.

Oak Ridge National Laboratory is continuing to invest in sustainable, energy efficient technologies that are good for the environment and for the "bottom line." ORNL is planning another \$700 million in additional modernization projects during the next decade. ORNL, like all federal facilities, must reduce its energy intensity even more, by up to 30% within the next 10 years, and must deploy more renewable sources of energy. For example, we recently installed the first grid-connected photovoltaic system on the campus, which can provide as much as half of the energy consumed by the average home in east Tennessee. We've introduced dramatic steam conservation measures and are now considering an energy savings performance contract with Johnson Controls to install a biomass cogeneration plant to reduce the demand for fossil fuels used at the ORNL Steam Plant. The biomass gasification process would use wood residuals sourced from within about 100 miles as a renewable fuel source. The plant design may incorporate features to permit possible future expansion to develop biomass research opportunities. ORNL is also considering ways to decentralize the steam distribution system for remote areas of ORNL's campus. One solution could include installation of a "Super Boiler" that is highly efficient (near 94%), produces low emissions, and would be used as the primary boiler to supply the steam service to a remote research area of the campus. The existing steam distribution lines from the existing steam plant would be decommissioned, eliminating the inefficiencies associated with them. This project would help ORNL move forward with the federally-mandated energy efficiency goals. It is expected that additional monitoring of the plant and system performance will occur to help qualify and to promote these technology plant options to the wider federal sector.

To help on the local and state level ORNL also contributes to the City of Knoxville's Energy & Sustainability Task Force, which is analyzing the city's energy use and developing a strategic plan to make changes needed to lower consumption, costs, and emissions. In addition, ORNL supports the Governor's Task Force on Energy Policy. The Task Force is charged with developing a state energy plan to make Tennessee a leader in energy efficiency and conservation, use of alternative fuels and renewable energy sources, and the development of clean-energy technology.

Within the next ten years ORNL employees may be purchasing and driving to work plug-in hybrid electric vehicles (PHEVs) in numbers that are of the same order as the number of conventional hybrid electric vehicles owned by ORNL employees. ORNL is pursuing a strategy and action plan to assure that the campus remains a national leader among federal facilities in sustainable practices in electricity, buildings, renewable fuels, and transportation, including providing its employees with opportunities for personal contributions to energy intensity reductions.