

 OAK RIDGE NATIONAL LABORATORY

Annual Sustainability Report 2010–2011



U.S. DEPARTMENT OF
ENERGY



Contents

<i>Message from the Director</i>	1
<i>ORNL Overview</i>	2
Introduction	2
Integrating ORNL's Resources to Achieve Sustainability	2
Safety and Environmental Performance	3
<i>Sustainable Campus Initiative</i>	4
<i>Roadmaps</i>	6
Greenhouse Gas Management	6
Transformational Technologies	6
High-Performance and Sustainable Buildings	7
Energy Efficiency	9
Utilities	9
Transportation	12
Waste	14
Systems	15
Employees	16
External Engagement	17
Landscaping	17
<i>In Closing</i>	18
Awards	18
Global Reporting Initiative	18
Next Steps	18
Contacts	18

Message from the Director



Thom Mason
Laboratory Director

Oak Ridge National Laboratory (ORNL) is both the largest science and energy laboratory of the U.S. Department of Energy (DOE) and one of the oldest in the national laboratory system. These characteristics provide a unique opportunity to integrate sustainability into our facilities and activities.

As a leading performer of clean energy research and development (R&D), ORNL delivers advances in energy efficiency, renewable energy, and environmentally sound technology and practices. We are committed to accelerating the deployment of these advances in support of DOE's goal of catalyzing the timely, material, and efficient transformation of the nation's energy system and securing U.S. leadership in clean energy technologies.

A comprehensive modernization effort, undertaken to provide ORNL with a 21st century research environment, provided the starting point for our Sustainable Campus Initiative, a 10 year effort to achieve benchmark levels of sustainability across ORNL. This aggressive campaign will continue the transformation of the Laboratory's physical environment and enable us to meet DOE goals for energy management and environmental performance.

As outlined in this report, the Sustainable Campus Initiative brings together our researchers and support staff in leveraging the outcomes of our DOE-sponsored R&D programs to maximize the efficient use of energy and natural resources across the Laboratory. Wherever possible, we are integrating ORNL innovations into new and existing facilities, systems, and processes. We are also taking actions to transform our culture and engage employees in supporting sustainability at work, at home, and in the community.

These efforts have enabled us to make substantial progress in reducing the energy intensity of our operations and meeting our sustainability goals. This report describes our progress and our plans to continue integrating sustainable practices into the planning, execution, and evaluation of all ORNL activities as we deliver the science and technology needed to transform the nation's energy system. We welcome your comments, questions, and suggestions.

ORNL Overview

Introduction

The mission of Oak Ridge National Laboratory (ORNL) is to deliver scientific discoveries and technical breakthroughs that will accelerate the development and deployment of solutions in clean energy and global security, and in doing so create economic opportunity for the nation. To execute this mission, ORNL integrates and applies distinctive core capabilities that provide it with signature strengths in neutron scattering, advanced materials, high-performance computing, and nuclear science and engineering. The intended outcome is to produce transformational innovations that will enable a 21st century industrial revolution.

Managed by UT-Battelle, a partnership of the University of Tennessee (UT) and Battelle Memorial Institute, ORNL was established in 1943 to support the Manhattan Project. From an early focus on chemical technology and reactor development, ORNL's research and development (R&D) portfolio broadened to include programs supporting DOE missions in scientific discovery and innovation, clean energy, and nuclear security. Today, as DOE's largest science and energy laboratory, ORNL is engaged in programs and partnerships that leverage major national investments in critical research infrastructure, including the world's foremost resources for neutron sciences, the Spallation Neutron Source (SNS) and the High Flux Isotope Reactor (HFIR), and the nation's most powerful scientific computing complex. ORNL also manages the U.S. ITER project for DOE. Each year, ORNL hosts thousands of facility users and visiting scientists, many of whom perform work at its 10 user facilities, and supports the development of the next generation of scientific and technical talent. ORNL has a staff of about 4,400 and an annual budget of more than \$1.6 billion. The Laboratory's extensive capabilities for scientific discovery and innovation are applied to the delivery of mission outcomes for DOE and other sponsors.

Integrating ORNL's Resources to Achieve Sustainability

In its management of ORNL for DOE, UT-Battelle is committed to simultaneous excellence in science and technology; operations and environment, safety, and health; and community service. UT-Battelle has established a Laboratory Agenda that provides a structured framework for delivering on this commitment. The Laboratory Agenda includes three critical outcomes:

- Apply ORNL's capabilities to deliver discovery and innovation for clean and affordable energy, global security, environmental sustainability, and economic competitiveness.
- Sustain and improve ORNL's ability to serve the needs of DOE and the nation through responsible stewardship.
- Be viewed by our neighbors as a highly valued partner in the region.

Our Sustainable Campus Initiative supports all of these critical outcomes. It leverages the results of ORNL's extensive research



programs to improve the Laboratory's operations, and it provides a host of opportunities for engaging with regional partners to advance sustainability.

Safety and Environmental Performance

ORNL's environmental and safety performance is a critical requirement for achieving sustainability and, in fiscal year (FY) 2011, ORNL's performance was outstanding. The permit compliance rate was >99.9%, there were no reportable releases to the environment, and no findings were reported during inspections conducted by regulators. Sustainability initiatives

The Laboratory's Significant Footprint

- Over 4 million square feet of buildings on 4,400 acres of land
- Extensive utilities with centralized and distributed systems
- Over 4,400 staff
- 3,000 guest researchers annually
- 3,000 short-term visitors annually
- FY 2011 funding: \$1.6 billion

ORNL, located near Knoxville, Tennessee, is the largest of the DOE Office of Science laboratories.

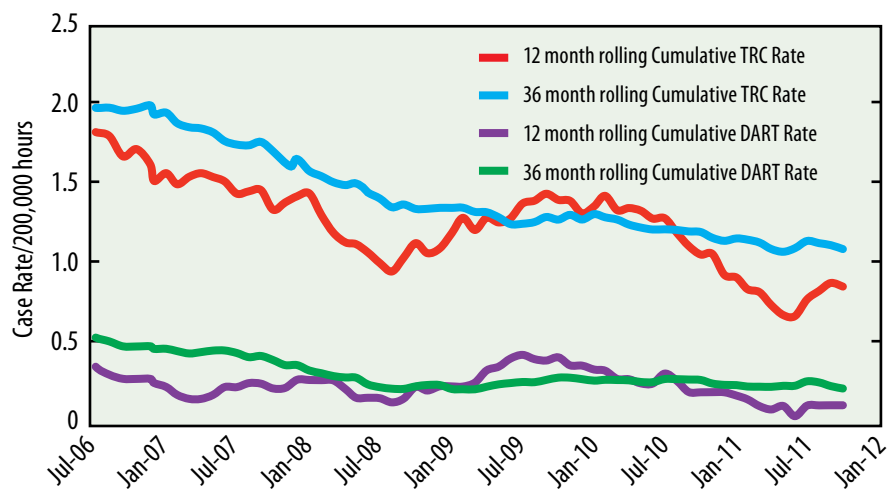


such as recycling, LEED construction, improved energy efficiency, and reduced water usage improve ORNL's environmental performance and position the Laboratory to meet the requirements of DOE and Presidential Executive Orders.

Safety and health sustainability includes the responsibility to ensure that the protection of human life and the safety, health, and well-being of workers, customers, and neighboring communities are a primary consideration. UT-Battelle is committed to providing a safe and healthy workplace at ORNL by developing and implementing work processes and equipment that abate hazards, protect and restore the environment, and integrate pollution prevention into planning and decision making.

In June 2011, ORNL celebrated an historic milestone—7.8 million hours worked without a serious injury. The record surpassed the Laboratory's previous record of 5 million hours. ORNL Director Thom Mason said, "If you look at what is required to do work safely, you also have what you need to do good work. Speak up, stay vigilant, report problems, and learn from what happens. Always maintain a questioning attitude."

ORNL has experienced steady improvement in safety performance, and this trend has continued in FY 2011. Long-term trends for lagging injury metrics indicate that ORNL



ORNL safety performance TRC rate and DART rate

continues to maintain a decrease in the overall number and severity of injuries. In FY 2011, ORNL experienced a total reportable case (TRC) rate of 0.79 and a days away, restricted, or transferred (DART) rate of 0.12. These rates represent a drop of 39% and 62%, respectively, from FY 2010 and are 30% and 40% lower, respectively, than the rates in FY 2008, previously one of ORNL's safest years on record.

Sustainable Campus Initiative

In 2000, ORNL charted a course for sustainability and never looked back. Through a creative mix of construction and renovation, ORNL's 68-year-old infrastructure became home to state-of-the-art facilities hosting major new research programs in bioenergy, nanoscience, and high-performance computing. Advanced building technologies—many developed, tested, and proven at ORNL—have been incorporated into new construction and renovation to further advance the Laboratory's goal of sustainability. ORNL's Sustainable Campus Initiative integrates energy and resource efficiency and cutting-edge technologies with operational and business processes. Sustainable development does not reflect a trade-off between business and the environment; rather, it reflects the synergy between them. ORNL's R&D programs, along with the Facilities and Operations Directorate, are working together in unprecedented fashion to help make ORNL a national leader in sustainability. This unique partnership is adopting new energy-saving technologies developed at the Laboratory to achieve

sustainability while supporting its R&D goals. By embracing sustainability, ORNL continues a commitment to excellence, innovation, job creation, and the sharing of our expertise in energy technologies and environmental management. In leading by example, ORNL helps to ingrain a culture of sustainable practices for our employees, our families, and our communities.

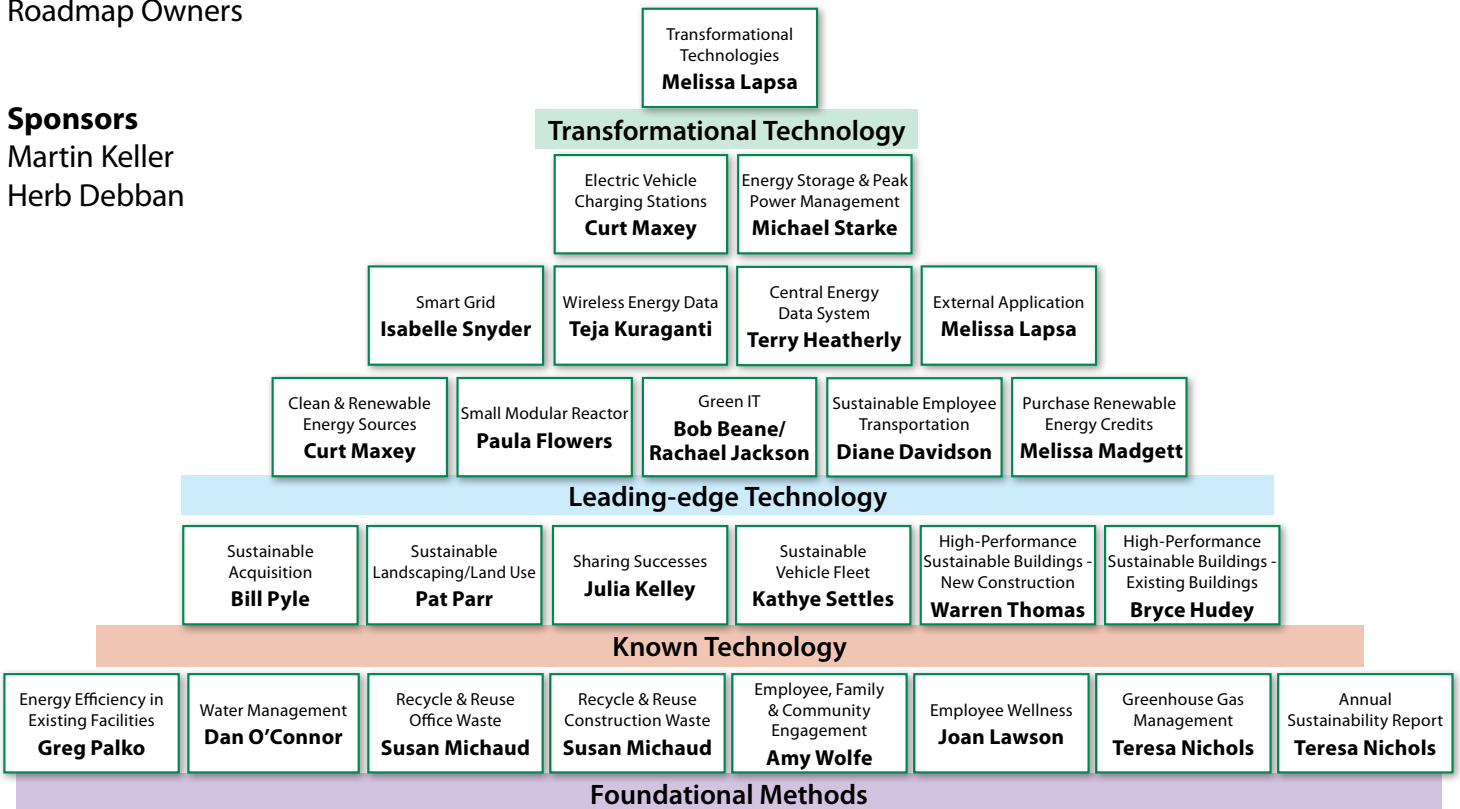
In its current form, the Sustainable Campus Initiative consists of 26 unique projects, or roadmaps, ranging from foundational methods to transformational technologies. Sustainability is a dynamic process that addresses components of environmental, economic, and social elements. ORNL strives to be a leader in sustainability by embracing sustainable practices and using the Laboratory's vast scientific and technical expertise to benefit individuals, communities, commercial and industrial facilities, and the nation at large. This report highlights some of the progress made since FY 2010.

Lead Team

Melissa Lapsa
Teresa Nichols
Randy Overbey
Roadmap Owners

Sponsors

Martin Keller
Herb Debban





I'm proud to have been a part of the Oak Ridge National Laboratory's revitalization that began when UT-Battelle arrived in 2000. From day one, we embraced sustainability as a core value. We made great strides in making ORNL a beacon for change toward sustainability in our region.

But never could we have imagined back then what is happening now with the Sustainable Campus Initiative and the highly motivated volunteers who are making it happen. Their use of the ORNL campus as a proving ground for sustainability, whether it's implementing the cutting-edge ideas of our researchers or the tried-and-true, is earning ORNL national and international recognition.

Herb Debban, Director of Programs, Facilities and Operations Directorate
Cosponsor, ORNL Sustainable Campus Initiative

I am pleased to cosponsor the Sustainable Campus Initiative along with Director of Programs, Facilities and Operations Directorate Herb Debban. As we move forward, it is critical for the Laboratory's future that we deploy, on campus, the best of our research and development initiatives and our operating skills. Together they will bring the Laboratory to benchmark levels of sustainability. We are pursuing alternative fuels both for the transportation sector and for power generation, energy storage, advanced energy data systems, smart grid, buildings technologies, and a host of other tools that will shape the future of the Laboratory. In addition, we desire to see our technologies and methods widely utilized in society. We will continue our efforts to make these available through our external initiatives, partnerships, and through technology transfer. This past spring, we held an exciting 2 day onsite summit on sustainability with a goal of sharing best practices with and among all participants. We were pleased to have over 100 in attendance, and we look forward to scheduling this event again in 2012. We have been actively embracing a sustainable future for many years, and are now 3 years into our Sustainable Campus Initiative, which has accelerated our efforts. We have made solid progress, have many opportunities we are pursuing, and are excited about the future.

Martin Keller, Associate Laboratory Director, Energy and Environmental Sciences
Cosponsor, ORNL Sustainable Campus Initiative



Greenhouse Gas Management

ORNL has conducted a comprehensive greenhouse gas (GHG) inventory covering all three scopes of GHG emissions: Scope 1, direct emissions; Scope 2, purchased energy; and Scope 3, other indirect emissions. ORNL is aggressively pursuing reduction in all three scopes as part of the Sustainable Campus Initiative.

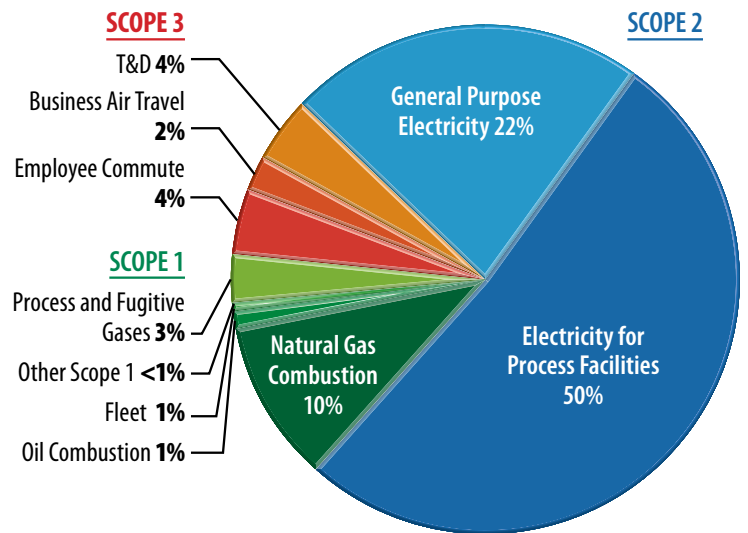
ORNL's primary sustainability challenge, given energy consumption forecasts associated with its High-Energy Mission-Specific Facilities (HEMSFs), is meeting the goal of reducing its Scope 2 GHG emissions by 28%. However, as a result of operational improvements and management vision, ORNL is on target to reduce energy intensity by at least 30% by 2015, notably supporting its GHG emission reduction goal.

Transformational Technologies

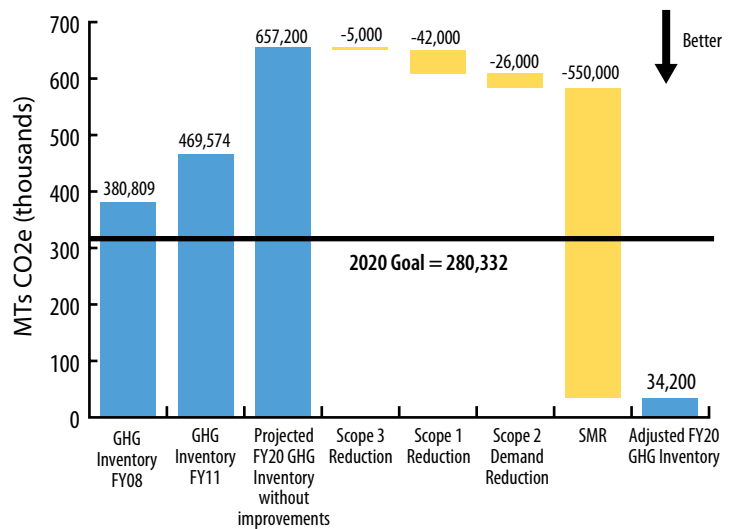
Transformational technology is needed to achieve overall reductions in emissions without limiting economic growth. The emergence of the Small Modular Reactor (SMR) concept provides ORNL with an opportunity to support the development and deployment of a particularly promising innovation. The Tennessee Valley Authority (TVA), which is ORNL's sole source of purchased electricity, is pursuing the development and deployment of an SMR at a site close to ORNL. The introduction of SMR technology will not be without its own challenges, including regulatory hurdles and environmental concerns; however, nuclear power is the cleanest (lowest life-cycle carbon content) power source available at this time with the capacity to meet the large power demands of advanced research institutions and other major facilities.

DOE has launched a research, development, and deployment (RD&D) program to enable the deployment of a fleet of SMRs in the United States. ORNL is supporting this RD&D program and has developed a "business case" for the deployment by TVA of at least one SMR to provide power for DOE's Oak Ridge facilities. The business case includes the following conclusions:

- A 125 MW SMR yields very low (near zero-carbon) life-cycle GHG emissions.
- Aggressive time lines allow construction and commissioning by 2020.
- A single module could supply the majority (~75%) of the electrical power needed by DOE's Oak Ridge facilities in 2020, even with projected growth.
- The SMR project would be constructed by TVA close to ORNL, minimizing transmission and distribution losses. Power for ORNL operations would be purchased by DOE from TVA.
- The SMR is capable of dramatically reducing GHG emissions in our region, and a successful implementation by the year 2020 represents 40% of DOE's entire carbon emissions reduction goal.



Greenhouse Gas Inventory FY 2010



*Greenhouse Gas Reduction Plan
Deployment of SMR technology by TVA, which supplies electricity to ORNL, provides a pathway to achieving ORNL's GHG emission reduction goal.*

High-Performance and Sustainable Buildings

The Laboratory's modernization efforts focus on decreasing facility square footage through more efficient building use and the elimination of obsolete structures. Over the past decade, 2 million square feet of older, energy-intensive building areas has been torn down with another 1.8 million square feet of structures still to be demolished. New facilities are designed to be energy efficient, and ORNL has made the commitment to construct all new buildings to meet Leadership in Energy and Environmental Design (LEED) standards. Already 1 million square feet of office and laboratory space is LEED certified, a first for DOE and Tennessee. New construction and existing building retrofits contribute to the Laboratory's goal of a maximum energy efficiency campus.

Several Presidential Executive Orders and legislative mandates direct Federal agencies to adhere to a set of Guiding Principles for Federal Leadership in High-Performance and Sustainable Buildings (HPSB). With 22 HPSBs planned through new construction and retrofits, ORNL is on track to meet DOE's requirement that 15% of its facilities meet the Guiding Principles by FY 2015.

New Buildings

The following new and planned facilities will achieve LEED Gold and Guiding Principle status:

- Chemical and Materials Science Building (opened July 2011)
- Computational Sciences Building Expansion (opened April 2011)
- Maximum Energy Efficiency Buildings Research Laboratory (MAXLAB) – Scheduled completion 2012

Building 4100, the new Chemical and Materials Science Building, completed in 2011, provides 160,000 gross square feet of state-of-the-art research space. Its laboratories are modular and organized along a central service corridor for maximum flexibility. Exterior solar shading and interior light shelves bounce natural daylight indirectly throughout the building, reducing energy usage. The building's massive air-handling system uses a glycol loop heat and energy recovery system to precondition outside air required for the laboratory environment. The system also features HEPA filtration for nanotechnology laboratories. Overall, the building will use 30% less energy annually than a comparably sized laboratory facility.

Existing Buildings

Lessons learned from extensive research on maximizing the cost-effective energy efficiency of homes, built in partnership with local builders and energy providers, are being applied to the Laboratory's maximum energy efficiency campus project. This project includes four central campus buildings that comprise the Building Technologies Research and Integration Center. Data collected on two of the buildings, which have already undergone a number of energy conservation upgrades, will be used to fine-tune similar plans for the remaining buildings.

Chemical and Materials Science Building

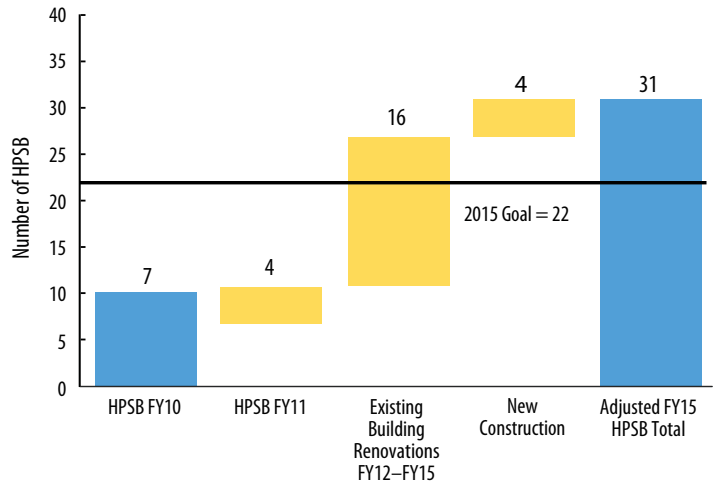


Building 3156 retrofits succeeded in establishing ORNL's first zero-energy building. Before the renovations, the building used approximately 100 megawatt-hours (MWh) of electricity each year. Through equipment upgrades, including a new Metasys digital energy management and control system, high-efficiency heat pumps, and occupancy sensors, energy use dropped to 60 MWh/year. The intention is for the remaining electricity use to be offset by ORNL's grid-integrated, 51.25 kW photovoltaic array.

The capabilities of the Metasys Building Automation System represent a significant share of the energy savings in Building 3156. The system's network of sensors and controls allows modulation of HVAC equipment to maximize efficiency. The system also monitors total electricity consumption of the building and sub-metered electricity use of lighting, packaged heat pump units, and water heaters, as well as hot water consumption and the building's total water usage.

Building 1059 was chosen as a test case for retrofitting existing facilities to LEED standards and was designated as LEED EB (Existing Buildings). Built in the early 1990s, Building 1059 is one of 15 buildings with a common design at ORNL that were designed and commissioned to ENERGY STAR® (EStar) standards. Over time, the energy-efficient systems in these

“generic” facilities were no longer sufficient to maintain the highest standards. In 2010, the Facilities Management Division was successful in obtaining the LEED Gold EB designation for Building 1059. The design and efficiencies of the sustainable renovations for this facility will serve as a template to revitalize the remaining generic buildings. During FY 2011, ORNL successfully implemented energy-efficient upgrades to achieve four additional HPSBs. There are plans to add four HPSBs each year to meet the 2015 goal.



High-performance and sustainable buildings plan (2010 and 2015)

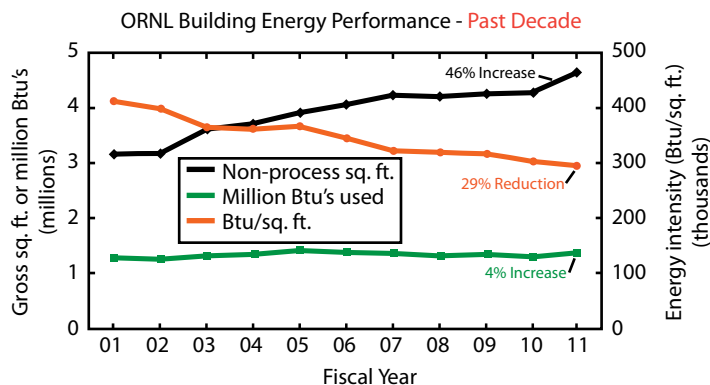
Building 1059



Energy Efficiency

Energy Intensity Reduction (Audits and Commissioning)

ORNL is making steady progress toward a 30% reduction in energy intensity by FY 2015 compared with an FY 2003 baseline. Energy intensity will be reduced through continued construction of new facilities and demolition of legacy facilities combined with ongoing audits and energy conservation measures (ECMs) and new efforts in building commissioning. Since 2008, ORNL through DOE has had an energy savings performance contract (ESPC) with Johnson Controls, Inc. Annual savings from the ESPC will be approximately \$8 million. Several ECMs are in place or are near completion, including steam system decentralization, building management system improvements, mechanical equipment upgrades, and a new Biomass Steam Plant. In recent years, additional ECMs not included in the ESPC have been implemented to further reduce energy usage, including EStar assessments and related actions, improvements in HVAC equipment, lighting improvements, replacing motors with more efficient units, and improving the efficiency of the steam distribution system. The energy audit program is progressing, with audits completed in FY 2009 and 2011 covering more than



ORNL building energy performance: 46% increase in space and 4% energy increase

50% of the ORNL campus square footage. ORNL has achieved a 29% reduction in energy intensity in the past 10 years. Currently, ORNL has realized a 19.6% energy reduction from the goal's 2003 baseline. Based on these measures and continuing dedication to identify real-time energy savings opportunities, ORNL anticipates meeting the 30% energy intensity goal by FY 2015.

Utilities

Grid

To better monitor electricity use and manage demand, advanced meters are being installed at ORNL. Forty-three buildings are currently equipped with advanced meters, though almost every building that consumes electricity has a standard meter. Another five buildings are awaiting advanced meter installation, and once the project is completed, advanced metering will monitor 85% of ORNL's electrical consumption. These meters will be especially important as continued new construction increases energy demand.

Advanced meters allow communication to and from the meter. Currently, two systems are being utilized for the potential of demand-side management and efficiency improvements.

Steam

The ORNL Biomass Steam Plant will be ready for production in 2012. This innovative and collaborative project will use wood chips supplied within a 100 mile radius in a gasification process to replace most of the natural gas and fuel oil currently used by ORNL. The Biomass Steam Plant will reduce the ORNL onsite fossil fuel consumption by over 77%. This project is instrumental in helping ORNL to meet our goal of GHG emission reductions for onsite fuel sources. We anticipate the ability to achieve a greenhouse gas reduction of ~20,000 tons per year. The project also upgrades the steam distribution system, providing much needed repairs and maintenance, and upgrades the efficiency of the existing natural gas boilers, resulting in an overall improvement to the steam system.

Use of biomass fuel will provide a direct economic benefit to the region since the fuel source will be renewable, locally grown and processed, and supplied by a number of local small businesses.

Water

Water consumption is the final major component of planned utility renovations. Sixty-five buildings have received plumbing upgrades such as dual-flush toilets, low-flow showers and urinals, and improved sink aerators. Additionally, system leaks are being repaired and once-through cooling water systems are being corrected. When those activities are completed, ORNL's water consumption will be reduced by over 200 million gallons per year, or about 25%. In addition to just being a good steward of our water, these conservation efforts are critical to offsetting the increase in water consumption from newly constructed facilities and any future facilities.

Biomass Steam Plant

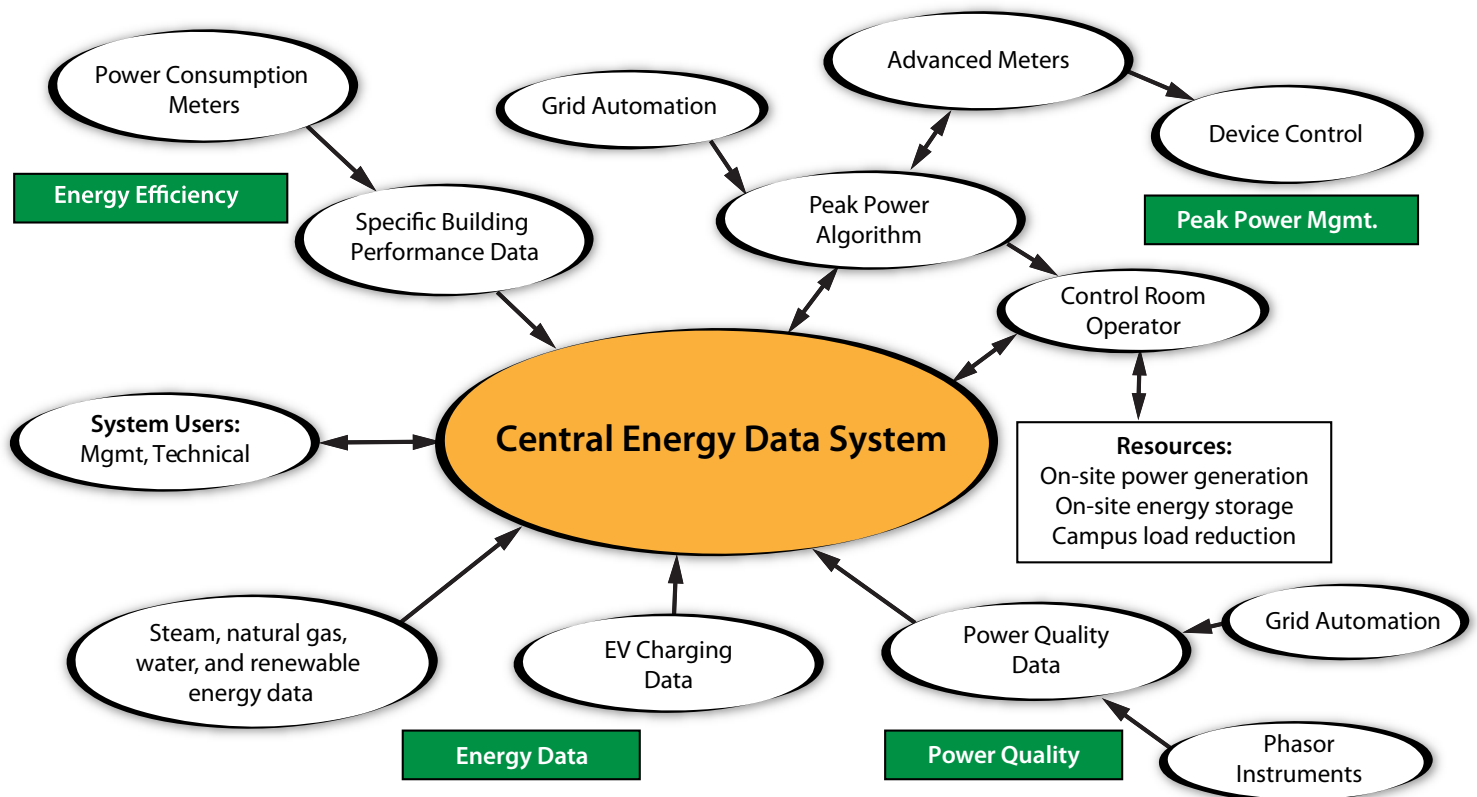


Steam

Wireless Steam Data Collection is being piloted and deployed at ORNL. The steam distribution system at ORNL is composed of three loops containing 12 miles of steam lines and 1,600 steam traps. The Extreme Measurement and Communications Center's Wireless System will allow the steam lines to be monitored wirelessly and provide system data in real time. Sensors will be installed to monitor traps, valves, and steam flows and will help to identify trouble spots and leaks. The system will provide information that will enable energy managers to pinpoint areas of inefficiency. A feasibility study showed that 30% of the steam energy in a system could be saved if faulty valves and traps were quickly identified and repaired. Eventually, application of the wireless system could be expanded to any critical system of interest such as chilled water, electricity, and airflow, all of which could benefit from the wealth of information the wireless system provides. When implemented, the wireless system concept will deliver significant benefits for improved energy management, safety, and operability.

Energy Storage

ORNL is assessing the feasibility of installing a small (5–10 MW) pumped-storage hydroelectric facility to shave demand during peak electricity demand periods. A pumped-hydro system pumps water to a reservoir at a higher elevation during periods of low energy demand and releases it to a lower level through turbines to produce power when demand is high. It is one of several technologies that can store the large amounts of energy necessary for peak shaving, which also include compressed gas storage, flywheels, and batteries. The target is to have an active energy storage facility installed and operational within a few years.



Central Energy Data System

ORNL is actively developing a Central Energy Data System that will collect and manage data on all forms of energy consumption for the campus. It will have the capacity to collect data for water, electricity, natural gas, steam, renewable power, and electric vehicle (EV) charging information and to trend and analyze the information by building and by system. Over time, the system will have the capability to help manage

peak power demand, improve electric grid performance, and, overall, reduce energy consumption. This centralized energy data repository allows role-based users (e.g., facility managers, engineers, and energy managers) access from their computer desktops to monitor and collect just-in-time data for trending as well as managing resources to maximize efficiencies.

Renewable Energy

ORNL consumes 874 MWh of renewable electrical power each year: 107.7 MWh derived from on-site solar collectors and 675 MWh of renewable power from TVA Green Power Switch Program. Additionally, in FY 2011 ORNL purchased 90,000 MWh

in renewable energy certificates in support of renewable technologies, far exceeding the FY 2011 goal. The Laboratory is constantly evaluating new sources of renewable electricity.

Bethel Valley Road 51.25kW Solar Array

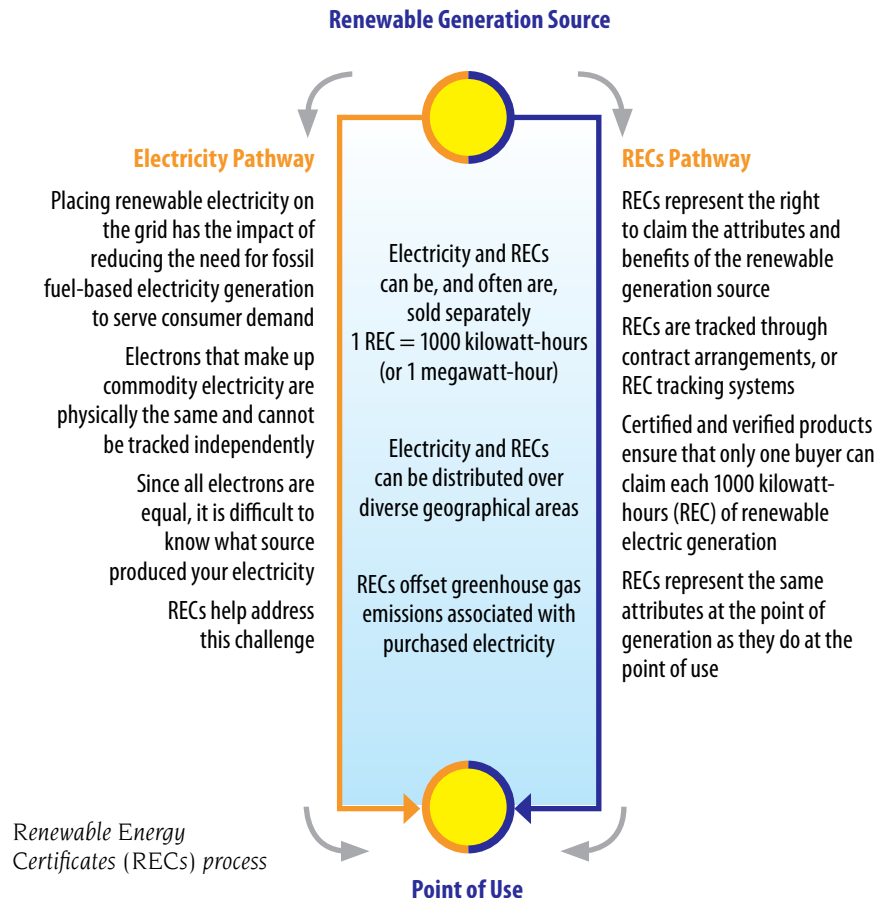


Renewable Energy Certificates*

Renewable Energy Certificates (RECs), as described by the Environmental Protection Agency (EPA), represent the property rights to the environmental, social, and other non-power qualities of renewable electricity generation. A REC may be sold separately from the underlying physical electricity associated with a renewable-based generation source. RECs provide buyers flexibility

- in procuring green power across a diverse geographical area and
- in applying the renewable attributes to the electricity use at a facility of choice.

This flexibility allows organizations to support renewable energy development and protect the environment when green power products are not locally available. The emission reductions associated with the use of renewable energy including the acquisition of electricity, heat, or steam generated from RECs acquired separately from electricity are considered indirect and may be used to reduce a purchaser's Scope 2 emissions associated with conventional energy purchase and consumption. During FY 2011, ORNL purchased 90,000 mWh of Green-e Vintage RECs.



*Source: Environmental Protection Agency web site, Green Power Partnership, Renewable Energy Certificates, <http://www.epa.gov/greenpower/gpmarket/rec.htm>.

Transportation

Sustainability in employee transportation is significantly affected by growth, and since 2005, the Laboratory has grown by nearly 1,000 employees. This poses unique challenges to the sustainability efforts of the campus. A transportation survey in the fall of 2009 resulted in a 30% response rate and identified the current habits of ORNL commuters. This survey provided a baseline from which to develop an approach to improve employee commute choices and behaviors.

ORNL will provide more options for employees such as nontraditional work schedules, and alternative modes of transportation. Based on the extensive findings in the report, numerous recommendations and potential programs have been identified and are under consideration.

- A fully developed telecommuting program
- High-occupancy modes of transportation
- Electric vehicles
- Preferential parking for carpoolers
- Training in transit modes
- Conferencing strategies
- Participation in regional transportation planning
- Onsite services
- Financial commuting benefits
- Guaranteed ride-home services
- Intensive communication and marketing programs

Electric Vehicle Charging

With support from DOE, ORNL is working with ECOTality, Nissan North America, TVA, the state of Tennessee, the Electric Power Research Institute, local governments, and power distributors to set up solar-assisted EV charging stations across Tennessee. At ORNL, these stations consist of a 25-space parking area covered by a solar panel canopy, connected to the grid, to help offset the charging demand of the EVs. Battery storage is included to accommodate peaks in energy demand due to vehicle charging. Non-solar stations are also planned

for late in 2012. This project, in addition to furthering employee options for sustainability, demonstrates the use and integration of renewable power, external battery storage, EVs, and the power grid to maximize energy efficiency. Open since May 2011, 18 EV owners are now utilizing this onsite charging station.

Fleet

ORNL has been working steadily over the past several years to transition its vehicle fleet from conventional, fossil-fueled transport to vehicles running on sustainable, alternative fuels. These include electric, hybrid, diesel, and flex-fuel vehicles.

ORNL has 38 low-speed EVs. These vehicles are dedicated to campus acreage, cannot be driven on public roads, and are not included in the ORNL overall fleet count. They have a top speed of 25 miles per hour and an average fuel cost of about 1.5 cents per mile. The Laboratory also has 36 hybrid cars, which consist of 34 Ford Fusions and 2 Chevy Malibus. These vehicles achieve an impressive 41 miles per gallon. These environmentally friendly automobiles replaced less efficient vehicles in the fleet. Additionally, there are plans for acquiring EVs at ORNL for research purposes.

To support its growing alternative fuel fleet, ORNL's 8,000 gallon E85 fuel tank offers an easy way to refuel on campus. E85 is an 85% ethanol, 15% gasoline biofuel made from plant-based materials such as corn, grains, and wood chips, and it is a renewable resource. Additionally, E85-powered vehicles, when compared with gasoline-powered vehicles, have overall reduced tailpipe emissions (carbon monoxide, ozone-forming compounds, nitrogen oxides, sulfates, and particulates). Currently, ORNL has 251 flex-fuel vehicles in its fleet (57%).

The Laboratory's diesel vehicles run on biodiesel fuel when possible. This biodiesel is based on soybeans (a renewable resource), but the use of waste cooking oil is also being

ORNL solar-assisted charging station





Susan Redmon of AAA Travel of East Tennessee presents ORNL's Daniel Pelfrey with the Smart Trips 2011 Commuter Challenge grand prize of \$1,500 towards the price of an airline trip, cruise, or package tour. Pelfrey commutes with four other ORNL employees to his job at ORNL. "I save as much as \$600 a year by carpooling," said Pelfrey.



Ted Biewer of the Nuclear Science and Engineering Directorate was the grand prize winner of Smart Trips' Clean Commute Day in June 2011. Biewer, who rides his bike to work from his home in Oak Ridge whenever he can, was awarded an Amazon Kindle by Smart Trips coordinator Alisa Ashouri.

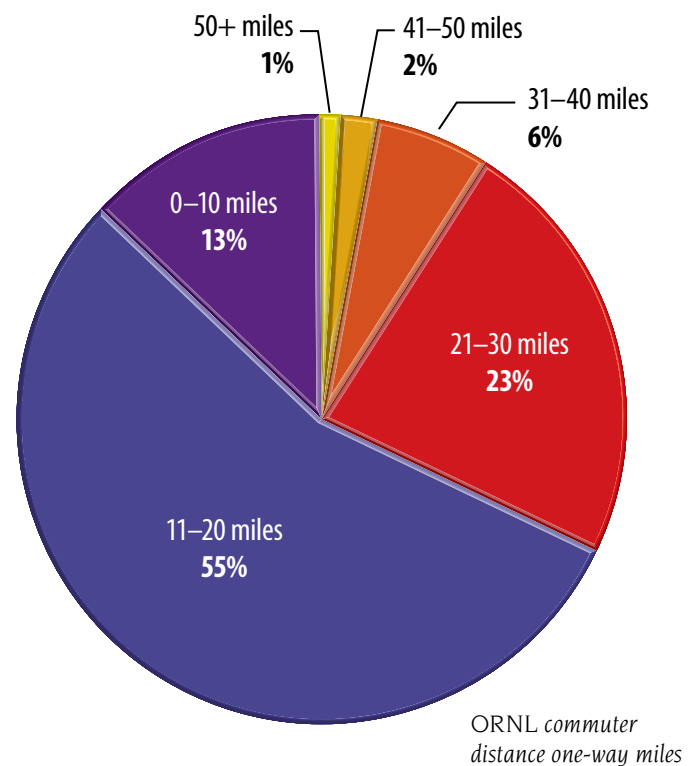
explored. Biodiesel-powered vehicles, when compared to traditional diesel-powered vehicles, have overall reduced tailpipe emissions. The existing 6,000 gallon diesel fuel tank and 600 gallon tank truck were cleaned prior to receiving the first delivery of biodiesel. The type of biodiesel gradually transitioned from the lowest percentage, B5 (5% biodiesel), to an optimal grade, B20 (20% biodiesel). ORNL has 98 diesel vehicles and 79 vehicles utilizing biodiesel. Emergency vehicles, some diesel maintenance vehicles, and emergency generators still run on conventional diesel.

Commuting

Smart Trips is part of the Knoxville Regional Transportation Planning Organization and promotes green commuting through its web site (www.knoxsmartrips.org). It offers ride matching, emergency rides home, prizes, and other benefits to anyone interested in choosing alternative forms of commuting. Each year, from May 1 through July 31, Smart Trips promotes its "Commuter Challenge" as a way to boost participation in green commuting among the region's employers.

The green commuting of ORNL employees highlighted this year's Smart Trips Commuter Challenge awards, which were presented at a special recognition event on September 13, 2011. ORNL earned the 2011 Commuter Challenge Outstanding Achievement award and Green Spirit award by showing the highest percentage gain, approximately 14%, in Smart Trips participation. In addition, Daniel Pelfrey of the Computing and Computational Sciences Directorate earned the overall grand prize – a \$1500 travel certificate from AAA Travel of East Tennessee – while Ceris Hamilton of the Neutron Sciences Directorate and Chris Layton of the Computing and Computational Sciences Directorate each won Amazon Kindles. Pelfrey, Hamilton, and Layton earned their awards through

random selection of employees logging green commute hours into the Smart Trips web site database. All three are avid carpoolers to and from their jobs at the ORNL main campus.



Waste

The Pollution Prevention Program at ORNL strives to conserve resources and reduce the cost of R&D activities by developing and implementing techniques, technologies, and programs that minimize waste and pollution. During FY 2009 and FY 2010, new pollution prevention initiatives eliminated approximately 562,000,000 pounds (255,000 metric tons) of waste, with an associated cost avoidance of more than \$8 million.

Each year ORNL's Property Disposition Program prevents millions of dollars of usable equipment, furniture, and supplies from ending up in a landfill. Through its Reutilization Program, unwanted furniture and equipment can be given a new home at another ORNL office or DOE facility. Since FY 2010, ORNL has generated a return on taxpayer investment of over \$800,000 through the sale of government property no longer needed by ORNL or DOE. Donations are also made to the Computers-for-Learning Program, which provides excess computers and related equipment to primary and secondary schools throughout the state. In addition, ORNL supports the Energy-Related Laboratory Equipment Grant Program established by DOE to donate available used equipment to institutions of higher education for energy-related research.

Having set a goal of sending no routine waste to a landfill by 2018, the program also conducted "dumpster dives" during FY 2010 to identify the kinds of waste employees were disposing of and determine what could be done to reduce and recycle such waste. In response to what was found, it was decided that more central locations for plastic collection were needed across the Laboratory. Custodians also began collecting recyclables from labeled bins placed in employee offices, rather than relying solely on employees to take waste

to a central location. To make recycling easier for those moving to other offices or leaving the Laboratory, extra collection containers were sent to their offices prior to their scheduled moves. ORNL also partnered with the Michael Dunn Center to sort plastic and aluminum for recycling. The Michael Dunn Center has operated since 1980 as a private nonprofit agency that empowers individuals living with disabilities to provide quality staffing, services, and production support to businesses, government, and the community.

Construction and Demolition

Contracts for new construction always address the recycling of excess building material, but before 2011 waste generated from the remodeling of existing structures went to a landfill. A contract was subsequently put in place to recycle a large portion of waste materials resulting from remodeling. In FY 2011, 62% of the construction and demolition waste was diverted from the landfill.

In 2010 the Facilities Development Division set as a goal to recycle milled asphalt from ORNL construction projects. Destined for disposal in a landfill, the milled asphalt was instead used for maintenance of non-paved surfaces at the Laboratory in lieu of purchasing newly quarried gravel for that purpose.

Municipal Waste

ORNL is always searching for new ways to reduce the amount of industrial waste it generates. Efforts at the Laboratory to reduce this waste, categorized as municipal, construction, and demolition waste by DOE, are described as follows.



Dumpster diving

- The National Transportation Research Center found a way to recycle Swagelok tubing fittings. By ultrasonically cleaning, testing, and reusing these expensive, high-quality fittings, the staff was able to (1) eliminate the procurement of approximately \$54,000 in new fittings, (2) avoid disposal of the fittings to an on-site landfill, and (3) achieve a future cost avoidance of approximately \$12,000 per year through continued implementation.
- In 2010 ORNL was unable to recycle personal protective equipment (PPE) through its established vendor. Upon further examination of the process, it was determined that PPE garments used in clean rooms and for training purposes that had previously been sent for disposal could instead be recycled and sold to the public. This effort resulted in reuse of 328 pounds of PPE garments and a cost avoidance of approximately \$128.
- Through ORNL's Computers-for-Learning (CFL) program, working computers and other electronic equipment no longer needed by the Laboratory are donated to primary and secondary schools. Non-working equipment is sent to a qualified recycler. Through recycling and donations, ORNL reduces the amount of used electronics sent to landfills.
- ORNL reexamined the effectiveness of its office recycling program by conducting "dumpster dives" to identify recyclable wastes that were not being properly disposed of. Specialty recycling containers were subsequently purchased to help maximize the amount of office waste generated by the staff that can be recycled.

Systems

Information Technology

A pilot study to incorporate sustainability into the desktop computer network was conducted in Buildings 3147 and 3156 in the fall of 2009. The study used a software application called Verdiem Surveyor to manage a computer's power use through the Laboratory's central information technology (IT) system. The software powers down idle computers and attached monitors into sleep and standby modes to save energy. The Verdiem Surveyor pilot program was such a success that the software was deployed to the rest of ORNL in 2010, and in 2011, it grew to include over 8,000 desktop computers that are actively power managed.

In addition, smart power strips are used campus wide and perform the same power-saving function for printers and peripheral devices when the computer goes into sleep mode. The power strip senses when the computer is sleeping and turns off all devices plugged into the strip.

IT sustainability efforts also include piloting the use of a more centralized, networked printing infrastructure and an increased emphasis on document scans instead of hard copies to reduce paper, toner, and power consumption. Another Green IT program goal is to ensure that energy-efficient computers and related hardware are readily available for requisition from ORNL's Managed Hardware Program (MHP). The MHP provides an easy way to purchase Electric Product Environmental Assessment Tool (EPEAT) and Energy Star-rated computer hardware that is delivered with preloaded software configured to meet most ORNL users' needs. A significant challenge to managing IT resources at ORNL involves the extensive scientific and technical needs of campus users. The IT landscape of ORNL is far from simplistic yet has been conducive to significant and measurable energy savings.

The entire pilot program and initiative are intended to serve as a model for DOE, other federal organizations, and private agencies by demonstrating the ability to model energy-saving opportunities in areas of operations common to most

organizations, energy savings through standardized processes and procedures, and the ability to monitor power consumption of IT equipment in real time. The Verdiem implementation at ORNL is estimated to save \$288,000/yr.

Procurement

The Contracts Division is working to improve processes and tools that advance sustainable acquisition objectives while elevating awareness of environmentally preferable purchasing throughout ORNL.

Four key sustainable acquisition initiatives have been identified.

- Promote and increase availability of environmentally preferable products
- Minimize deliveries by suppliers to ORNL
- Maximize the use of electronic documentation and minimize printed paper transactions
- Use the Accelerated Vendor Inventory and Delivery (AVID) ordering system, the preferred purchasing method at ORNL

Through advances in ordering technology, the Laboratory is making substantial progress in its efforts to better guide the purchasing habits of the entire staff toward greener, more sustainable products. Improvements made to the current purchasing system will not only provide a wider and greener selection of products but will also help consolidate and reduce the number of deliveries made to ORNL, increase the use of paperless transactions, and provide more complete information regarding required products during the specification and selection stage.

Within the Contracts Division, processes and procedures have been modified to promote the use of electronic procurement files. Hard-copy paper procurements are now limited to those that exceed \$25,000. During FY 2010 over 28,000 transactions were executed, 80% of which were less than \$25,000.

Employees

Wellness

Recognizing that employee well-being is a key component of any sustainability effort, ORNL makes safety and health a top priority. This commitment is evidenced by a well-developed Employee Wellness Program with the goal of creating a culture of wellness at ORNL that will achieve the following.

- Keep healthy people healthy
- Improve the health of those who are unhealthy
- Offer options that encourage all employees to engage in wellness
- Provide an environment that supports employee engagement in wellness
- Flatten the healthcare cost trend for ORNL and its employees

To help create a culture of wellness, ORNL employees are encouraged to participate in the annual Reward Points Program, which offers a reduction in the cost of medical benefits, and in the online Mayo Clinic health assessment. Participants are provided a detailed action plan to help them to reach their healthiest potential. Targeted programs are then offered to those individuals who indicate a readiness to change to healthier behaviors.

A supportive environment in which the healthy choice is the easiest choice is the key to changing behaviors and creating a culture of wellness. Monthly educational seminars with associated screenings are offered to encourage employees to make better lifestyle decisions and promote early detection of diseases. Various assessments, such as one to determine the level of fitness, are offered, along with personalized follow-up programs for change and success. Individualized consultations with a registered dietitian and an exercise physiologist located onsite along with weight management classes and challenges are also popular offerings. The Employee Wellness Program has become a staple for Laboratory staff that continues to address employee-identified needs and help them make the best decisions regarding their health.

Bike It Green



Engagement

Bike It Green. An employee-focused initiative, Bike It Green, distributed 105 bicycles across campus in an effort to combine employee fitness with sustainable travel. The program started in October 2008 and was an immediate success. Staff and visitors alike can ride a three-speed “share bike” anywhere on campus, except on Bethel Valley Road. Riding one of these communal bicycles has a few basic requirements. Participants must complete online training, wear a helmet while riding the bikes, and stay off the sidewalks. So far, more than 1,700 ORNL employees have completed the training.

ORNL Community Sustainability Award. In an effort to encourage sustainability across ORNL, an annual awards program was created to recognize employees who demonstrate a strong commitment to sustainable practices at ORNL, their home, and in their community. Steve Lewis of ORNL’s Environmental Protection and Waste Services Division was cited for his significant contributions to community sustainability. Steve was honored at ORNL’s 2010 Earth Day Celebration—along with Melinda Watson of TVA and Sarah Brobst and Peg Beute of Ijams Nature Center—for their continued promotion of community sustainability through River Rescue. Twenty years ago, Steve and a neighbor founded River Rescue to clean up Melton Hill Lake. It has grown into an annual cleanup of multiple waterways in the Tennessee River system, with over 1,000 volunteers who participated last spring!

The 2011 award went to Mike Ryon, an aquatic ecologist in the Environmental Sciences Division. Through Mike’s initiative in working with his neighbors, his homeowners’ association, the Boy Scouts, and in securing a small watershed grant from TVA, the stream that runs through his neighborhood has been returned to a more natural state.

Volunteers created a 25- to 100-foot-wide buffer zone of plants, shrubs, and small trees that shade the stream water, filter contaminants and silt, prevent erosion, and provide habitat for birds and mammals. Mike continues to collaborate with neighbors to improve their local stream habitat, assists in other community projects, and provides information on native plantings to schools and parks.

Mike Ryon, 2011 ORNL Community Sustainability awardee



Steve Lewis (far left), 2010 ORNL Community Sustainability awardee



External Engagement

Summit

ORNL is actively engaged in making our technologies and methods available for use outside the Laboratory. For example, in the spring of 2011, an exciting 2 day summit on sustainability was held at ORNL, with a goal of sharing best practices among all its participants. Over 100 people were in attendance, and plans for 2012's event are already being made. In addition, ORNL regularly shares the content and methodology of its

Sustainable Campus Initiative through conferences; by hosting visitors on campus; and by participating in national, regional, and community events. As a result of this inaugural summit, ORNL is working with a regional leadership team to explore how sustainability can best be promoted all across the Southeast. ORNL is actively engaged in specific partnerships for advancing sustainability, welcomes the opportunities these bring, and is interested in developing additional ones.



Plug-in vehicles highlighted at ORNL's sustainability summit

Landscaping

Ecological landscaping uses sustainable practices to improve habitat, protect water quality, and enhance native wildlife. ORNL's landscaping plan specifies that species native to the Oak Ridge Reservation are the preferred choice for new plantings. The plan advocates using practical ecological approaches to protect and enhance the Laboratory's environment. Sustainable approaches implemented at ORNL also serve as models for implementation across the DOE Oak Ridge National Environmental Research Park, which encircles the campus with 20,000 acres of undeveloped land.

An ecological, watershed approach to landscaping has resulted in significant benefits. ORNL research has led to improved landscape-management techniques that have been successfully implemented such as rain gardens to handle storm-water runoff, wetland plantings in detention basins, vegetation buffers to enhance riparian areas, aquatic plantings to improve the East Campus pond, and newly established native grass communities that highlight the local setting.

Detention or retention basins have typically been seeded in fescue, resulting in a sterile environment that is difficult to mow, especially when wet. A change in approach by planting the basin with native plants adapted to wet conditions requires less maintenance, provides habitat and food for native wildlife, and filters sediment and contaminant runoff more efficiently. Rain gardens improve water quality, help to recharge local groundwater supplies, provide nesting sites and habitat for songbirds and other wildlife, and bring beauty and visual interest to the landscape.

Using local plant species in an appropriate community design instead of typical ornamentals highlights the Laboratory's uniqueness, strengthens its relationship with its natural surroundings, and demonstrates its dedication to conserving and showcasing the environment.

Rain gardens along First Creek and adjacent to the new parking structure reduce stream bank erosion and flooding by slowing storm-water runoff.



In Closing

The goal for innovation at ORNL is to help maintain U.S. global leadership in science, engineering, and energy management. ORNL will continue to research, develop, demonstrate, and deploy innovative solutions and initiatives to advance sustainability. Our diverse operational and research

staff members are dedicated to achieving these goals and are supporting a large number of innovative projects and initiatives. We are well positioned to demonstrate leadership in science, engineering, and energy management and to further advance sustainability in federal operations and scientific research.

Awards

Awards from the DOE Office of Science, EPA, and the President's "Closing the Circle Award" for Leadership in Environmental Stewardship are listed as follows.

- 2007 WasteWise Gold Achievement
- 2010 Federal Energy and Water Management Award
- 2010 DOE Management Award
- 2011 EStar Award for Building 1059
- 2011 Tennessee Chamber of Commerce and Industry Award for Comprehensive Environmental Excellence
- DOE FEMP Award
 - GreenIT
- Two DOE EStar Awards
 - Energy and Fleet Management
 - LEED Existing Buildings
- 2011 Tennessee Chamber of Commerce and Industry Award for Comprehensive Environmental Excellence
- East Tennessee USGBC—Green Light Award for Exemplary Contributions to Sustainability in the Built Environment

Global Reporting Initiative

The Global Reporting Initiative (GRI) publishes a comprehensive set of Sustainability Reporting Guidelines. With the movement to incorporate sustainable practices growing rapidly worldwide, these guidelines provide a framework in which organizations can share their sustainability progress. Considering the variety of institutes beginning to adopt an earth-friendly focus, consistency is critical in enabling groups to understand and follow one another's progress. It is the purpose of GRI's Sustainability Reporting Guidelines to supply this consistency. This report of ORNL sustainability highlights does not comprehensively address all the elements of the GRI; however, we encourage you to visit the ORNL public website at www.ornl.gov and link to our GRI Index.

Efforts Earned National Recognition





“With a serious commitment to energy efficiency, widespread deployment of technologies we have, and an aggressive investment in science, we can dramatically reduce our carbon emissions and reinvigorate our economy at the same time. This is not only our opportunity; it is our responsibility to future generations.”

Dr. Steven Chu, Secretary of Energy
 Sustainability Performance Office
 DOE Energy Efficiency & Renewable Energy
www1.eere.energy.gov/sustainability/about.html

Next Steps

Sustainability is an ongoing, evolving process committed to maximizing energy use across ORNL. ORNL will continue to set new goals and integrate sustainable practices within the Laboratory to promote research and operational successes and achieve energy and resource efficiency. ORNL’s efforts to ingrain a culture of sustainable practices at the Laboratory serve as an example to others in the community, the state, and beyond. Additional information on ORNL’s Sustainable Campus Initiative may be found at www.sustainability-ornl.org.

Contacts

Melissa Lapsa 865-576-8620 lapsamv@ornl.gov	Teresa Nichols 865-576-0541 nicholsta@ornl.gov	Randy Overbey 865-805-7870 overbeyrm@ornl.gov
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ORNL Sustainability Website
www.sustainability-ornl.org



OUTDOORS

Nature preservation and natural landscaping have been a major component of ORNL's development plan. The landscaping plan is designed to provide a natural setting for the new campus and to provide a natural setting for the existing ORNL campus. The plan is designed to provide a natural setting for the new campus and to provide a natural setting for the existing ORNL campus. The plan is designed to provide a natural setting for the new campus and to provide a natural setting for the existing ORNL campus.

Combined landscape design provides better collaboration, better sound, better quality requirements, and better overall results. The plan is designed to provide a natural setting for the new campus and to provide a natural setting for the existing ORNL campus. The plan is designed to provide a natural setting for the new campus and to provide a natural setting for the existing ORNL campus.

The number of trees planted in the new campus will be at least 100,000. The plan is designed to provide a natural setting for the new campus and to provide a natural setting for the existing ORNL campus. The plan is designed to provide a natural setting for the new campus and to provide a natural setting for the existing ORNL campus.

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Oak Ridge National Laboratory

A SUSTAINABLE CAMPUS

SUSTAINABLE CAMPUS INITIATIVE

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