

Pacific Northwest National Laboratory

# 2011 Sustainability Report

*Innovative Solutions for a Sustainable World*



**Pacific Northwest**  
NATIONAL LABORATORY

*Proudly Operated by **Battelle** Since 1965*

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***This report follows the Global Reporting Initiative (GRI) sustainability reporting framework, which enables organizations of all types to assess their triple bottom line performance and disclose the results in a similar way.***

## MESSAGE FROM THE DIRECTOR

Considered a founder of sustainability, George Washington Carver pioneered crop rotation for soil enrichment and found dual uses for natural resources, such as making paint from soybeans. These ideas are hailed as early evidence of synergies that can be realized from balancing environmental, social, and economic needs. Committed to this legacy of sustainability, Pacific Northwest National Laboratory (PNNL) strives to make an impact through our science and technology by balancing the environment, people, and prosperity.

PNNL's efforts demonstrate that we take environmental stewardship seriously with ecologically safe, environmentally sound, and innovative science and solutions that lead the way for operations in other organizations. In 2011, we excelled in reducing building-water intensity, using renewable energy, diverting waste, and improving fleet fuel use. Our two greatest sustainability challenges are energy use in our buildings and water use for landscape irrigation. As you'll read in the following pages and on our website, we remain committed to our aggressive goals in this area.

PNNL is deeply committed to social responsibility through enabling and inspiring the achievement of excellence, and it shows. The Laboratory and its employees exercise sustainability practices both at the Lab and within our community. We strive to be good citizens and the employer of choice by investing in professional development, creating a sense of community, and providing staff with opportunities to make a difference. We endeavor to be trusted and valued in our community and the nation, as we are obliged to be leaders in both sustainability and science.

Through these difficult financial times, PNNL has found ways to maintain financial viability and achieve economic prosperity through research and operational excellence, while continuing to create value for our community and the nation. We've maintained our high economic contribution to the nation by delivering technology that is making a real difference in people's lives.

We are a scientific institution that has set and achieved aggressive sustainability goals, as you'll see in our Performance Scorecard. And we will not rest with the milestones in sustainability that you are about to read in this, our third annual Sustainability Report. This report showcases the progress we're making in many areas – including the areas where we seek to continuously improve. We are determined to continue delivering innovative scientific solutions for a sustainable future.

Michael Kluse  
Laboratory Director

## PNNL OVERVIEW

Located in Richland, Washington, PNNL is one of ten U.S. Department of Energy (DOE) national laboratories managed by DOE's Office of Science. Our research strengthens the U.S. foundation for innovation, and, in addition to our work for DOE, we help find solutions for the U.S. Department of Homeland Security, the National Nuclear Security Administration, other government agencies, universities, and industry.

Interdisciplinary teams at PNNL address many of America's most pressing issues in energy, the environment, and national security through advances in basic and applied science. At the end of fiscal year 2011, PNNL employed approximately 4,300, had a budget of nearly \$1.1 billion, and has been managed for DOE by Ohio-based Battelle since the Laboratory's inception in 1965. For more, visit PNNL's News Center, or follow PNNL on Facebook, LinkedIn, and Twitter.



Much like a honeycomb with its interlocking pieces that gain strength through mutual support and integration—our three pillars and twelve priorities create a sustainability program that is greater than the sum of its parts. This is our triple bottom line.

At PNNL, our **mission** is to transform the world through courageous discovery and innovation. Our *Vision* is for our science and technology to inspire and enable the world to live prosperously, safely, and securely. Our **values** of integrity, creativity, collaboration, impact, and courage provide the foundation for all we do.

## OUR SUSTAINABILITY VISION

PNNL will be recognized as a **THOUGHT LEADER** in sustainability by our customers, our employees, and the community.

Our solutions, which **BALANCE** environmental, social, and economic forces, will be sought out and used to make the world a more sustainable place.

Every employee is **EMPOWERED** to improve our sustainability performance and enables us to achieve our ambitious sustainability goals.

# SUSTAINABILITY PERFORMANCE SCORECARD

		2010	2011	
ENVIRONMENT	 <b>Reducing building energy use and greenhouse gas (GHG) emissions</b>			
	<ul style="list-style-type: none"> <li>Reduce GHG emissions from building energy use 28% from 2008-2020 (Target: 31,794 MTCO<sub>2</sub>e)</li> </ul>	50,069	51,567	
	<ul style="list-style-type: none"> <li>Reduce energy use intensity in buildings 30% from 2003-2015 (Target: 143 kBtu/ft<sup>2</sup>)</li> </ul>	174	173	
	<ul style="list-style-type: none"> <li>At least 7.5% of electricity use from renewable sources by 2013 and thereafter</li> </ul>	60%	58%	
	 <b>Traveling smarter</b>			
	<ul style="list-style-type: none"> <li>Reduce petroleum-based fuel use in fleet vehicles 20% from 2005-2015 (Target: 31,060 GGE)</li> <li>Reduce GHG emissions from employee transportation 13% from 2008-2020 (Target: 20,382 MTCO<sub>2</sub>e)</li> </ul>	50,546 29,725	41,146 28,157	 
ENVIRONMENT	 <b>Minimizing water use</b>			
	<ul style="list-style-type: none"> <li>Reduce water use intensity in buildings 16% from 2007-2015 (Target: 51 gallons/ft<sup>2</sup>)</li> </ul>	31	21	
	<ul style="list-style-type: none"> <li>Reduce irrigation water use 20% from 2010-2020 (Target: 331.9M gallons)</li> </ul>	414.8M	450.0M	
ENVIRONMENT	 <b>Reducing material purchases and waste</b>			
	<ul style="list-style-type: none"> <li>Divert at least 50% of sanitary waste from landfill</li> </ul>	47%	53%	
SOCIAL	 <b>Keeping employees healthy and safe</b>			
	<ul style="list-style-type: none"> <li>Total recordable case rate ≤ .65<sup>1</sup></li> </ul>	0.77	0.49	
	<ul style="list-style-type: none"> <li>Days away, restricted, or transferred rate ≤ .25<sup>1</sup></li> </ul>	0.24	0.21	
	 <b>Investing in our employees' professional development</b>			
	<ul style="list-style-type: none"> <li>Average participant satisfaction rating from professional development programs ≥ 4.5/5</li> </ul>	-	4.6	
	 <b>Creating an inclusive work environment</b>			
<ul style="list-style-type: none"> <li>Goal to be established by the end of 2012</li> </ul>				
SOCIAL	 <b>Fostering the next generation of scientists and engineers</b>			
	<ul style="list-style-type: none"> <li>Average participant rating of work-based learning programs ≥ 4.0/5</li> </ul>	4.5	4.7	
ECONOMIC	 <b>Transferring technology that makes a difference</b>			
	<ul style="list-style-type: none"> <li>Economic contribution to global economy from licensed technologies (Target: 5-yr moving average &gt;\$90M)</li> </ul>	\$107.3M	\$105.5M	
	 <b>Maintaining financial viability through research and operational excellence</b>			
	<ul style="list-style-type: none"> <li>Sales (Target: \$913.1M)</li> <li>Business volume (operating costs) (Target: \$1,074.8M)</li> </ul>	\$1,162M \$1,112.4M	\$973M \$1,106M	 
	 <b>Supporting small businesses</b>			
<ul style="list-style-type: none"> <li>Award at least 50.2% procurement dollars to small businesses</li> </ul>	52.3%	54.0%		
ECONOMIC	 <b>Giving back to our communities</b>			
<ul style="list-style-type: none"> <li>Philanthropic investments (No target)<sup>2</sup></li> </ul>	\$1,092,500	\$1,059,164	N/A	

1. Reported per 200,000 employee hours worked.

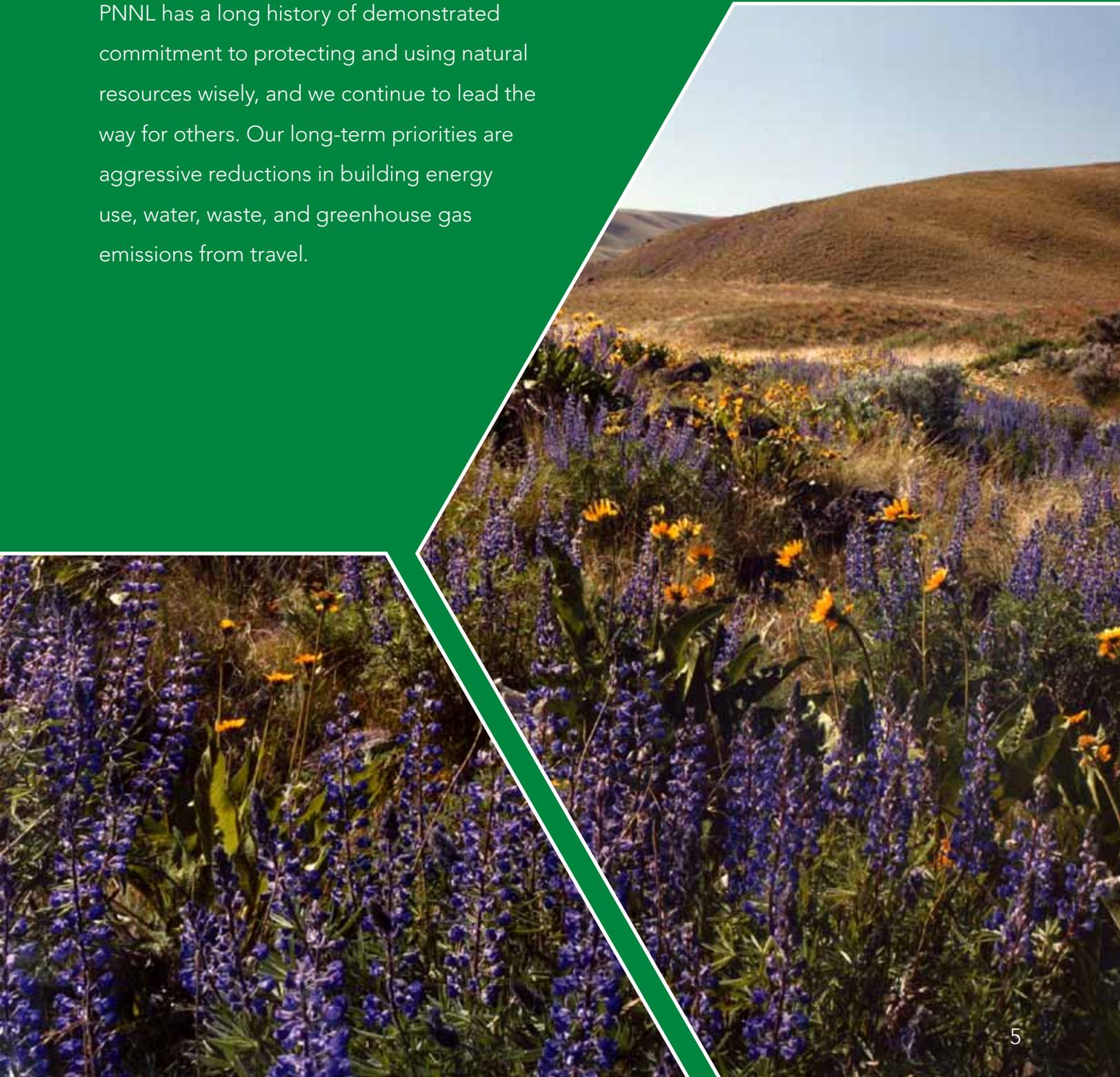
2. Philanthropic investments in the community are distributed by a committee made up of employees from Battelle's Pacific Northwest Division. These investments are determined throughout the year based on many factors including alignment with strategic goals, project impact and real-time needs within the local community.



# Environmental Stewardship



PNNL has a long history of demonstrated commitment to protecting and using natural resources wisely, and we continue to lead the way for others. Our long-term priorities are aggressive reductions in building energy use, water, waste, and greenhouse gas emissions from travel.



# ENVIRONMENTAL

## WE WALK THE TALK

Operations and research staff seek ways to improve building and campus efficiencies. One such collaboration involved studying the effectiveness of several brands of new 48" LED bulbs versus traditional fluorescent tubes at the Environmental Molecular Sciences Laboratory (EMSL), our user facility. They were tested for brightness, color, and overall appearance. In the area tested, PNNL decreased the energy use per fixture by more than **50%** without negatively impacting the social benefits derived from the appearance and functionality of the space.



## BUSINESS TRAVEL

Greenhouse gas emissions

down

**5%**



## ZERO WASTE EVENTS

All major employee events in 2011 were Zero Waste. Nearly **1,000 pounds**

of waste was avoided through diligent planning, recycling, and donating food scrap to staff or local farmers for hog/ chicken feed.



## WASTE DIVERSION

**53%**

of sanitary waste produced is recycled



## FLEET VEHICLES

### Petroleum-based fuel use



down **19%**

Alternative fuel use is up

**10%**



## POLLUTION PREVENTION PAYS

Process and product improvement opportunities identified by staff through the P2 Pays Program help PNNL achieve our pollution prevention goals. Over \$40,000 of staff-generated ideas were funded in 2011. For example, a proposal to purchase an environmental filtering and re-circulating system resulted in an annual reduction of over 37,000 liters of hazardous waste from a grinding and polishing process.

All percent changes on pages 6-7 are relative to 2010 unless otherwise noted.

# STEWARDSHIP

## GETTING TO THE CORE OF SUSTAINABILITY

PNNL received a prestigious EStar Award from DOE in 2011 for efforts to help PNNL “walk the talk” when it comes to solving environmental challenges. Through the Environmental Management System Core Team, Lab operations experts and researchers seek out opportunities to integrate our research knowledge into the Lab’s operations. In a symbiotic relationship, operations staff members draw on researchers’ knowledge, and in turn, researchers can pilot their technologies in a scalable operating environment.



## OPPORTUNITIES FOR IMPROVEMENT

### Electricity Use

Building electricity consumption is up 2% despite a number of efficiency measures, including better temperature control in some buildings and ongoing re-commissioning. We added new laboratory space and data-intensive computing resources, and this growth outpaced our efficiency measures. To address this, we’re investing in a number of new efforts to continue to reduce electricity use, such as establishing core operating hours in laboratory space and further consolidation of data centers.

We reduce the impact of our electricity use by greening our power supply.

# 58%

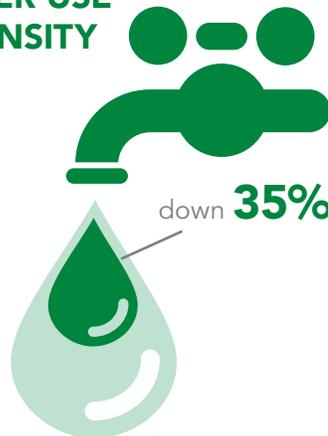
of the power we consumed came from renewable sources

# 16%

reduction in building energy use intensity from 2003 baseline



## BUILDING WATER USE INTENSITY



## BUILDING OPERATIONS CONTROL CENTER

PNNL’s recently installed Building Operations Control Center (BOCC) acts as a hub for monitoring, identifying, and analyzing data across our 2 million square foot campus, resulting in increased operational efficiency along with energy and water savings. See page 8 for a description of PNNL’s award-winning “DSOM” monitoring software—it is used in our own BOCC and deployed to other organizations.



## Irrigation Water



Water use for irrigation and industrial processes increased 8%, in part from increased irrigation for the new 200,000 ft<sup>2</sup> Physical Sciences five-building complex. Yet, we saved **4,251,712 gallons** of water in a year by xeriscaping one major facility. We plan to incorporate more water-conserving landscapes in the years to come.

# Science for Planet

## From building efficiency to photovoltaic power: putting our science to work

- » PNNL's Decision Support for Operations and Maintenance™ (DSOM) software, an R&D 100 Award winner, is a large part of why the buildings at PNNL are functioning as efficiently as they are. DSOM enables the balance between high production rates, machine stress, and failure. This software allows online condition monitoring of equipment and provides early warning signs of degraded performance. DSOM's diagnostic capabilities empower the operations staff to become the first line of maintenance. Moreover, clients and sponsors can see the software at work on PNNL's campus—it is being demonstrated in buildings undergoing commissioning and retrofitting.
- » Jordan Henderson, a sustainability engineer at PNNL, performed a Leadership in Energy and Environmental Design for existing Buildings (LEED EB) gap analysis of PNNL facilities. The Department of Energy has a goal of increasing the amount of High Performance Sustainable Buildings in its portfolio and LEED EB certification is one method to achieve that. Jordan's study identified areas of opportunity to achieve those goals and has resulted in PNNL initiating the LEED EB process for three buildings.
- » Utilizing some of the expert knowledge already employed by PNNL, Jeff McCullough, a senior engineer and Lighting Certified Professional, has been engaged in PNNL's lighting upgrades since 2010. As part of a Department of Energy testing effort, Jeff has been monitoring and managing PNNL's switch to LED lighting throughout campus (see "Walk the Talk," page 6).
- » Using the photovoltaic (PV) array located on campus as a test-bed, PNNL staff are using existing facilities and capabilities to discover the full potential of PV. Researchers are using data collected at the PV array, focusing on software to predict cloud cover and possible down time for solar power. PNNL's research could lead to adjustment of renewables in the nation's ultimate goal of finding sustainable sources of energy.



PNNL's PV array produced 136.3 MWh of electricity for our super-computing facility and adjacent car charging stations

## Making renewable energy viable

PNNL is a scientific leader in multi-disciplinary research, providing the scientific foundations for integrating renewable energy into the nation's energy portfolio. New technologies are needed to maximize efficiency, smoothly add power from renewable sources to the electrical grid and minimize impacts on the environment.

**More wind for our buck.** Wind and solar energy check the box for low greenhouse gas emissions, but there are challenges to incorporating these variable resources into the existing electric power grid. In 2011, PNNL scientists led a study to understand current wind farm technologies and wind forecasting. This understanding will lead to cost-effective design and operational efficiencies.

**Making room for renewables on the grid.** A PNNL-developed analysis tool helps electric grid controllers monitor and predict where wind and solar power generation falls short of demand. Smoothing out such electric grid variability allows for a broader mix of energy sources and makes renewables more cost-competitive with traditional power.

**Leave it as you found it.** To minimize impact on the natural environment, PNNL assessed remote sensing technologies that monitor risks for avian and marine animals in offshore wind farm environments. Using these technologies will help developers plan for wind energy development with minimal impact to the environment along U.S. coastlines.

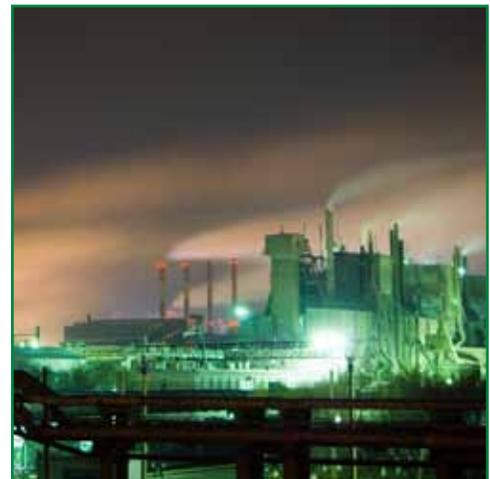


300-MW Stateline Wind Energy Center, located on VanSycle Ridge between Washington and Oregon

## From the gulf to Fukushima: science with global impact<sup>1</sup>

**Protecting the environment.** During the summer of 2010, when the Deepwater Horizon oil spill was occurring in the Gulf of Mexico, researchers from PNNL collaborated with seven other national laboratories to estimate the rate of oil flowing into the Gulf. In the wake of the devastating earthquake and tsunami in Japan in 2011, researchers from PNNL teamed to provide technical analysis and advice to U.S. and Japanese government officials to support immediate decision-making and longer term stabilization planning efforts.

**Protecting people.** Since the end of the Cold War, countries such as Kazakhstan have been tasked with disposing of spent nuclear fuel from their nuclear facilities. For the past four years, researchers from PNNL teamed to help Kazakhstan transport and secure spent fuel containing 10 metric tons of highly enriched uranium and three metric tons of weapon-grade plutonium—enough for 775 nuclear weapons. The fuel was transported approximately 3,000 km via rail and road to a long-term storage facility; it was the largest spent fuel shipment in the history of the National Nuclear Security Administration.



Fukushima Daiichi Nuclear Power Plant, Japan

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<sup>1</sup>Three teams of PNNL researchers received Honor Awards from Energy Secretary Steven Chu for their work.



The Energy Smart Data Center (ESDC) testbed facility at EMSL is a first-of-its-kind center of excellence dedicated to developing more efficient methods of managing energy use and associated cooling of data centers. The ESDC supercomputer, NW-ICE, is used for scientific research while ESDC researchers study energy consumption and test new cooling technologies.

$$\text{PUE} = \frac{\text{Total data center power}}{\text{IT equipment power}}$$

Power utilization effectiveness (PUE) = unit for measuring efficiency of energy use in our data centers.

## SUSTAINABLE OPERATIONS

### Data center efficiency improvements

Our work requires energy-intensive laboratories and operation of data centers with high-performance computing equipment that ranks among the fastest in the world. Balancing the growing demand for computing power with our goal of reducing total power consumption is a critical challenge for PNNL.

High-performance computing equipment generates heat, and that heat must be removed to ensure optimal performance. To increase the efficiency of our data centers, we aim to minimize the proportion of power used for cooling, lighting, and other pieces of supporting infrastructure, compared to the power used to operate the IT equipment.

We measure the efficiency of energy use in our three major data centers—the Computational Science Facility, the Information Services Building, and EMSL (housing the Chinook supercomputer) with the power utilization effectiveness (PUE) metric. The PUE is total power entering the data center divided by the power used to run the IT equipment within it. As an example, an average data center has a PUE of 2.0, which means that the data center energy demand is two times greater than the energy necessary to power the IT equipment.<sup>1</sup>

In 2011 the data center in EMSL averaged 1.87 PUE, the Information Services Building averaged 1.6 PUE, and the Computational Science Facility averaged 1.2 PUE. PNNL's goal is to achieve PUE of 1.4 or lower at all three data centers by 2015.

We continually assess our data centers to make energy efficiency improvements. In 2011 we

- » conducted a data center consolidation assessment that resulted in a prioritized list of equipment to move and computer rooms to close.
- » continued virtualizing servers across our campus, which increased the utilization rates of computers, decreased the footprint of the hardware, and decreased energy costs. In the United States, 43% of servers are virtual<sup>2</sup>, while 80% of PNNL's business systems servers are virtual.
- » installed rear-door heat exchangers—twice as efficient as computer room air conditioning units—to cool high density, high-performance computing in the Computational Science Facility data center. This data center continued to show efficiency benefits from use of a novel geothermal system deployed in 2009.
- » upgraded the uninterruptible power supply in Information Services Building, which reduced energy use for that data center by 14%.

<sup>1</sup>Belady, C, ed. 2012. *Green Grid Data Center Power Efficiency Metrics: PUE and DCIE*. Accessed February 24, 2012 at [http://www.thegreengrid.org/~media/WhitePapers/White\\_Paper\\_6\\_-\\_PUE\\_and\\_DCIE\\_Eff\\_Metrics\\_30\\_December\\_2008.pdf?lang=en](http://www.thegreengrid.org/~media/WhitePapers/White_Paper_6_-_PUE_and_DCIE_Eff_Metrics_30_December_2008.pdf?lang=en)

<sup>2</sup>Virtualization Industry Quarterly. 2012. *Virtualization Penetration Rate, September 2011*. Accessed February 24, 2012 at <http://www.v-index.com/virtualization-penetration-rate.html>

# Social Responsibility



PNNL is committed to enabling and inspiring people to achieve excellence, and it shows. We strive to be good citizens and the employer of choice by offering the best and the brightest talent meaningful work, investing in professional development, advancing STEM education, creating a sense of community, and giving our employees opportunities to make a difference. We aim to be trusted and valued in our community, our region, and the world.



# SOCIAL RESPONSIONS

## DIVERSITY STREET FAIR

PNNL people come from many backgrounds and experiences, and as a result, the perspectives they bring are a source of strength for our business. At the second annual Taste of Diversity Street Fair hundreds took a break from their work to have fun together, learn, and share their passions for food, live music, dancing, sailing, native plants, pets, fossils, cars, charities, and sustainable living—there was something for everyone.

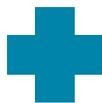


## FUTURE SCIENTISTS CELEBRATE EARTH DAY

A total of 507 kids descended on the Laboratory for the annual "Take Your Sons and Daughters to Work Day." Kids and their parents enjoyed laboratory tours, demonstrations, and workshops all designed to further science and technical education and encourage good citizenship. The activities took on a distinctly greener look and feel this year, in celebration of Earth Month. Kids learned about greenhouse gas emissions, composting, and PNNL's new solar array installation.



## EMPLOYEE HEALTH AND SAFETY



*Injury & Illness Incident Rate*

down **36%**

*Days Away From Work, Restricted Activity, or Transferred*

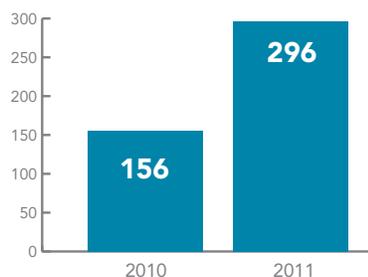
down **13%**  
from 2010

## SAFETY ROADSHOW

Nearly 300 interns spent their summer at PNNL engaged in research activities. We kick off their summer experience with a Safety Roadshow that provides an interactive introduction to our safety and operational culture and engages them in discussions with Safety, Health and Operations subject matter experts. Toward the end of their summer appointments, PNNL holds an special event to recognize students for their commitment to excellence in safety and operations.

## STAFF DEVELOPMENT PROGRAM PARTICIPATION

The number of staff participating in career development programs doubled in 2011. Programs include: Advanced Leadership, Science and Engineer Development, and Project Manager Development.



Staff also participated in PNNL's first Sustainability Fair with information and resources on green living at home and at work, including native and low-water plants and the pros and cons of traditional light bulbs compared to CFL and LED lights. A local community supported agriculture program introduced staff to the idea of "slow food" and their fresh produce subscription service to promote healthy eating while supporting local farmers. PNNL's volunteer organization, Team Battelle, shared highlights from two local conservation projects with the Tapteal Greenway and Friends of Badger Mountain.

# ABILITY

## INCLUSIVENESS THROUGH LIFE@PNNL

Sustainability at PNNL is only as good as the people who embrace it, believe in doing the right thing, and bring it to life. Like feet that pedal a bicycle forward, our employees are the energy behind the culture of sustainability that's growing stronger each year, especially through Life@PNNL. This is "one-stop shopping" for employees to learn about ways to live out their "citizenship" at the Lab, doing their part to lessen the Lab's operational footprint and boost our reputation—whether through participation in events, recreational activities, volunteerism, or staff-organized clubs and networks.

Some clubs directly contribute to a more sustainable environment, such as the Cycling Club, which was employee Bora Akyol's idea. Bora is a veteran cyclist, bikes to work on a regular basis, and wanted to share his passion with fellow employees. Through the club, cyclists make connections and enjoy better health and environment with fewer cars on the road burning gasoline.



## PREPARING STUDENTS TO BE STEM-LITERATE CITIZENS

PNNL has a vested interest in increasing the STEM workforce through our three signature programs—Washington's Leadership and Assistance for Science Education Reform (LASER) project, Delta High School partnership, and Work-based Learning.



### Delta students outperform peers

After two years of operation, the STEM-focused Delta High School, a program of three local school districts, would rank 15th on Washington State's High School Proficiency Exam as a stand-alone high school. Delta's pass rate on the science exam was 30% higher than the state average. This is an impressive achievement when you consider that enrollment is open to any student, regardless of academic standing.

### Scientists engage elementary children

PNNL scientist Kayte Denslow unlocks the wonders of light, sound, and electricity for students at Finley Elementary's science day. The activities enriched and expanded the school's core science curriculum.



## OPPORTUNITIES FOR IMPROVEMENT

### Driving down emissions with telework

In 2011 a team of PNNL leaders was tasked by our executive team to look for areas where we needed to improve the Lab's sustainability performance. Reducing greenhouse gas emissions from employee commuting was one of the areas that jumped to the top of the list. Commute emissions have increased 23% due largely to the addition of 450 new employees since our baseline year. Yet, the Lab's DOE goal is to reduce indirect GHG emissions from employee travel by 13% from 2008 to 2020. It was determined that one of the most impactful ways to drive change would be to promote and enable a Lab-wide telework program. Beyond helping us achieve our greenhouse gas goals by eliminating commute miles, flexible work arrangements will save our staff members money and time, reduce stress, increase productivity, and help staff strike a better work-life balance.



As the world and technology change, our workplace will evolve to remain competitive. Teleworking is one way to help us get there.

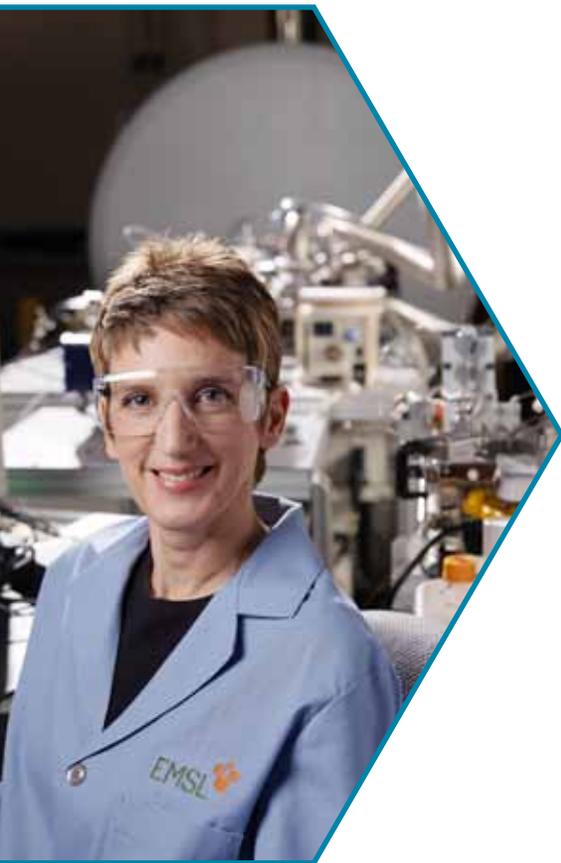
## SCIENCE FOR PEOPLE

### Biomarkers could hold key to early detection of breast cancer

A comprehensive, collaborative research project is looking for protein biomarkers that can be used for early breast cancer detection with blood tests. Current detection methods—including mammograms and self-exams—typically find breast cancer after it's established. The goal is to find a method to diagnose cancer before it can grow.

PNNL researchers have employed advanced mass spectrometry techniques and a novel proteomics process to discover potential biomarkers. They have narrowed their list from more than 2,000 proteins of interest to just 200 promising candidates. The suspect biomarker proteins were found in breast tissue and a liquid called nipple aspirate fluid, which is secreted by the ducts in female breasts. To identify the potential biomarkers, the researchers compared their own experimental data with previously published data on cancer genomes, among other methods. The 200 biomarker candidates are currently being tested and evaluated in patient blood samples. Scientists will further narrow their list of potential biomarkers so they can identify a handful of proteins to study in a clinical trial.

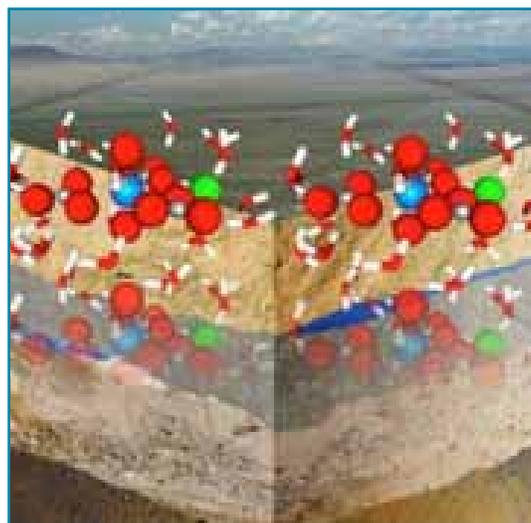
Three leading proteomics laboratories—at PNNL, the Broad Institute of Massachusetts Institute of Technology and Harvard University, and the Fred Hutchinson Cancer Research Center— joined forces for the project. This research is funded by Entertainment Industry Foundation's Women's Cancer Research Fund and Susan G. Komen for the Cure.



At the Environmental Molecular Sciences Laboratory (EMSL), researchers use this mass spectrometer and other tools to facilitate advanced global proteomics research and allow detailed visualization and analyses of cellular proteins.

### Predicting underground transport

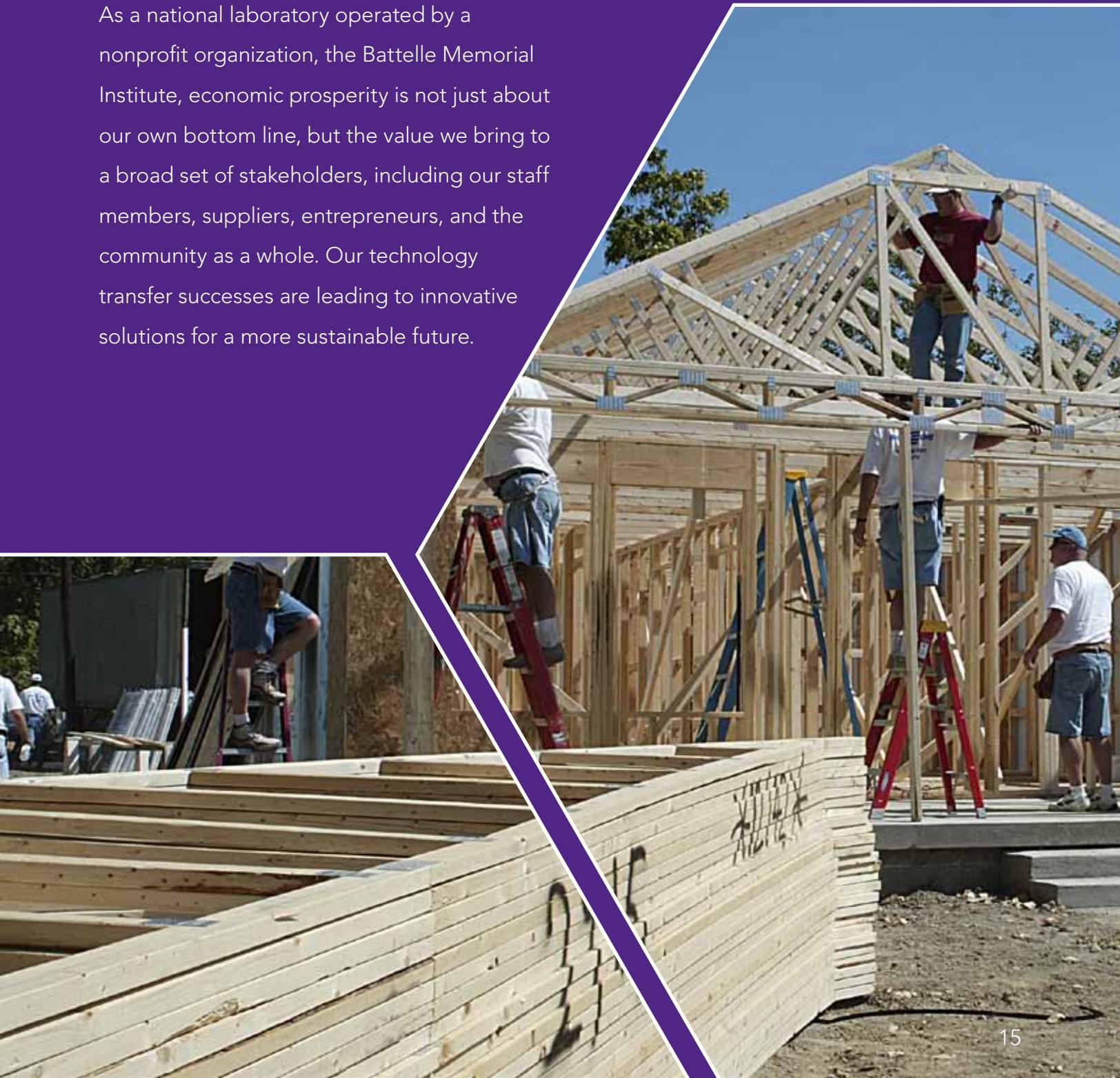
Knowing how uranium contaminants diffuse in water is critical for predicting their movement underground, in order to protect people and ecosystems. New research using molecular dynamics techniques and EMSL's Chinook supercomputer shows that previously accepted estimates may have significantly overestimated the speed at which uranium moves with the groundwater. Taking into account uranium's non-uniformity in chemical species and particle shape, these findings support more accurate diffusion models—which will help policymakers and engineers develop better cleanup approaches.



# Economic Prosperity



As a national laboratory operated by a nonprofit organization, the Battelle Memorial Institute, economic prosperity is not just about our own bottom line, but the value we bring to a broad set of stakeholders, including our staff members, suppliers, entrepreneurs, and the community as a whole. Our technology transfer successes are leading to innovative solutions for a more sustainable future.



# ECONOMIC PROS

## TEAM BATTELLE

One of the ways we influence the prosperity of our local community is through our employee-led volunteer group, Team Battelle, which includes PNNL staff members, their families, and retirees. In 2011, Team Battelle volunteers raised money for charities and provided supplies and labor to the region.

- » **Duck Nesting Boxes** – volunteers maintain and repair wooden nesting boxes along the banks of local rivers, which helps the local population of ducks.
- » **Hygiene Kits** – volunteers combine travel-sized toiletries staff receive at hotels while traveling into hygiene kits that are distributed to individuals below the poverty line.
- » **Project Linus** – volunteers make hundreds of blankets for children who are ill, traumatized, or otherwise in need.



## AVERAGE VOLUNTEER HOURS



## COMMUNITY INVESTMENTS

PNNL  
and  
Battelle

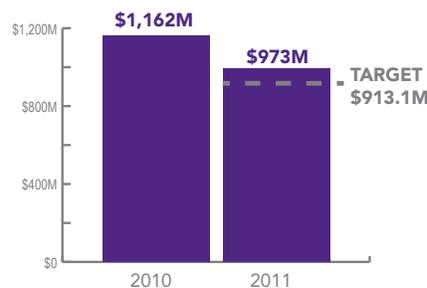


OVER  
\$1 MILLION

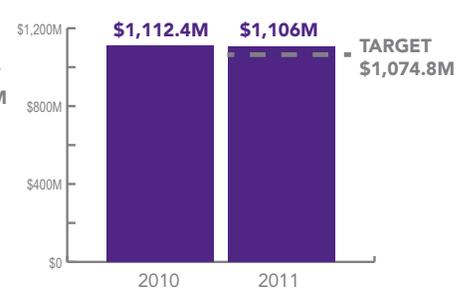
## STAFF PARTICIPATION IN 401K RETIREMENT PLANS



## SALES



## BUSINESS VOLUME



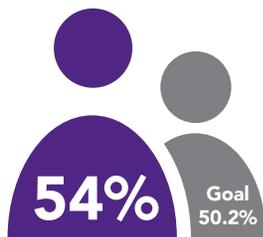
# PERITY

## WORKFORCE

4,841



## SUPPORT SMALL BUSINESSES



*of procurement spending*

## Small veteran-owned

6%

*of procurement spending*



## PURCHASED GOODS AND SERVICES

More than \$415 million



## PATENTS

50 U.S. • 66 foreign

combined total  
2,026 since 1965

## OPPORTUNITIES FOR IMPROVEMENT

### Operational efficiencies help offset federal funding challenges



Fiscal years 2012 and 2013 will be particularly challenging financially because of continuing federal budget uncertainty. Decreases in funding have affected some of our programs, particularly in the environmental and national security sectors. The need to maintain a competitive cost structure through operational efficiencies is more important than ever.

One of our strengths as a national laboratory is our ability to remain relevant, deliver impact, and respond to the critical needs of the nation in uncertain times. Through the years, we've weathered changes in national priorities, political administrations, funding, and budgets. Below are two examples of how we're becoming more efficient in our operations:

- » The Integrated Management System (IMS) is a multi-year plan to streamline business processes and systems across the Laboratory, which will lead to increased research productivity while reducing research staff frustration, research costs, and operational non-compliance. One of the goals of PNNL is to consider the impacts on people and planet so that we are taking a holistic, sustainable approach to our business decisions.
- » Staff members are required to take training courses each year to reinforce an understanding of PNNL policies and operating procedures. In 2011, seven refresher training modules were combined into a single course that should only take an hour to complete. In the past, about seven hours of general refresher course training was required over a period of one to three years. The labor and tuition cost savings to the Laboratory is expected to be upwards of \$1.7 million in 2012—money that can be redirected to science and technology.



## SCIENCE FOR PROSPERITY

### Technology Deployment - Hydrovolts

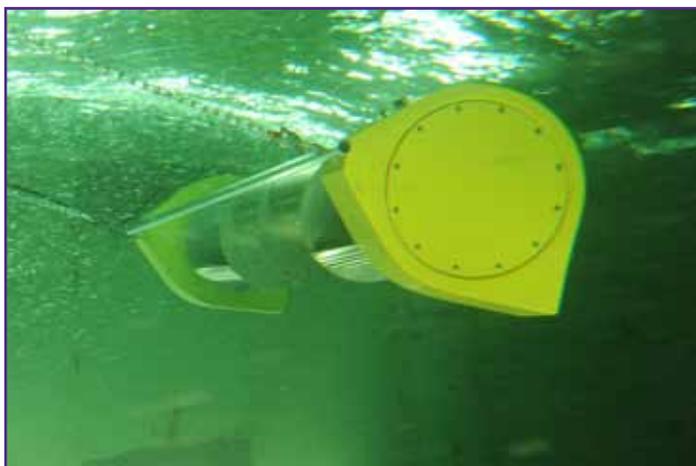
Flowing water exists all over the world and, because of its dynamic characteristics, it naturally serves as a source of energy. Hydrovolts, a Seattle-based renewable energy company, invented and manufactures a solution for turning this untapped resource into a renewable power source.

Through PNNL's Technology Assistance Program (TAP), the company improved its hydrokinetic turbine products and directed its commercial strategy away from tidal power sources, which are offshore and more difficult to harvest.

***The Technology Assistance Program leverages PNNL's expertise in a variety of scientific disciplines to help members of the tech-based small business community solve important challenges free of charge.***

Following a succession of free TAP consultation projects with Laboratory engineers and environmental experts, Hydrovolts' engineers designed a turbine that produces clean, renewable power using predictable and controlled water currents commonly found in artificial waterways. With much of the world having no electricity at all, and most the population living near water channels, the portable floating turbines were applicable to a multitude of life-changing applications. The turbines operate below water and can generate power for small-scale applications, such as charging cell phones or computers or to run a refrigerator for medicine. Additionally, the turbines can be chained together for community-scale power—enough to power a school or clinic or a water purification system—bringing improved quality of life to millions of people in developing countries.

With a multitude of flexible applications, Hydrovolts' turbines deliver cost-effective, renewable energy to remote locations. Backed by several important rounds of funding, today the company is poised to move into full-scale commercialization of its turbines, with plans to add canal installations throughout the United States and internationally.



A Hydrovolts hydrokinetic turbine operates below water to generate clean, renewable energy. A single turbine can power one to ten homes along the waterway where installed.

## ABOUT THIS REPORT

PNNL recognizes the value of using an external standard for sustainability reporting to enable a balanced, transparent, and comparable representation of our organizational performance toward the goal of sustainable development. We use the GRI G3 Sustainability Reporting Guidelines as a framework for measuring and reporting our environmental, social, and economic performance.

The following pages describe how the content of this report meets GRI disclosures and where that information can be found. The external assurance letter offers a third party's opinion of whether we have effectively met these guidelines. Finally, the performance indicator table elaborates on our performance against the GRI indicators considered most material to our organization. On our website you will find expanded management disclosures and performance data against all GRI "core" indicators.

### GRI Content

This report highlights PNNL's view of sustainability in both the context of the work we do and how we do it. We measured and reported on those aspects of the GRI indicators that were applicable to our business, fell into opportunity areas for improvement, were material to our key stakeholders, and were closely tied to our organizational values. Both the qualitative and quantitative content in the print report were defined to focus on performance areas that are of the highest priority to our primary customer, DOE, and our employees. In many cases these performance measures are codified in our operating contract with DOE and the results will influence decisions it makes about our organization. Performance measures that are less significant to our customers and our employees, and less impactful on our operations, are included in a summary table on our website for completeness. The scope of topics covered in both the PDF and Web versions of our report include the majority of core, and some additional, GRI indicators and provide a representative view of our significant economic, environmental, and social impacts.

This report is for fiscal year 2011 and all years are reported as fiscal years, which run from October 1 to September 30. While PNNL is operated by Battelle, the boundary of this report is restricted to the activities that occur by the employees and operations of PNNL. The reporting boundaries include government-owned, and contractor-operated facilities, Battelle-owned facilities, and leased facilities that are jointly managed at PNNL as a "consolidated laboratory." It does not include Battelle's corporate headquarters, or other facilities operated by Battelle outside of the consolidated laboratory, unless otherwise noted.

More detailed information about how we defined the content for this report to ensure balance, accuracy, and completeness, our approach to stakeholder involvement, and governance and management disclosures can be found on our website at <http://sustainable.pnnl.gov>.

For more information about this report and its contents, please contact:

Mike Moran  
Sustainability Program Manager  
(509) 375-2344  
[mike.moran@pnnl.gov](mailto:mike.moran@pnnl.gov)



### Science as Art: PNNL images selected for national magazine

A dozen stunning science images, representing cell structures, microorganisms, polymer films, degraded metals and more, were selected by the voting public as winners in the Lab's Science as Art contest.

The photos are representative of research projects and two were selected by the American Chemical Society as winners in their "Science as Art" contest. The top image (above), taken by a high-powered microscope showing mineral buildup as carbon dioxide reacts with rock, for deep underground storage of carbon dioxide, was featured in the Society's prestigious Chemical & Engineering News magazine.

## Report Application Levels

PNNL self-declares this report to meet the standard set out by GRI for an A+ level report.



Report Application Level		C	C+	B	B+	A	A+
Standard Disclosures	G3 Profile Disclosures ➔ OUTPUT	Report on: 1.1 2.1-2.10 3.1-3.8, 3.10-3.12 4.1-4.4, 4.14-4.15	Report Externally Assured	Report on all criteria listed for Level C plus: 1.2 3.9, 3.13 3.1-3.8, 3.10-3.12 4.1-4.4, 4.14-4.15	Report Externally Assured	Same as requirement for Level B	Report Externally Assured
	G3 Management Approach Disclosures ➔ OUTPUT	Not Required		Management Approach Disclosures for each Indicator Category		Management Approach Disclosures for each Indicator Category	
	G3 Performance Indicators & Sector Supplement Performance Indicators ➔ OUTPUT	Report on a minimum of 10 Performance Indicators, including at least one from each of: Economic, Social, and Environmental		Report on a minimum of 20 Performance Indicators, at least one from each of: Economic, Environmental, Human rights, Labor Society, Product Responsibility		Report on each G3 and Sector Supplement Indicator with due regard to the Materiality Principle by either: a) reporting on the Indicator or b) explaining the reason for its omission	

## GRI Index

The index below provides an overview of our reporting and the location within the report for all G3 Sustainability Reporting Guidelines.

Standard GRI Disclosures	G3 Indicator	Page
<b>Strategy and Analysis</b>	1.1-1.2	Message from the Director, 2 Sustainability Performance Scorecard, 3 <a href="http://sustainable.pnnl.gov/report/kpi_tables.stm">http://sustainable.pnnl.gov/report/kpi_tables.stm</a>
<b>Organizational Profile</b>	2.1-2.7	3, <a href="http://www.pnnl.gov/">www.pnnl.gov/</a>
	2.8-2.10	19, <a href="http://sustainable.pnnl.gov/report/gri_content.stm">http://sustainable.pnnl.gov/report/gri_content.stm</a>
<b>Governance</b>	4.1-4.10	<a href="http://sustainable.pnnl.gov/report/gri_content.stm">http://sustainable.pnnl.gov/report/gri_content.stm</a> <a href="http://www.pnnl.gov/about/leadership.asp">http://www.pnnl.gov/about/leadership.asp</a> <a href="http://sustainable.pnnl.gov/report/stakeholder_engagement.stm">http://sustainable.pnnl.gov/report/stakeholder_engagement.stm</a>
	4.11	<a href="http://sustainable.pnnl.gov/report/gri_content.stm">http://sustainable.pnnl.gov/report/gri_content.stm</a> , PR1
	4.12-4.13	<a href="http://www.pnnl.gov/about/partnerships.asp">http://www.pnnl.gov/about/partnerships.asp</a> ; <a href="http://www.pnnl.gov/edo/about/collaborators.asp">http://www.pnnl.gov/edo/about/collaborators.asp</a>
<b>Stakeholder Engagement</b>	4.14-4.17	<a href="http://sustainable.pnnl.gov/report/gri_content.stm">http://sustainable.pnnl.gov/report/gri_content.stm</a>
<b>Disclosures on Management Approach</b>		<a href="http://sustainable.pnnl.gov/report/gri_content.stm">http://sustainable.pnnl.gov/report/gri_content.stm</a>
Environmental		5-10; <a href="http://sustainable.pnnl.gov/report/env_stewardship.stm">http://sustainable.pnnl.gov/report/env_stewardship.stm</a>
Economic		15-18; <a href="http://sustainable.pnnl.gov/report/economic_prosperity.stm">http://sustainable.pnnl.gov/report/economic_prosperity.stm</a>
Society, Labor, and Human Rights		11-14; <a href="http://sustainable.pnnl.gov/report/social_responsibility.stm">http://sustainable.pnnl.gov/report/social_responsibility.stm</a>
Product Responsibility		8-9, 14,18
<b>Performance Indicators</b>		The print and PDF versions of this report contain only a subset of GRI performance indicators. All indicators can be found online at: <a href="http://sustainable.pnnl.gov/report/kpi_tables.stm">http://sustainable.pnnl.gov/report/kpi_tables.stm</a>
Economic	EC 1-9	22
Environment	EN 1-30	22-23
Society and Labor	LA 1-14, SO 1-8	23
Product Responsibility and Human Rights	PR 1-9, HR 1-9	23

## External Assurance Letter



Sustainable Business Consulting evaluated Pacific Northwest National Laboratory's (PNNL) sustainability report to establish that the information in the report was an authentic representation of the company's social, environmental, and economic performance in relation to the Global Reporting Initiative (GRI) reporting framework as specified in the GRI G3 Guidelines. Our responsibility was to carry out an assurance engagement, verify data and provide specific suggestions for improvement.

We found that PNNL satisfactorily meets the guidelines and reported the information in the spirit of GRI disclosure. The 2011 Sustainability Report provides a reasonable and balanced representation of information concerning report content, quality, boundary setting and material indicators. PNNL reported on all the management approaches, profile disclosures and core performance indicators. While these are not all detailed in the print version, we have reviewed all data and content that will be posted on the organization's Sustainability at PNNL Web pages for complete disclosure. We are not aware of the exclusion of any material issues or misstatements of information.

After we reviewed the initial draft of the report and highlighted concerns or made suggestions for improvement, PNNL responded to each concern with a thorough explanation and plan for addressing each one. These changes were included for the final version of the report.

### **Assurance approach:**

Our activities included a review of the reporting metrics, report content and a selection of source data. We also performed a site visit and conducted several meetings with PNNL employees to discuss the accuracy and authenticity of report content, data, policies and methodologies around the organization's social, environmental, and economic data and activities.

Our assurance team was made up of sustainability experts, one of which is certified in GRI reporting. As part of this process, we:

- reviewed all profile disclosures and core performance indicators, assessing the information based on the GRI Guidelines
- took a random sample of data points and interviewed employees who provided that data to verify accuracy and understand the procedures for data collection, tracking and analysis
- analyzed stakeholder engagement activities and materiality determination process
- provided suggestions after initial readings and review
- assessed the final version of the report content to ensure it met the principles for ensuring report content and quality, as defined by the GRI

### **Recommendations for improvement**

PNNL should continue to be methodical about engaging stakeholders and obtaining stakeholder input on sustainability efforts and future reports. Also, if PNNL could report on its sustainability performance in relation to its peers in the industry, it would provide stakeholders with more context and the ability to compare PNNL's performance against other similar organizations.

**Opinion:** This was PNNL's third GRI-based sustainability report. The organization has demonstrated rigorous procedures for data gathering and reporting, and has improved its reporting efforts by committing to a stronger stakeholder engagement process. It is in our opinion that in the instances where PNNL does not collect data or have a specific policy or procedure, it is because the issue is deemed not applicable at this time or immaterial. Therefore, we support the company's self-assessment that its 2011 report meets the GRI application level of A+.

A handwritten signature in black ink, appearing to read "Kevin Wilhelm".

Kevin Wilhelm, CEO  
Sustainable Business Consulting

Seattle, Washington.  
April 19, 2012

## Key Performance Indicator Summary Table

GRI Indicator	Indicator Title	2008	2009	2010	2011
<b>Economic Performance</b>					
EC1	Sales	\$1,123,136,000	\$1,074,450,000	\$1,162,000,000	\$973,000,000
	Business volume (total operating costs)	\$881,224,000	\$1,058,584,000	\$1,112,400,000	\$1,106,000,000
EC3	Coverage of the organization's defined benefit plan obligations.				
	Estimated value of pension plan liabilities	\$764,242,552	\$775,117,033	\$805,103,296	\$985,232,652
	Percentage contributed by employer	4%	4%	4%	4%
	Level of participation in retirement plans	not available	90%	92%	96%
<b>Environmental Performance</b>					
<b>Materials</b>					
EN2	Percentage of materials used that are recycled input materials	Represents standard sizes of uncoated copy and printing paper with at least 30% recycled post-consumer content. <sup>a</sup>			
		not reported	not reported	98%	97%
<b>Energy</b>					
EN3	Direct energy consumption by primary energy source (kBtu) <sup>b</sup>	117,140,128	123,399,463	124,277,979	115,286,625
	Natural gas	115,201,600	118,781,300	120,341,500	110,824,100
	Propane	627,786	1,066,778	627,511	589,661
	Gasoline	5,348,750	4,391,240	4,875,000	3,814,259
	Diesel	1,582,567	1,765,880	1,792,287	1,584,803
	Jet Fuel	3,151,845	908,292	2,907,630	3,571,155
	E85	759,159	908,292	945,888	1,388,706
EN4	Indirect energy consumption by primary source (kBtu)	290,613,524	305,805,420	330,557,569	338,468,496
	Non-renewable <sup>c</sup>	259,196,531	281,714,789	132,173,353	141,331,736
	Renewable	31,416,993	24,090,631	198,384,216	197,136,760
<b>Water</b>					
EN8	Total water withdrawal (gallons) <sup>d</sup>	607,938,451	634,529,882	638,262,078	624,953,887

<sup>a</sup>Revised from 2010 report, which erroneously included miscellaneous paper items (e.g., notepads) that could not be compared by weight consistently across years.

<sup>b</sup>Propane and natural gas data reported in the 2010 report was updated to include fuel use at the Marine Sciences Laboratory, which was previously not available. Jet fuel data was reported for the first time in 2011. E85 data for 2010 was determined to be miscoded as gasoline in the fleet fuel data management system; this was corrected by reviewing actual invoices.

<sup>c</sup>Non-renewable energy use data was changed from the 2010 report. Total energy use was erroneously put in the non-renewable energy row. Also, some previous values from 2008-2010 were based on estimated energy use and corrected to reflect actual energy use.

<sup>d</sup>This includes a small amount of water use from facilities outside of our operational boundaries that is not metered separately. This may be removed in future reporting.

<sup>e</sup>Data reported in 2010 revised based on changes to EN3 and EN4 described above.

<sup>f</sup>Scope 1 "direct emission" sources include fuel combustion in our facilities (e.g., natural gas, propane), fuel combustion in our fleet vehicles, and fugitive emissions (e.g., refrigerants). Scope 2 "indirect emission" sources include electricity use in our facilities. Calculations are based on the "Federal Greenhouse Gas Accounting and Reporting Guidance."

<sup>g</sup>Scope 3 "other indirect emission" sources include employee business travel (air and ground), employee commuting, and waste disposal.

GRI Indicator	Indicator Title	2008	2009	2010	2011
<b>Emissions</b>					
EN16 <sup>a</sup>	Total direct (scope 1) <sup>f</sup> and indirect (scope 2) greenhouse gas emissions (metric tons of CO <sub>2</sub> equivalent)	44,158	44,056	50,069	51,567
EN17 <sup>a</sup>	Other relevant indirect greenhouse gas emissions (scope 3) <sup>g</sup> by weight (metric tons of CO <sub>2</sub> equivalent)	23,428	26,408	29,725	28,157
<b>Waste</b>					
EN22	Total weight of waste by type and disposal method (tons)				
	Recycled	494	492	692	718
	Recycled demolition	118	2,474	558	1,047
	Landfilled	575	666	766	635
	Composted	0.60	0.64	0.86	1.5
	Regulated hazardous waste	30	289	138	47
	Rad-containing waste—landfilled (after stabilization, size reduction, and/or thermo-treatment)	75	70	467	199
<b>Social Responsibility</b>					
<b>Labor Practices &amp; Workforce Performance</b>					
LA1	Total workforce by employment type, employment contract, and region (excludes interns)	3,850	4,136	4,289	4,299
LA2	Total number and rate of employee turnover by age group, gender, and region	5.8%	4.5%	5.7%	6.4%
LA7	Rates of injury, occupational diseases, lost days, absenteeism, and total number of work-related fatalities by region	All numbers reported are per 200,000 employee hours worked.			
	Total Recordable Case Rate (TRCR)	0.87	0.79	0.77	0.49
	Days Away, Restricted, or Transferred	0.34	0.29	0.24	0.21
LA11	Programs for skills management and lifelong learning that support the continued employability of employees and assist them in managing career endings	170 participants	161 participants	156 participants	279 participants
<b>Product Responsibility Performance</b>					
PR5	Practices related to customer satisfaction, including results of surveys measuring customer satisfaction	Each year DOE evaluates PNNL's performance against established goals. Two of the most important goals relate to the quality of S&T we deliver in support of our mission and the effectiveness with which we manage and operate the Laboratory. We have consistently and notably exceeded DOE's expectations for S&T performance and have met its very high expectations for management and operations (M&O) performance.			
	Mission accomplishment (S&T performance)	A	A	A	A-
	Operating, maintaining, and renewing facility and infrastructure (M&O performance)	B+	B+	B+	B+
<p>The indicators reported in this table are representative of our key performance indicators. PNNL has reported on all of its core indicators as required by the GRI and on our performance relative to 2011 goals on the Web version of the report at <a href="http://sustainable.pnnl.gov/report/kpi_tables.stm">http://sustainable.pnnl.gov/report/kpi_tables.stm</a>.</p>					

## LIVING OUT SUSTAINABILITY THROUGH PNNL

# Values

### IMPACT: Taking the bus to work

As an architect, Greg Turpen researches materials and methods to make PNNL facilities more energy efficient. This friendly, unassuming architect is also an ardent recycler, earth-conscious consumer, and one of the Lab's biggest proponents for public transportation. As a kid, Greg and his friends recycled aluminum and glass for money. Greg says, "We made a game out of it by stockpiling cans in the garage and researching aluminum values to find the best price per pound." Today, Greg's whole family practices sustainable living—his grandparents dutifully collect and crush their cans, and the kids opt for riding bikes over carpooling.



Also known as "Mr. Bus Pass," Greg sells bus passes subsidized by PNNL to staff so they can ride to work, as well as on the weekends and after hours. Greg urges everyone to try the bus at least once a week. "It's a great time to decompress, and it can be productive time. I often see commuters catching up on their smartphones or reading books. Once in while I'll see someone break out their laptop. In the bad weather, it's nice to relax and let someone else drive!"

### INTEGRITY: Teaching students to soar

PNNL is advancing STEM education and sustaining a diversified workforce through laboratory immersion experiences like the one Tumwater, WA middle school science teacher Scott Cutler devoted part of three consecutive summer vacations to attend. In the program, PNNL scientists and engineers share their expertise with science educators and classroom teachers.



After completing the three-year program, Scott followed his dream, starting a class entitled "The Physics of Flight" that has since become a two-year program for seventh- and eighth-graders. Students study aeronautics and aerospace on alternating years, complete hands-on projects like building bottle rockets, and work collectively on an ongoing effort to build a simple parasol-wing airplane called a Pietenpol Air Camper.

Scott has been awarded nearly \$48,000 in the last four years, for purchasing educational and project materials. The latest award came from the state of Washington and, in return, he has been asked to help create a statewide model that could be implemented at other schools.



PNNL Web Site



PNNL News Center



PNNL Sustainability





**Pacific Northwest**  
NATIONAL LABORATORY

*Proudly Operated by **Battelle** Since 1965*



U.S. DEPARTMENT OF  
**ENERGY**