

Pacific Northwest National Laboratory

Innovative Solutions for a Sustainable World

2012 SUSTAINABILITY REPORT

ENVIRONMENTAL STEWARDSHIP | SOCIAL RESPONSIBILITY | ECONOMIC PROSPERITY



Pacific Northwest
NATIONAL LABORATORY

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PACIFIC NORTHWEST NATIONAL LABORATORY

operated by

BATTELLE

for the

UNITED STATES DEPARTMENT OF ENERGY

under Contract DE-AC05-76RL01830

Printed in the United States of America

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(9/2003)

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MESSAGE FROM THE DIRECTOR

At Pacific Northwest National Laboratory (PNNL), we strive to achieve excellence in sustainability through our science and technology, management and operations, and through our role in the community.

We demonstrate our environmental stewardship through sound campus operations. In 2012, we excelled in reducing building water use intensity, using renewable energy, diverting waste, and standing up a new telework option for employees. We also received a U.S. Department of Energy (DOE) Sustainability Award for fleet management.

As you read our fourth annual Sustainability Report, you'll see on our Scorecard (p. 4) that we've made great strides with our efforts, and we'll be tackling two of our biggest environmental challenges in the coming years—energy use in our buildings and greenhouse gas (GHG) emissions from employee transportation. Our scientists partner with facilities staff to find and implement innovative solutions, while at the same time we educate our employees about ways they can help the environment, as well as help the Lab meet aggressive goals in these areas.

We cultivated the next generation of scientists by welcoming nearly 1,000 interns, fellows, and research associates to our campus for work-based learning experiences this past year. I'm proud of not only the impact that we're making to advance and accelerate science, technology, engineering, and math (STEM) education, but also the advocacy and leadership of our staff on a broader scale within the community in which we work and live.

PNNL has found ways to maintain financial viability and achieve economic prosperity through research and operational excellence, despite difficult financial times due to constricted federal budgets. This year, we'll continue to invest in our infrastructure—our staff, our facilities, and our equipment—while keeping our costs stable and competitive.

I am optimistic about our future and am inspired by the value we bring to the nation by delivering technology in a way that sustains the safety and security of our planet for future generations.



Michael Kluse
Laboratory Director



PNNL OVERVIEW

Located in Richland, Washington, Pacific Northwest National Laboratory is one of 17 U.S. Department of Energy national laboratories and one of ten overseen by DOE's Office of Science. 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. In addition to work for DOE, PNNL conducts research for other government agencies including the U.S. Department of Homeland Security and the National Institutes of Health, as well as private industry.

At the end of fiscal year 2012, PNNL employed 4,454 people and had a budget of nearly \$1 billion. PNNL has been managed for DOE by Ohio-based Battelle since the Laboratory's inception in 1965.

ABOUT THIS REPORT

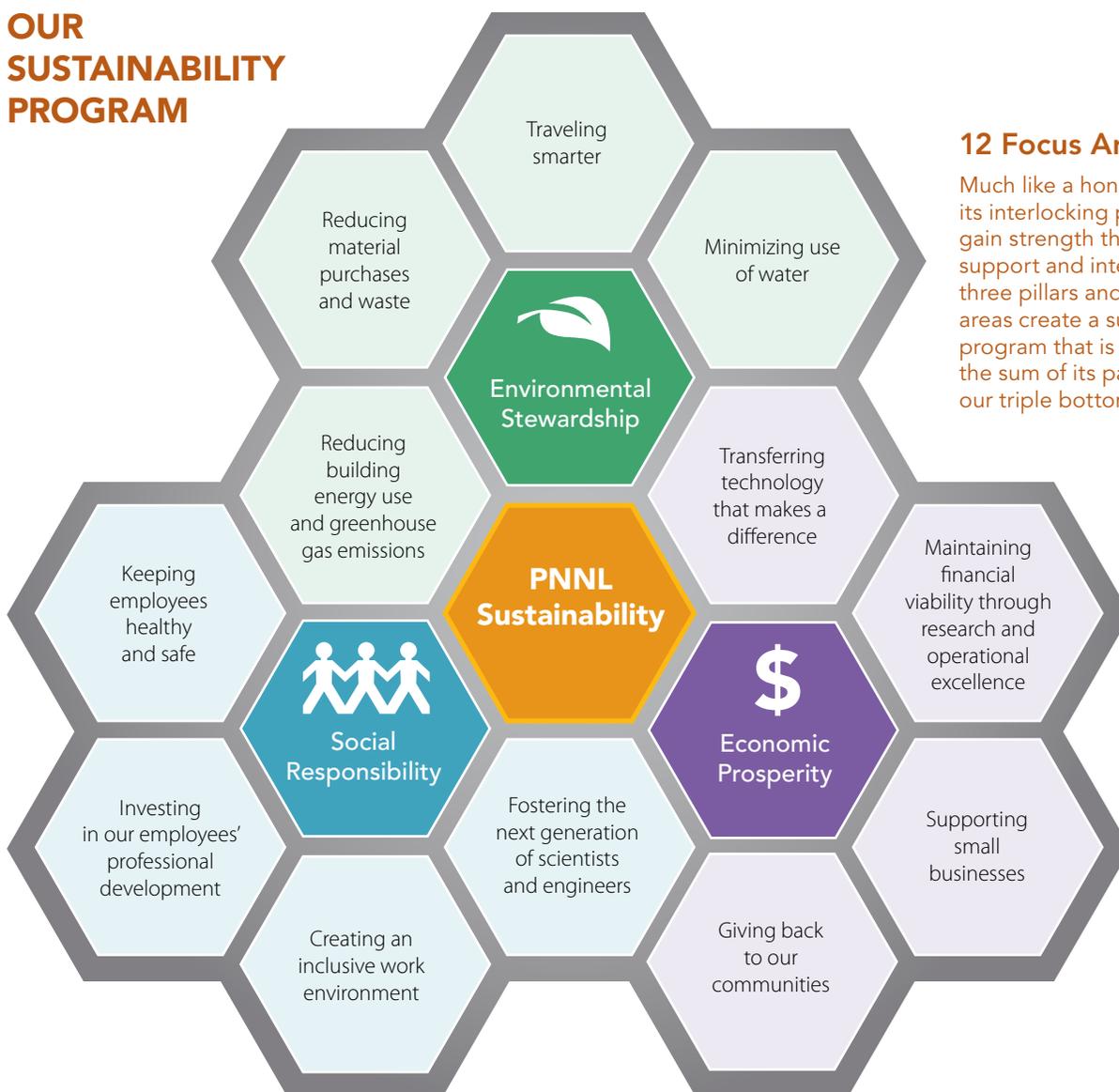
This report follows the Global Reporting Initiative (GRI) sustainability reporting framework, which enables organizations of all types to assess their triple bottom line performance and disclose the results in a similar way.

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 G3.1 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 (p. 21) offers a third party's opinion of whether we have effectively met these guidelines. Finally, the performance indicator table (p. 22) elaborates on our performance against the GRI performance indicators considered most material to our organization. On our website you will find expanded management disclosures and performance data against all GRI "core" indicators.

<http://sustainable.pnnl.gov>

OUR SUSTAINABILITY PROGRAM



12 Focus Areas

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

SUSTAINABILITY PERFORMANCE SCORECARD



did not meet target



risk of not meeting target



met or on track to meet target

2011 2012

| | | 2011 | 2012 | |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|-------------|--|
| ENVIRONMENT | Reducing building energy use and greenhouse GHG emissions | | | |
| | <ul style="list-style-type: none"> Reduce GHG emissions from building energy use 28% from 2008-2020 (Target: 31,794 MTCO₂e) | 51,577 | 44,560 | |
| | <ul style="list-style-type: none"> Reduce energy use intensity in buildings 30% from 2003-2015 (Target: 145 kBtu/ft²) | 173 | 169 | |
| | <ul style="list-style-type: none"> At least 7.5% of electricity use from renewable sources by 2013 and thereafter | 58% | 62% | |
| | Traveling smarter | | | |
| <ul style="list-style-type: none"> Reduce petroleum-based fuel use in fleet vehicles 20% from 2005-2015 (Target: 30,341 GGE) | 42,068 | 36,575 | | |
| <ul style="list-style-type: none"> Reduce GHG emissions from employee transportation 13% from 2008-2020 (Target: 21,005 MTCO₂e) | 28,757 | 26,827 | | |
| ENVIRONMENT | Minimizing water use | | | |
| | <ul style="list-style-type: none"> Reduce water use intensity in buildings 16% from 2007-2015 (Target: 57 gallons/ft²) | 33 | 31 | |
| | <ul style="list-style-type: none"> Reduce irrigation water use 20% from 2010-2020 (Target: 428.2M gallons) | 599.8M | 487.5M | |
| | Reducing material purchases and waste | | | |
| <ul style="list-style-type: none"> Divert at least 50% of sanitary waste from landfill | 53% | 50% | | |
| SOCIAL | Keeping employees healthy and safe | | | |
| | <ul style="list-style-type: none"> Total recordable case rate ≤ .65¹ | 0.49 | 0.65 | |
| | <ul style="list-style-type: none"> Days away, restricted, or transferred rate ≤ .25¹ | 0.21 | 0.20 | |
| | Investing in our employees' professional development | | | |
| | <ul style="list-style-type: none"> Average participant satisfaction rating from professional development programs ≥ 4.5/5 | 4.6 | 4.6 | |
| SOCIAL | Creating an inclusive work environment | | | |
| | <ul style="list-style-type: none"> No goal established | | N/A | |
| | Fostering the next generation of scientists and engineers | | | |
| <ul style="list-style-type: none"> Average participant rating of work-based learning programs ≥ 4.0/5 | 4.7 | 4.8 | | |
| ECONOMIC | Transferring technology that makes a difference | | | |
| | <ul style="list-style-type: none"> Economic contribution to global economy from licensed technologies (Target: 5-yr moving average >\$90M)² | \$105.5M | \$88.5M | |
| | Maintaining financial viability though research and operational excellence | | | |
| | <ul style="list-style-type: none"> Sales (Target: \$881M) | \$967.6M | \$1,049.1M | |
| | <ul style="list-style-type: none"> Business volume (operating costs) (Target: \$1,021M) | \$1,105.5M | \$1,1031.7M | |
| ECONOMIC | Supporting small businesses | | | |
| | <ul style="list-style-type: none"> Award at least 52% procurement dollars to small businesses | 54.0% | 50.1% | |
| | Giving back to our communities | | | |
| <ul style="list-style-type: none"> Philanthropic investments (No target)³ | \$859,164 | \$616,925 | N/A | |

1. Reported per 200,000 employee hours worked.

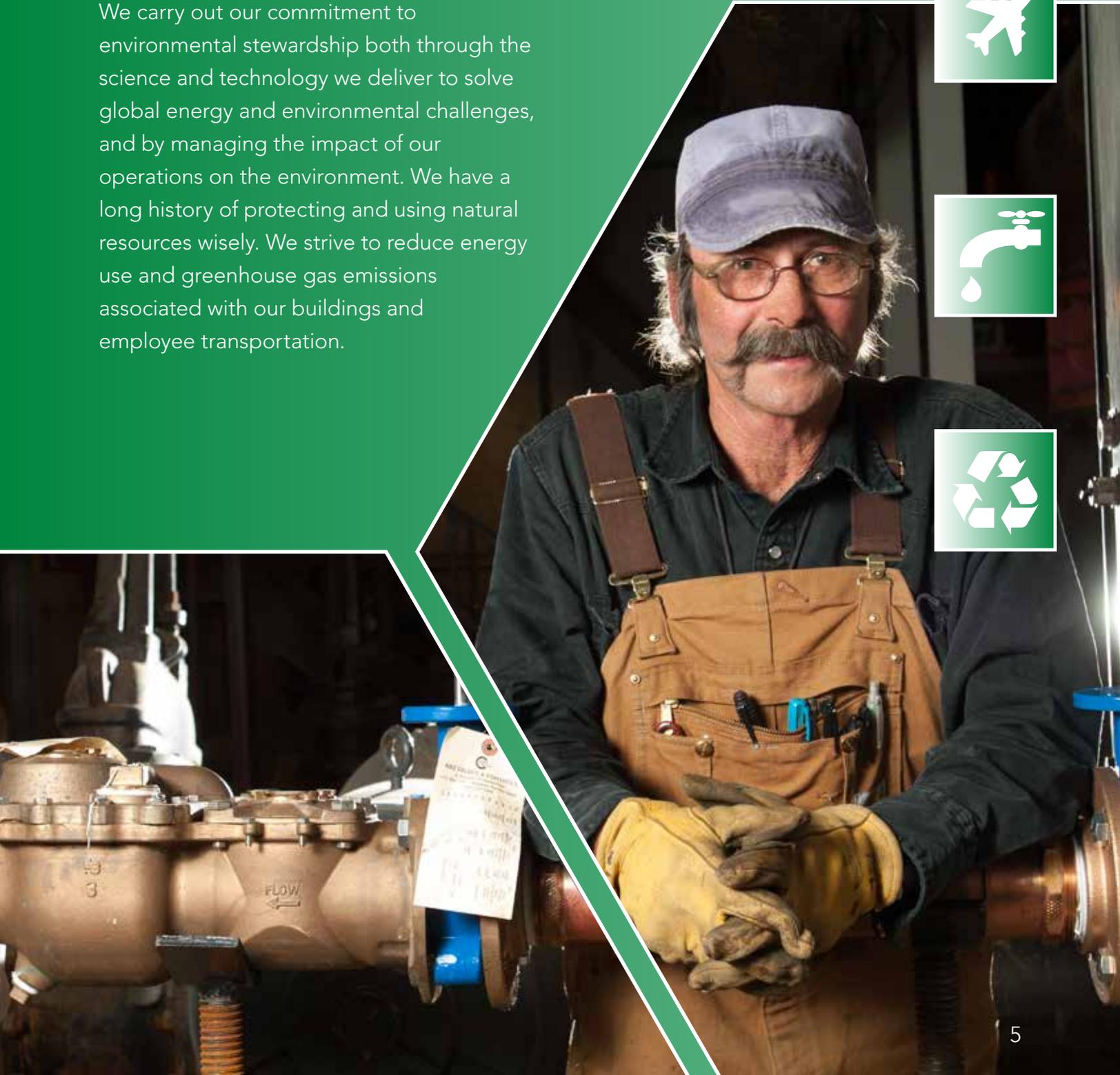
2. Economic contribution is an estimate of the value to the economy of goods and services embodying licensed PNNL technologies. The measure is consistently calculated across all DOE labs and is reported to DOE headquarters on an annual basis, but not submitted against a related target. The number fluctuates from year to year, and a five-year simple moving average was used to smooth the data for this report. For this report, a target was developed for the measure. While a continual upward trend in results is the goal, performance is most directly controlled by licensees of Lab technology and their efforts to commercialize it.

3. Community investments include those made by PNNL and Battelle's Pacific Northwest Division because of Battelle's management role of the Laboratory.

Environmental Stewardship



We carry out our commitment to environmental stewardship both through the science and technology we deliver to solve global energy and environmental challenges, and by managing the impact of our operations on the environment. We have a long history of protecting and using natural resources wisely. We strive to reduce energy use and greenhouse gas emissions associated with our buildings and employee transportation.



Environmental Performance



HIGH-PERFORMANCE, SUSTAINABLE BUILDINGS (HPSB)



25% of the PNNL campus comprises HPSBs. We exceeded DOE's goal of 15%.

We exceeded the DOE goal through strategic investments in building efficiency and collaboration with our research scientists on how we operate and measure energy performance. In 2012, PNNL certified two additional buildings as HPSBs.

FLEET VEHICLES

Petroleum-based fuel use

down **13%**

PNNL received a **2012 Sustainability Award** from DOE for efforts to right-size the vehicle fleet by removing inefficient



vehicles and replacing some with alternatively-fueled and electric vehicles. Drivers were engaged in the vehicle selection process to facilitate the transition. By right-sizing our fleet and changing the way we use vehicles, PNNL reduced petroleum use by 13% in only one year.

UNCOATED PAPER PURCHASES



PAPER PURCHASED WITH 30% RECYCLED CONTENT



SUSTAINABILITY PAY\$

Staff know best how to innovate, prevent waste, and conserve resources.

\$30,000
in staff-generated ideas were funded

ZERO WASTE EVENTS

All major employee events in 2012 were "zero waste." The largest event was the annual picnic, attended by nearly 1,000 employees, friends, and family members. Only through diligent planning, recycling, and donating food scraps to local farmers for feed are these sustainable events possible. Administrators put the zero waste tools to use at events throughout the year, and employees see and contribute to this responsible recycling culture. Waste reduction is taking hold at PNNL.



All percent changes on pages 6-7 are relative to 2011 unless otherwise noted.

Energy and Water Performance

BUILDING ENERGY USE INTENSITY

18%

reduction in building energy use intensity from 2003 baseline



RENEWABLES PURCHASED

Goal: at least 7.5% of electricity used from renewable sources by 2013



Met and exceeded goal with **65%** in 2012.

SCOPE 3 GHG EMISSIONS

down **7%**



IRRIGATION WATER USE

19%
reduction



Water use is down due to irrigation and landscaping efficiencies. One example is a project to reduce irrigated lawn area by creating an outside collaboration space with low-water plants and pervious concrete. Pervious concrete allows water to flow through it, which eliminates run-off and facilitates groundwater recharge.

OPPORTUNITIES FOR IMPROVEMENT

Building energy use

PNNL is striving to meet the aggressive federal goal of reducing energy use intensity in our facilities by 30% by 2015. Key energy saving measures implemented in 2012 included testing "core business hours" with evening system setbacks in a major research facility, consolidating server rooms into an efficiently operated data center, and use of real-time metering and building control data to more quickly identify and correct building operational inefficiencies.

Meanwhile we are driven by our DOE mission to solve problems of national interest in energy, environment, and security, such as bioenergy production and climate modeling, which require energy intensive computing.

Continued investment in efficiency measures and employee engagement in energy management will be essential to overcoming the growth in energy intensive research equipment and meeting our goals.

In the coming year, we plan to:

- perform energy audits and retro-commissioning.
- use Building Operation Control Center (BOCC) data to support real-time commissioning of building systems.
- continued data center consolidation, more efficient equipment, and air management strategies.
- purchase renewable energy certificates to further reduce the impact of our operations.

CHEMAGAIN

Surplus chemicals redistributed to those who need them.



600 chemical containers redeployed avoiding **\$686K** in costs

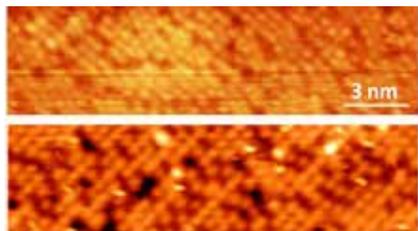
WASTE DIVERSION



diverted from landfill



Science for Planet

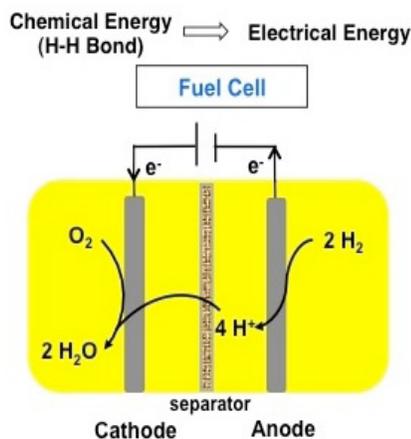
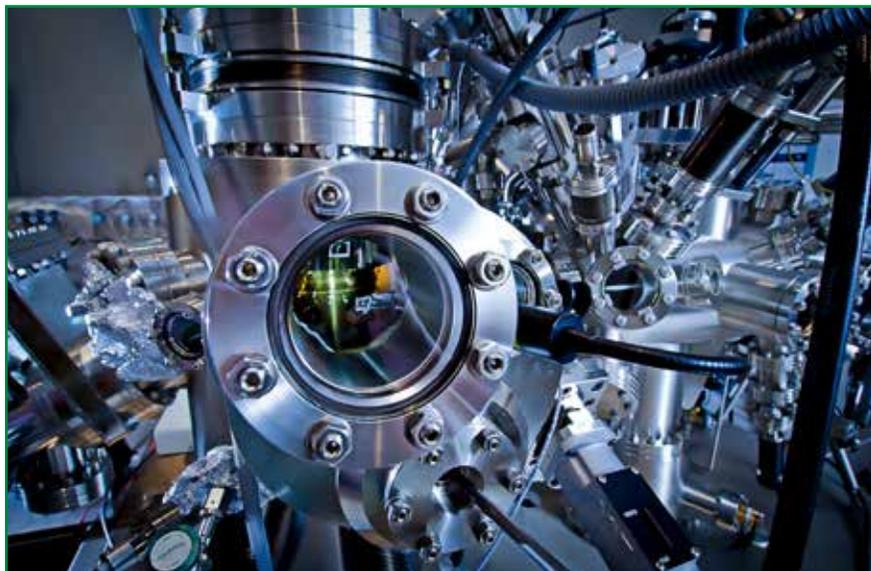


The team's new method is a two-step photochemical process. STM images show a rutile $\text{TiO}_2(110)$ surface first saturated with trimethyl acetic acid (top) then exposed to ultraviolet light irradiation to produce a highly hydroxylated surface (bottom).

Take water, add sunshine and produce energy

In theory, the correct combination and arrangement of atoms on a catalyst will split water when exposed to sunlight, producing energy-rich hydrogen. A team comprising Environmental Molecular Sciences Laboratory (EMSL), PNNL, and Worcester Polytechnic Institute scientists got closer to that theoretical goal. Their research findings were featured on the cover of the March 7, 2012, issue of *Physical Chemistry Chemical Physics*.

The EMSL user team developed a novel, two-step method to produce a titania (or titanium dioxide) surface rich in highly reactive hydroxyl groups. The team used several EMSL capabilities, including scanning tunneling microscopy and computing resources, to fully understand the fundamental structure and reactivity of the titania surface. The researchers' most important finding was that heating the surface did not affect the performance of the material. The atomic-level insights from the study have implications for better understanding how to tailor titania thin films for optimal performance in a variety of applications—from water splitting to hydrophilic coatings, transparent electrodes, gas sensors, water purification, pollutant degradation, and medical implants.



Biologically inspired catalyst could make fuel cells cheaper

Burning hydrogen in a fuel cell typically generates an electric current using expensive noble-metal catalysts.

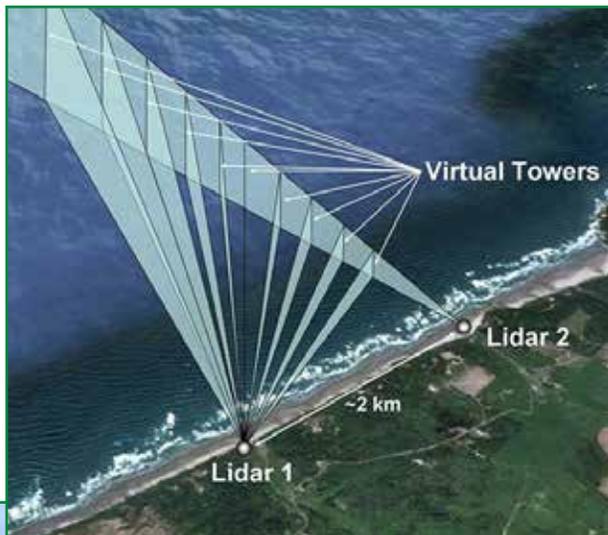
To make fuel cells more economical, engineers want a fast and efficient iron-based molecule that splits hydrogen gas to make electricity. On February 17, 2012 "Nature Chemistry" reported such a catalyst. It is the first iron-based catalyst that converts hydrogen directly to electricity. The result moves chemists and engineers one step closer to widely affordable fuel cells.

"A drawback with today's fuel cells is that the platinum they use is more than a thousand times more expensive than iron," said chemist R. Morris Bullock, who leads the research at PNNL.

Bullock's team in the Center for Molecular Electrocatalysis has been developing catalysts that use cheaper metals, such as nickel and iron. The one they report here can split hydrogen as fast as two molecules per second, with an efficiency approaching those of commercial catalysts. The center is one of 46 Energy Frontier Research Centers established by the DOE Office of Science across the nation in 2009 to accelerate basic research in energy.

PNNL to map the wind as part of DOE Offshore Wind Demonstration Project

PNNL scientists Larry Berg and Rob Newsom have laid the necessary groundwork for a DOE project that maps Oregon coast wind patterns. One of seven demonstration projects that are distributed around the U.S., the study site will be located in Coos Bay, Oregon, where the PNNL and Seattle, Washington-based Principle Power, Inc. team will use dual scanning Doppler lidars and mesoscale meteorological models to map wind speed and direction over large areas. Measurements obtained will be used to project the wind energy potential for onshore and offshore locations. In the next phase of the assessment, the lidars will be deployed offshore on the turbine platforms. PNNL partner Principle Power's innovative, semi-submersible, triangular platform foundations will be assembled near the project site in Oregon and deployed 10 to 15 miles off shore. The instruments will provide detailed measurements of wind coming into the turbine array and the wakes induced by the turbines. All the data collected will be used to optimize meteorological models.



WALK THE TALK

PNNL facilities and operations staff work closely with our energy researchers to ensure that our own campus uses resources with maximum efficiency. In this symbiotic way, the campus serves as a test-bed for and benefits from our own research. And research is accelerated with access to a real-world test bench.

The monitoring software (DSOM) used in the Building Operations Control Center (BOCC) was developed at PNNL. As a result of a research-operations partnership, a new function has been added to expedite the discovery of energy drains during core business hours, saving thousands of kWh. The new function helped BOCC operators easily see on a red bar chart that the HVAC systems in the Battelle Auditorium were running 24/7, when they should have been shut down during core business hours.

DSOM has now been programmed to automatically read the room schedule from Microsoft Outlook and control the occupancy mode in rooms or auditoriums based on real-use, as scheduled by employees in Outlook.

BOCC operators applied learning from "Building Re-Tuning" training to PNNL facilities. The free, web-based training was developed by PNNL researchers and is being deployed on university campuses; it only makes sense that we apply it to our own. Operators did building energy audit walk-throughs and knew what pitfalls to look for, thanks to the Re-Tuning training.

Automation of climate controls per real-time usage, monitoring and ensuring appropriate energy use for core business hours, and providing world-class building tuning training are all examples of how these research-operations partnerships help further the sustainability of the Lab.



Science for Planet

Nation's largest smart grid demo now live

PNNL's staff teamed with the University of Washington (UW), a participant in the ARRA-funded Pacific Northwest Smart Grid Demonstration Project, to launch phase 3 of the project at the UW campus in the fall of 2012.

The demonstration involves a two-way communications system, an evolution of PNNL's pioneering work in transactive controls, and will provide data from 60,000 metered customers within 11 utilities across 5 states, including students at UW. Participants will receive and be able to respond to real-time cost signals, curbing energy use during peak hours and reducing strain on the grid. Beyond testing transactive control on its own power generation, the demo has helped UW transform to a networked, "smart" campus where students can track and control their energy use. The project is expected to provide an unprecedented view into how smart grid concepts can provide regional benefits while improving consumer choice and reliability locally.



Bio-inspired technology enhances cybersecurity in the energy grid (Digital Ants)

Cybersecurity researchers at PNNL have developed a bio-inspired technology for detecting threats to the security of the electric grid. "Digital ants" can roam a computer network the same way that real ants patrol a nest. When a digital ant perceives a threat, it releases digital pheromones to attract other digital ants to the vicinity. Each ant provides a small piece of information that can be correlated to reveal the issue and the information is transmitted to human operators who can act on it. The algorithms that run digital ants were designed specifically for the Smart Grid. Digital Ants technology was selected by Scientific American as one of the "10 World Changing Ideas in 2010."

Social Responsibility



We carry out our commitment to social responsibility both through the science and technology we deliver to solve human health and safety challenges, and by enabling and inspiring our employees to achieve excellence. 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.



Social Performance



FARMER'S MARKETS

A dozen vendors
plus ~200 staff weekly

Buying local fruits and vegetables on campus once a week is healthy for the environment and the local economy.



OPERATIONAL EXCELLENCE ANNUAL SURVEY

87%



of respondents agreed that supervisors are accessible, care about their employees' success, and take their concerns seriously.

EMPLOYEE HEALTH AND SAFETY

Injury & Illness Incident Rate

TARGET MET!



Days Away From Work, Restricted Activity, or Transferred

down 5%
from 2011

TELEWORK LAUNCHED



Goal is 40% by 2020



3% participation weekly

Training, technology, and staff helped this new option become a rapid success in just a few short months. The telework option is an effort to get staff engaged in curbing GHG emissions from commuting. By the end of 2012, teleworkers were saving nearly \$5,000 in gas each month.

BUILDING A LEARNING ORGANIZATION

90% of staff members read

Operating Experience/Lessons Learned



When we learn from our own as well as others' experiences, we are part of creating an adaptive, dynamic Lab culture that strengthens collaboration, supports positive changes in behavior, and enhances operational excellence. In 2012 we:

- conducted 5 program demos for other national labs and DOE organizations
- partnered with SLAC National Accelerator Laboratory to share our program (over 1,900 articles) and innovative analysis tools, built with PNNL technology.

20TH ANNUAL WASHINGTON GOVERNOR'S EMPLOYER AWARD WINNER

Honors employers who have demonstrated exemplary practices to recruit, hire, retain, and promote individuals with disabilities.



Fostering the Next Generation

PNNL has a vested interest in helping underrepresented students excel in math and science and become the next generation American workforce.



MATH IS COOL

PNNL staff makes math fun for all local students by mentoring, starting a math club, and collaborating with educators to add a computer science curriculum at our local STEM high school, Delta High. The Delta Math Club (organized by PNNL scientist Eric Bell in 2010) took first place in "Math is Cool Masters," administered by Academics Are Cool. Chris Johnson and his Team Battelle Math Mentors/Coaches group tutors beyond Delta.

1,000

interns, fellows, and post-docs hosted at PNNL in 2012



The Lab's Mission, Vision, and Values were refreshed. They have a unifying theme for the Laboratory and were well received by staff. 182 employees submitted stories showing their engagement in one of the five core values—**courage, integrity, collaboration, creativity, and impact.**



CRAFT CAREER DAY

STEM isn't just for scientists and engineers. Every spring our crafts workers host **~40 high school students** to give them a glimpse of careers that demand technical skills.

30,000

jobs will go unfilled in Wash. by 2017 due to a lack of qualified STEM candidates.*



OPPORTUNITIES FOR IMPROVEMENT

Diversity in the STEM Workforce

As a national laboratory, we are trying to improve the ratio of employees from under-represented groups, especially females in science and technology. Part of the challenge is the lack of role models for women. At the same time, we are fostering STEM education in Washington among teachers and students of all genders and races, especially locally.

Through our Science & Engineering Education Division, teachers are immersed in STEM training and give students hands on science that sows the seeds of wonder and inquiry at an early age and fosters a passion for life-long learning. We are proud of our partnerships to advance STEM education in Washington, including Delta High School, Leadership in the Advancement of Science Education Reform (LASER), and MESA (Mathematics, Engineering, and Science Achievement).

MESA provides enriching opportunities in mathematics, engineering, and science for local 6-12 grade students who are underrepresented in STEM fields through the use of exemplary materials and instructional approaches. MESA is a catalyst and model for educational excellence and equity.

Hosting MESA and other interns and giving strong support to our partners is how we do our part to sustain a quality STEM workforce.



* Washington STEM

Science for People



SPLAT II, a single particle mass spectrometer, was used for detailed analysis of individual aerosol particles along a linear reaction chamber. For their study, the team transported the EMSL-built SPLAT II to UC Irvine. SPLAT II is shown above with co-inventor and PNAS article co-author Alla Zelenyuk.

SOA particles are long-lasting quasi-solids. These findings are significant in determining the effect of airborne particles on human health and in accounting for airborne particles in climate prediction models.

Climate models underestimate organic aerosols

Airborne particles impact human health, cause haze, and influence climate. An EMSL user team's findings may explain why secondary organic aerosols (SOA) have been significantly underestimated by currently accepted air quality and climate models. Results from the team's study were reported in the *Proceedings of the National Academy of Sciences*.

SOA make up more than half of the mass of airborne particles and result from the oxidation of volatile organics, such as pinene, which is excreted from pine trees into the air. The team members from the University of California, Irvine; PNNL; Imre Consulting; and Portland State University used EMSL's SPLAT II mass spectrometer to detail the chemistry that leads from pinene to SOA formation. The data also showed

New technology can "sniff" explosives

This PNNL technology provides a rapid, yet highly sensitive and accurate detection system to detect minute amounts of explosives in air. It is envisioned as a screening tool for passengers or luggage at airports or to assess large cargo containers at ports. Just like dogs, the technology can "sniff" the air to detect vapors from explosives. That includes explosives such as RDX and PETN, commonly used military explosives that are very dense and powerful, but have almost no vapor component. The technology collects a sample of air and efficiently converts the small number of explosives molecules to ions within a reaction tube. The ions then move directly to a mass spectrometer for detection and identification, which takes about one second. The technology is in the prototype stage, but the use of a commercially available mass spectrometer system should speed commercialization, and several companies have already expressed interest.



While a commercial-off-the-shelf mass spectrometer is used, the truly unique capability analysis lies in PNNL's ionization chemistry approach developed on the front end of the system.

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 Performance



EMPLOYEE VOLUNTEERISM THROUGH TEAM BATTELLE

Hygiene Kit Project – a corner stone for the past seven years. The effort is simple–take advantage of the travel our staff does and collect excess travel-sized toiletry products. Collection bins for these products are conveniently spread all over campus and donations are given to local food banks and the Union Gospel Mission.



Serving Food – over 20 PNNL staff members and their families gave up part of their Thanksgiving day to help serve our community at the annual Salvation Army Thanksgiving Dinner helping people have a brighter holiday.

Professional Clothing Drive – connects our staff’s gently used professional clothing with students at Columbia Basin College who aren’t able to afford the professional wardrobe necessary to start their new careers.

VOLUNTEER HOURS



**team
battelle**

WORKFORCE

4,454

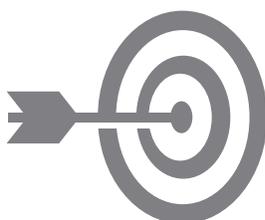


PURCHASED GOODS AND SERVICES

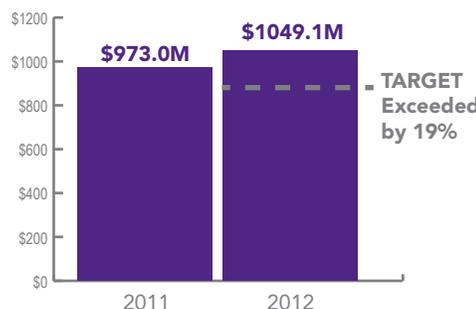
> \$392 million



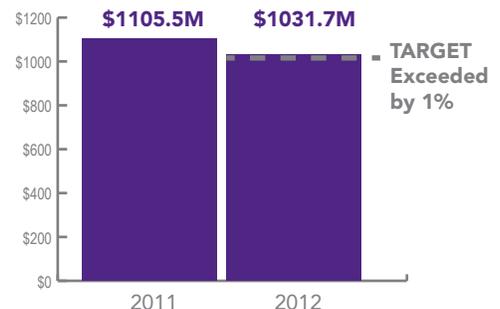
BUSINESS TARGETS MET



SALES



BUSINESS VOLUME



PNNL WINS 2 R&D 100 AWARDS



Fast-charging batteries for vehicles, electronics

Improving air quality in confined spaces

ANNUAL EMPLOYEE REFRESHER TRAINING

Consolidated from 7 to ~ **1½ hours** and offset over **\$2.8 million** in labor costs and training fees in first year, money redirected to Science & Technology.



OPPORTUNITIES FOR IMPROVEMENT

Small Business Procurement

PNNL is committed to the socioeconomic objectives of the U.S. Government and recognizes that diversity in subcontracting provides a vital link to the local community and strengthens the economy. Each year we set goals that challenge us to leverage the dollars we spend on goods and services required to support our research for the benefit of small and socioeconomically disadvantaged businesses. These include an overall goal for small business concerns, as well as goals for procurement spending on specific socio-economically disadvantage groups, including small disadvantaged business, women-owned small businesses, HUBZone small businesses, veteran-owned small businesses, and service-disabled, veteran-owned small businesses.

PNNL has consistently met most of the established small business goals in recent years. However, due to a small number of high value awards in 2012, we met only two of our six small business goals. To improve our performance in 2013, the Small Business Program Office will be working with employees who issue contracts for goods and services to:

- designate a Contracting subject matter expert for HUBZone and service disabled veteran-owned small business categories
- establish goals at lower levels in the organization
- engage with the Small Business Program Office earlier in the procurement process on procurements >\$150,000
- engage upper level management and our customers (e.g. Chief Operating Officers, Program Management Office Directors, Technical Oversight representatives) in discussions regarding small business goals.

\$413,000

Invested in Delta High School, STEM-focused and local



SUPPORTING VETERAN-OWNED BUSINESSES

6.5%

(goal 3%)



PATENTS

43 U.S. patents

75 foreign

2,153 combined total since 1965



SUPPORTING SMALL BUSINESSES

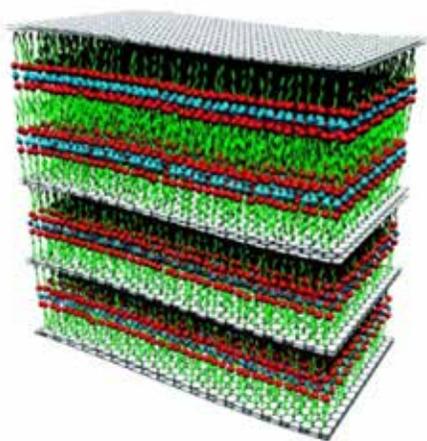
50%

spent on small and socioeconomically disadvantaged businesses (52% goal)



Science for Prosperity

“Today, a typical cell phone battery takes between two and five hours to fully recharge, and an electric vehicle has to be plugged in most of the night to recharge,” explained John Lettow, president of Vorbeck Materials. “The pioneering work done by Vorbeck, Princeton University, and PNNL is leading to the development of batteries that recharge quickly, reducing the time it takes to charge a smartphone to minutes and an electric vehicle to just a couple of hours.”



A material made of titanium oxide crystals and graphene enables electrodes for lithium-ion batteries to recharge twice as fast.

LITHIUM ION BATTERIES WITH GRAPHENE

Users of laptops, smart phones, and electric vehicles have a new friend, and it's called graphene. This revolutionizing substance, when added to lithium ion, dramatically improves the power and cycling stability of lithium ion batteries. But what really excites the every-day consumer is the potential the technology has to reduce the time it takes to charge cell phones, laptops, electric vehicles, and other battery-powered devices from hours to minutes.



The graphene technology was developed by PNNL in collaboration with Princeton University, and has been licensed to Vorbeck Materials of Jessup, Maryland. PNNL and Princeton's pioneering work in the field of graphene-based battery electrodes, together with Vorbeck's leading expertise in the production and application of high-quality graphene, will enable the rapid commercialization of this energy storage technology. Vorbeck is already working with materials distribution and supply company, Targray Technology International, to bring the novel battery electrode materials to market.

The innovative graphene-based battery technology led to Vorbeck being one of three companies selected in 2011 as America's Next Top Energy Innovators, an honor bestowed through the White House's "America's Next Top Energy Innovator Challenge," and in 2012, the technology won a prestigious R&D 100 Award.

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 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 us.

Performance measures that are less significant to DOE 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 2012 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." The reporting boundaries include government-owned/contractor-operated facilities, Battelle-owned facilities, and leased facilities that are managed as part of PNNL. It does not include Battelle's corporate headquarter or other facilities operated by Battelle outside of PNNL, 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:

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RECOGNITION

Sample Awards

- DOE Sustainability Award
- R&D 100 Awards (see p. 17)
- Federal Laboratory Consortium Award for Technology Transfer
- Federal Laboratory Consortium Interagency Partnership Award
- DOE Presidential Early Career Award for Scientists and Engineers (PECASE)
- DOE Secretary's Award of Excellence in Project Management
- DOE Classification Award of Excellence
- DOE Early Career Research Award
- 3 Fellows, American Chemical Society (ACS)
- 5 Fellows, American Association for the Advancement of Science

PNNL on the Cover



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 | G3.1 Indicator | Page, URL |
|-------------------------------------------|-------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Strategy and Analysis | 1.1-1.2 | Message from the Director, 2 Sustainability Performance Scorecard, 4 http://sustainable.pnnl.gov/report/kpi_tables.stm |
| Organizational Profile | 2.1-2.7 2.8-2.10 | 2, www.pnnl.gov/ http://sustainable.pnnl.gov/report/gri_content.stm |
| Governance | 4.1-4.10 4.11 4.12-4.13 | http://sustainable.pnnl.gov/report/gri_content.stm http://www.pnnl.gov/about/leadership.asp http://sustainable.pnnl.gov/report/stakeholder_engagement.stm http://sustainable.pnnl.gov/report/gri_content.stm , PR1 http://www.pnnl.gov/about/partnerships.asp ; http://www.pnnl.gov/edo/about/collaborators.asp |
| Stakeholder Engagement | 4.14-4.17 | http://sustainable.pnnl.gov/report/gri_content.stm |
| Disclosures on Management Approach | | http://sustainable.pnnl.gov/report/gri_content.stm |
| Environmental | | 5-10; http://sustainable.pnnl.gov/report/env_stewardship.stm |
| Economic | | 15-18; http://sustainable.pnnl.gov/report/economic_prosperity.stm |
| Society, Labor, and Human Rights | | 11-14; http://sustainable.pnnl.gov/report/social_responsibility.stm |
| Product Responsibility | | 8-10, 14,18 |
| Performance Indicators | | The print and PDF versions of this report contain only a subset of GRI performance indicators. All indicators can be found online at: http://sustainable.pnnl.gov/report/kpi_tables.stm |
| 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 G3.1 Guidelines. Our responsibility was to carry out an assurance engagement, verify data and provide specific suggestions for improvement.

We found that PNNL meets the guidelines and reported the information in the spirit of GRI disclosure. The 2012 Sustainability Report provides a balanced and reasonable representation of information concerning boundary setting, quality, report content, and material indicators. PNNL reported on all the core performance indicators, profile disclosures and management approaches. While these are not all incorporated in the print version, we have reviewed all the 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 and are confident in PNNL's disclosure.

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 addressed each one. These changes were included for the final version of the report.

Assurance approach:

Our activities included a review of the report content, reporting metrics and a selection of source data. We conducted several meetings with PNNL employees to discuss the accuracy and authenticity of report content, data points, methodologies and policies 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 the core performance indicators, profile disclosures, management approaches and assessed 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 two reviews
- 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 is doing more for sustainability than they have time to describe in their reporting procedures. Many of the efforts are simply from the employees' regular day to day and PNNL has the opportunity to put policy in place to support those efforts and have an even stronger sustainability performance and reporting. Community impact could be tracked with more metrics than just how many dollars are spent in the community. Social and environmental impacts come from each philanthropic effort at PNNL and the recipients could be asked to deliver the results of these impacts after project completion. This will assist future decisions when assessing the PNNL mission and its relation to incoming grant proposals. Risks associated with PNNL's sustainability efforts could be discussed as part of the overall benefit of sustainability and why PNNL chose the areas for its honeycomb.

Opinion: This was PNNL's fourth GRI-based sustainability report. The organization has once again demonstrated rigorous procedures for data gathering and reporting, and has improved its reporting efforts by committing to a stronger stakeholder engagement process. We fully support the company's self-assessment that its 2012 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 5, 2013

Key Performance Indicator Summary Table

| GRI Indicator | Indicator Title | 2009 | 2010 | 2011 | 2012 |
|----------------------------------|------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|-----------------|-----------------|-----------------|
| Economic Performance | | | | | |
| EC1 | Sales ¹ | \$1,074,450,000 | \$1,162,000,000 | \$972,743,000 | \$1,049,100,000 |
| | Business volume (total operating costs) | \$1,058,584,000 | \$1,112,400,000 | \$1,105,500,000 | \$1,031,700,000 |
| EC3 | Coverage of the organization's defined benefit plan obligations. | | | | |
| | Estimated value of pension plan liabilities | \$775,117,033 | \$805,103,296 | \$985,232,652 | \$919,274,442 |
| | Percentage contributed by employer | 4% | 4% | 4% | 3.5% |
| | Level of participation in retirement plans | 90% | 92% | 96% | 85% |
| Environmental Performance | | | | | |
| Materials | | | | | |
| 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. | | | |
| | | not reported | 98% | 97% | 99% |
| Energy | | | | | |
| EN3 | Direct energy consumption by primary energy source (kBtu) ² | 130,065,345 | 131,047,079 | 121,887,466 | 126,157,198 |
| | Natural gas | 118,781,300 | 120,341,500 | 110,824,100 | 116,916,100 |
| | Propane | 1,066,778 | 627,511 | 589,661 | 385,103 |
| | Gasoline | 4,391,250 | 4,435,875 | 3,938,750 | 3,417,880 |
| | Diesel | 1,765,880 | 1,788,675 | 1,575,909 | 1,293,308 |
| | Jet Fuel | 3,151,845 | 2,907,630 | 3,571,155 | 2,587,815 |
| EN4 | Indirect energy consumption by primary source (kBtu) | 305,805,420 | 330,557,569 | 338,468,496 | 330,633,480 |
| | Non-renewable | 281,714,789 | 132,173,353 | 141,331,736 | 125,295,328 |
| | Renewable | 24,090,631 | 198,384,216 | 197,136,760 | 205,338,152 |
| Water | | | | | |
| EN8 | Total water withdrawal (gallons) ³ | 634,529,882 | 638,262,078 | 668,869,887 | 553,205,569 |

¹Sales values for 2011 modified to reflect final values after accounts were reconciled.

²Historic values for gasoline, diesel, and E85 were updated for the years 2010-2011 due to incomplete accounting of some fuel receipts in those years.

³This includes a small amount of water use from facilities outside of our operational boundaries that is not metered separately. Also, water use in one facility was inadvertently underreported for 2011. That value has been updated based on actual metered consumption.

⁴Emissions values reported for 2009 were updated with more complete data on fugitive emissions. Values reported in 2010 and 2011 were updated with more accurate data on fleet vehicle fuel use as noted above.

⁵Values reported for business travel emission for all pasts years were updated due to a calculation error found during QA. Also, the commute calculation methodology was changed to use more conservative assumptions about miles driven by part-time employees.

⁶Scope 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."

⁷Scope 3 "other indirect emission" sources include employee business travel (air and ground), employee commuting, and waste disposal.

| GRI Indicator | Indicator Title | 2009 | 2010 | 2011 | 2012 |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|------------------|------------------|
| Emissions | | | | | |
| EN16 ⁴ | Total direct (scope 1) ⁶ and indirect (scope 2) greenhouse gas emissions (metric tons of CO ₂ equivalent) | 44,145 | 50,030 | 51,577 | 44,560 |
| EN17 ⁵ | Other relevant indirect greenhouse gas emissions (scope 3) ⁷ by weight (metric tons of CO ₂ equivalent) | 27,197 | 30,322 | 28,757 | 26,827 |
| Waste | | | | | |
| EN22 | Total weight of waste by type and disposal method (tons) | | | | |
| | Recycled | 492 | 692 | 718 | 656 |
| | Recycled demolition | 2,474 | 558 | 1,047 | 2,007 |
| | Landfilled | 666 | 766 | 635 | 667 |
| | Composted | 0.64 | 0.86 | 1.5 | 47 |
| | Regulated hazardous waste | 289 | 138 | 47 | 34 |
| | Rad-containing waste—landfilled (after stabilization, size reduction, and/or thermo-treatment) | 70 | 467 | 199 | 230 |
| Social Responsibility | | | | | |
| Labor Practices & Workforce Performance | | | | | |
| LA1 | Total workforce by employment type, employment contract, and region (excludes interns) | 4,136 | 4,289 | 4,299 | 3,907 |
| LA2 | Total number and rate of employee turnover by age group, gender, and region | 4.5% | 5.7% | 6.4% | 12.5% |
| 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) | 0.79 | 0.77 | 0.49 | 0.65 |
| | Days Away, Restricted, or Transferred | 0.29 | 0.24 | 0.21 | 0.20 |
| LA11 | Programs for skills management and lifelong learning that support the continued employability of employees and assist them in managing career endings | 161 participants | 156 participants | 296 participants | 180 participants |
| Product Responsibility Performance | | | | | |
| 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+ | A- | A- |
| 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 http://sustainable.pnnl.gov/report/kpi_tables.stm | | | | | |

CREATIVITY

Chris Montgomery displayed *Creativity* when she instituted a process/approach that encouraged EMSL staff to use previously printed-on paper for working draft copies. By doing this, she was able to reduce their paper consumption by 43%—saving 30,000 pieces of paper. Chris took the initiative to implement a new process and track the results. It’s a well-organized activity with clear directions, making it easy for people to participate. She even went through old files and salvaged one-sided papers.



INTEGRITY

Allison Campbell, Associate Laboratory Director for EMSL, has the *Integrity* to climb on her bike early in the morning to ride the 17 miles to work (and back again in the evening). Her passion for sustainability emerges when she leads a change leadership team for the Lab to find ways we all can contribute to be less impactful on our environment. She routinely partners to further new ideas involving technology that can save power, water or fuel, and she challenges us to be better stewards of our environment, even if it makes us a little uncomfortable. Anyone who works for Allison also knows that she frowns upon printing paper documents, unless absolutely necessary.



COLLABORATE

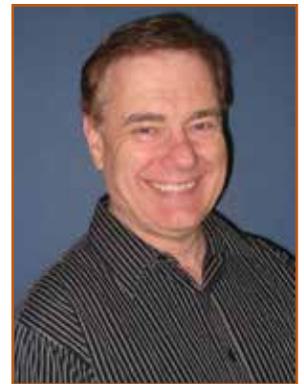
Battelle Washington Office Operations Manager Wavery Brown *Collaborated* with others around her to change their habits for the better. Wavery’s enthusiasm for sustainability is contagious; just ask any one of the approximately 2,000 folks from the 12 organizations that occupy the 10-floor building where she spearheaded the formation of a Sustainability Council for the entire building, including non-PNNL tenants. In its first year, the Council held an Earth Day event, promoted healthy habits for wellness and recycling, educated about climate change and energy efficient homes, provided CPR/AED training, and added bike racks in the parking garage.



Inaugural Earth Day event at our Washington, D.C. office, organized by **Wavery Brown**

IMPACT

When Steve Butterworth walked past a pop machine one day, he thought about electricity instead of soda, which prompted him to suggest equipping them with a Vending Mi\$er® that cuts power consumption up to 60%. Provided with a rebate by Seattle City Light, wall-mounted Mi\$ers use sensors to power down lights on pop machines when people are away, running the compressor just enough to keep drinks cold for the next buyer. The units are “invisible,” because lights come up as people approach, but the positive *impact* on the balance sheet is readily apparent—coming mostly after hours and on weekends.



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.

Mission

We transform the world through courageous discovery and innovation.

Vision

PNNL science and technology inspires and enables the world to live prosperously, safely, and securely.

DISCOVERY

in Action

CREATIVITY
integrity *Values* courage Impact
COLLABORATION



Pacific Northwest
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Pacific Northwest
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U.S. DEPARTMENT OF
ENERGY

PNNL Sustainability

