



Pacific Northwest
NATIONAL LABORATORY

Proudly Operated by Battelle Since 1965

Innovative Solutions
for a Sustainable World

SUSTAINABILITY REPORT EXECUTIVE SUMMARY

2016

ENVIRONMENTAL STEWARDSHIP | SOCIAL RESPONSIBILITY | ECONOMIC PROSPERITY



U.S. DEPARTMENT OF
ENERGY

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PACIFIC NORTHWEST NATIONAL LABORATORY

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MESSAGE FROM THE DIRECTOR

At the United States (U.S.) Department of Energy's (DOE's) Pacific Northwest National Laboratory (PNNL), we have long recognized that excellence in scientific discovery, technological innovation, environmental stewardship, and social responsibility is foundational to delivering solutions to some of America's greatest challenges.

In fiscal year (FY) 2016, we achieved many successes, including impactful contributions to our sponsors' missions, strong programmatic growth, and investment in our campus and people. We also managed operations with distinction, including improved safety and reduced costs. Together with our academic and industry partners, we are building innovative solutions to protect the environment and reduce energy, waste, and water use through smarter technologies.

In this report, we share a snapshot of our FY2016 activities aimed at global sustainability challenges across the science, energy, environmental, and security realms, including:

- **Leading the way for sustainable design** – Our campus master plan is putting our sustainability science and technology (S&T) to use right here at home. This year, we put the finishing touches on another building that achieves the Guiding Principles for High Performance and Sustainable Buildings, broke ground on our new S&T Collaboration Center, and implemented several novel concepts to support sustainable operations.
- **Planning for a cleaner future** – This year, our research into hydrothermal liquefaction explored how human waste may be converted into biocrude oil with properties similar to fossil fuels. Additionally, both of the PNNL technologies recognized with R&D 100 Awards this year address environmental concerns—one contributes to reducing global greenhouse gas emissions and the other tracks contamination beneath the Earth's surface.
- **Going green in our purchasing** – We were one of four DOE sites to earn the top honor of Three-Star 2016 EPEAT® (Electronic Product Environmental Assessment Tool) Purchaser Award for excellence in the sustainable procurement of electronics. Nearly 100 percent of our eligible acquisitions were EPEAT-registered products and ENERGY STAR® certified.
- **Fostering the next generation** – In addition to hosting more than 1,000 interns, fellows, and research associates this year, we welcomed more than 480 children to Take Our Daughters & Sons to Work Day to engage them in science, technology, engineering, and math activities and careers.

Going forward, I believe that PNNL is positioned to make even greater contributions, delivering more impactful S&T and providing solutions for more affordable and environmentally friendly operations. We will continue our focus on creating a culture of creativity and innovation, strengthening partnerships with our sponsors and the scientific community, and becoming more widely recognized as a world-class scientific research institution. We hope this annual report enables you to follow our triple-bottom-line journey of **environmental, social,** and **economic** responsibility.


Dr. Steven Ashby
Laboratory Director



INTRODUCTION

This executive summary of PNNL's FY2016 Sustainability Report provides performance highlights across the environmental, social, and economic dimensions of our operations. The full report is available online at the website <http://sustainable.pnnl.gov>. PNNL uses an external standard for sustainability reporting to enable a balanced, transparent, and comparable representation of our organizational performance. Our performance assessment and reporting approach aligns with the Global Reporting Initiative (GRI) guidelines, which enable organizations of all types to disclose results in a similar way. The GRI provides an integrated view of the environmental, social, and economic impacts that are important to our stakeholders and PNNL's long-term success.

SUSTAINABILITY REPORT

See the full contents of our sustainability report at <http://sustainable.pnnl.gov>

Much like a honeycomb with its interlocking pieces that gain strength through mutual support and integration—our three pillars and 12 focus areas create a sustainability program that is greater than the sum of its parts. This is our triple bottom line.



ABOUT PNNL

Located in Richland, Washington, PNNL is one of 17 DOE national laboratories and one of 10 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 Defense and the National Institutes of Health, as well as private industry. At the end of FY2016, PNNL employed approximately 4,400 people and had an annual budget of nearly \$1 billion. PNNL has been managed for DOE by Ohio-based Battelle since the Laboratory's inception in 1965.

2016 SUSTAINABILITY SCORECARD

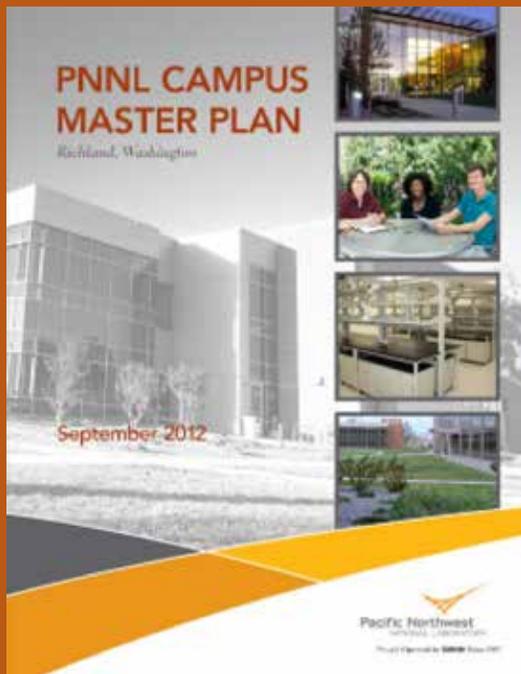
		2015	2016	
ENVIRONMENT	Reducing building energy use and greenhouse gas (GHG) emissions			
	<ul style="list-style-type: none"> Reduce Scope 1 and 2 GHG emissions 50% from 2008-2025 after renewable electricity purchases (FY25 Target: 21,843 MTCO₂e) 	0	12,609	
	<ul style="list-style-type: none"> Reduce energy use intensity in buildings 25% from 2015-2025 (FY25 Target: 126 kBtu/ft²) 	167	167	
	<ul style="list-style-type: none"> At least 10% of electricity use from renewable sources 	53%	53%	
SOCIAL	Traveling smarter			
	<ul style="list-style-type: none"> Reduce petroleum-based fuel use in fleet vehicles 20% from 2005-2015 and maintain thereafter (FY16 Target: 31,060 GGE) 	28,988	31,053	
	<ul style="list-style-type: none"> Reduce fleet-wide per mile GHG emissions 30% from 2014-2025 (FY16 Target: 744 gCO₂e/mile) 	728	738	
	<ul style="list-style-type: none"> Reduce Scope 3 GHG emissions from employee transportation 25% from 2008-2025 (FY25 Target: 18,091 MTCO₂e) 	21,190	22,804	
ECONOMIC	Minimizing water use			
	<ul style="list-style-type: none"> Reduce potable water use intensity 36% from 2007-2025 (FY25 Target: 45 gallons/ft²) 	23	24	
	<ul style="list-style-type: none"> Reduce irrigation water use 30% from 2010-2025 (FY25 Target: 123M gallons) 	168M	167M	
SOCIAL	Reducing material purchases and waste			
	<ul style="list-style-type: none"> Divert at least 50% of sanitary waste from landfills 	54%	54%	
	Keeping employees healthy and safe			
	<ul style="list-style-type: none"> Total recordable case rate ≤ .65² Days away, restricted, or transferred rate ≤ .25¹ 	0.86 0.46	0.45 0.42	
ECONOMIC	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	
	Creating an inclusive work environment			
	<ul style="list-style-type: none"> No goal established 			N/A
ECONOMIC	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	4.6	
	Transferring technology that makes a difference			
	<ul style="list-style-type: none"> Economic contribution to global economy from licensed technologies (Target: Minimum=\$50M, Stretch=\$100M) 	\$108.7M	\$130.0M	
ECONOMIC	Maintaining financial viability through research and operational excellence			
	<ul style="list-style-type: none"> Sales targets: >\$812M in 2015 and >\$885M in 2016 	\$918.5M	\$1,082.9M	
	<ul style="list-style-type: none"> Operating budget targets: >\$931M in 2015 and >\$934M in 2016 	\$955.1M	\$920.4M	
ECONOMIC	Supporting small businesses			
	<ul style="list-style-type: none"> Award at least 50% of procurement dollars to small businesses² 	57%	49.3%	
	Giving back to our communities			
	<ul style="list-style-type: none"> Philanthropic investments (No target)³ 	\$621,740	\$625,114	N/A

1. Reported per 200,000 employee hours worked.
 2. While PNNL did not meet the overall target, the procurement spent to small businesses classified as disadvantaged, woman-owned, and service-disabled veteran-owned was above the goal.
 3. Philanthropic investments are distributed by a committee of employees from Battelle's Pacific Northwest Division.

did not meet target risk of not meeting target met or on track to meet target

BUILDING A SUSTAINABLE CAMPUS

As a leading research institution, we aim to enhance global sustainability by operating as a “living laboratory.” We explore issues that affect not only our campus but also the world around us by putting our own scientific discoveries and sustainability best practices into action where we work.



One of our greatest environmental challenges is reducing building energy intensity and water use necessary to maintain the facilities and operational requirements to achieve our mission. The PNNL Campus Master Plan captures our holistic, campus-wide approach that helps us be forward-thinking in our efforts to foster a sustainable, collaborative, modern, and flexible campus.

FY2016 Campus Highlights

- We checked off a key action item in our campus development— construction of the General Purpose Chemistry Laboratory (GPCL), which is a 16,000-square-foot, single-story facility that meets the High Performance and Sustainable Building (HPSB) guidelines.
- We developed a comprehensive Water Management Plan that examines PNNL’s water consumption. The plan presents opportunities to improve water conservation and efficiency, which have contributed to effectively reducing consumption by 5.5% from the 2011 baseline. This includes utilizing natural plants and rockeries requiring minimal irrigation at our GPCL and Systems Engineering Building facilities.
- We observed a net energy reduction of 0.3% from FY2015, which was supported by stronger staff engagement and effective use of our Building Operations Control Center (BOCC). While we did not achieve our target of a 2.5% reduction by FY2016, we are committed to using the BOCC to continuously monitor the campus to look for opportunities to improve energy usage at our high-energy, mission-specific facilities. These efforts will continue to be captured in our annual Site Sustainability Plan and future reports.
- We extended our electrical vehicle (EV) infrastructure with two new EV charging stations and three additional pedestals underway. PNNL also incorporated installation of EV charging stations into our Engineering Design Standards, which enables the process to be repeated in all major renovations to buildings, parking lots, and new building construction projects.
- In anticipation of our new S&T Collaboration Center, the PNNL Operations Management Team decided to discontinue irrigation of the turf on the soon-to-be construction site, avoiding an estimated 900,000 gallons of water.



Our newest HPSB, the GPCL, houses 10 laboratories to support a variety of DOE missions, including energy storage.

LOOKING FORWARD

We challenge ourselves to set priorities and continuously improve performance for the benefit of our employees, our organization, and our community. Our agenda for FY2017 is packed with activities to advance our sustainability performance across our campus and our organization. Planned activities include:

- Begin construction on a new S&T Collaboration Center and push the envelope on sustainable design.
- Revisit our approach to promote use of alternative commute options to reduce emissions from employee transportation.
- Work with DOE, other Hanford contractors, and the City of Richland regarding changes to the 300 Area fire, water, and sewer service provider over the next two years.
- Promote vehicle sharing and short-term rentals (where viable) to reduce petroleum consumption.
- Complete development of and begin prioritizing recommendations from PNNL's Net Zero Energy Roadmap.
- Continue fostering a culture of sustainability by leveraging the Building Sustainability Champions and other communication channels to promote initiatives such as the "Let's Recycle Right – Single-Stream Recycling" campaign.
- Use the 2016 Water Management Plan to reduce irrigation water use.



Looking forward, we will continue to integrate best practices for sustainable buildings into the day-to-day operations of our campus.

ENVIRONMENTAL STEWARDSHIP



ENVIRONMENTAL STEWARDSHIP

It may sound like science fiction, but wastewater treatment plants may one day turn ordinary sewage into biocrude oil, thanks to research at PNNL. The technology, hydrothermal liquefaction (HTL), mimics the geological conditions the Earth uses to create crude oil, using high pressure and temperature to achieve in minutes something that takes Mother Nature millions of years. The resulting material is similar to petroleum pumped out of the ground, with a small amount of water and oxygen mixed in. This biocrude can then be refined using conventional petroleum refining operations.

In other words, what we flush can be converted into a biocrude oil with properties very similar to fossil fuels. Wastewater treatment plants treat approximately 34 billion gallons of sewage every day. That amount could produce the equivalent of up to approximately 30 million barrels of oil per year. PNNL estimates that a single person could generate two to three gallons of biocrude per year.

HTL eliminates the need for drying, which historically has made wastewater-to-fuel conversion too energy intensive and expensive. HTL may also be used to make fuel from other types of wet organic feedstock, such as agricultural waste, and the process could give local governments significant cost savings by virtually eliminating the need for sewage residuals processing, transport, and disposal.

Hydrothermal liquefaction (HTL) mimics the geological conditions the Earth uses to create crude oil, using high pressure and temperature to achieve in minutes something that takes Mother Nature millions of years.



The technology mimics how the Earth makes crude oil. Biocrude oil, produced from wastewater treatment plant sludge, looks and performs virtually like fossil petroleum. (Left photo courtesy of WE&RF).

Sustainability Pay\$



Through Sustainability Pay\$, PNNL's Sustainability and Pollution Prevention (P2) Programs jointly provide funding to empower staff to lead grassroots sustainability improvement projects. Since 2013, the program has awarded more than \$200,000 to staff-generated sustainability initiatives in the areas of energy and water conservation, materials purchasing, greenhouse gas (GHG) emissions reduction, and waste minimization.

Championing Sustainability by Changing Behavior

Modeled after the success of the FY2015 "Rock the Watt" conservation campaign, the sustainability team embedded additional Building Sustainability Champions across campus to build advocacy for a sustainability culture shift at PNNL. These 18 volunteers identified nearly 40 employee-driven energy- and recycling-related improvement opportunities in FY2016. Additionally, leveraging the volunteers' personal outreach, the composting team has grown from 5 to 21 leads.



Row 1 (l to r): Judy Thomas, Lelia Cosimbescu, Jennifer Su-Coker, Miranda Striluk, Michael Dion. Row 2: Brian Moon, Joe Brown, Derek Neal, Maggie Jones, Filipe Leon, Brandon Thayer. Row 3: Meg Pirrung, Colleen Winters, Michel Gray. Row 4: Mike Moran, Leo Fifield, Margaret Pieczkowski, Danny Taasevigen. Not pictured: Sadie Bender, Shan Belew, Juliet Homer, John LaFemina, Briana Durkin, Robin Sullivan, Franny White, Sam Bigger, Tricia Smurthwaite, Stephanie Gregory, Allison Coyne, Morris Good, Ryan Bouffieux, and Nancy Washton.

At a Glance



FLEET VEHICLES

Petroleum-based fuel use

20%

reduction from FY05 baseline



- ▶ 79% of light-duty vehicles are alternative fuel vehicles
- ▶ 4% reduction in fleet-wide per-mile GHG emissions from FY14 baseline



ENERGY USE



0.3%

reduction in building energy use intensity from FY15 baseline

53%

of annual electricity consumption is renewable electric energy

SUSTAINABLE BUILDING DESIGN

67%

of existing buildings greater than 5,000 gross square feet are High Performance and Sustainable Buildings

SUSTAINABLE ACQUISITION

99.75%

of eligible acquisitions were Electronic Product Environmental Assessment Tool (EPEAT) registered products – earned recognition from Green Electronics Council for an EPEAT Purchaser Award



PNNL received DOE's GreenBuy Award for excellence in the purchasing of custodial, construction, and office products

WATER USE

66%

reduction in building water use intensity from FY07 baseline



5.5%

decrease in irrigation water use from FY11 baseline.

WASTE DIVERSION

54%

of nonhazardous solid waste diverted from landfills through recycling and composting



PAPER

96%

of uncoated paper purchased contains at least 30% post-consumer content

ALTERNATIVE COMMUTING

5.5%

reduction in GHG emissions related to employee commute and business travel



SOCIAL RESPONSIBILITY



SOCIAL RESPONSIBILITY

Fostering the next generation of scientists and engineers means getting kids of all backgrounds excited about STEM subjects. This year, we hosted our annual Take Our Daughters & Sons to Work Day and welcomed 20 Native American students from Yakama Nation Tribal School as part of the White House "My Brother's Keeper" initiative. In total, more than 480 children converged on our campus to learn more about PNNL and their parents' jobs. The sustainability leadership team educated staff members and their children about how we can make our campus and community more sustainable.



Two staff members received the 2016 Fitzner-Eberhardt Award.

Enhancing STEM Outreach

Two staff members received the 2016 Fitzner-Eberhardt Award, given in memory of two scientists at PNNL who dedicated their lives to wildlife preservation and education. The award is given annually to those who go above and beyond to enhance public understanding of STEM education.

Christian Johnson, a chemical engineer, was awarded for his support of mathematical education. His volunteerism inspired an additional 31 volunteers to contribute 163 hours each month to coach and tutor math students. In 2009, Chris started the Math Mentors/Coaches project as part of the Team Battelle program. Since then, more than 2,500 students have benefited from the project, which includes student mentoring, math competitions, and after-school clubs. Additionally, Chris supports efforts related to PNNL's Office of STEM Education.



One of Elizabeth's most notable contributions was successfully preparing community partners and educators to teach a programming component of MESA's annual engineering design challenge for students.

Elizabeth Stephens, materials science engineer, was recognized with a Fitzner-Eberhardt Award for her support of numerous local, regional, and national STEM education efforts. Liz serves as PNNL's official liaison for the Yakima Valley/ Tri-Cities Mathematics, Engineering, Science Advancement (MESA). Liz promotes STEM education in a variety of ways, from conducting workshops to providing technical assistance at academic competitions. One of her most notable contributions was successfully preparing community partners and educators to teach a programming component of MESA's annual engineering design challenge for students. Liz also has dedicated numerous evenings and weekends to running workshops for students and parents on STEM-field career development. Her contributions have impacted more than 1,200 students, 150 teachers, and 250 principals throughout the years.



Grants Take STEM Education to Next Level

Across the Tri-Cities and Washington State, students have increasingly more opportunities to get pumped about science, engineering, technology, and mathematics, thanks to a host of STEM education organizations. Battelle, which operates PNNL, boosted that network in 2016, awarding over \$300,000 in grants to benefit K-12 schools, higher education institutions, community partnerships, and other non-profit organizations. PNNL is also a co-founder of the Mid-Columbia STEM Education Collaboratory, which seeks to improve STEM education, increase STEM workforce preparation for all, and actively engage the Mid-Columbia community in its projects.



Social Performance



VOLUNTEER HOURS



for 66 local organizations

**team
battelle**

HEALTH & SAFETY

910 participants and
74 teams participated in the 2016 Summer Wellness Challenge

1.4M exercise points logged



BIKE ANYWHERE

88 staff members in Richland, Seattle, and Sequim participated in the national "Bike Anywhere Challenge" and logged their miles throughout the month of May

14,600 miles ridden by 7 PNNL teams participating in the federal league of the challenge nationwide



AWARDS



Received the 2016 Large, Non-Profit Employer of the Year Award for commitment to creating disability friendly workplace

EMPLOYEE SATISFACTION

4.6/5

average participant satisfaction rating from professional development program



TELEWORKING



6% staff teleworked weekly

52,781 days teleworked



OUTREACH

~1,500

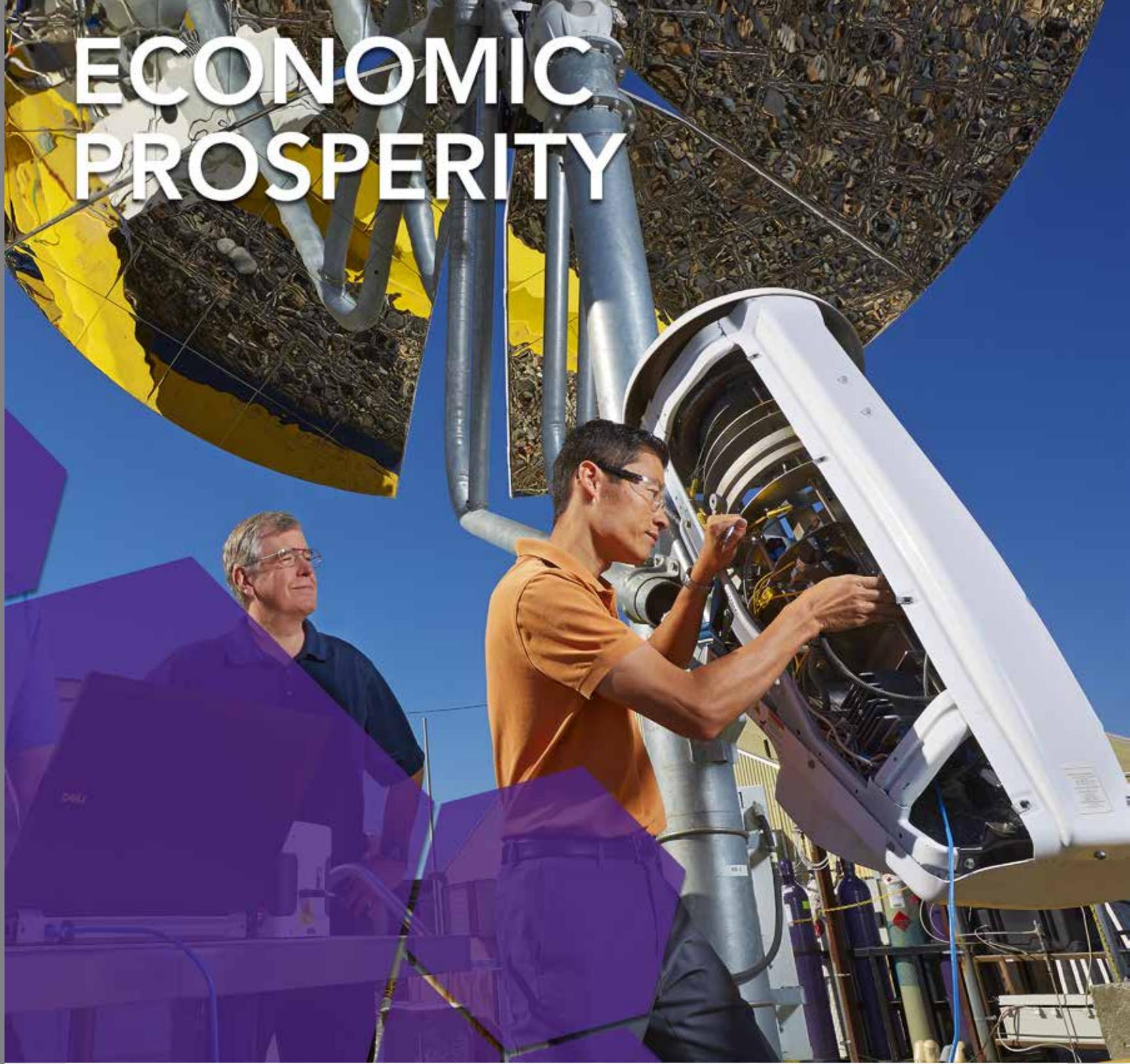
staff members attended the annual zero-waste Voluntary Protection Program picnic

480

children visited PNNL for Take our Daughters and Sons to Work Day, including 20 Native American students as part of the "My Brother's Keeper" Initiative



ECONOMIC PROSPERITY



ECONOMIC PROSPERITY

PNNL was one of four DOE sites to earn the top honor of Three-Star 2016 EPEAT® (Electronic Product Environmental Assessment Tool) Purchaser Award in recognition of excellence in the sustainable procurement of electronics.

In FY2016, 99.75% of eligible acquisitions were EPEAT-registered products and 100% are currently ENERGY STAR certified. PNNL accomplished this with a policy that requires all personal computers, printers, and peripheral device procurements to go through our Managed Hardware Program. The Managed Hardware Program selects EPEAT-registered products almost exclusively, and staff members make purchase selections within those options.

EPEAT purchasers must have a written policy in place that requires the purchase of EPEAT-registered electronics and commit to report annual purchase volumes of EPEAT-registered products.



PNNL earned the top honor of Three-Star 2016 EPEAT® Purchaser Award for sustainable electronic purchases.

Helping Small Green Energy Businesses

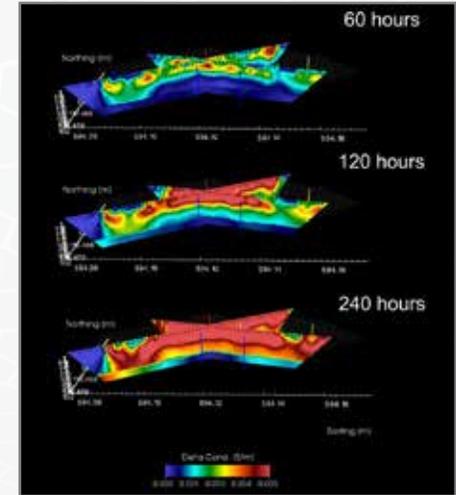
Hydropower costs could be reduced, buildings could use less energy, and adhesives could be made from plants under three new projects announced by the DOE in FY2016. PNNL is being awarded a total of \$625,000 to advance these technologies as part of the first round of funding for DOE's new Small Business Vouchers Pilot. Nearly \$6.7 million in total funding to national laboratories was announced to support technologies being developed by 33 different small businesses.



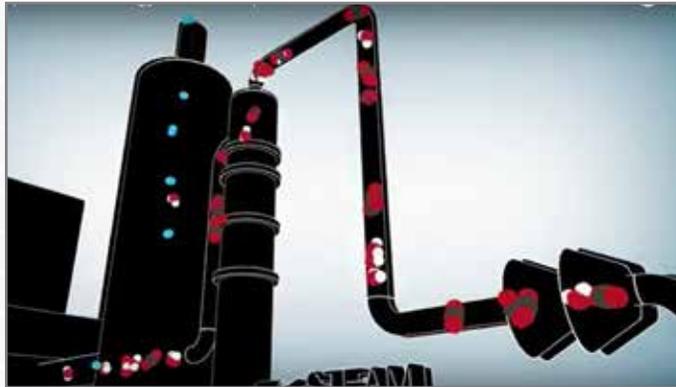
AWARD-WINNING S&T PROTECTING THE ENVIRONMENT

Two PNNL tools that track underground contaminants and speed carbon capture technology development were among the 100 most innovative scientific breakthroughs announced by R&D Magazine in 2016.

- The **Carbon Capture Simulation Initiative, or CCSI, Toolset** is a suite of computational tools and models that supports and accelerates the development, scale-up, and commercialization of post-combustion carbon capture technologies, which are critical for reducing global GHG emissions resulting from fossil fuels. The CCSI Toolset was developed through the Carbon Capture Simulation Initiative, sponsored by DOE's Office of Fossil Energy and led by DOE's National Energy Technology Laboratory.
- **Real-time Four-Dimensional Subsurface Imaging Software, also known as E4D-RT**, is helping protect the environment below the Earth's subsurface. The software is used to determine the extent of soil contamination and what is driving its migration—which can ultimately assist in cleanup decisions and solutions.



E4D-RT allows users to remotely differentiate contaminants from clean soils and determine what is causing the contaminants to migrate underground.



Power plant carbon emissions could be captured with the help of more detailed information and with reduced technical risk thanks to the CCSI Toolset.

Economic Performance



ECONOMIC DEVELOPMENT

179 businesses with roots to Battelle, operator of the Laboratory, and PNNL technology or personnel

3,701 total employees; for Washington State this represents 2,293 jobs



PROCUREMENT OF GOODS AND SERVICES

\$314
million

INVESTMENT IN STEM

\$71,000

invested in FY16 in Tri-Cities, WA to Delta High School, a STEM-focused school; total support since 2007, including cash and in-kind support, is estimated at **\$4.5 million**

LOCALLY OWNED

14%

portion of spending on local suppliers

PHILANTHROPIC AND CIVIC ORGANIZATIONS

\$625,114

invested in local area philanthropic and civic organizations

SMALL BUSINESS PROCUREMENT

49.3% to Small Businesses

11.5% to Small, Woman-Owned Businesses

4.4% to Veteran-Owned Businesses

EMPLOYEES TAKE ACTION FOR EFFICIENCY



\$5,000

in efficiency rebates received from local utility

PENSION PLAN

\$1.211

billion - value of pension plan liabilities

R&D 100 AWARDS

2 R&D 100 Awards in FY16, for a total of 100 since 1969

PUBLISHING SCIENCE FOR THE PUBLIC GOOD



1,058

peer-reviewed, published articles

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<http://sustainable.pnnl.gov>
or
e-mail sustainability@pnnl.gov
for more information.

