FY2017

SITE SUSTAINABILITY PLAN

Building Blocks for a Sustainable Campus

Pacific Northwest
NATIONAL LABORATORY

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PNNL-26048

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Site Sustainability Plan

Building Blocks for a Sustainable Campus

Contents

On The Cover: The newest High Performance and Sustainable Building at PNNL, the nearly completed 3850 General Purpose Chemistry Laboratory, is featured with the recently completed LEED Gold 3820 Systems Engineering Building in the background. Low-impact and sustainable landscaping was used at these new facilities including native plants and grasses that require very little water.

Acronyms and Abbreviations

AFV	alternative fuel vehicles
BOCC	Building Operations Control Center
BSC	Building Sustainability Champion
BTu	British Thermal Unit(s)
C&D	construction and demolition
CO_2e	carbon dioxide equivalent
COR	City of Richland
CSF	Computational Sciences Facility
DOE	U.S. Department of Energy
DOEGRIT	DOE Green IT
ECM	energy conservation measure
EISA	Energy Independence and Security Act of 2007
EMSL	Environmental Molecular Sciences Laboratory
EO	Executive Order
EPA	U.S. Environmental Protection Agency
EPAct	Energy Policy Act of 2005
EPEAT	Electronic Product Environmental Assessment Tool
ESPC	Energy Savings Performance Contract
ESS	Engineering Standards and Specifications
EV	electric vehicle
FY	fiscal year
GHG	greenhouse gas
GP	Guiding Principles
GPCL	General Purpose Chemistry Laboratory
GRI	Global Reporting Initiative
GSA	General Services Administration
GSF	gross square foot/feet
HEMSF	High-Energy Mission-Specific Facility
HPSB	high performance and sustainable building
HVAC	heating, ventilation, and air conditioning
ILA	industrial, landscaping, and agricultural (water)
IT	information technology
kBtu	thousands British thermal units
kW	kilowatt(s)
LCC	lifecycle cost
LDV	light-duty vehicle
LEED®	Leadership in Energy and Environmental Design
$MTCO_2e$	metric tons of carbon dioxide equivalent
P2	Pollution Prevention
PNNL	Pacific Northwest National Laboratory
PSL	Physical Sciences Laboratory
PUE	power usage effectiveness
R&D	research and development
REC	Renewable Energy Certificate
SCC	Safer Choice Certified
SF_6	sulfur hexafluoride
SPO	DOE's Sustainability Performance Office
SSP	Site Sustainability Plan
T&D	transmission and distribution
UESC	utility energy service contract
UPS	uninterruptible power supply
U.S.	United States

Executive Summary

Sharing hands-on science, technology, engineering and mathematics (STEM) activities with families in the community gets kids excited about STEM subjects. Fostering the next generation of scientists and engineers is an important part of PNNL's mission

Building Blocks for a Sustainable Campus

For more than 50 years, the United States (U.S.) Department of Energy's (DOE's) Pacific Northwest National Laboratory (PNNL) has advanced the frontiers of science and technology through courageous discovery and innovation. Our multidisciplinary team of more than 4,400 scientists, engineers, and support professionals is tackling global sustainability challenges in our science, energy, environmental, and security missions. For example, our research on how human and natural systems interact is critical to informing sustainable solutions to the nation's energy and environmental challenges.

PNNL is equally committed to sustainability right here at home, and we are making excellent progress toward the goals described in this plan. We are working on ongoing challenges, such as reducing the energy required to meet our research mission and promoting conservation among our employees.

Looking forward, we will pursue aggressive, long-term goals to reduce water and energy consumption. Our greatest challenge is in reducing building energy intensity and greenhouse gas (GHG) emissions. To meet these goals, we are working with the Pacific Northwest Site Office to pursue alternate financing for

several large projects aimed at reducing energy use in the coming years. We have also incorporated a holistic approach to sustainability into our Campus Master Plan and are committed to constructing facilities that meet the Guiding Principles for High Performance and Sustainable Buildings (HPSB). As a leading research institution, we aim to enhance global sustainability by continuing to operate our facilities as a living laboratory, exploring the challenging issues that affect not only our campus, but also the world around us.

Our plan includes actions to conserve energy, water, and financial resources and improve the comfort and productivity of our staff members. In fiscal year (FY) 2016, we achieved several sustainability milestones, as highlighted below.

- **Partnering with Research and Development**: The Sustainability Program commissioned the water efficiency research team at PNNL to develop a comprehensive water management plan, in an effort to use the PNNL campus as a "living laboratory" by harnessing the expertise of PNNL research staff and testing novel concepts to support sustainable operations. Measures identified in the plan will continue to be implemented over the coming years, with the objective of more sustainable water management.
- **Leading the Way with Sustainable Design**: PNNL is putting the finishing touches on a new facility, the General Purpose Chemistry Laboratory (GPCL). The GPCL was designed to meet the Guiding Principles for HPSB. Currently, 67 percent of our applicable buildings meet the HPSB criteria, exceeding the DOE goal of 17 percent by FY16. Construction is underway for two additional HPSBs, which will become operational in FY17 and FY18.
- **Planning for a Cleaner Future**: PNNL has assumed a leadership position and continues to look toward the future with its electric vehicle charging strategy. Existing charging stations located throughout the campus are being augmented with additional locations at existing facilities and at all new buildings. The use of commercial ChargePoint stations allows pedestals, installed for fleet charging, to be used by employees during the day, when available.

For additional information about these projects, please refer to the corresponding sections of this Site Sustainability Plan (SSP).

The following table summarizes each of DOE's Office of Science goals, along with PNNL's performance and planned actions, as noted below.

Summary Table of Goals and Targets

SSPP Goal	DOE Goal	Performance Status Through FY16	Planned Actions and Contribution
Goal #1: Greenhouse Gas Reduction			
1.1	50% Scope 1 & 2 greenhouse gas (GHG) reduction by FY25 from a FY08 baseline (FY16 target: 22%).	**FY08 Baseline**: 43,686 metric tons of carbon dioxide equivalent ($MTCO_2e$) **FY16 Actual**: 2,233 $MTCO_2e$ (40,898 $MTCO_2e$ without renewable energy certificates [RECs]) **FY25 Goal**: 21,843 $MTCO_2e$ **Status**: 95% reduction	Continue REC purchases for near-term GHG reduction goal and implement energy conservation measures (ECMs), where cost-effective.
1.2	25% Scope 3 GHG reduction by FY25 from a FY08 baseline (FY16 target: 7%).	**FY08 Baseline**: 24,143 $MTCO_2e$ **FY16 Actual**: 22,804 $MTCO_2e$ **FY25 Goal**: 18,091 $MTCO_2e$ **Status**: 5.5% reduction	Continue promoting telework and use of video teleconferencing to reduce travel; encourage staff through bus and carpool promotions and incentives.
Goal #2: Sustainable Buildings			
2.1	25% energy intensity (British thermal units [Btu] per gross square foot [GSF]) reduction in goal-subject buildings, achieving 2.5% reductions annually, by FY25 from a FY15 baseline.	**FY15 Baseline**: 167,612 Btu/GSF **FY16 Actual**: 167,066 Btu/GSF **FY25 Goal**: 125,709 Btu/GSF **Status**: 0.3% reduction	Continue implementing energy conservation measures and operational improvements.

SSPP Goal	DOE Goal	Performance Status Through FY16	Planned Actions and Contribution
2.2	Energy Independence and Security Act of 2007 (EISA) Section 432 energy and water evaluations.	Completed fourth year of the four-year EISA cycle of 11 buildings.	Continue executing EISA evaluations.
2.3	Meter all individual buildings for electricity, natural gas, steam, and water, where cost-effective and appropriate(1).	All individual buildings metered for electricity, natural gas, steam, and water, where cost-effective and appropriate.	Improve building performance through data analysis.
2.4	At least 17% (by building count or gross square feet) of existing buildings greater than 5,000 GSF to be compliant with the revised Guiding Principles for HPSB by FY25, with progress to 100% thereafter(2).	67% of PNNL buildings > 5,000 GSF are HPSB compliant.	Continue trending toward 100% of facilities meeting HPSB.
2.5	Efforts to increase regional and local planning coordination and involvement.	Collaborated with City of Richland (COR) Energy Services on new buildings at PNNL.	Continue leveraging partnerships to obtain SSP goals.
2.6a	Net Zero Buildings: 1% of the site's existing buildings above 5,000 GSF intended to be energy, waste, or water Net Zero Buildings by FY25.	Participated in DOE effort to establish guidance on Net Zero Building requirements.	Continue working with Net Zero community on guidance development.
2.6b	Net Zero Buildings: All new buildings (>5,000 GSF) entering the planning process designed to achieve energy net zero beginning in FY20.	Participated in DOE effort to establish guidance on Net Zero Building requirements.	Continue working with Net Zero community on guidance development.
Goal #3: Clean & Renewable Energy			
3.1	"Clean Energy" requires that the percentage of an agency's total electric and thermal energy accounted for by renewable and alternative energy shall be not less than: 10% in FY16-17, working towards 25% by FY25.	**FY16**: 39% of annual electric and thermal energy from renewable and alternative energy.	Continue to meet the clean energy goal through onsite generation and RECs.
3.2	"Renewable Electric Energy" requires that renewable electric energy account for not less than 10% of a total agency electric consumption in FY16-17, working towards 30% of total agency electric consumption by FY25.	**FY16**: 53% of annual electric consumption is renewable electric energy.	Continue to meet the renewable energy goal through onsite generation and RECs.
Goal #4: Water Use Efficiency and Management			
4.1	36% potable water intensity (gallon [gal] per GSF) reduction by FY25 from a FY07 baseline (FY16 target: 18%).	**FY07 Baseline**: 70.08 gal/GSF **FY16 Actual**: 24.1 gal/GSF **FY25 Goal**: 44.85 gal/GSF **Status**: Exceeded goal	Continue to implement site water management plan opportunities for additional reductions.

(1) Per NECPA (42 U.S.C Section 8253) the term "buildings" includes industrial, process, or laboratory facilities.
(2) HPSB targets cited in this SSP Guidance correlate with previous Executive Orders. Revised Guiding Principles will be published in the near future that will amend these targets through 2025. Until those updates are completed and distributed, report progress in this goal area using the previously established targets.

SSPP Goal	DOE Goal	Performance Status Through FY16	Planned Actions and Contribution
4.2	30% water consumption (gal) reduction of industrial, landscaping, and agricultural (ILA) water by FY25 from a FY10 baseline (FY16 target: 12%).	**FY11 Baseline**: 176,248,000 gal **FY16 Actual**: 166,614,000 gal **FY25 Goal**: 123,374 gal **Status**: 5.5% decrease	Continue to implement site water management plan opportunities for additional reductions.
Goal #5: Fleet Management			
5.1	30% reduction in fleet-wide per-mile greenhouse gas emissions reduction by FY25 from a FY14 baseline (2016 target: 3%; 2017 target: 4%).	**FY14 Baseline**: 767.25 gCO_2e/mile **FY16 Actual**: 738.47 gCO_2e/mile **FY25 Goal**: 537.08 gCO_2e/mile **Status**: 4% decrease	Continue education to staff members on the importance of avoiding extra idling time, speed control, combining trips with other staff members when feasible, and proper maintenance to help reduce their GHG impact.
5.2	20% reduction in annual petroleum consumption by FY15 relative to a FY05 baseline; maintain 20% reduction thereafter (2016 target: 20%).	**FY05 Baseline**: 38,824 gallons of gasoline equilavent (GGE) **FY16 Actual**: 32,729 (GGE) **FY16 Goal**: 31,060 (GGE) **Status**: 16% reduction	Continue education to staff members on the importance of avoiding extra idling time, speed control, combining trips with other staff members when feasible, and proper maintenance to help reduce petroleum consumption.
5.3	10% increase in annual alternative fuel consumption by FY15 relative to a FY05 baseline; maintain 10% increase thereafter (2016 target: 10%).	**FY06 Baseline**: 456 gal of GGE (note: FY05 usage not measured) **FY16 Actual**: 6,227 (GGE) **FY16 Goal**: 502 (GGE) **Status**: Far Exceeded	PNNL has worked with GSA to replace conventional fueled vehicles with alternative fueled vehicles. PNNL is currently at 58% AFV capable. PNNL periodically checks the availability in the local area for bio-diesel fuel. As vehicles are replaced, PNNL works with General Services Administration (GSA) to determine if an alternative fuel or fully electric vehicle (EV) is an option for replacement.
5.4	75% of light duty vehicle acquisitions must consist of alternative fuel vehicles (AFV) (2016 target: 75%).	In FY16, 62% of the new LDV fleet acquisitions consisted of AFV vehicles. Currently, PNNL has a total of 39 LDVs, of which 31 (79%) are AFVs.	PNNL will continue working with GSA to replace vehicles with AFV types whenever available.
5.5	50% of passenger vehicle acquisitions consist of zero emission or plug-in hybrid electric vehicles by FY25 Interim target of 20% by FY20 (2016 target: 4%).	In FY16, PNNL evaluated this new goal and is working to determine how best to further integrate zero emission and plug-in hybrid EVs into the existing fleet.	PNNL will work closely with GSA to acquire Zero Emission or Plug-in Hybrid vehicles for all newly acquired passenger vehicles. Consideration for Zero Emission or Plug-in Hybrid will also be taken into account when ordering other vehicle classes.
Goal #6: Sustainable Acquisition			
6.1	Promote sustainable acquisition and procurement to the maximum extent practicable, ensuring BioPreferred and biobased provisions and clauses are included in 95% of applicable contracts.	100% of acquisition actions contain a clause regarding sustainable acquisitions considerations, which includes reference to BioPreferred and biobased requirements.	Continue being proactive with sustainable item procurement.

SSPP Goal	DOE Goal	Performance Status Through FY16	Planned Actions and Contribution
Goal #7: Pollution Prevention & Waste Reduction			
7.1	Divert at least 50% of non-hazardous solid waste, excluding construction and demolition debris.	**FY16**: Diverted 54% of nonhazardous solid waste.	Continue conducting assessments for waste reduction opportunities.
7.2	Divert at least 50% of construction and demolition materials and debris.	**FY16**: Diverted 93% of construction & demolition (C&D) waste.	Continue monitoring C&D recycling performance and raising awareness on waste diversion requirements.
Goal #8: Energy Performance Contracts			
8.1	Annual targets for performance contracting to be implemented in FY17 and annually thereafter as part of the planning of section 14 of Executive Order 13693.	Three Energy Savings Performance Contracts (ESPCs) have been implemented at PNNL.	Work with Pacific Northwest Site Office on Utility Energy Services Contract.
Goal #9: Electronic Stewardship			
9.1	Purchases – 95% of eligible acquisitions each year are Electronic Product Environmental Assessment Tool (EPEAT)-registered products.	In FY16, 99.75% of eligible acquisitions were EPEAT-registered products.	Continue to purchase EPEAT- registered products when available.
9.2	Power management – 100% of eligible personal computers (PCs), laptops, and monitors have power management enabled.	100% Windows and Mac systems are shipped with power management capabilities enabled.	Continue to implement power management features on initial setup.
9.3	Automatic duplexing – 100% of eligible computers and imaging equipment have automatic duplexing enabled.	The default printer software is configured to use automatic duplex printing.	Continue to use duplex printing as default configuration.
9.4	End of Life – 100% of used electronics are reused or recycled using environmentally sound disposition options each year.	In FY16 all assets identified as electronics to be disposed of as excess were reused or recycled using environmentally sound disposition options.	Continue to reuse and recycle electronics.
9.5	Data Center Efficiency. Establish a power usage effectiveness (PUE) target in the range of 1.2–1.4 for new data centers and less than 1.5 for existing data centers.	Existing data center weighted PUE is 1.36. Target PUE for new data centers is 1.2–1.4.	Continue performing energy assessments and profiling of data centers using DOE Green IT (DOEGRIT).
Goal #10: Climate Change Resilience			
10.1	Update policies to incentivize planning for and addressing the impacts of climate change.	In FY15 PNNL completed a vulnerability assessment and developed a climate resiliency action plan.	The internal climate resiliency planning stakeholder team established in FY15 will meet in FY17 to determine the need to revise plans and procedures.
10.2	Update emergency response procedures and protocols to account for projected climate change, including extreme weather events.	The PNNL Sustainability Program met with members of the Emergency Preparedness office to discuss the status of relevant emergency procedures protocols.	The Sustainability Program will continue to engage Environmental Planning and Emergency Preparedness as part of the bi-annual climate resiliency review.

SSPP Goal	DOE Goal	Performance Status Through FY16	Planned Actions and Contribution
10.3	Ensure workforce protocols and policies reflect projected human health and safety impacts of climate change.	The FY15 vulnerability assessment identified six potential regional climate exposures that could influence worker health and safety. Existing plans and procedures were determined to address the risk in most cases.	Continue working with Worker Safety and Health professionals to mitigate risks due to climate change.
10.4	Ensure site/lab management demonstrates commitment to adaptation efforts through internal communications and policies.	The climate resiliency planning internal stakeholder team established during FY15 was comprised of senior managers of programs deemed critical to PNNL's climate resiliency.	The climate resiliency planning internal stakeholder team will meet bi-annually to ensure that we have followed through on our commitments to improve PNNL's resiliency, review metrics that could indicate changes in our vulnerability, and determine the need to revise plans and procedures.
10.5	Ensure that site/lab climate adaptation and resilience policies and programs reflect best available current climate change science, updated as necessary.	PNNL's research on atmospheric processes and the interconnections among energy, climate, and other human and natural systems is helping to inform sustainable solutions to the nation's energy and environmental challenges.	The Sustainability Program team members responsible for climate resiliency planning will review updates to national plans as they occur and will continue to consult with internal subject matter experts as warranted to discuss evolving climate change scenarios.

LEED Gold Biological Sciences Facility and Computational Sciences Facility on the PNNL campus

Greenhouse Gas Reduction

PNNL will continue targeting opportunities that have a net positive effect on Scope 1, 2, and 3 GHG emissions.

Goals

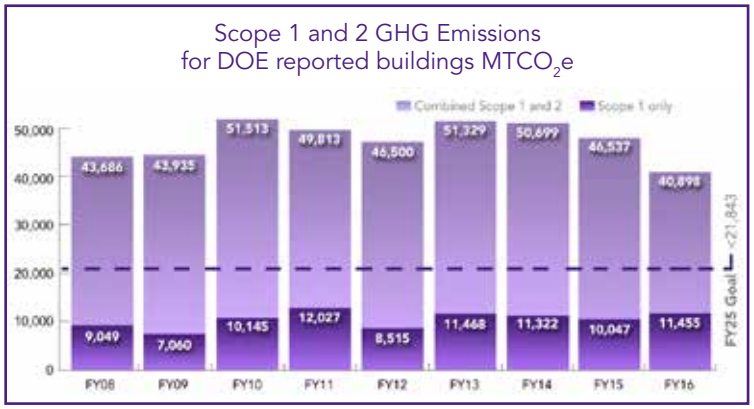
1.1 – 50% Scope 1 & 2 GHG reduction by FY25 from a FY08 baseline (2016 target: 22%).

1.2 – 25% Scope 3 GHG reduction by FY25 from a FY08 baseline (2016 target: 7%).

FY16 Performance Status

Scope 1 & 2

Reducing GHG emissions is a priority at PNNL. Scope 1 GHG emissions are from sources owned or controlled by PNNL, such as combustion of fossil fuels in boilers and from vehicles. Scope 2 GHG emissions are those that result from the consumption of purchased energy and are generated upstream of PNNL. The PNNL Scope 1 and 2 GHG emissions FY08 baseline is 43,686 metric tons of carbon dioxide equivalent ($MTCO_2e$). Between FY08 and FY16, Scope 1 and 2 GHG emissions decreased from 43,686 $MTCO_2e$ to 40,898 $MTCO_2e$. PNNL executed multiple reduction projects as part of the energy intensity goal, while also continuing to implement its strategy of procuring Renewable Energy Certificates (RECs). In FY16, RECs offset 38,665 $MTCO_2e$, resulting in an overall Scope 1 and 2 GHG emissions reduction of 95 percent, exceeding the FY25 goal of 50 percent.



The Campus Master Plan leverages Guiding Principles to inform decisions for current and future developments, fostering a sustainable, collaborative, and flexible PNNL campus. Activities targeted to lower GHG emissions typically benefit both the Scope 1 and 2 goals, such as ongoing commissioning with support of building dashboards, core business hours, and whole building diagnostics in our Building Operations Control Center (BOCC).

Scope 1

The largest single source of Scope 1 GHG emissions at PNNL is natural gas that is burned in boilers to heat our facilities. In FY15, the BOCC was relocated to our Systems Engineering Building and, working with operations staff, implemented strategies to minimize natural gas use across the campus. Areas of focus included maximizing the summer shutdown of boilers, heating water temperature setbacks in the spring and fall, repairing gas metering, and monitoring of core business hours. PNNL also uses sulfur hexafluoride (SF_6) for research, which contributes to Scope 1 GHG emissions. PNNL has inventoried existing sources and has a good understanding of its uses (e.g., as an insulator in electron microscopes and as tracer gas). In FY11, PNNL worked with researchers who used SF_6 as a tracer to adopt a substitute gas, nitrous oxide, which has a lower global warming potential. This replacement has continued, and no new project work has included SF_6. For electron microscopes, SF_6 is relatively stable, and year-to-year fluctuations are primarily due to use of a mass balance inventory method.

Scope 2

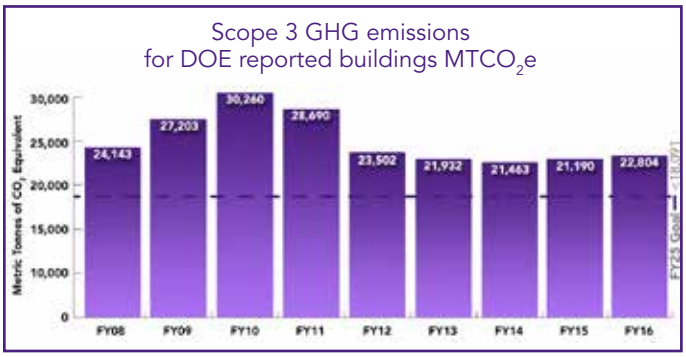
Scope 2 electricity consumption is our largest source of GHG emissions. The large computational research mission area at the PNNL high-energy mission-specific facilities (HEMSFs) makes reducing Scope 2 challenging; however, the BOCC is continuously monitoring the campus to look for opportunities for improvement. In FY16, PNNL implemented multiple projects to reduce Scope 2 emissions. Examples include the installation of a new, high-efficiency magnetic bearing centrifugal chiller with variable frequency drive control at the Environmental Molecular Science Laboratory (EMSL) that is 35 to 40 percent more efficient than the older unit. Chiller control optimization was performed at the Life Sciences Laboratory (Building 331) and EMSL, allowing staging of different size chillers to meet varying load requirements at maximum efficiency. At the Physical Science Laboratory, twelve exhaust fans operating at maximum volume were replaced with three fans with premium efficiency motors, controlled by variable frequency drive. Exhaust ducting was reconfigured, and only two of the three fans operate at any given time. In addition to energy savings, this project increased capacity and reliability.

Scope 3

All Scope 3 Emissions

Scope 3 emissions totaled 22,804 $MTCO_2e$, representing a 6 percent reduction from the FY08 baseline.

Business travel was the largest contribu tor to these emissions (65.7 percent), followed by employee commuting (33.4 percent) and contracted solid waste disposal and wastewater treatment (3.9 percent). Emissions from transmission and distribution (T&D) losses resulted as a negative emission contributor and made up -2.9 percent, after reductions from REC purchases were accounted for. Reducing Scope 3 emissions continued to be a strategic priority at PNNL in FY16. Specific activities are discussed in more detail below.



Business Air and Ground Travel

In FY16, total emissions resulting from business travel were 14,982 $MTCO_2e$, an increase of 7.5 percent compared with FY15. Air travel alone totaled 14,234 $MTCO_2e$, which was 95 percent of total business travel emissions, and increased 9 percent compared with FY15. Business ground travel accounted for 748 $MTCO_2e$, a decrease of 9 percent from the previous year.

Emissions from business travel continue to exceed the baseline, at 15 percent above FY08 levels.

Employee Commuting

PNNL's employee commute emissions in FY16 totaled 7,606 $MTCO_2e$, an increase of 3.1 percent from FY15. The increase in employee commute emissions can be attributable to the increase of PNNL staffing levels compared with FY15.

Employee commute emissions are calculated using the results of the General Services Administration (GSA) Scope 3 Commuter Survey. The survey is conducted bi-annually, and for years in which the survey is not conducted, results from the prior year are extrapolated based on changes in the total employee population at PNNL. The bi-annual survey was conducted in October 2016, in which over 50 percent of PNNL staff members participated. FY16 employee commute emissions were

calculated using the results of this survey. Although employee commute emissions in FY16 increased since FY15, they were still 10 percent below the FY08 baseline.

A reduction in emissions associated with employee commuting will largely come from PNNL staff members participating in alternatives to a single-occupant-personal-vehicle commute, especially as PNNL's staff continues to grow. Alternatives to this traditional commute include teleworking (a popular alternate commute option), biking or walking to work, using public transportation, or carpooling. By the end of FY16, approximately 15 percent of employees had signed telework agreements, and according to time billing data, 5.6 percent of staff teleworked once per week on average. PNNL staff members teleworked 52,781 days in FY16, based on data provided by the time billing system, and avoided an estimated 417 $MTCO_2e$. In addition to teleworking, the employee commute survey results in 2016 showed an increased use of bicycling, walking, intercity rail, and commuter rail when commuting to PNNL, compared to the 2014 survey.

A Laboratory alternate commute advocate helps raise staff member awareness of commute alternatives through directorate-level and all-staff communications, including articles in PNNL's twice-weekly employee e-newsletter, websites, quarterly sustainability e-newsletter, monthly safety and health newsletters hung in rest rooms, and seasonal challenges like Bike to Work Month.

In addition to the month-long Bike to Work challenge, national Bike to Work Day had a record turnout at the Richland PNNL campus in 2016. Employees can join social rides and other cycling activities through the PNNL cycling club and may use the Whiteboard (an electronic bulletin board for staff) to connect with other PNNL riders and organize events, as well. Wellness at PNNL also promotes cycling rather than driving during the annual wellness challenge, and this year Bike to Work Day was once again part of a Lab-wide Wellness Week campaign. PNNL staff members are represented at the Three Rivers Bicycle Club, which works with the Richland City Council to set plans for continued road safety improvements and developing a more bike-friendly community.

Other Scope 3 Emission Sources

All other emission sources comprised 1 percent of PNNL's Scope 3 emissions. Specifically, T&D losses attributable to DOE-owned and -leased facilities at PNNL totaled -668 $MTCO_2e$, a 128 percent decrease from FY15. Note that this negative emissions value is due to the T&D credit received for REC purchases. Contracted wastewater treatment and waste disposal totaled 884 $MTCO_2e$, a 56 percent increase from FY15.

PNNL does not plan to actively manage wastewater emissions, as it can be controlled only by reducing staff numbers under the current accounting methodology. T&D losses will be managed as a result of our Scope 2 electricity reduction efforts. Waste management emissions will be actively managed, as described in the P2 section.

Plans, Actions, and Projected Performance

Scope 1 & 2

The Scope 1 and 2 GHG emissions reduction goal is a 50 percent reduction by FY25 from a FY08 baseline. The PNNL FY08 baseline is 43,686 $MTCO_2e$. Targeted areas for reduction of Scope 1 and 2 GHG emissions are described below.

Scope 1

The largest opportunity for reduction of natural gas (Scope 1) GHG emissions at PNNL is to offset the large amount of electricity (Scope 2) that our HEMSFs consume to operate supercomputers by using the considerable amount of low-grade "waste" heat they generate. EMSL and the Computational Sciences Facility (CSF) have the ability to capture some of this waste heat and utilize it to help heat the buildings during cold weather. Mission strategy projects an increase in computational capacity where the waste heat generated would exceed the heating needs of both EMSL and CSF and could be used to heat other buildings as well. PNNL issued a Request for Interest to serving utilities for a utility energy services contract (UESC) in 2016. Capture of supercomputer waste heat is listed as a potential energy conservation measure in the Request for Interest. This and other conservation strategies will be pursued in the UESC process.

Scope 2

Projects being pursued as part of the UESC process initiated this year will reduce electricity consumption. Examples being considered include heating, ventilation, and air conditioning (HVAC) upgrades that would separate office and laboratory systems in some buildings, allowing night setback, building automation upgrades including hardware and software, lighting

upgrades, and building envelope improvements. We will also continue to operate our 125-kilowatt (-kW) solar array and procure RECs at competitive rates to offset our GHG emissions.

Scope 3

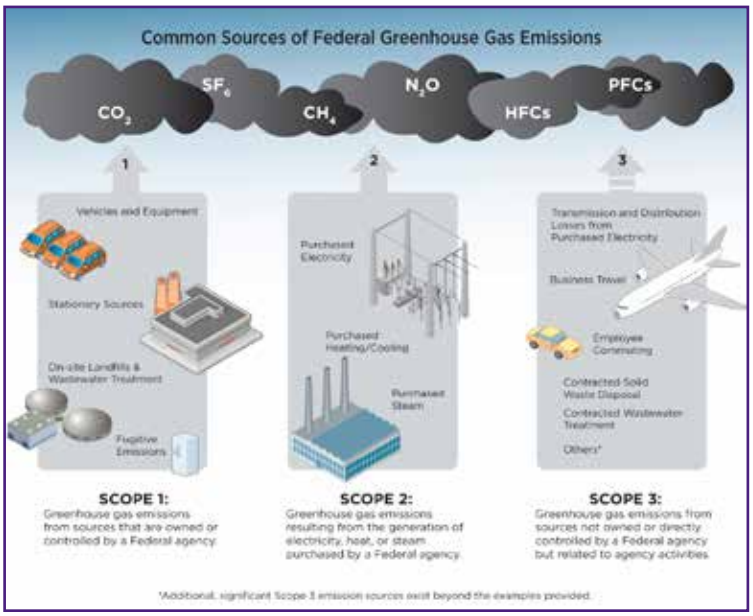
To achieve the 25 percent reduction in Scope 3 emissions by 2025, PNNL will need to reduce annual emissions by another 4,695 $MTCO_2e$ over the next eight years. Most of this decrease will be achieved through a combination of activities aimed at reducing business travel, employee commuting, and T&D losses associated with electricity use. PNNL will continue advancing the programs conducted in FY16 and will pursue additional activities to decrease Scope 3 emissions further.

Business Travel Emissions

PNNL's business travel emission reduction strategy will continue to encourage efficient traveling and alternatives when they are equally effective. Many PNNL conference rooms have been made collaboration-ready and work seamlessly with Skype for Business meetings, while being equipped with high-definition web cameras and large video displays for presentations. Informing and encouraging staff to efficiently use these connection-ready rooms to work with offsite staff members and clients can lead to less business travel emissions and help achieve Scope 3 emission reduction goals.

Employee Commute Emissions

PNNL's commute emissions reduction strategy will continue to emphasize alternative commute options in FY17 and beyond. A large part of this strategy will include promoting the teleworking option to staff. PNNL established a goal of 20 percent of all employees teleworking one day per week on average by FY20; achieving this goal will contribute to meeting the goal of a 25 percent reduction in commute emissions by FY25. Additional strategies include encouraging the use of public transportation by making monthly bus passes easily available for purchase on the Richland campus and encouraging staff members to build relationships with colleagues, while saving money by carpooling to work.



Greenhouse Gas Reduction

Success Story

On Friday, May 20, 2016, approximately 75 staff members at PNNL celebrated National Bike to Work Day, which also marked the last day of an Employee Wellness Week. After their ride to work, participants were welcomed to the Richland campus with a ceremony, music, breakfast and other refreshments, and participation prizes. Earth and Biological Sciences Associate Laboratory Director Allison Campbell spoke to the participants about the importance of sustainability and wellness. PNNL Security also escorted the cyclists on a victory lap around the Richland campus after the welcome festivities, ending in front of the Research Operations Building for a group photo. Participation in the event was stronger than in any years prior, and it was a great kick-off to a strong biking season at PNNL. The day was part of Bike Everywhere month, a national biking challenge in which many teams from PNNL participated.

Sustainable Buildings

Improved analytics, HPSB, Energy Independence and Security Act (EISA) of 2007 evaluations, and energy efficiency project implementation continue positive progress toward PNNL's energy goals.

Goals

2.1 – 25% energy intensity (Btu per GSF) reduction in goal-subject buildings, achieving 2.5% reductions annually, by FY25 from a FY15 baseline.

2.2 – EISA Section 432 energy and water evaluations.

2.3 – Meter all individual buildings for electricity, natural gas, steam, and water, where cost-effective and appropriate[(1)].

2.4 – At least 17% (by building count) of existing buildings greater than 5,000 GSF to be compliant with the *revised* Guiding Principles for HPSB by FY25, with progress to 100% thereafter.

2.5 – Efforts to increase regional and local planning coordination and involvement.

2.6 – Net Zero Buildings.

(1) Per NECPA (42 U.S.C Section 8253) the term "buildings" includes industrial, process, or laboratory facilities.

FY16 Performance Status

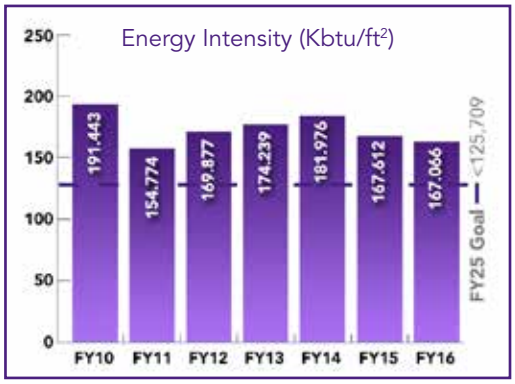
Energy Intensity

Between FY15 and FY16, PNNL's energy intensity fell from a baseline of 167,612 British thermal units (kBtu) per gross square foot (GSF) to 167,066 kBtu per GSF—a net reduction of 0.3 percent.

In FY15, PNNL stimulated cultural change to help achieve building energy intensity reductions. An energy challenge was initiated at the beginning of the fiscal year, which brought about friendly competition between building occupants. The objective of the competition was to raise staff member awareness on how their behavior can impact our overall energy usage and to empower them to make positive changes within their building. Prizes for the winning buildings were given out monthly, and the results were published in our electronic newsletters. Staff members were also encouraged to submit ideas to further improve building energy intensity, and those who did also received an award. During the energy challenge, the value of having a building sustainability champion—someone you recognize from your building who sends email communications, posts information, and personally engages fellow building occupants—became apparent. Seeing the value these champions bring, we continued the use of building sustainability champions to personalize our sustainability outreach in 2016.

The successful reduction of energy intensity requires the combination of an engaged staff and the appropriate tools and equipment to execute the work. PNNL's BOCC is vital to our success and is staffed by our sustainability and commissioning engineers, along with three student interns. Together, they analyze data from our advanced meters and building control systems, while also performing functional testing of building systems with our operations staff.

PNNL remains aggressive about reducing its energy intensity. To meet reduction goals, the BOCC monitors and reports using benchmarking, energy and water



meetings, and energy and water conservation measures. As a hub for energy tracking and control systems to connect with building managers, building engineers, design engineers, and the building occupants, the BOCC is the integrator for ensuring that energy and water goals are met through continuous monitoring and reporting. Specifically, the BOCC links historical data and real-time monitoring and diagnostics with analytics to optimize energy and water, extend asset life, and enhance the reliability and efficiency of the PNNL campus. The BOCC leverages data from multiple platforms, including Lucid Design Group's BuildingOS, EnergyCAP, Inductive Automation's Ignition, Johnson Control's Metasys®, and the U.S. Environmental Protection Agency's (EPA's) Portfolio Manager®, to perform diagnostics, trending, and analytics.

While we did not achieve our target of a 2.5 percent reduction by FY16, PNNL was aggressive about reducing its energy intensity overall. Mission-driven increases in energy use were offset through a combination of energy-saving projects, operational efficiencies, construction of high-performance buildings, improvements to our Engineering Standards and Specifications (ESS), and promoting conservation behavior among occupants.

Buildings excluded from the energy intensity goal, along with a copy of the exclusion self-certification letter, can be found in Appendix A.

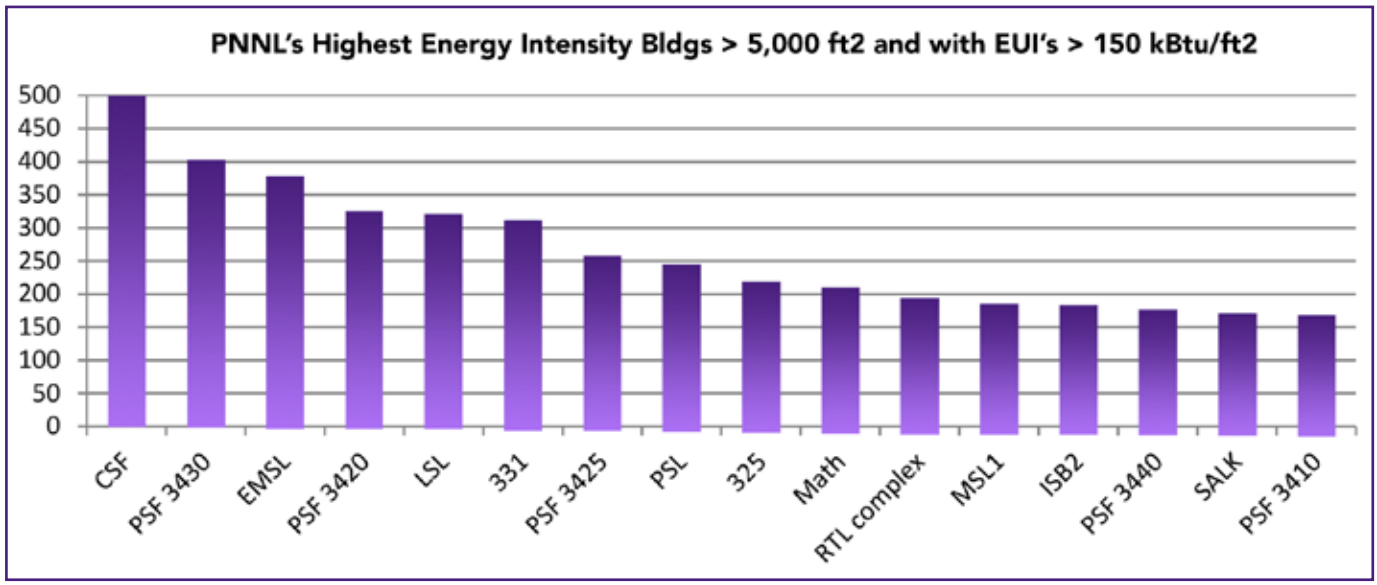
EISA Evaluations

The PNNL Energy Program Office successfully completed comprehensive energy and water evaluations for multiple buildings (EMSL, the Physical Sciences Laboratory [PSL], Life Sciences Laboratory II, and the Biological Sciences Facility) that achieve compliance with Section 432 of EISA 2007. These comprehensive evaluations include a commissioning assessment and energy and water audit, with the objective of identifying energy conservation measures (ECMs) and optimizing building systems operation. ECMs identified at both the Building 331 and PSL buildings were implemented for an estimated annual energy savings of approximately $17,830. Control strategies for the Building 331 northwest supply fan system and the PSL north exhaust fan system were adjusted to operate fans in parallel, and the Building 331 northwest supply fan system was rebalanced by PNNL air balance in order to reduce total airflow, fan speeds, and unnecessary energy use.

In 2016, the BOCC created Sequence of Operations documentation and corresponding Functional Test Procedures for all major building systems (e.g., HVAC and lighting) in an effort to continuously monitor and test required control strategies using the preventative maintenance process. Functional Test Procedures are distributed to the BOCC, where each system is analyzed annually, resulting in an ongoing commissioning program that increases building efficiently and still achieves EISA compliance in regards to systems testing implementation, verification, and correction.

Metering

Individual building metering, as required by the Energy Policy Act (EPAct) of 2005, EISA, and Executive Order (EO) 13693, for electricity, natural gas, and water has been completed for all buildings where "appropriate" per DOE's November 2014 *Federal Building Metering Guidance*. With real-time meter data, our BOCC has all the necessary information to perform system analyses on facilities. The 2016 PNNL *Metering Plan*[1] details our successful completion of this goal and outlines future strategies for how we intend to use the data.



(1) Pope JE. 2016. Metering Plan: Intelligent Operational Strategies Through Enhanced Metering Systems. PNNL-25587, Pacific Northwest National Laboratory, Richland, Washington.

High Performance and Sustainable Buildings

Currently, 67 percent of PNNL buildings meet HPSB requirements. All existing Facilities Information Management System buildings have been assessed against the HPSB Guiding Principles using the checklist provided in the EPA's ENERGY STAR Portfolio Manager.

PNNL is nearing completion of a new laboratory facility designed as an HPSB, using the Guiding Principles for New Construction criteria. This will be the first new facility at PNNL to use the Guiding Principles as a path toward HPSB status.

In 2016, construction began on a new office building that was designed as an HPSB, using the Guiding Principles for New Construction, and will follow the process through building completion.

Regional and Local Planning

In FY16, the transfer of 1,641 acres from the Tri-Cities Washington Economic Development Council to the City of Richland (COR), Port of Benton, and Energy Northwest was completed, for the purpose of non-federal land development. The new tenants of this land will be our future neighbors, so PNNL was involved in this process to ensure appropriate deed restrictions and covenants were included, as well as to promote economic development in the community.

The construction of the new GPCL in 2016 prompted coordination with COR for new city services, including electrical, water, sewer, and fire response. PNNL also held conversations with DOE, other Hanford contractors, and COR to discuss transfer of 300 Area fire, water, and sewer service providers in the coming years.

Net Zero

In FY16, researchers in PNNL's Energy and Environmental Directorate performed a needs assessment for meeting NetZero requirements in EO 13693. They interviewed multiple sites, collecting information needed to advise DOE's Sustainability Performance Office (SPO) on guidance needs related to NetZero requirements. PNNL was one of the sites selected to participate in the interviews, along with eight other DOE sites. PNNL's sustainability manager, engineering manager, strategic planning manager, and chief engineer all provided input on existing and planned HPSBs, anticipated challenges in meeting NetZero requirements, existing guidance available, and needs for additional guidance and support.

Plans, Actions, and Projected Performance

Energy Intensity

Continuing in FY17, PNNL will work toward the new goal to reduce energy use intensity 25 percent by FY25 from a FY15 baseline. PNNL is targeting a 1 percent EUI reduction in FY17, while pursuing funding for large, high-impact projects. PNNL intends to work toward goal attainment by establishing annual energy reduction goals within directorate business plans, increasing collaboration with our research scientists, and expanding the tools and equipment available. Plans to implement Metasys Connected, bringing information and control to operators in the field using tablets, will advance this effort. PNNL will continue making real-time, informed decisions using our advanced analytical tools and institutionalize real-time commissioning of facility systems to increase attention on daily building operations versus periodic retro commissioning efforts. We have shown with the BOCC that the ability to monitor, perform diagnostics, and make informed decisions enhances the overall performance of PNNL facilities, leading to increased energy savings and greater operational performance.

Implementation of conservation projects through a UESC between DOE and a serving utility have the potential to significantly reduce energy intensity at PNNL. The UESC process enables the significant investment needed to implement large projects with high up-front costs.

Maintaining the core competencies of our highly qualified staff is vital to the long-term success of the Sustainability Program and, ultimately, the completion of the goals outlined herein. We will continue to train staff regarding the latest building efficiency technologies and maintain or increase the number of qualified Certified Energy Managers and Certified Building Commissioning Professionals.

We believe that achieving the 25 percent energy intensity reduction goal by FY25 will continue to be challenging. Projected business growth in key areas of PNNL's portfolio may result in energy intensity increases, which we will strive to offset by aggressively managing energy usage in other areas. We will continue to look for additional ways to reduce energy while conducting our world-class research.

EISA Evaluations

PNNL will continue to conduct energy and water evaluations in our EISA-covered facilities. In FY16, our plan is to evaluate four buildings and implement ECMs outlined in previous evaluations. This will keep us on track to complete approximately 25 percent of our facilities every year, allowing us to distribute workload and funding. Identified ECMs will be tracked, with funding requests integrated into our planning process.

The PNNL administrative procedure that outlines requirements for facility commissioning will be revised in early 2017 to detail requirements specific to EISA Commissioning Assessments.

Metering

With buildings being added to the PNNL campus each year, PNNL will continue to meet metering requirements by installing the most appropriate metering for each asset. As meter installations continue, PNNL will continue to gather and analyze data as we strive to meet the energy and water reduction challenges. Using meter and sensor data, operational improvements or maintenance corrections can be easily identified and corrected in real time. Future strategies for data use will be outlined in the PNNL *Metering Plan* (Pope 2016).

High Performance and Sustainable Buildings

An assessment in FY16 detailed the path to 100 percent conformance with the Guiding Principles. This assessment listed steps necessary and approximate costs to complete the Guiding Principle requirements for each appropriate building. In some buildings, investments needed to achieve HPSB status may not be cost-effective, based on facility age, mechanical equipment design, or specific and specialized research activities.

In 2017, PNNL will begin construction on a new Collaboration Center. We have committed that all new construction, major renovations, and alterations of buildings greater than 5,000 GSF will comply with the Guiding Principles. Planning for future facilities, including line item, general plant project, or leases, will consider these requirements.

Regional and Local Planning

PNNL will continue conversations with DOE, other Hanford contractors, and the COR regarding changes to the 300 Area fire, water, and sewer service provider over the next two years. We will also continue discussions with the COR to improve the land-use planning and development processes in north Richland. Goals of those conversations include engaging PNNL early to better address potential impacts to current and future PNNL operations from new COR development.

In 2017, PNNL will continue coordination with COR on new electrical, water, sewer, and fire response services for the new office building and new collaboration center on the PNNL campus, presently under construction.

PNNL is also optimistic about the possibility of involvement in the new solar project currently being discussed between COR and regional energy producer Energy Northwest.

Net Zero

PNNL is looking forward to additional guidance from DOE's SPO on meeting NetZero requirements. While PNNL is committed to meeting the goals outlined in EO 13693, constructing a NetZero building while meeting the test of lifecycle cost effectiveness with the low-energy rates in the Northwest will be a challenge. We look forward to participating with the NetZero community to meet this challenge.

Success Story

Being a leader in Sustainable Buildings, PNNL continues to construct new facilities using the Guiding Principles for HPSBs. With construction nearing completion on the new GPCL on the Richland campus, PNNL will add another HPSB to our portfolio. Using the guidelines set forth in the recently updated 2016 version of the Guiding Principles, PNNL is exceeding the EO goal and also has 53 percent of buildings compliant by measure of square footage and 67 percent measured by building count. PNNL has succeeded in incorporating Guiding Principle requirements into its ESS, construction specifications, and operating documents. Construction and operations utilizing the Guiding Principles is institutionalized at PNNL and is just one way we show that at PNNL, it can be done.

Clean and Renewable Energy

Leveraging competitive REC procurements continues to enable purchasing at the lowest cost possible.

Goal

3.1 – "Clean Energy" requires that the percentage of an agency's total electric and thermal energy accounted for by renewable and alternative energy shall be not less than: 10% in FY16-FY17, working towards 25% by FY25.

3.2 – "Renewable Electric Energy" requires that renewable electric energy account for not less than 10% of a total agency electric consumption in FY16-17, working towards 30% of total agency electric consumption by FY25.

FY16 Performance Status

In FY16, PNNL procured enough RECs to offset 39 percent of its electrical and thermal energy use and is already meeting both the FY16 goal of 10 percent and the FY25 goal of 25 percent annual clean electric and thermal energy consumption.

Fifty-three percent of annual electric consumption is renewable electric energy, already exceeding the 10 percent goal for FY16 and the 30 percent goal by FY25.

As noted in this section's "Success Story," we standardized the process for evaluating and procuring RECs, sometimes through a third-party supplier, leveraging multi-agency REC procurements. This competitive bidding process enables us to achieve the best price and was recognized during a DOE Inspector General audit.

Aside from RECs, PNNL has several on-site solar arrays. The solar hot water heater installed at EMSL produces approximately 160,000 Btu/hr of hot water and is dedicated to the lunchroom and associated restrooms, fulfilling the majority of that area's hot water needs. Several solar photovoltaic arrays also power various air and water monitoring stations throughout the campus. In addition, PNNL operates a 125 kW photovoltaic array, which includes charging stations for electric fleet vehicles and is used for several research and development (R&D) projects.

Plans, Actions, and Projected Performance

Effects of RECs on Scope 1 and 2 GHG emissions for DOE reported buildings $MTCO_2e$

PNNL annually assesses the necessary number of RECs based on growth, LEED commitments, and desired GHG Scope 1 and 2 renewable energy reductions. Our strategy of REC procurement will continue to meet (and likely exceed) the "Clean Energy" and "Renewable Electric Energy" goals.

PNNL is committed to finding ways to increase the amount of renewable power generated on-site. We will periodically review the addition of new projects where economically feasible.

Water Use Efficiency and Management

PNNL will continue balancing water use with enhanced energy efficiency and sustainable landscaping for overall water reduction.

Goals

4.1 – 36% potable water intensity (Gal per gross square foot) reduction by FY 2025 from a FY07 baseline (2016 target: 18%).

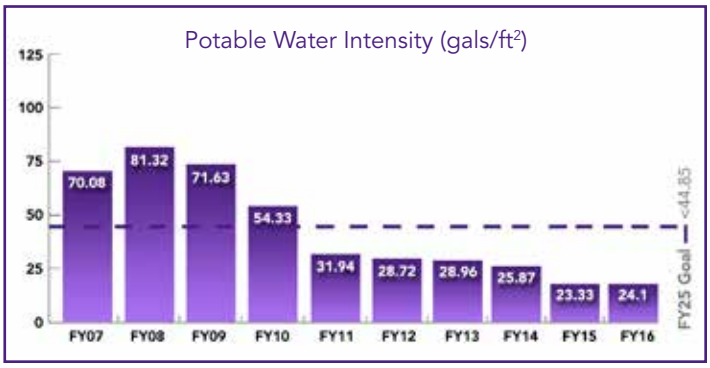
4.2 – 30% water consumption (Gal) reduction of industrial, landscaping, and agricultural (ILA) water by FY25 from a FY10 baseline (2016 target: 12%).

FY16 Performance Status

Water Intensity

PNNL has met the FY25 potable water reduction goal and, as of FY16, has reduced its intensity by 66 percent. In FY16, the Sustainability Program commissioned the water efficiency research team at PNNL to develop a comprehensive water management plan. This plan examines water consumption at the Lab and presents opportunities to improve water conservation and efficiency.

EMSL and CSF, both HEMSFs, accounted for 37 percent of the potable water used at PNNL.



Industrial, Landscaping, and Agricultural Water

Industrial, landscaping, and agricultural (ILA) water at PNNL is withdrawn from the Columbia River, supplied from both the PNNL and COR river irrigation systems, and used primarily for landscaping, cooling ponds, and aquatics research. Recommendations from the *2016 Water Management Plan* highlighted opportunities for ILA water savings and contributed to effectively reducing consumption by 5.5 percent since FY11. In FY16, the following targeted actions were taken to reduce ILA:

- New ILA meters were installed, resulting in better ILA water management and understanding of ILA water use south of Battelle Boulevard.
- Stopped irrigating grass on new Collaboration Center site prior to start of construction.

- Implemented landscaping strategies utilizing natural plants and rockeries requiring minimal irrigation at the new GPCL and Systems Engineering Building facilities.
- Removed grass at existing PSL and EMSL buildings and replaced it with zero-scape landscaping, specifically designed with drought-tolerant, yet beautiful plantings.
- Increased staff communication around ILA usage to help Laboratory employees better understand the challenges and strategies used to manage ILA water on the campus.
- Several landscape areas were targeted in an effort to better understand ILA usage. Sprinkler broadcast patterns along with actual water intensity were measured. The results were mixed, showing many areas being overwatered, while a few needed a little more. This led to improvements in sprinkler nozzle sizing and watering times, resulting in an overall reduction of ILA.
- The grounds maintenance department continued managing several large landscaped areas by daily resetting or even turning off irrigation when possible. This active management of our grounds maintenance team shows how an engaged staff can make a difference.

Plans, Actions, and Projected Performance

Water Intensity

In FY17, PNNL plans to continue performing facility water audits, specifically on the EISA-covered facilities. We believe that the trending of water usage through our BOCC will help identify additional savings. Projects that are determined to be cost-effective will be completed.

In the soon-to-be completed GPCL, the newest building on the PNNL campus, indoor water use was calculated using the U.S. Green Building Council LEED water savings estimator, based on the actual water consumption rates for the specified plumbing fixtures and expected number of full-time and transient occupants. The expected water use reduction is 45 percent compared to EPAct 1992 requirements, far exceeding the Guiding Principles requirement of a 20 percent reduction from the baseline requirement.

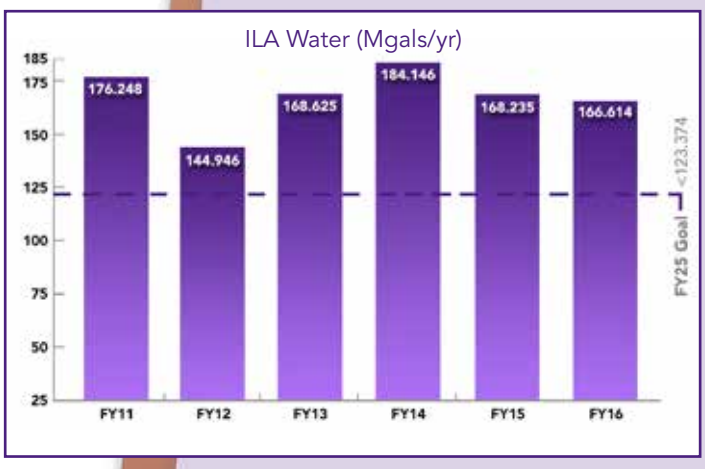
ILA Water

As PNNL modernizes through new construction or major facility renovation, landscaping remains necessary for fire offsets, dust control, and heat island reduction. In FY17, PNNL will continue using the *Landscape Master Plan* and implement recommendations made in the *2016 Water Management Plan*. Even with integrated ILA water reduction in our ESS, meeting this goal will be a challenge, especially as new buildings are added to the campus in areas that are currently semi-arid desert.

Rendering of collaboration center currently under construction

Success Story

Groundbreaking for a collaboration center, the newest building at PNNL, took place in October 2016. In anticipation of this $9M, 22,000-square-foot facility, the operations management team at PNNL decided to discontinue irrigation of the turf on the soon-to-be construction site. The grass went brown for the latter part of the irrigating season, saving an estimated 900,000 gallons of water. PNNL took advantage of the "big brown spot" to send staff communications educating employees about the water reduction efforts at PNNL and heralding the coming new facility.



Fleet Management

PNNL will continue working diligently to meet all fleet goals and program requirements by expanding our alternative fuel fleet and integrating additional electric vehicles (EVs) into service.

Goals

5.1 – 30% reduction in fleet-wide per mile greenhouse gas emissions reduction by FY25 from a FY14 baseline (2016 target: 3%; 2017 target: 4%).

5.2 – 20% reduction in annual petroleum consumption by FY15 relative to a FY05 baseline; maintain 20% reduction thereafter (2016 target: 20%).

5.3 – 10% increase in annual alternative fuel consumption by FY15 relative to a FY05 baseline; maintain 10% increase thereafter (2016 target: 10%).

5.4 – 75% of light duty vehicle acquisitions must consist of alternative fuel vehicles (AFV) (2016 target: 75%).

5.5 – 50% of passenger vehicle acquisitions consist of zero-emission or plug-in hybrid electric vehicles by FY25 (2016 target: 4%).

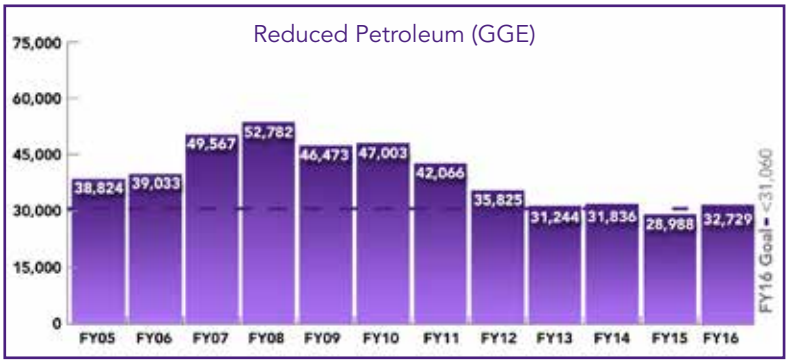
FY16 Performance Status

Vehicle Greenhouse Gas Emission Reduction

PNNL's FY14 GHG emissions baseline is 767.25 grams of CO_2e per mile. The FY16 GHG emissions score for PNNL is 738.47 grams of CO_2e, showing a 4 percent decrease in FY16.

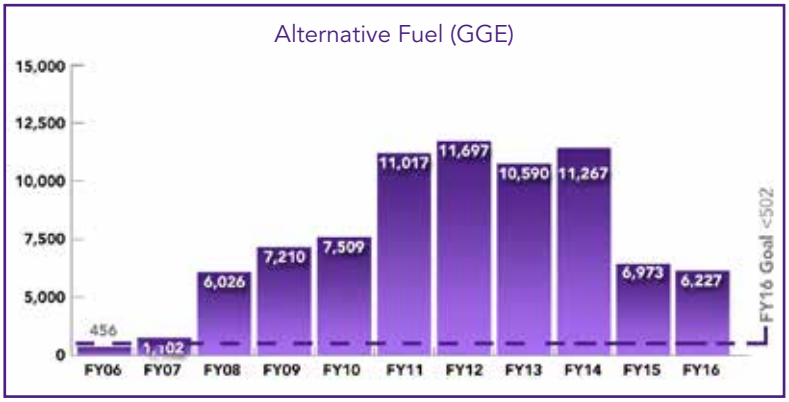
Reduced Petroleum

PNNL has reduced petroleum use 16% from the FY05 baseline. Petroleum reductions can be attributed to expanded use of AFVs, including EVs. PNNL achieved a 20 percent reduction in FY15 and continued to focus on efforts to reduce petroleum in FY16.



Alternative Fuel

Through continued training and proactive management, PNNL has far exceeded the goal of increasing alternative fuel use from the original baseline of 456 gallons of gasoline equivalent. PNNL continues to work with local fuel stations to secure a continued supply of E85 fuel.



Alternative Fuel Vehicles

PNNL strives to meet the annual goal of 75 percent of light-duty vehicles (LDVs) as AFV acquisitions by working with vehicle suppliers to acquire AFVs whenever possible. During FY16, 62 percent of the new LDV fleet acquisitions consisted of AFVs. Currently, PNNL has a total of 39 LDVs, of which 31 (79 percent) are AFVs.

Zero Emission/Plug-in Hybrid Acquisitions

PNNL fleet custodians are working closely with GSA to determine the appropriate vehicle to meet the business needs while still working to achieve this goal. At the time of the FY16 vehicle procurement process, GSA did not offer zero-emission or plug-in hybrid options for vehicle types acquired for FY16 delivery; as a result, PNNL has no zero-emission or plug-in hybrid passenger vehicles. PNNL will make every effort to meet the goal of 20 percent of passenger vehicle acquisitions to consist of zero-emission or plug-in hybrid vehicles by FY20, working towards a goal of 50 percent by FY25.

Plans, Actions, and Projected Performance

Vehicle Greenhouse Gas Emission Reduction

PNNL will continue to look at optimizing routes traveled by vehicles and consolidating deliveries where applicable. We will provide continued education to staff members on the importance of avoiding extra idling time, speed control, combining trips with other staff members when feasible, and proper maintenance to help reduce their GHG impact.

Reduced Petroleum

Due to the reduction in the number of gas combustible vehicles, PNNL will continue to promote the sharing of vehicles among staff and short-term rentals (where viable) to reduce petroleum consumption. We will continue to educate vehicle custodians about the importance of avoiding extra idling time, speed control, combining trips with other staff members when feasible, and proper maintenance.

Alternative Fuel

PNNL periodically checks the availability in the local area for bio-diesel fuel. As older vehicles are replaced, PNNL works with GSA to determine if an AFV or fully EV is an option for replacement.

Alternative Fuel Vehicles

PNNL will continue working with GSA to replace vehicles with AFVs whenever available.

Zero-Emission/Plug-in Hybrid Acquisitions

PNNL will work closely with GSA to acquire Zero-Emission or Plug-in Hybrid vehicles for all newly acquired passenger vehicles. Consideration for Zero-Emission or Plug-in Hybrid vehicles will also be taken into account when ordering other vehicle classes.

Success Story

The PNNL fleet currently consists of low-speed EVs, strategically located throughout the campus to support PNNL's business needs in an efficient manner. PNNL's charging infrastructure consists of three main types—facility connected direct plug-ins, government-use-only pedestals, and ChargePoint stations—and has capacity to support continued EV fleet growth, positioning PNNL to meet the future requirements outlined in EO 13693, *Planning for Federal Sustainability in the Next Decade*. ChargePoint stations facilitate streamlined oversight and data management, allowing staff to utilize the stations when not in use by fleet vehicles. PNNL has also incorporated the installation of EV charging stations into our *Engineering Design Standards*, which enables the process to be repeated in all major renovations to buildings and/or parking lots, as well as new facility construction projects.

In FY16, PNNL successfully extended the infrastructure to include two new EV charging stations, with three additional pedestals underway. As the PNNL campus strategy continues to take shape, Fleet Management will work to ensure adequate stations are available to meet the future needs, as outlined in EO 13693.

Sustainable Acquisition

PNNL includes sustainable acquisition provisions in 100% of applicable solicitations and contracts.

Goal

6.1 – Promote sustainable acquisition and procurement to the maximum extent practicable, ensuring BioPreferred and biobased provisions and clauses are included in 95% of applicable contracts.

FY16 Performance Status

During FY16, PNNL implemented several improvements to its acquisition system for sustainability compliance. Below are highlights

- Provided continuing education to contracts specialists and technical oversight representatives about sustainable requirements and their roles/responsibilities to comply through a variety of training methods.
- Training plans were updated and education was provided to end users and management via vendor product demonstrations and training, focusing on energy-efficient equipment and laboratory-grade, ultra-low temperature freezers.
- In addition, the Business to Business Program Office (managing PNNL's eProcurement program) advertised sustainable ideas to employees via an information booth at events and remained actively involved with various ongoing internal issues to enhance PNNL's staff awareness of and commitment to sustainable purchasing.
- PNNL was the recipient of two green purchasing awards, the Electronic Product Environmental Assessment Tool (EPEAT) for exemplary procurement of electronics and DOE's Green Buy Award for excellence in the purchasing of custodial, construction (specifically carpet), and office products.
- Participated as a subject matter expert at the DOE Office of Science peer review on "Implementation of Sustainable Acquisitions (SA) at Pacific Northwest National Laboratory" with very positive feedback.

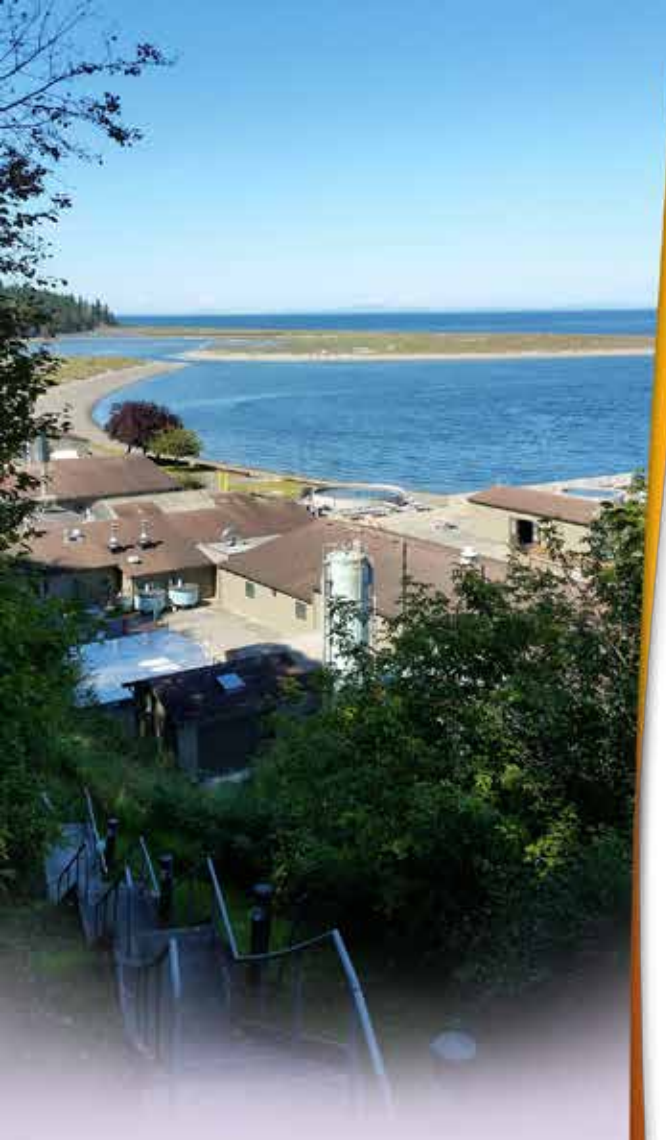
Plans, Actions, and Projected Performance

PNNL will continue increasing the staff's awareness on available sustainable products, participate in on-campus events, and educate staff about sustainable acquisitions. Benchmarking with other federal agencies on best practices will also proceed. Planned activities for FY17 include the following:

- Provide continuing education to contracts specialists and technical oversight representatives about sustainable requirements and their roles/responsibilities to comply with the requirements of PNNL's SSP and Prime Contract updates relative to sustainable acquisitions requirements.
- Provide education to end users and management via vendor product demonstrations, as well as a focused, small order initiative promotion aimed toward reducing supplier GHGs.
- Continuing to partner with the DOE SPO on their supply chain GHG impact analysis and reporting.

Success Story

A PNNL staff member was selected to participate with colleagues from a variety of industries from all over the world on EPA's Pilot Program to Assess Standards and Ecolabels, which aims to pilot and offer recommendations on EPA's proposed Draft Guidelines for Product Environmental Performance Standards and Ecolabels for Voluntary Use in Federal Procurement by reviewing and providing comments and feedback on the guidelines. Considering initial Pilot assessment results and discussions with the Panels and Governance Committee, EPA has worked to develop potential revisions to the Guidelines and approaches to presenting EPA's recommendations to federal purchasers in an effort to create a transparent, fair, and consistent approach to selecting environmental performance standards and ecolabels that support DOE's and, ultimately, PNNL's mission and SSP goals. The fact that PNNL was selected to participate on the committee gives it a unique opportunity to work on guidelines and standards from inception and provide feedback from a subcontractor perspective.



Pollution Prevention and Waste Reduction

PNNL will continue to focus on waste diversion and minimize its chemical inventory.

Goals

7.1 – Divert at least 50% of non-hazardous solid waste, excluding C&D debris.

7.2 – Divert at least 50% of C&D materials and debris.

FY16 Performance Status

Waste Diversion

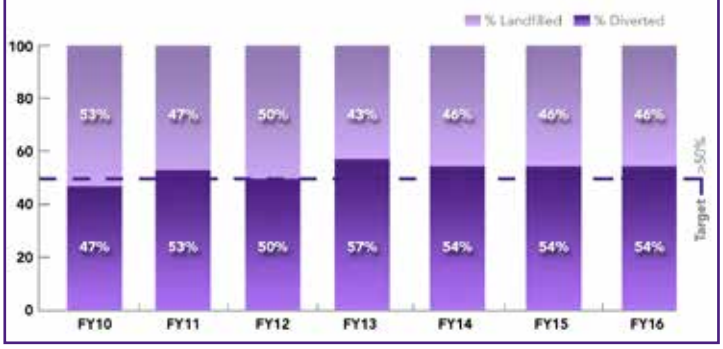
Solid Waste

PNNL has integrated a recycling and excessing program for multiple waste streams, which includes electronics, batteries, research equipment, furniture, office products, scrap metal, wood, paper, plastic, glass, aluminum, tin, and cardboard. A procedure guide in PNNL's online instructional portal, How Do I, provides staff with requirements and instructions for releasing any materials or equipment from PNNL. How Do I also provides instructions on waste minimization through recycling or redistribution.

Recognizing that nitrile gloves create one of the largest waste streams from PNNL's research activities, the P2 team piloted a nitrile glove recycling program in FY15. Building upon the success of the pilot, additional nitrile gloves collection stations were added in four buildings: EMSL; PSL; Bioproducts, Sciences, and Engineering Laboratory; and the Biological Sciences Facility. Through this program, nearly 300 pounds of gloves have been collected and recycled at Kimberly Clark's RightCycle® facility. PNNL will continue identifying appropriate laboratory spaces for nitrile glove recycling in FY17.

In FY16, PNNL diverted approximately 54 percent of nonhazardous sanitary waste, which resulted in an increase of over 100 tons of recycling compared to 2015. This success is contributed to innovative program communication and infrastructure/process improvements.

Diversion of Non-Hazardous Waste from Landfill



Construction and Demolition Waste

PNNL has a wide variety of construction and demolition (C&D) work activities that vary from large construction projects to small scopes of work. Reuse and recycling strategies are integrated with project planning, enabling continued success in C&D waste diversion. For example, during FY16, PNNL removed existing asphalt in parking lots and roadways around three buildings that needed repaving. All of the removed asphalt (approximately 225 tons) was recycled through a local recycling facility. PNNL diverted 93 percent of C&D waste in FY16.

Composting

PNNL's composting program consists of both off-site and on-site composting. Typically, yard waste is collected in a designated yard waste container for off-site composting through COR. In FY16, nearly 15 tons of green waste was diverted. PNNL has six plastic hot composters to support the on-site composting activities. Management of the on-site composting station is a group effort between the P2 program, the Battelle Garden Club members, and volunteer composting leads. Composting leads collect food scraps from building lunch rooms and empty them into the hot composters, allowing Garden Club members to use the compostable materials as a natural fertilizer for their vegetable gardens. In FY16, increased staff engagement has led to the expansion of the composting team, tripling in size from 5 to 17 leads, resulting in approximately 1.5 tons of food scraps being diverted from the landfill.

Toxic Chemical Reduction

Chemical Management

PNNL's ChemAgain chemical redistribution program provides the primary means of collecting and redistributing usable chemicals. This program successfully redirected nearly 530 containers of chemicals in FY16 through internal transfer or donation.

During FY16, PNNL partnered with the Washington State Department of Ecology Hazardous Waste & Toxics Reduction Safer Choice Project to identify opportunities in replacing existing janitorial products with Safer Choice Certified (SCC) products. As a result, PNNL added two SCC products to the janitorial inventory and retired one non-SCC product.

The P2 Pays and Sustainability Pays programs are the fundamental mechanisms for assessing opportunities in reducing chemicals and waste at PNNL. In FY16, P2 Pays and the National Security Directorate have jointly provided funds to modify an existing sub-boiling acid distiller to convert sufficient quantities of reagent-grade acid to ultra-trace Optima-grade nitric acid. The modified unit is now capable of generating up to four times the original throughput and provides sufficient quantities to support ongoing research activities. This effort is expected to reduce acid waste by approximately 50 to 100 gallons and offset procurement costs of Optima-grade acid by approximately $18,000 annually.

Integrated Pest Management

PNNL's ground maintenance staff uses state-licensed, commercial-grade pesticide applicators. These professionals are required to complete continuing education training annually to learn about the latest trends in pest control, current chemical and biological control agents, and updated legislative changes. The grounds maintenance staff is committed to integrated pest management principles, where applicable.

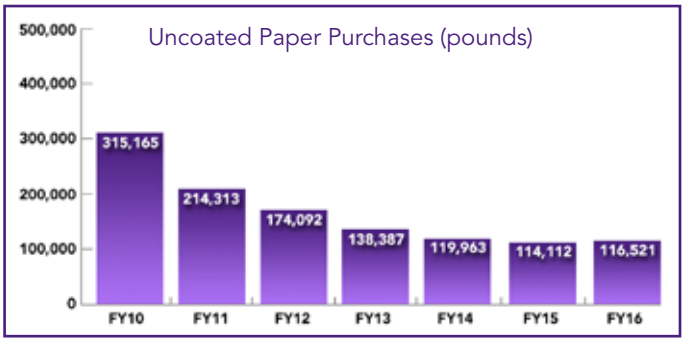
The grounds staff recognizes the responsibility to provide a clean, low-pest environment at PNNL and strives to limit control efforts to those absolutely required for optimal results. Pest control methods begin with the lowest impact, only escalating, when required, to the level necessary for acceptable control.

Best practices include:

- Using wasp traps in lieu of spraying
- Removing unwanted cardboard and wood pallets
- Using sticky and metal traps for mouse control
- Using netting and spikes to reduce bird issues

Printing Paper Use

Printing continues to be an essential element for conducting PNNL's mission-related work. However, many processes are moving to electronic or paperless systems. At PNNL, records are now maintained electronically in the Hewlett Packard Record Management system. Required training records are completed electronically and conference rooms are equipped with audiovisual equipment that enables staff to deliver presentations electronically. All existing network printers are now set to duplex, and new printing servers have been deployed. PNNL has successfully implemented a paperless procurement process, leading to an overall reduction in printing paper usage.



In FY16, a revised Shipping Request form has resulted in an annual savings of 36,000 pages—an outstanding team effort by the Logistics, Communications, and Quality groups. Prior to the release of the new form,

each 2-page Shipping Request form defaulted to print the full 10-page document, including 8 pages of instructions. The team observed an opportunity to reduce paper use and took the initiative to develop an e-form, reducing the document instructions and limiting the form to print on two pages.

Approximately 96 percent of uncoated paper, by weight, purchased during FY16 contains at least 30 percent post-consumer content. Overall paper use by weight was similar to FY15.

Plans, Actions, and Projected Performance

Waste Diversion

PNNL has achieved DOE's 50 percent nonhazardous solid waste diversion and 50 percent C&D waste diversion goals. The following initiatives have been established to identify and address continuous improvement opportunities in the P2 program.

P2 Program

PNNL plans to reduce sanitary waste through:

- Conducting a "Recycler of the Month" challenge to raise recycling awareness and improve recycling performance.
- Collaborating with COR to reduce PNNL's paper towel waste through the city's composting facility, which is currently limited to yard waste and the Waste Water Treatment Plant bio-solid waste.
- Continuing to expand nitrile gloves recycling from pilot to a Laboratory-wide program, as appropriate.
- Encouraging the removal of personal printers in an effort to reduce printing.
- Continuing to host all-staff celebrations as "zero waste" events.

Toxic Chemical Reduction

PNNL will explore an additional teaming opportunity with the Washington State Department of Ecology's Hazardous Waste & Toxics Reduction Safer Choice Project to evaluate opportunities for replacing existing Facilities and Operations products with biobased or Safer Choice products.

Success Story

Improvement opportunities identified in an FY15 performance assessment were used to develop the P2 program improvement strategy. FY16 efforts largely focused on improving staff engagement and streamlining P2 operations. As a result, PNNL has observed a positive culture shift in recycling and increased recycling by over 100 tons. Key accomplishments include:

- Modeled after the success from the FY15 "Rock the Watt – Building Energy Challenge" campaign, the Sustainability Team recruited additional Building Sustainability Champion (BSC) volunteers to identify sustainability opportunities by engaging in conversations about conservation and recycling with fellow staff members, adding a personal, peer-to-peer approach to the program. This approach has yielded over 30 energy- and recycling-related improvement opportunities identified by the BSCs for FY16. Additionally, leveraging the BSCs' personal outreach, the composting team has grown from 5 to 17 leads.
- A nitrile glove recycling program was initiated in 2015 to divert this high-volume, yet hard-to-recycle waste stream from laboratory spaces. Nearly 300 lbs of gloves have been collected and recycled from four buildings during FY16.
- Recycling at PNNL has become easier with "single-stream recycling," launched in late 2016. Before single-stream recycling, routine recyclables were separated into several different bins; we hope to improve the recycling culture with this new, zero-sort recycling.

Energy Performance Contracts

First steps taken toward new UESC.

Goals

8.1 – Annual targets for performance contracting to be implemented in FY 2017 and annually thereafter as part of the planning of section 14 of E.O. 13693.

FY16 Performance Status

Energy Performance Contracts

PNNL successfully leveraged alternative financing in 1996, 1997, and 2002, utilizing Energy Savings Performance Contracts (ESPCs) worth several million dollars. The projects targeted the replacement of outdated building infrastructure, including boilers, chillers, standby generators, air compressors, lighting, variable air volume units, and building controls. The upgrades eliminated significant amounts of deferred maintenance and improved the overall building efficiency and reliability.

Three additional projects were evaluated for the use of alternative financing in 2005, 2008, and 2011 and were found to not be financially viable. Conservation measures investigated during these evaluations included upgrades to systems, such as compressed air, lighting, HVAC, and building controls, as well as installation of photovoltaics.

In 2016, a Request for Interest for a UESC was sent to serving utilities. The request sought interest regarding companies' energy management services offerings in the form of a UESC, discussed locations for consideration, and potential conservation projects.

Plans, Actions, and Projected Performance

Energy Performance Contracts

In FY17 and beyond, in partnership with the Pacific Northwest Site Office, we will evaluate received interest responses and select a utility to work with. The next step will be energy and water evaluations performed on-site by the selected utility. The utility provider will then develop preliminary ECMs and water conservation measures, which we will evaluate. Selected measures will undergo an investment-grade audit and engineering design. Consideration will be given to strategies that support Net Zero building goals. Projects that are determined to be lifecycle cost effective will be candidates for implementation, provided they are compatible with the Laboratory strategy moving forward.

Electronic Stewardship

Sustainable computing considers each lifecycle stage.

Goals

9.1 – Purchases - 95% of eligible acquisitions each year are EPEAT-registered products.

9.2 – Power management - 100% of eligible PCs, laptops, and monitors have power management enabled.

9.3 – Automatic duplexing - 100% of eligible computers and imaging equipment have automatic duplexing enabled.

9.4 – End of Life - 100% of used electronics are reused or recycled using environmentally sound disposition options each year.

9.5 – Data Center Efficiency. Establish a power usage effectiveness target in the range of 1.2-1.4 for new data centers and less than 1.5 for existing data centers.

FY16 Performance Status

Purchases

In FY16, 99.75 percent of eligible acquisitions were EPEAT-registered products and 100 percent are currently Energy Star qualified. 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.

Power Management

All managed Windows and Mac systems ship with power management capabilities enabled. Staff members are encouraged not to change these settings unless there is a valid business need, such as monitoring a long-running experiment.

Automatic Duplexing

PNNL's default position is to configure all duplex-capable printers to use duplex printing and encourages staff to retain this setting. Staff members with a valid business need may request duplex printing be overridden to single-side printing by contacting the Help Desk. As of FY16, 31 percent of printers at PNNL are not capable of duplex printing. Of the 615 capable printers, 93 percent have duplex printing enabled by default.

End of Life

In FY16, all assets identified as electronics to be disposed of as excess were reused or recycled using environmentally sound disposition options.

Prior to excess, custodians have the ability to advertise equipment as available for sharing or redeployment within the "Assets" tool. Excess computers and associated electronics are routinely redeployed within the Lab upon request. Excess electronics with remaining life may be advertised for redeployment to other national laboratories, transferred to schools, or distributed through the Community Re-Use organization. Electronics that are not in working order, or that cannot be sanitized, are recycled with an E-Cycle vendor that has been approved by our Environmental Protection and Regulatory Program.

The PNNL approval process includes:

- Certifications.
- The Resource Conservation and Recovery Act, as well as the air and water record with the EPA and the applicable state.
- History of violations.

Data Center Efficiency

PNNL performed energy assessments and profiled its data centers during FY16 using DOEGRIT, part of the Data Center Profiler software tool suite. Assessment results help outline projects that will guide us to better data center efficiencies.

Since FY06, PNNL has aggressively pursued virtualization as the tool to minimize server sprawl, conserve energy, and reduce the equipment footprint of the Information Sciences Building 2 data center.

All three data centers have been profiled using Data Center Profiler by our Certified Data Center Energy Practitioner. The combined weighted existing data center power usage effectiveness (PUE) is 1.36. Individual data center PUE results are as follows:

- **CSF**: PUE 1.18 annualized, average Information Technology (IT) Load – 574.46 kW
- **EMSL**: PUE 1.37 annualized, average IT Load – 877.46 kW
- **ISB2**: PUE 1.58 annualized, average IT Load – 149.18 kW.

Plans, Actions, and Projected Performance

PNNL will continue to accomplish electronic stewardship goals through a variety of mechanisms, including the use of power management capabilities (part of our current management suite). We continuously look for more energy-efficient end-user devices as they appear on the market and work hard to educate users about how they can be more efficient consumers of computational resources.

We are currently making significant investments in migrating staff to a network-based telephone system. This brings added flexibility and untethers them further from their offices, allowing staff members to be productive wherever they need to work. We are confident this will be a key enabler in supporting telework and encourage greater use of virtual collaboration technologies.

PNNL will continue to establish and implement policy and guidance to encourage the use of appropriate power management, duplex printing, and other energy-efficient or environmentally preferred options and features on capable electronic products. Low-energy-intensive laptop computers will become the norm as PNNL works toward its teleworking goal.

Success Story

The ability for staff to advertise electronic assets for internal sharing or redeployment in the new online tool will remain available moving forward. Enhancements that would allow staff to search on additional attributes are being considered. While staff can perform a wide variety of searches now, plans include the ability to browse the entire list of assets advertised for sharing or redeployment.

We will continue performing energy assessments and profiling of data centers using DOEGRIT. Assessment results will be analyzed using the Decision Tool and implemented if cost-effective. Data center metering is now active across all three data centers and reporting PUE. Additional refinements, data collection, and data center infrastructure management software used to monitor and warn of thresholds being exceeded are being added to make the measurements more useful.

We will also continue to upgrade and augment data collection and our automated monitoring of uninterruptible power supplies (UPSs) in laboratory spaces. Programmed power interruption notification, standardized UPS equipment, and automatic UPS maintenance and battery replacement are proving popular with users.

Climate Change Resilience

Preparing today to mitigate potential climate change impacts.

Goal

10.1 – Update policies to incentivize planning for, and addressing the impacts of, climate change.

10.2 – Update emergency response procedures and protocols to account for projected climate change, including extreme weather events.

10.3 – Ensure workforce protocols and policies reflect projected human health and safety impacts of climate change.

10.4 – Ensure site/lab management demonstrates commitment to adaptation efforts through internal communications and policies.

10.5 – Ensure that site/lab climate adaptation and resilience policies and programs reflect best available current climate change science, updated as necessary.

Resiliency Planning

Vulnerability Assessment Approach

During FY15, PNNL completed a robust vulnerability assessment and developed a *Climate Resilience Action Plan*, which is available on the PNNL Sustainability website. Our approach drew from established methodologies and our practical experience supporting other agencies in conducting vulnerability assessments. Our methodology involved:

1. Creating a core project team and work plan.
2. Securing the commitment from an internal stakeholder team of 10 to 15 decision-makers.
3. Understanding locally relevant climate exposures and what PNNL "core systems" could be impacted by those exposures.
4. Assessing existing internal and external plans and identifying potential vulnerabilities to highlighted exposures.
5. Prioritizing vulnerabilities during an internal stakeholder workshop and engagement with select external stakeholders.
6. Establishing a resiliency action plan, an approach to integrating actions into PNNL's ongoing operations, and a limited set of metrics to monitor future changes in resilience.
7. Sharing findings with key external stakeholders.

The climate resilience planning framework and guiding questions are depicted in the following figure. The initial phase of the project focused on internal stakeholder engagement with outreach to select external groups, as needed, to fill information gaps. The internal stakeholder team included a cross-cutting group of program managers and technical personnel with responsibility for employee

safety, environmental management, energy and water resource management, IT systems, emergency planning, facility engineering and design, and campus master planning. The members of this group have direct responsibility for plans, infrastructure, and systems that are potentially vulnerable to climate impacts. Subject matter experts in climate impacts assessment, risk assessment, and resiliency planning were also engaged as part of the planning team.

Risks to Mission, Operations, and People

Our assessment of potential climate exposures, impacts on core systems, and current levels of preparedness highlighted both strengths and opportunities in our current plans and procedures. Higher priority areas, shown in the figure below, are the focus of PNNL's near-term climate resiliency planning actions.

Climate Exposure/Core System	High Temperatures	Intense Precipitation	Wildfire	Drought	Storms and Winds	Ice Storms
Buildings	Higher	Higher	Medium	Medium	Medium	Medium
Energy	Higher	Lower	Lower	Medium	Medium	Lower
IT Services	Medium	Medium	Lower	Lower	Medium	Lower
Worker Safety & Health	Lower	Lower	Medium	Lower	Lower	Lower
Water Resources & Infrastructure	Lower	Lower	Lower	Lower	Lower	Lower
Transportation	Lower	Lower	Lower	Lower	Lower	Lower

The two climate exposures of highest concern to our campus operations are the projected increase in the number of high-temperature days and intense precipitation events that we experience each year. Of particular concern is how these climate exposures could impact our building infrastructure and energy systems. For example, an increased number of high-temperature days in the decades ahead could raise costs and decrease reliability as building exteriors and HVAC systems degrade at a faster rate, energy use increases as cooling systems work harder, and facility maintenance costs increase due to the added stress on systems. An increase in the number of intense precipitation events could lead to flood damage to roofs and damage to ground-level and below-grade facilities. Of particular concern is the flood risk to a below-grade data center on our campus.

See the *Climate Resilience Action Plan* on the PNNL Sustainability website for more information on climate exposures and core system vulnerabilities rated medium or low priority.

Actions to Building Resilience

The PNNL *Climate Resilience Action Plan* describes current and planned actions to build PNNL's resiliency to future climate exposures. Actions for our highest priority systems are summarized in the table below.

Most current measures are well-established procedures that are documented in plans and design standards. In FY16, PNNL has begun incorporating new measures into existing procedures and assessments, and this effort will continue through FY17. Once fully implemented, the new measures should help reduce these vulnerabilities and increase resilience.

Current and Future Actions to Address High Priority Climate Impacts on PNNL Systems		
Climate Exposure and System Impacts	**High Temperature Impact on Building and Energy Systems**	**Intense Precipitation Impact on Building Systems**
Current Measures	• Preventative maintenance plans are reviewed annually • Cool roofs are the design default • Maximize use of light-colored materials for roofs and hard-paved areas • Use of shade trees • Optimize building orientation • Plans for a mobile chiller to boost systems stressed by heat • Three ESPCs will reduce energy demand • Ensure energy escalation rates reflect risk in facility design and operations planning	• Preventative maintenance procedures to clean roof drains • Current building drain systems are designed for 1" of rain in 24 hours
New Measures Identified in FY15 to Build Resilience and FY16 Status	• Track equipment life relative to life expectancy and adjust in lifecycle cost (LCC) analyses if needed – FY16 Status: Equipment LCC is tracked via MARS (PNNL's maintenance program software). Premature equipment failures due to climate are reviewed during annual assessment. Equipment LCC will be adjusted in MARS. • Use building control systems to alternate operating schedules and reduce power load if needed – FY16 Status: PNNL has the ability to reduce power load if needed through its building control system (Johnson Controls Metasys). Operation of this system is captured in a PNNL operating procedure. Additionally, Facility Operation is partnering with R&D to enable automating power load reduction program, VOLTTRON, in several buildings. • Model temperature increases in new building designs and consider trade-offs for changes in envelope and HVAC design – FY16 Status: Evaluation to assess the current ASHRAE requirements against the U.S. National Oceanic and Atmospheric Administration climate predictions was initiated in FY16 and anticipated to be completed in FY17. • Implement continuous commissioning and facility-tuning to reduce energy demand – FY16 Status: Initiated continuous commissioning and facility-tuning for EISA "covered facilities" to reduce energy demand.	• Revisit preventative maintenance procedure for building drainage systems for adequate frequency – FY16 Status: Preventative maintenance measures associated with building drainage were reviewed and determined to be adequate. • Include drains in five-year facility condition assessments – FY16 Status: Five-year condition assessment procedure was reviewed and determined that it includes drainage system integrity. • Consider flood risk changes in building design and leasing decisions – FY16 Status: Evaluated the flood risk changes in building design and determined that this is a low risk and no further action is needed at this time. • Assess risk of buildings with below-ground access – FY16 Status: Evaluated the flood risk for building with below-ground access and determined that this is a low risk and no further action is needed at this time. • Assess building and parking lot catch-basins/storm drains annually to ensure effective infiltration – FY16: Preventative maintenance measures associated with catch-basins/storm drains were reviewed and determined to be adequate.
Responsible Offices	• Sustainability Program • Facilities Strategic Planning • Facilities Engineering • Facilities & Grounds Maintenance	• Sustainability Program • Facilities Engineering • Facilities & Grounds Maintenance

Additionally, as part of the FY15 climate resilience planning effort, we defined a set of metrics that could be tracked over time to help gauge changes in climate risk. The effort to integrate these metrics into the Sustainability Management and Operations Program management system began in FY16. Based on further conversations with data holders and other stakeholders, some of the indicators have been modified or refined. The revised metrics are provided in the table below. And status of the metrics will be provided to the internal climate resilience planning team in FY17.

For the next few years, we will use this information to better understand baseline conditions. Over time, we will be in a better position to understand whether risk thresholds have been crossed, which may necessitate new policies, procedures, or plans for adoption.

Risk	Indicator
High Temperature Risk	Number of days over 100°F per year
	Premature HVAC equipment failure rates for envelope degradation rate
	Cooling season utility costs, sustained year-over-year
	Total water use during cooling season for cooling
Wildfire Risk	Number of fire events per year in region
	Cost of responding to (managing) wildfire events
Intense Precipitation Risk	Number of rainfall events per year that exceed 1" in 24 hours
	Number of flood incidents per year that affect facilities and infrastructure (e.g., vaults)
	Cost of responding to flood events
	Number of times catch-basins are clogged per year and require maintenance (beyond annual preventative maintenance)

Climate Resilient Design and Management of New Buildings

Plans for the future build-out of the PNNL campus focus primarily on the development of federally owned lands that are currently part of PNNL's core campus (see the PNNL *Campus Master Plan* for more information). While some existing leases may be renewed, new leases are not currently the focus of our facility acquisition strategy for the PNNL site. Most of PNNL's future real property decisions will involve new construction at the north end of the core campus.

Based on our initial vulnerability assessment, we do not believe that planned development will increase PNNL's exposure to wildfire or flood events. River levels on the Columbia are largely controlled by dams. And fire risk is currently addressed by the requirement of the PNNL fire protection program to maintain defensible space between PNNL-managed facilities and natural cover or wildland areas. Current maintenance and building design standards that support this objective include ensuring that vegetation is kept away from buildings, increasing the use of xeriscaping and rock garden features, and focusing development on the existing core campus rather than in outer wildland areas.

During FY17, PNNL will assess the current ASHRAE requirements against the U.S. National Oceanic and Atmospheric Administration predictions to incorporate PNNL's climate resiliency plan into building designs.

Regional and Local Coordination

During FY15, we took our first steps to engage select local and regional stakeholders in a dialogue around climate impacts and resiliency planning. Our stakeholder engagement efforts informed our assessment of PNNL site vulnerabilities and helped inform the resiliency planning efforts of others by sharing findings from our analysis.

To fulfill our mission, we depend on a number of local and regional organizations to provide us with a reliable and uninterruptible flow of services and products. As part of our vulnerability assessment, we identified services that could be interrupted or diminished by regional climate impacts, and we initiated a dialogue with those key service providers to better understand their current levels of preparedness and plans. For example, we spoke with our local electric utility and internet service providers to better understand the extent to which lines serving our campus were underground (i.e., at lower risk from wildfire or trees falling during more intense precipitation events) and whether existing wood poles had fire retardant pole wraps or plans for replacement with steel poles. This input shaped our prioritization of vulnerabilities.

We also began sharing with select external stakeholders the results of our assessment of regional climate impacts, PNNL campus vulnerabilities, and plans for building resilience. At the end of FY15, we presented our findings to a group of representatives from the DOE-Richland Site Office, the DOE Office of River Protection, lead Hanford contractor Mission Support Alliance, and other organizations responsible for clean-up at the Hanford Site. Based on this dialogue, Sustainability Program personnel from PNNL and Hanford agreed to collaborate on the development of a forthcoming, similar vulnerability assessment for the Hanford Site.

In FY16, PNNL partnered with Sustainability Program personnel from Hanford to facilitate development of that assessment and produced the first-ever climate vulnerability assessment and resilience plan for the Hanford Site. We were able to leverage the climate exposure data and analysis completed for the PNNL vulnerability assessment. PNNL research scientists helped form the Hanford stakeholder team, facilitated planning workshops, and provided technical analysis of potential climate impacts. The findings from both the Hanford and PNNL assessments were shared at Energy Exchange 2016. The very different vulnerabilities identified across the two sites, which share a border, illustrates how the local context can influence vulnerability and the importance of site-level assessments.

In FY17, the PNNL and Hanford climate assessment teams will continue to collaborate and share data that is of interest to both organizations, such as extreme weather events, high-heat days/wet-bulb globe temperature data, and fire-risk days.

Beyond our efforts to make PNNL campus operations more resilient, research staff members in our Atmospheric Science and Global Change Division are helping DOE and others advance the fundamental science behind climate change, from regional to global scales. We are collaborating with a number of federal entities, including DOE, the U.S. Department of Homeland Security, EPA, and the National Aeronautics and Space Administration; universities; and industry to better understand how human activities and natural systems interact to affect the earth's climate.

In addition, scientists at PNNL's Joint Global Change Research Institute at the University of Maryland are collaborating with DOE, the U.S. Department of Defense, the National Aeronautics and Space Administration, GSA, and other agencies to improve methods and data for conducting vulnerability assessments and using the results to improve design, acquisition, and maintenance of infrastructure and facilities to account for uncertainty in future climate. In addition to conducting climate science research that is essential for identifying vulnerabilities and planning adaptation, Atmospheric Sciences and Global Change scientists play leading roles in national and international assessments, such as the National Climate Assessment and the Intergovernmental Panel on Climate Change. More information on PNNL's contribution to climate science can be found on PNNL's Atmospheric Sciences and Global Change webpage.

Emergency Response Procedure

The PNNL Emergency Management and Business Continuity Plans adequately address most hazards that could result from long-term climate variability and change through the Emergency Preparedness hazards surveys, conducted on a triennial basis, which cover a multitude of natural phenomena events (e.g., flood, wildfire, earthquake). Both PNNL Emergency Management and Business Continuity Plans utilize an all-hazards-based approach to include response processes that are flexible and adaptable to a multitude of scenarios. These plans are considered sufficient to address any climate change concerns and no further actions are necessary. The Sustainability Program will continue to engage this office as part of our internal stakeholder team that conducts a bi-annual climate resilience review and will adjust accordingly in the future.

Health and Safety Procedures

Worker health and safety represents one of PNNL's "core systems" that we evaluated for potential climate impacts. As part of the FY15 vulnerability assessment, we identified six potential regional climate exposures that could influence worker health and safety, as depicted in the corresponding figure. Based on an assessment of the vulnerabilities associated with each exposure and current or planned measures in place to manage those vulnerabilities, we applied a "high, medium, or low" priority rating.

Five of the six exposures were deemed low concern, with no additional actions required. For example, "heat stress, heat stroke, and dehydration of outdoor

maintenance personnel" was identified as a vulnerability from having an increased number of high-temperature days each year. However, current procedures in place (e.g., educating staff to take breaks, drink fluids, and know symptoms of heat stress and heat stroke, as well as starting shifts of outdoor workers two hours earlier in hot months) were deemed adequate for managing this risk.

Worker health and safety concerns associated with wildfires were assessed to be of medium concern. Specific vulnerabilities identified included potential health effects from smoke pulled into buildings through ventilation systems and driving hazards posed by low visibility on campus roads. Current measures in place will help mitigate this risk to a great extent. For example, our fire response plans already look at air filter loading during fire events, and we maintain a high-efficiency particulate air intake filter inventory. For driving hazards, our hazard advisory system and Laboratory workday closures/delays encourage staff to stay off roads when unsafe, and our flex time and telework policies help to reduce commuting risks in such circumstances.

During FY17, PNNL will review applicable new measures to help manage deficiencies, including adding an assessment of air quality risk to the field work checklist for research staff.

More information on the worker health and safety assessment can be found in the *Climate Resilience Action Plan* on the PNNL Sustainability website.

Management Commitment

The climate resiliency planning internal stakeholder team established during FY15 comprised senior managers of programs deemed critical to PNNL's climate resiliency, as described above. This team will meet in FY17 to ensure that we have followed through on our commitments to improve PNNL's resilience to climate impacts, review metrics that could indicate changes in our vulnerability, and determine the need to revise plans and procedures. The climate vulnerability assessment and resiliency planning process helped increase awareness and commitment of the staff to this process on an ongoing basis.

Use of Best Available Climate Change Science

PNNL's research on atmospheric processes and the interconnections among energy, climate, and other human and natural systems is helping to inform sustainable solutions to the nation's energy and environmental challenges. Having subject matter experts on-site puts PNNL in a good position to stay on top of the best available science and to understand how regional climate dynamics could impact our own campus operations.

The *National Climate Assessment*, which includes a series of reports on the Northwest (Dalton 2013)[1] was a key resource consulted during our FY15 vulnerability assessment process. Furthermore, one of PNNL's senior research scientists delivered an assessment of key regional risks and helped the internal stakeholder team understand how those exposures may play out at a local scale during our first stakeholder workshop.

The Sustainability Program team members responsible for climate resilience planning will continue to review updates to national plans as they occur and consult with internal subject matter experts, as warranted, to discuss evolving climate change scenarios. The team has also started using the U.S. Climate Resilience Toolkit to help understand climate issues and improve PNNL's climate change resilience strategy. For example, we are considering how to use the locally downscaled data from global climate models on the projected number of annual high-temperature days as an input to our new building designs.

Climate Change Resiliency Survey

Inputs to the climate change resiliency survey are provided through the DOE Sustainability Dashboard. The results of the survey have shown the following opportunities for improvement to PNNL's climate resilience review and planning process:

- Record and track severe weather events, extreme events, and/or resulting site-shutdowns.
- Designate a single point of contact to coordinate and communicate climate resilience-related topics to PNNL's diverse stakeholders.

(1) Dalton M., P.W. Mote, and A.K. Snover, eds., 2013: *Climate Change in the Northwest: Implications for Our Landscapes, Waters, and Communities*. 224 pp. Island Press, Washington, D.C.

Fleet Management Plan

Program description and related policies that govern fleet procurement, utilization, and disposition.

PNNL's Fleet Management is aligned within the Asset Management organization, which oversees the efficient lifecycle management of assets and materials at the Laboratory. One of Fleet Management's primary responsibilities is to oversee the government-owned vehicles and equipment that support PNNL's mission. Fleet Management provides the vehicles that help facilitate research in the field, relocate offices, and keep our facilities fully operational. In addition to Fleet Management, the business areas for which Asset Management has responsibility include Property Management, Logistics, Excess and Redeployment, and Property Accounting.

Following recent DOE fleet allocation guidance, PNNL's fleet procurement activity is limited to replacement of vehicles based on the GSA replacement standards. PNNL has no additional future procurement plans. GSA-leased vehicles are replaced according to the GSA retention schedule, depending on the type of vehicle and the vehicle's current mileage. Any deviation from the current allocation requires DOE approval. Each year, PNNL holistically reviews the eligible vehicles for replacement and the current business requirements of the fleet, then requests replacement vehicles that meet DOE requirements and business needs. Replacement vehicle orders are reviewed to meet Acquisition & Sustainability goals, by ensuring that all LDVs acquired use alternative fuel and all medium- and heavy-duty vehicles are the most fuel efficient possible (EISA Section 142; EO 13693 & EPAct 1992, Section 303). Vehicle fuel type is also taken into consideration based on location and availability of fuel types at the location where the vehicle is utilized.

PNNL vehicles are fueled at local fueling stations that accept either the Wright Express card supplied with GSA vehicles or a P-card issued to the vehicle driver of any DOE-owned vehicle. PNNL has increased our on-site alternative fuel infrastructure by incorporating the installation of EV charging stations into the Engineering Design Standards (ADM-CM-057-PG1). The process can be repeated as part of major renovations to buildings and/or parking lots, as well as new facility construction projects. In addition to PNNL's expanding electrical charging infrastructure, access to Unleaded, Diesel, and E85 fuel types are also available in PNNL operational locations. Only EVs or vehicles accepting these types of fuels are acquired for the PNNL fleet.

PNNL's entire fleet is assigned to a permanent custodian/organization to meet the business objectives. Custodians are required to provide annual justification for their assigned vehicle. The justification provides the business need and estimated utilization goals. These plans are reviewed by Fleet Management to ensure vehicles are being utilized effectively and to determine if vehicles need to be redistributed in order to enhance the overall utilization of PNNL's fleet. At the time the vehicle is assigned to the organization, drivers are instructed on basic policies of operating a vehicle. In addition, internal policies outline the responsibilities of operating a government vehicle.

In response to the new EO 13693 requirements, PNNL will continue to partner with our DOE fleet manager and our GSA fleet representative on development of implementation plans and guidance for acquiring and installing telematics in vehicles.

Fleet-related policies and procedures will be reviewed with an emphasis on sustainability. Fleet management continues to look for ways to partner with process owners to incorporate sustainability into business process improvements. Education and training on all policy changes will be communicated to appropriate staff members.

The PNNL fleet currently has a total of 89 vehicles, one of which is DOE-owned in support of R&D activities. PNNL replaces 9 to 10 vehicles per year, depending on the age and mileage utilization. Currently, we have 39 LDVs, of which 79 percent (31) are AFVs. The average age of the PNNL fleet is four-and-a-half years old.

Budget and Funding

The successful implementation of long-term sustainability goals requires a sound budgeting strategy and adequate funding. PNNL uses several methods, as outlined below, to secure the appropriate funding for energy and water efficiencies.

- The most efficient and preferred method is budgeting sustainable components into projects through our ESSs. We recognize that key project energy and water efficiency components (e.g., advanced building electrical meters) are mandatory, and we plan accordingly within project funding requests.
- Projects that result from energy and water evaluations are identified in ECMs and water conservation measures. They are submitted in our annual budgeting process and prioritized along with all other requests using a weighted analysis to incorporate LCC, deferred maintenance, return on investment, and direct ties to the PNNL mission.
- Direct utility savings identified from implemented energy or water projects are used to fund additional ECMs, as directed by DOE Order 436.1 and encouraged by EPAct 2005, section 102(e).
- Where available, Utility Incentive Programs will be leveraged to the maximum extent practicable to enhance energy and water reductions, as encouraged by EPAct 1992, section 152, and EISA 2007, section 516.
- If internal funding is not feasible, PNNL will pursue opportunities to use direct project funding through DOE's SPO, when available, or alternative financing mechanisms, such as ESPCs, although our low cost of energy often makes these challenging to negotiate.

PNNL recognizes that energy and water savings program success requires appropriate funding. Using our ESSs in tandem with our annual prioritized budgeting process will contribute to the completion of all viable energy and water measures. The below table summarizes our budget.

Using our annual prioritized budgeting process, along with institutional Engineering Standards and Specifications, PNNL will complete all viable energy and water measures.

Summary of Sustainability Project Funding ($K)

Category	FY16 Actual	FY17 Planned/ Request	FY18 Projected
Sustainability Projects(1)	900	850	850
Sustainability Activities (other than projects)	2345	2375	2400
SPO Funded Projects (SPO funding portion only)	50	120	0
Site Contribution to SPO Funded Project	30	40	0
ESPC/UESC Contract Payments (if applicable)	1216	1115	1200
Renewable Energy Credits (REC) Purchase Costs (if applicable)	47	50	50
Total	**4588**	**4550**	**4500**

(1) Projects specifically funded to meet sustainability goals. Such projects generally involve construction. Do not include contribution to SPO funded projects which is shown elsewhere in table.

Supercomputing at PNNL employs a forward-looking strategy to maintain leading-edge capabilities and encourages users to combine computational and state-of-the-art experimental tools, providing a cross-disciplinary environment to further research.

High-Energy Mission-Specific Facilities

HEMSFs are constructed, mission-specific facilities, such as accelerators (particle and light sources), reactors (fusion and fission), high-performance computers, high-performance lasers and similar facilities, and the closely coupled conventional facilities that are necessary to achieving DOE's mission goals. HEMSFs represent unique and often world-leading, core-mission relevant capabilities.

High-performance computing is integral to the mission, and PNNL has two Facilities Information Management System excluded facilities that meet the definition of HEMSF.

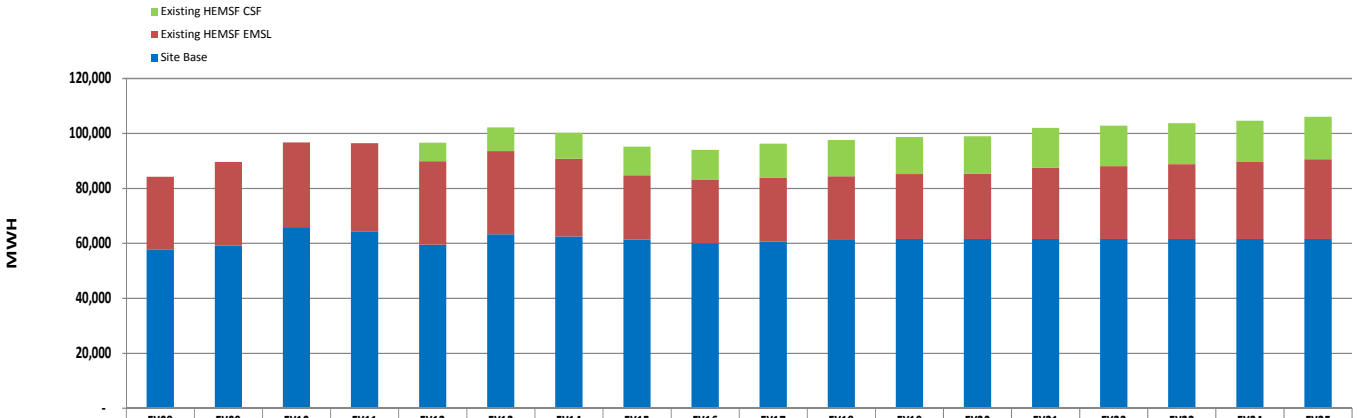
EMSL provides integrated experimental and computational resources for discovery and technological innovation in the environmental molecular sciences to support the needs of DOE and the nation. The Molecular Science Computing capability at EMSL provides users with an integrated production computing environment that includes advanced high-performance computing resources, EMSL-wide data storage, and an expert staff critical to support world-class fundamental research with the increasingly predictive, system-level simulation tools required to address complex environmental molecular science challenges. Solving intricate scientific problems requires multidisciplinary science, including close integration of cutting-edge experiments and simulations, instantaneous data access, and essential analysis and visualization capabilities. The integration of EMSL's advanced instrumentation and computational techniques is part of an unparalleled collection of capabilities designed to enable unique, cross-discipline research into core science themes—Biological Interactions and Dynamics, Geochemistry/Biogeochemistry and Subsurface Science, and Science of Interfacial Phenomena.

The foundation of EMSL's computational capabilities is the 3.4 petaflop Cascade supercomputer with 23,000 Intel processors that have 184,000 gigabytes of memory available—about four times as much memory per processor as other supercomputers. Testing has shown that it is 14 times more energy efficient per teraflop than its predecessor Chinook by incorporating rear door heat exchangers at every computer cabinet.

CSF is focused on the design and efficient implementation of computational capabilities for analysis of data from high-throughput experimental technologies, the abstraction of models from this data, and the predictive simulation of these

models. Multidisciplinary expertise spanning technical pillars of high-performance computing, data science, and computational mathematics work toward building computational capabilities that position PNNL as a computing leader. Continuous focus on enhancing the science of computing to achieve high-performance, power-efficient, and reliable computing at extreme scales for a spectrum of scientific endeavors that address significant problems of national interest, especially among PNNL's core pursuits—energy, the environment, national security, and fundamental science. CSF's newest computer, Constance, consists of 452 Intel Haswell-based nodes in quad form (when initially installed with 300 compute nodes, it ranked number 297 on the Top 500 list). Incorporating the use of rear door heat exchangers coupled with an innovative ground source cooling system has resulted in the lowest PUE at PNNL.

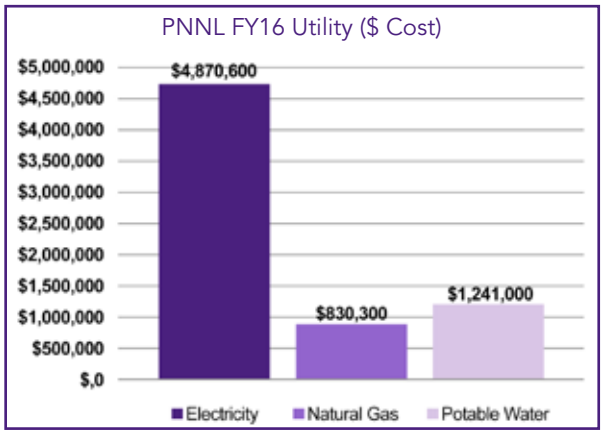
Electricity Usage, Actual and Projections, by HEMSFs at PNNL

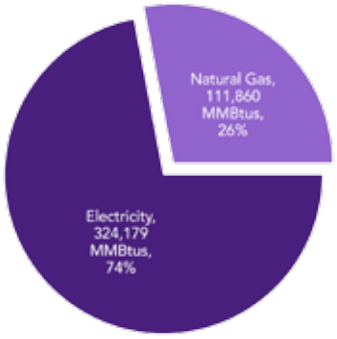


	FY08	FY09	FY10	FY11	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY23	FY24	FY25
Existing HEMSF CSF					6,773	8,600	9,411	10,476	10,764	12,330	13,240	13,460	13,570	14,430	14,770	14,950	15,020	15,420
Existing HEMSF EMSL	26,426	30,516	30,820	32,076	30,401	30,324	28,337	23,373	23,196	23,200	23,200	23,640	23,770	25,970	26,500	27,200	28,000	29,000
Site Base	57,741	59,091	65,843	64,365	59,460	63,231	62,435	61,341	60,020	60,670	61,170	61,570	61,570	61,570	61,570	61,570	61,570	61,570

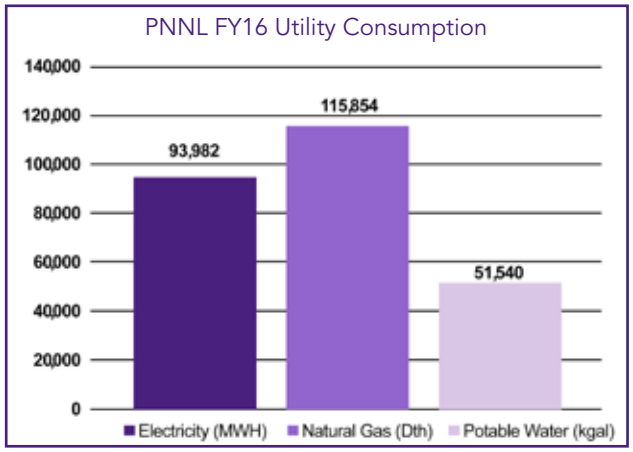
Utility Usage, Costs, and Projections

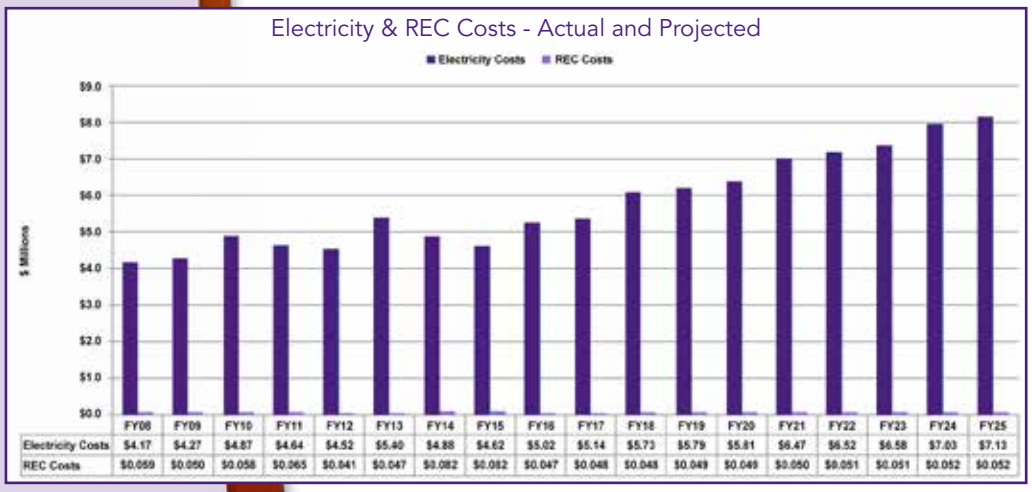
Costs and usage of electricity, water, and natural gas with electrical projections through FY25.





PNNL FY16
Energy (MMBtus)





	FY08	FY09	FY10	FY11	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY23	FY24	FY25
Electricity Costs	$4.17	$4.27	$4.87	$4.64	$4.52	$5.40	$4.88	$4.62	$5.02	$5.14	$5.73	$5.79	$5.81	$6.47	$6.52	$6.58	$7.03	$7.13
REC Costs	$0.059	$0.050	$0.058	$0.065	$0.041	$0.047	$0.082	$0.082	$0.047	$0.048	$0.048	$0.049	$0.049	$0.050	$0.051	$0.051	$0.052	$0.052

Appendix A — Excluded Buildings List and Self-Certification

Department of Energy
Pacific Northwest Site Office
P.O. Box 350, K9-42
Richland, Washington 99352

NOV 18 2016

17-PNSO-0045

MEMORANDUM FOR SUSTAINABILITY PERFORMANCE OFFICE

FROM: DOE PACIFIC NORTHWEST SITE OFFICE (PNSO)
PACIFIC NORTHWEST NATIONAL LABORATORY (PNNL)

SUBJECT: FY 2016 SELF-CERTIFICATION FORM FOR THE ENERGY INTENSITY GOAL OF ENERGY INDEPENDENCE AND SECURITY ACT (EISA) 2007

Each PNNL building excluded under the criteria for a Part G exclusion is metered for energy consumption and their consumption is reported annually. No PNNL buildings have been excluded under the criteria for a Part H exclusion.

A justification statement that explains why process-dedicated energy in the facility may impact the ability to meet the goal has been provided in the Dashboard Energy Exclusions Report.

I certify that the buildings listed on the PNNL Excluded Buildings List produced by the Dashboard, as dated November 18, 2016, meet the exclusion criteria in *Guidelines Establishing Criteria for Excluding Buildings* published by FEMP on January 27, 2006.

Roger E. Snyder
PNSO Site Office Manager

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E-mail: ron.gallagher@science.doe.gov

Energy Consuming Excluded Buildings and Trailers

Pacific Northwest National Laboratory

Property ID	Real Property Unique ID	Property Name	Exclusion Part	Property Type	Program Office	Gross SqFt	Excluded Facilities SqFt
2460STVCN	216995	2460STVCN Records Storage	C - Fully serviced lease	Building	SC	3,957	3,957
Fully Serviced Lease							
3020EMSL	131274	3020 Env Molecular Science Lab	G - Metered intensive loads	Building	SC	234,566	234,566
Excluded starting in FY07 because the supercomputer dominates usage in the building. 9/18/13 building is separately metered and LCC ECMs have either been implemented or are in progress for implementation.							
318TRL4	117400	318TRL4 Office Trailer	E - Skewed energy usage	Trailer	EM	3,669	3,669
Removed from the PNNL portfolio midyear during FY16.							
ALBUQUERQUE	142911	Albuquerque NM Office	C - Fully serviced lease	Building	SC	3,102	3,102
Fully serviced lease. No utility data is available.							
APEL	142813	Applied Process Engineering Lab	C - Fully serviced lease	Building	SC	55,731	55,731
Fully serviced lease. No utility data is available.							
BSRC	200709	Battelle Seattle Research Center (ILA)	C - Fully serviced lease	Building	SC	34,442	34,442
Fully serviced lease. No utility data is available.							
BWO	142814	Battelle Washington Office (ILA)	C - Fully serviced lease	Building	SC	4,872	4,872
Fully serviced lease. No utility data is available.							
CSF	207161	Computational Sciences Facility	G - Metered intensive loads	Building	SC	74,000	74,000
Excluded started in FY12 because the data centers and supercomputers dominate the energy usage in the building. 9/18/13 building is separately metered and was recently constructed as a LEED Gold Facility							

Energy Consuming Excluded Buildings and Trailers
Pacific Northwest National Laboratory

Property ID	Real Property Unique ID	Property Name	Exclusion Part	Property Type	Program Office	Gross SqFt	Excluded Facilities SqFt
EVANSGA	216207	Evans Georgia Office	C - Fully serviced lease	Building	SC	596	596
Fully serviced lease. No utility data is available							
ISB2	139811	Information Sciences Building 2	G - Metered intensive loads	Building	SC	60,080	3,854
Excluding the data center located in this building. 9/18/13 building is separately metered and data center is the predominant load in the building and all LCC ECMs have been implemented.							
JGCRI	206372	Joint Global Change Research Inst	C - Fully serviced lease	Building	SC	18,043	18,043
Fully serviced lease. No utility data is available.							
PLL	216474	Portland Lighting Lab	C - Fully serviced lease	Building	SC	3,020	3,020
Fully serviced lease. No utility data available.							
PORTLAND	142816	Portland Office	C - Fully serviced lease	Building	SC	7,298	7,298
Fully serviced lease. No utility data is available.							
RSW	204732	Research Support Warehouse	C - Fully serviced lease	Building	SC	8,000	8,000
Fully serviced lease. No utility data is available.							
VTARC	214253	Virginia Tech Applied Research Corp	C - Fully serviced lease	Building	SC	1,535	1,535
Fully serviced lease. No utility data is available.							
WSUBSEL	205031	WSU Bioproducts Sci and Eng Lab	C - Fully serviced lease	Building	SC	30,000	30,000
Fully serviced lease. No utility data is available.							

Appendix B — Metering Plan

PNNL-25587

Pacific Northwest
NATIONAL LABORATORY

Proudly Operated by Battelle Since 1965

Metering Plan

Intelligent Operational Strategies Through Enhanced Metering Systems

July 2016

JE Pope

U.S. DEPARTMENT OF ENERGY

Prepared for the U.S. Department of Energy
under Contract DE-AC05-76RL01830

The 2016 PNNL Metering Plan, Intelligent Operational Strategies Through Enhanced Metering Systems, and is available upon request.

Appendix C — Integrated Sustainability Performance

Since 2009, PNNL has used the Global Reporting Initiative (GRI) guidelines as a basis for reporting our governance approach and sustainability performance. Our annual GRI report provides an integrated view of the environmental, social, and economic impacts that are important to our stakeholders and PNNL's long-term success. The following pages provide an overview of our FY16 performance. The full PNNL FY16 Annual Sustainability Report will be released in early FY17 and made available at **http://sustainable.pnnl.gov**.

SUSTAINABILITY PERFORMANCE SCORECARD

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

	2014	2015	2016	
ENVIRONMENT				
Reducing building energy use and greenhouse gas (GHG) emissions				
• Reduce Scope 1 and 2 GHG emissions 50% from 2008-2025 after renewable electricity purchases[1] (Target: 21,843 $MTCO_2e$)	18,030	0	12,609	
• Reduce energy use intensity in buildings 25% from 2003-2015 (Target: 150 kBtu/ft²) and 25% from 2015-2025 (Target: 126 kBtu/ft²)	182	167	167	
• At least 10% of electricity use from renewable sources	50%	53%	53%	
Traveling smarter				
• Reduce petroleum-based fuel use in fleet vehicles 20% from 2005-2015 and maintain thereafter (Target: 31,059 GGE)	31,836	28,988	31,060	
• Reduce fleet-wide per mile GHG emissions 30% from 2014-2025 (Target: 468 gCO_2e/mile)	767	728	738	
• Reduce Scope 3 GHG emissions from employee transportation 25% from 2008-2025 (Target: 18,091 $MTCO_2e$)	21,463	21,190	22,804	
Minimizing water use				
• Reduce potable water use intensity 36% from 2007-2025 (Targets: 45 gallons/ft²)	26	23	24	
• Reduce irrigation water use 30% from 2010-2025 (Target: 123M gallons)	184M	168M	167M	
Reducing material purchases and waste				
• Divert at least 50% of sanitary waste from landfills	54%	54%	54%	
SOCIAL				
Keeping employees healthy and safe				
• Total recordable case rate ≤ .65[2]	0.87	0.86	0.45	
• Days away, restricted, or transferred rate ≤ .25[2]	0.22	0.46	0.42	
Investing in our employees' professional development				
• Average participant satisfaction rating from professional development programs ≥ 4.5/5	4.7	4.6	4.6	
Creating an inclusive work environment				
• No goal established				N/A
Fostering the next generation of scientists and engineers				
• Average participant rating of work-based learning programs ≥ 4.0/5	4.6	4.7	4.6	
ECONOMIC				
Transferring technology that makes a difference				
• Economic contribution to global economy from licensed technologies (Target: Minimum=$50M, Stretch=$100M)	$97.3M	$108.7M	$130.0M	
Maintaining financial viability through research and operational excellence				
• Sales targets: >$812M in 2015 and >$885M in 2016	$938M	$918.5M	$1,082.9M	
• Operating budget targets: >$931M in 2015 and >$934M in 2016	$1,020M	$955.1M	$920.4M	
Supporting small businesses				
• Award at least 50% of procurement dollars to small businesses	57%	57%	49%	
Giving back to our communities				
• Philanthropic investments (No target)[3]	$634,383	$621,740	$625,114	N/A

1. PNNL reduces Scope 2 GHG emissions by the quantity of GHGs avoided from purchasing renewable energy certificates.
2. Reported per 200,000 employee hours worked.
3. Philanthropic investments are distributed by a committee of employees from Battelle's Pacific Northwest Division.

Social Performance

VOLUNTEER HOURS

> 45,741 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

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

EVENTS

~1,500

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

480

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

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

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. Delta High School, a STEM-focused school; total estimated 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 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

Chilling Up

5 **inefficient ultra-low-temperature freezers replaced with high-energy efficient units**

~$5,000

received in rebate from City of Richland

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.

PUBLICATIONS

1,058

peer-reviewed, published articles

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NATIONAL LABORATORY

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PNNL-26048