SITE SUSTAINABILITY PLAN
An Authentic Commitment

Pacific Northwest
NATIONAL LABORATORY
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FY2013

PNNL-22109
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On The Cover:  PNNL Sustainability Engineer Shan Belew with Washington State University Intern Andrew Jensen in the Building Operations Control Center.
### Acronyms and Abbreviations

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<tr>
<th>Acronym</th>
<th>Definition</th>
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<tbody>
<tr>
<td>AFV</td>
<td>alternative fuel vehicles</td>
</tr>
<tr>
<td>ASHRAE</td>
<td>American Society of Heating, Refrigerating, and Air-Conditioning Engineers</td>
</tr>
<tr>
<td>B2B</td>
<td>business-to-business</td>
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<tr>
<td>BioEarth</td>
<td>Biosphere-Relevant Earth System Model</td>
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<tr>
<td>BOCC</td>
<td>Building Operations Control Center</td>
</tr>
<tr>
<td>BTU/hr</td>
<td>British Thermal Units per hr</td>
</tr>
<tr>
<td>C&amp;D</td>
<td>construction and demolition</td>
</tr>
<tr>
<td>CD-2</td>
<td>Critical Decision 2</td>
</tr>
<tr>
<td>CEDR</td>
<td>Consolidated Energy Data Report</td>
</tr>
<tr>
<td>CEM</td>
<td>Certified Energy Manager</td>
</tr>
<tr>
<td>COR</td>
<td>City of Richland</td>
</tr>
<tr>
<td>CRAC</td>
<td>computer room air conditioning</td>
</tr>
<tr>
<td>CSF</td>
<td>Computational Sciences Facility</td>
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<tr>
<td>DC Pro</td>
<td>Data Center Profiler Software Tool Suite</td>
</tr>
<tr>
<td>DHS</td>
<td>U.S. Department of Homeland Security</td>
</tr>
<tr>
<td>DOE</td>
<td>U.S. Department of Energy</td>
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<tr>
<td>DSOM™</td>
<td>Decision Support for Operations and Maintenance Software</td>
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<tr>
<td>EB</td>
<td>existing building</td>
</tr>
<tr>
<td>EC</td>
<td>electronically communicated</td>
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<tr>
<td>ECM</td>
<td>energy conservation measures</td>
</tr>
<tr>
<td>EMSL</td>
<td>Environmental Molecular Sciences Laboratory</td>
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<tr>
<td>EPA</td>
<td>U.S. Environmental Protection Agency</td>
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<tr>
<td>EPEAT</td>
<td>Electronic Product Environmental Assessment Tool</td>
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<tr>
<td>EPP</td>
<td>environmentally preferable purchasing</td>
</tr>
<tr>
<td>ESPC</td>
<td>Energy Savings Performance Contract</td>
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<tr>
<td>FIMS</td>
<td>Facilities Information Management System</td>
</tr>
<tr>
<td>F&amp;O</td>
<td>Facilities and Operations</td>
</tr>
<tr>
<td>ft²</td>
<td>square foot/feet</td>
</tr>
<tr>
<td>FY</td>
<td>fiscal year</td>
</tr>
<tr>
<td>gal/ft²</td>
<td>gallons per square foot</td>
</tr>
<tr>
<td>GGE</td>
<td>Gallons of Gasoline Equivalent</td>
</tr>
<tr>
<td>GHG</td>
<td>greenhouse gas</td>
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<tr>
<td>GSA</td>
<td>General Services Administration</td>
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<tr>
<td>GSF</td>
<td>gross square foot/feet</td>
</tr>
<tr>
<td>GWhr</td>
<td>gigawatt hour(s)</td>
</tr>
<tr>
<td>HDI</td>
<td>How Do I?, PNNL's standards-based management system</td>
</tr>
<tr>
<td>HEMSF</td>
<td>High Energy Mission Specific Facilities</td>
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<tr>
<td>HPSB</td>
<td>high performance sustainable building</td>
</tr>
<tr>
<td>HVAC</td>
<td>heating, ventilation, and air conditioning</td>
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<tr>
<td>ILA</td>
<td>industrial, landscaping, and agricultural</td>
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<tr>
<td>IPCC</td>
<td>Intergovernmental Panel on Climate Change</td>
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<tr>
<td>IPM</td>
<td>integrated pest management</td>
</tr>
<tr>
<td>iRESM</td>
<td>integrated Regional Earth System Modeling</td>
</tr>
<tr>
<td>ISB-II</td>
<td>Information Sciences Building 2</td>
</tr>
<tr>
<td>JGCRI</td>
<td>Joint Global Change Research Institute</td>
</tr>
<tr>
<td>kBtu</td>
<td>thousand British thermal units</td>
</tr>
<tr>
<td>kW</td>
<td>kilowatt(s)</td>
</tr>
<tr>
<td>Laboratory</td>
<td>see PNNL</td>
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<tr>
<td>lbs</td>
<td>pound(s)</td>
</tr>
<tr>
<td>LDV</td>
<td>light duty vehicle</td>
</tr>
<tr>
<td>LDRD</td>
<td>Laboratory Directed Research and Development</td>
</tr>
<tr>
<td>LEED®</td>
<td>Leadership in Energy and Environmental Design</td>
</tr>
<tr>
<td>Mgal/yr</td>
<td>Millions of gallons per year</td>
</tr>
<tr>
<td>MHP</td>
<td>Managed Hardware Program</td>
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<tr>
<td>MT</td>
<td>metric ton(s)</td>
</tr>
<tr>
<td>MTCO₂ₑ</td>
<td>metric tons of carbon dioxide equivalent</td>
</tr>
<tr>
<td>NASA</td>
<td>National Aeronautics and Space Administration</td>
</tr>
<tr>
<td>NC</td>
<td>new construction</td>
</tr>
<tr>
<td>NCA</td>
<td>National Climate Assessment</td>
</tr>
<tr>
<td>N₂O</td>
<td>nitrous oxide</td>
</tr>
<tr>
<td>PC</td>
<td>Personal Computer</td>
</tr>
<tr>
<td>P2</td>
<td>Pollution Prevention Program</td>
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<tr>
<td>P-card</td>
<td>purchase card</td>
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<tr>
<td>PNRL</td>
<td>Pacific Northwest National Laboratory</td>
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<tr>
<td>PUE</td>
<td>power usage effectiveness</td>
</tr>
<tr>
<td>PV</td>
<td>photovoltaic</td>
</tr>
<tr>
<td>R&amp;D</td>
<td>research and development</td>
</tr>
<tr>
<td>REC</td>
<td>Renewable Energy Certificate</td>
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<tr>
<td>RPL</td>
<td>Radiochemical Processing Laboratory</td>
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<tr>
<td>SCCM</td>
<td>(Microsoft) System Center Configuration Manager</td>
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<tr>
<td>SF₆</td>
<td>sulfur hexafluoride</td>
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<tr>
<td>SSP</td>
<td>Site Sustainability Plan</td>
</tr>
<tr>
<td>TCE</td>
<td>trichloroethylene</td>
</tr>
<tr>
<td>T&amp;D</td>
<td>transmission and distribution</td>
</tr>
<tr>
<td>TRIM</td>
<td>Total Records Information Management</td>
</tr>
<tr>
<td>UESC</td>
<td>Utility Energy Savings Contract</td>
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</tbody>
</table>
Executive Summary

At Pacific Northwest National Laboratory (PNNL; Laboratory), we embrace sustainability by focusing on our organization’s operational impacts in the areas of environmental stewardship, social responsibility, and economic prosperity—a triple bottom line approach that helps us think holistically about our contributions to society. Much like a honeycomb with its interlocking pieces that gain strength through mutual support and integration, our three pillars and twelve priorities create a Sustainability Program that is greater than the sum of its parts. By evaluating and continuously improving upon our sustainability performance, we are better Laboratory stewards.

With its comprehensive approach to fulfilling Executive Order 13514, PNNL advances the U.S. Department of Energy (DOE) sustainability mission with a diverse, concentrated effort toward goals of the fiscal year (FY) 2020 and beyond. Our plan includes practical actions to conserve energy, water, and financial resources; improve the comfort and productivity of our staff; and benefit the environment. In FY12, we achieved several sustainability milestones, as highlighted below.

- **Scope 3 Greenhouse Gas (GHG):** In FY12, we began a Laboratory-wide telework program to reduce GHG from employee commuting. Beyond helping achieve GHG goals by eliminating commuting miles, flexible work arrangements save our staff members money and time, reduce stress, increase productivity, and help staff strike a better work/life balance.

- **Fleet Management:** PNNL received a 2012 Sustainability Award from DOE for efforts to right-size the fleet through “putting words into actions.” An interdisciplinary team challenged the way we use vehicles and by right-sizing our fleet, PNNL reduced petroleum use by 13% in only 1 year.

- **High Performance Sustainable Buildings (HPSBs):** We matched and exceeded DOE’s goal for 15% of existing buildings meeting the five Guiding Principles. In FY12, PNNL certified an additional two buildings and currently have 25% of our portfolio meeting the HPSB goal.

- **Data Center Consolidation:** Consolidating four server rooms and relocating one data center, PNNL produced significant energy savings and re-purposed the vacated space for additional research activities.

PNNL’s sustainability vision is to continue being recognized as thought leaders by our customers, our staff members, and the community. We develop and use solutions to make the world a more sustainable place. We set and achieve aggressive goals by empowering employees to be part of the solution.
The following table summarizes each of DOE’s Office of Science goals, along with PNNL’s performance status, planned actions, and an assessment of the risk of non-attainment as noted below:

<table>
<thead>
<tr>
<th>SC/SSPP/OMB Goal</th>
<th>DOE Goal</th>
<th>Performance Status</th>
<th>Planned Actions and Contribution</th>
<th>Risk of Non-attainment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Goal #1: Greenhouse Gas Reduction and Comprehensive Greenhouse Gas Inventory</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.1</td>
<td>Energy intensity reduction of 30% by FY15 from FY03 baseline</td>
<td>FY03 Baseline: 197,817 Btu/GSF FY12 Actual: 164,078 Btu/GSF FY15 Goal: 138,472 Btu/GSF Status: 17.1% reduction</td>
<td>Continue implementing Consolidated Energy Data Report (CEDR) projects and operational improvements</td>
<td>Medium</td>
</tr>
<tr>
<td>1.2</td>
<td>7.5% of annual electricity consumption from renewable sources by FY13 and thereafter (5% FY10–12)</td>
<td>FY12: 72% of annual electric consumption from on-site generation and renewable energy certificate (REC) purchases</td>
<td>Continue operating our 125 KW on-site photovoltaic (PV) array and purchasing RECs</td>
<td>Low</td>
</tr>
<tr>
<td>1.3</td>
<td>Sulfur hexafluoride (SF₆) reduction</td>
<td>FY08 Usage: 207 lbs FY12 Usage: 121 lbs Status: 42% Reduction</td>
<td>Complete evaluation of alternate tracer gases and implement where feasible</td>
<td>Low</td>
</tr>
<tr>
<td>1.4</td>
<td>Individual buildings metering for 90% of electricity (by October 1, 2012); for 90% of steam, natural gas, and chilled water (recommended; by October 1, 2015)</td>
<td>FY12: 100% metering of electricity, 100% metering of natural gas</td>
<td>Improve building performance through data analysis from the meters</td>
<td>Low</td>
</tr>
<tr>
<td>1.5</td>
<td>Unless uneconomical, install cool roofs for replacements unless project already has CD-2 approval; new roofs must have thermal resistance of at least R-30</td>
<td>FY12: 61% of PNNL roof area per Facilities Information Management System (FiMS) are cool roofs</td>
<td>Unless uneconomical, all new roofs will have a thermal resistance of at least R-30 and be solar reflective, consistent with DOE Secretary Chu requirements</td>
<td>Low</td>
</tr>
<tr>
<td>1.6</td>
<td>Training</td>
<td>PNNL has Certified Energy Managers (CEMs) and a Data Center Energy Practitioner</td>
<td>Continue developing staff skills by providing energy and water training opportunities</td>
<td>Low</td>
</tr>
<tr>
<td>1.7</td>
<td>Net zero energy in new or major renovation facilities</td>
<td>Institutionalizing this long-term goal into our Engineering Standards and Specifications</td>
<td>Leverage new technologies as available to trend toward net zero goal</td>
<td>Low</td>
</tr>
<tr>
<td>1.8</td>
<td>Evaluate 25% of 75% of facility energy use over 4-year cycle</td>
<td>Completed first 4-year Energy Independence and Security Act of 2007 (EISA) cycle of 8 Buildings</td>
<td>Execute next cycle of EISA evaluations</td>
<td>Low</td>
</tr>
</tbody>
</table>
1.9 13% Scope 3 GHG reduction by FY20 from a FY08 baseline  
FY08 Baseline: 23,747 MTCO₂e  
FY12 Actual: 26,495 MTCO₂e  
FY20 Goal: 20,660 MTCO₂e  
Status: 11.6% Increase  
Continue promoting telework; install high-end video capabilities in strategic locations to reduce travel; encourage staff bus and carpool promotions and incentives  
Medium

1.10 28% Scope 1 & 2 GHG reduction by FY20 from a FY08 baseline  
FY08 Baseline: 36,075 MTCO₂e  
FY12 Actual: 37,900 MTCO₂e (0 MTCO₂e adjusted for RECs)  
FY20 Goal: 25,974 MTCO₂e  
Status: Including REC’s goal achieved  
Continue REC purchases for near-term GHG reduction goal: implement comprehensive energy conservation plan, including core business hours and aggressive real-time commissioning for future strategy  
Low

Goal #2: Buildings, Energy Savings Performance Contract (ESPC) Initiative, Regional and Local Planning

| 2.1.a | 15% of existing buildings greater than 5,000 GSF are compliant with HPSB Guiding Principles by FY15  
25% of PNNL buildings > 5,000 GSF per FIMS are HPSB compliant  
Continue trending toward 100% of facilities meeting HPSB standards  
Low |
|---|---|
| 2.1.b | All new construction, major renovations, and building alterations greater than 5,000 GSF must comply with Guiding Principles  
Institutionalized Guiding Principles in PNNL Engineering Standards  
Achieve Guiding Principles for all new construction greater than 5,000 GSF  
Low |
| 2.2 | ESPC Initiative  
PNNL has no prospective ESPC or Utility Energy Savings Contract (UESC) projects at this time  
Continue reviewing projects to determine viability of this funding mechanism  
Low |
| 2.3 | Regional & Local Planning  
DOE and City of Richland (COR) agreement for long-term Hanford Area utility strategy  
Execute utility strategy  
Low |

Goal #3: Fleet Management

| 3.1 | 10% annual increase in fleet alternative fuel consumption by FY15 relative to FY05 baseline  
FY06 Baseline: 456 gal (GGE)  
(note: FY05 usage not measured)  
FY12 Actual: 11,238  
FY20 Goal: 1,183  
Status: Exceeded Goal  
Actively manage alternate fuel use through fleet oversight and staff training; increase percentage of alternative fuel vehicles (AFVs) when available  
Low |
| 3.2 | 2% annual reduction in fleet petroleum consumption by FY20 relative to FY05 baseline  
FY05 Baseline: 37,926 gal (GGE)  
FY12 Actual: 36,575  
FY20 Goal: 28,011  
Status: 3.6% Decrease  
Continue assessing fleet and right-sizing, along with executing Goal 3.4  
Low |
| 3.3 | 75% of light duty vehicle purchases must consist of AFVs by FY00 and thereafter  
Of total 50 LDVs in PNNL fleet, 37 (74%) are AFVs; added 5 E85 AFVs in FY12  
Continue working with fleet vendors to replace vehicles with AFV types where available  
Low |
Drafting requested plan  
Execute results of plan  
Low |
| Goal #4: Water Use Efficiency and Management | FY07 Baseline: 66.88 gal/ft²<br>FY12 Actual: 29.02 gal/ft²<br>FY20 Goal: 49.49 gal/ft²<br>Status: Exceeded Goal | Continue implementing potable water projects to reduce overall use as feasible | Low |
| 4.1 26% water intensity reduction by FY20 from a FY07 baseline | FY10 Baseline: 97,522,000 gal<br>FY12 Actual: 113,593,000 gal<br>FY20 Goal: 78,017,600 gal<br>Status: 16.4% Increase | Continue implementing Landscaping Plan with focus on reducing ILA where possible | Medium |
| 4.2 20% water consumption reduction of industrial, landscaping, and agricultural (ILA) water by FY20 from FY10 baseline | | | |

| Goal #5: Pollution Prevention and Waste Reduction | FY12: Diverted 50% of non-hazardous solid waste | Continue conducting assessments for waste reducing opportunities | Low |
| 5.1 Divert at least 50% of non-hazardous solid waste, excluding construction and demolition debris, by FY15 | | | |
| 5.2 Divert at least 50% of construction and demolition materials and debris by FY15 | FY12: Diverted 98% of construction and demolition (C&D) waste | Continue monitoring C&D recycling performance and raising awareness on waste diversion requirements | Low |

| Goal #6: Sustainable Acquisition | 100% of acquisitions have sustainability requirements and clauses | Continue proactivity with sustainable item procurement | Low |
| 6.1 Procurements meet sustainability requirements and include sustainable acquisition clause (95% each year) | | | |

| Goal #7: Electronic Stewardship and Data Centers | Two of PNNL's three data centers are metered | Complete data center metering before FY15 | Low |
| 7.1 All data centers are metered to measure a monthly power utilization effectiveness (PUE; 100% by FY15) | One of PNNL's three data centers is below 1.4 PUE | Implement projects to trend toward goal | Medium |
| 7.2 Maximum annual weighted average PUE of 1.4 by FY15 | | | |
| 7.3 **Electronic Stewardship:** 100% of eligible PCs, laptops, and monitors with power management actively implemented and in use by FY12 | 100% of eligible equipment is complete | Assure new equipment has power management features | Low |

| Goal #8: Agency Innovation & Government-Wide Support | PNNL has piloted multiple R&D technologies and hosted DOE and other national laboratories to showcase our sustainable practices | Continue researcher collaboration to showcase new R&D, plus benchmarking and assisting other agencies in meeting goals | Low |
| 8.1 Deployment of R&D technologies and support of other governmental agencies | | | |
Greenhouse Gas

PNNL continues its leadership in GHG management, targeting opportunities that have a net positive effect on Scope 1, 2, and 3 GHG emissions.

FY12 Performance Status

Scope 1 & 2

PNNL continues to reduce GHG Scope 1 & 2 emissions 28% by FY20 compared with our FY08 baselines. In FY12, PNNL targeted several goal areas to reduce Scope 1 & 2 GHG further. Items include consolidating and moving one of four datacenters on campus, implementing core business hours at our Environmental Molecular Sciences Laboratory (EMSL) user facility, hiring our first sustainability engineer, and initiating a weekly Building Operations Control Center (BOCC) meeting with building engineers.

The PNNL FY08 Scope 1 & 2 baseline is 36,075 metric tons (MT) of carbon dioxide equivalent (MTCO₂e). Between FYs 2008 and 2012, Laboratory growth, especially in computational sciences, increased our overall energy usage, resulting in a FY12 Scope 1 & 2 of 37,900 MTCO₂e. However, PNNL performance between FYs 2011 and 2012 shows a decrease of Scope 1 & 2 of 11.4%, primarily driven by reduced industrial process emissions. PNNL continues to implement its strategy of procuring RECs in FY12, resulting in an offset of 41,339 MTCO₂e.

Goals

1.3 – Sulfur hexafluoride (SF₆) reduction
1.9 – 13% Scope 3 GHG energy intensity reduction by FY20 from a FY08 baseline
1.10–28% Scope 1 & 2 GHG reduction by FY20 from a FY08 baseline

SF₆ Reduction

PNNL conducted an evaluation of methods for reducing SF₆ emissions used for facility stack emissions testing. The evaluation identified a procedural change using current instrumentation with SF₆ and nitrous oxide (N₂O) as a potential alternative tracer gas.
The procedural change was implemented in tests of three scale-model stacks conducted in FY12. This change allows the SF$_6$ emissions to be reduced by half, resulting in an estimated reduction in emissions of approximately 21 MTCO$_2$e per scale-model set.

We also began testing to compare N$_2$O and SF$_6$ results in scale-model exhaust tests. Preliminary findings at this point suggest that N$_2$O may indeed be a technically and economically viable substitute for SF$_6$ in stack testing applications. Additional testing, including humidifying the sample stream, is necessary to establish N$_2$O as an acceptable substitute. If implemented, N$_2$O tests would reduce MTCO$_2$e emissions immensely.

**Scope 3**

**All Scope 3 Emissions**

Scope 3 emissions totaled 26,495 MTCO$_2$e in FY12. This represents a 6.5% decrease compared to the previous year. Business travel was the largest contributor to PNNL’s FY12 Scope 3 emissions at 56%, followed by employee commute (34%), and transmission and distribution (T&D) losses (8%). Emissions from contracted solid waste disposal and wastewater treatment made up just 2% of Scope 3 emissions.

Reducing Scope 3 emissions was a strategic priority at PNNL in FY12. Over the past 2 years, a team of senior managers participating in PNNL’s Advanced Leadership Program (ALP) used PNNL sustainability as their learning challenge, with reducing Scope 3 emissions as a priority sustainability opportunity. During 2012, the ALP participants recommended to the Leadership Team a set of specific strategies for reducing Scope 3 emissions related to business travel and employee commuting. Most of these actions were approved by the Leadership Team and initiated during 2012. Specific measures are discussed in more detail below.

The new telework program provides staff a well-received work life balance option while helping our environment by avoiding commutes to work. Feedback from surveys deployed during the telework pilot was extremely positive. More than half the respondents said telework improved their morale, work-life balance, and satisfaction with their job and organization. Virtually no teleworkers indicated teleworking affected their productivity in a negative way and some indicated that it improved different areas of productivity (e.g. quality of work, ability to meet deadlines, and volume of work).
Business Air and Ground Travel

In FY12, total emissions from business travel were 15,024 MTCO2e, a decrease of 3.3% compared with FY11. Air travel totaled 13,675 MTCO2e, and decreased 2.8% compared with FY11, with business ground travel decreasing 11% over the previous year.

While PNNL has had 2 years of business travel decreases, emissions remain 11.6% above FY08 baseline levels. As noted in previous SSPs, PNNL experienced a dramatic increase during FY09 and FY10 in both employment levels to fulfill mission requirements and business travel to support project-specific requirements (e.g., the Department of Homeland Security's Radiation Portal Monitoring Program).

Compared with FY11, the decrease in business travel emissions is primarily attributed to changes in project work requiring travel. PNNL implemented improved video conferencing capabilities in FY12 which also aided the emissions decrease. In response to working group recommendations in FY11, Microsoft Lync, a collaboration software with desktop video conferencing capabilities, was deployed Laboratory-wide in FY12, allowing enhanced collaboration between employees located in different cities and when teleworking.

Other FY12 activities included developing resources and coordinating with PNNL's travel accounting office to consolidate and share data more effectively. Leadership established a new automated travel process intended to build awareness about current travel trends and identify opportunities for reducing future travel.

The decrease in FY12 emissions is attributed to implementing the telework program, increasing the use of alternative commute methods, and modestly decreasing the number of employees.

The telework program was piloted in two directorates then rolled out Laboratory-wide over a 6-month period. Key accomplishments included:

- designation of a Laboratory-wide telework advocate
- development of a telework policy, guidelines for teleworkers and managers, and an electronic telework agreement form
- establishment of manager and teleworker training
- deployment of Lync collaboration software to facilitate virtual meetings with instant messaging, screen sharing, and video calls
- integration of telework tracking in the Laboratory’s daily time reporting system to support more accurate estimates of telework use

During the pilot telework phase, approximately 10% of employees signed telework agreements and recorded telework days through an electronic tracking tool.

Assigning an employee commute coordinator increased and promoted staff awareness of commute alternatives. Promotion was accomplished through several methods, including establishing a PNNL Employee Commute website; contracting with a regional alternative commute support service, RideShareOnline, to provide PNNL individualized ride matching and alternative commute tracking support; subsidizing bus passes; and recognizing a “alternative commuter of the month.”

The PNNL RideShareOnline website helps employees find ridesharing and tracks the number of miles they have commuted using an alternative mode. Over 200 employees logged their commute modes since the site was launched in April 2012 and reported a total of 72,310 miles and 19.80 MTCO2e avoided.

(1) The RideShareOnline tool is managed by the Washington Department of Transportation to help reduce traffic congestion, improve air quality, and sustain the quality of living in the Pacific Northwest region.
Finally, PNNL hosted several events in FY12 to bring alternative commuters together, including two carpool-to-work days, two bike-to-work days, and three bicycling workshops.

Commute emission estimates were generated using the General Services Administration’s (GSA’s) Carbon Footprint Tool employee commute survey. PNNL worked with GSA and Noblis to customize questions and maintain consistency with previous in-house survey methodologies.

Other Scope 3 Emissions Sources

All other emission sources comprise 10% of PNNL’s Scope 3 emissions. Specifically, T&D losses attributable to DOE-owned and leased facilities at PNNL totaled 2,053 MTCO₂e using the national loss factor of 6.18%, a 3% decrease from FY11. While electricity purchases increased slightly in FY12, the more favorable national loss factors resulted in lower calculated emissions from T&D losses.

Plans, Actions, and Projected Performance

Scope 1 & 2

During FY13, PNNL will implement continuous commissioning, continue consolidating server areas, and refine core business hours for operations, including enhanced heating, ventilation, and air conditioning (HVAC) night setback strategies. We will also continue procuring RECs at competitive rates to offset the remainder of our GHG emissions.

SF₆ Reduction

Testing of N₂O as a technically and economically viable substitute for SF₆ in stack testing applications will be concluded in FY13. If it is determined to be an acceptable substitute, procedures will be changed to implement the new process. At a minimum, we plan to continue implementing the modified procedure on stack testing to reduce the use of SF₆.

Scope 3

To achieve the 13% reduction in Scope 3, PNNL will need to reduce annual emissions by another 5,800 MTCO₂e over the next 8 years. Most of this decrease is expected to come from business travel and employee commuting, which will pose a significant challenge given our specific travel requirements for research work. However, PNNL will continue advancing many of the new programs deployed during FY12 and will pursue additional activities to decrease Scope 3 emissions further.

Business Travel Emissions

A sustainable business travel website similar to the employee commuting website is under development and will serve as a resource and information center to assist employees in traveling more sustainably. Current travel trends will be routinely updated and shared using the new travel reporting program developed in FY12.

In FY12, PNNL purchased 30 new Polycom® cameras that will be added to conference rooms across the Richland campus and in satellite offices (e.g., Seattle) during FY13. These collaboration devices enable remote
meeting participants to see everyone in a conference room at the same time (and vice versa) by displaying simultaneous panoramic views of the meeting space and individual views that track according to the current speaker. Polycoms are expected to enhance collaboration with remote participants and enable employees to avoid some travel between PNNL and Seattle, and other client sites served by videoconferencing.

**Employee Commute Emissions**

PNNL’s commute reduction strategy will continue to emphasize telework in FY13 and beyond. PNNL established a goal of 40% of all employees teleworking 1 day/week on average by FY20. This would correspond with a 13% reduction in commute emissions. We plan to establish more explicit alternative commute adoption goals this year as well.

Priority commute reduction activities in FY13 to help accomplish PNNL’s Scope 3 emission reduction goals include:

- monthly technical training sessions to help staff leverage telework software collaboration tools
- ride-matching events
- bi-monthly bicycling seminars
- designated carpool days, with local vendor support incentives
- cycle-to-work days
- alternative commuter of the month awards

PNNL does not plan to manage wastewater emissions actively, 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.

**Barriers**

Scope 3 emissions pose the most significant risk to PNNL achieving GHG reduction goals. Two important factors – the number of employees and amount of research we do in a year – drive these emissions. Achieving a 13% reduction from PNNL’s Scope 3 emissions in FY08 is feasible now that employment and research activity have stabilized. PNNL remains committed to working toward the goal.

The primary barriers specific to business travel reductions include new mission-related research opportunities that require extensive field work, lack of sophisticated IT collaboration tools, and IT connectivity barriers that limit the use of tools (e.g., desktop video via Lync).

Potential barriers that could impact reductions in employee commute emissions include:

- culture change from traditional face-time, where some management might discourage teleworking
- significant investment in conference room capability investments
- on-site work that requires research facilities
- few viable commute alternatives for many employees due to remote location (e.g., bus transit times to PNNL campus are limited and can take up to 4 times longer than driving) and resources (e.g., the local transit authority has fewer vanpool vehicles available)
Goals

1.1 – Energy intensity reduction of 30% by FY15 from FY03 baseline
1.2 – 7.5% of annual electricity consumption from renewable sources by FY13 and thereafter (5% FY10–12)
1.4 – Individual buildings metering for 90% of electricity (by October 1, 2012); for 90% of steam, natural gas, and chilled water (recommended; by October 1, 2015)
1.5 – Unless uneconomical, install cool roofs for replacements unless project already has CD-2 approval; new roofs must have thermal resistance of at least R-30
1.6 – Training
1.7 – Net zero energy in new or major renovation facilities
1.8 – Evaluate 25% of 75% of facility energy use over 4-year cycle

Energy

Renewable energy integration, HPSB, EISA evaluations, and energy efficiency project implementation continues positive trending toward PNNL’s energy goals.

FY12 Performance Status

Energy Intensity

PNNL remains aggressive about reducing its energy intensity by 30% before FY15. We are accomplishing this goal through a combination of energy savings projects, operational efficiencies, and improvements to our engineering standards.

The PNNL FY03 energy intensity baseline is 198 thousand British thermal units (kBtu) per GSF. Between FYs 2003 and 2012, energy efficiency projects, operational improvements, and vacating several less efficient facilities offset energy use increases despite additional staff and equipment, resulting in a FY12 energy intensity of 164 kBtu per GSF and a net 17.1% energy intensity reduction.

With its advanced metering data and building control system graphics, PNNL’s BOCC hired its first sustainability engineer and two interns. Developed at PNNL, Decision Support for Operations and Maintenance (DSOM™) software, an advanced supervision and diagnostic tool, reduced energy use and operations and maintenance costs and extended equipment life in facilities. DSOM has been deployed across select PNNL facilities and resulted in many informed decisions to reduce energy use.

For reference, the final FIMS list of buildings dated November 13, 2012 (excluded from the energy intensity goal) and a copy of the exclusion self-certification letter can be found in the Appendix.
Success Story | Energy

Scope 1 & 2

With leadership from research operations, our EMSL user facility was the first laboratory building to pilot and implement core business hours. With occupancy data that measures foot traffic, building management determined the facility’s most and least used hours. Additionally, reviews of temperature-sensitive equipment concluded that over 50% of the building could be placed on a setback schedule. Based on this data, core business hours were established and communicated to staff. Building heating, cooling, and lighting operational schedules were modified, resulting in the laboratory areas in setback mode 64% of the time. Ultimately, this was a collaborative effort between research and operations that helped EMSL achieve a 10% reduction in energy usage during FY12.

Renewable Energy

In FY12, a solar hot water heater was installed at EMSL. The unit produces approximately 160,000 Btu/hr of hot water and is dedicated to the lunchroom and associated restrooms, fulfilling the majority of this area’s hot water needs. EMSL continued operating the 125 kW PV array, which includes charging stations for our electric fleet vehicles and is used for several research and development (R&D) projects. PNNL also continued to implement its strategy for purchasing RECs to offset GHG emissions. Through competitive bidding, PNNL procured enough RECs to offset 71.9% of its electrical use as provided in the CEDR.

Metering

Whole building metering as required by EISA for electricity, natural gas, and water has been completed for all buildings where economic calculations showed that it was viable to install. With real-time meter data, our BOCC has all the necessary information to perform system analysis on campus facilities. The FY12 annual update of our Metering Plan detailed our successful completion of this goal and outlined future strategies of how we intend to use the data.

Cool Roofs

PNNL’s Engineering Standards and Specifications meet the cool roof requirements established by DOE Secretary Chu. In FY12, PNNL added an additional cool roof, bringing the total cool roof area to 679,000 ft² or approximately 61% of FIMS facilities. We will continue to add cool roofs in new construction and when replacing existing building roofs.

Training

Engaged staff who have the right tools, equipment, and training is one of the most important contributors to our success as leaders in sustainability. We believe that staff certification through a qualified training program is a vital component of refreshing and sharpening staff skills about the latest energy and water saving techniques. In FY12, PNNL provided multiple training opportunities for our staff. A notable accomplishment is that two staff members attended the Certified Energy Manager (CEM) course and successfully passed the exam. This brings our total CEM certified staff level to four in the Sustainability Program, enhancing knowledge base and organization depth.

Net Zero Buildings

Potential strategies to achieve the FY30 goal of net zero buildings were discussed during FY12. While several ideas and methods were evaluated, it was determined that, at this time, it is not economically practicable to construct a net zero building.
EISA Evaluations

The Laboratory successfully completed the first four-year cycle of the 8 buildings under the EISA Energy and Water evaluation requirements. The information obtained was used immediately to improve plant performance and plan for future energy conservation measures (ECMs) whenever cost effective. As it is difficult to project the exact energy and water reductions specific to the retro commissioning efforts, completed buildings showed overall energy and water use improvement.

Plans, Actions, and Projected Performance

Energy Intensity

Through the BOCC, PNNL will continue initiating real-time commissioning of facility systems to increase attention on daily building system operations and reduce dependency on periodic retro commissioning over time. Select energy intensity projects will be evaluated using the Decision Tool for life cycle cost effectiveness and return on investment calculations. The ability to monitor, perform diagnostics, and make informed decisions will enhance the overall performance of PNNL facilities, leading to increased energy savings and better operational performance.

Renewable Energy

PNNL is committed to finding ways to increase the amount of on-site generated renewable power. Using our Engineering Standards, we will review the potential of adding new projects where economically feasible. Our strategy of competitively bidding for REC procurement will continue to meet (and likely exceed) the renewable energy goal of 7.5% of annual electrical consumption.

Metering

With advanced metering installations complete, PNNL will gather data for BOCC use and analyze it with our award-winning DSOM software. Any operational improvements or maintenance corrections can be easily found and corrected in real time. Future strategies for data use will be outlined and annually updated in the PNNL Metering Plan.

Cool Roofs

By institutionalizing the values and systems in our engineering standards, PNNL is committed to continue installing cool roofs.

Training

Maintaining a highly qualified organization is vital to the long-term success of the Sustainability Program and ultimately the completion of the goals outlined in this plan. We will continue to train our staff on the latest building efficiency technologies and maintain or increase the amount of qualified CEM staff.

Net Zero Buildings

The availability of high efficiency facility equipment and incorporation of advancements in engineering methods will allow PNNL to work toward net zero buildings. PNNL will strive to meet this goal and will use life cycle cost analysis methods to implement viable technologies and strategies.

EISA Evaluations

PNNL will continue to conduct energy and water evaluations of our eight covered facilities. Our plan is to complete approximately 25% of our facilities every year, allowing us to distribute workload and funding. Identified ECMs will be tracked in the CEDR, with funding requests initiated into our planning process.

Barriers

PNNL believes that meeting the 30% energy intensity reduction goal by FY15 will be difficult. Business growth in key areas of PNNL's portfolio has led to energy intensity increases, most of which have been offset by aggressive management of energy usage in other areas. We will look for more ways to reduce energy while continuing our world-class research.
High Performance Sustainable Buildings

Through our enhanced Engineering Standards and Specifications and improved acquisition training, PNNL will continue achieving HPSB for additional PNNL facilities.

FY12 Performance Status

Existing Buildings

Currently, 25% of PNNL buildings meet HPSB requirements. All existing buildings have been assessed against the HPSB Guiding Principles using the checklist provided in U.S. Environmental Protection Agency’s (EPA’s) ENERGY STAR Portfolio Manager.

A gap analysis in FY11 determined that pursuing Leadership in Energy and Environmental Design (LEED®) for Existing Buildings (EB) Silver certification was a viable strategy to progress toward 100% of all buildings meeting the Guiding Principles. PNNL identified three ENERGY STAR-rated buildings, submitted applications, and began the process of documenting the LEED EB requirements. In FY12, PNNL achieved its first certified HPSB EB by obtaining LEED EB Gold certification for the Sigma 2 Building.

Goals

2.1a – 15% of existing buildings greater than 5,000 GSF are compliant with HPSB Guiding Principles by FY15

2.1b – All new construction, major renovations, and building alterations greater than 5,000 GSF must comply with Guiding Principles

2.2 – ESPC Initiative

2.3 – Regional & local planning

New Construction

In FY12, PNNL leased a new 47,676 ft² research building with a combination of computer analysis and office space. The Systems Engineering Facilty was constructed to LEED standards and is certified LEED-New Construction (NC) Gold.

ESPC Initiative

The Laboratory supports the use of ESPCs or UESCs as a funding mechanism to implement energy and water savings projects. Both funding types have been
investigated; however, we do not have a portfolio of projects that when bundled has a reasonable return on investment. Therefore, we are not planning to use these types of funding avenues at this time.

Regional and Local Planning
Collaboration with the City of Richland (COR), our local utility provider, allows PNNL to secure long-term reliable utility services. The COR is the primary electrical service provider for the PNNL Campus. In FY11, DOE requested that PNNL evaluate 300 Area site services, particularly electrical, to consider options to determine the best value for the government. PNNL completed the evaluation and in FY11 recommended that DOE pursue the COR for 300 Area electrical services. With the approval and completion of various agreements, PNNL is working to establish COR 300 Area electrical service. It is anticipated to be completed in FY13 so that electrical service to the 300 Area can commence in FY14.

Plans, Actions, and Projected Performance

Existing Buildings
In FY13, PNNL is planning to complete one LEED EB Silver or better certification and one HPSB Guiding Principles certified building. These certifications will increase campus HPSB to approximately 31%.

New Construction
PNNL has committed all new construction, major renovations, and alterations of buildings greater than 5,000 GSF will comply with the Guiding Principles or equivalent certification methods. Planning for future facilities, including line item, general plant project, or leases, will include these requirements.

ESPC Initiative
PNNL will continue to consider ESPC and UESC funding methods to deliver energy and water saving projects. This is a viable mechanism to fund large capital intensive projects if the return on invest falls within the Laboratory's strategic plan or facility life cycle.

Regional and Local Planning
PNNL will continue to strengthen our existing relationships and act as a role model for how the community can implement sustainable practices.

Barriers

Existing Buildings
PNNL sees challenges in achieving 100% of all campus buildings classified as HPSB. Investments needed to achieve HPSB status may not be cost effective based on facility ages, mechanical equipment designs, or specific research activities.

Success Story | HPSB
In 2012, Sigma II became PNNL’s first HPSB building to be certified as LEED Gold for EB through the building’s energy effectiveness. Sigma II will be used as a model to help PNNL certify its remaining buildings as HPSB.
Goals

3.1 – 10% annual increase in fleet alternative fuel consumption by FY15 relative to FY05 baseline

3.2 – 2% annual reduction in fleet petroleum consumption by FY20 relative to FY05 baseline

3.3 – 75% of light duty vehicle purchases must consist of AFVs by FY00 and thereafter

3.4 – Submit Right-Sizing the Fleet Management Plan for approval by December 31, 2012; identify mission critical/non-mission critical vehicles by December 31, 2012

PNNL will continue working diligently to meet all fleet goals by increasing our alternative fuel fleet and integrating more electric vehicles into service while balancing program requirements.

FY12 Performance Status

Alternative Fuel

Alternate fuel use is increasing and petroleum only vehicle use is decreasing. Beginning in FY06 with the community’s first dedicated AFV fueling station, our baseline was established at 456 gal. Through proactive management and staff training, we have exceeded the FY15 goal as of FY12. Fleet vehicles during FY12 used 11,238 gal of alternative fuel compared to the baseline of 456 gal.

Reduced Petroleum

Throughout FY12, PNNL reduced the total number of petroleum only combustible engine vehicles. To do so, we downsized the existing fleet, replaced with AFV whenever possible, and introduced several low speed electric vehicles. These efforts resulted in a FY12 petroleum consumption of 36,575 gal, a reduction of 13% from FY11.
Alternative Fuel Vehicles
The existing PNNL fleet inventory currently has 50 GSA-leased light duty vehicles (LDV) in inventory. In FY12 as part of our continuous refreshment program, PNNL replaced eight gasoline or diesel LDVs, of which five were AFV. This brings our current AFV inventory of LDV to 74%.

Right-Sizing the Fleet Management Plan
In the Right-Sizing the Fleet Management Plan, PNNL projects identifying 100 mission-critical and 0 non-mission-critical vehicles remaining in the fleet (as of October 1, 2012). PNNL has already exceeded the 35% reduction goal by reducing 22 vehicles that were deemed non-mission critical by fleet management over the past several years.

Plans, Actions, and Projected Performance

Alternative Fuel
PNNL plans to continue actively managing the use of alternate fuel through fleet oversight and staff training. We will also increase our overall percentage of AFVs as they become available.

Reduced Petroleum
PNNL will continue assessing the fleet and, through refreshment, intends to add AFV and electric vehicles wherever possible. Along with execution of Goal 3.4 (Right-Sizing the Fleet Management Plan), this strategy will keep us progressing toward the FY20 goal.

Alternative Fuel Vehicles
PNNL will continue working with GSA or other vehicle suppliers to replace vehicles with AFV types whenever available.

Right-Sizing the Fleet Management Plan
PNNL will submit the Right-Sizing the Fleet Management Plan by December 31, 2012, as requested. We fully expect to meet our assigned reduction goals.

Barriers
PNNL is aggressively working alternate strategies but believes that achieving an overall 30% reduction of fleet petroleum by FY20 will be challenging. Successful implementation of our AFV and right-sizing fleet strategies has allowed us to progress toward the goal. However, there has been substantial growth in both Laboratory staff and programs that require larger vehicles and distances traveled above what was established since the goal’s baseline year. We will continue seeking alternatives for petroleum reductions with the goal of reaching as close to a 30% reduction as possible.

Success Story | Fleet
In September 2012, PNNL was honored to receive a 2012 DOE Sustainability Award recognizing our efforts toward sustainable operations in the area of fleet management. PNNL was one of only 20 government organizations to receive an award.

In all, 18 commercial petroleum vehicles (15%) were eliminated from the fleet, with 25 more slated to be retired by FY13 end. By right-sizing the fleet, PNNL reduced its consumption of petroleum based fuel use more than 20% from the peak in 2008. Currently, 37 of the 50 light-duty vehicles in PNNL’s fleet (74%) are AFVs. During FY12, five AFVs were added.

Prior to ordering the smaller, electric vehicles, Fleet Program leaders asked for input from those that would be using them the most—the Facility Operations Management staff. A group of approximately 20 “testers” provided input and then selected the best option meeting campus needs and sustainability goals. Right-sizing PNNL’s Fleet Program remains an ongoing effort between Fleet Management and Facility Operations Management.
Goals

4.1 – 26% water intensity reduction by FY20 from a FY07 baseline
4.2 – 20% water consumption reduction of industrial, landscaping, and agricultural (ILA) water by FY20 from FY10 baseline

Water

PNNL will balance water use for energy efficiency and landscaping needs with an overall goal of optimizing water reduction.

FY12 Performance Status

Water Intensity

PNNL has met the FY20 water reduction goal and, as of FY12, has reduced its intensity by 56.6%. Discharge permit regulatory reviews uncovered several opportunities for non-contact cooling water reductions that yielded 7% less water intensity in FY12.

Industrial, Landscaping, and Agricultural (ILA) Water

PNNL continued to leverage its Landscape Master Plan and implemented opportunities for ILA water savings at our campus. In FY12, four specific actions were taken to reduce ILA by 18.5%:

- At our EMSL user facility, high maintenance landscape was replaced with low intensity plants and staff collaboration areas. This modification also incorporated the first use of pervious concrete, promoting water drainage and reducing runoff as outlined under EISA Section 438.
- A multi-year utility construction project completed in FY12 impacted several landscaped areas. PNNL determined the impacted areas could be xeriscaped versus replanting what originally existed. This modification resulted in 93,325 ft² of landscaping being removed, conserving not only ILA water but also saving maintenance effort and funding.
- The grounds maintenance department also activity managed several large landscaped areas by daily resetting or even turning off irrigation when possible. Throughout FY12, maintenance succeeded in turning off the water 29 times, which resulted
in 20,000 gal of water each time the system remained off. This active management of our grounds maintenance shows how engaged staff can make a difference.

- Irrigation meters are being installed in several areas of our grounds to help better monitor, analyze, and control our ILA water usage.

![ILA Water (Mgal/yr)](image)

**Plans, Actions, and Projected Performance**

**Water Intensity**

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

**ILA Water**

PNNL intends to continue using the Landscape Master Plan, installing metering and moisture monitoring, and using our Engineering Standards and Specifications to pursue opportunities for additional ILA reductions.

**Barriers**

**ILA Water**

Unlike the water intensity goal (which is based on usage per ft²), each new piece of landscape – even low intensity landscaping – adds to the overall ILA water usage. As PNNL modernizes the campus through new construction or major facility renovation, landscaping is necessary for fire offsets, dust control, and heat island reduction. Even with integrated ILA water reduction in our Engineering Standards and Specifications, meeting this goal will be a challenge.

With thoughtful planning, the 331 Building underwent an extensive landscape and xeriscaping project that led to substantial water intensity reductions.

**Success Story | Water**

**Water Intensity**

PNNL has already achieved the FY20 goal for potable water intensity reduction in part with our 331 Building improvements project. First, landscaping was drastically reduced for a 70% water savings – over 5,000,000 gal of water – along with applicable decreased amounts of fertilizer and required maintenance. The project retained 13 mature trees and added 18, the mix of which offers long-term water savings. Finally, a 10- to 15-ft building/parking lot setback minimizes building damage, redirects water to proper landscaped locations, and eliminates wasted water. Our advanced water meters and facility divesting strategies formed a comprehensive approach to water management that led to an overall water intensity reduction of 56.6% compared with the FY07 baseline.

**ILA Water**

PNNL reduced its ILA water use by creating an outdoor collaboration space that incorporates an innovative, sustainable material. First used on EMSL facility walkways, pervious concrete, which resembles traditional cement, allows water to infiltrate the soil, eliminating erosion from runoff and facilitating groundwater recharge. We are the first local organization to use this material and estimate that it will save around 500,000 gal of ILA water annually.
Pollution Prevention

In FY12, PNNL established goals to increase waste diversion, reduce laboratory chemical inventory, and improve environmentally preferable purchasing (EPP) compliance paper purchases.

FY12 Performance Status

Waste Diversion

Solid Waste

PNNL has strong recycling and excessing programs in place for multiple waste streams: electronics, research equipment, furniture, office products, scrap metal, wood, paper, plastic, glass, tin, and cardboard. In FY12, PNNL expanded plastic recycling to accept all plastic coded 1 through 7.

Our excessing process includes verification of items that are free of radiological, beryllium, or biological contamination. A procedure is in place through PNNL’s How Do I? (HDI) standards-based management program, which provides instructions and requirements to all staff prior to releasing any materials or equipment from the Laboratory.

PNNL also continues to host zero waste picnic events. In FY12, an agreement with the recycling vendor was established to allow for comingle recycling from these events. This change streamlined the event planning and implementation process and garnered positive feedback from staff. PNNL diverted approximately 50% of non-hazardous sanitary waste in FY12.

Goals

5.1 – Divert at least 50% of non-hazardous solid waste, excluding construction and demolition debris, by FY15

5.2 – Divert at least 50% of construction and demolition materials and debris by FY15
Construction and Demolition Waste

PNNL has a wide variety of C&D work activities from large construction projects to small scopes of work. Based on available data, PNNL diverted 98% of C&D waste in FY12.

Composting

The Laboratory’s current composting program consists of two industrial size hot composters and a yard waste collection lugger. PNNL composted over 1 MT of food waste in FY12.

Installation of a lugger cover has prevented non-yard waste material from contaminating the off-site yard waste compost, allowing PNNL to divert another waste stream. We sent approximately 44 MT of yard waste and tree trimmings for off-site composting in FY12.

P2 Program

The fundamental mechanism for reducing waste at the Laboratory has been through our P2 assessments and the P2 Pays program. P2 assessments are conducted to identify opportunities associated with operational process improvements and product substitution. The most significant effort completed in FY12 was replacing trichloroethylene (TCE) solvent with non-toxic EnSolve® from a vapor degreaser, which helped to reduce the chemical toxicity associated with this activity.

Toxic Chemical Reduction

Chemical Management

PNNL’s ChemAgain chemical redistribution program provides the primary means of collecting and redistributing usable chemicals. This program has successfully redirected nearly 4 MT of chemicals through internal transfer or donation.

In FY12, PNNL’s Risk-Based Chemical Management pilot program was expanded Laboratory wide. PNNL’s strategy for implementing an integrated, risk-based approach differentiates between the varieties of chemicals used at the Laboratory on the basis of their level of impact to safety, operations, and contributions to the Laboratory’s R&D missions. The strategy takes into account the lifecycle of the materials, their impact on facilities, and the data generated and used by staff and management. This process is designed to improve integration and effectiveness and to help reduce costs while maintaining excellence in management, research, and operations.

In FY11, PNNL conducted an evaluation of R&D activities using SF₆ to identify opportunities to reduce...
emissions through recovery. The evaluation found that approximately 50 pounds (lbs) per year were released in a variety of bench-scale processes and that recovery was inherently not feasible. It also found that approximately 30 lbs per year is released through leakage or during maintenance from laboratory equipment. Although one equipment user judged that recovery might be feasible for their applications, implementation of an SF$_6$ capture program at that time was deemed not cost effective. PNNL will periodically reevaluate options for cost-effective recovery and reuse.

PNNL also conducted an evaluation of methods for reducing SF$_6$, which is used for facility stack emissions testing. The evaluation identified a procedural change using current instrumentation with SF$_6$ and N$_2$O as a potential alternative tracer gas.

During FY12, we compared N$_2$O and SF$_6$ results in scale-model exhaust tests. Preliminary findings suggest that N$_2$O may indeed be a technically and economically viable substitute for SF$_6$ in stack testing applications. Additional testing, including those that humidify the sample stream, is necessary to establish N$_2$O as an acceptable substitute. If implemented, N$_2$O tests would reduce the CO$_2$eq emissions by an order of magnitude compared with the previous SF$_6$ testing emissions.

Integrated Pest Management

PNNL has state-licensed private commercial pesticide applicators on our grounds crew who are required annually to complete continuing education classes to learn about the latest trends in pest control, current chemical and biological control agents, and updated legislative changes. All applicators are committed to integrated pest management (IPM) principles, where applicable.

Our grounds staff recognizes the responsibility to provide a clean, low-pest environment at the Laboratory. We also strive to limit our control efforts to those absolutely required for optimal results. Our pest control methods begin with the lowest impact, escalating when required and only to the level necessary for acceptable control.

Examples of our IPM best practices are summarized below:

- using wasp traps in lieu of spraying, when appropriate
- good housekeeping by removing cardboard and unwanted wood pallets in yards and storage areas to prevent pest nesting
- using sticky and metal traps for mice control
- using netting and spikes when possible to reduce bird droppings.

Printing Paper Use

Printing continues to be an essential element for conducting the Laboratory’s mission-related work. However, many processes are moving to electronic or “paperless” systems. For example, records are maintained electronically in the Total Records Information Management (TRIM) system, newsletters at all levels have moved to electronic distribution, annual training records are completed electronically, and conference rooms are equipped with audiovisual equipment that enable staff to deliver presentations electronically. Currently, network duplex printers are provided throughout the PNNL complex, for which new printing servers were deployed.

PNNL utilizes the Business-to-Business (B2B) program as the primary mechanism for purchasing office products. Through this program, vendors only offer products that meet PNNL requirements, including the 30% post-consumer content. Compliance with EPP requirements is evaluated and reported by the vendors quarterly. Paper purchase is also available through the purchase-card (P-card) process, when appropriate. Overall, 99% of the uncoated paper purchased in FY12 contains at least 30% post-consumer content. The Laboratory has also reduced consumption of uncoated printing paper by approximately 18% by weight from FY11.
Plans, Actions, and Projected Performance

Waste Diversion

The following initiatives have been established to improve waste diversion and to identify and address opportunities in our current programs. PNNL is on track to achieve both 50% waste diversion goals.

Solid Waste

- Continue evaluating opportunities for reducing sanitary waste by reviewing sanitary dumpster contents, focusing on opportunities in increasing off-site green composting of grass cutting material from our leased facilities and cardboard recycling.
- Continue fostering culture and behavior changes in waste reduction through comingle recycling at Laboratory-wide “zero waste” events.

Construction and Demolition Waste

- Raise awareness with C&D project managers of the waste tracking, recycling, and reporting expectation by working closely with the Facility Operations Environmental Compliance Representative.
- Continue monitoring C&D waste recycling performance and identify additional opportunities for improvements.

Composting

PNNL's composting program is constrained by the lack of off-site food waste composting facilities. Therefore, plans to improve Laboratory’s on-site composting program are as follows:

- Maintain on-site food waste composting program and identify barriers and opportunities for improvement.
- Maintain off-site yard waste composting.

P2 Program

PNNL will maintain the ChemAgain program to help reduce chemical inventory, thus reducing chemical disposals. PNNL will also continue to support implementation of staff generated P2 opportunities from research activities, when appropriate. P2 assessments will be conducted, with the focus of increasing bio-based products such as antifreeze inhibitor or ice melt.

Testing of N₂O as a technically and economically viable substitute for SF₆ in stack testing applications will be concluded in FY12. If it is determined to be an acceptable substitute, procedures will be changed to implement the new process.

Toxic Chemical Reduction

Chemical Management

As noted in the P2 section, PNNL will maintain the ChemAgain program to help reduce chemical inventory, thus reducing chemical disposals.

Integrated Pest Management

PNNL is always looking for less toxic and more targeted methods of control, achieved mostly through our annual retraining courses for our pest control licensing process. IPM will implement cost-effective, new techniques that allow for timely response, as applicable.

Printing Paper Use

PNNL will continue utilizing technology and encouraging behavior to minimize paper use and enable the automatic purchasing of 30% post-consumer content paper. Additionally, the following actions are planned to improve paper use:

- assess opportunities to consolidate printing
- provide training for P-card holders about sustainable acquisition requirements
- retire old printers that have no duplex printing capability
- encourage the digital storage of records and files wherever the law allows
- procure uncoated printing and writing paper containing at least 30% post-consumer content.

Barriers

PNNL has already met the two 2015 waste diversion goals and does not foresee any barriers in continuing to maintain performance. We intend to challenge ourselves to increase waste diversion wherever it is economically viable.
Goals

6.1 – Procurements meet sustainability requirements and include sustainable acquisition clause (95% each year)

Success Story | Sustainable Acquisition

“Ac”quiring Minds Want to Know

PNNL’s commitment to sustainability gained momentum in FY12. A mobile Sustainability Office was displayed at several annual PNNL events, an interactive approach that allowed staff to ask questions about sustainability. Showcasing a variety of office items purchased consistent with PNNL’s Sustainable Acquisition Guidelines, the mock office featured dozens of recycled and energy efficient items, including ENERGY STAR-certified computer equipment, recycled desktop accessories, folders, and paper. Each item was labeled with product information and included recycled content percentages, where applicable.

The Sustainability Office will be displayed at future PNNL gatherings and will continue to be used to increase staff member awareness and knowledge about sustainable purchases.

Sustainable Acquisition

PNNL procures energy and water efficient, bio-based, environmentally preferable, non-ozone depleting, recycled content, or non/less toxic alternative products that contribute to our sustainable leadership.

FY12 Performance Status

During FY12, PNNL implemented several improvements to its acquisition system for sustainability compliance. Below are highlights:

- included sustainable acquisition provision in all applicable solicitations and contracts
- revised Sustainable Acquisitions Guidelines to reflect changes to sustainability requirements
- implemented Electronic Product Environmental Assessment Tool (EPEAT) standards for copiers, printers, and televisions
- educated technical administrators by updating new and existing training courses and offering other forms of interactive education.

In addition, the PNNL Contracts Department advertised sustainable ideas with a booth at several PNNL events and remained active with ongoing issues to enhance PNNL’s awareness of and commitment to sustainability.

Plans, Actions, and Projected Performance

PNNL intends to continue increasing staff awareness of available sustainable products, participating in Earth Day and other staff educational programs, and benchmarking with other federal agencies on best practices. Activities in FY13 include:

- Implement a policy of no incandescent lighting (research equipment exceptions permitted)
- Implement a policy to increase the usage of rechargeable batteries
- Perform a targeted self-assessment of compliance with sustainable acquisitions.

Barriers

PNNL does not foresee any barriers preventing us from continuing to achieve sustainable acquisition goals.
Goals

7.1 – All data centers are metered to measure a monthly power utilization effectiveness (PUE; 100% by FY15)
7.2 – Maximum annual weighted average PUE of 1.4 by FY15
7.3 – Electronic stewardship: 100% of eligible PCs, laptops, and monitors with power management actively implemented and in use by FY12

Electronic Stewardship and Data Centers

PNNL balances high performance computing and electronic stewardship while maximizing energy efficiency and operational effectiveness.

FY12 Performance Status

Data Center Metering

PNNL performed energy assessments and profiling of its data centers during FY12 using DOERGRIT, which is part of the Data Center Profiler (DC Pro) Software Tool Suite. Assessment results help outline projects that will guide us to better data center efficiencies. Metering of data centers continues, with two of the three data centers now complete.

Power Usage Effectiveness

PNNL continued to leverage a previous campus-wide data center consolidation assessment that resulted in a prioritized list of equipment to move and computer rooms potentially from which to migrate. Additional power and cooling was recently added to the CSF to accommodate data center consolidation and the installation of a large institutional computer named Olympus. PNNL aggressively pursued eliminating small computer rooms by migrating users onto Olympus where possible and relocated user servers when necessary. In FY12, approximately 30% of the less efficient computer rooms were emptied and re-purposed for other Laboratory uses.

Since FY06, PNNL has aggressively pursued virtualization as the tool to reduce server sprawl, conserve energy, and reduce equipment footprint of the ISB2 data center. As of 1Q FY13, PNNL business virtualization is above 80%, which translates to over 2 gigawatt hours (GWhr) or about $162k annually in electricity savings alone. With our virtual desktop early adopters, PNNL is strategically positioned to continue being a leader in data center energy efficiency.

Achieving an annual PUE weighted average of 1.4 across all three PNNL data centers will require different solutions at each building to maximize each data center's existing configuration. Our PUE metering will allow us to determine the success and degree of impact of various energy efficient projects. Some energy saving projects have included under-floor cable removal, or...
replacement of outdated equipment and supplies, and use of rear door heat exchangers (RDHx) to cool a high density high performance computer.

**Electronic Stewardship**

With the deployment of Windows 7, PNNL minimized power consumption with user pre-configurations on new Windows- and Mac-based systems and displays. The Laboratory made a concerted effort in FY12 maximize system upgrades, resulting in a 23% improvement in Windows 7 adoption. An aggressive campaign is underway to upgrade or retire remaining Windows XP systems. Windows management tools have been updated to System Center Configuration Manager (SCCM) 2012 to facilitate further improved reporting of power management settings on capable systems.

Telework, a new program tested in FY12, was formally rolled out in FY13 and specifically targets Scope 3 commuting emissions. A side benefit of teleworking will be a migration toward energy efficient laptop devices (for ease of mobility and taking home) in the office environment, which will decrease further PNNL’s overall energy use.

In FY12, Information Management Services partnered with Facilities and Operations (F&O) to assess and deploy the JouleX energy consumption monitoring software. JouleX provides energy information for all monitored assets, which helps PNNL to identify energy-inefficient legacy equipment and shows overall energy consumption trends for our computing equipment.

The acquisition of electronic office products is through our Managed Hardware Program (MHP), where 100% of the PC offerings are EPEAT and ENERGY STAR registered. Any deviation from purchasing using the pre-approved MHP list is discouraged and requires management approval.

Disposition of 100% of PNNL’s electronic assets is through the Excess Materials and Redeployment Service group, where equipment can follow one of the following four paths: Computers for Learning, redeploy within PNNL, Tri-City Asset Recovery, or recycle through a DOE approved vendor.

**Plans, Actions, and Projected Performance**

**Data Center Metering**

PNNL will continue performing energy assessments and profiling of its data centers using DOEGRIT. Assessment...
results will be analyzed using the Decision Tool and implemented if cost effective. Installation of data center metering will also continue, and PNNL intends to meet the FY15 goal of having all data centers metered. More immediate plans for FY13 include the start of data center metering in EMSL during the next building scheduled power outage, to include computer cabinet environmental sensors.

Power Usage Effectiveness

As PNNL continues to move toward the 1.4 PUE goal, various methods will be employed and considered to improve energy efficiency in the data centers. This includes minimizing the number of systems that exist in general laboratory space and educating users about how they can be more efficient consumers of computational resources. All three data centers have been profiled using DC Pro by our Certified Data Center Energy Practitioner. Results are:

- ISB2 – PUE 1.59 annualized
- CSF – PUE 1.20 annualized
- EMSL – PUE data not available but assumed at 2.0–2.2 annualized.

Some of the major focuses to achieve the PUE goal are listed below:

- Install environmental instrumentation in data centers, allowing higher operating temperature set points, and newer, more energy efficient uninterruptible power supplies and transformers.
- Move cooling as close to the load as possible, reducing moving air costs
- Revamp 240 V power distribution to sensored, higher voltage units, where appropriate
- Continue virtualizing systems to reduce physical footprint and reduce energy use
- Use ceiling plenums as hot air returns to avoid hot and cold aisle mixing
- Eliminate humidification cycle in data centers while maintaining American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE)-recommended parameters
- Use hot aisle/cold aisle containment to increase computer room air conditioning (CRAC) efficiency and raise overall room temperature to save cooling energy and lower the PUE
- Specify more energy efficient cluster computers by including the total cost of ownership in the evaluation of future bids
- Replace CRAC air circulation fans with high efficiency electronically commutated (EC) fans
- Install aerodynamic fans and more efficient motors on outdoor chillers.

Electronic Stewardship

PNNL will continue to accomplish electronic stewardship goals through a variety of mechanisms, including the use of power management capabilities that are part of our current management suite, accelerating the pace of upgrading the remaining workstations to Windows 7, and upgrading to the latest version of the Mac operating system. We continuously look for more energy efficient end user devices as they appear on market and work hard to educate users about how they can be more efficient consumers of computational resources. PNNL will be proactive with our existing MHP for the acquisition and proper disposal and disposition of excess computers and electronic equipment.

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 the Laboratory works towards its goal of 40% of employee’s teleworking at least 1 day per week by FY20.

Potential energy conservation initiatives in the desktop/end user computing space that are under consideration in the Laboratory’s initiative planning and prioritization process include increasing utilization of virtual desktops and more energy efficient end user devices, and increasing the use of mobile and collaboration technologies. The use of virtual desktops also reduce the need for multiple user systems. Other potential conservation initiatives include implementing a power management strategy for desktops and conducting an evaluation and pilot for the use of public cloud for targeted services. Self-service provisioning is available and functional campus-wide via PNNL’s private cloud.

Barriers

PNNL believes that achieving an annual PUE weighted average of 1.4 by FY15 across all three data centers will be challenging due to the age and design of some infrastructure. Continual use of DC Pro and DOEGRIT along with our data center metering will help identify solutions to maximize efficiency. Out-year capital projects, if economical, will incorporate energy savings aspects to the extent practical, helping us to achieve the 1.4 PUE goal.
Sustainable Leadership

PNNL maintains its leadership through our triple bottom line approach, helping us to make informed, sustainable decisions.

A triple bottom line approach is how PNNL embraces a holistic approach to sustainability. We recognize that our everyday actions can have positive, sustainable impacts on our earth and throughout our community.

**Environmental**: PNNL's outstanding commitment to the environment is highlighted throughout this document in tangible ways—from increases in water goals, to decreases in petroleum-based fuel vehicles, to more efficient energy practices, and real-time data gathering. Sometimes in sustainability efforts, PNNL research and operations staff have the opportunity to build, design, and test technology—like DSOM, a diagnostic tool that provides real time data on building energy efficiency. Throughout the year, this tool and its training have been shared with other federal agencies. PNNL will continue striving to reach DOE sustainability goals while institutionalizing best practices and innovative solutions in all areas. We will continue to use the BOCC as a real-time, living laboratory to analyze building energy data and develop solutions to support effective operations and innovative research.

**Social**: PNNL also provides ways for staff members to live out their “citizenship” at the Lab. We take action to make our workplace safe and secure. Through on-site mentoring and classroom learning opportunities, we reach future scientists, engineers, mathematicians, and technologists and provide them with real-life work experiences. Participating in events, recreational activities, volunteer work, or clubs and networks allows staff to share their talents and pursue their passions for the betterment of society both on and off campus. We will continue to be mentors and volunteer our time to support our community and the nation.

**Economic**: PNNL’s third pillar is not just about our own bottom line but the value PNNL brings to a broad set of stakeholders, including our staff members, suppliers, entrepreneurs, and the community as a whole. We provide opportunities to further technology within small businesses through our Technology Assistance Goals

8.1 – Deployment of R&D technologies and support of other governmental agencies
Program. Recently, we helped entrepreneurs test a hydrovolt hydrokinetic turbine that operates below water to generate clean, renewable energy. More than half of our procurement spending is to small businesses, and 6% goes to veteran-owned businesses. PNNL will continue working with small businesses to help entrepreneurs pursue their dreams and meet their business objectives.

For a broader view of PNNL’s sustainability efforts, read our Sustainability Report, which highlights our annual environmental, social, and economic progress and is available at http://sustainable.pnnl.gov. There you will also find our video, Sustainability in Action, which highlights numerous sustainable features on campus (also available on YouTube).

For the past 3 years, the building manager, system engineers, and core work team staff at the Radiochemistry Processing Laboratory (RPL) reduced energy use by 24% from the baseline year (2003) and 10% in FY12. Traditionally, the RPL’s impact on the utility budget has been significant as one of the largest energy users on campus. With this challenge, the RPL team embraced implementing energy reduction. This effort was accomplished with strategic investments to remove old HVAC equipment and controls, repair pre-heat and heat recovery systems, replace old windows with high energy efficiency models, program wider temperature set points, and respond more quickly to HVAC maintenance needs.
Climate Change Adaptation

PNNL continues to examine the impacts of climate variability and change on our site’s operations and is integrating approaches to managing these impacts into strategic planning efforts for our campus.

Goal 1: Improve Understanding of Climate Change Effects and Impacts

Objective 1.1: Work with other agencies to improve our understanding of climate change

PNNL has a number of collaborative research efforts underway that seek to improve our understanding of climate change effects and impacts. Our Climate and Earth Systems Science research tackles key questions related to atmospheric aerosols, clouds, and precipitation; human systems, such as agriculture and energy; the cycling of water, carbon, and other important constituents; and the impacts of and potential responses to climate change. To help understand better the atmospheric processes that drive regional and global earth systems, PNNL draws from core research capabilities in:

- climate, aerosol, and cloud physics
- regional and global scale modeling
- integrated assessment of energy and the environment
- complex regional meteorology and chemistry
- computational science and mathematics.

Much of this work involves collaboration with other federal entities, including DOE, the U.S. Department of Homeland Security (DHS), EPA, National Aeronautics and Space Administration (NASA), and universities and industry. A few examples of the programs and facilities we bring to bear on climate research include the following:

- Joint Global Change Research Institute (JGCRI) – With the University of Maryland, PNNL has domestic and international collaborators to deepen our understanding of the interactions between climate, energy production and use, economic activity, and the environment.

- The integrated Regional Earth System Modeling (iRESM) initiative – A Laboratory-level Laboratory Directed Research and Development (LDRD) initiative, iRESM evaluates interactions among...
climate, energy, land, and water systems at a regional scale in an integrated manner.

- Olympus supercomputer – PNNL researchers are leveraging the power of Olympus, a theoretical 162-Teraflop peak supercomputer, to perform more complex, advanced research in climate science and ultimately improve our ability to project future climate change.

Objective 1.2: Work with other Federal agencies and local jurisdictions (as appropriate) to develop regional partnerships for climate change information sharing and collaboration and

Goal 4: Improve the Climate Resiliency of all DOE Sites

Objective 4.2: Identify or establish and participate in regional climate change adaptation partnerships, as appropriate, for all DOE facilities

PNNL engages with other Pacific Northwest institutions on regional climate change impacts and adaptation primarily through research collaboration partnerships. For example, PNNL researchers are collaborating with scientists at Washington State University, Oregon State University, and several other institutions through the Biosphere-Relevant Earth System Model (BioEarth) collaboration. This activity is designed to “improve understanding of the interactions among carbon, nitrogen, and water at the regional scale, in the context of climate change, to inform decision makers’ strategies regarding natural and agricultural resource management.” PNNL researchers working at JGCRI have also collaborated with researchers at the University of California-Davis on transportation-related climate issues and with scientists at the University of Washington and Oregon State University on the impacts of climate change on agriculture and land use change.

Several PNNL staff participate in ongoing regional, national, and international climate change assessment activities, including the Intergovernmental Panel on Climate Change (IPCC) and the National Climate Assessment (NCA), a Congressionally-mandated effort in nationwide climate change. Toward these efforts, PNNL staff write and contribute technical papers and serve on committees.

During FY13, we will seek opportunities to participate in existing partnerships of agencies in the Pacific Northwest region focusing on adaptation strategies. The goal of this engagement is to help PNNL learn actions that other regional entities are taking to prepare for regional climate change impacts and begin defining critical adaptation measures to incorporate in PNNL’s campus operations plans.

Goal 2: Improve Understanding of Climate Change Vulnerabilities and Risk

Objective 2.2: Conduct detailed risk or vulnerability assessments, as appropriate, for specific DOE programs or facilities

PNNL reviewed the DOE High Level Analysis of Vulnerability to Climate Change and the Washington State Integrated Climate Response Strategy (both April 2012). Both studies were used to revise our previous assessment of potential climate change vulnerabilities at our major sites.

The greatest concern about the potential effects of climate change to PNNL’s operations in the Pacific Northwest region include the issues noted below.

- **Facility energy shortages** – Projected declines in springtime snowpack will lead to reduced streamflows during the summer months and potentially reduced hydro-electric power generation. Considering that over 75% of the COR’s fuel mix currently comes from regional hydropower sources, changes in water supply could affect the seasonal availability and reliability of power for PNNL.

- **Reduced water supply** – Projected reductions in seasonal water supply may lead to policy changes regarding use of Columbia River water. PNNL currently withdraws the full amount of its water permit for use in our cooling ponds and facility landscaping and to irrigate Battelle-owned land adjacent to PNNL facilities: 330 million gal of water each year, half the Laboratory’s total annual water usage. Changes to PNNL’s water permit could necessitate increased withdraws from municipal sewer/water and groundwater sources and impair our ability to perform aquaculture research in support of our DOE mission.

- **Physical damage from wildfires** – Higher summer temperatures and earlier spring snowmelt are also projected to increase the risk of wildfires.

- **Physical damage from sea level rise and storm surge** – Increases in sea level and/or in the frequency or intensity of coastal storms could pose a physical threat to PNNL coastal research facilities in Sequim, Washington.
• **Loss of fish and natural systems** – Higher summer stream temperatures and reduced flow are projected to increase lethal stream conditions for salmon and other coldwater species. Sea level rise is also projected to eliminate valuable coastal habitats, and increased acidity in marine waters from carbon dioxide emissions and upland runoff threatens the aquaculture and shellfish industry.

**Goal 4: Improve the Climate Resiliency of all DOE Sites**

**Objective 4.1: Update all appropriate DOE site plans to address climate change resiliency**

In addition to this SSP, PNNL F&O will review its *Building Emergency Procedure for Low Hazard and Radiochemical Processing Facilities* to ensure that all vulnerabilities identified in this SSP are adequately addressed in the emergency response plans.

PNNL F&O staff will also review the 2012 Campus Master Plan to ensure that the proposed development approach – from building siting to landscaping to building energy and water systems – works to reduce climate change vulnerabilities and risks identified in this SSP.

Changes to future versions of these documents will be recommended based on these assessments.
High performance computing is integral to the PNNL mission, and the Laboratory has two facilities that meet the definition of high energy mission specific facilities (HEMSF).

EMSL, a FIMS excluded facility, 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. EMSL boasts an unparalleled collection of state-of-the-art computational and experimental capabilities focused on its three science themes – biological interactions and dynamics; subsurface science, geochemistry, and biogeochemistry; and the science of interfacial phenomena – to address critical challenges in DOE’s environmental and energy mission areas. Advanced instrumentation, including the 163 teraflops, 18,000+ core super-cluster with a 4.5 petabyte data archive Chinook computer, is integrated with expert collaborators who resolve complex scientific problems, including high-performance mass spectroscopy, high-resolution microscopy, high-field magnetic resonance spectroscopy and imaging, and high-performance molecular science computing.

CSF, also a FIMS-excluded facility, is focused on the design and efficient implementation of computational capabilities for the analysis of data from high-throughput experimental technologies, the abstraction of models from this data, and the predictive simulation of these models. High-performance computing merges science and technology by 1) employing hardware that maximizes processor speed, memory and interconnect bandwidth, efficient use of secondary storage, and reliability; 2) developing algorithms that are scalable, resource-efficient, and load-balanced and that manage computational complexity and exploit space-time locality; and 3) creating programming models, numerical libraries, communication libraries, compilers, and debuggers that support data decomposition, low communication overhead, and portability. In FY12, PNNL installed the 162-Teraflop Olympus Supercomputer. Unlike other large-scale computers, Olympus uses water instead of air conditioning to remain cool. The novel system uses a closed water loop that absorbs the heat generated by Olympus. The system is expected to use about 70 percent less energy than traditional air conditioning, which will save PNNL operating funds and reduce our GHG emissions.
HEMSF Electricity Projections for PNNL

<table>
<thead>
<tr>
<th></th>
<th>FY08</th>
<th>FY09</th>
<th>FY10</th>
<th>FY11</th>
<th>FY12</th>
<th>FY13</th>
<th>FY14</th>
<th>FY15</th>
<th>FY16</th>
<th>FY17</th>
<th>FY18</th>
<th>FY19</th>
<th>FY20</th>
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</thead>
<tbody>
<tr>
<td>New HEMSF CSF</td>
<td>6,773</td>
<td>10,406</td>
<td>14,786</td>
<td>16,276</td>
<td>16,746</td>
<td>19,604</td>
<td>20,743</td>
<td>21,794</td>
<td>23,316</td>
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<tr>
<td>Existing HEMSF ENSL</td>
<td>26,426</td>
<td>30,516</td>
<td>30,820</td>
<td>32,076</td>
<td>30,401</td>
<td>37,570</td>
<td>32,095</td>
<td>33,628</td>
<td>33,599</td>
<td>40,052</td>
<td>41,337</td>
<td>41,950</td>
<td>42,465</td>
</tr>
<tr>
<td>Site Base</td>
<td>43,982</td>
<td>44,730</td>
<td>51,361</td>
<td>50,505</td>
<td>46,247</td>
<td>48,445</td>
<td>49,759</td>
<td>51,183</td>
<td>51,370</td>
<td>59,190</td>
<td>50,394</td>
<td>50,482</td>
<td>51,073</td>
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The successful implementation of long-term sustainability goals requires a sound budgeting strategy and funding. PNNL uses several methods to secure the appropriate funding for energy and water efficiencies.

- The most efficient and preferred method is budgeting sustainable components into projects through our Engineering Standards and Specifications. 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. They are submitted in our annual budgeting process and prioritized along with all other requests using a weighted analysis to incorporate life cycle cost, deferred maintenance, return on investment, and direct ties to the Laboratory mission.

- Direct utility savings identified from implemented energy or water projects or derived from utility rebates are used to fund additional ECMs as encouraged by the Energy Policy Act (EPAct) of 2005, Section 102(e).

- If internal funding is not feasible, PNNL is willing to leverage the use of alternate financing through ESPCs or UESCs.

PNNL recognizes that the success of the program requires appropriate funding. Using our engineering standards along with our annual prioritized budgeting process will contribute to the completion of all viable energy and water measures.
Appendix — Self Certification

DOE BUILDING EXCLUSION
SELF-CERTIFICATION FORM
FY 2012

FROM: DOE Pacific Northwest Site Office (PNSO)
Pacific Northwest National Laboratory (PNNL)

TO: Sustainability Performance Office

DATE: November 14, 2012

SUBJECT: SELF-CERTIFICATION FORM FOR THE ENERGY INTENSITY GOAL OF
EISA 2007

Each building or group of buildings excluded under the criteria for a Part G or Part H exclusion
is/are metered for energy consumption and their consumption is reported annually.

If any building has been excluded under the criteria for Part H for impracticability, then all
practicable energy and water conservation measures with a payback of less than 10 years have
been installed. 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 FIMS Report 063.

I certify that the buildings for PNNL listed on the Excluded Buildings List, produced by FIMS as
Report 063 dated November 13, 2012, meet the exclusion criteria in Guidelines Establishing

[Signature]
Roger L. Snyder, Manager
PNSO

11/14/12
Date

Contact Information:

Ron Gallagher, Engineer
PNSO Operations Division
Phone: (509) 372-4260
E-mail: ron.gallagher@pnsd.science.doe.gov
# Energy Consuming Excluded Buildings and Trailers List

<table>
<thead>
<tr>
<th>Property ID</th>
<th>Real Property Unique ID</th>
<th>Property Name</th>
<th>Exclusion Part</th>
<th>Property Type</th>
<th>Gross SCFT</th>
<th>Excluded SCFT</th>
</tr>
</thead>
<tbody>
<tr>
<td>LSB</td>
<td>143716</td>
<td>Laboratory Support Building</td>
<td>G - Metered intensive loads</td>
<td>Building</td>
<td>63,921</td>
<td>657</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Excludes data center located in the building.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CSF</td>
<td>207161</td>
<td>Computational Sciences Facility</td>
<td>G - Metered intensive loads</td>
<td>Building</td>
<td>65,861</td>
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<tr>
<td></td>
<td></td>
<td>excluded started in FY12 because the data centers dominate the energy usage in the building</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>3C20</td>
<td>131274</td>
<td>William R. Wiley - EMSL</td>
<td>G - Metered intensive loads</td>
<td>Building</td>
<td>234,593</td>
<td>234,593</td>
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<tr>
<td></td>
<td></td>
<td>Excluded starting in FY67 because the supercomputer dominates usage in the building. Changed to G in 2010, somehow went back to H, now on 5/17/12 per Marc Berman changed back to G. GSF increased from 224,483 to 234,593 5/12 with Owing.</td>
<td></td>
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</tr>
<tr>
<td>ISS2</td>
<td>130811</td>
<td>Information Sciences Building - 2</td>
<td>G - Metered intensive loads</td>
<td>Building</td>
<td>60,080</td>
<td>3,864</td>
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<tr>
<td></td>
<td></td>
<td>Excluding the data center located in this building.</td>
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<td></td>
</tr>
<tr>
<td>SEF</td>
<td>210259</td>
<td>Systems Engineering Facility</td>
<td>E - Skewed energy usage</td>
<td>Building</td>
<td>47,676</td>
<td>47,676</td>
</tr>
</tbody>
</table>

Building was added to portfolio mid-year FY12; per requirements for a partial year it will not count until its first full year (FY13)

This report qualifies DOE Owned, DCE Leased, and Contractor Leased buildings and trailers where the Energy Consuming Metered Process (Excluded) Facilities gsf is greater than zero.
Contact Information

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http://sustainable.pnnl.gov

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