Site Sustainability Plan

FY2016

Princeton Plasma Physics Laboratory

Operated by Princeton University For the U.S. Department of Energy Under Contract DE-AC02-09CH1

PPPL
PRINCETON PLASMA PHYSICS LABORATORY

U.S. DEPARTMENT OF ENERGY

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List of Acronyms

A&E – Architect & Engineering (firm)
AFVs – Alternative Fuel Vehicles
ASHRAE – American Society of Heating, Refrigerating and Air Conditioning Engineers
B20/B100 – Biofuel 20 %/100%
BAS – Building Automation System
Btu/sf – British thermal units per square foot
C&D - construction and demolition (materials and debris)
CRAC - Computer room air conditioner
CEDR – Comprehensive Energy Data Report
CFC - chlorofluorocarbons
CFL – Computers for Learning
CRAC - Computer Room Air Conditioning
DLA – Defense Logistics Agency
DSOM – Decision Support for Operations & Maintenance (software)
D&R – Delaware & Raritan (Canal)
E85 – Ethanol 85 %
EADS – Energy Asset Disposal System
ECMs – Energy Conservation Measures
EFCOG – Energy Facility Contractors Operating Group
EISA07 – Energy Independence and Security Act of 2007
EMS – Environmental Management System
EO13693 – Executive Order 13693, *Planning for Federal Sustainability in the Next Decade*
EPACT05 – Energy Policy Act of 2005
EPEAT – Electronic Product Environmental Assessment Tool
EPDM - ethylene propylene diene monomer
ERLE – energy related laboratory equipment
ESD – Environmental Services Division
ES& H – Environment, Safety & Health (Department)
ESPC– Energy Savings Performance Contract
EUI – Energy Utilization Intensity
FAST -Federal Automotive Statistical Tool
FEDS – Federal Disposal System
FEMP – Federal Energy Management Program
FIMS – DOE's Facilities Information Management Systems
FTE – Full Time Employee

GHG – Greenhouse Gas

GPs – Guiding Principles

GPP – General Plant Projects

GSA -General Services Administration

GSF – gross square feet

HEMSF – High Energy Mission Specific Facility

HPSB – High Performance Sustainable Buildings

HVAC – Heating, Ventilation and Air Conditioning

ILA – Industrial, Landscaping, & Agricultural

IOI – Infrastructure and Operations Improvement project

IPM – Integrated pest management

ISO-14001 – International Organization for Standards, Standard 14001, *Environmental Management Systems – Requirements with guidance for use*

IT - Information technology

ITER – International Thermonuclear Experimental Reactor

kBtu/gsf – kilo British thermal unit per gross square feet

kW(hr) – kilowatt (per hour)

LEED – Leadership in Energy and Environmental Design

LSB – Lyman Spitzer Building

MSW – Municipal Solid Waste

MWh/yr – Megawatt hour per year

mtCO2e – Metric tons carbon dioxide equivalent

NOO –Notice of Opportunity

NSTX –National Spherical Torus Experiment

NSTX-U – National Spherical Torus Experiment Upgrade

O436.1 – DOE Order 436.1, *Departmental Sustainability*

OPEX – Operating funds expenditure project

ORNL – Oak Ridge National Laboratory

PCBs – polychlorinated biphenyls

PFC -Princeton Forrestal Center

PNNL – Pacific Northwest National Laboratories

PPA – purchase power agreement

PPLCC - PPPL computer center

PUE – Power Utilization Efficiency

REC – Renewable Energy Credit

RF - Radio Frequency

RFP - request for proposal

SEWG – Sustainability and Environmental Working Group (EFCOG)

sf – square feet

SF_6 – Sulfur Hexafluoride

SPOFOA – Sustainability Performance Office (DOE) Funding Opportunity Announcement

SSPP – DOE Strategic Sustainability Performance Plan

T&D – Transmission & Distribution

UESC – Utility Energy Service Contract

USDA - US Department of Agriculture

VFD - variable frequency drive

VOC – volatile organic compound

1. Executive Summary

The Princeton Plasma Physics Laboratory (PPPL) conducts world-leading collaborative scientific research into plasma physics to develop and demonstrate the practical application of fusion power as a sustainable global alternative energy source. This research mission enables the fundamental technology discoveries that advances DOE's energy, national security and sustainability mission. Fusion energy research experiments are by nature high-energy intensive devices – designed to replicate deep space and stellar conditions. Development of magnetic fusion energy as a viable global energy source could dramatically change the course of fossil fuel use and global climate change by providing a globally available environmentally attractive carbon-neutral energy alternative. PPPL is located on Princeton University's James Forrestal Campus in Plainsboro Township, Middlesex County, New Jersey, and has operated at the current site since 1958.

PPPL has institutionalized a comprehensive approach to fulfilling the requirements of Executive Orders 13693, as well as applicable DOE Orders, to advance the DOE energy, national security and sustainability missions. The DOE sustainability goals are fully integrated into PPPL's ISO-14001 certified Environmental Management System (EMS) as our EMS objectives and targets. PPPL reduced its Scope 1 and 2 Greenhouse Gas (GHG) emissions by 54% in FY15 compared to the FY08 baseline. This represents an increase from FY14 primarily due to increased fuel consumption during the cold winter of 2014/15 and the commissioning and restart of experimental systems supporting NSTX-U. As anticipated, with the start of NSTX-U operations, experimental electricity use increased by 31.8% from the previous year. Fleet GHG emissions are down 60% from baseline as a result of careful fleet management and the use of cleaner burning alternative fuels like E85 (85% ethanol) and B20 (20% biodiesel). Scope 3 GHG emissions were 7.1% higher in FY15 than in FY08 due to increased emissions from business travel and employee commuting.

PPPL maintains a robust waste diversion program that maintained a combined recycling rate of 84% for solid waste and construction waste. PPPL continues efforts to facilitate the purchase of environmentally preferable products through lab-wide subcontracts and by enhancing sustainable acquisition guidance and resources available to employees. On-site renewable energy and high performance building improvements will be evaluated in the context of the Laboratory's Campus Modernization Plan.

Table 1 provides a summary of FY15 performance and planned actions to make progress on DOE's sustainability goals. Figure 1, below, provides a graphical summary of GHG emissions from FY08 to FY15 showing dramatic reductions in the Laboratory's GHG footprint between FY08 and FY15 and the increase in FY15 which was anticipated with the return to experimental operations.

Table 1 - DOE Goal Summary Table

SSPP Goal #	DOE Goal	Performance Status through FY 2015	Planned Actions & Contribution	Risk of Non-attainment
Goal 1: Greenhouse Gas Reduction				
1.1	50% Scope 1 & 2 GHG reduction by FY 2025 from a FY 2008 baseline (2015 target: 19%)	**MET** FY15 emissions 54% below baseline	Continue to focus on energy efficiency, especially electricity use, and fugitive emissions	NA
1.2	25% Scope 3 GHG reduction by FY 2025 from a FY 2008 baseline (2014 target: 6%)	**IN PROGRESS** Previous years were below baseline but FY15 emissions increased.	Focus on telework and employee commuting; continue to emphasize energy efficiency and business travel.	Moderate. Ongoing international research emphasis
Goal 2: Sustainable Buildings				
2.1	25% energy intensity (Btu per gross square foot) reduction in goal-subject buildings, achieving 2.5% reductions annually, by FY 2025 from a FY 2015 baseline	**EXCEEDED** FY15 goal New baseline year.	Continue to focus on energy efficiency and building energy performance	Moderate. Limited funding available for ECMs
2.2	EISA Section 432 energy and water evaluations	**MET** 100% of covered buildings had Type 1 audit in FY15	25% of buildings will be evaluated in 2016	NA
2.3	Meter all individual buildings for electricity, natural gas, steam and water, where cost-effective and appropriate	**MET**	Additional sub-metering as cost-effective and programmatically appropriate	Moderate. Current utility configuration doesn't allow building-level metering.
2.4	At least 15% (by building count or gross square feet) of existing buildings greater than 5,000 gross square feet (GSF) are compliant with the Guiding Principles (GPs) of HPSB by FY 2025, with progress to 100% thereafter	**MET** Using GSF option	Plan to continue HPSB Guiding Principles on additional facilities in conjunction with facility repairs & renovations.	Moderate. LEED-Gold certification of LSB due to renewal. Limited funding available for ECMs
2.5	Efforts to increase regional and local planning coordination and involvement	**MET**	Continue to coordinate with Princeton Forrestal Center.	NA
2.6	Net Zero Buildings: Percentage of the site's existing buildings above 5,000 gross square feet intended to be energy, waste, or water net-zero buildings by FY 2025.	**NONE**	Evaluating existing buildings to identify opportunities and strategies to address this goal	High. Critical infrastructure needs may not allow sufficient funds in the near term.
2.7	Data Center Efficiency. Establish a power usage effectiveness target in the range of 1.2-1.4 for new data centers	**IN PROGRESS** Data center PUE for FY15 was 1.58	Reviewing near-term options to improve cooling efficiency. Evaluating potential	Low.

SSPP Goal #	DOE Goal	Performance Status through FY 2015	Planned Actions & Contribution	Risk of Non-attainment
	and less than 1.5 for existing data centers		GPP project to replace existing HVAC with chilled water cooling.	
Goal 3: Clean & Renewable Energy				
3.1	"Clean Energy" requires that the percentage of an agency's total electric and thermal energy accounted for by renewable and alternative energy shall be not less than: 10% in FY 2016-2017, working towards 25% by FY 2025	New Goal **ON TARGET**	Continue purchasing RECs and evaluate ESPC/PPA opportunities	Moderate.
3.2	"Renewable Electric Energy" requires that renewable electric energy account for not less than 10% of a total agency electric consumption in FY16-17, working towards 30% of total agency electric consumption by FY 2025	**MET** Purchased RECs to meet goal.	Continue purchasing RECs and evaluate ESPC/PPA opportunities	NA
Goal 4: Water Use Efficiency and Management				
4.1	36% potable water intensity (Gal per gross square foot) reduction by FY 2025 from a FY 2007 baseline (2015 target: 16%)	**EXCEEDED** FY15 goal **MET** new goal	Continue to identify water conservation opportunities. Maintain previous savings.	NA
4.2	30% water consumption (Gal) reduction of industrial, landscaping, and agricultural (ILA) water by FY 2025 from a FY 2010 baseline (2014 target: 10%)	**IN PROGRESS** Exceeded goal for previous 4 years. FY15 water use exceeded goal level	Mission-critical operational use of industrial water caused FY15 increase. Will continue to seek and maximize opportunities to reduce industrial water use.	Moderate. Additional water conservation opportunities are limited.
Goal 5: Fleet Management				
5.1	20% reduction in annual petroleum consumption by FY2015 relative to a FY05 baseline; maintain 20% reduction thereafter. (2015 target: 20%)	**EXCEEDED**	Continue to manage fleet composition and emphasize alternative fuel use.	NA
5.2	10% increase in annual alternative fuel consumption by FY15 relative to a FY05 baseline; maintain 10% increase thereafter. (2015 target: 10%)	**EXCEEDED**	Continue to manage fleet composition and emphasize alternative fuel use.	NA
5.3	30% reduction in fleet-wide per-mile greenhouse gas emissions reduction by FY 2025 from a FY14 baseline. (2015 target: N/A; 2017 target: 4%)	New Goal. Note: FY15 fleet GHG intensity is down 49.2% from FY08.	Continue to manage fleet composition and emphasize alternative fuel use.	Low.

SSPP Goal #	DOE Goal	Performance Status through FY 2015	Planned Actions & Contribution	Risk of Non-attainment
5.4	75% of light duty vehicle acquisitions must consist of alternative fuel vehicles (AFV). (2015 target: 75%)	**MET**	Continue to emphasize AFV and alternative fuel use.	NA
5.5	50% of passenger vehicle acquisitions consist of zero emission or plug-in hybrid electric vehicles by FY 2025. (2015 target: N/A)	New Goal	Work with GSA to identify opportunities in vehicle lease program. Limited number of passenger vehicles.	NA
Goal 6: Sustainable Acquisition				
6.1	Promote sustainable acquisition and procurement to the maximum extent practicable, ensuring BioPreferred and biobased provisions and clauses are included in 95% of applicable contracts.	**MET**	Continue to integrate sustainable acquisition information into applicable contracting documents.	NA
Goal 7: Pollution Prevention & Waste Reduction				
7.1	Divert at least 50% of non-hazardous solid waste, excluding construction and demolition debris.	**EXCEEDED** FY15 MSW recycling rate was 74.1%	Continue existing programs and expand as appropriate.	NA
7.2	Divert at least 50% of construction and demolition materials and debris.	**EXCEEDED** FY15 C&D recycling rate was 85.8%	Continue existing programs and expand as appropriate.	NA
Goal 8: Energy Performance Contracts				
8.1	Annual targets for performance contracting to be implemented in FY 2017 and annually thereafter as part of the planning of section	**ON TARGET**	Currently investigation new ESPC/PPA opportunities.	NA
Goal 9: Electronic Stewardship				
9.1	Purchases – 95% of eligible acquisitions each year are EPEAT-registered products	**EXCEEDED**	EPEAT products specified as default	NA
9.2	Power management – 100% of eligible PCs, laptops, and monitors have power management enabled	**IN PROGRESS** for desktops & laptops **MET** for monitors	Plans to procure power management software for Macs.	Moderate.
9.3	Automatic duplexing – 100% of eligible computers and imaging equipment have automatic duplexing enabled	**IN PROGRESS**	Specify purchase of duplex-capable networked printers as older units are retired.	Moderate. Dependent on operational funds for replacement & upgrades.
9.4	End of Life – 100% of used electronics are reused or recycled using environmentally sound disposition options each year	**MET**	Continue to re-use electronic assets internally & recycle through UNICOR	NA

Goal 10: Climate Change Resilience		
10.1	Update policies to incentivize planning for, and addressing the impacts of climate change.	DOE GHG and climate adaptation goals are integrated into lab-wide ISO-14001 certified environmental management system (EMS).
10.2	Update emergency response procedures and protocols to account for projected climate change, including extreme weather events.	Existing Emergency Plan includes various weather-related emergencies. Plan is tested and exercised during major weather events.
10.3	Ensure workforce protocols and policies reflect projected human health and safety impacts of climate change.	Existing ES&H directives address weather-related risks. Continue to revise and update ES&H directives as necessary.
10.4	Ensure site/lab management demonstrates commitment to adaptation efforts through internal communications and policies.	DOE GHG and climate adaptation goals are integrated into lab-wide ISO-14001 certified environmental management system (EMS).
10.5	Ensure that site/lab climate adaptation and resilience policies and programs reflect best available current climate change science, updated as necessary.	Continue to participate in state and regional climate change initiatives. Monitor developments in climate science and update policies and programs as necessary.

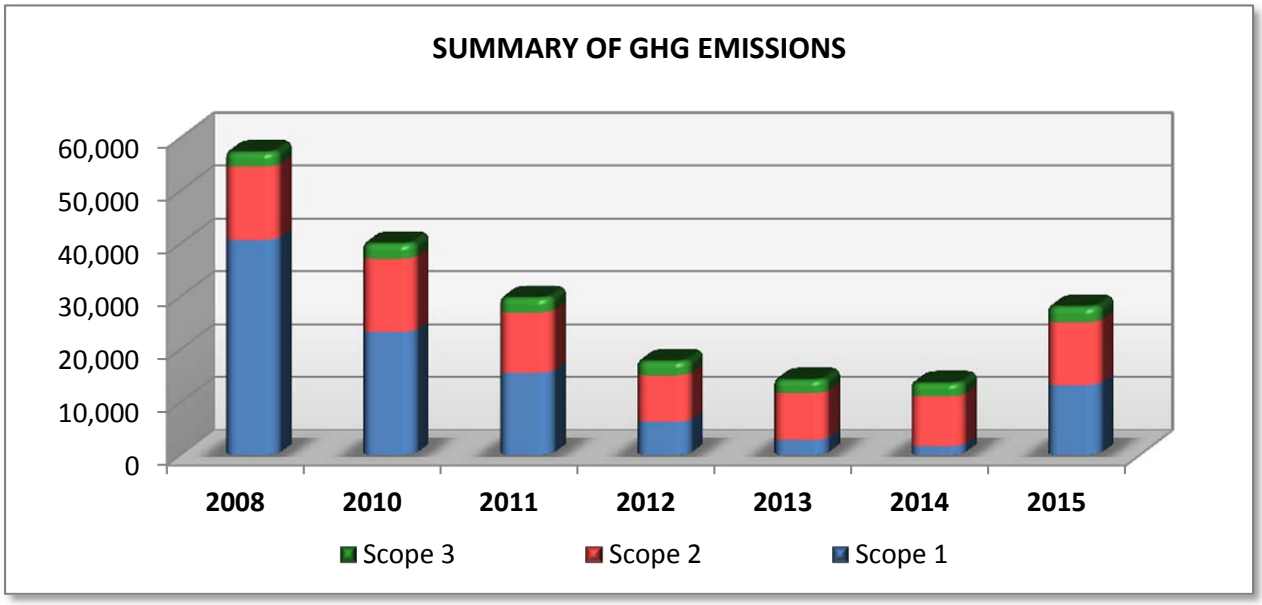


Figure 1 – Annual summary of GHG emissions (mtCO2e), FY08–FY15.

2. Performance Review and Plan Narrative

2.1 Goal #1: Greenhouse Gas (GHG) Emission Reduction

2.1.1 Scope 1 & 2 Greenhouse Gas Reduction

The Princeton Plasma Physics Laboratory (PPPL) will focus efforts to maintain its Scope 1 and 2 Greenhouse Gas (GHG) emissions below 50% of FY08 baseline levels through 2025. The National Spherical Torus Experiment (NSTX) recently completed a multi-year upgrade project, known as NSTX-U, to increase its experimental capabilities. Experimental electricity use and resulting GHG emissions are returning to near FY10 levels as NSTX-U systems ramp up for experimental operations.

PPPL's Scope 1 & 2 GHG emissions for the baseline year of FY08 totaled 57,179.4 metric ton CO_2 equivalent (mtCO2e), primarily from losses of sulfur hexafluoride (SF_6), purchased electricity and on-site fuel combustion. Scope 1 & 2 GHG emissions in FY15 were 25,027 mtCO2e – a reduction of 54% from the baseline but an increase of 27% over FY14. Scope 1 & 2 emissions represent 89.5% of PPPL's total GHG emissions for FY15. Table 2, below, presents a summary of GHG emissions over the past five years and the baseline year of 2008.

PPPL may encounter challenges in sustaining GHG emission reductions if there is programmatic growth for our fusion energy research and related programs. PPPL's magnetic confinement fusion energy research experiments are energy intensive devices, recreating deep space and stellar conditions in the terrestrial environment. This research is PPPL's primary mission and is dedicated to understanding plasma science and technology and developing a future carbon-neutral sustainable global energy source.

In order to maintain its GHG reduction goal, PPPL continues to plan and implement energy efficiency projects and operational improvements as programmatic funding and priorities permit. We will also continue to focus on minimizing fugitive emissions of sulfur hexafluoride (SF_6) which is used in specialized high-voltage equipment supporting its experimental devices. Preparations for NSTX-U experimental operations in FY15 resulted in a one-time purchase of SF_6 to commission experimental support equipment. Commissioning and testing of this equipment resulted in some SF_6 losses, but overall SF_6 emissions are still 70% below baseline. The SF_6 management skid's new computerized control system, operational procedures and operator training should minimize future SF_6 losses.

A graphical summary of Scope 1 and 2 emissions from FY08 to FY15 is presented in Figure 2, below. Scope 1 GHG emissions are down 67.5% from FY08. Scope 2 GHG emissions resulting from purchased electricity are down 14.3% from the FY08 baseline. Combined Scope 1 & 2 GHG emissions are 54% below the FY08 baseline.

Table 2 – Summary of Scope 1 & 2 GHG Emissions

GHG CATEGORY	FY08 Baseline	FY11	FY12	FY13	FY14	FY15
Fugitive - SF_6	38,360.0	13,555.8	4,452.3	1,203.3	0	11,544
Purchased Electricity	13,816.0	11,442.6	8,808.7	8,848.6	9,424.5	11,835
On-Site Fuel Combustion	2,015.0	1,556	1,336.8	1,280.8	1,391.0	1,546
Fugitive - HFCs	160.0	482.9	345.8	227.8	163.1	63.8
Fleet Vehicles	96.4	83.9	78.0	64.9	41.8	38.3
TOTAL (mtCO2e)	**54,447.4**	**27,121.2**	**15,021.6**	**11,625.4**	**11,020.4**	**25,027.1**

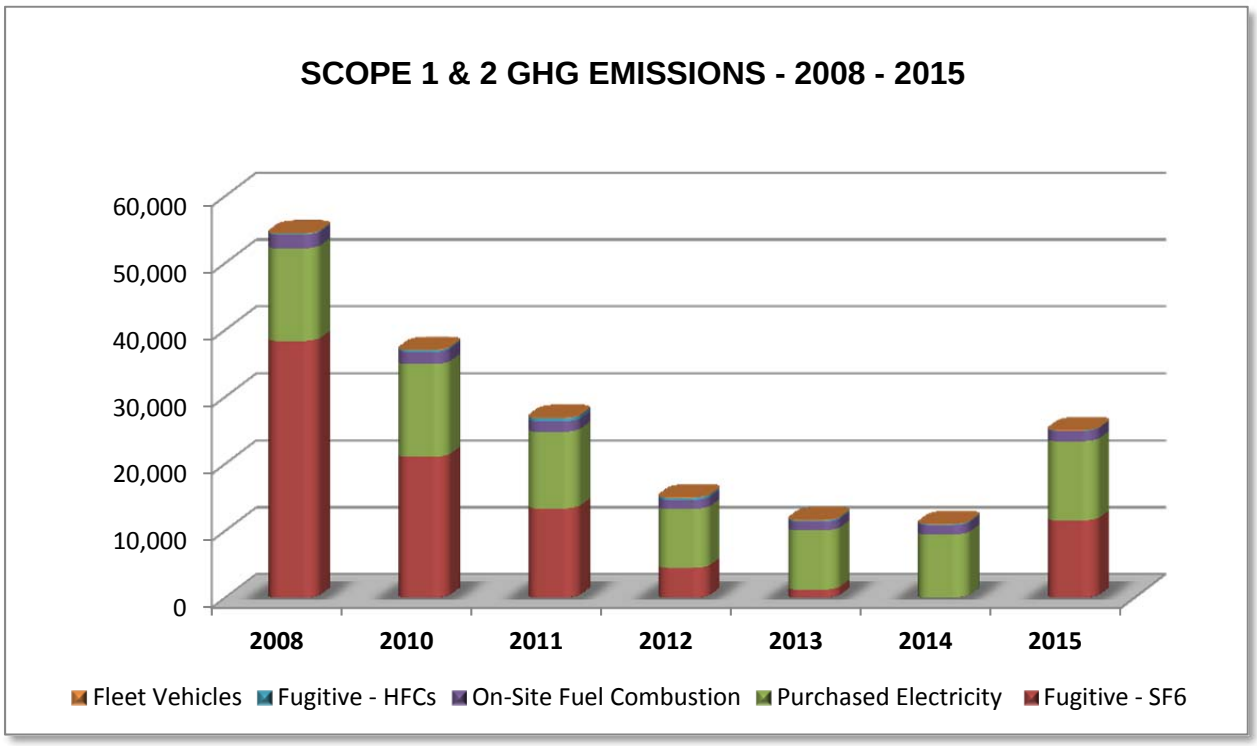


Figure 2 – Summary of Scope 1 & 2 GHG emissions by category, FY08-FY15.

Plans, Actions and Projected Performance:

PPPL will continue to focus on the control of SF_6 emissions, improve building energy performance in conjunction with maintenance and infrastructure investments, manage fleet fuel consumption, and affect employee behavioral changes to reduce our overall GHG footprint. PPPL's ISO14001-certified Environmental Management System (EMS) includes measureable goals to reduce PPPL's GHG footprint and institutionalize the behavioral changes necessary to make PPPL's operations more sustainable.

2.1.2 Scope 3 Greenhouse Gas Reduction

EO 13693 and DOE's SSPP establish a goal of reducing Scope 3 GHG emissions by 25% by FY25 from the FY08 baseline. The goal for FY15 is a 6% reduction. PPPL's Scope 3 GHG emissions include business travel, employee commuting, electricity transmission and distribution (T&D) losses, business travel, offsite wastewater treatment and off-site municipal solid waste (MSW) disposal.

Performance Status:

In FY15, Scope 3 GHG emissions of 2,926.2 mtCO2e representing 10.5% of PPPL's total GHG emissions. This value represents a 7.1% increase from the FY08 baseline, primarily as a result of increases in electricity use from FY14, business travel and employee commuting. Tabular and graphical summaries of PPPL's Scope 3 GHG emissions are provided in Table 3 and Figure 3, below.

Table 3 – Summary of Scope 3 GHG Emissions

SCOPE 3 GHG CATEGORY	FY08 Baseline	FY11	FY12	FY13	FY14	FY15
Employee Commuting	1,211.2	1,204	1,251.9	1,204.9	1,204.8	1,453.4
Electricity T&D Losses	949.7	753.7	580.3	582.9	620.8	779.6
Business Travel	586.1	718.1	755.9	695.2	626.6	660.1
Off-site Solid Waste Disposal	57	52.4	31.5	25.1	26.5	29.3
Off-site Wastewater Treatment	3.6	4.7	3.7	3.8	3.6	3.8
TOTAL (mtCO2e)	**2,807.6**	**2,732.9**	**2,623.3**	**2,511.9**	**2,482.3**	**2,926.2**

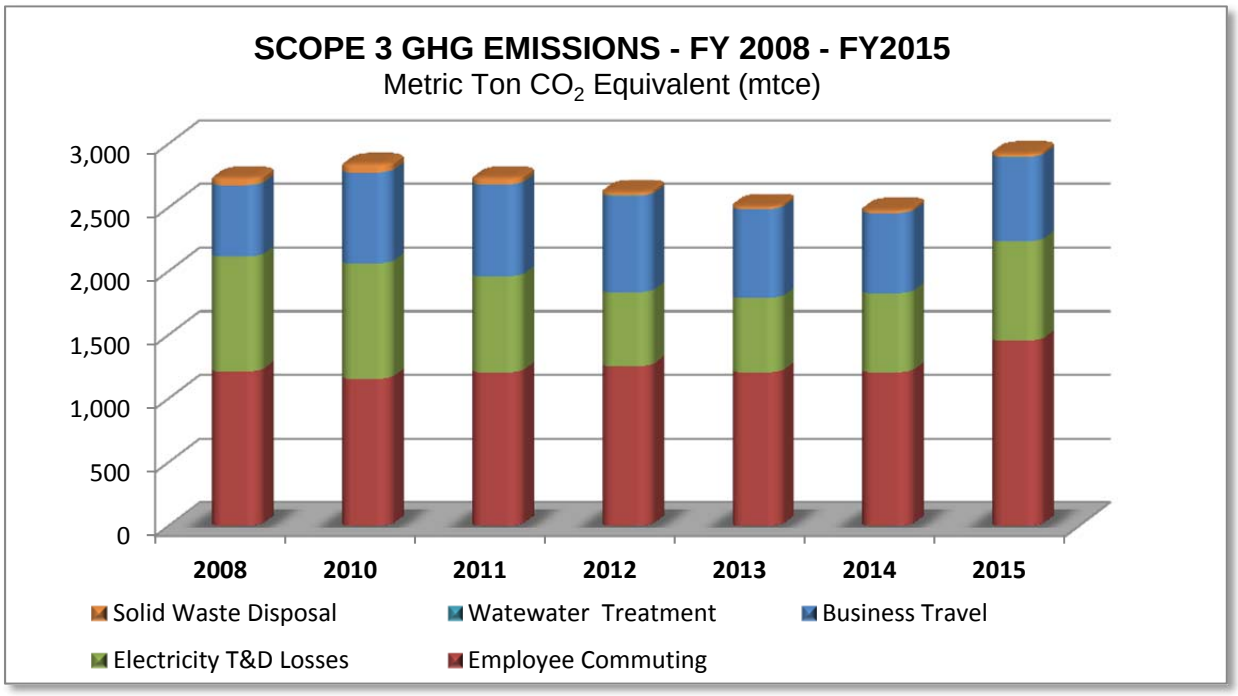


Figure 3 – Summary of Scope 3 GHG emissions by category, FY08-FY15.

Employee Commuting: Employee commuting accounted for 1,453.4 mtCO2e of GHG emissions in FY15. While this represents only 5.2% of PPPL's overall emissions, it accounts for nearly half of our Scope 3 emissions in FY15. GHG emissions from employee commuting are based on employee survey results, discussed below.

PPPL completed a baseline employee commuting survey in FY08 as part of a voluntary GHG inventory. The survey was expanded in FY10 to identify commuting patterns and associated GHG emissions. Over 95% of employees responded to the 2010 survey. A commuting survey conducted in November 2013 had a 55% employee participation rate. PPPL conducted a new employee commuting survey in November 2015 with a 43% employee participation rate. A review of the survey results yields several observations.

Approximately 37% of survey respondents indicated that they participated in some sort of telework arrangement and reported a total of 554 telework days. Scaled the full employee population this results in a total of 1,285 telework days, which avoided nearly 52,000 commuter miles.

We note that as employee participation in the survey drops a greater level of extrapolation is necessary to scale the survey results to the full employee population. Earlier surveys indicated an average round-trip commuting distance of 36 miles while the 2015 survey resulted in an average round-trip commute of 40.3 miles, an increase of almost 12%. While it is possible that changes in employee demographics account for the increase in average commuting distance, a significantly lower survey participation rate may also skew the results. PPPL will be evaluating its survey methods and results to determine if changes are necessary to provide the best possible data.

Princeton University's Transportation Demand Management Office provides employee incentive programs for vanpooling, carpooling, and mass transit use, and has a shuttle that links PPPL with main campus and the regional transportation system. In 2010, 10% of respondents indicated that they utilized some sort of alternative transportation, including biking, walking, mass transit and car/van pooling. In 2013, 18% of respondents utilized some sort of alternative transportation. In 2015 that number had risen to 21%, indicating continued growth in alternative commuting options. PPPL offers covered bicycle parking and shower facilities to encourage bicycle commuting. We organized bike commuting teams for National Bike Month in 2014 and 2015 with participation more than doubling in 2015 to 42 employees, who logged over 700 bike trips totaling over 5,000 miles.

Electricity Transmission & Distribution (T&D) Losses: Electricity T&D losses were calculated for the electrical energy used by PPPL as reported in the CEDR spreadsheet. T&D losses are directly related to electrical energy use and, thus, reductions in electricity use will result in associated reductions in T&D losses. GHG emissions associated with electricity T&D losses were 779.6 mtCO2e in FY15, representing approximately 2.8% of total GHG emissions and a reduction of 14% from the FY08 baseline. NSTX-U experimental operations will cause upward pressure on Scope 3 GHG emissions from increased electricity use.

Business Travel: Travel records from FY15 were used to calculate GHG emissions from air travel in the short, medium and long trip categories. In addition, rental car mileage, limo trips and rail travel were included in the calculation of business travel GHG emissions. GHG emissions calculated for business travel in FY15 were 660.1 mtCO2e, up from the 588 mtCO2e FY08 baseline. PPPL employees traveled over 3.4 million air miles in FY15, an increase of approximately 250,000 miles from FY14. This represents 2.4% of PPPL's total GHG emissions and 22.6% of Scope 3 emissions. While international travel in support of the ITER project and other collaborations continues to grow, employees continue to expand the use of video-conferencing. PPPL conducts regular video and web conferences with foreign locations in China, France, Japan, Korea, and the UK as well as domestic locations such as Oak Ridge National Laboratory (ORNL), General Atomics, Massachusetts Institute of Technology and the University of Wisconsin.

Off-site Wastewater Treatment: PPPL discharges all sanitary wastewater to the South Brunswick Municipal Utilities Authority for appropriate off-site treatment. Water conservation implemented in previous years will continue to limit the volume of wastewater requiring offsite treatment. FY14 GHG emissions for off-site wastewater treatment were 3.6 mtCO2e. This figure represents only 0.03% of PPPL's total GHG emissions for FY14.

Off-site Municipal Solid Waste Disposal: PPPL subcontracts for municipal waste collection and disposal services as well as certain recycling services (paper/cardboard, glass, food waste, concrete, etc.). Municipal solid waste is collected at PPPL by a subcontractor and transported to a permitted solid waste landfill for disposal. PPPL has a mature and effective waste minimization and recycling program that include food and yard waste composting as well as single-stream recycling. We continue to recycle concrete, asphalt, wood, roofing ballast and other building materials. PPPL's combined recycling rate for both municipal solid waste (MSW) and construction/demolition (C&D) wastes was 80%. GHG emissions from solid waste disposal are down by 49% from the 2008 baseline. More details are provided in Section 2.7.

Plans, Actions and Projected Performance:

Employee Commuting: PPPL continues to promote the programs offered by Princeton University to encourage employees to use mass transit, car pools and van pools. Further reductions will require significant policy changes such as flex time or expanded work days requiring University and DOE approval. PPPL has an informal telework policy that allows supervisors to approve remote work on a case-by-case basis. With employee commuting now accounting for nearly half of all Scope 3 emissions, it is prudent for the Laboratory to evaluate the use of this policy and explore ways to expand telecommuting. PPPL will expand its National Bike Month programs to include bicycle maintenance clinics, "commute with a friend," and a bike mentor program. We will also consider expanding the bike commuting teams beyond just National Bike Month to span the entire summer season. As noted above, PPPL would be interested in learning from other DOE sites or Federal facilities how they have promoted telework and alternative transportation programs and reduced employee commuting GHG emissions.

Business Travel: PPPL will continue efforts to encourage employees to utilize video, web, and teleconferencing services in lieu of travel. PPPL routinely conducts video and web conferences to foreign and U.S. locations. Where feasible, train travel is encouraged over short-haul airline travel. The sustained reduction of GHG emissions related to employee business travel may be difficult to meet in the face of growing or changing site missions that increase the number and extent of international scientific collaborations, especially the ITER Project.

Electricity Transmission & Distribution (T&D) Losses: PPPL will continue its low-cost energy efficiency efforts in order to reduce electrical energy use. We have identified many opportunities for the energy efficiency projects, including the introduction of on-site renewable energy. Implementation of these projects is severely limited by other competing infrastructure priorities. We also encourage the use of T&D loss factors from the utility provider when available, to enable DOE to account for improvements in the electricity grid as they are implemented by electric utilities.

Off-site Wastewater Treatment: PPPL will evaluate additional water conservation projects to reduce wastewater discharge. In past years, PPPL has installed low-flow fixtures throughout the facility and has identified and redirected industrial and process water discharges to the sanitary sewer that unnecessarily increased wastewater flow. With off-site wastewater treatment representing less than one percent of PPPL's overall GHG footprint, there are higher priority GHG reduction measures that will require more attention in the near term.

Off-site Municipal Solid Waste Disposal: PPPL will continue to emphasize its waste minimization, composting and recycling programs to reduce the amount of solid waste shipped offsite for disposal. We will strive to identify and act on cost-effective waste minimization and diversion opportunities to further reduce Scope 3 GHG emissions.

2.2 Goal #2: Sustainable Buildings

2.2.1 Energy Intensity Reduction

Performance Status:

Between FY03 and FY15, PPPL's energy intensity fell from a baseline of 176 thousand British thermal units (kBtu) per GSF to 98 kBtu per GSF – a net reduction of 44%. PPPL has been consistently ahead of the reduction target, year-over-year.

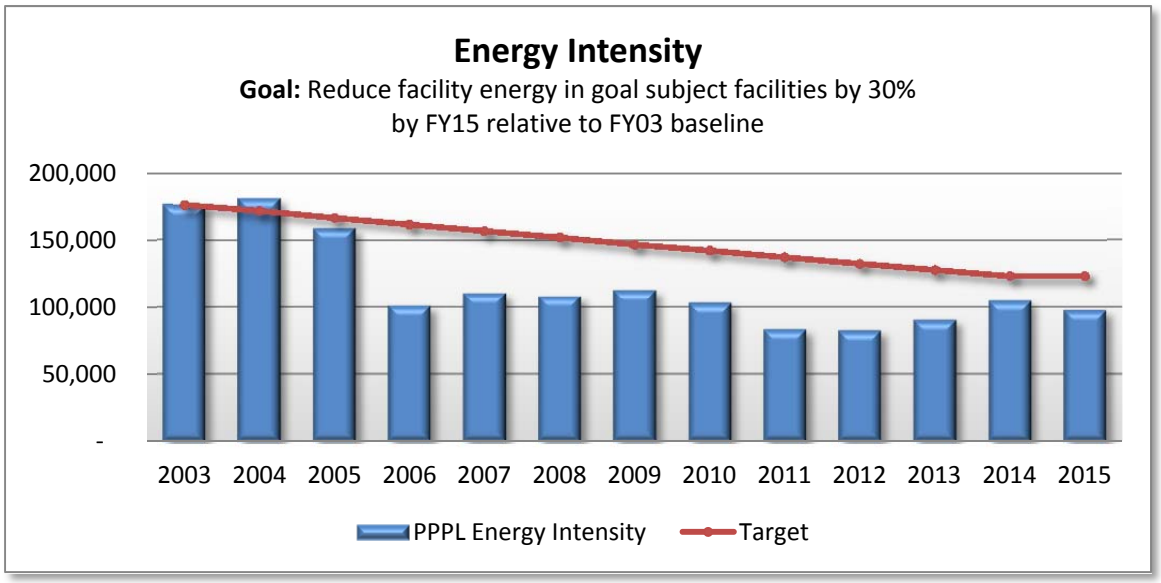


Figure 4 – Non-exempt energy utilization intensity (EUI) in Btu/sf, FY03-FY15.

While we are on target, PPPL remains aggressive about reducing its energy intensity. We are actively developing plans to offset mission-driven increases in energy use through a combination of energy savings projects, operational efficiencies, improvements to our design specifications, and promoting conservation behavior among Laboratory staff.

Engaged staff members are actively receiving improvements in their tools, equipment, and training. FY15 was a year that PPPL refocused its maintenance and facility operations to prepare for the challenge in the years ahead. This refocusing chapter was a vital phase to our future success.

PPPL's Facilities and Site Services Division adopted energy conservation into their daily activities and decision making processes. Throughout their maintenance and renovation activities, they incorporate energy efficient and green building choices in their office, lab, and shop renovations.

In FY15, PPPL began execution of a Demand Flow project. This project focuses on chilled water plant performance and will achieve savings in several areas of the chilled water system. Control algorithms will optimize the plant's operations and seek energy efficiency through eliminating waste and manual processes that are currently used to operate the chilled water system. Completion of this project is expected in FY16. The Demand Flow project includes optimization and energy efficiency through:

- Controlling select pumps, both condenser and chilled water, along with cooling tower fans, to employ Variable Frequency Drives (VFDs),
- Temperature set points for chilled water and condenser water in combination with the speed of all pumps and tower fans to optimize the energy expended for a given tonnage load, and
- Chiller on/off sequencing will be greatly simplified and will not require elaborate equipment, manual and labor intensive oversight.

Additional projects identified in FY15 are listed in the CEDR submittal. These projects will further reduce energy intensity for years to come and will be executed pending availability of operational and infrastructure funding.

Plans, Actions and Projected Performance:

PPPL's goal is to build a safe, efficient, and modern campus that showcases efficient use of energy and renewable sources while ensuring our researchers and collaborators can continue to conduct world-leading research in fusion energy and plasma science and technology.

The PPPL Campus Modernization Plan, published in July 2014, supports this goal while addressing aging infrastructure, reducing deferred maintenance, and modernizing existing space with investment in site design and building development that maximizes energy efficiency and renewable energy opportunities. The first phase of the campus plan is under development with PPPL's Infrastructure & Operations Investment (IOI) project. This project features major renovations of three separate facilities. PPPL's energy and sustainability requirements are at the core of the design. The project features energy efficient choices throughout the design and development. Federal Guiding Principles for High Performance Sustainable Buildings (HPSB) were incorporated into the design requirements and project specifications. PPPL ensured that the latest requirements were included, and these are reviewed at each milestone with HPSB and ASHRAE checklists, and dedicated sustainability meetings with the A&E firm.

Throughout FY15, PPPL looked to identify future opportunities and incorporate these into future plans. PPPL has initiated new discussions into investigating alternative financing opportunities to supplement what the Campus Plan does not cover. As this energy management and modernization plan develops, PPPL's focus will remain on designing high performance, low-energy consuming facilities through a variety of financing mechanisms that help minimize PPPL's energy footprint, exceed the new energy intensity goals, while accommodating campus growth in support of the Laboratory's research mission. Focusing on ways to utilize energy savings projects to help address PPPL's deferred maintenance is a top priority in project prioritization. The new energy intensity targets can be seen in Figure 5, below, which will be updated annually to show PPPL's progress.

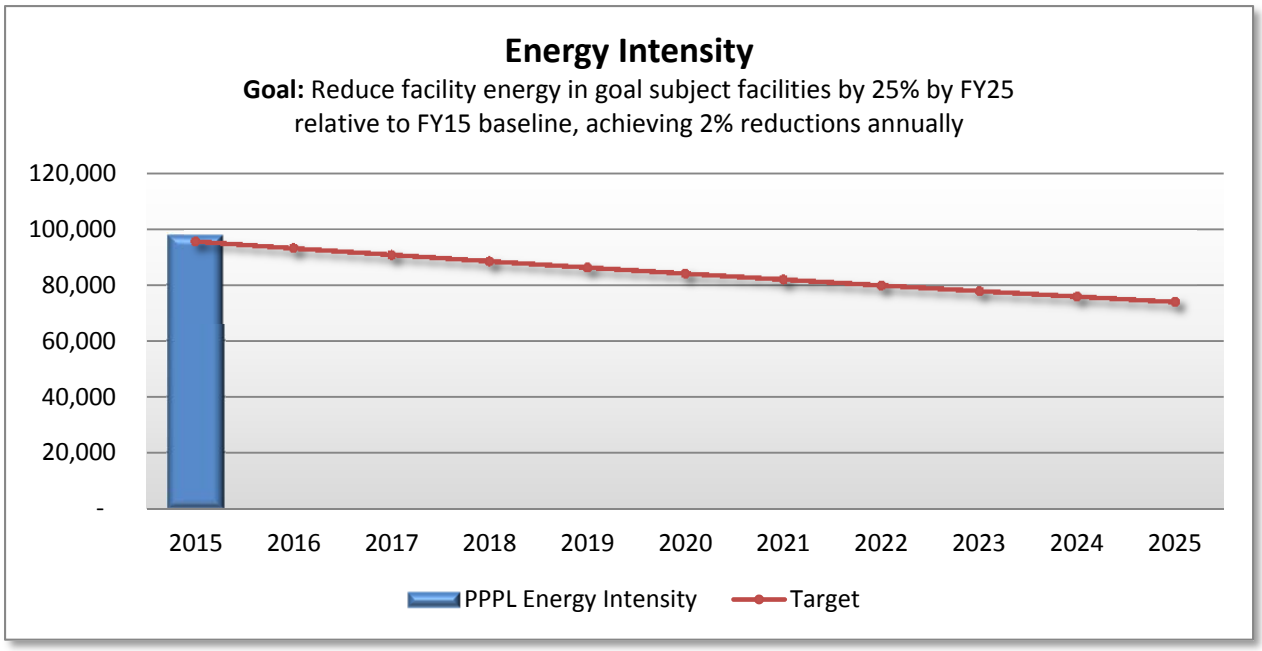


Figure 5 – Non-exempt energy intensity (EUI) in Btu/sf, relative to new FY15 baseline.

PPPL plans to also address conservation behavior in FY16 with a "Rock the Watt" campaign similar to the campaign at PNNL. The Sustainability and Environmental Working Group (SEWG), an EFCOG sub-group, has been a great benefit to sharing ideas and successful projects from lab to lab. In addition, the relationships vital to the success of the working group were greatly improved through the person-to-person interaction achieved at the DOE Energy Exchange.

The final list of buildings excluded from the energy intensity goal and a copy of the exclusion self-certification documents can be found in Appendix A.

In FY15, PPPL completed the final phase of the NSTX upgrade (NSTX-U). The upgrade added significant additional plasma heating capabilities in the form of an additional neutral beam line, doubled the plasma current, increased magnetic fields, enabled longer experimental pulses, and added other capability enhancements. Any increase in energy supporting the experiment is reflected in the HEMSF category. While each experimental "shot" will use more energy, there will be a longer inter-shot period resulting in approximately the same annual energy use as during NSTX operations.

2.2.2 EISA Section 432 Energy & Water Evaluations

Performance Status:

In FY15, we extended the model of refocusing to developing a thorough and methodical baseline assessment of all our facilities. This included bringing in an independent assessor to perform a 100% building condition assessments (defined EISA Type 1 audit) with the objective of providing our energy team a more comprehensive picture of equipment condition and life-cycle

status reports in order to support and target areas for more in-depth energy audits. Opportunities were identified in insulation, HVAC efficiency upgrades, and lighting upgrades. PPPL also performed Type II audits in various locations to develop a more detailed evaluation of energy conservation measures. This information was used to submit projects to the SPOFA funding submission, the plant performance plan, and for future energy conservation measures.

Plans, Actions and Projected Performance:

PPPL will continue to conduct energy and water evaluations in our EISA-covered facilities. In FY15 PPPL focused on performing a site-wide Type 1 audit evaluation, covering 100% of covered facilities. In FY16, PPPL plans to focus the EISA auditing effort on , new high-impact opportunities within a minimum of 25% of our EISA-covered facilities. PPPL plans to target buildings that currently do not have planned renovation projects, yet are suspected to have potential for future HPSB status improvements. With PPPL's aging infrastructure retro/re-commissioning remains a high priority for several targeted facilities, however, is subject to the availability of funds. Identified ECMs will be tracked in the CEDR/Dashboard, with funding requests initiated into our planning process.

Those buildings which are both metered and covered with ENERGY STAR Portfolio Manager (Portfolio Manager) are continuously being updated. PPPL is exploring new metering opportunities and new building data may be available within 2016. In addition, PPPL is planning on re-evaluating the number of EISA covered facilities. The current assumption is that PPPL is significantly higher than the 75% threshold for covered energy use. PPPL has not had any recent changes to its building inventory and none are planned for 2016. Current covered building data and planned evaluations are included in the CEDR Tab 11. Final updates on covered building data and planned evaluations will be included in the June 2016 CTS upload.

2.2.3 <u>Building Energy Metering</u>

Performance Status:

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. Many of these meters are connected to and communicating with our Building Automation System (BAS). The requested data of PPPL's Metering Plan is provided in the CEDR submission on tab 2.1a. This data outlines future strategies, estimated installation funding needs, and the developing plans of how we intend to meet the additional metering requirements defined in the DOE updated guidance, "Federal Building Metering Guidance, November 2014 Update".

Personnel supporting PPPL's metering efforts:

- Kathryn Morrison, PPPL Energy Manager
- Mark Kijek, PPPL Senior Technician specializing in HVAC and Building Automation System Technician
- Mike Bernardo, PPPL Building Assessor, HVAC Technician, and Building Automation System Operator

Currently, PPPL's meters feed their data to the PPPL Building Automation System. Here meter data is trended and sent to the Energy Manager for tracking and analysis. Standard meters and utility meter are manually captured and feed to the PPPL Energy Manager on a weekly and/or monthly basis.

Plans, Actions and Projected Performance:

PPPL's greatest barrier has been the complexity of the existing utilities and building infrastructure. Due to the phased development of PPPL's campus over more than 60 years, it is nearly impossible to separate utilities between defined FIMS buildings. Because of past building history, utilities are intertwined among several FIMS buildings. PPPL's Energy Team is currently working with the FIMS team to investigate potential benefits of changes to the defined FIMS buildings to reduce complexity and offer cost-effective metering opportunities.

In FY15, PPPL submitted a project proposal for metering potable water in response to the Sustainability Performance Office Funding Opportunity Announcement (SPOFOA). While this project was not selected, PPPL has continued its meter investigation and is currently completing the exercise for remaining steam/hot water, chilled water, and electrical metering opportunities. This will complete PPPL's metering plan and will seek funding resources that prioritize these needs with other planned work activities. Additional plans for FY16 involve discussions with PNNL and the use of their award-winning Decision Support for Operations & Maintenance (DSOM) and Smart Building software.

2.2.4 HPSB Goal Progress

Performance Status:

All existing FIMS buildings have been entered into the U.S. Environmental Protection Agency's (EPA's) ENERGY STAR Portfolio Manager. Currently approximately 3% of PPPL buildings have been classified as HPSB. This percentage is achieved by one PPPL facility being certified LEED Gold. In FY14, five PPPL buildings were selected to be HPSB key target buildings and we felt that meeting the 15% (5 buildings for PPPL) goal would be very challenging and in many cases not cost effective. However, with the change in guidance allowing the option of either building count or square footage, PPPL can meet this goal. Our LEED-Gold building accounts for 15.5% of PPPL's total GSF and 22.2% of PPPL's goal-subject buildings. Although this change in reporting criteria enables PPPL to meet the goal, we anticipate being able to qualify more HPSB buildings with the actions described below.

Plans, Actions and Projected Performance:

The PPPL Campus Modernization Plan, published in 2014, provides a comprehensive plan to cost-effectively modernize the Laboratory's aging infrastructure, renovate and reutilize older buildings, provide quality space for research and support activities and enhance our environmental footprint. Throughout the Plan, potential renovation and new construction proposals incorporate energy and water management goals and requirements to support the efficient management of resources while mitigating the related costs. The planned actions found in PPPL's Campus Modernization Plan presents new challenges to PPPL to further prioritize

energy reduction, as well as carbon abatement and climate resilience strategies to further DOE's mission.

We are continuing to pursue energy efficiency upgrades via energy performance service contracts and internal overhead funding in our first wave of HPSB target facilities, where cost effective. In FY16 we will perform a comprehensive gap analysis on remaining existing facilities by assessing all FIMS buildings against the newly revised HPSB Guiding Principles.

PPPL's Facilities and Engineering organizations will continue to include energy conservation into their daily activities and decision making processes. Throughout their maintenance and renovation activities, they incorporate energy efficient choices in their office, lab, and shop renovations.

2.2.5 Regional Planning

PPPL is located at the Princeton Forrestal Center (PFC) - Princeton University's 2,200 acre premier mixed commercial, office, research and residential development. Princeton University's mission in planning and developing PFC was to protect and enhance the quality of life in the region as Central New Jersey experiences continued population growth and development. It did this by implementing a master plan that protects the land's natural systems, requires high quality design, and anticipates the expanding mobility and infrastructure requirements of the region. PPPL's overall site development, including the amount of impermeable cover (paving, buildings, etc.), are controlled by the PFC Master Plan. As part of PFC, PPPL is integrated into the regional planning process. PPPL has invested recently in significant beneficial landscaping and exterior infrastructure projects to facilitate pedestrian traffic and enhance wildlife habitat at the site.

PPPL's Campus Modernization Plan, published in July 2014, outlines a 10-year vision to transform the Laboratory's infrastructure to support future scientific missions and enhance our energy and environmental performance. The Plan focuses primarily on the modernization of existing facilities and infrastructure with a future campus vision that includes new modern energy-efficient lab, office and storage spaces. All proposed refurbishment and new construction takes place within the previously developed portion of the site and do not disrupt the surrounding open spaces.

Princeton University has a Transportation Demand Management Office, providing employee incentive programs for vanpooling and mass transit use, and has two shuttles that link PPPL with main campus and the regional transportation system. PPPL continues to participate in other transportation management programs coordinated by the Greater Mercer Transportation Management Association.

2.2.6 Net Zero Buildings

PPPL has not identified any existing buildings above 5,000 square feet which have significant potential to be either energy, waste, or water net zero by FY25 without significant funding dedicated to such an effort. Additionally, at this time no new facilities have started the planning or CD process. Future updates to the Campus Modernization Plan will consider the feasibility of net zero buildings. With an aging building inventory and no new buildings in the planning

stages, such opportunities are limited. PPPL is seeking guidance and best practices with other labs and other federal entities on efforts to move their existing buildings toward the net zero goal.

2.2.7 Data Center Energy Efficiency

Performance Status:

The PPPL Computer Center (PPLCC) is the only area considered a data center per DOE's definition of a data center published in the SSP Guidance of 2012. PPPL completed the process of permanently relocating experimental control computers and associated equipment from the Fusion Control Center (FCC) consolidating them into a single data center in the PPLCC. The annual average PUE for the PPLCC in FY15 was 1.58.

During the past few years, several improvements were implemented to reduce energy consumption and reduce the cooling demand. Windows servers continue to be consolidated into a virtualized blade environment. 15 Linux servers were consolidated into a single high availability cluster of 3 systems, reducing server count by 12.

PPPL's Facilities Division installed a hot aisle containment system in rows F & G of the data center to direct the exhaust air from these servers directly back to the air conditioning units and reduce hot/cold air mixing in the room. An underfloor baffle was installed to direct cold air directly to front of rack floor vents. Additionally, diffusers were installed in the floor vents to lower the exit velocity of the cooled air so it would no longer bypass the equipment racks. The raised floor tile has been retrofitted to reduce leakage of air from beneath the tiles to the room.

In addition, above ceiling barriers were installed along the length of the two containment areas, rows F/G, and H/I. These barriers direct hot air exclusively from the hot aisle(s) directly into the top of the A/C units, increasing efficiency of the A/C units. Blank panels were installed to seal the front of all unused racks. All cabling holes in the raised floor were sealed to limit infiltration of cooled air into the hot aisle.

Implementation of the above actions enabled PPPL to raise the ambient temperature in the room from 67ºF to 74ºF while maintaining appropriate cooling for critical computer equipment. The combined actions provided significant immediate energy savings by reducing cooling load on the existing chillers.

The number of equipment rows in the PPLCC has been reduced by 40%, through consolidation of rows A, B, C, D into F, and G into rows E, F, G, H, and I. This has allowed floor openings to be closed, improving cool air egress, and reduces the number of racks to be cooled.

Plans, Actions and Projected Performance:

PPPL is currently evaluating energy efficiency opportunities in the PPLCC to further enhance its energy performance. Consolidation of equipment from row D and E to the contained rows F, G, H, and I allowed for the installation of additional hot aisle containment, with the F and G rows designated for any new equipment installation. A long-term project to replace their existing

computer room air conditioning ("CRAC") units with a chilled-water cooled system is being considered in conjunction with the Campus Modernization Plan.

2.3 Goal #3: Clean & Renewable Energy

Performance Status:

In FY15, PPPL purchased renewable energy credits (RECs) to offset 8% of its electrical use and established a standardized process for procuring RECs through a third-party supplier and competitive bid process. The Defense Logistics Agency (DLA) determined that PPPL does not qualify to participate in their multiple lab/installation/DOE site REC purchase contract. In FY15, 2,760 MWh were procured from Green-e Certified Clean Source derived from American-made wind energy. Aside from purchasing RECs, PPPL has begun the initial steps to investigate on-site solar arrays via potential ESPC & PPA projects. PPPL currently does not have any significant on-site renewable or clean energy systems.

FY15 saw the start of the first major facility renovation project PPPL has initiated in quite some time. Within the design of this renovation project, the engineering team has investigated the use of solar water heaters (per EISA Section 523) and determined them not cost effective for this specific project. PPPL has not had any new construction, or any new renewable/clean energy assessments, since the exploration of a PPA in FY10/11.

Plans, Actions and Projected Performance:

While PPPL is still committed to meeting the FY16 10% goal through purchasing RECS, we are also committed to finding ways to increase the amount of renewable and alternative energy & power generated on site or purchased through our energy supplier. On-site and clean energy opportunities will be scrutinized and heavily vetted in the alternative financing project investigation. All future procurements will incorporate DOE Procurement Policy Guidance on Purchase of Electricity, Energy Products and Energy By-Products from Indian Tribes as outlined in the DOE Draft Procurement Policy Guidance.

2.4 Goal #4: Water Use Efficiency and Management

2.4.1 <u>Potable Water Intensity</u>

Performance Status:

It should be noted that PPPL operations require cross-connection capability between the potable and non-potable water systems. This cross-connection is necessary to ensure sufficient water for non-contact cooling and fire protection purposes in the event that the D&R Canal Pump House is off-line. Thus, operational conditions may result in dramatic annual fluctuations in potable water use. Total water use is a more useful measure at PPPL.

PPPL made significant progress in water conservation beginning in 1996. Between 1996 and the potable water baseline year of FY07, PPPL reduced annual water consumption by over 110 million gallons – an 88% reduction. PPPL has met the FY20 potable water reduction goal and as of FY15, has reduced its potable water intensity by 51% from baseline. At this time, PPPL is not experiencing any operational issues related to water consumption such as system leaks or equipment maintenance problems.

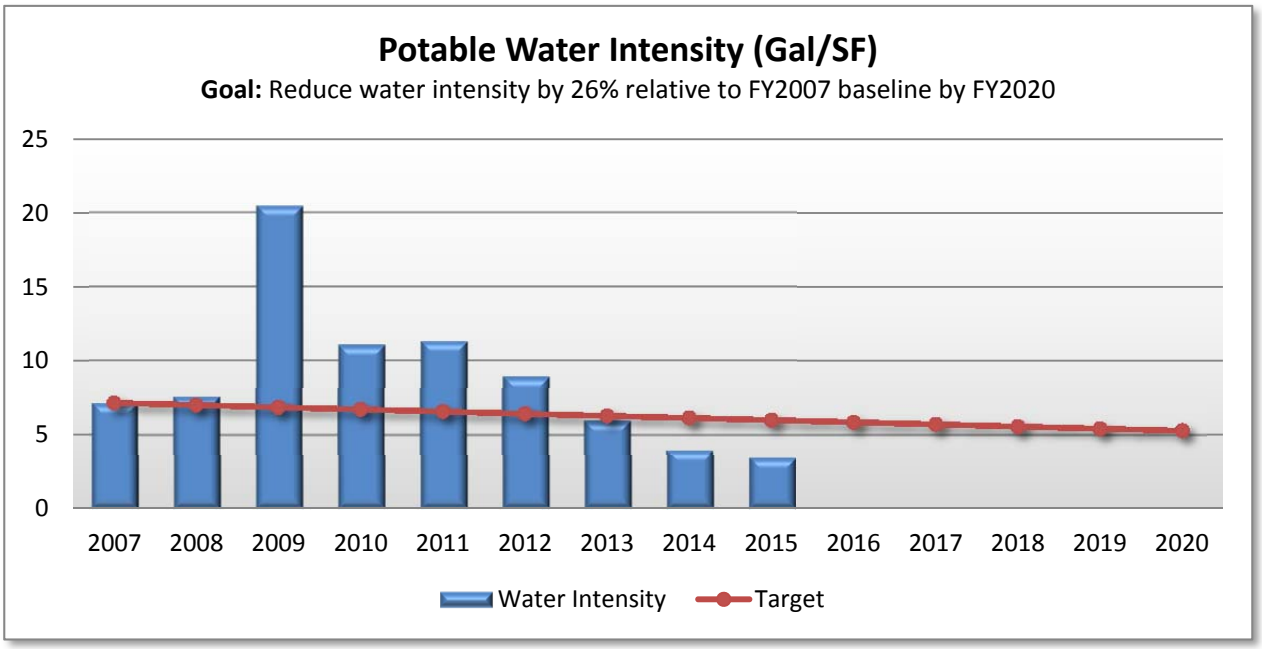


Figure 6 - Annual potable water intensity, FY07–FY20.

Plans, Actions and Projected Performance:

PPPL receives its potable water supply from the New Jersey American Water Company. While PPPL has not completed a detailed water balance in the past three years, the Environmental Services Division maintains a site water flow diagram that includes average annual uses for most potable and ILA water uses. This diagram and flow data will be used as the basis for a site-wide water balance analysis in the next two years. Significant focus has been placed on identifying once through cooling systems operating with potable water and changing them to coolant recirculating chillers suitable for use with closed loops where possible. PPPL's Campus Modernization Plan supports these efforts and will help proactive water conservation practices while addressing PPPL's aging infrastructure. Currently, no water efficiency projects are being pursued. PPPL does not have a dedicated site water management plan; however, PPPL has incorporated a steadfast priority of water conservation throughout its operations. PPPL will review the need for a dedicated water management plan in FY16 as part of the comprehensive Energy Management Program development. Finally, PPPL has identified nine prominent locations for additional potable water meters which will assist in tracking water use and developing future water conservation opportunities.

2.4.2 Industrial, Landscaping & Agricultural (ILA) Water Use

Performance Status:

PPPL's grounds maintenance crew continues to maintain the campus without the use of irrigation/landscape water use. As stated in the Potable Water section, PPPL operations require cross-connection between the potable and non-potable water systems. This cross-connection is necessary to ensure sufficient water for non-contact and fire protection purposes in the event that our main Canal Pump House goes off-line. Thus, it is believed that operational conditions may result in dramatic annual fluctuations in potable water use. We maintain that total water use is a more useful measure at PPPL.

PPPL does not use ILA water for routine irrigation or landscaping. Short-term watering may be implemented to establish new plantings. The primary use of ILA water is to support PPPL facility and experimental operations by providing non-contact cooling water and fire protection. The NSTX experiment did not run from late FY11 thru FY14, resulting in lower cooling water use. The increase seen in the Figure 11, below, for FY15 is attributed to the return to NSTX-U experimental operations.

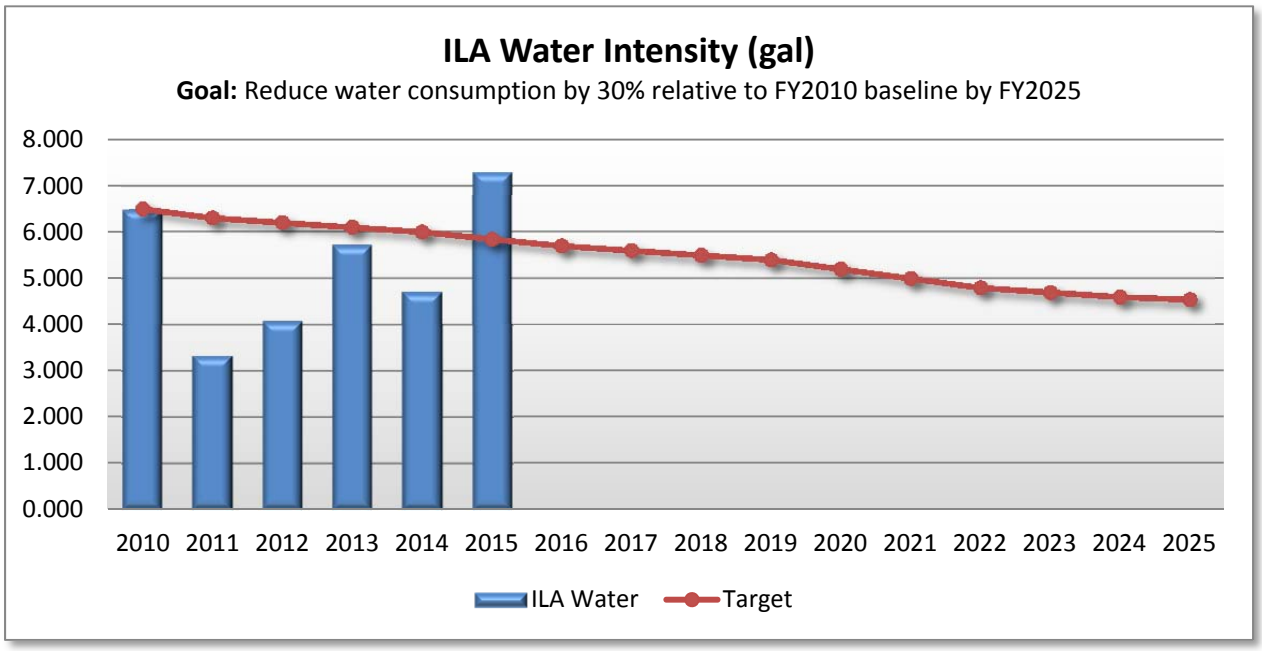


Figure 7 - Annual ILA water intensity, FY10–FY25.

Plans, Actions and Projected Performance:

PPPL's main cooling tower is inefficient when compared to today's technology. It is over 30 years old and requires regular repairs to maintain operations. It represents a single point of failure in PPPL's cooling water systems. Replacement of the central cooling tower is one of the few remaining water conservation projects with significant water savings potential. PPPL's GPP program has identified a replacement high-efficiency cooling tower as a necessary site investment, but limited GPP funding has precluded initiation of the project in order to execute

other critical infrastructure repairs or replacements. Replacement of the existing cooling tower, and the eventual installation of a second parallel tower, are including in PPPL's Campus Modernization Plan.

PPPL does not have any capital cost, water saving projects currently in the works. No new opportunities to offset ILA water use with alternative water sources have been identified. PPPL is currently metering at the site level industrial water use, but continues to identify areas in which building level industrial water meters can be beneficial and will continue to install where cost effective and when funds become available.

2.5 Goal #5: Fleet Management

Please see Section 3.0 – Fleet Management Plan – for details on DOE's goals related to vehicle fleet management.

2.6 Goal #6: Sustainable Acquisition

2.6.1 Subcontractor Sustainability Goal

DOE's and PPPL's goals in Sustainable Acquisition is to ensure that 95% of new contract actions, including task and delivery orders under new contracts and existing contracts, require the supply or use of products and services that are energy efficient (ENERGY STAR® or FEMP-designated), water efficient, biobased, environmentally preferable (including EPEAT-registered products), non-ozone depleting, contain recycled content, or are non-toxic or less toxic alternatives.

Actions to improve the management of chemicals have been underway for years (e.g., inventory management, redistribution of excess chemicals, and improved lifecycle chemical use planning). PPPL continues to utilize bulk biobased cleaners for all cleaning purchases. The use of bulk supplies also reduces the MSW stream by minimizing packaging. On many applicable building construction contracts, PPPL requires the use of USDA bio-based materials or references the use of ASTM E2432-11, a standard guide for general principles of sustainability relative to buildings. Additionally, many construction contracts ordain that waste is properly recycled or disposed.

Performance Status:

PPPL's standard subcontract document Representative and Certifications Booklet includes the required sustainability clauses for federal acquisition of sustainable products and services. PPPL's Environmentally Preferable Purchasing policy (P-082) encourages all employees to identify and specific suitable environmentally preferable products. Targeted contracts and/or purchase specifications contain standard requirements for ENERGY STAR®, WaterSense®, biobased, and recycled or non-toxic products. PPPL's procedure for preparation, review, and

approval of specifications and statements of work (ENG-006) was recently amended to also include sustainable acquisitions for pertinent work.

As applicable, vendors are required to report EPP purchasing data for inclusion in the Laboratory's CEDR submittals. In FY14 PPPL's Environmental Services Division launched a green purchasing webpage to help employees facilitate sustainable procurement of products. Examples include the paperless on-line office supply system that automatically directs users to recycled, remanufactured, and other "green" products, a standard specification for EPEAT-qualified electronics, and the exclusive use of recycled and biobased janitorial supplies. In addition, PPPL's Facilities Division has standardized its specifications to use an extensive array of energy efficient and sustainable building and maintenance products including solid-state LED and low-mercury lighting, recycled content carpeting and ceiling tiles, and the use of ultra-low VOC paints and adhesives.

PPPL's Environmentally Preferable Purchasing policy (P-082) identifies a broad range of environmentally preferable products and outlines responsibilities to promote sustainable acquisition. It encourages all employees to identify and specify suitable environmentally preferable products in the course of their work. Procedure ENG-006 ensures that PPPL employees who write specifications or statements of work will ascertain if sustainable acquisition or sustainable design practices are applicable, and include them into the contract language as they are needed. An Environmentally Preferable Purchasing web page was developed to provide a convenient green product and services reference for employees. Existing Federal products guidance and listings are being linked to this page.

PPPL's P-Card purchasing system (credit card orders) is used when the dollar amount for the acquisition is less than $3,000. These transactions represent a large portion of the lab's purchases. To ensure that all of PPPL's acquisitions are reviewed for potential sustainable initiatives, the system was modified to include a sustainability review check box. This function allows P-Card holders to review if their procurement needs to meet sustainable requirements, when the box is finally checked a message is sent to sustainability specialists whom will provide further guidance to the purchaser.

Plans, Actions and Projected Performance:

PPPL will continue to review its procurement process to identify suitable contracts for inclusion of the requirement for products and services that are energy efficient (ENERGY STAR® or FEMP-designated), water efficient, biobased, environmentally preferable (including EPEAT-registered products), non-ozone depleting, contain recycled content, or are non-toxic or less toxic alternatives. We will also continue to review and update applicable specifications and purchasing guidelines to specify that applicable Federally-mandated designated products and services are included in relevant acquisitions and will identify opportunities to further strengthen implementation of the requirement for federally-mandated designated products in purchasing programs as appropriate.

2.7 Goal #7: Pollution Prevention & Waste Reduction

This section discusses the pollution prevention (P2) programs and waste reduction efforts to meet the goals contained in EO13693 and the DOE SSPP. These goals include the recycling of at least 50% of municipal solid waste (MSW) and non-hazardous, non-contaminated construction and demolition (C&D) materials and debris and to increase the diversion of compostable waste and organic material from the waste stream. In addition, PPPL strives to identify and implement sustainable pollution prevention best practices and to reduce use of toxic, hazardous, and GHG-emissions contributing chemicals that are acquired, used or disposed of through source reduction, the use of acceptable alternative chemicals and processes, and recycling. Over the past five years, PPPL has maintained average recycling rates for MSW and C&D waste streams of 70% and 84%, respectively. The combined recycling rate by weight for the MSW and C&D waste streams was 84% for FY15.

PPPL's subcontracted pest management service has implemented integrated pest management (IPM) practices through its written IPM Plan. To the maximum extent practicable, chemical pesticides are minimized and animal-friendly capture and off-site release is used to remove unwanted animals. The interior application of pesticides is carefully controlled and minimized so as not to affect indoor air quality and to minimize potential employee exposure.

The preferred method of disposing of hazardous and universal waste at PPPL is through recycling. One hundred percent (100%) of recyclable hazardous and universal wastes generated at PPPL are sent off site for recycling or treatment. This includes all mercury waste, lead-acid batteries, NiCad batteries, capacitors (PCB and Non-PCB), and lighting ballasts. In FY15 PPPL recycled 8,123 pounds of ballasts, bulbs and batteries and diverted 7,393 pounds of hazardous waste via incineration.

2.7.1 Solid Waste Diversion

Performance Status:

Solid waste data, including construction, composting, and recycling is reported annually in CEDR Tabs 9.1b and 9.1c. PPPL continues to exceed the FY15 goal of a 50% recycling rate for both MSW and C&D waste by achieving recycling rates of 74.1% and 85.8%, respectively, for FY15 (see Figures 11 and 12, below). The red lines in these graphs represent the DOE waste diversion goal of 50%.

Municipal solid waste trash totaling 24.2 tons was collected at PPPL and transported to a permitted solid waste landfill for disposal. PPPL has a mature and effective waste minimization and recycling program that limits the amount of waste disposed in landfills. PPPL's waste subcontractor participates in a single stream recycling program, which has increased recycling and waste diversion at PPPL. PPPL has incorporated recycling and sustainability requirements into appropriate subcontracts. In FY15 PPPL diverted 74.1% of municipal solid waste away from landfill and into recycling or composting.

In FY15 PPPL continued its food/compostable waste composting program, collecting compostable waste from the cafeteria and satellite locations for off-site processing. Our cafeteria

vendor has embraced the composting program by supplying compostable food service items and establishing practices that minimize waste disposal. PPPL's fifth full year of composting has yielded nearly 22 tons of compost, more than double the amount of material composted in the first year of implementation.

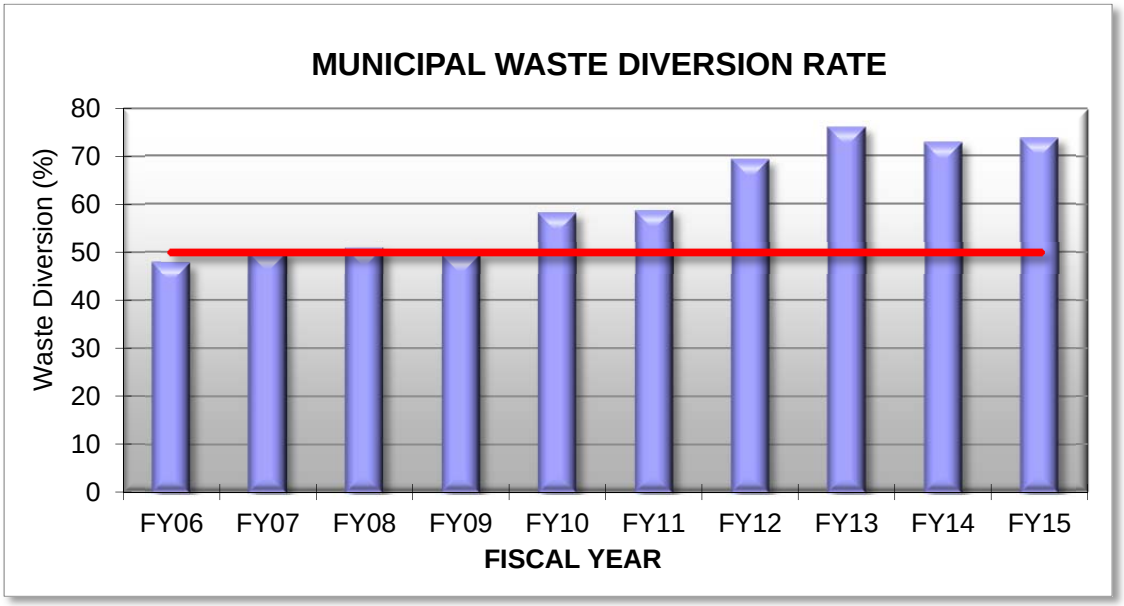


Figure 8 – Annual MSW recycling rate, FY06-FY15.

2.7.2 Construction & Demolition (C&D) Waste Diversion

PPPL will continue to maximize the recycling of C&D waste and continue to meet or exceed the 50% goal. In FY15 PPPL diverted 85.8% of C&D wastes, by weight, into recycling. For many years, PPPL has recycled concrete, asphalt, wood, roofing ballast, scrap metal and other building materials. Subcontracts for construction and facility renovation services include provisions to maximize recycling. Recycling contracts are in place for many waste streams (i.e., electronics, scrap metal, wood, paper, plastic, glass, tin, etc.) and all recycling data are reported in the CEDR.

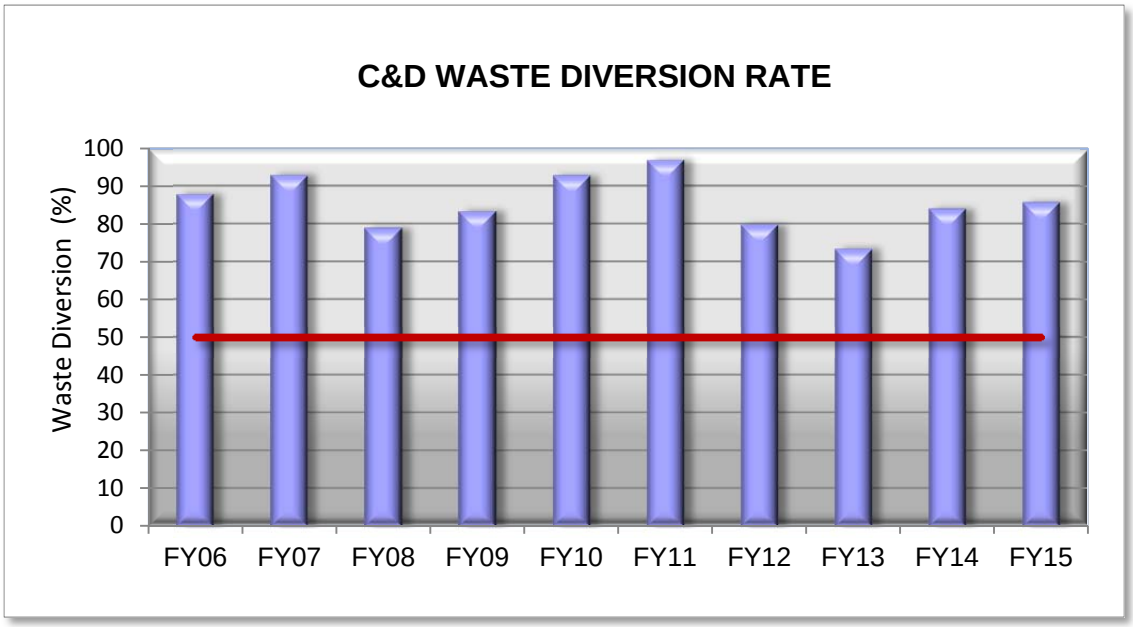


Figure 12 – Annual C&D waste diversion rate, FY06-FY15.

Plans, Actions and Projected Performance:

PPPL will continue to maximize the recycling of C&D waste and continue to meet or exceed the 50% goal. We will continue to divert hazardous and universal wastes to the maximum extent practicable as well as identifying opportunities to eliminate hazardous materials from the Laboratory's waste streams.

2.8 Goal #8: Energy Performance Contracts

Performance Status:

PPPL does not have current Energy Service Performance Contracts (ESPCs), Utility Energy Service Contract (UESC), or Power Purchase Agreements (PPAs). Previous investigations into these types of contracts were deemed not financially viable. Internal funding continues to be a challenge and PPPL has begun to again look at using these alternative financing mechanisms.

In FY15, PPPL met with DOE Site Office personnel to discuss the potential of seeking a new ESPC, PPA, and/or a UESC opportunity focused not only on on-site renewable energy options, but also to include infrastructure improvements and energy efficiency upgrades. PPPL initiated discussions and took the first steps to seek an alternative finance project in the immediate future. PPPL is engaged and working directly with the Federal Energy Management Program (FEMP). Investigation and performance contract development will continue in FY16.

PPPL pursued an on-site renewable power project of approximately 1MW in size through both ESPC and PPA processes in the 2008-2011 timeframe, with an initial ESPC proposal completed

in December 2007. These projects were found not to be financially viable, due to several constraints including the property lease duration for the PPPL site, the financial risks associated with solar energy credits, and a 10 year statutory limit on PPAs.

Plans, Actions and Projected Performance:

As stated earlier, PPPL met with DOE Site Office personnel to discuss the potential of seeking a new ESPC, PPA, and/or a UESC opportunity focused not only on on-site renewable energy options, but also to include infrastructure improvements and energy efficiency upgrades. PPPL initiated discussions and took the first steps to seek an alternative finance project in the immediate future. PPPL is engaged and working directly with the Federal Energy Management Program (FEMP) in currently drafting a Notice of Opportunity (NOO).

2.9 Goal #9: Electronics Stewardship

2.9.1 Electronics Stewardship

PPPL currently has approximately 984 desktop and laptop computer systems. Approximately 60% are Windows, 30% Macs and 10% Linux. PPPL has established the following goals to meet sound electronic stewardship and management of data centers.

- Reduce the energy consumed by computing resources through equipment upgrades, employee outreach/education, and the appropriate use of network power management solutions.
- Maintain environmentally-sound practices for disposition of all excess or surplus electronic materials.
- Continue efforts to reduce the energy consumption of the PPPL data center (PPLCC).
- Procure EPEAT and Energy Star compliant electronics.

2.9.2 Power Management

PPPL strives for 100% EPEAT compliance when purchasing new desktop and laptop computers, monitors, imaging equipment and TV's. PPPL's P-Card system is updated to limit electronics purchases to certain individuals to ensure EPEAT compliance. When this is not possible, special approval must be obtained. Users are required to submit substantial evidence to obtain approval to purchase a device that is not EPEAT compliant. The review process, required for all computer, printer, and TV purchases, ensures that the equipment being purchased adheres to EPEAT standards. Linux desktop systems run either RedHat or Ubuntu linux, with Ubuntu the preferred OS. By default, all Linux desktops enter a "Suspend" state after a period of inactivity, which powers off monitors, spins down the disk, and places the CPU into a suspend state which consumes less than 1 watt of power. The inactivity period that initiates the suspend state is only settable by a privileged user.

PPPL presently uses Windows Group Policy to control the power management settings on monitors attached to Windows systems and Casper was used to control monitors attached to Mac systems. After 20 minutes of inactivity, monitors enter sleep mode.

Settings which allow Windows systems to enter sleep/hibernate mode have also been developed using Group Policy and SCCM. PPPL's main fusion experiment NSTX-U has gone online in FY15. NSTX-U is now operational, in which more systems have been added, which has increased the number of laptops and computers no longer eligible for power management.

PPPL is in the process of deploying these settings to all eligible systems. Due to BIOS settings, a one-time visit to each computer is necessary, which is time consuming. A pilot program was launched using Casper to control these settings on Macs but was unsuccessful. Instead, a new pilot program using Faronics Power Save was started and deemed successful. PPPL is in the process of putting together a plan for procurement of this software to enable more extensive power savings on Mac computers.

2.9.3 Automatic Duplex Printing

PPPL utilizes a centralized print server which configures printers to use the duplex feature by default. Currently PPPL has 124 printers and multi-function devices (MFDs) that are using power saving and duplex printing by default. Printers on this server are also set to enter power saving mode when possible. Users are encouraged to take advantage of the printers on the print server rather than individual printers. The use of personal printers is also strongly discouraged when requests for such are received.

2.9.4 End-of-Life Management

PPPL has lab-wide policies to manage excess or surplus electronic products in an environmentally-responsible manner. Best practices to manage equipment that meets PPPL requirements and is still usable are:

- Redeployed within PPPL to other staff,
- Listed for reutilization/transfer to other DOE facilities in Federal Disposal System/Energy Asset Disposal System (FEDS/EADS),
- Listed for reutilization/donation to Used Energy-Related Equipment (ERLE) & Computers for Learning (CFL) programs in FEDS/EADS,
- Listed for reutilization/transfer to federal agencies in FEDS/EADS,
- Listed for reutilization/donation to state agencies in FEDS/EADS,
- Offered for sale by GSA sales, and
- Unsold items are boxed and shipped to UNICOR, a certified e-waste recycler.

All computer equipment must pass through the Helpdesk and be properly wiped before it can be excessed. Once wiped, or destroyed if proper sanitization isn't possible, the equipment is handed over to Property Control to ensure proper disposition.

Planned Actions

The following actions are planned to promote power management:

1. Procure Faronics Power Save software to deploy power management for PPPL's Mac computers.
2. Continue deployment of power management to all eligible computers using Group Policy and SCCM for Windows systems

Barriers:

A pilot power management program for Macs using Casper was unsuccessful. A second pilot program was launched using Faronics Power Save and deemed successful. Procurement of Power Save is expected to be completed in FY16.

Additional challenges are met with older hardware that does not play well with modern power management software. Although measures are being taken to eliminate this hardware, it still exists in small quantities.

Although PPPL offers two types of thin clients, user acceptance has proven to be very challenging. Many users have experienced technical limitations when using a thin client and resist this option.

2.10 Goal #9: Climate Change Resilience

As a relatively small facility located in Central New Jersey, climate change represents a fairly limited direct risk to the PPPL facility. PPPL has completed the DOE vulnerability assessment survey addressing and location-specific risks of climate change, and has identified on-site and nearby impacts of recent severe weather events that have impacted the Central New Jersey region. We have also identified how the Laboratory used these experiences to identify risks posed by severe weather events and adapt its emergency planning and communications processes to enable better preparations and response.

The 2014 National Climate Assessment identified a number of anticipated climate change impacts for the Northeastern United States, including New Jersey. They include:

- Heat waves, coastal flooding and river/inland flooding will increasingly impact the region's environmental, social and economic systems.
- Infrastructure will be increasingly compromised by heat, cold, flooding and other severe weather events.
- The adaptive capacity of regional ecosystems will be increasingly compromised with the increased frequency and intensity of severe weather events.

Regional climate change impacts relevant to PPPL include:

- Operational and budget impacts due to magnified water and energy/electricity shortages, greater energy price fluctuations and/or prolonged droughts,

- Damage to facility infrastructure or operational disruptions due to flooding or other extreme weather events,
- Operational constraints due to increased temperatures, as well as supply chain and energy disruptions,
- Workforce issues due to heat, health, quality of life, and cost of living,
- Reduced operational efficiency, increased costs and other operational constraints, disruptions, and/or delays due to regional and international impacts, and
- New mission opportunities, both domestic and international to enhance U.S. climate change resilience and ensure U.S. energy and economic security.

Severe weather events are increasingly likely as a result of global climate change. Potential direct impacts from such events may include more frequent strong storms. Waterways and wetlands adjacent to the site may be subject to more frequent and more severe flooding. Some buildings and infrastructure near these features have been identified for potential relocation to other parts of the site. Capital projects to support such relocations were previously identified for other purposes, however funding for the relocations has not been identified.

Increased hot and cold weather extremes will impact the site's energy use profile, potentially resulting in increased GHG emissions from the added heating and cooling loads. The Campus Modernization Plan includes facility and infrastructure investments to enable future scientific missions. The Plan is expected to be updated and revised regularly to reflect changes to Laboratory mission other development. Potential direct climate impacts will be considered in future revisions to the Plan.

The disruption of energy supplies, materials, subcontracted services, and the displacement of employees are potential indirect risks to Laboratory operations. Recent operating experience, especially hurricanes Irene (2011) and Sandy (2012), indicates that such severe weather events will likely affect regional infrastructure, such as roads and bridges, even if the Laboratory is not directly impacted. Regional damage will likely impact employee's ability to report for work, may result in extended power and/or water outages, and may result in fuel and other supply chain shortages. Such disruptions could result in reduced Laboratory operations and a resulting impact to its scientific mission. In response to recent severe weather events, PPPL's emergency planning and response process has been strengthened to include a range of anticipated severe weather events. Key Laboratory organizations, including facilities, experimental operations, engineering, safety, and security participate in pre-event planning meetings and post-event debriefings.

2.10.1 Climate Policies

PPPL does not have a specific climate change policy. Our ISO-14001 certified Environmental Management System integrates the DOE climate change and GHG management goals as objectives and targets. PPPL will evaluate the need to adopt specific policy changes to address climate change resilience in the course of its regular document review process that includes lab-wide policies, plans and procedures.

2.10.2 Emergency Response

Severe weather events are increasingly likely as a result of global climate change. Potential direct impacts from such events may include more frequent and/or more severe storms. PPPL's existing Emergency Plan addresses a wide range of weather-related emergencies. This plan was exercised during hurricanes Irene (2011) and Sandy (2012) and is regularly used to prepare for and respond to a variety of storm events including heavy rain, high winds and snow. Pre-event briefings help coordinate preparation and response actions. If necessary, PPPL's Emergency Operations Center is utilized to coordinate response actions. Post-event briefings are used to identify opportunities for improvement and lessons learned that can be applied to future events.

2.10.3 Workplace Safety

An increase in the frequency of severe weather conditions, including excessive heat and potential storm events, are predicted as a result of a changing climate. Severe weather conditions, including high winds and thermal stress, are already addressed in PPPL's ES&H Directives. Applicable worker safety measures, up to and including stopping work, are outlined in these Directives. Temperature, humidity and winds are monitored during periods of unusual or extreme weather to evaluate safe conditions for outdoor work. During periods of severe cold, excessive heat and/or high winds, work may be modified, restricted or suspended. Changes to worker safety measures are regularly evaluated and updated based on operating experiences both at PPPL and other facilities.

2.10.4 Management Commitment

PPPL's ISO-14001 certified Environmental Management System (EMS) is the primary management tool for addressing sustainability goals and the issue of climate resilience. The EMS program monitors developments in the field of climate resilience and identifies areas of interest that may be applicable to PPPL. As PPPL continuously improves its EMS and adapts to the new ISO-14001 standard it will include climate resilience in its environmental sustainability goals.

2.10.5 Climate Science

PPPL participates in the DOE Climate Change Adaptation Working Group and is engaged with state-level climate adaptation/resilience efforts led by Rutgers University. We will continue to participate in these efforts as appropriate to Laboratory planning and operations. The Laboratory has not assigned climate change adaptation planning to any individual or organization. It is a subject of consideration for our Environmental Review Committee and ES&H Executive Board.

3. Fleet Management Plan

PPPL's current fleet, including exempt emergency vehicles, consists of 23 vehicles:

- One (1) DOE owned fire engine, and
- 22 GSA-leased vehicles.

PPPL's fleet contains 23 vehicles. The DOE-owned fire engine is 15 years old, while GSA leased vehicles average 4 years old. The fleet consists of one (1) sedan, one (1) ambulance, nine (9) light duty trucks, nine (9) medium duty trucks and two (2) heavy duty trucks. The replacement schedule of GSA-leased vehicles is determined by GSA. Over the past 5 years, two to three vehicles are replaced each year. We currently have no plans to replace the DOE-owned fire engine.

PPPL ensures efficient management of its vehicle fleet through our annual vehicle & mobile/heavy equipment justification process and established Local Use Objectives (LUOs) for each vehicle. The Justification Form is used to review and consider any impact in Laboratory Operations to insure that only the minimum number of vehicles & mobile/heavy equipment are retained. The justification includes the vehicle or mobile/heavy equipment identification, vehicle or mobile/heavy equipment POC, reason for need (justification narrative), vehicle or mobile/heavy equipment sharing information. All vehicles and mobile/heavy equipment assets must be reviewed and justified by Division and Department managers annually to continue assignments using associated vehicle or mobile/heavy equipment. Sharing of vehicles and pooling of mobile equipment is utilized to limit fleet size and maximize equipment utilization. LUOs reflect the local mileage necessary to meet the Laboratory's mission while continuing to meet fleet petroleum fuel reduction goals contained in Executive Orders 13423 and 13514. The LUOs for each vehicle are reviewed annually and vehicles not meeting LUOs are subject to additional scrutiny and potential elimination.

PPPL's only DOE-owned vehicle is one (1) fire engine (E-66) which is fueled with B20 biodiesel. Of the 22 GSA leased vehicles we have two (2) electric hybrid, nineteen (19) vehicles using alternative fuels (E85 and B20), and one (1) vehicle using exclusively petroleum fuel (diesel). Thus, 96% of PPPL's fleet is made up of alternative fueled vehicles (AFVs).

Only Alternative Fueled Vehicles (AFV) are leased through GSA when replacing existing fleet. The items addressed and considered when leasing a vehicle is the necessity, usage requirements for organization and/or sharing organization, cost and fueling type. Leasing GSA vehicles are cost effective for PPPL's fleet size and the 1 FTE who manages the operation under Engineering Department.

PPPL has plans to change its fleet make-up this year, which will not increase or decrease the size of its fleet in FY16. PPPL is presently performing an Infrastructure and Operational Improvements (IOI) Project which includes rehabilitating the RESA building for storage of Equipment Held for Future Projects (EHFFP) and essentially eliminating 60+ trailers on-site. PPPL is looking to reutilize a vehicle within the ES&H Department for Engineering Department's increased activities and for the safety of moving various types of Equipment and Materials. The vehicle, if approved for exchange by DOE will be used to move gas cylinders,

equipment, and materials on and off site, to include transportation of excess equipment to UNICOR for disposition. We do not anticipate changes to the Laboratory's mission that would necessitate the addition or elimination of vehicles at this time.

In addition to the use of alternative fuels in its covered fleet vehicles, PPPL uses B20 in several pieces of heavy-mobile equipment, including a 15 ton forklift, backhoe, and skid steer loader(s). PPPL's fleet of Off-road vehicles, consist of electric and diesel operated. The vehicles that are designated as diesel operated, run exclusively on B20 after the manufacturer warranty is expired. This is to eliminate any impact to warranty repairs. PPPL's on-site fleet refueling station supports the storage and dispensing of E85 and B20 fuels. As shown in Figure 10, below, PPPL's fleet petroleum fuel use has dropped by 75% over the past ten years. In addition, PPPL's fleet GHG intensity, defined as pounds of CO_2 emitted per mile, is down by 49.2% since PPPL's baseline GHG emission year of 2008 (see Figure 11, below).

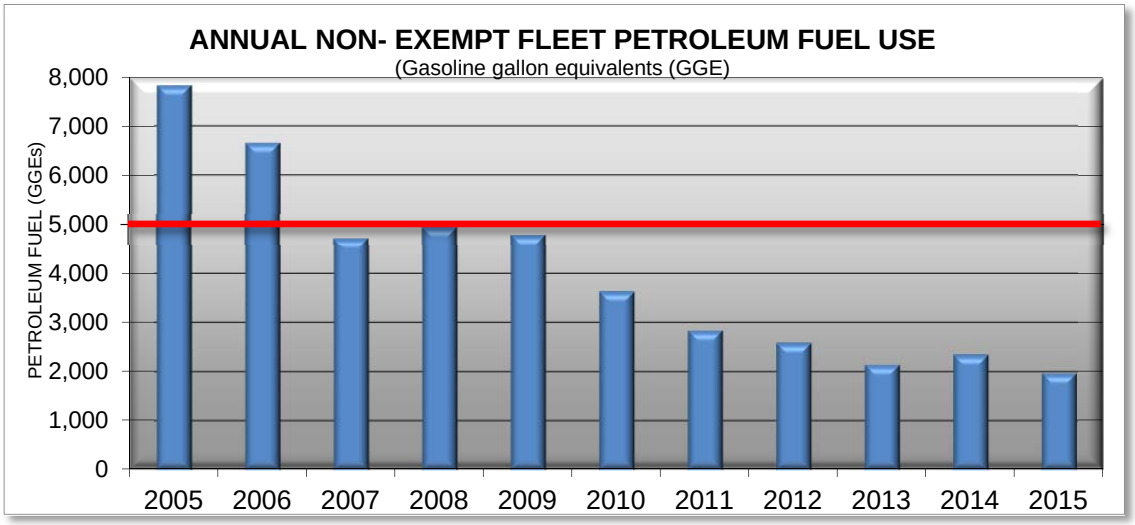


Figure 10 - Annual non-exempt fleet petroleum use, FY05-FY15.

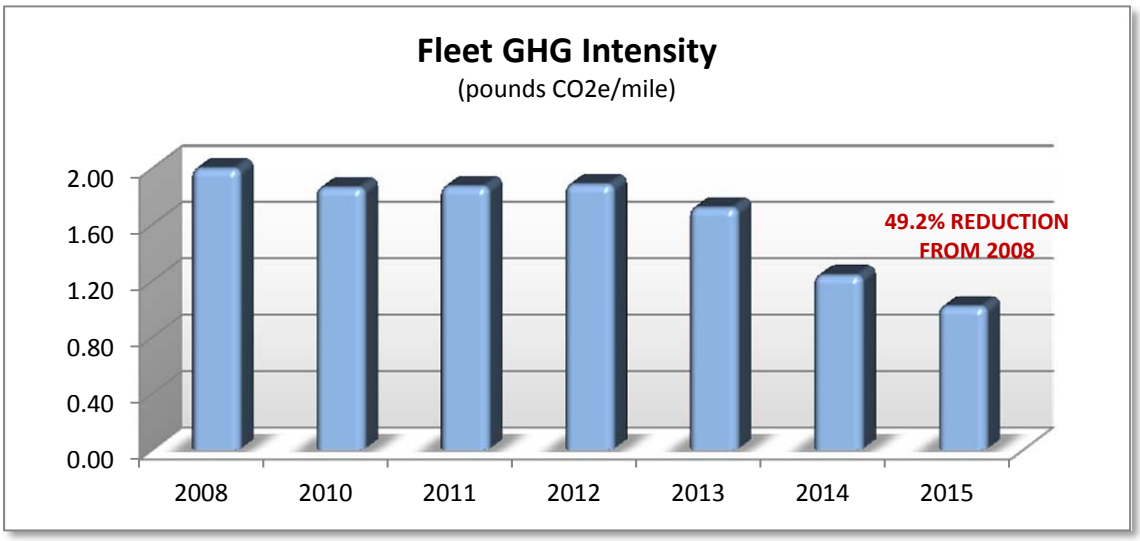


Figure 11 - Annual fleet GHG intensity, FY08-FY15.

4. Funding

Performance Status:

The successful implementation of long-term sustainability goals requires a sound budgeting strategy and adequate funding. PPPL is developing methods, such as those outlined below, to secure the appropriate funding for energy and water efficiencies in the immediate future.

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, such as advanced electrical, steam, chilled water, or potable meters, are mandatory, and we are planning accordingly within project funding requests., While our project teams have typically built these requirements into the individual projects, we are revising our standards to incorporate and highlight energy measures as standard design requirements and specifications.

Throughout FY15, energy and water evaluations, projects have been identified as energy conservation measures (ECMs) and we anticipate more to be identified in FY16. They will be 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 PPPL mission. Internal funding has been a challenge in the recent past and often the ECM projects have been deemed not feasible.

PPPL has funded sustainability projects to-date with existing programmatic overhead funds, including GPP and OPEX funding. Examples of these projects include lighting and other energy efficiency improvements, cool roof installation, green building renovations, boiler efficiency improvements and enhanced management of fugitive SF_6. Sustainability projects are evaluated annually by a technical review committee along with other proposed GPP- and OPEX-funded facilities and experimental projects. All projects are prioritized using the same CAMP evaluation system. Completion of additional sustainability projects is subject to availability of funding and competing operational priorities, such as safety and corrective maintenance needs. Long-standing funding constraints have required PPPL to look toward new and different methods for conserving energy and reducing utility costs. Therefore, executing a strategic energy management program is essential. PPPL's Energy Management Plan will provide a roadmap to achieve our goals. This plan is currently in development and will be finalized in FY16.

Plans, Actions and Projected Performance:

While PPPL did not gain any SPOFOA funding during the FY15 submission, we have been continuing to identify new opportunities and hope to compete and earn SPOFOA in the upcoming FY16 submission.

PPPL has begun to explore new opportunities using alternative financing mechanisms, such as ESPCs. PPPL has already completed the initial steps to investigate the viability of a project and is working directly with the Federal Energy Management Program (FEMP).

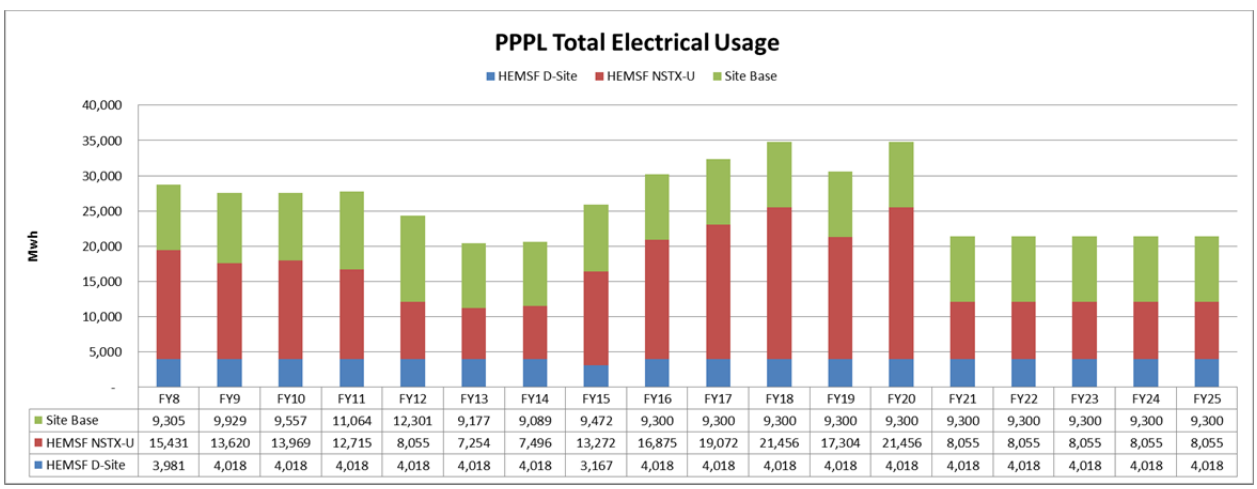
5. Electrical Energy & Cost Projections including High-Energy Mission-Specific Facilities (HEMSFs)

PPPL's magnetic confinement fusion energy research experiments are energy intensive devices, recreating deep space and stellar conditions in the terrestrial environment. This research is PPPL's primary mission and is dedicated to understanding plasma science and technology and developing a carbon-neutral sustainable global energy source for the future. Experimental support systems include critical climate controls (temperature and humidity), ventilation (safety-related), power storage/distribution (motor-generators), high-voltage power conditioning systems, neutral beam heating systems, as well as critical experimental magnet, cryogenic, and vacuum systems. In addition to extensive experimental operation and support systems, the HEMSF also includes mission-critical experimental data collection on control systems.

Performance Status:

For the purposes of electrical projections and currently metering structures, PPPL rolls up our FIMS-excluded facilities that meet the definition of high-energy mission-specific facilities (HEMSF) into two HEMSF's: HEMSF D-Site and HEMSF NSTX-U. These buildings represent 235,000 square feet of buildings space and approximately 31% of PPPL's overall real property footprint. These facilities house critical experimental devices, including the recently upgraded NSTX-U and its support systems. The list of HEMSF excluded buildings is included in Appendix B.

This chart includes actual and projected electricity use for each HEMSF and the Site Base. The data presented is in MWh. In the recent past, PPPL's premiere experiment, the National Spherical Torus Experiment (NSTX) has just completed an upgrade phase of improvements and experimental energy used during the FY12 to FY14 period was lower than normal. In FY15 we see the usage rebounding close to FY10 levels as it began the "start-up" phase that will transition to experimental operations for the coming fiscal years. The chart below shows a drop in experimental energy use in FY21 based on current research plans for NSTX. Out-year energy projections will be revised to reflect any changes to experimental research plans.

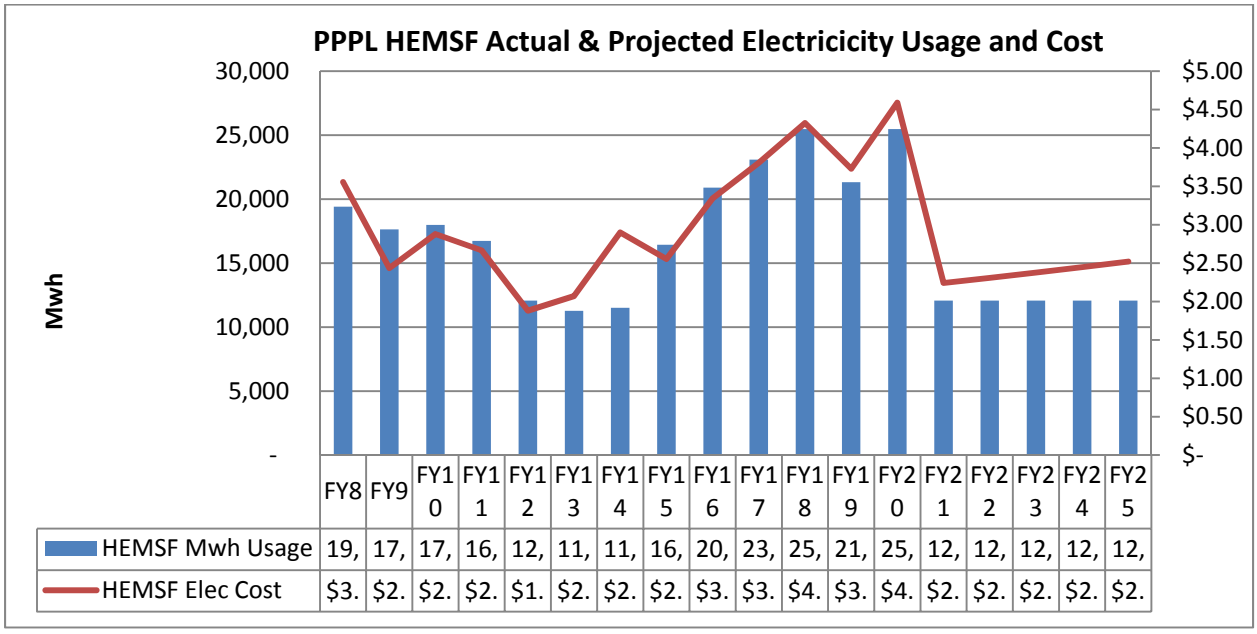


	FY8	FY9	FY10	FY11	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY23	FY24	FY25
Site Base	9,305	9,929	9,557	11,064	12,301	9,177	9,089	9,472	9,300	9,300	9,300	9,300	9,300	9,300	9,300	9,300	9,300	9,300
HEMSF NSTX-U	15,431	13,620	13,969	12,715	8,055	7,254	7,496	13,272	16,875	19,072	21,456	17,304	21,456	8,055	8,055	8,055	8,055	8,055
HEMSF D-Site	3,981	4,018	4,018	4,018	4,018	4,018	4,018	3,167	4,018	4,018	4,018	4,018	4,018	4,018	4,018	4,018	4,018	4,018

Figure 12 – HEMSF actual and projected electricity usage, FY13-FY20.

Plans, Actions and Projected Performance:

PPPL's Site Base electrical usage is not projected to increases significantly over the planning period. In fact, we are working on an energy management plan to develop energy efficiency improvements to decline our Site Base usage. Experimental projections are based on a typical annual experimental run period of approximately 16 weeks. If experimental operations are expanded or reduced, or if significant experimental missions are added, energy use will change accordingly.



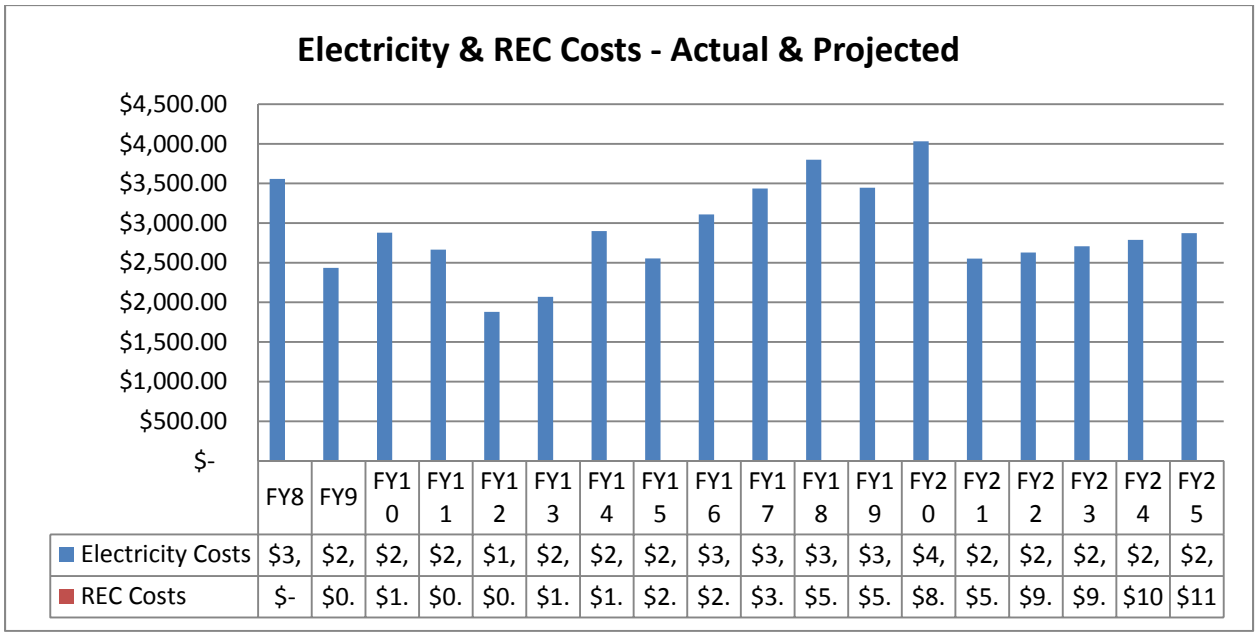
	FY8	FY9	FY10	FY11	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY23	FY24	FY25
HEMSF Mwh Usage	19,	17,	17,	16,	12,	11,	11,	16,	20,	23,	25,	21,	25,	12,	12,	12,	12,	12,
HEMSF Elec Cost	$3.	$2.	$2.	$2.	$1.	$2.	$2.	$2.	$3.	$3.	$4.	$3.	$4.	$2.	$2.	$2.	$2.	$2.

Figure 14 – HEMSF actual and projected electricity usage and cost, FY08-FY20.

HEMSF cost projections are based on the estimated HEMSF usage amounts, current rates, and an annual 3% increase in rates which PPPL and all of New Jersey has historically experienced.

Energy Conservation Measures (ECMs) & Energy Savings for HEMSF: Currently there are no planned investments to improve energy efficiency within the HEMSF facilities. Through the FY16 EISA audits, we plan identify potential energy efficiency improvements and based on familiarity with these facilities, we anticipate the ECMs associated with lighting, HVAC, and other support infrastructure to be identified. Additionally, PPPL remains aggressive in identifying one-pass through water savings. PPPL will continue to implement ECMs projects where lifecycle cost effective and as funding permits.

Electricity and REC Costs: PPPL plans to purchase RECs in pursuit of the renewable energy mandate, but also plans to explore third party financing opportunities. Any executed project will adjust these projections. Additionally, PPPL is not currently planning on purchasing RECs to support reaching the 50% reduction goal for Scope 1 & 2 GHG emissions by 2025, but as PPPL's strategy to reach this goal develops the projections for purchased RECs may increase. The current projections shown in the graph and data table, below, only capture the current estimates for reaching the 30% renewable energy source goal by 2025.



	FY8	FY9	FY10	FY11	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY23	FY24	FY25
Electricity Costs	$3,	$2,	$2,	$2,	$1,	$2,	$2,	$2,	$3,	$3,	$3,	$3,	$4,	$2,	$2,	$2,	$2,	$2,
REC Costs	$-	$0.	$1.	$0.	$0.	$1.	$1.	$2.	$2.	$3.	$5.	$5.	$8.	$5.	$9.	$9.	$10	$11

Figure 14 – Actual and projected electricity and REC costs, FY08-FY25.

APPENDIX A – Excluded Buildings List and Self-Certification

Department of Energy
Princeton Site Office
P.O. Box 102
Princeton, New Jersey 08542-0102

FROM: Princeton Site Office
Office of Science
TO: Sustainability Performance Office

DATE: November 24, 2015

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

Each building or group of buildings excluded under the criteria Part G is/are metered for energy consumption and their consumption is reported annually. These process loads are drive by mission and operational requirements. These loads are not influenced by conventional building energy conservation measures. The metered loads includes both process load and a nominal amount of process-related lighting and space conditioning energy, which are both the metered energy and the square footage are excluded. Their consumption is reported annually.

I certify that the buildings listed on the Excluded Buildings list produced by FIMS as Report 063 dated Nov 2015, Princeton Plasma Physics Laboratory, meet the exclusion criteria in *Guidelines Establishing Criteria* for Excluding Buildings published by FEMP on January 27, 2006.

Anthony J. Indelicato

DOE Site Office Official – printed name

DOE Site Office Official – signature

November 24, 2015

Date

Contact Information:
Anthony J. Indelicato
Federal Project Director
Phone: (609) 243-3703
Email: anthony.indelicato@science.doe.gov

Property ID	Property Name	Gross/Rentable Sqft	Goal Subject Facilities (GSF)	Excluded Facilites (GSF)
00010328	Pppl-Forrestal Campus	N/A, Land Record	-	-
00CPEASM	Canal Pump House Easement	N/A, Land Record	-	-
011502CWL	Canal to Water Tower Line	N/A, OSF not floor SF	-	-
031802NSTXSS	NSTX Support Systems	N/A, OSF not floor SF	-	-
031902RP	TFTR Reactor Parts	N/A, OSF not floor SF	-	-
032010	Pedestrian Walkway	N/A, OSF not floor SF	-	-
09246A	Fire Alarm System	N/A, OSF not floor SF	-	-
09246B	Fire Sprinkler System	N/A, OSF not floor SF	-	-
103001STC	Steam Generation & Distribution	N/A, OSF not floor SF	-	-
103001TC	Fuel Storage & Containment Facilities	N/A, OSF not floor SF	-	-
111001SWC	Sewer System	N/A, OSF not floor SF	-	-
140821RD	Roads	N/A, OSF not floor SF	-	-
140821VPAR	Vehicle Parking	N/A, OSF not floor SF	-	-
140821WKS	Sidewalks	N/A, OSF not floor SF	-	-
403030283	Gas Facility (Gasoline Tanks)	N/A, OSF not floor SF	-	-
403030284	D Site Helium/Gas Yard	N/A, OSF not floor SF	-	-
7119030290	D Site Electric Utility	N/A, OSF not floor SF	-	-
7119030291	C Site Electric Utility	N/A, OSF not floor SF	-	-
7119030292	Building Automation System (BAS)	N/A, OSF not floor SF	-	-
7119030299	4 Dry Core Transformer Units East Wing	N/A, OSF not floor SF	-	-
7131030298	C/D Water Utility System	N/A, OSF not floor SF	-	-
7132030301	Mg Free Cooling Ext. Pipe	N/A, OSF not floor SF	-	-
7164030307	Retention Basin	N/A, OSF not floor SF	-	-
802030316	C/D Site Perimeter Fences	N/A, OSF not floor SF	-	-
811030324	Support Structure - ICRF Power to MockUp	N/A, OSF not floor SF	-	-
811030335	Natural Gas Piping	N/A, OSF not floor SF	-	-
C01	Lyman Spitzer Building (LSB)	118,959	118,959	-
C03	Guardbooth	169	169	-
C12	Admin Wing/Cafeteria	10,862	10,862	-
C13	Admin Bldg/Library/Computer Addition	21,747	21,747	-
C20	Engineering Wing	19,770	19,770	-
C21	L-Wing	4,320	4,320	-
C22	Laboratory Building	33,220	33,220	-
C23	Theory Wing	5,665	5,665	-
C32	Shop Building	18,396	18,396	-
C40	RF Building	41,404	41,404	-
C41	CS Building, PBX Control Room Passageway	31,154	31,154	-
C42	COB Building	11,186	11,186	-
C50	ESAT Building	9,695	9,695	-
C51	C-Site MG Building	64,857	64,857	-
C52	PLT Power Building	6,742	6,742	-
C55	Module 6	8,216	8,216	-
C60	C-Site Pumphouse (Cool Tower Demolished)	1,532	1,532	-

Site Name	Property ID	Real Property Unique ID	Property Name	Exclusion Part	Property Type
PPPL-Forrestal Resrch. Ctr	D42	124618	D-Site Experimental Area	G - Metered intensive loads	Building
PPPL-Forrestal Resrch. Ctr	D72	124605	D-Site MG Building	G - Metered intensive loads	Building
PPPL-Forrestal Resrch. Ctr	D70	124606	D-Site Cooling Tower/Pumphouse	G - Metered intensive loads	Building
PPPL-Forrestal Resrch. Ctr	D53	124607	NBPC Building	G - Metered intensive loads	Building
PPPL-Forrestal Resrch. Ctr	D52	124617	FCPC Building	G - Metered intensive loads	Building

Gross Sqft	Excluded Facilities (GSF)-Building/Trailer
87978	87978
45420	45420
4743	4743
49238	49238
43672	43672

Justification Comment
Two advanced electrical meters were installed at D-Site in FY08 as part of PPPL's site metering upgrade plan. Due to the electrical distribution configuration on D-Site, we are unable to divorce all major experimental power consumption (NSTX) from building hotel loads.
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Property ID	Property Name	Gross/Rentable Sqft	Goal Subject Facilities (GSF)	Excluded Facilites (GSF)
C61	Facilities Engineering	22,677	22,677	-
C64	Material Services Building	45,040	45,040	-
C67	Emergency Services Building (ESU)	8,143	8,143	-
C74	Gas Cylinder Storage		1,374	-
C90	RESA Building	20,900	20,900	-
C91	CAS Building	17,372	17,372	-
C93	Hazmat Storage Building	4,608	4,608	-
D34	Liquid Effluent Collection Tank		Excluded	4,750
D42	D-Site Experimental Area	87,978	Excluded	87,978
D45	Rad Waste Handling Facility	6,360	6,360	0
D52	FCPC Building	43,672	Excluded	43,672
D53	NBPC Building	49,238	Excluded	49,238
D70	D-Site Cooling Tower/Pumphouse	4,743	Excluded	4,743
D72	D-Site MG Building	45,420	Excluded	45,420
P1	Canal Pumphouse(offsite)	792	792	0
T050	OFFICE TRAILER	672	672	0
T051	OFFICE TRAILER	672	672	0
Totals		**766,181**	**536,504**	**235,801**

APPENDIX B – Policy and Program Status Summary Table

Optional Policy and Program Status Summary Table

SSPP Goal – Policy/Program	In Place (Y/N)	Last Update (MM/YY)	Additional Information
Goal 1: Greenhouse Gas Reduction			
Program: Sulfur hexafluoride (SF_6) capture	Y	12/14	Commissioned new automated SF_6 management system.
Plan: Commuter reduction	N		
Policy: Teleworking and/or alternative work schedule	Y	12/12	Personnel Practices Manual
Goal 2: Sustainable Buildings			
Policy: Space management	N		
Policy: Cool roof installation	Y		
Policy: Design new Federal buildings to achieve net-zero energy by FY 2030	N		No new buildings currently planned.
Program: Participation in critical local and regional efforts and initiatives	Y		On-going coordination with Princeton Forrestal Center
Plan: Update agency/site policy and guidance (EIS's and EA's)	N/A		
Policy: Dispose and consolidate excess and underutilized property	Y	7/14	Campus Modernization Plan
Policy: Reduce need for new building and field office space	Y	7/14	Campus Modernization Plan
Policy: Conserve, rehabilitate, and reuse historic Federal properties	Y	7/14	Campus Modernization Plan
Policy: Incorporate sustainable practices into new/renew leases	Y	7/14	Campus Modernization Plan
Plan: Green buildings roadmap	Y	7/14	Campus Modernization Plan
Program: Sustainable landscape	Y	08/08	Beneficial Landscaping Plan
Plan: Metering	N		
Goal 3: Clean & Renewable Energy			
Policy: Prioritization of on-site renewable	N		
Policy: Purchase renewable energy from sources on tribal land	N		
Policy: Prioritization of on-site clean or alternative energy	N		
Program: Vehicle sharing/pooling	Y		Princeton University programs
Goal 4: Water Use Efficiency and Management			
Policy: Storm water management	Y	08/12	Stormwater Pollution Prevention Plan
Policy: Water reuse	N		
Plan: Water	N		

SSPP Goal – Policy/Program	In Place (Y/N)	Last Update (MM/YY)	Additional Information
Goal 5: Fleet Management			
Program: Fleet Optimization/Vehicle Allocation Methodology (VAM)	Y		MC – Fleet Procedures
Program: Sustainable transportation options	N		
Program: Vehicle sharing/pooling	Y		ES&H Department, Dispatch vehicles
Policy: Fleet-wide per mile greenhouse gas emissions	N		Current fleet GHG intensity down by 49.2% from FY08
Program: Zero Emission Vehicles	NA		Not suitable for current fleet configuration
Goal 6: Sustainable Acquisition			
Policy: Inclusion of FAR sustainability clause	Y	11/14	P-082, Environmentally Preferable Purchasing; ENG-006, Preparation, review and Approval of Specifications & Statements of Work; Procurement Representations & Certifications
Policy: Inclusion of biobased products	Y	11/14	P-082, Environmentally Preferable Purchasing
Policy: Inclusion of energy efficient products (e.g. Energy Star, FEMP-designated)	Y	11/14	P-082, Environmentally Preferable Purchasing
Policy: Inclusion of recycled content products	Y	11/14	P-082, Environmentally Preferable Purchasing
Policy: Inclusion of water efficient products (e.g. WaterSense)	Y	11/14	P-082, Environmentally Preferable Purchasing
Policy: Inclusion of environmentally preferable products/services (excluding EPEAT)	Y	11/14	P-082, Environmentally Preferable Purchasing
Plan: Environmentally preferable purchasing	Y	11/14	P-082, Environmentally Preferable Purchasing
Policy: Paper containing at least 30% post-consumer fiber	Y		By default in office supplies subcontract

SSPP Goal – Policy/Program	In Place (Y/N)	Last Update (MM/YY)	Additional Information
Goal 7: Pollution Prevention and Waste Reduction			
Program: Reduce and minimize hazardous chemicals and materials	Y	11/14	P-014, Waste Minimization
Policy: Integrated pest management and landscape management	Y		Integrated Pest Management Plan
Policy: Increase use of acceptable alternative chemicals and processes	Y	11/14	P-014, Waste Minimization
Policy: Report per Sections (301-313) of EPCRA of 1986	Y		ESHD, Section 8
Program: Composting	Y	12/14	Ongoing composting and recycling programs in place
Goal 8: Energy Performance Contracts			
Policy: Utilize performance contracts	Y	9/13	P-105, Energy Management
Goal 9: Electronic Stewardship			
Policy: Power management	Y	01/11	IT-007, Configuration Management
Policy: Print management and duplex printing	Y		Network print server, duplex default setting
Goal 10: Climate Change Resilience			
Plan: Update all appropriate plans to address climate change resiliency	Y		On-going updates to Emergency Plan, Campus Modernization Plan, etc.
Program: Identify or establish and participate in regional climate change programs	Y	12/14	On-going participation in NJ climate adaptation programs through Rutgers University
Program: Cost savings reinvestment	N		

Appendix C – Metering Plan

PPPL ENERGY WATER METERS

PROPERTY ID	PROPERTY NAME	Electricity	Gas - Natural	Fuel Oil	Steam	Chilled Water	Potable Water	Non-Potable Water
BUILDINGS								
C01	Lyman Spitzer Building (LSB)	Metered-Advanced	Not Used	Not Used	Metered-Advanced	Metered-Advanced	Metered-Advanced	Not Used
C12	Admin Wing/Cafeteria	Not Metered	Not Used	Not Used	Not Metered	Currently Metered-Advanced as one facility	Not Metered	Not Metered
C13	Admin Bldg/Library/Computer Addition	Not Metered	Not Used	Not Used	Not Metered		Not Metered	Not Used
C20	Engineering Wing	Metered-Advanced	Not Used	Not Used	Metered-Advanced	Metered-Advanced	Metered-Advanced	Not Used
C22	Laboratory Building	Not Metered	Not Used	Not Used	Not Metered	Metered-Advanced	Not Metered	Metered-Standard
C23	Theory Wing	Not Metered	Not Used	Not Used	Metered-Advanced	Metered-Advanced	Not Metered	Not Used
C32	Shop Building	Not Metered	Not Used	Not Used	Not Metered	Not Metered	Not Metered	Not Used
C40	RF Building	Not Metered	Not Used	Not Used	Not Metered	Not Metered	Not Metered	Not Used
C41	CS Building, PBX Control Room Passageway	Not Metered	Not Used	Not Used	Not Metered	Not Metered	Not Metered	Not Used
C42	COB Building	Not Metered	Not Used	Not Used	Not Metered	Not Metered	Not Metered	Not Used
C50	ESAT Building	Not Metered	Not Used	Not Used	Not Metered	Not Metered	Not Metered	Not Used
C51	C-Site MG Building	Not Metered	Not Used	Not Used	Not Metered	Not Metered	Not Metered	Not Used
C52	PLT Power Building	Not Metered	Not Used	Not Used	Not Metered	Not Metered	Not Used	Not Used
C55	Module 6	Not Metered	Metered-Standard	Not Used	Not Used	Not Used	Not Metered	Not Metered
C61	Facilities Engineering	Metered-Advanced	Not Used	Not Used	Metered-Advanced	Metered-Advanced	Metered-Advanced	Not Used
C64	Material Services Building	Metered-Advanced	Not Used	Not Used	Metered-Advanced	Not Used	Metered-Advanced	Not Used
C67	Emergency Services Building (ESU)	Metered-Advanced	Metered-Standard	Not Used	Not Used	Not Used	Metered-Advanced	Not Used
C90	RESA Building	Not Metered	Metered-Standard	Not Used	Not Metered	Not Used	Not Metered	Not Metered
C91	CAS Building	Not Metered	Metered-Standard	Not Used	Not Metered	Not Used	Not Metered	Not Metered
D42	D-Site Experimental Area	Not Metered	Not Used	Not Used	Not Metered	Not Metered	Not Metered	Not Used
D45	Rad Waste Handling Facility	Metered-Advanced	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used
D52	FCPC Building	Not Metered	Not Used	Not Used	Not Metered	Not Metered	Not Metered	Not Used
D53	NBPC Building	Not Metered	Not Used	Not Used	Not Metered	Not Metered	Not Metered	Not Used
D70	D-Site Cooling Tower/Pumphouse	Metered-Advanced	Not Used	Not Used	Not Metered	Not Used	Not Metered	Not Used
D72	D-Site MG Building	Not Metered	Not Used	Not Used	Not Metered	Not Metered	Not Metered	Not Used

Appendix D – 2015 Employee Commuting Survey

PPPL Commuter Survey FY2015

* Required

1. **What is your current employment status at PPPL?** *
   Mark only one oval.

   - Full Time Employee
   - Part Time Employee
   - Graduate Student
   - Visiting Researcher
   - Contractor
   - Internship

2. **How many miles do you commute to PPPL ONE Way?** *
   Miles One Way

   _____

3. **How do you primarily travel from home to PPPL:**
   Mark only one oval.

   - Alone
   - Carpool (2-3 People)
   - Vanpool (4+ People)

4. **What is your Primary & Secondary Method of Transportation to/from PPPL?**
   Mark only one oval per row.

	Primary Transportation	Secondary Transportation (Only if applicable)
Car, Gasoline		
Car, Diesel		
Car, Hybrid/Electric		
Truck/SUV/Van, Gasoline		
Truck/SUV/Van, Diesel		
Truck/SUV/Van, Hybrid/Electric		
Motorcycle		
Bike or Walk		
Bus (Including Tiger Transit)		
Train		
Car Pool (2-3 People)		

5. **What percentage of the time do you use your Secondary Transportation?**
   Percentage (%) - If none, please leave blank or put 0%

6. **Approximately how many days in FY15 did you work from home?**
   # Days in FY15

7. **Approximately how many business days in FY 2015 did you travel for PPPL work?**
   # Days in FY15

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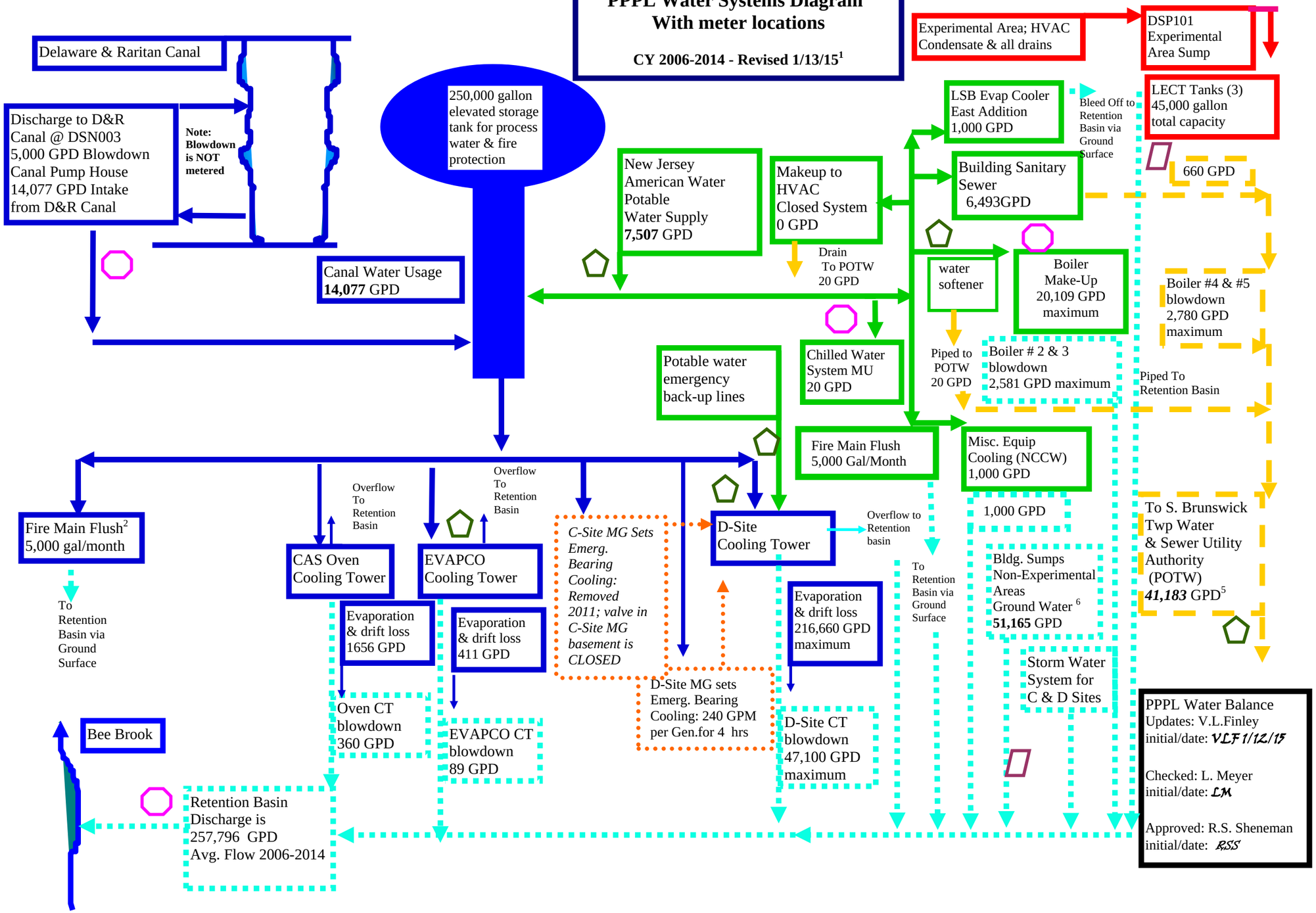
Appendix E – 2015 Water Flow Diagram

PPPL Water Systems Diagram[4] With meter locations

CY 2006-2014 - Revised 1/13/15[1]



Notes

1. **This water flow diagram is updated every calendar year; this diagram uses average data from calendar years (CY) 2006 to 2014.**
2. **Unless otherwise noted, gallons per day (GPD) rate is an estimated average.**
3. **Maximum GPD rates are based on 100 % flow & firing rates.**
4. **This diagram shall be included in the New Jersey Pollution Discharge Elimination System [NJPDES, N.J.A.C. 7:14A-4.3 (a) 17 Application Information Requirements] for DSN001 & DSN003.**
5. **The Sanitary Sewer meter has been deemed inoperable. POTW has agreed to discontinue using the sewer meter and report sewage flow based on a water mass balance as of calendar year 2013.**
6. **The only D-site system which normally uses Canal water is the D-Site cooling tower.**

LEGEND for Meter Point [MP]

MP connected to BAS& could be manually read:

MP could be read manually:

MP not functioning:

Volume records maintained manually: