

Princeton Plasma Physics Laboratory (PPPL) DOE Order 430.2B Executable Plan

To meet the goals of Executive Order 13423
and the TEAM Initiative

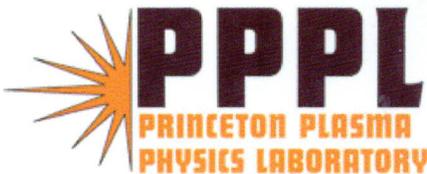
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DOE ORDER 430.2B EXECUTABLE PLAN TEAM GOAL SUMMARY

Goal Elements	Plan Meets Goal	Plan Exceeds Goal	Plan Falls Short of Goal	Highlights
Energy Efficiency	<input type="checkbox"/>	X	<input type="checkbox"/>	37% reduction in non-experimental energy intensity between FY2003 and 2007. Additional energy savings projects underway in FY2009 and planned for FY2010.
Renewable Energy	X	<input type="checkbox"/>	<input type="checkbox"/>	ESPC evaluation completed in FY2008; not cost effective. PPPL is pursuing on-site renewable energy generation through a long-term power purchase agreement through the Defense Energy Supply Center (DESC). Additional on-site solar installations being evaluated.
Water	<input type="checkbox"/>	<input type="checkbox"/>	X	Since FY2000 PPPL has reduced its consumption of potable water by 73.5% through equipment upgrades, low-flow fixture installation and enhanced operational controls. PPPL will continue to pursue water conservation measures and has two projects scheduled for FY2009.
Transportation/Fleet Management	<input type="checkbox"/>	X	<input type="checkbox"/>	PPPL has achieved a 43% reduction in petroleum fleet fuel use and ~900% increase in alternative fuel use since FY2005. Installation of alternative fuel infrastructure and AFV fleet transition are in progress.
High Performance and Sustainable Buildings	X	<input type="checkbox"/>	<input type="checkbox"/>	Pursuing LEED-EB certification of the Lyman Spitzer Building which will meet the 15% goal for high performance sustainable buildings. Other HPSB evaluations scheduled.

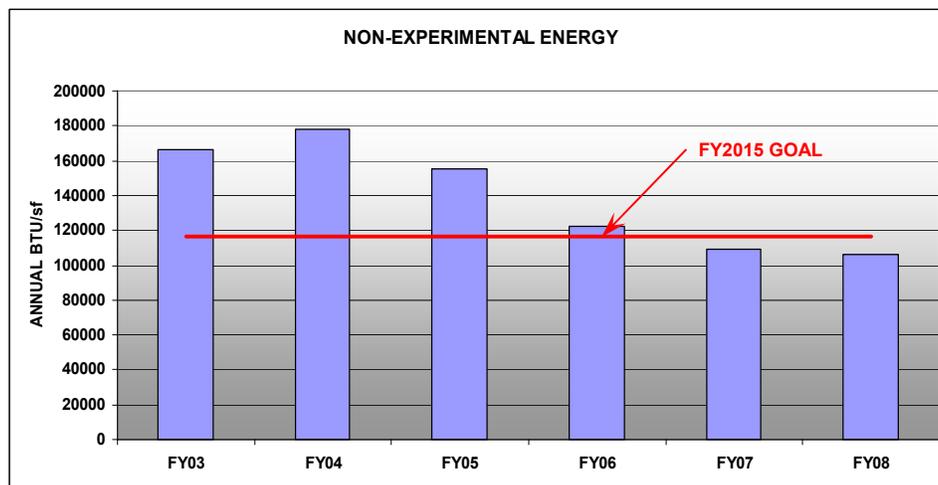
This Executable Plan outlines the progress and planned actions for the Princeton Plasma Physics Laboratory (PPPL) to meet the goals of Executive Order (EO) 13423 and the Secretary's Transformational Energy Action Management (TEAM) Initiative. It has been prepared in accordance with the DOE guidance issued on July 8, 2008 by the DOE Office of Science (SC).

In August 2007, Secretary of Energy Samuel W. Bodman launched the Transformational Energy Action Management (TEAM) initiative, which is a plan for the Department of Energy to meet/exceed the goals outlined in Executive Order 13423 "Strengthening Federal Environmental, Energy, and Transportation Management." The goal of the TEAM is to transform the way DOE manages its energy, water use, buildings and vehicle fleets. DOE Order 430.2B was issued in February 2008, outlining the requirements and responsibilities for managing DOE facilities and fleets under EO13423 and the TEAM Initiative. It also directs each DOE site to develop and commit to an Executable Plan that formalizes its plans meeting the goals outlined in DOE Order 430.2B.

A. Energy Efficiency

The purpose of this TEAM goal is to reduce energy intensity in non-exempt facilities by no less than 30% on average by FY2015, relative to the site energy use in FY2003 as outlined in DOE Order 430.2b, 1.b.(1) and Attachment 1, 5.a.

PPPL's Annual Energy Management Report was submitted to DOE in December 2007 showing 37% lower energy intensity in the site's non-exempt facilities against the FY2003 baseline, meeting the energy efficiency goal (see graph below). PPPL achieved this reduction in energy intensity through a variety of measures, including energy efficient equipment upgrades, expanded lighting and temperature controls through the Building Automation System (BAS), operational changes in the central steam plant, and system configuration changes to the chilled water system to save on pumping power consumption. PPPL will continue to focus on energy efficiency improvements and currently projects that it will continue to meet the energy efficiency goals on EO13423 and DOE Order 430.2B.



In April 2008, during its annual Earth Day celebration, PPPL became the first DOE facility to join the ENERGY STAR® program as an ENERGY STAR® Partner. As a Partner, PPPL is using ENERGY STAR® tools, such as Portfolio Manager, to baseline and track its energy use, develop energy reduction targets, and share lessons learned with employees, other DOE facilities, and the community. In December 2008 the Lyman Spitzer Building (LSB), PPPL's main office building, earned the prestigious ENERGY STAR® label with a score of 81, indicating that it is among the top 20% of facilities in the United States in energy performance. The LSB is only the eighth building in the DOE complex to earn the ENERGY STAR® label.



PPPL and the DOE Princeton Site Office (PSO) engaged the DOE Mid-Atlantic Super Energy Savings Performance Contract (ESPC) process in FY2008 to evaluate potential ESPC implementation. Constellation Energy conducted a site visit, evaluated a number of energy conservation measures (ECMs) and prepared an Initial Proposal for an ESPC project. The project included several operational ECMs, evaluation of renewable energy options, and a biomass boiler. Further evaluation of the proposal, discussions with Constellation and DOE, and review by the DOE proposal review board determined that a cost-effective ESPC project could not be developed for the PPPL site without additional DOE-allocated funding to support the project. Such funding was not available and the ESPC project was discontinued.

PPPL's Advanced Metering Plan has been updated for FY2008 as required by DOE. The Advanced Metering Plan outlines the prioritized installation of advanced electric meters at PPPL buildings to meet the FY2012 deadline. PPPL is ahead of schedule, having completed the installation of five advanced meters, and has six additional meter installations planned for FY2009. PPPL's plan outlines a combination of operating and GPP funding to support completion of the advanced metering transition. PPPL has building-level utility metering (e.g., steam, chilled water, potable water, etc) at certain buildings, but not all buildings on the campus. PPPL will implement additional building-level utility metering in conjunction with its high performance and sustainable buildings (HPSB) initiative (see Section E, below) as funding allows.

New Jersey's electricity market was deregulated in August 2003. Since that time PPPL's electricity rates have fluctuated depending on electricity demand and other market factors. In order to manage utility costs PPPL has implemented a number of electric load-shedding processes to reduce electricity usage during periods of peak demand. Non-critical systems are shutdown or reduced, lighting is curtailed in certain areas and employees are asked to turn off unneeded electrical devices. In FY2008, PPPL shed an average of 500 kW of base load during peak demand periods. PPPL continues to evaluate participation in formal demand response programs, either through the PJM interconnect or third-party providers, where such participation is economically advantageous to DOE and the Laboratory.

PPPL has conducted a number of building- and process-level energy audits in the past in conjunction with various energy-conservation projects and initiatives. PPPL will continue to implement energy audits in conjunction with its HPSB initiative (see Section E, below). The

evaluation of existing buildings for LEED or other HPSB certification will include energy audits and the retro-commissioning of building systems and equipment. The evaluation and commissioning work will be completed with a combination of in-house PPPL resources and subcontracted services. PPPL will perform energy audits of major non-exempt facilities by April 30, 2009 (six months from the inclusion of DOE Order 430.2B in PPPL's operating contract) and will conduct energy audits of 25% of non-exempt buildings each year for the next four years and will re-evaluate building energy performance every four years thereafter. Priority will be given to buildings that are occupied during normal work hours and where significant energy use is identified.

In addition to the accomplished energy reductions, PPPL has identified additional areas where additional energy reductions can be accomplished. The following energy efficiency projects are currently being implemented:

- Upgrade of Central Boiler System Controls - This project is a multi phase project to upgrade the controls on three boilers. The first boiler will be completed in the first quarter of FY2009 and is projected to save 8-10% in natural gas and fuel oil consumption. The project has a projected simple payback period of less than four years and is funded through PPPL's GPP program.
- Single Pane Window Replacement - 250 old single-pane windows with an R-value of ~1 have been identified for replacement throughout the site. 131 of those windows are scheduled to be replaced, using GPP funding in FY2009. This project is expected to improve significantly the thermal performance of several buildings in the Laboratory's older core facilities.

PPPL will continue to identify and implement best practices with regard to energy efficiency. Further expanding the use of automated controls for lighting and HVAC systems, using Start/Stop time optimization based on building-specific thermal characteristics and the purchase of ENERGY STAR® certified equipment are initiatives being pursued through operating funding.

The Energy Efficiency metrics table below provides a summary of PPPL's energy efficiency performance from FY2003 through FY2007:

		2003	2007		
Gross Square Feet		499,113	517,271		
Total Buildings Energy Use (MBtu)		88,339	57,916		
ESPC Project or Energy Conservation Measure *	Actual or Estimated Energy Saved MBtu/yr (Contribution to Buildings 30% goal from Total Savings)	Actual or Estimated Implementation Cost	Expected Year of Implementation	Funding Source (ESPC, UESC, Overhead, GPP, Other)	For ESPCs, indicate expected date of Delivery Order Award
Boiler Control Upgrades	2.45	\$127K	FY2009	GPP	N/A
Phase 1 Window Replacements	628.5	\$293K	FY2009	GPP	N/A
Phase 2 Window Replacements	571	\$285k	FY2010	GPP	N/A

B. Renewable Energy

The purpose of this goal is to maximize installation of on-site renewable energy projects at sites to acquire at least 7.5 percent of each site's total (buildings and metered process) annual electricity and thermal consumption from on-site renewable sources by FY 2010, (DOE Order 430.2B, 4.c.(2) and Attachment 1, 6.b, as well as the Energy Policy Act (EPACT) of 2005, Section 203 and E.O. 13423, Section 2 (b)).

PPPL and the DOE Princeton Site Office (PSO) have pursued renewable energy projects for several years, engaging the Federal Energy Management Program (FEMP) and the National Renewable Energy Laboratory (NREL) to conduct feasibility studies for a large-scale photovoltaic solar power installation. The NREL feasibility study was updated in October 2008 to address current New Jersey energy market conditions and on-site technical considerations.

PPPL and DOE-PSO also engaged the DOE Mid-Atlantic Super ESPC Contract process in FY2008 to evaluate potential ESPC implementation that would include energy conservation measures, photovoltaic energy generation and an on-site biomass boiler. Constellation Energy conducted a site visit, evaluated a number of energy conservation measures and prepared an Initial Proposal for an ESPC project. Further evaluation of the proposal, discussions with Constellation and DOE and review by the DOE proposal review board determined that a cost-effective ESPC project could not be developed for the PPPL site.

Following the ESPC process, PPPL and DOE-PSO have engaged the Defense Energy Supply Center (DESC) and Federal Energy Management Program (FEMP) to pursue a potential on-site photovoltaic (PV) renewable electricity project through a long-term power purchase agreement (PPA). Tax credits, state rebates, solar renewable energy certificates (SRECs) and other economic incentives that contribute substantially to the financial success of PVs are not available to DOE and Princeton University, but could contribute to a third party-financed project. PPPL and DOE-PSO are working with FEMP and DESC to develop the criteria for a competitive proposal process to implement an on-site PV project. Preliminary estimates indicate that as much as 1.4 MW of on-site renewable generation capacity is technically feasible at the site. The terms and conditions of the PPA proposal will determine the scale of the project and if such a project is lifecycle cost effective for DOE and the third-party owner.

If a viable PPA-funded renewable energy project can not be developed at PPPL, additional appropriated funds would be required to meet the Executive Order and TEAM Initiative goal to maximize the use of on-site renewable electricity generation at DOE sites. Based on the NREL solar power feasibility study, approximately \$8.5 million in additional funds would be required to support a photovoltaic array capable of generating approximately 1.4 MW of electricity.

In addition to the PPA-funded photovoltaic project, PPPL is evaluating potential solar-powered street, parking and pathway lighting options. While these installations represent a small percentage of PPPL's overall electrical use and have long return-on-investment (ROI) periods, they will contribute to the DOE goal of having some renewable power at every site.

During the ESPC process a biomass boiler project was evaluated to meet the goal of providing on-site renewable thermal energy. Biomass fuel appears to be available in the PPPL area.

However, due to the relatively high implementation cost (\$1.4 million) and limited projected savings (\$100,000), the ESPC contractor determined that such a project is not lifecycle cost effective with a simple payback period of 14 years.

PPPL does not currently purchase renewable energy credits (RECs) preferring instead to pursue on-site renewable energy generation. PPPL’s previous electricity contract included a renewable energy portfolio contribution of 6%. The current contract through DESC does not include a renewable energy portfolio requirement. The current estimated price for RECs in the New Jersey region is \$4.50 per annual MWh. In order to purchase approximately 2,100 MWh of RECs, meeting the 7.5% renewable energy target, approximately \$15K of operating funds would be required.

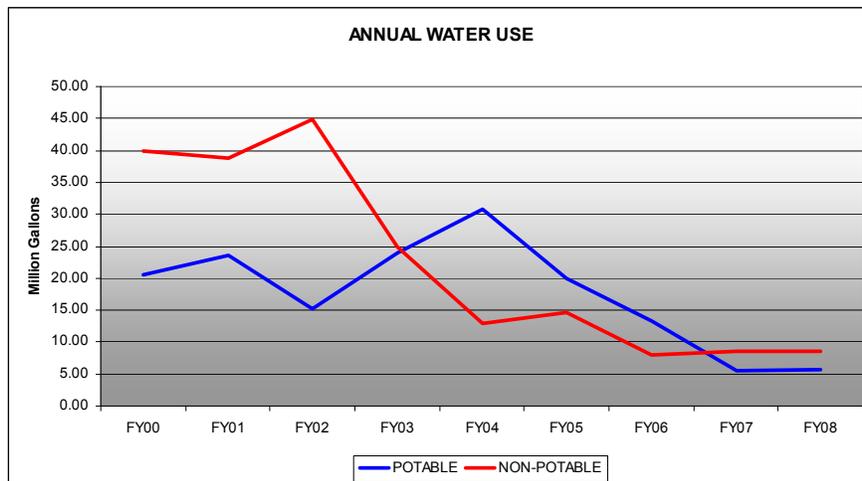
A summary of planned renewable energy projects is provided in the table below.

Renewable Energy/Thermal Energy Technology including RECs	System Size (capacity)	Total MWh/yr	Renewable Energy Initial Project Capital Cost	Funding Source (ESPC, UESC, PPA, Other)	Expected Year of Implementation
Solar Electric System	0.6 – 1.4 MW	~1.3	~\$8.4M	PPA	FY2009-10
Solar Street Lighting Pilot	50 kW	0.05	\$55k	Operating Funds	FY2009-10
Renewable Energy Credits	2100 MWh	2100	\$15k	Operating Funds	FY2009

C. Water

The purpose of this goal is to reduce potable water use by no less than 16 percent by FY 2015, relative to the site potable water use in FY 2007, (DOE Order 430.2B, 4.b.(4) and Attachment 1, 5.d.).

PPPL has made significant progress since FY2000 in reducing the use of both potable and non-potable water (see graph below). Potable water use is down 73.5% since 2000 and non-potable water use is down 78.7%. Total water use is down 76.4 % during this period. These reductions were made during a period of consistent or growing research mission at PPPL and are not the result of mission changes.



PPPL will continue to pursue additional water conservation opportunities through its HPSB efforts (see Section E, below) including expanded use of low-flow restroom fixtures, a pilot test of waterless urinals, and continued careful management of process water systems. PPPL will also evaluate the potential for water reuse, although such a project would likely reduce non-potable water consumption and, thus, would not impact the stated goal of reducing potable water use. Continued large-scale reductions in potable water use are not anticipated because PPPL implemented those identified projects in advance of EO13423 and DOE Order 430.2B.

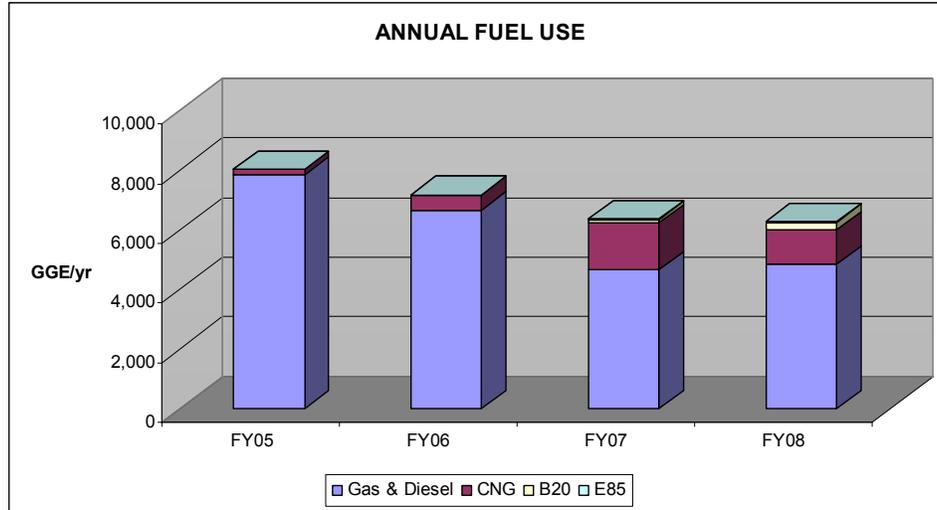
A summary of planned water conservation measures is provided in the table below.

ESPC Project or Water Conservation Measure *	Actual or Estimated Water Saved kgal/yr	Expected Year of Implementation	Actual or Estimated Implementation Cost	Funding Source (ESPC, GPP, Other)
Low-Flow Fixtures	40	FY2009 to FY2011	\$12K	Operating Funds
Waterless Urinals Pilot	45	FY2009 to FY2012	\$20K	Operating Funds
Process Water Controls	12	FY2009 to FY2012	TBD	Operating Funds

D. Transportation/Fleet Management

The purpose of this goal is to reduce petroleum fleet petroleum consumption, increase the use of alternative fueled vehicles (AFVs), and increase the use of alternative vehicle fuels to meet the goals of EPACT 1992 and 2005, E.O.13423 Section 2(g) and DOE Order 430.2B.

PPPL has moved aggressively in the area of alternative fuel vehicles (AFVs) and fleet fuel conservation and has exceeded the established goals in this area. Since FY2005, PPPL has decreased its use of petroleum fleet fuel by 38% and has increased its use of alternative vehicle fuels by nearly 900% (see graph below). PPPL has three compressed natural gas (CNG) vehicles that contribute significantly to petroleum fuel savings. PPPL has converted 85% of its covered fleet diesel vehicles to use B20 biodiesel and has begun using B20 in non-covered heavy and mobile equipment. PPPL pilot tested the use of B20 biodiesel in the John Deere “Gator” neighborhood vehicle in a test program negotiated with John Deere and currently runs a fleet of six “Bio-Gators” for on-site use. Beginning in FY2005, all suitable replacement vehicles acquired have been AFVs as part a multi-year program to transition PPPL to a fully AFV fleet as much as possible. Finally, in FY2008 PPPL initiated a GPP project to install new on-site fuel storage and dispensing systems for E85 and B20. By the first quarter of FY2009 PPPL will have fueling infrastructure to support the use of CNG, E85 and B20. PPPL will continue to pursue opportunities to reduce petroleum fuel consumption, improve overall fleet fuel efficiency, and maximize the use of alternative transportation fuels.



In FY2008 PPPL received several DOE and Federal awards for its fleet management program and its use of alternative transportation fuels. The DOE Office of Science recognized PPPL’s efforts with a Pollution Prevention “Noteworthy Practice” Award. The DOE Pollution Prevention program gave PPPL an Honorable Mention in its annual “P2 Star Awards” program. Finally, in October 2008, PPPL received the 2008 Federal Energy and Water Management Award for Fleet Management.



E. High Performance and Sustainable Buildings

The high performance sustainable buildings goal specifies that at least 15% of an agency’s building portfolio must meet standards for high performance sustainable buildings. In addition, major renovations and new construction projects must meet applicable LEED certification standards (DOE Order 430.2B, 4.d.(1) and (2) and Attachment 1, 7.a-c.).

PPPL is currently pursuing certification of the Lyman Spitzer Building (LSB) under the U.S. Green Building Council (USGBC) Leadership in Energy and Environmental Design – Existing Buildings (LEED-EB) standard. The LSB is PPPL’s largest office building and represents approximately 16% of the Laboratory’s gross building footprint. The project was registered with USGBC in October 2007 with project number 1811368944145915. PPPL is currently tracking building energy use to establish the baseline necessary for LEED and ENERGY STAR® ratings.

The project is scheduled for completion in the second quarter of FY2009. LEED-EB certification of the LSB would meet the requirement for 15% of the site's building portfolio to be high performance sustainable buildings as specified in the *High Performance and Sustainable Buildings Guidance* issued December 1, 2008.

PPPL has increasingly integrated HPSB principles and practices into facility operations and renovation projects. Beginning in FY2006 PPPL has purchased only ultra-low VOC paints and adhesives for renovation work. Over 35,000 square feet of recycled-content flooring have been installed. Waste carpeting generated during office area renovations is recycled. PPPL has a very successful construction waste recycling program, achieving a 96% construction recycling rate in FY2007. PPPL uses bio-based cleaners for office areas and restrooms and has standardized on office furniture that meets the stringent Cradle-to-Cradle[®] certification requirements for sustainability.

PPPL has completed extensive beneficial landscaping work throughout the campus and continues to enhance the site's landscaping with native and drought tolerant plants that provide wildlife habitat. Implementation of PPPL's beneficial landscaping plans over the past two years has reduced soil erosion and reduced the area of mowed lawn by 3.4 acres, resulting in 5,000 pounds per year of reduced CO₂ emissions.



As part of the LEED project, PPPL has documented numerous campus-wide credits in the categories of Sustainable Sites (SS), Materials and Resources (MR), Water Efficiency (WE) and Indoor Environmental Quality (EQ) that would be applicable to other Laboratory buildings that may be evaluated in the future. After completion of the LSB LEED-EB certification project, PPPL will screen other buildings for future qualification under the Existing Buildings standards in the *High Performance and Sustainable Buildings Guidance* (December 1, 2008).

PPPL does not currently have new buildings or major building renovation projects underway, although a major renovation and construction project is outlined under the Office of Science (SC) Strategic Laboratory Improvement Infrastructure Initiative (SLI II) program. The proposed project includes the construction of a new, contemporary Science and Technology Center and the relocation of associated science and technology research from outdated and inefficient 50 year-old facilities. In addition, the proposed project would refurbish and upgrade 30 to 50 year-old critical components of the electrical power distribution system, upgrade the Building Automation System for the purpose of maximizing energy efficiency, upgrade and modernize HVAC, cooling water, steam, and control systems in critical areas of the Laboratory which have been deteriorating and negatively impacting the development and operation on small experiments.

New construction and major renovation projects, including the SLI II project, will be designed to meet the EO and TEAM goals of LEED-Gold certification, building-level energy metering, renewable energy systems, and campus-wide sustainability measures to the maximum extent practicable. The evaluation of existing buildings for LEED or other HPSB qualification will include energy audits and the retro-commissioning of building systems and equipment.

F. FY2009 Executable Plan Performance Measures

The PPPL performance metrics table below outlines the expected implementation of key measures in this Executable Plan for FY 2009:

<u>Performance Category</u>	<u>FY2009 Target</u>
1. Energy Efficiency	<ul style="list-style-type: none"> • Maintain 30% or more reduction in energy intensity relative to FY2003 baseline. • Phase I central plant boiler control upgrades. • Phase I window replacement project. • Complete energy audits of major non-exempt buildings. • Further improve energy efficiency with lifecycle cost effective projects.
2. Renewable Energy	<ul style="list-style-type: none"> • Solicit proposals for on-site renewable energy project through a power purchase agreement (PPA) if lifecycle cost effective. If the PPA is not economically viable, appropriated funds would be required to pursue this large-scale renewable energy project at PPPL. • Pilot test solar-powered parking and pathway lighting.
3. Water	<ul style="list-style-type: none"> • Solidify water savings performance improvements made since FY2000 through process water management. • Expand use of low-flow restroom fixtures and pilot test waterless urinals.
4. Transportation/ Fleet Management	<ul style="list-style-type: none"> • Complete installation of B20 and E85 refueling infrastructure. • All suitable replacement vehicles will be AFVs or more fuel efficient than current vehicles.
5. High Performance & Sustainable Buildings	<ul style="list-style-type: none"> • Complete LEED-EB and ENERGY STAR® certification of the LSB, meeting the 15% target. • Evaluate additional campus-wide LEED credits. • Enhance energy management capabilities by implementing PPPL's Advanced Electric Metering Plan.