

BROOKHAVEN NATIONAL LABORATORY

FY 2019 Site Sustainability Plan



This page is intentionally blank.

Table of Contents

LIST OF TABLES AND FIGURES	III
I. EXECUTIVE SUMMARY	1
II. MISSION CHANGE.....	3
II. PERFORMANCE REVIEW AND PLAN NARRATIVE	4
Energy Management.....	4
Water Management.....	13
Waste Management	18
Fleet Management.....	22
Renewable Energy	23
Green Buildings.....	25
Acquisitions & Procurement	27
Measures, Funding, & Training	30
Travel & Commute	32
Fugitives & Refrigerants.....	35
Electronic Stewardship	38
Organizational Resilience.....	42
APPENDIX A: DASHBOARD DATA ACCURACY SELF-CERTIFICATION	44
APPENDIX B: COMPREHENSIVE SCORECARD	45
APPENDIX C: LIST OF ACRONYMS & ABBREVIATIONS	53

List of Tables and Figures

List of Tables

Table 1: Sustainability Funding	30
Table 2: Fugitive GHG Emissions	36

List of Figures

Figure 1: EUI for Non-Excluded Buildings	5
Figure 2: BNL Historical and Projected Electricity	9
Figure 3: Electricity and REC Cost – Actual and Projected	10
Figure 4: Annual Potable Water Use (1999-2018)	13
Figure 5: 2015 Potable Water Utilization	14
Figure 6: Forecasted Annual Potable Water Use (2007-2028)	17
Figure 7: BNL’s Recycling Rate	18
Figure 8: Scope 3 GHG Emissions	32

I. Executive Summary

Brookhaven Science Associates (BSA) is pleased to submit this annual Site Sustainability Plan for Brookhaven National Laboratory (BNL). Effectively managing such a large, diverse portfolio of programs takes many committed individuals working towards a common goal. This document is the work of a large cross-functional team of BSA employees both within the science directorates as well as the support or operations directorates.

BNL is operated and managed for the Department of Energy Office of Science (DOE-SC) by BSA, a partnership formed by Stony Brook University (SBU) and Battelle Memorial Institute. BNL is staffed by over 2,600 research and support employees and hosts an even greater number of facility users, guest researchers, and scientists annually. The Laboratory operates from an extensive campus located in Upton, New York, on 5,320 acres with approximately 4.9 million gross square feet (gsf) of space in over 300 buildings.

BNL conceptualizes, designs, builds, and operates major scientific facilities and makes them available to university, industry, and government researchers in support of the SC mission. The sustainability vision for BNL leverages this unique combination of access to diverse research talent, stewardship for a significant national research infrastructure, and a location in the energy intensive northeastern United States.

As a result, BNL is well established as a northeastern regional resource for sustainability expertise and is effectively utilizing its physical infrastructure to demonstrate sustainability technology. This approach to development and deployment of technology, combining the unique resources of both research and operations, is the vision of the BNL Site Sustainability Plan (SSP) to help ensure a successful future for our nation.

The Laboratory's efforts in sustainability have been consistent over the last several years and they focus on four broad principles:

1. Striving to be climate neutral through reducing energy use and effective energy management;
2. Lowering the environmental impact of the campus through sustainable infrastructure;
3. Leveraging research in conjunction with our operations and in support of the northeastern region;
and
4. Fostering a culture of sustainability with our employees and our community.

The Laboratory remains strongly committed to supporting and achieving the targets in the DOE Strategic Sustainability Performance Plan (SSPP). Leadership in sustainability is demonstrated through the Laboratory's management practices, stewardship of the BNL campus, as well as our research and education programs. The efforts in sustainability are communicated widely across the Laboratory, and the Senior Leadership team remains actively engaged.

BNL's energy management program continues to be the centerpiece of our Sustainability program. We continue to maintain solid relationships with local utility providers ensuring cost effective power rates for operating the energy intensive user facilities and general infrastructure. BNL collaborates with the local utilities to leverage purchasing power and assist in renewable energy production to jointly support the goals of BNL and the New York region.

BNL continues to host the Long Island Solar Farm (LISF), a solar photovoltaic (PV) power plant, developed through a collaboration that included BP Solar, the Long Island Power Authority (LIPA), and DOE. The LISF, located on the BNL site, began delivering power to the LIPA grid in November 2011. The LISF is made up of 164,312 PV panels and can produce up to 32 MW of electricity.

Additionally, the Laboratory has developed the Northeast Solar Energy Research Center (NSERC) on its campus that serves as a solar energy research and test facility for the solar industry. The mission of the NSERC is to support the expansion of solar power by providing high-quality data, field-testing, analyses, and solar energy expertise to address technical, economic, environmental, and policy issues facing solar power deployment in northeastern climates. The NSERC will be a proving ground for BNL and our industrial partners to test new solar technologies, including electrical inverters, storage devices, and solar modules, which effectively adds solar energy research to the user facility portfolio of BNL.

These projects demonstrate how BNL is continuing to collaborate with many organizations both internally and externally to enhance research at the Laboratory with the sustainability goals in mind. Staff members from the BNL Environment, Biology, Nuclear Science, and Nonproliferation (EBNN) Directorate, Facilities & Operations (F&O) Directorate, Information Technology Division (ITD), and the DOE Brookhaven Site Office (BHSO) have been instrumental in preparing our research agenda and developing a plan to bring it to fruition.

The Comprehensive Scorecard illustrates the areas we've been extremely successful, and they include compliance with the Guiding Principles (GPs) of High Performance Sustainable Buildings (HPSB), construction and demolition recycling, fleet management, and sustainable purchasing.

The Laboratory has made significant progress this year in meeting the goals of the SSPP. We have challenges that we are working on creative solutions to overcome. This coming year we will be maintaining focus on those areas that are performing well and will be concentrating on making improvements in those areas that are not on track to meeting the requirements, including evaluating zero emission buildings, GHG emissions, as well as data center efficiencies.

Sustainability remains an important focus for BNL. BSA and BHSO work collaboratively on these efforts. We continue with our quarterly meetings to ensure that we are on track to meet the goals as well as to discuss challenges in meeting these goals. This is a marathon, not a sprint and requires a strong team effort to ensure that we continue to press forward in doing our part to protect the environment. We are on a very good path.

A copy of the Comprehensive Scorecard for BNL is provided in Appendix B.

II. Mission Change

This category discusses mission changes and program direction over the next five to ten years. It includes potential impact on sustainability goals and provide projections. For major initiatives, it discusses the site strategic vision and how sustainability goals will be influenced.

BNL expects High Performance Computing to continue to grow. Supporting that, the new Core Facility Revitalization (CFR) facility will meet or exceed High Performance and Sustainable Buildings (HPSB) Guiding Principles as referenced in the DOE Order 413.3B and Executive Order 13693 and comply with the Data Center Optimization Initiative (DCOI) metering and power usage guidelines. Construction subcontract provisions require the use of environmentally preferred products and services to the maximum extent possible. Throughout construction, environmentally sensitive construction practices will be followed to reduce site disturbance, minimize construction waste, and improve indoor air quality. The CFR construction will include a construction waste management plan and a construction Indoor Air Quality Management Plan. Waste management requirements will include recycling and waste minimization actions.

In addition, the Science User and Support Center (SUSC) project funded through the Science Laboratories Infrastructure (SLI) program will be designed to meet or exceed the HPSB requirements. All new equipment and new systems will be selected to maximize energy efficiencies and green building technologies.

BNL expects a slow growth in National Synchrotron Light Source II (NSLS-II) beamlines over the 10-year planning period that will slightly increase energy use at NSLS-II.

Towards the latter part of the planning period, the BNL initiative to transition the Relativistic Heavy Ion Collider (RHIC) to an Electron-Ion Collider (EIC) will come into play, which will for the first time enable researchers to measure the properties of gluons contained in nucleons and nuclei with precision and to study how these fields generate nearly all of the mass of visible matter in the universe. The BNL version of an EIC is called eRHIC; however, the site selection has not yet been made. This would require the addition of a few additional buildings, but details are not yet known.

BNL continues to look for consolidation opportunities to right-size the site and thus eliminate the older WW II-era buildings which do not meet the Guiding Principles.

II. Performance Review and Plan Narrative

Energy Management

This category focuses on all energy-related topics such as energy intensity, metering and benchmarking, Energy Independence & Security Act (EISA) §432 audits, non-fleet fuel use, and greenhouse gas (GHG) emissions.

Performance Status

Energy Intensity

BNL's energy intensity for FY18 was 231,564 Btu/gsf and was 4.7% lower than the relatively new base year of 2015. It is important to note that BNL was able to meet each of the previous three (3) energy intensity reduction goals of 30%, all of which had earlier base years.

Energy intensity is easily affected by many factors, including several beyond our ability to control, the most significant of which is weather. Being located in the Northeast results in the fuel for heating being the most dominate energy source for our buildings. Other factors include changing outdoor air code requirements, increased density of new facilities, and constantly changing technologies including computers and related IT systems, lighting, and others.

Figure 1 (below) depicts the energy use intensity (EUI) for non-excluded buildings (i.e., goal subject ones) at BNL greater than 5,000 gsf with an EUI of 150 kBTU/GSF or above:

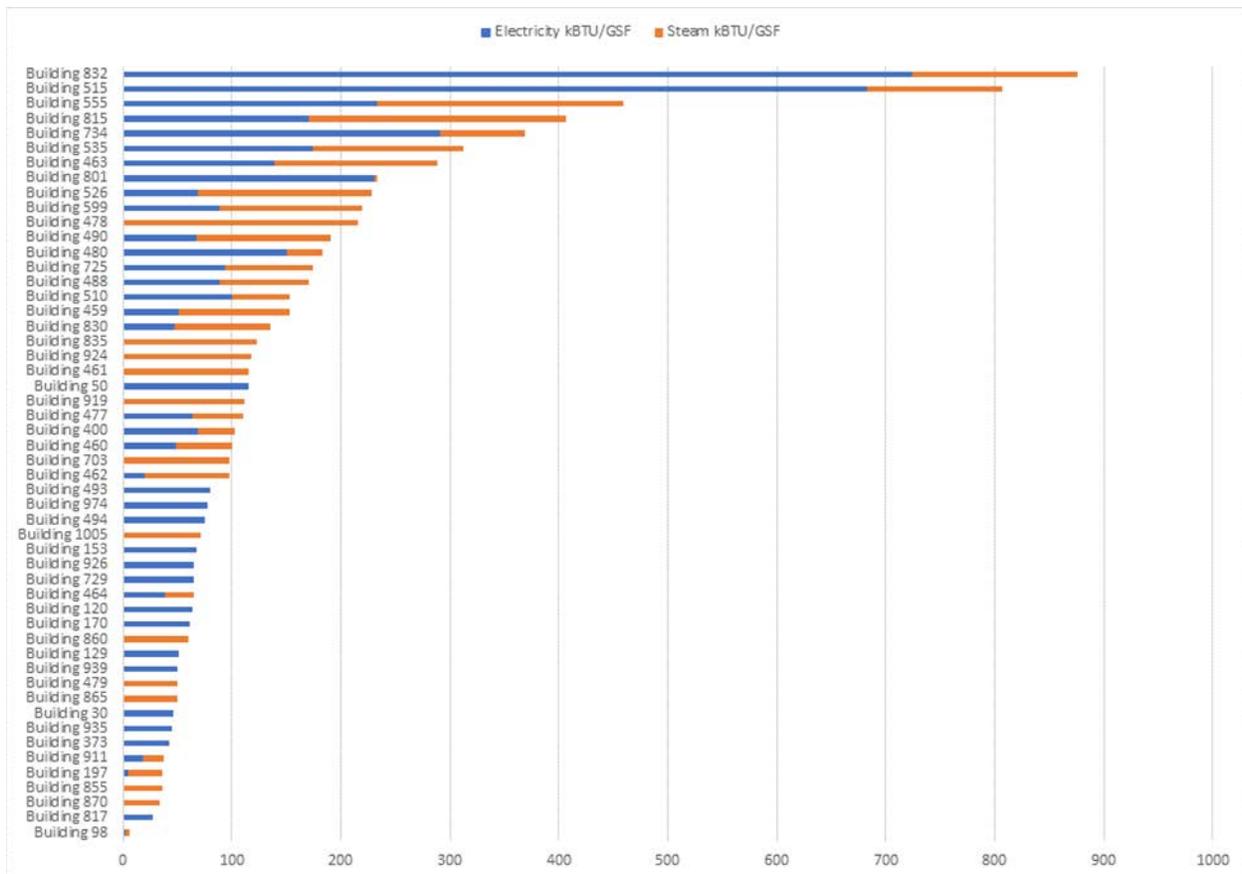


Figure 1: EUI for Non-Excluded Buildings

FY18 was the third full year with the results of the Utility Energy Service Contract (UESC) Phase I project. The energy savings were once again verified and contributed to the lower energy intensity value. Additionally, the Temperature Setback Policy is continually communicated to the Laboratory via several methods, including Earth Day events and presentations to facility managers and Laboratory management.

BNL is continuing to develop a second UESC project—UESC Phase II—that in addition to energy and GHG deductions will also target deferred maintenance in the areas of greatest need.

The biggest factor affecting BNL’s ability to continue to reduce energy intensity is our lower electricity rates and current low fuel prices. While the low rates/prices are excellent for continuing our research programs they make it extremely difficult to find cost-effect projects, particularly when most of the most attractive projects have already been completed. Regardless, BNL will continue to strive to reduce energy intensity.

BNL has a long-standing, well developed energy conservation program that utilizes a number of the tools and Best Management Practices (BMP) including:

- Utilizing the latest Building Automation System (BAS) software to identify inefficiencies (remote auditing);
- Participating in Demand Management programs;

- Entering performance data in Environmental Protection Agency (EPA) Energy Star Portfolio Manager;
- Utilizing the latest BAS software to communicate building energy usage (effectively “Green Button”);
- Space management and optimization practices;
- Comprehensive Data Center metering and monitoring; and
- Targeting Data Center power utilization effectiveness (PUE) of less than 1.5 for existing facilities and 1.2 to 1.4 for new facilities.

Deferred Maintenance Reduction

BNL’s recently completed UESC project specifically targeted buildings that had systems in need of maintenance and replacement of obsolete controls and lighting. Not only was our deferred maintenance reduced by approximately \$8.9 million but energy efficiency was also improved. BNL is in the process of developing a second UESC project—UESC Phase II—that in addition to energy and GHG deductions, will also target deferred maintenance.

Life-Cycle Cost Analysis

Virtually all of BNL’s major initiatives and all energy related projects have Life-Cycle Cost (LCC) Analyses performed to ensure that they are economically viable. The level of rigor is based on numerous factors including the complexity, scope, environmental impact, and cost of the project/initiative. DOE’s Building Life-Cycle Cost (BLCC) programs, among several others are used for the evaluations.

Fossil Fuel Reduction (EISA Section 433) in New Buildings

BNL strives to reduce fossil fuel use in new buildings by having them designed and constructed to the most efficient, cost effective levels possible. By meeting the High-Performance and Sustainable Buildings (HPSB) criteria, energy use is minimized. Further, alternatives to fossil energy sources are thoroughly evaluated (renewable energy, daylighting, ground source heat pumps, etc.) during the design.

Energy and Facility Manager Training

The manager of Energy Management at BNL is a Certified Energy Manager (CEM). In addition, all of the facility complex managers (FCMs) throughout the BNL campus have the Certified Facility Manager (CFM) recognition from the International Facilities Management Association (IFMA). All of the FCMs and Facility Complex Engineers (FCEs) participate in various training programs throughout the year to ensure core competencies.

New Construction Design for 30% Improvement over ASHRAE 90.1 2010

All new construction designs at BNL are required to design for a 30% improvement in energy efficiency, as compared to ANSI/ASHRAE/IESNA Standard 90.1, whenever cost effective.

DOE Better Buildings Program / ISO 50001 Ready Program

BNL is in the preliminary stages of evaluating the DOE Better Buildings Program. Recent discussions regarding ISO 50001 have taken place.

EISA Section 432 Evaluations and Benchmarking

Energy audits of HVAC systems, lighting, and office equipment will continue to be used to identify opportunities for energy conservation. The findings will help to develop policies on operation and equipment needs. These audits are being performed in conjunction with ongoing Facility Condition Assessment (FCA) surveys in order to reduce additional costs and administrative oversight needs. All information has been placed in EPA's Portfolio Manager Program for benchmarking.

Information from the energy and water audits is being taken into consideration with the development of BNL's UESC II project.

Measurement and Verification (M&V)

Measurement and Verification (M&V) is an important process to ensure performance of energy and water conservation projects. BNL's existing comprehensive metering system is and has been a tremendous resource for our M&V efforts. For the UESC Phase I project a Performance Assurance Plan was used to verify project performance after initial completion and will continue to be used going forward. BNL was intimately involved with the development of his plan. With the UESC I project BNL required the contract to complete the first year M&V effort. For the remaining years BNL has the responsibility of reporting on the project performance. This approach has worked extremely well and will be used as a model for other M&V related efforts going forward.

Facility Metering

BNL continued its long tradition of advanced metering efforts in FY18 and is meeting the metering goals for electricity, natural gas, and chilled water. During FY18 two (2) additional advanced electric meters were installed; three (3) advanced chilled water meters were replaced; and two (2) advanced steam meters were installed and two (2) existing advanced meters were connected to the building automation system.

Overall, 290 advanced electric meters are installed and they capture over 98% of consumed electricity. Of the 159 buildings greater than 4,000 square feet, 151 (95%) advanced meters are installed.

Chilled water is metered at 100% with thirty-four (34) advanced chilled water meters installed in 34 buildings or loads with chilled water, and all three (3) of BNL's natural gas-supplied facilities have advanced meters installed.

Approximately 90% of the steam consumption is metered with advanced steam/condensate metering in 44 of the largest buildings. However, 24 buildings still have conventional steam meters that will be upgraded as appropriate. BNL will install new steam metering in larger use buildings where steam metering is insufficient with a goal of upgrading three or more meters per year. This will assist in our planned steam charge-back effort.

Due to the low cost of water, the installation of water meters is not economically justifiable. However, BNL's major facilities with cooling towers, as well as new buildings and major renovations include water

metering. A substantial amount of the water used at BNL is utilized by cooling towers, most of which are currently metered. BNL plans to meter all cooling towers within the next few years.

As previously stated BNL has a long history of advanced metering dating back over 35 years. Energy data is utilized for the following purposes:

- Verification of utility bills.
- Internal utility cost re-distribution of all energy streams (electric, chilled water, steam) to various departments and organizations.
- M&V for both third party and internal energy and water conservation projects.
- Participation in electric load curtailment programs that allows BNL to reward individual departments and organizations in direct relation to their contribution to the curtailment.
- Live monitoring of energy usage.
- Troubleshooting and evaluation of unusual loads.
- Sizing of energy distribution systems.
- Energy use optimization when combined with the site-wide energy management control system.

Electric Usage Projections

The following chart summarizes BNL’s historical and projected electricity usage for High-Energy Mission-Specific Facility (HEMSF) and the Site Base.

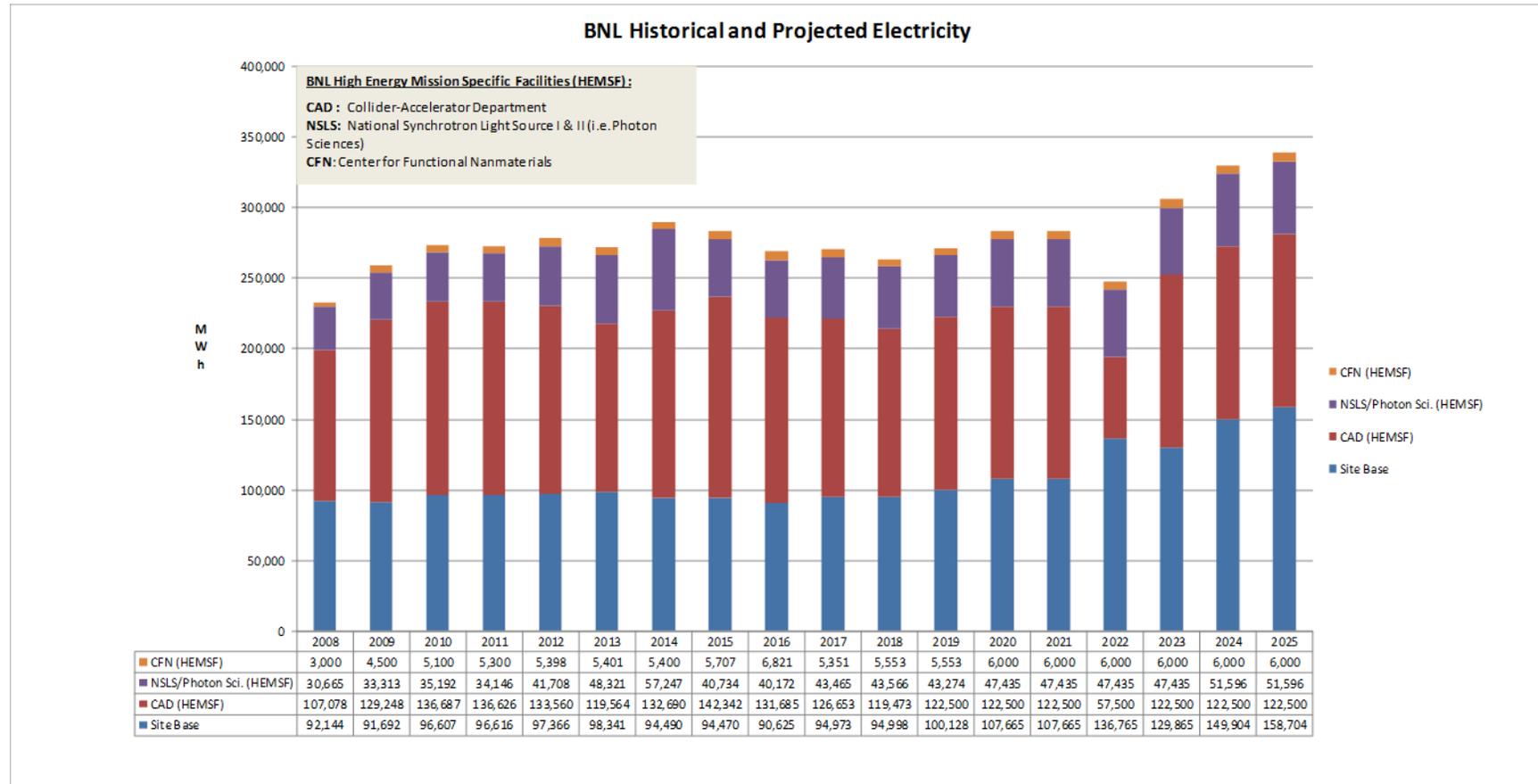


Figure 2: BNL Historical and Projected Electricity

The electric projections take into account current plans, HEMSf operation schedules, and anticipated future projects, including the Core Facility Revitalization Project (CFR) that will consolidate and expand BNL’s data center operations.

Electricity and REC Cost Projections

The chart below shows electricity and Renewable Energy Credit (REC) cost history and projections. REC pricing rates through FY18 are actual. BNL made advanced purchases due to the attractive pricing available of \$0.0007/kWh.

However, given the increasing renewable and clean energy requirements from not only the federal government, but many other entities, including New York State’s 50% renewable by the year 2030 goal, rates are expected to increase substantially. The table assumes that rates will increase to ~\$2/MWh by 2019 and to ~\$5/MWh by 2025. These assumptions are based on discussions with a few REC providers. These assumptions will be updated in future Site Sustainability Plans (SSPs).

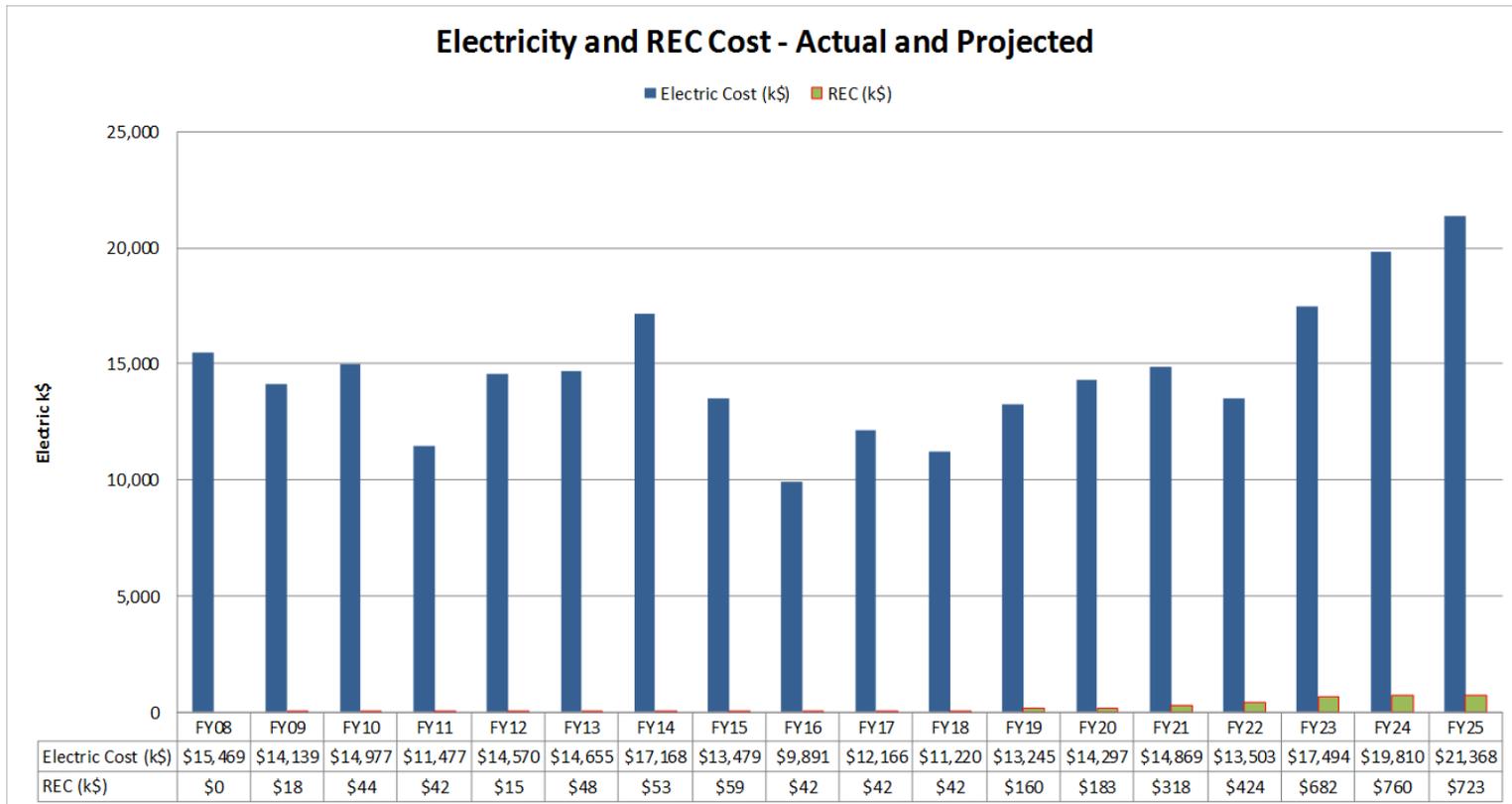


Figure 3: Electricity and REC Cost – Actual and Projected

Plans and Projected Performance

Energy Intensity

One of the biggest challenges for BNL will be continuing goals of further energy intensity reductions. Since the late 1970's, BNL has implemented numerous energy conservation projects, meeting all three previous energy intensity reduction goals of 30% (1985 vs. 1973), 30% (2003 vs. 1985), and 30% (2015 vs. 2003). As a result of these past efforts, BNL has reduced our energy intensity by approximately 440,000 Btu/sq. ft. (66%). Unfortunately, the previous reductions make it very difficult to identify new cost-effective projects.

As previously stated, BNL has begun a UESC Phase II effort. If cost-effective projects can be identified for Phase II, BNL will be able to reduce energy intensity. All energy-related projects will be analyzed using Life-Cycle Analyses.

Heating, Ventilation, and Air Conditioning (HVAC) Setback

A setback capability for HVAC systems continues to be implemented throughout the BNL campus. The FCMs and their staff regularly evaluate systems to ensure that this function is operating as intended. Setback will be captured by using the new Building Automation Program. FCMs will communicate with building occupants about energy usage and the benefits of HVAC setback and energy conservation. Any future lease agreements will be modified to incorporate setback clauses. Further, the existing preventative maintenance (PM) program was recently enhanced for all HVAC systems. The HVAC setback initiative will continue to be emphasized in FY18 as part of BNL's educational effort for the facility managers. This is part of a larger site-wide effort to encourage active employee participation in various conservation efforts.

Steam Charge-back

A steam cost charge-back program was developed for implementation in the near future to encourage energy conservation. BNL uses direct charges to bill occupants for electricity and chilled water, and finds it to be one of the most effective methods to increase energy conservation. One option under consideration is to have the steam charges be phased into a full cost recovery program over several years to accommodate the varying financial impacts to each building's occupants. It is estimated that this should provide energy savings of approximately 62,000 mmBtu/year.

Lighting Upgrades

Planning will continue for BNL's ongoing program of upgrading lighting through the Laboratory with high efficiency replacements. Automated controls will be installed where appropriate.

Metering

Additional meters will be installed as opportunities become available. Electric and steam meter installations often require extensive coordination and shutdown of operations. BNL strives to install at least five (5) electric meters and three (3) steam/condensate meters annually but a number of factors affect our ability to complete the work. The biggest issue is limited funds and coordination of building operations if shutdowns are required. In FY18 just two (2) advanced electric meters were installed due to limited resources with BNL's energy and utilities division.

Water Management

This category focuses on activities undertaken to reduce potable and non-potable water consumption, comply with stormwater management requirements, and improve water efficiency.

Performance Status

BNL obtains its potable, process cooling, and fire protection water from Long Island’s underground aquifer. BNL runs its own New York State (NYS)-regulated “community water system” which consists of five (5) water wells, a Water Treatment (Iron Removal / Filter) Plant, two (2) elevated water storage tanks with a capacity of 1.3 million gallons, and an underground distribution system with about 45 miles of piping, valves, and hydrants.

BNL has a long history of reducing water consumption – even though water on Long Island is plentiful and inexpensive. BNL has conducted an effective water-reduction and conservation program for more than 20 years, illustrated in Figure 4 by the trend in annual potable (includes process) water usage.

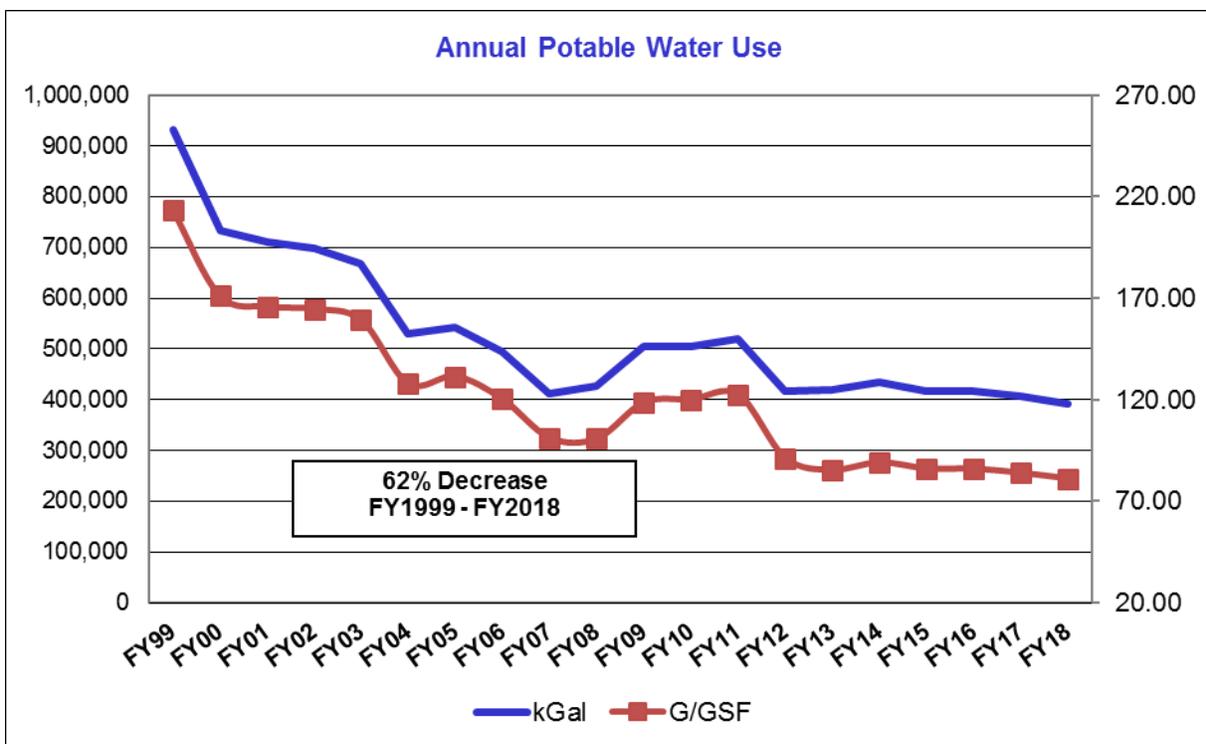


Figure 4: Annual Potable Water Use (1999-2018)

Potable-water usage fell from 931 million gallons/year in FY 1999 (average of 2.55 million gallons per day) to about 393 million gallons/year in FY 2018 (average of 1.07 million gallons per day), a reduction of 62.0%. When normalized by site growth (building area in gross square feet), BNL’s annual water use intensity has decreased from 101 gallons per square foot to 81 gallons per square foot, a 19.8% water usage reduction since base-year 2007.

Figure 5 depicts how BNL uses its potable water, and where it goes thereafter. Note that less than 10% is used for human consumption and sanitation. The majority of BNL's water production is spent for process cooling. This non-contact cooling water is used (once-through) to cool heat exchangers and returned to the groundwater. Water is also used to make up for evaporative, drift and blowdown losses from re-circulating cooling towers. Tower blow-down is typically discharged into sanitary or storm sewers, treated, and ultimately, returns to the groundwater.

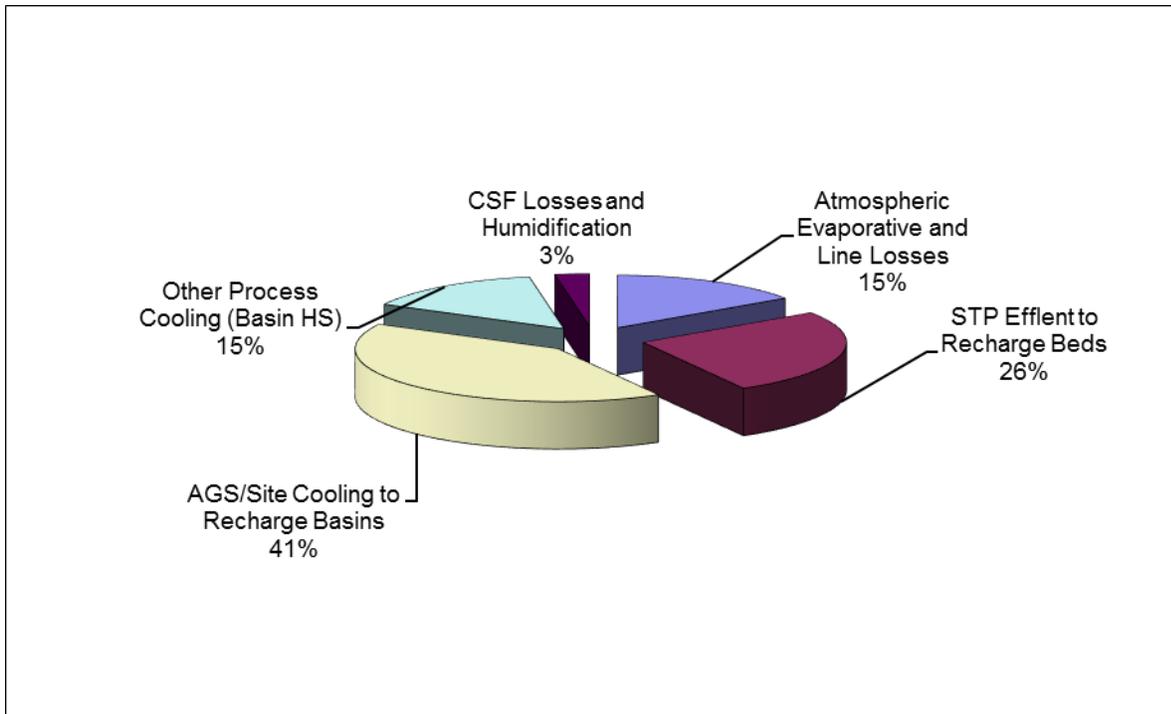


Figure 5: 2015 Potable Water Utilization

In October 2014, BNL implemented groundwater recharge of treated wastewater at its Sewage Treatment Plant. Currently, about 82% of water used at BNL is recharged (recycled) to groundwater via groundwater recharge basins. The water recharged is near potable water quality.

It is estimated that over two-thirds of BNL's water production is attributable to High Energy Mission Specific Facilities.

Plans and Projected Performance

Water Management Plan

BNL's Water Management Plan describes how BNL designs and operates the Laboratory's buildings and facilities to be sustainable and water efficient. It outlines our efforts to continue to reduce water usage by implementing best-management practices. The E.O. 13693 goals require that BNL reduce water consumption by 2% per year toward the goal of 36% reduction by FY 2025 compared to the FY 2007 baseline.

Presently, we are implementing best-management practices (BMPs) as detailed in Section 2.2 of our Water Management Plan. Implementing water conservation is a significant economic challenge. Water is plentiful and inexpensive at BNL. The variable cost of producing water currently is about \$0.50 per thousand gallons. Most water conservation measures are capital- and labor-intensive. We are always evaluating the return on investment of implementing additional BMPs. These BMPs have the potential to lower water consumption by more than 40 million gal/yr. Our ability to implement these capital-intensive measures depends upon obtaining additional benefits (such as replacing obsolete equipment, extending equipment's end-of-life, reduced maintenance costs, reducing waste water discharges to the sewage treatment plant, and increasing energy savings) and upon obtaining capital funding to install them (aligned with other priorities).

The reconstruction of Well House No. 2 on site will reduce the need to use older wells therefore reducing the Water Treatment Plant filter back-wash cycles by restoring the carbon filtration system. This has anticipated water usage reduction of 3% to 5% overall.

Finally, we emphasize that over 80% of BNL's water consumption is returned and recharged to groundwater at potable water quality. We believe that BNL's groundwater recharge fully meets the DOE's water management "recycling" or "non-consumptive" criteria (except for insignificant temperature changes). To increase the rate of on-site recharge, BNL completed a project in 2014 to re-route the treated effluent from the sewage treatment plant from



a surface water discharge to a groundwater recharge system. This project eliminates a potential source of trace metals contamination to the Peconic River and improves the quality of the river down-stream of BNL. Review of analytical data for the Sewage Treatment Plant effluent shows that the water quality meets all Federal and state groundwater quality standards. This change resulted in an increase of over 100 million gallons per year recharged locally versus off-site flow via the Peconic River.

The following paragraphs summarize BNL's past and present (ongoing) efforts in water conservation (best management practices); more details are available in BNL's Water Management Plan.

- Public Information and Education Programs. BNL's water-related public information and education programs emphasize the excellent quality of BNL's potable water supply and seek to minimize employee's use of expensive, environmentally unfriendly bottled water.
- Distribution System Audits/Metering. BNL periodically audits its water distribution system as part of infrastructure planning and utility reviews (e.g., 10-year Master Plans). BNL's utility engineers

understand BNL's water system to be "tight" and relatively leak-free. Because of the plentiful supply and low cost of water at BNL, water meters are not available at most buildings or major process users. We bill one major process user for water.

- Water-efficient Landscaping. BNL's minimal formal landscaping is compatible with the local climate and rainfall. BNL does not routinely irrigate lawns and landscape.
- Toilets and Urinals. BNL currently specifies low consumption toilets and flushometers (1.6 gallons per flush (gpf) for toilets, 1.0 gpf for urinals) for new constructions, renovations, and maintenance.
- Faucets and Showerheads. BNL specifies low-flow, WaterSense faucets and showerheads for new constructions, renovations, and maintenance.
- Boiler/Steam Systems. BNL has a district steam-system and Central Steam Facility. Depending on the season, 75-85% of the steam exported from the facility returns as condensate. (This is excellent return for a large district steam-system and the condensate return conserves water and energy).
- Single-Pass Cooling Systems. BNL has reduced water flow through single-pass cooling systems that discharge to the sanitary sewer system. The marked success of these efforts is reflected in the 55% water use intensity reduction.
- Cooling-tower Systems. To reduce water use in once-through cooling systems, BNL has 16 cooling towers with a flow rate of over 300 gallons per minute (gpm). Many other smaller towers are located around the site. To maximize cooling efficiency and minimize water use, BNL controls the blowdown rates on the large towers to maintain the "cycles of concentration" between 4 and 5.
- Water Reuse and Recycling. Over 80% of BNL's water consumption (except evaporation and drift at cooling towers) is recharged back to the ground (where the well water came from). All of BNL's process water (e.g., make-up and cooling) currently is obtained from the Laboratory's potable-water system and is accounted for in accordance with Executive Order 13693, "Planning for Federal Sustainability in the Next Decade".
- Sewage Treatment Plant Effluent Recharge. A modification to convert BNL Sewage Treatment Plant from surface water discharge (Peconic River) to groundwater recharge / recycling was completed in September 2014. Purified wastewater (effluent) from BNL operations is currently being recharged and recycled to groundwater.

All new construction and renovation at BNL will continue to utilize water-efficient processes and plumbing fixtures to conserve water.

In FY16, the Laboratory has funded engineering and design of a new Well House No. 12. Start of construction of the new well house is now planned for FY20. Total estimated cost (TEC) for the project will be about \$1,000K. The new well house will replace the well house structure destroyed in a propane explosion in October 2008. Well No. 12 is located in an area of the BNL site with low-iron groundwater. Return of Well No. 12 to operation will reduce the need operate BNL's high-iron wells – Well Nos. 4, 6, and 7. This in turn will reduce the duty on BNL 's Water Treatment (i.e., Iron Removal / Filter) Plant, and

reduce the number of backwash cycles and backwash wastewater. This could reduce BNL’s water usage by 3% to 5%.

We continue to expect that increased, “main-mission” science program activities, with their need for accelerator cooling will tend to increase water consumption, due to cooling tower evaporation. This is not as significant an issue at BNL as it is at DOE facilities located in arid locales. Groundwater recharge from annual precipitation (almost all storm water is recharged on site) is orders of magnitude greater BNL’s water usage that is “lost” due to evaporation (in evaporative cooling towers).

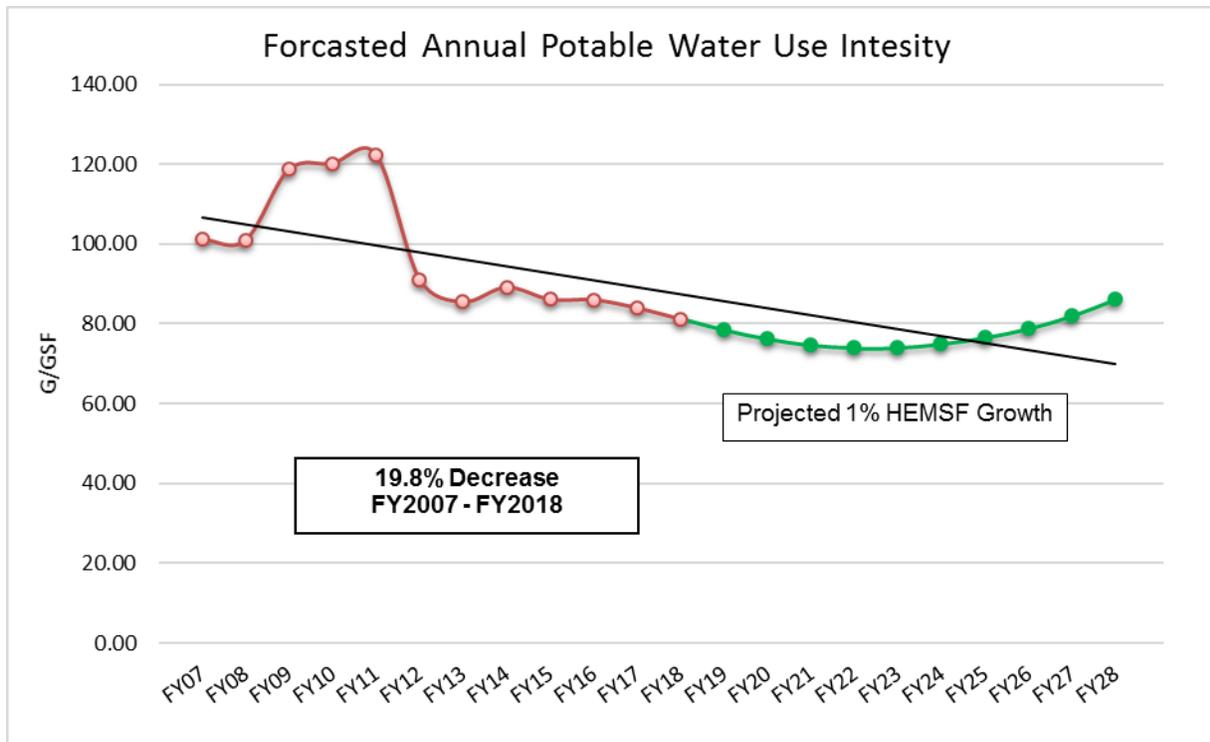


Figure 6: Forecasted Annual Potable Water Use (2007-2028)

Waste Management

This category focuses on waste management, pollution prevention, (source reduction) and recycling measures, and construction and demolition waste reduction.

Performance Status

BNL has a mature established waste reduction and diversion program that recycles the following components:

- mixed paper;
- cardboard;
- bottles and cans;
- tires;
- construction debris;
- used motor oil;
- metals;
- concrete/asphalt;
- automotive batteries;
- garnet;
- fluorescent bulbs;
- Blasocut (cutting oil coolant);
- scrap electronics; and
- animal bedding (composted).

As evidenced by the graph below, BNL's annual diversion rate on non-hazardous solid waste has been above the Department's 50% goal for the past 19 years. During FY18, the recycling rate was approximately 71%.

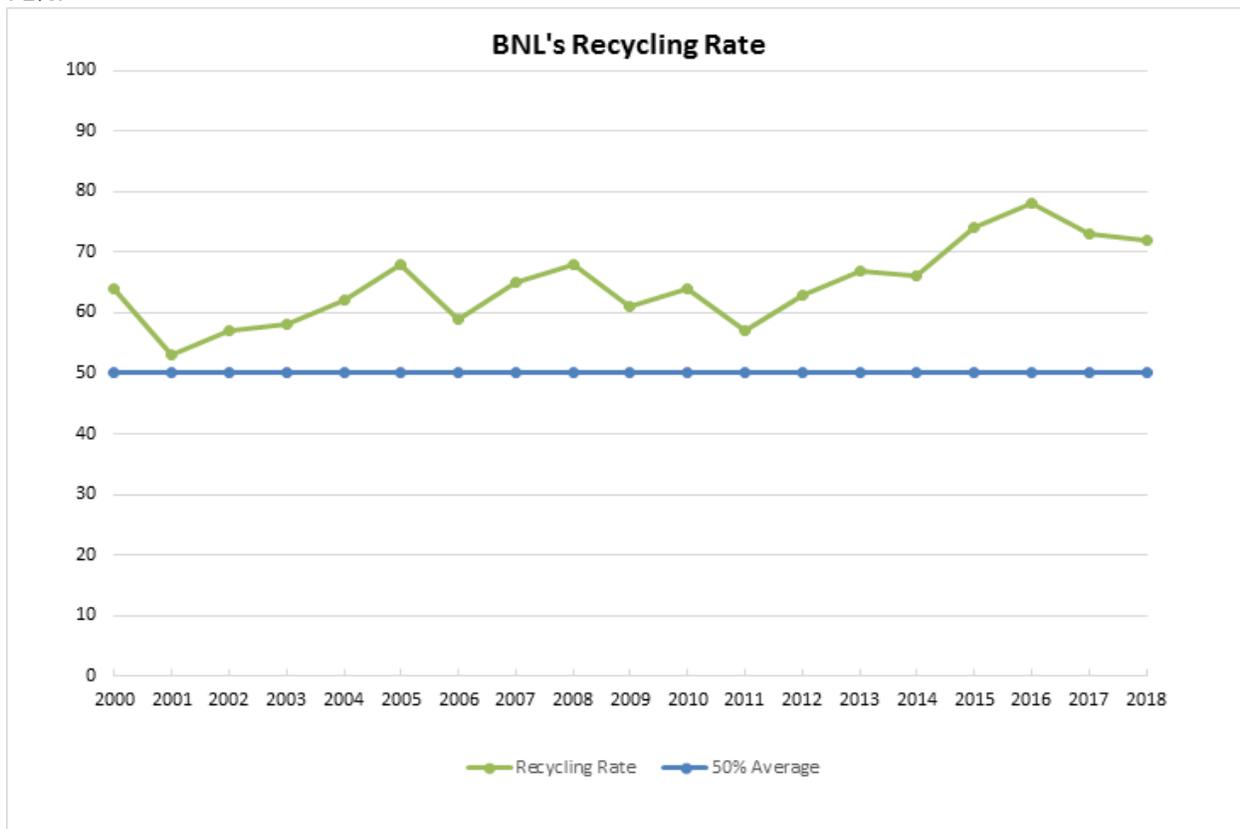


Figure 7: BNL's Recycling Rate

Site population changes, construction, and demolition activities do not heavily influence the Lab's diversion percentage since recycling and diversion rates are measured against municipal solid waste rates which are a function of work and population. There were no significant building cleanouts during 2018 where materials were repurposed. There were two small demolition projects during the year, the Biology Greenhouses and the Fleming House. The small volume of recyclable materials recovered were captured in this year's overall recycling rate.



Demolition of the Biology Greenhouses

The Lab's putrescible waste (municipal solid waste) is sent to the Town of Brookhaven, which then is subsequently sent to a local waste-to-energy facility. Hence, no Lab municipal solid waste is sent to a landfill.

BNL continues to evaluate new processes and products to minimize the Laboratory's environmental footprint. During this upcoming year, BNL will look into the operational and economic feasibility of diverting its food waste to a commercial food waste composter, which is currently scheduled for start-up in September 2018.

The Lab activity promotes its recycling program through use of special containers, labels, flyers, and websites. Staff Services put together a recycling program promotion event during the Lab's Earth Day Celebrations that showcased the bio-preferred products they use for custodial services. They also promoted good recycling habits by engaging staff in interactive question and answer activities.



Earth Day Recycling Program Promotion

BNL's Chemical Management System (CMS) allows the Lab to control chemical inventory and to minimize the acquisition and use of hazardous chemicals and materials. Prior to allowing a new chemical or product on site, the Safety Data Sheet is evaluated for the products hazardous properties. If an acceptable non-toxic or less toxic alternative is not available, then limited amounts of the product may be purchased and used.

BNL has an Integrated Pest Management program that has been audited by a third party on a periodic basis. BNL does not use sprinkler systems to water any areas on-site and has planted native plants and grasses to help reinvigorate pollinators in post-demolition areas.

Plans and Projected Performance

BNL's waste diversion program is expected to remain intact in the future years and may grow with the addition of food waste composting pending the start-up of a commercial food waste composter in relatively close proximity to the Lab.

Though significant demolition of World War II (WWII) structures didn't occur during 2018, plans are in place to continue demolition of these structures in 2019, beginning with the demolition of Building 134 in the first quarter. Resulting concrete from the demolition will be crushed on site to covert to Recycled Concrete Aggregate (RCA) for use as a road base on firebreak roads or as underlay in parking areas, saving dollars that would otherwise be used to purchase this type of material. Wood and metal debris will also be segregated and sent for recycling.

Before



After



Before/After of Building 134 Demolition

Fleet Management

This category focuses on the site's approach and vision for addressing fleet optimization, and strategies used to reduce petroleum use and increase alternative fuel use.

Performance Status

Facilities and Operations completed a major restructuring in FY18 which consolidated personnel, stock areas, and central reporting locations. This resulted in less miles needing to be traveled by all trades vehicles, thus further reducing our need to drive unnecessarily. This will help achieve goals surrounding the reduction of greenhouse gas emissions.



Plans and Projected Performance

Fleet management will continue to work with the General Services Administration (GSA) to order alternative-fueled and newer, more fuel-efficient vehicles during every replacement cycle.

For those available for replacement, plug-in hybrids and zero emissions vehicles will be ordered. Alternative fuel use is not an issue, as we continue to utilize our E-85 fueling station on-site. Alternative fuel use is also enforced through fuel station programming, which only allows for E-85 in our dual-fueled vehicles.

Telematics units were installed in all Light and Medium Duty Vehicles. This will facilitate improved analysis of fleet utilization and allow for better fleet inventory decision making. Idle time information will be monitored and conveyed to management to curb excessive idling of fleet vehicles.

Renewable Energy

This category focuses on site efforts towards utilizing renewable energy resources.

Performance Status

BNL purchased 62,600,000 kilowatt hours (kWh) of RECs for 2018 to meet prior “Clean and Renewable Energy” requirements. BNL’s RECs have been and will continue to be purchased through a competitive solicitation process. Each solicitation includes the latest DOE requirements, including the required in-service dates.

In 2018 the NSERC facility produced 1,095,083 kWh on site. No RECs from Northeast Solar Energy Research Center (NSERC) were sold in 2018. The NSERC facility was expanded by 324 kW to 816 kW in 2016 with the help of Sustainability Performance Office (SPO) funding.

BNL continues to host the Long Island Solar Farm (LISF), a 32 MW Solar PV generation system that provides power to the Long Island Power Authority (LIPA). Even though BNL does not receive any of the power generated from the LISF, it provides clean, renewable energy to the local area and region.



BNL hosts the Long Island Solar Farm

BNL regularly evaluates alternative energy opportunities. The most recent effort was an updated economic evaluation of a CHP in 2016. The report highlighted the potential to reduce GHGs by approximately 50,000 MtCO₂e per year and act as an on-site source of “clean energy.” There are a number of other benefits associated with CHP including providing increased resilience in the event of impacts from

weather or other events that could affect the electric grid. However, current and estimated low energy costs in the future prevent CHP from being economically viable at this time.

Plans and Projected Performance

BNL will continue to operate the NSERC facility and provide for further expansion when sufficient funds are identified. REC purchases will continue in order to meet applicable renewable energy and clean energy goals.

A renewable energy assessment that included the BNL site was completed by National Renewable Energy Laboratory (NREL) in 2016. The report concluded that even though the site is over 5,000 acres, given the existence of the 31-MW Long Island Solar Farm (LISF) on the BNL site and that much of the land is forested and in environmentally sensitive areas, BNL is concerned about clearing additional land for another renewable energy (RE) project.

The NREL report also states: “PV, biomass, LFG, and SHW do not appear economically viable at this time. Should the cost of electricity increase or escalate at a rate higher than what is assumed in the model, or should the price of RE decrease or new incentives become available, then it is possible additional RE projects could become cost effective.” NREL did suggest consideration of small wind turbines given the Federal Aviation Administration’s (FAA’s) determination that large (300 ft. high) ones would pose an aviation problem in the area.

As indicated above, BNL completed an updated economic evaluation of a CHP in 2016 which concluded that BNL’s low energy rates keep a CHP from being economically viable. We will continue to revisit the CHP concept when the economic or other conditions change that could make it a viable undertaking.

Renewable energy systems, especially solar hot water, are considered in all new construction and major building renovations. To date, it has been difficult to find cost effective projects. However, a new office building, the Science and User Support Center, (SUSC) will be designed in 2020 and will potentially incorporate a number of concepts including solar hot water heating and potentially a solar wall for pre-heating.

BNL continues to pursue opportunities to implement a true microgrid on site. The ~1 MW NSERC facility is intended as one of the first segments that will ultimately be combined with energy storage. We are currently having preliminary discussions with energy storage providers and various governmental agencies to explore options.

Green Buildings

This category focuses on green building initiatives such as HPSB as well as building inventory changes.

Performance Status

Guiding Principles

Currently 9% of non-excluded buildings have achieved 100% of the Guiding Principles and an additional 6% are at 90% or higher. As BNL constructs new buildings and demolishes old non-compliant buildings, this percentage will increase.

New Building Design

All buildings designed from 2007 were designed to meet the NYS Energy Code. In addition, BNL incorporates these principles into major renovations. As such, these buildings, some of which also obtained LEED certification, meet or exceed the Guiding Principles. BNL does not have any leased facilities. BNL's Design Standards (Modernization Project Office [MPO] Procedure 100E) for new buildings includes requirements to ensure that all new construction is at least 30% more efficient than ASHRAE 90.1-2013. Current EISA Section 433 is not applicable, as BNL does not have any planned commercial or multi-family high-rise residential buildings.

The new buildings that were designed during FY18 were the Building 742 HEX Beamline Satellite Building and Building 748 (Laboratory for Bio-Molecular Science).

Net Zero Buildings

With respect to net-zero energy buildings, BNL has the option of applying the output of the NSERC to make it net-zero. The determination will be made in concert with the Brookhaven Site Office (BHSO).

Regional and Local Planning, Coordination, and Involvement

Discovery Park

Discussions continue with staff of the Long Island Rail Road (LIRR) where the vision for Discovery Park includes a proposed railroad station. Under this vision, the Yaphank station would be closed and a new "Brookhaven National Laboratory" station would be constructed with service from diesel trains followed by electrification of the rails at a later date.

Plans and Projected Performance

Guiding Principles

Although overall site funding will drive the exact schedule, as new buildings are constructed to be fully compliant with the Guiding Principles (GPs) and old non-compliant buildings are demolished, the percentage of buildings that are compliant with the GPs will further increase.

New Building Design

Projects currently in various stages of planning such as the SUSC building, the CFR major renovation of Building 725, and the Building 906 renovation will be designed to meet the Guiding Principles.

Net Zero Buildings

Although not an issue at this point, BNL has not made specific progress on the net-zero energy building goals, but there is continued discussion with BHSO and DOE-HQ. BNL will continue to engage the national laboratory community on techniques to economically meet the net-zero requirements.

For designs starting in FY20, where economically feasible, BNL will ensure net-zero requirements are included in future designs. BNL will consider net-zero concepts in the preliminary design of the SUSC but discussions with staff in the Science Laboratories Infrastructure (SLI) program indicate the current funding constraints will make it difficult to justify additional costs associated with achieving net zero.

Acquisitions & Procurement

This category focuses on sustainable acquisitions and GHG supply chain emissions.

Performance Status

BNL has incorporated contract clauses within its vendor contracts that designate environmentally preferred products (EPP), services, and equipment. These contract clauses include the preference of:

- energy efficient (ENERGY STAR or Federal Energy Management Program [FEMP]-designated);
- water efficient (WaterSense);
- bio-based (U.S. Department of Agriculture [USDA] BioPreferred);
- environmentally preferable (including Electronic Product Environmental Assessment Tool [EPEAT]-registered products);
- non-ozone depleting (Significant New Alternative Policy [SNAP]) chemicals or other alternatives to ozone-depleting substances and high global warming potential hydrofluorocarbons;
- recycled content, including paper containing 30% post-consumer fiber; and
- non-toxic or less toxic alternatives products (Safer Choice labeled).

BNL's transition to the Vinimaya system ("E-Buy") is complete with twenty catalogs coming on line and in use since 2016. The tabular matrix of commonly purchased items (based on the manufacturer's part number) that are EPP compliant has been updated with additional products. The Vinimaya system can use the manufacturer's part number and scan all of the catalogs to come up with the most efficient pricing from each vendor.

Challenges remain as vendor information regarding recycled content for all categories is lacking, making conformance time-intensive and difficult for purchasers. BNL offers assistance to E-Buy requisitioners on request to help find conforming items and continues to develop the "Commonly Purchased Items" guide of EPP-compliant office products. The guide was originally developed during FY16 to help requisitioners easily select compliant E-Buy items. However, better product information from manufacturers would go much further toward improving purchasing performance and BNL does not have the purchasing power to influence the vendors to provide the needed information.

In 2017, BNL also established Environmental Management System (EMS) objectives to improve EPP purchasing performance for a wide-range of products. The efforts focused on promoting the requirements with requisitioners. The requirements continue to be communicated to E-Buy users via procurement training. The Procurement Division audits E-Buy purchases for EPP conformance, an effort directed mostly at office products. Decreasing numbers of nonconforming product purchases identified throughout the year indicate performance is improving. Procurement and Property Management (PPM) contracts include EPP purchasing performance reports from vendors, but the information received is not detailed enough to allow BNL to measure actual performance.

Other product/equipment categories are evaluated during various project/research design phases. For example, pre-planning for construction or major maintenance work by the F&O Directorate is initially

screened via an Environmental, Security, Safety & Health (ESSH) Evaluation form (i.e., 500A Form), to which EPP considerations have been added. This screening step allows an opportunity to ensure that EPP contract provisions are met for all product categories, from bio-based items, low-solvent paints, energy efficiency, SNAP chemicals, recycled content building materials, office furniture, water efficient products, etc. During this past year, BNL received the Green Electronics Council's 2018 EPEAT Purchaser Award. BNL maintained the same level of purchasing that allowed it to win the 2017 DOE EHSS Greenbuy Program Award at the Gold Level for sustainable acquisition of 14 products in 7 different categories but did not add the additional categories needed to win at this level again for 2018. Regardless, this information indicates that BNL continues to have effective processes in place to maximize or drive acquisition of sustainable products.



BNL also promoted the EPP program during this past year's Earth Day activities. An "Office Sustainability Showcase" event was held that included a background session on the rationale and requirements behind EPP requirements followed by a tutorial for how to successfully identify and purchase compliant items. The event provided sample products and give-a-ways, was well attended and resulting in increased interaction between requisitioners and environmental staff regarding EPP purchases.



Plans and Projected Performance

During 2019, BNL will continue to develop the Commonly Ordered Items page, provide E-Buy training specific to EPP purchasing requirements, and provide support to requisitioners with questions. BNL will also write new EMS objectives to promote that program and drive improvement.

Measures, Funding, & Training

This category focuses on efforts to implement identified Efficiency & Conservation Measures (ECM) via appropriations, performance contracts, or other funding mechanisms, as well as provide sustainability-related training or education for employees.

Performance Status

Efficiency & Conservation Measures

Internally funded energy conservation and sustainability related initiatives include a continuation of best practices, particularly temperature setback during unoccupied periods. BNL regularly implements small lighting and water conservation projects as part of on-going maintenance efforts.

Energy and water evaluations are completed annual per EISA 432 requirements. The information is placed into a database for BNL's use as well as into EPA's Portfolio Manager program. Potential projects are reviewed to determine if they are cost-effective. Small cost-effective projects are sometimes implemented with operating funds. If larger cost-effective projects are identified they will be directed for potential inclusion in BNL's UESC II project.

Energy Performance Contracts

As indicated in previous sections BNL completed its first UESC in 2015 and has been performing very well, meeting the original energy savings estimates within a few percent each year. Given the success of this project we are currently in the process of developing a second UESC project. Lessons learned from the first project, UESC Phase I, are being included with the UESC Phase II effort. An Investment Grade Audit (IGA) is currently underway and is estimated to be completed by early summer 2019.

A robust Performance Assurance Plan (PAP) will be included with the UESC II project. It will be similar to the M&V efforts included with the first UESC effort but will incorporate important lessons learned regarding how data is collected and analyzed.

Funding

Funding is very difficult for energy conservation and sustainability related projects in the current budget constrained environment. BNL, like other DOE sites, has been increasingly using third party financing options that utilize cost savings to pay for the projects. However, while BNL is extremely fortunate to have low energy rates to operate its' research programs it makes it difficult to find cost-effective projects.

Table 1: Sustainability Funding

Category	FY18 Actual	FY19 Planned/ Request	FY20 Projected
Sustainability Projects*	355	840	1581
Sustainability Activities other than projects	272	550	585

Category	FY18 Actual	FY19 Planned/ Request	FY20 Projected
SPO Funded Projects (SPO funding portion only)	0	0	0
Site Contribution to SPO Funded Project	0	0	0
ESPC/UESC Contract Payments (if applicable)	1,506	1,551	1,597
Renewable Energy Credits (REC) Purchase Costs (if applicable)	0	134	152
Total	2,133	3,075	3,915

Training

The manager of Energy Management at BNL is a Certified Energy Manager (CEM). In addition, all of the Facility Complex Managers throughout the BNL campus have the Certified Facility Manager (CFM) recognition from the International Facilities Management Association. All of the Facility Complex Managers and Facility Complex Engineers participate in various training programs throughout the year to ensure core competencies.

Further, numerous employees attend training programs to maintain their professional certifications including PE, CEM, Green Professional, LEED, and many others.

Plans and Projected Performance

As previously indicated BNL is in the process of developing a UESC Phase II project that will include various energy conservation measures such as lighting, HVAC, and controls and may include solar preheating, energy (chilled water) storage, efficient boilers, and others. While it is not possible to estimate energy savings at this early stage we anticipate savings to be equal to or greater than the recent UESC Phase I project.

An Investment Grade Audit (IGA) for a base project of energy efficient lighting and HVAC upgrades is in process and is expected to be completed by early summer 2019. The UESC II effort also included Preliminary Assessments (PA's) for a number of additional potential energy conservation projects. If cost-effective projects are identified they may be included and financed in the UESC II project.

Travel & Commute

This category focuses on travel and commute data, including participation in regional and local planning.

Performance Status

The figure below illustrates that, overall Scope 3 GHG emissions are down 26.1% from FY 2016 (6,023 MtCO_{2e}), and 14.5% lower than the FY 2008 baseline value.

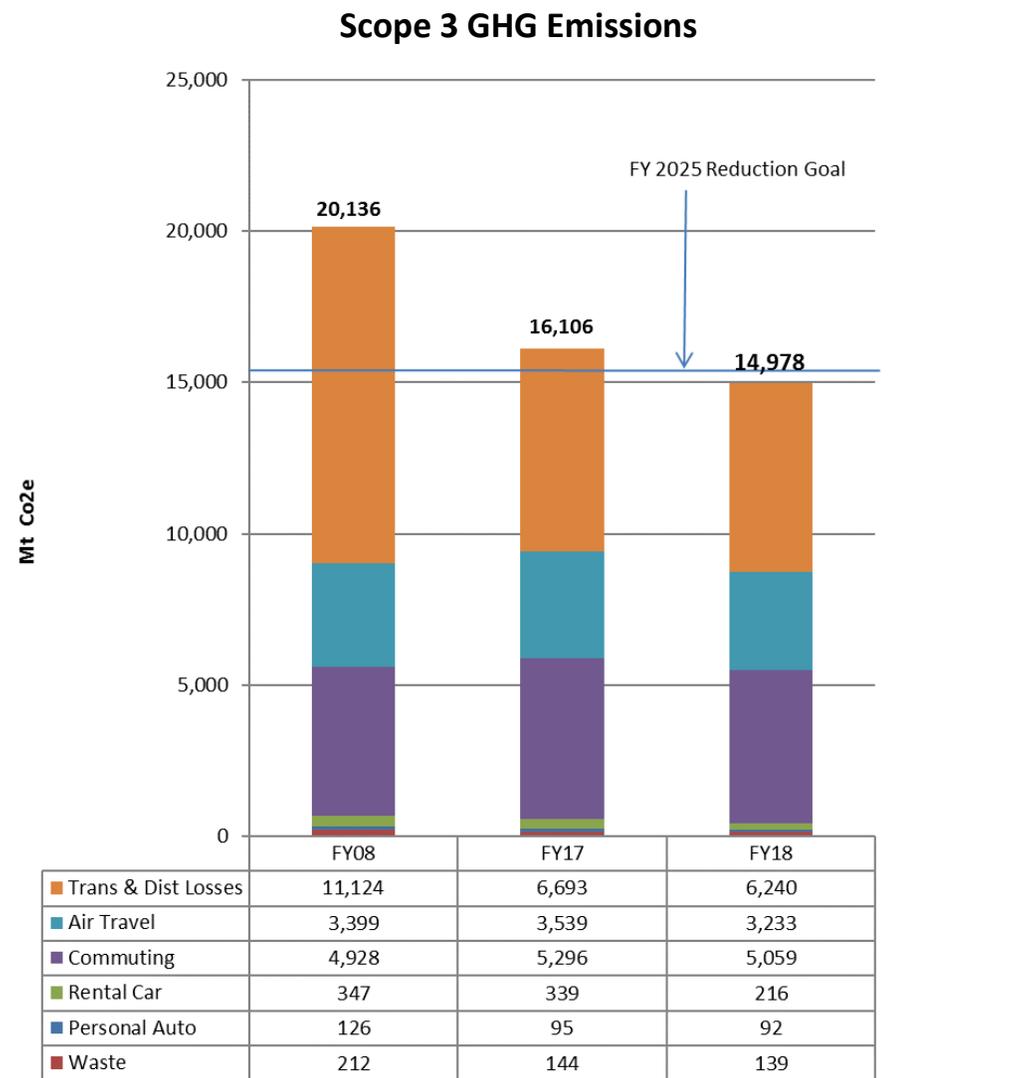


Figure 8: Scope 3 GHG Emissions

Note: The commuting GHG emissions indicated in the FY17 Sustainability Dashboard were recalculated after an error in the calculated value of the average roundtrip commute distance was identified and corrected, lowering the distance from 35.6 miles to 34.88 miles. Previously reported commuting GHGs for FY17 were 6,264.62 MT CO_{2e}.

The decrease from FY 2017 is mostly due to a 453 MtCO₂e drop in GHG emissions from purchased electricity transmission & distribution (T&D) losses and a 237 MtCO₂e decrease in commuting GHGs. The T&D loss and GHG emission reduction was primarily due to 10% and 9.8 % drops in the respective e-Grid Distribution Loss Adjustment Factors that were used to calculate T&D losses from electricity purchased from the local NY Long Island sub-region and losses from hydroelectricity purchased from the NY Upstate sub-region. The decrease in commuting GHG emissions was mostly due to a reduction in workforce that caused the number of BNL commuters to decline 6.2% from 2570 employees in FY 2017 to 2411 in FY 2018.

BNL participated in the Annual Car Free Day Long Island (LI) celebration on September 22, 2018 in an effort to increase employee awareness and appreciation of the environmental, health, and economic benefits of sustainable means of transportation. To participate, employees completed a pledge on the Car Free Day LI website to be car-free or car-lite on September 22 and commit to drive less by carpooling, biking, walking, or telecommuting.

To encourage participation in Car Free Day, a September 10th Monday Memo segment encouraged employees to consider making a pledge to carpool, telework, or even use existing commitments in an approved compressed work schedule to pledge. The segment also provided information links that employees could access for more information on carpooling and flexible work arrangements. Thirty-five employees made pledges to be car-free or car lite.

Regional and Local Planning

BNL continues to maintain close interaction with NY State, the Metropolitan Transportation Authority (MTA), Long Island Rail Road (LIRR) and Suffolk County and Brookhaven Town officials regarding plans for relocation of the Yaphank rail station to become a Yaphank/BNL rail station that is more proximate to BNL and public transportation arteries. Last year NY State budgeted \$20M for relocation of the Yaphank rail station and an RFP has been issued to begin a planning study for the relocated station.

The scope of the study includes planning for a station that would be more easily accessible for the general public, BNL and potential public bus routes and vehicle access along the William Floyd Parkway corridor. The scope includes provisions for potential electrification of the rail line and capability for up to 3 platforms of 12 cars each. This potential electrification would make the Yaphank/BNL station the Eastern terminus of the LIRR Ronkonkoma electrified line and relieve some of the congestion at the Ronkonkoma station. A station with more frequent electrified service within a mile of BNL (in conjunction with public bus routes or shuttle service) would make commuting by public transportation a viable option for BNL employees and would make work at BNL attractive for New York City residents. The relocated station would also make travel to/from regional airports (JFK, Laganardia, Islip) a very convenient option for the thousands of researchers visiting BNL annually from all over the US and the World.

Plans and Projected Performance

Combined electricity purchases of conventional power and hydropower are expected to rise 28.5% from the FY2018 total to 338,800 MWh in FY2025. Using eGrid 2016 T&D loss factors and Northeast Power Coordinating Council, Inc. (NPCC) Long Island total output and NPCC Upstate non-baseload output emission rates, estimated T&D GHG emission will increase to 6,936 MtCO₂e in FY 2025. If GHG emissions

from other Scope 3 categories don't rise, projected Scope 3 GHG emissions for FY 2025 will be 3.8% above the Scope 3 reduction goal of 15,102 MtCO₂e.

To meet the goal, BNL will continue to strive to reduce other Scope 3 GHG emissions. Some of the ongoing activities related to this goal that will continue in FY 2019 are as follows:

- The Environmental Protection Division will continue to work with BHSO to advocate for the SPO to make the necessary programming changes to enable BNL to use the proposed alternative methodology for estimating commuting GHG emissions.
- The Environmental Protection and Information Technology Divisions will reach out to Blue Jeans video conference service users to ascertain how often they used the service, whether they used it while working on-site or on business travel, what they liked and didn't like about the service, and to what extent they avoided business travel. The results of these discussions will help determine how to better communicate the benefits of this service and encourage more widespread use of this valuable communications resource.
- The Environmental Protection Division will reach out to Human Resources to jointly explore how the resources and recommendations in the Sustainable Commuting US DOE National Laboratories Report & Toolkit can be used to engage employees and managers on the benefits of ridesharing, telework, and alternative work schedules.

Regional and Local Planning

The Discovery Park development continues to make excellent progress. SUSC is the Federally funded anchor for the Discovery Park development and was approved for funding in FY19. Development of standard ground lease requirements are underway to enable start of private funded development at Discovery Park in parallel with the SUSC. Initial agreements for utility services to Discovery Park have been reached to enable finalization and installation as needed to support development. The initial phase of development of Discovery Park, called Upton Square, would include the SUSC, a dormitory like housing facility and a possible education center. These three facilities would largely serve existing BNL staff and visitors and have little to no impact on local traffic. The later phases of Discovery Park development would include creation of technology partnership facilities which could bring in an additional 1200 to 1500 daily visitors to BNL when fully built-out. This added traffic demand will be discussed with Suffolk County (Wm Floyd Pkwy) and Brookhaven Town (Longwood Road) and be evaluated as part of the National Environmental Policy Act (NEPA) process for the technology partnership area development. Note that the potential Yaphank/BNL commuter rail station discussed above could significantly reduce the number of vehicles coming to BNL from current values.

Fugitives & Refrigerants

This category focuses on the emissions of fugitive gases and refrigerants.

Performance Status

Fugitive and Refrigerant GHG Emissions

A variety of activities and operations at BNL use greenhouse gases for different purposes. The largest user of greenhouse gases at BNL is the Tandem Van de Graaff Facility. The two Tandem accelerator vessels with a combined storage volume of 16,050 ft³ are filled with an insulating gas mixture consisting of 46%v SF₆, 44%v N₂, 6%v CO₂, and 4%v O₂. Annually, there are some emissions of SF₆ and CO₂ due to insulating gas leaks and the transfer of insulating gases during periodic maintenance of the Tandem accelerators.



Tandem Van de Graaff Facility

The table below provides a summary of the sources of BNL fugitive greenhouse gas emissions in FY 2018.

Table 2: Fugitive GHG Emissions

Source	Activity	Gas	GHG Emissions (MtCO ₂ e)
Tandem Van de Graff	Insulating gas leaks	SF ₆	2,933.38
		CO ₂	0.005
	Accelerator gas transfers	SF ₆	40.33
STAR Experiment	Detector gas purging	CH ₄	4.81
		CO ₂	0.02
		HFC-134a	998.32
		SF ₆	86.87
Fleet Vehicle Repair	Fleet Motor Vehicle A/C Leaks	HFC-134a	20.76
Whole Site		CO ₂	0.01
Refrigeration/AC Equipment	Gas leaks	HFC-134a	6.55
		HFC-32	0.92
		HFC-125	4.76

The bulk of BNL’s process and fugitive GHG emissions (besides those from insulating gas leaks of SF₆ from the Tandem Van de Graeff accelerator vessels) were due to periodic purging of carrier gases used in STAR detector subsystems during the FY 2018 Relativistic Heavy Ion Collider experimental run. The recirculation system on the STAR multi-gap resistive plate TOF subsystem reduced purged gas releases of HFC-134a by 86.5% throughout the experimental run.

A refresher training for A/C Engineers was held on May 4th to ensure that refrigeration and air conditioning equipment was being effectively serviced to minimize refrigerant emission leaks. The session included a high-level overview of the 2016 EPA revisions to the Refrigerant Management Requirements of 40 CFR 82 Subpart F and how new/revised requirements have been incorporated into the F&O Refrigerant Management Plan. During the session, the Preventative Maintenance Coordinator explained how information from completed work orders and completed Refrigerant Usage Service Usage Forms (SUF) should be entered into the Refrigerant Compliance Manager Database. The database documents that repairs to leaking appliances were completed in a timely manner and effectively to demonstrate compliance with Subpart F regulatory requirements and conformance with F&O Refrigerant Management Plan expectations. Finally, recent amendments to the Refrigerant Usage SUF were reviewed to explain why the new highlighted fields must be completed and the level of detail they are expected to provide to document effective leak repairs. On June 27 and September 13, the Environmental Protection Division worked with F&O Production Division staff to conduct joint self-audits of their Refrigerant Management Program to identify actions that may be taken improve the program, and to address any program gaps and deficiencies.

Preventative maintenance inspections of eight 2.4 kilovolt (kV) & nineteen 13.8 kV sulfur hexafluoride (SF₆) gas insulated switches, plus eight 69 kV SF₆ gas insulated circuit breakers were conducted in September as part of BNL’s proactive program to identify and mitigate leaks of the Laboratory’s SF₆ gas insulated high-energy equipment. Recorded equipment temperature readings and pressure gauge readings during the inspection provided no evidence of SF₆ leaks.

In response to the SC Supplemental Guidance, the BNL site has not exceeded SF₆ emissions of 500 lbs or more in either FY17 or FY18.

Plans and Projected Performance

Job plans for the next scheduled preventative maintenance inspections of SF₆ gas insulated switches and circuit breakers will be released on April 1, 2019. Annual preventative maintenance inspections will also be released on April 1, in concurrence with the job plans.

Electronic Stewardship

This category focuses on the acquisition, operations and management, and disposal techniques of all electronics reported, as well as data centers efficiency improvements.

Performance Status

Acquisition

The contract governing the procurement of printers, laptops, and desktop computers ordered through the BNL E-Pro system requires that they have an EPEAT “Gold” certification. BNL has met this goal for FY18.

Operations

All systems in the BNL domain that are capable of power management have the setting enabled. BNL has met this goal for FY18.

BNL has published Managed Printing guidelines, which recommend the use of network/department-wide printers configured for black ink only and duplex printing. BNL has effectively met this goal for FY18.

End of Life

BNL tracks computer components through its PeopleSoft program to ensure full utilization of these products throughout their lifespans. The average age of a BNL computer prior to disposal is approximately six years, which is 50 % above the average retirement age of four years.

Usable computers and peripherals are sent to an on-site warehouse where departments can go to acquire computers as needed. Last year, approximately 1,100 desktop computers, 380 laptops, 150 tablets and 550 servers were reused internally by BNL personnel as well as numerous other small electronics.

New York State environmental regulations prohibit household electronic waste (E-Waste) to be disposed of with municipal solid waste (household trash) and requires that home owners dispose of their E-Waste through Town specified collection points, usually located at solid waste transfer stations. As an incentive for employees to dispose of their E-Waste in an environmentally acceptable manner, while easing the burden of finding and scheduling a time to travel to a transfer station, BNL held two employee household E-Waste collection days during the year. Information is supplied to employees on how to sanitize and/or remove their computer hard drives to avoid personal information from getting into the open domain.



BNL disposed of approximately 39 tons of electronic equipment through an R2 certified recycler during 2018

Data Centers

Existing Data Centers

BNL completed an evaluation of our existing data centers in response to the Data Center Optimization Initiative (DCOI) from the summer of 2016. Our internal assessment identified eight (8) data centers that meet the new DCOI criteria. Previously, BNL had two (2) data centers based on the former definition. A comprehensive assessment has yet to be completed but it is clear that additional resources will be needed to meet the goal of a PUE < 1.5. Four of the eight data centers will require the installation of additional metering in order to determine the actual PUE.

New Data Centers

It was determined that a mission need exists to provide mid-range computational and data storage support to current BNL programs and planned particle physics experiments using RHIC and the ATLAS detector at CERN. Significant infrastructure in terms of space, power, and cooling within the existing RHIC ATLAS Computing Facility (RACF) has degraded over time due to obsolete equipment and increasingly stringent operating standards for data centers. Capable, reliable, and efficient computing facilities are required to support experiments that are expected to generate ever greater amounts of data that must be stored and analyzed. Additionally, the evolution of the technologies employed to deliver computation and data storage capabilities is expected to require higher levels of reliability and demand more robust

infrastructure. These factors combine to effectively make almost half of the current computing and data storage facility functionally obsolete. The projected capability gaps in computing infrastructure are due to a combination of decreases from degrading capacities and increases in future requirements of mid-scale computing performed by RACF.

The Core Facility Revitalization (CFR) project is being designed to renovate and revitalize Building 725—the former home to the NSLS-I. This project includes repurposing a significant portion of the building for use as a new computing facility with associated support space and new infrastructure. The proposed project will renovate approximately 50,000 gross square feet of the first floor area. In late FY16, a conceptual design was completed for the CFR project, BNL’s new data center initiative. Critical Decision 1 (CD-1) was received in April of 2017 and CD-2 was received in October of 2018.

Plans and Projected Performance

Acquisition

The Laboratory will continue to require that all printers, laptops, and desktop computers ordered through the E-Pro system have an EPEAT “Gold” certification.

Operations

BNL will continue to evaluate the feasibility of extending the desktop computer power management policy to other operating systems.

The majority of printers and copiers are not centrally managed. BNL will continue to communicate the importance and benefits of duplex printing.

End of Life

BNL will continue to evaluate methods of increasing computer useful life and will continue to dispose of electronic waste in an environmentally sound manner through a certified R2 recycler.

Data Centers

Existing Data Centers

Meeting the PUE of 1.5 for the existing data centers will require a significant investment. Further, four of the eight existing data centers will require the installation of new metering, which is partially in progress.

BNL will work to identify the actions and resources needed to meet the PUE 1.5 requirement for the eight existing data centers and if cost effective, begin the process of obtaining potential funding. The first effort will focus on determining the most cost effective metering on four of the data centers that are currently not metered in order to determine their actual PUE.

New Data Centers

The data center associated with the CFR project is in the design phase and is targeting a PUE of < 1.3 in accordance with the recent DCOI. The CFR project has received CD-2 approval and is estimated to start construction in June of 2019, with an projected completion of 2023.

Organizational Resilience

This category focuses on resilience-related topics. Organizational resilience is the ability of an agency to prepare for and withstand an extreme event, or quickly recover. Resilience efforts help sites manage risks to DOE assets, infrastructure, and operations.

Performance Status

Organizational Resilience

Emergency Response and Local/Regional Coordination

BNL conducts all hazard surveys every three years or when there are significant changes made to the laboratory. BNL Office of Emergency Management (OEM) works with state and local emergency management organizations in assessing the risks that may occur in the local and regional area. Once risks and hazards have been identified, BNL OEM determines the need for either stand-alone plans or identifies where the risks and hazards can be incorporated into existing plans.

OEM maintains the following are the plans and procedures to comply with DOE O 151.1D, Comprehensive Emergency Management System:

- BNL Site Emergency Plan
- BNL All Hazards Survey
- Maintain the Management System
- Power Outage Plans
- Severe Weather Plans

OEM works with Safeguards and Security, the Regional Counterterrorism Office, and the County Joint Terrorism Taskforce to monitor potential threats against the region and the laboratory.

Risk/Vulnerability Assessment

BNL has created a Threat Hazard Identification and Risk Assessment (THIRA) that discusses catastrophic incidents that could affect or occur at BNL and identifies the resource needs for a response and recovery. These hazards included in a THIRA are both man-made and natural.

Climate-Resilient Design of New or Newly Retrofitted Buildings

BNL does not currently have design guidelines specifically for climate-resilient design. However, as a standard practice, new facilities and retrofit projects are designed considering climate change and its projected impact on human health and safety.

Plans and Projected Performance

Emergency Response and Local/Regional Coordination

During major weather events, OEM participates on the National Weather Service regional severe weather calls. These calls begin the coordination efforts for the region in determining the predicted damage for the area. BNL is also part of Suffolk County's Comprehensive Emergency Plan to support Suffolk County in times of catastrophic emergencies. BNL attends periodic meetings with Suffolk County Office of Emergency Management regarding emergency management and response.

BNL is now a member of the State's Office of Emergency Management's Regional Planning Committee. This committee brings public agencies and key private infrastructure organizations together to conduct planning for emergencies and to identify possible risks and threats to the local system.

Climate-Resilient Design of New or Newly Retrofitted Buildings

MPO has evaluated the applicability of the Climate Resiliency Design Guidelines developed by New York City's Office of Recovery and Resiliency and plans to utilize them on Laboratory projects, based upon applicability and cost benefit analysis.

To date, climate design values in national building design codes have not been updated to reflect increases in regional climate loads. Uncertainties in climate change models and their projections limit the ability to design for future extremes and the infrastructure related climate loads. MPO has focused on reducing vulnerability to present climate variability by early integration of climate resilience consideration into the project delivery process. A cost benefit analysis is essential to ensure effective and cost-conscious design decision making.

The Architectural/Engineering Statement of Work issued by MPO for designs requires firms to consider and assess climate change risks in the design.

Appendix A: Dashboard Data Accuracy Self-Certification

Self-Certification of the Dashboard

BNL has utilized the built-in approval process within DOE's Sustainability Dashboard to certify the accuracy and completeness of the data submission.

Appendix B: Comprehensive Scorecard

12/6/2018

Sustainability Dashboard: Comprehensive Scorecard



FY 2018 Scorecards are based on prior DOE targets. Currently the prior DOE targets are under review; however, essentially all the related goals are included in the new E.O. 13834 and have a statutory underpinning. SPO plans to use your data and Site Sustainability Plans to develop estimates for DOE's future goal targets and reporting.

Comprehensive Scorecard

All Dept / Under Secretaries
All Program Offices
Brookhaven National Laboratory
FY 2018 (tentative)

Greenhouse Gas Inventory



Scope 1 & 2 Greenhouse Gas Emissions

Goal: Reduce direct GHG emissions by 50 percent by FY 2025 relative to FY 2008 baseline.
Interim Target (FY 2018): -28.0 %

Current Performance: -43%

	FY 2008	FY 2018	% Change
Facility Energy	198,085.9	112,397.4	-43.3%
Non-Fleet V&E Fuel	265.6	315.5	18.8%
Fleet Fuel	942.4	0.00	-100.0%
Fugitive Emissions	6,266.9	4,066.3	-34.6%
On-Site Landfills	65.4	38.3	-41.4%
On-Site WWT	2.1	1.0	-52.4%
Renewables	0.0	0.00	N/A
RECs	0.0	0.00	N/A
Total (MtCO₂e)	205,628.2	116,848.4	-43.2%



Scope 3 Greenhouse Gas Emissions

Goal: Reduce indirect GHG emissions by 25 percent by FY 2025 relative to FY 2008 baseline.
Interim Target (FY 2018): -11.0 %

Current Performance: -473%

	FY 2008	FY 2018	% Change
T&D Losses*	10,700.2	-82,093.6	-867.2%
T&D RECs Credit	0.00	0.00	N/A
Air Travel	3,398.7	3,232.5	-4.9%
Ground Travel	473.0	307.2	-35.1%
Commute	4,929.0	5,059.0	2.6%
Off-Site MSW	212.8	0.00	-100.0%
Off-Site WWT	0.0	0.00	N/A
Total (MtCO₂e)	19,713.6	-73,494.8	-472.8%

* Includes T&D losses for purchased renewable electricity

Facilities



Energy Intensity

Goal: The latest energy intensity reduction goal, requires a reduction in energy intensity for goal subject facilities by 25 percent by FY 2025 relative to FY 2015 baseline. The prior goal, required a 30 percent reduction by FY 2015 relative to FY 2003 baseline.
Interim Target (FY 2018): -7.5%

Current Performance: -3%

	FY 2015	FY 2018	% Change
Purchased Utilities (MMBtu)	718,305.2	690,800.7	-3.8%
Purchased Renewables (MMBtu)	0.0	0.0	N/A
Goal-subject GSF	2,957,443.0	2,941,235.0	-0.5%
Energy Intensity (Btu/GSF)	242,880.5	234,867.5	-3.3%



Renewable Electricity

Goal: By FY 2025, use 30 percent renewable energy as a percentage of overall facility electricity use.
Interim Target (FY 2018): 15%

Current Performance: 25%

	FY 2018 Electricity Consumption	FY 2018 Renewable Electricity w/ Bonuses	% of Total
Grid Electricity	263,544	0.00	N/A
On-Site Renewable Energy	1,096	2,192	0.8%
Purchased Green Electricity	0	0.00	N/A
Renewable Energy Certificates	N/A	62,600	23.7%
Total (MWh)	264,640	64,792	24.5%



Clean Energy

Goal: By FY 2025, use 25 percent renewable energy as a percentage of overall facility electric and thermal energy use.
Interim Target (FY 2018): 13.0 %

Current Performance: 14%

	FY 2018 Energy Consumption	FY 2018 Clean Energy w/ Bonuses	% of Total
Grid Electricity	899,213	0.00	N/A
Non-renewable Thermal Energy	652,359	0.00	N/A
On-Site Renewable Energy	3,739	7,479	200.0%
Purchased Green Electricity	0	0.00	N/A
Renewable Energy Certificates	N/A	213,591	N/A
Total (MMBtu)	1,555,311	221,070	14.2%



Potable Water Intensity

Goal: Reduce potable water intensity by 36 percent by FY 2025 relative to FY 2007 baseline.
Interim Target (FY 2018): -22.0 %

Current Performance: -45%

	FY 2007	FY 2018	% Change
Water Consumption (million gal)	412.9	393.1	-4.8%
Aquifer Recharge (million gal)	322.1	334.1	3.7%
Total GSF	4,081,900.0	4,835,492.0	18.5%
Water Intensity (Gal/GSF)	22.3	12.2	-45.3%



Industrial, Landscaping, Agricultural Water

Goal: Reduce industrial, landscaping and agricultural water use by 30 percent by FY 2025 relative to FY 2010 baseline.
Interim Target (FY 2018): -16.0 %

Current Performance: 0.0%

	FY 2010	FY 2018	% Change
Industrial	0.0	0.0	N/A
Landscaping	0.0	0.0	N/A
Agricultural	0.0	0.0	N/A
Total ILA Water (million gal)	0.0	0.0	N/A



High Performance Sustainable Buildings

Goal: Ensure 17 percent by building count comply with the Guiding Principles for sustainable buildings by FY 2025.
Interim Target (FY 2018): 15.3 %

Current Performance: 13.7%

	Building Count	GSF
Guiding Principles Certified	17	1,214,504
Total Applicable*	124	4,506,565
Performance (%)	13.71%	26.95%

* Applicable means buildings and trailers that are DOE owned or DOE leased where the gross/rentable SqFt is greater than 5,000.



EISA S432 Compliance

Goal: Ensure all covered facilities, comprising 75% of total energy use, are evaluated 4-years, with audit findings reported, and benchmarked.

Current Performance: At Risk of Compliance

	Due Date	Covered Energy	Evaluated Square Footage Status	# of Covered Facilities Benchmarked
Current Evaluation Cycle Status	06/18/2018	104.25% 1,575,124.09 MMBtu	Completed: 0 Remaining: 4,805,635	0 out of 314
Current Evaluation Findings		# of Identified ECMs: 45	# of Awarded/Funding Approved ECMs: 0	# of implemented ECMs with reported M&V data: 0
				\$ value of all implemented ECMs: 60,489,049

Fleet



Fleet Greenhouse Gas Emissions/Mile

Goal: Reduce per-mile greenhouse gas emissions by 30 percent by FY 2025 relative to FY 2014 baseline
Interim Target (FY 2018): -16.0 %

Current Performance: 0%

	FY 2014	FY 2018	% Change
Fleet Fuel GHG (MtCO ₂ e)	0.7	0.00	-100.0%
Fleet Miles (x1000)	792.0	0.0	-100.0%
Greenhouse Gas Emissions / Mile (gCO₂e/Mile)	1.0	0.00	-100.0%



Fleet Petroleum

Goal: Reduce fleet petroleum use by 20 percent by FY 2015 and thereafter relative to FY 2005 baseline
Interim Target (FY 2018): -20.0 %

Current Performance: -100%

	FY 2005	FY 2018	% Change
Gasoline	91,140	0	-100.0%
Diesel	24,544	0	-100.0%
Biodiesel*	0	0	N/A
Total Petroleum (GGE)	115,684	0	-100.0%

* Includes only the diesel content of B20



Fleet Alternative Fuel

Goal: Increase fleet alternative fuel use by 10 percent by FY 2015 and thereafter relative to FY 2005 baseline
Interim Target (FY 2018): 10.0 %

Current Performance: 0%

	FY 2005	FY 2018	% Change
E-85	0	0	N/A
Biodiesel*	0	0	N/A
CNG	26,000	0	-100.0%
Other*	0	0	N/A
Total Alternative (GGE)	26,000	0	-100.0%

* Biodiesel contains B100 plus the biodiesel content from B20. Other contains LNG, LPG, and electric

Waste



Municipal Solid Waste Diversion

Goal: Divert at least 50 percent of non-hazardous solid waste (excluding construction and demolition debris)
 Interim Target (FY 2018): 50.0 %

Current Performance: 78%

	FY 2018	%
Off-Site Landfills	0.0	0.0%
On-Site Landfills	0.0	0.0%
Waste to Energy*	340.2	21.6%
Non-diverted Waste	340.2	21.6%
Diverted Waste	860.0	54.7%
On-Site Composted	32.5	2.1%
Off-Site Composted	0.0	0.0%
Waste to Energy Credit	340.2	21.6%
Total Diverted Waste	1,232.7	78.4%
Total Waste (metric tons)	1,572.9	100.0%

* For E.O. 13693, waste to energy does not count as diverted waste, but some credit may be applied



Construction & Demolition Diversion

Goal: Divert at least 50 percent of construction and demolition materials and debris
 Interim Target (FY 2018): 50.0 %

Current Performance: 100%

	FY 2018	%
Landfilled C&D Waste	0.0	0.0%
Diverted C&D Waste	3,175.1	100.0%
Total C&D Waste (metric tons)	3,175.1	100.0%

Electronics



Electronics Acquisition

Goal: 100 percent of eligible electronics procurements must be environmentally sustainable (e.g. EPEAT)
 Interim Target (FY 2018): 95.0 %

Current Performance: 80%

	EPEAT Acquired	Total Acquired	%
Monitors	265	409	64.8%
Computers	1,747	1,749	99.9%
Imaging Equipment	104	104	100.0%
Televisions	0	0	N/A
Total Acquired	2,288	2,871	79.7%



Electronics Recycling

Goal: Dispose of 100 percent of electronics through government programs and certified recyclers
 Interim Target (FY 2018): 100.0 %

Current Performance: 100%

	Amount	%
Transferred or Donated	0.000	0.0%
Recycled by Certified Recycler	35.788	100.0%
Recycled by non-Certified Recycler	0.000	0.0%
Amount disposed (e.g. landfill)	0.000	0.0%
Total Electronics Waste (metric tons)	35.788	100.0%



Power Management

Goal: Implement and actively use power management features on 100 percent of eligible computers (PCs & laptops) and monitors
 Interim Target (FY 2018): 100.0 %

Current Performance: 24%

	Total Owned	PM Enabled	Exempt	%
Monitors	0	0	0	N/A
Computers	3,741	890	0	23.8%
Total Items	3,741	890	0	23.8%



Duplex Printing

Goal: Implement and actively use duplex printing features of 100 percent of eligible printers
 Interim Target (FY 2018): 100.0 %

Current Performance: 0%

	Total Owned	Duplex Enabled	Incapable	%
Total Printers	0	0	0	0.0%

Acquisition



Sustainable Acquisition

Goal: Ensure 95 percent of new contract actions for products and services meet sustainable acquisition requirements
 Interim Target (FY 2018): 95.0 %

Current Performance: 100%

	Contracts Reviewed	Contracts Without Opportunity	Contracts Meeting All Requirements	%
Number of Contracts	45,146	0	45,146	100.0%

Appendix C: List of Acronyms & Abbreviations

AGS	Alternating Gradient Synchrotron
ANSI	American National Standards Institute
ASHRAE	American Society of Heating, Refrigerating, and Air-Conditioning Engineers
ATF	Accelerator Test Facility
BAS	Building Automation System
BHSD	Brookhaven Site Office
BLCC	Building Life-Cycle Cost
BNL	Brookhaven National Laboratory
BMP	Best Management Practice
BSA	Brookhaven Science Associates
Btu	British thermal unit
C-AD	Collider-Accelerator Department
CAFE	Corporate Average Fuel Economy
CD	Critical Decision
CEM	Certified Energy Manager
CERN	European Organization for Nuclear Research
CFL	Computers for Learning
CFM	Certified Facility Manager
CFN	Center for Functional Nanomaterials
CFR	Code of Federal Regulations
CFR	Core Facility Revitalization
CHP	Combined Heat and Power
CMS	Chemical Management System
CSF	Central Steam Facility
DCOI	Data Center Optimization Initiative
DOE	Department of Energy
ECM	Efficiency & Conservation Measures
EHSS	Office of Environment, Health, Safety & Security
EISA	Energy Independence and Security Act
EMS	Environmental Management System
EO	Executive Order
EPA	Environmental Protection Agency
EPEAT	Electronic Product Environmental Assessment Tool
EPP	Environmentally Preferable Purchasing
ESCO	Energy Service Company
ESPC	Energy Savings Performance Contract
ESSH	Environmental, Security, Safety & Health
EU	Energy & Utilities
EUI	Energy Utilization Index
F&O	Facilities and Operations
FAA	Federal Aviation Administration
FCA	Facility Condition Assessment
FCE	Facility Complex Engineer
FCM	Facility Complex Manager

FEMP	Federal Energy Management Program
FIMS	Federal Information Management System
FY	fiscal year
gal	gallons
GHG	Greenhouse Gas
GOCO	Government-Owned, Contractor-Operated
GP	Guiding Principle
gpf	gallons per flush
GPM	Gallons Per Mile
GSA	U.S. General Services Administration
gsf	gross square feet
HASP	Health and Safety Plan
HEMSF	High-Energy Mission-Specific Facility
HFC	hydrofluorocarbon
HPSB	High Performance Sustainable Buildings
HQ	Headquarters
HR	Human Resources
HVAC	heating, ventilation, and air-conditioning systems
IESNA	Illuminating Engineering Society of North America
IFM	Integrated Facility Management
IFMA	International Facilities Management Association
IGA	Investment Grade Audit
IGPP	Institutional General Plant Projects
ILA	industrial, landscaping, and agricultural
ISB-I	Interdisciplinary Science Building I
ITD	Information Technology Division
JFK	John F. Kennedy International Airport
kV	kilovolt
kW	kilowatt
kWh/yr	kilowatt hour per year
LCC	Life-Cycle Cost
LDT	light-duty truck
LEED	Leadership in Energy & Environmental Design
LI	Long Island
LINAC	linear accelerator
LIPA	Long Island Power Authority
LIRR	Long Island Railroad
LISF	Long Island Solar Farm
M&V	measurement and verification
mmBtu	one million Btu
MPO	Modernization Project Office
MTA	Metropolitan Transportation Authority
MtCO ₂ e	metric tons of carbon dioxide equivalent
MW	megawatts
MWh	megawatt hours
NEPA	National Environmental Policy Act
NPCC	Northeast Power Coordinating Council, Inc.
NREL	National Renewable Energy Laboratory

NSERC	Northeast Solar Energy Research Center
NSLS-I	National Synchrotron Light Source
NSLS-II	National Synchrotron Light Source II
NYC	New York City
NYS	New York State
NYSDEC	New York State Department of Environmental Conservation
ODS	ozone depleting substance
OEM	Office of Emergency Management
OH&P	Overhead and Profit
PA	Preliminary Assessment
PAP	Performance Assurance Plan
PE	Professional Engineer
PFC	perfluorocarbon
PHENIX	Pioneering High Energy Nuclear Interaction Experiment
PM	preventative maintenance
PPM	Procurement and Property Management
PUE	power utilization effectiveness
PV	photovoltaic
RACF	RHIC ATLAS Computing Facility
RCA	recycled concrete aggregate
RE	Renewable Energy
REC	Renewable Energy Credit
RFP	Request for Proposals
RHIC	Relativistic Heavy Ion Collider
SC	Office of Science
SF ₆	Sulfur Hexafluoride
SLI	Science Laboratories Infrastructure
SNAP	Significant New Alternative Policy
SPO	Sustainability Performance Office
SSP	Site Sustainability Plan
STAR	Solenoidal Tracker at RHIC
STP	Sewage Treatment Plant
SUF	Service Usage Forms
SUSC	Science User Support Center
SWP	Safe Work Plan
T&D	Transmission & Distribution
TEC	total estimated cost
THIRA	Threat and Hazard Identification and Risk Assessment
TOF	time of flight
UESC	Utility Energy Service Contract
USDA	U.S. Department of Agriculture
WWII	World War II