

FY 2022 Site Sustainability Plan



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I. Executive Summary and Executive Summary Table

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.

Fiscal Year 2021 presented unique challenges as we continued to face the global COVID-19 pandemic, which caused BNL to adapt to changing guidance and operational postures. We successfully transitioned through the requirements of the DOE COVID-19 Workplace Safety Plan, diligently planned recovery operations, maintained critical infrastructure throughout, and implemented the Resumption of Operations Plan (ROOP). Throughout the COVID-19 pandemic, all facilities remained operational and we were able to successfully support all essential operations.

Despite the global challenge, 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. In addition, BSA and BHSO have started cultivating relationships with local providers on a potential Grid Facility that will bring the laboratory's sustainability efforts to the entire nation.

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.

The Lab's strategy for mission readiness will provide a revitalized physical plant to improve scientific productivity, promote the attraction and retention of the scientific workforce, including the significant BNL user population, and assure the safe, reliable functioning of BNL's major scientific facilities. The resulting strategy consists of five major elements:

- Focus limited DOE investment in critical core buildings and infrastructure to enable the scientific agenda. An example of this is the Core Facility Revitalization (CFR) Science Laboratories Infrastructure (SLI) line item project. This project replaces an old data center and will meet data center PUE requirements.

- Make research safe and cost effective by downsizing the campus and demolishing old buildings. This is evidenced by BNL's consolidation planning and right-sizing of its campus footprint.
- Ensure scientific reliability through targeted investments in buildings and utility infrastructure. The Critical Utility Rehabilitation Project (CURP) SLI line item project will start to address this and is followed by a proposed SLI utility line item referred to as CURE. In addition, Well Houses 10 and 11 were recently upgraded and Well House 12 reconstruction is nearing completion. This will result in reduced water treatment at the central plant and improvement of potable water quality.
- Support the growing population of scientific users through an innovative concept called "Discovery Park". The construction of the Science and User Center will allow for the demolition of inefficient facilities across the campus.
- Ensure renewed critical infrastructure and buildings are resilient against severe climate and weather. Climate resiliency is being factored into all projects.

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 Executive Summary Table is provided below, highlighting plans for anticipated performance towards DOE targets as a guide.

Prior DOE Goal	Current Performance Status	Planned Actions & Contributions	Overall Risk of Non-Attainment
Energy Management			
Reduce energy use intensity (Btu per gross square foot) in goal-subject buildings.	FY21 energy intensity was nearly identical to the base year of 2015. 243,174 Btu/GSF vs. 243,031 respectively.	A second UESC II (or self-funded effort) effort focusing on Building HVAC controls, temperature set-back, re-heat minimization and lighting. Increased emphasis on Temperature Set-back policy.	High
EISA Section 432 continuous (4-year cycle) energy and water evaluations.	269,325 sq. ft. were audited in FY21.	Continue audits meeting the 4-year cycle.	Low
Meter individual buildings for electricity, natural gas, steam, and water, where cost-effective and appropriate.	12 new smart meters were added in FY21. 99% of electricity, 100% of natural gas, +90% of steam are metered. Most potable water is used for cooling tower make-up. Metering ~30% of cooling tower	Continue maintaining and expanding metering installations, with an emphasis on potable water make-up for cooling towers.	Low

Prior DOE Goal	Current Performance Status	Planned Actions & Contributions	Overall Risk of Non-Attainment
	make-up and adding meters regularly.		
Water Management			
Reduce potable water use intensity (Gal per gross square foot).	Potable-water usage fell from 931 million gallons/year in FY99 to about 304 million gallons/year in FY21, a reduction of 67.4%. BNL's annual water use intensity has decreased from 101 gallons per square foot to 63.2 gallons per square foot, a 37.5% water usage reduction since base-year.	<ul style="list-style-type: none"> Commissioning of Well No. 12 in early FY22. BNL will continue to implement BNL's Water Management Plan and reduce water usage by implementing best-management practices. BNL will continue to utilize water-efficient processes and plumbing fixtures to conserve water in new construction buildings and renovations. 	Low to Medium
Reduce non-potable freshwater consumption (Gal) for industrial, landscaping, and agricultural.	BNL does not have any industrial landscaping.	N/A	N/A
Waste Management			
Reduce non-hazardous solid waste sent to treatment and disposal facilities.	BNL continues its successful waste diversion program, exceeding the DOE goal by continuing to divert > 50% of material from the municipal solid waste stream for recycling or reuse during FY21. BNL continued its Pollution Prevention Opportunity Program for FY21 to identify and promote new ideas for waste reduction, recycling, and reuse.	<ul style="list-style-type: none"> BNL will open discussions with the site's current waste hauler regarding options for transfer of MSW from landfills to a Waste-to-Energy facility in order to evaluate the feasibility of the change. Diversion of this waste stream would make BNL a Net-zero site. EPD will refocus the P2 Program towards ideas that divert MSW and/or otherwise directly contribute to any of the SSP goals and will capture the contributions from these projects in future SSP 	Low

Prior DOE Goal	Current Performance Status	Planned Actions & Contributions	Overall Risk of Non-Attainment
		reporting. <ul style="list-style-type: none"> BNL's internal procedure (SBMS subject area Pollution Prevention) and the associated website will be revised in FY22 to better reflect the current direction of the applicable executive orders. 	
Reduce construction and demolition materials and debris sent to treatment and disposal facilities.	<ul style="list-style-type: none"> Demolition of Building 650 (Former Hot Laundry) and Building 421 (Structural Biology Office) included contracts for offsite crushing and reuse of concrete, as well as collection of uncontaminated metal for recycling. Most of the Building 650 waste was handled as low-level radioactive waste. The project also generated unrecyclable waste that was landfilled. BNL has better defined its C&D baseline and can now identify areas for improvement. 	<ul style="list-style-type: none"> Reduction efforts will be challenging as site expansion will increase overall generation rates. BNL will look for opportunities to increase the percentage of C&D recycled but may not be able to reduce the total amount generated. BNL will assess how effectively F&O-managed C&D debris dumpsters are managed to determine if efforts to improve segregation of recyclables is justified. Numerical improvement goals will be developed if deemed worthwhile. 	Low
Fleet Management			
Reduce petroleum consumption.	Flex Fuel vehicles will only be assigned E-85.	Order more AFVs as they become available.	Medium
Increase alternative fuel consumption.	Flex Fuel vehicles will only be assigned E-85.	Order more AFVs as they come available.	Medium

Prior DOE Goal	Current Performance Status	Planned Actions & Contributions	Overall Risk of Non-Attainment
Acquire alternative fuel and electric vehicles.	Order more AFVs when they are available for the type of vehicle needed.	Order more AFVs as they are available for the type of vehicle needed.	Medium
Clean & Renewable Energy			
Increase consumption of clean and renewable electric energy.	<ul style="list-style-type: none"> Purchased 24,000,000 kWh of REC's for FY21. NSERC Solar PV array produced 605,125 kWh. 	<ul style="list-style-type: none"> Increase purchase REC's Maintain and improve NSERC output. Look for additional opportunities locally and on-site. 	Low to Medium
Increase consumption of clean and renewable non-electric thermal energy.	Biofuel use in off-road utility vehicles.	Increase biofuel use, potentially in satellite hot water or steam heating systems on site.	Low to Medium
Sustainable Buildings			
Increase the number of owned buildings that are compliant with the Guiding Principles for Sustainable Buildings.	Currently 8 buildings have achieved 100% of the 2008 GP's and an additional 9 buildings are considered meeting them as they have achieved LEED Gold or higher status. This represents 15.3% of non-excluded buildings.	As BNL constructs new buildings and demolishes old non-compliant buildings, this percentage will increase.	High
Acquisition & Procurement			
Promote sustainable acquisition and procurement to the maximum extent practicable, ensuring all sustainability clauses are included as appropriate.	BNL fully assessed its sustainability program during 2021 with an eye towards identifying weakness and areas for improvement. The resulting corrective actions set the stage for program improvements during 2022. The types of improvements identified mainly include the development of better tools for requisitioners.	During 2022, 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 review and rewrite the Pollution Prevention Subject Area and EPD P2 Webpage incorporating the improvements identified during the 2021 Sustainability Assessment. Specific actions are tracked with BNL's IOPS and	Low

Prior DOE Goal	Current Performance Status	Planned Actions & Contributions	Overall Risk of Non-Attainment
		are geared at providing requisitioners improved tools for EPP conformance.	
Efficiency & Conservation Measure Investments			
Implement life-cycle cost effective efficiency and conservation measures with appropriated funds and/or performance contracts.	Internally funded energy conservation and sustainability related initiatives include a continuation of best practices, with continued emphasis on temperature setback during unoccupied periods.	Re-evaluate the UESC II project and other potential initiatives using updated energy cost escalation factors. BNL will also revisit the UESC II scope to aggressively address energy and GHG savings.	Near-term - High Longer term - Medium
Electronic Stewardship			
Electronics stewardship from acquisition, operations, to end of life.	The Lab will continue to require that all printer, laptops, and desktop computers ordered through the E-Pro system have an EPEAT "Gold" certification as well as its internal reuse efforts.	<ul style="list-style-type: none"> • Maintain the current, successful program and reestablish Home Electronics Collection Days when COVID staffing restrictions are lifted and personal can return to site. • Investigate cause of EPEAT conformance decrease during 2021 and correct for 2022. • BNL also has plans to Increase communication around EMS in general during 2022. Those communications will also focus on general sustainability topics, including messages to staff about purchasing EPEAT conforming electronics. 	Low
Increase energy and water efficiency in high-performance computing and data centers.	Additional metering was installed in some of the existing data centers.	Meeting the PUE of 1.5 for the existing data centers will likely require a significant investment. Four of the eight	Low for the new data center.

Prior DOE Goal	Current Performance Status	Planned Actions & Contributions	Overall Risk of Non-Attainment
	The new data center in Building 725 was essentially complete in 2021. The design is expected to result in PUE of <1.3.	existing data centers require the installation of new metering, which is in progress. BNL will work to determine the best approach, including consolidation of data centers. Evaluate the new data center performance	Medium for the existing data centers.
Organizational Resilience			
Implement climate adaptation and resilience measures. Ensure BNL's Mission Essential Function # 13 is included in the COOP Plan.	Continue to implement resiliency measures as part of DOE Order 150.1A	Current planning efforts include: <ul style="list-style-type: none"> • Development of a Continuity of Operations (COOP) Plan template for the six BNL Mission Essential Functions to utilize and develop their programmatic COOP Plans. Develop and implement Senior Leadership Delegation of Authority training. • Create COOP event matrix to for declaring a COOP event. • Develop COOP Coordinators notification list. • Develop, implement, and update current COOP Plan to comply with the new DOE Continuity of Operations Order 150.1B. 	Medium
Multiple Categories			
Reduce Scope 1 & 2 greenhouse gas emissions.	According to the DOE Sustainability Dashboard, BNL's Scope 1 & 2 emissions for FY21 were 167,520 MtCO ₂ e, -18.5%	Continued efforts for Energy Intensity Reductions through UESC's, Energy Savings Performance Contracts (ESPC's) and other methods including	Low for the near-term. Medium for the long term.

Prior DOE Goal	Current Performance Status	Planned Actions & Contributions	Overall Risk of Non-Attainment
	<p>relative to the 2008 baseline.</p> <p>BNL's electricity purchases included 45% clean hydropower for FY21, as well as 22 million kWh of REC's</p>	<p>self-funding. Continued hydropower allocation, REC purchases \$ operation of the NSERC Solar photovoltaic (PV) array.</p> <p>Meeting the goal may be difficult in the near-term (2028 – 2030+) due to increased electrical load associated with EIC and the new data center.</p> <p>However, New York States aggressive energy goals as part of the CLCPA will result in dramatic reductions of BNL's Scope 2 emissions, and to a lesser extent Scope 1.</p>	
Reduce Scope 3 greenhouse gas emissions.	<p>COVID-19 restrictions that limited domestic and foreign air travel trips to those which were mission critical and the fact that 67 % of employees teleworked over the course of the year are the primary reasons for the 26.1 % drop in the Laboratory's Scope 3 greenhouse gas emissions.</p>	<p>The Laboratory's "New Telework and Remote Work Policy" announced on October 25 will affect reductions in commuting GHGs in FY 22 and beyond. Since Laboratory use of Microsoft Teams and Zoom virtual communication tools during the pandemic has shown they can serve as effective alternatives to travelling to meetings, seminars, and conferences, EPD plans to work with the SME for the Domestic Travel & Foreign Travel on possible revisions to the guidelines that Department Chairs and Division Managers use to determine if travel requests are appropriate and feasible.</p>	Low

II. Performance Review and Plan Narrative

Energy Management

This category focuses on efforts to reduce energy intensity, non-fleet fuel use, and associated GHG emissions. This category also discusses site metering and benchmarking efforts and the site's approach to conducting Energy Independence and Security Act (EISA) Section 432 evaluations.

Current Performance

Energy Intensity Initiatives

For FY21 BNL re-evaluated the planned Second Utility Energy Service Contract (UESC) project. As discussed in last year's SSP, the economics were marginal at best. During FY22 we will continue the evaluation process, refining the scope, and utilizing the latest forward energy cost estimates. Due to aggressive planned energy goals in New York State that includes "carbon pricing", there will be a significant upward pressure on energy costs and rates.

Energy intensity for FY21 was 243,174 Btu/gsf, which is essentially the same at the base year of 2015 at 243,022. Energy intensity is well known to be greatly impacted by several factors, including some challenges that are beyond a site's ability to control. The most significant factor at BNL is weather. Since the site is located in the Northeast, fuel for heating is the most dominate energy source for buildings. Other factors affecting energy intensity include changing outdoor air code requirements, increased density/occupancy of new facilities, and constantly changing technologies including computers and related IT systems, lighting, and control systems.

Best practices continue to be implemented including temperature set-back during unoccupied periods, maximizing outdoor air when the temperature and enthalpy levels are appropriate (economizer operation), and appropriate building maintenance.

Even with substantially reduced building occupancy resulting from the minimum-safe (Min-Safe) operating mode (due to COVID-19), there has been virtually no reduction in energy intensity. This is due to the fact building spaces still needed to be maintained (in most cases with additional outside air ventilation requirements from COVID-19 protocols).

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.

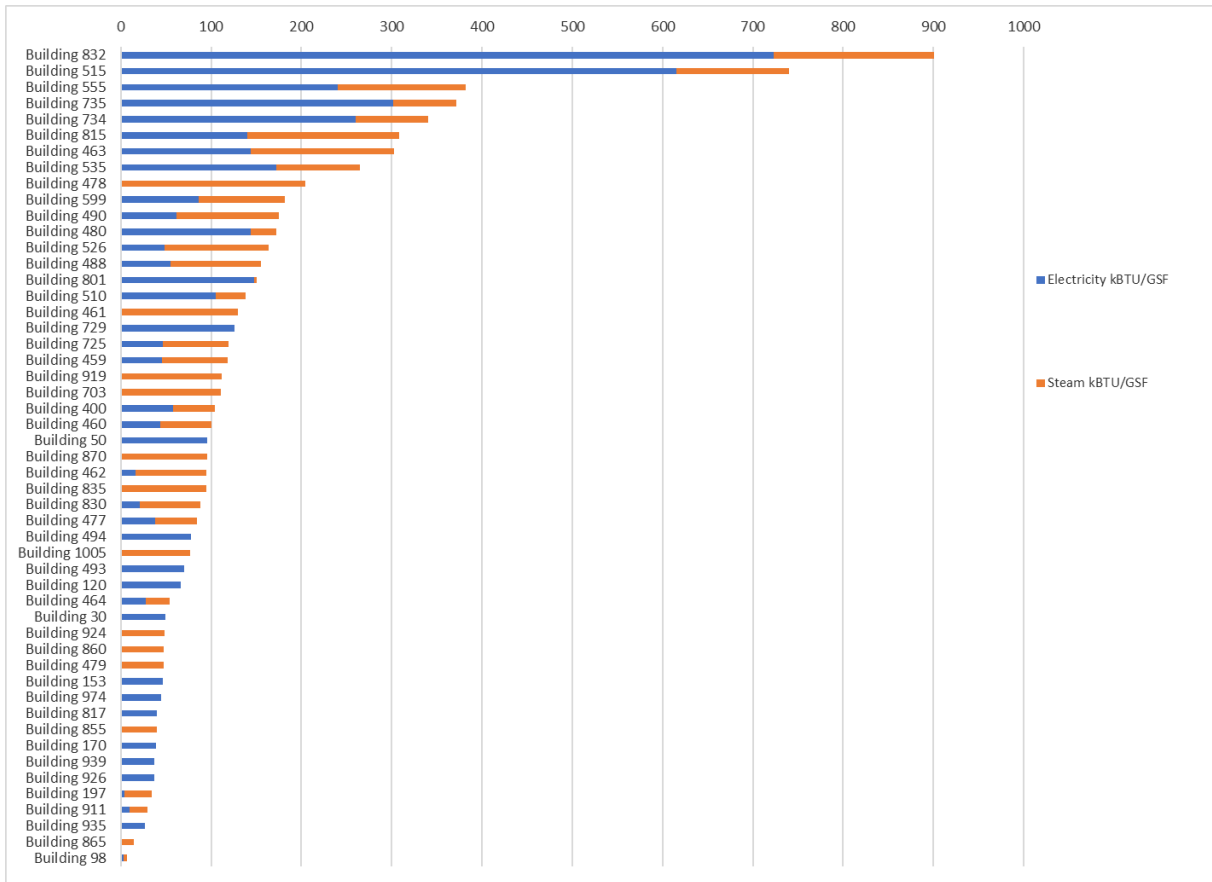


Figure 1: EUI for Non-Excluded Buildings

ISO 50001

BNL is in the early stages of discussing pursuit of the ISO 50001 and potential certification.

Net-Zero Buildings and Carbon Pollution Free

BNL continues to evaluate opportunities for Net-Zero buildings and completed a high-level concept for a net-zero short-term housing project we hope to further develop.

Approximately 45% of BNL's electricity comes from clean hydropower. We also purchase REC's equal to ~8% of the total electricity use and generated ~600,000 kWh of clean electricity from the on-site solar PV system. Further, New York State's aggressive clean energy goals include the requirement for 100% zero emission electricity by 2040.

Non-Fleet Vehicle and Equipment (V&E) Fuel Use

BNL continues to maximize bio-fuel use in non-fleet vehicles.

Metering and Advanced Metering

BNL continues its decades-long tradition of advanced metering efforts and is meeting the metering goals for electricity, natural gas, and chilled water. During FY21, 12 additional advanced electric meters were installed on large critical loads including the new data center.

A comprehensive real-time and historical energy use dashboard continues to be enhanced. The dashboard includes all forms of energy use on a high-level and allows users to drill down to local building meters. Chilled water meters are calibrated annually. Electric meters require virtually no maintenance.

Plans and Projected Performance

Continued reductions in Energy Intensity have been and will continue to be one of the biggest energy related challenges for BNL. BNL will continue to work to develop financeable energy projects that can be funded via third party (such as a UESC, internally funded, or a combination of funding). The biggest obstacles are BNL's low energy rates and high construction costs. As discussed earlier we anticipate a sharp increase in energy prices in the future as the cost of carbon emissions gets factored into pricing. Higher energy rates will allow more projects to be economically justified.

BNL's electric demand is expected to increase dramatically over the next decade, increasing from a current peak of ~52 MW to ~125 MW. This increase will predominately be due to the Electron Ion Collider (EIC) but other loads, such as the new data center and those at the National Synchrotron Light Source-II (NSLS-II), will contribute. The increase in demand and consumption will also result in a large increase in both electricity costs and rates. A high-level graph of the expected electricity demand increase is provided below:

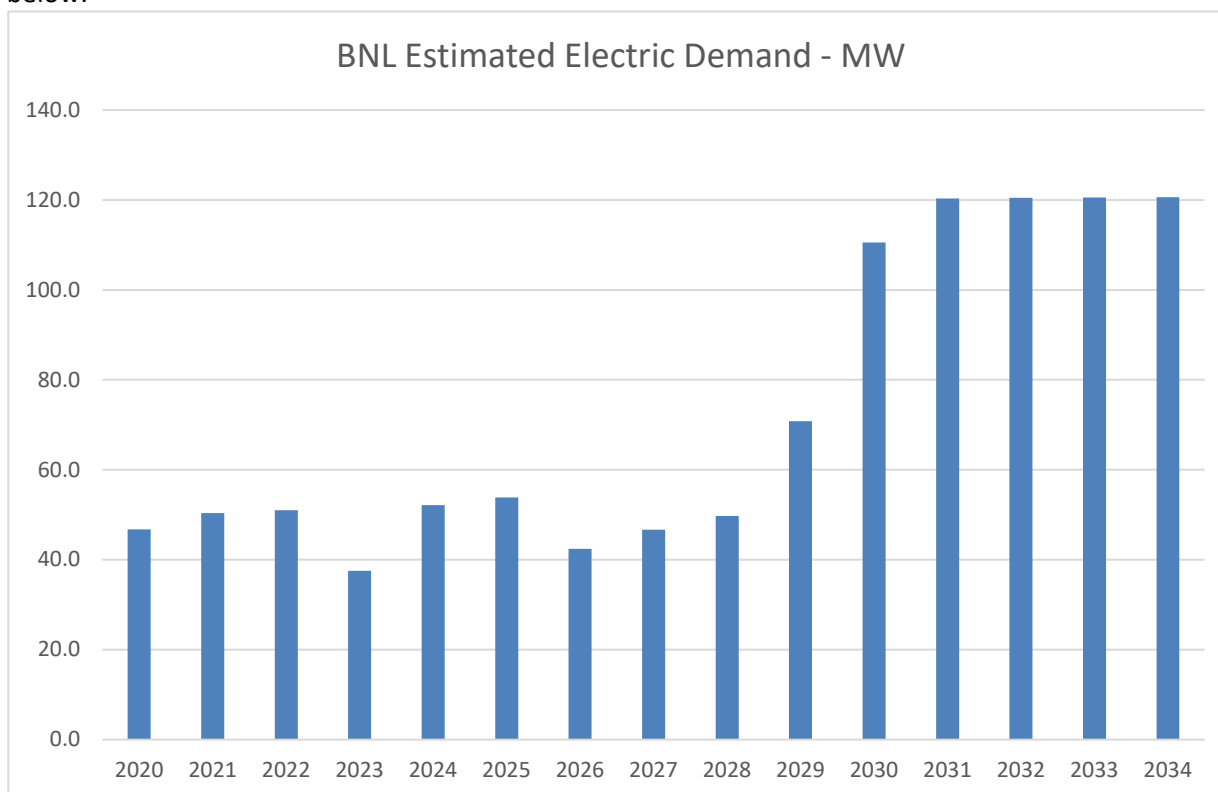


Figure 2: Estimated Electricity Demand

Water Management

This category focuses on initiatives to reduce potable and non-potable water consumption, comply with stormwater management requirements, and improve water efficiency. In addition, the category summarizes any obstacles related to the implementation of conservation strategies or the collection of water consumption data.

Current Performance

BNL obtains its potable, process cooling, and fire protection water from Long Island's underground aquifer. BNL runs its own NYS-regulated "community water system" which consists of five water wells, a Water Treatment (Iron Removal / Filter) Plant, two 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 3 by the trend in annual potable (includes process) water usage.

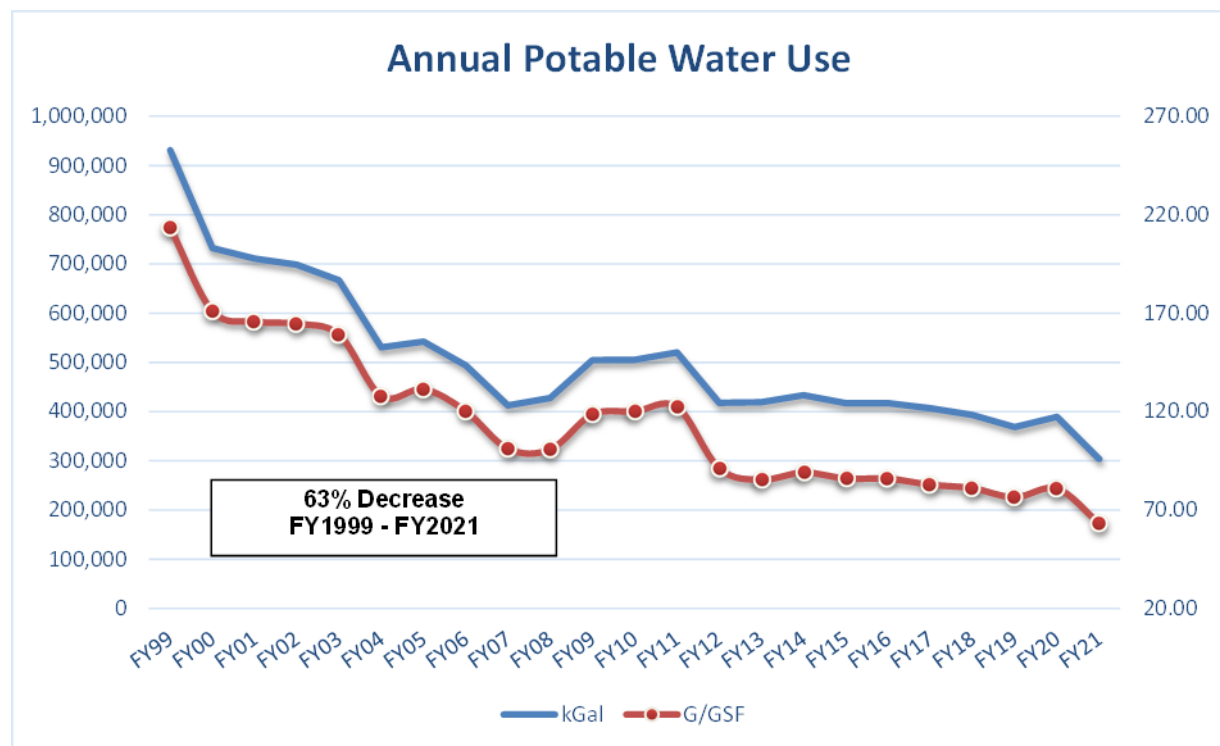


Figure 3: Annual Potable Water Use (1999-2021)

Potable-water usage fell from 931 million gallons/year in FY99 (average of 2.55 million gallons per day) to about 304 million gallons/year in FY21, a reduction of 63.0%. When normalized by site growth (building area in gross square feet), BNL's annual water use intensity has decreased from 101 gallons/GSF to 63.24

gallons/GSF, a 38% water usage reduction since base-year 2007. The table below illustrates the change in site gross square footage.

Table 1: Annual Change Gal/GSF Water Use (1999-2021)

FY	kGal	GSF	G/GSF
FY99	931,452	4,363,224	213.48
FY00	732,408	4,281,455	171.07
FY01	710,583	4,286,993	165.75
FY02	698,340	4,241,450	164.65
FY03	666,916	4,191,562	159.11
FY04	530,414	4,148,593	127.85
FY05	542,568	4,128,355	131.42
FY06	493,641	4,105,635	120.23
FY07	412,935	4,081,900	101.16
FY08	427,400	4,237,100	100.87
FY09	504,500	4,252,200	118.64
FY10	505,075	4,203,457	120.16
FY11	520,308	4,249,150	122.45
FY12	418,153	4,586,455	91.17
FY13	419,372	4,906,797	85.47
FY14	433,718	4,865,753	89.14
FY15	416,904	4,843,649	86.07
FY16	417,364	4,854,679	85.97
FY17	406,876	4,905,386	82.94
FY18	393,096	4,845,380	81.13
FY19	368,520	4,815,914	76.52
FY20	389,437	4,812,662	80.92
FY21	304,042	4,807,484	63.24

Water usage decreased significantly from FY20 to FY21. BNL has not had time to fully analyze the data but there is one likely explanation for the decreased usage. In FY21 the primary water source wells were switched due to water quality. Wells 10 and 11 were used almost exclusively and the backwashing required for the other wells was eliminated.

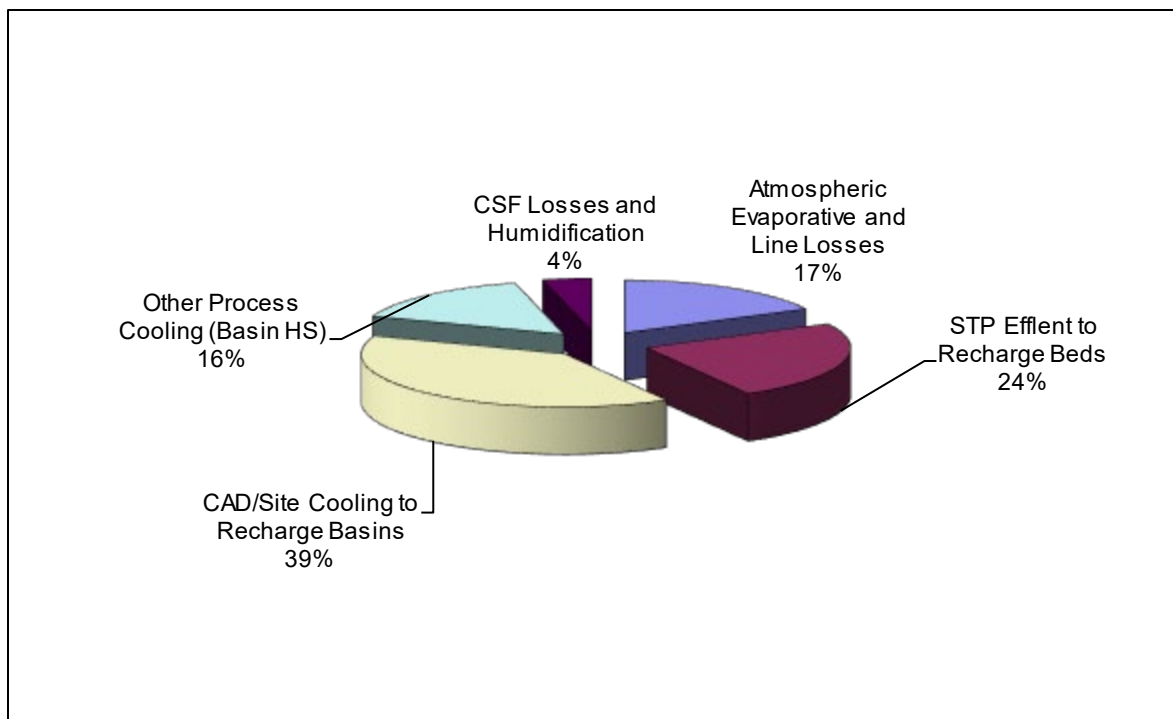


Figure 4: 2021 Potable Water Utilization

Beginning October 2014 BNL implemented groundwater recharge of treated wastewater at its Sewage Treatment Plant. Currently, about 85% of water used at BNL is recharged (recycled) to groundwater via groundwater recharge basins. The water recharged is near potable water quality.

We estimate that over two-thirds of BNL's water production is attributable to High Energy Missions 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. 13834 goals require that BNL reduce potable water intensity (Gal per gross square foot) by 20% relative to FY07 by FY15 and 0.6% year after year thereafter.

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 \$0.48 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 wastewater discharges to the sewage treatment plant, and increasing energy savings) and upon obtaining capital funding to install them (aligned with other priorities).

A carbon filtration system was renovated and returned to service for PFAS removal. Well House No. 11 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. We have already seen a tremendous reduction in FY21.

Finally, we emphasize that ~85% 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. (While the return level have decreased slightly in recent years this is excellent return for a large district steam-system and the condensate return conserves water and energy).

- Single-Pass Cooling Systems: BNL continues to reduce water flow through single-pass cooling systems that discharge to the sanitary sewer system. The marked success of these efforts is reflected in the 63% water use intensity reduction.
- Cooling-tower Systems: To reduce water use in once-through cooling systems, BNL has 32 cooling towers with a flow rate of over 300 gpm. To maximize cooling efficiency and minimize water use, BNL controls the blowdown rates on the large towers to maintain the “cycles of concentration” between four and six.
- Water Reuse and Recycling: Approximately 85% 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 13834 “Efficient Federal Operations”.
- 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 funded engineering and design of a new Well House No. 12. Construction of the new well house has begun and was nearly complete by the end of FY21. Total estimated cost (TEC) for the project will be about \$2.5 million. 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.

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).

Waste Management

This category focuses on the site's approach/vision for addressing waste management, pollution prevention (source reduction), diversion measures (e.g., recycling, composting), and construction and demolition (C&D) waste reduction.

Current Performance

BNL is currently diverting a wide variety of waste streams consistently performing above DOE's 50% goal. The first steps in moving closer to Net-zero include defining the waste baseline and identifying areas where further diversion opportunities exist (mainly expanded recycling opportunities, or diversion of MSW from a landfill to a Waste to Energy Facility.) The generation of both recyclables and MSW has been decreasing for several years. This year's large increase is due to BNL sending 90 tons of concrete, blasting garnet out for recycling for the first time in a few years, which always impact the recycling rate along with several large transformers that increased metal collection numbers by 10 tons over normal. However, BNL also sees the start of an increase in recycling associated with staff returning to work onsite (lingering COVID-19 impact). Site expansion activities anticipate further increases in staff and associated recycling and MSW waste streams as well as C&D wastes streams associated with active, ongoing C&D projects associated with Discovery Park and growing scientific organizations.

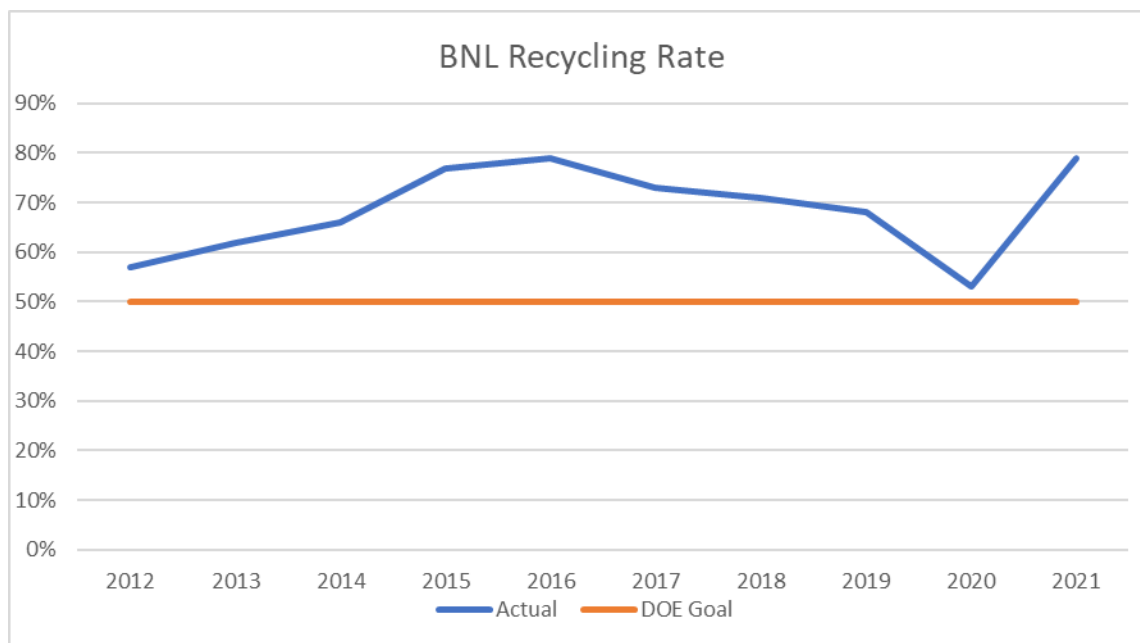


Figure 5: BNL's Recycling Rate

Plans and Projected Performance

As discussed in the Acquisition Section, BNL will implement improvement initiatives identified during 2021 to improve EPP purchasing conformance by creating improved tools and information to simplify the purchasing process. BNL will also write institutional EMS objectives that promote the review of the chemical inventory to identify and replace environmentally hazardous substances.

During 2022, BNL will open discussions with the site's current waste hauler regarding options for disposal of MSW to a Waste-to-Energy facility as a first step towards evaluating the feasibility of diverting the site's remaining waste that is currently going to a landfill. Diversion of this waste would make BNL a Net-zero site, but the associated costs need to be understood.

BNL's recycling options are limited by what the various Long Island Town Waste Management Facilities will accept. Glass is no longer accepted unless it is transported directly to a Town facility. Only plastics from food and beverage containers marked with a 1, 2 or 5 are accepted for recycling leaving BNL no options for recycling the large volume of clean plastic and glass generated by laboratory operations. Therefore, BNL will investigate alternative vendors for its glass and/or plastic collection and recycling program, though distance and low generation rates are expected to make it challenging to identify an economically feasible option.

C&D reduction efforts will be challenging as site expansion will increase overall generation rates. BNL will base C&D goals on increasing the percentage of C&D recycled, not on volume reduction. BNL still needs to collect data before setting targets.

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.

Current Performance

Due to increased population on campus over the course of FY21, vehicle usage has been slowly increasing in comparison to FY20. Year over year, utilization has increased by 15%. Drivers are encouraged not to idle during shifts to reduce GHG emissions and engine hours. The new Geotab telematics will assist in reviewing vehicle use more accurately and provide comprehensive reports of activity and idling hours. The current GSA fleet is currently composed of 73% Alternative Fuel Vehicles. Of the 25 government vehicle replacements ordered in FY21, 22 of the replacements were Alternate Fuel Vehicles (AFVs).

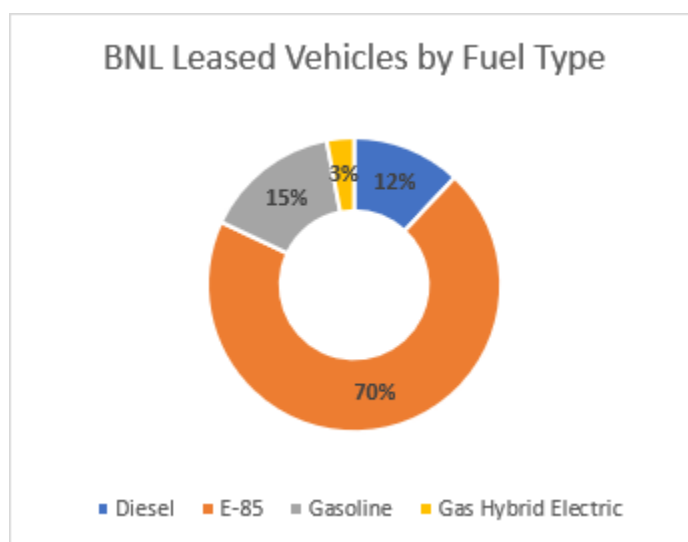


Figure 6: Leased Vehicles by Fuel Type

In September 2021, eight Chargepoint charging ports were activated for electric vehicles. Since the program's launch, seven personal vehicles have been added to the program and have saved 345 kg of greenhouse gas emissions onsite to date. This is essentially equivalent to planting nine trees. In addition to charging the future government fleet, the fast-charging stations will incentivize onsite employees to acquire electric vehicles due to the charging access onsite. The fast-charging stations will be expanded to more buildings as the Lab transitions to an electric fleet.

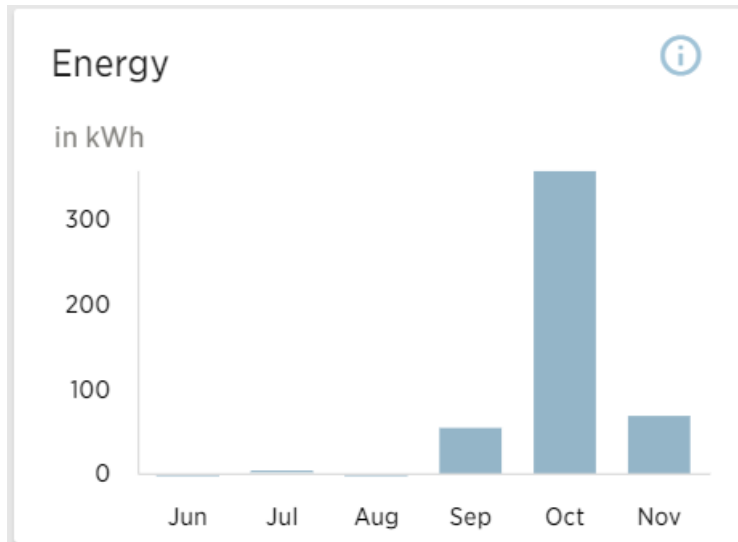


Figure 7: Chargepoint Energy Usage

The VAM (Vehicle Allocation Methodology) Survey was sent out in 2021 which gives Congress and DOE a better understanding of each agency’s fleet needs and usage. This information will be used to “right-size” the Lab’s fleet. The Fleet Supervisor will also consider the reduction of employees onsite to reassess utilization goals and assign vehicles as needed.

The Lab’s onsite shuttling service has been adjusted to accommodate the reduced staffing on campus. The current schedule is reservation only which reduces excess trips and gas emissions until population increases on campus. This strategy has saved a significant amount of idling time and mileage.

Plans and Projected Performance

BNL will continue to order AFVs and electric vehicles as they become available through GSA. BNL’s goal is to be at 75% AFVs. The Geotab telematics have been installed into new GSA vehicles. The new telematics will continue to be added to Geotab units for the existing GSA vehicles to accurately monitor vehicle use and idling times.

In FY23, BNL anticipates replacing approximately 100 vehicles with newer and more fuel-efficient vehicles. The reduction of the remaining aging vehicles will assist in the annual vehicle costs and reduce GHG emissions at the Lab.

The Spot Checks started in FY21 will continue to ensure all vehicles are being maintained for optimal performance. The Spot Checks on the government vehicles evaluates and identifies tread depth, unoccupied idling vehicles, and damage. For FY21, the Spot Checks at BNL demonstrated positive changes in custodial vehicle care and Fleet Management will continue to communicate the outcome to the Lab quarterly.

Clean & Renewable Energy

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

Current Performance

45% (120 million kWh) of BNL's FY21 electricity was clean hydropower provided by the New York Power Authority.

BNL purchased 24,000,000 kilowatt hours (kWh) of RECs for 2021 to meet the "Renewable Energy" minimum requirement of 7.5%. The 24 million kWh of REC's represents 9% of the total site electric consumption.

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. It is important to note the price of REC's more than **tripled** compared to last year. By most accounts the price of REC's will continue to increase in the future.

BNL's 816 kW Northeast Solar Energy Research Center (NSERC) facility produced 605,128 kWh in FY21 that were consumed by BNL's facilities. The RECs are retained by BNL and are not sold. The output for FY21 was significantly less than prior years due to a needed shut-down for ~1 month to address operational issues as well as some failed components.

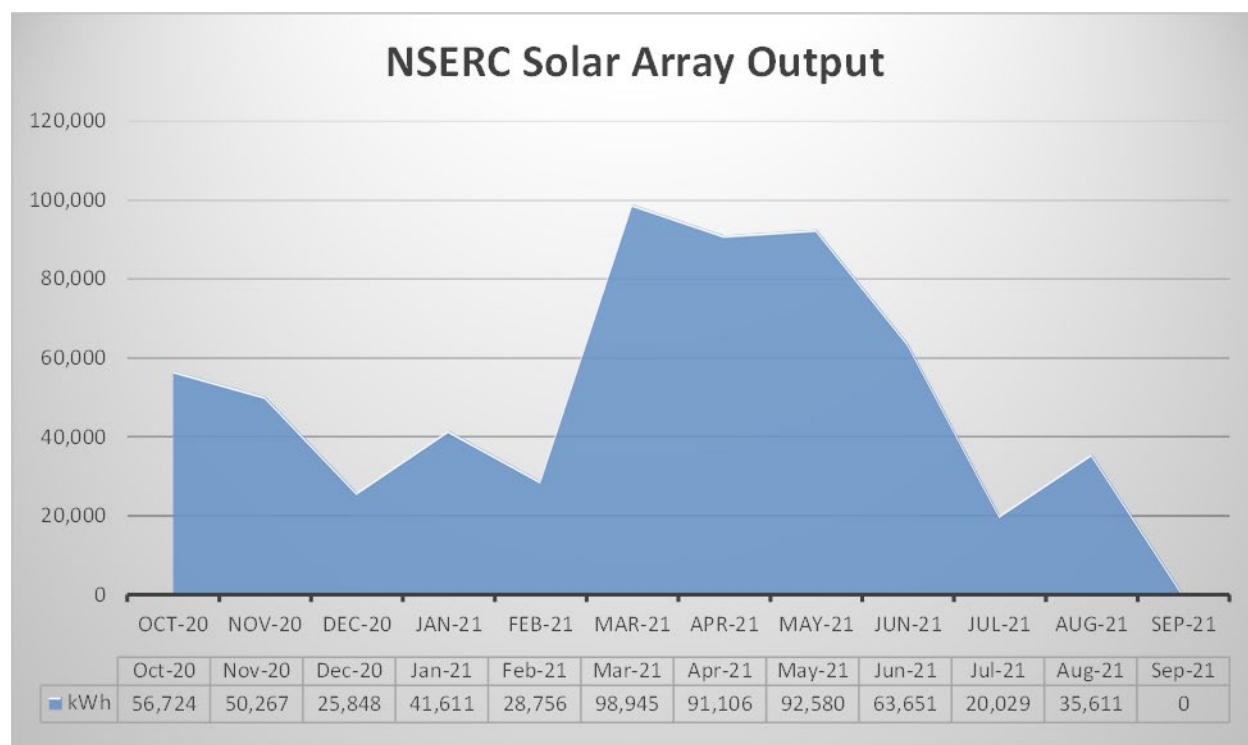


Figure 8: NSERC Solar Array Output

FY21 is the 9th year of BNL's hosting 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. The LISF produced 48,935,000 kWh in FY21. The average of the past 9 years is 49,982,000 kWh/year.

As discussed in previous SSP's an evaluation of combined heat and power (CHP) was last completed 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 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 continue to 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 for the foreseeable future to meet the latest renewable energy and clean energy goals.

BNL continues to regularly evaluate alternative energy opportunities. The Long Island Power Authority (LIPA) recently issued a Request for Proposal (RFP) for utility scale battery storage on Long Island to facilitate planned 9,000 MW of offshore windfarms and 3,000 MW of battery storage. BNL has had high-level discussions regarding potential hosting of utility scale batteries.

The most recent 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 32-MW Long Island Solar Farm (LISF) on the BNL site and that much of the land is forested and in environmentally sensitive areas (core Pine Barrens), BNL continues to be concerned about clearing additional large tracts of 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 decreases or new incentives become available, then it is possible additional RE projects could become cost-effective." NREL did suggest consideration of small wind turbines. However, given the Federal Aviation Administration's (FAA's) determination that large (300 ft. high) ones would pose an aviation problem in the area, as well as concerns from BNL's neighbors, this option is not currently being pursued.

BNL's low energy rates and high construction costs have thus far precluded renewable energy projects from being economically viable. 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, even with the new office building, the Science and User Support Center, (SUSC). During the design several renewable concepts were evaluated including solar hot water heating and a solar wall for pre-heating. Unfortunately, they proved too expensive and were not included.

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 we ultimately plan to be combined with energy storage.

BNL is continuing discussions with energy storage providers and various governmental agencies to explore options such as hosting large utility scale battery storage systems on site as mentioned.

As discussed in the previous section, BNL has regularly evaluated CHP as a potential clean energy initiative. However, New York State's aggressive Community Leadership and Climate Protection Act (CLCPA) is putting considerable pressure on all fossil fuel sources as they are planned to be eliminated over time. New natural gas consuming facilities are being discouraged or denied.

On the positive side, the CLCPA goals include 100% zero emission electricity by 2040 thus virtually eliminating BNL's electric consumption emissions.

Sustainable Buildings

This category focuses on all aspects pertaining to sustainable building initiatives such as Sustainable Buildings, formerly referred to as High Performance Sustainable Buildings, as well as building inventory changes.

Current Performance

Guiding Principles

Currently 8 buildings have achieved 100% of the 2008 GP's and an additional 9 buildings are considered meeting them as they have achieved LEED Gold or higher status. This represents 15.3% of non-excluded buildings. 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, either meet or exceed the Guiding Principles. BNL does not have any leased facilities. The Modernization Project Office's Design Standards (MPO Procedure 100E) includes requirements to ensure that all new construction is at least 30% more efficient than ASHRAE 90.1.

The design documents for the new Science and User Support Center (SUSC), which was completed in FY21, incorporated the guiding principles and new building design criteria into the design.



Preliminary Design Rendering of the Science and User Support Center (SUSC)

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.

Climate-Resilient Design and Management

The Modernization Project Office's Design Standards (MPO Procedure 100L) requires that all large new construction projects (i.e., new buildings, building additions, or Level 3 alterations) consider present and future climate conditions in assessing environmental impacts on the project. The design criteria is based upon the latest version of the "Climate Resiliency Design Guidelines" prepared by the New York City Mayor's Office of Recovery and Resiliency with respect to increasing temperatures, frequency of heat waves, and precipitation. The Climate Resiliency Evaluation were incorporated into the designs for the SUSC project and an addition to Building 744 during FY21.

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

Criteria for meeting energy reduction goals and guiding principles will be incorporated into the designs for new buildings.

Net Zero Buildings

Where economically feasible, BNL will ensure net-zero requirements are included in future designs.

Strategies for Design (42 USC 6834)

In lieu of the requirement gap between 42 USC 6834 and 10 CFR Part 433 Subpart B, new building construction and/or modernization will follow the Guiding Principles for Sustainable Federal Buildings to reduce energy consumption.

Climate-Resilient Design and Management

Climate resilient design will be considered for large new construction projects (i.e., new buildings, building additions, or Level 3 alterations).

Acquisitions & Procurement

This category focuses on all relevant sustainable acquisition clauses, recent sustainable purchases, and efforts to improve your supply chain GHG emissions.

Current Performance

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 FEMP-designated);
- water efficient (WaterSense);
- bio-based (USDA BioPreferred);
- environmentally preferable (including 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 uses the Vinimaya system ("E-Buy") for most purchases of the items that fit into the above product categories. 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.

BNL assists E-Buy requisitioners on request while also maintaining the "Commonly Purchased Items" guide of EPP-compliant products on PPM's webpage. The guide helps requisitioners easily identify compliant E-Buy items. As mentioned, requisitioners can also save identified, commonly ordered items in the Vinimaya system for future reference and ordering. However, challenges in performance will continue until the EPP conformance is part of the online catalog product descriptions. Improved online product descriptions would remove a significant barrier to purchasing conformance created when a requisitioner must interact with the vendor (chat/call) to determine conformance.

BNL's E-Buy training is used to communicate EPP requirements to new and existing users. The Procurement Division audits E-Buy purchases for EPP conformance, an effort directed mostly at office products. 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.

BNL 2021 improvements include EMS objectives aimed at non-conforming product identification in BNL's current chemical inventory. Six products were identified in inventory that had EPP conforming alternatives. BNL will continue to identify new items and work with product owners to replace the current products with EPP alternatives.

BNL's sustainable acquisition strategy for new construction is built into the Lab's Project Management Process. The Lab captures EPP purchasing requirements in contract terms and conditions to ensure use of EPP conforming products. For projects > 50M, the Lab evaluates the projects using the High-Performance Sustainable Building (HPSB) process to incorporate sustainable design concept including the use of environmentally sustainable building materials. Smaller projects are evaluated during various project review design phases. For example, pre-planning for construction or 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. BNL's Environmental Protection Division (EPD) assessed project-related activities during the 2021 Sustainability Assessment and identified numerous opportunities to improve Lab communications around sustainability that can help increase performance by increasing awareness as well as developing tools and guides that help requisitioners identify conforming products.

Biobased purchases are tracked manually by collecting and adding together purchasing receipts because the Lab's current purchasing system can't identify EPP conforming items in its database. The cost to resolve this limitation is prohibitive. BNL is in the process of evaluating a new purchasing software system with plans of implementation within the next five years that will include improvements in capture and tracking of EPP purchasing information.

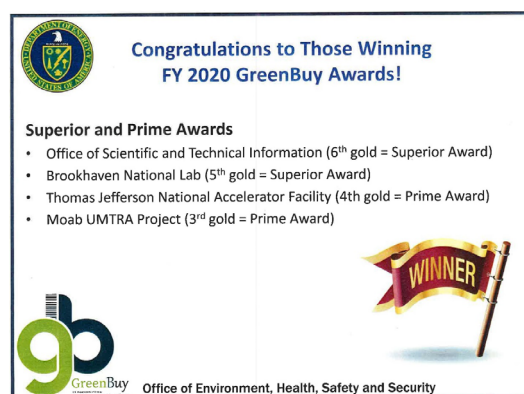
During this past year, BNL received the Green Electronics Council's 2021 EPEAT Purchaser Award at the Gold Level, and the GreenBuy award for the sustainable acquisition of 13 products in 6 different categories in FY20. In addition, BNL won the GreenBuy Superior Award which is given when a facility wins Green Buy Awards five times indicating that BNL continues to have effective processes in place to maximize or drive acquisition of sustainable products. However, BNL is concerned with the substantial decrease in EPEAT conformance in electronics purchasing during 2021, dropping from typical performance over 90%. FY21 purchases conformance dropped to mid-50% range. Understanding the change is addressed in the Electronics Acquisition Section.



BNL 2021 Environmental Impact Reduction and Cost Savings



**Global Electronics Council: 2021
EPEAT Gold Purchaser Award**



GreenBuy Superior Award

Plans and Projected Performance

During 2022, 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 review and rewrite the Pollution Prevention Subject Area and Environmental Protection Division P2 Webpage incorporating the improvements identified during the 2021 Sustainability Assessment. Specific actions are tracked with BNL's Integrated Operational Performance System (IOPS) and are geared at providing requisitioners improved tools for EPP conformance.

The limitations of our PeopleSoft purchasing system is the primary roadblock and while BNL is anticipating a new system that can be designed to better manage EPP-related data, that is five years away.

Efficiency & Conservation Measure Investments

This category focuses on efforts to implement identified Efficiency & Conservation Measures (ECM) through appropriations, performance contracts, or other funding mechanisms, and discuss sustainability-related training or education provided for employees. This section also highlights implemented ECMs and funding needed beyond planned activities as well as typical operation costs for meeting sustainability goals.

Current Performance

Efficiency & Conservation Measure Investments

Internally funded energy conservation and sustainability related initiatives include continuation of best practices, with continued emphasis on temperature setback during unoccupied periods.

As discussed previously, some were initially somewhat surprised at the minimal (~0.3%) reduction in energy use intensity (EUI) between FY19 and FY20, and an increase of ~3% from FY20 to FY21. The expectation was a reduction due to the minimal staffing on site. However, the buildings needed to be maintained at their normal conditions for those working on site, and to ensure proper environmental conditions for the building and equipment. Further, in many cases outside air use was increased due to COVID and in some cases additional filtration was added. Both increase energy use.

A high-level analysis was done regarding a reduction of on-site personal computer use. We estimate a reduction of ~0.3% in the EUI.

Consistent with past efforts BNL continues to implement small lighting and water conservation projects by using the latest, most efficient equipment as part of on-going maintenance efforts.

Energy and water evaluations are completed annually 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. Unfortunately, in FY21 once again due to the limited site presence during the COVID / MinSafe mode little to no progress in the area occurred. When larger cost-effective projects are identified they have been and will be directed to areas that may have funding available, or to a UESC or ESPC effort.

Energy Performance Contracts

As indicated previously, BNL completed its first UESC in 2015. The project continues to perform well, meeting the original energy savings estimates within a few percent each year. As a result of the success of this project a second UESC was developed in FY20. An Investment Grade Audit (IGA) was complete at the end of FY19. Lessons learned from the first project, UESC Phase I, were included with the UESC Phase II effort. Virtually all the necessary documentation for a Task Order was developed.

Unfortunately, the economics of this Second UESC project are marginal and BNL decided to put the effort on hold while other options are evaluated, including a potential internally phase funded effort, a rescoped effort, and revisiting the estimated future energy costs due to the most recent regulations and laws in New York State that will increase energy costs for the foreseeable future.

Investments

Funding continues to be difficult for energy conservation and sustainability related projects in the current budget constrained environment. BNL, like other DOE sites, has been increasingly trying to take advantage of third-party financing options that utilize cost savings to pay for the projects. However, while BNL's low-energy rates are a tremendous benefit in operating the large research machines they, when combined with our high construction costs make it extremely difficult to find economical projects that can be financed.

Payments for BNL's current UESC project will be complete in FY23, freeing up funds for other energy conservation initiatives.

Table 2: Sustainability Funding

Category	k\$		
	FY21 Actual	FY22 Planned/ Request	FY23 Projected
Sustainability Projects	0	100	200
Sustainability Activities other than projects	27.2	45	45
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)	1,645	1,695	2,174
Renewable Energy Credits (REC) Purchase Costs (if applicable)	163.2	200	250
Total	1,835.733	2,040	2,669

Plans and Projected Performance

As discussed, the economics of the potential second UESC II effort are currently considerably less cost-effective than the previous UESC. The all-in electric rate for FY21 was the lowest it has been in 42 years. This, combined with near historic lows in natural gas rates, and high construction costs, made it extremely difficult to find cost-effective energy / GHG savings projects.

However, due to the requirements of the New York State Community Leadership and Climate Projection Act (CLCPA) energy rates/costs are expected to increase substantially in the relative near future. Further, BNL's large electric demand increase (more than double the existing) associated with the E-IC project will have a major impact on electricity rates/costs. These expected increases will make investment in energy and GHG reduction projects easier to justify.

BNL will re-evaluate the UESC II initiative, as well as other potential energy and GHG projects using updated energy cost escalation factors.

Travel & Commute

This category focuses on all information pertaining to the site's business travel and commute data, including participation in regional and local planning.

Current Performance

BNL continues to track its Scope 3 Greenhouse Gas Emission in relation to the previously established Scope 3 greenhouse gas reduction goal established under Executive Order 13514. The figure below illustrates that, overall Scope 3 emissions are down 26.1% from FY 2020 (13,855 MtCO₂e), and 49.2% lower than the FY 2008 baseline value.

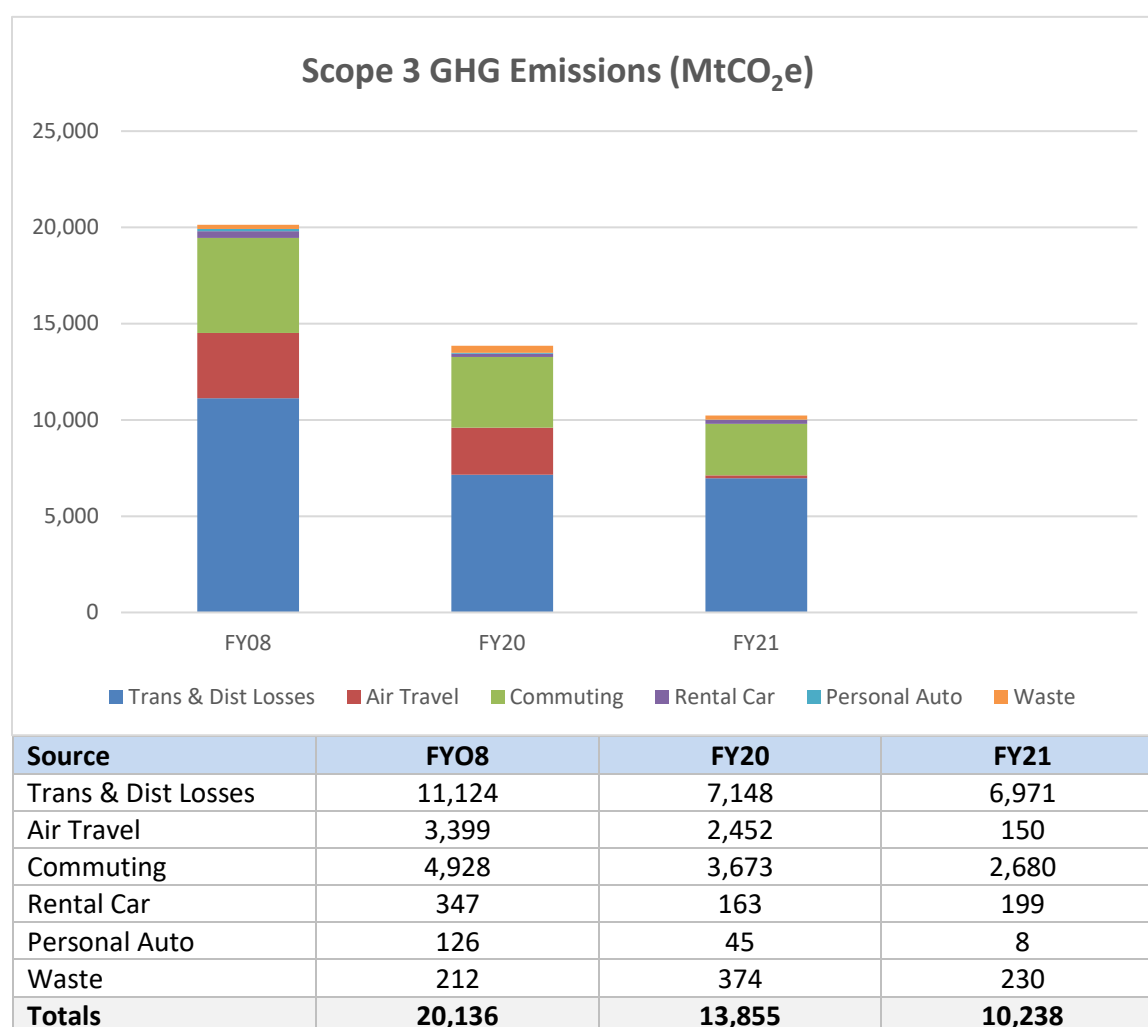


Figure 9: Scope 3 GHG Emissions

The decrease from FY 2020 is primarily due to a 94 % decline in air travel GHG emissions and a 27 % drop in commuting GHGs. Air travel GHG emissions have dropped due to Covid-19 restrictions that have limited domestic and foreign air travel trips to those which are mission critical. Commuting GHG emissions have

declined because the Laboratory has remained in Phase 2 limited operations throughout the year in accordance with DOE guidelines with 65 – 70% of staff telecommuting.

The 2.5 % (177 MtCO₂e) decrease in transmission and distribution losses in FY21 was due to a 5.3 % decline in transmission and distribution losses from electricity purchased off the local grid and 2.6 % rise in transmission and distribution losses from hydro-electricity purchased upstate.

FY21 commuting GHG emissions were estimated using employee residency zip code records to determine the average employee roundtrip commuting distance and the daily average number of employees commuting to work was estimated based on a review of periodic COVID-19 Situation Reports prepared and distributed to staff by the Laboratory's COVID-19 Task Force. Aside from statistics on new COVID-19 cases at the Laboratory, in New York and across Long Island, each report included an estimate of the percentage and/or the number of staff teleworking. Estimates of the percentage of staff teleworking were based on Safeguard & Security daily counts of the number of employees passing through north and main entry gates. The review of 55 periodic COVID-19 Situation Reports showed that 67 % of staff teleworked in FY 2021 or that 881 employees commuted to work each day. It was assumed that all employees commuted alone.

Scope 1 & 2 Greenhouse Gas Emissions

According to the DOE Sustainability Dashboard, BNL's Scope 1 & 2 emissions for FY21 were 167,520 MtCO₂e, -18.5% relative to the 2008 baseline.

There has been a continued improvement of the generation mix on Long Island that has contributed to some modest Scope 2 reductions. Further, BNL has been using natural gas virtually exclusively (vs. oil) for its central steam facility, keeping Scope 1 emissions at a minimum.

BNL's electricity purchases included 45% clean hydropower for FY21, as well as 22 million kWh of REC's, and ~600,000 kWh of on-side solar PV generated electricity

Regional and Local Planning

BNL continues to maintain close interaction with NY State, the Metropolitan Transportation Authority (MTA), Long Island Railroad (LIRR) and Suffolk County/Brookhaven Town officials regarding plans for the relocation of the Yaphank rail station. The plan is for the station to become a Yaphank/BNL rail station that is more proximate to BNL and public transportation arteries. New York State budgeted \$20M for the relocation of the Yaphank rail station. A planning study for the relocated station has recently been completed. 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/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 make work at BNL attractive for New York City residents. The relocated station would also make travel to/from regional airports (John F. Kennedy International Airport [JFK], LaGuardia,

Islip) much more convenient 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 projected to rise 15.9% from the FY21 total to 309,400 megawatt hours (MWh) in FY25 and by more than 57% to 420,800 MWh in FY30 when testing of the Electron Ion Collider is expected to begin. Using eGrid 2019 transmission and distribution (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 8,080 MtCO₂e in FY25 and to 10,992 MtCO₂e in FY30.

Recent declines in COVID-19 cases in the US and globally and easing of travel restrictions to Europe will likely lead to an increase in air travel in FY22. The anticipated gradual reopening of the Laboratory when Suffolk County's new cases fall and remain below the "moderate" threshold of 50 cases per 100,000 residents/seven days will permit more employees to work onsite and cause commuter GHGs to rise in FY22. Future decisions on domestic and foreign travel will likely be influenced by positive experience using the Microsoft Team and Zoom platforms to collaborate with colleagues during the pandemic.

The approval of exempt and non-exempt employee requests to telework or work remotely under the Laboratory's new telework and remote work policy will likely keep commuting GHG emissions much lower than the FY19 pre-pandemic total of 5,440 MtCO₂e.

Scope 1 & 2 Greenhouse Gas Emissions

BNL will continue aggressive efforts for Energy Intensity Reductions through UESC's, Energy Savings Performance Contracts (ESPC's) and other methods including self-funding.

Our allocation of 15 MW of clean hydropower will meet ~45-50% of our annual electricity needs for the next several years. We will also continue REC purchases and operation of the NSERC Solar photovoltaic (PV) array.

Meeting the goal may be difficult beyond 2030 due to increased electrical loads associated with the EIC and the new data center that will more than double electricity consumption. However, New York States aggressive energy goals as part of the CLCPA and especially the 2040 goal of zero emission electricity, will provide a dramatic reduction in BNL's long-term outlook for Scope 2.

BNL's Scope 1 emissions are expected to decline somewhat over time even with the current fuel/energy source mix. The CLCPA goals include other requirements that will lead to lower Scope 1 GHG reductions as well

Regional and Local Planning

Discovery Park development continues to make excellent progress. Design of the SUSC facility is now complete. DOE approval for start of construction is anticipated for the late fall 2021. Utility installations are scheduled to start late fall 2021.

Fugitives & Refrigerants

This category focuses on efforts to reduce GHG from fugitive emissions or refrigerants.

Current Performance

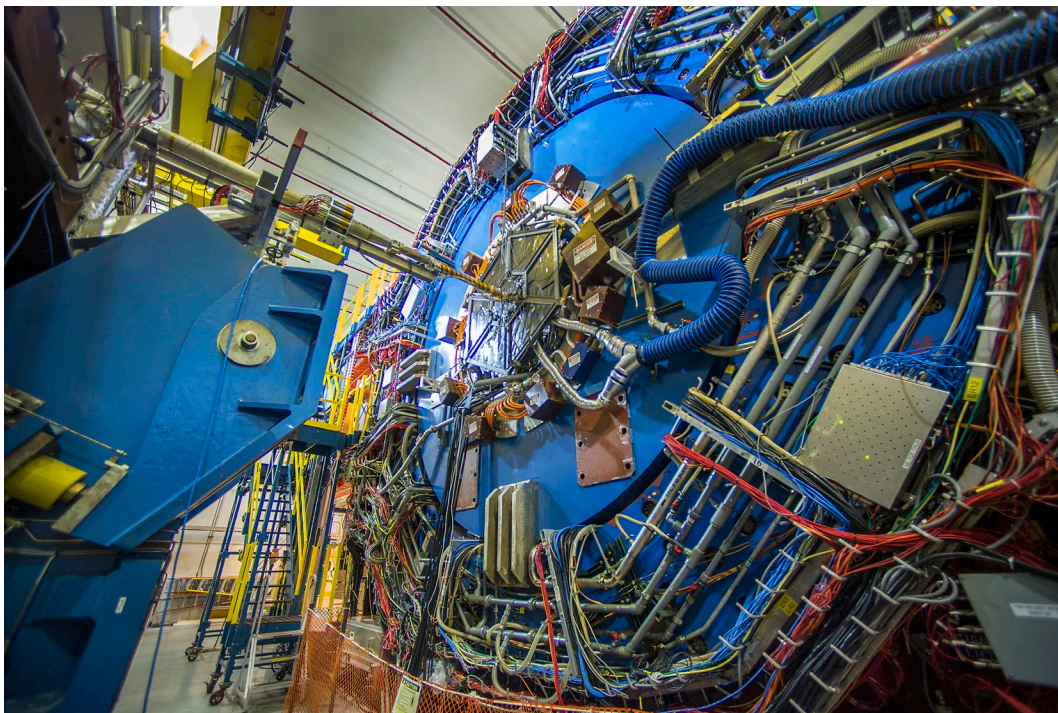
A variety of activities and operations at BNL use greenhouse gases for different purposes. The largest user of greenhouse gases at BNL is the Tandem Van de Graaff Facility. The two Tandem accelerator vessels with a combined storage volume of 16,050 ft³ are filled with an insulating gas mixture consisting 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.

The table below provides a summary of the sources of BNL fugitive greenhouse gas emissions in FY21.

Table 3: Fugitive GHG Emissions

Source	Activity	Gas	GHG Emissions (MtCO ₂ e)
Tandem Van de Graff	Insulating gas leaks	SF ₆	3,965.02
		CO ₂	0.00
	Accelerator gas transfers	SF ₆	40.33
STAR Experiment	Detector gas purging	CH ₄	6.53
		CO ₂	0.00
		HFC-134a	1,072.85
		SF ₆	276.13
Fleet Vehicle Repair	Fleet Motor Vehicle A/C Leaks	HFC-134a	15.84
Whole Site		CO ₂	0.02
Refrigeration/AC Equipment	Gas Leaks	R-410A	167.06
LEReC Accelerator DC Gun	SF ₆ service cart compressor leak	SF ₆	0.0
Current Landfill	Methane generation	CH ₄	32.95
Wastewater Treatment Plant	Effluent discharges	N ₂ O	0.49

The bulk of BNL's process and fugitive GHG emissions (besides those from insulating gas leaks of SF₆ from the Tandem Van de Graaff accelerator vessels) were due to periodic purging of carrier gases used in STAR detector subsystems during the FY 2021 Relativistic Heavy Ion Collider experimental run. During the STAR experimental run, the Time-of-Flight detector operated in a recirculation mode for 24 days recirculating 86.5 % of the detector gases reducing its HFC-134a emissions by 1472 pounds (955 MtCO₂e).



STAR Detector at the Relativistic Heavy Ion Collider (RHIC)

Preventative maintenance inspections of twenty-seven 15.5 kV sulfur hexafluoride (SF_6) gas insulated switches and eight 72.5 kV SF_6 gas insulated circuit breakers were conducted in FY 2021 as part of BNL's proactive program to identify and mitigate leaks of the Laboratory's SF_6 gas insulated high-energy equipment. Recorded equipment temperature readings and pressure gauge readings during the inspection provided no evidence of SF_6 leaks.

Plans and Projected Performance

Scheduled annual preventative maintenance inspections to identify and mitigate gas leaks (in twenty-seven 15.5 kV SF_6 gas insulated switches and eight 72.5 kV SF_6 gas insulated circuit breakers) were finalized in November 2021. Further reductions of HFC-134a emissions in FY22 are anticipated as the Collider-Accelerator Department's Time of Flight detector will be operated in recirculation mode during the entire FY22 STAR experimental run with 86.5 % of the gas mixture being recirculated.

Electronic Stewardship

This category focuses on the acquisition, operations and management, and disposal of electronics, as well as efforts to consolidate and optimize high performance computers (HPCs)/data centers with a particular focus on energy and water efficiency.

Current Performance

Acquisitions and Electronic Asset Disposal

BNL's ITD Division offers staff a variety of computer options that have been preselected to meet EPEAT Gold criteria driving high conformance to purchasing requirements as most employees purchase computers from preapproved stock. A certain number of computers are exempt based on scientific use and related high-power computing needs. All servers that will be purchased for the new BNL computing facility fall under the EPEAT exemption for scientific use. BNL has a high EPEAT conformance rate evidenced by the receipt of the EPEAT Gold Award discussed in the "Acquisitions" Section. Improvements in BNL's purchasing software would allow small improvements related to data collection and tracking but would be very costly compared to the benefit. Despite consistently high performance for some time, BNL has noted significantly decreased conformance with EPEAT purchasing requirements during FY21, dropping unexpectedly from typical performance around 95% to the 55-60% range. BNL will investigate to understand the cause.

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 413 desktop computers, 147 laptops, 46 tablets and 72 servers were reused internally by BNL personnel as well as numerous other small electronics. Past efforts to donate used computers to external parties for reuse were ended because of the resources needed to meet data security concerns (removal/shredding of hard drives and other data storage devices) prior to donation.

New York State environmental regulations prohibit household electronic waste (E-Waste) to be disposed of with municipal solid waste (household trash) and requires that homeowners dispose of their E-Waste through Town specified collection points, usually located at solid waste transfer stations. BNL typically incentivizes employees to dispose of their E-Waste in an environmentally acceptable manner by allowing them to bring items onsite during specific times to be sent for recycling through the Lab's R2 Certified recycler. However, this event is on hold due to COVID impacts on staffing with no events held during 2021. BNL hopes to revive the program during 2022.

The figure below summarizes the amount of electronic equipment that has been recycled annually by BNL since 2012.

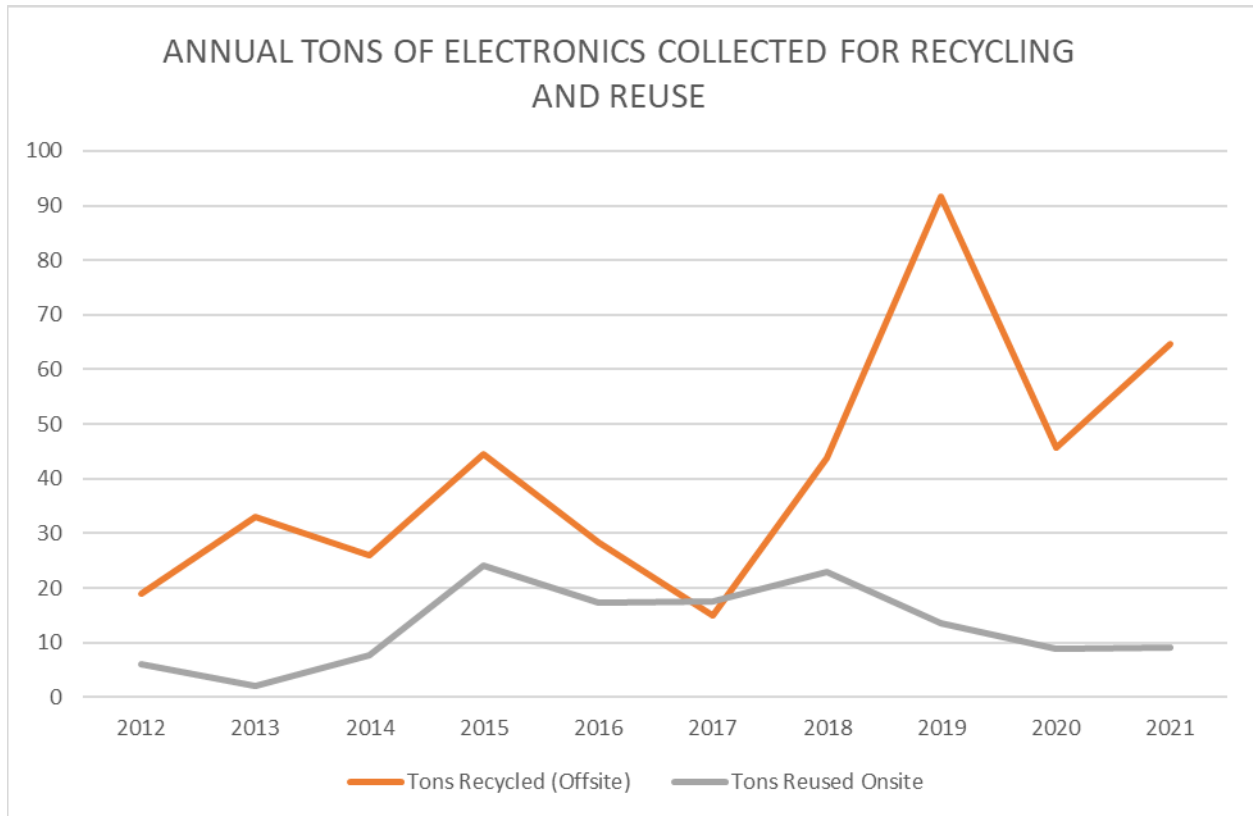


Figure 10: Annual Tons of Electronics Collected for Recycling

Data Centers

Existing Data Centers

The most recent evaluation of its existing data centers in response to the Data Center Optimization Initiative (DCOI) dates from the summer of 2016. The internal assessment identified eight data centers that meet the new DCOI criteria.

Due to limited resources a formal assessment has yet to be completed but it is obvious 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 to determine the actual PUE. The metering effort is in process with one new meter installed in FY20. Additional meters were planned for FY21 but did not occur. This will be addressed in FY22.

New Data Centers

The data center in Building 725 associated with the CFR project was essentially complete in 2021. Some final commissioning activity is currently underway. The data center is expected to have a PUE of < 1.3 in accordance with the recent DCOI.

Plans and Projected Performance

Acquisitions and Electronic Asset Disposal

BNL has a very mature electronics collection program and excellent conformance rates. BNL looks forward to a modernized purchasing system allowing for improved performance in the future, but the system is still a number of years from implementation. In the meantime, BNL will continue to dispose of electronic waste in an environmentally sound manner through a certified R2 recycler. The weights of any home electronics collected will be tracked separately from internal collections to help monitor the effectiveness of the home collection days.

The primary barrier to offsite donation of electronics is the human and physical resources needed to remove and shred hard drives in order to meet cyber security concerns.

Data Centers

Existing Data Centers

Meeting the PUE of 1.5 or less for the existing data centers will require a significant investment. Additional metering is in progress with at least two new meters scheduled to be installed in FY22. The new metering will help to identify prioritized areas for actions and resources needed to meet the PUE 1.5 requirement.

Consolidation of some of the existing eight data centers is also being considered to maximize performance and minimize the required investment.

New Data Centers

As discussed, the new data center in Building 725 is in its final commission phase. It is important to note this is only the first phase of the anticipated build-out. And while the data center is designed for a PUE of <1.3 it may be initially difficult to achieve since some of the equipment is sized and designed for the full buildout. BNL is looking forward to evaluating and reporting on its' performance.

Adaptation & Resilience

This category focuses on site efforts to increase site adaptation and resilience to address the impacts of climate change. Resilience is the ability to adapt to changing conditions and withstand or recover from disruption. Adaptation refers to actions taken to reduce risks from changed climate conditions (e.g., even current conditions) and to prepare for impacts from additional changes expected in the future. Resilience and adaptation efforts help sites manage risks to DOE assets, infrastructure, operations, and personnel.

Current Performance

The Office of Emergency Management (OEM) integrates climate resilience by attending trainings and biannual meetings provided by the National Weather Service (NWS) (who are a part of the National Oceanic and Atmospheric Administration). Additionally, OEM monitors the NWS and National Hurricane Center for all severe weather activities that have the potential to impact the BNL site. OEM provides BNL Leadership with timely weather-related data updates used to evaluate the lab posture, to remain open or close the BNL site.

OEM analyzes the potential for the Peconic River to flood using the FEMA National Flood Hazard Layer, a geospatial database that contains current effective flood hazard data. Both the 100- and 500-year analysis is included in the Site Emergency Plan and the recently updated All Hazards Survey.

OEM also included continuity of operations planning as part integrating climate resilience per the DOE 150.1A, Continuity of Operations Order.

OEM maintains a Threat and Vulnerability Assessment Plan as required and the All-Hazards Survey both of which address the potential for severe weather and weather-related hazards onsite.

Plans and Projected Performance

New requirements are expected during FY22 for DOE O 150.1A Continuity of Operations. The OEM will develop, implement, and update the Continuity of Operations Program, as required, and integrate new requirements into the Emergency Management Program.

Appendix A: List of Acronyms & Abbreviations

AFV	Alternative Fuel Vehicles
AGS	Alternating Gradient Synchrotron
ANL	Argonne National Laboratory
ANSI	American National Standards Institute
ASHRAE	American Society of Heating, Refrigerating, and Air-Conditioning Engineers
ATF	Accelerator Test Facility
BAS	Building Automation System
BHSO	Brookhaven Site Office
BLCC	Building Life-Cycle Cost
BNL	Brookhaven National Laboratory
BMP	Best Management Practice
BORE	Beneficial Occupancy Readiness Evaluation
BSA	Brookhaven Science Associates
Btu	British thermal unit
C&D	Construction & Demolition Debris
C-AD	Collider-Accelerator Department
CAFE	Corporate Average Fuel Economy
CD	Critical Decision
CEM	Certified Energy Manager
CERG	Continuity of Emergency Response Group
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
CLCPA	Climate Leadership and Community Projection Act
CMS	Chemical Management System
COOP	Continuity of Operations Plan
CSF	Central Steam Facility
CSI	Computational Science Initiative
CURP	Critical Utility Rehabilitation Project
DBT	Design Based Threat
DCOI	Data Center Optimization Initiative
DOE	Department of Energy
ECM	Efficiency & Conservation Measures
EIC	Electron-ion collider
EHSS	Office of Environment, Health, Safety & Security
EISA	Energy Independence and Security Act
EMI SIG	Emergency Management Issues Special Interest Groups
EMS	Environmental Management System
EO	Executive Order
EOC	Emergency Operations Center
EPA	Environmental Protection Agency

EPEAT	Electronic Product Environmental Assessment Tool
EPHA	Emergency Preparedness Hazard Assessment
EPP	Environmentally Preferable Purchasing
ERO	Emergency Response Organization
ESCO	Energy Service Company
ESF	Emergency Support Functions
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
FPDS	Federal Procurement Data 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
HPC	High-Performance Computing
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
LBNL	Lawrence Berkley National Laboratory

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
LOB	Laboratory Office Building
M&V	measurement and verification
mmBtu	one million Btu
MPO	Modernization Project Office
MSW	Municipal Solid Waste
MTA	Metropolitan Transportation Authority
MtCO _{2e}	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
NYSERDA	New York State Energy Research and Development Authority
ODS	ozone depleting substance
OEM	Office of Emergency Management
OH&P	Overhead and Profit
OMB	Office of Management and Budget
OMC	Occupational Medicine Clinic
ORNL	Oak Ridge National Laboratory
PA	Preliminary Assessment
PAP	Performance Assurance Plan
PE	Professional Engineer
PFAS	per- and polyfluoroalkyl substances
PFC	perfluorocarbon
PHENIX	Pioneering High Energy Nuclear Interaction Experiment
PM	preventative maintenance
PNNL	Pacific Northwest National Laboratory
PPPL	Princeton Plasma Physics Laboratory
PPM	Procurement and Property Management
PSC	Public Service Commission
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
SLAC	Stanford Linear Accelerator
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
SUV	Sports Utility Vehicle
SWP	Safe Work Plan
T&D	Transmission & Distribution
TEC	total estimated cost
THIRA	Threat and Hazard Identification and Risk Assessment
TJNAF	Thomas Jefferson National Accelerator Laboratory
TOF	time of flight
UESC	Utility Energy Service Contract
USDA	U.S. Department of Agriculture
WWII	World War II
YOY	Year-over-year

Facility Management



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 2021): -15.0%

Current Performance: -23.0%

	FY 2015	FY 2020 (PY)	FY 2021	% Change from Baseline	% Change from Last Year
Purchased Utilities (MMBtu)	4,473,508.6	3,291,464.2	3,325,213.1	-25.7%	1.0%
Purchased Renewables (MMBtu)	0.0	191,627.8	144,178.0	N/A%	-24.8%
Goal-subject GSF	19,386,483.0	18,491,844.0	19,521,939.0	0.7%	5.6%
Energy Intensity (Btu/GSF)	230,754.0	188,358.3	177,717.5	-23.0%	-5.6%



Renewable Electricity

Goal: Use 30 percent renewable energy as a percentage of overall facility electricity use by FY 2025
Interim Target (FY 2021): 20%

Current Performance: 21.1%

	FY 2020 (PY)	FY 2021	% Change from Last Year	% Compliant
Grid Electricity	1,808,981	1,531,579	-15.3%	
On-Site Renewable Energy	17	19,188	112,770.6%	
Purchased Green Electricity	56,163	42,256	-24.8%	
Renewable Energy Certificates	226,369	217,574		
Bonuses	59,015	57,309	-2.9%	
Total Renewable Electricity with Bonuses (MWh)	341,564	336,327	-1.5%	N/A%
Total Electricity Consumed (MWh)	1,865,161	1,593,023	-14.6%	



EISA S432 Compliance

Goal: Reduce per-mile greenhouse gas emissions by 30 percent by FY 2025 relative to FY 2014 baseline

Current Performance:

	Due Date	Covered Energy	Evaluated Square Footage Status	# of Covered Facilities Benchmarked
Current Evaluation Cycle Status				

of Identified ECMs

of Awarded/Funding
Approved ECMs# of implemented ECMs
with reported M&V data\$ value of all
implemented ECMsCurrent Evaluation
Findings**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 2021): 0.0%

Current Performance: 11.0%

	FY 2020 (PY)	FY 2021	% Change from Last Year	% Compliant
Grid Electricity	6,172,242	6,153,650	-0.3%	
Non-renewable Thermal Energy	3,054,548	2,937,373	-3.8%	
On-Site Renewable Energy	59	59	0.0%	
Purchased Green Electricity	191,628	144,178	-24.8%	
Renewable Energy Certificates	772,371	742,362	-3.9%	
Bonuses			N/A%	
Total Renewable Energy with Bonuses (MMBtu)	1,133,009	1,055,550	-6.8%	N/A%
Total Energy Consumed (MMBtu)	9,418,477	9,235,260	-1.9%	

**Potable Water Intensity**

Goal: Reduce water intensity by 36 percent by FY 2025 relative to FY 2007 baseline
Interim Target (FY 2021): -28.0%

Current Performance: -43.3%

	FY 2007	FY 2020 (PY)	FY 2021	% Change from Baseline	% Change from Last Year
Water Consumption (million gal)	1,909.3	1,443.7	1,298.5	-32.0%	-10.1%
Aquifer Recharge (million gal)	322.1	331.0	258.4	-19.8%	-21.9%
Total GSF	25,676,490.0	28,593,096.0	29,653,400.0	15.5%	3.7%
Water Intensity (Gal/GSF)	61.8	38.9	35.1	-43.2%	-9.8%

**Non-Potable Water Consumption**

Goal: Reduce potable water intensity by 36 percent by FY 2025 relative to FY 2007 baseline.
Interim Target (FY 2021): -22.0%

Current Performance: 32.5%

	FY 2010	FY 2020 (PY)	FY 2021	% Change	% Change from Last Year
Industrial	277.5	260.1	285.3	2.8%	-6.3%
Landscaping	143.3	229.6	272.1	89.9%	60.2%
Agricultural	0.0	0.0	0.0	N/A%	N/A%
Total Non-Potable Water (million gal)	420.8	489.7	557.4	32.5%	16.4%



Sustainable Buildings

Goal: Ensure 17 percent by building count comply with the Guiding Principles for sustainable buildings by FY 2025. Interim Target (FY 2017): 15.0 %
Interim Target (FY 2021): 16.0%

Current Performance: 14.5%

	Building Count	GSF
Guiding Principles Certified	60	3,295,590
Total Applicable*	414	21,950,130
Performance (%)	14.49%	15.01%

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

Fleet Management



Fleet Petroleum

Goal: Reduce fleet petroleum use by 20 percent by FY 2015 and thereafter relative to FY 2005 baseline
Interim Target (FY 2021): -20.0%

Current Performance: -100.0%

	FY 2005	FY 2021	% Change
Gasoline	453,253	0	-100.0%
Diesel	94,254	0	-100.0%
Biodiesel*	24,930	0	-100.0%
Total Petroleum (GGE)	572,437	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 2021): 10.0%

Current Performance: 0.0%

	FY 2005	FY 2021	% Change
E-85	82,780	0	-100.0%
Biodiesel*	6,233	0	-100.0%
CNG	44,600	0	-100.0%
Other*	0	0	N/A%
Total Alternative (GGE)	133,613	0	-100.0%

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



Fleet Greenhouse Gas Emissions/Mile

Goal: Reduce potable water intensity by 36 percent by FY 2025 relative to FY 2007 baseline.
Interim Target (FY 2021): -22.0%

Current Performance: 32.5%

	FY 2014	FY 2021	% Change
Fleet Fuel GHG (MtCO ₂ e)	3.1	0.0	-100.0%
Fleet Miles (x1000)	5,314.4	0.0	-100.0%
Greenhouse Gas Emissions / Mile (gCO₂e/Mile)	1.0	0.0	-100.0%

Waste Management



Municipal Solid Waste

Goal: Divert at least 50 percent of non-hazardous solid waste (excluding construction and demolition debris)
Interim Target (FY 2021): 50.0%

Current Performance: 59.3%

	FY 2021	%
Off-Site Landfills	2,588.0	39.7%
On-Site Landfills	0.0	0.0%
Waste to Energy*	66.1	1.0%
Non-diverted Waste	2,654.1	40.7%
Diverted Waste	3,395.3	52.0%
On-Site Composted	202.3	3.1%
Off-Site Composted	208.5	3.2%
Waste to Energy Credit	66.1	1.0%
Total Diverted Waste	3,872.1	59.3%
Total Waste (metric tons)	6,526.3	100.0%

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



Construction & Demolition

Goal: Divert at least 50 percent of construction and demolition materials and debris
Interim Target (FY 2021): 50.0%

Current Performance: 55.3%

	FY 2021	%
Landfilled C&D Waste	2,648.8	44.7%
Diverted C&D Waste	3,281.0	55.3%
Total C&D Waste (metric tons)	5,929.8	100.0%

Electronics Stewardship



Electronics Acquisition

Goal: 100 percent of eligible electronics procurements must be environmentally sustainable (e.g. EPEAT)
Interim Target (FY 2021): 95.0%

Current Performance: 92.0%

	EPEAT Acquired	Total Acquired	%
Monitors	6,061	6,376	95.1%
Computers	8,302	9,026	92.0%
Imaging Equipment	315	351	89.7%
Televisions	273	283	96.5%
Total Acquired	16,726	18,185	92.0%



Electronics Recycling

Goal: Dispose of 100 percent of electronics through government programs and certified recyclers
Interim Target (FY 2021): 100.0%

Current Performance: 99.1%

	Amount	%
Transferred or Donated	24.525	1.5%
Recycled by Certified Recycler	1,603.023	97.6%
Recycled by non-Certified Recycler	14.494	0.9%
Amount disposed (e.g. landfill)	0.000	0.0%
Total Electronics Waste (metric tons)	1,642.042	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 2021): 100.0%

Current Performance: 99.0%

	Total Owned	PM Enabled	Exempt	%
Monitors	51,877	49,154	2,724	100.0%
Computers	53,803	40,519	12,364	97.8%
Total Items	105,680	89,673	15,088	99.0%



Duplex Printing

Goal: Implement and actively use duplex printing features of 100 percent of eligible printers
Interim Target (FY 2021): 100.0%

Current Performance: 98.5%

Total Owned	Duplex Enabled	Incapable	%
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Total Printers

5,353

2,951

2,356

98.5%

Acquisition



Sustainable Acquisition

Goal: Ensure 95 percent of new contract actions for products and services meet sustainable acquisition requirements
Interim Target (FY 2021): 95.0%

Current Performance: 0.0%

	Contracts Reviewed	Contracts Without Opportunity	Contracts Meeting All Requirements	%
Number of Contracts	0.0	0.0	0.0	0.0%

Greenhouse Gas Management



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 2021): -37.0%

Current Performance: -49.5%

	FY 2008	FY 2020 (PY)	FY 2021	% Change from Baseline	% Change from Last Year
Facility Energy	1,365,729.7	906,386.7	912,179.3	-33.2%	0.6%
Non-Fleet V&E Fuel	1,184.7	5,368.6	996.4	-15.9%	-81.4%
Fleet Fuel	5,438.9	2,016.7	0.0	-100.0%	-100.0%
Fugitive Emissions	193,761.2	26,330.3	25,648.4	-86.8%	-2.6%
On-Site Landfills	2,053.1	1,333.5	1,268.2	-38.2%	-4.9%
On-Site WWT	180.9	32.6	28.1	-84.5%	-13.8%
Renewables	0.0	162.1	170.2	N/A	5.0%
RECs	0.0	-159,638.8	-148,294.4	N/A	-7.1%
Total (MtCO₂e)	1,568,348.5	781,991.8	791,996.3	-49.5%	1.3%



Scope 3 Greenhouse Gas Emissions

Goal: Reduce indirect GHG emissions by 25 percent by FY 2025 relative to FY 2008 baseline
Interim Target (FY 2021): -17.0%

Current Performance: -70.7%

	FY 2008	FY 2020 (PY)	FY 2021	% Change from Baseline	% Change from Last Year
T&D Losses*	77,888.1	30,109.7	40,479.9	-48.0%	34.4%
T&D RECs Credit	0.0	-8,878.1	-8,481.9	N/A	-4.5%
Air Travel	51,969.3	20,705.8	2,307.9	-95.6%	-88.9%
Ground Travel	5,601.5	1,828.3	811.5	-85.5%	-55.6%
Commute	73,289.1	41,316.6	25,615.9	-65.0%	-38.0%
Off-Site MSW	3,531.3	1,635.2	1,439.4	-59.2%	-12.0%
Off-Site WWT	88.5	64.4	30.2	-65.9%	-53.1%
Total (MtCO₂e)	212,367.8	86,781.9	62,202.9	-70.7%	-28.3%

* Includes T&D losses for purchased renewable electricity