Brookhaven National Laboratory

U.S. DEPARTMENT OF ENERGY

BNL Site Sustainability

Tom Daniels, Associate Laboratory Director F&O
Debbie Bauer, Environmental Protection Division
Dennis Yuan, Modernization Project Office

November 10, 2022

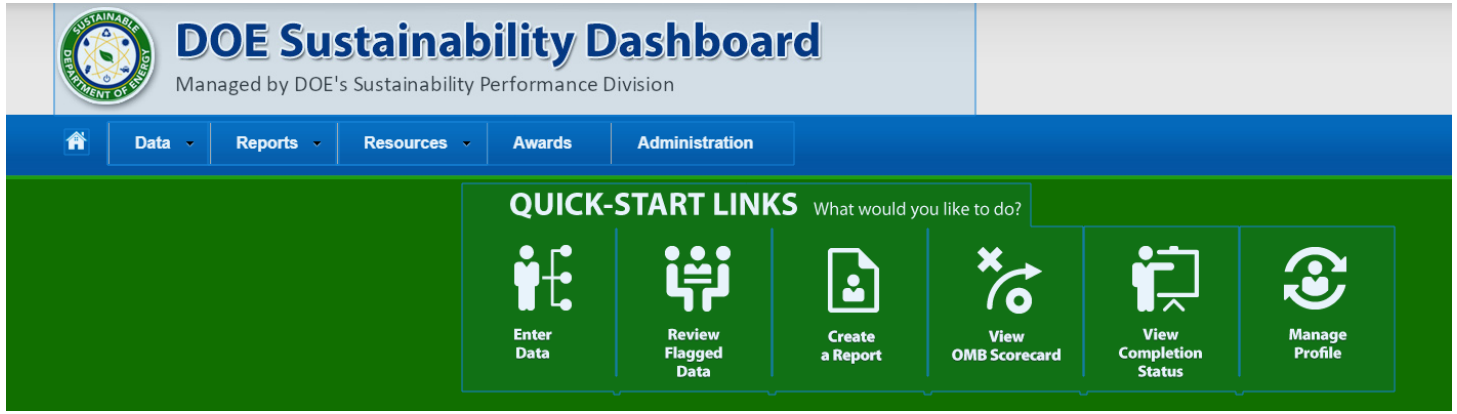
@BrookhavenLab

Agenda

- Site Sustainability Plan
- Science User Support Center (SUSC) Sustainable Design
- Path to Carbon Pollution – Free Energy

Background

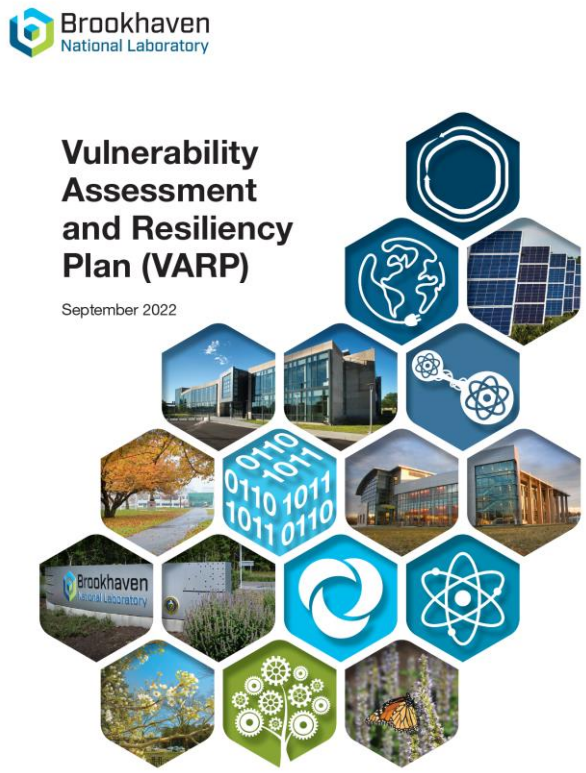
- The U.S. Department of Energy (DOE) oversees compliance with federal sustainability laws and requirements as reported by each site through the DOE Sustainability Dashboard.
- The BNL Site Sustainability Plan is prepared annually to set goals and track performance.
- BNL uses a cross Laboratory Team approach to ensure all operations are aligned.



Brookhaven National Laboratory

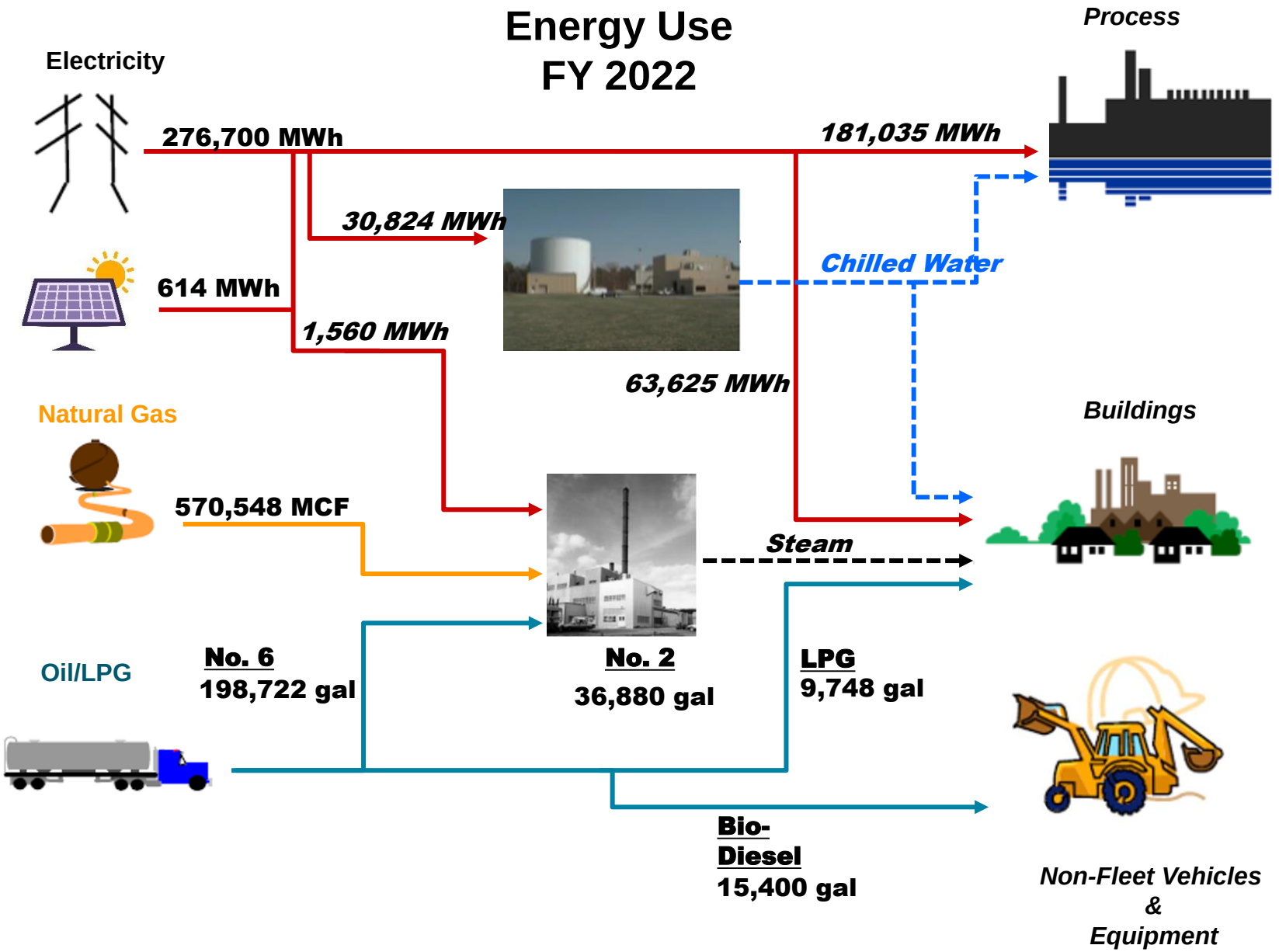
BNL's Site Sustainability Plan

- Energy Management
- Water Management
- Waste Management
- Fleet Management
- Clean & Renewable Energy
- Sustainable Buildings
- Acquisitions & Procurement
- Investments: Improvement Measures, Workforce & Community
- Travel & Commute
- Fugitives & Refrigerants
- Electronic Stewardship & Data Centers
- Climate Adaption & Resilience



Brookhaven National Laboratory

Brookhaven National Laboratory
Energy Use
FY 2022



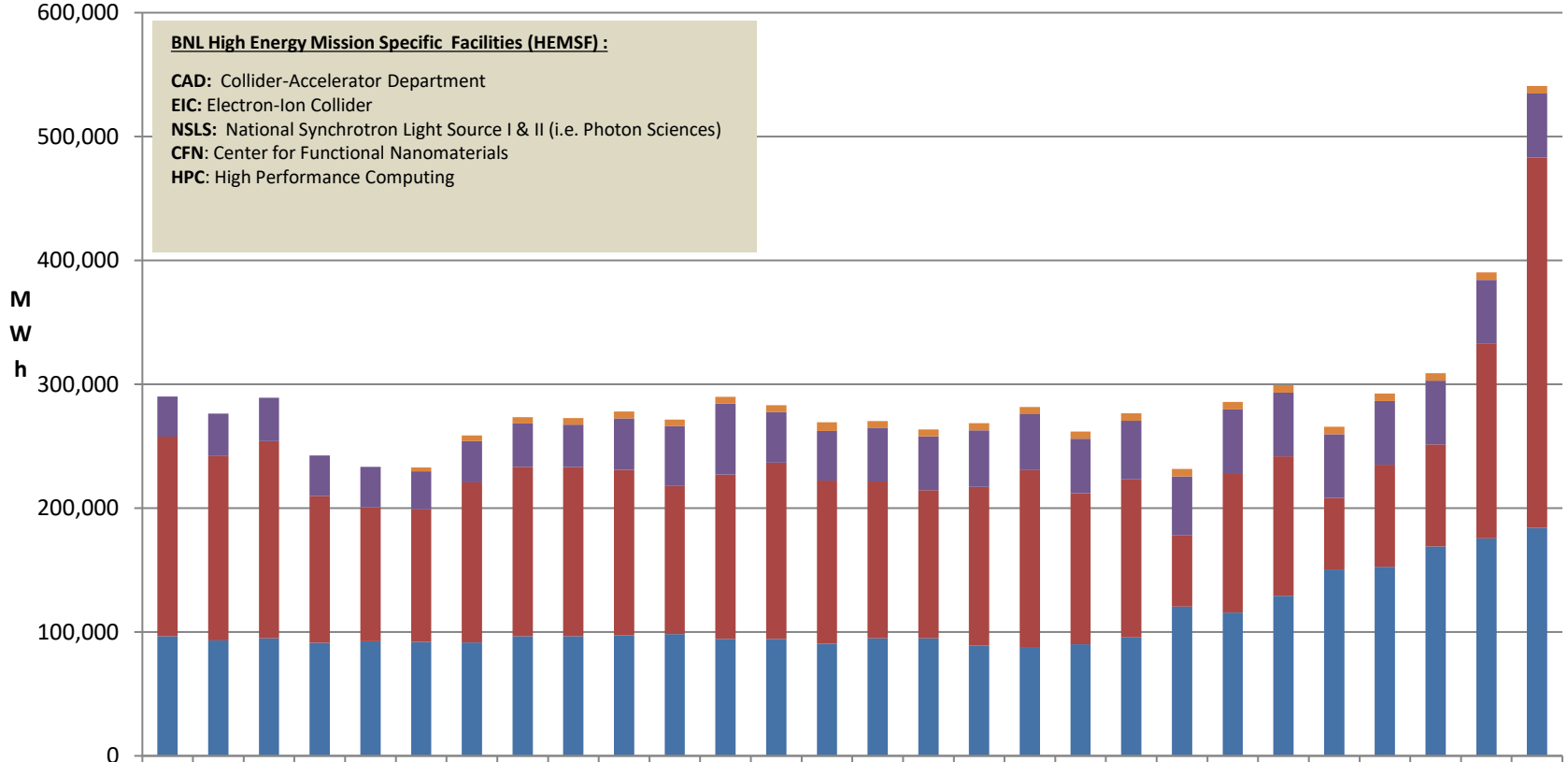
Brookhaven National Laboratory

Electricity Use at BNL

BNL continues to develop a plan in the SSP to reduce/offset the estimated increase in greenhouse gas emissions that exceed the 50% reduction target by 2025 as compared to the base year of 2008.

BNL's Sustainability initiative will require major infrastructure and other investments.

BNL Historical and Projected Electricity

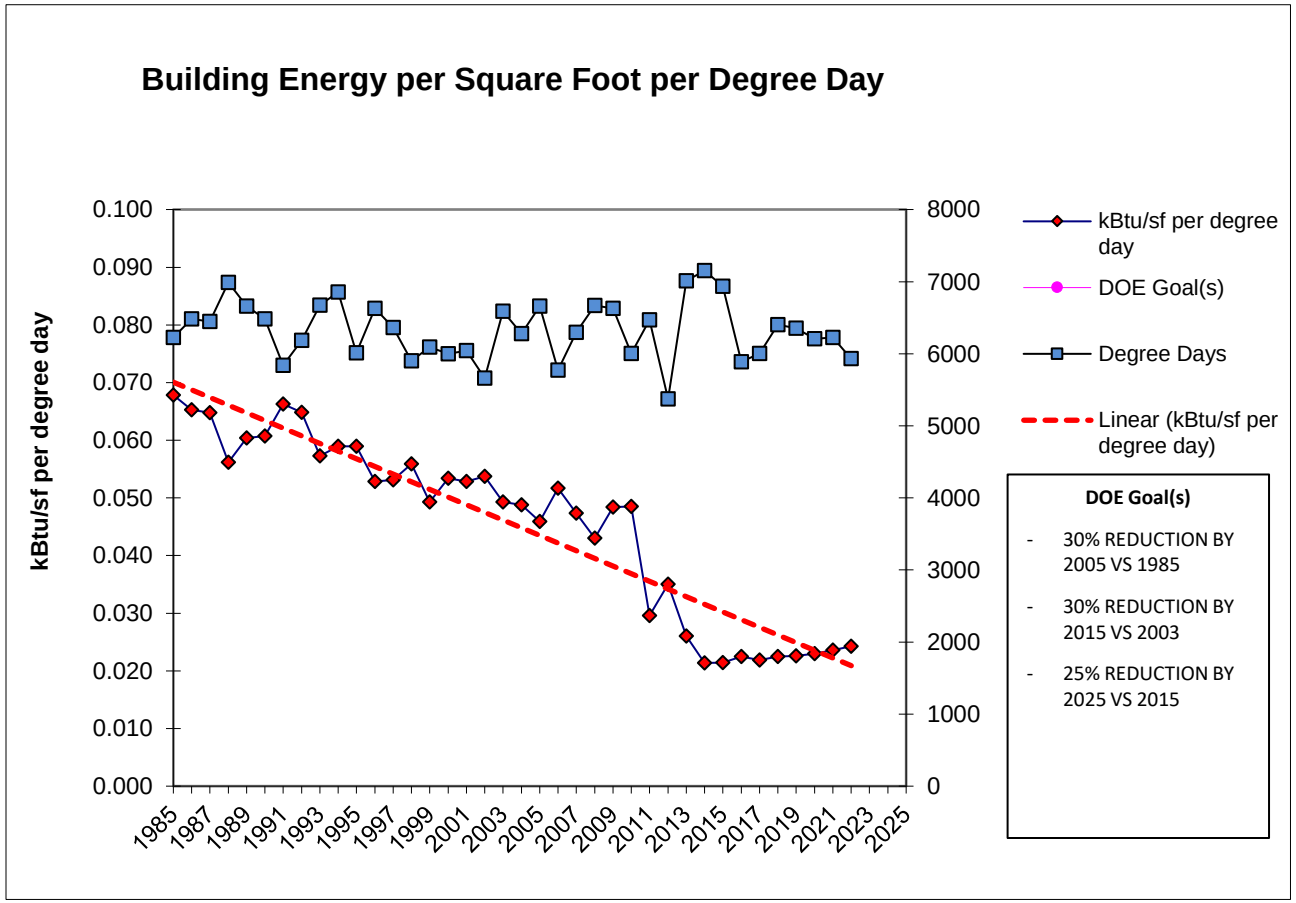


	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
CFN (HEMSF)						3,000	4,500	5,100	5,300	5,398	5,401	5,400	5,707	6,821	5,351	5,553	5,924	5,664	5,666	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000
NSLS/Photon Sci. (HEMSF)	32,574	34,341	34,859	32,611	32,565	30,665	33,313	35,192	34,146	41,708	48,321	57,247	40,734	40,172	43,465	43,566	45,501	45,263	43,893	47,435	47,435	51,596	51,596	51,596	51,596	51,596	51,596	51,596
CAD -> EIC 2026 (HEMSF)	160,93	148,90	159,33	118,45	108,15	107,07	129,24	136,68	136,62	133,56	119,56	132,69	142,34	131,68	126,65	119,47	128,11	143,58	121,99	127,60	57,600	112,60	112,60	57,600	82,310	82,310	157,20	299,12
Site Base and HPC	96,792	93,272	94,907	91,457	92,701	92,144	91,692	96,607	96,616	97,366	98,341	94,490	94,470	90,625	94,973	94,998	89,174	87,203	90,283	95,665	120,66	115,70	129,20	150,60	152,69	169,19	175,59	184,08

Brookhaven National Laboratory

BNL's Energy Reduction Efforts

- BNL has a long and successful history of identifying and implementing energy conservation projects
- Began an energy conservation program in 1973 to combat high energy costs (first oil crisis)
- Over $60 million has been invested in a wide range of efforts that has curbed BNL's energy consumption dramatically
- Energy intensity (Btu/GSF) has been reduced by over 64% comparing FY2022 to FY1985

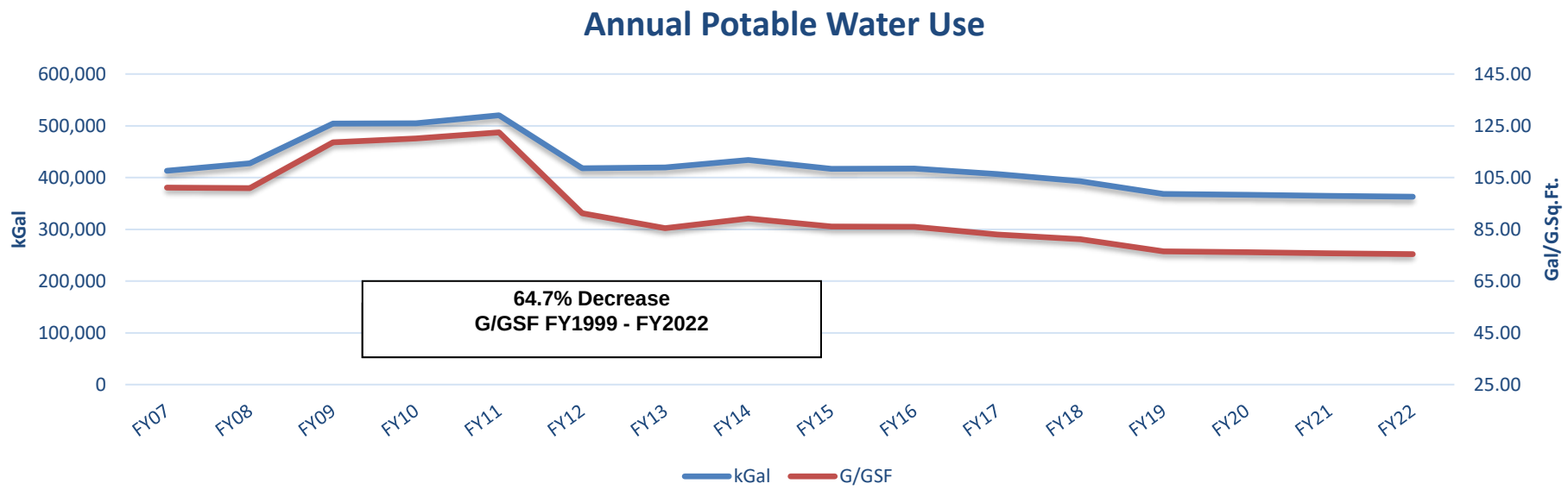


Brookhaven National Laboratory

Water Management

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

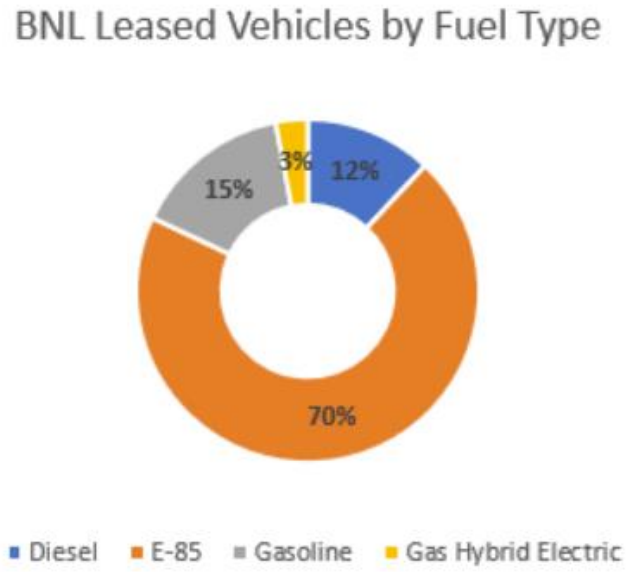
- Long history of reducing water consumption
- Over 80% of water used is recharged back to groundwater

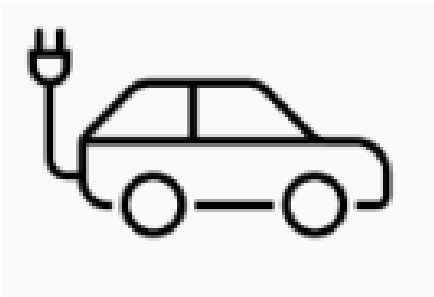


Brookhaven National Laboratory

Fleet Management

- 75% alternative fuel-efficient vehicles-includes hybrid and E85 vehicles
- Request in for 100 vehicles with newer and more fuel-efficient vehicles in FY23 including 8 EV's
- (8) ChargePoint charging ports were activated for electric vehicles
  - Currently used by onsite employees
  - Expansion is planned to more buildings as BNL transitions to electric fleet





Science and User Support Center (SUSC)

Sustainable Design Strategies

SUSC – An Introduction

- A new 75,000 sq. ft., 3 story building to support the BNL's administrative groups, guest services, and large conference needs.

- Approximately 23 acres of site development for parking, exterior meeting spaces and utilities.

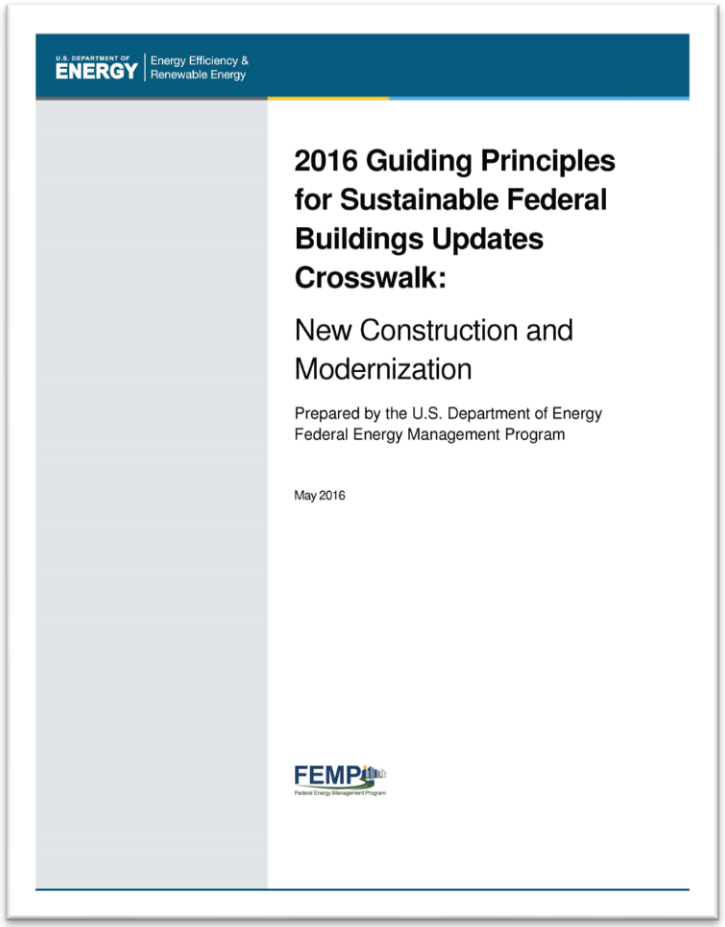
Brookhaven National Laboratory

Sustainability Design Intent

High Performance Sustainable Building

[This Guide describes suggested nonmandatory approaches for meeting requirements. Guides are not requirements documents and are not to be construed as requirements in any audit or appraisal for compliance with the parent Policy, Order, Notice, or Manual.]

U.S. Department of Energy
Washington, D.C.



Completed Department of Energy Guiding Principles Checklist to verify compliance

1. Employ Integrated Assessment, Operation, and Management Principles
2. Optimize Energy Performance
3. Protect and Conserve Water
4. Enhance Indoor Environmental Quality
5. Reduce the Environmental Impact of Materials
6. Assess and Consider Climate Change Risks

Project complies with 20 out of 21 metrics

Design Strategies

Landscaping with native plants

Regrading and planning of site for net zero fill

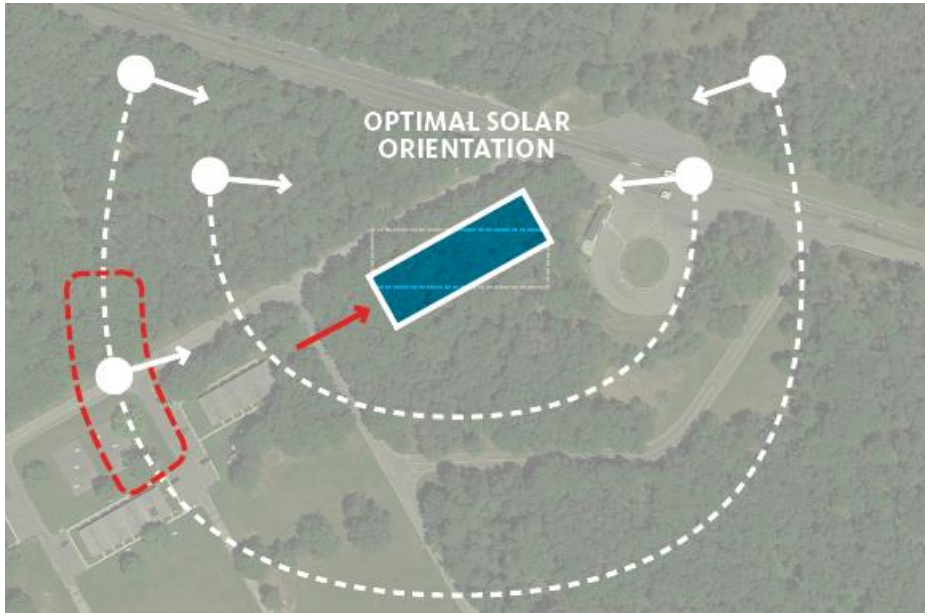
- Swale and bioretention designs provide natural filtration of stormwater

Building Orientation

- High performance curtainwall
- Maximize daylight to workspaces

LED lighting for all fixtures and intelligent lighting controls

- Occupancy/Vacancy Sensors
- Time clock
- Daylight harvesting
- Dimmable fixtures



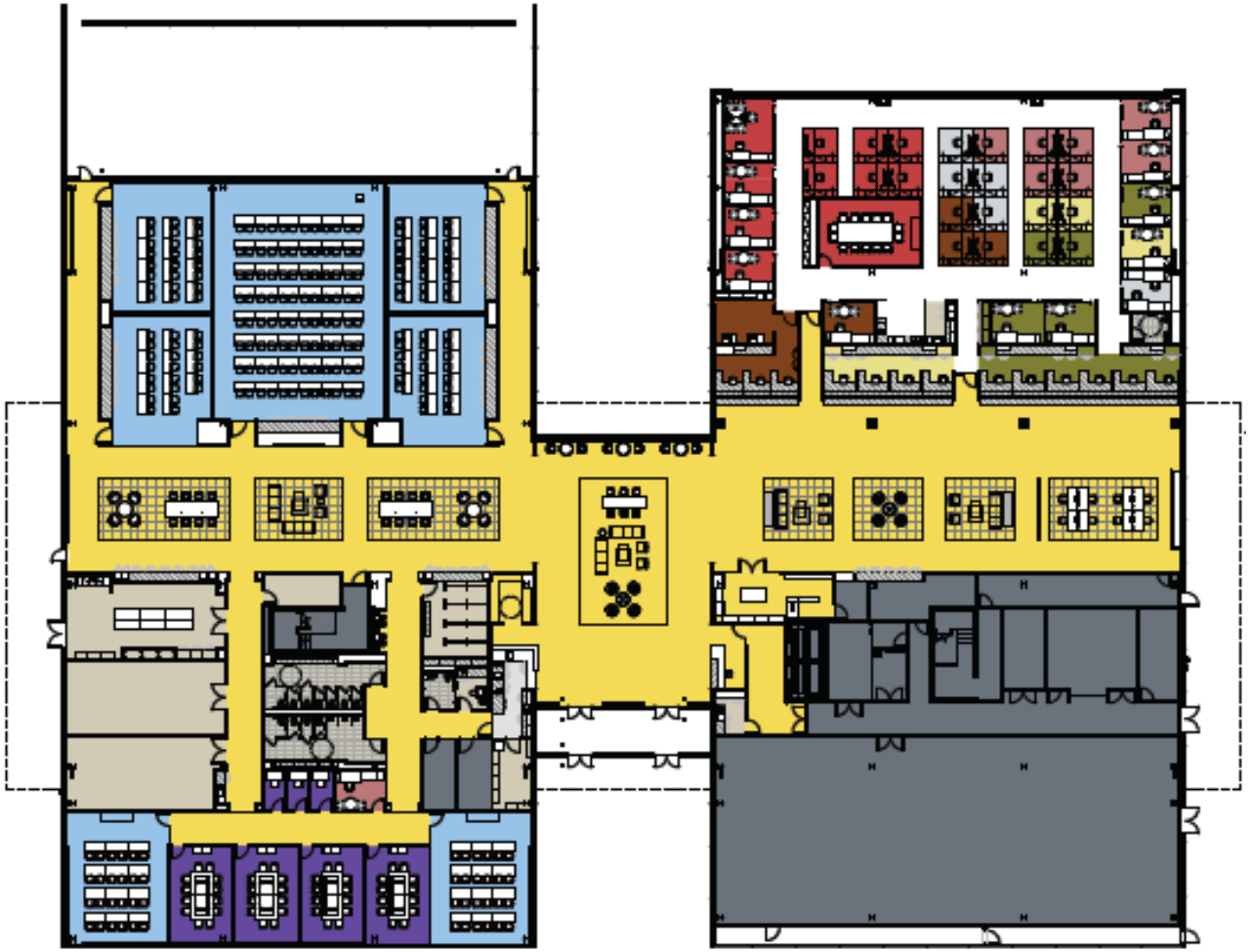
Design Strategies (cont.)

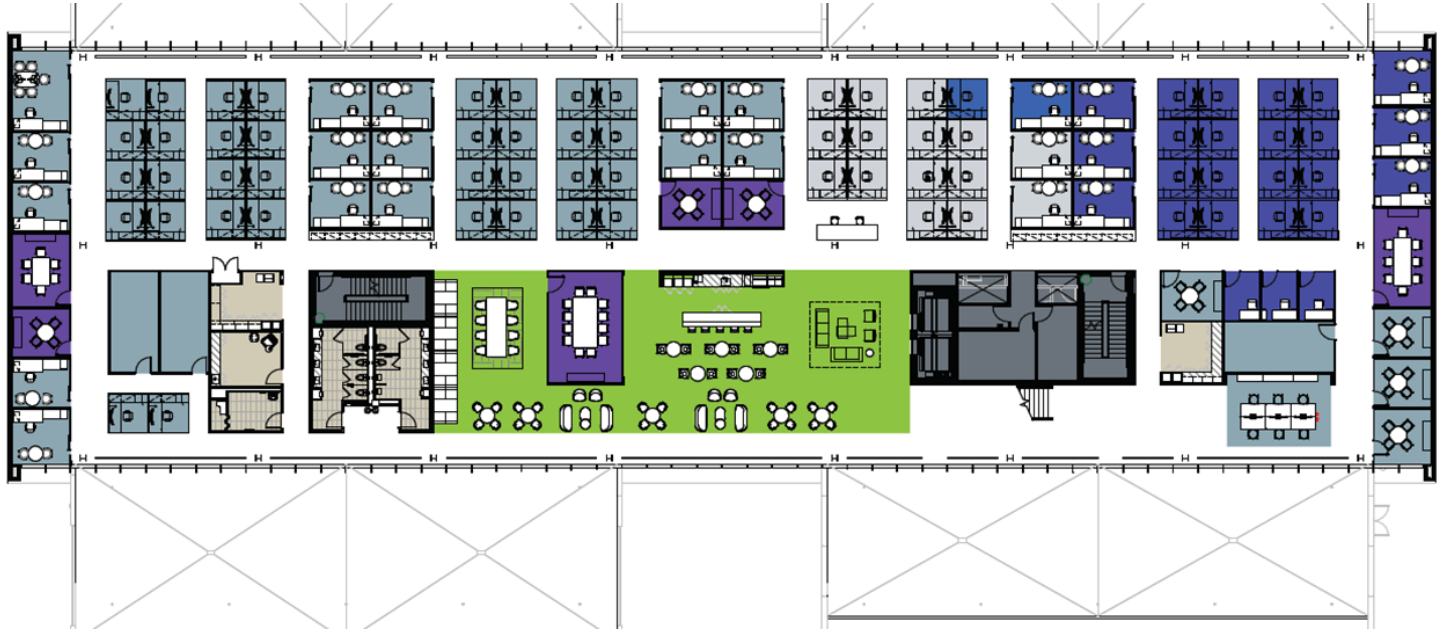
Building Management System

- Variable frequency drive for fans and motors
- VAV boxes along branch ductwork

Energy modeling shown building performs at least 30% better than ASHRAE 90.1 baseline

Life cycle cost done for solar water heaters and photovoltaics. Analysis showed these solutions were cost prohibitive to the project





Acquisitions & Procurement - Purchasing

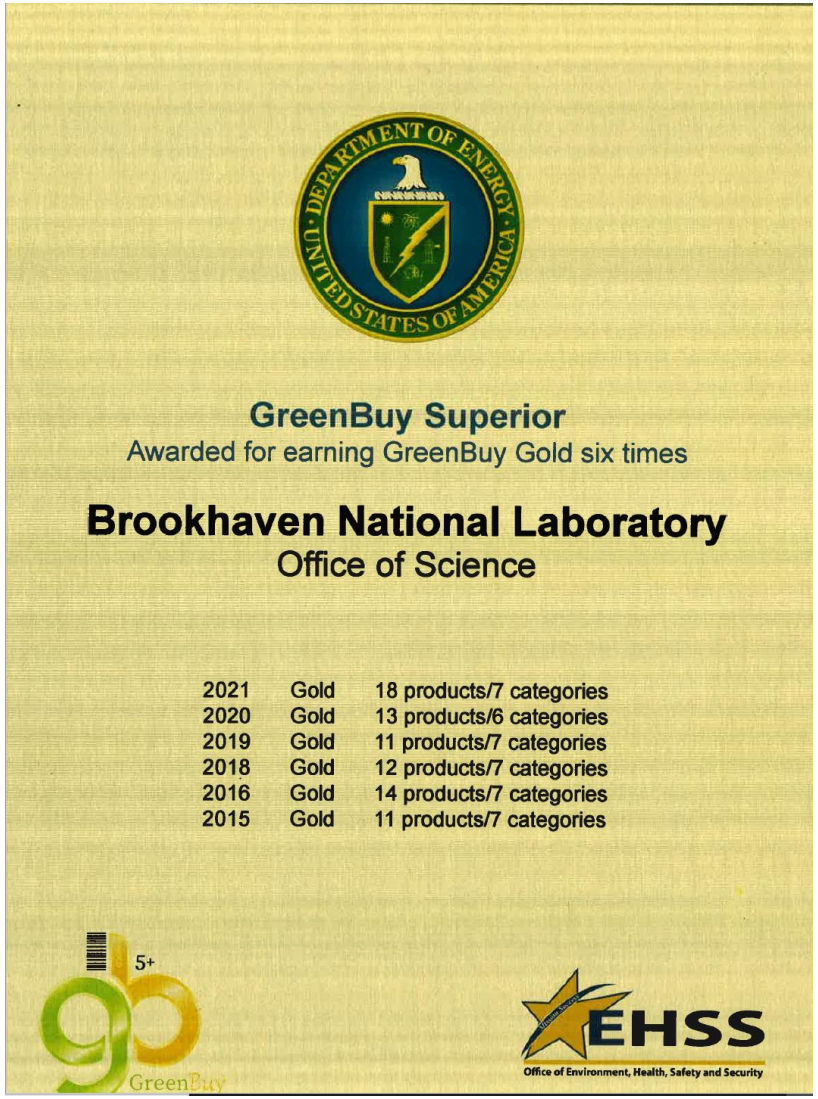
EPA's **Environmentally Preferable Purchasing Program** (EPP) helps federal agencies procure greener products and services and harness federal purchasing power to green markets. The program applies to a wide array of products in the following categories:

- energy efficient (ENERGY STAR or FEMP-designated);
- water efficient (WaterSense);
- bio-based (USDA BioPreferred);
- environmentally preferable (including EPEAT-registered products);
- DOE's Priority 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;
- non-toxic or less toxic alternatives products (Safer Choice labeled).

Most purchasing occurs through contractual agreements, which include terms and conditions that include EPP requirements that apply to the sub-contractor or buyer.

Non-contracted purchasing occurs by staff for computers and related equipment as well as office supplies.

Acquisitions & Procurement - Performance



GreenBuy Superior
Awarded for earning GreenBuy Gold six times

Brookhaven National Laboratory
Office of Science

2021	Gold	18 products/7 categories
2020	Gold	13 products/6 categories
2019	Gold	11 products/7 categories
2018	Gold	12 products/7 categories
2016	Gold	14 products/7 categories
2015	Gold	11 products/7 categories

5+ GreenBuy

EHSS
Office of Environment, Health, Safety and Security

EHSS
Office of Environment, Health, Safety and Security

GREENBUY PROGRAM

Fiscal Year 2021 GOLD AWARD

Brookhaven National Laboratory

Is recognized for achieving leadership-level goals in *Sustainable Acquisition of* 18 products in 7 different categories

GreenBuy

Ingrid Kolb Digitally signed by Ingrid Kolb Date: 2022.04.06 17:15:44 -04'00'

Ingrid Kolb
Chief Sustainability Officer

4/6/22
Date

Acquisitions & Procurement – 2023 Objectives

Per Federal Executive Orders, BNL 2023 Objectives will:

Identify and evaluate for replacement products that contain PFAS chemicals

- Research chemicals;
- Items that may contain PFAS: ex: engineered coatings used in semiconductor production, metal plating and etching, carpets and textiles, coated paper products.

Reduce the Use of Single-Use Plastics

- Form Lab Team to generate enthusiasm and ideas for this program.
- Specifically target reduction/replacement of single-use water bottles by field staff.

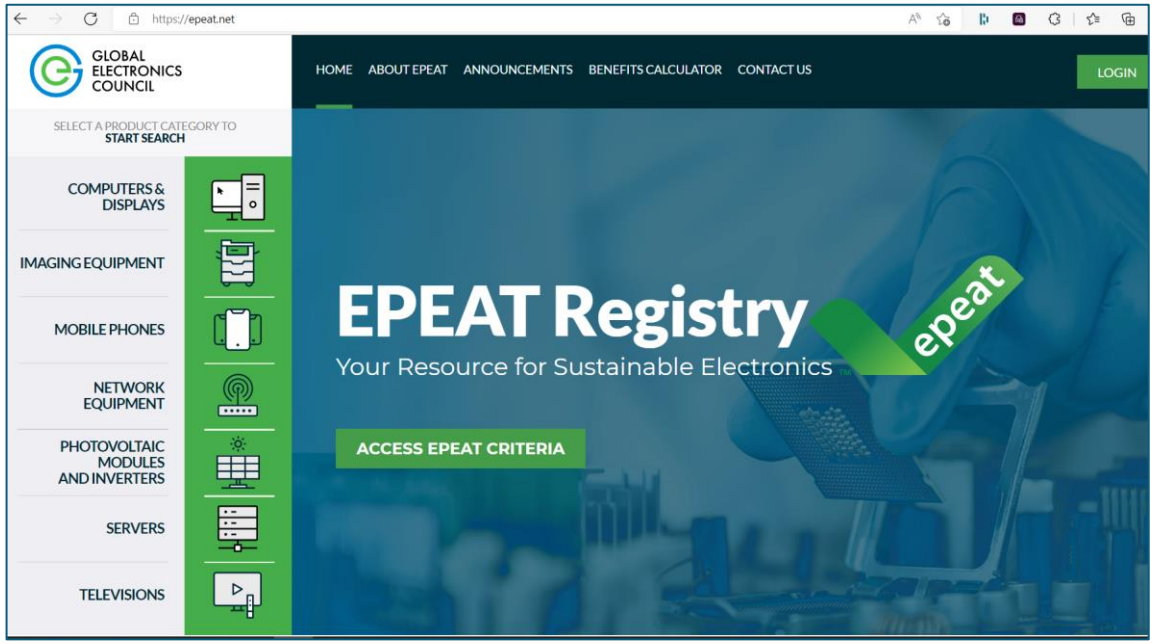
Expand recycling opportunities as well

- Specifically for plastics.

Electronics Stewardship - Purchasing

Purchasing Criteria for Electronics

www.epeat.net



Ranks electronics in various categories against a long list of strict environmental criteria such as packaging, recycle content, design for repair, reuse, recycling, use of low toxicity components or chemicals; energy efficiency, carbon emissions, etc.…

Designations:

- Gold
- Silver
- Bronze

ENERGY STAR

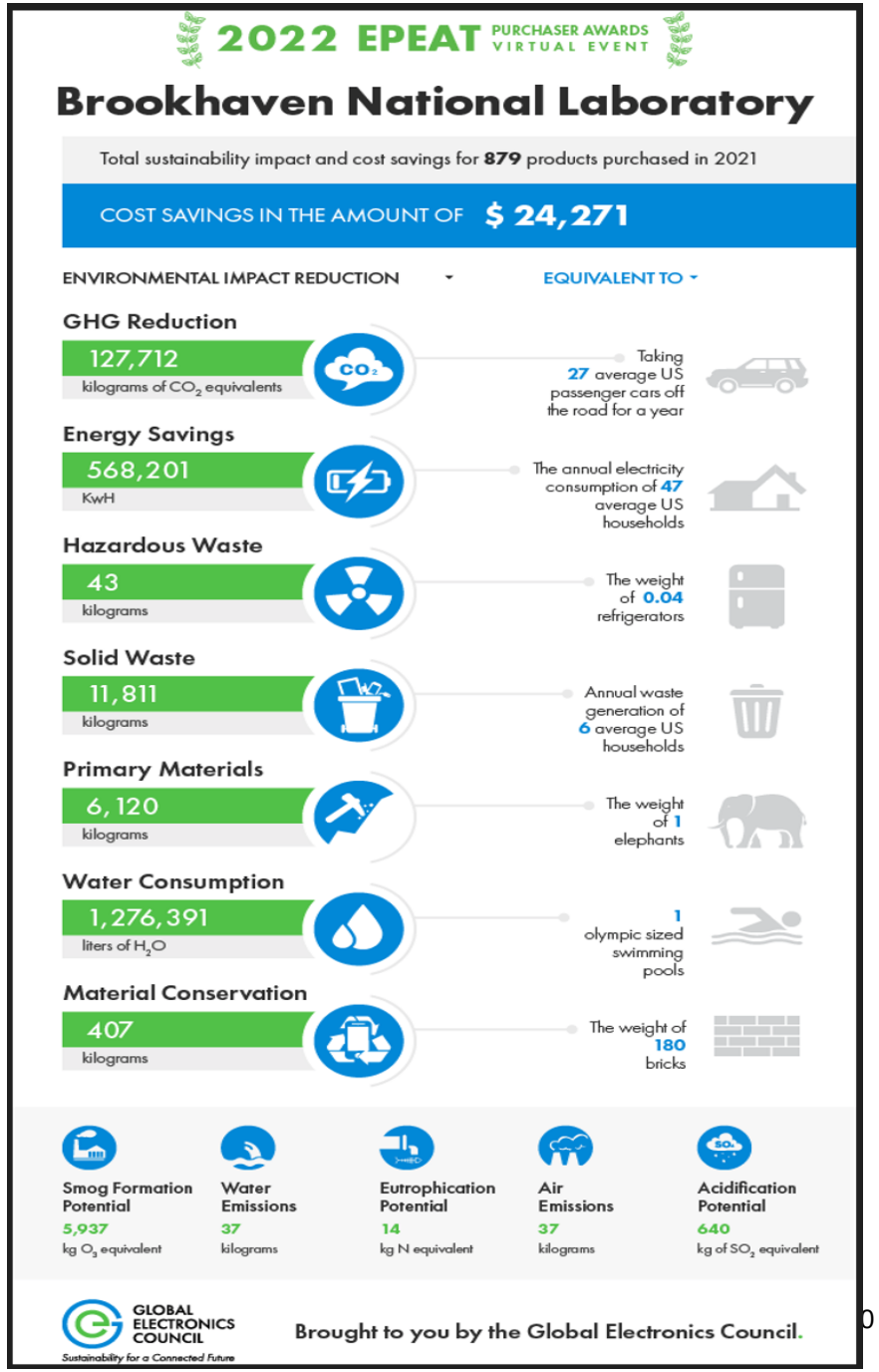
Other electronics that don't fall into an *EPEAT category must meet Energy Star certification.*

- Uninterrupted Power Supplies (UPS)
- Appliances
- Lightbulbs

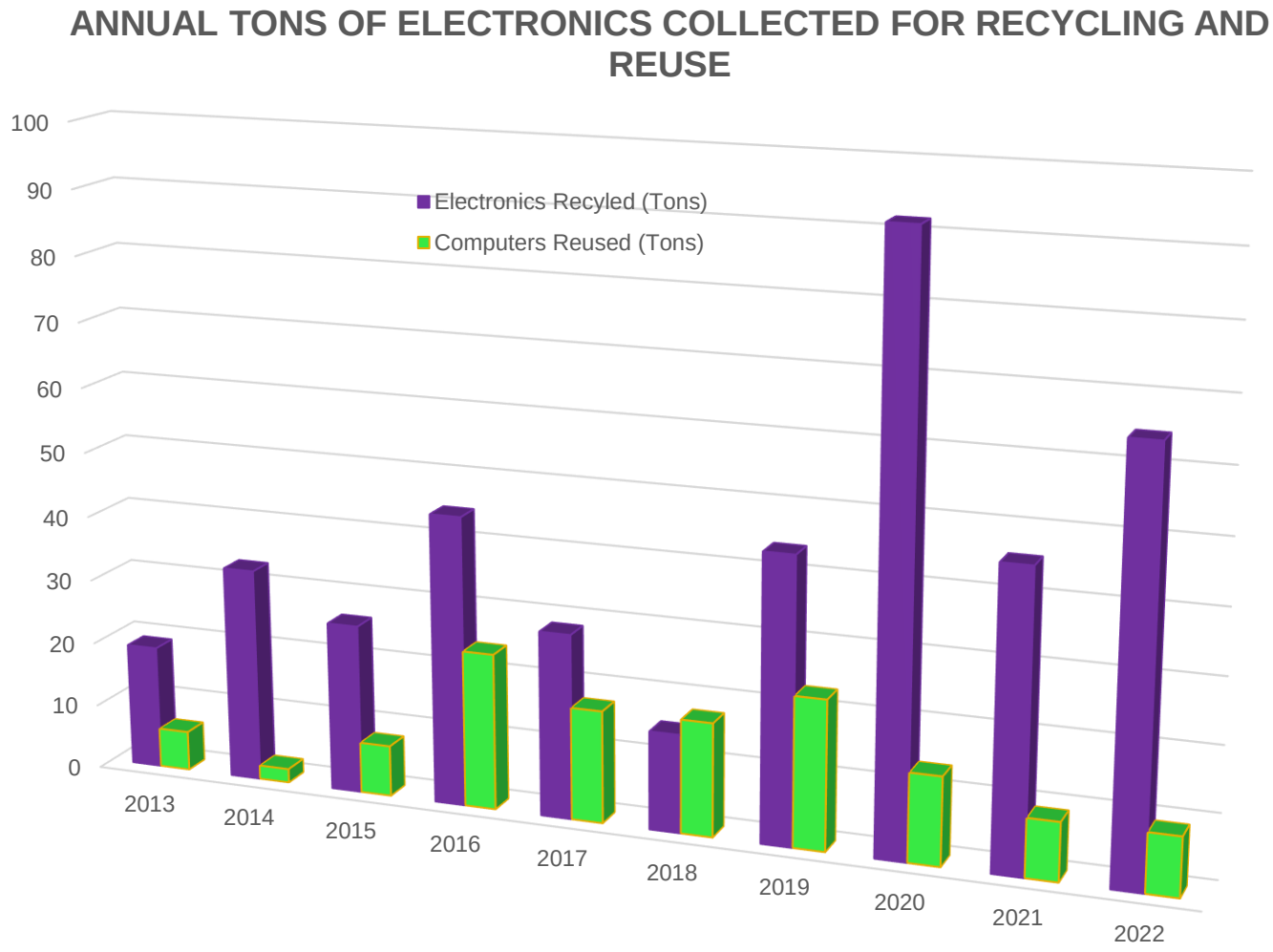
Power savings functions activated on staff computers except as exempted under specific circumstances.

Electronics Stewardship - Performance

Consistently purchase +90% EPEAT conforming items.



Electronics Stewardship - Performance



Electronic Property, Tracked via Barcode

- Barcoded electronics are tracked through “disposal”
- Working electronics kept for reuse
- Nonworking electronics – collected as scrap metal by a Certified R2 Recycler

Waste Management

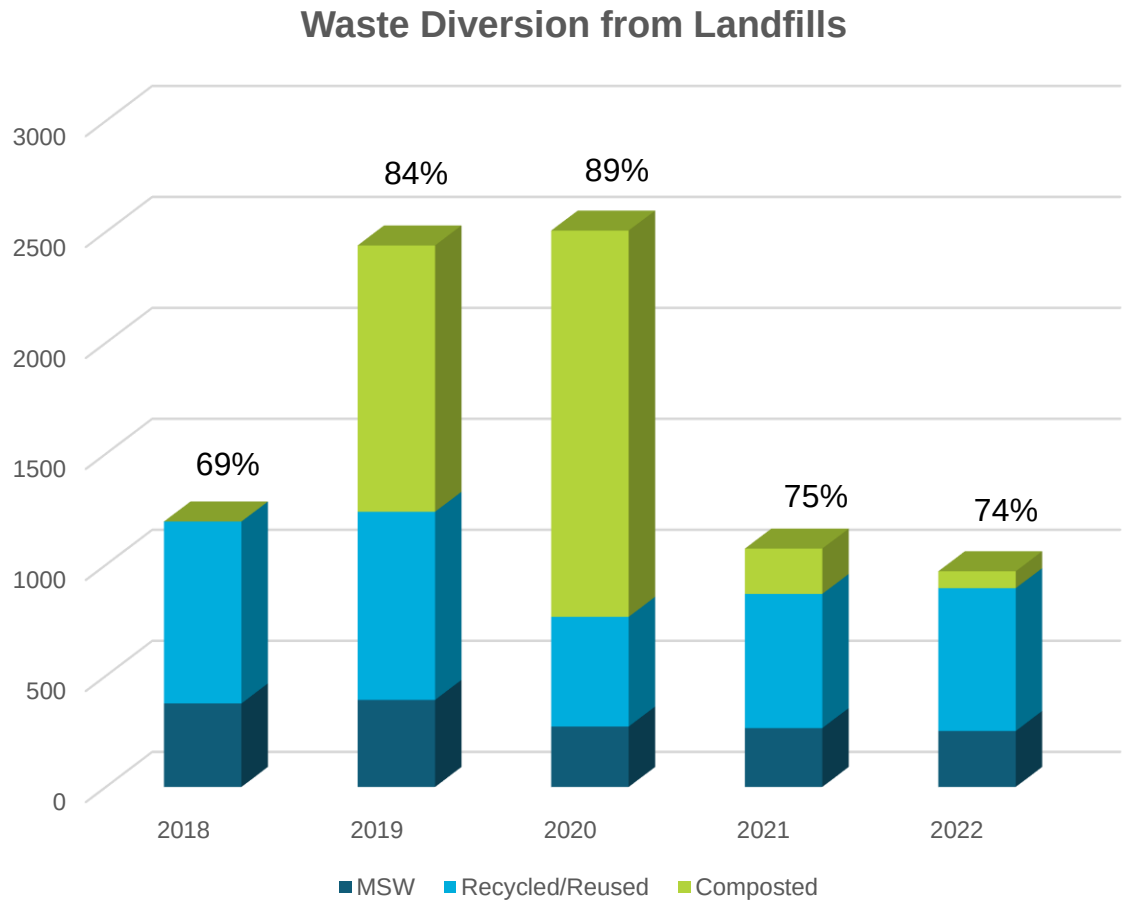
BNL maintains a high recycling rate, averaging around 78%.

Future Expectations: Waste Reduction by Source Reduction

Net ZERO Waste

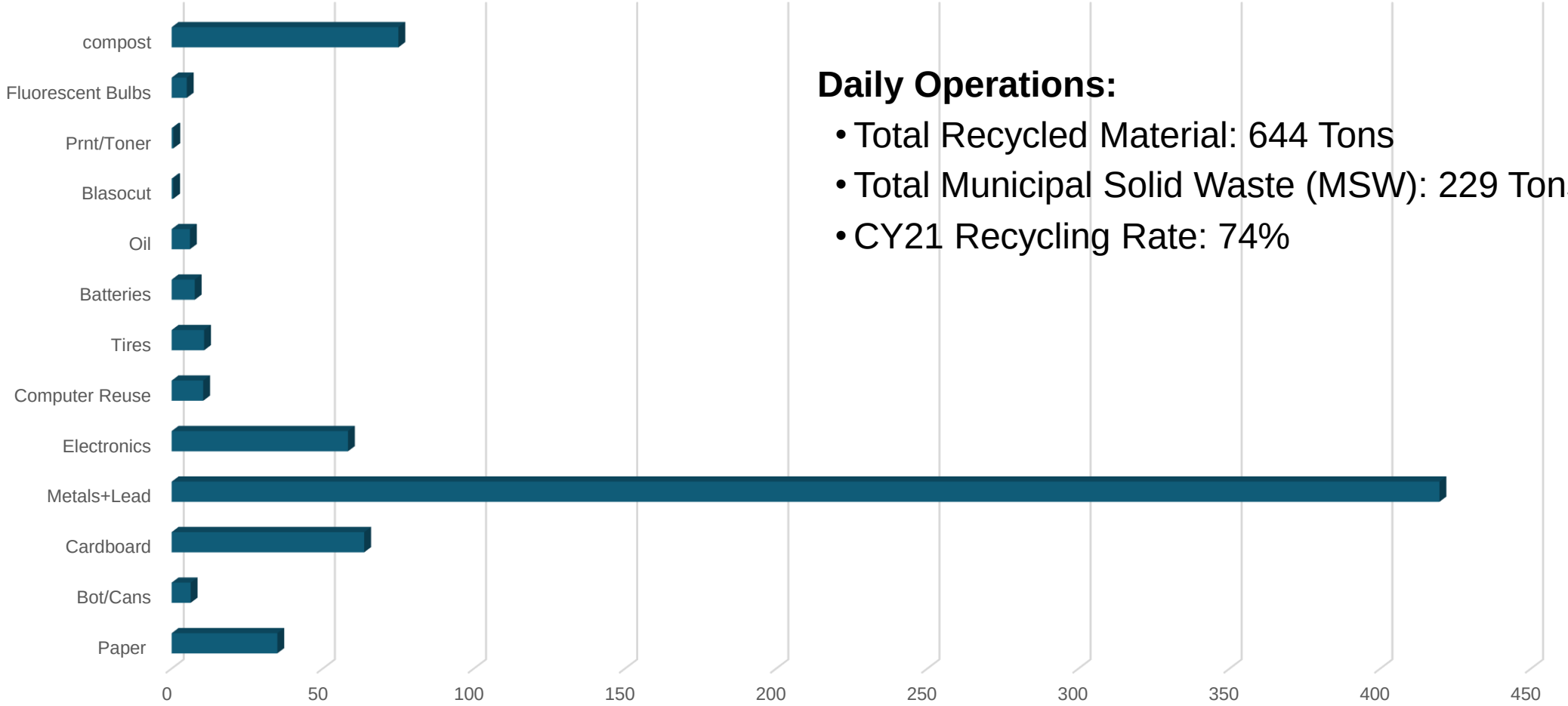
In terms of:

- Carbon emissions
- Tons of waste Landfilled (vs. Energy Recovery)



2021 BNL Program Recycling Performance

BNL Total Recycling by Tons (Daily Operations)



Daily Operations:

- Total Recycled Material: 644 Tons
- Total Municipal Solid Waste (MSW): 229 Tons
- CY21 Recycling Rate: 74%

Summary

BNL will adopt a “Net-Zero” mindset for addressing future waste management activities. The focus will be on source reduction across a wide range of products starting with replacing products containing PFAS and reducing of the use of single-use plastics.

BNL will seek support from staff who share these values to propel the program forward.

DOE Carbon Pollution-Free Roadmap: Introduction and Overview

U.S. DEPARTMENT OF ENERGY

August 4, 2022

Office of Management

DOE Carbon Pollution-Free Electricity Roadmap and Guidance Approved

- CFE Roadmap Signed by Secretary Granholm on July 26, 2022
- CFE Roadmap Implementing Guidance signed by Deputy Secretary on August 2, 2022
- Development guided by DOE's Sustainability Steering Committee
- Establishes Departmental goals and objectives, implementation strategies, and specific near and longer-term actions to achieve the CFE goals in Executive Order (EO) 14057

Driver for DOE CFE Roadmap

CFE Goals of Executive Order 14057

100 percent carbon pollution-free electricity on a net annual basis by 2030, including 50 percent 24/7 carbon pollution-free electricity. (Sec. 102(a)(i) of E.O. 14057)

Facilitate new carbon pollution-free electricity generation and energy storage capacity by authorizing use of [Federal] real property assets. (Sec. 203 of E.O. 14057)

Path to Carbon Pollution – Free Energy

DOE Carbon Pollution – Free Electricity (CFE) Roadmap

- Near and long-term actions to meet EO ***Catalyzing Clean Energy Industries Through Federal Sustainability***

Three Strategies

- Improved Energy Efficiency and Energy Demand Flexibility
- Expanded Onsite CFE Generation and Storage
- Increased CFE Procurement (Currently 48% of BNL's power is CFE)

Improved Energy Efficiency and Energy Demand Flexibility

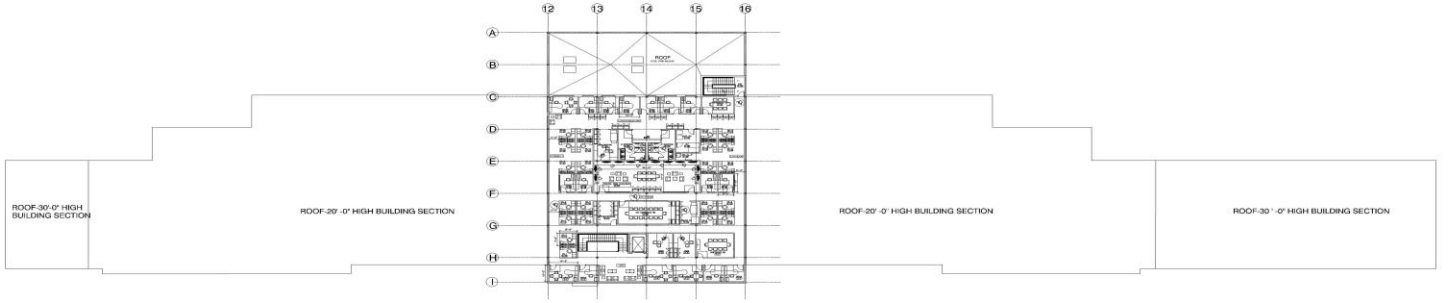
- Identify proposed projects and costs to reduce energy load and increase flexible load management, including:
    - Energy efficient equipment (e.g., HVAC systems, lighting, etc.)
    - Rightsizing facilities
    - Applying green building standards to new construction and renovations
    - Expanding metering to more effectively track electricity usage and decrease electricity use during peak demand periods
- Identify opportunities to deploy electrification for buildings and transportation, and CFE implications
- Leverage existing planning mechanisms (e.g., VARP, ECMs) to identify new energy efficiency projects and opportunities

INTEGRATED SITE OPERATIONS AND SUPPORT FACILITY

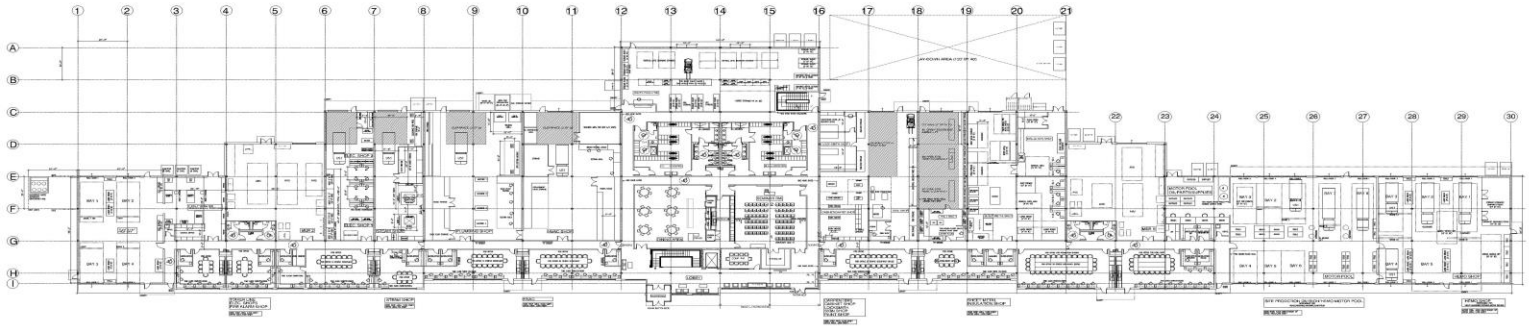
Brookhaven National Laboratory - BNL operates and maintains major scientific and support facilities to a growing population of university, industry, and government researchers in support of its DOE Office of Science (SC) mission. Craft resources significantly contribute to the core mission in support of research for SC programs.

Scope:
The design and construction of an approximately 70,000-120,000 GSF, net-zero facility with modern shops, operations, and administrative/support spaces

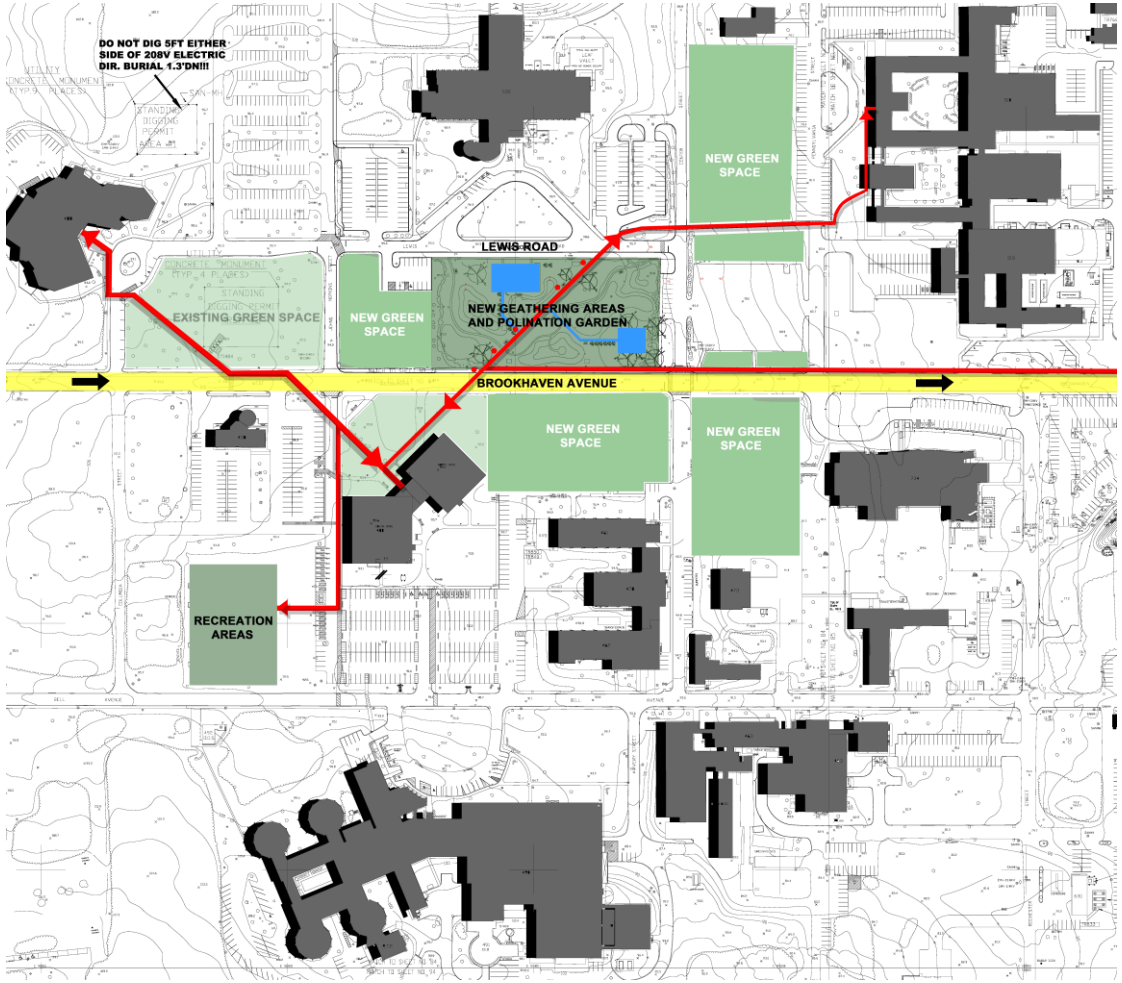
Benefits:
- Increase productivity
- Increase operational efficiency and safety
- Reduce energy, operations, and maintenance costs.
- Eliminate WWII era facilities with over $16M in repair and modernization needs
- Provide the infrastructure for maintaining and charging the new fleet as we transition to 100% electric vehicles.
- Reduce F&O footprint



SECOND FLOOR



MAIN BUILDING FIRST FLOOR



Brookhaven National Laboratory

Using BNL Assets for Synergy

- PSEG-LI RFP for bulk energy storage resources to be interconnected to the Long Island electric grid.
- DOE offered to make available up to four acres within BNL's boundaries for the purpose of installing a bulk energy storage facility.
- Benefits to BNL
  - The developer will provide BNL with access to real-time data; and
  - The developer will provide a research battery to BNL on the scale of 1MWh.
- This is exciting and will be complicated – we're beginning work with DOE and the developer on details.