

Brookhaven National Laboratory Site Sustainability Overview

Community Advisory Council
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BROOKHAVEN
NATIONAL LABORATORY

a passion for discovery

 Office of
Science
U.S. DEPARTMENT OF ENERGY



Topics

- Laboratory Environmental Footprint
- Strategic Sustainability Plan and Accomplishments
- Modernizing with Green Infrastructure
- National Perspective



Brookhaven National Laboratory

A passion for discovery

5321 acres

321 buildings

4.88 M sq ft

29 miles
paved roads

12 miles
sidewalks

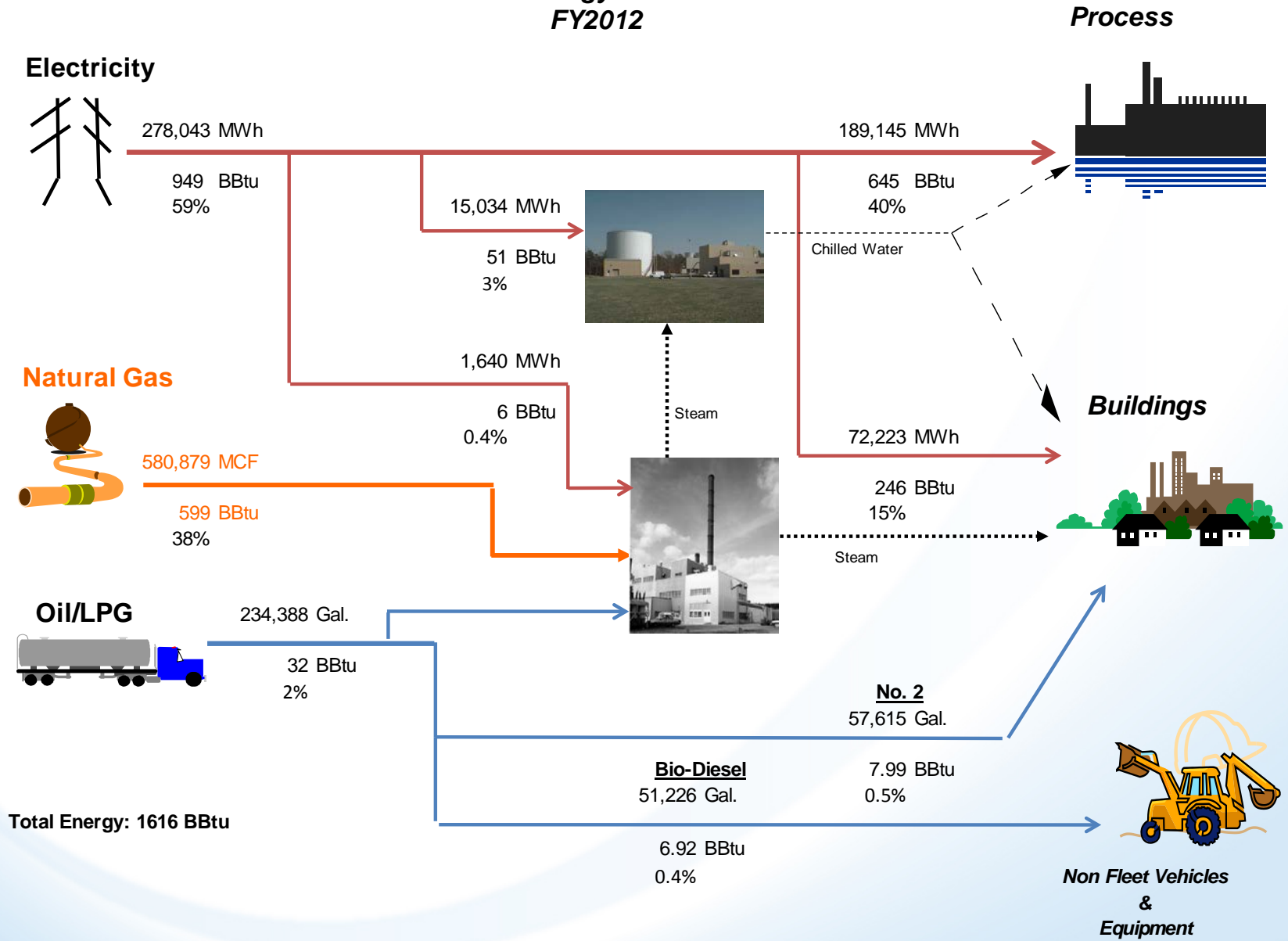
Housing for 550

~3000 employees

>4000 guest users per year

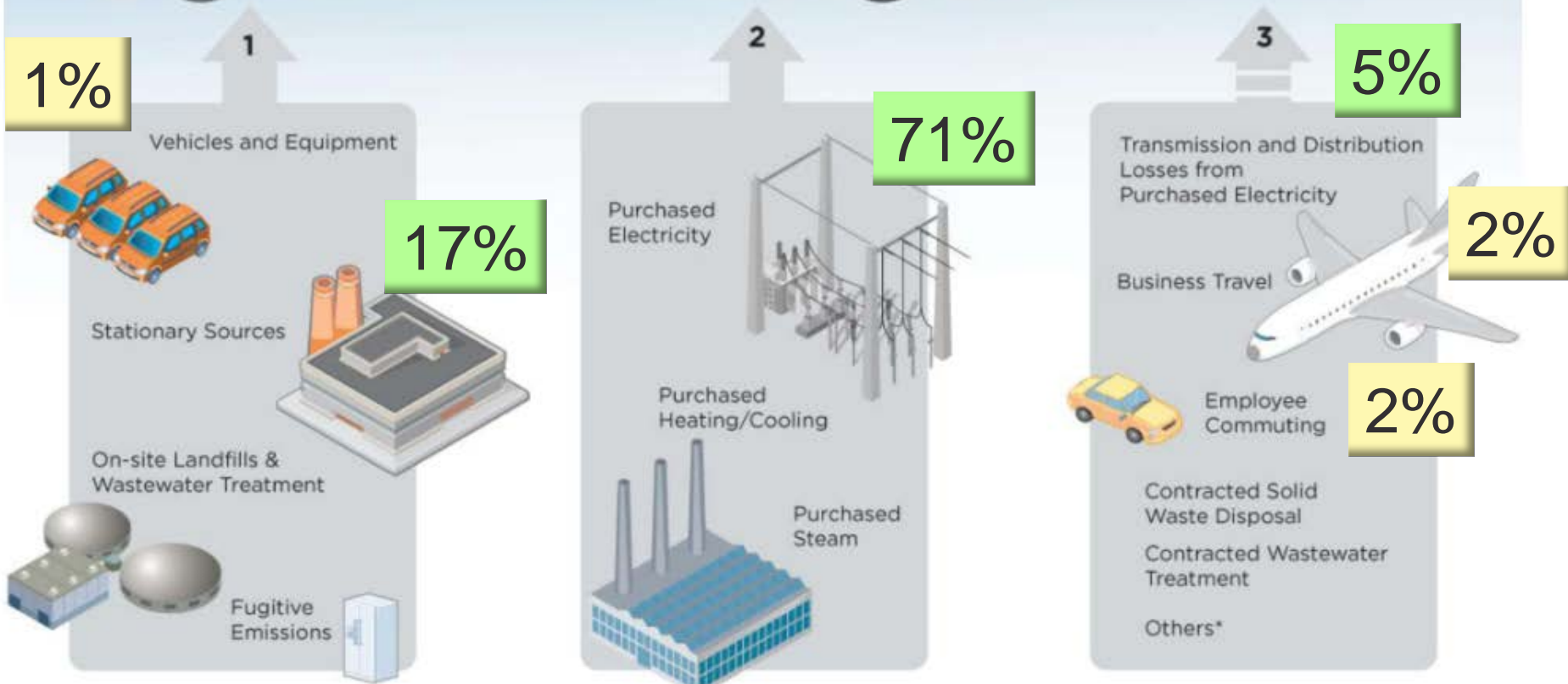
Long Island Economic Impact:
\$650M and over 5000 jobs

Brookhaven National Laboratory Energy Use FY2012



Common Sources of Federal Greenhouse Gas Emissions

Energy Use represents 93% of BNL GHG Production



SCOPE 1:

Greenhouse gas emissions from sources that are owned or controlled by a Federal agency.

SCOPE 2:

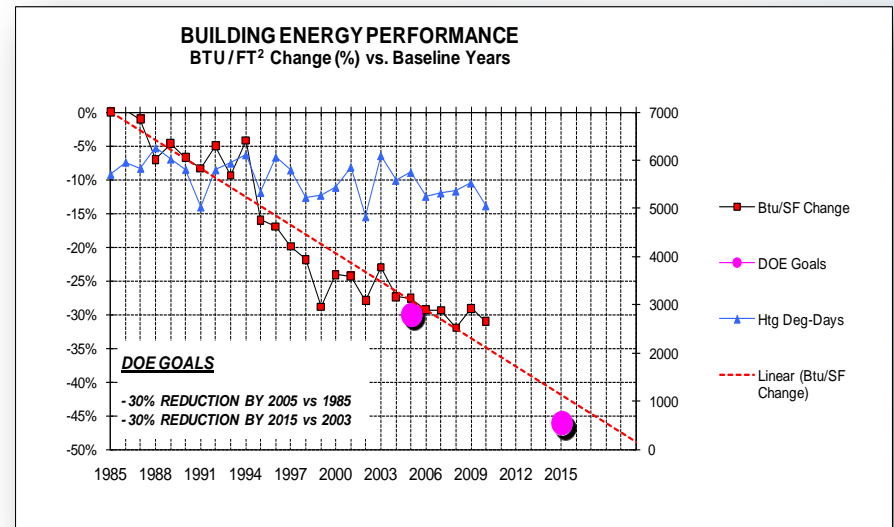
Greenhouse gas emissions resulting from the generation of electricity, heat, or steam purchased by a Federal agency.

SCOPE 3:

Greenhouse gas emissions from sources not owned or directly controlled by a Federal agency but related to agency activities.

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 57% comparing FY2010 to FY1973
 - Saves about \$15 million/year in energy costs
 - Over 112,000 MTCO₂e per year avoided



BNL Energy Usage

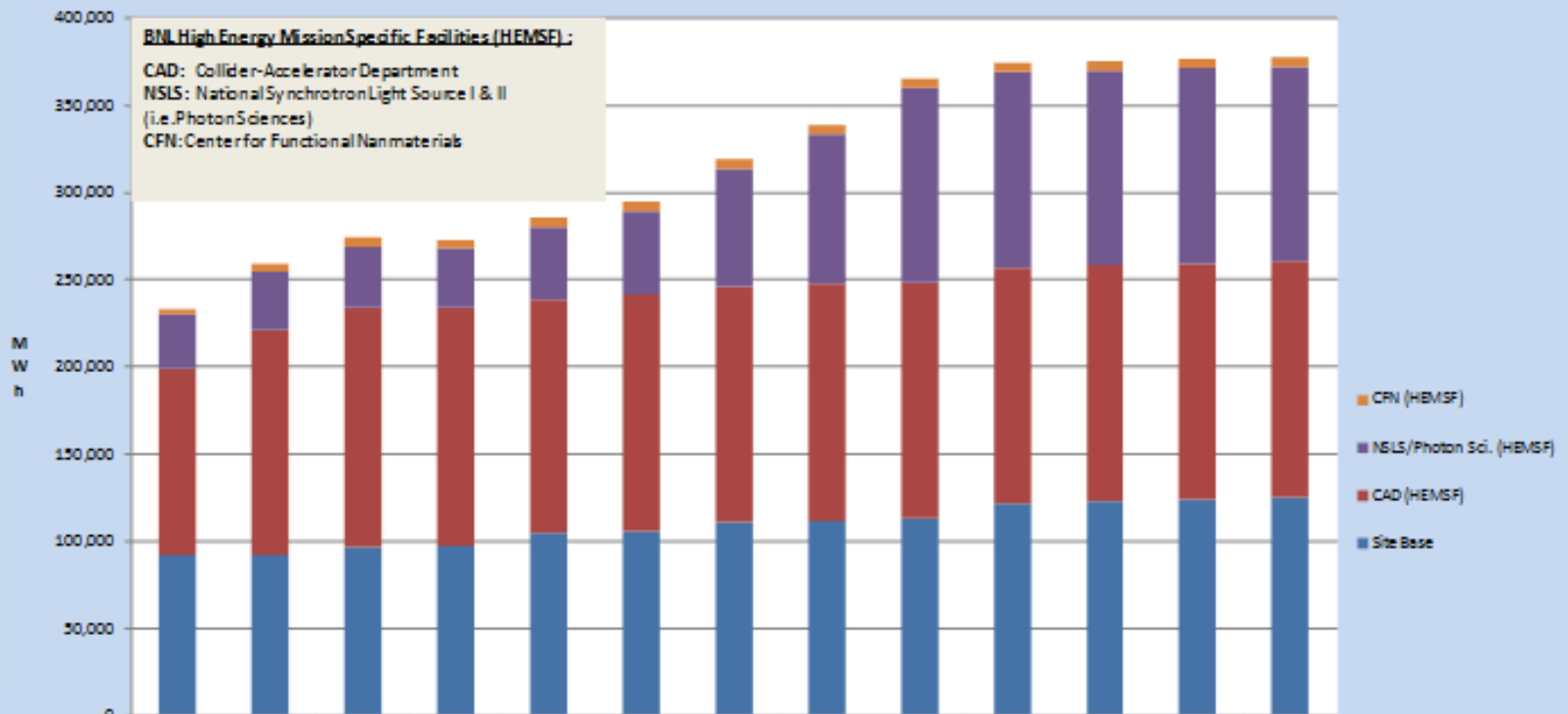
- BNL's electricity use is driven by High Energy Mission-Specific Facilities (HEMSF)

Total purchased electricity is estimated to increase over 60% by 2020 compared to 2008 levels.

BNL has developed a preliminary plan in the SSP to reduce/offset the estimated increase in Greenhouse Gas (GHG) emissions to meet or exceed the 28% reduction target by 2020 as compared to the base year of 2008, for a total reduction/offset of ~115%.

BNL's sustainability initiative will require major infrastructure investments.

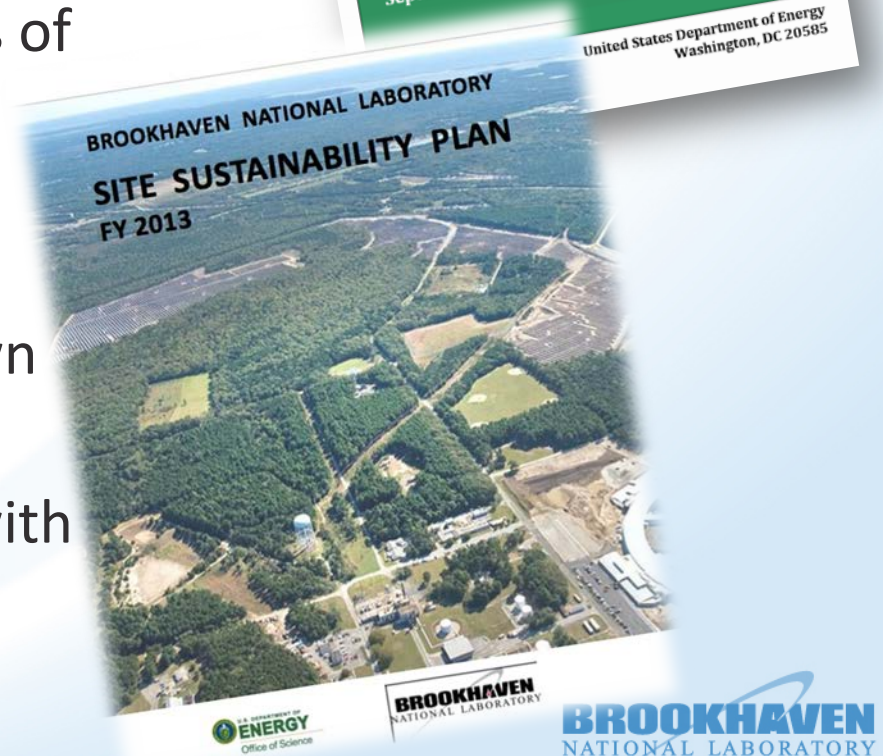
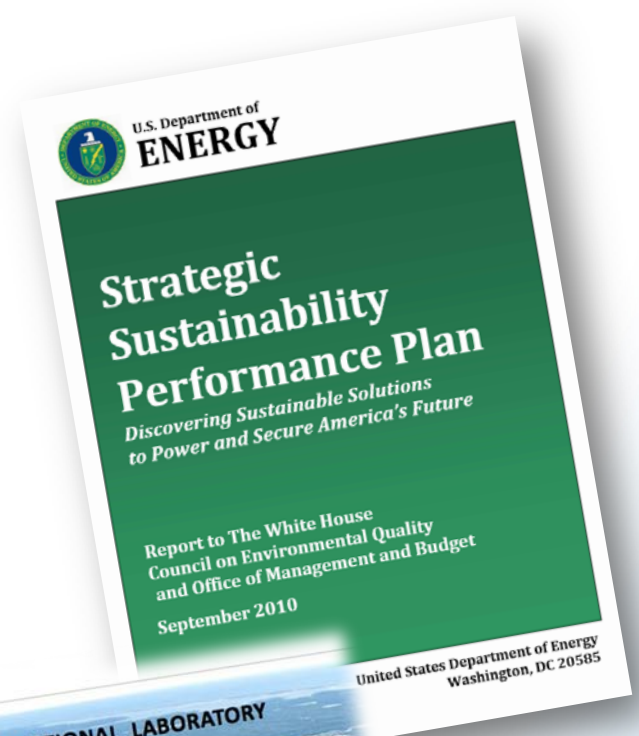
BNL Historical and Projected Electricity



	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
CFN (HEMSF)	3,000	4,300	3,100	3,300	3,398	3,400	3,400	3,400	3,400	3,400	3,400	3,400	3,400
NLS/Photon Sci. (HEMSF)	30,665	33,313	35,192	34,146	41,708	48,164	67,360	83,848	111,778	111,778	111,778	111,778	111,778
CAD (HEMSF)	107,078	129,248	136,687	136,626	133,560	133,200	133,200	133,200	133,200	133,200	133,200	133,200	133,200
Site Base	92,304	91,902	96,923	96,991	104,826	106,030	110,892	112,074	113,257	121,798	122,981	124,163	125,346

Department of Energy Commitment

- DOE has developed a Strategic Sustainability Performance Plan in response to Executive Order 13514
- The plan establishes Department goals in a wide variety of areas of sustainability
- DOE requested each site to develop and implement a Site Sustainability Plan to flow down these goals
- BNL submits annual updates with quarterly progress reviews



Major Site Sustainability Plan (SSP) - Goals

- 28% reduction Scope 1 & 2 greenhouse gas by 2020 from 2008 baseline
- 30% reduction energy intensity by 2015 from a 2003 baseline
- 7.5% of annual electricity consumption from renewable sources by 2010
- 10% per year increase in fleet alternative fuel consumption from 2005 baseline
- Cool roofs for all new construction and retrofits
- 13% Scope 3 GHG reduction by 2020 from a 2008 baseline
- All new construction and major renovations greater than \$5 million to be LEED® Gold certified.
- 15% of existing buildings larger than 5,000 GSF must comply with the five HPSB guiding principles by 2015
- 16% water intensity reduction by 2015 from a 2007 baseline; 26% by 2020; 20% reduction in industrial / other water use by 2020 from 2010 baseline

Major BNL Sustainability Actions

■ Energy Conservation Projects

- Lighting upgrades (17 buildings), enhanced energy controls and retro-commissioning (10 Buildings)
- Chiller efficiency and chilled water storage increase
- Implemented with a Utility Energy Service Contract (UESC)

■ High Performance Sustainable Buildings

- LEED for new construction
- Evaluate buildings to meet LEED HPSB standards
 - 18 are required by 2015
- Data center efficiency improvements

■ Renewable Energy

- Hosting the LISF
- Purchasing Renewable Energy Credits (REC's)
- Northeast Solar Energy Research Center (NESRC)

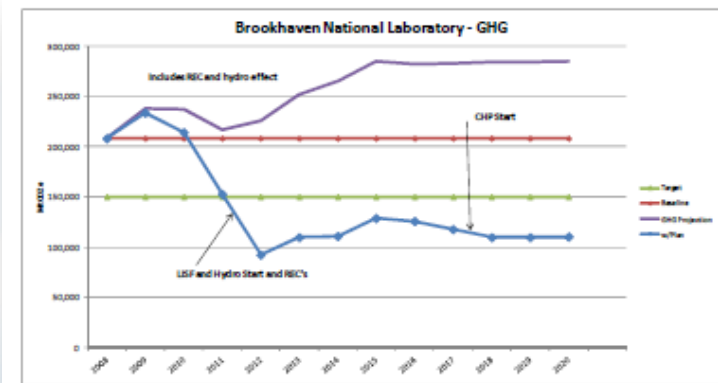


Figure 2. Effect and Timing of Current GHG Reduction Strategy.

Long Island Solar Farm at BNL

- DOE with BNL support has successfully made available the BNL site to host a major solar PV array
- The project was executed through a Request for Proposal from the local utility (LIPA)
- To promote renewable energy, 200 acres of federal land has been made available through an easement
- The project which began commercial operation in November 2011 produces 31.5 MW and avoids ~31,000 tons of carbon per year
- Both large array and a smaller research array will be utilized by BNL in research programs



Transportation / Vehicles

- 259 vehicles of light, medium and heavy duty vehicles on BNL site
- Compressed natural gas (CNG) fueling infrastructure installed 2001
 - BNL provides compressed natural gas refueling to local governments that partner with DOE Clean Cities
- E85 refueling infrastructure operational in 2010
- Biodiesel use initiated in early 2010



FY 2012 Government Vehicle Fleet – 259 Vehicles

Fuel Type	Gasoline	CNG	Diesel	E-85	Total
Totals	93 (36%)	66 (25%)	37 (14%)	63 (24%)	259 (100%)

BNL Concrete Crushing and Recycling

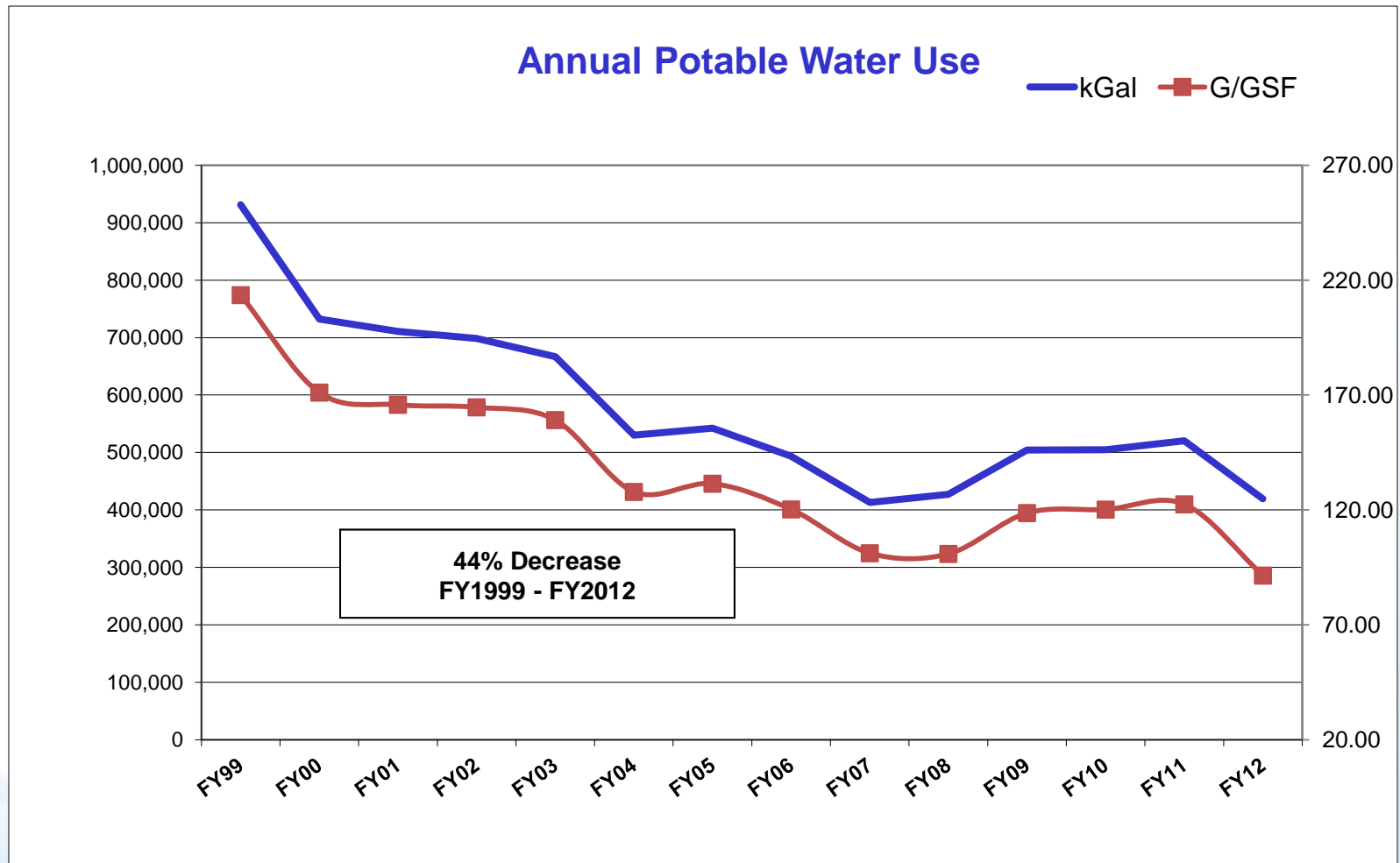


- Achieved a 99%+ C&D recycling rate by storing most of its concrete rubble (from building demolitions) on-site until enough material is generated to warrant the cost of bringing in a contractor with a concrete crusher.
- Resulting crushed concrete is used on-site as base for BNL's fire-breaks, new roads and parking lots.
- Savings (against purchased stone) averages ~\$350,000 per crushing event.

BNL Water Usage

DOE Goal: 16% water reduction by FY 2015 from a FY 2007 baseline, 26% by 2020

We are not on track to make goal



Leadership in Energy & Environmental Design (LEED)

- USGBC rating system that focuses on sustainable design:
 - Sustainable Sites
 - Water Efficiency
 - Materials & Resources
 - Energy & Atmosphere
 - Indoor Environmental Quality
 - Innovation and Design Process
- LEED Silver
 - Research Support Building
 - Center for Functional Nanomaterials
- LEED Gold
 - Interdisciplinary Science Building – Phase I



NSLS-II LEED Status

■ Facility consists of:

- 400 ksf Ring Building and Hard X-Ray Nanoprobe Building
- Lab-Office Buildings (LOBs) (five @ 40 ksf each)
 - Identical buildings contiguous to Ring Building



■ The LOBs and Ring Building are two separate registrations

- Ring Building /HXN Building – Achieved LEED Gold
- LOBs – Target LEED Gold

■ Ring Building Features

- Includes many LEED features for sustainable construction, site planning and building design
- Most notable feature is process cooling design that substantially reduces use of mechanical cooling by increasing operating temperatures, “free cooling” via cooling tower

Storm Water Management

- BNL development is designed to minimize both construction impact and long term impacts to the site
 - Site specific erosion and sediment control plans to prevent construction and post-development storm water impacts
 - Construction of on-site storm water management and treatment systems
- Recently developed facilities have employed increasing levels of sophistication to manage GW within the site boundaries



Selected slides from:

Office of Science's Progress in Meeting Federal Sustainability Goals

FY 2011 Data

Informational Briefing November 2012




U.S. DEPARTMENT OF
ENERGY


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Science


FY2011 Sustainability Goals and Performance Statuses

Goal #	Description	DOE Office of Science Sites												
		Ames	ANL	BNL	Fermi	LBNL	ORISE	ORNL	ORO	OSTI	PNNL	PPPL	SLAC	TJNAF
1.1	Scope 1 and 2 Greenhouse Gas (GHG) Emissions Reduction*	H	L	L	H	H	H	H	M	M	H	L	H	H
1.2	Energy Reduction	H	M	M	M	H	H	L	M	H	L	L	L	L
1.3	Metering	L	L	L	L	L	L	L	M	M	L	L	M	L
1.4	Cool Roofs	L	L	L	L	L	L	L	L	N/A	L	L	L	L
1.5	Renewable Energy	L	L	L	L	L	L	L	M	L	L	L	L	L
1.6	Fleet – Alternative Fuel Consumption	L	L	L	L	L	L	M	L	L	L	L	L	L
1.7	Fleet – Petroleum Consumption	L	L	L	L	L	L	M	L	H	L	L	L	L
1.8	Fleet – Light Duty Vehicles	L	L	L	L	L	L	L	L	L	L	L	L	L
1.9	Reduce fleet inventory	L	M	M	H	L	L	H	L	L	L	L	L	L
2.1	Scope 3 GHG Emissions Reduction	L	H	L	M	M	H	H	L	M	M	L	H	H
3.1	Buildings: existing	M	L	L	H	L	L	M	H	L	L	L	H	L
3.2	Buildings: new construction, major renovations	L	L	L	L	L	L	M	L	L	L	L	L	L
4.1	Water Intensity Reduction	M	L	M	L	H	L	H	L	H	L	H	M	M
4.2	Water Consumption Reduction (ILA use)	N/A	L	N/A	H	N/A	N/A	N/A	N/A	N/A	M	M	N/A	N/A
5.1	Non-hazardous solid waste	L	L	L	L	L	L	L	L	H	M	M	M	L
5.2	Divert construction and demolition materials	M	L	L	L	L	L	L	L	L	L	L	L	L
6.1	Procurements meet sustainability requirements	L	L	L	L	L	L	L	L	L	L	L	L	L
7.1	All data centers metered	L	L	L	L	L	N/A	L	L	H	L	L	L	H
7.2	Maximum annual weighted average PUE 1.4	L	M	L	M	L	N/A	L	M	H	M	M	L	H
7.3	Electronic Stewardship	L	L	L	L	L	L	L	L	H	L	L	L	L

KEY

 High risk

 Medium risk

 Low risk

*Currently must buy RECs to meet goal
Data source: FY11 Site Goal Sheets

Questions?

