

Department of Energy  
2010 FIMS/Real Estate Workshop  
Cincinnati, OH

# Office of Science 2010 Facility Update



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U.S. DEPARTMENT OF  
**ENERGY**

Office of  
Science

# Office of Science

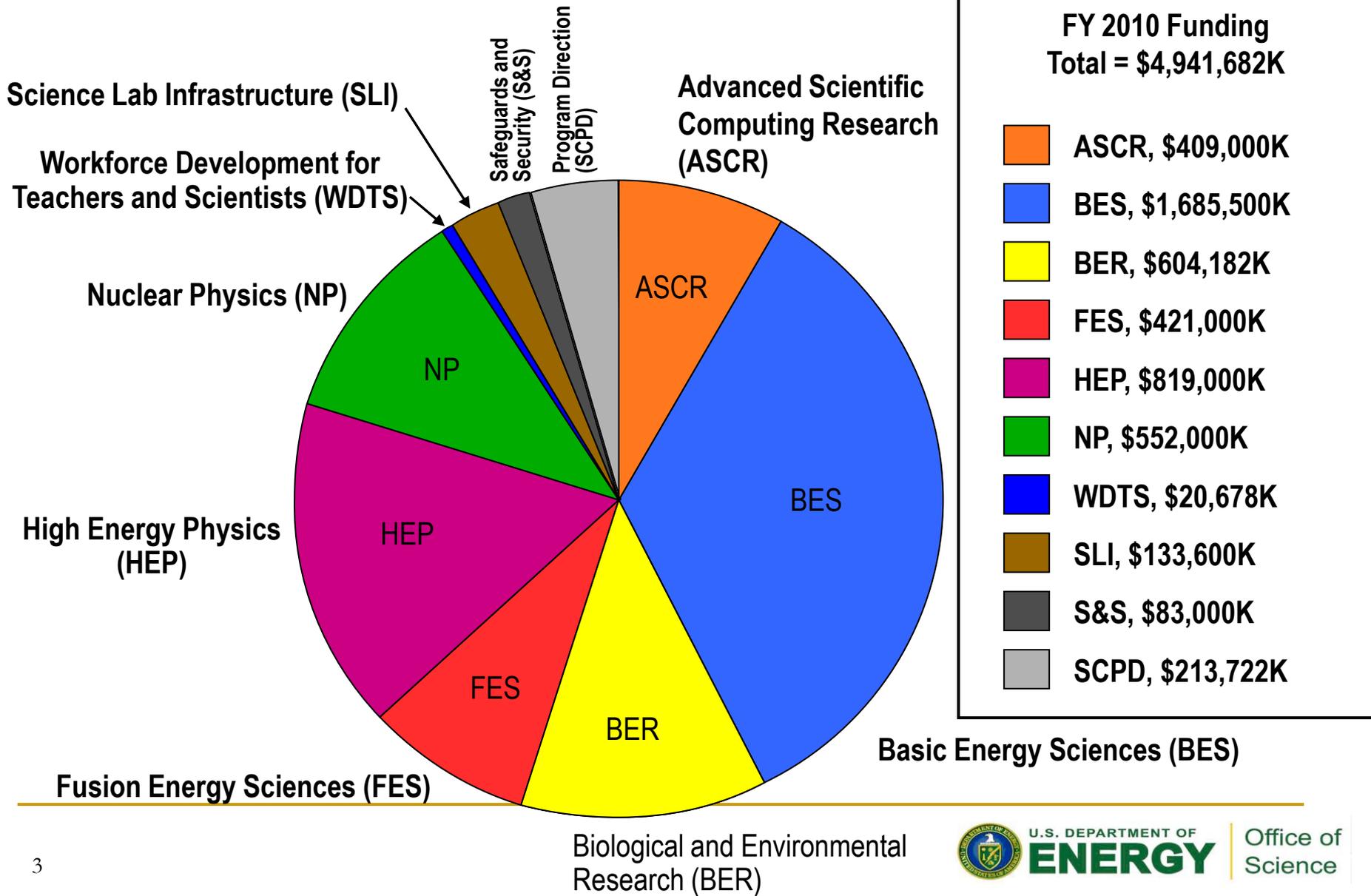
*One of the nation's largest supporters of peer-reviewed basic research, providing 40% of Federal support in the physical sciences and supporting ~25,000 Ph.D.s, graduate students, undergraduates, engineers, and support staff at more than 300 universities and at all 17 DOE laboratories.*

Three themes describe the work supported by the Office of Science:

- **Science for discovery**
  - Unraveling Nature's deepest mysteries—from the study of subatomic particles; to atoms and molecules that make up the materials of our everyday world; to DNA, proteins, cells, and entire natural ecosystems
- **Science for national need**
  - Advancing a clean energy agenda through basic research on energy production, storage, transmission, and use
  - Advancing our understanding of the Earth's climate through basic research in atmospheric and environmental sciences and in climate modeling
  - Supporting DOE's missions in national security
- **National scientific user facilities, the 21st century tools of science**
  - Providing the Nation's researchers with the most advanced tools of modern science including accelerators, colliders, supercomputers, light sources and neutron sources, and facilities for studying the nanoworld, the environment, and the atmosphere

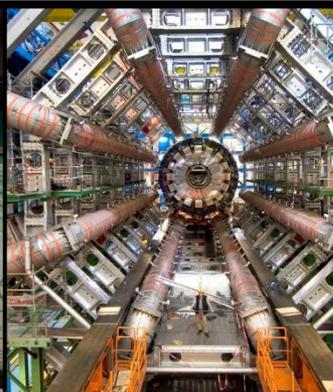


# Office of Science Programs

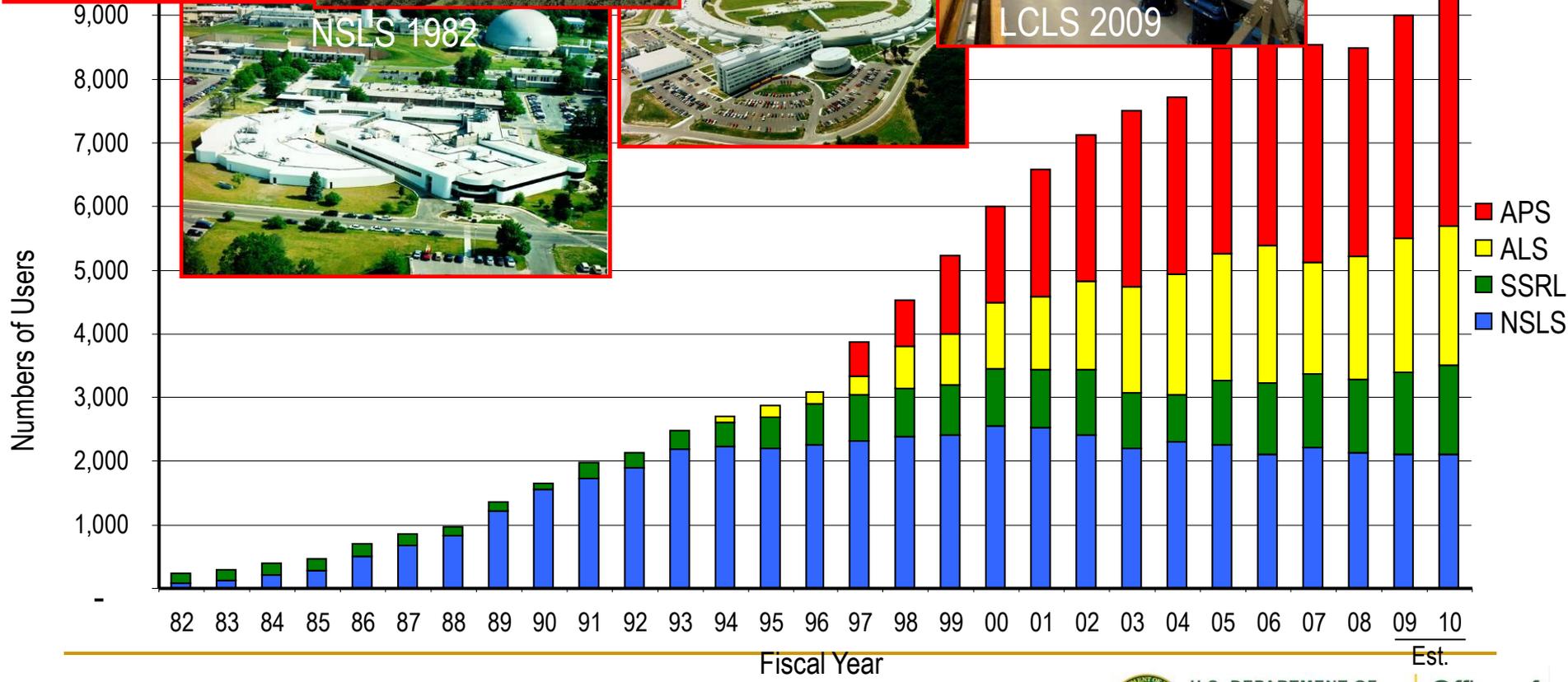
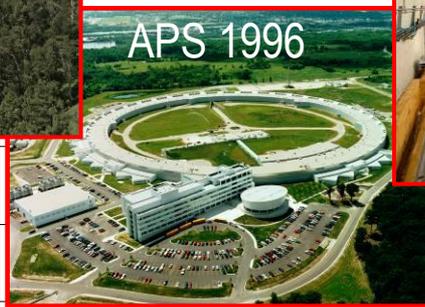


# User Facilities

- Advanced **computational resources** – terascale to petascale computing and networks for open science
- Four **synchrotron light sources**, and two next-generation light sources in construction
- Three **neutron sources** for scattering
- **Particle accelerators/colliders/detectors** for high energy and nuclear physics
- **Fusion/plasma facilities**, including **ITER** which seeks to demonstrate a burning plasma
- Five **Nanoscale Science Research Centers** – capabilities for fabrication and characterization of materials at the nanoscale
- **Joint Genome Institute** for rapid whole genome sequencing
- **Environmental Molecular Science Laboratory** – experimental and computational resources for environmental molecular sciences
- **Atmospheric and Environmental Facilities** – capabilities for cloud and aerosol measurement and for carbon cycling measurements



# 35 Years of Light Sources



# Linac Coherent Light Source (LCLS) at SLAC

*Already producing new science today, the LCLS is the world's first x-ray free electron laser*

**LCLS is SC's newest x-ray light source user facility, providing an unprecedented combination of high spatial and temporal resolution for the investigation of atomic-scale structure and processes.**

**On target for an on time, within budget (\$420M) completion in FY 2010**

- Time between first start up and first light was, remarkably, under two hours!

**Meeting or exceeding design specifications to enable new science**

- Peak brightness 10 orders of magnitude greater than existing x-ray sources
- X-ray pulses as short as 2 millionths of a nanosecond (2 femtoseconds)

**Overwhelming demand for access**

- More than 850 researchers have applied for time on LCLS during the early access experimental runs, prior to CD-4



# DOE Energy Innovation Hubs

*Three new Hubs are launched in FY 2010 with SC leading the Fuels from Sunlight Hub*

**Modeled after the Office of Science Bioenergy Research Centers, the Energy Innovation Hubs focus on critical energy technology challenges by building creative, highly-integrated research teams that can accomplish more, faster, than researchers working separately.**

**FY 2010 Hubs tackle three important energy challenges:**

- 1. Production of fuels directly from sunlight (SC)**
- 2. Energy-efficient building systems design (EERE)**
- 3. Modeling and simulation of advanced nuclear reactors (NE)**

**The Fuels from Sunlight Hub** will accelerate the development of a sustainable commercial process for the conversion of sunlight directly into energy-rich chemical fuels, likely mimicking photosynthesis, the method used by plants to convert sunlight, carbon dioxide, and water into sugar. In FY 2011, BES has budgeted \$24,300K for the 2<sup>nd</sup> year of the Fuels from Sunlight Hub. The FOA was released on 12/22/2009, and proposals are due on 3/29/2010.

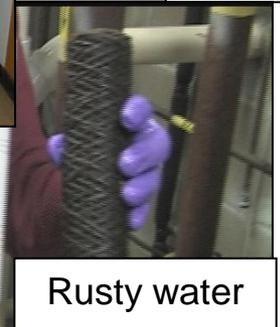
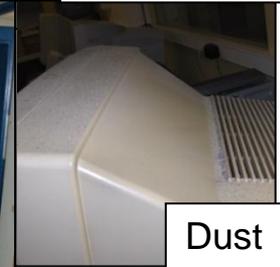
***SC/BES Hub for Batteries and Energy Storage (\$34,020K)  
proposed in FY 2011***



# Status of Laboratory Infrastructure

- Ten research laboratories with over 1,500 buildings and 20 million square feet of space.
- Much of our infrastructure is old, expensive to maintain, and can no longer meet the requirements of a modern research facility. RPV of \$10B
- Improvements have been made – increased annual maintenance investment, focus on reducing deferred maintenance.
- An integrated approach is needed, including
  - Capital Investment
    - **SC funded Modernization Initiative**
    - **Increased IGPP funded by labs**
  - Elimination of Excess Facilities
  - Maintenance

**Maintenance alone will not ensure our laboratories can continue to fulfill their missions.**



# Ten Year Site Plans (TYSP) Focus on Mission Readiness and Identify the F&I Gaps and Action Plans

- The TYSP is integrated into Annual Laboratory Plans as the “Infrastructure/Mission Readiness” section.
- Provides normal TYSP information plus an assessment of the current condition of facilities and infrastructure in the context of laboratory’s core capabilities and identify those investments needed to ensure continued mission readiness for those capabilities.
- Outline:
  - ***Overview of Site Facilities and Infrastructure (½ page)***
  - ***Facilities and Infrastructure to Support Laboratory Missions (3 pages)***
  - ***Strategic Site Investments (3 pages)***
  - ***Trends and Metrics (1 page)***
  - ***Sustainability (1 page)***
  - ***Appendices: IFI Xcut***



# Mission Readiness Assessment Process Identifies Gaps and Investment Needs and Plans

Technical Facilities and Infrastructure									
Core Capabilities		Mission Ready Assumes TYSP Implemented				Key Buildings	Facility and Infrastructure Capability Gap	Action Plan	
		N <sup>a</sup>	M <sup>b</sup>	P <sup>c</sup>	C <sup>d</sup>			Laboratory	DOE
	Now								
	In 5 Years								
	In 10 Years								
	Now								
	In 5 Years								
	In 10 Years								
	Now								
	In 5 Years								
	In 10 Years								

N<sup>a</sup> = Not, M<sup>b</sup> = Marginal, P<sup>c</sup> = Partial, C<sup>d</sup> = Capable

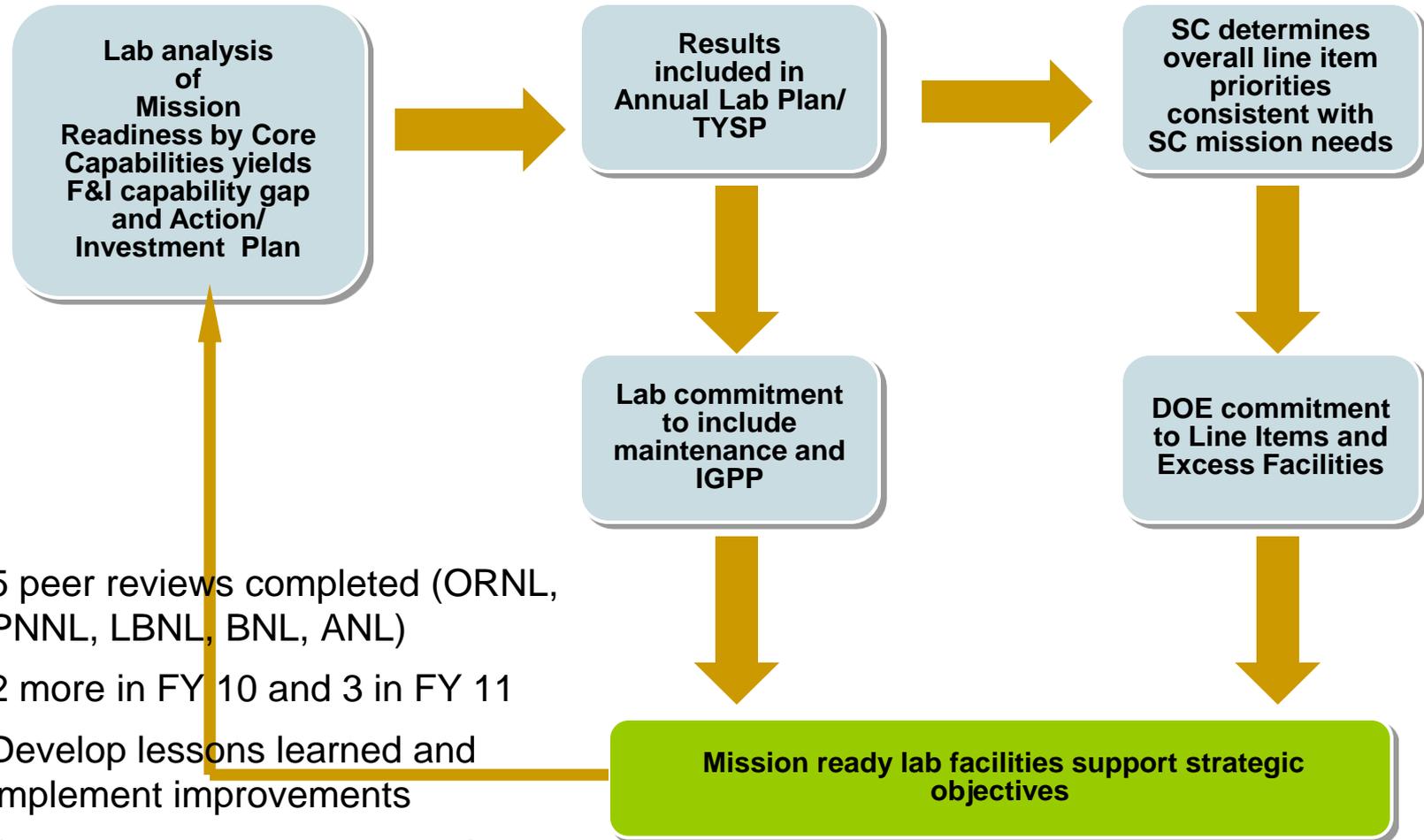
- **Labs assess state of facilities and infrastructure, now and in the future.**
  - **Not capable, Marginally Capable, Partially Capable, Capable**
- **Capability gaps are identified, and translated into an investment action plan.**
  - **Laboratory investments: IGPP, deferred maintenance reduction. funds, maintenance funds, and non-capitalized alterations.**
  - **DOE investments: ~~SLI~~ line items and GPP.**
- **An evaluation of support facilities is also prepared.**



# Mission Readiness Assessment Process

Driven by Science – executed through budget and contract commitments

Labs perform Peer Reviews



- 5 peer reviews completed (ORNL, PNNL, LBNL, BNL, ANL)
- 2 more in FY 10 and 3 in FY 11
- Develop lessons learned and implement improvements
- Continue to ensure that FIMS is populated with key data (Maintenance, RPV, Deferred maint)

# SC Modernization Initiative

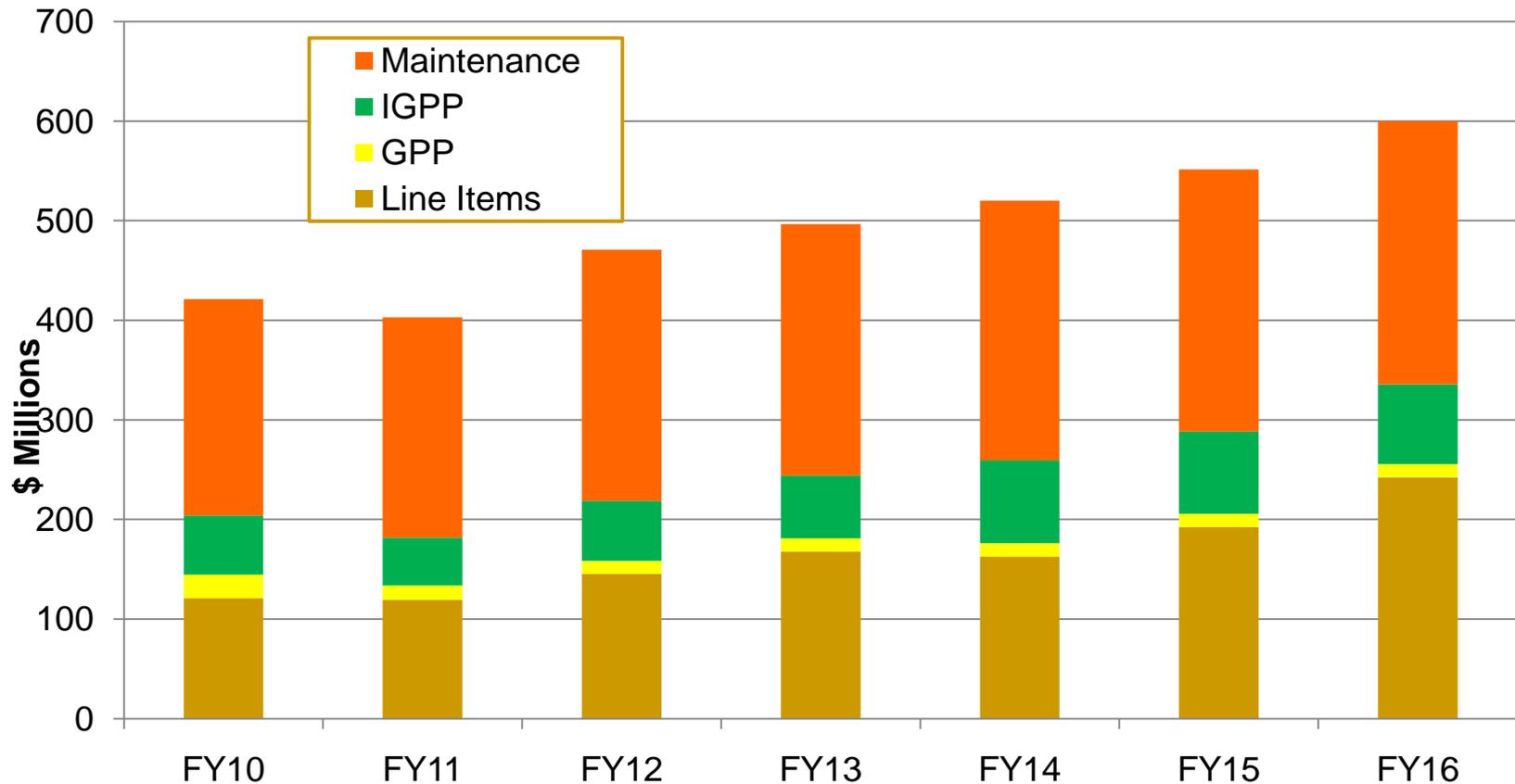
- Includes more than 30 prospective projects at our 10 major laboratories totaling over \$2 billion.
- Projects replace and rehab/renovate existing buildings and infrastructure
- Completion is expected to take 10 years but will depend on budget availability for the ramp up to the needed annual funding level of \$200M a year.
- When completed, the Initiative will have improved each laboratory's ability to fully support the missions of the Office of Science
- The initiative is will eliminate more than \$200 million of deferred maintenance, construct nearly 2 million square feet of modern building space, eliminate over 1.5 million square feet of obsolete building space, and renovate more than 1 million square feet of space. (These are current estimates.)



# Planned SC Infrastructure Investment

Source: FY 12 IFI Xcut

(Does not include programmatic projects such as new accelerators)



SC received \$200M of ARRA funds in FY 09



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# Ongoing Projects (continued)

## Modernization of Laboratory Facilities, ORNL TEC: \$95M

Construction of a new chemical sciences, materials science and technology core capabilities laboratory that will allow researchers to move from the 4500 Complex. Construction started in June 2009 and is forecast to be complete December 2101.



## Interdisciplinary Science Building, Ph I, BNL TEC\*: \$61.3M - \$66.3M

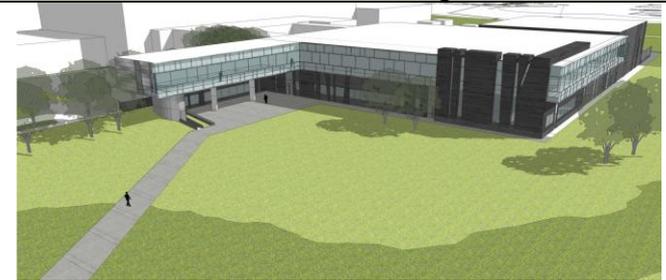
Demolition of inadequate facilities and construction of a new building with state-of-the-art laboratories, associated offices and support space. Site preparation activities began in August 2009.



\*Baseline has not yet been established.

## Technology and Engineering Development Facility, TJNAF TEC: \$72.2M

Renovation of the Test Lab Building and construction of new space that will eliminate severe overcrowding and improve workflow and productivity. Also eliminates inadequate work space in and near the Test Lab. Early construction activities are scheduled to begin in FY 2100.



# Ongoing Projects (continued)

**Seismic Life-Safety & Modernization of  
General Purpose Buildings Phase 2, LBNL  
TEC\*: \$91.9M - \$94.6M**

Replacement of seismically “very poor” and “poor” facilities with a new laboratory/office building, upgrade of the Hazardous Waste Handling Facility, and modernization of another laboratory/office building (Bldg 74, Life Sciences). Construction activities began on Building 74 in FY 2010 utilizing Recovery Act funding.



Building 85 (Hazardous Waste Handling Facility)



Rendering of new General Purpose Laboratory



Building 74 (Life Sciences)

# Ongoing Projects (continued)

## Research Support Building and Infrastructure Modernization, SLAC

**Preliminary TEC Range\*: \$80M - \$96M**

This project will integrate the lab's Accelerator Physics community across programmatic boundaries and will provide more uniform service (training, ES&H, business services) for the lab-wide user community. Project scope includes the construction of a modern office building for technical staff currently dispersed throughout the site in aged trailers and other inefficient locations, and modernization of two facilities for operations staff supporting the research mission. Project engineering and design activities will begin in FY 2010.



## Energy Sciences Building, ANL

**Preliminary TEC Range\*: \$84.5M - \$95M**

Scope includes construction of a new multidisciplinary Energy Sciences Building that will provide efficient and modern research space that will provide the interdisciplinary science platform needed to discover and develop alternative approaches to energy production, storage, and utilization. Project engineering and design activities began in FY 2010.



## Renovate Science Labs 2, BNL

**Preliminary TEC Range\*: \$45M - \$50M**

This project will upgrade and rehabilitate obsolete systems in Buildings 510 (Physics) and 555 (Chemistry). Although the basic core and shell construction of these buildings is sound, the lab and office spaces including their utilities and environmental support systems are obsolete. Project engineering and design activities will begin in FY 2010.

\*Baseline has not yet been established.

# E.O. 13514 – Requirements

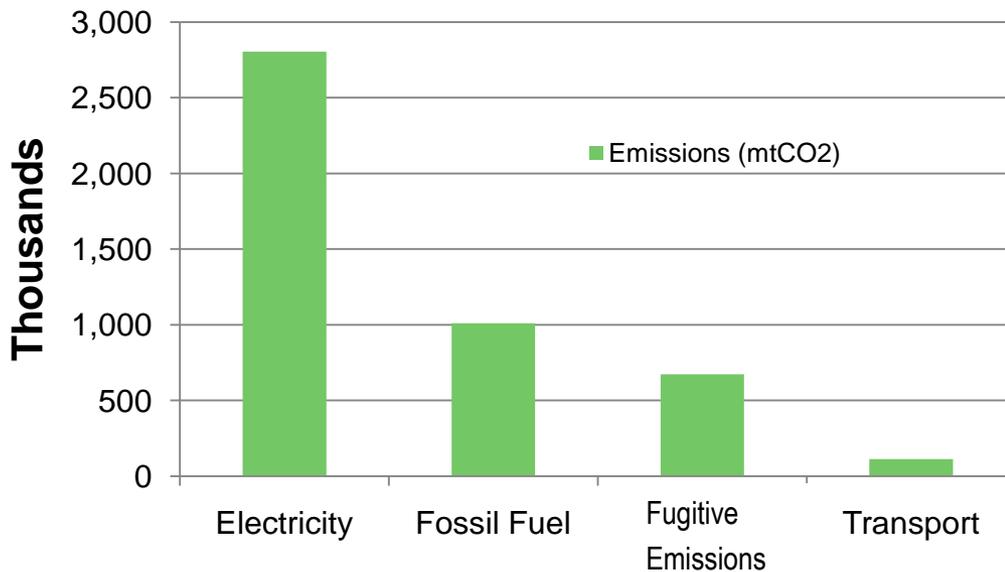
	<b>Requirement</b>
<b>Scope 1&amp;2 Greenhouse Gas (GHG) emission reduction from 2008 to 2020</b>	<b>28% (2020)</b>
• Energy Intensity reduction (Btu/ft <sup>2</sup> )	30% (2003- <b>2015</b> )
• Renewable electricity use	7.5% ( <b>2013</b> forward)
• Fleet petroleum reduction	30% (2005-2020)
• Potable water intensity reduction (gal/ft <sup>2</sup> )	26% (2007-2020)
• Industrial/other water consumption reduction (gal)	20% (2010-2020)
• Recycling & waste diversion	50% (by <b>2015</b> )
• Procurements meet sustainability requirements	95% (each year)
• Buildings meet sustainability principles	15% (by <b>2015</b> )
• <b>Net-zero energy in new facilities</b>	<b>100% (by 2030)</b>
<b>Scope 3 Greenhouse Gas (GHG) emission reduction from 2008 to 2020</b>	<b>10% (2020)</b>



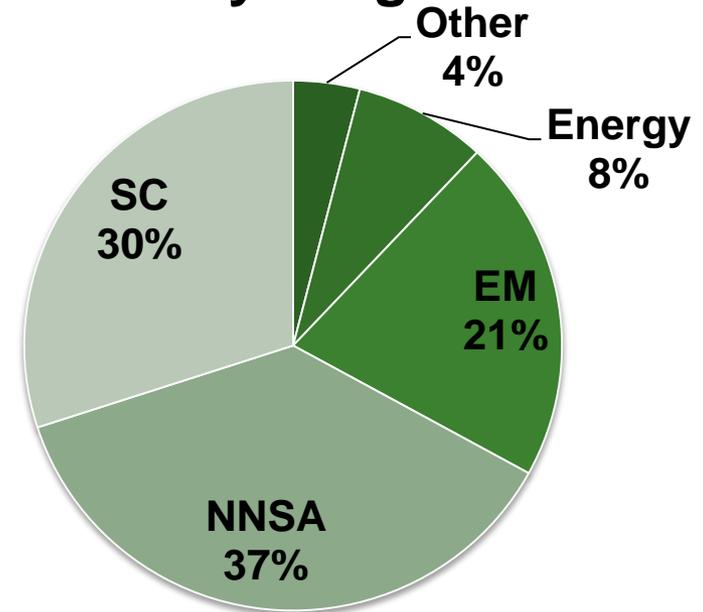
# DOE GHG Emission Profile

**Preliminary DOE 2008 Baseline for  
Scope 1 & 2 GHG Emissions = 4,600,000 mtCO<sub>2</sub> (in 2020 with growth)  
28% Reduction by 2020 = 1,290,000 mtCO<sub>2</sub>**

### DOE GHG by Source

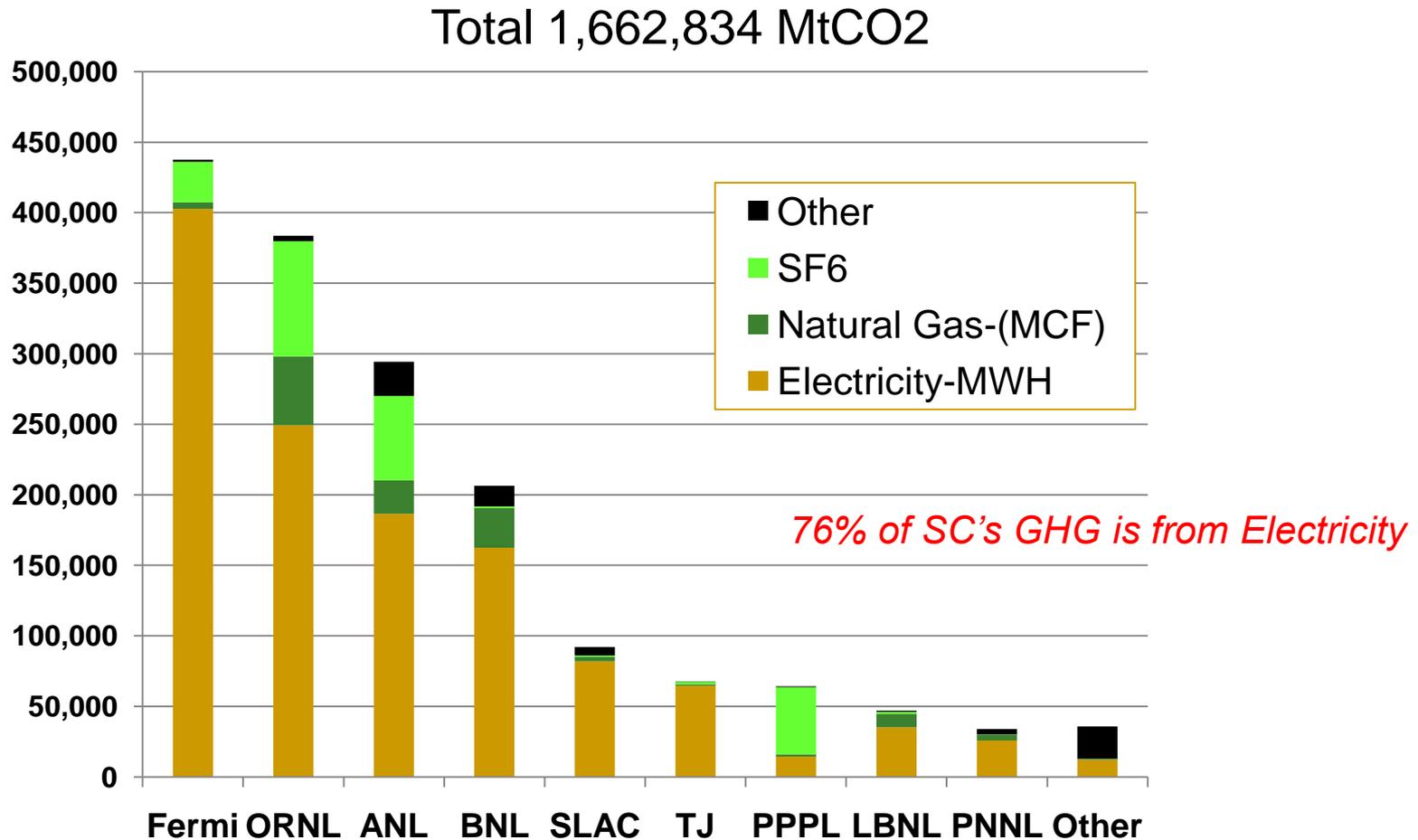


### GHG by Program

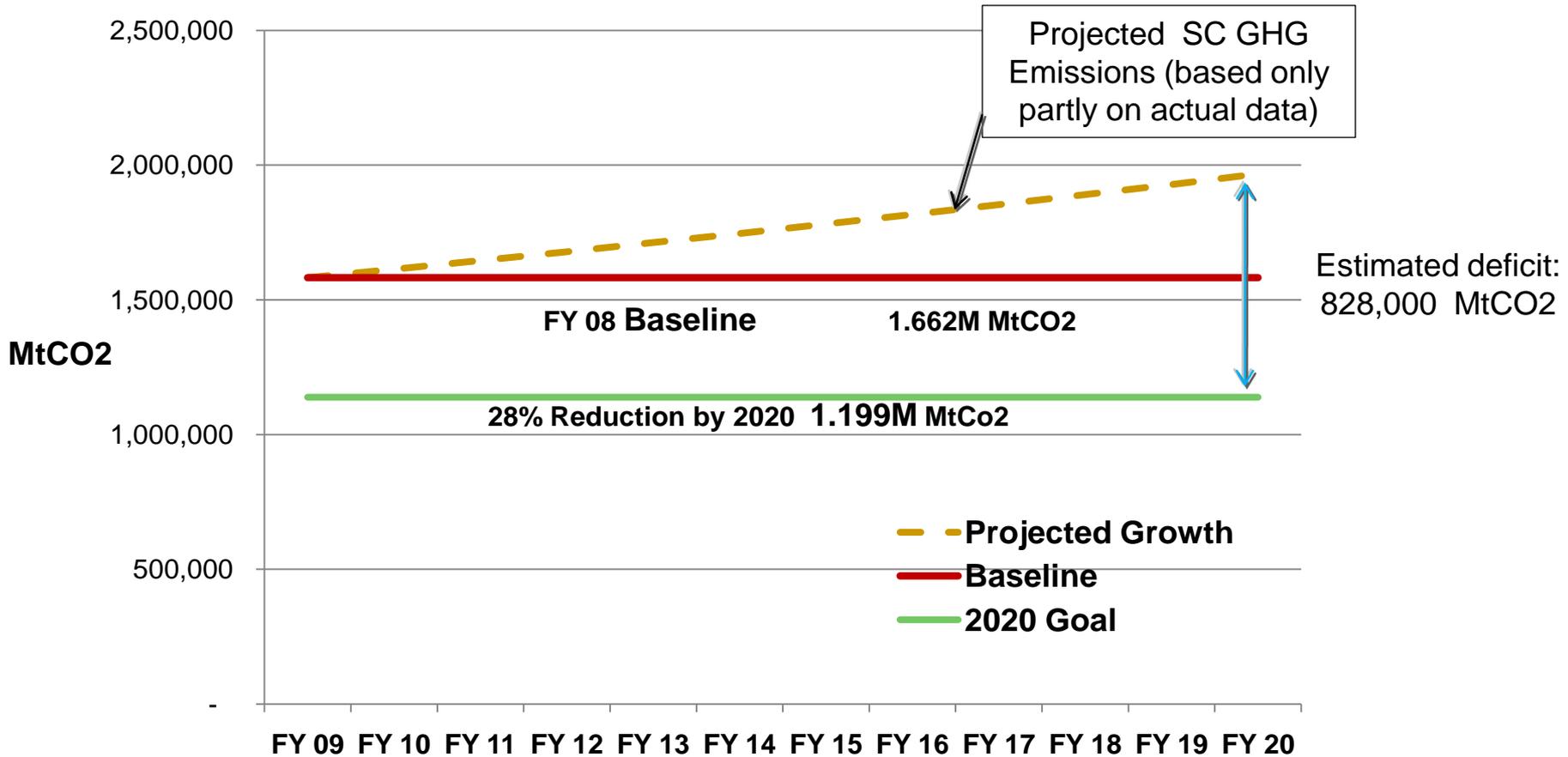


**Purchased electricity is the biggest contributor of DOE GHG while fugitive emissions offers the best opportunities for immediate impact...**

# GHG Footprint by Site and Fuel Type



# Office of Science GHG Emissions

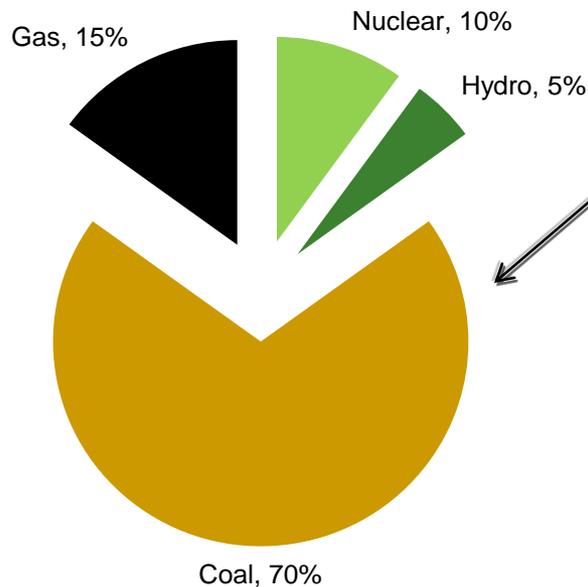


# Strategy for GHG Reductions

*Goal is 28% Reduction from FY 08 to FY 20*

- Reduce demand
- Increase use of renewable energy in supply

## Site Electrical Energy Mix



Replace coal and gas with nuclear, solar, wind, geothermal

*One 100MwH nuclear power plant on-site (or via Power Purchase Agreement (PPA) would provide 875,000 Mwh/yr (at 100% availability) or 1/2 SC's current GHG emissions*

# TEAM GOALS from DOE Order 430.2b and EO 13423

Energy: reduce energy intensity 30% by 2015 (baseline year FY 2003)

Renewable Energy (RE): achieve renewable energy on site 3.75% by FY 2010

Water: decrease water intensity 16% by 2015 (baseline year FY 2007)

Buildings: 15% of bldgs space meets guiding principles by FY 2015; all new bldgs LEED Gold

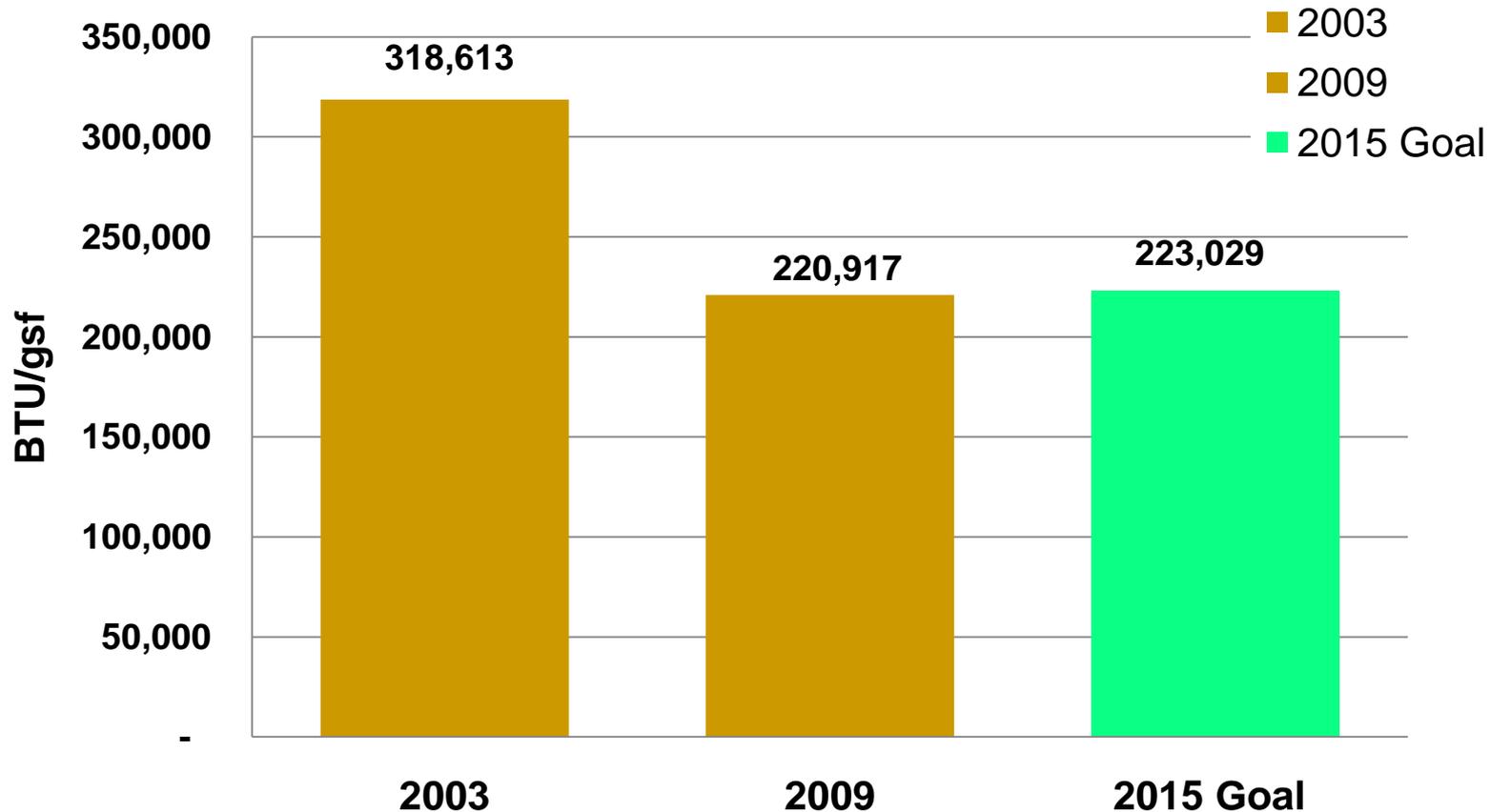
Fleet: various sub goals for vehicles and fuel type

PROJECTED GOAL COMPLIANCE					
FY 2010 Executable Plan Update					
LabGoal	Energy	RE	Water	Buildings	Fleet
AMES	Yes	No	Yes	Yes	n/a
ANL	Yes	No	Yes	No	No
BNL	Yes	No	No	Yes	No
FERMI	Yes	No	Yes	Maybe	Yes
LBNL	Yes	No	Yes	Yes	No
ORISE	No	No	Yes	No	Yes
ORNL	Yes	No	No	Yes	Yes
ORO	No	No	No	No	Yes
OSTI	No	No	Yes	TBD	Yes
PNNL	Yes	No	Unknown	Yes	Yes
PPPL	Yes	Yes	No	Yes	Yes
SLAC	Yes	No	No	No	No
TJNAF	Yes	No	No	Yes	Yes



# SC Energy Intensity Trend for SC non-Excluded Buildings

Goal is 30% Reduction from FY 03 to FY 15



# Goal: 15% of Buildings (not SF) Meet 100% of the Guiding Principles by 2015

Site	# of Bldgs 5000 sf or greater	Goal by lab	Status March 2010	New Buildings that will be completed by end of FY 15 and be LEED Gold	Existing Buildings to be Assessed in FY 10	Buildings that will be upgraded to meet the GP in FY 10
ANL	72	11	2	1		
BNL	122	18	2	2		
LBNL	53	8	1	2		
ORNL	120	18	4	2		
PNNL	1	0				
AMES	8	1				
Fermi	99	15				
PPPL	25	4				
SLAC	55	8		1		
TJNAF	20	3		1		
Other	35	5				
<b>Total</b>	<b>610</b>	<b>91</b>	<b>9</b>	<b>9</b>		



# Example of Planned Investments for a Building to Achieve 100% of the Guiding Principles

Property ID	Property Name	GSF	Sustainability Notes			GP Pts
3020	Office Lab Building	120,000	Offices, Data Center & Lab			81
	<b>Project Type</b>	<b>Project</b>	<b>Funding</b>	<b>Cost</b>	<b>Completion Year</b>	
	HVAC	IDEC Pump Replacement & VFD	ARRA	\$200,000	2010	
	Photovoltaic	PV Array	ARRA	\$150,000	2010	
	Lighting Improvements	Occupancy Sensors	Indirect	\$10,000	2010	
	Building Automation Systems/EMCS	Temperature Sensors	Indirect	\$160,000	2009	
	Appliance/Plug-load reductions	All Building – Isole' Occupancy Power Strips	Indirect	\$10,000	2010	
	Advanced Metering Systems	Chilled Water Meter	Indirect	\$30,000	2010	
	Chiller Plant Improvements	Install weather station to control cooling tower setpoint	Indirect	\$600,000	2010	
	HVAC	CO2 Sensors	Indirect	\$5,000	2011	
	Commissioning/Re-commissioning	CA leak fixes at	Indirect	\$40,000	2014	



# Summary

- The Office of Science is integrating infrastructure management with the SC mission.
- The Mission Readiness Assessment Process ties investments to SC's missions and is fully integrated with Annual Lab Planning.
- The Infrastructure Modernization Initiative will improve condition and mission readiness of the SC labs.
- We are on track to meet the Sustainability Goals and developing plans to address Green House Gas Goals.
- FIMS will continue to be an important tool for tracking implementation & status
- End result: Modern, safe, mission ready and sustainable infrastructure that enables transformational research.



# Question Time



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## For More Information:

Office of Safety, Security and Infrastructure Home Page:  
<http://www.sc.doe.gov/sc-31/>

Infrastructure Modernization Initiative Home Page:  
[http://www.sc.doe.gov/sc-31/inf\\_mod.shtml](http://www.sc.doe.gov/sc-31/inf_mod.shtml)

Mission Readiness Home page:  
[http://www.sc.doe.gov/sc-31/infrastructure/Mission\\_Readiness.html](http://www.sc.doe.gov/sc-31/infrastructure/Mission_Readiness.html)





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CLIMATE RESEARCH FACILITY

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BROOKHAVEN NATIONAL LABORATORY

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THOMAS JEFFERSON NATIONAL ACCELERATOR  
FACILITY

LAWRENCE BERKELEY NATIONAL LABORATORY

OAK RIDGE NATIONAL LABORATORY

PACIFIC NORTHWEST NATIONAL LABORATORY

PRINCETON PLASMA PHYSICS LABORATORY

SLAC NATIONAL ACCELERATOR LABORATORY

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