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Federal Efficiency Goals and Reporting Requirements for Specialty Buildings

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Evolution of Federal Energy Intensity Reduction Goals

- Prior to the Environmental Policy Act of 2005 (EPAct 2005), energy reduction goals varied by facility type, per Executive Order (EO) 13123:

Standard facilities	**30 percent** reduction by FY 2005 **35 percent** reduction by FY 2010 (below FY 1985 baseline)
Industrial/laboratory facilities	**20 percent** reduction by FY 2005 **25 percent** reduction by FY 2010 (below FY 1990 baseline)

- EPAct 2005 amendments combined these sectors into one "goal-subject" category for energy reduction goal
  - Created **single** energy reduction target for all federal facilities, regardless of building type

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Historical Progress Toward Industrial/Laboratory Goal 1990-2005

	FY 1990			FY 2005				FY 2005 (unadjusted)		
	GSF (Thou.)	Billion Btu	BTU/GSF	GSF (Thou.)	Billion Btu	BTU/GSF	%Δ 1990-2005	Billion Btu	BTU/GSF	%Δ 1990-2005
USDA[1]†	13,403.8	2,416.2	180,262	14,533.3	*1,375.0*	*94,612*	-47.5	1,375.9	94,672	-47.5
EPA†	2,090.0	747.0	357,414	3,706.7	*793.5*	*214,065*	-40.1	1,310.3	353,485	-1.1
TVA	404.9	112.2	277,180	404.9	75.2	185,799	-33.0	75.2	185,799	-33.0
GSA†	10,071.3	4,354.0	432,313	20,288.5	*5,893.5*	*290,487*	-32.8	5,959.8	293,751	-32.1
IBB	1,012.5	1,406.9	1,389,496	962.6	910.8	946,187	-31.9	910.8	946,187	-31.9
DOE†	18,852.8	7,507.9	398,237	24,291.2	*7,083.7*	*291,615*	-26.8	7,269.6	299,269	-24.9
DOC†	3,090.6	976.6	315,975	5,717.2	*1,358.9*	*237,678*	-24.8	1,552.0	271,454	-14.1
DOD†	183,779.2	39,209.1	213,349	158,230.2	*26,459.4*	*167,221*	-21.6	27,239.7	172,152	-19.3
HHS[2]†	18,294.7	*7,738.3*	*422,981*	24,567.2	*8,482.0*	*345,258*	-18.4	8,494.6	345,768	-18.3
TRSY†	7,018.5	1,773.8	252,734	9,005.7	*1,865.1*	*207,103*	-18.1	1,891.7	210,054	-16.9
NASA†	12,787.9	4,142.9	323,972	12,159.8	*3,303.9*	*271,710*	-16.1	3,469.3	285,309	-11.9
SSA[3]	611.3	215.5	352,599	611.0	183.5	300,362	-14.8	183.5	300,362	-14.8
TOTAL	271,417.5	70,600.4	260,117	274,478.3	*57,784.6*	*210,525*	-19.1	59,732.3	217,621	-16.3

1USDA Agricultural Research Service laboratory facilities consumption is measured in Air-Quality Adjusted Btu/Square Foot.

2HHS/NIH adjusted its baseline to account for mandated air quality improvements in later years.

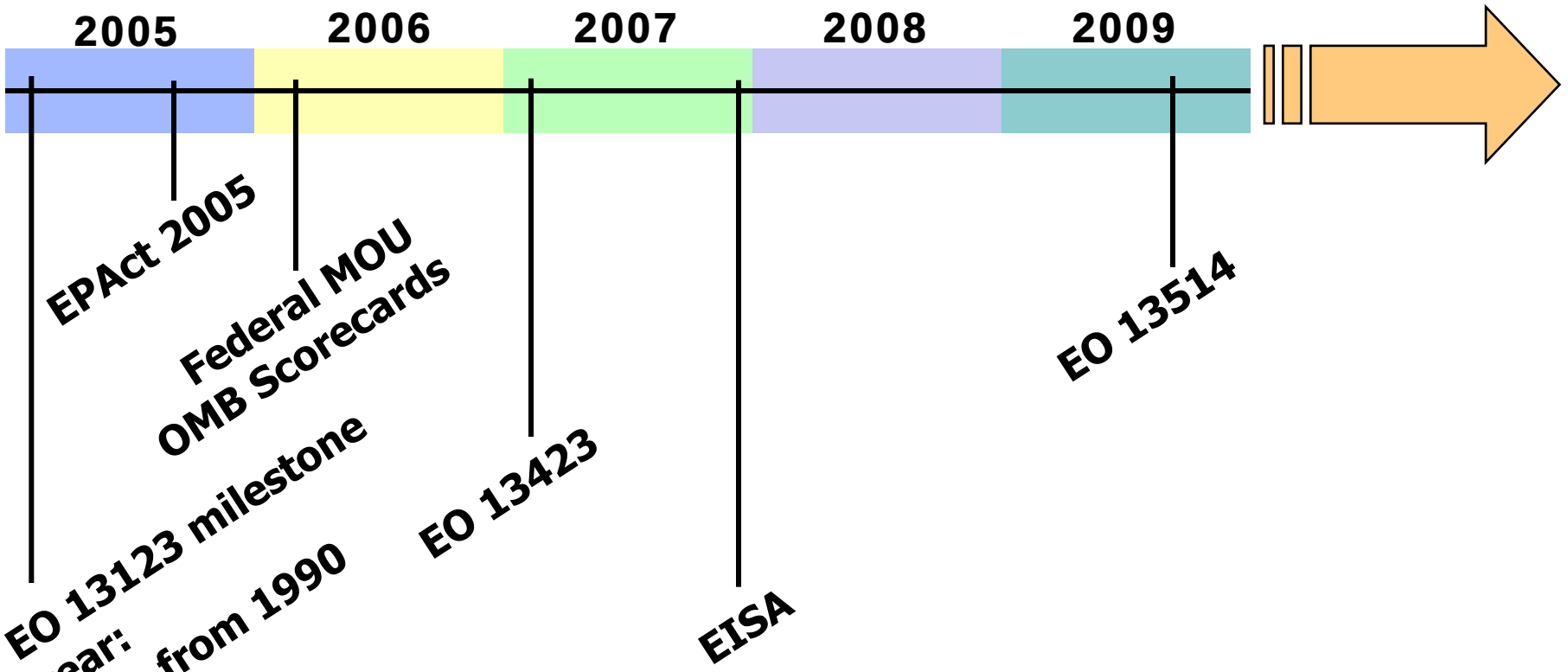
3Indicates estimated baseline

†Indicates that reductions were made to FY 2005 energy use and Btu/GSF (shown in italics) to reflect purchases of renewable energy.

Federal Energy-Related Legislation and Mandates

- EPAct 2005
- Federal Leadership in High Performance and Sustainable Buildings Memorandum of Understanding (MOU) (2006)
  - Guiding Principles
- Office of Management and Budget (OMB) Scorecards
- EO 13423 (2007)
- Energy Independence and Security Act of 2007 (EISA)
- EO 13514 (2009)

Recent Timeline of Legislation and Mandates



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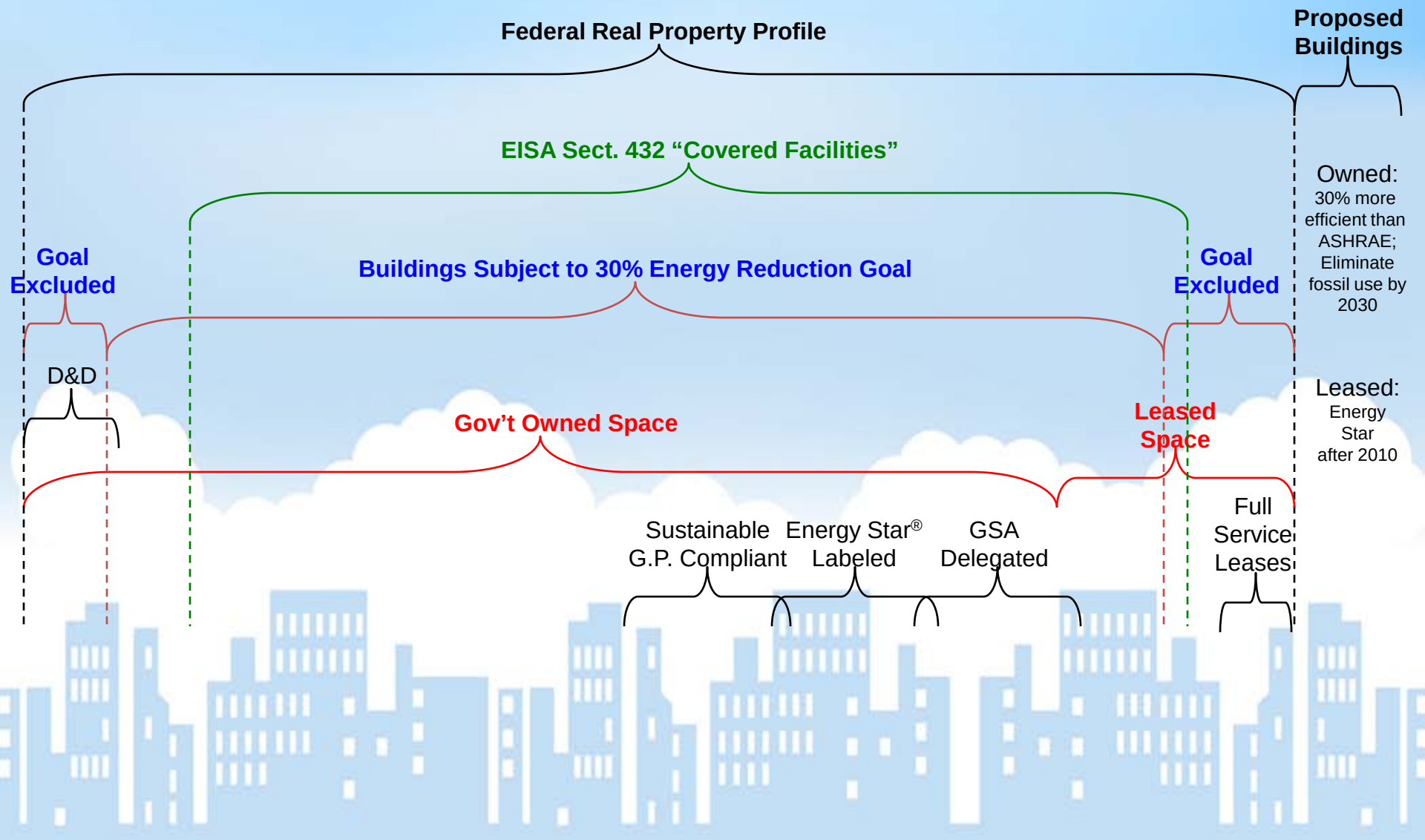
Federal Facility Categories for Energy/Sustainability Requirements



Federal Energy Efficiency Requirements

- **EPAct 2005**
  - **2 percent** annual reduction in energy intensity through FY 2015 compared to FY 2003 baseline
- **EO 13423**
  - **3 percent** annual reduction in energy intensity through FY 2015 compared to FY 2003 baseline
- **EISA**
  - Adopted EO 13423 requirements

Energy Intensity Goal Exclusions

Which federal buildings are subject to the goals and what are the criteria for excluding them?

Type of Building/Structure	Criteria for Goal Exclusion	Reporting Requirement
Non-federal building where tenant agency receives no energy bills (no expectation to report), e.g. co-located facilities or fully serviced leases.	None required	None
Structures and processes not qualified as federal buildings (assumed excluded)	None required	• Identity of structure/process • Energy consumption and costs • Square footage (if applicable)
Federal buildings excluded from energy performance requirements	1. Impracticability due to energy intensiveness or national security function 2. Completed energy management reports 3. Compliance with all energy efficiency requirements 4. Implementation of all cost-effective energy projects in the building	• Identity of building • Energy consumption and costs • Square footage

Structures/Processes Assumed to be Excluded

- Outside parking garage, airport, and street lighting not directly associated with a building
- "Cold iron energy" consumed by federal ships
- Buildings where energy usage is skewed significantly
  - Buildings entering or leaving the inventory during the year, down-scaled operationally to prepare for disposal, or undergoing major renovation and/or major asbestos removal
- Certain types of leased space where:
  - The government may pay for some energy but not all;
  - The space comprises only part of a building; or
  - The expiration date of the lease limits the ability to undertake energy conservation measures
- ***Separately-metered*** energy-intensive loads that are driven by mission and operational requirements
  - Training simulators
  - Health-care equipment
  - Facilities that generate and/or transmit electricity or steam
  - Waterway shipping locks
  - Transmitters and other types of electronic installations

Criteria for Excluding Federal Buildings

For each federal building (or collection of buildings) to be excluded, the agency must demonstrate four critical findings:

1. Energy requirements are impracticable based on:
   - The energy intensiveness of activities carried out in the federal building or collection of federal buildings; or
   - The fact that the federal building or collection of federal buildings is used in the performance of a national security function
2. All federally required energy management reports have been completed and submitted
3. Agency has achieved compliance with all energy efficiency requirements
4. Implementation of all practicable, life cycle cost-effective projects at the excluded building(s)

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Some Advice Regarding Exclusion of Specialty Buildings

- Take a portfolio approach to meeting this **Agencywide** energy intensity reduction goal
  - Usually not appropriate to hold specialty buildings to the same performance in the face of varying mission tempo
  - Separately meter and exclude only the process if impact is overwhelming
- Don't exclude facilities that may offer the greatest energy-saving opportunities
  - Central plants to cogeneration
  - Process load energy conservation measures (ECMs)

Requirements for GHG Emissions Quantification and Reduction

- **EO 13514**
  - Set first federal requirements for GHG emissions management and reporting
  - Reduction target for Scope 1 and 2 emissions was due in January 2010 – 28% Federal wide target.
  - Reduction target for Scope 3 GHG emissions was due in June 2010 – 13% Federal wide target.
  - Scope 1, Scope 2, and specified Scope 3 GHG emissions inventory for FY 2008 and FY 2010 due in January 2011.

Renewable Energy Requirements

- **EPAct 2005**
  - Requires at least **7.5 percent** of annual electricity consumption to come from renewable sources by FY 2013
- **EO 13423**
  - Requires at least **half** of the statutorily required renewable energy to come from "new" sources (i.e., brought into service after January 1, 1999)
- **EISA**
  - Requires **30 percent** of the hot water demand in new federal buildings/major renovations to be met with solar hot water equipment, if life cycle cost-effective

Water Efficiency and Quality Requirements

- **EO 13423**
  - Two percent annual water intensity reduction annually through **FY 2015** compared to an FY 2007 baseline
- **EISA**
  - All development and redevelopment projects disturbing more than 5,000 square feet must use site planning, design, construction, and maintenance strategies to maintain and restore the predevelopment hydrology (i.e., control stormwater runoff)
- **EO 13514**
  - Extends existing water efficiency goals an additional five years for a cumulative 26 percent water intensity reduction by FY 2020
  - New requirement to reduce landscaping and industrial water use 20 percent by FY 2020, using FY 2010 baseline

Overall Facility Goal Progress

Federal facility performance under EPAct 2005 and EO 13514, FY 2009

Goal/Requirement	FY 2009 Federal Performance (Preliminary)
EO 13514/13423/EISA: Reduce energy intensity (Btu/SF) by 3 percent annually compared to FY 2003 to 30 percent reduction required in FY 2015.	18 of 23 covered agencies exceeded the goal. *Note: Broadcasting Board of Governors excludes its energy requirements. The government decreased energy use per square foot by 13.1 percent in FY 2009 relative to FY 2003. (9.4 percent without additional credits)
EPAct 2005/EO 13423: Use renewable electric energy equivalent to at least 3 percent of total electricity use, at least half of which must come from sources developed after January 1, 1999.	19 of 24 agencies met the goal. The government purchased or produced renewable energy in FY 2009 equivalent to 4.2 percent of electricity use.
E.O. 13514: Reduce water consumption intensity (gallon/SF) relative to FY 2007 baseline by 2 percent annually to 20 percent by the end of FY 2020.	16 of 24 agencies met the goal. The government reduced water use per square foot by 4.6 percent in FY 2009 compare to FY 2007.

Energy and Water Audit Requirements

- **EOs 13123/13423**
  - Required(s) annual energy and water audits of **at least 10 percent** of facility square footage
- **EISA**
  - Agencies must designate “covered facilities” comprising at least 75 percent of Agencywide energy use
  - Each covered facility must have a designated energy manager responsible for:
    - Completing comprehensive energy and water evaluation audits for **at least 25 percent** of all “covered” facilities each year
    - Implementing identified ECMs
    - Following up on implemented ECMs
  - Agencies must conduct comprehensive energy and water evaluations at covered facilities every four years, including
    - Energy assessments
    - Water assessments
    - Recommissioning

Advanced Metering Requirements

- **EPAct 2005**
  - Requires metering of individual buildings; advanced meters for **electricity** at all federal facilities, where cost-effective, by **October 1, 2012**
- **EISA**
  - Builds upon EPAct 2005 by requiring advanced meters for **natural gas and purchased steam** at all federal facilities, where cost-effective, by **October 1, 2016**

High Performance Building Requirements

- **EPAct 2005**
  - Requires newly constructed federal buildings be designed to use at least **30 percent** less energy than specified in the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) standard 90.1-2004, where life-cycle cost-effective
- **Federal High Performance Sustainable Buildings MOU**
  - Requires federal buildings be designed to earn the ENERGY STAR® label for new construction and major renovations.
  - **New construction**: reduce energy use **30 percent** below ASHRAE 90.1-2007
  - **Major renovations**: reduce energy use **20 percent** below pre-renovation 2003 baseline

High Performance Building Requirements (cont'd)

- For commercial and institutional buildings, ENERGY STAR offers ratings and recognition for the 11 most common space types. ENERGY STAR:
  - Offers five ratings and recognition for industrial plants
  - Offers rating but not recognition for municipal water treatment plants
  - Is working on a number of new ratings
- Non-standard buildings are difficult for ENERGY STAR to develop ratings for
- For existing specialty buildings, building owners can use ENERGY STAR's Portfolio Manger tool track and benchmark a sites performance against itself, over time

High Performance Building Requirements (cont'd)

- EO 13423
  - New construction/renovation/extension of leases
    - Requires all federal agencies to address each of the MOU's Guiding Principles:
      - Employing integrated design
      - Optimizing energy performance
      - Protecting and conserving water
      - Enhancing indoor environmental quality
      - Reducing the environmental impact of materials
  - Existing buildings
    - Requires federal agencies to incorporate the *Guiding Principles for Sustainable Existing Buildings* in at least **15 percent** of an agency's full building inventory by FY 2015

High Performance Building Requirements (cont'd)

- **EISA**
  - Established a Federal High-Performance Green Buildings Office and Advisory Committee at the U.S. General Services Administration (GSA), headed by the Federal Director
  - Established a Commercial High-Performance Green Buildings Office at the U.S. Department of Energy (DOE), headed by the Commercial Director
  - Requires federal agencies to lease space that has earned the ENERGY STAR label in the most recent year
  - Requires federal buildings overseen by GSA be equipped with ENERGY STAR qualified lighting fixtures and bulbs or those designated by DOE's Federal Energy Management Program (FEMP)

High Performance Building Requirements (cont'd)

- **EO 13514**
  - Requires new construction and major renovations to meet the Guiding Principles
  - **15 percent** of an agency's existing buildings and leases must meet the *Guiding Principles for Sustainable Existing Buildings* by FY 2015
  - Agencies must make **continued progress** to ensure that all buildings will meet the Guiding Principles
  - Requires reduction in energy, water, and material use through cost-effective strategies and quality operations and maintenance (O&M) procedures

Zero-Net-Energy/Carbon Neutrality Requirements

- **EISA**
  - Established a zero-net-energy commercial buildings initiative
    - National goal to achieve zero-net-energy use for commercial buildings built after 2025
    - Retrofit all pre-2025 buildings to achieve zero-net-energy use by 2050
  - Requires federal energy-related carbon neutrality
    - For all new federal buildings and major renovations, fossil fuel-generated energy consumption must be **eliminated by 2030**
- **EO 13514**
  - Federal buildings must be designed to achieve **zero-net-energy by FY 2030**, starting in FY 2020

EISA Section 432 - Assessments

- At approximately 25 percent of its covered facilities each year, each agency must conduct a comprehensive assessment consisting of:
  - Energy audit
  - Water audit
  - Recommissioning assessment
- Findings from these assessments must be entered into DOE's Web-based tracking system
- Measurement and verification is required on all projects entered into the tracking system

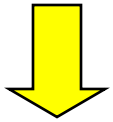
EISA Section 432 - Benchmarking

- EISA Section 432 requires DOE to select a benchmarking system for federal covered facilities – guidance is now final and on the FEMP website at: http://www1.eere.energy.gov/femp/regulations/guidance.html. DOE chose ENERGY STAR Portfolio Manager for benchmarking energy use for most Federal buildings
- ENERGY STAR has a Data Center rating tool.
- ENERGY STAR is working to incorporate ratings for laboratories once adequate data has been collected within the Labs21 benchmarking tool

Federal Energy Reporting Process

Annually

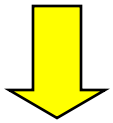
- Agencies submit *Annual Report on Energy Management* to DOE/OMB



- DOE compiles *Annual Report to Congress on Federal Government Energy Management*

Biannually

- Agencies submit summary of progress on OMB scorecard milestones



- OMB formally evaluates agencies' performance in achieving milestones in a scorecard, which is available for public review

Energy Reduction Strategies for Specialty Buildings

- Laboratories
- Data Centers
- Central Plants

Laboratories

- A typical lab can use up to **three to six times** as much energy and water per square foot as a typical office building

- The potential energy reduction at federal laboratories can be as high as **60 percent**

ENTIFY POTENTIAL ENERGY EFFICIENCY OPPORTUNITIES IN YOUR LABORATORY

LABORATORY ENERGY EFFICIENCY PROFILER (LEEP)

helps users to quickly identify and prioritize potential energy efficiency actions in laboratory facilities. It does not require users to have any specialized knowledge of energy audits or analysis. The tool inputs are the key characteristics of the facility's ventilation, heating, cooling and lighting systems as well as plug and process equipment. Based on these inputs, the tool provides information on the relevance, impact, and comparative cost of over 60 actions to reduce energy use. These results can then be used to help establish the scope and priorities for more detailed energy audits.

Username

Password

Login

Request A User Account

ields. Leave blank or select 'Don't Know' if unknown.

ntilation system type	Variable Air Volume (VAV)
ystem	
building supply airflow (CFM)	25,000
lab-only supply airflow (CFM)	3,500
ab-only supply airflow (CFM)	1,000
al system pressure (TSP) drop (inches w.g.)	3.2
e age of your oldest supply fan motor?(years)	12
of fan motors nearing replacement (rating)	Standard
times each year are fan motor belts changed? (Enter zero for direct drive fans)	3
emporary pre-filter remaining in the main AHU?	Yes
type	Bag/Cartridge
pressure drop (inches w.g.)	3.2
lters inspected within the last six months?	Yes

Print Actions Report

High	Big	High $$$	⊗ Not applicable	
Likely	Medium	Medium $$	? Provide more information	
Efficient	Small	Low $		
		Variable $-$$$		

Actions	Relevance	Impact	Cost	More Information
lation				
e (reduce) lab exhaust on rate to minimum.	○	⊗	⊗	
e (reduce) exhaust on rate to minimum during pied periods	●	●	$	**Notes**: Uses occupancy of less than 160 hours **Caution**: Ability to setback ventilation limited by AHJ + Ensure all stakeholders are included in setback scheme *More...*
e (reduce) supply on rate.	○	⊗	⊗	
e (reduce) number or size s i.e. decomission some	○	⊗	⊗	
irect digital control (DDC)	●	●	$-$$$	**Notes**: DDC systems have considerable energy-efficiency advantages over conventional pneumatic systems. Substantial advantages are realized in

Energy Reduction Strategies: Laboratories

- Know your benchmarks and benchmarking tools!
- Scrutinize air changes
  - Optimize ventilation rates
- Tame exhaust hoods
  - Compare available devices
- Get real with loads
  - Right-size heating, ventilation, and air conditioning (HVAC) equipment

Energy Reduction Strategies: Laboratories (cont'd)

- Just say no…to re-heat
  - Eliminate simultaneous heating and cooling
- Drop the pressure
  - Implement low static pressure design methods
- Know your flow
  - Understand water reduction strategies
- Heat recovery
- Hazardous waste programs

Laboratories: Helpful Resources

- EPA/DOE - Laboratories for the 21st Century Program (Labs21)

  www.labs21century.gov

- Energy Efficiency and Renewable Energy (EERE) Program at Oak Ridge National Laboratory

  www.ornl.gov/sci/eere/


LABS FOR THE 21ST CENTURY®
Labs21 2010 Annual Conference
www.i2sl.org/labs21/conference
September 28–30, 2010
Albuquerque Convention Center
Albuquerque, New Mexico
Exhibitor registration is now open!

Case Study: Laboratory

National Renewable Energy Laboratory

U.S. Department of Energy

Golden, Colorado

Case Study: Laboratory

- First federal building to achieve LEED® Platinum
- 100 percent day-lighted
- Energy-efficient mechanical systems
- Design reduces energy use up to 41 percent compared to similar facilities
- Low-flow chemical fume hoods and laminar flow hoods
- Saving water with stormwater collection, xeriscaping, and high-efficiency fixtures

Source: www.cres-energy.org/reba_2008_inst.html

Data Centers

- Data centers make up **1.5 percent** of U.S. energy use
- Data center power demand is increasing **12 percent** annually

Source: DOE's EERE Save Energy Now

Data Center Goals

- Consolidate data centers to achieve cost savings, reduced energy consumption, optimal space utilization, and improvements in information technology asset utilization
- Define and monitor standard operational metrics across Agencies, achieve efficiency gains and realize operational cost savings by improving:
  - Server (CPU) utilization (%)
  - Rack space utilization (%)
  - Rack floor utilization (%)
  - Power usage / SF
  - Power usage efficiency

Data Center Requirements

- **Preliminary inventory assessment** must be submitted by April 30, 2010, in line with the OMB passback considerations for FY 2011
- ***Notional data center consolidation plan*** must be submitted by June 30, 2010
- Final ***asset inventory baseline*** must be submitted by agencies by September 30, 2010
- ***Final data center consolidation plan*** must be submitted by September 30, 2010, and approved by OMB no later than December 31, 2010

Data Center Power Usage Effectiveness (PUE)

- PUE is used to determine a data center's energy efficiency
  - Created by the Green Grid, an industry group focused on data center energy efficiency
  - Calculated by dividing the amount of power entering a data center by the power used to run the computer infrastructure within it
  - Expressed as a ratio, with overall efficiency improving as the quotient decreases toward 1

Data Center PUE (cont'd)

- PUE can range from 1.0 to infinity. PUE approaching 1.0 would indicate 100% efficiency (i.e., all power used by IT equipment only)
- A 2007 EPA report assumes 2.0 PUE is average
  - Under "Improved Operations" scenario, PUE drops to 1.7 by 2011
  - Under "Best Practice" scenario, PUE drops to 1.5 by 2011
  - Under "State of the Art" scenario, PUE drops to 1.4 by 2011
- Study of 22 data centers by Lawrence Berkley National Laboratories showed PUE values between 1.3 to 3.0
- Google has PUE of 1.2

Data Center Programs

- LEED Data Centers Adaptation
  - New rating standard specifically for data centers
  - Tools for UPS/electrical system efficiency
  - Integrated IT and facilities energy reduction process
  - New water reduction credit
  - To be released in late 2010
- ENERGY STAR for Data Centers
  - Portfolio manager specifically for data centers
  - New measurement and reporting methodology
  - Uses PUE as metric
  - Released in June 2010
- DOE Data Center Certified Energy Practitioner Program
- DOE Notice of Proposed Rulemaking for Energy Efficiency and Sustainable Design Standards for New Federal Buildings
  - Published in May 2010

Energy Reduction Strategies: Data Centers

- Know your benchmarks and benchmarking tools!
- Computing options
  - Load management and server innovation
- HVAC systems
  - Managing air flow
  - Liquid cooling
  - Varying environmental conditions
- Power
  - High voltage
  - DC power
  - UPS systems

Data Centers: Helpful Resources

- DOE – Save Energy Now Data Center Program

  www1.eere.energy.gov/industry/saveenergynow/partnering_data_centers.html

Case Study: Data Center

Research Triangle Park–National Computer Center

U.S. Environmental Protection Agency

Research Triangle Park, North Carolina

Case Study: Data Center

- Achieved LEED Silver certification in 2005
- FEMP High Performance Federal Building
- Solar roof offsets 5 percent of NCC's total energy use
- Advanced metering system
- High-efficiency toilets and faucets
- Efficient heating and cooling strategies: sensors, economizers, passive solar heating
- Total construction costs comparable to conventional data centers

Source: www.femp.buildinggreen.com/overview.cfm?projectid=344

Central Plants

- Combined heat and power (CHP) systems are potentially **70 to 85 percent** efficient
- CHP generates **7 percent** of total U.S. electrical power
- Approximately **13 percent** of all federal electric use is produced by CHP systems

Source: DOE DER/CHP Program

Energy Reduction Strategies: Central Plants

- Interconnectivity issues
- Power generation de-centralization
- Clean renewable power vs. fossil fuels
- Waste heat for heating and cooling
- Primary pumping vs. 3-2-1 systems

Energy Reduction Strategies: Central Plants (cont'd)

- Backpressure and other turbine power generation
- Demand limiting and peak-shaving
- Water reclamation and use; chemical treatment
- Real-time power
- Re-commissioning central plants (part-load issues)

Central Plants: Helpful Resources

- Combined Heat and Power Partnership

  www.epa.gov/chp/

  DOE DER/CHP Program

  www1.eere.energy.gov/femp/der/index.html

Other Specialty Buildings

- Hospitals
- Clean rooms
- Industrial plants

Contact and Links

- Contact:
  - Dan Amon
    U.S. Environmental Protection Agency
    202-586-7632
    amon.dan@epa.gov
- Exclusion Criteria:
  http://www1.eere.energy.gov/femp/pdfs/exclusion_criteria.pdf
- EISA Section 432 Covered Facilities Criteria/Evaluation Guidelines
  http://www1.eere.energy.gov/femp/pdfs/eisa_s432_guidelines.pdf
- 10 CFR 433 Performance Standards for New Federal Buildings:
  http://ecfr.gpoaccess.gov/cgi/t/text/text-idx?c=ecfr&tpl=/ecfrbrowse/Title10/10cfr433_main_02.tpl