

# Charting a Course to Energy Independence

Providence, RI  
August 9-12, 2009





# Overview: Energy Savings Opportunities in Federal Specialty Buildings

- Federal energy and square footage profile
- Energy reduction strategies for specialty buildings
  - ☐ Laboratories
  - ☐ Data Centers
  - ☐ Hospitals
  - ☐ Clean Rooms
  - ☐ Industrial Plants
  - ☐ Central Plants
- Case studies



# Federal Energy and Square Footage Profile



# Federal Real Estate Portfolio

- **446,000** federal buildings
- **3.35 billion** total square feet
- Total replacement value = **\$772.8 billion**



Source: The Federal Real Property Council's FY 2007 Federal Real Property Report:  
An Overview of the U.S. Federal Government's Real Property Assets. May 2008. [www.gsa.gov/graphics/ogp/FRPP\\_FY07.pdf](http://www.gsa.gov/graphics/ogp/FRPP_FY07.pdf)



# FY 2008 Federal Energy Consumption & Cost

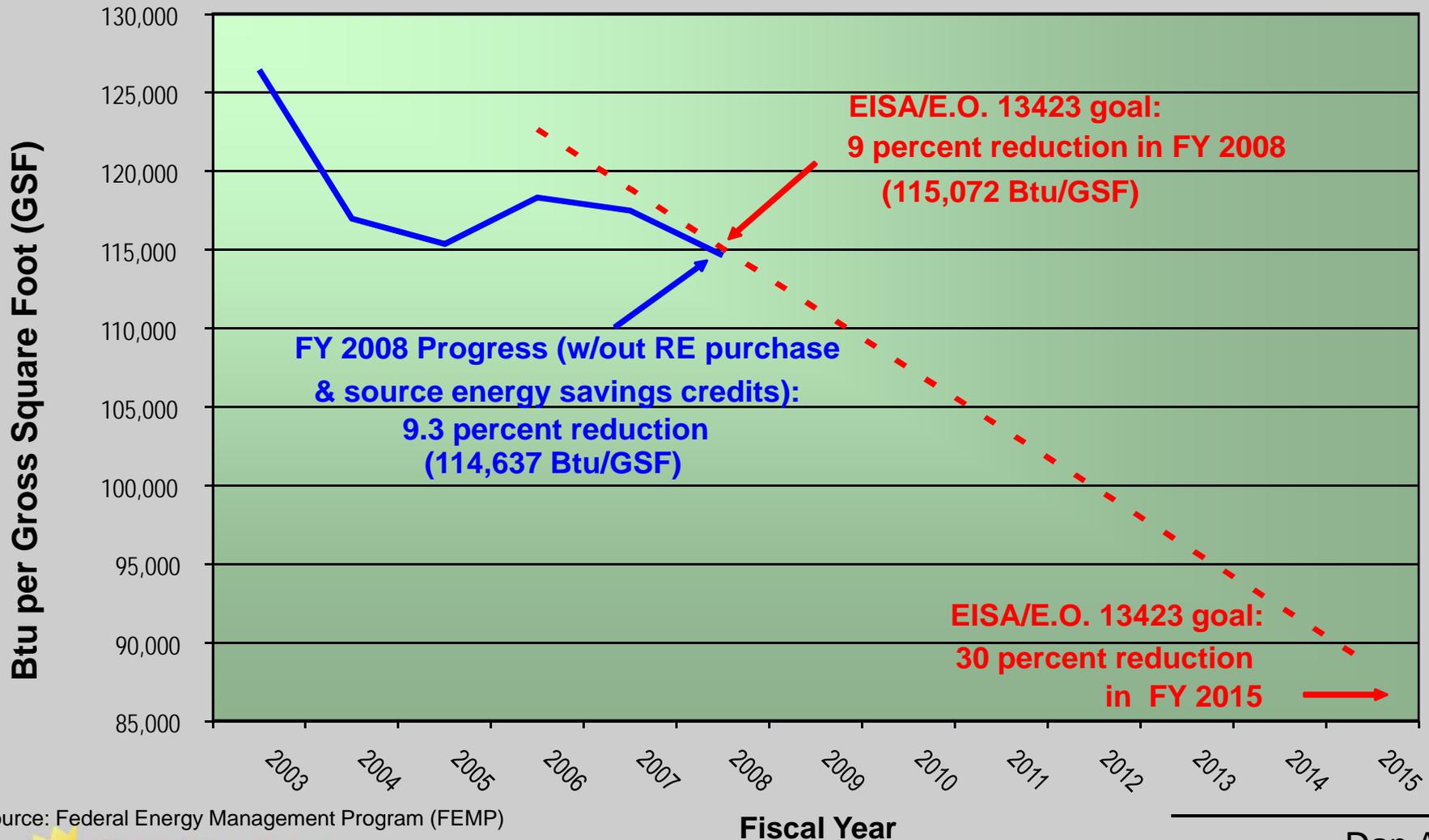
- Total federal energy use = **351,772 billion Btu**
- **1.6 percent** of the nation's total energy use
- Total federal building operating cost = **\$19.3 billion**
- Annual federal energy costs = **\$17.4 billion**



Source: FY 2007 Federal Real Property Report, and FEMP



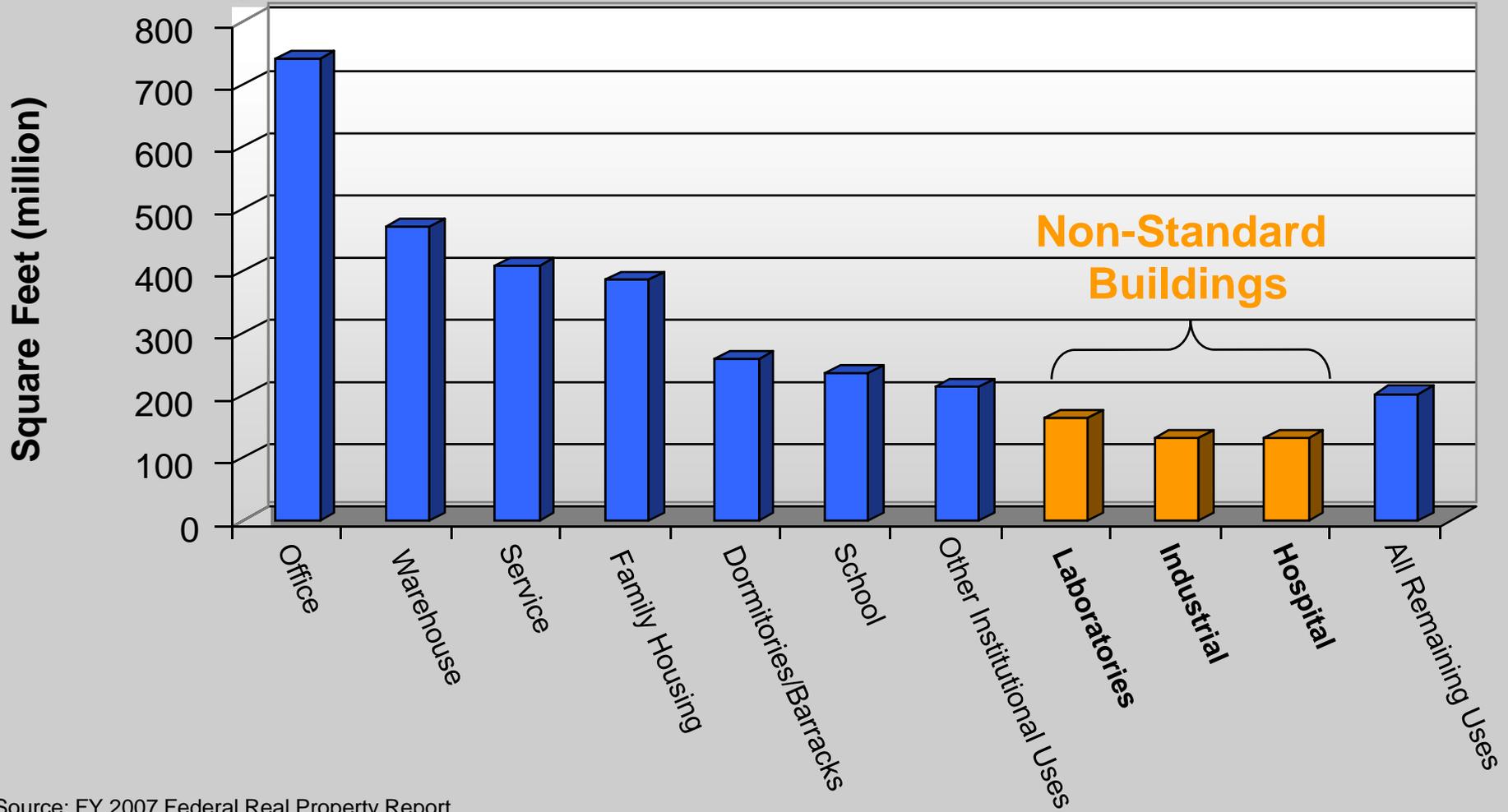
# Preliminary FY 2008 Federal Building Energy Intensity



Source: Federal Energy Management Program (FEMP)



# FY 2007 Federal Square Footage by Building Type



Source: FY 2007 Federal Real Property Report



# FY 2007 Federal Building Use & Square Footage

Predominant Use	FY 2007 Square Feet (million)
Office	740.4
Warehouse	471.0
Service	409.2
Family Housing	386.0
Dormitories/Barracks	259.1
School	237.3
Other Institutional Uses	213.5
<b>Laboratories</b>	<b>163.1</b>
<b>Industrial</b>	<b>132.3</b>
<b>Hospital</b>	<b>131.1</b>
All Remaining Uses	202.8
<b>Total Square Feet</b>	<b>3,345.8</b>

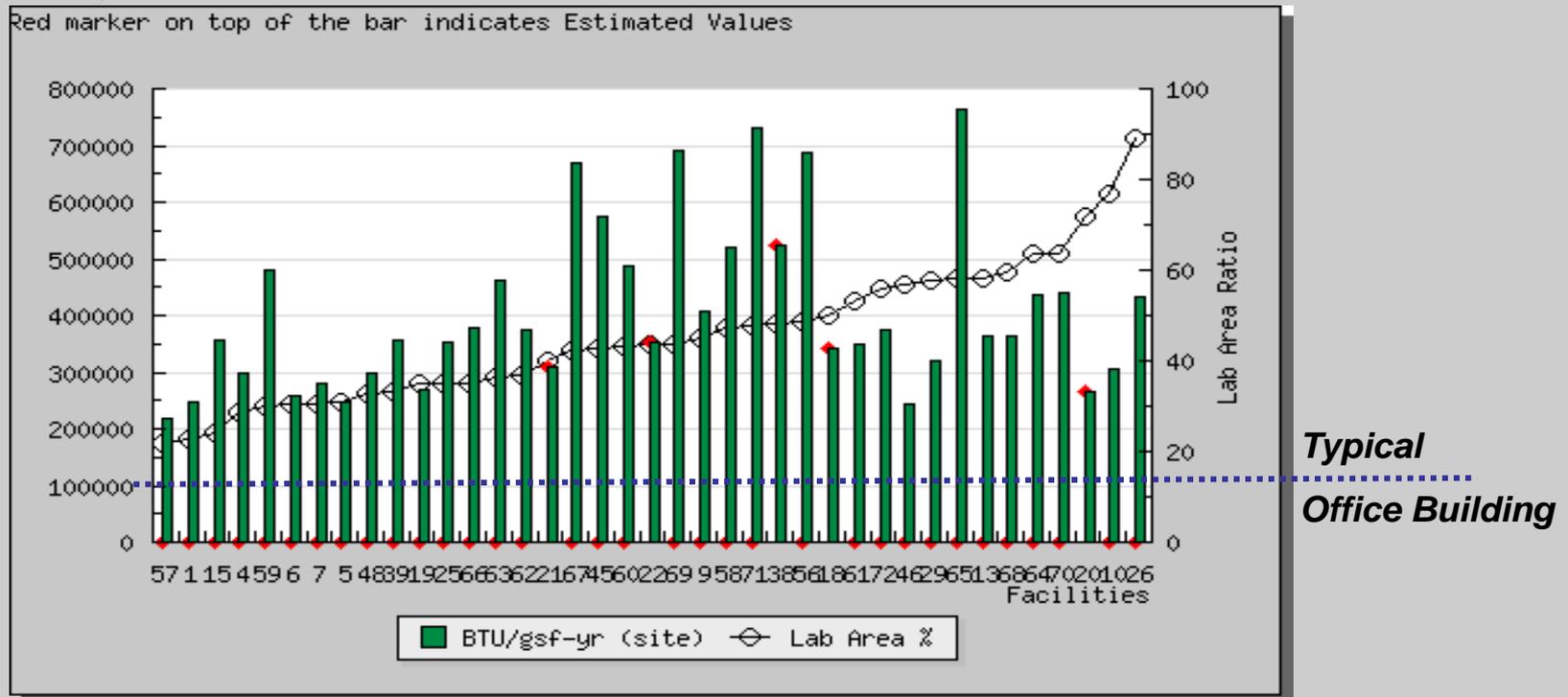
Non-standard buildings make up **12.8 percent** of the total federal square footage.



Source: FY 2007 Federal Real Property Report



# All Buildings Are Not Created Equal

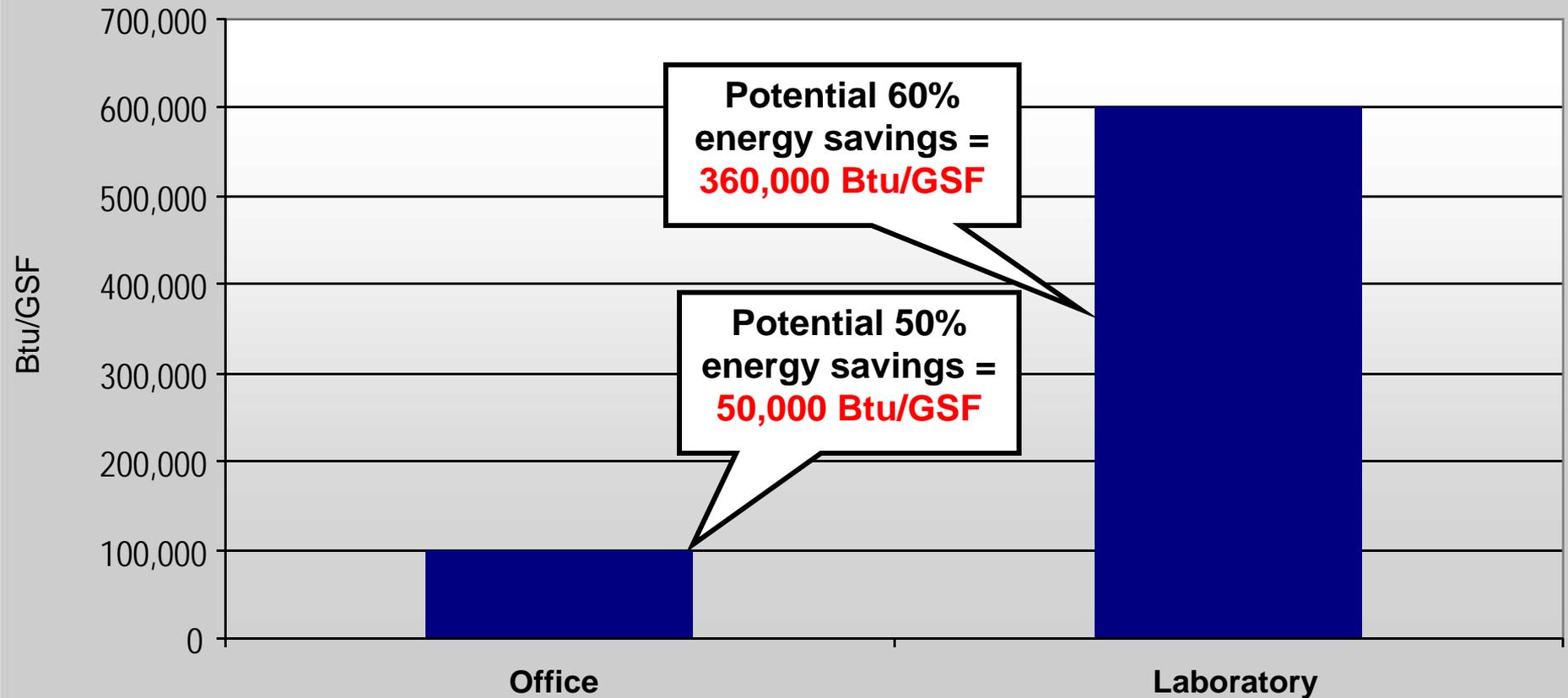


Total annual site energy use intensity (Btu/GSF) for various laboratories in the Labs21 Benchmarking Database

- Based on data in the Laboratories for the 21st Century (Labs21<sup>®</sup>) energy benchmarking tool, laboratories consume **three to eight times** more energy per square foot than typical office buildings.



# Greater Savings Potential in Specialty Buildings





# Energy Reduction Strategies for Specialty Buildings



# Overview

- Laboratories
- Data Centers
- Hospitals
- Clean Rooms
- Industrial Plants
- Central Plants





# Laboratories

- A typical lab can use up to **6 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**





# 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 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 design methods
- Know your flow
  - ☐ Understand water reduction strategies
- Heat recovery
- Hazardous waste programs



# Laboratories: Helpful Resources

- EPA/DOE - Laboratories for the 21<sup>st</sup> Century Program

[www.labs21century.gov](http://www.labs21century.gov)



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

[www.ornl.gov/sci/eere/](http://www.ornl.gov/sci/eere/)

A nighttime photograph of the Indianapolis skyline, featuring several illuminated skyscrapers against a dark blue sky with light clouds. The city lights are reflected in a blue wavy banner at the bottom of the image.

  
LABS FOR THE 21ST CENTURY®

# Labs21 2009 Annual Conference

September 22-24, 2009  
Indianapolis Convention Center  
Indianapolis, Indiana  
Exhibitor registration now open!



# 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



# 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](http://www1.eere.energy.gov/industry/saveenergynow/partnering_data_centers.html)





# Hospitals

- Annual Hospital Energy Use = **836 trillion Btu**
- Spend more than **\$5 billion** on energy each year
- Use more than **2.5 times** as much energy as commercial office buildings



Source: [apps1.eere.energy.gov/buildings/publications/pdfs/energysmarthospitals/esh\\_factsheet.pdf](http://apps1.eere.energy.gov/buildings/publications/pdfs/energysmarthospitals/esh_factsheet.pdf)



# Energy Reduction Strategies: Hospitals

- Again, know your benchmarks!
- High-efficiency lighting
  - ☐ Find the right fit
- Heat recovery
- ENERGY STAR-qualified equipment
- Water-efficient fixtures
  - ☐ Look for WaterSense® label





# Hospitals: Helpful Resources

- DOE – EnergySmart Hospitals

[www1.eere.energy.gov/buildings/energysmarthospitals/](http://www1.eere.energy.gov/buildings/energysmarthospitals/)

- ENERGY STAR for Healthcare

[www.energystar.gov/index.cfm?c=healthcare.bus\\_healthcare](http://www.energystar.gov/index.cfm?c=healthcare.bus_healthcare)





# Clean Rooms

- Clean rooms are **10 to 100 times** more energy intensive than typical office buildings



Source: [www.osti.gov/bridge/servlets/purl/840976-AwDHTs/native/840976.pdf](http://www.osti.gov/bridge/servlets/purl/840976-AwDHTs/native/840976.pdf)



# Energy Reduction Strategies: Clean Rooms

- Know your benchmarks and classification criteria!
- When it comes to air, quantity does not equal quality
- Count your HEPA's
- Maintain positive static pressure ... *barely*



# Clean Rooms: Helpful Resources

- Lawrence Berkeley Lab

[www.lbl.gov](http://www.lbl.gov)



- NASA's Goddard Space Flight Center  
[www.nasa.gov/mission\\_pages/hubble/servicing/series/cleanroom.html](http://www.nasa.gov/mission_pages/hubble/servicing/series/cleanroom.html)





# Industrial Plants

- Industrial plants make up **33 percent** of U.S. energy use
- 1 large plant uses enough energy to power **20,000 homes**
- Large plants = big energy savings opportunities
- Driving force for change: Sustainability





# Energy Reduction Strategies: Industrial Plants

- Using existing and proven technologies, industry can cut energy use and carbon dioxide emissions by **20-30 percent**

Existing Industrial Technology	Payback Period
<ul style="list-style-type: none"><li>• Insulation</li><li>• Steam traps</li><li>• Clean heat transfer surfaces</li></ul>	<b>&lt; 9 months</b>
Correcting boiler issues, such as: <ul style="list-style-type: none"><li>• Blowdown</li><li>• Excess oxygen</li><li>• Flue gas heat recovery</li></ul>	<b>&lt; 2 years</b>
<ul style="list-style-type: none"><li>• Process steam modification</li><li>• Steam turbine modification</li></ul>	<b>&lt; 4 years</b>
<ul style="list-style-type: none"><li>• Combined heat &amp; power</li><li>• Biofuels</li><li>• SuperBiolers</li><li>• Cooling storage</li></ul>	<b>&gt; 4 years</b>



# Industrial Plants: Helpful Resources

- DOE – Industrial Technologies Program

[www.eere.energy.gov/industry/](http://www.eere.energy.gov/industry/)

- ENERGY STAR for Industry

[www.energystar.gov/index.cfm?c=industry.bus\\_industry](http://www.energystar.gov/index.cfm?c=industry.bus_industry)





# 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 & 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/](http://www.epa.gov/chp/)



DOE DER/CHP Program

[www1.eere.energy.gov/femp/der/index.html](http://www1.eere.energy.gov/femp/der/index.html)





# Case Studies



# 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 & laminar flow hoods
- Saving water with storm water collection, xeriscaping, and high-efficiency fixtures



Source: [www.cres-energy.org/reba\\_2008\\_inst.html](http://www.cres-energy.org/reba_2008_inst.html)



# Case Study: Hospital



San Francisco Veterans Affairs Medical Center

U.S. Department of Veterans Affairs

San Francisco, California





# Case Study: Hospital

- Energy upgrades made possible by FEMP's Super Energy Savings Performance Contracts (Super ESPCs)
- Retrofitted boilers with steam production system, increasing efficiency by about 5 percent
- 25,000 high-efficiency light bulbs
- Energy savings equal to powering 400 homes
- Annual energy cost savings of more than \$500,000

Source: [www1.eere.energy.gov/femp/financing/superespcs\\_sanfran\\_va.html](http://www1.eere.energy.gov/femp/financing/superespcs_sanfran_va.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 rating 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](http://www.femp.buildinggreen.com/overview.cfm?projectid=344)



# Questions?

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Slide 12: Greening EPA, [www.epa.gov/greeningepa](http://www.epa.gov/greeningepa)

Slide 16: <http://www.labs21century.gov/>

Slide 17: [http://www1.eere.energy.gov/industry/saveenergynow/pdfs/doe\\_data\\_centers\\_presentation.pdf](http://www1.eere.energy.gov/industry/saveenergynow/pdfs/doe_data_centers_presentation.pdf)

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Slide 21: EPA WaterSense Program

Slide 22: ENERGY STAR Program

Slide 23: Napa Gateway, [cnx.org/content/m14503/latest/Graphic4.jpg](http://cnx.org/content/m14503/latest/Graphic4.jpg)

Slide 25: Lawrence Berkeley Lab, NASA

Slide 26: [www.thyssenkrupp.com/ml/pb/bilder/173/KU\\_01.jpg](http://www.thyssenkrupp.com/ml/pb/bilder/173/KU_01.jpg)

Slide 28: <http://www.earth.columbia.edu/news/2003/story06-25-03b.html>

Slide 29: <http://www.epa.gov/rtp/facilities/virtualtour/energy/cup.htm>

Slide 32: U.S. EPA's CHP Program; U.S. Department of Energy

Slide 34: Bill Timmerman, [BuildingGreen.com](http://BuildingGreen.com)

Slide 35: [http://www.printworksrestaurant.com/images/LEED\\_platinum.jpg](http://www.printworksrestaurant.com/images/LEED_platinum.jpg)

Slide 36: University of California San Francisco Department of Medicine: [medicine.ucsf.edu/campuses/vamc.html](http://medicine.ucsf.edu/campuses/vamc.html)

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