



# High Performance Buildings

Session 7



**GovEnergy**  
[www.govenergy.gov](http://www.govenergy.gov)



**Lance Davis, AIA, LEED**  
**PBS, Office of Applied Science**  
**Sustainable Design Program**

**August 7, 2007**

# High Performance Buildings

**What is a Federal High Performance Building?**

# EO 13423

## Strengthening Federal Environmental, Energy, and Transportation Management

- **Reduce greenhouse emissions 3% annually till 2015**
- **Purchase new renewable energy**
- **Reduce water consumption 2% annually till 2015**
- **Use biobased, EP, energy and water efficient and recycled products**
- **Comply with guiding principles of HPSB MOU for all new, 15% of existing capital asset building inventory by 2015**

# EO 13423

## Strengthening Federal Environmental, Energy, and Transportation Management

- Sec 2
- (a) improve energy efficiency and reduce greenhouse gas emissions of the agency, through reduction of energy intensity by (i) 3 percent annually through the end of fiscal year 2015, or (ii) 30 percent by the end of fiscal year 2015, relative to the baseline of the agency's energy use in fiscal year 2003;

# EO 13423

## Strengthening Federal Environmental, Energy, and Transportation Management

- (c) beginning in FY 2008, reduce water consumption intensity, relative to the baseline of the agency's water consumption in fiscal year 2007, through life-cycle cost-effective measures by 2 percent annually through the end of fiscal year 2015 or 16 percent by the end of fiscal year 2015;

# EO 13423

## Strengthening Federal Environmental, Energy, and Transportation Management

- (d) require in agency acquisitions of goods and services (i) use of sustainable environmental practices, including acquisition of biobased, environmentally preferable, energy-efficient, water-efficient, and recycled-content products, and (ii) use of paper of at least 30 percent post-consumer fiber content;

# EO 13423

## Strengthening Federal Environmental, Energy, and Transportation Management

- (e) ensure that the agency (i) reduces the quantity of toxic and hazardous chemicals and materials acquired, used, or disposed of by the agency, (ii) increases diversion of solid waste as appropriate, and (iii) maintains costeffective waste prevention and recycling programs in its facilities;

# EO 13423

## Strengthening Federal Environmental, Energy, and Transportation Management

- (f) ensure that (i) new construction and major renovation of agency buildings comply with the *Guiding Principles for Federal Leadership in High Performance and Sustainable Buildings* set forth in the *Federal Leadership in High Performance and Sustainable Buildings Memorandum of Understanding (2006)*, and (ii) 15 percent of the existing Federal capital asset building inventory of the agency as of the end of fiscal year 2015 incorporates the sustainable practices in the *Guiding Principles*;

# EO 13423

## Strengthening Federal Environmental, Energy, and Transportation Management

- Sec 3
- (e) ensure that contracts entered into after the date of this order for contractor operation of government-owned facilities or vehicles require the contractor to comply with the provisions of this order with respect to such facilities or vehicles to the same extent as the agency would be required to comply if the agency operated the facilities or vehicles;

# Guiding Principles for High Performance and Sustainable Buildings

- **Energy Efficiency 30% better than ASHRAE 90.1.**
- **Energy Star Benchmarking**
- **Indoor water efficiency of 20%.**
- **Outdoor water efficiency of 50%.**
- **Ventilation and comfort to meet ASHRAE 55 and 62.1.**

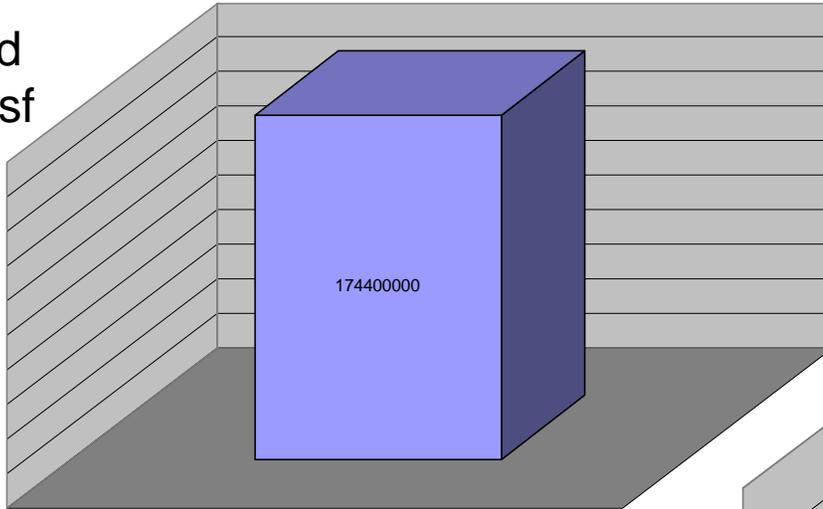
# High Performance and Sustainable Buildings MOU

- Moisture Control strategy.
- Daylight factor of 2% in 75% of occupied space.
- Low emitting materials.
- Construction IAQ, 72 hour flush out.
- Recycled products per EPA or calculation.
- USDA biobased products.
- Salvage 50% construction waste.
- Eliminate ozone depleting compounds.

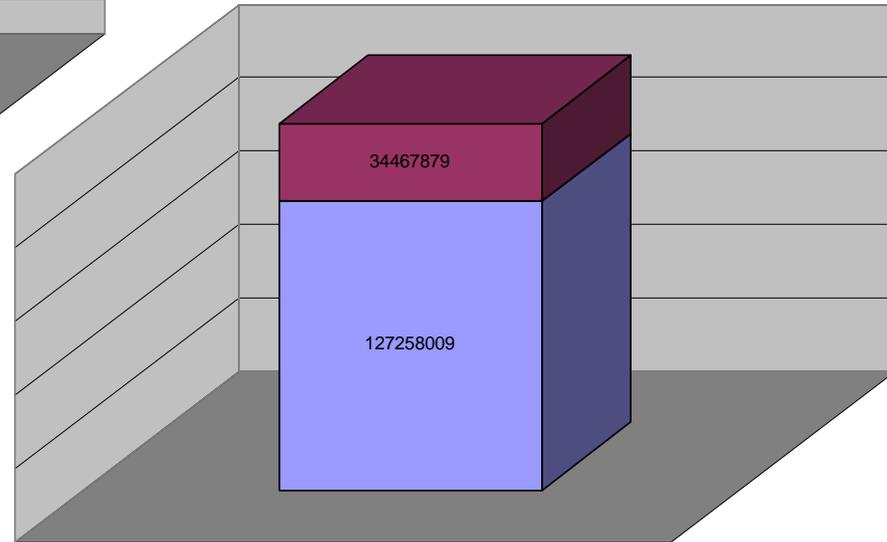
**How are we going to get there?**

2006  
GSA Owned  
174 million sf

GSA Owned 2006

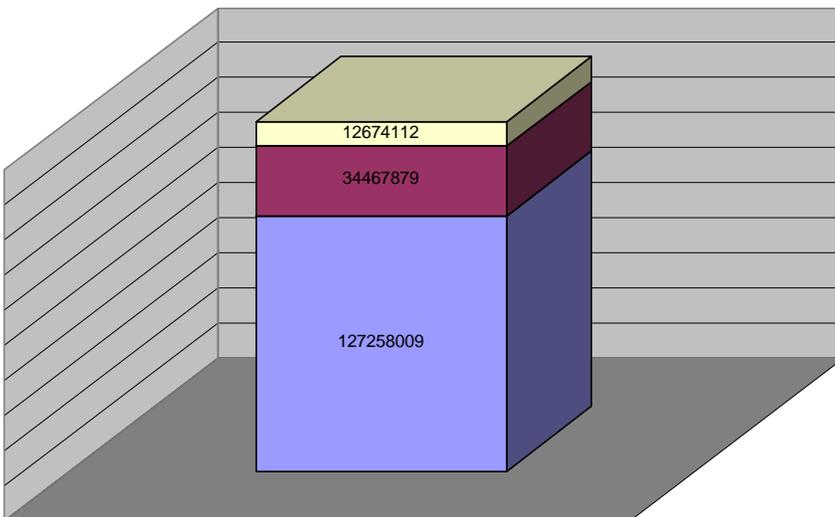


GSA Renovated and Altered



10 years  
renovate  
34 million sf

GSA Inventory, 2016



10 years  
add  
13 million sf

27% of the portfolio  
can be changed to  
meet regulations.

# Sustainable Design, EO, MOU, EPACT 05, LEED

Boiler  
Plate  
Scope -  
Contracts

Boiler  
Plate  
Scope –  
Feasibility  
Studies

Boiler Plate  
Scope –  
Contractors,  
CM,  
Commissioning

P100  
being  
revised

Boiler  
Plate  
Scope -  
Leases

OCA memo for  
A/E Scope

Green Leasing  
–Realty  
Services Letter  
Forthcoming

O&M policies for LEED EB and  
Green Cleaning,

Money

A new model of thinking.

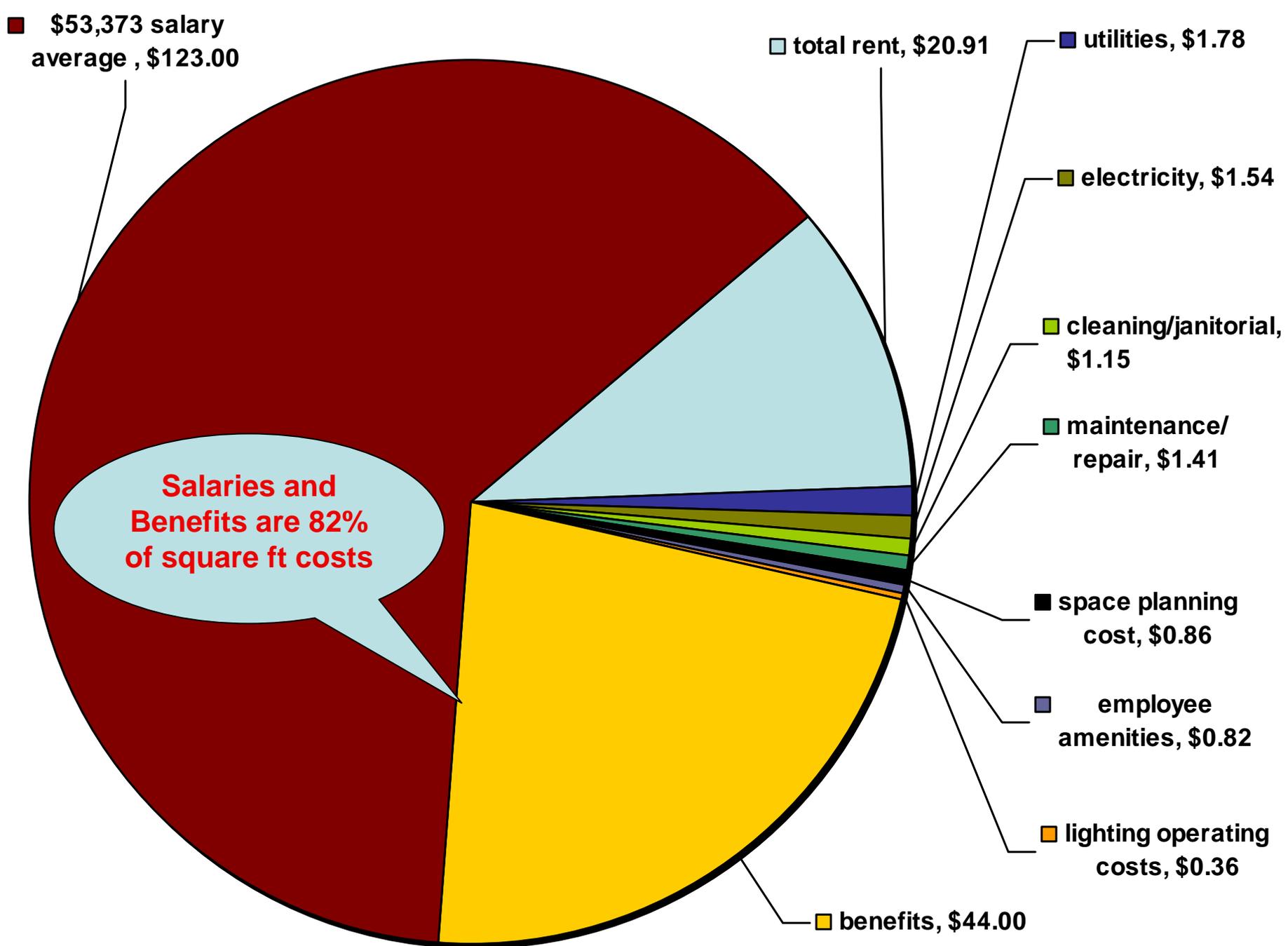
Brain Power

Step 4: Mental  
Intuition

Step 3: Process

Step 2: Tools

Step 1:  
Products/Technology



Annual Office Costs / SF

**Where can we find help?**

# FEMP Sustainable Building Program

## Program Goal

- Lead Federal agencies efforts to institutionalize sustainability into policies, procedures, and practices for new construction and existing buildings

<http://www1.eere.energy.gov/femp/sustainable/>

## Program Strategies

- Partner with other DOE offices, Federal agencies, non-profits, and private industry to leverage limited resources
- Reduce Federal agency duplication of effort; streamline and standardize requirements, processes, and implementation tools
- Influence design and construction community at planning stages, targeting each of the 5 Guiding Principles, and verify that design intentions translate into high performance buildings
- Maximize potential of existing buildings, largely through the O&M/sustainable commissioning

# Interagency Sustainability Working Group (ISWG)

“Being able to connect with others across the federal sector ... improves the quality of our work. The networking has resulted in new projects and new ideas on how to improve the performance of green buildings.”



- **Authority**
  - Working Group under the Interagency Energy Management Task Force since 2001
- ~300 members (50-60 active) from across the Federal government
- Bi-monthly meetings; intranet site
- **Purpose:**
  - Serves as forum for information exchange
  - Advocates for sustainable building practices in new construction and existing buildings
  - Eliminates barriers to sustainable design in the Federal sector by developing policy, technical guidance and other resources

## ISWG Mandate



Tour at USGBC Headquarters  
*Washington, DC*



ISWG Bi-Monthly Meeting  
*March 13, 2007*

# Whole Building Design Guide

- Design Guidance focused on Federal facilities:
  - Building Types
  - Design Objectives: Sustainable, Accessible, Aesthetics, Cost-Effective, Functional, Historic, Productive, Safe/Secure
  - Products and Systems
- Interagency cooperation managed by NIBS
- August 2006: about 27,000 hits and 33,500 downloads *per day*



**WBDG**  
WHOLE BUILDING DESIGN GUIDE

**Design Guidance**  
Building Types  
Space Types  
Design Disciplines  
Design Objectives  
Products & Systems

**Project Management**  
Delivery Teams  
Planning & Development  
Building Commissioning  
Delivery & Controls

**Operations & Maintenance**

**Mandates / References**  
Federal Mandates  
Publications  
Case Studies  
Participating Agencies  
Industry Organizations  
Related Links

**Tools**

**WBDG Services**  
CONSTRUCTION CRITERIA ASE  
productguide

Visit WBDG Partners:  
**GreenerBuildings**  
TISP The Source for Critical Facilities Insight™  
**SUSTAINABLE BUILDINGS INDUSTRY COUNCIL**

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The Whole Building Design Guide  
The Gateway to Up-To-Date  
Whole Building Design Tools

**THE WHOLE BUILDING DESIGN APPROACH**  
The goal of 'Whole Building' Design is to create a successful high-performance building. To achieve that goal, we must apply the integrated design approach and the integrated team approach to the project during the planning and programming phases. [Read more](#)

**National BIM Standard™ Version 1.0—Part 1: Out for Industry Review**  
The first version of the National Building Information Modeling Standard™ (NBIMS) was released for a two month industry review period today. The document titled "National Building Information Modeling Standard Version 1.0—Part 1: Overview, Principles, and Methodologies" provides the capital facilities industry with its first comprehensive look at the full scope of requirements for Building Information Modeling (BIM). [Read more](#)

**FEMA Releases New Natural Hazards Protection Criteria**  
FEMA recently released two new criteria documents on natural hazard mitigation: [FEMA 454 Designing for Earthquakes: A Manual for Architects](#) and [FEMA 543 Design Guide for Improving Critical Facility Safety from Flooding and High Winds: Providing Protection to People and Buildings](#). These documents and more are referenced in the WBDG page [Resist Natural Hazards](#).

**6th Annual TISP Congress**  
The TISP Congress, being held March 28-29, is an annual event that brings together leaders in the public and private sectors taking a proactive approach to improving the resilience of our nation's critical infrastructure and key assets. Now in its 6th year, the TISP Congress is affecting positive change through information sharing and collaboration. [Read more](#)

**New Suite of Stormwater Management Guide Specifications Available for Comment**

[www.wbdg.org](http://www.wbdg.org)

# DOE Sustainable Building Databases

## FEMP's High Performance Federal Buildings Database: 36 Federal Case Studies

## BT's High Performance Buildings Database: 94 Total Case Studies

The screenshot shows the homepage of the FEMP High Performance Federal Buildings Database. At the top, it features the U.S. Department of Energy logo and the text "Energy Efficiency and Renewable Energy" with the tagline "Bringing you a prosperous future where energy is clean, abundant, reliable, and affordable." Below this is the "Federal Energy Management Program" header with a navigation menu including "About the Program", "Program Areas", "Information", "Resources", "Financing Mechanisms", "Technologies", "Services", and "Home". The main heading is "High Performance Federal Buildings". On the left, there is a sidebar titled "Using the Database" with search options: "Search by Project Name", "Search by Owner", "Search by Location", "Search by Building Type & Size", and "List All Projects". The main content area includes a paragraph about the database's purpose and a small image of a building. At the bottom, there is a section for "Related Topics" with links to "Buildings Database", "Performance Metrics", "Residential Building Information", "Green Building Challenge", and "Laboratory Implementation".

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

The screenshot shows the homepage of the BT's High Performance Buildings Database. It features the U.S. Department of Energy logo and the text "Office of Energy Efficiency and Renewable Energy" with the tagline "Bringing you a prosperous future where energy is clean, abundant, reliable, and affordable." Below this is a navigation menu including "Search Web", "Search Site", "News", "PageRank", "Page Info", "Us", and "Help". The main heading is "High Performance Buildings". On the left, there is a sidebar titled "High Performance Buildings" with a sub-heading "An Initiative of the U.S. Department of Energy Building Technologies Program" and a "Related Topics" section with links to "Buildings Database", "Performance Metrics", "Residential Building Information", "Green Building Challenge", and "Laboratory Implementation". The main content area includes a paragraph about DOE's support for commercial buildings and a small image of a building. At the bottom, there is a section for "Feature Project" with a link to "News & Events".

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

# WHAT IS GREEN BUILDING

## AND OPERATIONS?



Operating and maintenance practices that improve building performance by meeting specified standards to reduce the negative impact of buildings on occupants and on the environment.



**LEED**

Build green. Everyone profits.

WHO ARE WE?

A coalition of the country's  
foremost leaders from across  
the building industry

We promote buildings that are:

1. Environmentally Responsible
2. Economically Profitable
3. Healthy Places to Live and Work

USGBC



# WHAT IS THE LEED SYSTEM?

## LEADERSHIP in ENERGY and ENVIRONMENTAL DESIGN

A leading-edge system for certifying the greenest performing buildings in the world

Scores are tallied among five credit categories:

1. Site Planning
2. Water Efficiency
3. Energy Performance
4. Material & Resource Use
5. Indoor Environmental Quality

Five additional credits can be earned through Innovation in Operation and Upgrades



LEED

Build green. Everyone profits.



# Categories of LEED Ratings

**LEED-NC** New Construction

**LEED-CI** Commercial Interiors



**LEED-EB** Existing Building

# FUTURE PROGRAMS

**LEED-CS** Core & Shell

**LEED-HOMES**

**LEED-ND** Neighborhood Development

**LEED** Application Guides

Healthcare, Laboratories, Schools, Retail, Multi-building Campuses, Multi-family Residential



# Key Differences Between LEED-NC and LEED-EB

## LEED-NC

an event

affects design & construction

capital budgets

NC

## LEED-EB

a process



**Are there good examples?**

# Atlanta Federal Center

Atlanta, GA - Collecting Documentation for EB

- Complex of buildings.
- Over 2 million sf.
- Includes a historic structure.
- Major energy issues with initial energy star of 57.

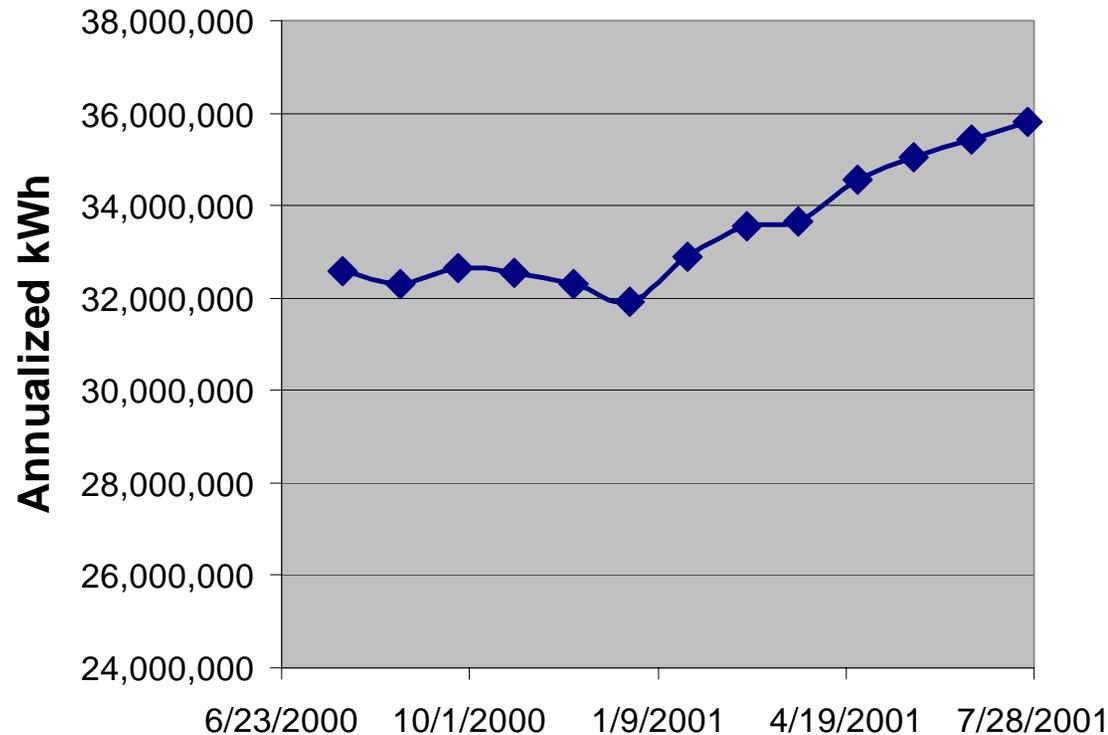


# Atlanta Federal Center

Atlanta, GA - Collecting Documentation for EB

- Energy Star was a goal.
- \$300,000 annual savings in energy cost.
- Building Manager attended Green Build

## AFC Annualized Electric Use



# Byron Rogers Courthouse

Denver, CO - LEED EB GOLD

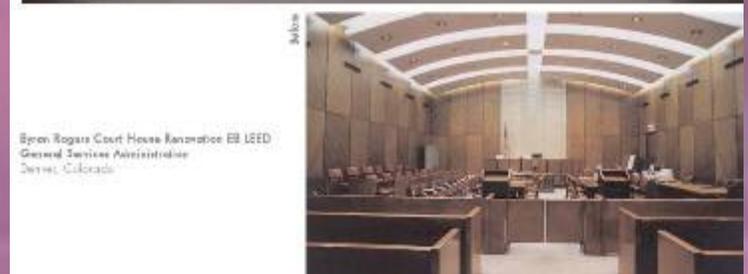
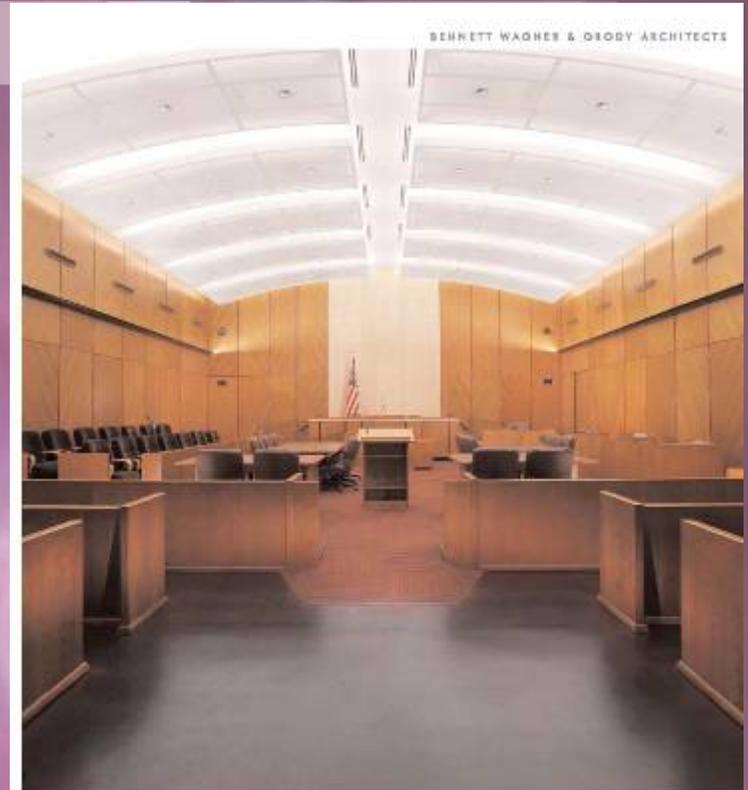
- Built 1965
- 260,000 gsf
- \$45.8 Million in renovation
- GSA's 1<sup>st</sup> EB Building
- GSA's 1<sup>st</sup> owned building to get GOLD.



# Byron Rogers Courthouse

## Denver, CO - LEED EB GOLD

- New white, high emissivity roof to reduce reflectance.
- Approximately 50% saving in water usage from plantings and drip irrigation
- The Courthouse is powered by 100% wind power.
- More than half of all materials had recycled content.
- Used environmentally friendly cleaning products



# John Duncan FOB

## Knoxville, TN - LEED EB Certified

- Energy Star Rating of 95.
- 668,000 gallons of water saved per year.
- Saving 225 megawatt hours annually.



# Leadership

In FY 2004, a project to replace an outdated energy management system at the John J. Duncan Federal Building allowed GSA to reduce energy use and operating costs while creating a healthier work environment for building occupants. Along with the new energy management system, the project incorporated high efficiency lighting, variable frequency drives, a new cooling tower, high efficiency motors, and motion sensors, resulting in savings of almost 225 megawatt hours annually. Restrooms were retrofitted with water-saving equipment, and new secondary meters were placed on water supplies to reduce water sewage and runoff charges, saving 668,000 gallons of water each year. These and other environmentally-friendly practices have resulted in an ENERGY STAR<sup>®</sup> rating of 94 and a Leadership in Energy and Environmental Design (LEED<sup>™</sup>) certification nomination.

John J. Duncan Federal Building  
Knoxville, Tennessee

 YOU HAVE the POWER<sup>™</sup>

U. S. General Services Administration  
Federal Energy Management Program


For more information on how you can get involved in the You Have the Power campaign, visit the EEMAP Web site at [www.eemapp.gov/etmp](http://www.eemapp.gov/etmp).

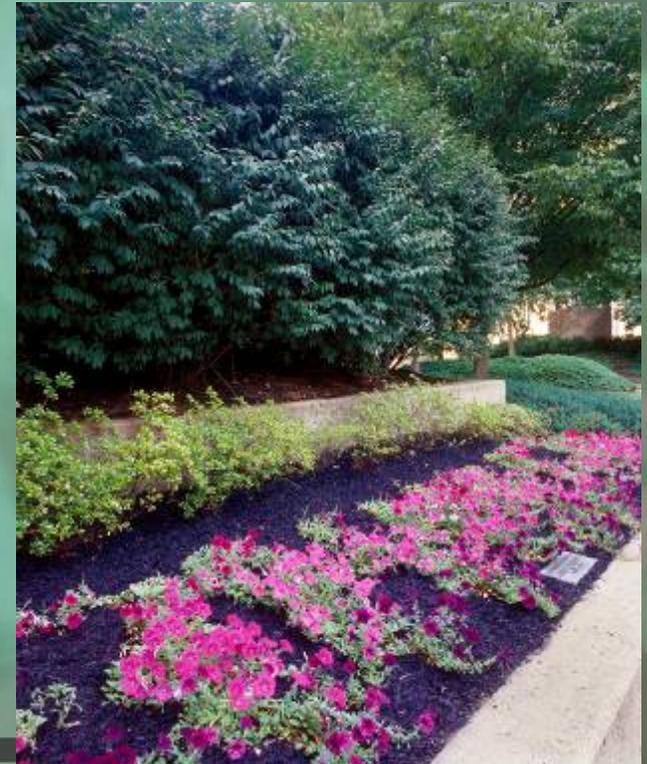
# John Duncan FOB

## Knoxville, TN - LEED EB Certified

- New EMS system and new cooling tower.

- Clients now want to move into the building.

- O&M and cleaning contractors enthusiastic.



2002

2003

2004

2005

2006

2007



SSA Building,  
Woodlawn, MD  
(NC2-O-02)



SSA Child Care  
Center, Woodlawn,  
MD (NC2-O-03)



DOT Office Building,  
Lakewood, CO  
(NC2-L-04)



U.S. Border Station,  
Sweetgrass, MT  
(NC2-O-05)



Metzenbaum  
Courthouse, Cleveland  
OH (NC2-O-06)



W.L.Morse Courthouse,  
Eugene, OR  
(NC2-O-06)



Duncan Building  
Knoxville, TN  
(EB2.0-O-07)



U.S. Courthouse,  
Youngstown, OH  
(NC2-O-02)



EPA New England Regional  
Laboratory, Chelmsford, MA  
(NC1-L-03)



Scowcroft Building  
(IRS), Ogden, UT  
(NC2-L-05)



Potomac Yards I,  
Arlington, VA  
(NC2-L-06)



DHS/CIS  
Lincoln, NE  
(NC2.0-L-06)



EPA Science & Technology  
Center, Kansas City, KS  
(NC2-L-03)



OSHA Salt Lake  
Technical Center,  
Sandy, UT (NC2-L-05)



Potomac Yards II,  
Arlington, VA  
(NC2-L-06)



EPA Computer Center,  
Research Triangle Park,  
NC (NC2-L-05)



Byron Rogers  
Courthouse, Denver,  
CO (EB1.0-O-06)



NPS Midwest Regional  
Headquarters, Omaha,  
NE (NC2-L-05)



DHS/CIS  
Omaha, NE  
(NC2.0-L-06)



LEED®  
Rated  
Buildings

**What are others doing?**



# Background

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- ✦ Issued FY 2003 policy letter
  - FY 2004 & FY 2005 projects strive for LEED Silver
  - FY 2006+ projects obtain LEED Silver
- ✦ Conduct internal Sustainable Design of Facilities course to help Field Centers adopt practices
- ✦ Signed High-Performance Buildings MOU in Jan 2006
- ✦ Constructed 3 LEED-rated buildings
- ✦ Pursuing LEED rating on additional projects



# First Project

- ✦ MSFC Building 4600
  - LEED Silver
  - Federal Energy Saver Showcase

**Leadership**

Environmentally sensitive construction practices make the 139,000 square-foot NASA Building 4600 at George C. Marshall Space Flight Center a model for sustainable design. The building's east-west orientation and sun shades minimize sun exposure, while an open floor plan allows for an abundance of natural light. Other energy-saving features include light sensors, photovoltaic roof panels, and a white, reflective ENERGY STAR® roof membrane. Waste water from the campus chiller plant is distributed to a retention pond for irrigation, saving 3.5 million gallons of potable water annually. More than 85 percent of construction waste was re-used or recycled, and 20 percent of the building material is made of recycled content. Low-VOC materials, efficient air flow, and greater access to daylight and views provide a healthy and productive interior work environment.

Building 4600  
Marshall Space Flight Center  
Huntsville, Alabama

 YOU HAVE the POWER™

National Aeronautics and Space Administration  
Federal Energy Management Program

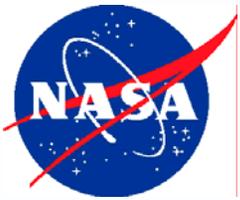

For more information on how you can get involved in the You Have the Power campaign, visit the EEMAP Web site at [www.energy.gov/ehp](http://www.energy.gov/ehp).



# First Project

## MSFC Building 4600 rooftop PV





# First Project

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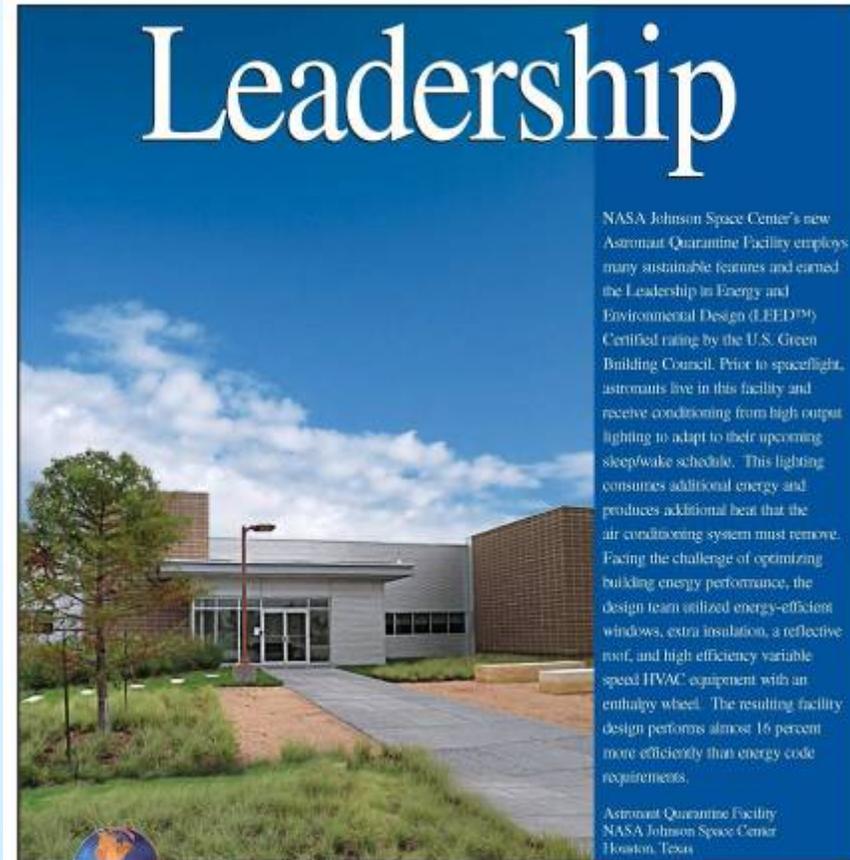
## ✦ MSFC Building 4600 lessons learned

- Design/construct HVAC system to operate separately for electronic equipment rooms
- Ensure maintenance contract requires using approved replacement materials/furnishings to maintain integrity
- Train maintenance personnel on proper cleanup during maintenance repairs to avoid contamination
- Ensure custodial contract requires green cleaning to avoid contamination



# Second Project

- ✦ JSC replacement Astronaut Quarantine Facility
  - LEED Certified
  - NASA energy showcase



## Leadership

NASA Johnson Space Center's new Astronaut Quarantine Facility employs many sustainable features and earned the Leadership in Energy and Environmental Design (LEED™) Certified rating by the U.S. Green Building Council. Prior to spaceflight, astronauts live in this facility and receive conditioning from high output lighting to adapt to their upcoming sleep/wake schedule. This lighting consumes additional energy and produces additional heat that the air conditioning system must remove. Facing the challenge of optimizing building energy performance, the design team utilized energy-efficient windows, extra insulation, a reflective roof, and high efficiency variable speed HVAC equipment with an enthalpy wheel. The resulting facility design performs almost 16 percent more efficiently than energy code requirements.

Astronaut Quarantine Facility  
NASA Johnson Space Center  
Houston, Texas



**YOU HAVE  
the POWER™**

National Aeronautics and Space Administration  
Federal Energy Management Program

For more information on how you can get involved in the "You Have the Power" campaign, visit the EEMP Web site at [www.nasa.gov/eemp](http://www.nasa.gov/eemp).





# Third Project

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✦ WSTF Columbia Health and Fitness Center  
– LEED Silver, NASA energy showcase





# For More Information

Would you like to know more about this session?

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Don't forget to fill out and drop off your session evaluations!



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August 7



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**New Orleans**  
**August 5-8**