

ASHRAE's Path to Net Zero Energy Buildings

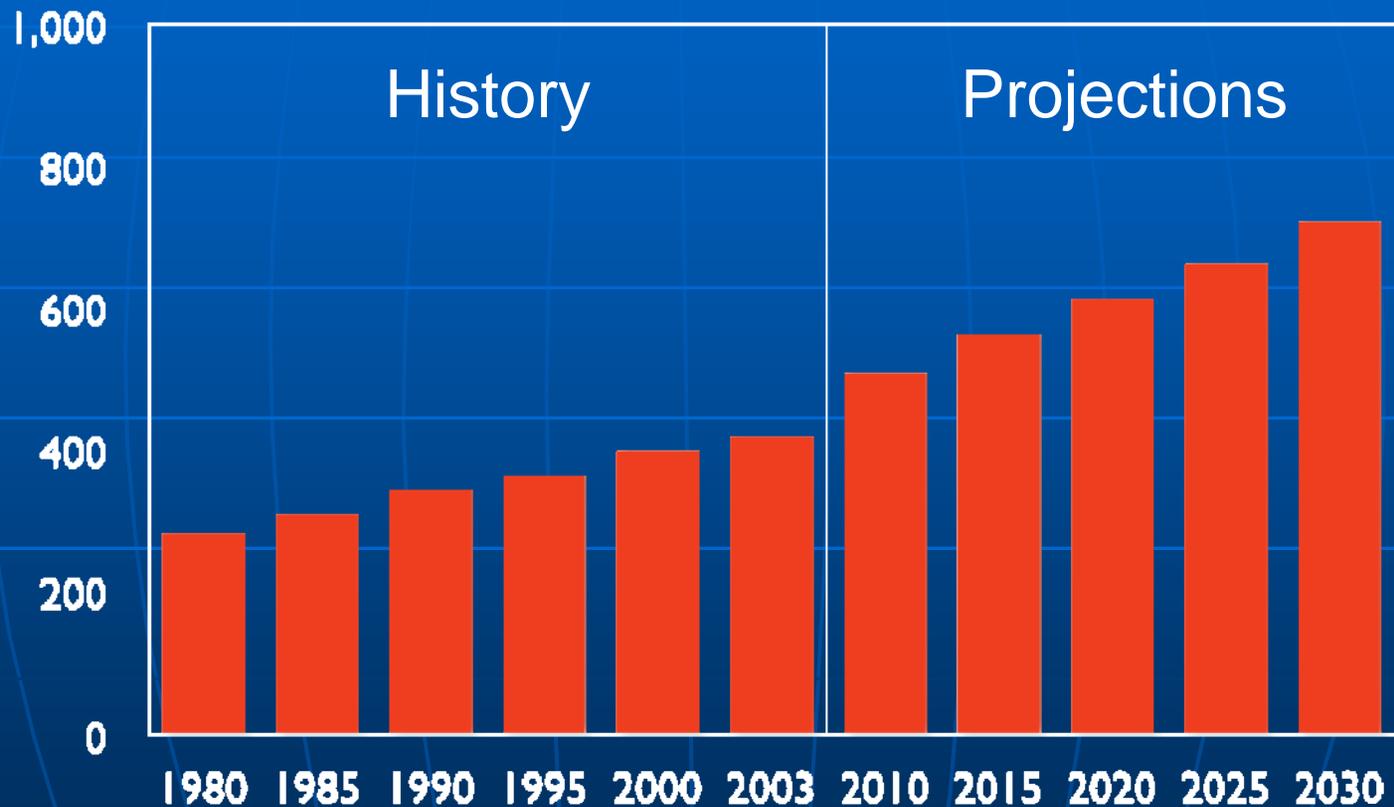


Energy Codes 2008
July 2008

Lynn G. Bellenger, PE, Fellow ASHRAE
ASHRAE Treasurer
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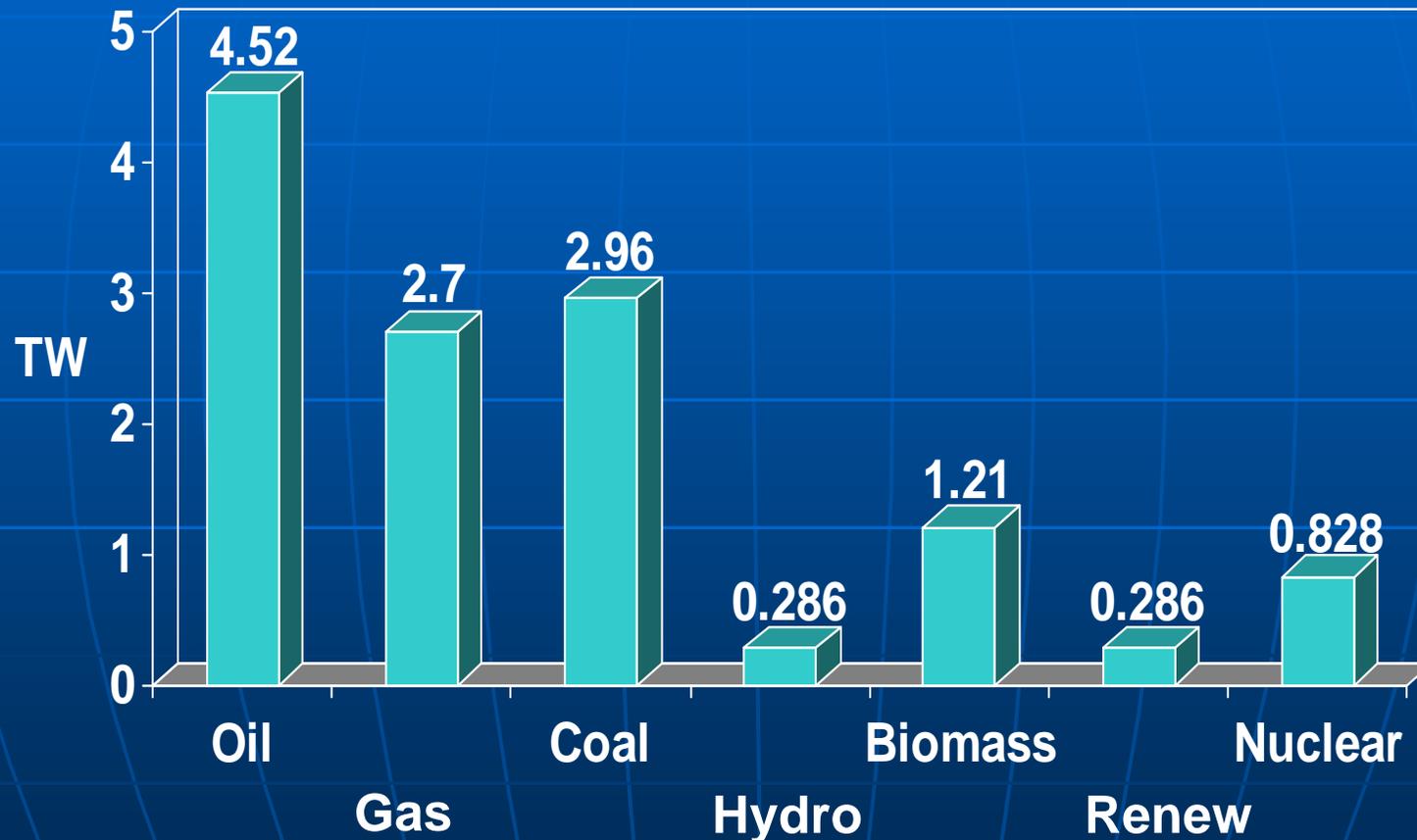
World Marketed Energy Consumption

Quadrillion Btu



Source: Energy Information Administration (EIA), International Energy Annual Report 2004

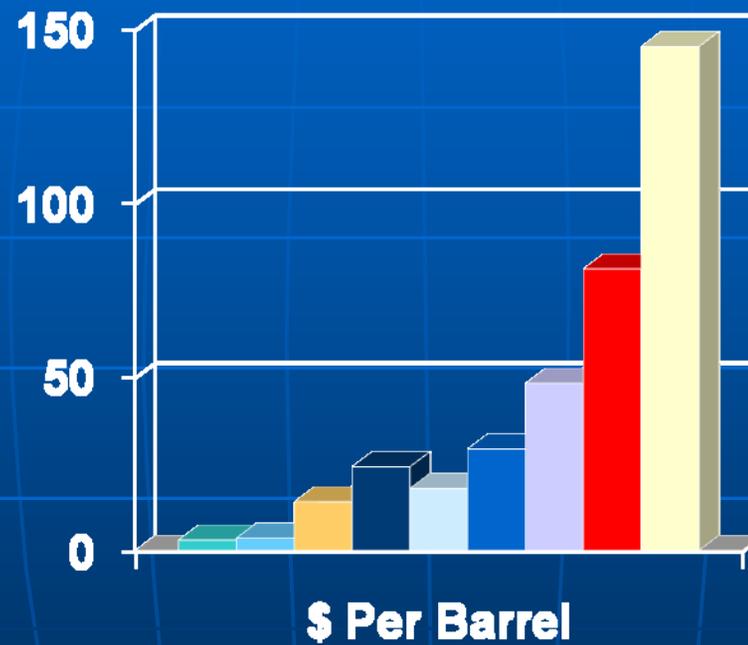
Global Energy Consumption



Total: 12.8 TW

U.S.: 3.3 TW (99 Quads)

The Rising Cost of Oil



1960

1970

1974

1991

1996

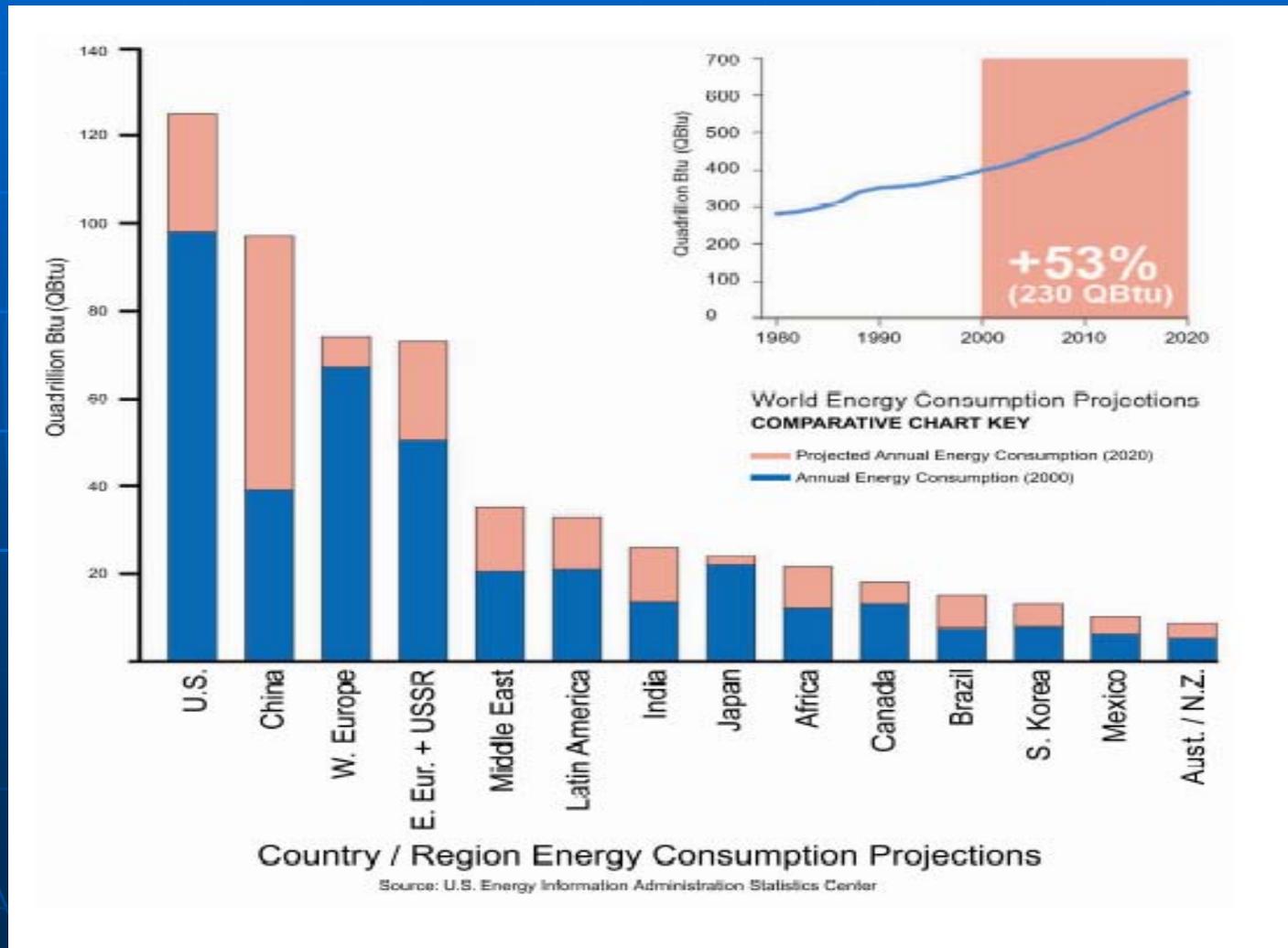
2000

2005

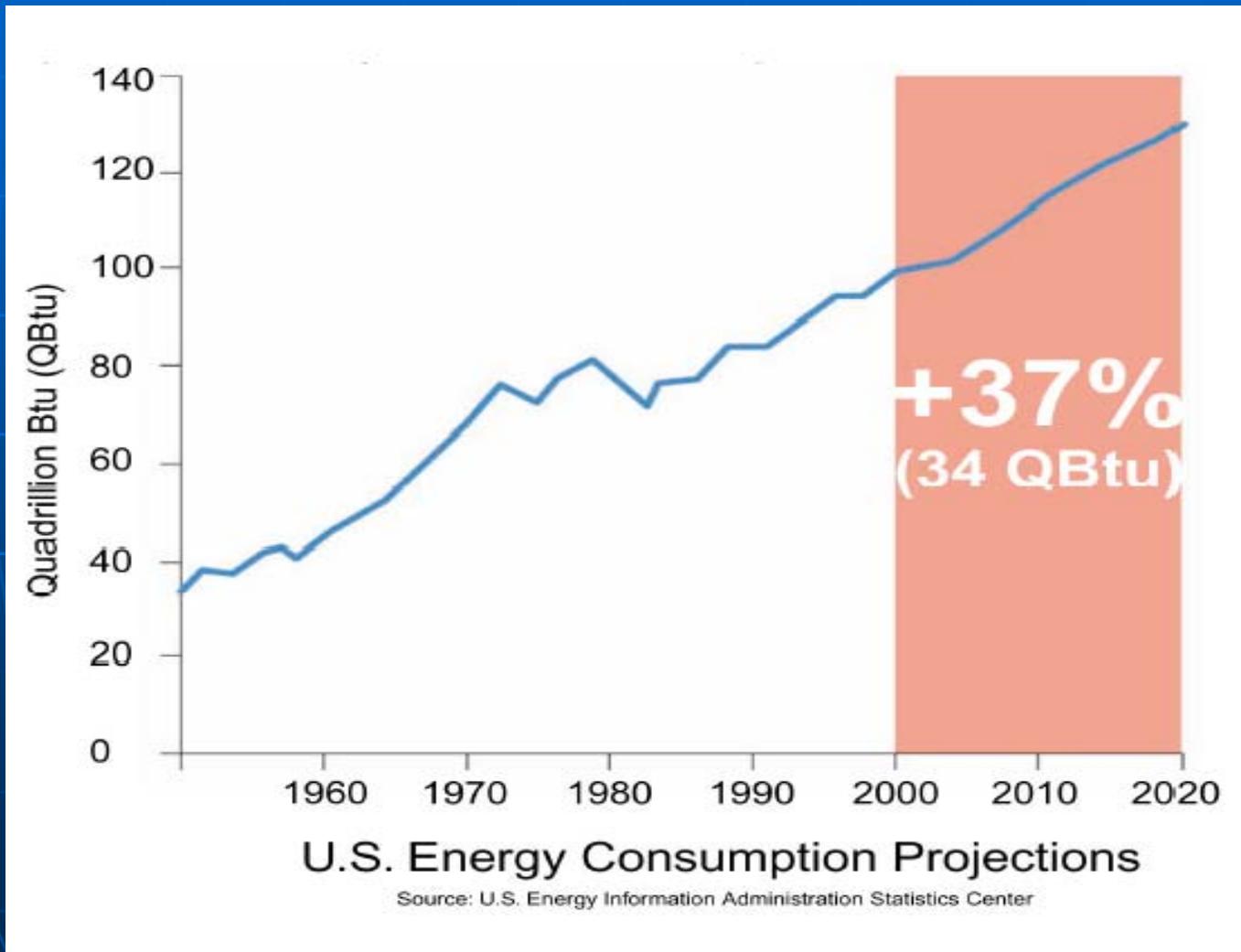
2007

2008

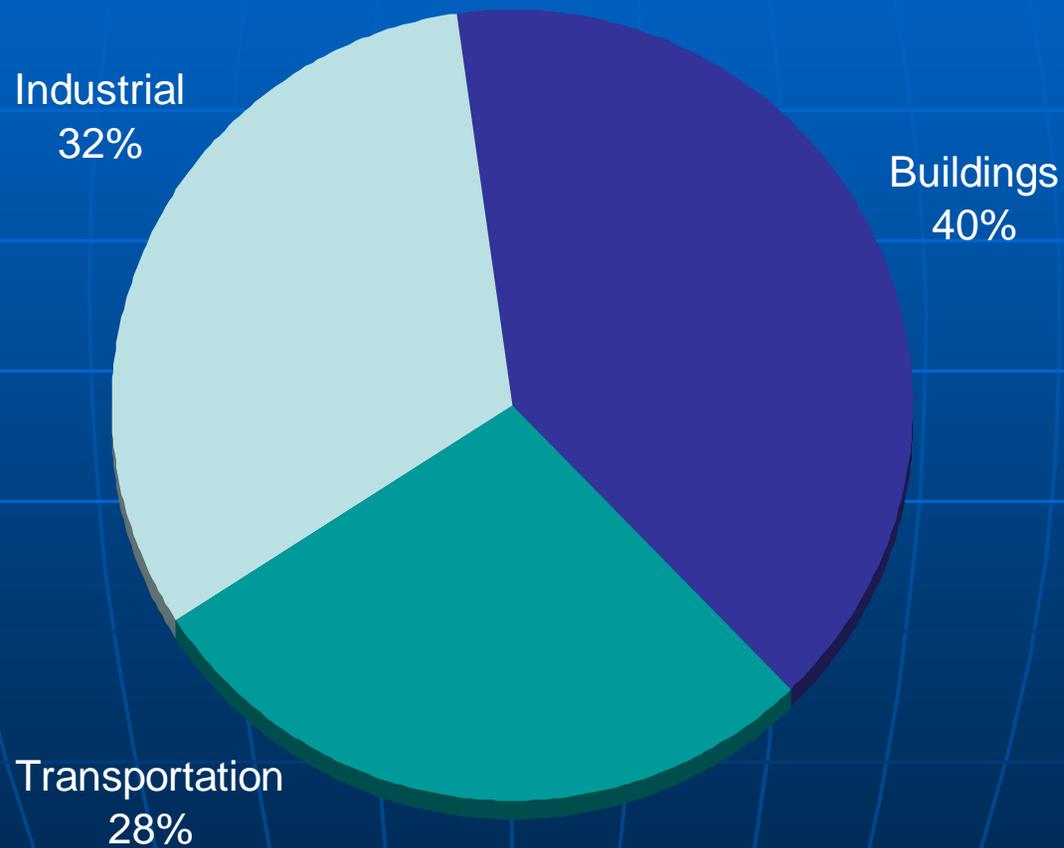
World Energy Consumption



U.S. Energy Consumption



United States Energy Consumption

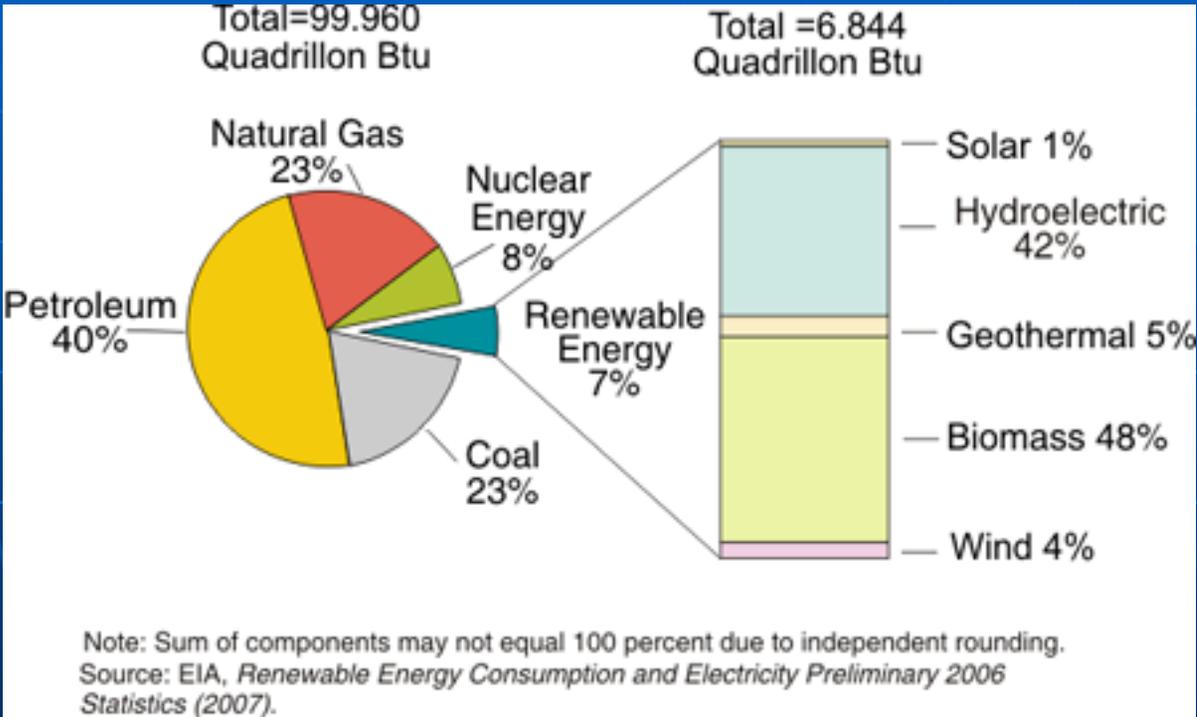


The Challenge

- Buildings fundamentally impact people's lives and the health of the planet
- Building Sector responsible for almost half of greenhouse gas emissions annually
- HVAC accounts for 40% to 60% of the energy used in U.S. commercial and residential buildings.

(<http://www.eere.energy.gov/buildings/info/components/hvac/>)

Renewable Energy Use



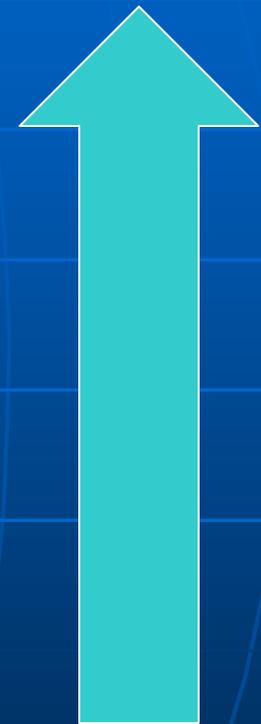
Wind & Solar Energy



21%



19%



2007

2006

Source: EIA, *Electric Power Monthly*, Table ES1.B "Total Electric Power Industry Summary Statistics, Year-to-Date 2007 and 2006"

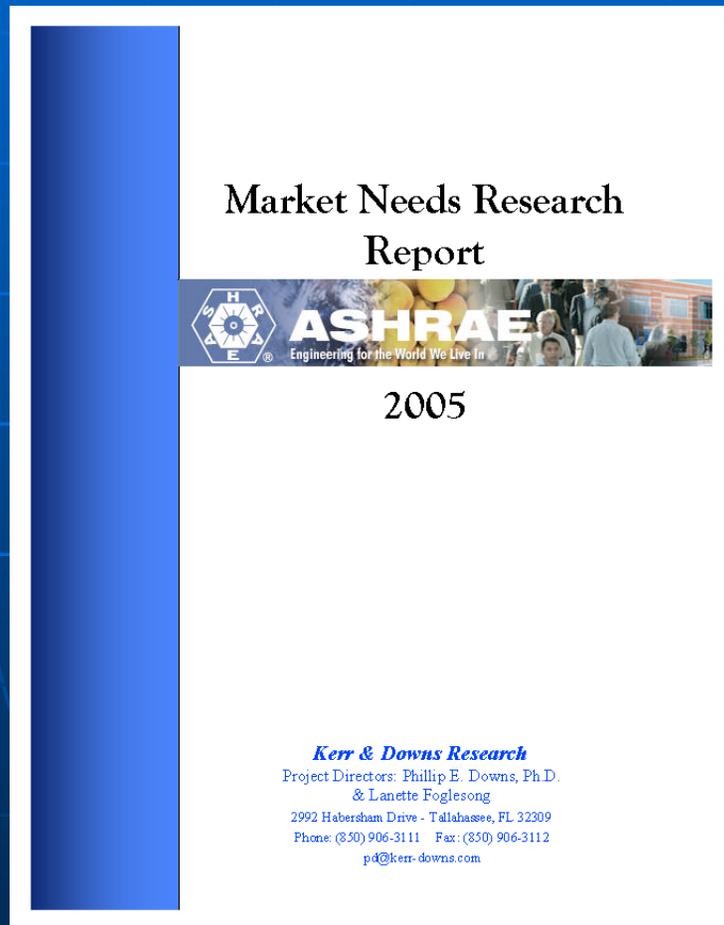
The Design Professional's Role

- Energy and sustainability concerns will increasingly drive future building decisions
- You will need the tools to remain competitive and help your clients make informed, cost-effective decisions

Industry Context

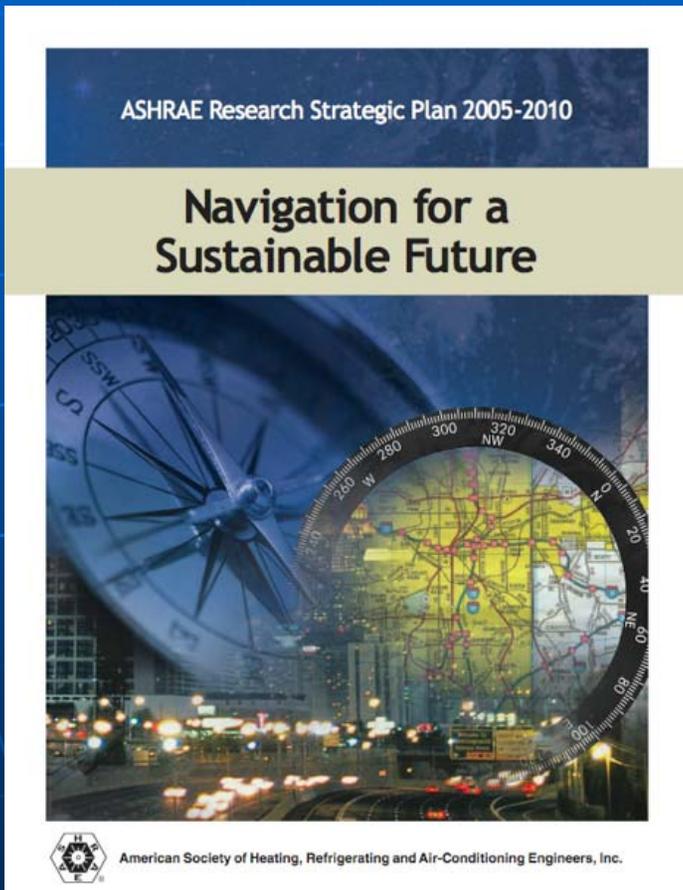
- Green building is becoming a mainstream design service requested by a variety of client types
- Green buildings provide benefits for owners, occupants, and neighbors
- Green design provides opportunities for Design Professionals to expand services and enhance their practices

Market Needs Research



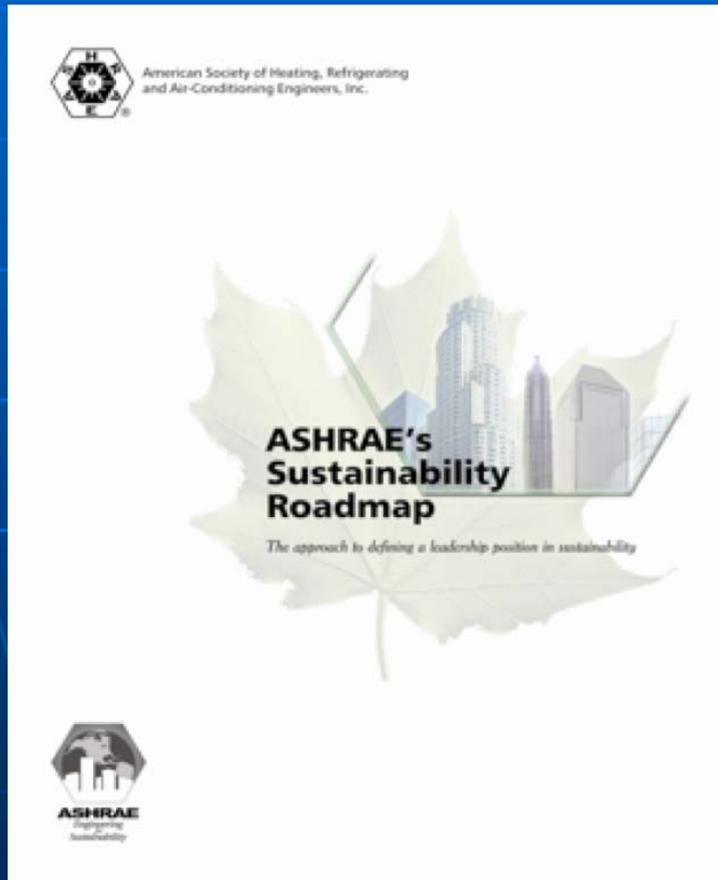
- Input from members and non-members
- Strong desire for green building engineering guidance
- This area resonated with all groups
- ASHRAE viewed as the credible source

Research Strategic Plan



- June 2005
- Broad input from stakeholders
- Provides guidance to the technical committees on research requirements

Sustainability Roadmap



- Approved Jan 06
- Defines an approach to developing a leadership position for ASHRAE in sustainability

ASHRAE Strategic Plan



Direction 1

- ASHRAE will lead the advancement of sustainable design and operations.

Approved by Board of Directors
March 2006

Strategies

1. Develop design guidance to integrate indoor environmental quality (IEQ), energy efficiency and other aspects of sustainable building performance.
2. Lead the drive toward the design, construction and operation of net-zero-energy buildings through research, publications and education.
3. Develop performance metrics and rating systems to certify operational performance of buildings for energy efficiency and IEQ.
4. Provide training, guidance and tools for building operators.
5. Conduct research and develop guidance to enhance the effectiveness of maintenance procedures.



Net-Zero-Energy Buildings

Buildings which, on an annual basis, use no more energy than is provided by on-site renewable energy sources.



Strategies

6. Promote the use of life-cycle-cost analysis to building owners that will encourage sustainable building construction, operation, and renewal.
7. Collaborate with other organizations to integrate HVAC&R systems with other building systems to enhance the effectiveness of Total Building Design and Integrated Practice.
8. Promote research leading to the development of equipment and systems that support sustainable buildings.



Architecture 2030 Challenge



- Architecture 2030 Challenge target:
in 2007 all new buildings and major renovations shall be designed to use 50% of the regional average for that building type, on fossil fuel reduction basis (2030 is on carbon basis)

Target increases to 60% in 2010 and by 10% for each 5 years thereafter until in 2030 all new and renovated building designs will be carbon neutral (using no net fossil fuel energy to operate)

Architecture 2030 Challenge



- Professional Societies
- 27 states
- 839 cites
- Federal government (EISA 2007)

Meeting the 2030 Challenge Through Building Codes
June 2008

www.architecture2030.org

NZEB for Federal Facilities



High-Performance Federal Buildings:
Meeting EISA Requirements through 2030

JULY 22-23, 2008
WASHINGTON, DC

Sponsored by the Federal
Facilities Council in
coordination with

Energy Independence and Security Act of 2007 (EISA) requires federal buildings to reduce their fossil fuel based energy use to zero by 2030.

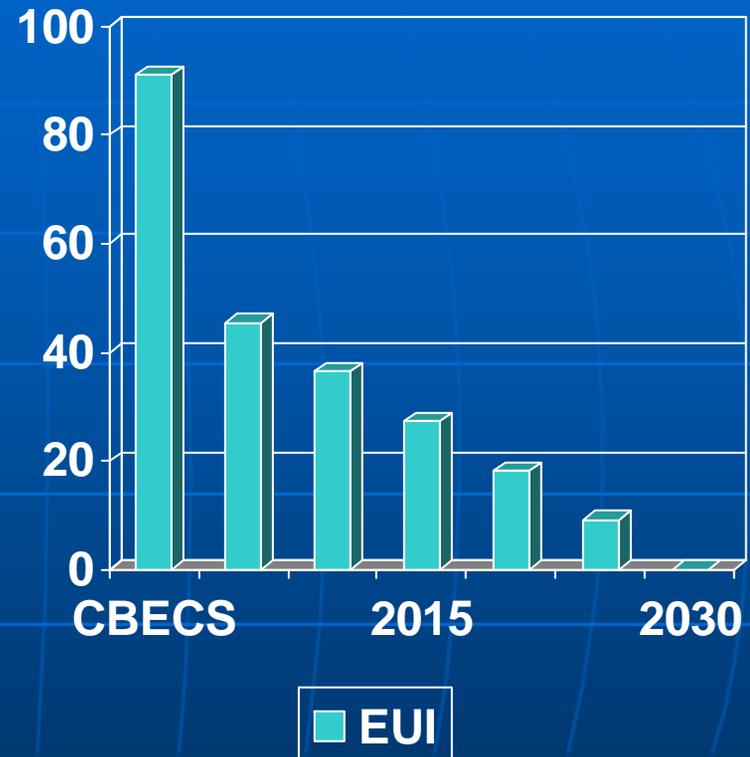
Co-Sponsors: ASHRAE, AIA, ACCA, GBI, ICC, IFMA, NFPA, NIBS, USGBC and others

AIA Green Building Coalition

*Adopted the Architecture
2030 Challenge*

- AIA
- U.S. Green Building Council
- ASHRAE

Adopted CBECS Baseline



Commercial Buildings Energy Consumption Survey

2003 CBECS average EUI for all commercial buildings in all climate zones is 91,000 Btu/ft²-yr (site energy use)

CBECS

Commercial Buildings Energy Consumption Survey

- Snapshot of entire commercial sector as of a certain date (done every 4 years—1999, 2003, 2007)
- Data masked to protect privacy—no real locations, no real areas, skewed number of floors
- Lots of detail about building composition (but it is self-reported)

Energy Information Administration

CBECS

Commercial Buildings Energy Consumption Survey

- Weighting factors to statistically bring totals to national numbers
- Cautions:
 - Slicing dataset can create small 'n' and hurt statistical validity of the numbers.
 - EUI's are computed based on information in database—not a real part of the dataset

<http://www.eia.doe.gov/emeu/cbecs/>

Standard 90.1

Standards Committee recommends . . . that the Board endorse in principle changing ANSI/ASHRAE/IESNA Standard 90.1-2004, *Energy Standard for Buildings Except Low-Rise Residential Buildings*,

to result in a goal of 30% energy reduction in ANSI/ASHRAE/IESNA Standard 90.1-2010 following the ASHRAE consensus process.

Approved by Board of Directors
September 29, 2006

Standard 189.1

Standard for the Design of High-Performance, Green Buildings Except Low-Rise Residential Buildings

- Purpose: To provide minimum requirements for the design of high-performance, green buildings to:
- (a) Balance environmental responsibility, resource efficiency, occupant comfort and well being, and community sensitivity, and
- (b) Support the goal of the development that meets the needs of the present without compromising the ability of future generations to meet their own needs.

Partners – USGBC, IESNA



Standard 189.2

Standard for the Design, Construction and Operation of High-Performance Green Health Care Facilities

- Purpose: To prescribe the procedures, methods and documentation requirements for the design, construction and operation of high performance green health care facilities.

Partner - ASHE

Standard 191

Standard for the Efficient Use of Water Use in Building, Site and Mechanical Systems

- Purpose: To provide baseline requirements for the design of buildings, site, and mechanical systems that minimize the volume of water required to operate HVAC systems, plumbing systems, and irrigation systems.



AWWA



USGBC

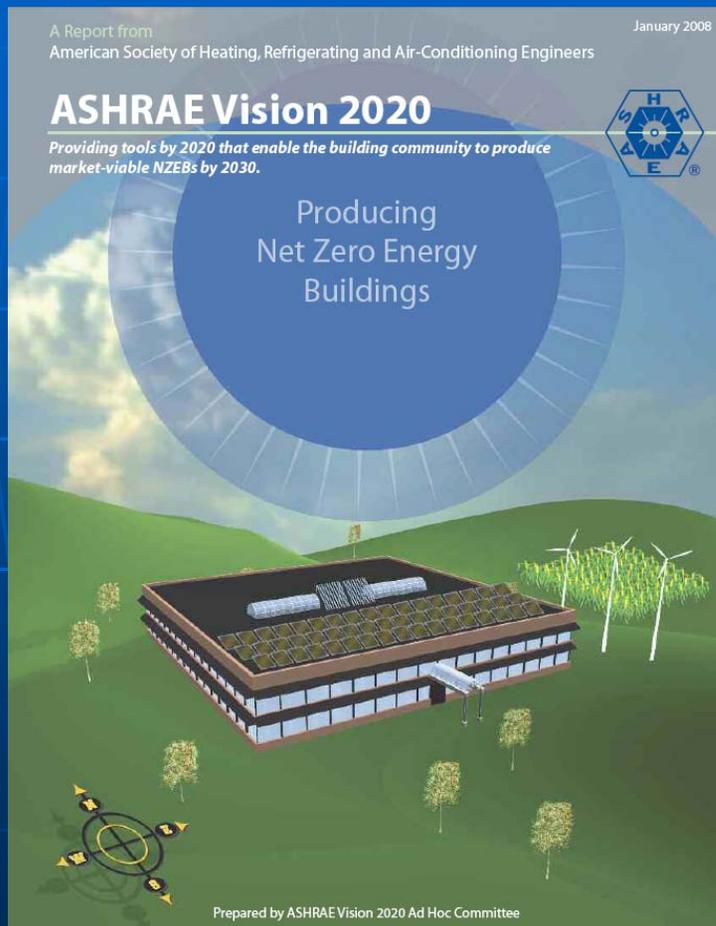


ASPE

Sustainability Standards

- 90.1-2010 – Prescriptive and Performance
- 189.1 – High Performance Green Buildings
- 189.2 – High Performance Green Healthcare Facilities
- 191 - Water Conservation Standard

Vision 2020



- June 2007
- Providing tools by 2020 that enable the building community to produce market viable NZEBs by 2030

Vision 2020 Recommendations

- ASHRAE will develop a rating system and branding for new and existing buildings, including design and operation
- Work with key players to reduce standby loss and parasitic power use (plug loads and power transformers)
- Host leadership roundtable to explore integrated design solutions
- Work with Research Advisory Panel (RAP) and USGBC Research Committee to identify high priority research

Vision 2020 Continued

- Add unregulated (plug and process) loads to 90.1, perhaps establishing W/ft² levels
- Develop target energy budgets for 90.1 by building type and climate zone
- AEDGs are best path to NZEBs – expand to include alternative packages for reaching 30% above 90.1
- After set of 50% guides, produce AEDGs for NZEBs instead of 70% guides
- Develop e-Learning modules for NZEB design guidance
- Launch Certified Sustainability Design Expert program

Building Energy Performance

Site EUI kBtu/ft ² -yr	Percent of 90.1-1999	
91	172	2003 CBECS Average
85	160	1999 CBECS Average
53	100	ASHRAE Std 90.1-1999
47	89	ASHRAE Std 90.1-2004
42	80	50% of 1999 CBECS Average
37	70	30% ASHRAE AEDGs
33	62	ASHRAE Std 90.1-2010 Goal
26	50	50% ASHRAE AEDGs

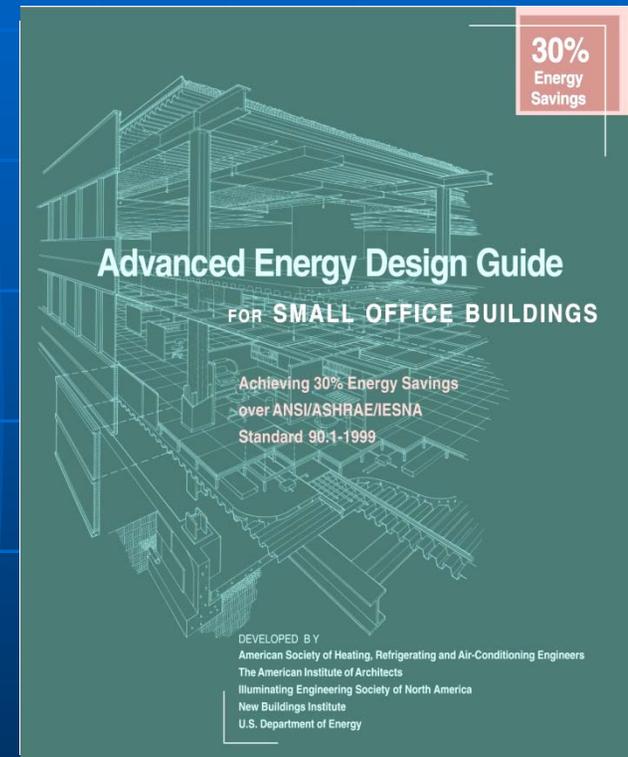
U.S. Energy Information Administration Commercial Buildings Energy Consumption Data

Advanced Energy Design Guides



AEDG – Small Office Buildings

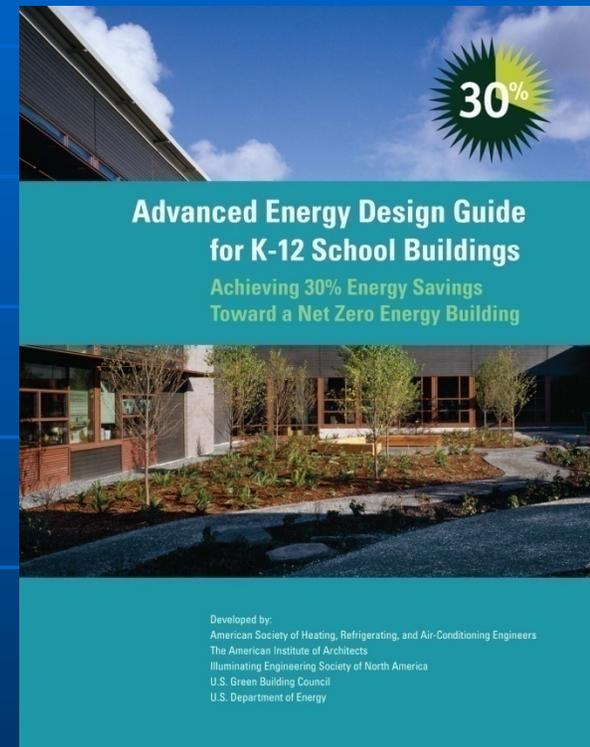
- 30% savings over 90.1-1999
 - New office buildings
 - ≤ 20,000 square feet
 - Unitary HVAC equipment
 - Envelope, lighting, HVAC, and service water heating
 - Practical and commercially available
-
- 4 LEED points for compliance



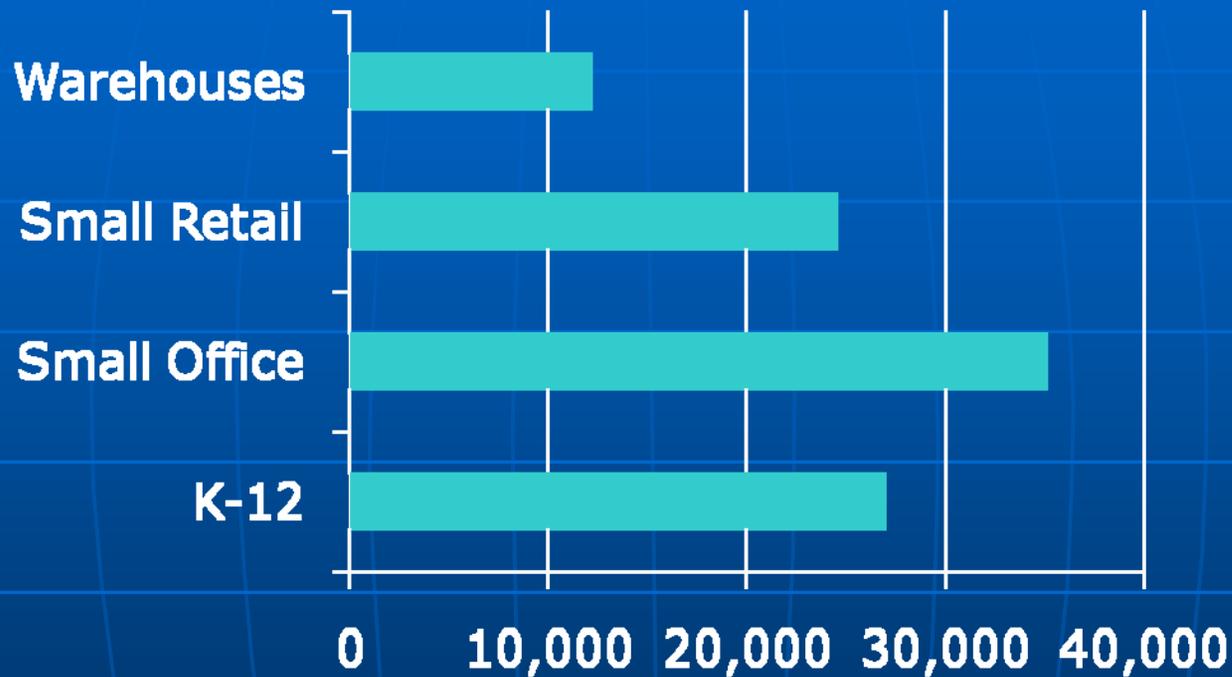
AEDG for K-12 School Buildings

- 30% savings over 90.1-1999
- Distributed to 13,000 school administrators
- All AEDG available for free download

www.ashrae.org



AEDG Downloads



98,864 downloads by 35,151 people
13,000 K-12 AEDG distributed to schools
5,392 printed copies sold
117,256 total circulation

as of 7/22/08

Advanced Energy Design Guides

- In development
 - 30% AEDG for Highway Lodging (4th Qtr 2008)
 - 30% AEDG for Healthcare Facilities (2nd Qtr 2009)
 - Advanced Energy Guide for Existing Buildings (4th Qtr 2008)
- 50% Guides next – Office, Retail, K-12
- Target – Net Zero Energy Buildings

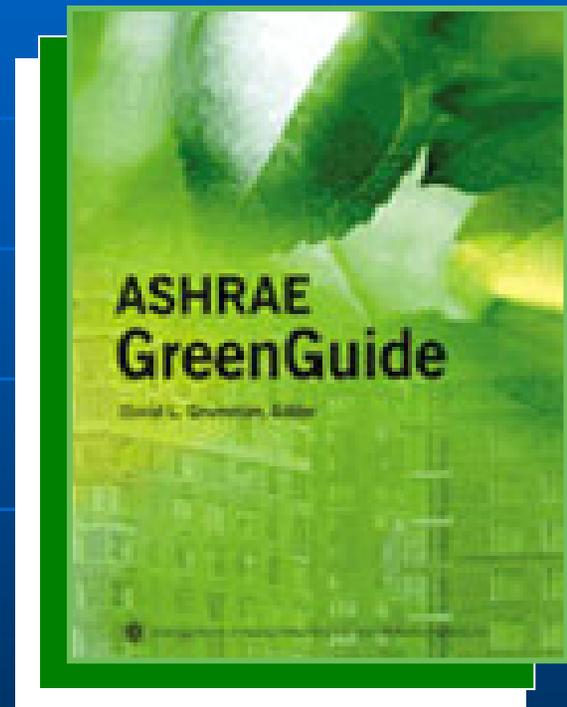
Advanced Energy Design Guides

- Scoping Study for 50% Savings
 - Integrated Design Procedures
 - Best Practice in Design & Construction
 - Improved Operating & Maintenance Procedures

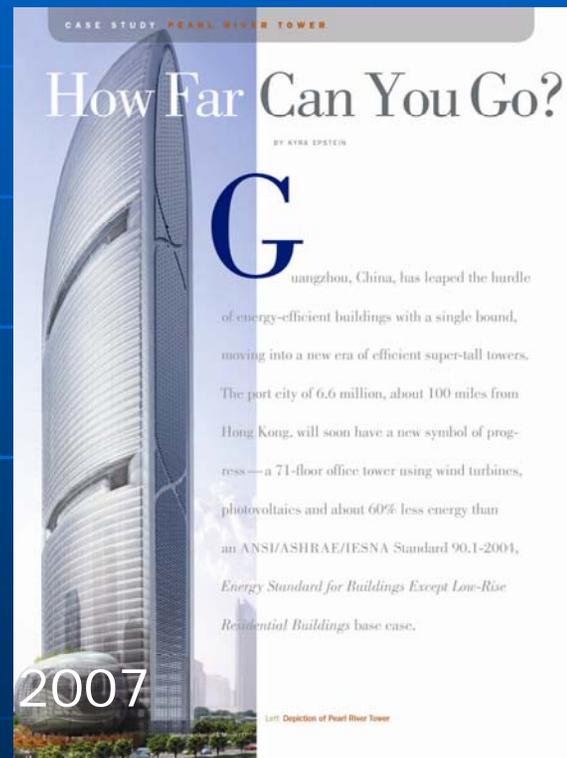
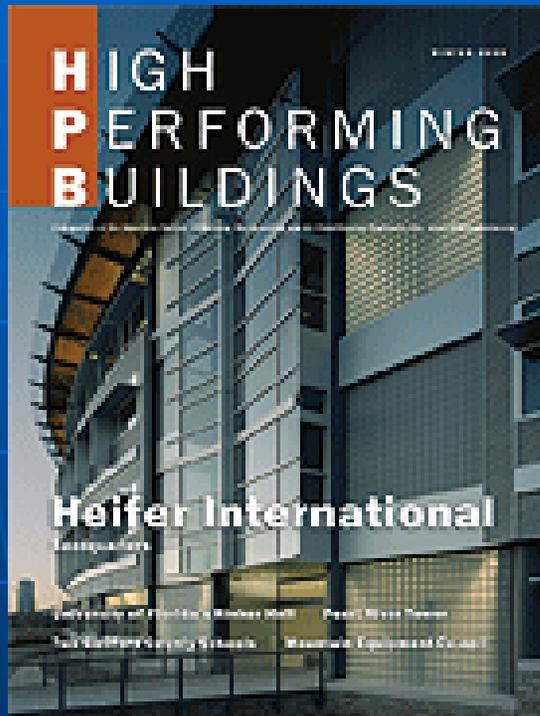
<http://www.ashrae.org/technology/page/938>

ASHRAE GreenGuide

- Second Edition
- Step-by-step manual for the entire building lifecycle
- Construction, operation, maintenance, and eventual demolition
- Techniques applicable to related technical disciplines
- 29 "Green Tips"
- Case studies, checklists, and other practical information

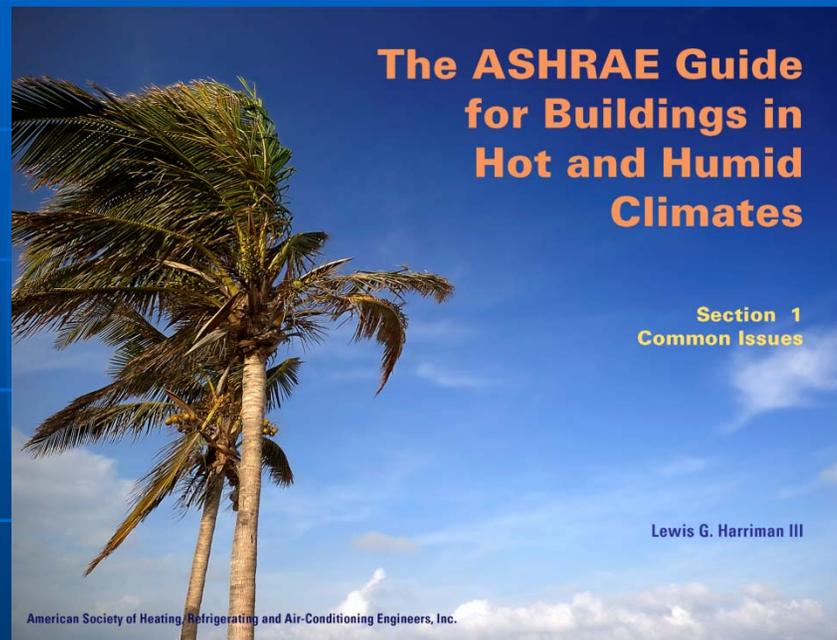


High Performing Buildings



- Launched November 2007
- Case Studies
- Lessons Learned

Hot and Humid Design Guide



- First Edition published January 2008
- Second Edition scheduled January 2009

Free Datacom Workshops

Attend a free ASHRAE/NYSERDA workshop to learn how you can reduce data center energy use by up to 75%



- July 29, Syracuse
 - September 9, Buffalo
 - November 6, New York
-
- *Thermal Guidelines for Data Processing Environments*
 - *Best Practices for Datacom Facility Energy Efficiency*
 - *High-Density Data Centers—Case Studies and Best Practices*

Advanced Design Guidance

- Advanced Energy Design Guides
- ASHRAE GreenGuide
- AEDG Existing Buildings
- High Performing Buildings Magazine
- Hot and Humid Climate Design Guide
- Best Practices for Datacom Facility Energy Efficiency
- Indoor Air Quality Guide – *in progress*
- Building Energy Benchmarks - *planned*

Certification

Available Certification

- Healthcare Facility HVAC&R Design
- High-Performance Building Design Professional

In Development

- Operations & Performance Management Professional, January 2009
- Commissioning, 2009

<http://www.ashrae.org/certification>

Greener Headquarters

- Incorporate ASHRAE technology
- Demonstrate commitment to sustainability
- LEED gold rating



www.ashrae.org/building

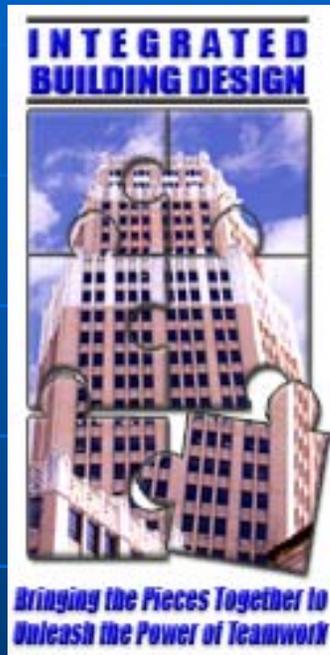
ASHRAE Headquarters

Move in Day July 25!



- New learning center
- Living Lab

Satellite Broadcast



- Integrated Building Design: Bringing the Pieces Together to Unleash the Power of Teamwork
- Broadcast April 16, 2008
- Working with DOE to re-broadcast for Federal Agencies

Integrated Building Design



- Site
- Fenestration
- Insulation
- Mass
- Daylighting
- HVAC

High Performance Buildings Congressional Caucus Coalition



Section 914 of the Energy Policy Act of 2005 addresses not just more energy efficient or “green” buildings but rather high performance buildings

National Institute of Building Science (NIBS) formed an ad hoc High-Performance Building Council consisting of representatives of approximately 100 private sector and governmental organizations to provide a sense of direction.

Luncheon briefing for Congressional staffers on June 18 to introduce the leadership of the new High Performance Building Congressional Caucus & to unveil the final High Performance Building report to Congress and the Department of Energy.

Under Development

- Building Performance Metrics
- BIM – Building Information Modeling
- Carbon Emissions Tool
- Building Energy Labeling Program
- DASH - Database for Analyzing Sustainable and High Performance Buildings
- Performance Based Energy Standards

We Have an Opportunity

- The decisions we make on project teams today will influence the energy future of the world
- We have the potential to change how buildings use energy to the point of zero-energy-buildings in the coming decades

What Can You Do?

- Embrace sustainability principles
- Define sustainable targets at beginning of projects
- Measure performance
- Share your experience
- Make a difference!
- *Participate in ASHRAE!*

