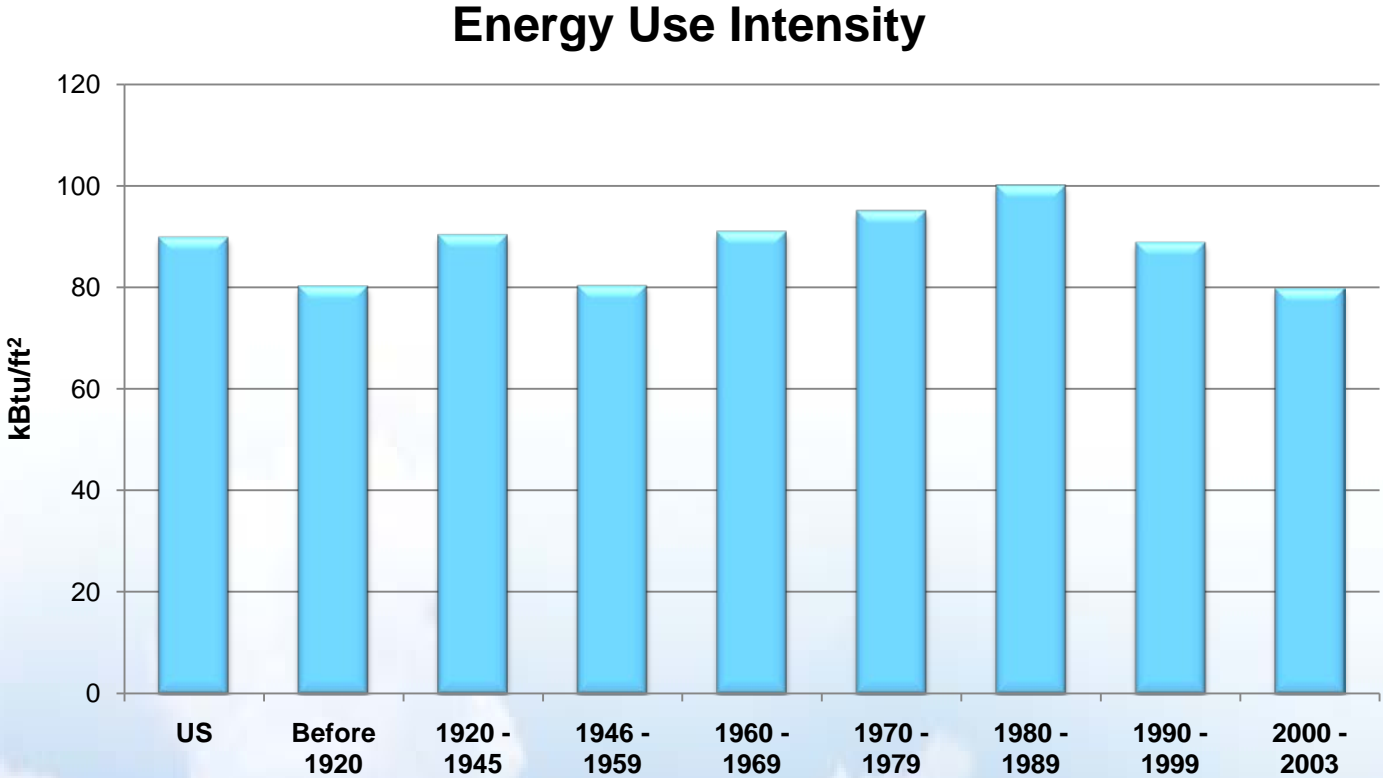


# **ASHRAE's Initiatives for Energy Conservation in Existing Buildings**

**Lynn G. Bellenger, PE  
ASHRAE President  
Pathfinder Engineers & Architects LLP**

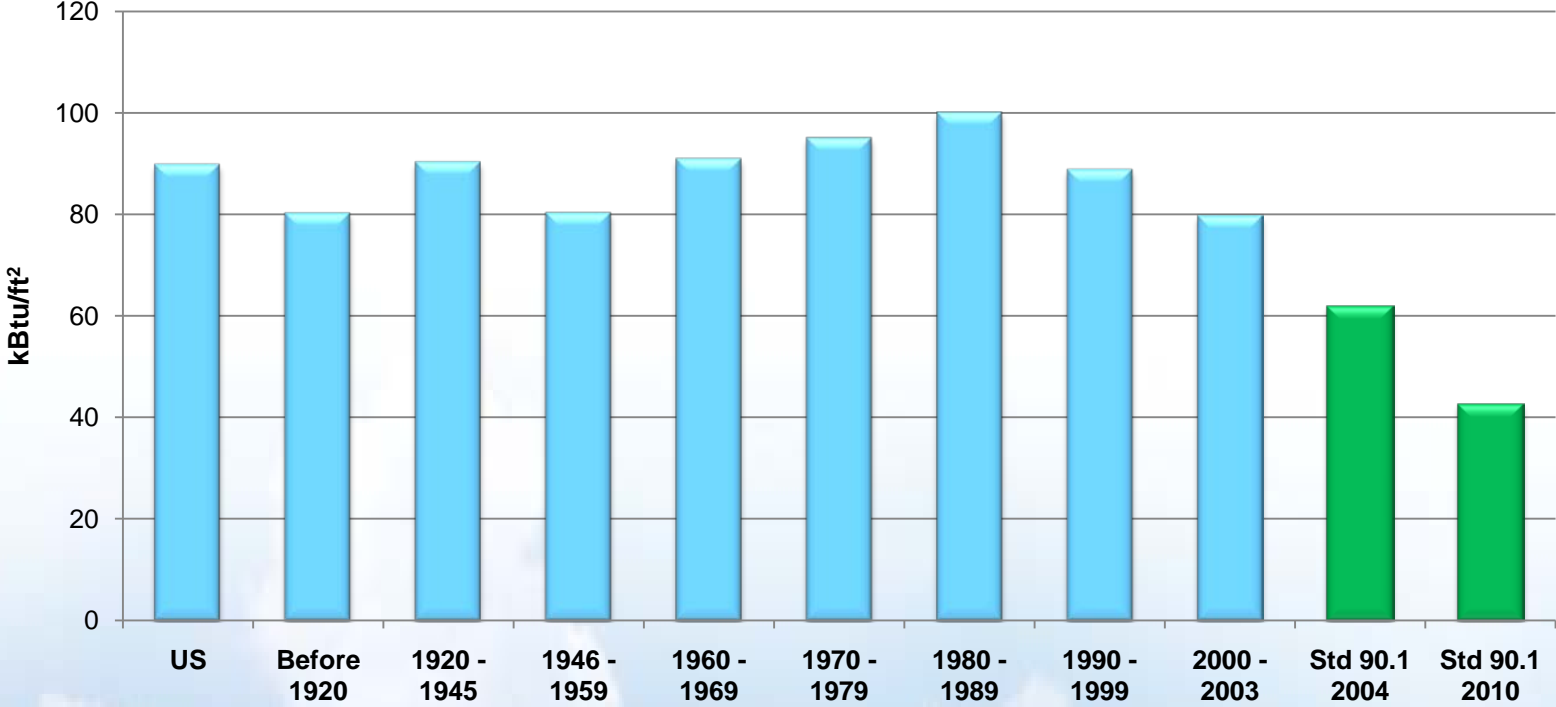
# Commercial Building Energy Use



US DOE, Energy Information Agency, Commercial Building Energy Consumption Survey 2003

# Commercial Building Energy Use

## Energy Use Intensity



US DOE, Energy Information Agency, Commercial Building Energy Consumption Survey 2003

# Agenda

- Standards & Guidelines
- Research Projects
- Design Guidance
- Education

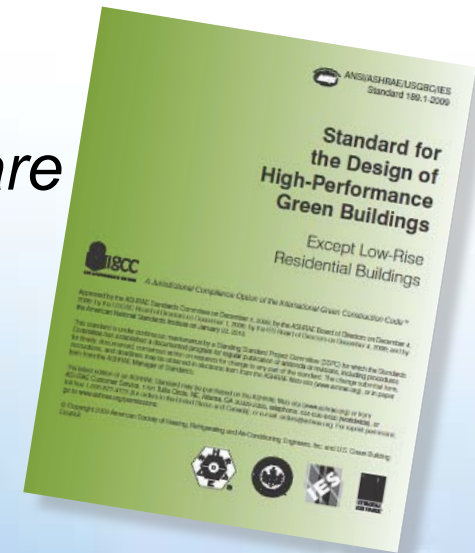


# Sustainability

# Sustainability

## Standards

- Standard 189.1  
*Standard for the Design of High-Performance, Green Buildings Except Low-Rise Residential Buildings*
- Standard 189.2P  
*Design, Construction and Operation of Sustainable High Performance Health Care Facilities*
- Standard 191P  
*Standard for the Efficient Use of Water in Building, Site and Mechanical Systems*



# Energy

# Energy

## Standards & Guidelines

- Standard 100-2006R  
*Energy Efficiency in Existing Buildings*
- Standard 90.1-2010  
*Energy Standard for Buildings Except Low-Rise Residential Buildings*
- Standard 90.2-2007R  
*Energy Efficient Design of Low-Rise Residential Buildings*
- Guideline 13-2007  
*Specifying Direct Digital Control Systems*





# Energy

## Research

- 1449-RP *Energy Efficiency and Cost Assessment of Humidity Control Options for Residential and Small Commercial Buildings*
- 1544-RP *Establishing Benchmark Levels and Patterns of Commercial Building Hot Water Use*
- 1590-RP *Implementation of Total Cost of Ownership (TCO) Principles into Higher Education as an Integrated Decision Making Tool*



# Building Envelope

# Building Envelope

## Standards

- Standard 119-1988  
*Air Leakage Performance for Detached Single-Family Residential Buildings*
- Standard 136-2006  
*A Method of Determining Air Change Rates in Detached Dwellings*
- Standard 160-2009  
*Criteria for Moisture-Control Design Analysis in Buildings*



# Building Envelope

## Research

- 1235-RP *The Nature, Significance and Control of Solar Driven Vapor Diffusion in Wall Systems*
- 1325-RP *Environmental Weather Loads for Hygrothermal Analysis and Design of Buildings*
- 1365-RP *Thermal Performance of Building Envelope Details for Mid- and High-Rise Buildings*
- 1478-RP *Measuring Air-tightness of Mid- and High-Rise Non-residential Buildings*



# **Ventilation & Indoor Environmental Quality**

# Ventilation & IEQ

## Standards

- Standard 55-2010  
*Thermal Environmental Conditions for Human Occupancy*
- Standard 62.1-2010  
*Ventilation for Acceptable Indoor Air Quality*
- Standard 62.2-2010  
*Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings*
- Standard 161-2007  
*Air Quality Within Commercial Aircraft*
- Standard 170-2008  
*Ventilation of Health Care Facilities*



# Ventilation & IEQ

## Guidelines

- Guideline 24-2008

*Ventilation and Indoor Air Quality in Low-rise Residential Buildings*

- Guideline 26-2008

*Guideline for Field Testing of General Ventilation Filtration Devices and Systems for Removal Efficiency In-Situ by Particle Size and Resistance to Airflow*

- Guideline 28P

*Air Quality Within Commercial Aircraft*



# Ventilation & IEQ

## Research

- 1262-RP *Relate Air Quality and Other Factors to Comfort and Health Related Symptoms Reported by Passengers and Crew on Commercial Transport Aircraft (Part 2)*
- 1306-RP *Incident-Response Monitoring Technologies for Aircraft Cabin Air Quality*
- 1322-RP *Productivity and Perception Based Evaluation of Indoor Noise Criteria*
- 1448-RP *Ventilation Requirements for Refrigerating Machinery Rooms*





# Ventilation & IEQ

## Research

- 1456-RP *Assess and Implement Natural and Hybrid Ventilation Models in Whole-Building Energy Simulations*
- 1547-RP *CO<sub>2</sub>-based Demand Controlled Ventilation for Multiple Zone HVAC*
- 1596-RP *Ventilation and Indoor Air Quality in Retail Stores*
- 1597-RP *Stochastic Control Optimization of Mixed-Mode Buildings*



# Plug & Process Loads

# Plug & Process Loads



## Standards

- Standard 203P  
*Method of Test for Determining Heat Gain of Office Equipment Used in Buildings*
- Standard 205P  
*Data Exchange Protocols for Energy Simulation of HVAC&R Equipment Performance*

# Plug & Process Loads

## Research

- 1343-RP *Method of Testing and Data Collection for Energy Characteristics of Healthcare Medical Equipment (complete)*
- 1395-RP *Heat Gains from Electrical and Control Equipment in Industrial Plants, Part 2*
- 1482-RP *Update to Measurements of Office Equipment Heat Gain (complete)*



# Kitchens/Commercial Cooking

# Kitchens/Commercial Cooking



## Standards

- Standard 154-2003R  
*Ventilation for Commercial Cooling Equipment*

# Kitchens/Commercial Cooking

## Research

- 1320-RP *The Impact of Household Refrigeration Storage Conditions on Shelf-Life of Fruits and Vegetables*
- 1376-RP *Method of Test to Evaluate Field Performance of Commercial Kitchen Ventilation Systems*
- 1467-RP *Balancing Latent Heat Load between Display Cases and Store Comfort Cooling*
- 1469-RP *Thermal Comfort in Commercial Kitchens*
- 1480-RP *Island Hood Energy Consumption and Energy Reduction Strategies (completed)*



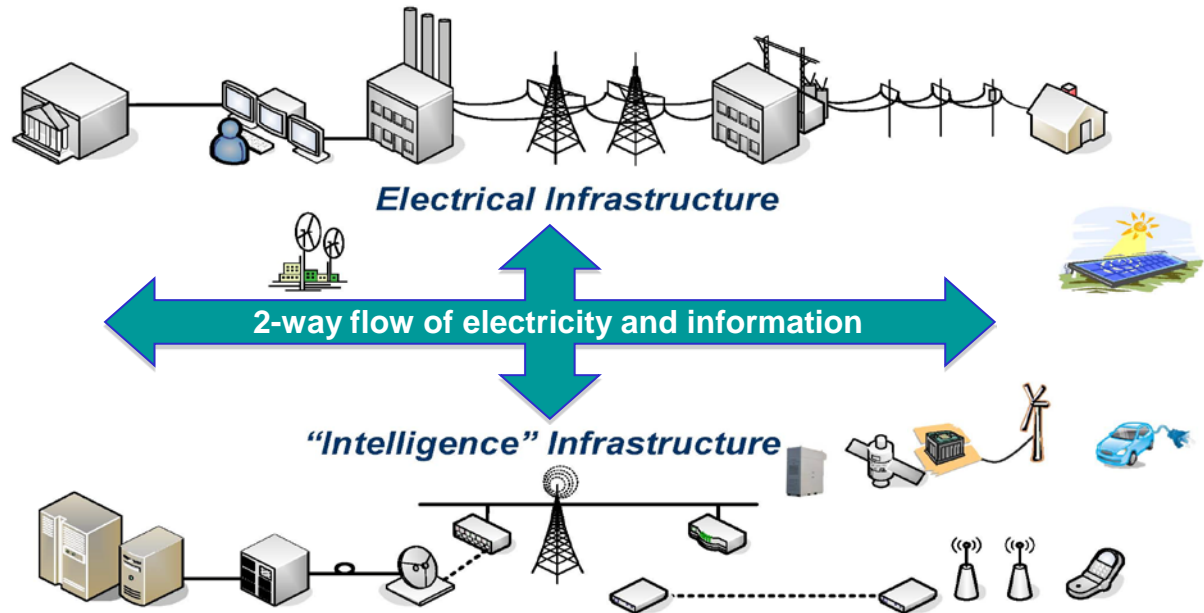
# Smart Grid



# Smart Grid – The “Energy Internet”

## Standards & Research

- Standard 201P  
*Facility Smart Grid Information Model*
- 1390-RP *Short-Term Curtailment of HVAC Loads in Buildings*



# Commissioning

# Commissioning



## Standards

- Standard 111-2008  
*Measurement, Testing, Adjusting and Balancing of Building Heating Ventilation and Air-Conditioning Systems*
- Standard 202P  
*Commissioning Process for Buildings and Systems*

# Commissioning



## Guidelines

- Guideline 0  
*The Commissioning Process*
- Guideline 0.2P  
*The Commissioning Process for Existing Systems and Assemblies*
- Guideline 1.1  
*HVAC&R Technical Requirements for the Commissioning Process*
- Guideline 1.2P  
*The Commissioning Process for Existing HVAC&R Systems*

# Commissioning

## Research

- 1274-RP *Field Performance Assessment of Package Equipment to Qualify the Benefits of Proper Service and Determine the Long Term Need for Monitoring, FDD and Continuous Commissioning Technology*



# Operations & Maintenance

# Operations & Maintenance

## Standards & Guidelines

- Standard 180-2008  
*Standard Practice for Inspection and Maintenance of Commercial-Building*
- Guideline 4  
*Preparation of Operating and Maintenance Documentation for Building Systems*
- Guideline 32P  
*Sustainable, High Performance Operations & Maintenance HVAC Systems*

# Operations & Maintenance

## Research

- 1515-RP *Thermal and Air Quality Acceptability in Buildings that Reduce Energy by Reducing Minimum Airflow from Overhead Diffusers*





# Measurement

# Measurement

## Standards & Guidelines

- Standard 105-2007  
*Standard Methods of Measuring and Expressing Building Energy Performance*
- Guideline 8-1994  
*Energy Cost Allocation for Multiple-Occupancy Residential Buildings*
- Guideline 14  
*Measurement of Energy and Demand Savings*

# Design Guidance

# Advanced Energy Design Guides

- Office Buildings
- Retail Buildings
- K-12
- Warehouses
- Highway Lodging
- Health Care

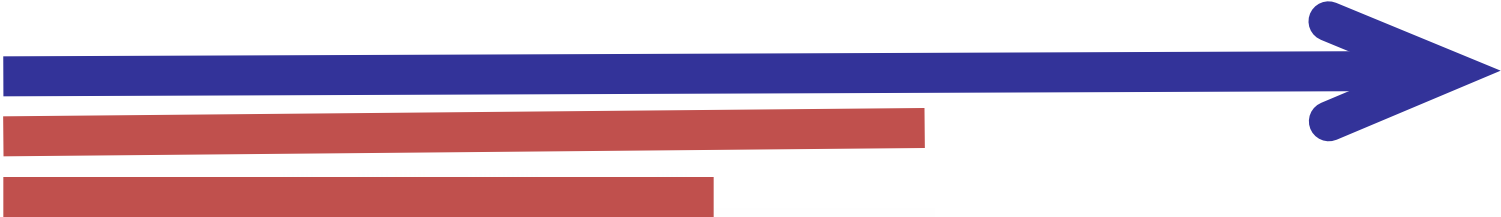


# Advanced Energy Design Guides

1999

2012

2015



Std  
90.1

30%  
AEDG

50%  
AEDG

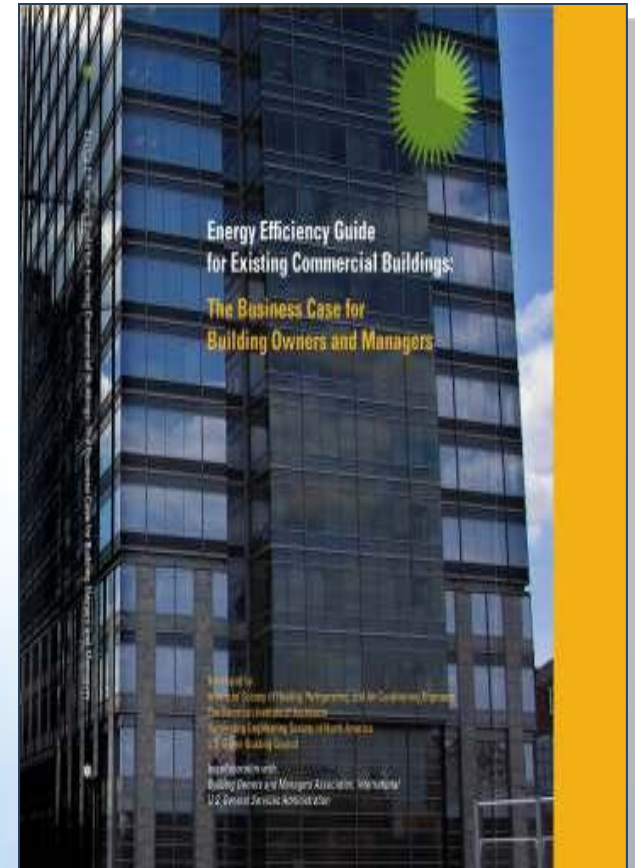
NZEB  
AEDG



# Existing Building Guidance

- Provides business case for energy improvements
- Demonstrates how to benchmark performance against comparable buildings
- Illustrates how energy use and cost can be reduced by up to 30 percent
- Developed with BOMA, AIA, USGBC, IES, GSA
- Follow up Technical Guidance due in June 2011

[www.ashrae.org/bookstore](http://www.ashrae.org/bookstore)



# Indoor Environmental Quality

- *The Indoor Air Quality Guide: Best Practices for Design, Construction and Commissioning*
- Practical guidance on achieving good IAQ in commercial buildings
- Joint effort of ASHRAE, AIA, BOMA, US EPA, SMACNA, USGBC

[www.ashrae.org/publications/page/1936](http://www.ashrae.org/publications/page/1936)



# Datacom Series

- Real-Time Energy Consumption Measurements in Data Centers
- Particulate and Gaseous Contamination in Datacom Environments
- High Density Data Centers – Case Studies and Best Practices
- Best Practices for Datacom facility Energy efficiency
- Structural and Vibration Guidelines for Datacom equipment Centers





# Datacom Series, Continued

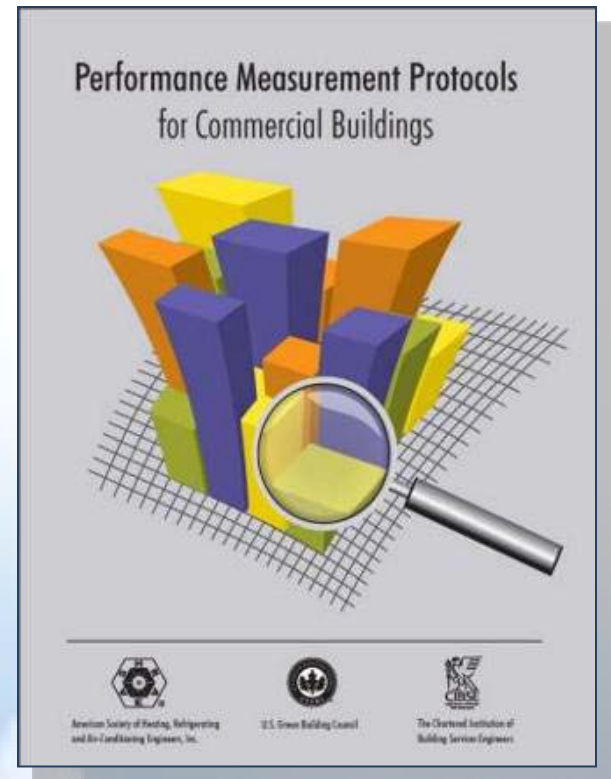
- Liquid Cooling Guidelines for Datacom Equipment Centers
- Design Considerations for Datacom Equipment Centers
- Datacom Equipment Power Trends and Cooling Applications
- Thermal Guidelines for Data Processing Environments
- Green Tips for Data Centers



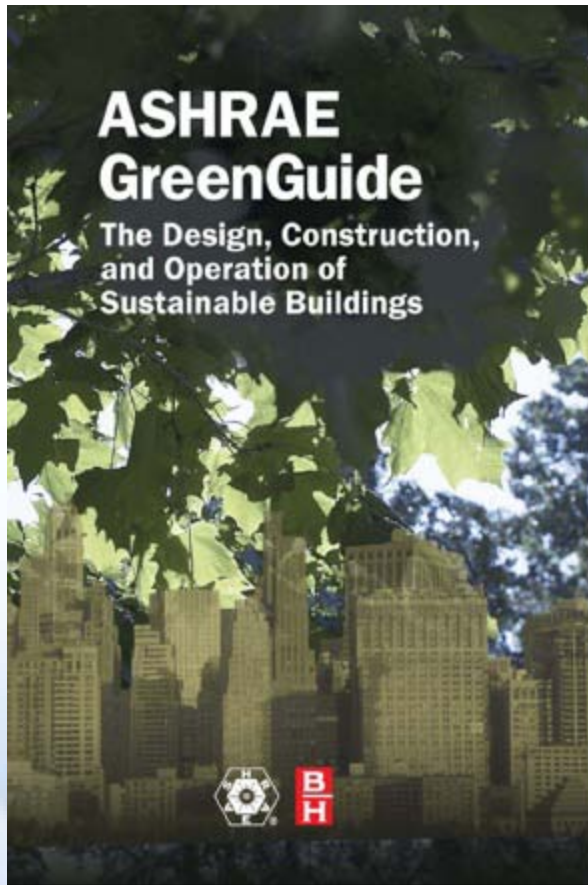
# Performance Measurement Protocols

- Addresses the what, how and when of measurement
- Protocols for six performance categories:
  - Energy
  - Water
  - Thermal comfort
  - Indoor air quality
  - Lighting
  - Acoustics
- Companion book focusing on best practices due out in June 2011
- Developed with CIBSE and USGBC

***[www.ashrae.org/bookstore](http://www.ashrae.org/bookstore)***

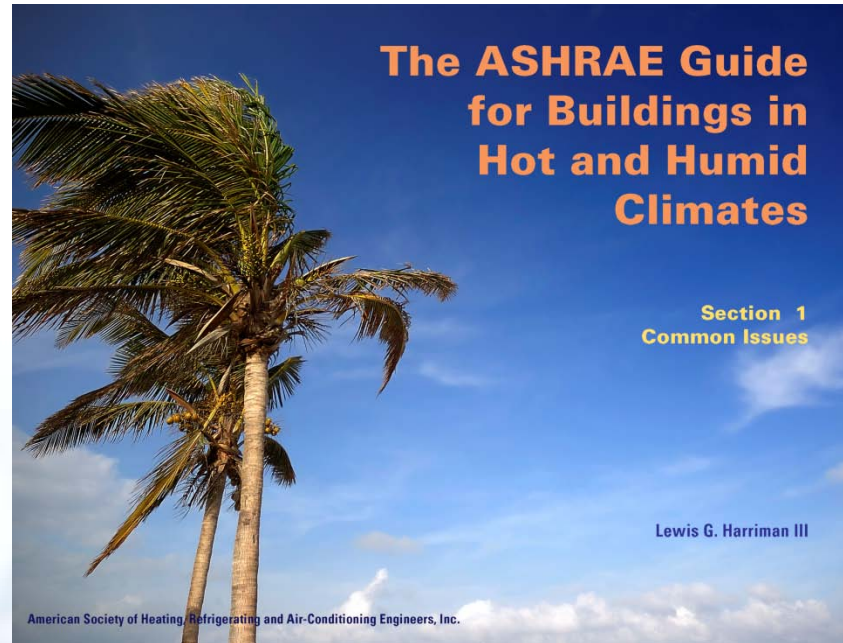


# ASHRAE GreenGuide



- Third Edition, Nov 2010
- Step-by-step manual for the entire building lifecycle
- Sustainable master planning
- Teaming strategies
- Case studies, checklists, and other practical information

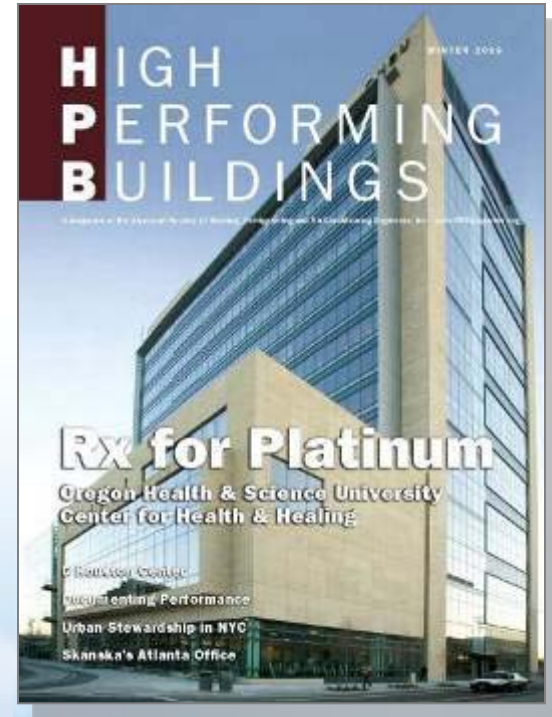
# Hot & Humid Design Guide



- Published 2009
- Second Edition

# Highlighting Innovative Technologies

- Cases studies featured provide performance data, verifying actual sustainability performance
- Free subscription for architects, building owners and facility managers
- [www.HPBmagazine.org](http://www.HPBmagazine.org)



# Design Guidance

## Research

- 1267-RP *Development of an ASHRAE Design Manual for District Heating and Cooling Systems*
- 13044-RP *Cleanroom Pressurization Strategy Update*
- 1353-RP *Stability and Accuracy of VAV Box Controls at Low Flows*
- 1353-RP *Stability and Accuracy of VAV Box Controls at Low Flows*
- 1385-RP *Development of Design Tools for Surface Water Heat Pump Systems (SWHP)*



# Design Guidance

## Research

- 1387-RP *Thermal Energy Storage Design for Emergency Cooling*
- 1397-RP *Experimental Investigation of Hospital Operating Room Air Distribution*
- 1415-RP *Thermal and Lighting Performance Metrics of Tubular Daylighting Devices*
- 1455-RP *Advanced Control Sequences for HVAC Systems – Phase I Air Distribution and Terminal Systems*



# Education & Training



# Education and Training

Seminars developed and delivered by subject matter experts

- Face-to-face
  - at ASHRAE and other industry meetings
  - at your chapter, for discounted rates

- Online

Self-paced courses

- eLearning
- Text-based



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# ASHRAE Resources on Existing Buildings

- Standards & Guidelines
- Research Projects
- Design Guidance
- Education

