

# Institute for Market Transformation

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

## Greening Building Codes

COG IGBG  
January 10, 2008

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# DC Greening Building Code

- DC's Green Building Act of 2006 requires the Mayor to “submit to the Council for approval construction code revisions that shall incorporate as many green building practices as practicable...”
- Amendments to the 2006 International Code Council model codes to be submitted to City Council by March 2008
- The Act also created a Green Building Advisory Council (GBAC)
- The DC Department of the Environment contracted with IMT and the Institute for Building Technology and Safety (IBTS) to work with the GBAC to identify best practices in green building code amendments

# Jurisdictions' Codes Reviewed

- Albuquerque, NM
- Boston, MA
- Boulder, CO
- Chicago, IL
- New York, NY
- Portland, OR
- San Antonio, TX
- San Francisco, CA
- Scottsdale, AZ
- Jurisdictions across the Washington region

# Removing Impediments to Greening Building

- Top Priority: Remove impediments to Greening Building
- We've identified surprising few impediments
  - Recommended amendment to make it easier to disconnect downspouts and retain rainwater on site
- Some impediments have been removed in the update to the 2006 ICC codes (e.g. waterless urinals and green piping)
- Many impediments are actually in zoning code – DC is separately seeking to green its zoning code
- Some impediments are the product of building officials misinterpretation of building codes
- We'd love to hear about other impediments

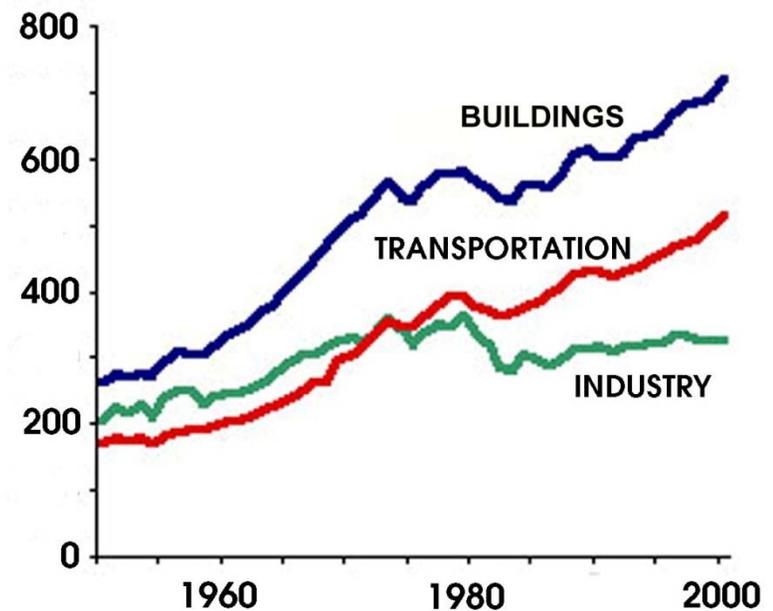
# Raising the Bar: Mandating Greener Practices

Amendments will likely mandate greener practices in a few key areas including:

- Water efficiency (e.g. low-flow fixtures)
- Reducing heat island effect with cool roofs or green roofs
- Energy efficiency

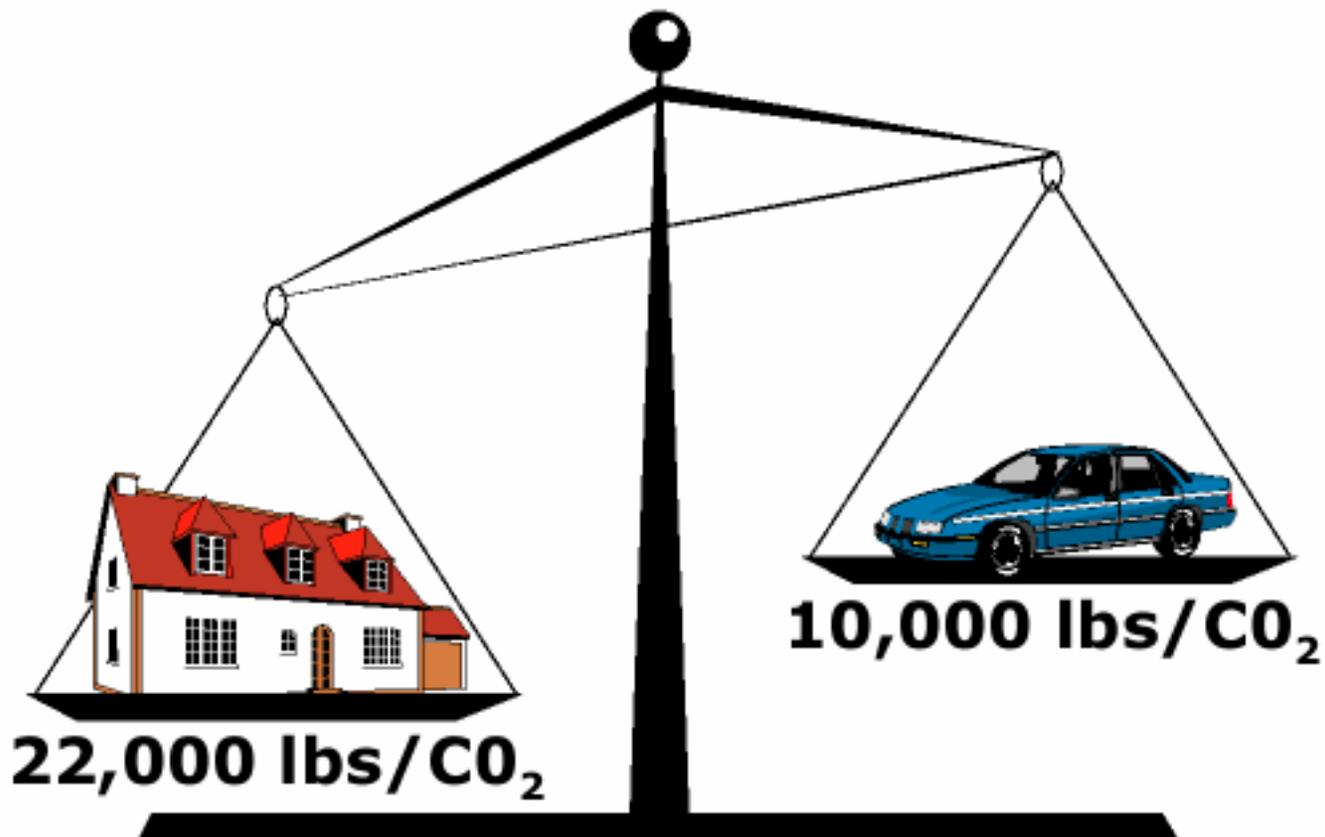
# The Case for Strengthening Energy Codes: Global Warming

- Energy codes are most powerful local weapon in the fight against global warming
- Majority of our electricity comes from burning coal
- Coal is worst fuel for causing
  - global warming
  - air pollution  
(23,600 US deaths annually)
- Buildings account for 40+% of greenhouse gases nationally and for about 75% in DC



**CO2 EMISSIONS by SECTOR**  
(Million Metric Tons of Carbon)

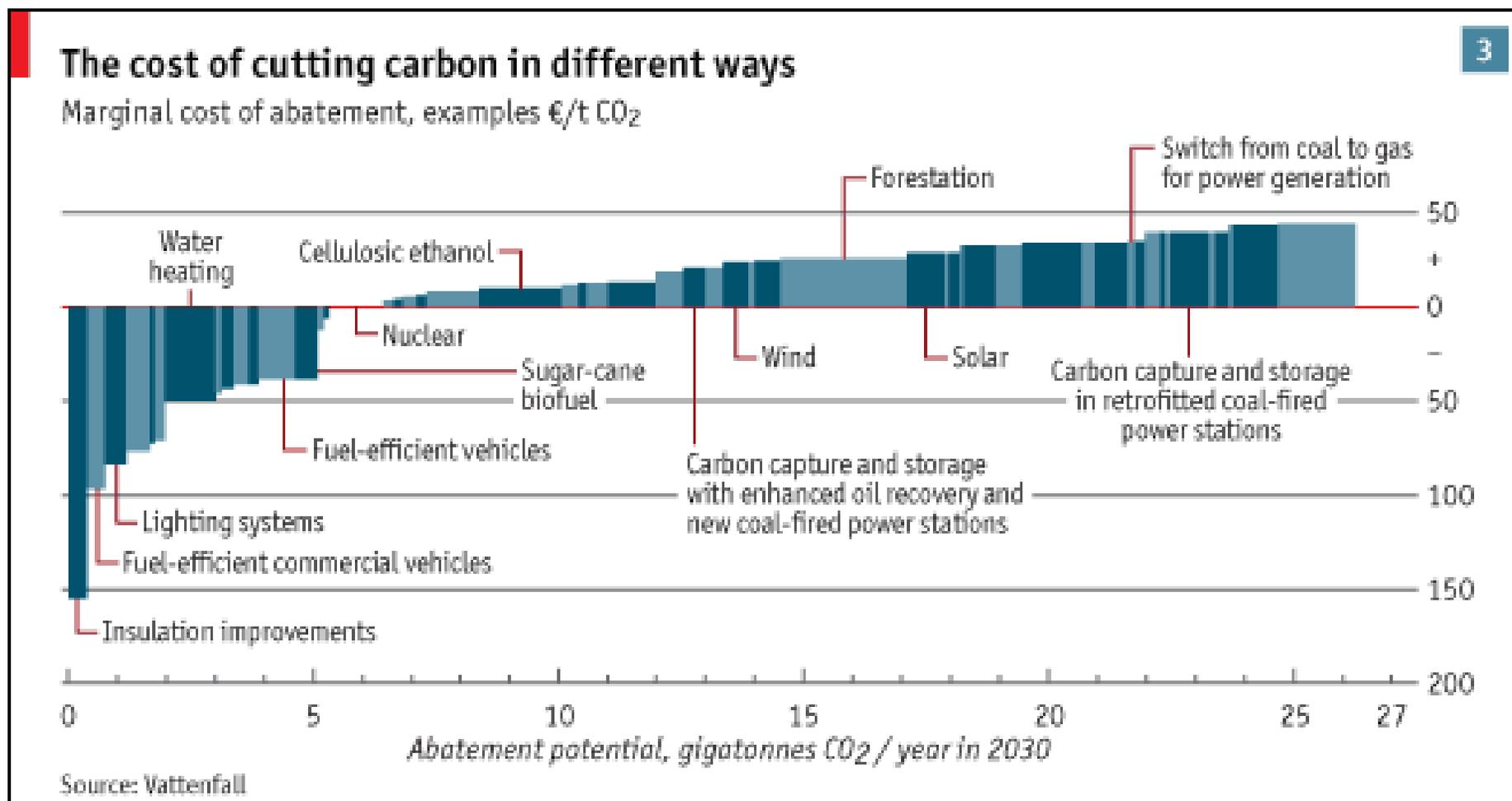
## Annual Carbon Dioxide Emissions from the Average House vs. the Average Car



Each year the average house releases over twice as much greenhouse gases as the typical car.

**Housing generates 20% of all U.S. CO<sub>2</sub> emissions**  
**Commercial buildings generate 18% of all US CO<sub>2</sub>**

# Energy Codes are Cost Effective



- Energy is local office buildings #1 operating expense at 30% of total
- Energy costs are particularly burde

# Washington's Proposed Commercial Energy Code

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## ASHRAE Standard 189's energy chapter

- Standard 189.1 is a model code that provides standards for high-performance, green buildings
- 189.1 applies to all buildings except low-rise residential buildings (same as ASHRAE Std 90.1)
- Second review draft due this week

*not a design guide, not a rating system*

# Sponsors and Project Committee 189.1

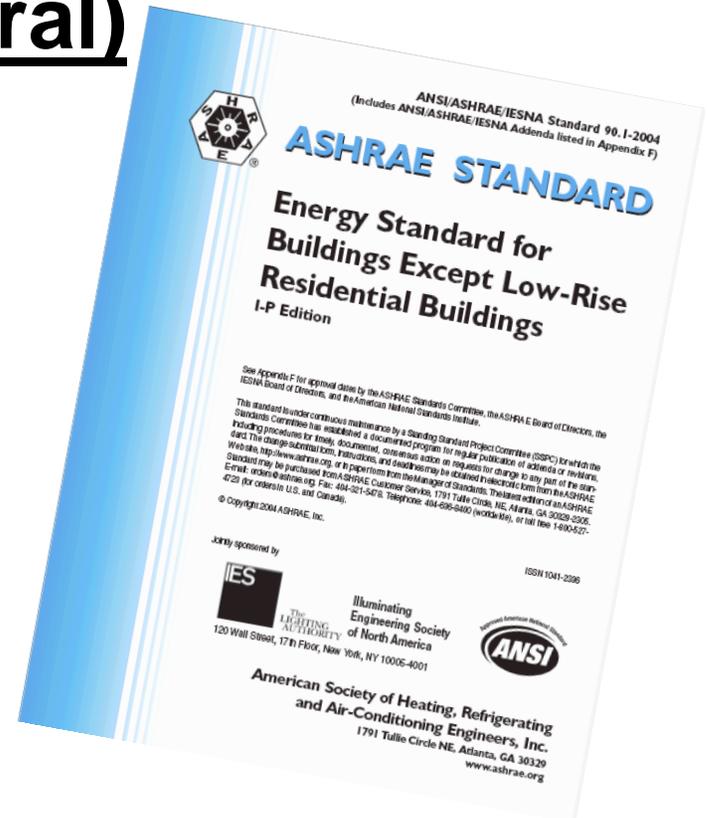
- Consensus process
- Sponsor and co-sponsors:
  - ASHRAE  
(American Society of Heating, Refrigeration and Air Conditioning Engineers),
  - USGBC (U.S. Green Building Council),
  - IESNA (Illuminating Engineering Society of North America)
- Project committee: 22 voting members



# Energy Efficiency

## Prescriptive Option (General)

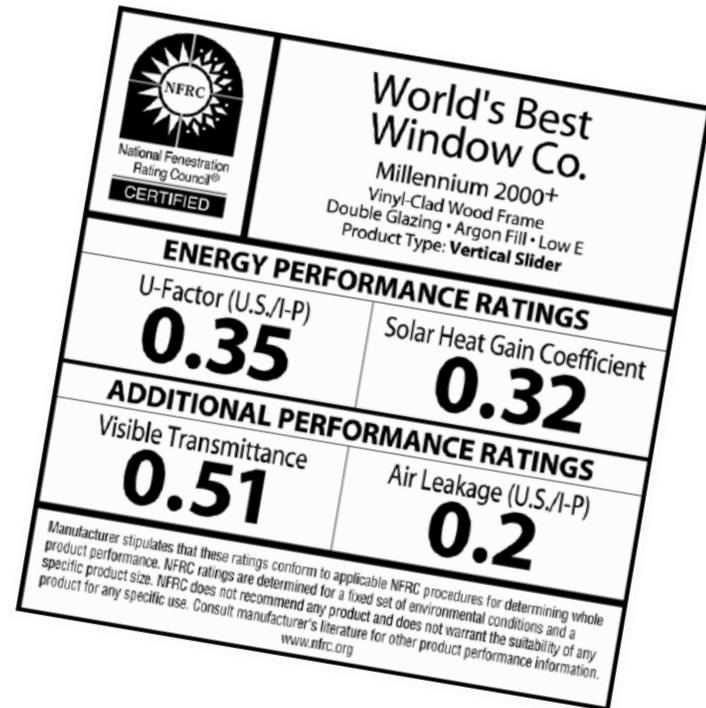
- ASHRAE/IESNA Standard 90.1-2007 plus...30% savings



# Energy Efficiency

## Prescriptive Option (Building Envelope) CZ-4 Washington, Maryland, Virginia

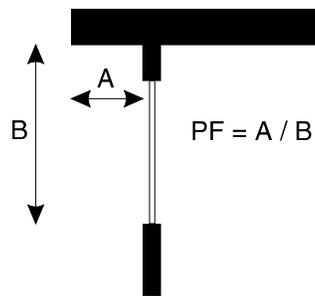
- **Roof insulation:** R-25 continuous,  
R-49 attic
- **Wall:** R-13 cavity + R-10 cont.  
R-11.4 mass wall
- **Fenestration assembly:**  
U-0.30 wood, vinyl,  
fiberglass frame  
U-0.40 curtainwall  
U-0.45 other metal  
SHGC-0.35



# Energy Efficiency

## Prescriptive Option (Building Envelope)

- Overhang:  $PF > 0.5$



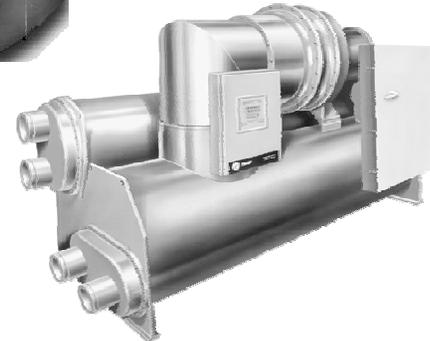
- Orientation:  
solar gain through  
east/west < north/south
- Continuous air barrier



# Energy Efficiency

## Prescriptive Option (Mechanical)

- Higher equipment efficiencies (CEE Tier II)
- More pipe/duct insulation
- Fan power to be 10% less
- Unoccupied hotel/motel rooms to have auto-shutoff



# Energy Efficiency

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## Prescriptive Option (Lighting)

- Interior lighting power to be 10% less
- Occupancy sensor controls
- Auto-controls for lighting in daylight zones



# Energy Efficiency

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## **Prescriptive Option (Other Equipment)**

- Energy Star equipment and appliances



# Energy Efficiency

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## Performance Option

Two criteria:

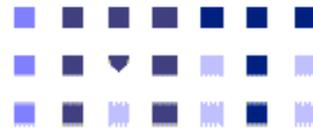
- Annual energy cost:  
proposed <  
mandatory plus prescriptive
- Annual carbon dioxide equivalent (CO<sub>2</sub>e):  
proposed < mandatory plus prescriptive



# National Model Energy Code

## The 30% Solution

- COG and local leaders should act now in support of strengthening the national model energy code – the 2009 International Energy Conservation Code (IECC) by at least 30% over the 2006 code
  - Support “The 30% Solution” submitted to ICC by the Energy Efficient Codes Coalition (EECC).
- Key opportunities for support
  - January 23-25 US Conference of Mayors meeting in Washington. 754 mayors have signed the U.S. Conference of Mayors’ Climate Protection Agreement
  - February 18 ICC committee meeting
  - September full ICC meeting in Minneapolis



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# Energy Efficiency

## Mandatory Provisions

- Metering: meters, meter data collection, and data storage and retrieval
- On-site renewable energy power systems with a peak electrical generating capacity of not less than 1.0% of the electrical service load



# Indoor Environmental Quality

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## Prescriptive Option

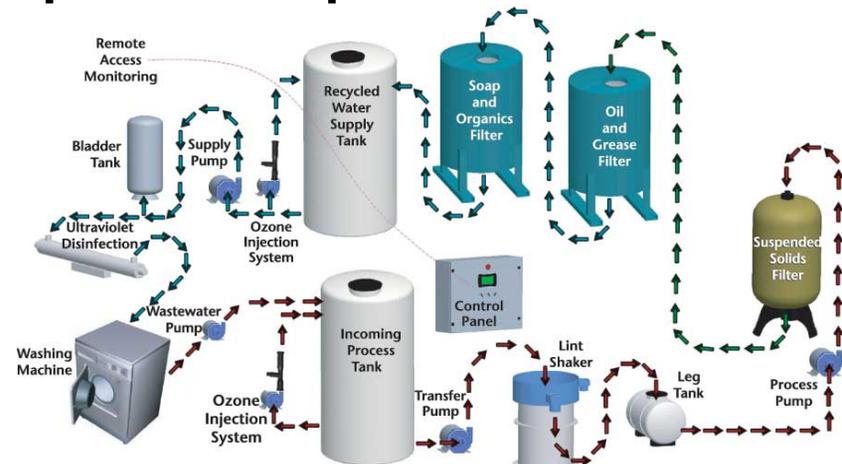
- Daylighting by sidelighting (office/class)
  - Minimum effective apertures
  - Minimum interior surface visible light reflectances
  - Minimum shading projection factors



# Water Use Efficiency

## Performance Option

- **Site water use reduction:**  
proposed potable water for irrigation  
< 35% of baseline evapotranspiration
- **Building water use:**  
proposed water use  
< mandatory  
plus prescriptive



# Indoor Environmental Quality

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## Prescriptive Option

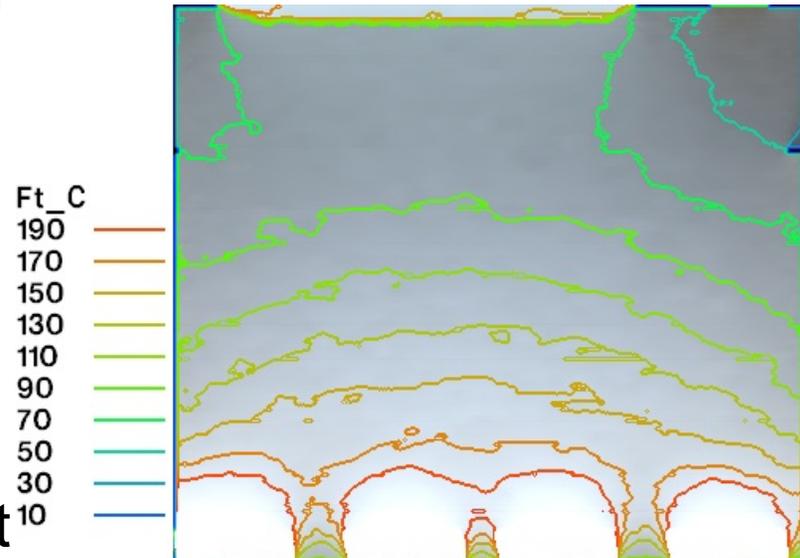
- Low emitting materials
  - Adhesives and sealants
  - Paints and coatings
  - Floor covering materials
  - Composite wood and agrifiber products



# Indoor Environmental Quality

## Performance Option

- Daylighting
  - Physical or computer model
  - All regularly occupied spaces
  - Minimum illuminance target 300 lux (30 fc) on work surfaces, 4.5 m (15 ft) from façade, noon equinox
  - Direct sunlight on workplane < 20% of occupied hours on equinox day

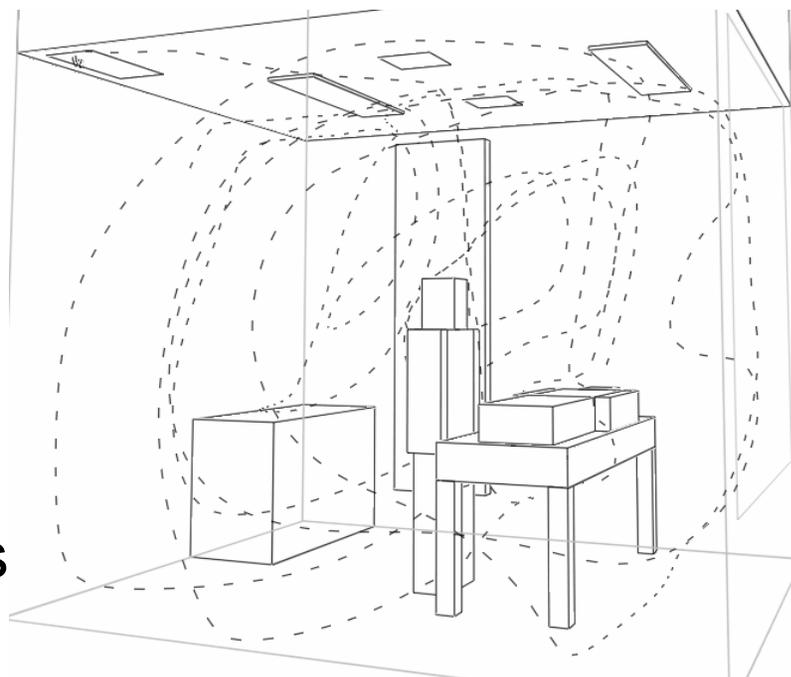


# Indoor Environmental Quality

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## Performance Option

- Low emitting materials
  - IAQ concentration model of all spaces
  - Materials testing in small scale environmental chambers
  - CDHS California Section 01350



# Construction and Operation

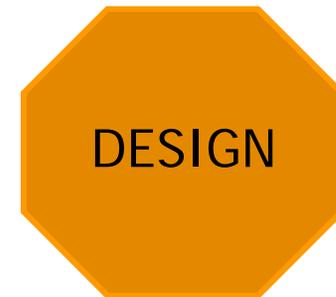
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## Mandatory Provisions

- M&V plan covers:
  - Tree and vegetation shading – within 5 years
  - Water consumption, using installed meters
  - Energy consumption, using installed meters
    - Applies to buildings above defined area thresholds
    - Either benchmark to CBECS data (top 8%) or
    - Calibrated energy simulation



VS



# Construction and Operation

## Mandatory Provisions

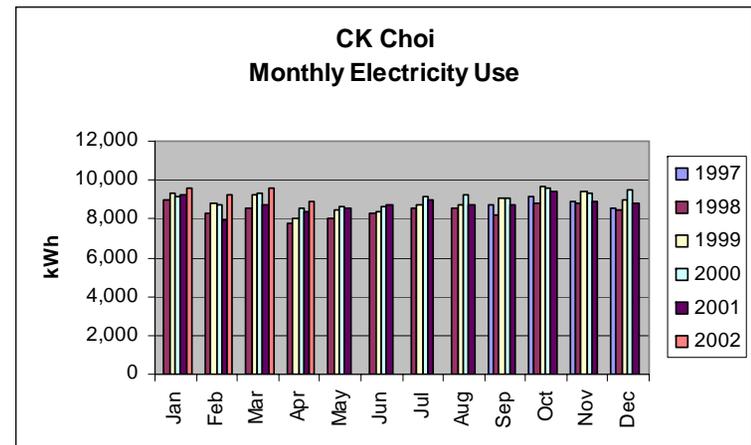
- Building Commissioning
  - Fundamental building commissioning > 500 m<sup>2</sup> (5000 ft<sup>2</sup>), or
  - Acceptance testing of HVAC and lighting, similar to CEC Nonresidential Compliance Manual
- Measurement and Verification Plan
  - Completed prior to 100% DD
  - Owner responsible for implementation



# Construction and Operation

## Mandatory Provisions

- M&V plan also covers:
  - Certification of lamp and ballast recycling
  - Verification/testing of air monitoring strategies
- EPA Energy Star Portfolio Manager:
  - Required reporting of energy consumption



# Construction and Operation

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## Mandatory Provisions

- Service Life Plan
  - Service life estimates for structural, building envelope, and hardscape materials that need to be replaced during the life of the building

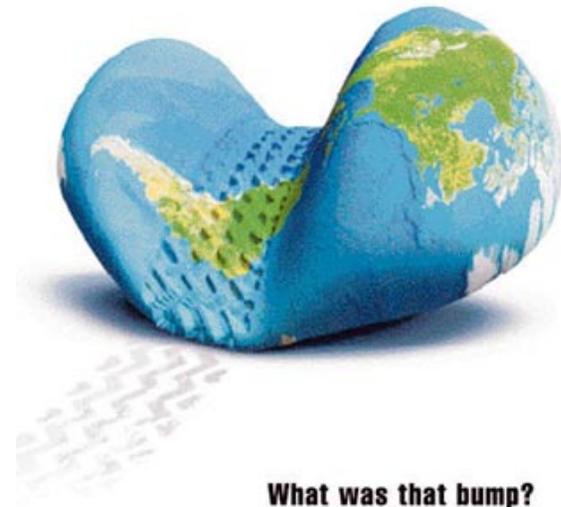


# Construction and Operation

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## Mandatory Provisions

- Transportation Management Plan
  - Target: 14% reduction in vehicle trips in 18 months
- Erosion and sediment control plan
  - Baseline: USEPA NPDES General Permit for Stormwater Discharges From Construction Activities



# Construction and Operation

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## Mandatory Provisions

- IAQ Management Plan
  - Cleanliness of HVAC air systems during construction
  - Post-construction “flush-out” or IAQ testing



## FURTHER INFORMATION

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- Information on ASHRAE standards:  
[www.ashrae.org](http://www.ashrae.org),  
*then follow “Standards”,  
includes listserv for Std 189.1*
- Information on USGBC programs:  
[www.usgbc.org](http://www.usgbc.org)
- Information on IESNA programs:  
[www.iesna.org](http://www.iesna.org)

# Goals for Standard 189.1

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- **Establish mandatory criteria in all topic areas:**
  - one “problem” with existing rating systems is that they contain few mandatory provisions
  - consequently, a designer can achieve “points” & claim that they have a “green building”, but still make **no** improvements in some areas
- **Provide simple compliance options:**
  - another critique of existing rating systems is the need for extensive calculations (e.g. energy)
- **Complement green building rating programs:**
  - Std 189.1 is **not** intended to compete with green building rating programs

# Challenges

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- Using normative (code) language
- Determining the stringency for a “minimum” standard
- Identifying standards or regulations to cite  
*(could not reference guidelines)*
- Prescribing universal strategies  
*(requirements for all, not a menu to choose from)*
- Coordinating with other U.S. National initiatives  
*U.S. Federal agencies Memo of Understanding,  
American Institute of Architects,  
National Conference of Mayors*
- Creating something that is enforceable by AHJs  
*(authority having jurisdiction)*

# **Indirect Impacts of Establishing Baselines**

- **Provides more certainty for manufacturing:**
  - manufacturers will provide the next-generation of products if there is a large-enough market for them
  - a program with a firm baseline provides this market (either regulatory like California for material emissions or voluntary like EnergyStar for windows)
- **Will have benefits for existing buildings:**
  - stores will stock better products as they become available (water-efficient, energy-efficient, low-emitting)
  - in Seattle, many stores sell paints that meet Calif. stds, all window products sold in large retail stores are EnergyStar (double-glass w/low-emissivity coating)
  - someone buying replacement windows can not buy a bad window even if they do not know about energy

# Development Process for Standard 189.1

- **June 2006:** Preliminary meeting
- **August 2006:** Review of 150 recommendations *including all 7 mandatory provisions (prerequisites) and all 69 optional credits in USGBC's LEED-NC program*
- **October, December 2006, January, March, April 2007:**  
2-day meetings to develop draft
- **May-July 2007:** First public review
- **August, October, December 2007:**  
2-day meetings to assess comments & revise
- **early 2008:** Second public review

# Potential Users for Standard 189.1

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- **Organizations with Green Building Rating Systems (USGBC, GBI):**  
incorporated as the baseline (prerequisite) in a green building rating system
- **Developers:** individual project
- **Corporations:** corporation buildings
- **Universities:** campus buildings
- **States/municipalities:** their own buildings
- **States/municipalities:** basis for incentives, such as zoning bonus for greater height
- **States/municipalities:** all private construction; may need to cite in multiple codes such as zoning, plumbing, energy, building

# Standard 189 Topic Areas

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- **Sustainable Sites**  
*(4 mandatory, 1 prescriptive/performance)*
- **Water Use Efficiency**  
*(3 mandatory, 2 prescriptive/performance)*
- **Energy Efficiency**  
*(4 mandatory, 1 prescriptive/performance)*
- **The Building's Impact on the Atmosphere, Materials and Resources**  
*(4 mandatory, 1 prescriptive/performance)*
- **Indoor Environmental Quality (IEQ)**  
*(7 mandatory, 2 prescriptive/performance)*
- **Construction and Operation Plans**  
*(9 mandatory, 0 prescriptive/performance)*

# Standard 189 Chapter Structure

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- x.1: Scope
- x.2: Compliance
- x.3: Mandatory  
(required for all projects)
- x.4: Prescriptive **option**  
(simple option, very few calculations)
- x.5: Performance **option**  
(more sophisticated, but more effort)

# Sustainable Sites

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## Mandatory Provisions

- **Heat island effect**

- Site hardscape:  
to be shaded, be SRI 29, or porous pavers
- Wall:  
to be shaded up to 20 feet above grade
- Roofs:  
to be SRI 78 (low-slope)/29 (steep-slope)  
or cool roof



# **Overview of ASHRAE/USGBC/IESNA Std 189.1P**

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Seattle, WA 98124-4019

**ASHRAE Winter Meeting  
New York City, 20 January 2008**

# Sustainable Sites

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## Mandatory Provisions

- **Reduction of light pollution**
  - Outdoor lighting trespass:  
limits on horizontal and vertical lux (footcandles)



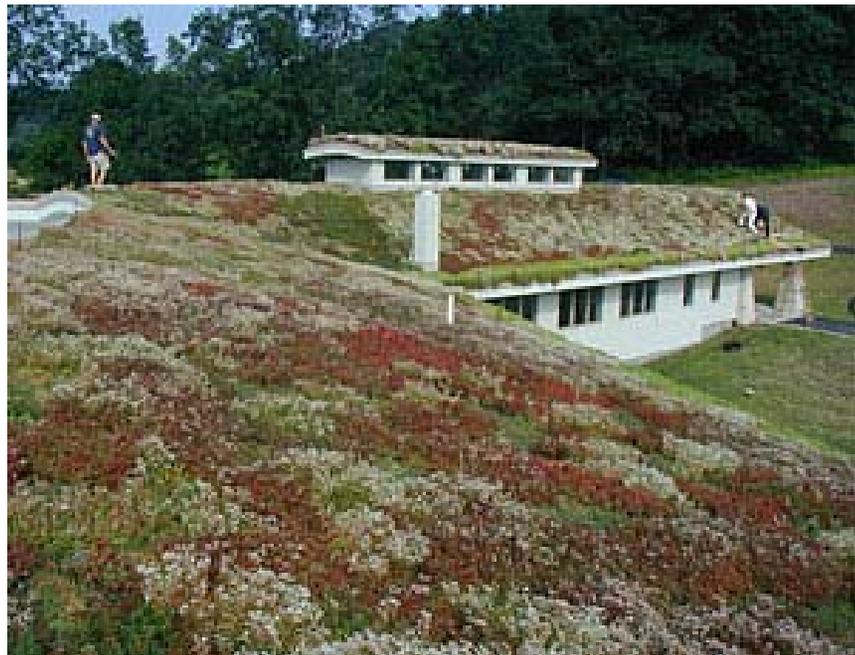
# Sustainable Sites

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## Prescriptive/Performance Options

- **Site development**

- All sites:  
Min. 40% of area  
to be effective  
pervious surface  
(vegetation, green  
roof, porous pavers)
- Greenfield sites:  
Min. 20% of area to be native or adapted plants



# Water Use Efficiency

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## Mandatory Provisions

- **Site water use:** bio-diverse plantings, hydrozoning, & smart irrigation controllers



# Water Use Efficiency

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## Mandatory Provisions

- **Building water use:** plumbing fixtures & fittings, appliances, HVAC systems & equipment, generally 20% lower than U.S. EPA Act
- **Metering:** meters, meter data collection, data storage & retrieval

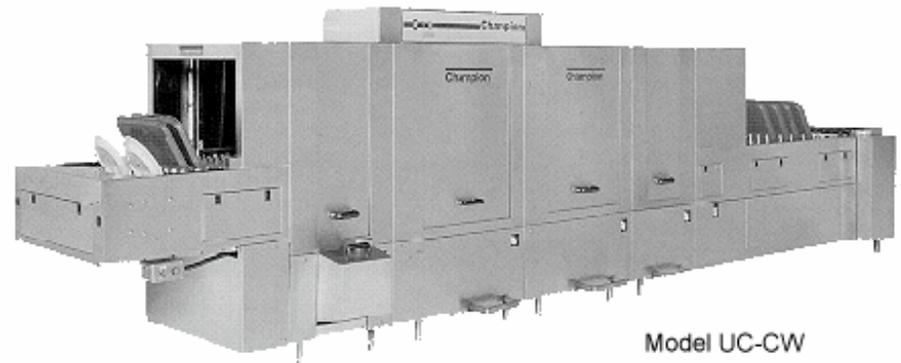


# Water Use Efficiency

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## Prescriptive Option

- **Site water use:**  
1/3 max. of improved landscape irrigated with potable water
- **Building water use reduction:** efficient comm. food service and laboratories
- **Special water features:** fountain water to be from alternate source or reclaimed



# Indoor Environmental Quality

## Mandatory Provisions

- Ventilation rates
  - Per ASHRAE Std. 62.1
  - 1.3 X ASHRAE 62.1 for offices and classrooms
- No smoking inside building

