Commercial Building Energy Alliances: Public-Private Partnerships

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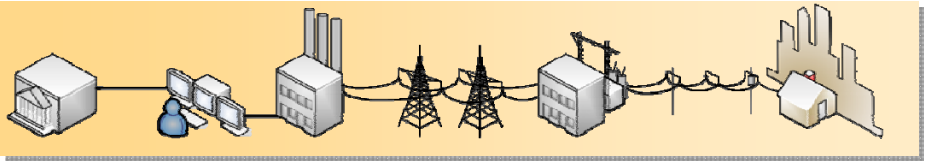
U S Department of Energy

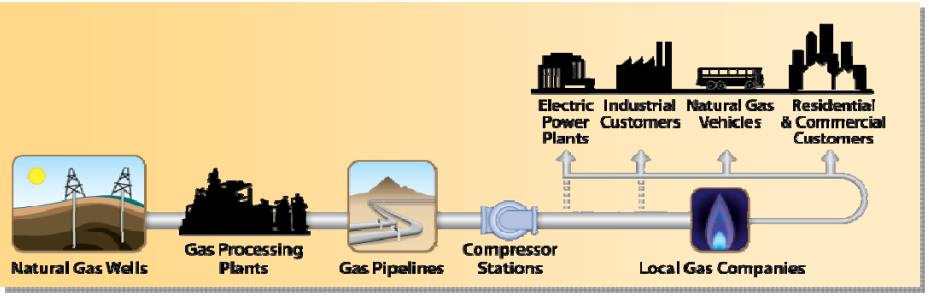
Why Is Buildings Energy Use Important?

Combined residential and commercial buildings sector is the U.S. largest energy consumer

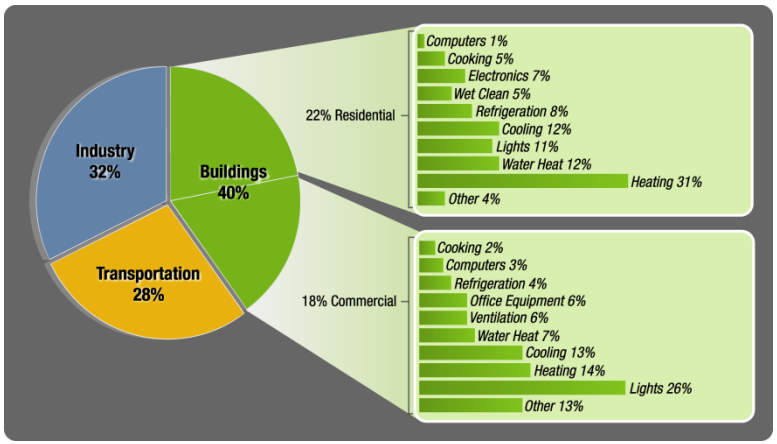
72% of U.S. Electricity



55% of U.S. Natural Gas

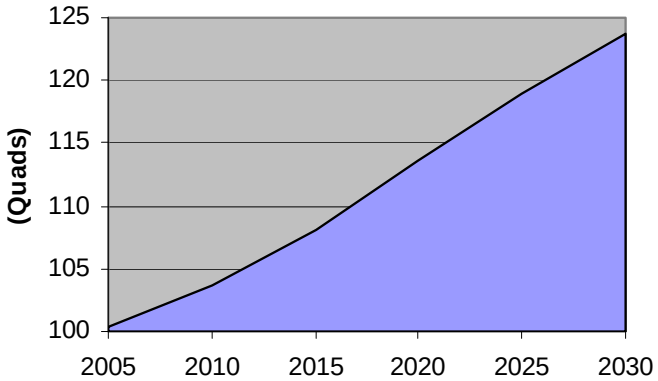


40% of U.S. Primary Energy Consumption



Source: 2007 Buildings Energy Data Book. Tables 1.1.3, 1.2.3, 1.3.3

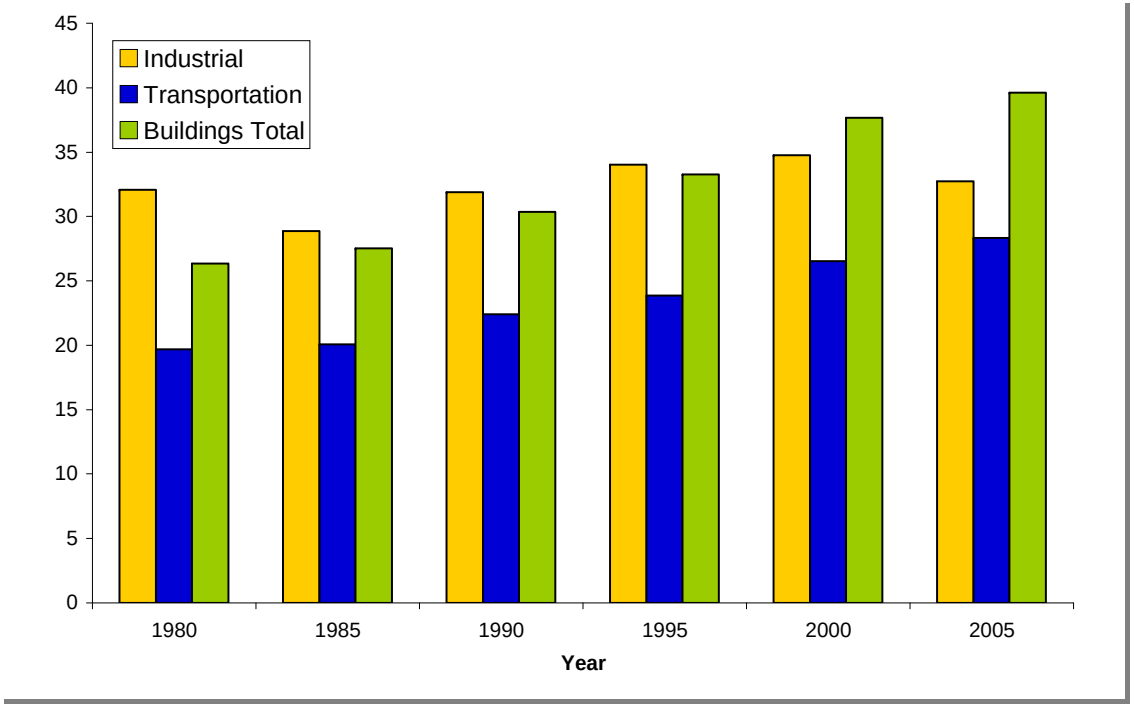
Total U.S. Energy Consumption



Source: 2008 EIA Annual Energy Outlook

Fastest Growing Energy Sector

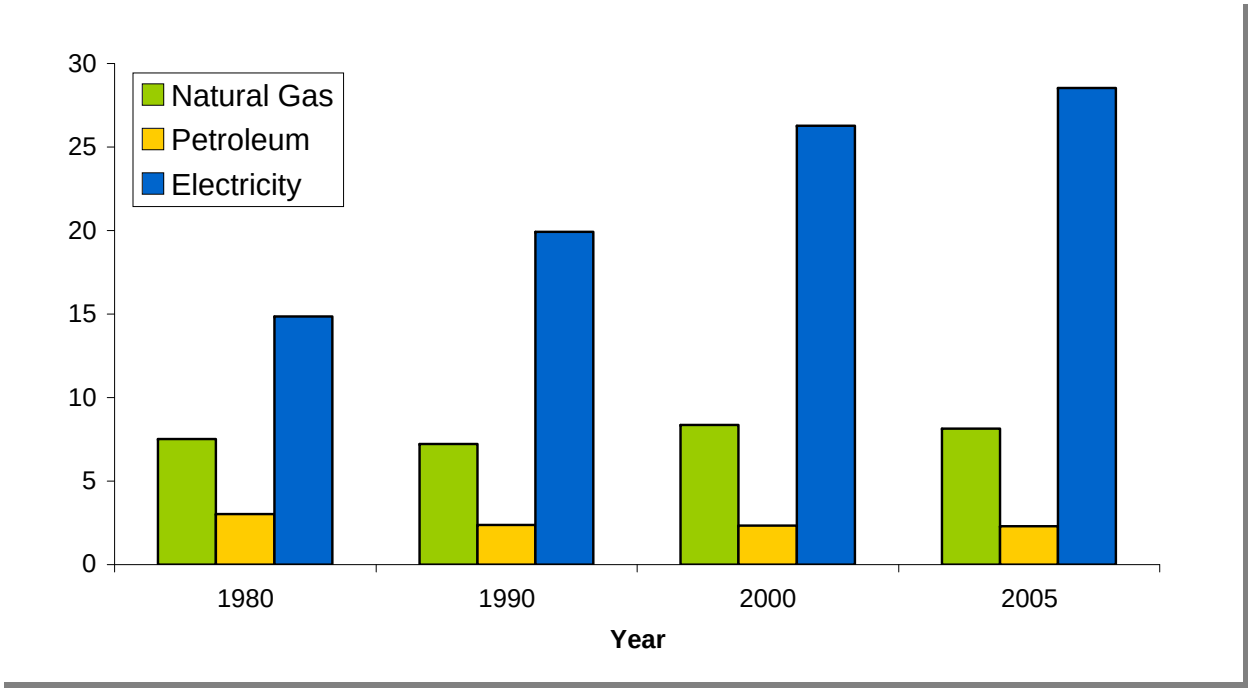
- Buildings sector energy consumption growing faster than any other sector.



Source: EIA Annual Energy Review, Tables 2.1b-2.1f., June 2007

Electricity Growing Source of Building Energy

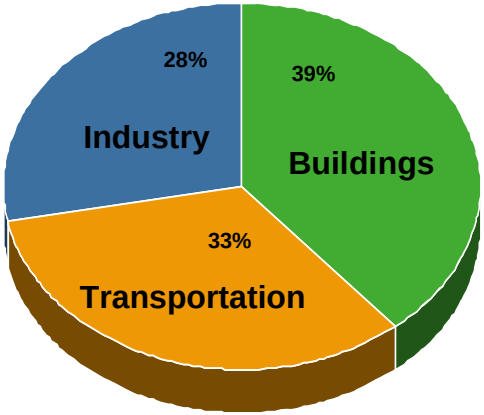
- Electricity increased from 56% of overall primary energy use in buildings in 1980 to 72% in 2005.



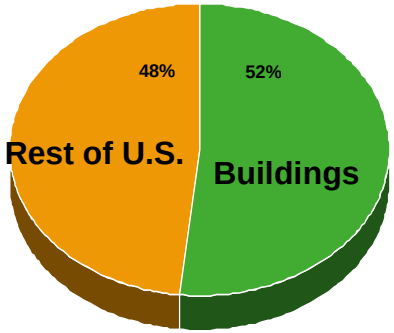
Source: 2007 BED, Tables 1.1.1

Buildings Environmental Footprint is Large

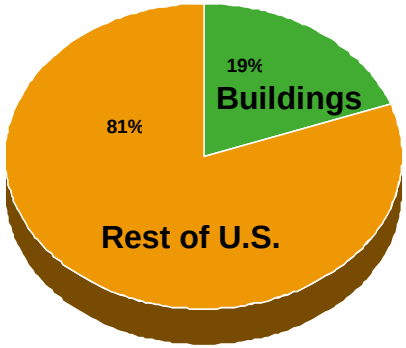
39% of U.S. CO_2 Emissions



52% of U.S. SO_2 Emissions



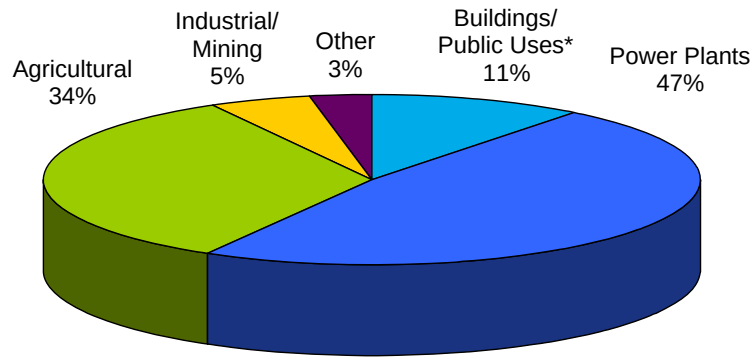
19% of U.S. NO_x Emissions



Source: 2007 BED, tables 3.1.1 and table 3.3.1; EIA

Buildings Consume Almost Half of U.S. Water

- Including electric generation, buildings account for 45% of U.S. water use
  - Excluding electricity, we use 100 gallons per day per person for domestic use.
  - Approximately 140 billion gallons of water per day is used to provide electricity to buildings.

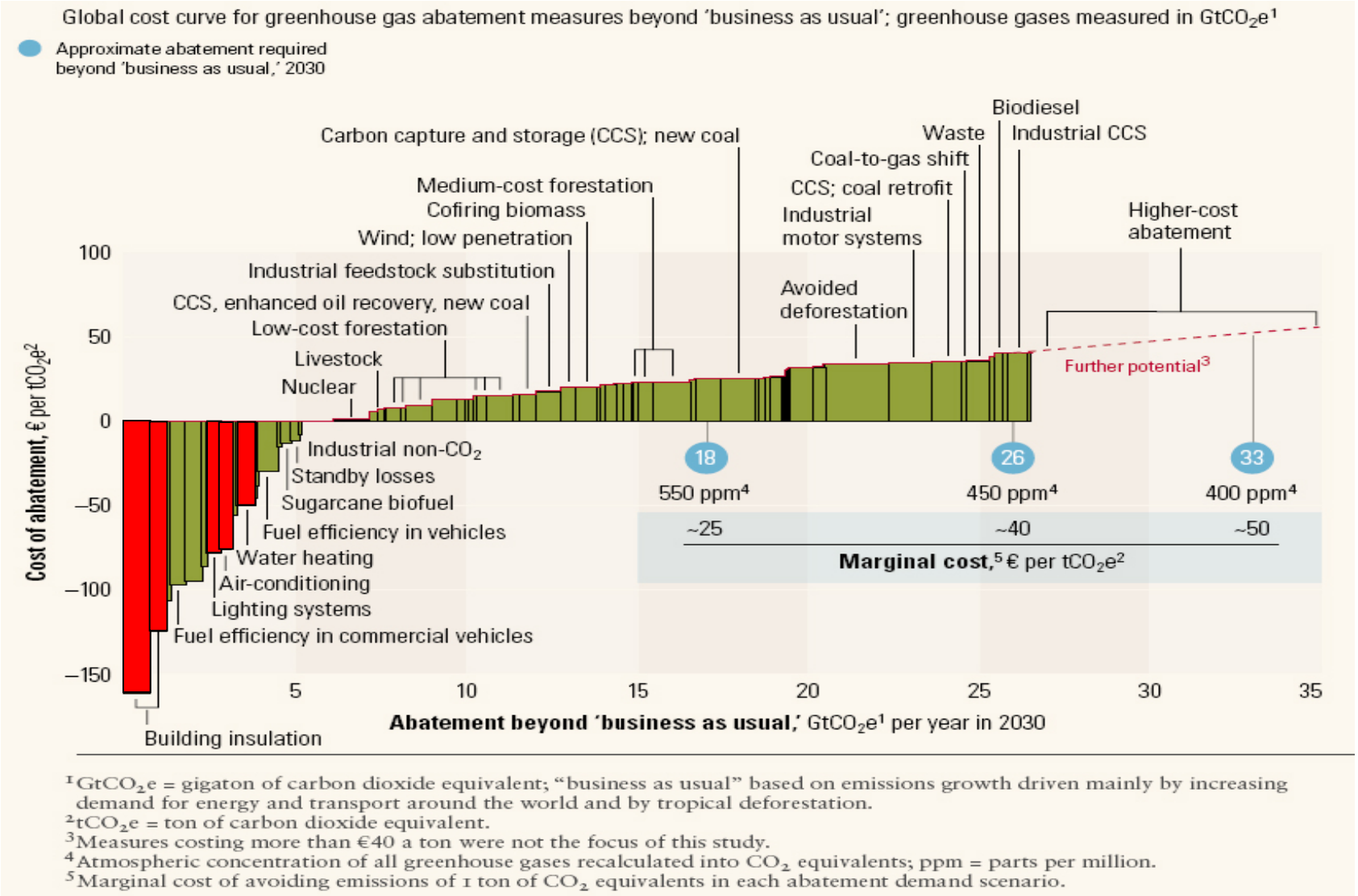


Total Water Use: 408 Billion Gallons per Day

*Does not include self-supplied water of approximately 4 billion gallons/day.

Source: Hutson, S.S., Barber, N.L., Kenny, J.F., Linsey, K.S., Lumia, D.S., and Maupin, M.A., 2004, Estimated use of water in the United States in 2000: Reston, Va., U.S. Geological Survey Circular 1268; www.epa.gov/WaterSense/water/save/use.htm

Low/No-Cost Carbon Reduction Options



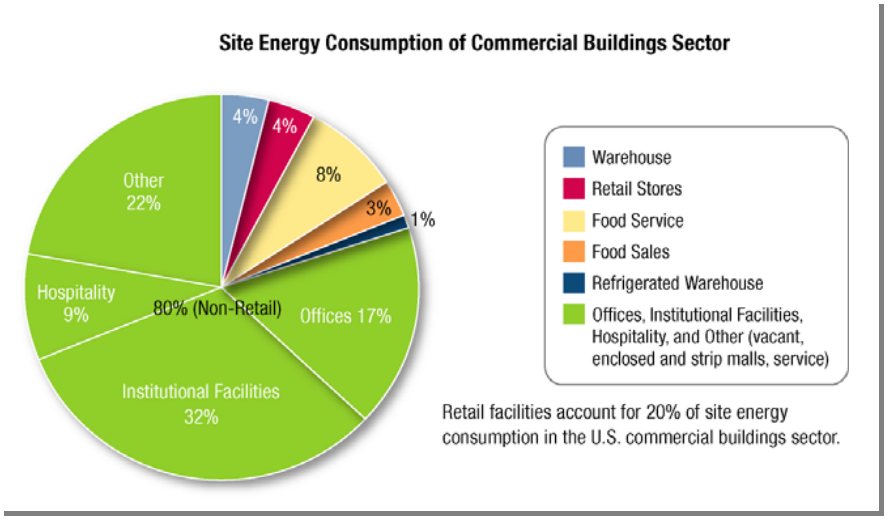
[1] $GtCO_2e$ = gigaton of carbon dioxide equivalent; "business as usual" based on emissions growth driven mainly by increasing demand for energy and transport around the world and by tropical deforestation.
[2] tCO_2e = ton of carbon dioxide equivalent.
[3] Measures costing more than €40 a ton were not the focus of this study.
[4] Atmospheric concentration of all greenhouse gases recalculated into CO_2 equivalents; ppm = parts per million.
[5] Marginal cost of avoiding emissions of 1 ton of CO_2 equivalents in each abatement demand scenario.

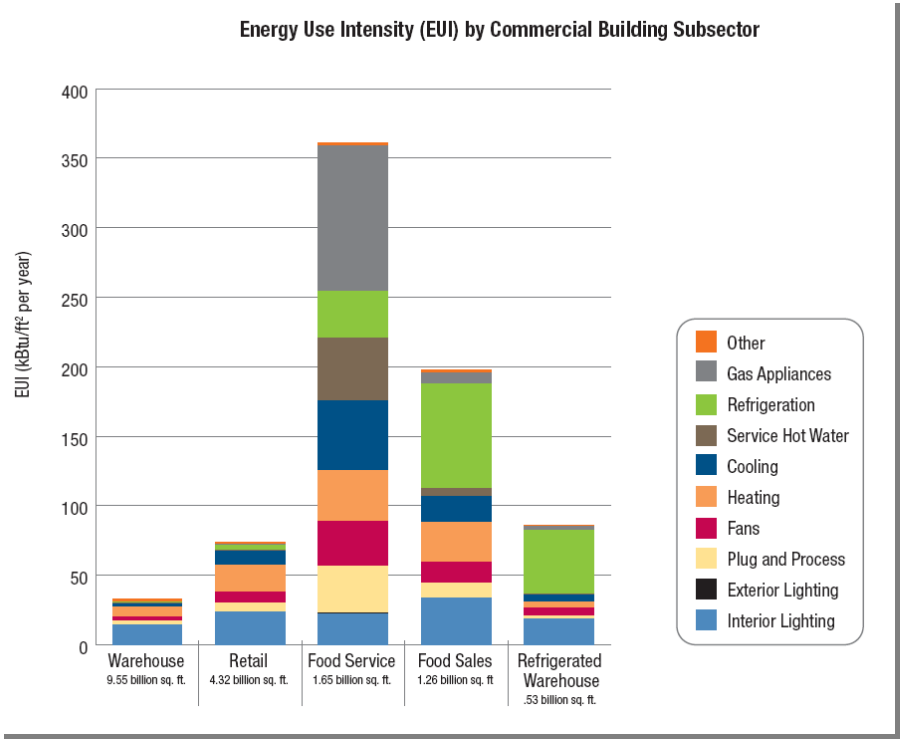
Source: McKinsey Global Institute, 2007

Business Case for Commercial Building Energy Efficiency

- Impacts last decades over the 50-100 year lifetime of building
- Most abundant, cost-effective and reliable source of energy
- Quickest, lowest cost, and lowest risk path to sustained reductions of greenhouse gas emissions
- Investment that reduces energy consumption mitigates future energy price risks
- Market-ready technologies are available today
- Reduces operating costs and boosts competitiveness
- Advanced, efficient technologies are creating new industries and jobs

The retail sector has the most immediate opportunity to realize efficiency savings





Tremendous opportunity to reduce energy intensity in commercial building subsector.

Restaurants and grocers have highest energy intensity per square foot.

Retailer Energy Alliance

- Independent consortium
- Tapping technical expertise of DOE and its National Laboratories.
- Information network for sharing best practices and ideas.
- Single voice for retail industry's needs for building energy technologies and services.
- Shaping Federal building R&D to address business needs.
- Sets the example in energy efficiency for our country's businesses, communities, and public institutions.
- Established last year and launched with a Retailer Roundtable in February 2008.
- Held a Supplier Summit in June 2008
- buildings.energy.gov/retailer

DOE's Role?

- Convene critical stakeholders to develop best practices, provide technical tools and training, and ensure openness.
- Collaborate with stakeholders on pilot projects of energy-saving technologies.
- Lead open verification process of results from pilot projects and technical tools.
- Provide a business case for using technologies and tools to communicate successes to internal and external audiences.
- Facilitate projects to bring energy-efficient technologies to market at a competitive price.

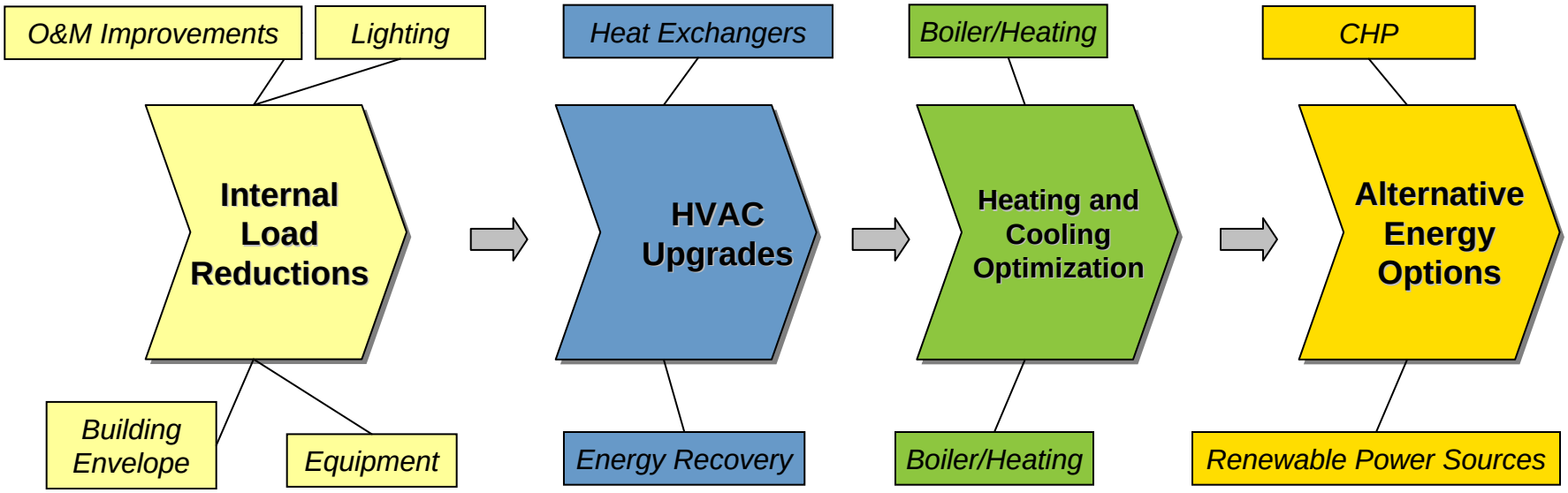
Retailer Energy Alliance

- **Mission:** Investigate, evaluate, and deploy technologies and systems that significantly improve energy efficiency of retail buildings using the retailer's business case.
- **Goals:**
  - Provide tools for retailers to tackle building energy efficiency challenges.
  - Reduce energy consumption in retail buildings, including retailers' $25 billion annual energy bill.
  - Speed market introduction of reliable, affordable, energy-saving technologies.
  - Minimize the impact of volatile energy prices on the bottom line.
  - Safeguard the reliability of energy delivery systems. Shape a future that supports energy security and economic opportunity for our nation.

REA: By Retailers, For Retailers

Retailers are increasingly aware of the importance of whole building integration

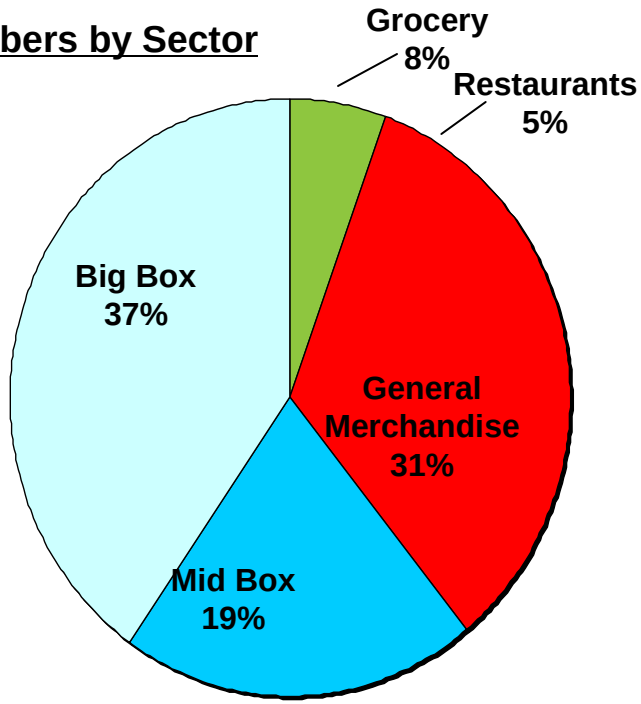
- Building systems are interdependent, and energy efficiency upgrades need to be considered together in sequence to:
  - Ensure building systems are right sized and optimally used
  - Avoid wasted improvement efforts and unnecessary expenses
- Improved building design and operation depend on the development and coordination of energy efficiency technologies across every major building system



Since launching in February, the Retailer Energy Alliance has grown dramatically

- Twenty five members
- Represents more than two billion square feet
- Market penetration of 14% (based on total square footage)
- $816 Billion in revenue
- 52,804 stores

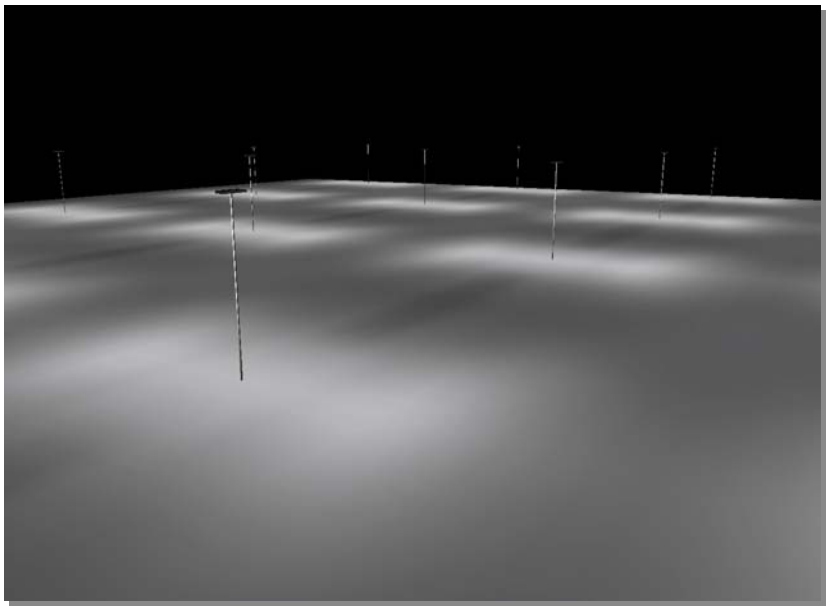
REA Members by Sector



Challenge Area: LED Outdoor Area (Parking Lot) Lighting

- Why LEDs make sense for retail parking lots
  - Save energy
    - Enhanced luminaire optical efficiency
    - Better total system efficacy (lumens per watt)
    - Control capability - dimming
  - Reduced maintenance costs
  - Improved uniformity
  - Environmentally friendly
- Timing
  - REA working group established in April 2008
  - Specifications completed by the end of 2008/early 2009

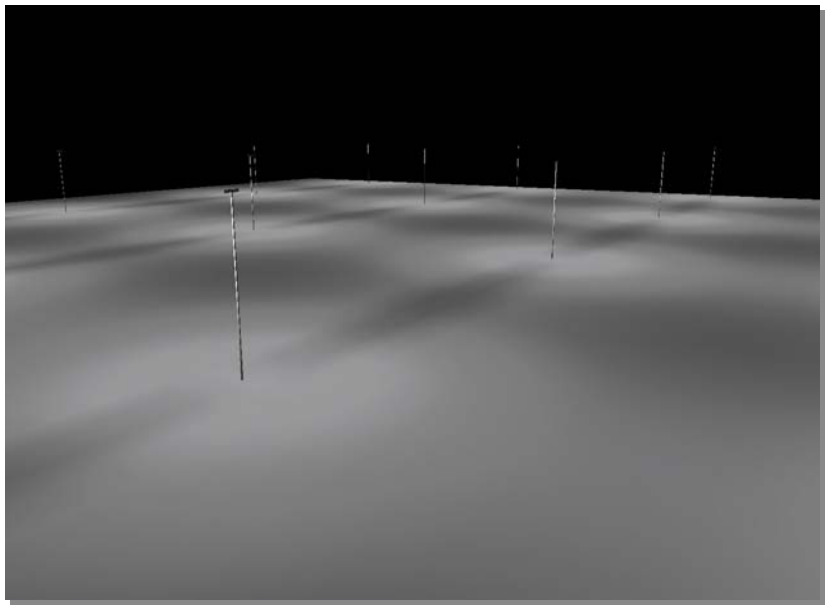
Metal Halide Parking Lot



Average: 3.5
Maximum: 9.0
Minimum: 0.9
Max : Min: 10.0

455W MH

LED Parking Lot



Average: 2.8
Maximum: 5.2
Minimum: 1.2
Max : Min: 4.3

218W LED

REA LED Parking Lot Lighting Working Group Activities

- Identify candidate luminaires and investigate field and laboratory performance, and life and reliability issues.
- Develop product specifications and evaluation procedures based on working group members' needs.
- Issue a Request for Proposals to LED outdoor lighting manufacturers to be released by participating REA members (or PNNL on their behalf).
- Maximize the sales of "selected" products.

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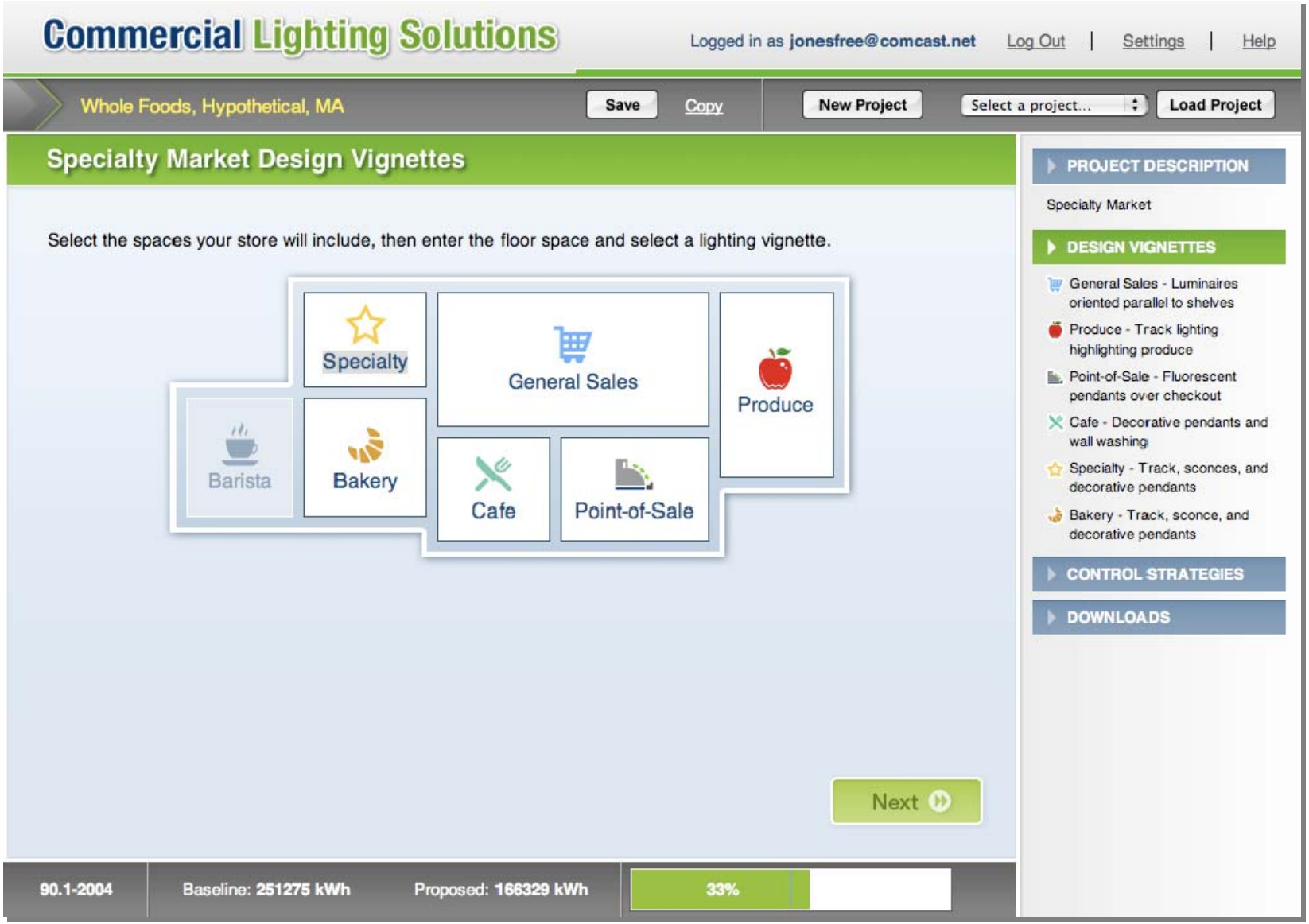
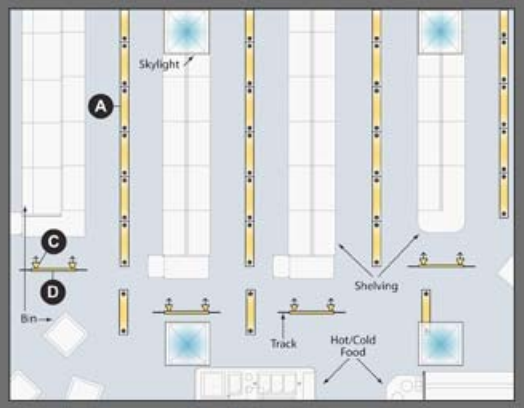
Introducing Commercial Lighting Solutions

- **Energy Savings Decision Tool.** Lighting solutions will be delivered via an interactive web tool and tied to an energy and economic analysis to support the decision process.
- **W/SF ⇒ kWh.** Energy savings quantified using kWh, will show savings against a series of common baselines (90.1-2004, 90.1-2001, Title 24, CBECS, etc.), and represents a way for utilities and EEPS to provide incentives for integrated systems using energy consumption rather than connected load.
- **Actionable Solutions.** Lighting solutions include detailed technical information in performance specification language, geared toward the A&E audience.


Commercial Lighting Solutions
Logged in as jonesfree@comcast.net
Log Out
Settings
Help
Whole Foods, Hypothetical, MA
Save
Copy
New Project
Select a project...
Load Project
Specialty Market Design Vignettes
Select the spaces your store will include, then enter the floor space and select a lighting vignette.
Specialty
General Sales
Produce
Barista
Bakery
Cafe
Point-of-Sale
Next
PROJECT DESCRIPTION
Specialty Market
DESIGN VIGNETTES
General Sales - Luminaires oriented parallel to shelves
Produce - Track lighting highlighting produce
Point-of-Sale - Fluorescent pendants over checkout
Cafe - Decorative pendants and wall washing
Specialty - Track, sconces, and decorative pendants
Bakery - Track, sconce, and decorative pendants
CONTROL STRATEGIES
DOWNLOADS
90.1-2004
Baseline: 251275 kWh
Proposed: 166329 kWh
33%

Luminaires oriented parallel to shelves

Perspective Diagram



Overhead Plan

Lighting Power Density: 1.68 W/ft^2

Concept | Strategy | Controls

Image: Lighting located parrallel to the gondolas provides product emphasis in a pleasing quality lighted atmosphere. In the main circulation paths, fluorescent pendants and track mounted uplight provide ambient lighting. Accent lighting is provided on specialty products and end caps. The store has high open ceilings with skylights and with merchandise displayed on standard to low height gondolas.

Electric Lighting: The pendant mounted lighting system running parallel to the gondolas and continuing in the main circulation aisle provides vertical light on products and uplight on the ceiling.The accent lighting track has an integral indirect light providing uplight on the ceiling. Accent lighting highlights specialty products and gondola end caps.

Daylighting: Toplighting is strongly recommended, and thus

LUMINAIRES

Pendant-mounted linear fluorescent direct/indirect fixture (82% downlight, 18% uplight) with diffuser. Minimum luminaire efficiency of 81%. Integral electronic 0-10V dimming ballast or programmed rapid-start ballast.

Pendant mounted linear fluorescent direct/indirect fixture (82% downlight, 18% uplight) with diffuser. Minimum luminaire efficiency of 81%. Integral electronic 0-10V dimming ballast or programmed rapid-start ballast.

Linear track/fixture combination with upper part linear fluorescent uplight (0% downlight, 100% uplight) and lower part 2 circuit track. Integral electronic programmed rapid-start ballast

Commercial Lighting Solutions—Next Steps

- Working with REA members to provide additional retail lighting solutions.
- Start developing office lighting solutions with Office of the Future project spearheaded by Southern California Edison.
- Pilot projects using lighting solutions, with measurement and verification.
- Work with utilities to design programs to incentivize integrated lighting systems, kWh-based rebates.

Where Next?

- **Commercial Building Energy Alliances**
  - **Retailer Energy Alliance**
    - General merchandise, grocery store, restaurant, and warehousing and distribution
  - **Commercial Real Estate Energy Alliance**
    - Office, shopping center, hospitality, medical office, GSA
    - Forming this summer
  - **Institutional Energy Alliances**
    - State and local government
    - **Hospitals (Hospital Energy Alliance)**
    - Colleges and Universities/K-12 Schools (EnergySmart Schools)
    - Federal government
    - Forming early next year
  - **Commercial Building Industry Energy Alliance**
    - Manufacturers, suppliers, designer community, utilities, ESCOs, finance
    - Forming early next year

- **National Accounts**
    - Challenging building owners/developers to build new buildings that use 50% less energy than 90.1-2004 and to retrofit existing buildings for 30% energy savings.

Thanks!

Building Alliances:

buildings.energy.gov/alliances.html

Retailer Energy Alliances:

buildings.energy.gov/retailer

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Team Lead, Commercial Buildings

Building Technologies Program

US Department of Energy

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