



U.S. Department of Energy  
**Energy Efficiency  
 and Renewable Energy**  
 Bringing you a prosperous future where energy  
 is clean, abundant, reliable, and affordable

## Market Analysis and Research Findings on Energy Efficiency Potential in Office Buildings

CEE

January 16, 2007

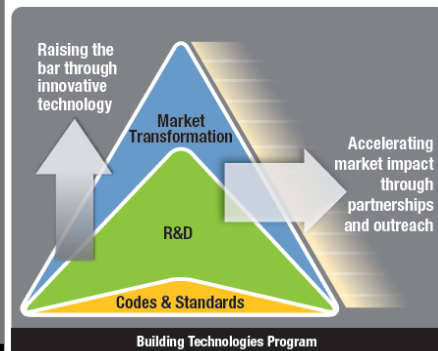
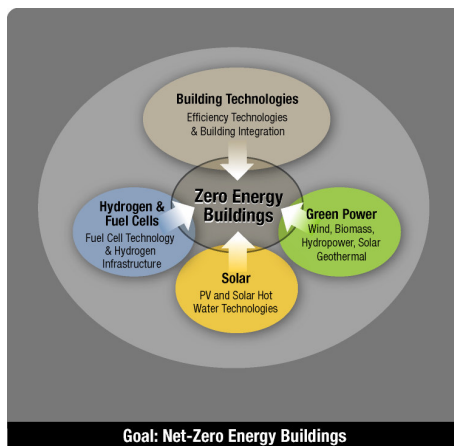
Mary Colvin

National Renewable Energy Laboratory on behalf of  
 DOE Building Technologies Program



U.S. Department of Energy  
**Energy Efficiency and Renewable Energy**  
 Bringing you a prosperous future where energy is clean, abundant, reliable, and affordable

## Building Technologies: Ultimate Goal

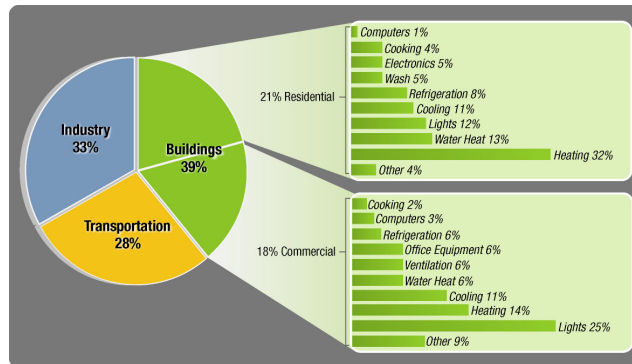




## Buildings = ENORMOUS Energy-Saving Opportunity

### Buildings consume 39% of total U.S. energy

- 71% of electricity
- 53% of natural gas (primary consumption)



Source: 2005 Building Energy Databook with remainder equal to SEDS adjustment.



## Who Plays and Who Decides

Report prepared for the DOE Office of Building  
Technologies Program by Innovologie, LLC.  
Issued March 2004

### Focuses on the Structure and Operation of the Commercial Building Market to identify:

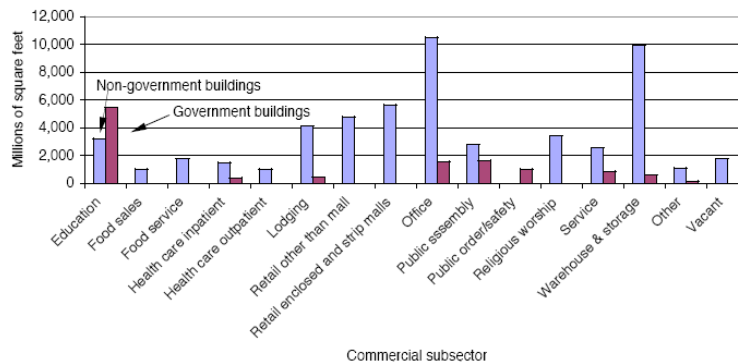
- Types and kinds of new construction in commercial area
- Number and size of players, including developers, owners, A&E firms
- Interactions between players
- Individuals who make decisions and influence trends
- Forces changing how buildings are being built
- Understanding differences among the various sub-markets



- 4.86 million Commercial buildings in the U.S. (based on 2003 data)
- Half of commercial buildings are less than 5,000 sqft.
- Approx. 70,000 new commercial buildings are added each year, primarily by:
  - Large-scale office
  - Malls
  - Chains or Franchises



### Offices are single largest building sector



Source: EIA, CBECS, 1999, Table B13



- 740,000 office buildings equaling 12 billion sqft. (1999 data)
  - 3 billion sqft is public office space
  - 6 billion sqft. is non-public owner-occupied
  - 3 billion sqft is commercial lease space
- 108 million square feet were built per year in the 1990's
- Top 50 Property managers manage 5 billion sqft.



**Top 5 Office Space Owners**

<u>Owner</u>	<u>M sqft</u>	<u>Market Share</u>
1) Equity Office Properties	124.6	4.3%
2) Hines	47.6	1.6%
3) LaSalle Investment Management	29.2	1.0%
4) Mack-Cali Realty Corp	28.8	1.0%
5) Duke Realty Corp	25.6	0.9%

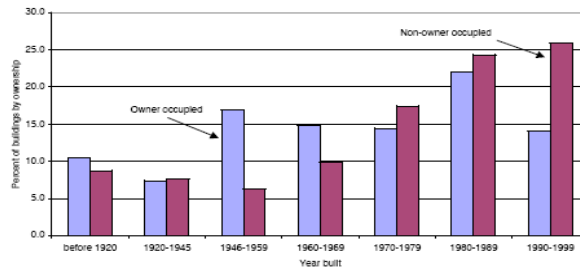
Based on 2002 data.

Source: National Real Estate Investor On-Line.



### 4 Common Office Building Structures:

- Owner occupies the building and pays the utility bills
- Owner does not occupy building but pays the utility bills
- Tenant pays the utility bills
- Property Management company operates the building but does not pay the utility bills



Source: EIA, CBECES public use sample, 1999 as analyzed by Innovio, LLC



### Trends

- **Buildings are not occupied or operated by owner**
- **Telecommuting**
- **Increases in electronics**
  - 5 times more computers are purchased a year than any other appliance
  - Top two are Dell who makes up approx. 30% of the market and HP makes up 20%.



### Decision Priorities:

**First:** Health, Safety, and the Environment

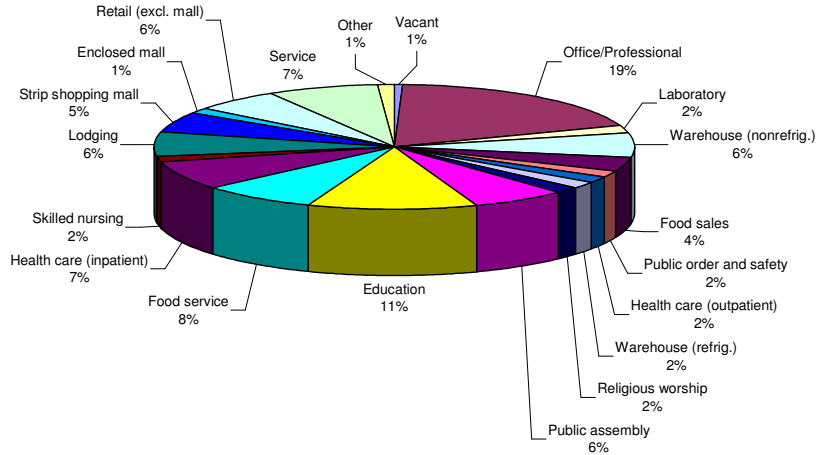
**Second:** Return on Investment

**Third:** Operational Efficiency

**Last:** Reliability, Energy, and Other



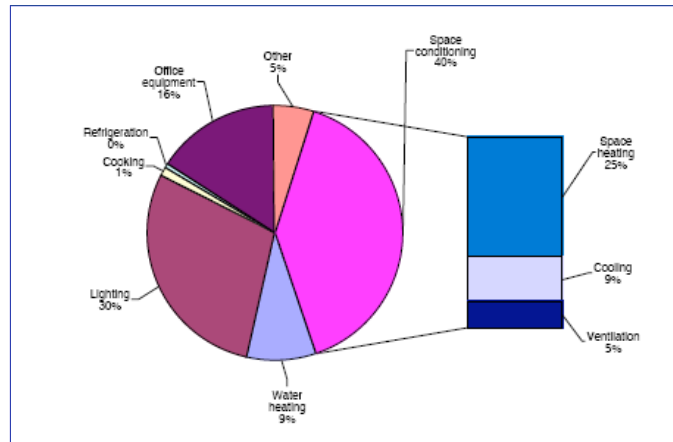
## Energy Use by Sector



**Percentage of energy use by subsector for all buildings  
(EIA 2002)**



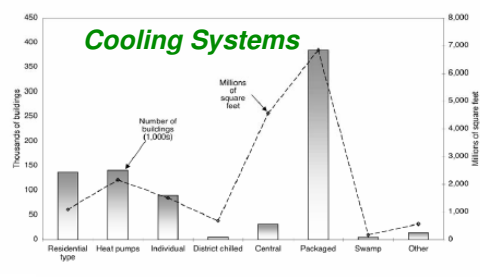
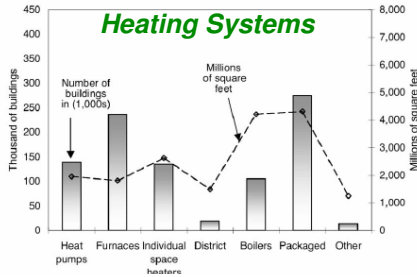
## Office Space: Energy Use Breakdown



**Space conditioning, lighting and office equipment make up 86% of the total load**



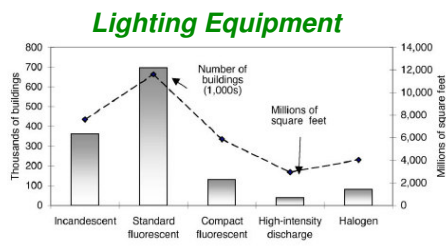
## Equipment Choices



Measure	Billions of square feet for buildings having the measure	Percent of total office square feet (12 billion)
Electronic ballasts	8.7	73
Economizer cycle	6.3	53
Variable air volume systems	6.0	50
Energy management systems	5.7	48
Multi-paned windows	5.8	48
Specular reflectors	5.0	42

Source: EIA, CBECs public use sample, 1999 as analyzed by Innovologie, LLC. Square footage is the square footage for buildings having the measure. Not all of the space in a building may have the measure.

EIA, CBECs Tables B34-B35; More than one type of air conditioning can exist in the same space. The sum of the values will exceed the number of buildings and the total square feet.



Source: EIA, CBECs 1999 Tables B36-B39



## Research Findings

- **Owners provide the main motivation for low-energy buildings**
- **Many decisions are not motivated by cost**
- **Establish benchmarks, metrics, and goals**
- **Buildings do not always perform as expected**
  - Information leads to better management and improved performance
- **Property Management companies are not energy focused**
- **Typical thinking is “run to failure” operation**





- **Daylighting**
  - Under utilized to date
  - Preliminary evidence indicates sales may increase with more natural light
- **Controls**
- **Monitoring**
- **Systems Integration**

Current Lighting data shows:

- 40% of commercial lighting electricity use is from T-12s
- 31% of commercial lighting electricity use is from incandescents



**Market Perspective: Who Plays and Who Decides**

**Technical Perspective: Case Studies on Six High Performance Buildings**  
**Lessons Learned from Case Studies**

**Advanced Energy Design Guide for Small Office Buildings**

<http://www.eere.energy.gov/buildings/>



U.S. Department of Energy  
**Energy Efficiency  
and Renewable Energy**  
Bringing you a prosperous future where energy  
is clean, abundant, reliable, and affordable

*Thank you*

Mary Colvin  
NREL Buildings Technology Manager  
[mary\\_colvin@nrel.gov](mailto:mary_colvin@nrel.gov)

Dru Crawley  
DOE Office of Building Technologies  
[Drury.Crawley@hq.doe.gov](mailto:Drury.Crawley@hq.doe.gov)

