



Commercial Building Energy Efficiency: Challenges and Opportunities for Improvement and the Role of Technicians

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BUILDING INTELLIGENCE GROUP LLC

- Independent consultants focused on high performance and intelligent commercial buildings.
- Work with developers, property managers and manufacturers on design and delivery of new and retrofit projects.
- Led research efforts for Laney College under NSF grants.
- See www.buildingintelligencegroup.com

Agenda

- Commercial building overview
- Energy use and efficiency
- Improving new construction
- Retrofitting existing buildings
- Roles for the technician
- Discussion

Report Summary

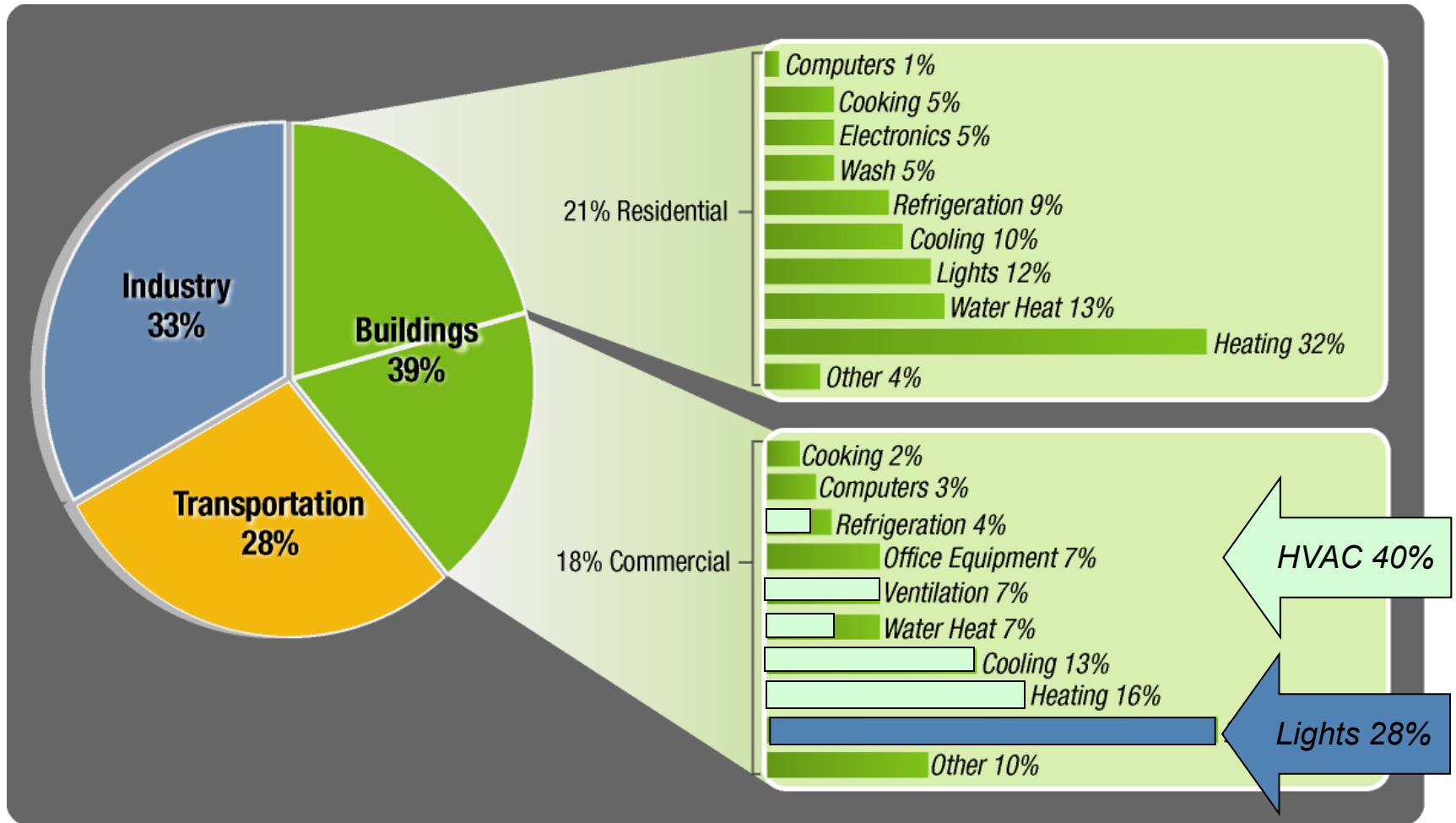
- Research
 - Interviews
 - Focus groups
 - Literature search
- Identified current state and needs
- Four case studies on specific sites
- See http://www.laney.edu/wp/environmental_control_tech/building_operations_report/

US Commercial Buildings

Existing buildings:	4.8 million
Floor space:	72 billion sq. ft.
Floor space per building:	Mean: 14,700 sq. ft. Median: 5,000 sq. ft.
Energy consumed:	6.5 trillion Btus



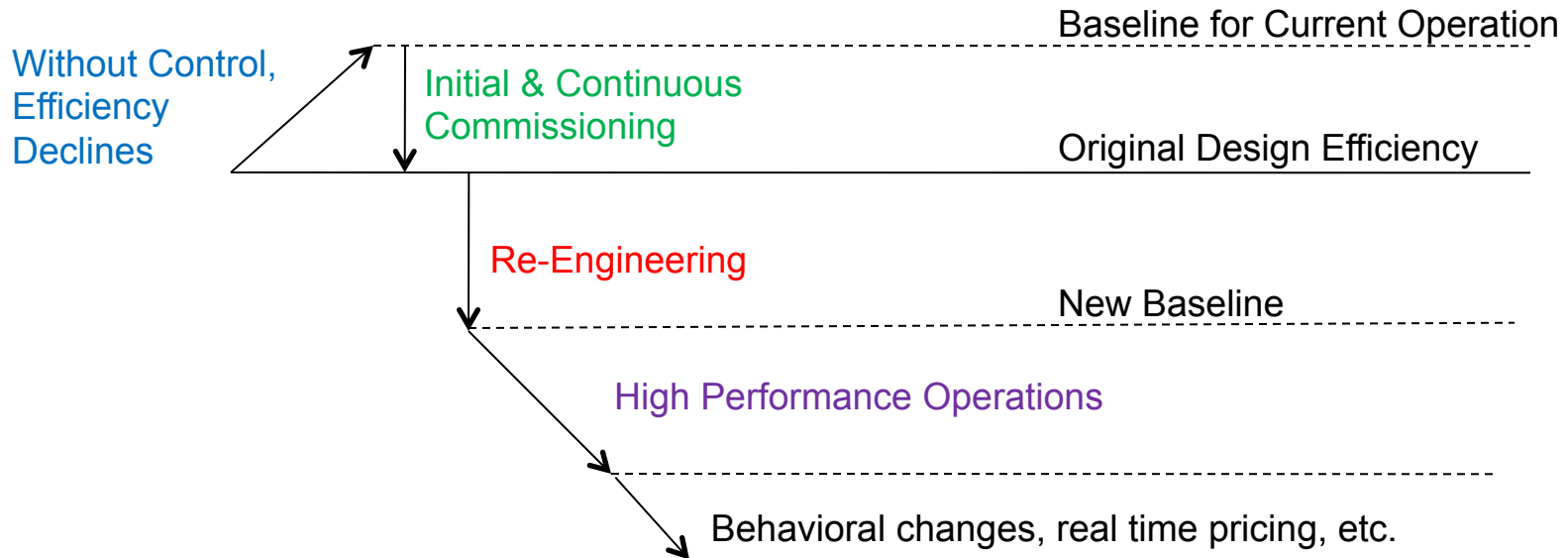
Where's Energy Used?



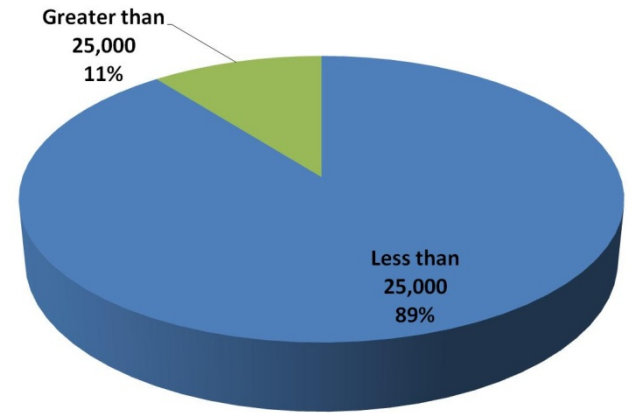
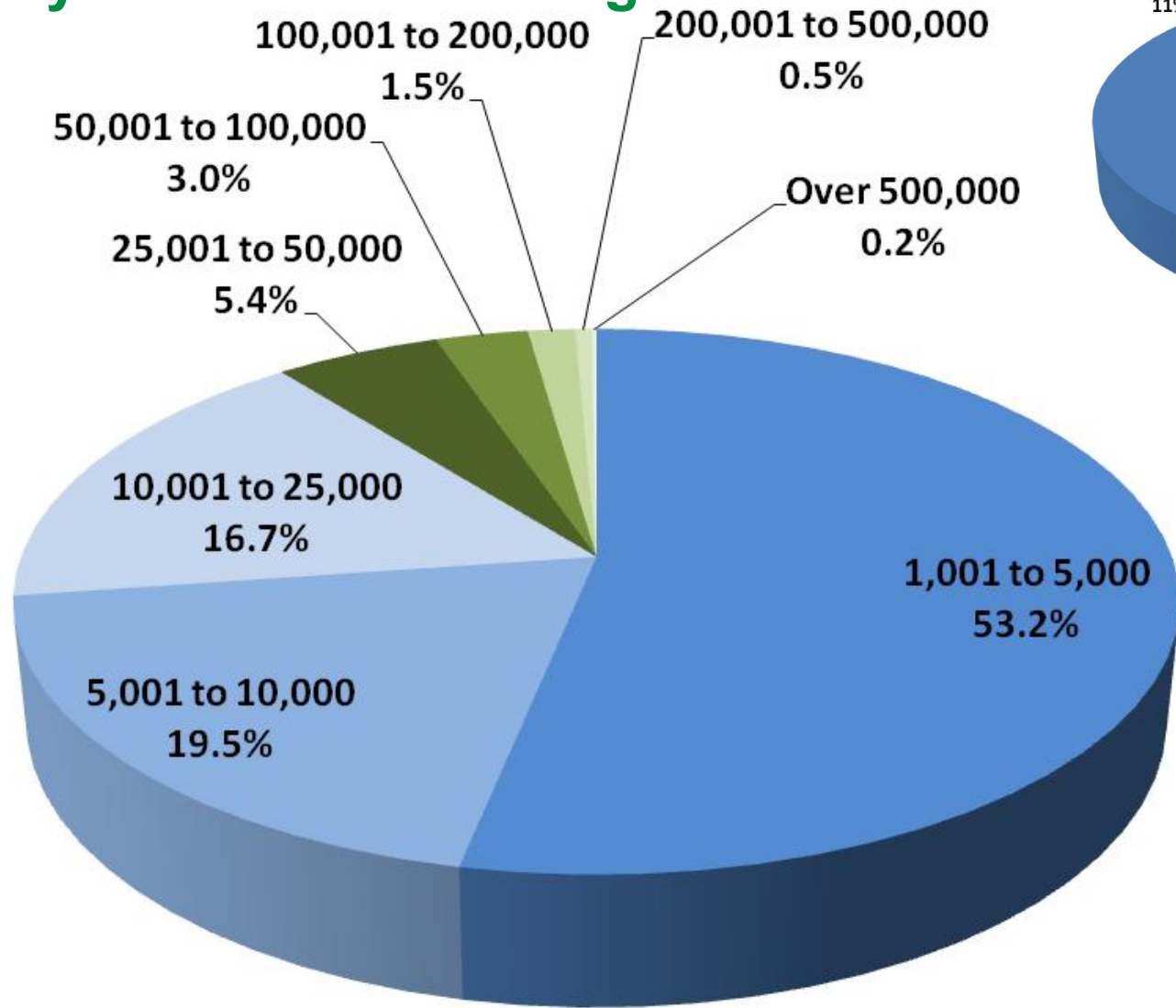
Commercial Buildings

- Wide range of ages and conditions
- Few are operating efficiently
- What owners and operators don't know
 - Efficiency and benchmarking
 - Design intent
 - Operating challenges
- Skeptical of investing in efficiency

Real World Challenges

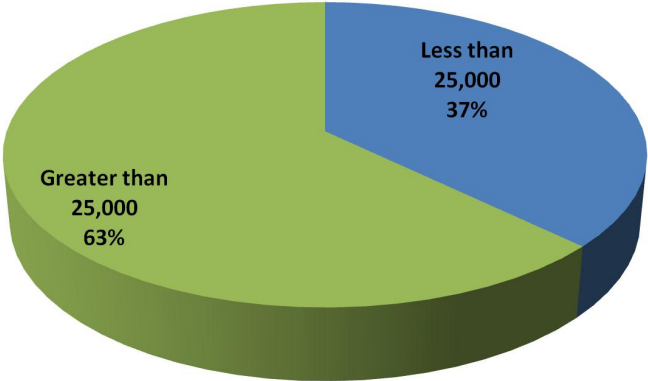
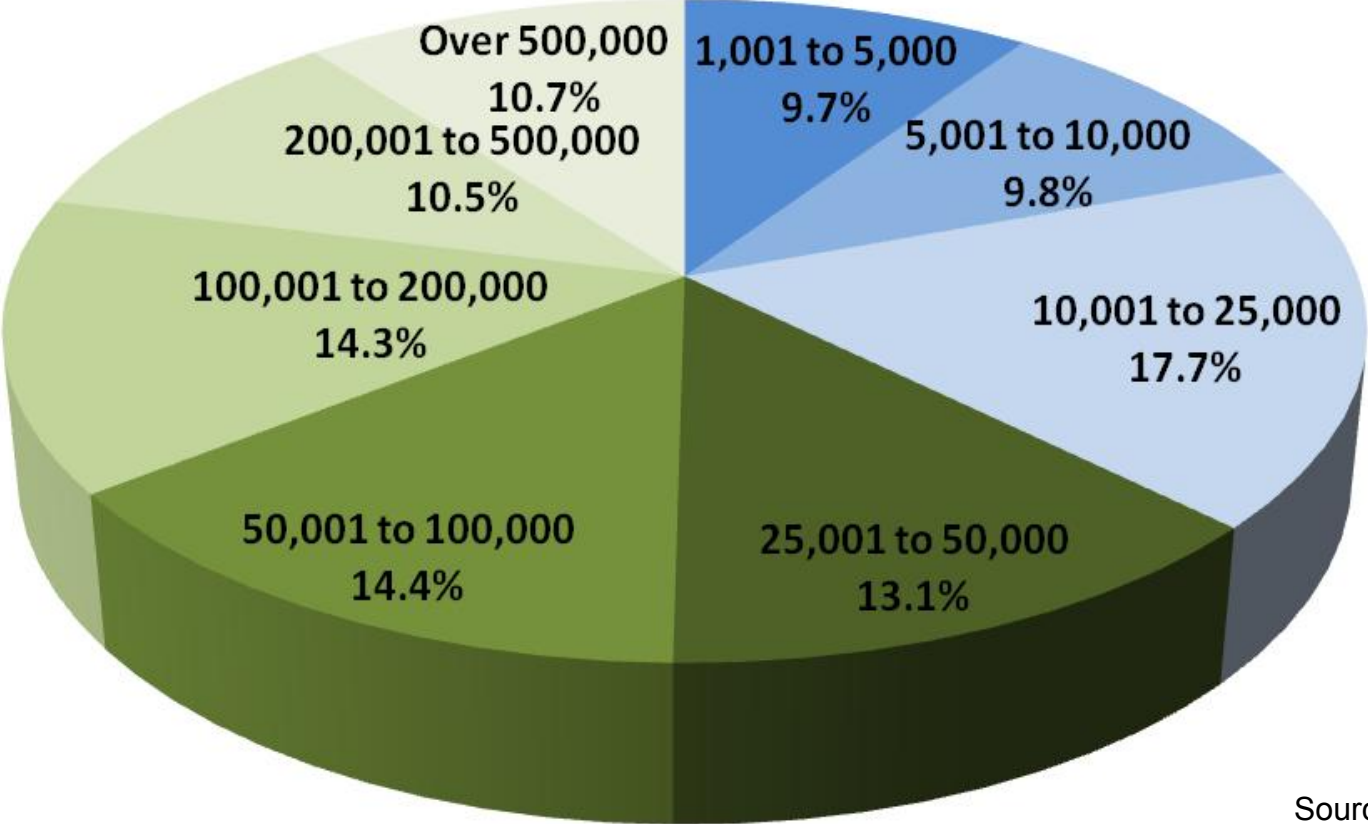


Building Size by Number of Buildings



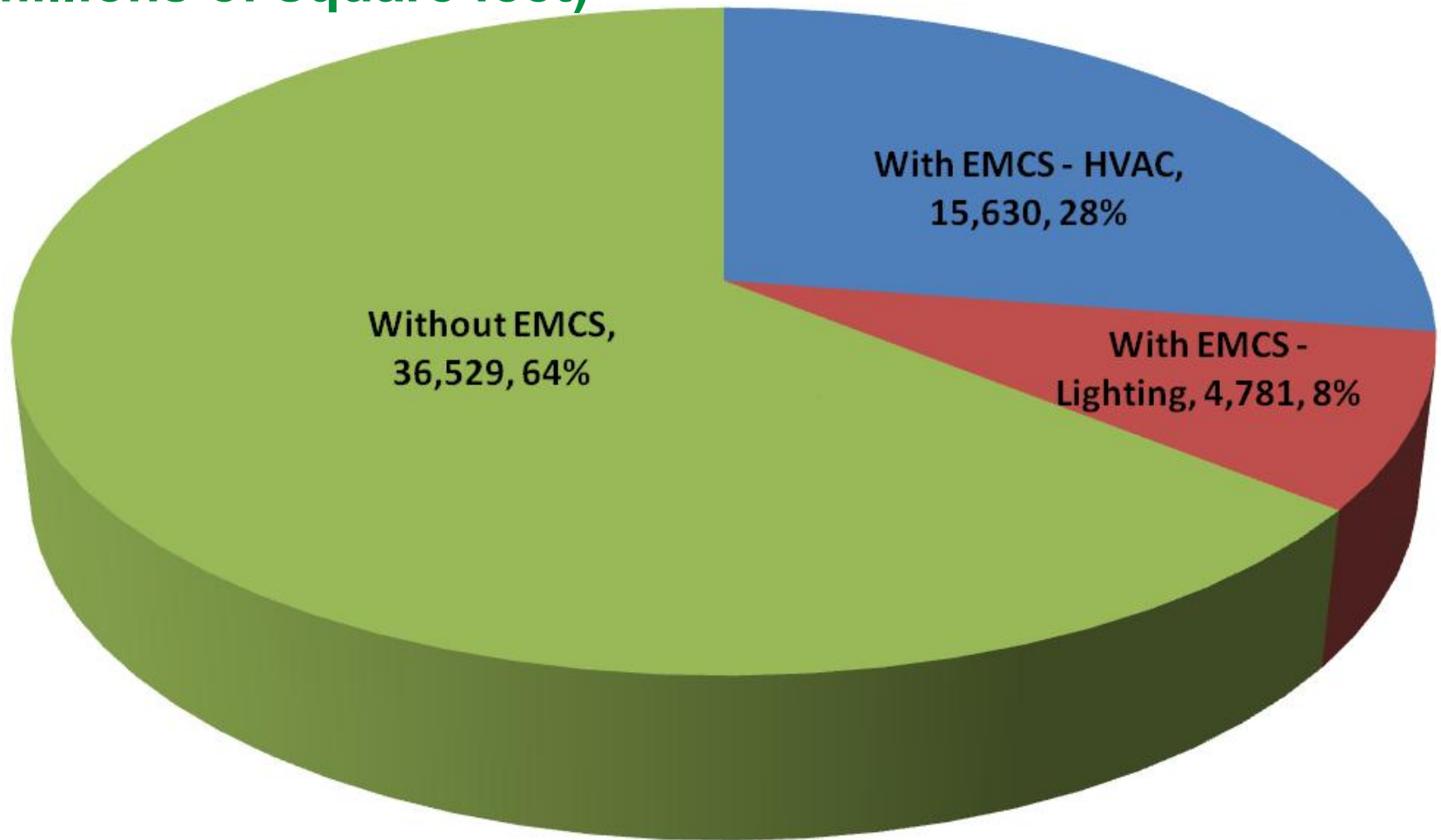
Source: U.S. EIA , CBECs 2003

Building Size by Total Floorspace per Building



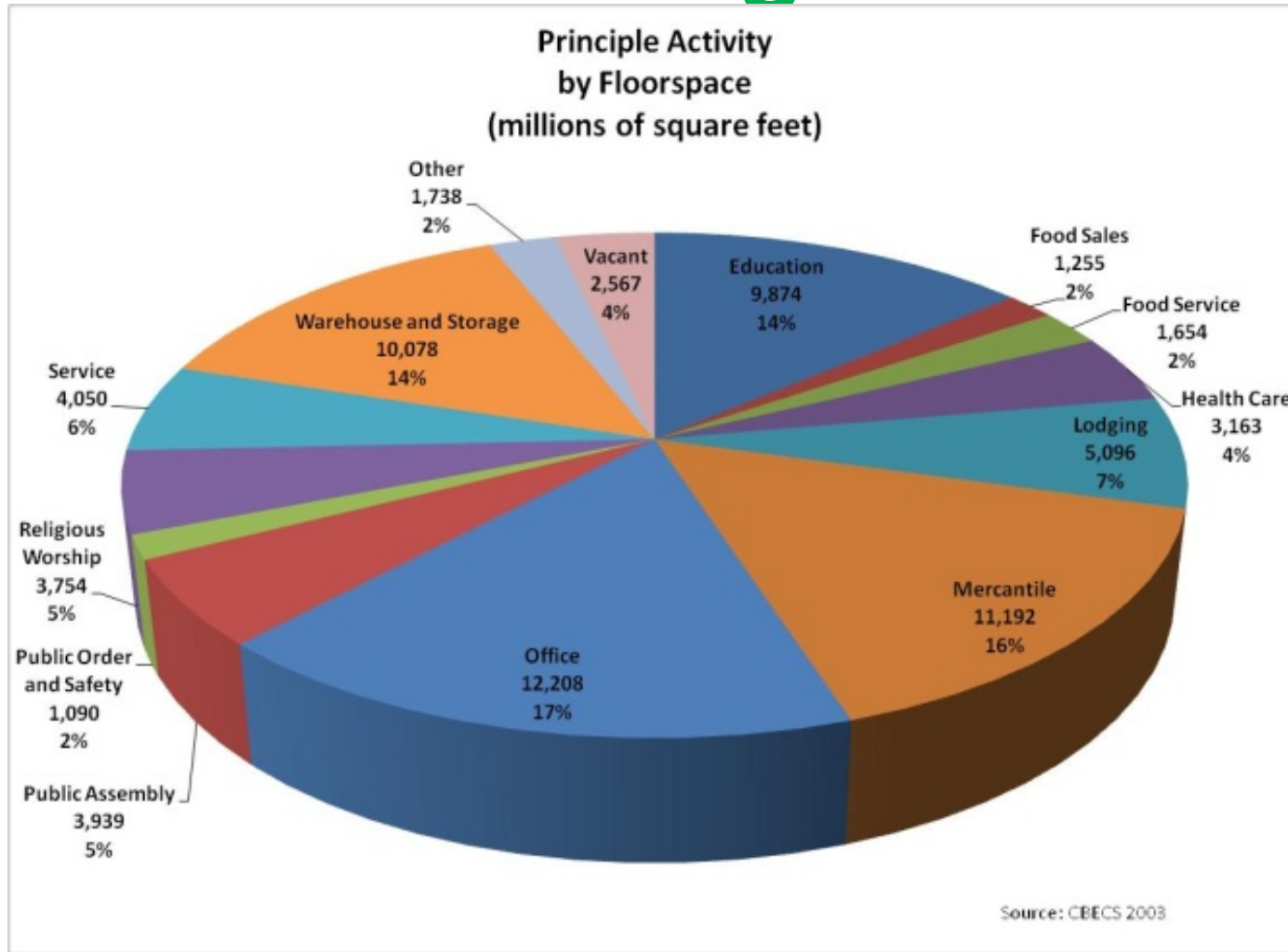
Source: U.S. EIA , CBECs 2003

Buildings with EMCS by Total Floorspace (millions of square feet)

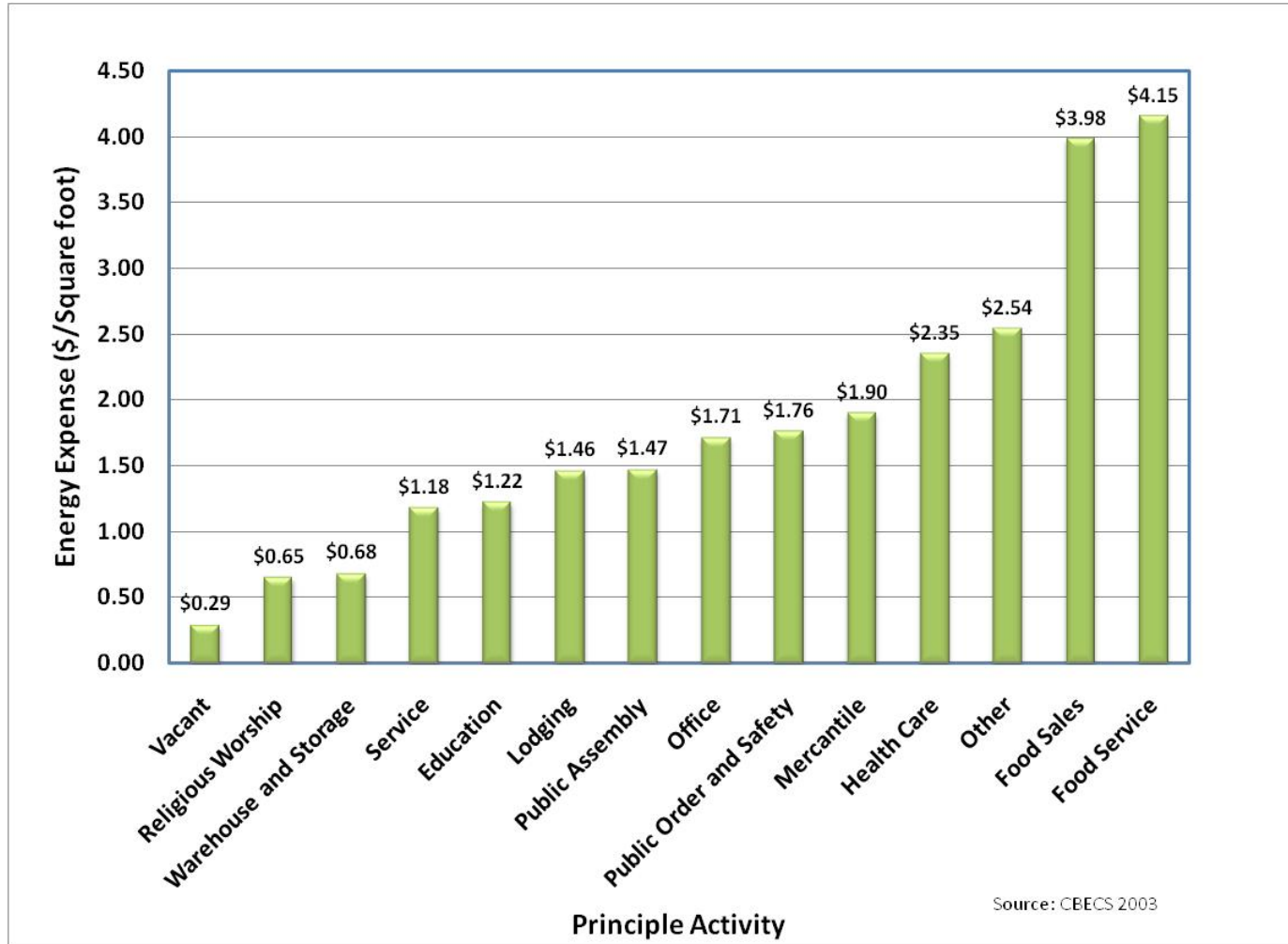


Source: U.S. EIA , CBECs 2003

Building Use



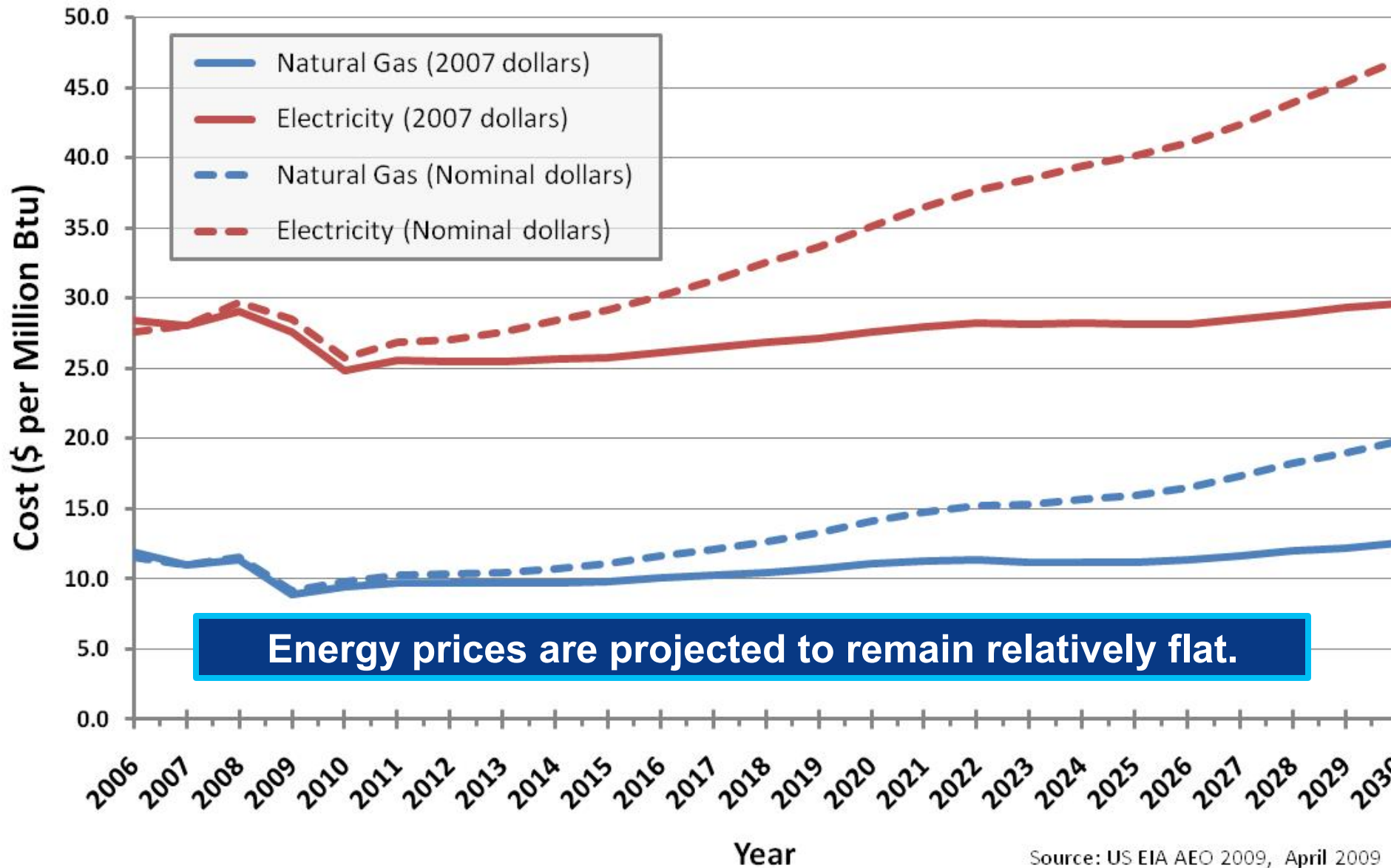
Energy Cost by Type



Energy Intensity



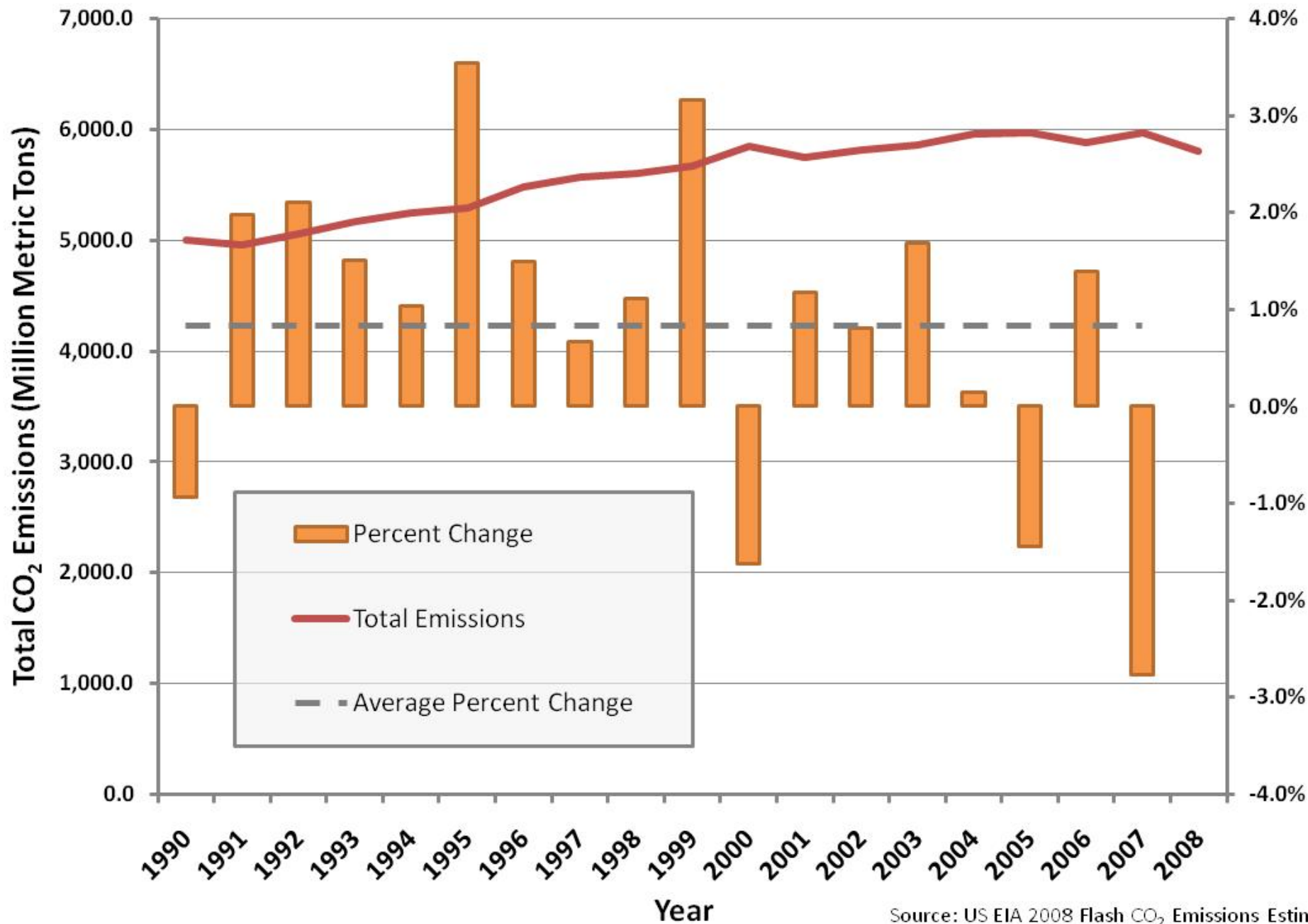
U.S. EIA Annual Energy Outlook for Commercial Natural Gas and Electricity End-Use Prices



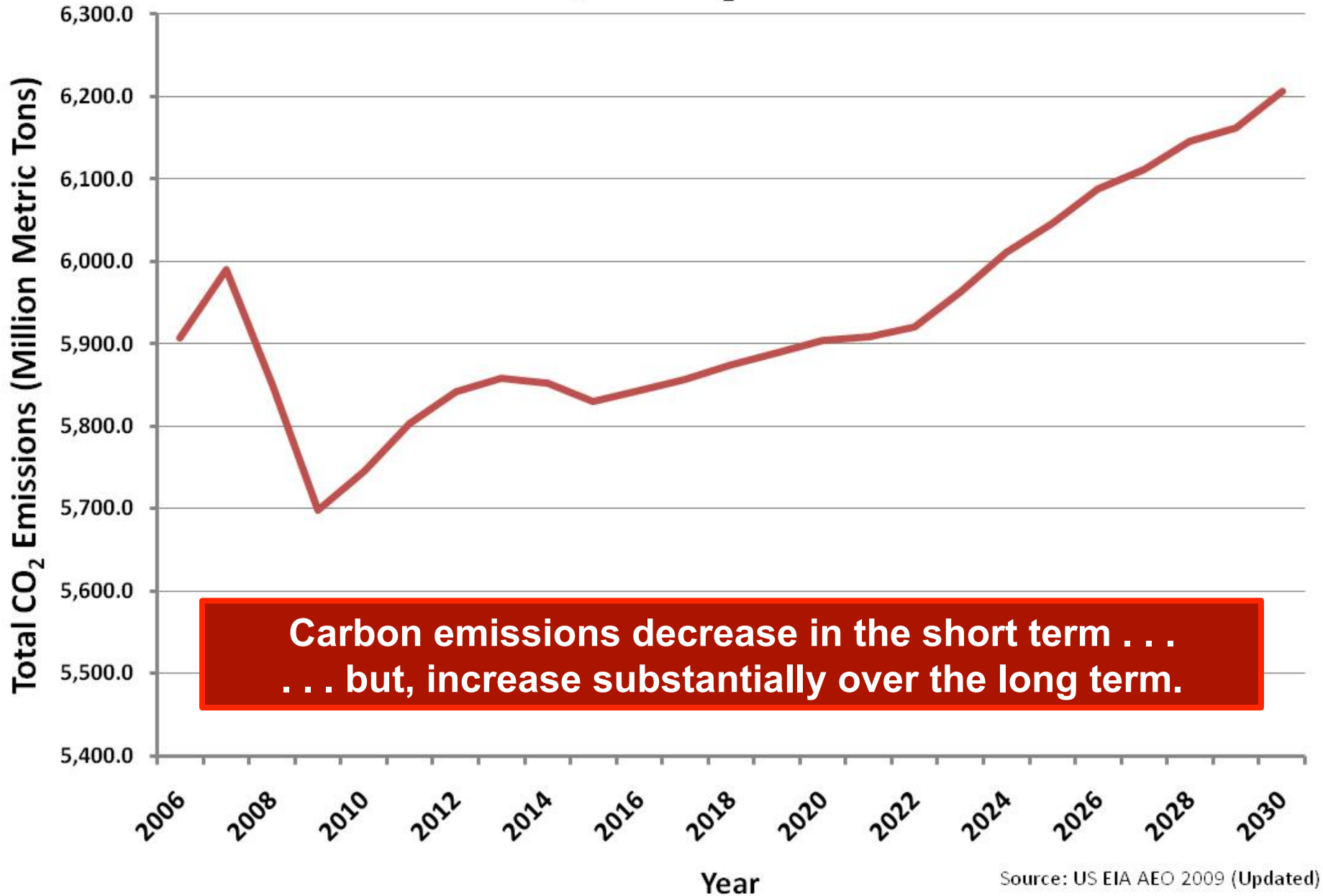
Energy prices are projected to remain relatively flat.

Source: US EIA AEO 2009, April 2009

U.S. EIA Estimated CO₂ Emissions



U.S. EIA Annual Energy Outlook Total Projected CO₂ Emissions

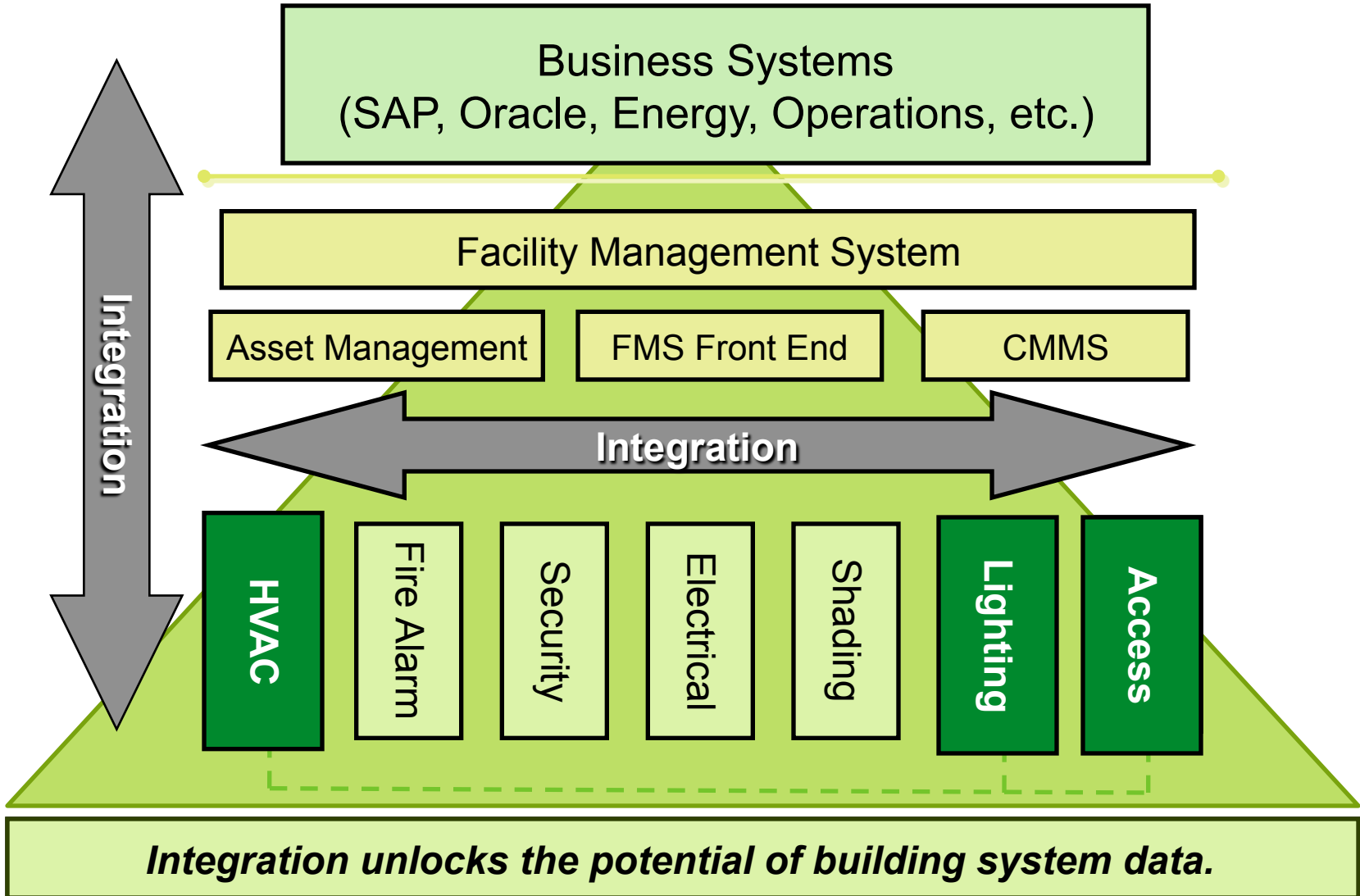


Market and Industry

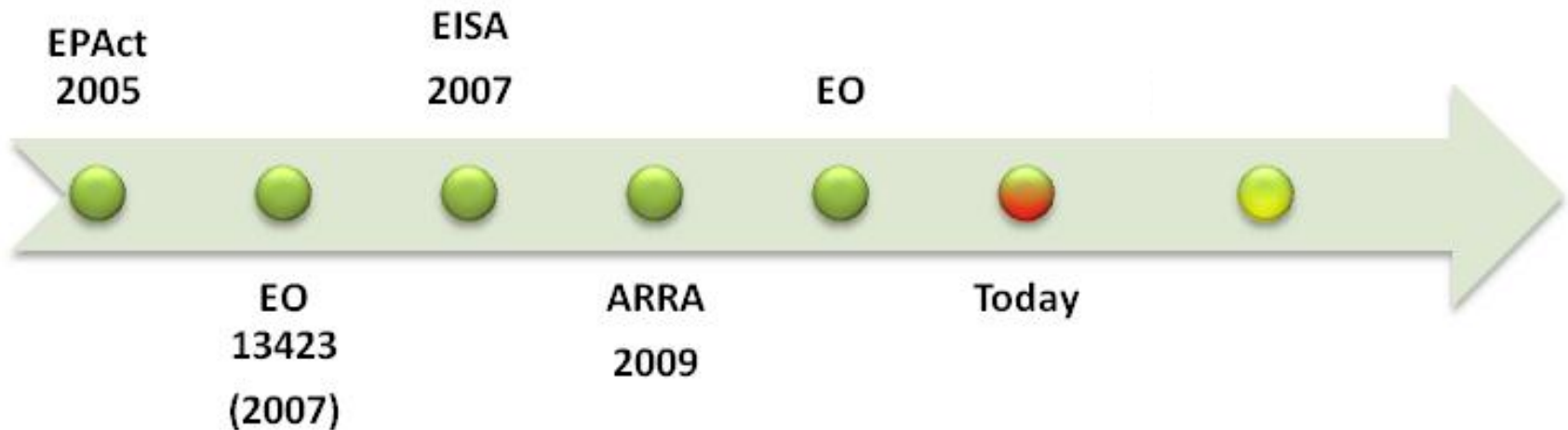


- Green buildings
- Energy efficiency
- Commissioning
- Indoor environmental quality
- Mission critical facilities
- Benchmarking
- Energy performance labeling
- Net-zero energy buildings
- Intelligent buildings
- Smart Grid & Demand Response

Integration

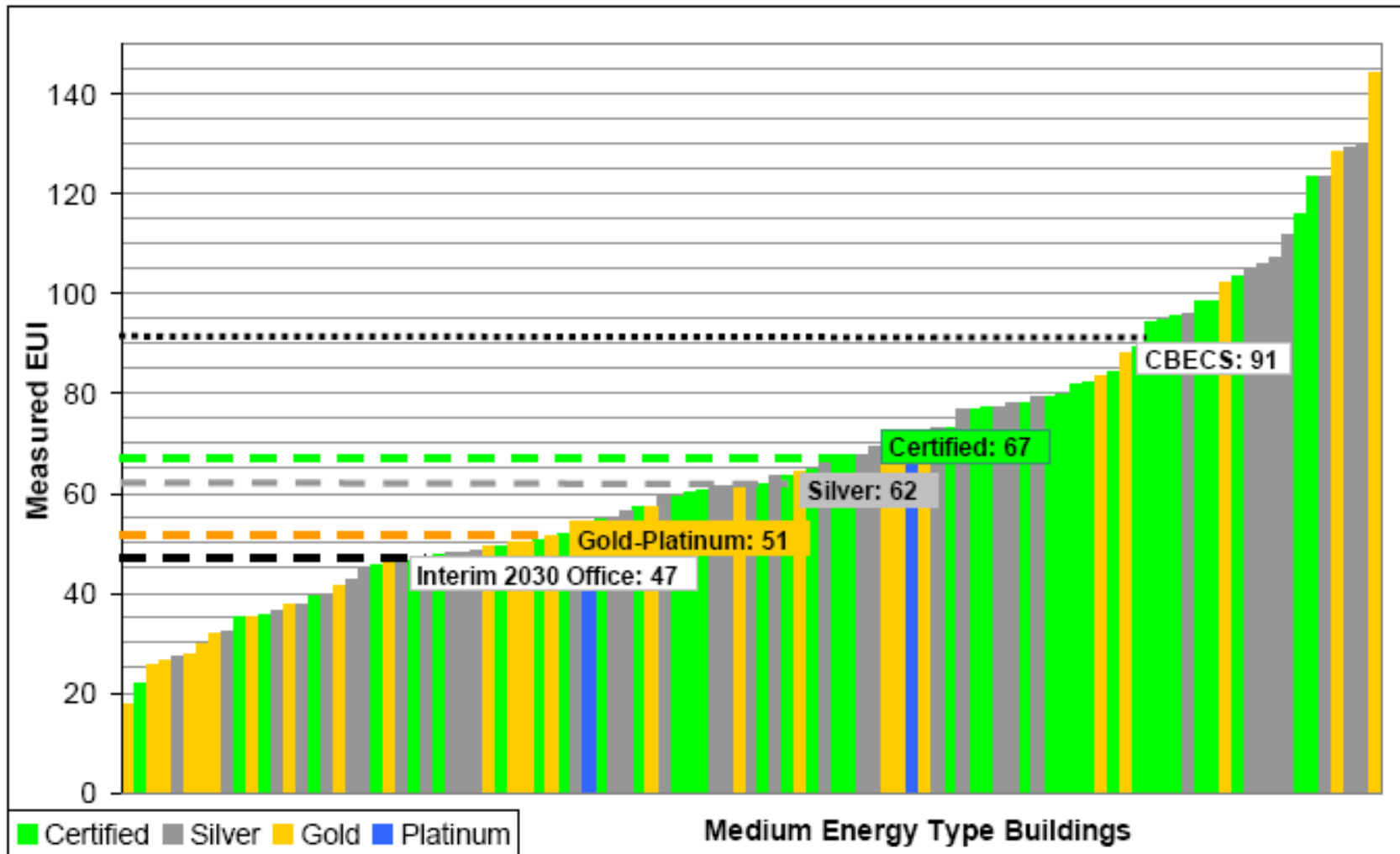


US Government

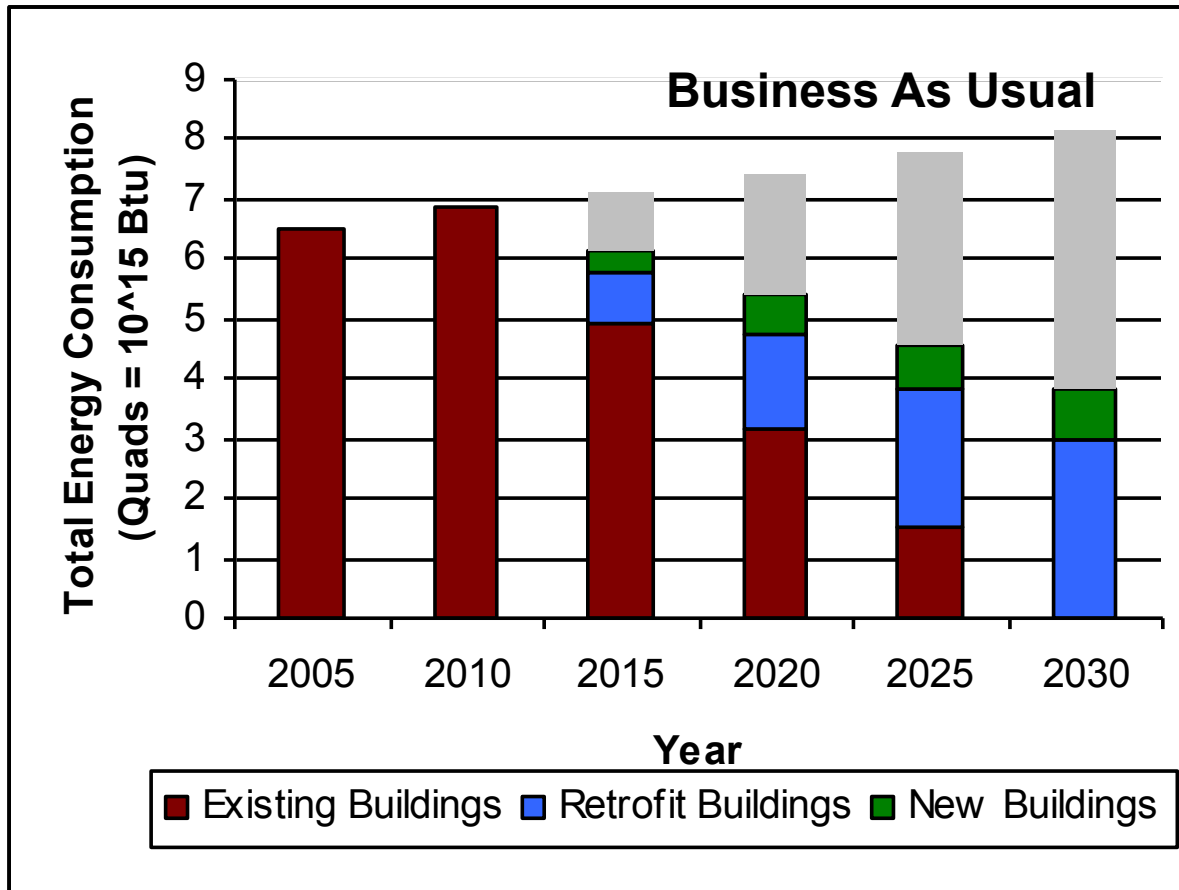


- 1) Increasing government mandates and support for energy efficiency.***
- 2) Increasing stringency in minimum energy efficiency requirements for buildings.***
- 3) Potential for greenhouse gas emissions reporting and controls.***

LEED & Energy Efficiency



What Might be Technically Achievable?

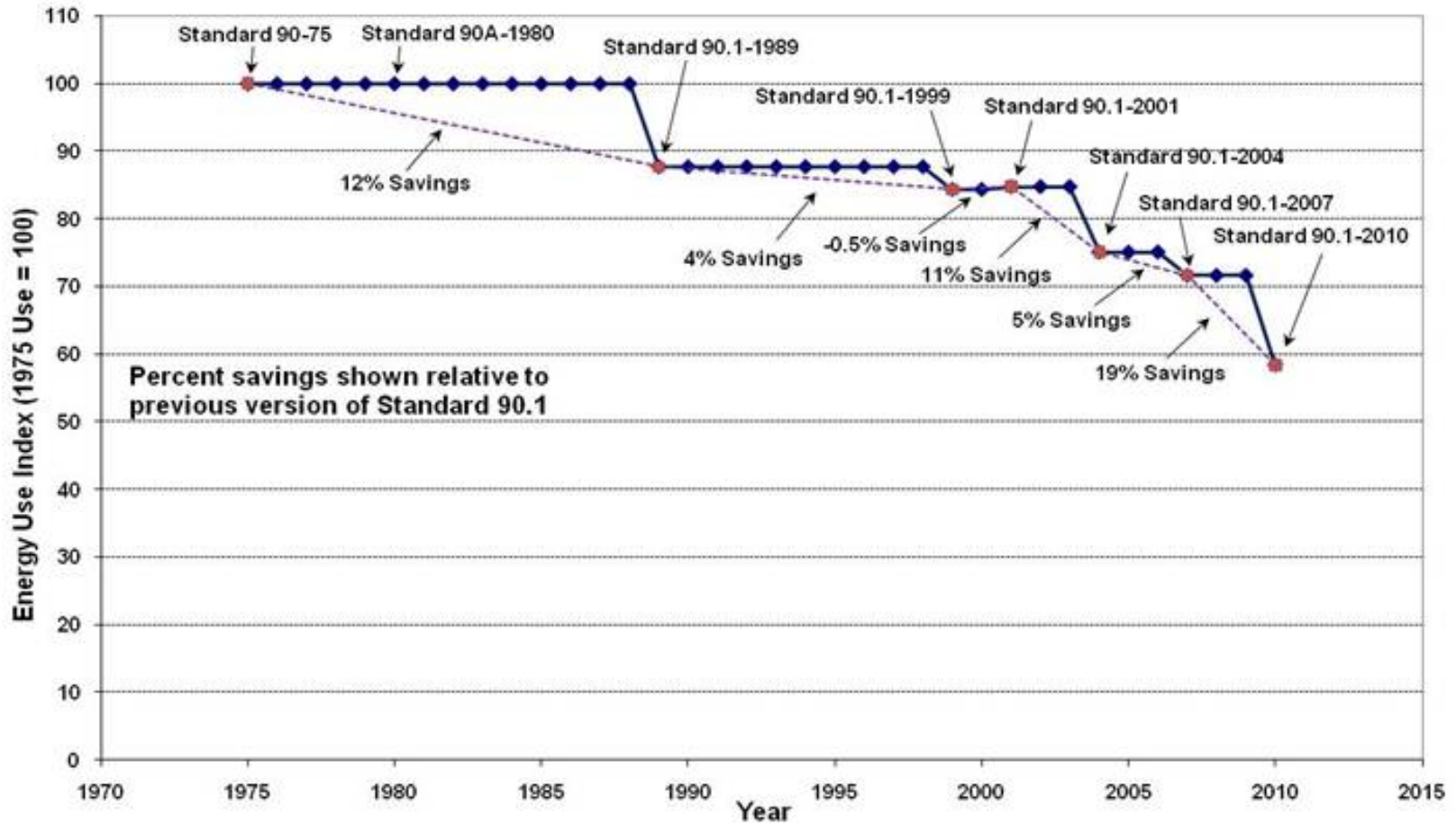


These levels of efficiency are unlikely to be achieved by market forces alone;

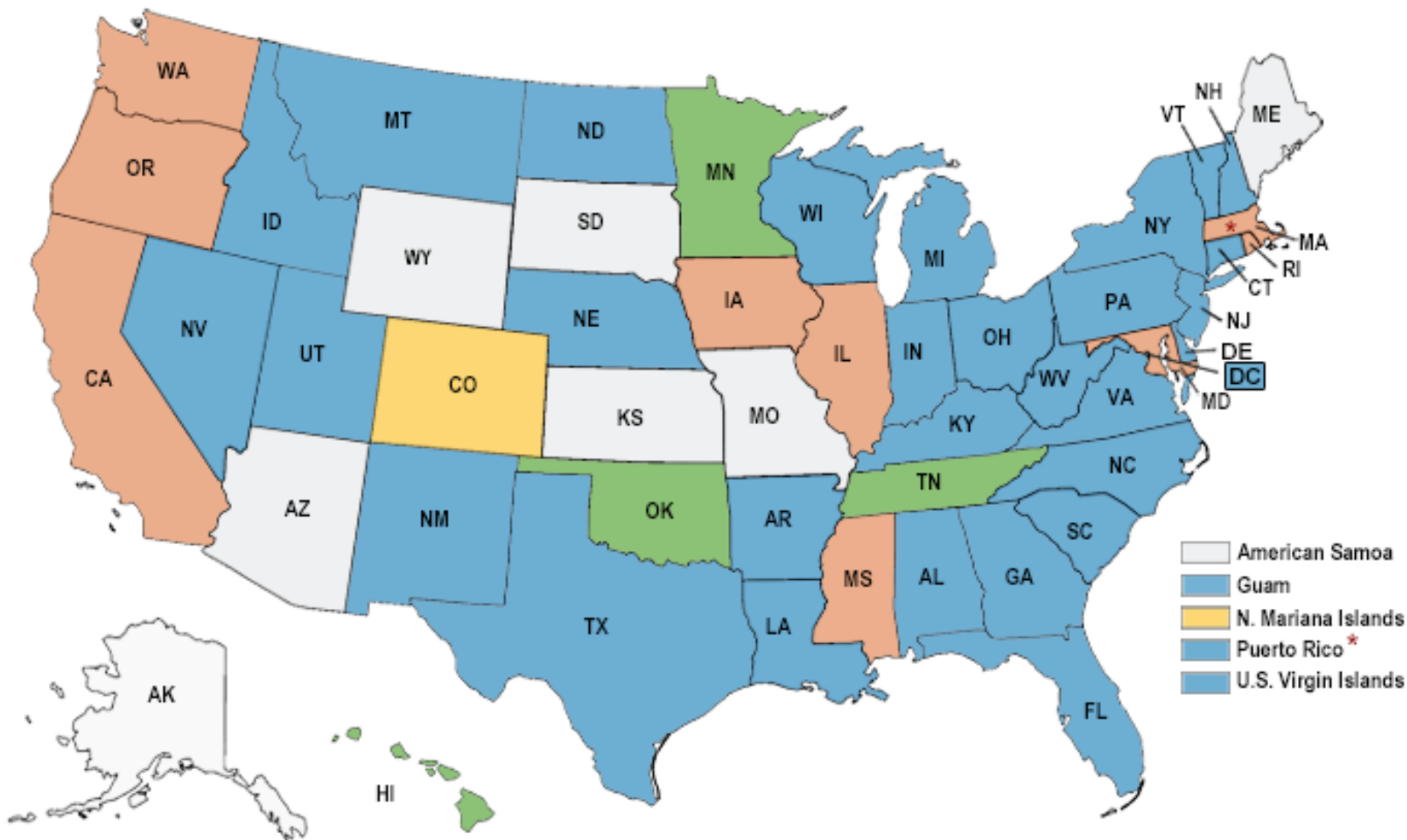
Major new public/private initiatives to drive toward goals

ASHRAE Standard 90.1

New Commercial Construction Code Stringency 1975-2010
(Relative to Standard 90-75=100)



Percent savings shown relative to previous version of Standard 90.1



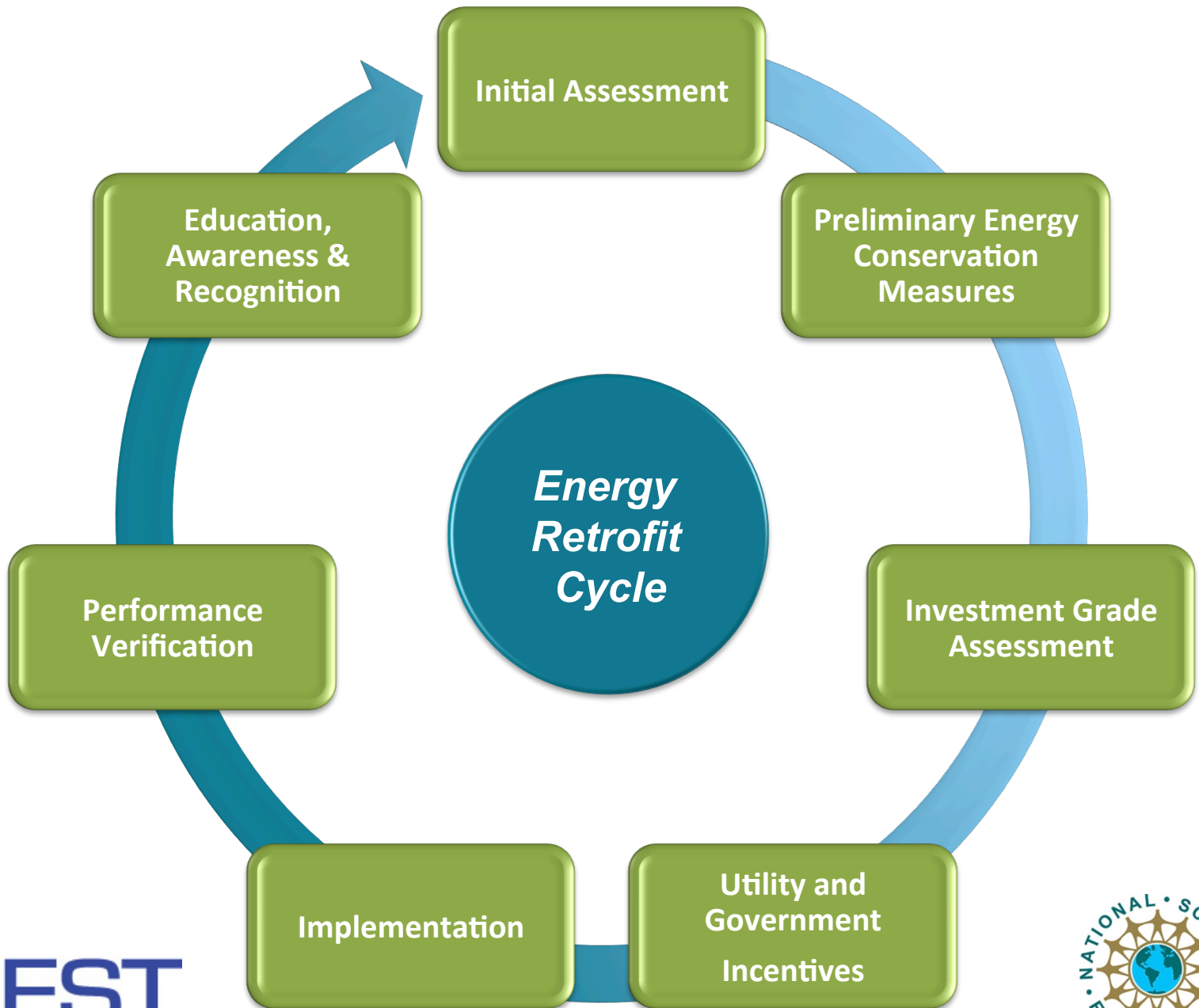
* Adopted new Code to be effected at a later date

As of March 2014

Making Existing Buildings High Performance

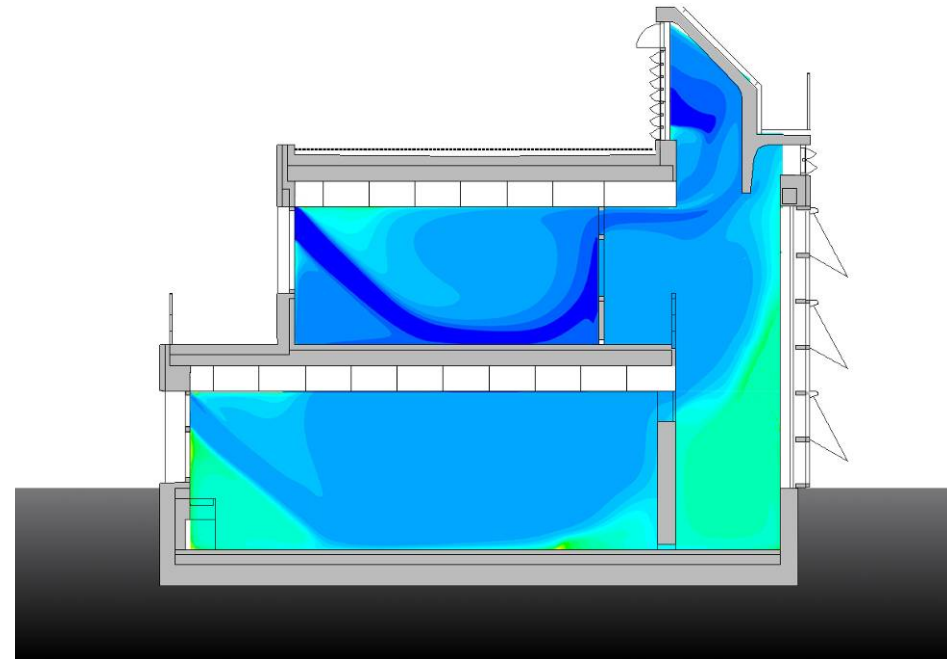
- Measure and benchmark
 - Energy
 - Comfort
 - Operations costs
- Plan
 - Commissioning
 - Energy retrofits
 - Upgrades
 - New processes and tools





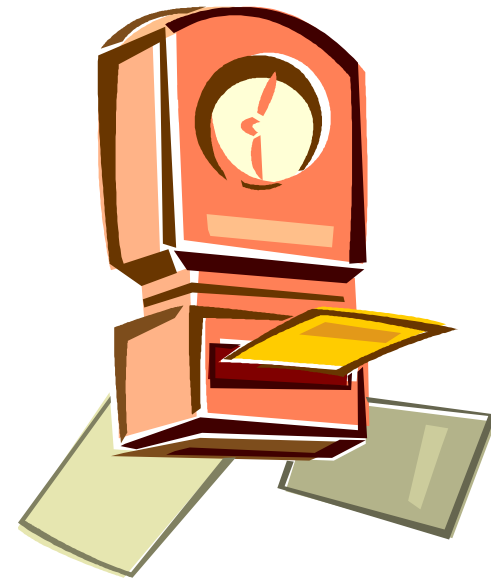
Building Energy Optimization

- Examples
 - Demand controlled ventilation
 - Pump and fan optimization
 - Chiller plant optimization
 - Day-lighting control
 - Inter-systems integration
 - Mechanical optimization
 - Heat recovery
 - Radiant heat / cool
 - Natural ventilation
 - Diffusion ventilation
 - Combined heat and power
 - Others
 - Envelope optimization



Run when needed

- Properly schedule systems
- Sense for occupancy
- Systems react to occupants



Process Challenges

Disjointed Design to O&M

- “Over the fence” approach to design
 - Design is not coordinated
 - Controls design left to the controls contractor
 - Lessons learned not shared between O&M and designers

“There is a lack of a holistic picture of the building because there is no continuity between the design of the building and the program it is being used for and the way it is being maintained.”

-Focus group participant

O & M Organizational Structures



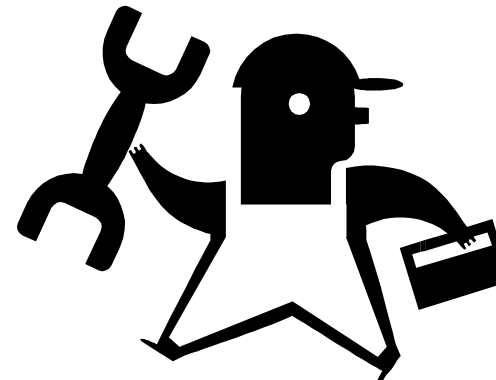
Capital Planning



Operations & Maintenance



Energy Efficiency



Operations & Maintenance



Transitioning from Reactive to Proactive O&M



→ Data driven



Current Challenges:

“We don’t have any standard processes.”

“A reactive approach to facility management is the norm, and precludes evolution to proactive and/or predictive practice.”

“Buildings run by myth and legend.”

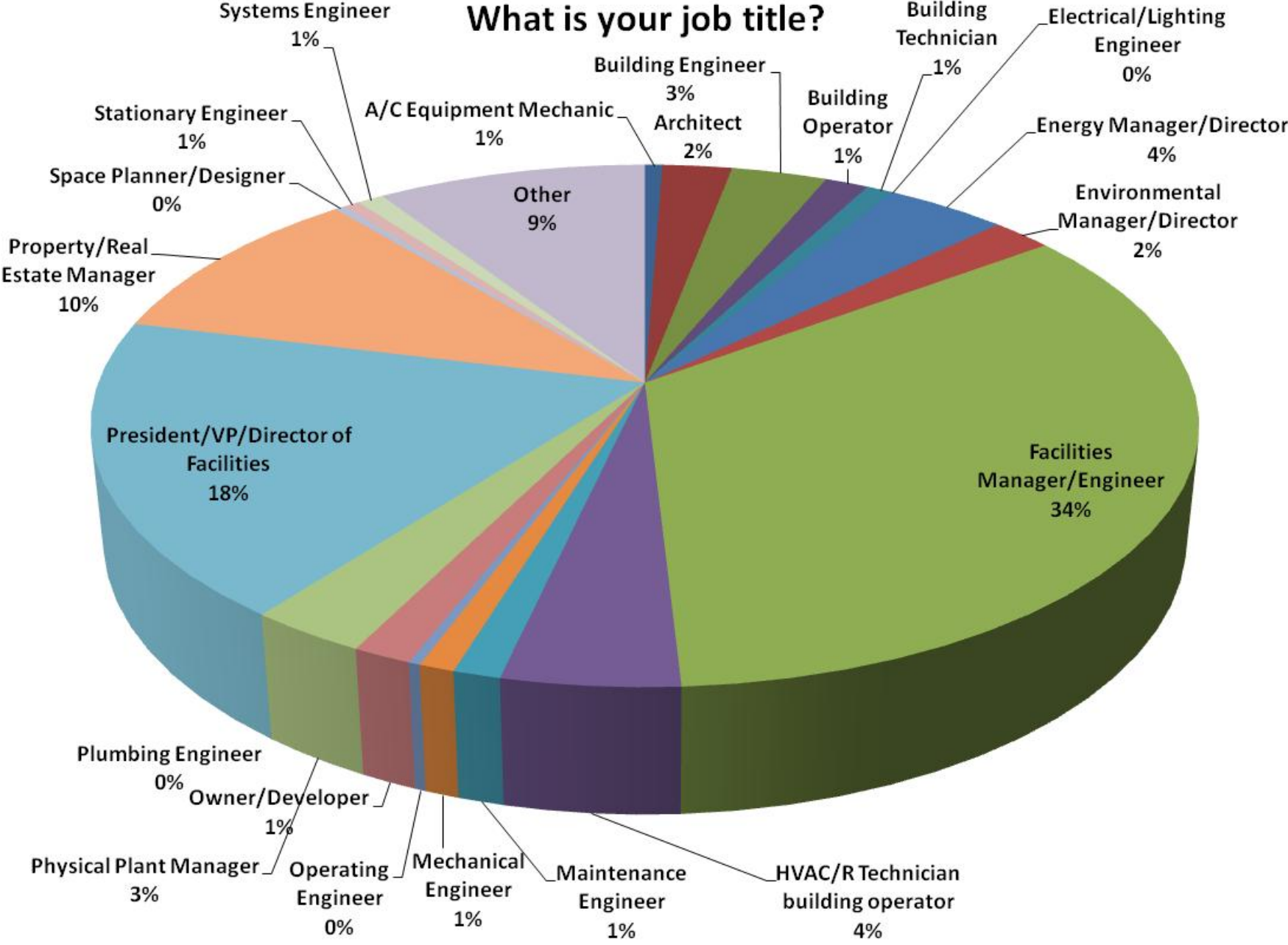
People Challenges

People

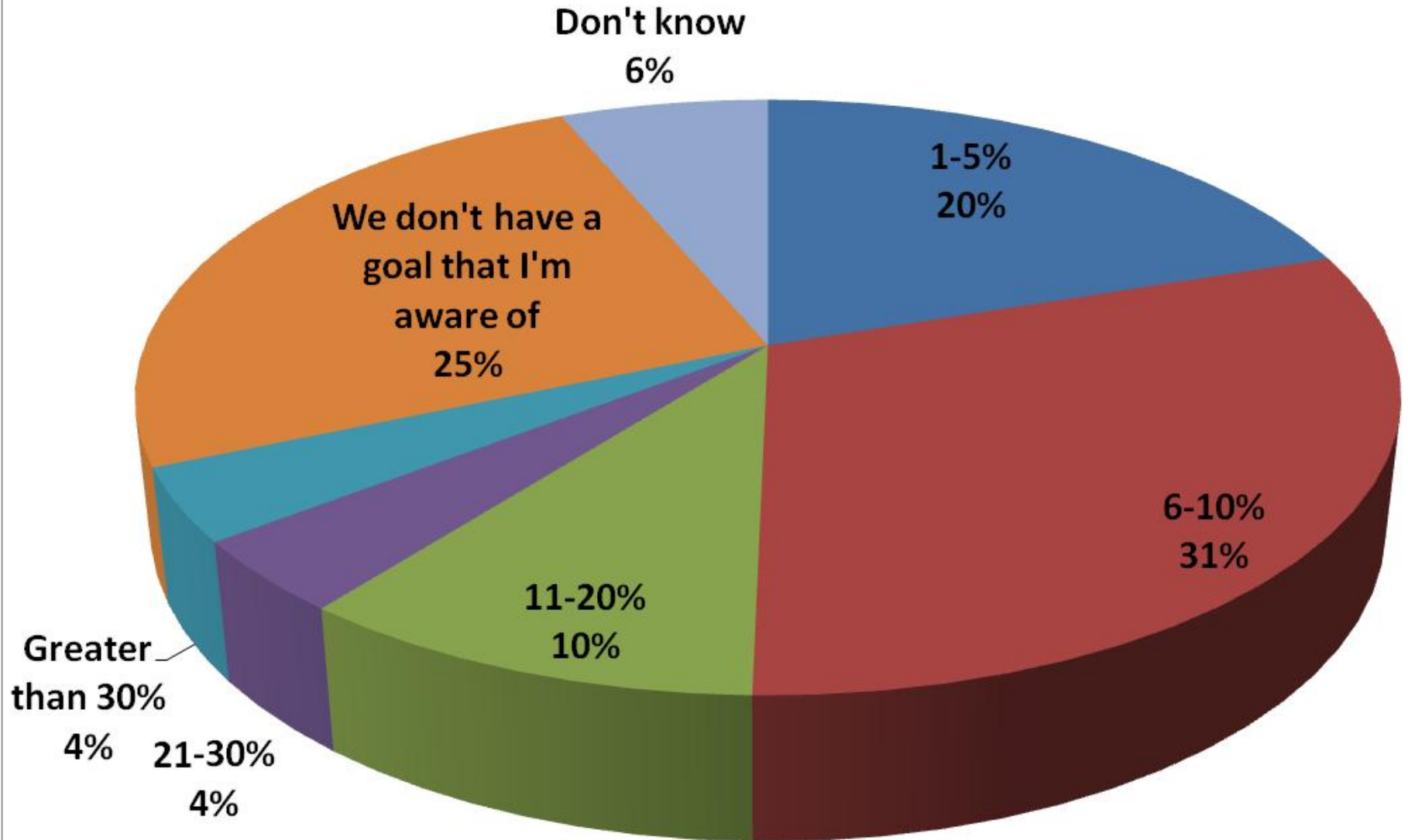
- Changing demographics
- Evolution of roles and responsibilities
- People fall into the profession by chance
- Extreme variation in education, training, and experience
- “On the job training” is the norm
- Career pathways and progression is unclear



What is your job title?



What is your organization's annual goal for reducing energy consumption within your facilities?



Demographics

- Older workers are leaving workforce
- Younger workers are computer savvy
- Predicted shortages in skilled trades

SF Bay area: Need for building control technicians expected to rise 40% in next three years (Carrese 2010)

Changing Role of the Technician

Historically: Responding to trouble calls/
fire fighting

Transitioning to: “Super hero” technical
skill set with basic management skills

- Energy efficiency
- System optimization
- Comfort
- Change management
- Systems
- Cost justification
- Customer service
- Budgeting
- Computer skills
- Troubleshooting

Expected Competencies

- “All I really need is a SuperTech”
- Managers want a single individual with building systems, customer relations and management skills that can adjust quickly to change



Career Pathways

Historically: Wide variety of backgrounds

- “Fell into the profession”
- Report found only 12% of people surveyed pursued studies related to building operations

Transitioning to:

- Purposeful entry into the profession with technical skills
- Technician to Facility Manager

Conclusion

- Building industry is undergoing a large cultural and technology shift
 - Community colleges, industry, government, professional organizations and universities need to work together
- **Question for Thought:** How will you help to prepare the current and future workforce to be a part of the solution?

Opportunity

- Re-defining the field and the profession
 - Sustainable high performance building operations
 - Key element of clean energy and green jobs
- Education, training and certification
 - Curriculum development
 - Professional certification programs
 - Training and re-training
 - STEM: Science, technology, engineering and math

“We cannot purchase efficiency; we can enable it through continual training, testing, certification and encouragement.”

***-Mark McGann
National Association of Power Engineers
(NAPE) National President (2010)***



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Questions

