

Data Needs to Achieve High-Performance Buildings



National Institute of
BUILDING SCIENCES

SOM

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Design Requirements

➤ Building Codes, Energy

- ICC: ASHRAE 90.1 – Energy Standard for Buildings Except Low-Rise Residential Buildings
- IgCC: ASHRAE 189.1 – Standard for the Design of High-Performance Green Buildings Except Low-Rise Residential Buildings

➤ Federal Mandates

- Federal Leadership Memorandum of Understanding
- Energy Policy Act of 2005
- Energy Independence and Security Act of 2007
- Executive Order 13423
- Executive Order 13514

➤ USGBC LEED® 2009

- Energy and Atmosphere Prerequisite 2
 - 10% improvement over a baseline ASHRAE 90.1 building for new buildings
 - 5% improvement for existing buildings
- Energy and Atmosphere Credit 1
 - Credits earned: new buildings > 12%; existing buildings >8%

FEDERAL ENERGY LEGISLATION AND EXECUTIVE ORDERS



Water Efficiency

Federal Leadership MOU/Guiding Principles

- ❖ Reduce indoor potable water by 20% relative to EPA 1992
- ❖ Reduce outdoor potable water use by 50%

EPA 2005

- ❖ Apply water conserving technologies

EO 13423

- ❖ Superseded by EO 13514

EO 13514

- ❖ Reduce potable water consumption 2% annual through FY2020, or 26% by the end of FY2020, relative to a FY2007 baseline
- ❖ Reduce agency industrial, landscaping, and agricultural water consumption 2% annually, or 20% by the end of FY2020, relative to a FY2010 baseline



Renewable Energy

EPA 2005

- ❖ The Federal Government's renewable electricity consumption must meet or exceed:

2010-2012	5%
2013 and after	7.5%

Double credit for renewable energy produced on Federal land

EO 13423

- ❖ Install renewable energy sources on agency property for agency use
- ❖ 50% of the renewable energy statutorily required by EPA 2005 comes from new renewable sources

EISA 2007

- ❖ 30% of the hot water demand for each new Federal building should be met through solar water heaters



Energy Efficiency

Federal Leadership MOU/Guiding Principles

- ❖ Reduce energy cost by 30% below ASHRAE 90.1-04

EPA 2005

- ❖ New Federal buildings to achieve at least 30% below ASHRAE 90.1-04 (excluding plug loads)

EO 13423

- ❖ Reduce energy intensity by 3% annually, to 30% by 2015 based on ASHRAE 90.1-04

EO 13514

- ❖ Ensure all new Federal buildings, entering the design phase in 2020 or later, are designed to achieve zero net energy by 2030
- ❖ Ensure at least 15% of existing agency buildings and leases (above 5000 SF) meet the MOU

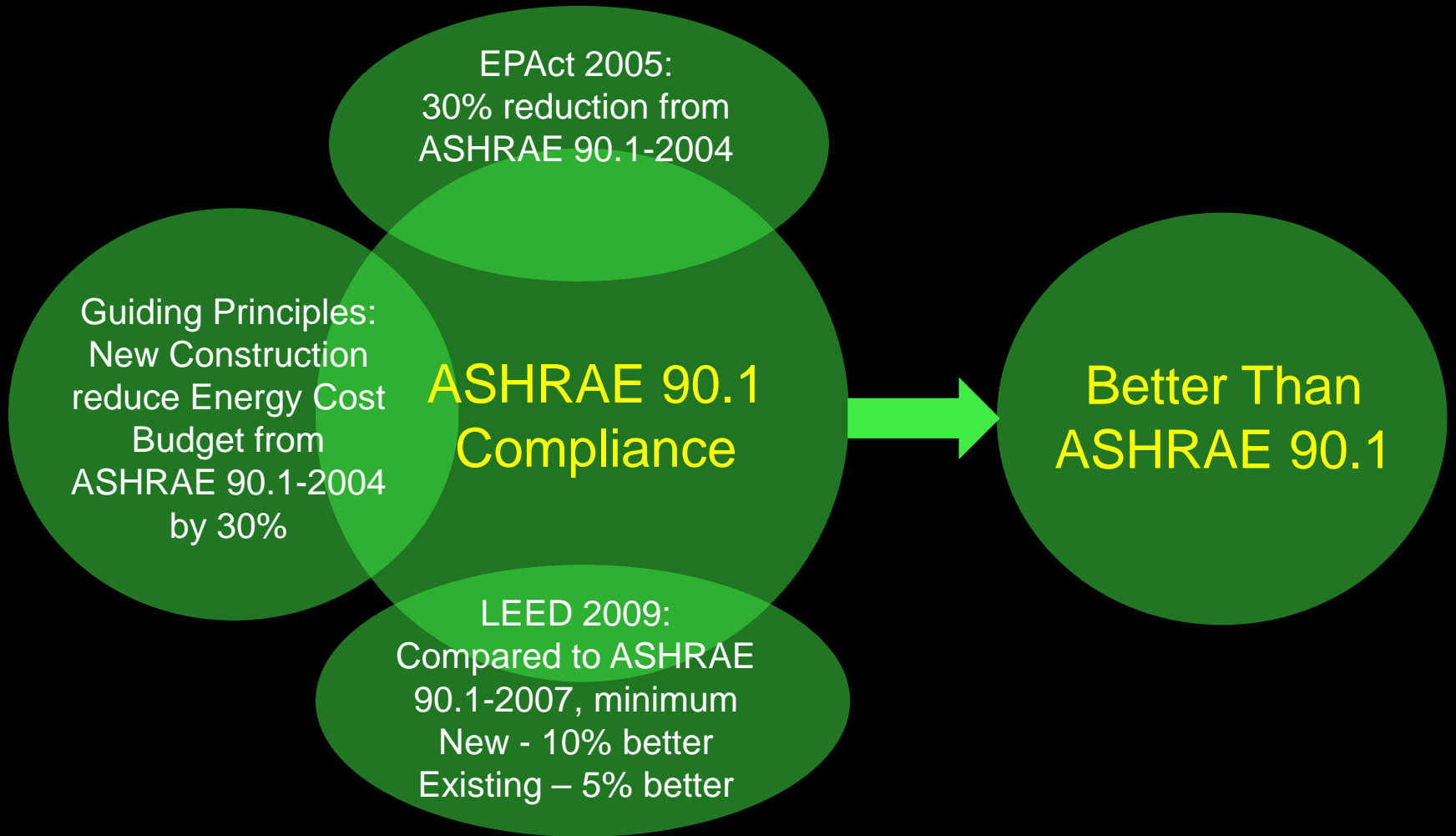
EISA 2007

- ❖ Each agency to reduce the energy consumption per SF of their Federal buildings as compared to the energy consumption of the buildings in FY2003 by:

2012	21% reduction
2013	24%
2014	27%
2015	30%
- ❖ Reduce fossil-fuel energy consumption as compared to CBECs 2003

2010	55% reduction
2015	65%
2020	80%
2025	90%
2030	100%

Energy Targets



Federal Energy Mandates

Energy Independence & Security Act of 2007

New Federal Buildings shall be designed so that the fossil fuel generated energy consumption of the building is reduced, as compared with such energy consumption by a similar building in FY 2003 (as measured by CBECS), by the percentage specified in the following table:

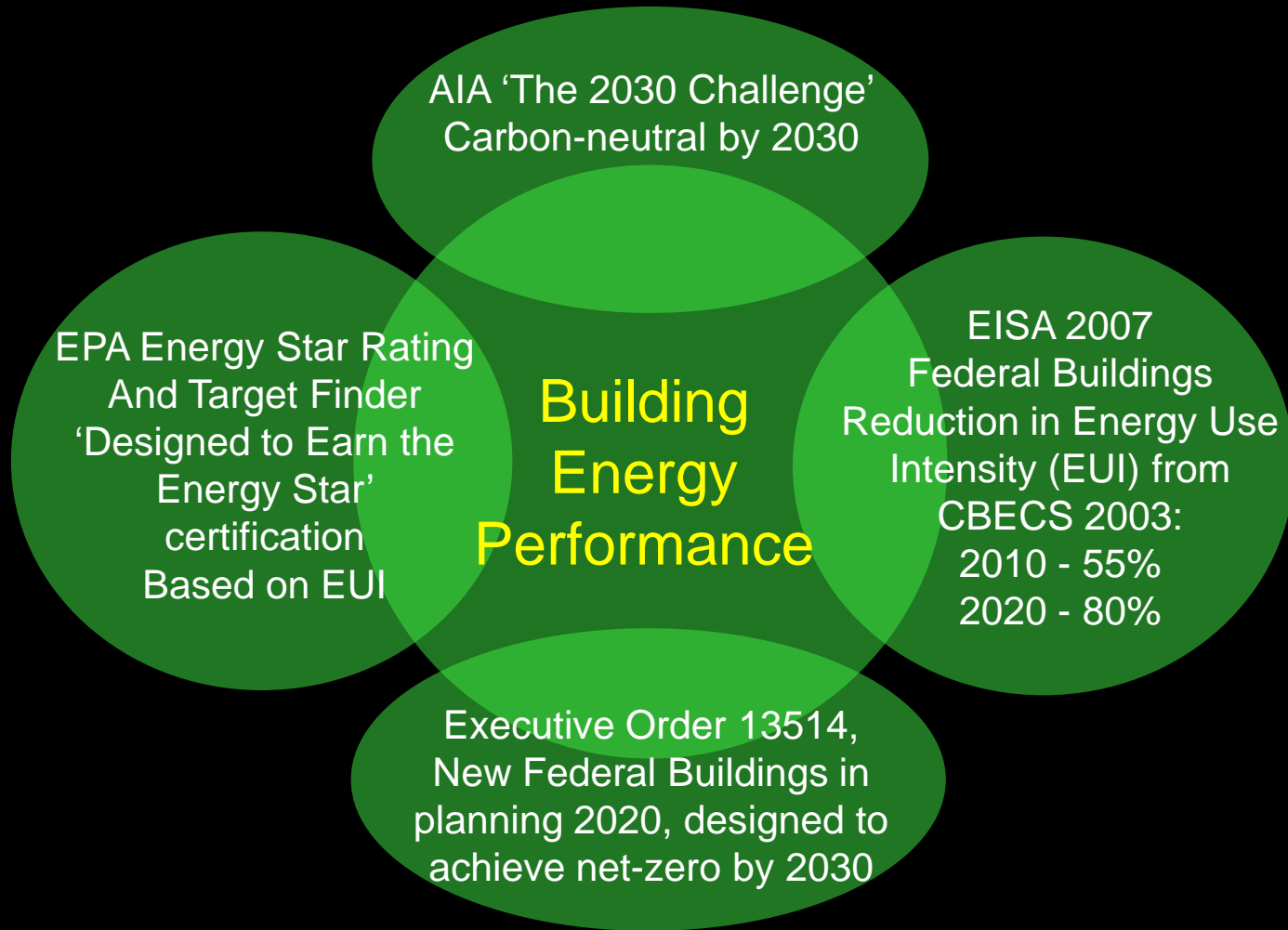
Fiscal Year	Percentage Reduction
2010	55
2015	65
2020	80
2025	90
2030	100

Federal Energy Mandates

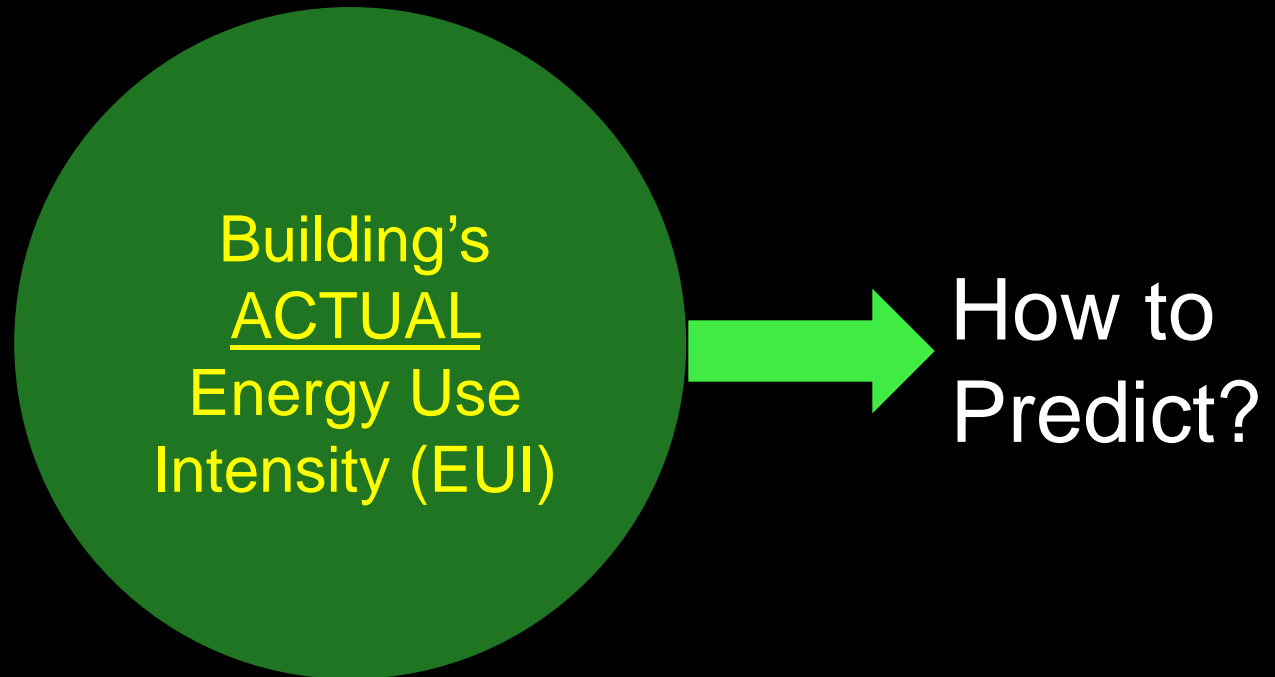
Executive Order 13514

- 2(g)(i) beginning in 2020, and thereafter, ensuring that all new Federal buildings that enter the planning process are designed to achieve zero-net-energy by 2030;
- 2(g)(ii) ensuring that all new construction, major renovation, or repair and alteration of Federal buildings complies with the *Guiding Principles for Federal Leadership in High Performance and Sustainable Buildings*

Next Generation of Energy Targets



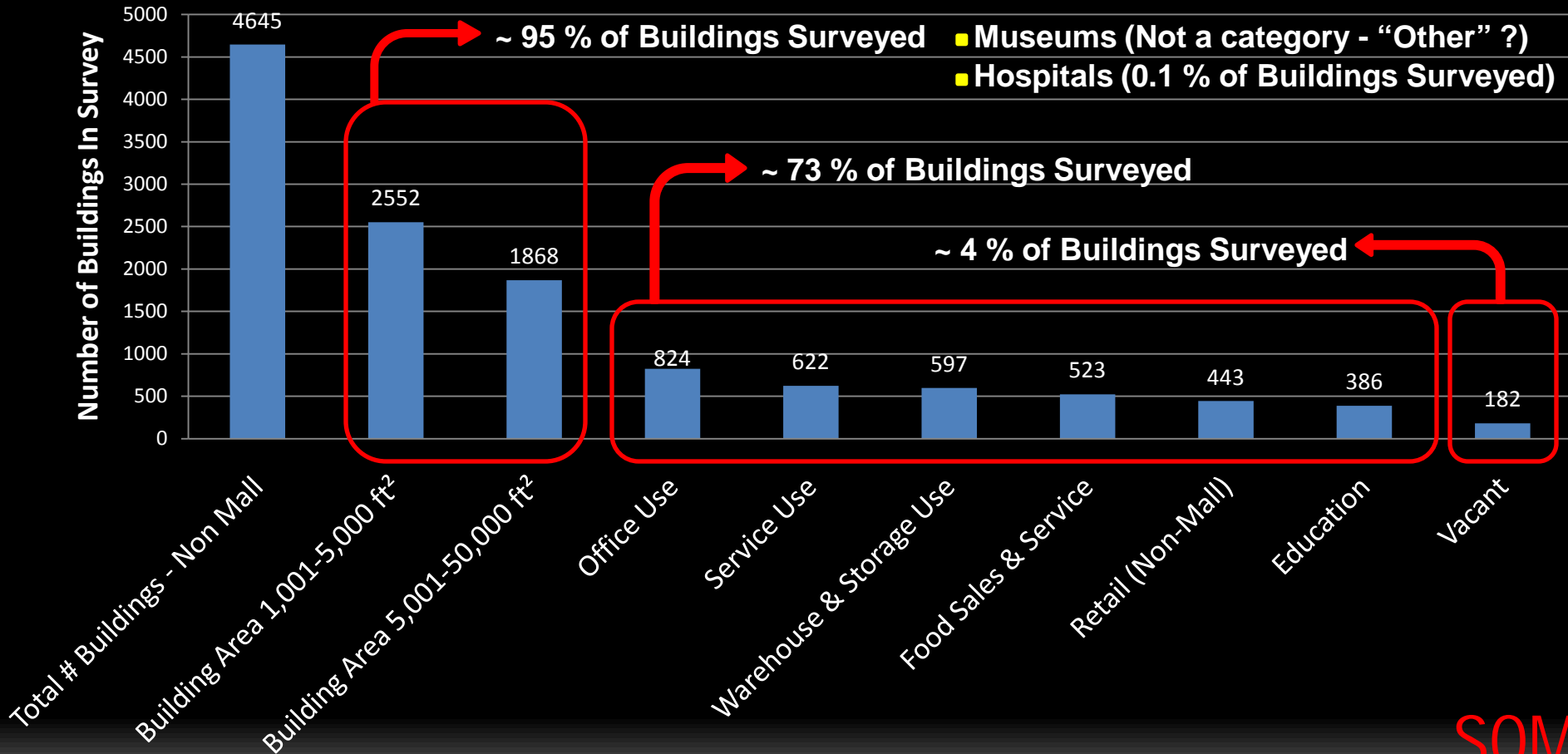
Predicted Energy Consumption



CBECS-2003 Data

Is the data complete?

Composition of 2003 CBECS Data - Table C3



Information Gaps

Plug Load Diversity Factors

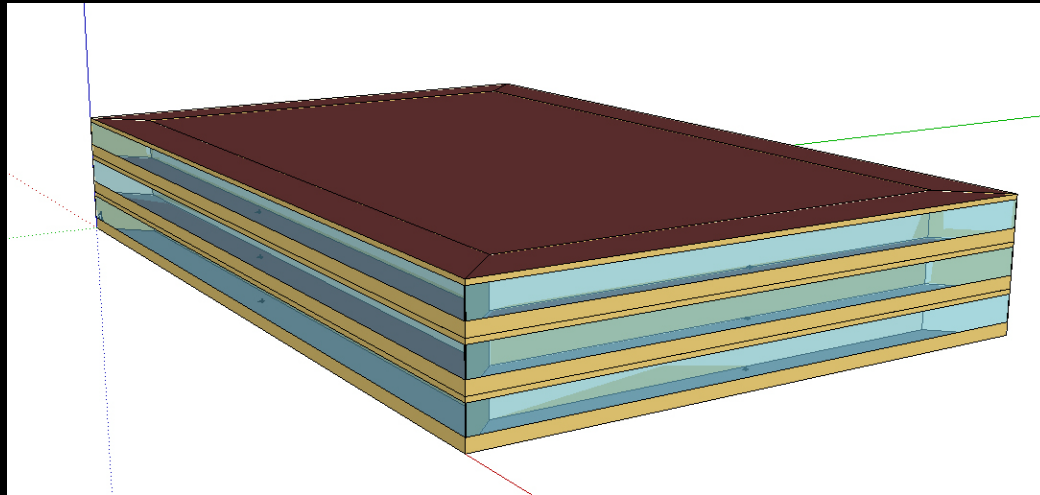
Example: 120,000 ft² Office Building

Owner Requirements - 4 W / ft² Plug Load Allowance

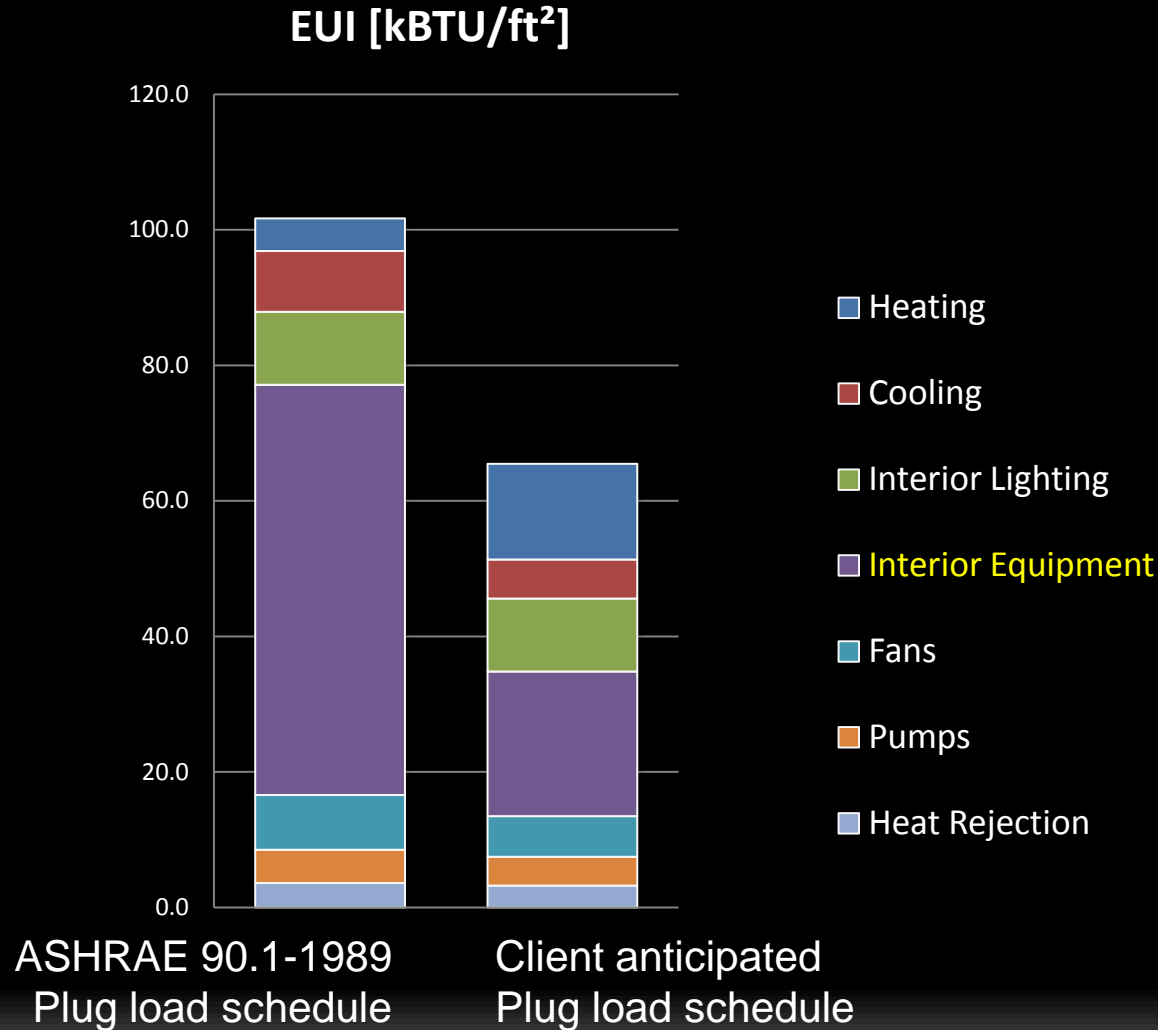
Occupancy - 2400 People

Lighting – 1.1 W / ft² (ASHRAE 90.1)

Scheduling – Typical Office



Information Gaps



Potential Sources of Data

- Commercial Building Energy Consumption Survey 2007
- LEED 2009 Minimum Program Requirements (#6)
 - All certified projects must commit to sharing whole-building energy and water usage data for a period of at least 5 years.
- EPA ENERGY STAR® Portfolio Manager
 - Tracks energy and water consumption for buildings
- New York Greener, Greater Buildings Plan - Local Law 87
 - Energy Audits for Existing Commercial Buildings > 50,000 SF
 - Required every 10 years
- San Francisco Existing Commercial Buildings Energy Performance Ordinance
 - Buildings > 50,000 SF meet ASHRAE Level II Audit
 - Buildings > 10,000 SF meet ASHRAE Level I Audit



Data Needed to Inform Targets

- Increase Building Performance Database
 - Building Size: Data for buildings > 50,000 SF
 - Add Primary Activity Type Buildings:
 - Museums
 - Hospitals
 - Laboratories
 - Data Centers
 - Call Centers

- Energy Consumption Data by End Use
 - Plug/Process loads
 - Lighting power
 - Mechanical equipment

- Collect Data on Actual Water Use
 - Base Building: core toilet rooms
 - Process Water: cooling tower makeup, laundry, food service
 - Landscape Irrigation

Data Needed to Aid Design

- Database of common Energy Conservation Measures (ECMs) by climate zone and building type:
 - Energy savings Impact
 - Lifecycle Cost
- Database of Water-Saving technologies and strategies:
 - Water saving impact
 - Lifecycle Cost
- Weather file data to include rainfall *amounts* by month
 - This is currently a “flag” indicating if there is rainfall
- Weather file data to include *measured* solar data
 - Data in the file is generated by a computer algorithm

Recommendations

- Create a Central Repository for Existing Building Information Databases:
 - EIA Commercial Building Energy Consumption Survey – funding needed
 - LEED 2009 MPR
 - EPA Energy Star Portfolio Manager
 - NY Local Law 87
 - SF Existing Commercial Buildings Energy Performance Ordinance

- Refine available energy and water consumption data by end use

- Weather file data to include rainfall amounts and measured solar data

- Engage Energy Service Companies (ESCOs) for database of:
 - Energy savings impact and Lifecycle Costs of ECMs by climate zone and building type
 - Water savings impact and Lifecycle Costs of water conservation measures and strategies