

# *Building Energy Benchmarks*



THE WEIDT GROUP

**CSBR** Center for Sustainable Building Research



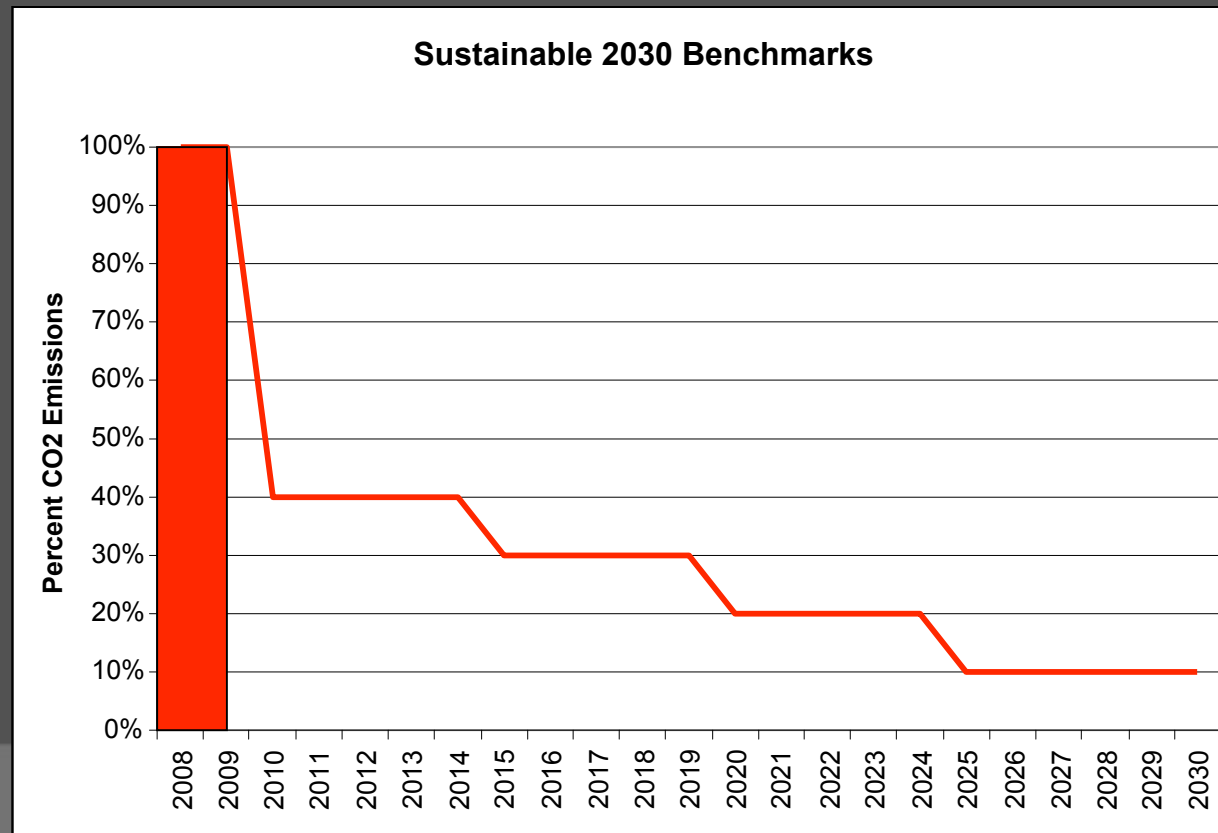
▶ We hate all bureaucracies except the ones we create ourselves

# The Legislation

- ▶ **S.F. No. 2706, 3rd Engrossment - 2007-2008th Legislative Session (2007-2008) (in part)**
- ▶ The purpose of this subdivision is to establish cost-effective energy-efficiency performance standards for new and substantially reconstructed commercial, industrial, and institutional buildings **that can significantly reduce carbon dioxide emissions by lowering energy use in new and substantially reconstructed buildings.**
- ▶ The performance standards should be designed to achieve reductions equivalent to the following reduction schedule, **measured against energy consumption by an average building in each applicable building sector in 2003:** (1) 60 percent in 2010; (2) 70 percent in 2015; (3) 80 percent in 2020; and (4) 90 percent in 2025.

# Benchmarks: Setting the Starting point

- ▶ The Benchmark sets the starting point for CO2 Reduction against which each subsequent target is measure



- ▶ Targets: Reduce CO2 60% by 2010, 90% by 2030

## *What are Metrics used to Benchmark Buildings?*

- ▶ For cars we use:  
**Miles per gallon**
- ▶ For lighting efficiency we use:  
**Lumens per Watt**
- ▶ For Cooling equipment efficiency we use:  
**kW/ ton**
- ▶ For buildings we use:  
Energy Use Intensity (EUI) typically expressed in units of  
**Annual energy consumption per floor area per year**  
  
**kBtu / Square feet / year**

## *Why are Buildings difficult to Benchmark?*

- ▶ Measured building consumption has many factors not related to its design that impacts its actual energy use
  - ▶ Number of hours the building is occupied
  - ▶ Number of occupants in the building
  - ▶ Capacity of plug equipment operating in the building
  - ▶ Was the building built as designed?
  - ▶ Are the complex control systems commissioned and operating to the design intent?
  - ▶ Weather variations in temperature, humidity, wind, and solar radiation from year to year

## *Criteria for a Good Benchmarking system*

- ▶ Easy to use
- ▶ Accurate
- ▶ Consistent
- ▶ Comprehensive

## *Our Research Plan*

- Establish the Benchmarking Goal
- Research Existing Building Energy Benchmarking Systems
- Compare the energy use index for different benchmark systems using 8 to 10 different building types.
- Select a methodology
- Generate energy use index results for a comprehensive list of building space uses consistent with the building practices and climate for Minnesota

## *Benchmarking Goal*

- ▶ Establish comprehensive energy consumption benchmarks for new commercial and institutional buildings in the State of Minnesota to use as the baseline for measuring the energy performance goals established in the Sustainable Building 2030 legislation.
- ▶ The Benchmarking system will consider:
  - ▶ Space usage types of the building
  - ▶ Occupancy characteristics of the building
  - ▶ Floor area of the building
  - ▶ Special use conditions of the building (pools, data centers, etc.)
  - ▶ Geographic location
  - ▶ Weather normalization
  - ▶ Mixed-use building types
  - ▶ Various Building/ meter relationships

# Benchmarking Methods in Use Today

- ▶ Comparing a building to itself
  - the “tracking” or “baseline” approach
- ▶ Empirical model from a sample of other similar buildings in a population
  - Target Finder / Energy Star approach
- ▶ Results of an energy simulation model with certain pre-defined baseline characteristics, such as meeting an energy code or standard
  - current Minnesota B3 Benchmarking and DOE method

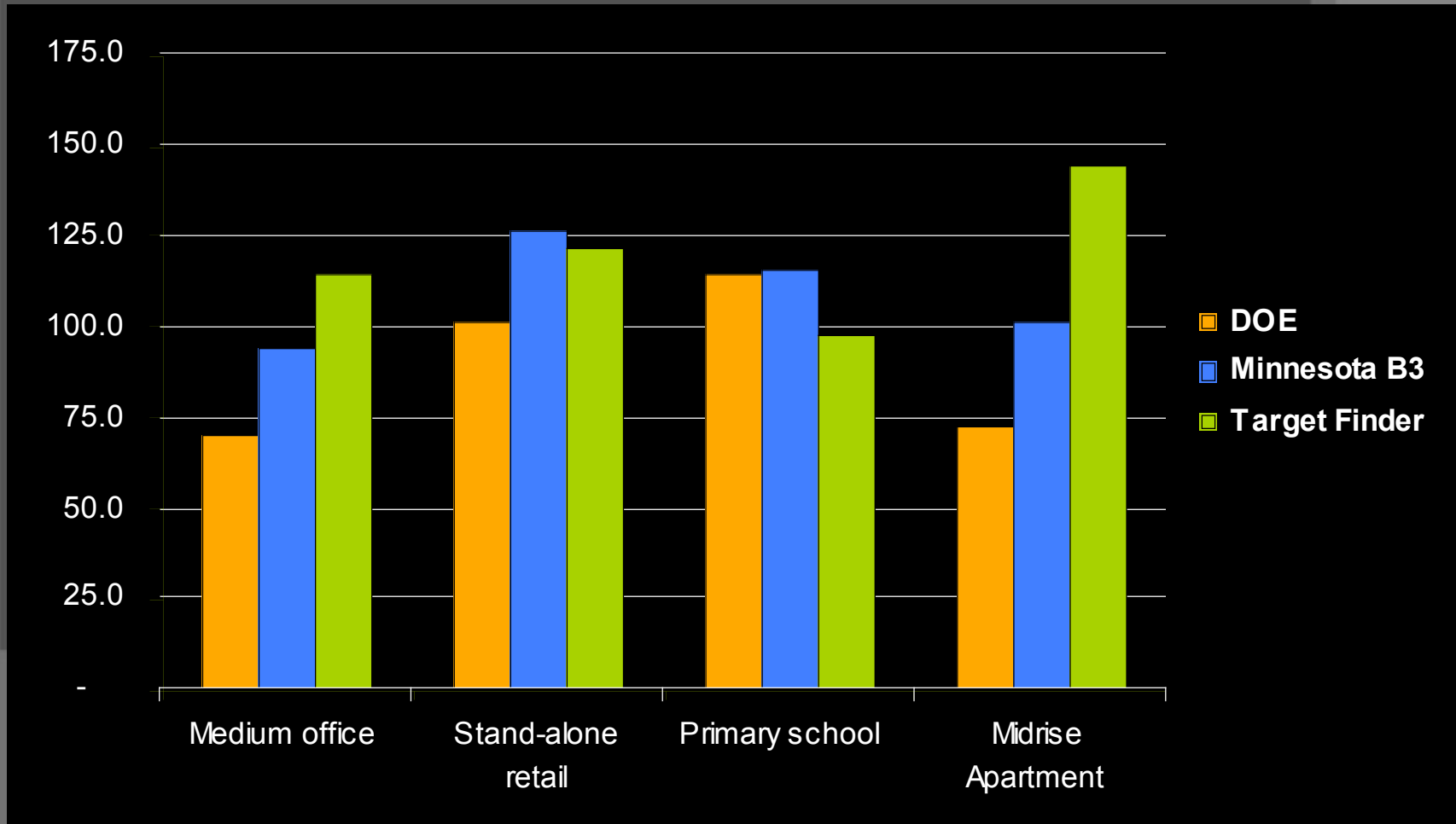
# Research Existing Building Energy Benchmarking Systems

- ▶ Target Finder / Portfolio Manager
  - ▶ 16 different building types – 5 are different hotel types
  
- ▶ Minnesota B3 Benchmarking system
  - ▶ Over 50 different building types
  
- ▶ New DOE Benchmarking system
  - ▶ Planned to have the same types as Target Finder

## *Compare characteristics and features of the different benchmarking methods*

- ▶ Identifying pros and cons based on benchmarking application goals
- ▶ Develop feature / benchmarking system matrix
  - ▶ Can the method accommodate changes in occupancy use, weather normalization, special uses, etc
- ▶ Develop building type / benchmarking system matrix
  - ▶ Can the system comprehensively cover the new building market

# Early Comparison of Different Benchmark System Results





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