ENERGY EFFICIENCY and DISTRIBUTED GENERATION IN COMMERCIAL BUILDINGS

An immediate solution to Green House Gases emissions reductions

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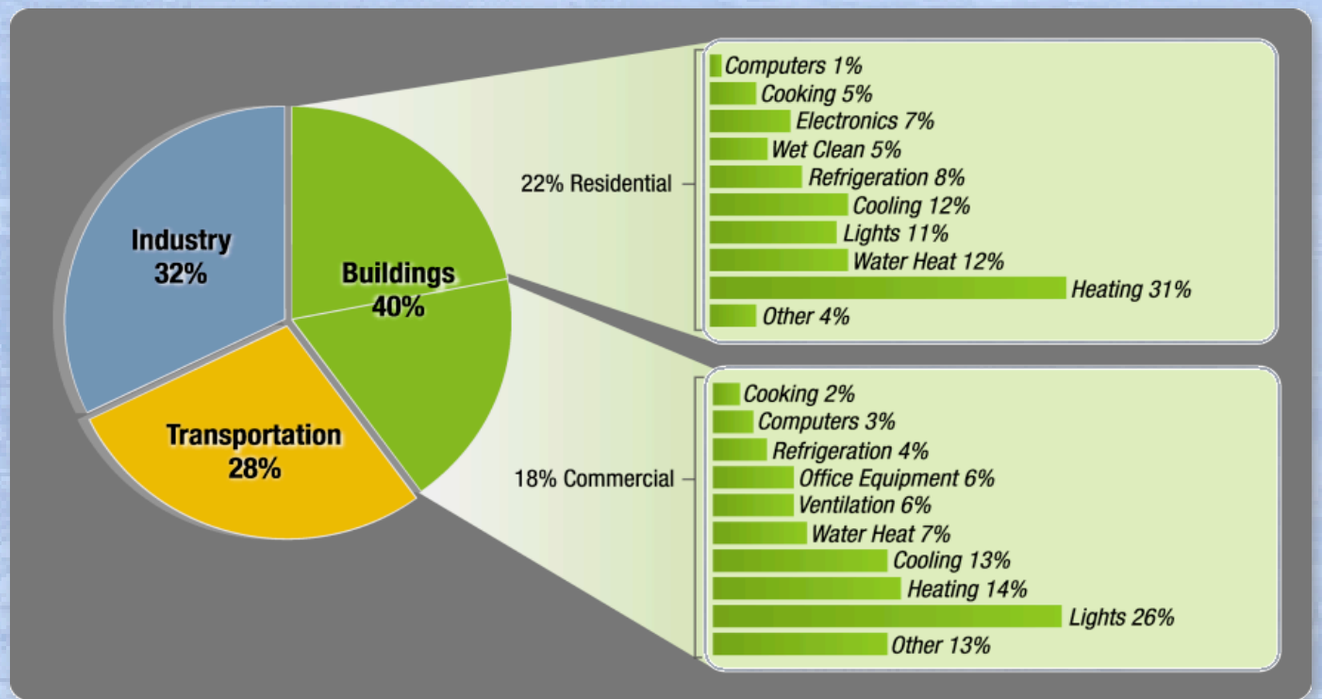
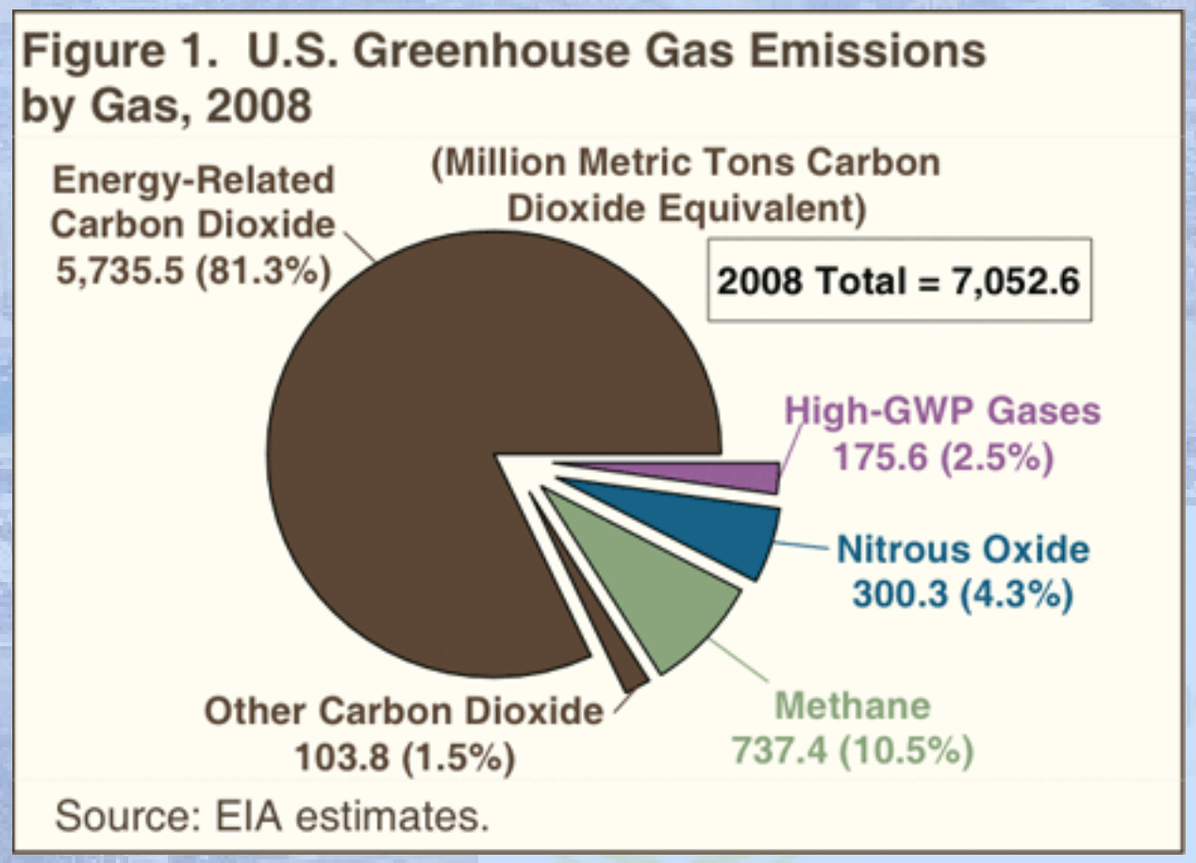
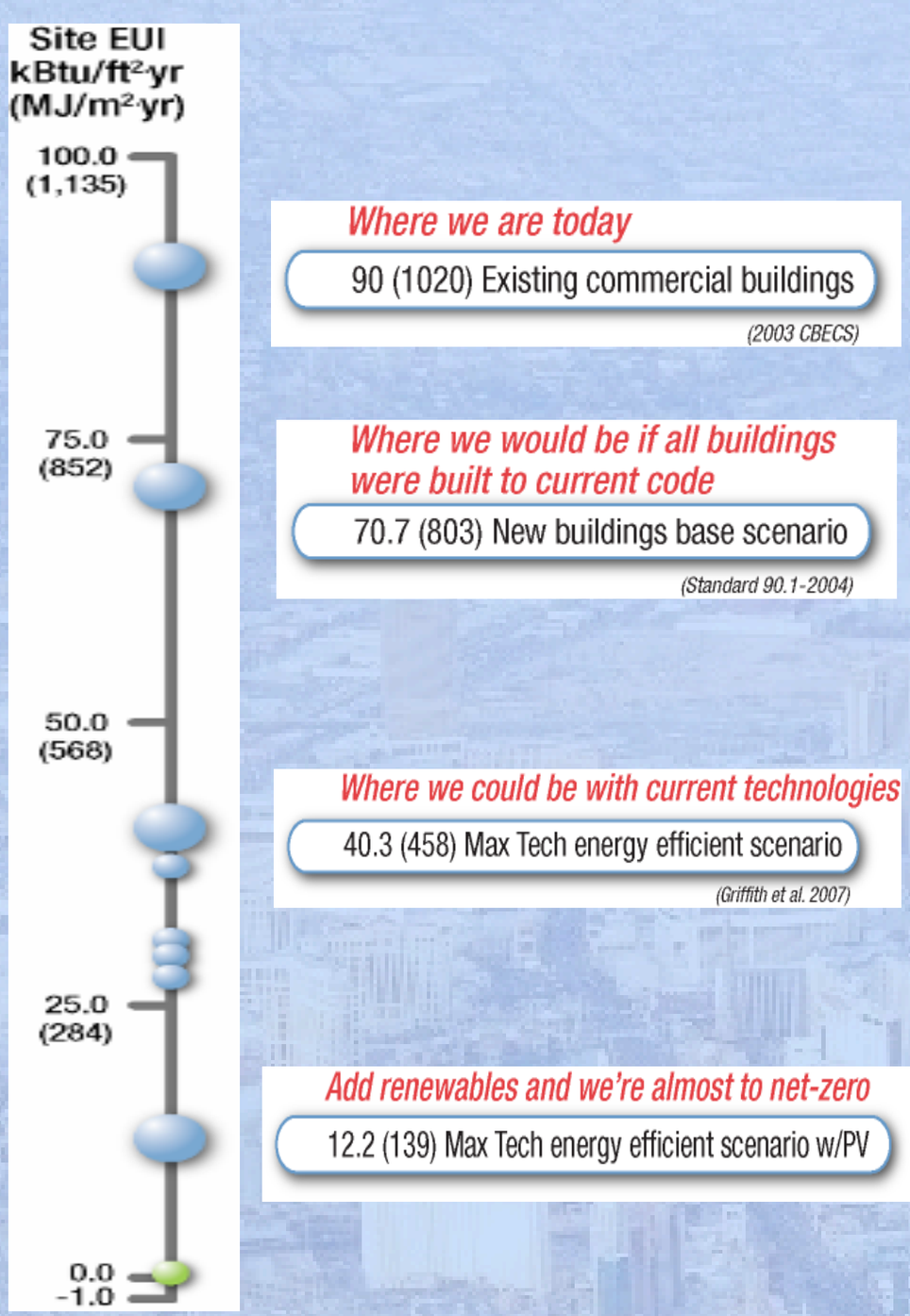
GREEN ENERGY & ENVIRONMENTAL SOLUTIONS

- Buildings are the Largest Energy Consumer in the U.S.
  - 40% of primary energy, 72% of electricity, 55% of natural gas



- 81.3% of US GHG emission are the result of energy generation and delivery.





Towards Net-Zero Energy Buildings

- **Reduce Loads**
  - Envelope and orientation to reduce loads
    - Insulation, air barrier & windows
  - Envelope and orientation to meet loads
    - Daylighting, passive solar heating, and natural ventilation
  - Lighting design
    - Daylighting
  - Plug loads
    - Design vs. owner loads

- **Match Equipment to Loads**
  - Climate-specific HVAC designed for the remaining loads

- **Make Sure the Building Works**
  - Enhanced Commissioning
  - Detailed "Owner's Manual"

- **Constant Evaluation**
  - Advanced Monitoring Technology

- **Keep It Simple**

- **Choose Site Specific Renewable Generation Carefully**

Set Ambitious Goals

- **New Constructions:**
  - Design Commercial buildings to use 50% less energy than the ASHRAE 90.1-2004 levels
  - Realistic if addressed in the early design stages.
  - Reduced OPEX makes it very attractive to building Owners and/or Operators

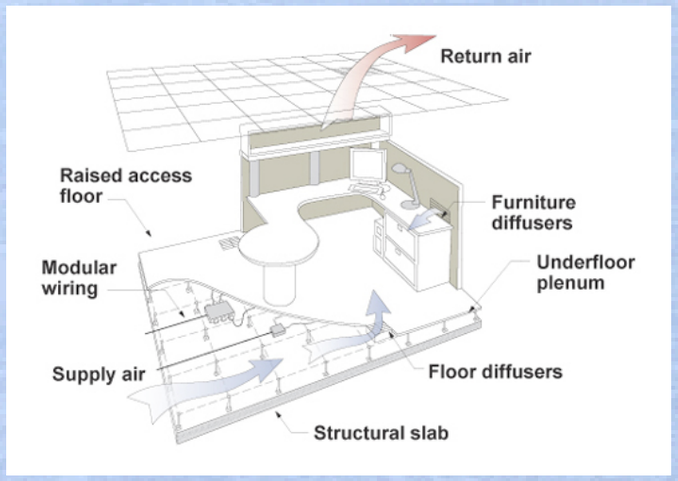
- **Existing Buildings**
  - Implement strategies to reduce energy use by 30% compare to recent historical energy use.

Tools.

- **New Constructions:**
  - Whole Building Energy Simulation:
    - Allows to predict the performance of a combination of energy strategies. To be used as a design tool.
  - Integrated Design:
    - The design team must address the building as a whole and integrate all potential strategies in a holistic fashion.
- **Existing Buildings**
  - Energy Star Portfolio Manager:
    - Allows to calculate Building Energy Intensity and compare its performance to a benchmark of similar buildings.
  - ASHRAE Energy Audits (Level I & II)
    - Allows to identify the simplest and most efficient energy strategies.
  - Retro-Commissioning:
    - Ensures that all systems are working properly. Allows to recalibrate the equipments for optimal operation.

Technology Strategies:

- Intelligent Building energy management systems (Ghost Loads management…)
- Smart Micro-grid
- HVAC systems (under floor air, geo-exchange systems…)
- Daylighting strategies (Concentrated sunlight and fiber optics…)
- Lighting controls and technology (LED,OLED…)
- Envelope (insulation, Translucent PV windows and curtain walls, cool roofs…)
- Waste to energy (Bio-gasification…)
- Waste heat recovery systems (for heating or electricity generation)
- Renewables (Solar PV and Thermal, Urban wind…)



Economics.

All strategies must make economic sense:

- Find the appropriate combination of Energy Efficiency measures and distributed generation that will meet a building owner's ROI targets.
- demonstrate a positive NPV on a 4 to 6 years lifecycle cost analysis
- Importance of the holistic approach.
- While Federal and State Incentives help increase the ROI, it is still hard to make the business case for high CAPEX inherent to the implementation of these strategies:
  - Need for creative Financing programs which would convert High CAPEX into medium to long term Lower OPEX.

How are we addressing Climate Change and GHG.

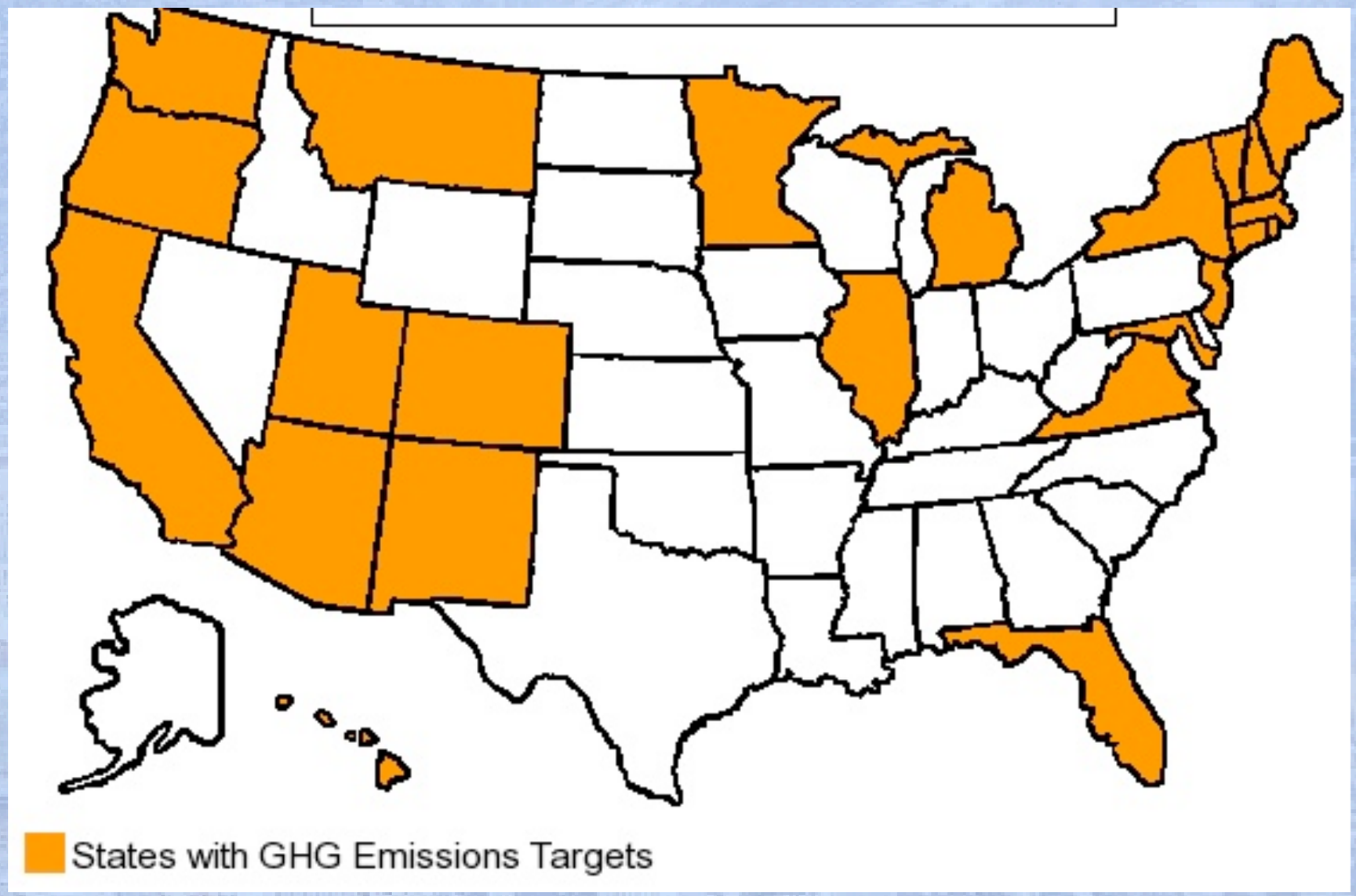
- **Renewable Portfolio Standard:**
  - Goal of 25% Renewable Electricity by 2020:
    - Energy efficiency can represent 1/4 of the Standard
  - Puts most of the responsibility solely on the Utility Companies

- **Tax Abatement for Green Buildings**
  - Based on LEED Rating systems:
    - While LEED most certainly helped raise awareness about carbon footprint problems and jumpstarted sustainability efforts, the early ratings had a limited energy scope, resulting building with low energy performance obtaining certification.

Alternative Solution.

- **Set GHG emissions reductions goals:**
  - i.e, 50% reduction from 1990 levels by 2020
  - Spread the accountability for Carbon emissions to commercial and industrial players
  - Implement a gradual regulation to lead towards the goal
  - Create a platform for trading GHG allowances (Those who go above and beyond the regulation requirements can sell their Energy/Carbon offsets to those who didn't meet the requirements, thus increasing the ROI)
  - Such framework would encourage Building and industry owners to reduce their energy intensity below the requirements, it would also allow the utility companies to purchase Energy offsets which in turn would help them meet the RPS, while reducing the need for additional generation.

What are others doing?



Thank you

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