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# **Benefits of Energy Efficiency and Sustainable Design**

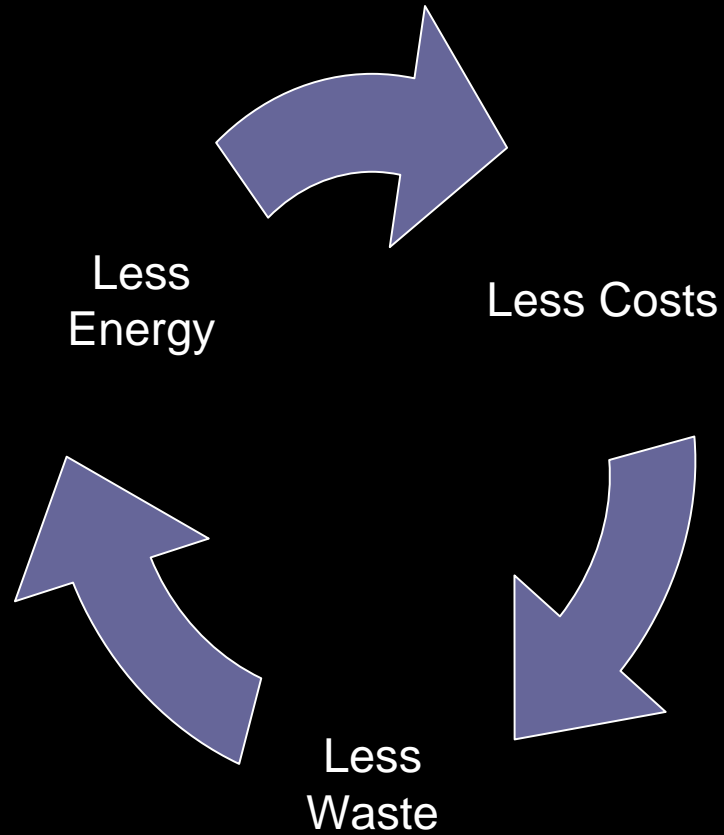
## ***Article 22***

# Why ?



- **Purpose:** To enhance a building's overall performance while improving comfort; indoor air; energy, water and materials efficiency; and the bottom line.
- **Buildings use or produce:**
  - Less energy
  - Less fuel
  - Less waste / pollution

# Break it Down



# What is happening now? What are we doing?

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- One – size fits all.
- Remote design.
- This is the way we have always done it.



# Why do we need to do this?

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- Unfortunate Truth.
- Agent of Change.
- Everywhere.

# Article 22

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- Does not apply to existing structures.
- Does not apply to new single family and duplex residences.
- Reflects existing codes and programs used all over the world.
- Does not prohibit use of fossil fuels.
  - Just requires energy efficiency and money savings.

# How it works.



- Performance Zoning.
  - Choice
  - Creativity
- **Home energy consumption averages:**
  - space conditioning, 44%
  - water heating, 13%
  - lighting, 12%
  - refrigeration, 8%
  - home electronics, 6%
  - laundry appliances, 5%
  - kitchen appliances, 4%
  - other uses, 8%

# Article 22

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- Requirements increase with building size.
- Even if up front cost increases, relative amount is really small.
- Payback, with incentives, likely to be instant up to two years.



# Learning More.

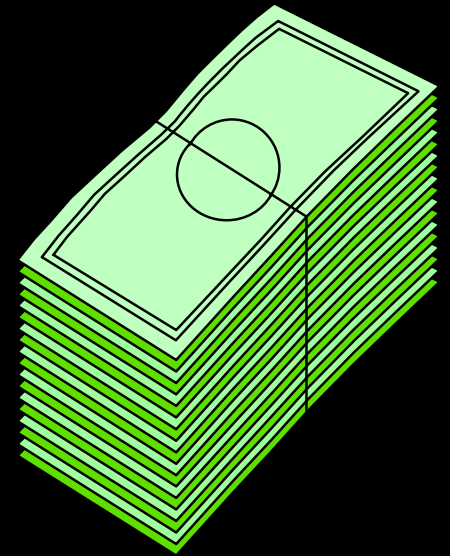
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- Planning Board Website.
  - [www.nhplanning.com](http://www.nhplanning.com)
    - Ordinance.
    - Examples.
    - Information.
- February 15 – Energy Pollution and Climate Change.
- March 1 – Environmental Solutions and Savings.

# Economic Factors



- **First Costs/Savings** = costs and savings from incorporating features into a building.
- **Life-Cycle Costs/Savings** = costs/savings over a building's or feature's useful life.
- **Relative costs components over 30 years**
  - Design & building = 2%
  - Operations, maintenance, finance & employees = 98%
  - Key point: more should be spent on better design



# What?



- Even if \$5,000 More.
  - 10% Tax Deduction = \$4,500 Total Cost.
  - Saves \$2,000/yr.
  - Payback in 2.5 years.
  - 10 more years = \$20,000.00.
- SENATORS GREGG, SUNUNU, BASS, BRADLEY ANNOUNCE \$1.5 MILLION IN WEATHERIZATION GRANTS FOR NH



# Economic Factors



- **Life-Cycle Savings from:**

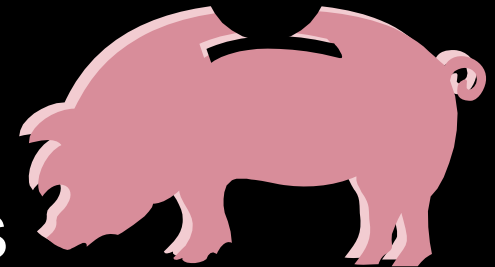
- ▶ Energy & Lighting Efficiency
- ▶ Heating and Cooling Efficiency
- ▶ Materials Efficiency
- ▶ Construction & Debris Recycling



# Energy Efficiency & Savings



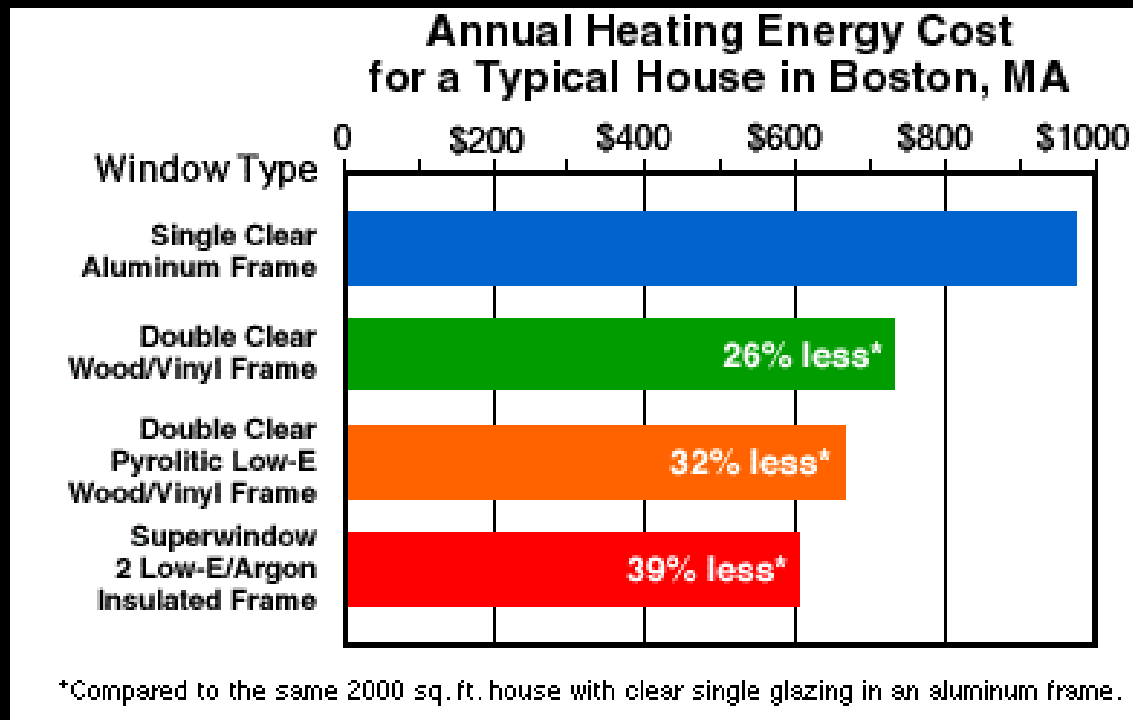
- **Easy Sources of Savings:**
  - ▶ Lighting
  - ▶ Windows
  - ▶ HVAC Systems
- Efficient lighting & better windows can lead to smaller and less costly HVAC system – **REGARDLESS OF FUEL SOURCE!**





# *Energy Efficient Windows*

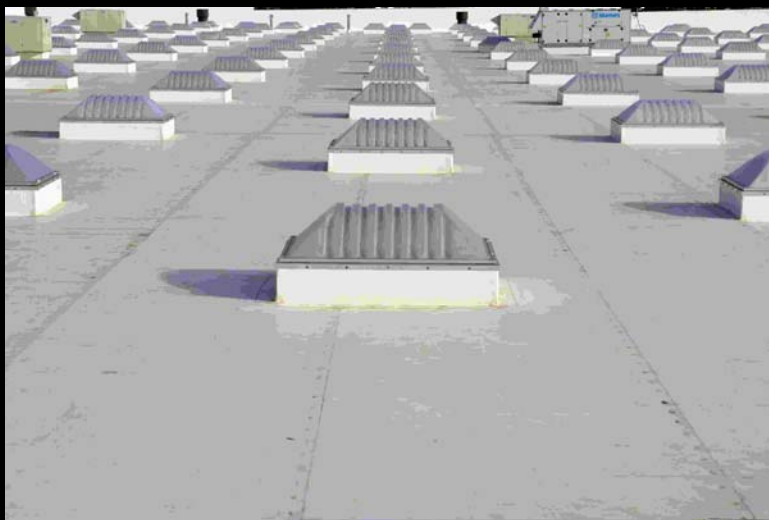
## Can decrease heating costs by 40%



# Lighting



- Efficiency.
- Daylighting.

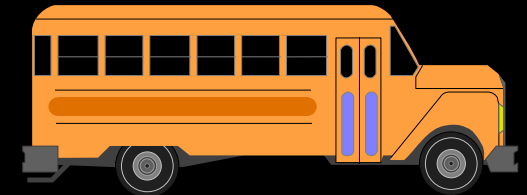


# *Example: Schools (lots of studies and data).*

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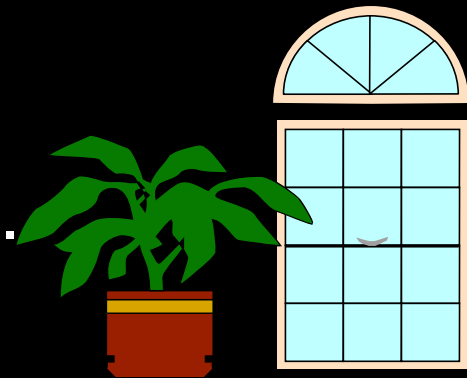
- Spend more than \$6 billion annually on energy
- Daylit schools vs. non-daylit schools:
  - ▶ 22%-64% energy cost reductions
  - ▶ Payback for new daylit schools < 3 years
  - ▶ Increase in student performance



# Employee Productivity



- Higher productivity and comfort
- Environmental factors impacting productivity
  - ▶ Indoor air quality
  - ▶ Climate control
  - ▶ Lighting, esp. daylighting
  - ▶ “Biophilic” features -- views, plants, etc.



# *Case Study: US Post Office, Reno, NV*



## Changes:

- ▶ Energy efficient lighting and dropped ceiling
- ▶ Cost = \$300,000
- ▶ Energy savings \$22,400/year, payback 13 years

## • **Impact on productivity**

- ▶ Sorting errors dropped to 0.1%
- ▶ 8% ↑ in mail sorted per hour
- ▶ Annual productivity gains \$400-500K
- ▶ Payback period < 1 year



# *Case Study: Herman Miller SQA Building*



- **295,000 s.f. office & manufacturing center**
  - ▶ Extensive daylighting
  - ▶ Interior “street” with plants
  - ▶ Passive heating & cooling
  - ▶ \$35,000+ annual energy savings
- **Impact on productivity**
  - ▶ ↑ worker effectiveness and productivity



# *Example: Daylighting & Student Performance*



- **↑ Daylighting, windows, skylights**
  - ▶ 15-25% faster progress on math and reading tests
  - ▶ 7-18% higher test scores
- **Students in daylit facility for multiple years**
  - ▶ 14% ↑ on standardized tests



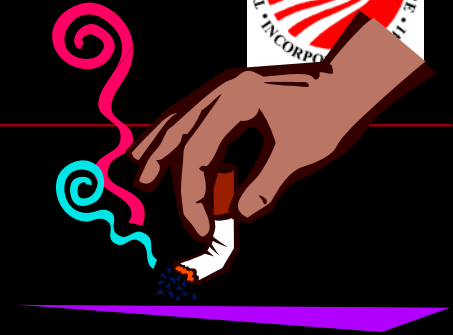
# Health

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- **US EPA ranks indoor air quality (IAQ) as one of top 5 environmental risks to public health.**
- **Indoor contamination levels can be 25 times as high as outdoors.**
- **Solutions: eliminate sources and increase ventilation**

# Employee Health



## Factors contributing to poor IAQ

- Inadequate ventilation
- Chemical contaminants from indoor sources
  - VOCs, smoke, other toxics
  - Sources: building materials, cleaning products
- Chemical contaminants from outdoor sources
  - Vehicle & building exhausts thru vents & windows
  - Combustion products from garages

# Site Use & Materials

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## Economic & Environmental benefits

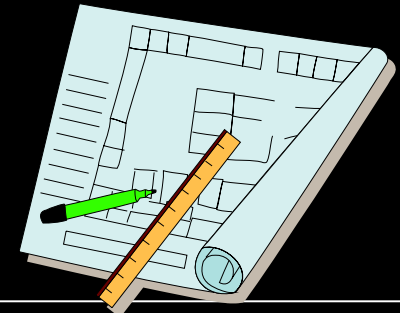
- Lowers construction costs
- Saves energy & water over life of building
- Use of regional and recycled materials
- Creates markets for NH products and workers.

# Design Efficiency

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- **Lower Initial costs**
  - ▶ “Right-sizing” of infrastructure and mechanical systems
- **Lower Life-cycle costs**
  - ▶ Durable materials last longer, lower costs





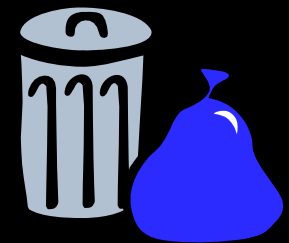
- Emeryville, CA affordable housing development
  - Framing at 24” instead of 16”
  - Significant saving on volume of wood used
- 50,000 sq. ft. school
  - Costs of carpet vs. durable floor compared
  - Includes installation, maintenance & replacement costs
  - Over 40 years, durable flooring saves \$5.4 million

# C & D Debris Recycling



## Scope of the Problem

- 136 million tons of building-related C&D debris (96)
- 43% from residential sources, 57% non-residential
- 20 - 30% recovered for processing & recycling
- Most often recycled: concrete, asphalt, metals, wood.



# C & D Debris Recycling



- Cost often < hauling and dumping as waste
- Daily pick-up by recycling company
  - ▶ Keeps site cleaner
  - ▶ ↑ Work efficiency & safety
- ↑ Compliance with landfill disposal reduction ordinances
- Landfill disposal (tipping) fees are increasing
- Revenue from sale of recovered materials



# C & D Debris Recycling



- Development of 95 large, single-family homes
- Builder worked with recycling subcontractor
- 85% of construction waste recovered and recycled
- 1,000 tons of materials diverted from landfill

*Case Study: New  
Construction  
- Union City, CA*

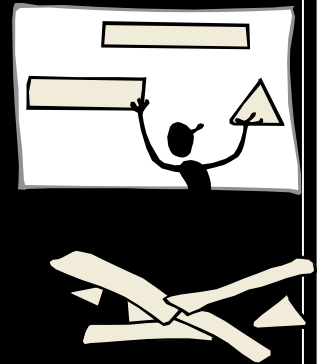


# “First Cost” Incentives



## ESCOs (Energy Services Companies)

- Construct & monitor energy-efficient systems
- Performance contracting
  - ▶ Compensation based on results measured over building life
  - ▶ ↑ savings from ↓ energy consumption
  - ▶ Minimizes customer risk and initial capital expenditures

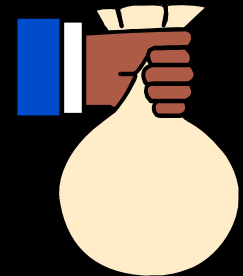


# “First Cost” Incentives



## Economic Incentives

- Tax credits for developers
  - ▶ Environmental performance criteria must be met
  - ▶ Approach minimizes overhead costs
- Federal tax incentives
  - 10% for CHP energy systems, 30% for fuel cells and renewables
  - A suite of deductions and credits for other energy efficiency measures



# We are not alone.

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- PSNH
- Keene
- NH DES
- NH PUC