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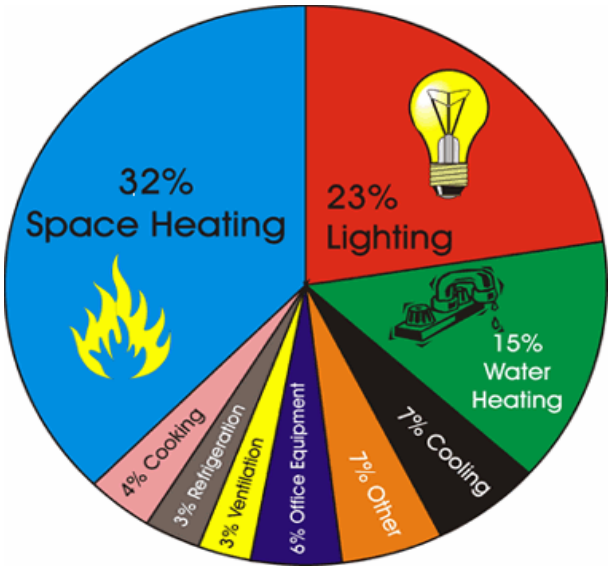
Energy in Buildings

Consumption

- Buildings are responsible for **40% of total annual U.S. energy consumption**
  - By comparison, the transportation sector consumes 28%; industry consumes 32%
- Of total U.S. resources, buildings use about:
  - Electricity: 70%
  - Potable water: 12%
  - Raw materials: 30%
  - Raw materials (excluding food and fuel): 60%
  - Petroleum: 8%
  - Natural gas: 53%
- Over $80 billion dollars are spent every year on electricity and natural gas in buildings
- Lighting alone comprises nearly a quarter of a building's total energy consumption

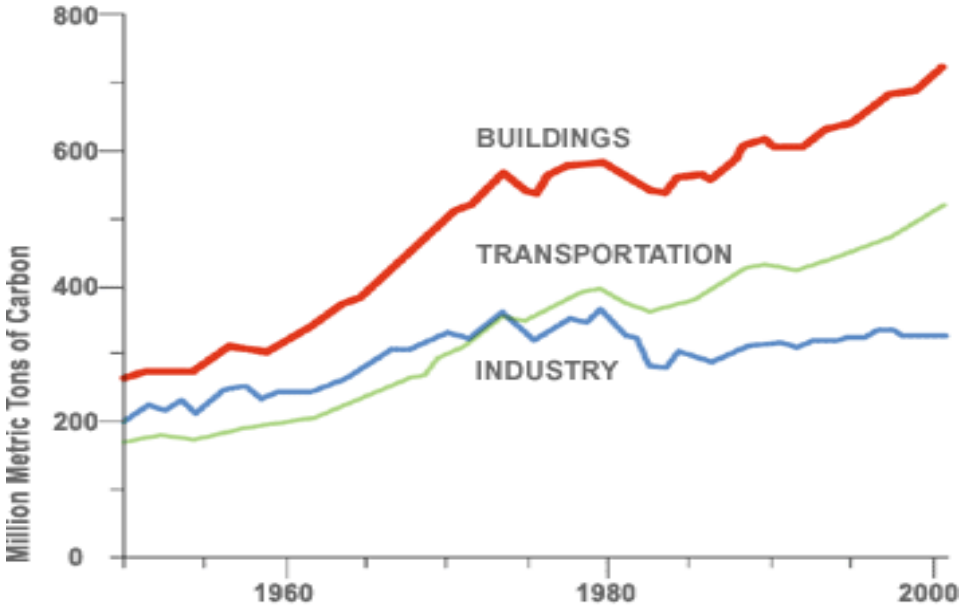


Source: "How Energy is Used In Commercial Buildings," 2004, Energy Information Administration

- The lifespan of a typical non-residential building is over 75 years, while public schools have a useful life of about 60 years
  (Survey on Service Lives of North American Buildings, 2004; http://www.durable-wood.com/pdfs/Service_Life_E.pdf)
- Therefore energy costs accumulate enormously over time and can easily surpass the initial cost of the building itself

Emissions

- The United States produces 25% of global greenhouse gas emissions
- Buildings are responsible for 48% of U.S. greenhouse gas emissions, including:
  - 35% of Carbon Dioxide (CO_2)
  - 49% of Sulfur Dioxide (SO_2), the main cause of acid rain. SO_2 is produced almost exclusively from the combustion of fossil fuels.
  - 25% of Nitrogen Oxides (NO_x)
  - 10% of Particulate Matter (PM)
    (OFEE 2006, http://www.ofee.gov/sb/fgb_report.html)
- The majority of these emissions come from burning fossil fuels
- 40% of non-industrial waste is produced by buildings (136 million tons annually)
  (U.S. EPA, http://www.epa.gov/epaoswer/hazwaste/sqg/c&d-rpt.pdf)
- Buildings are responsible for 31% of the Mercury (Hg) in municipal solid waste
  (U.S. EPA, http://www.p2pays.org/ref/03/02026.pdf)
- According to the graph below, the building sector is responsible for the majority of carbon emissions – emitting significantly more metric tons of carbon than the transportation and industrial sectors



Source:http://www.architecture2030.org/building_sector/index.html

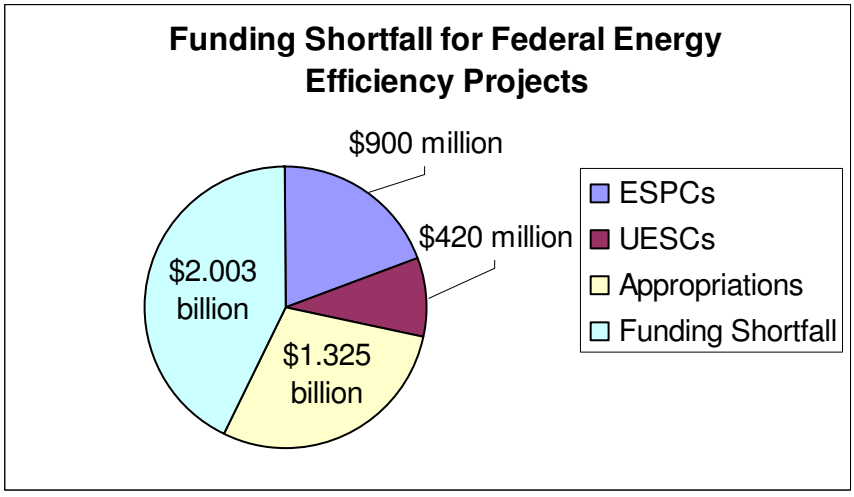
Federal Buildings Energy Facts

- The federal government owns and operates over 500,000 buildings
- These buildings encompass over 3.375 billion square feet
- The Federal Government used 1.7 quads of energy in 2004, with close to 34% of that energy going to buildings
    - Total U.S. energy consumption in 2004 was 99.74 quads, making the government's share more than 1.7%
      (Federal Energy Management Program 2004 Annual Report
      http://www1.eere.energy.gov/femp/pdfs/annrep04.pdf)
- In FY 2004, the federal government spent over $5.1 billion on energy costs for their buildings, or 0.22% of the total federal expenditures of $2.319 trillion
- Energy consumption per square foot in standard buildings in FY 2004 decreased 25.6% from FY 1985

Federal Buildings Energy Use FY 2004

Building Category	% of Energy Usage	Cost
Standard	77.65	$4.0 billion
Energy Intensive	16.18	$0.7 billion
Exempt	6.17	$0.4 billion

- According to the Federal Energy Management Program (FEMP), federal funding is inadequate to meet the Executive Order 13123 goal of reducing energy consumption, even with Energy Saving Performance Contracts (ESPCs) and Utility Energy Service Contracts (UESCs).
- According to the chart below, FEMP predicts a funding shortfall of over $2 billion for necessary energy-efficiency projects.



Source: Federal Energy Management Program 2004 "Improving the Energy Efficiency of the Federal Government" Fact Sheet <http://www.ase.org/uploaded_files/policy/FEMP%20Fact%20Sheet.pdf>

Success Stories

- Texas Instruments RFAB (semiconductor fabrication plant)
  - 1,000,000 square feet; $300 million initial investment
  - Uses 20% less energy and 35% less water than conventional "fabs," which can use 2-3 million gallons of waters per day (25% for cooling)
  - The 30% overall cost savings allowed this plant to be built in Richardson, TX instead of in Asia.
  - Expected to be first LEED-certified semiconductor facility
  - Contact: Paul Westbrook, Sustainable Development Manager, TI (Presentation available at www.eesi.org)
- Condé Nast Building, Four Times Square, New York City
  - $500 million project, 52 stories, 1.6 million square feet
  - Environmentally friendly gas-fired absorption chillers
  - High-performance insulating and shading curtain wall
  - The air delivery system provides 50% more fresh air than NYC code requires
  - Comprehensive set of tenant guidelines
  - A network of recycling chutes serves the entire building
  - 10-15% lower operational costs than a comparably-sized project
- Solaire, Battery Park, New York City
  - A 27-story residential tower. Designed to use 35% less energy, reduce peak demand by 65% and use 35% less potable water. Integrated PV panels, daylighting and a multitude of other technologies and techniques are utilized in this building.
  - Contact: David Hess, Project Manager, Cesar Pelli & Associates
- ING Bank Headquarters, Amsterdam
  - 540,000 sq. ft office building, built in 1987
  - Uses 92% less energy than conventional building, 80% less than a building of today.
  - 15% less absenteeism!
  - $2.9 million in annual energy savings with only $700,000 of extra initial costs
  - Technologies used: daylighting, passive heating, cooling and ventilation, cogeneration, etc.
- Ridgehaven Building, San Diego, CA
  - 73,000 sq. ft. office building with a nearly identical neighbor next door
  - Renovated in 1996 with sustainable performance technologies
  - Now saves $70,000/year in energy costs and uses 65% less total energy than its neighbor
- Sam Nunn Atlanta Federal Center, Atlanta, GA
  - Energy consumption reduced 9-25% each month
  - Monthly energy cost savings averaging $19,000
  - Tenant comfort complaints reduced by 35%

  (FEMP 2004 http://www.eere.energy.gov/femp/newsevents/fempfocus_article.cfm/news_id=8303)

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