

CIBSE ASHRAE Group

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How serious are the “Yanks” about energy?

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How serious are the “Yanks” about energy

- CIBSE and ASHRAE recently issued a joint statement calling for continued reductions in carbon dioxide emissions, guidelines leading to reduced energy consumption and responsible refrigerant use.
- But how serious are US Engineers and Architects about implementing real energy saving designs and developing low carbon zero energy sustainable buildings?

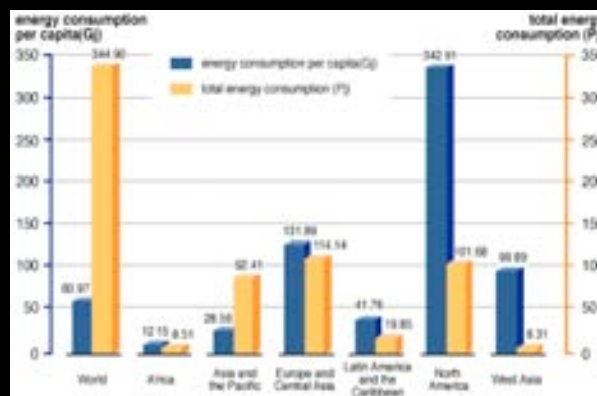


Energy and US Image

- Big cars
- Big Buildings
- Everything air conditioned
- Energy plentiful
- Energy cheap



North America – Energy per Capita



Energy consumption per capita in G-8 countries, 1990 and 2002

1990			2002	
G-8 countries	Terajoule per person	Rank	G-8 countries	Terajoule per person
United States	0.3300	1	United States	0.3411
Canada	0.3231	2	Canada	0.3407
G-8 Average ¹	0.2050		G-8 Average ¹	0.2198
U.S.S.R.	0.1995	3	France	0.1860
Germany	0.1921	4	Russia	0.1836
France	0.1673	5	Germany	0.1798
United Kingdom	0.1578	6	Japan	0.1736
Japan	0.1545	7	United Kingdom	0.1638
Italy	0.1151	8	Italy	0.1274

1. The G-8 average is used as a common based for comparison purposes even though it did not exist in 1990.

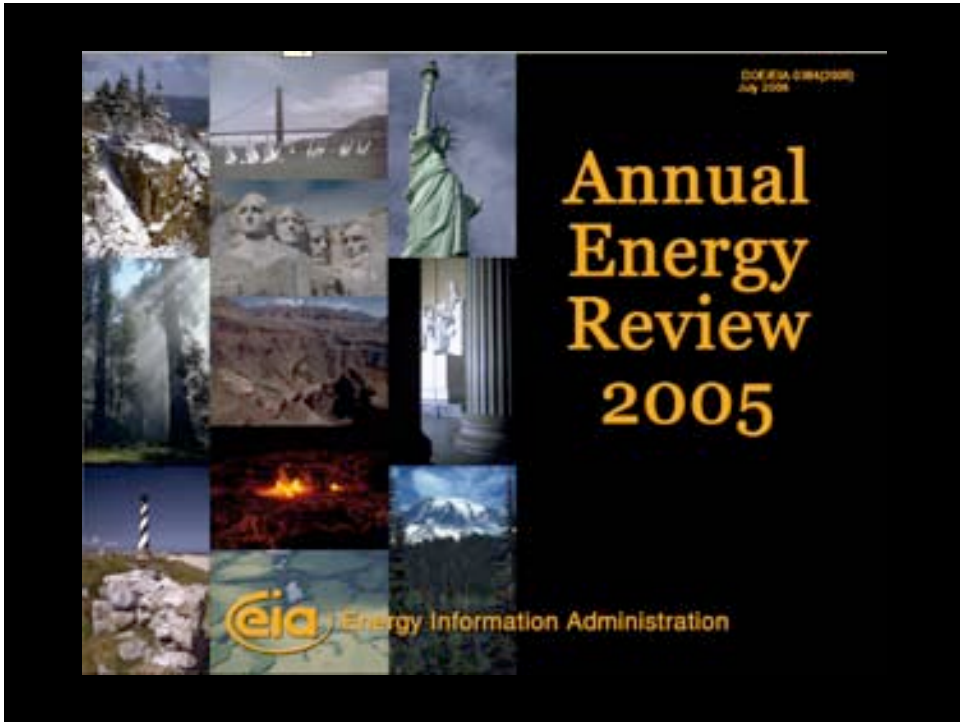
Source: International Energy Agency, special tabulation, December 6, 2004.

Weekly U.S. Retail Gasoline Prices, Regular Grade

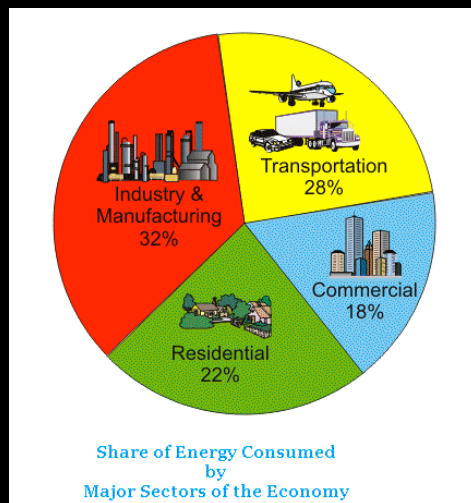


Source: Energy Information Administration

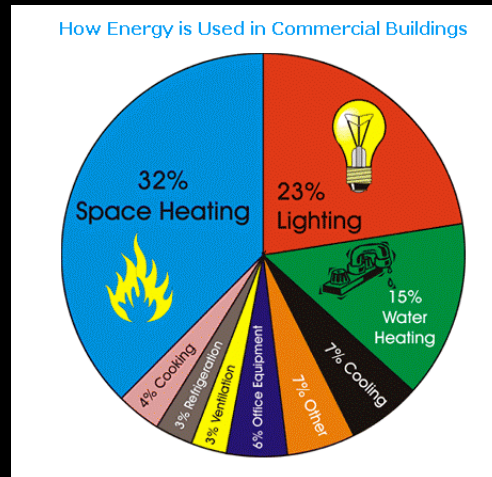




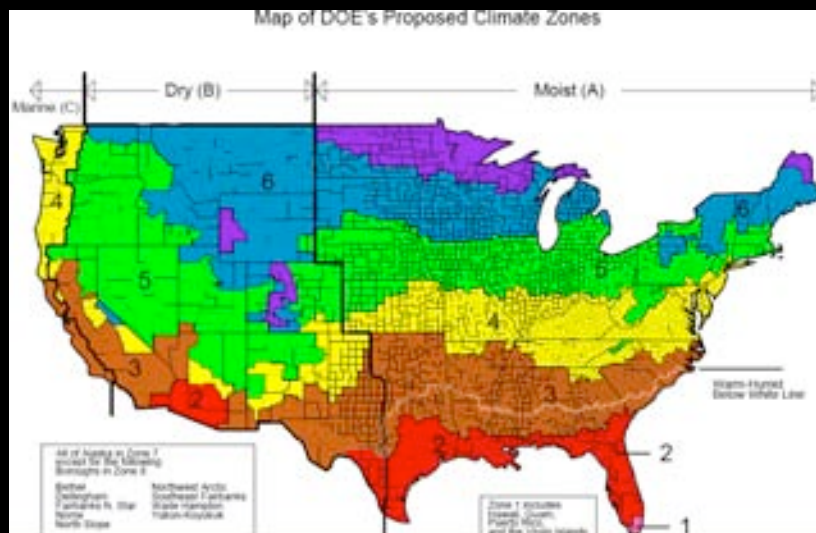
Where does the energy go?



Building Energy Use



Climate



Migration and Air Conditioning



Figure 1: Type of Air-Conditioning Equipment by Census Region, 1978, 1987, and 1997

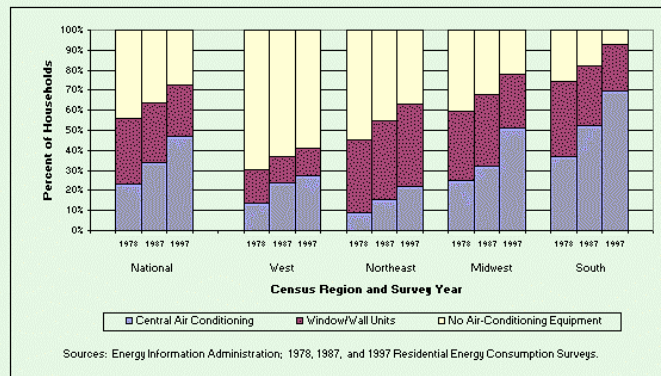
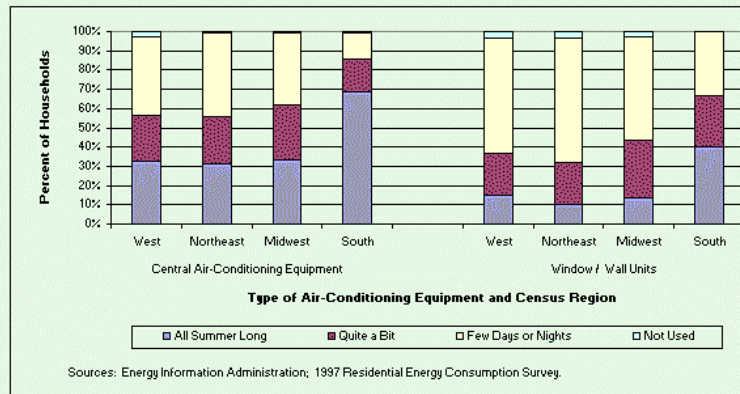


Figure 3: Frequency of Air-Conditioning Usage by Census Region, 1997



ASHRAE Standard 90

- ASHRAE's Flagship Energy Code
- First published 1975
- Residential and commercial buildings
- Covers Building, lighting and HVAC
- Mandatory and prescriptive options
- Allows trade offs – cost based

Standard 90-75 to 90.1-2004

- 1989 Divided into two separate standards
- Updated in 1980, 1989, 1999, 2001 & 2004
- New and alterations to existing buildings
- 8 climate zones for compliance by R-values
- Software to quickly evaluate trade-offs
- Efficiency standard for the HVAC
- Code - Compliance obligatory under The Energy Policy Act of 1992

California Title 24

- Developed at about same time as Std 90
- Originally more stringent
- Cost effectiveness based
- Part mandatory/ prescriptive/ performance
- Computer simulation
- Hydronic variable flow – mandatory
- Now similar to Standard 90.1

Title 24 Constraints

- Limitation on electrical resistance heating (can be used in performance compliance)
- Limitation on air cooled chillers < 352kW (Based on first versus running cost)
- Centrifugal fan cooling towers limited (Only for acoustic purposes)

US Energy Consumption for All Buildings

1,000s Btu/ft²/year - Site energy with electricity at 3,413 Btu per kWh

- Before 1920 80.2
- 1920 to 1945 90.4
- 1946 to 1959 80.9
- 1960 to 1969 91.5
- 1970 to 1979 97.0
- 1980 to 1989 100.0
- 1990 to 1999 90.2
- 2000 to 2003 81.6

US Energy Consumption for All Buildings

1,000s Btu/ft²/year - Site energy with electricity at 3,413 Btu per kWh

- Northeast 99.8
- New England 99.8
- Middle Atlantic 99.7
- Midwest 99.4
- East North Central 108.1
- West North Central 80.2
- South 84.7
- South Atlantic 88.7
- East South Central 91.4
- West South Central 75.8
- West 82.9
- Mountain 106.1
- Pacific 71.6

Electric Use Only kWh/ft²/year

	1959 or Before	1960 to 1989	1990 to 2003
• Education	6.8	12.3	14.4
• Food Service	16.7	42.9	59.4
• Health Care	19.2	25.5	21.0
• Lodging		15.3	15.1
• Mercantile	11.3	19.3	21.9
• Retail (Other Than Mall)	8.2	13.3	19.7
• Enclosed and Strip Malls	21.8	23.3	
• Office	11.9	19.2	17.9
• Public Assembly	4.6	13.9	21.6
• Religious Worship	2.9	4.8	8.1
• Service	6.3	13.4	11.4

Green Building Council - LEED



LEED Categories - Levels

LEED-NC Section	Points
Sustainable Sites	14
Water Efficiency	5
Energy & Atmosphere	17
Materials & Resources	13
Indoor Environmental Quality	15
Innovation & Design Process	5
Total	69
Certified 26–32 points	Silver 33–38 points
Gold 39–51 points	Platinum 52–69 points

Sustainable Sites

1 Sustainable Sites			14 Points
Y	Prereq 1	Erosion & Sedimentation Control	Required
	Credit 1	Site Selection	1
	Credit 2	Development Density	1
	Credit 3	Brownfield Redevelopment	1
	Credit 4.1	Alternative Transportation, Public Transportation Access	1
	Credit 4.2	Alternative Transportation, Bicycle Storage & Changing Rooms	1
	Credit 4.3	Alternative Transportation, Alternative Fuel Vehicles	1
	Credit 4.4	Alternative Transportation, Parking Capacity and Carpooling	1
	Credit 5.1	Reduced Site Disturbance, Protect or Restore Open Space	1
	Credit 5.2	Reduced Site Disturbance, Development Footprint	1
	Credit 6.1	Stormwater Management, Rate and Quantity	1
	Credit 6.2	Stormwater Management, Treatment	1
	Credit 7.1	Landscape & Exterior Design to Reduce Heat Islands, Non-Roof	1
	Credit 7.2	Landscape & Exterior Design to Reduce Heat Islands, Roof	1
	Credit 8	Light Pollution Reduction	1

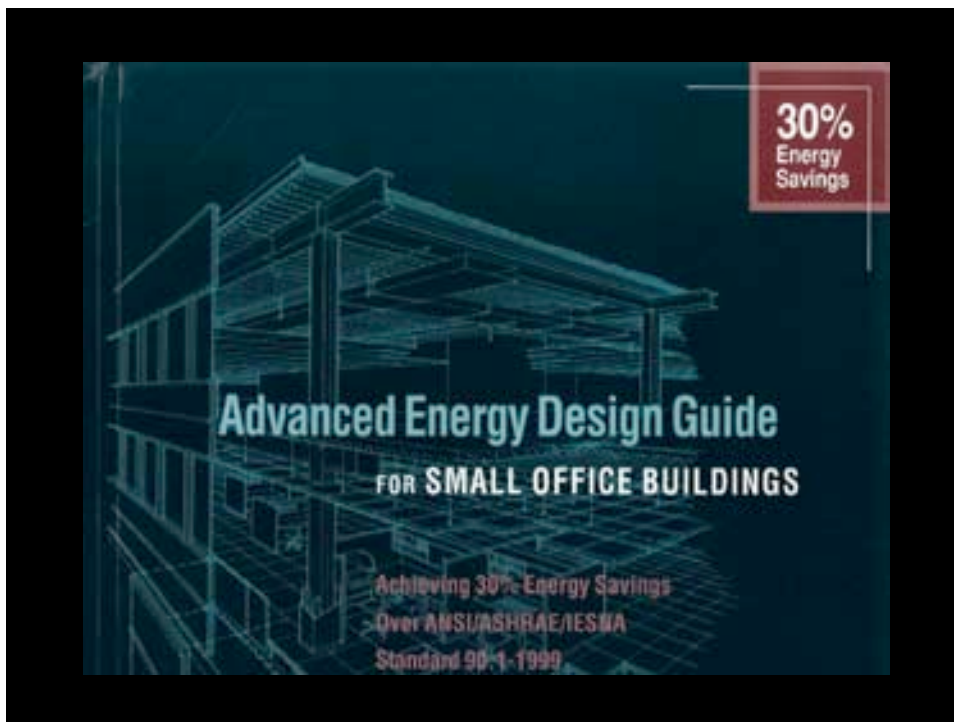
Yes ? No

Energy and Atmosphere

Energy & Atmosphere			17 Points
Y	Prereq 1	Fundamental Building Systems Commissioning	Required
Y	Prereq 2	Minimum Energy Performance	Required
Y	Prereq 3	CFC Reduction in HVAC&R Equipment	Required
	Credit 1	Optimize Energy Performance	1 to 10
	Credit 2.1	Renewable Energy, 5%	1
	Credit 2.2	Renewable Energy, 10%	1
	Credit 2.3	Renewable Energy, 20%	1
	Credit 3	Additional Commissioning	1
	Credit 4	Ozone Depletion	1
	Credit 5	Measurement & Verification	1
	Credit 6	Green Power	1

Indoor Environmental Quality

Y	Prereq 1	Minimum IAQ Performance	Required
Y	Prereq 2	Environmental Tobacco Smoke (ETS) Control	Required
	Credit 1	Carbon Dioxide (CO₂) Monitoring	1
	Credit 2	Ventilation Effectiveness	1
	Credit 3.1	Construction IAQ Management Plan, During Construction	1
	Credit 3.2	Construction IAQ Management Plan, Before Occupancy	1
X	Credit 4.1	Low-Emitting Materials, Adhesives & Sealants	1
X	Credit 4.2	Low-Emitting Materials, Paints	1
	Credit 4.3	Low-Emitting Materials, Carpet	1
X	Credit 4.4	Low-Emitting Materials, Composite Wood & Agrifiber	1
	Credit 5	Indoor Chemical & Pollutant Source Control	1
	Credit 6.1	Controllability of Systems, Perimeter	1
	Credit 6.2	Controllability of Systems, Non-Perimeter	1
	Credit 7.1	Thermal Comfort, Comply with ASHRAE 55-1992	1
	Credit 7.2	Thermal Comfort, Permanent Monitoring System	1
	Credit 8.1	Daylight & Views, Daylight 75% of Spaces	1
	Credit 8.2	Daylight & Views, Views for 90% of Spaces	1





- Advanced Energy Design Guides:
 - Initiate development of 30% guides for existing buildings – use contractors for product development and calculations (2006 Annual Meeting)
 - Initiate 30% guides for hi-rise residential (2007 Winter Meeting)
 - Complete all 30% guides by 2008 Winter Meeting
 - Complete all 50% guides by 2011 Winter Meeting
 - Complete all 70% guides by 2016 Winter Meeting
 - Complete “net-zero” guidance for all building types (2020 Annual Meeting)

The U.S. Department of Energy’s (DOE) Building Technologies Program has set a research goal of making commercial zero-energy buildings (ZEBs) marketable by 2025.¹

Using a Whole-Building Design Process

Each building we studied has a unique purpose and function, and all have commonalities. These buildings are successful because they are good energy performers. All had owners who pushed low-energy or sustainability goals and considered energy efficiency part of the decision-making process. The architects and engineers created a design to implement the vision, which required a whole-building design process.

The whole-building design process requires that the team responsible for the building design—the architect,

engineers (lighting, electrical, and mechanical), energy and other consultants, and the building’s owner and occupants—work together to set and understand the energy performance goals. The purpose of the whole-building design approach is to enable the entire design team to interact throughout the design process to understand system interdependencies. A systematic analysis of these interdependencies can help ensure that a much more efficient and cost-effective building is produced.

U.S Climate Change Technology Program (CCTP)

Program to accelerate development of new and advanced-technologies that address climate change. It focuses on six goals:

- Reducing emissions from energy use and infrastructure;
 - Reducing emissions from energy supply;
 - Capturing and sequestering CO₂;
 - Reducing emissions of other greenhouse gases (GHGs);
 - Measuring and monitoring emissions; and
 - Improving basic science's contributions to climate change.
- Buildings are identified as a significant opportunity for reducing GHG emissions.

Summary

- The US is serious about energy but for different reasons to UK
- Focus has been on security of supply and economics (US imports 50% oil)
- ASHRAE has supported minimising energy use for more than 30 years
- Major change in last year or so to promote sustainability per se

Summary

- ASHRAE is playing catch-up and knows it
- New Globalisation Road Map acknowledges need to import low energy technology from outside US
- **U.S Climate Change Technology Program (CCTP) giant leap forward**



Presidential Address

The ASHRAE Promise:

