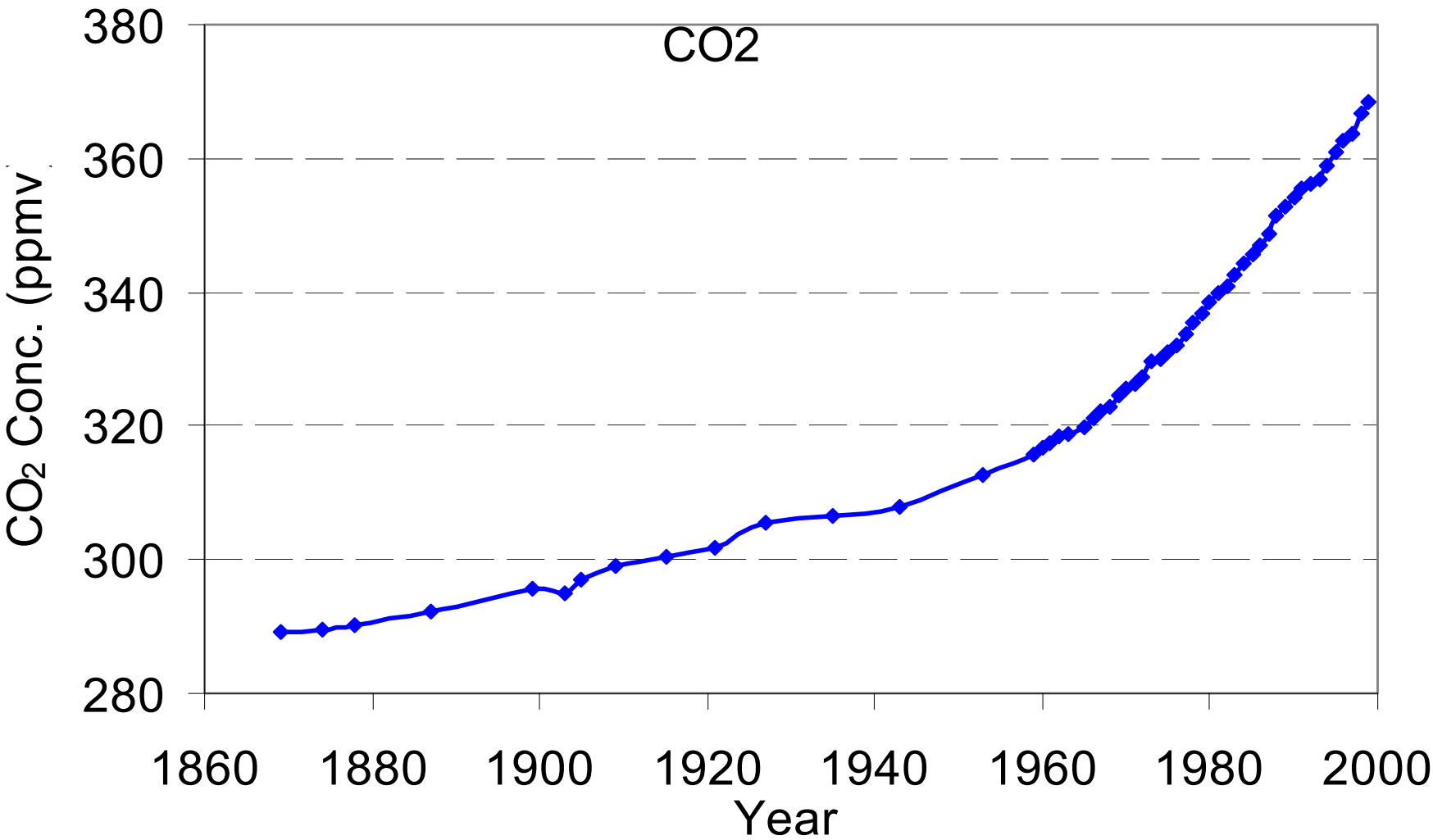
Strategic Challenges in the Energy Sector

Ecoefficiency and Sustainability

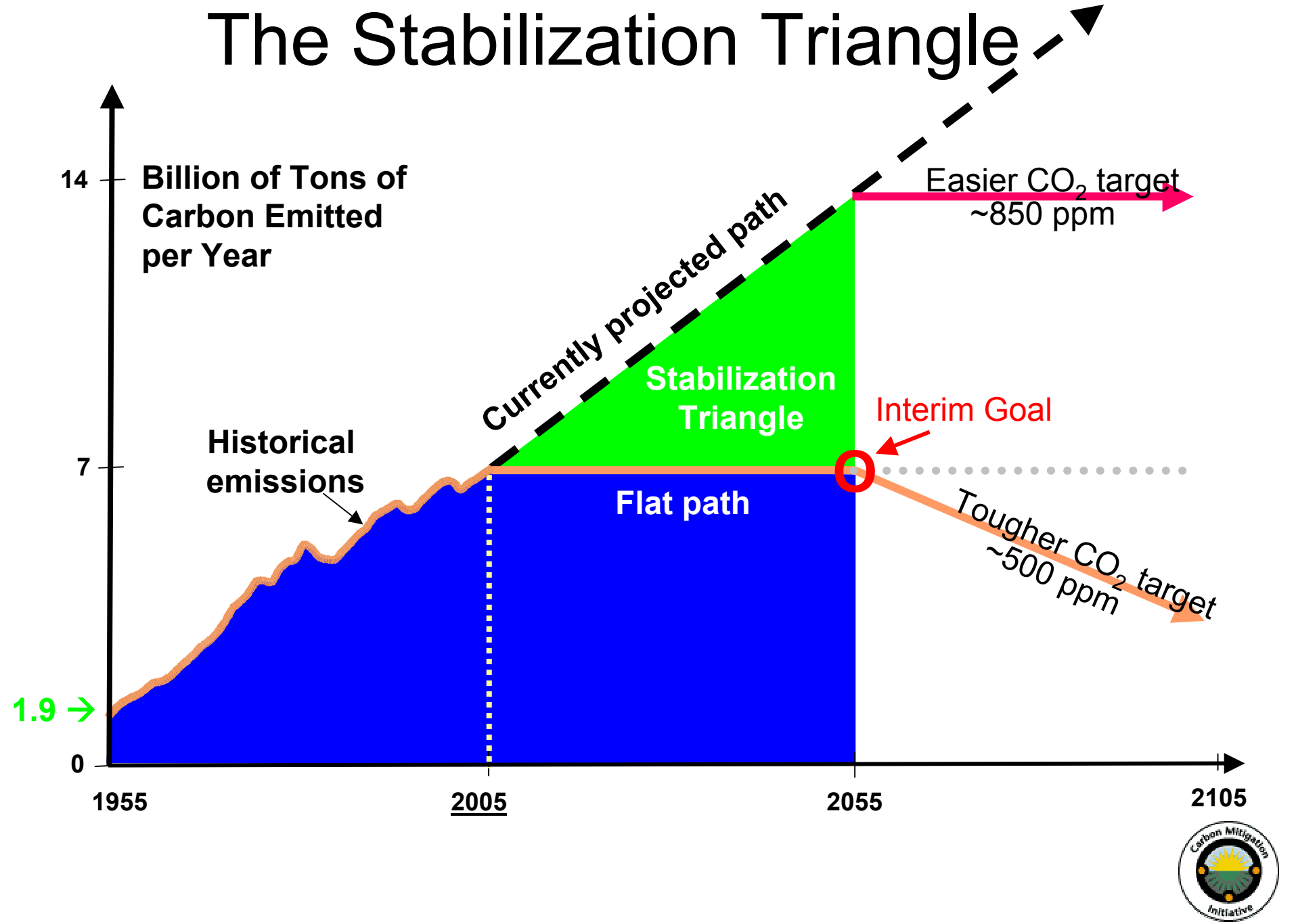
Leon Glicksman
Building Technology Program
MIT

February 11,2008

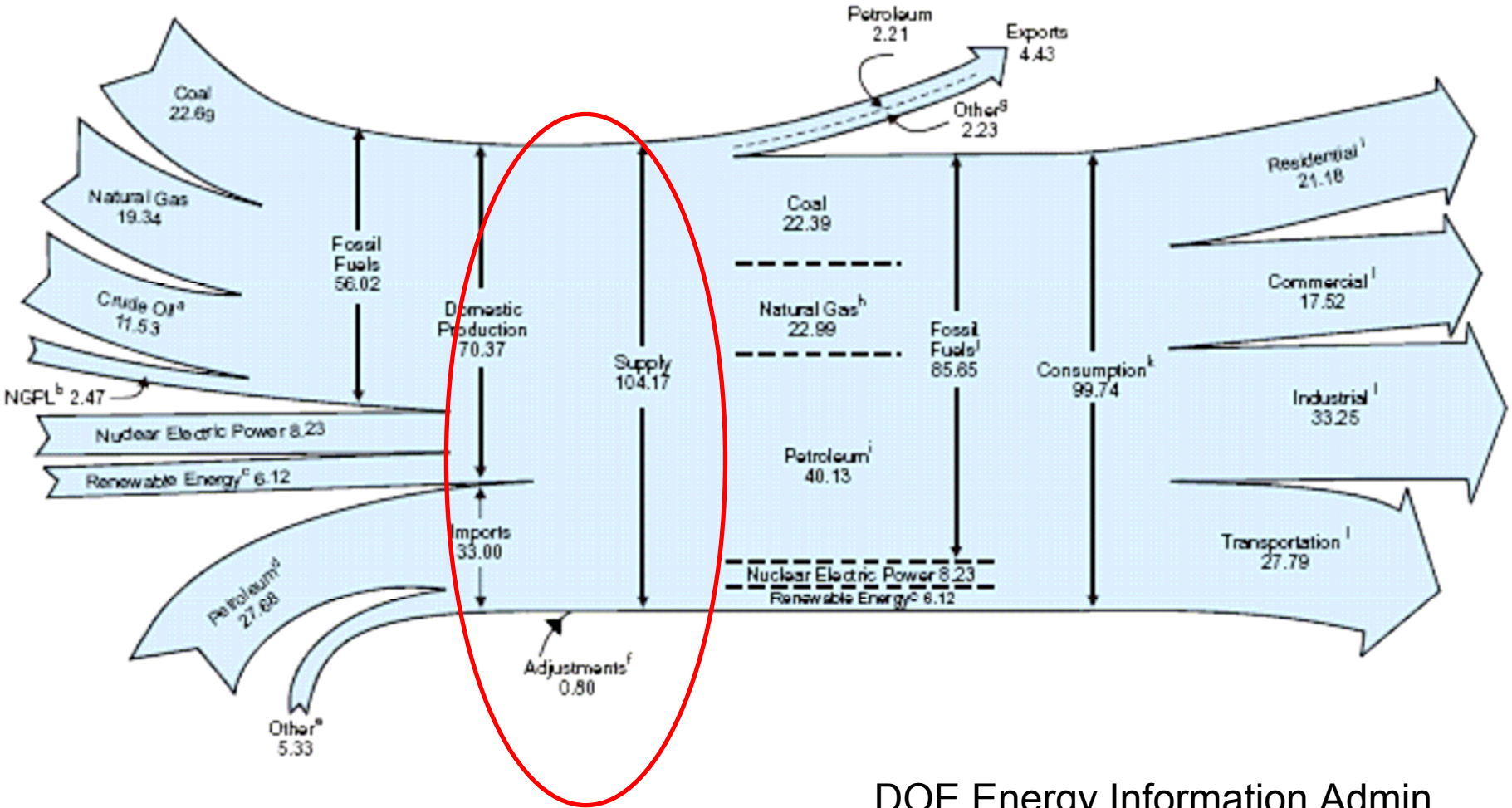
Atmospheric CO_2 Concentration



The Stabilization Triangle

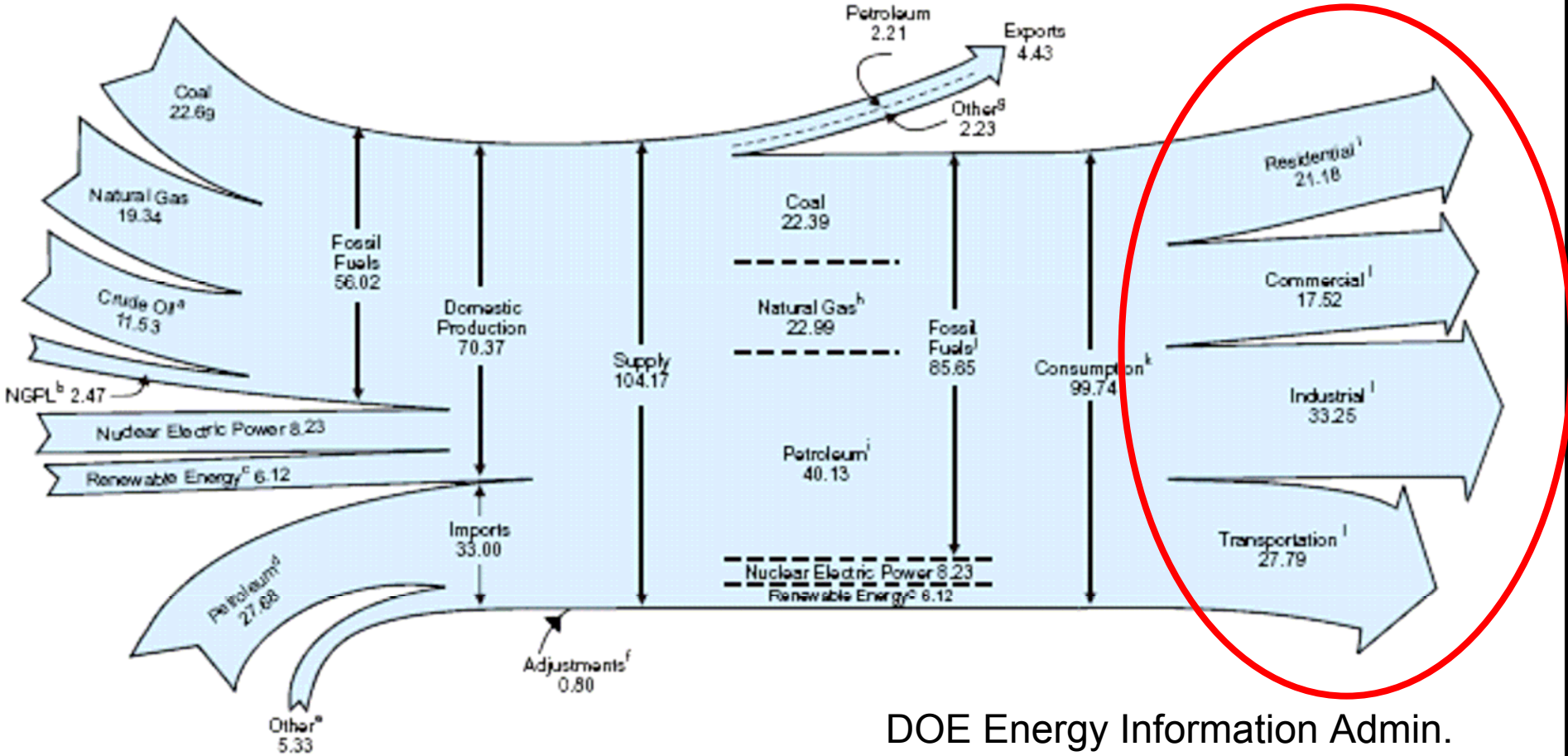


U.S. Energy Flow 2004
Traditional Solution Focus



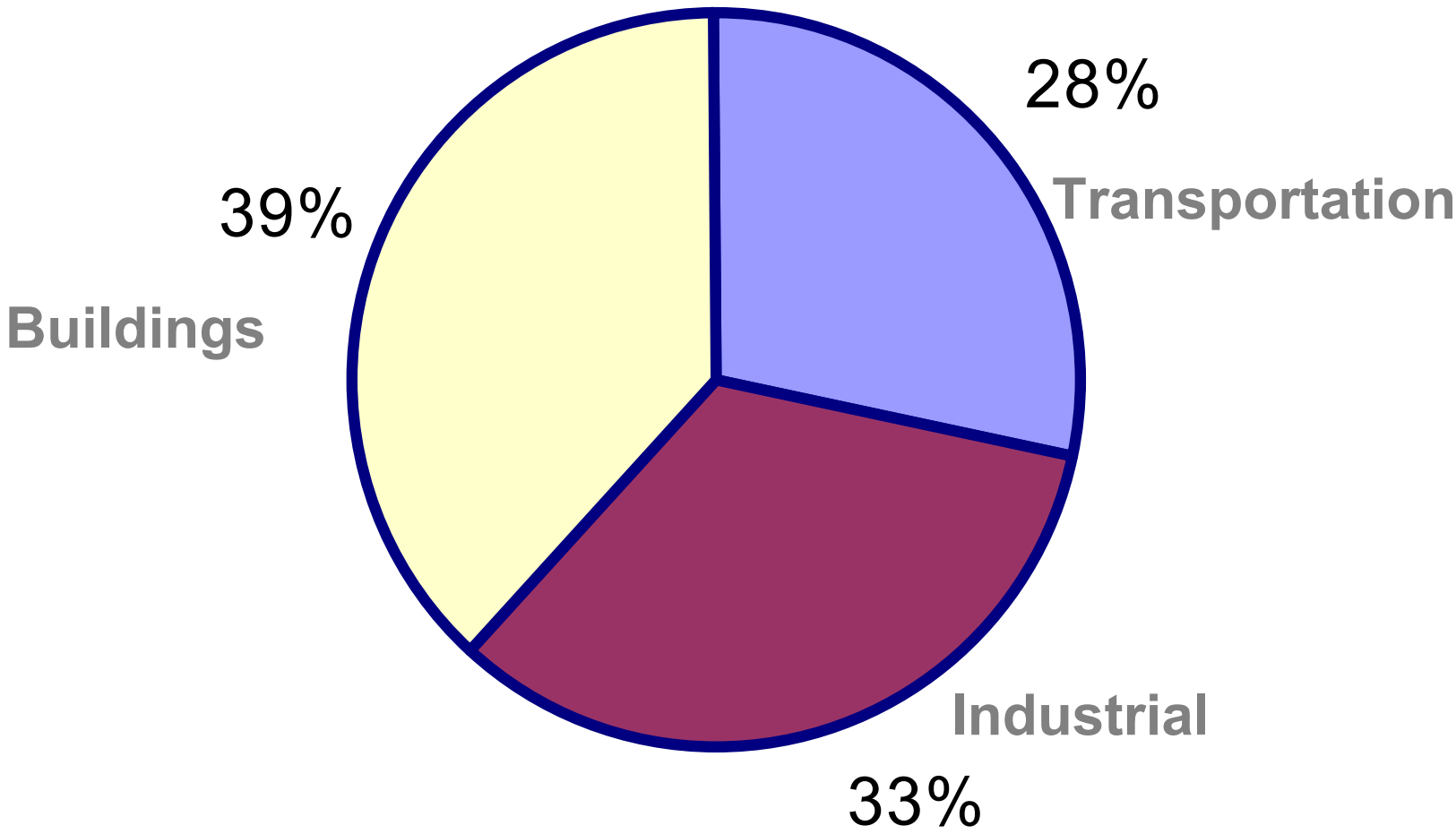
DOE Energy Information Admin.

U.S. Energy Flow 2004
Neglected Focus



DOE Energy Information Admin.

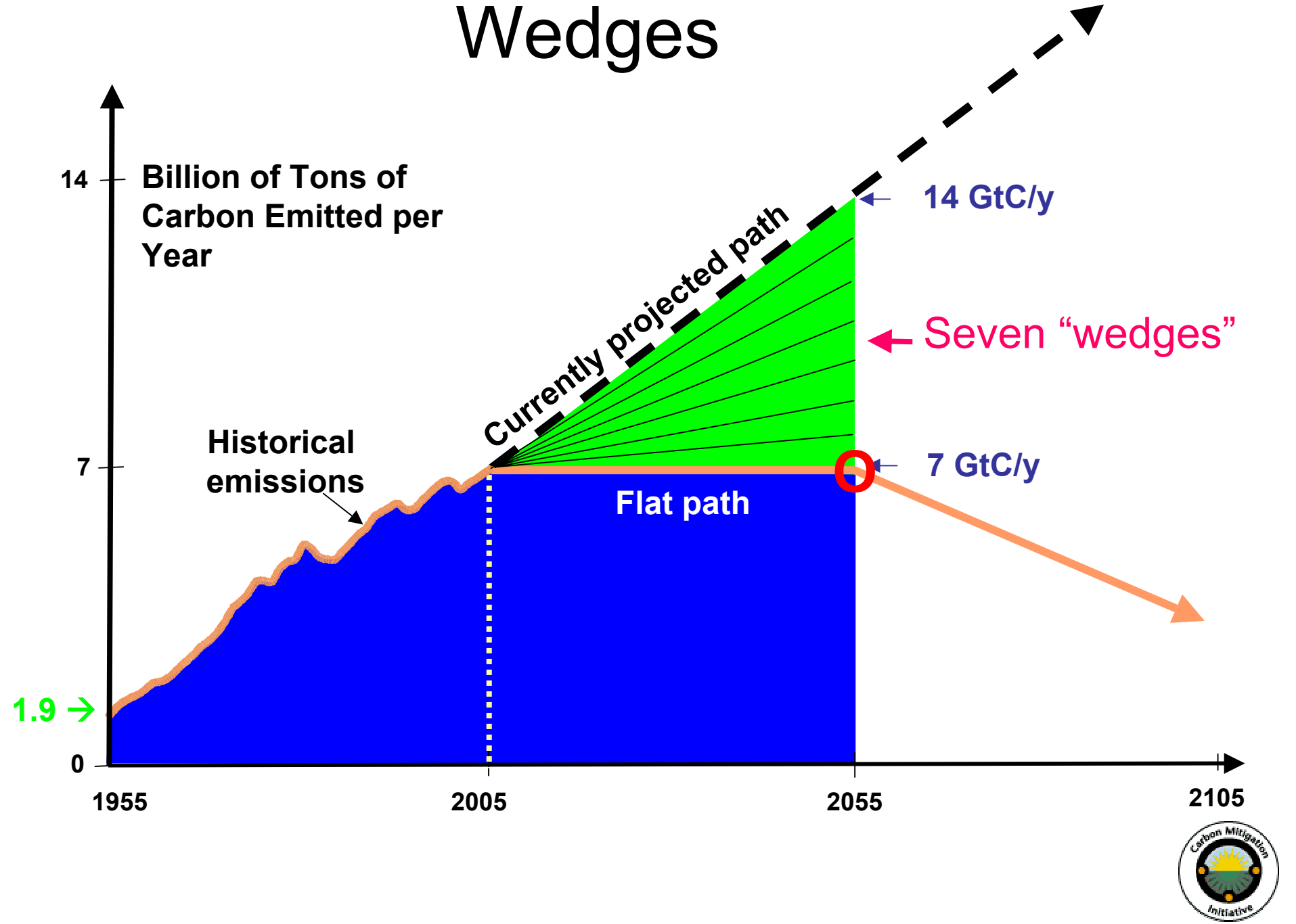
US Energy Consumption



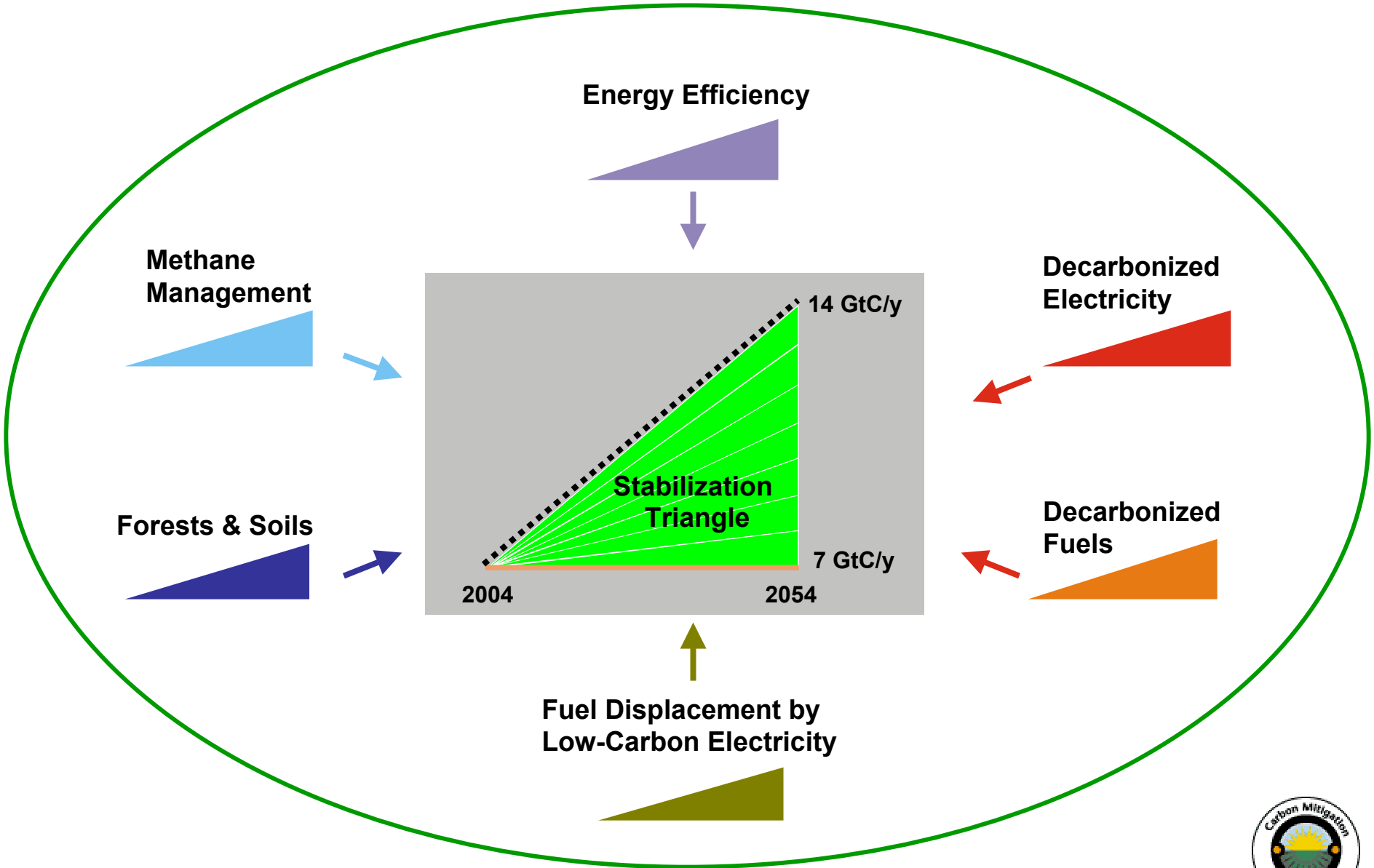
U.S. Buildings

- 39 % of total energy (in UK 50 %)
- 67 % of electricity
- 90% of time spent indoors
- Major health problems: indoor climate

Wedges


14
Billion of Tons of Carbon Emitted per Year
7
1.9
0
1955
2005
2055
2105
Historical emissions
Currently projected path
14 GtC/y
Seven "wedges"
7 GtC/y
Flat path

Fill the Stabilization Triangle with Seven Wedges



Energy Efficient Buildings

- Building Efficiency is an Important Solution to Energy Problem
- Cost Effective when Done Properly
- Requires Integrated Approach
- Important Contributions
  - New Technology
  - New Assessment Tools: Virtual Building
- Challenges in the future

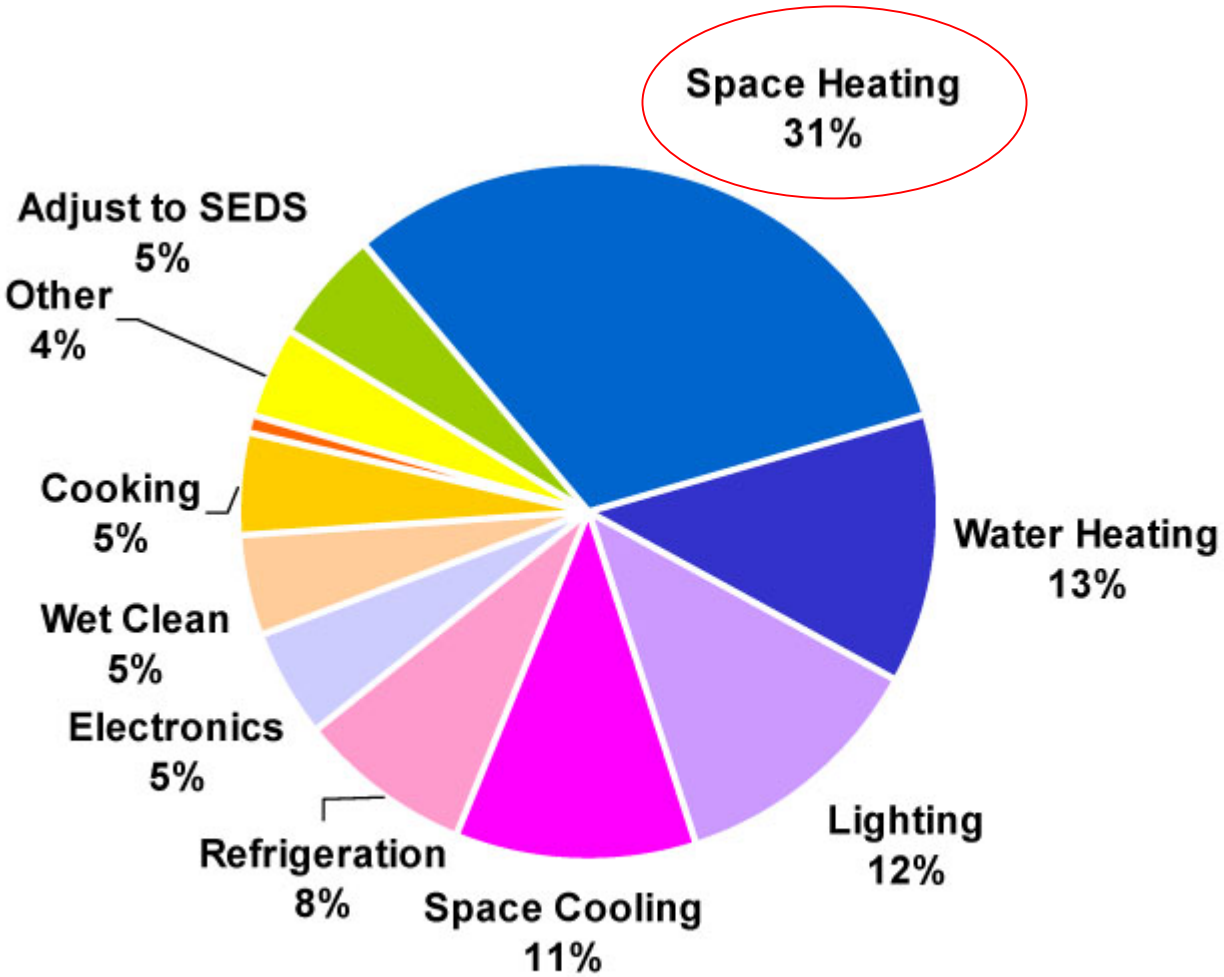
China
~ 10 M new residence units/year!


Boston, MA
Image MassGIS, Commonwealth of Massachusetts EOEA
Image © 2008 Sanborn

ABU-DHABI MASDAR DEVELOPMENT
Goal: Zero Carbon

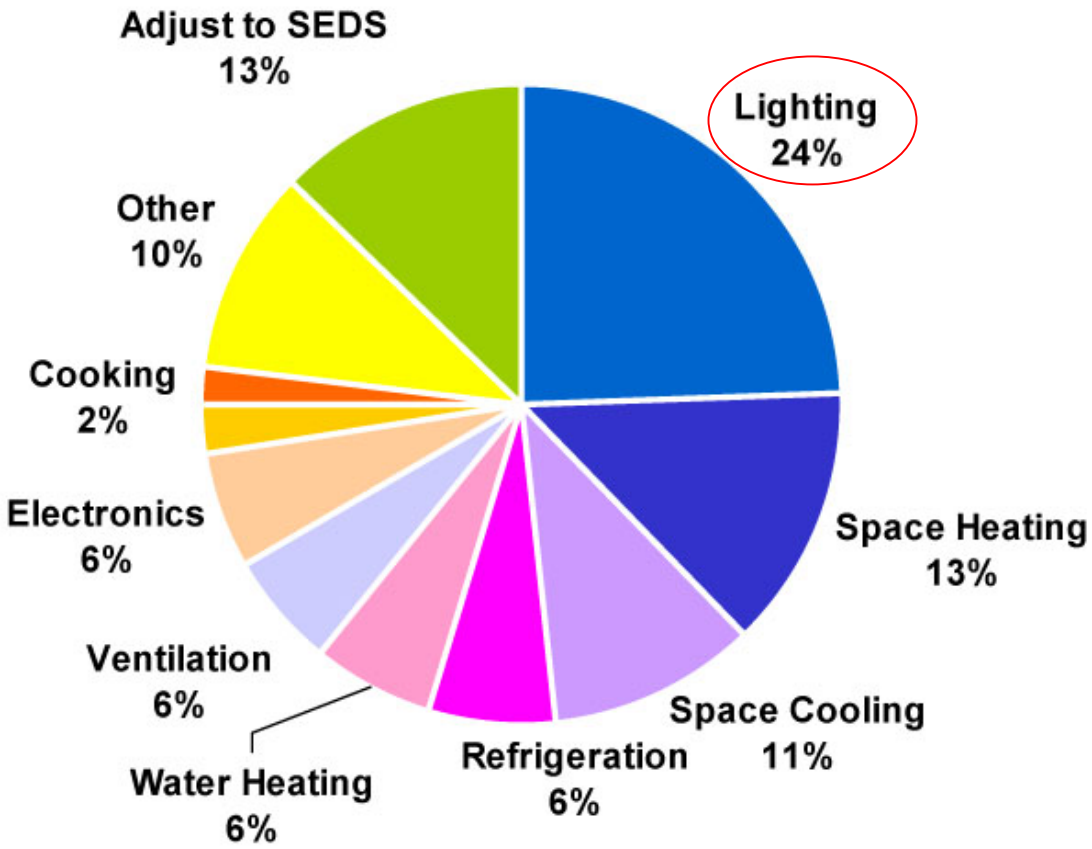
Foster and Partners

2004 Residential End Uses



Total Energy Consumption: 21.07 Quadrillion Btu

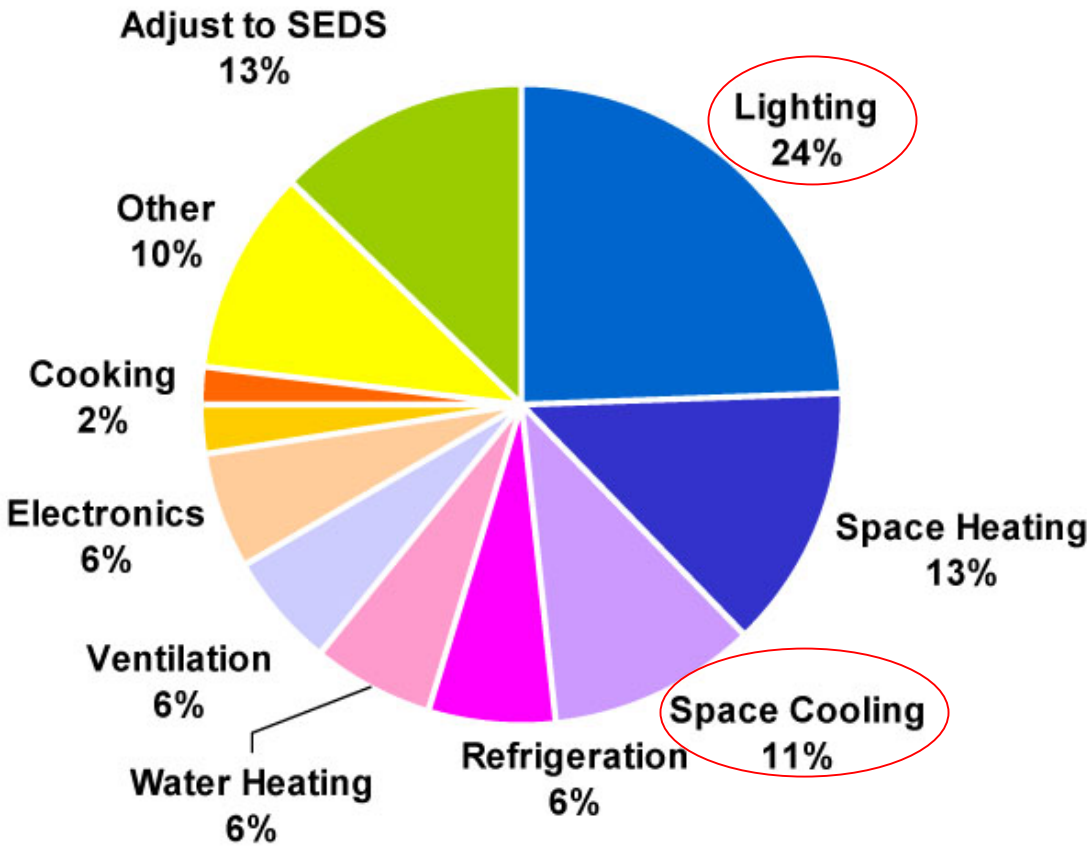
2004 Commercial Buildings End Use



Total Energy Consumption: 17.40 Quadrillion Btu

* -- Excludes buildings energy consumption in the industrial sector.

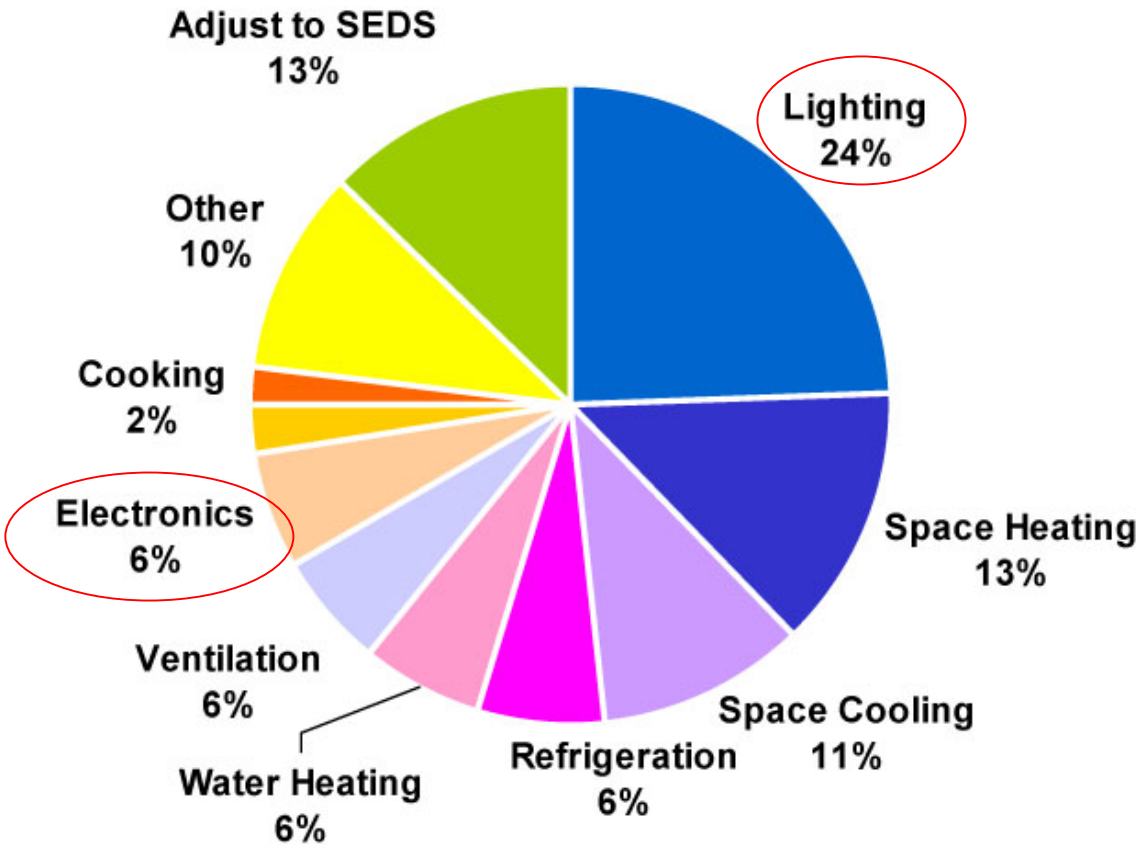
2004 Commercial Buildings End Use



Total Energy Consumption: 17.40 Quadrillion Btu

*** -- Excludes buildings energy consumption in the industrial sector.**

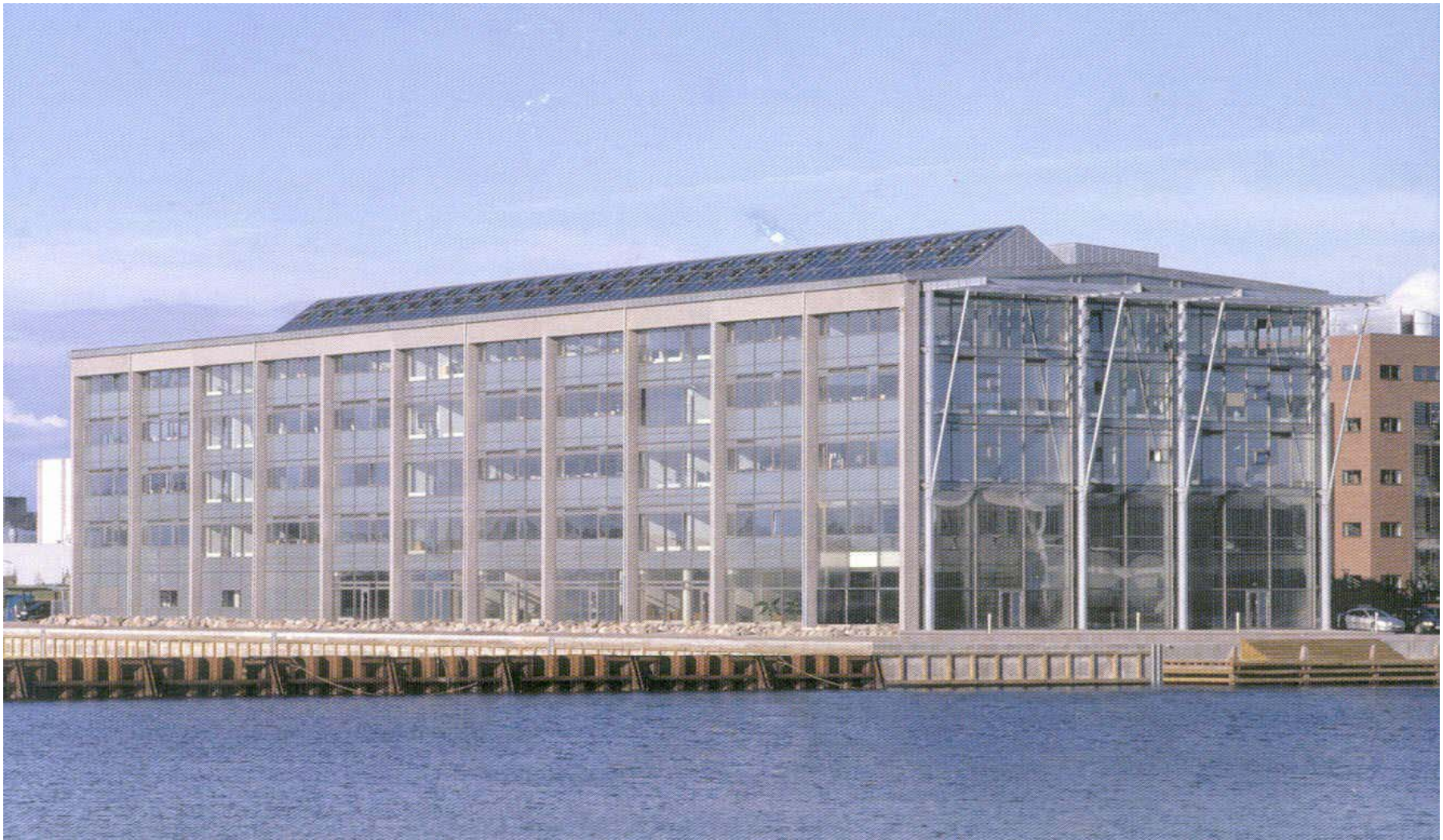
2004 Commercial Buildings End Use



Total Energy Consumption: 17.40 Quadrillion Btu

* -- Excludes buildings energy consumption in the industrial sector.

Energy Efficient Copenhagen: Cooled only by Natural Ventilation



Not very energy efficient

Percentage of glazed area, Building 3 East

William Welles Bosworth

W.W. Bosworth, S. Trowbridge, T. Vail & J.P Morgan, 1915

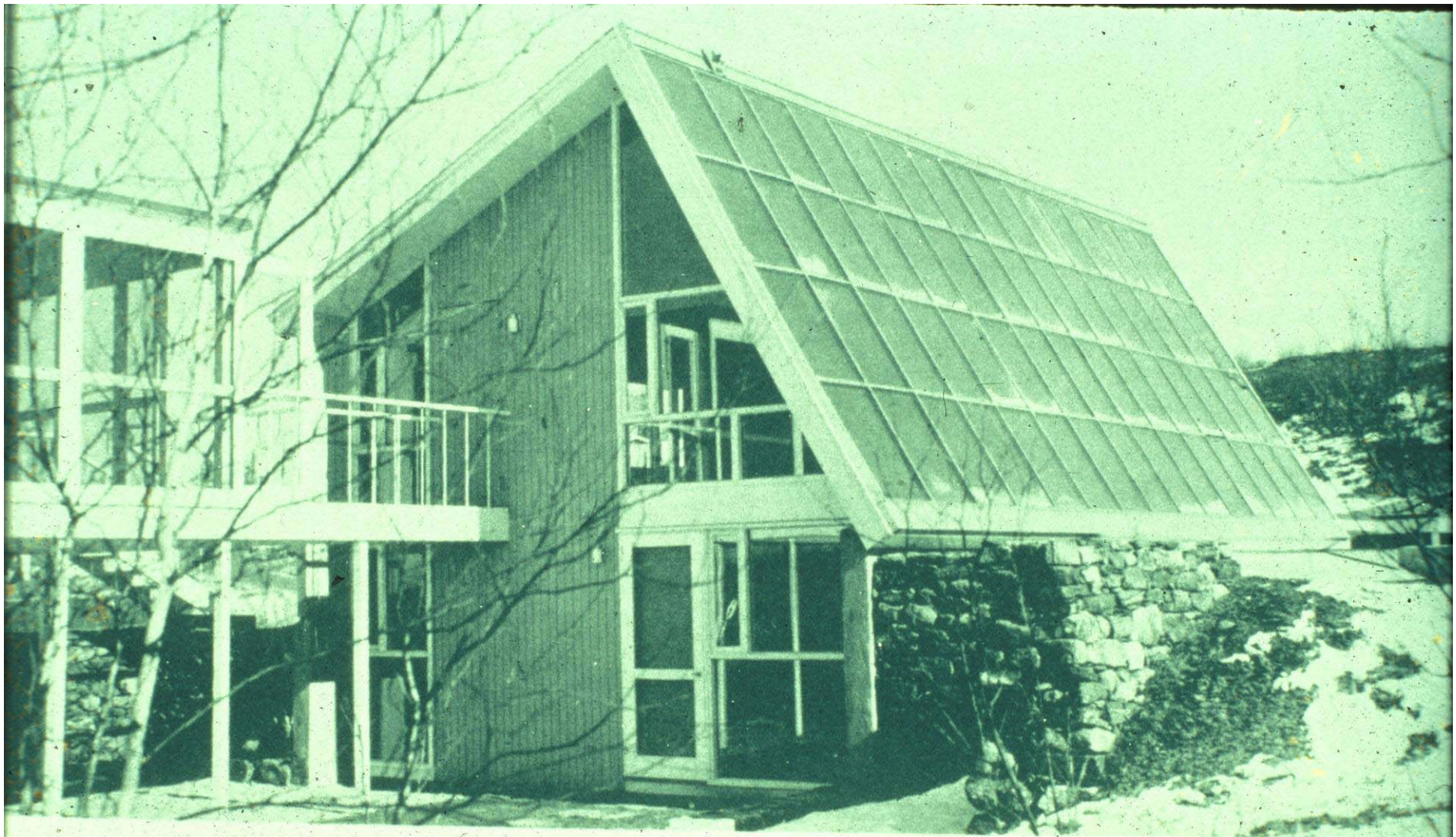


Fig. 1 The M. I. T. Solar House IV, Lexington (42° N, 71° W), Mass.

A More Recent MIT Solar House

… even more recent …

http://www.solardecathlon.org/homes_gallery.html#mit

Campus GHG Sources

- Building consumption 90%
- Transportation (including commuting) 9.5%
- Solid waste 0.5%
- + Recent UROP study:

  MIT air travel

  contributed 12- 22 % of MIT's CO_2 Emissions

Undergraduate Projects at MIT

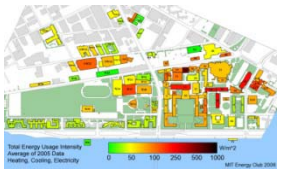
MIT Building 18 at 5PM

Steve Amanti

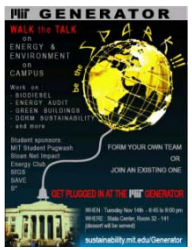
2AM

Student Campus Energy Project Grants

Wind Turbine Competition



Energy Mapping Project



MIT Generator

UA Campus Energy and Environment Pamphlet

FOCUS THE NATION

Campus Climate Awareness Project

Revolving Door Behavioral Change Campaign

Appliance Use Energy Audits and Case Studies

http://mit.edu/mitei/news/student-fund.html

For the Campus Energy Initiative