Teaching Energy Efficiency Policy at the University Level

A California Approach to Teaching Energy Efficiency

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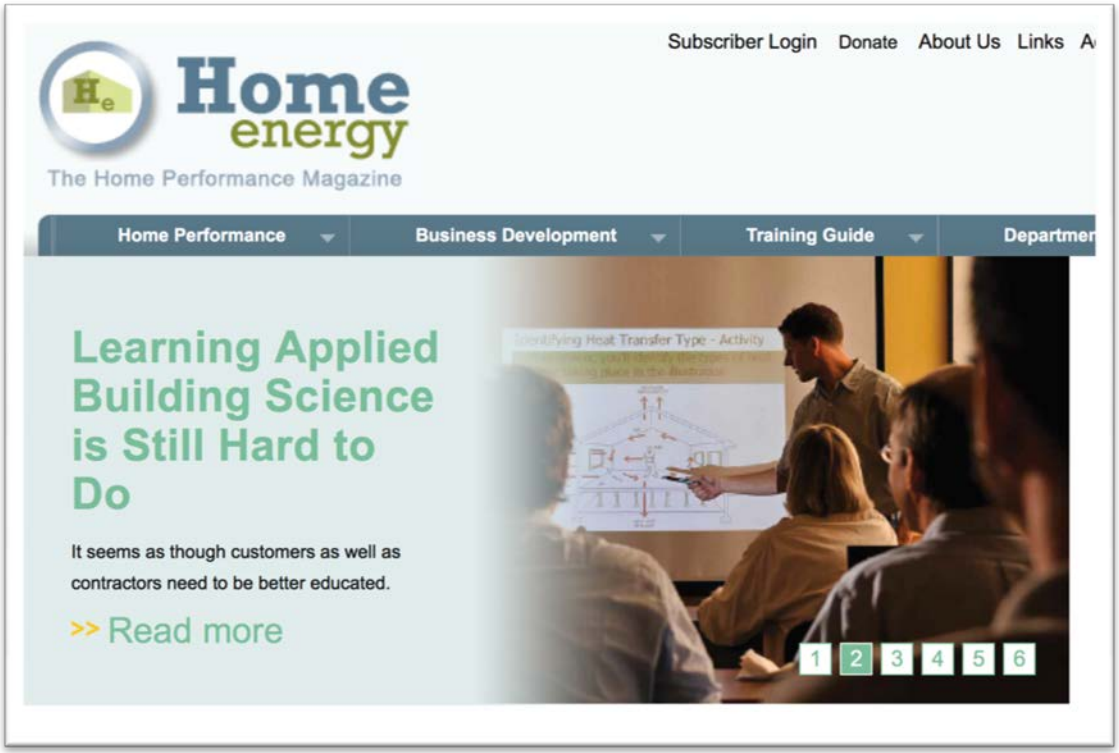
Topics

- Why teach energy efficiency policy?
- Who are the students?
- What do they need to learn?
  - How much technology? Economics? Policy?
- How do you keep them excited?
- Measures of success?

A Different Challenge – Training the Practitioner

homeenergy.org



The University of California, Davis Campus

Vancouver

Sacramento

Davis

Davis: 100 km Northeast from San Francisco, 30 km west of Sacramento

Toronto

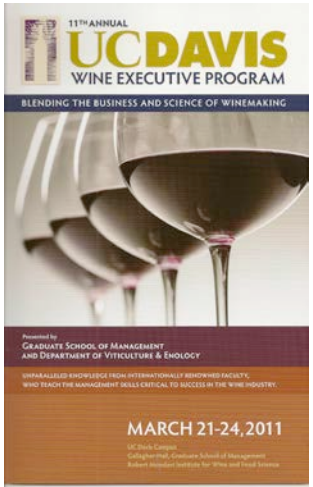
Ottawa

San Francisco

Berkeley

30,000 students: 3rd most popular UC campus (after Berkeley & UCLA)

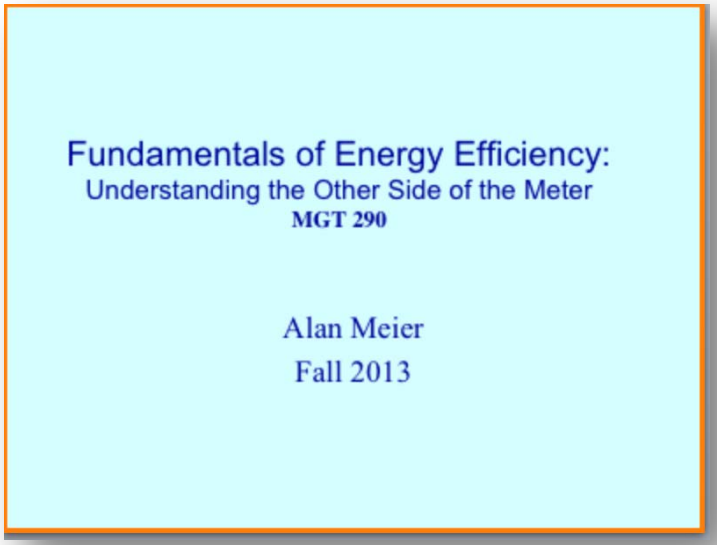
Famous for wine, bicycles, and now energy efficiency



Los Angeles

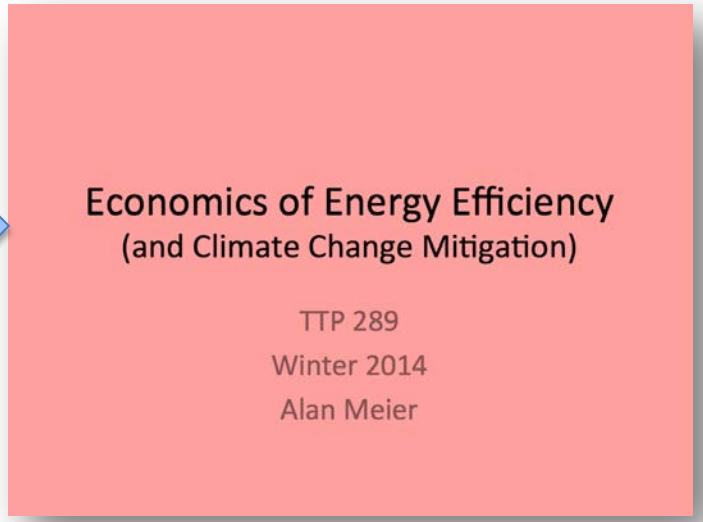
UCDAVIS
UNIVERSITY OF CALIFORNIA

My Classes at UC Davis



Other courses at
Berkeley, Stanford

UC DAVIS
UNIVERSITY OF CALIFORNIA



Who Are the UC Davis Students? And What Do They Want?

- Graduate students mostly
  - Engineering, Business, Chemistry, Physics, Sociology, Agronomy, Economics (**from all over the world!**)
  - Interested in sustainability, zero-energy, solar, climate change, jobs

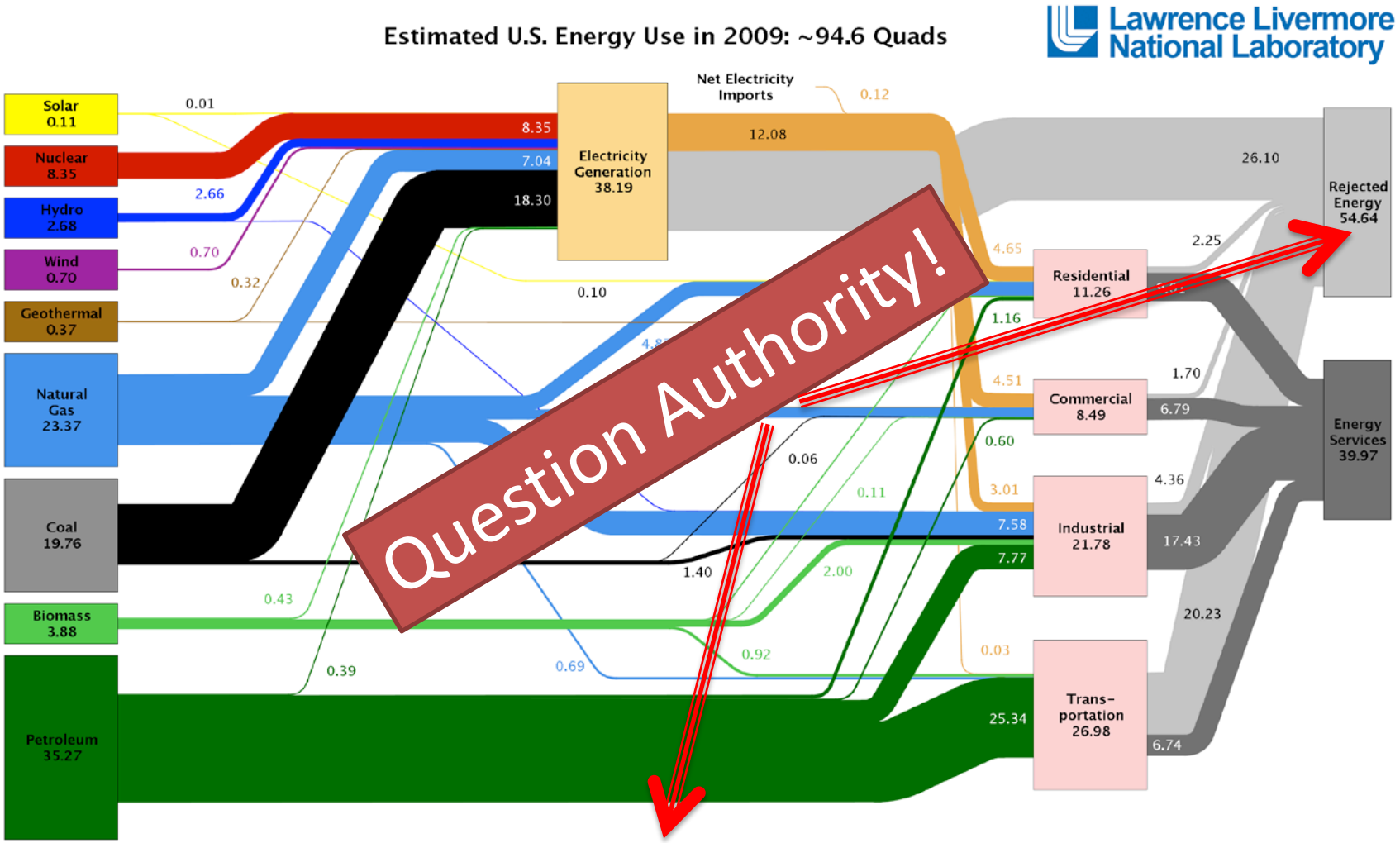
- Teaching EE as a supplement to other specialties
- For undergraduates, the course can be transformational

My goals: show different perspectives, think differently, question authority, collect data, provide context

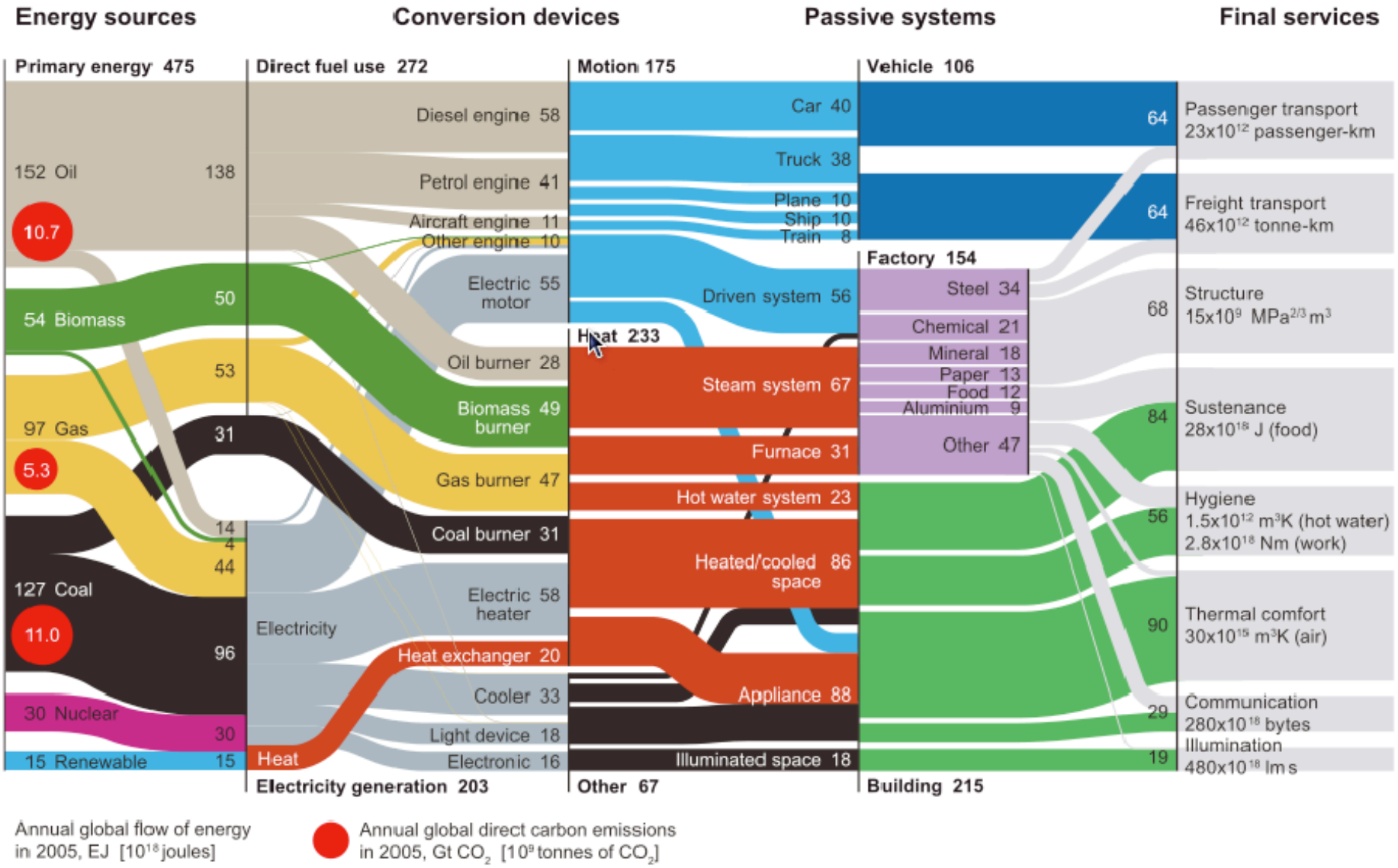
Treating Energy Demand as a Black Box

(and note the assumptions!)

https://flowcharts.llnl.gov/content/energy/energy_archive/energy_flow_2009/LLNL_US_Energy_Flow_2009.png



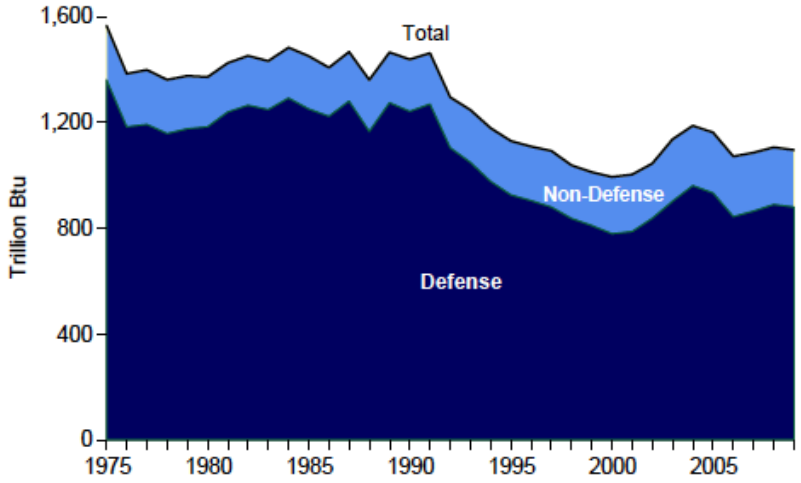
Global Energy Sankey Diagram



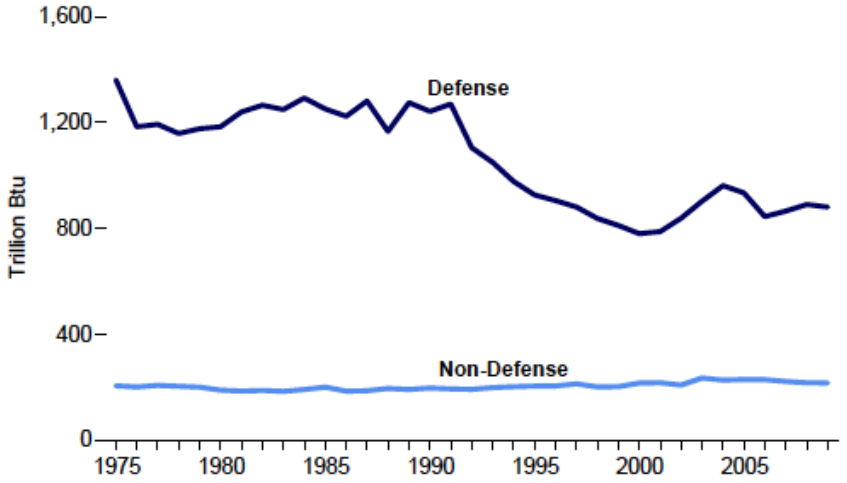
World Energy Flows Sankey Diagram, as shown on http://aspoireland.org/2011/05/08/a-review-of-green-energy-growth-prospects-at-the-oil-economy-maxima/ Diagram originally by Cullen, J.M. & Allwood, J.M. (2010)

Breakdown by Administrative unit

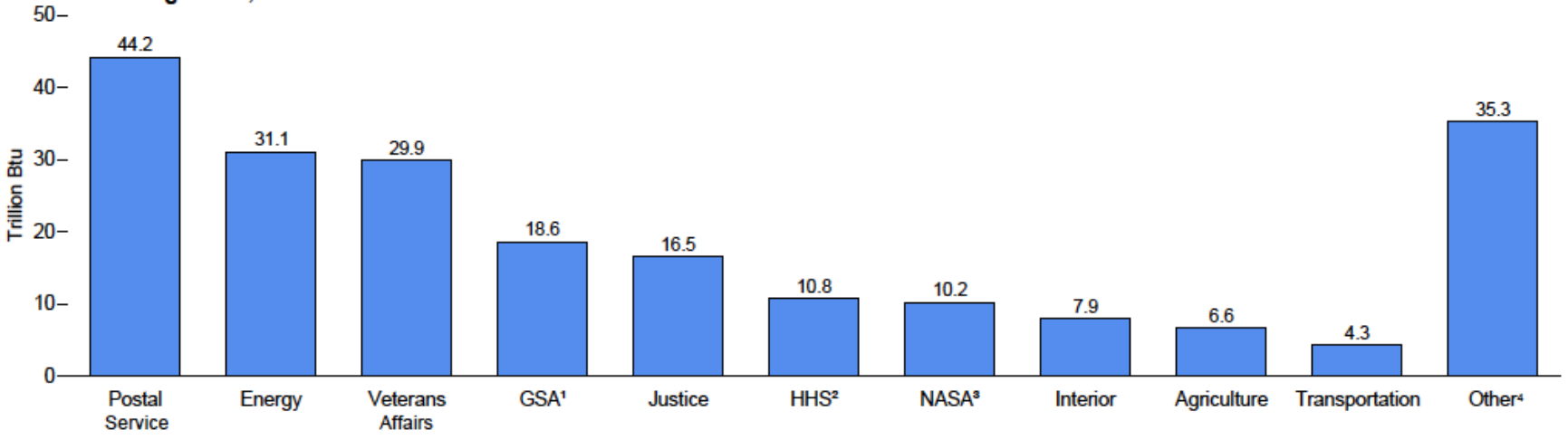
Total and U.S. Department of Defense, 1975-2009



U.S. Department of Defense and Non-Defense Agencies, Fiscal Years Fiscal Years 1975-2009



Non-Defense Agencies, Fiscal Year 2009

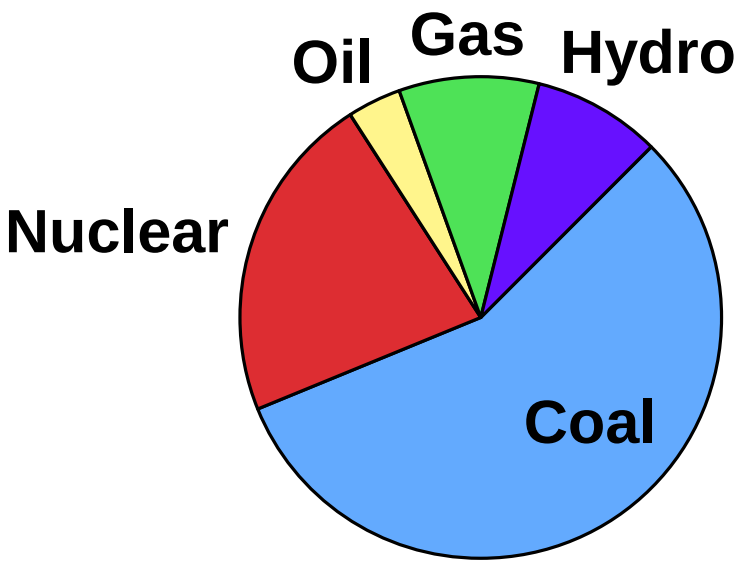


[1] General Services Administration.
[2] Health and Human Services.
[3] National Aeronautics and Space Administration.
[4] See Table 1.11 for list of agencies.

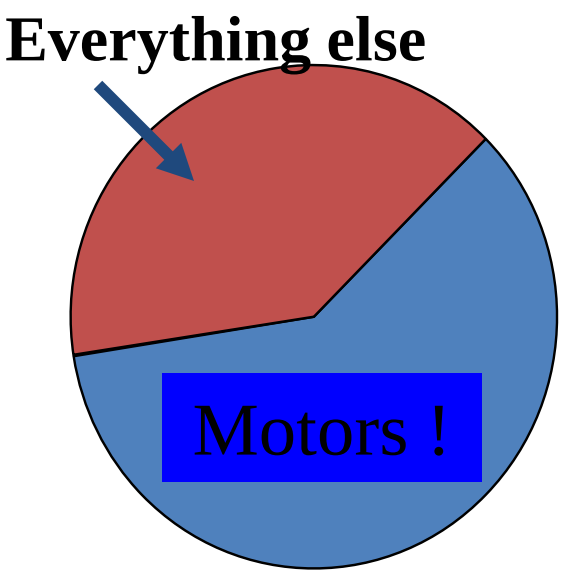
Note: The U.S. Government's fiscal year was October 1 through September 30, except in 1975 and 1976 when it was July 1 through June 30.
Source: Table 1.11.

Electricity (2)

Generation

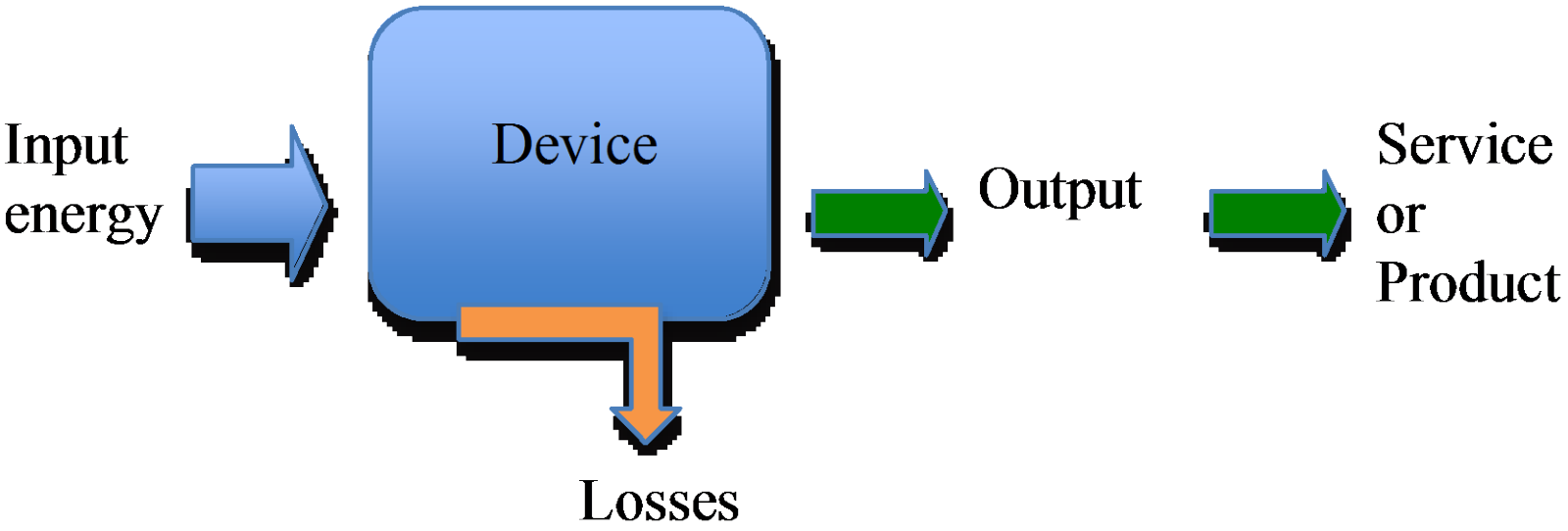


Use



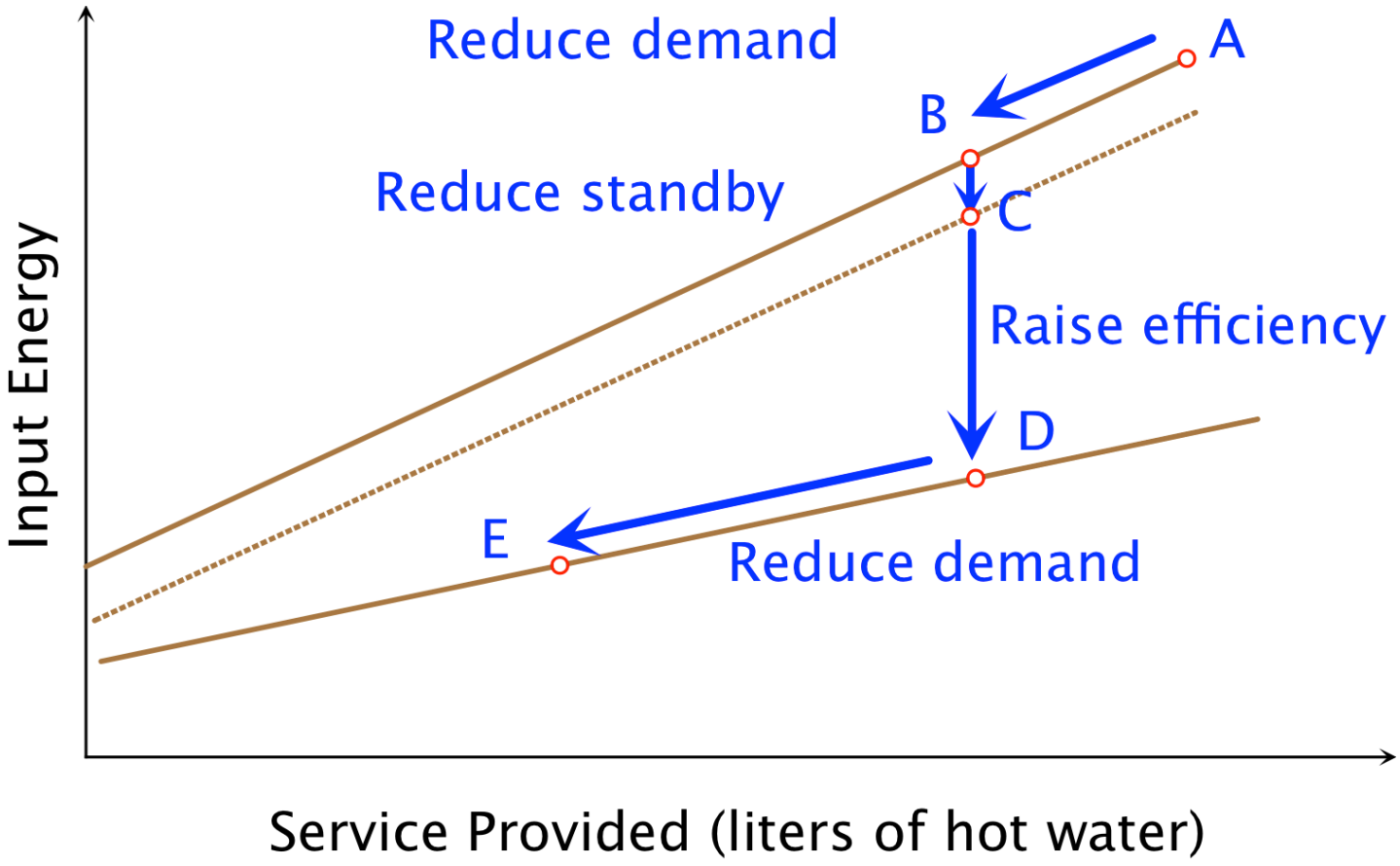
I ask the students to guess: they are never right!

A device transforms energy into a useful output, service, or product



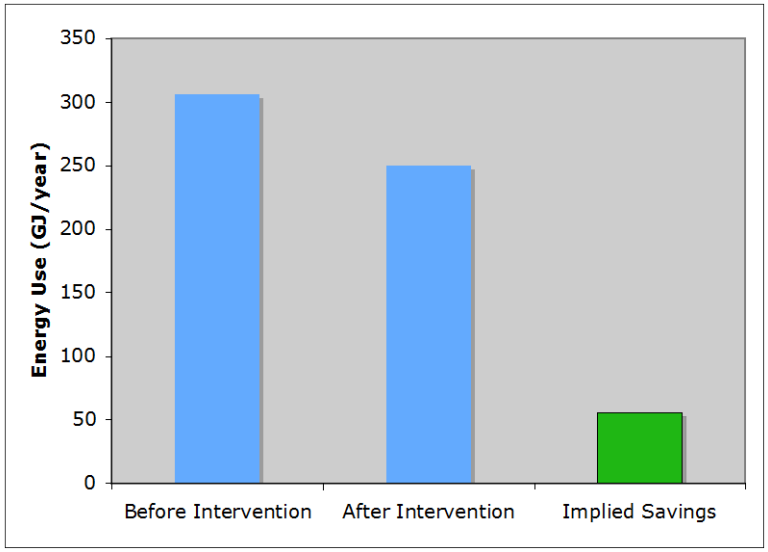
Students need to understand that people want services, not energy

A Service Plot for Water Heating

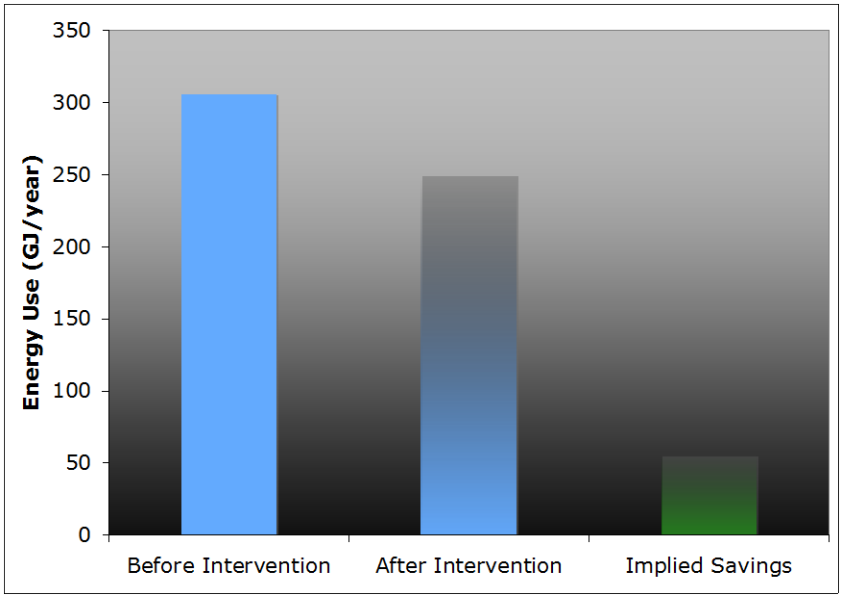


Estimation of Energy Savings

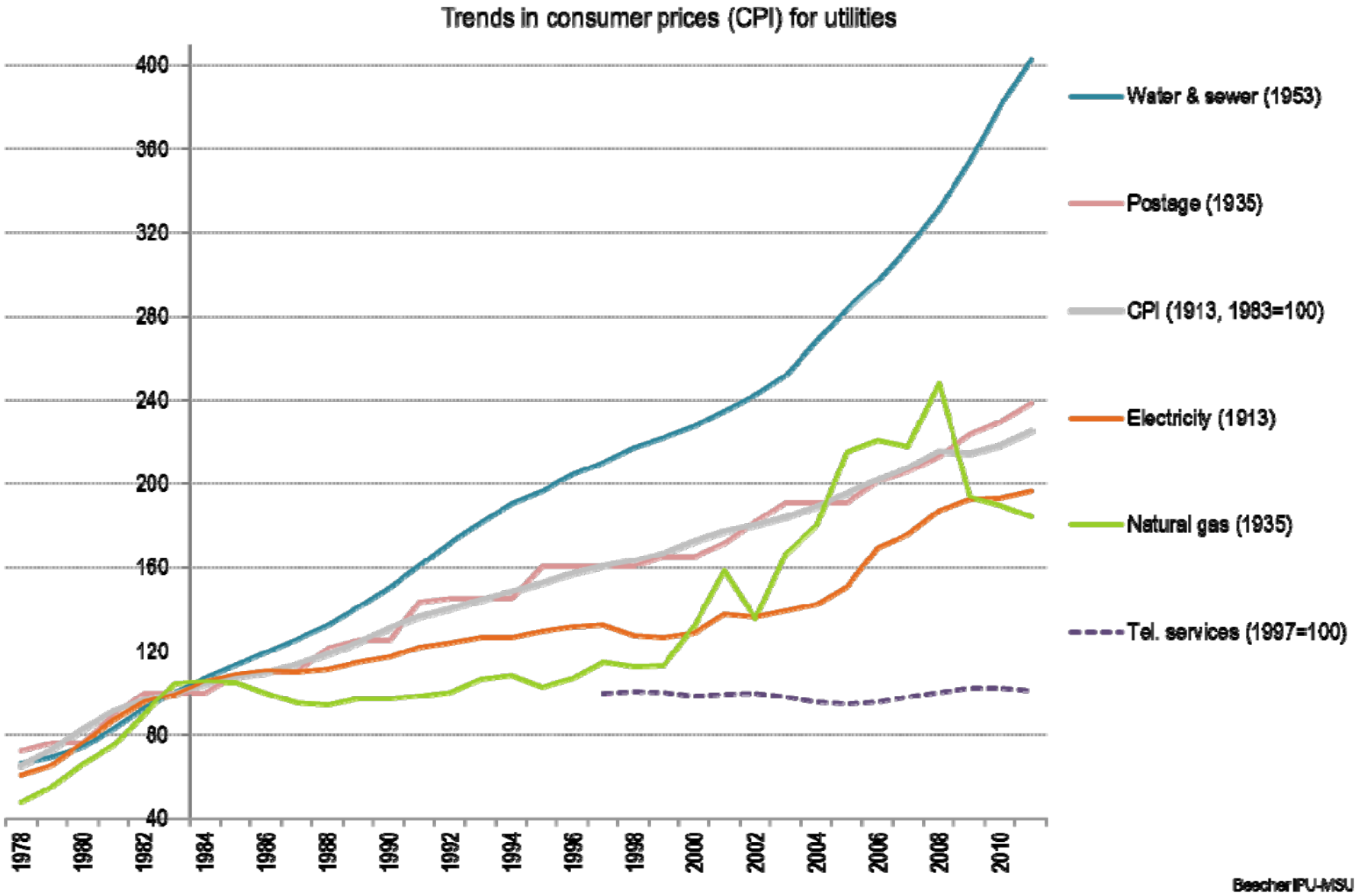
Ideal Conditions



More Common Situation
("the fog of uncertainty")



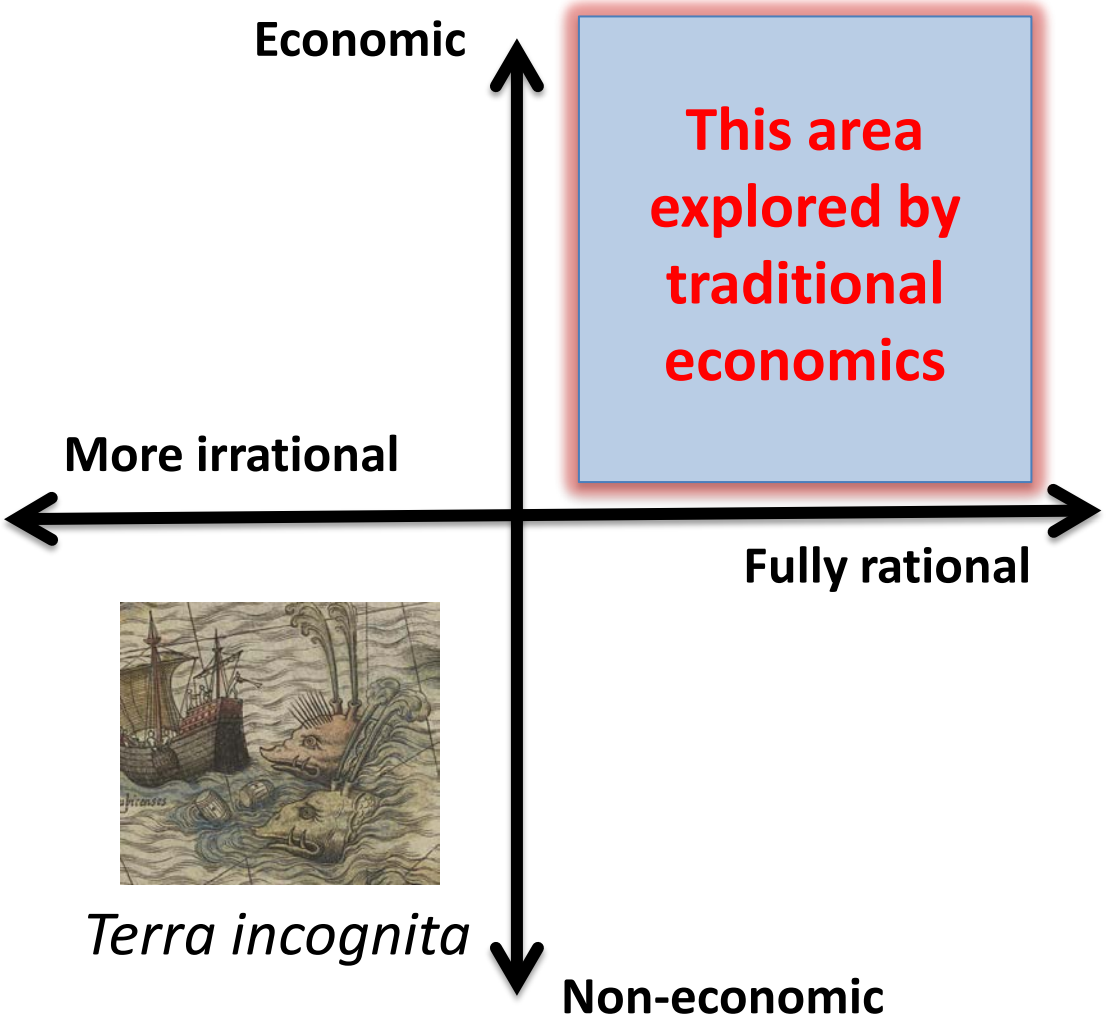
How Are Energy Costs Changing Compared to Other Utilities?



Source: Beecher, Institute of Public Utilities, MSU [2012]

Quadrants of People's Motivations

What kind of economics should we talk about?



CoolBiz

クールビズ

COOLBIZとは？

2005年春、環境省は、
地球温暖化対策の一環として、
夏のオフィスの冷房温度を28度と
しても涼しく快適に格好良く働ける
ビジネススタイルの一般的な愛称を
公募しました。審査委員による
選考の結果、選ばれた愛称が
"COOLBIZ(クールビズ)"です。
当社は、シャツで応援
しています。

Different approaches to energy efficiency

Prime Minister Koizumi wearing CoolBiz

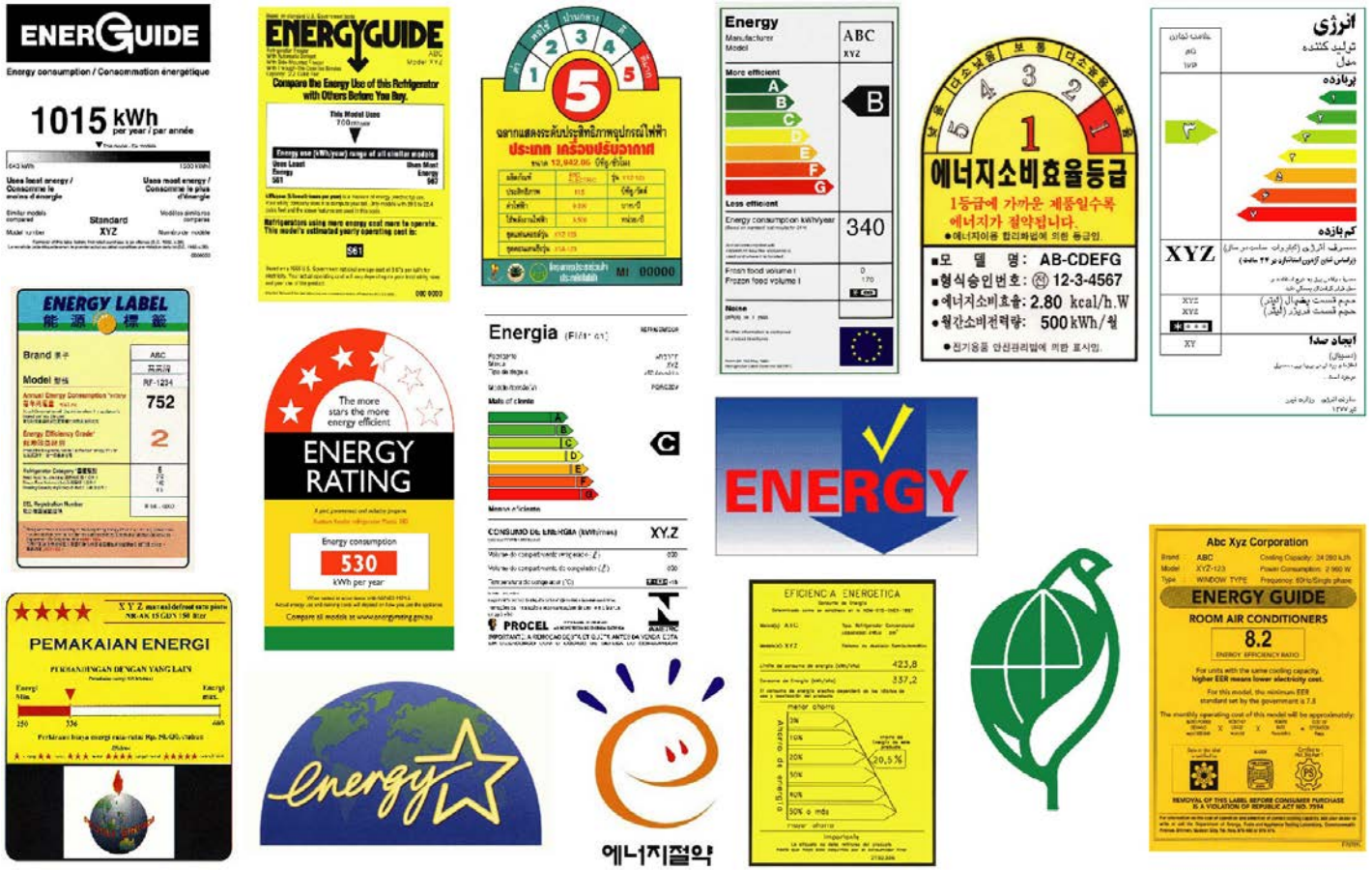
冷房は28℃に設定しよう

チーム・マイナス6%

チーム・マイナス6%とは？

深刻な問題となっている地球温暖化。この解決のために世界が協力して作った京都議定書が
平成17年2月16日に発効しました。世界に約束した日本の目標は、温室効果ガス排出量6%の削減。
これを実現するための国民的プロジェクト、それがチーム・マイナス6%です。

Energy Labels Around the World



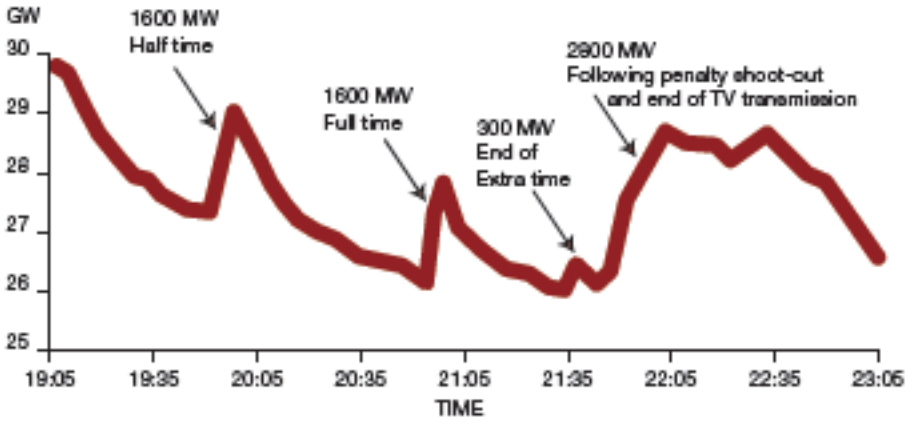
- > 60 countries operate product efficiency programmes
- Currently national schemes tailored for local markets & suppliers
- Now greater recognition of global markets & world suppliers needs

Source: Australian Greenhouse Office 2005

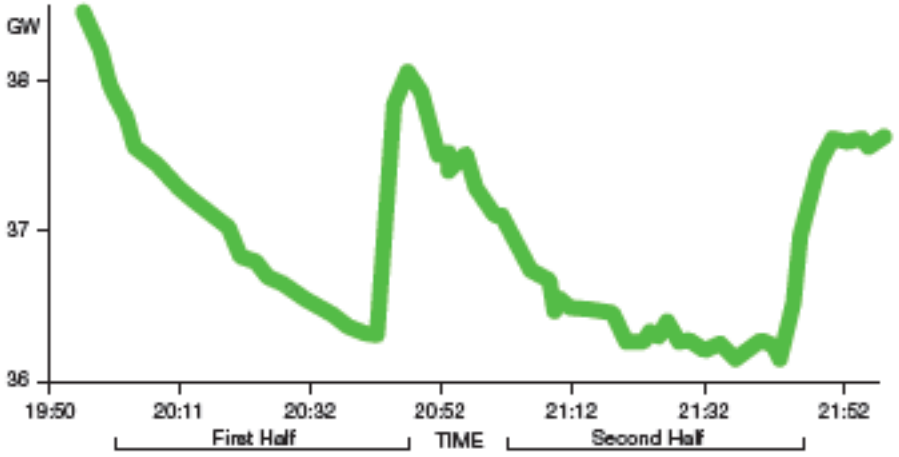
TV Pick-Ups

Electricity Demand and the Behavior of the Masses

England Vs Germany 1990, World Cup Semi-Final, Kick Off 19:00



England Vs Sweden 2006, World Cup 2006 First Round, Kick Off 20:00



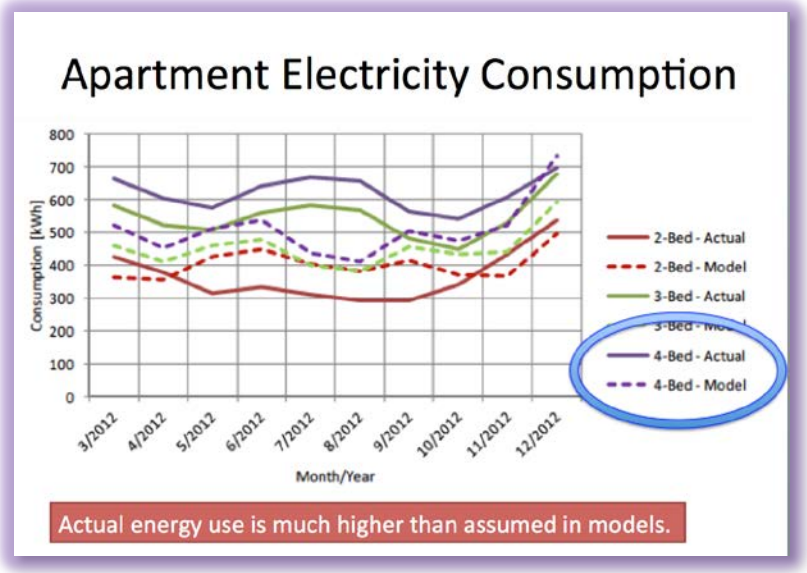
Most Students Enjoy Measuring Things

With luck they also learn the difference between energy and power.

In fact, it's sometimes their favorite part of the class!

West Village at UC Davis:
America's First Net-Zero Energy Community

Use the Community as a Lab



Topics for Discussion

- Why teach energy efficiency? Policy?
  - In what Department(s)?
- Who are the students?
- What do they need to learn?
  - How much technology? Economics? Behavior? Policy?
- How do you keep students excited?
- Measures of success?

Course Summary for "Fundamentals"

1. The demand-side perspective
2. Energy is transformed into services
3. Service plots and impacts of energy-saving measures on demand, standby, efficiency
4. Direct energy savings
5. Indirect energy savings (and increases)
6. Changing rules of game
7. Estimating energy use and savings