Setting the Stage

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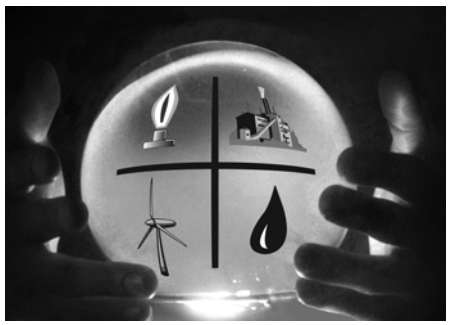
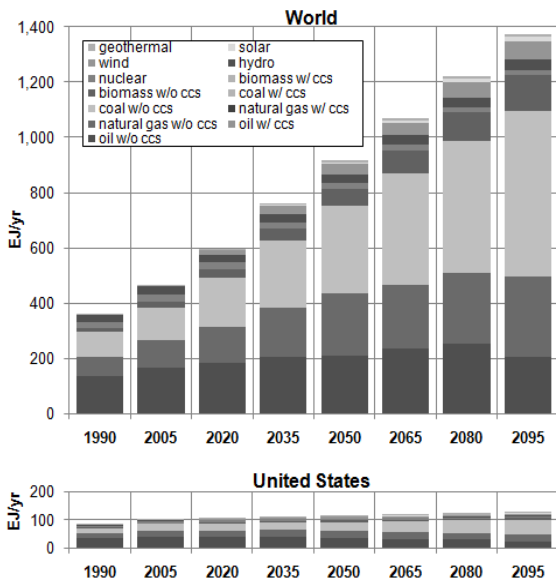


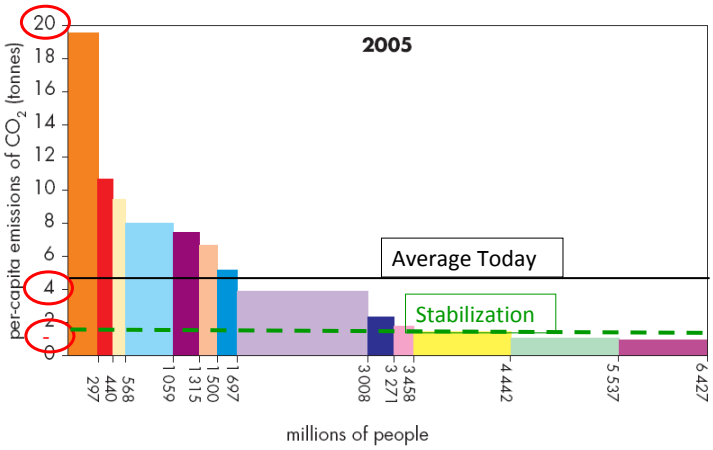
ACEEE 30th Anniversary Symposium:
Inventing the Future for a Low-Energy Building Stock
March 7, 2011 – Washington, DC

Energy Use Today and in the Future: the 25% "Rule" No Longer Works



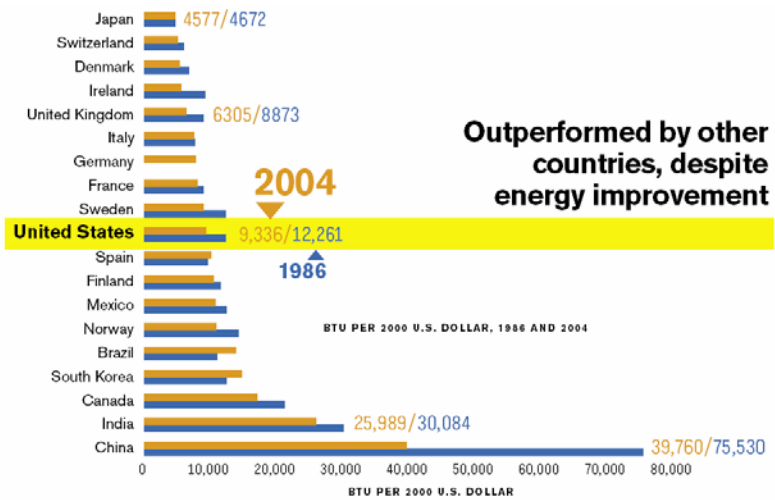
Redrawn from data published in L. Clarke, et al., 2009. *CO2 Emissions Mitigation and Technological Advance: An updated Analysis of Advanced Technology Scenarios.* (Richland, Washington, Pacific Northwest National Laboratory), PNNL-18075, January.

The CO_2 emissions of today's rich eventually must equal the emissions of today's poor



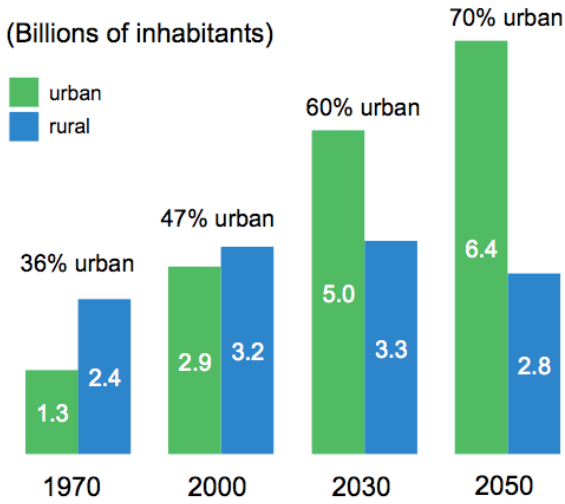
Source: IEA WEO 2007 and Socolow (2009)

Energy productivity in the U.S. is outperformed by many countries



Source: Council on Competitiveness. 2007. *Competitiveness Index: Where America Stands.* Figure 4.32, p. 103.

The Future Society Will be Increasingly Urban, With Energy Implications



Source: United Nations, *World Urbanization Prospects: 2007*.

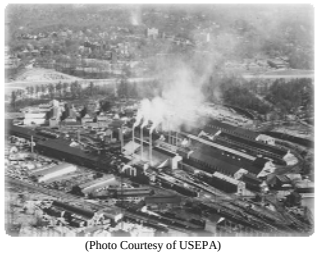
Where we Build may be as Important as What we Build

Atlanta, 2008

Atlanta, 2108

Source: LWARPS - "we can reverse sprawl", City of the Future competition, Georgia Tech entry

Atlantic Steel becomes Atlantic Station



(Photo Courtesy of USEPA)

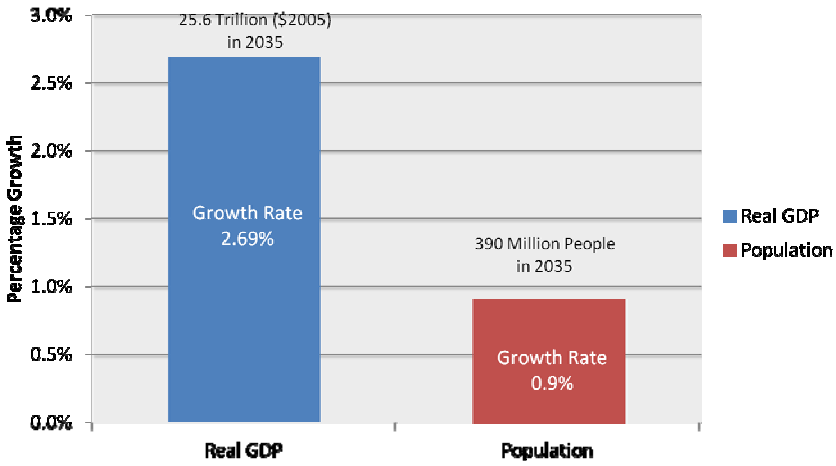
1997

- 138 acre brownfield site in Midtown
- Jacoby redevelopment plan
- Atlanta Clean Air Act nonconformity
- Moratorium on Federal highway spending
- Converted plan to GIS database
- Comparative analysis by EPA
- Project XL exception for 17th Street bridge

Today

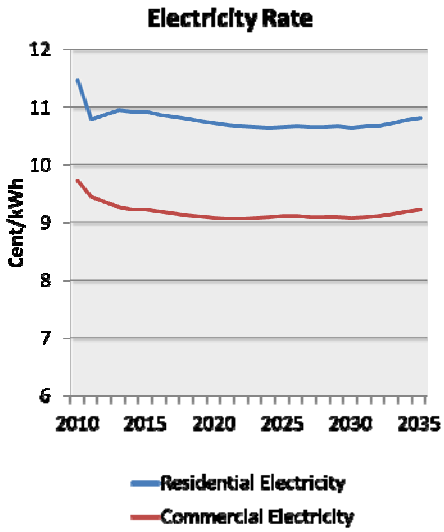
- Mixed Use Development
- 30,000 employees,10,000 residents
- 12 acres of public space
- Less traffic and air pollution
- Cleaned up brownfield site
- Improved tax base

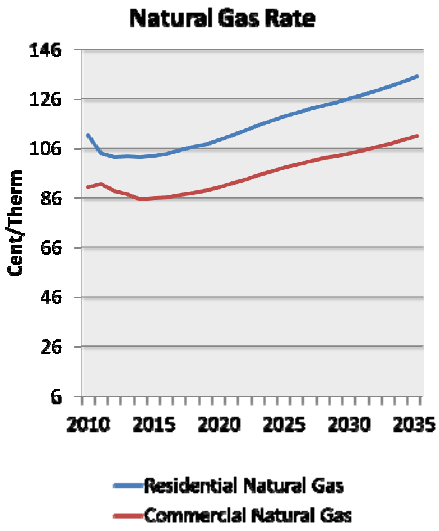
GDP and Population Growth Over the Next 25 Years



Source: Macroeconomic Indicators, AEO2011 Reference Case

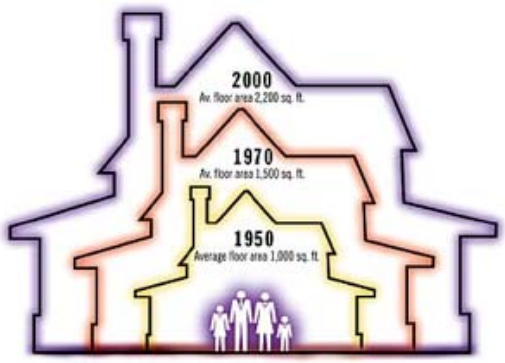
Projected Energy Rates





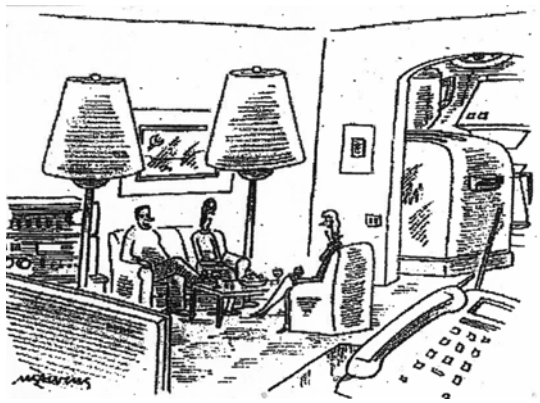
The Impact of Affluence and Cheap Energy

Growth in the Average Home Size in the U.S. Over Time



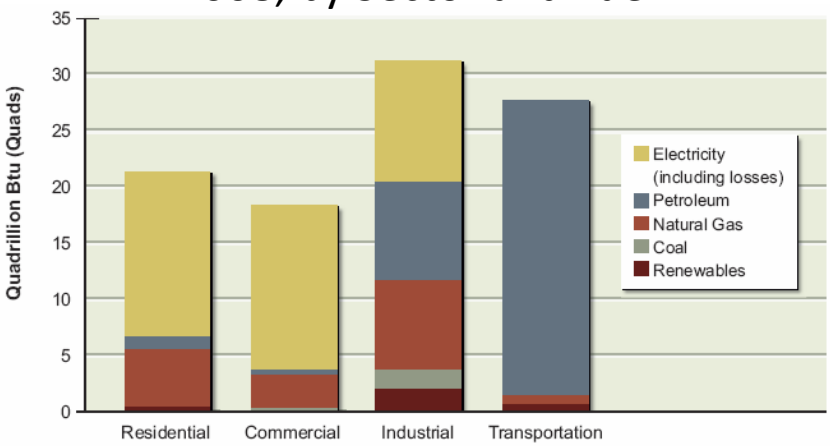
Source: U.S. Census Bureau, National Association of Home Builders

The Impact of Affluence and Cheap Energy



"You know how it is, first you buy the big screen TV, and then nothing seems to match."

Total Energy Consumption in the U.S. in 2008, by Sector and Fuel

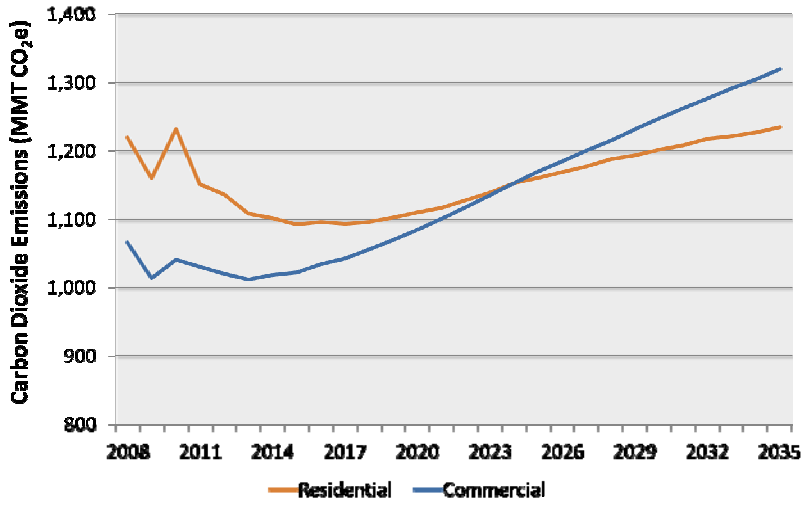


Renewables: 2010: 4% 2010: 1%
2035: 4% 2035: 1%

What if the "Sun Shot" succeeded and 1 watt of solar PV cost $1?

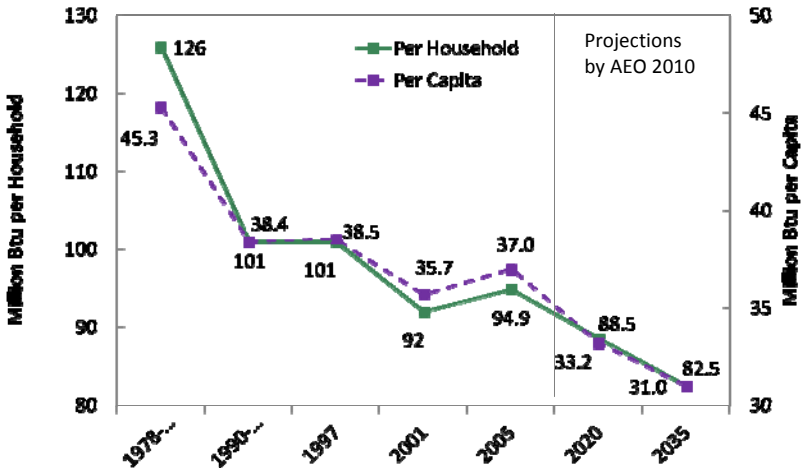
Source: Chart from *America's Energy Future.* 2009. Renewables data from *Annual Energy Outlook 2011.*

U.S. Energy Use and Carbon Emissions are Expected to Increase



Source: U.S. EIA, *Annual Energy Outlook 2010*

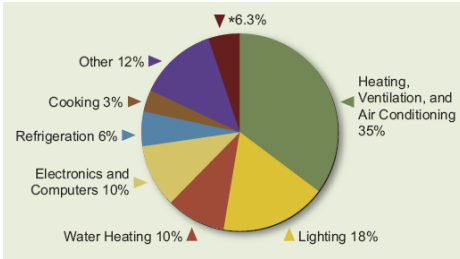
Per Capita Energy Consumption: Will it Continue to Decline?



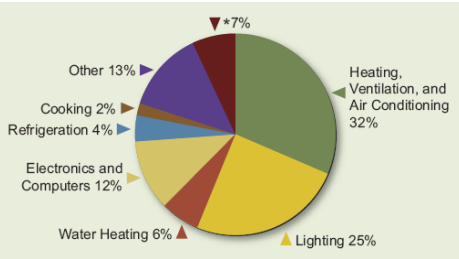
Source: U.S. EIA, 2010. Annual Energy Outlook (AEO) 2010.
U.S. EIA, Residential Energy Consumption Survey (RECS). 2005, 2001, 1997 & 1993

Energy Use in U.S. Buildings by End-Use

Residential Buildings, 2006



Commercial Buildings, 2006



Residential Buildings, 2035

Other Uses: 26% ↑

Lighting: 10% ↓

Commercial Buildings, 2035

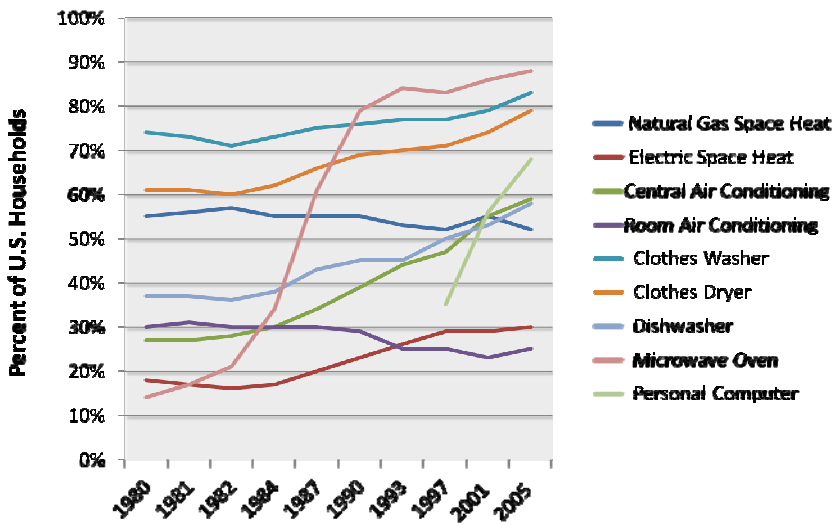
Other Uses: 38% ↑

Lighting: 20% ↓

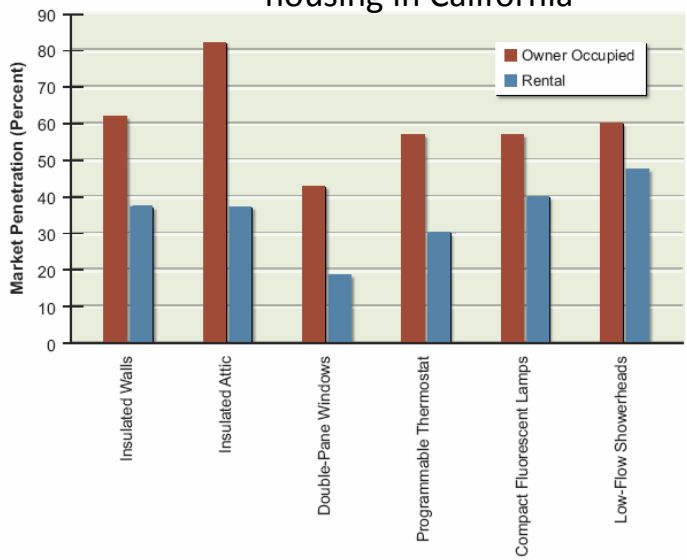
*Adjustment

Source: U.S. EIA, *Annual Energy Outlook 2010*

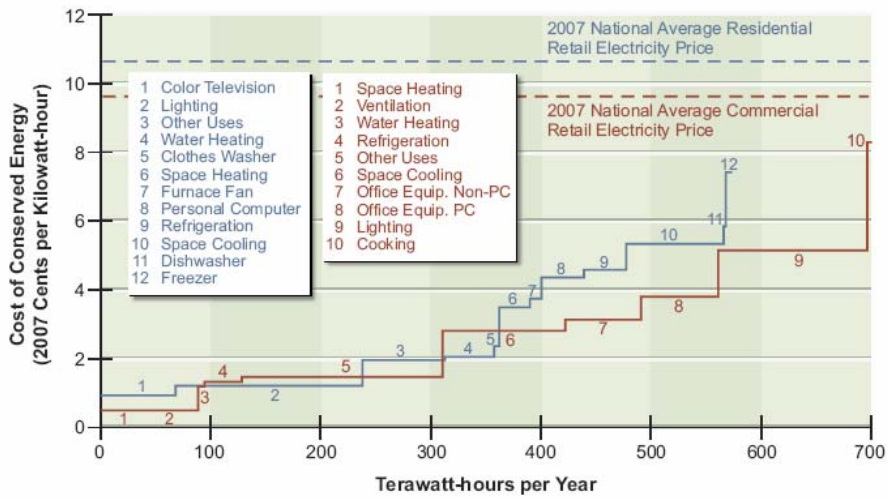
Household Appliance Penetration Trends: Transformations Can Be Rapid



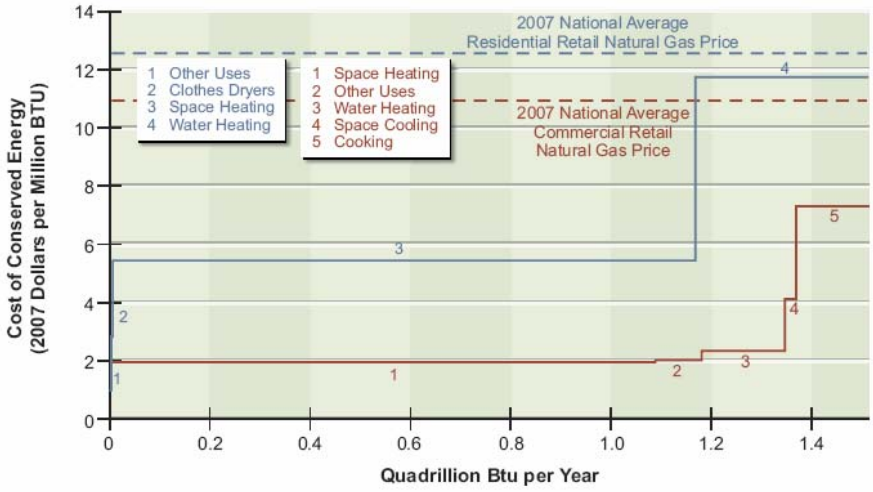
Comparison of the market penetration of energy efficiency measures in owner-occupied and rental housing in California



Estimates of the cost of conserved energy (CCE) and energy savings potential for electricity efficiency technologies in buildings in 2030



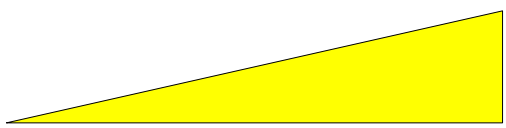
Estimates of the cost of conserved energy (CCE) and energy savings potential for natural gas efficiency technologies in buildings in 2030



The Behavioral Wedge

"Household Actions Can Provide a Behavioral Wedge to Rapidly Reduce U.S. Carbon Emissions"

Dietz, T., G. T. Gardner, J. Gilligan, P. C. Stern, and M. P. Vandenbergh. 2009. *Proceedings of the National Academy of Sciences.* http://www.pnas.org/content/106/44/18452.



17 types of household actions can reduce energy consumption with available technology, low cost, and without appreciable lifestyle changes.

Higher Electricity Prices will Enable the Behavioral Wedge

- Pending EPA regulations on air (SO_2, No_x, mercury, etc.), water, and coal ash on or around 2015:
  - ✓ May require retrofit, retirement or replacement of substantial portion of existing coal fleet in short period of time;
  - ✓ Some estimate potential for near-term retirement of 50 GW or more of coal capacity;
  - ✓ Regulations could impact reliability in some regions; and
  - ✓ Some estimates of capital costs exceed $100B.

Source: J. Edward Cichanowicz. 2011. "The Trouble with Being Coal," *Public Power* January-February, PublicPowerMedia.org

Grounds for Optimism

- Carbon emissions have just begun to be priced and local air pollution will see stronger regulations – these "market signals" will spur innovation and "lean" energy decisions.
- Most of the 2050 physical plant is not yet built – with growth comes opportunity.
- Our current energy system could be made much more efficient – creating jobs and reducing imports.