US Energy Use

![Bar chart showing US energy consumption by source from 2008 to 2010.](chart.png)
GHG reduction opportunities widely distributed – 2030 mid-range case

## Barriers to Optimality

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(About 9% of GDP)

- **Retail Electricity**
- **Biomass**
- **Petroleum**
- **Natural Gas**
- **Coal**

2007 US GDP: $14 Trillion
2007 Disposable Personal Income: $10.4 Trillion

- About 2.3% of DPI
- About 5.6% of DPI

Electricity includes non-primary energy costs of electric system.
Market Penetration of Energy Efficiency Measures in Owner-Occupied and Rental Housing in California (CEC 2004)

- Insulated walls
- Insulated attic
- Double pane windows
- Programmable thermostat
- Compact fluorescent lamps
- Low-flow showerheads

Market penetration (%)

- Owner occupied
- Rental
“It runs on its conventional gasoline-powered engine until it senses guilt, at which point it switches over to battery power.”
Some Motivational Approaches

• Pricing
  – A carbon price would have pervasive effects on energy use in all sectors
  – However, carbon prices will not address many of the market failures nor the information and cognitive issues
  – Navy experiment with base housing: benchmarks and charges or payments for deviations in energy use from the benchmarks
  – Gasoline taxes in Europe vs US motivate purchase of smaller more fuel efficient vehicles
Some Motivational Approaches

• Information
  – Labeling; e.g. Energy Star
  – Building performance rating and rating disclosure.
  – E.g., California mandatory building ratings
  – Easily processed economic data

• Information systems
  – New genre of enterprise-wide energy and carbon accounting and management software.
  – E.g., C3, Hara. Make it less costly to find energy efficiency options in large distributed organization, allow central management of energy and carbon savings, allow alignment of incentives with management energy goals
Other Motivational Approaches

• Feedback (immediate information linked to decisions)
  – Smart meters, sensors, energy information appliances
  – Google/Stanford experiment with Google Powermeter
  – Three levels of possible feedback
    • Consumer use of appliance/technology
    • Consumer purchase of appliance/technology
    • Manufacturer supply of appliance technology
Other Motivational Approaches

- Stochastic Rewards
  - Balaji Prabhakar congestion experiment with Infosys in Bangalore, India
  - Goal: incentives for Infosys commuters to travel at uncongested times
  - Infosys employees given chance for one month extra salary each time they took bus to arrive one half hour earlier than rush hour, two chances for arriving one hour earlier.
    - Expected value per ticket was 20 rupees – 10 cents.
    - Roughly 15% of employees decided to come one-half hour or one hour early.
Other Motivational Approaches

• Social norms
  – Billing information that compares electricity use to neighbors or other norms. E.g. OPower mailings.
  – Navy housing experiments mentioned in last slide