Energy Efficiency in California

Climate Group Breakfast
Preceding Gov. Schwarzenegger's Climate Summit
Nov. 18, 2008

Arthur H. Rosenfeld, Commissioner
California Energy Commission
(916) 654-4930
ARosenfe@Energy.State.CA.US

http://www.energy.ca.gov/commissioners/rosenfeld.html
or just Google “Art Rosenfeld”
Does Anyone See A Problem With This Picture?
Time runs out for islanders on global warming's front line
Rising sea levels threaten to flood many of the islands in the fertile Ganges delta, leading to an environmental disaster and a refugee crisis for India and Bangladesh

Dan McDougall in the Sundarbans
The Observer, Sunday March 30 2008

To find this story, Google "Sundarbans Refugee Camp"
Two Energy Agencies in California

• The California Public Utilities Commission (CPUC) was formed in 1890 to regulate natural monopolies, like railroads, and later electric and gas utilities.
• The California Energy Commission (CEC) was formed in 1974 to regulate the environmental side of energy production and use.
• Now the two agencies work very closely, particularly to delay climate change.
• The Investor-Owned Utilities, under the guidance of the CPUC, spend “Public Goods Charge” money (rate-payer money) to do everything they can that is cost effective to beat existing standards.
• The Publicly Owned utilities (20% of the power), under loose supervision by the CEC, do the same.

If intensity dropped at pre-1973 rate of 0.4%/year

Actual (E/GDP drops 2.1%/year)

12% of GDP = $1.7 Trillion in 2005

7% of GDP = $1.0 Trillion in 2005
How Much of The Savings Come from Efficiency

• Some examples of estimated savings in 2006 based on 1974 efficiencies minus 2006 efficiencies

<table>
<thead>
<tr>
<th>Product</th>
<th>Billion $</th>
</tr>
</thead>
<tbody>
<tr>
<td>Space Heating</td>
<td>40</td>
</tr>
<tr>
<td>Air Conditioning</td>
<td>30</td>
</tr>
<tr>
<td>Refrigerators</td>
<td>15</td>
</tr>
<tr>
<td>Fluorescent Tube Lamps</td>
<td>5</td>
</tr>
<tr>
<td>Compact Fluorescent Lamps</td>
<td>5</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>95</strong></td>
</tr>
</tbody>
</table>

• Beginning in 2007 in California, reduction of “vampire” or stand-by losses
  – This will save $10 Billion when finally implemented, nation-wide

• Out of a total $700 Billion, a crude summary is that 1/3 is structural, 1/3 is from transportation, and 1/3 from buildings and industry.
California’s Energy Action Plan

• California’s Energy Agencies first adopted an Energy Action Plan in 2003. Central to this is the State’s preferred “Loading Order” for resource expansion.

• 1. Energy efficiency and Demand Response
• 2. Renewable Generation
• 3. Increased development of affordable & reliable conventional generation
• 4. Transmission expansion to support all of California’s energy goals.

• The Energy Action Plan has been updated since 2003 and provides overall policy direction to the various state agencies involved with the energy sectors
Per Capita Electricity Sales (not including self-generation)
(kWh/person) (2006 to 2008 are forecast data)

2005 Differences
= 5,300 kWh/yr
= $165/capita

Per Capita Income in Constant 2000 $

<table>
<thead>
<tr>
<th></th>
<th>1975</th>
<th>2005</th>
<th>% change</th>
</tr>
</thead>
<tbody>
<tr>
<td>US GDP/capita</td>
<td>16,241</td>
<td>31,442</td>
<td>94%</td>
</tr>
<tr>
<td>Cal GSP/capita</td>
<td>18,760</td>
<td>33,536</td>
<td>79%</td>
</tr>
</tbody>
</table>
Annual Energy Savings from Efficiency Programs and Standards

~15% of Annual Electricity Use in California in 2003

Utility Efficiency Programs at a cost of ~1% of electric bill

Building Standards

Appliance Standards
New United States Refrigerator Use v. Time
and Retail Prices

0
200 400 600 800
1,000
1,200 1,400 1,600 1,800
2,000


~ 100 gallons Gasoline/year
~ 1 Ton CO2/year

Refrigerator Size (cubic ft)

Energy Use per Refrigerator (kWh/Year)

Refrigerator Price in 1983 $
Annual Energy Saved vs. Several Sources of Supply
In the United States

Billion kWh/year

- Nuclear energy
- Conventional hydro
- PV systems
- Renewables
- Energy Saved Refrigerator Stds
  = 80 power plants of 500 MW each

In the United States, nuclear energy can contribute significantly to the annual energy saved compared to other sources like conventional hydro, PV systems, and renewables.
In the United States

Value of Energy to be Saved (at 8.5 cents/kWh, retail price) vs.
Several Sources of Supply in 2005 (at 3 cents/kWh, wholesale price)

Energy Saved

Billion $ (US)/year in 2005

- Refrigerator Stds
- 100 Million 1 KW PV systems
- conventional hydro
- renewables
- nuclear energy
Air Conditioning Energy Use in Single Family Homes in PG&E
The effect of AC Standards (SEER) and Title 24 standards

- If only increases in house size -- no efficiency gains
- Change due to SEER improvements
- SEER plus Title 24
Comparison of 3 Gorges to Refrigerator and AC Efficiency Improvements

三峡电量与电冰箱、空调能效对比

Savings calculated 10 years after standard takes effect. Calculations provided by David Fridley, LBNL
Annual Energy Savings from Efficiency Programs and Standards

~15% of Annual Electricity Use in California in 2003

~1% of electric bill

Utility Efficiency Programs

Building Standards

Appliance Standards
Energy Efficiency, Innovation, and Job Creation in California

David Roland-Holst
October 2008
Center for Energy, Resource, and Economic Sustainability (CERES)

Accessible on the Next 10 Web Site: http://www.nextten.org/research/research_eeijc.html
Energy Efficiency Creates Jobs

- Using the BEAR econometric model
- Estimates of Job Creation since 1972:
  - Energy Efficiency Measures have created **1.5 Million Jobs** out of 18 million total Jobs in CA
California IOU’s Investment in Energy Efficiency

Millions of $2002 per Year

- Profits decoupled from sales
- 2% of 2004 IOU Electric Revenues
- Performance Incentives
- Market Restructuring
- Crisis
- IRP
- Forecast
- Public Goods Charges


Note: The graph shows the investment in energy efficiency by California IOUs from 1976 to 2012, with key events and trends highlighted.
Energy Efficiency Incentive Mechanism Earnings/Penalty Curve

(D.07-09-043, p. 8)

Reward (% of PEB)

Penalty (per unit below CPUC goal)

Earnings capped at $450 million

ER = 12%
ER = 9%

0% 65% 85% 100% % of CPUC goals

5¢/kWh, $25/kW, 45¢/therm below goals, or payback of negative net benefits (cost-effectiveness guarantee), whichever is greater.

Penalty capped at $450 million.

Earnings = ER x PEB

PEB = Performance Earnings Basis
ER = Earnings Rate (or Shared-Savings Rate)

Source: NRDC; Chang and Wang, 9/26/2007
Global Cooling: Increasing World-wide Urban Albedos to Offset CO2

July 28, 2008

Hashem Akbari and Surabi Menon
Lawrence Berkeley National Laboratory, USA
H_Akbari@lbl.gov
Tel: 510-486-4287

Arthur Rosenfeld
California Energy Commission, USA
Arosenfe@energy.state.ca.us
Tel: 916-654 4930

A First Step In Geo-Engineering Which Saves Money and Has Known Positive Environmental Impacts
100m² (~1000 ft²) of a white roof, replacing a dark roof, offset the emission of 10 tonnes of CO₂
Solar Reflective Surfaces Also Cool the Globe

Source: IPCC
CO$_2$ Equivalency of Cool Roofs World-wide (Tropics+Temperate)

• Cool Roofs alone offset 24 Gt CO2
• Worth > €600 Billion
• To Convert 24 Gt CO2 one time into a rate
• Assume 20 Year Program, thus
  1.2 Gt CO2/year
• Average World Car Emits 4 tCO2/year,
  equivalent to 300 Million Cars off the Road for 20 years.

US Greenhouse Gas Abatement Mapping Initiative

December 12, 2007
U.S. mid-range abatement curve – 2030

Source: McKinsey analysis
Possible Strategies to Reduce Electricity Sector Carbon Emissions in California, ignoring ramp up times and other implementation issues -- The ELECTRICITY Perspective

GWH

Source: Pat McAuliffe, pmcaulif@energy.state.ca.us
Possible Strategies to Reduce Electricity Sector Carbon Emissions in California, ignoring ramp up times and other implementation issues -- The CARBON Perspective

Source: Pat McAuliffe, pmcaulif@energy.state.ca.us
The End

For More Information:

http://www.energy.ca.gov/commissioners/rosenfeld_docs/index.html

or just Google “Art Rosenfeld”