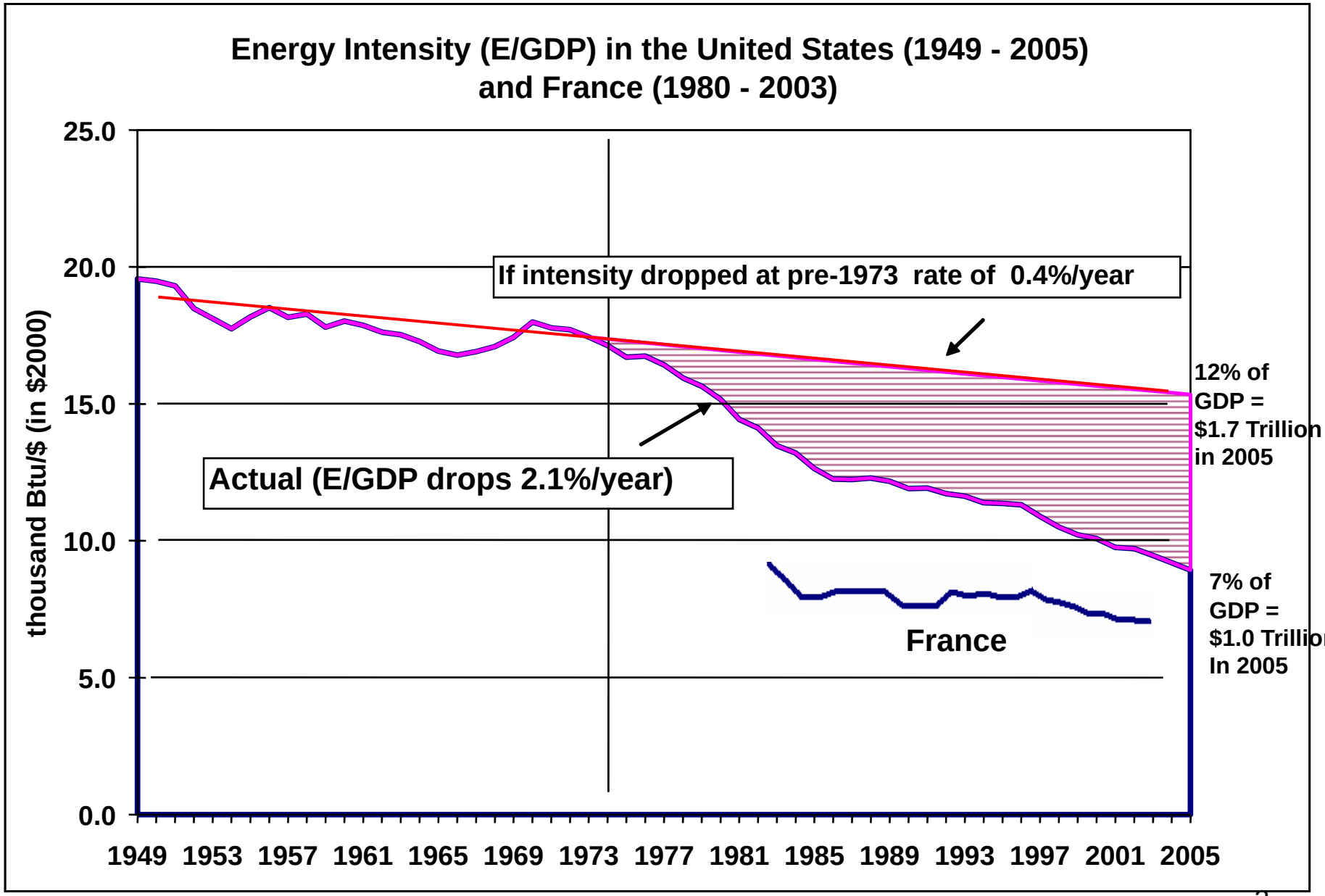
Financing Energy Efficiency in California, The First Priority

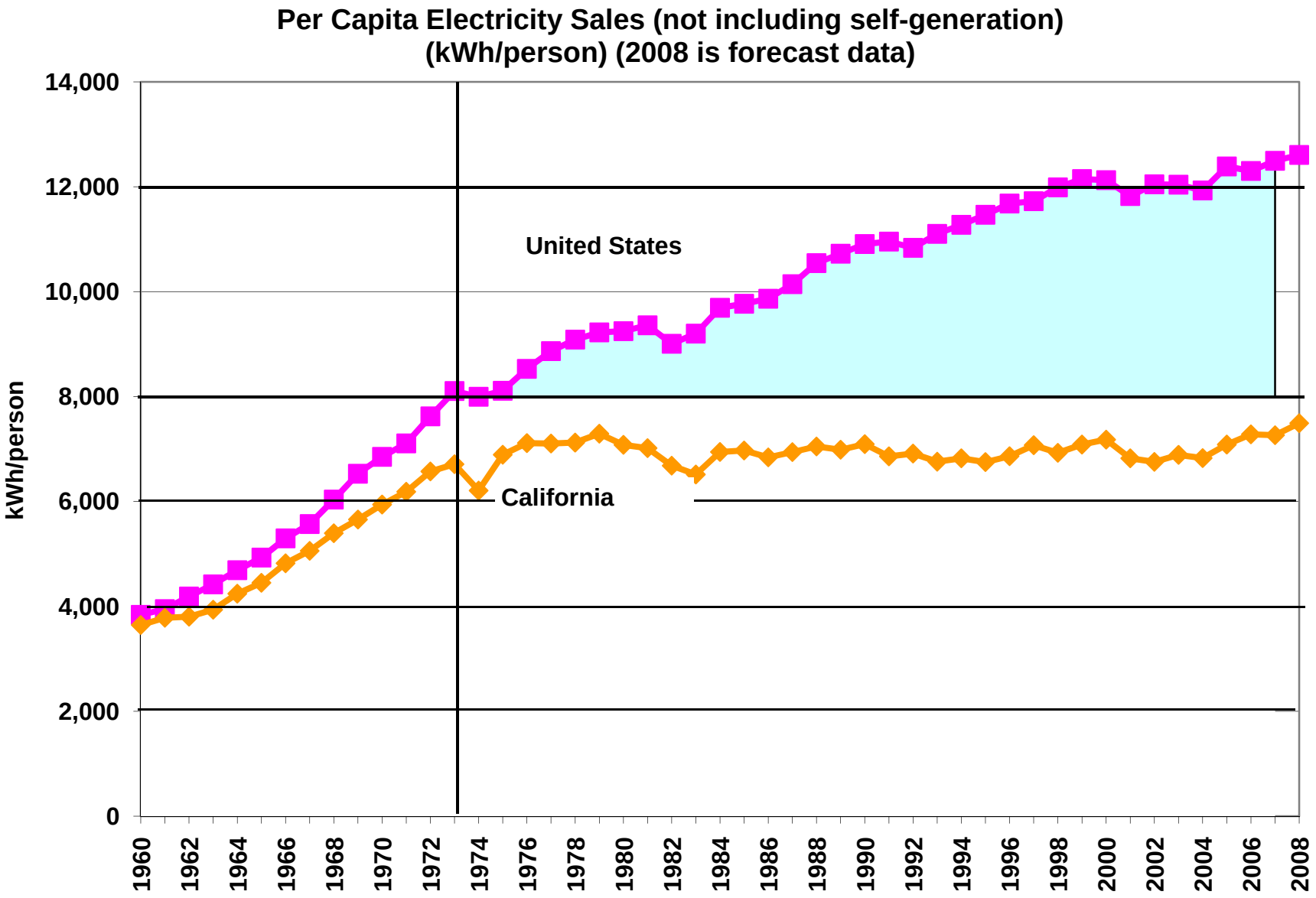
ACEEE/ FRA ROSENFELD Session
April 24, 2009

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

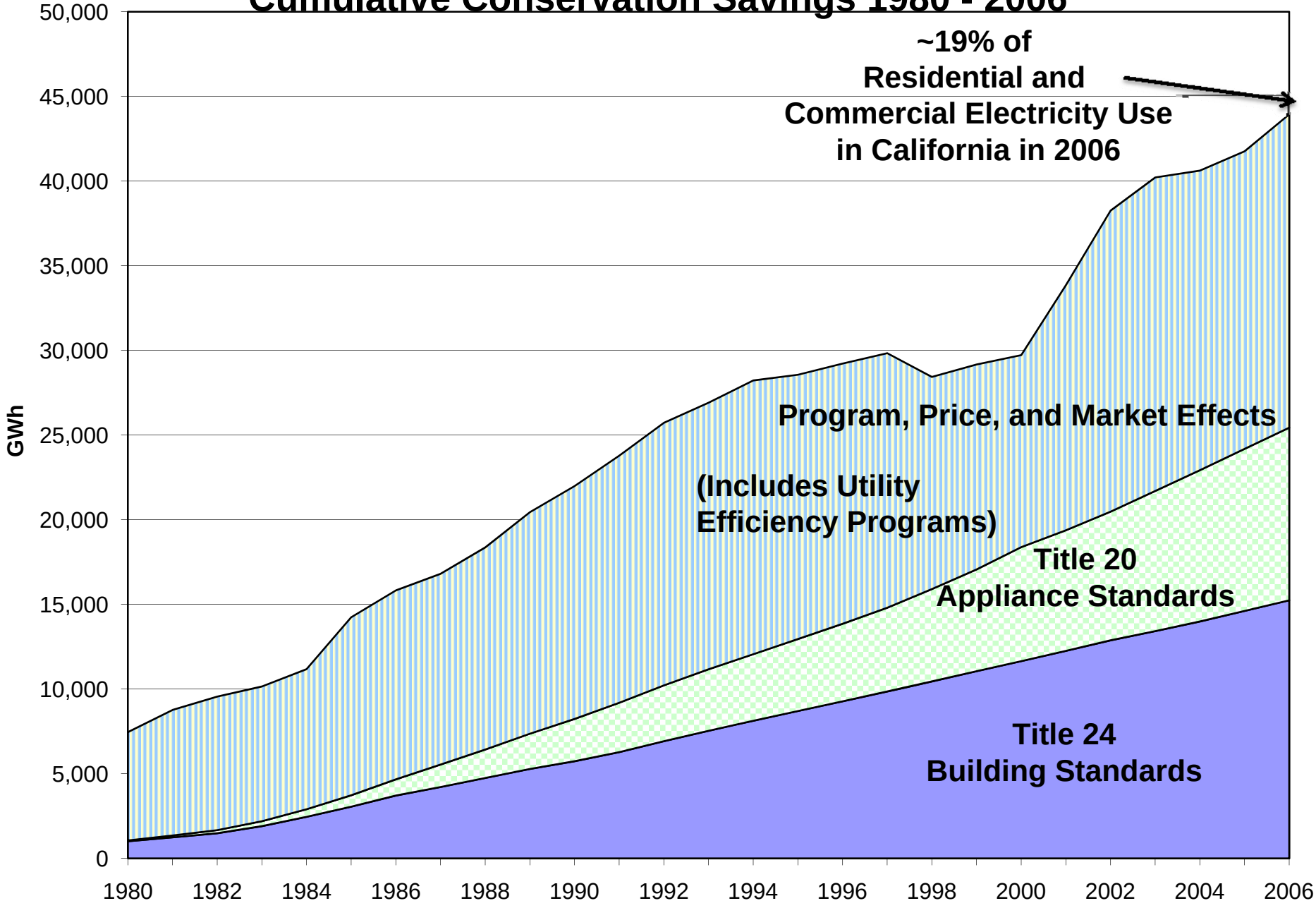
http://www.energy.ca.gov/commissioners/rosenfeld.html
or just Google "Art Rosenfeld"

Does Anyone See A Problem With This Picture?


Energy Intensity (E/GDP) in the United States (1949 - 2005)
and France (1980 - 2003)
thousand Btu/$ (in $2000)
25.0
20.0
15.0
10.0
5.0
0.0
1949
1953
1957
1961
1965
1969
1973
1977
1981
1985
1989
1993
1997
2001
2005
If intensity dropped at pre-1973 rate of 0.4%/year
Actual (E/GDP drops 2.1%/year)
France
12% of GDP = $1.7 Trillion in 2005
7% of GDP = $1.0 Trillion In 2005


Per Capita Electricity Sales (not including self-generation)
(kWh/person) (2008 is forecast data)
kWh/person
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
United States
California
1960
1962
1964
1966
1968
1970
1972
1974
1976
1978
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008

Residential and Commercial Cumulative Conservation Savings 1980 - 2006



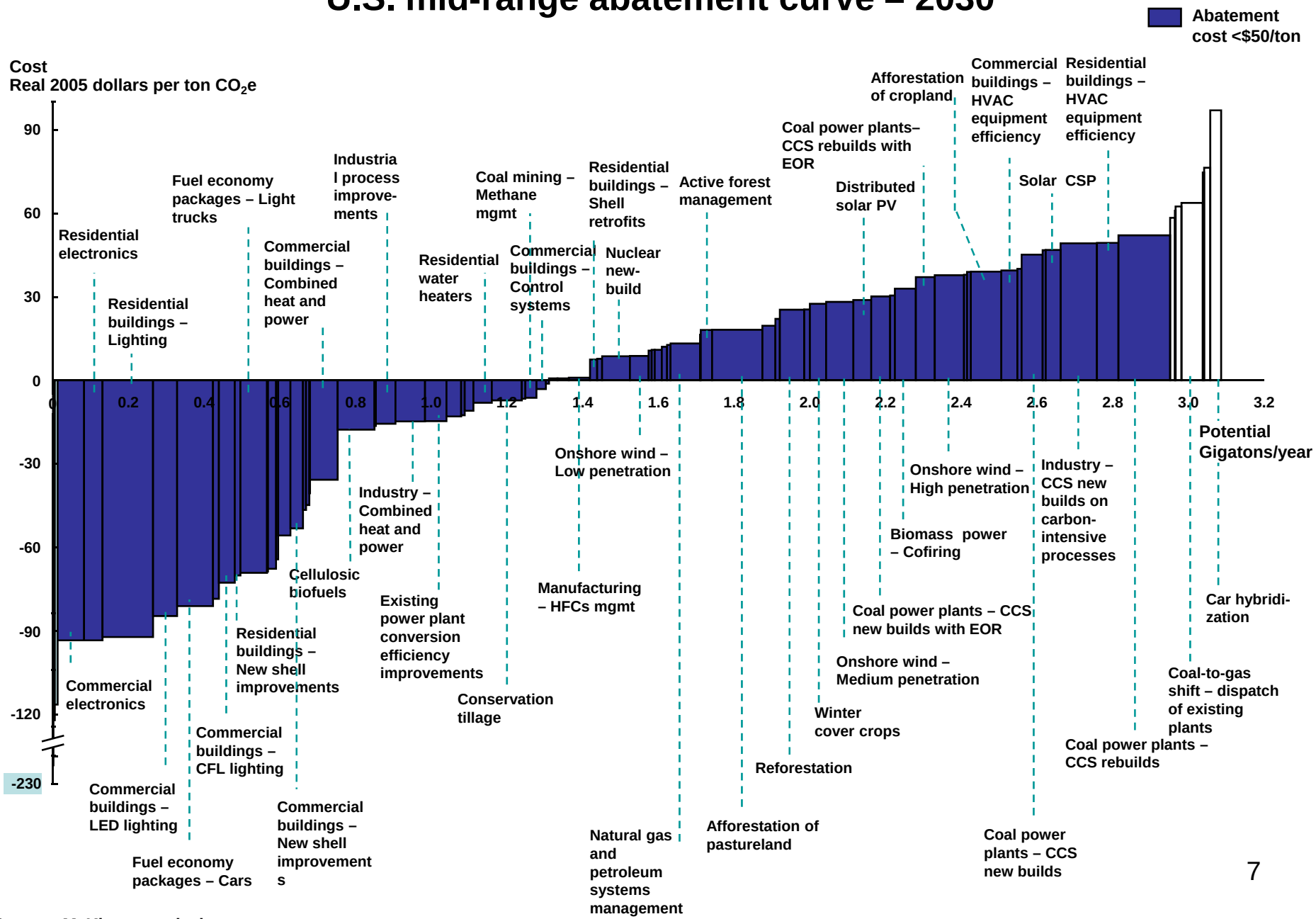
Reducing U.S. Greenhouse Gas Emissions: *How Much at What Cost?*

US Greenhouse Gas Abatement Mapping Initiative

December 12, 2007

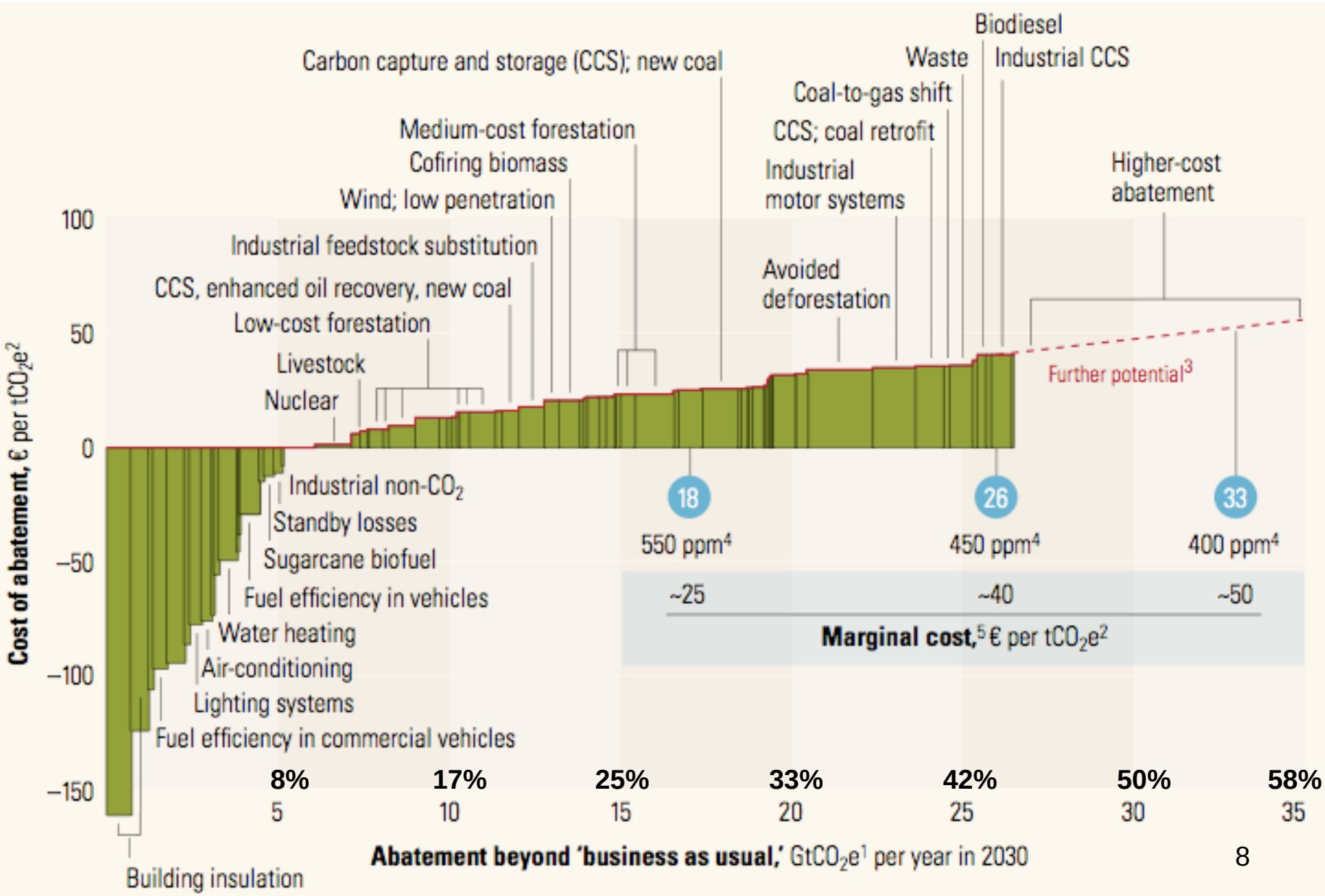
McKinsey&Company

U.S. mid-range abatement curve – 2030



Source: McKinsey analysis

Global CO2 Abatement Curve - 2030



Municipal Finance Districts

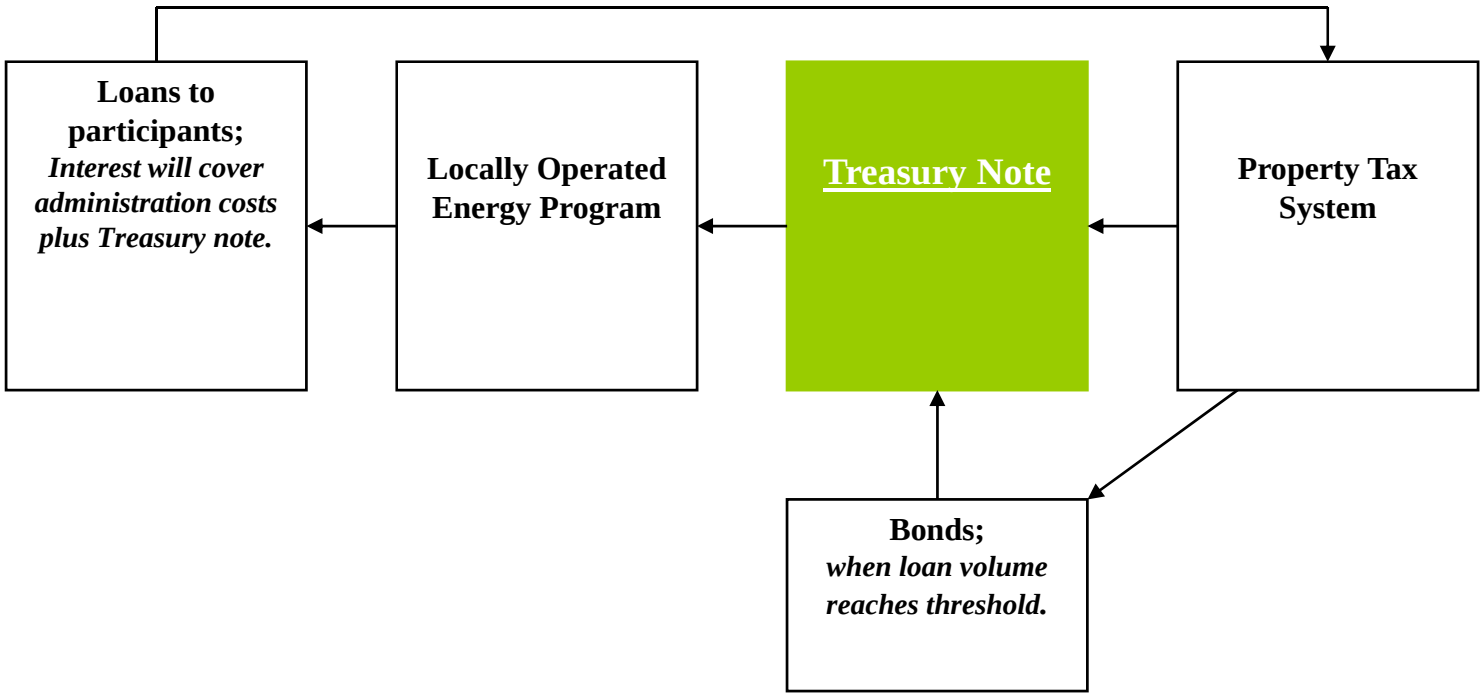
AB 811 (Levine), July 2008

AB 811 – Background

- Governor signed AB 811 (Levine) as an urgency measure
- Program enters into agreement with property owner to fund energy and water improvements to existing residential and commercial property
- **Property owner agrees to a contractual assessment on property tax bill for up to 20 years**
- Criteria for loan approval
  - No “Clouds” on Property Title
  - Current on Property Taxes
  - Current on Mortgage(s)
- Property secures the loan and stays with property

Source: Rod Dole – Auditor, Controller, Treasurer, Tax Collector, Sonoma County

AB 811 – FINANCES



Source: Rod Dole – ACTTC, Sonoma County

AB 811 – FINANCES

- Treasury invests in a series of notes
- Proceeds of the notes are used to finance loans to participants
- Participant payments come in via property tax system, paying the loan principal plus an interest rate to cover program operational expenses – analogous to a bank loan
- Bonds or other long term investment repays the note in full
- With long term financing, Treasury can invest in a new series of notes

Source: Rod Dole – ACTTC, Sonoma County

AB 811 – TECHNOLOGY

- **Energy Efficiency**
  - **High-efficiency HVAC**
  - **High-efficiency windows & Insulation**
- Renewables
  - Photovoltaic (PV)
  - Fuel Cells
  - Geothermal exchanges
- **Water Conservation**
  - **Tankless water heaters**
  - **Low-flow devices**
  - **Rain cisterns**
  - **Smart irrigation systems (e.g. moisture sensors)**

Source: Rod Dole – ACTTC, Sonoma County

AB 811 – Relation to Stimulus

DOE	US ($Million)	CA ($Million)	Administered By
Weatherization (low income)	5,000	186*	Community Services Development (CSD)
SEP (State energy Program)	3,000	226	Energy Comm'n (CEC)
EERE (Energy Eff. And Renewables)	7,000	---	
EEC BG (EE & Conservation Block Grants)	---	352	Large Cities, Counties, CEC

* California **IOU's (Investor-Owned Utilities's)** Low-Income Weatherization funding is $200 M/yr

AB 811 – Benefits

- Enabling Residential/Commercial/Industrial Property Owners to make responsible and affordable energy and resource conservation improvements to existing structures
- Provide unique financing and repayment vehicle to the Property Owner to fund Improvements
- Provide job opportunities in the energy and resource conservation improvement fields

Source: Rod Dole – ACTTC, Sonoma County

AB 811 – How Can We Sweeten the Deal?

- Current programs like weatherization have income tests (<200% of poverty level)
  - How do we reach the next income tier who may fall in the gaps?
  - How do we deal with landlord-tenant problems?
  - What about repossessed/empty homes?
  - What about using performance-based (M&V) incentives?

“Berkeley First” Program

Table 2. Net present value for average California home

Project type	Annual energy price escalation		
	EIA forecast (inflation only)	+2%	+4%
Solar installation only	($2,690)	($1,492)	$87
Energy-efficiency improvement only	$185	$1,017	$2,120
Solar installation and energy-efficiency improvement	($2,812)	($852)	$1,738
Solar installation, energy-efficiency improvement, and $30/ton carbon dioxide	($1,818)	$142	$2,732

NOTE: EIA=Energy Information Administration. Parentheses indicate negative net present value, base case highlighted.

Source: Merrian C. Fuller, Stephen Compagni Portis, and Daniel M. Kammen, *"Toward a Low-Carbon Economy: Municipal Financing for Energy Efficiency and Solar Power"* Environment Magazine, Online

“Berkeley First” Per Home Assumptions

- Baseline assumptions based on EIA data for 2006:
  - 7000 kWh/yr electricity
  - 276 therms/yr natural gas
- Savings assumptions are:
  - 5% Electricity and 25% Natural Gas from the first $4000 spent on homes (minimum required for program participation)
  - Higher payback measures such as resetting thermostats, replacing light bulbs, or purchasing high efficiency appliances are not included in this study.

White is ‘cool’ in Bermuda

and in Santorini, Greece

and in Hyderabad, India

…and in Gujarat, India

- *To be published in Climatic Change 2009*

- **Global Cooling: Increasing World-wide Urban Albedos to Offset CO2**

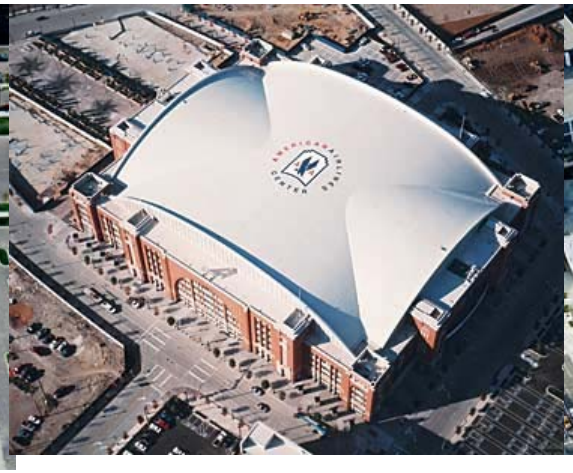
July 28, 2008

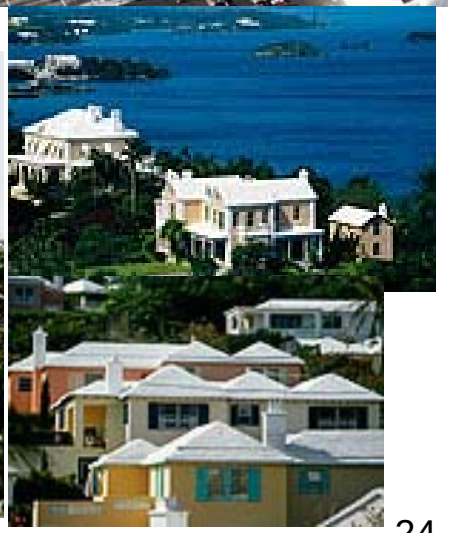
Hashem Akbari and Surabi Menon
Lawrence Berkeley National Laboratory, USA
H_Akbari@lbl.gov
Tel: 510-486-4287

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 Consequences**

100m^2(~1000 ft$^{2)}$ of a white roof, replacing a dark roof, offset the emission of 10 tonnes of CO_2





How to Relate to 10 Tons of CO2

- First – This is 10 tons ONCE, not 10 tons/year;
- But familiar measures are usually in terms of tons/**year**;
- So we will look at how many years of emissions 10 tons will offset

	Tons CO2/Yr	**Years Equivalent to 10 Tons**
Average US House Emits	10	1
Average US Car Emits	5	2
Average Global Car Emits	4	2.5
Average CFL **Saves**	.05=1/20	200

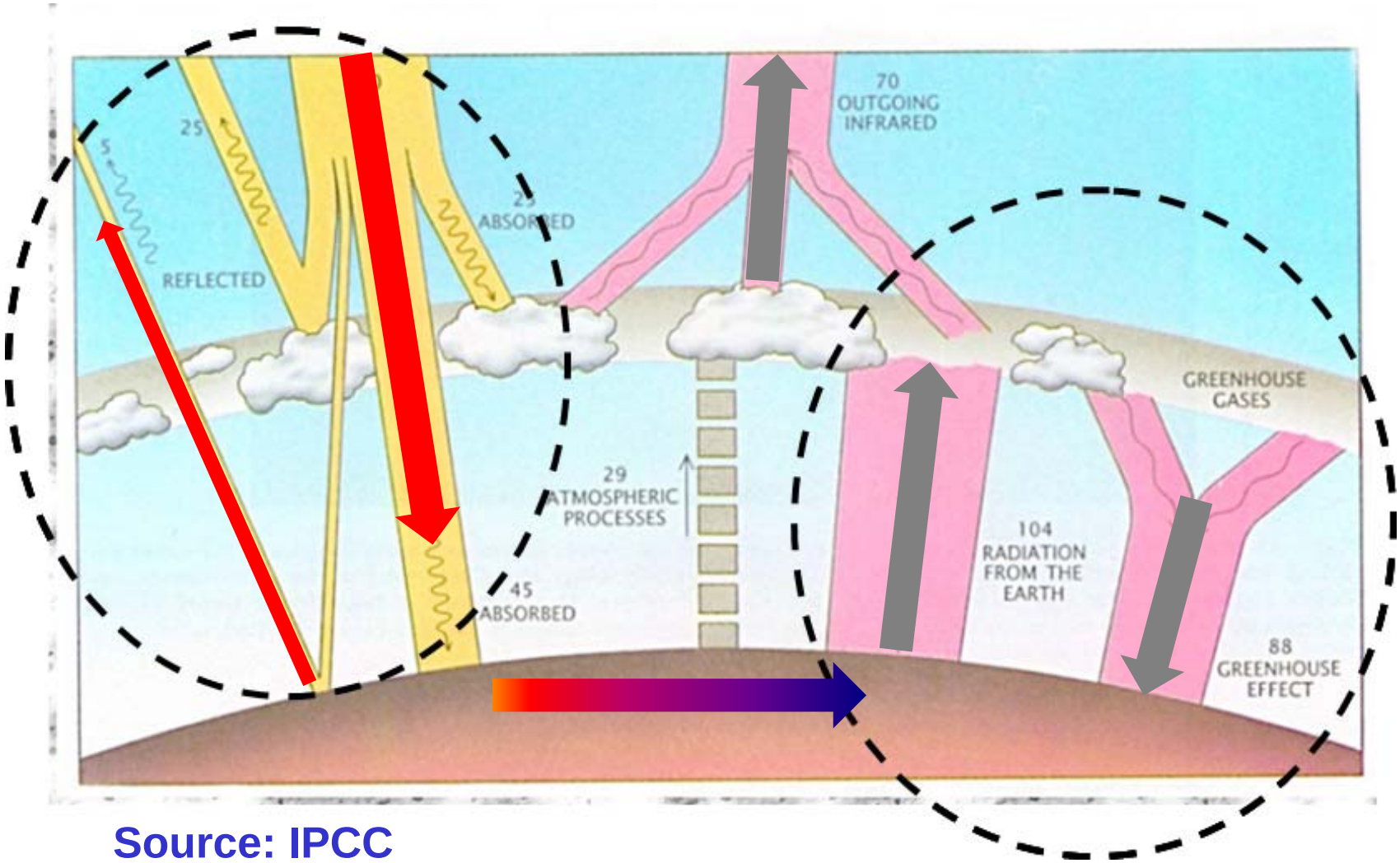
CO_2 Equivalency of Cool Roofs World-wide (Tropics+Temperate)

- Cool Roofs alone could offset a total of 24 Billion Tons (Gt) CO2, = world emissions this year !!!!
- Worth > €240 Billion (Pre-recession was €600B)
- 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.

(600 million cars in the world)

Solar Reflective Surfaces Also Cool the Globe



Source: IPCC

27

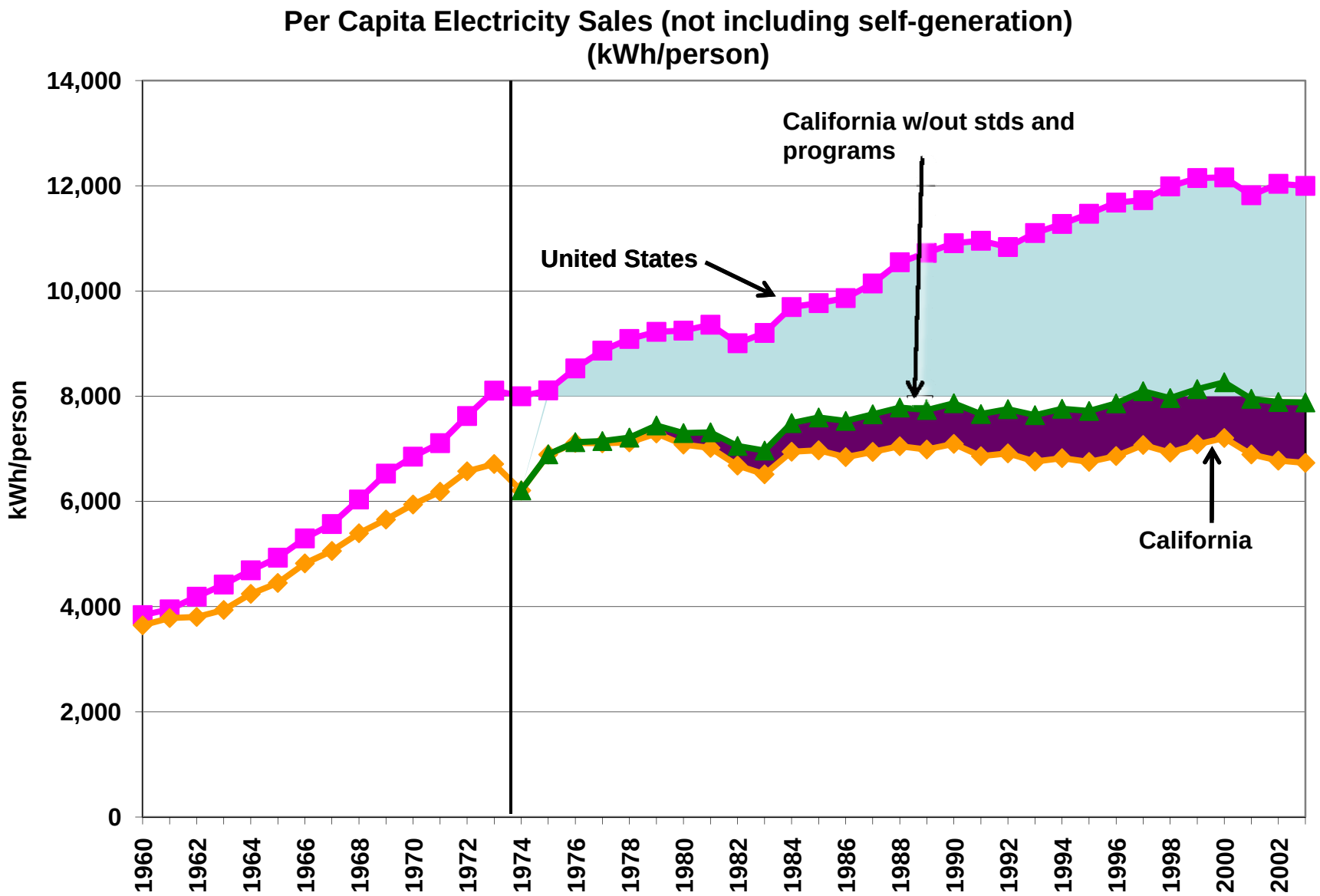
California Appliance and Buildings Efficiency Standards (Title 20 and 24)

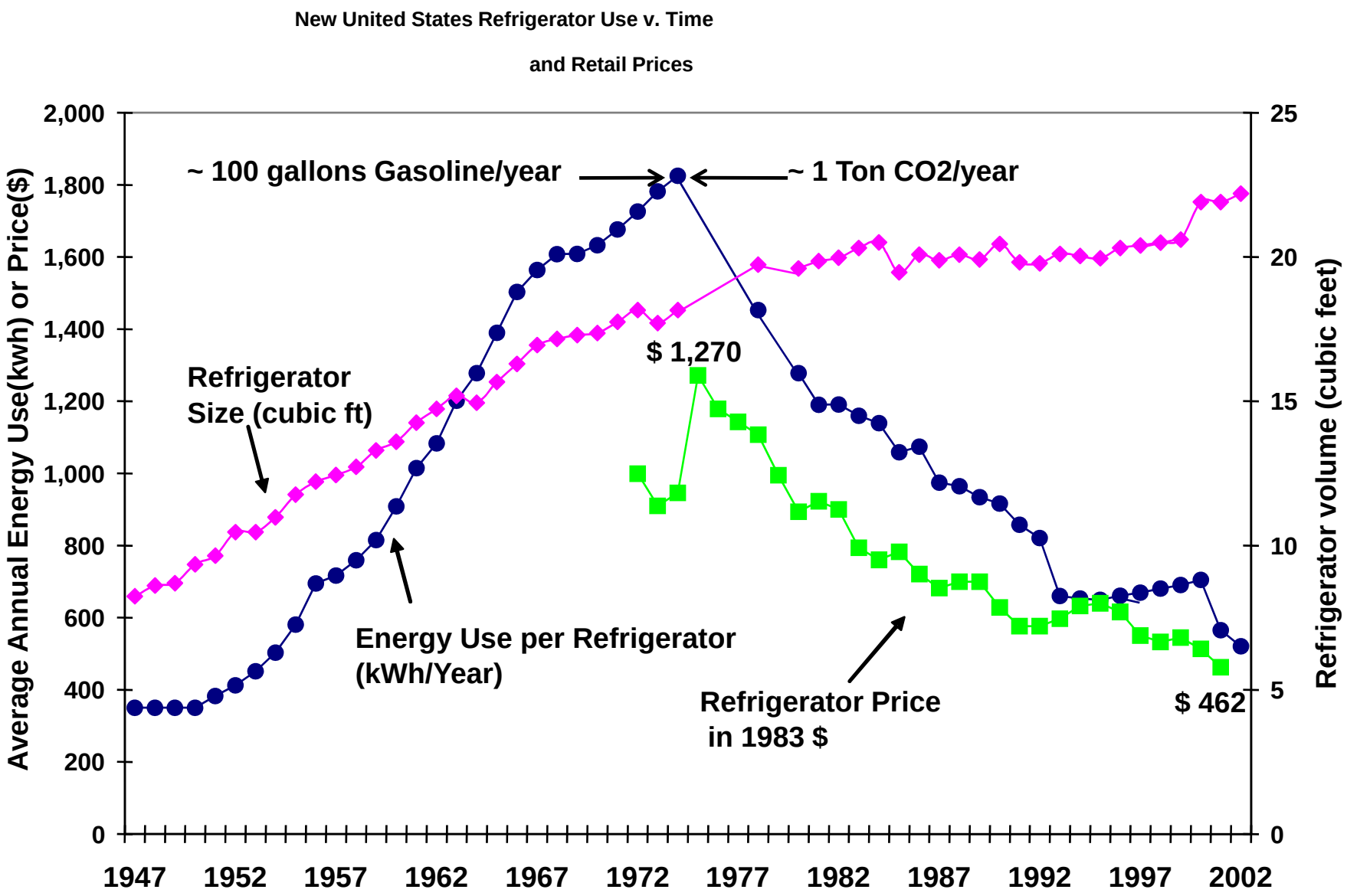
How Much of The Savings Come from Efficiency

- Some examples of estimated savings in 2009 based on 1974 efficiencies minus 2009 efficiencies

	Billion $/Yr
Space Heating	40
Air Conditioning	30
Refrigerators	15
Fluorescent Tube Lamps	5
Compact Fluorescent Lamps	10
Total	**100**

- 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.

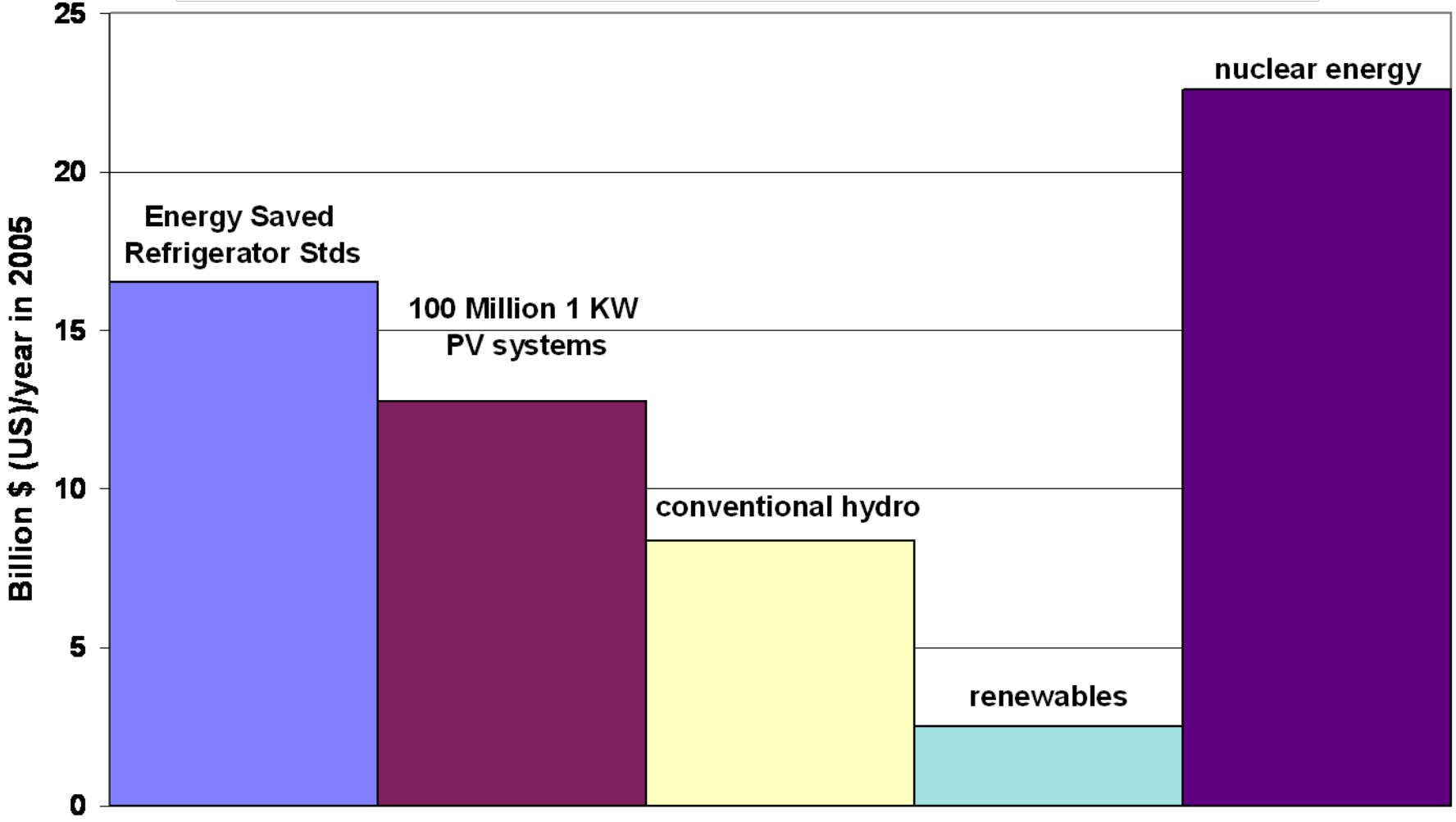

Per Capita Electricity Sales (not including self-generation)
(kWh/person)
kWh/person
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
1960
1962
1964
1966
1968
1970
1972
1974
1976
1978
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
California w/out stds and programs
United States
California

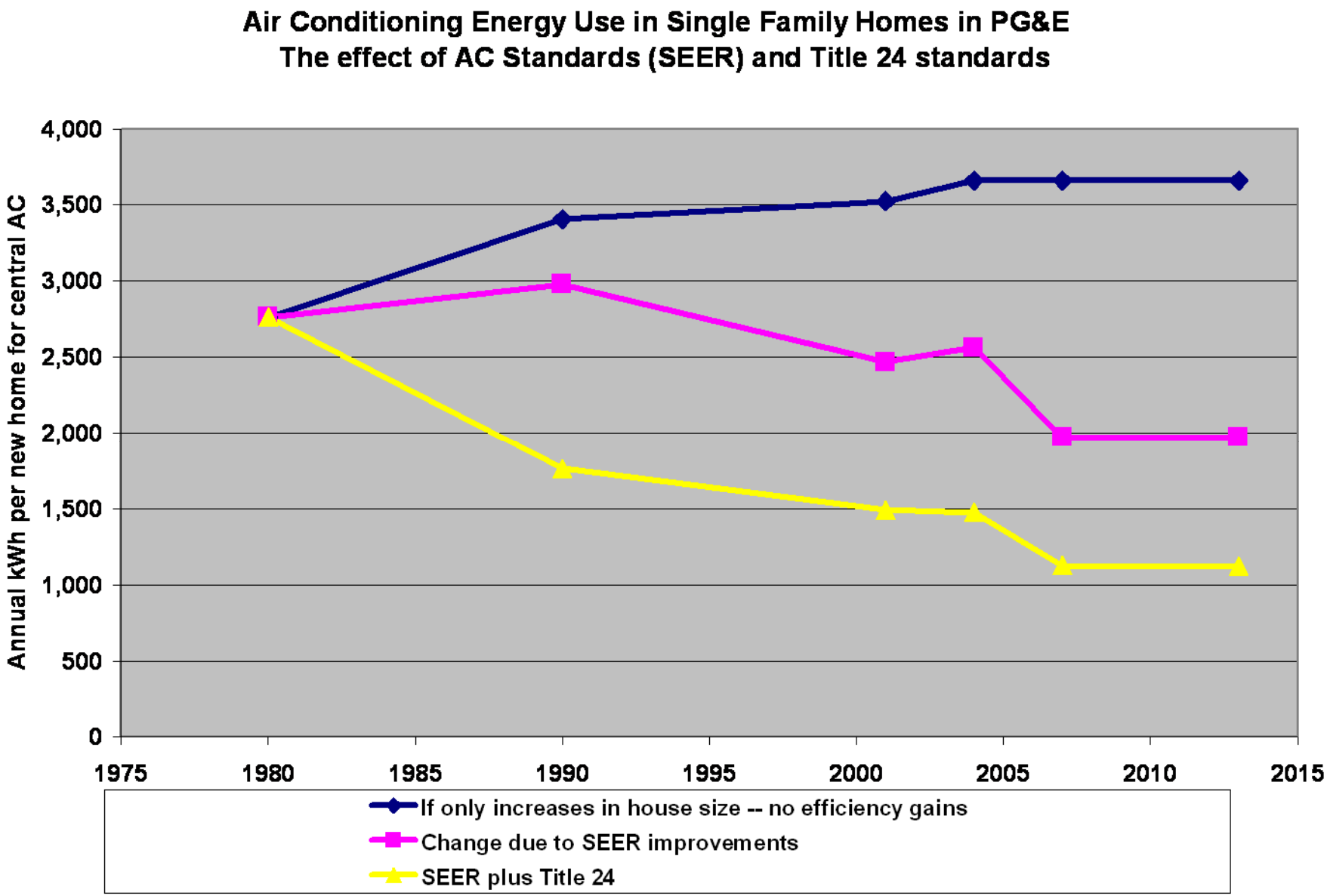


Source: David Goldstein

In the United States

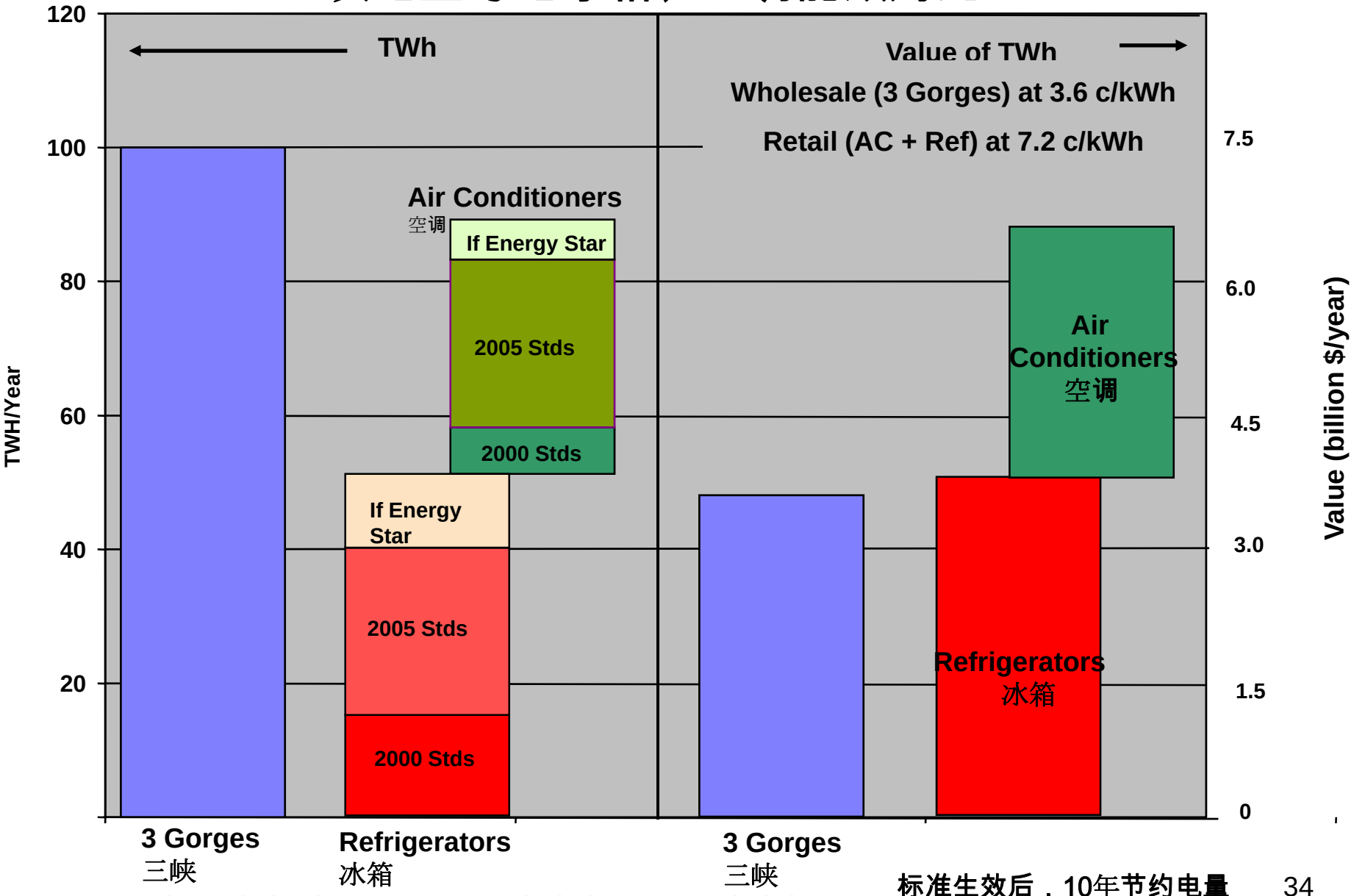
Value of Energy to be Saved (at 8.5 cents/kWh, retail price) vs. Several Sources of Supply in 2005 (at 3 cents/kWh, wholesale price)




Air Conditioning Energy Use in Single Family Homes in PG&E
The effect of AC Standards (SEER) and Title 24 standards
Annual kWh per new home for central AC
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
1975
1980
1985
1990
1995
2000
2005
2010
2015
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

标准生效后，10年节约电量

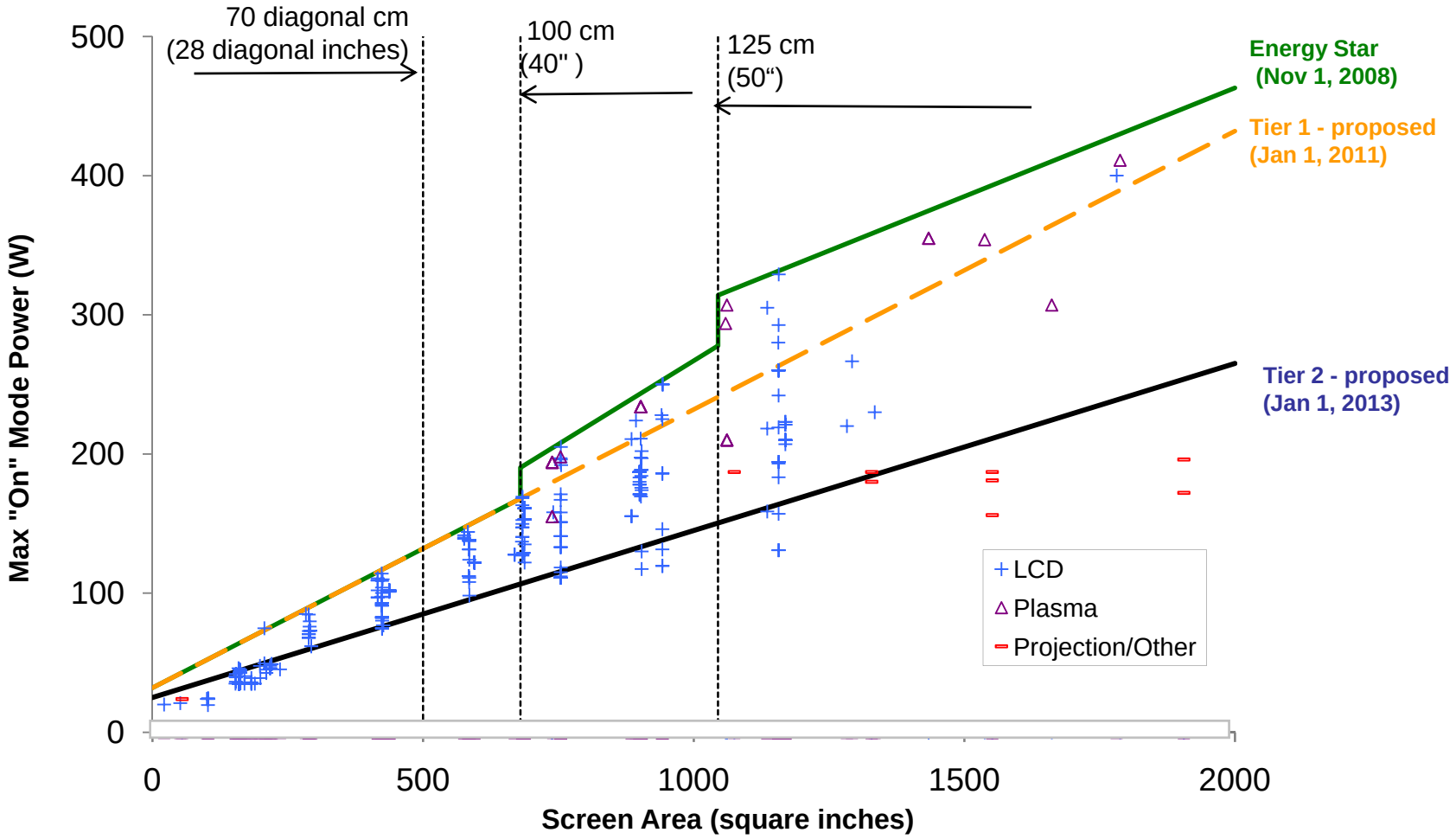
TV Power Trend

- Sales of conventional (CRT) televisions are rapidly declining in favor of flat screen technology (LCD) .
- TV load is now 5-10% of total residential electricity load and is growing ~ 3-4% per year.
- Standards will cap or reverse growth!

Power Consumption by TV vs Total Residential in CA

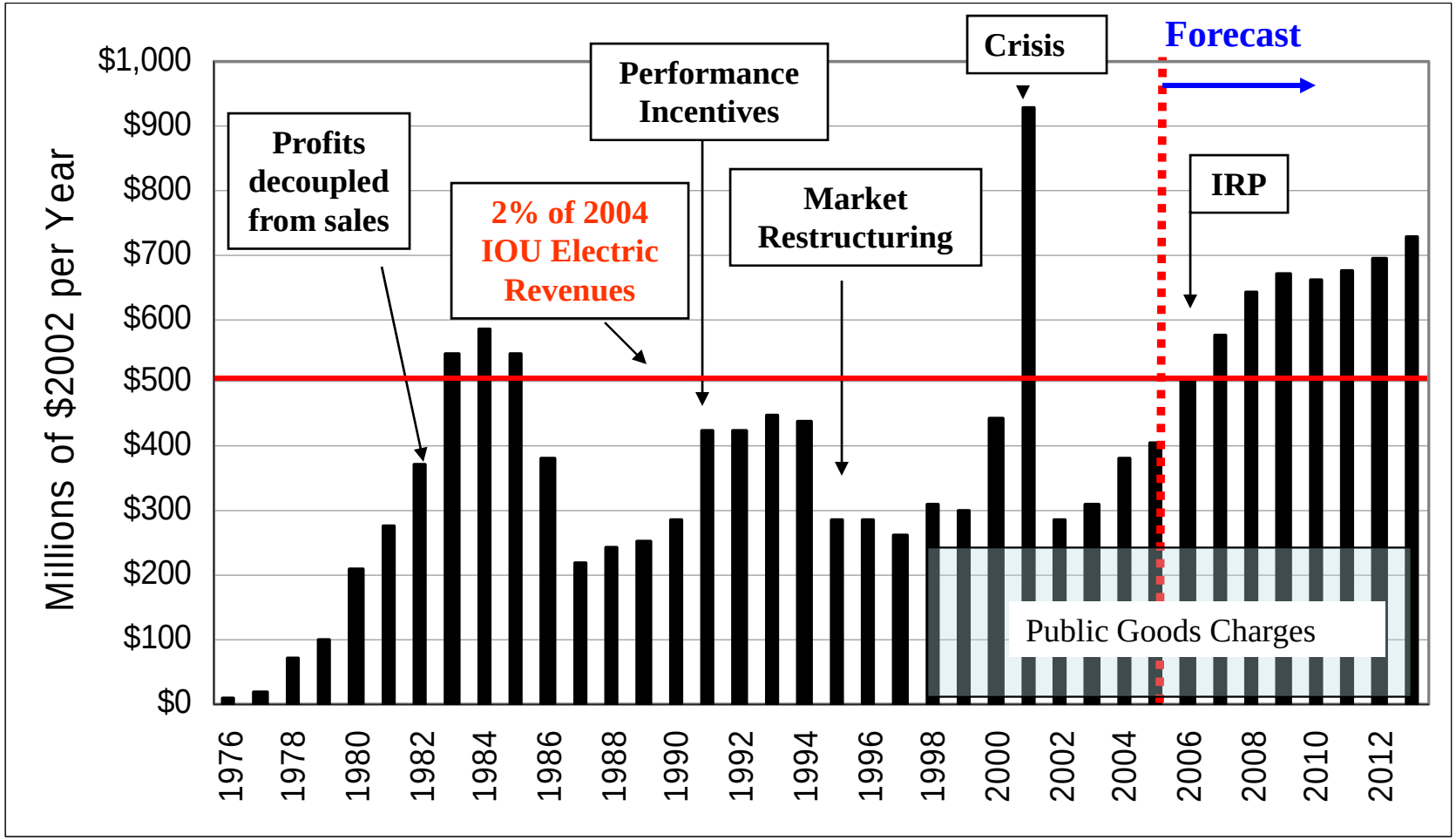
	Power Use (W) by Average Size TV	CA Energy Consumption Per Year in BkWh/year
CRT (Cathode Ray Tube)	101	4
LCD (Liquid Crystal Display)	144	3
Other	---	2
Total	245	9
Total Residential Power Consumption		90

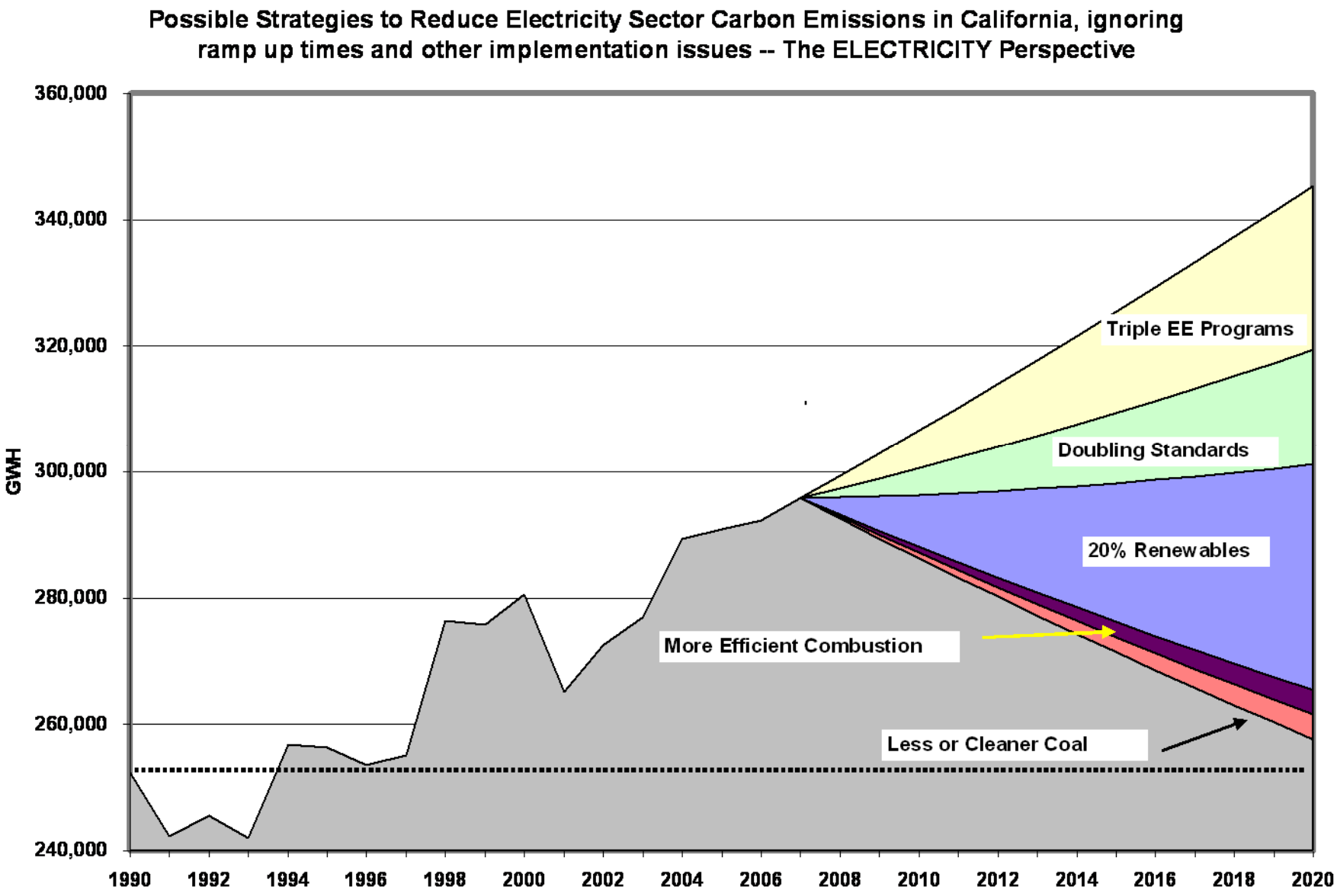
Proposed Standards and Energy Star Data



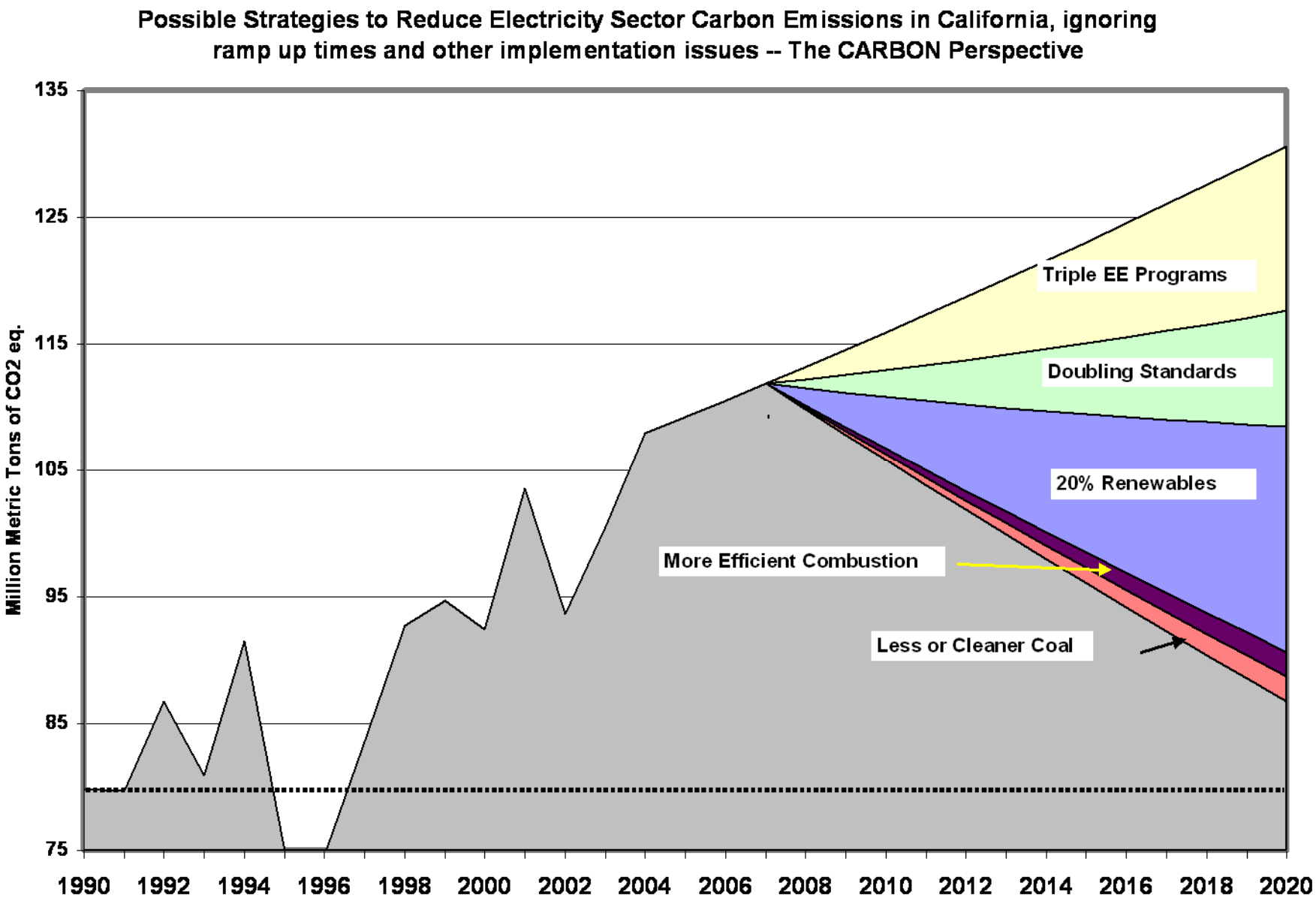
Incandescent Lamp Plot

California IOU's Investment in Energy Efficiency





Source: Pat McAuliffe



Source: Pat McAuliffe

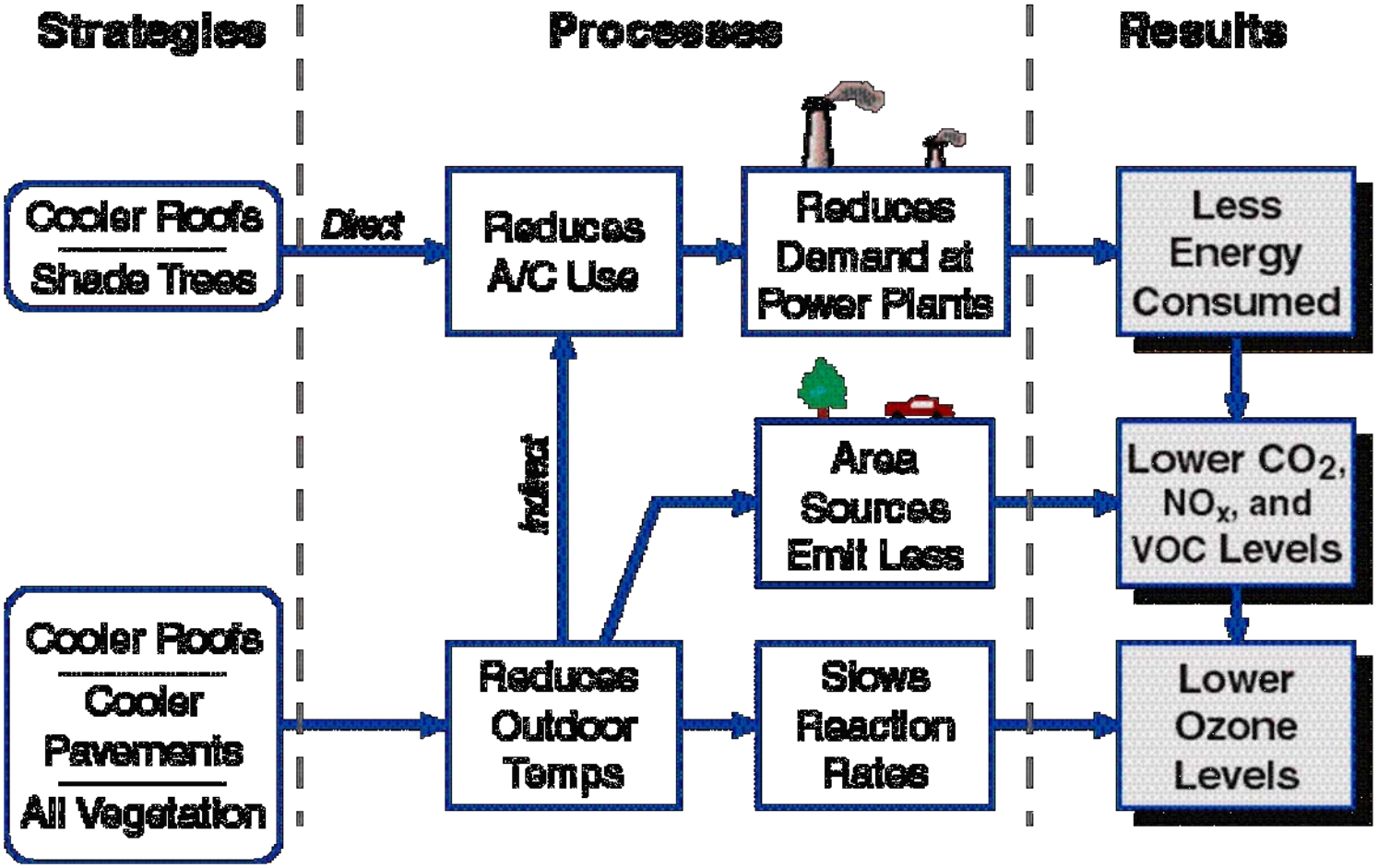
The End

For More Information:

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

or just Google “Art Rosenfeld”

Methodology: Energy and Air-Quality Analysis



Cool Roof Technologies

Old

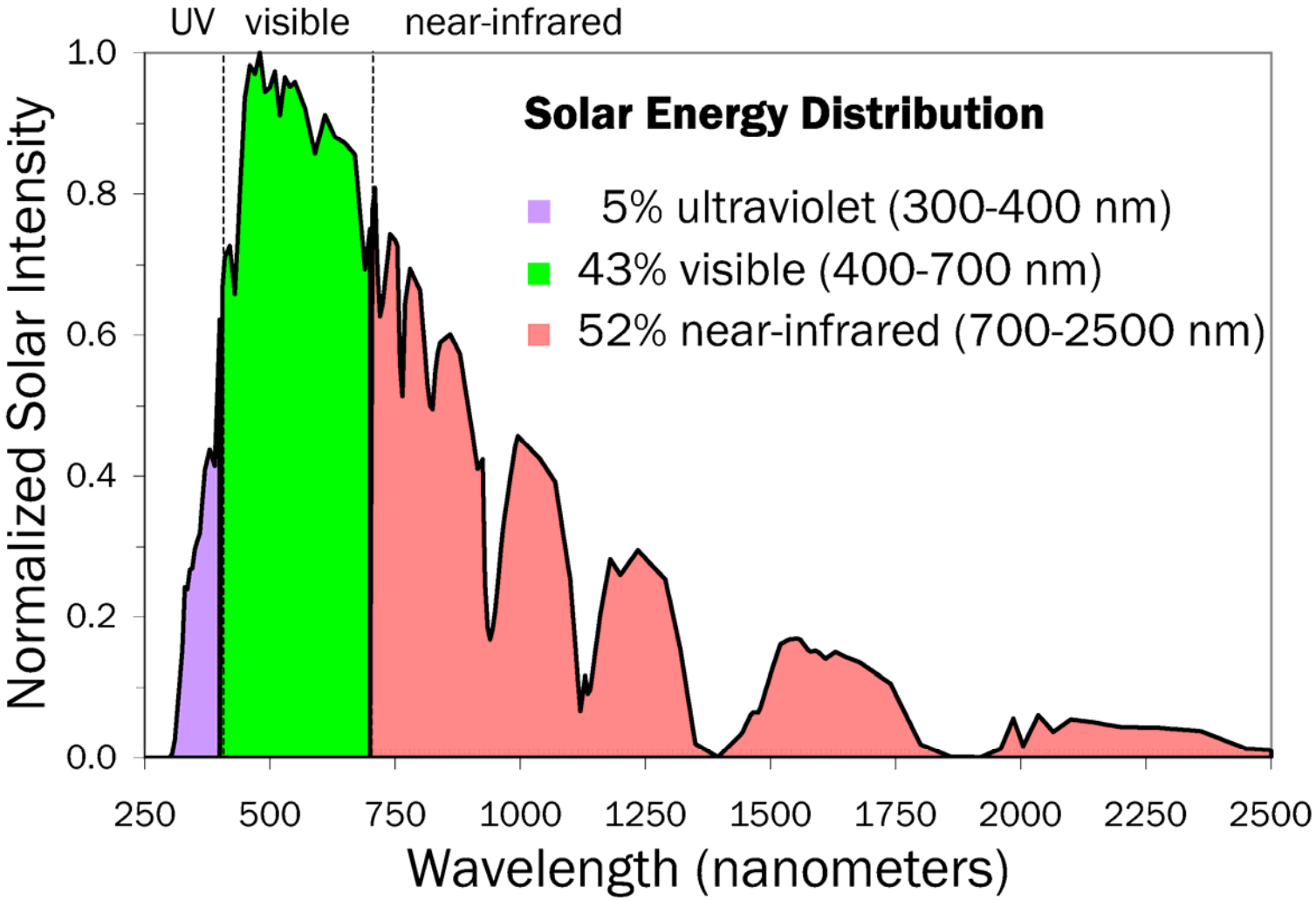
flat, white

pitched, white

New

pitched, cool & colored

Cool Colors Reflect Invisible Near-Infrared Sunlight

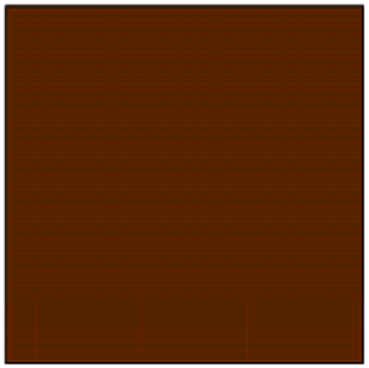


Cool and Standard Brown Metal Roofing Panels

- Solar reflectance ~ 0.2 higher
- Afternoon surface temperature ~ 10ºC lower

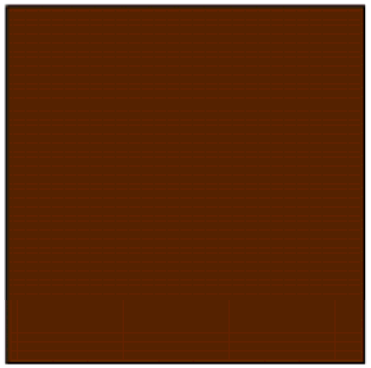
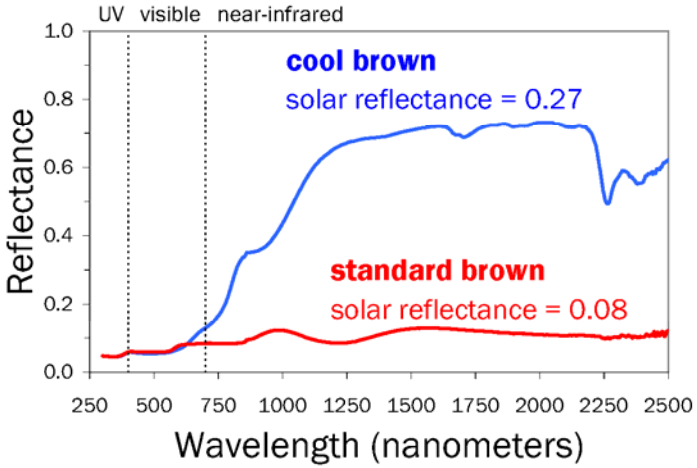
Courtesy BASF Coatings

cool



solar reflectance = 0.27
thermal emittance = 0.85
roof temp – air temp = 36ºC (65ºF)

standard



solar reflectance = 0.08
thermal emittance = 0.85
roof temp – air temp = 45ºC (81ºF)