

**Delaying Global Climate Change
Efficiency Lessons from California
&
Don't be distracted by the Hydrogen Car
Haagen-Smit Symposium
4-(6-8)-04**

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<http://www.energy.ca.gov/commission/commissioners/rosenfeld.html>



*Efficiency
Energy for the Future*

FILED⁴

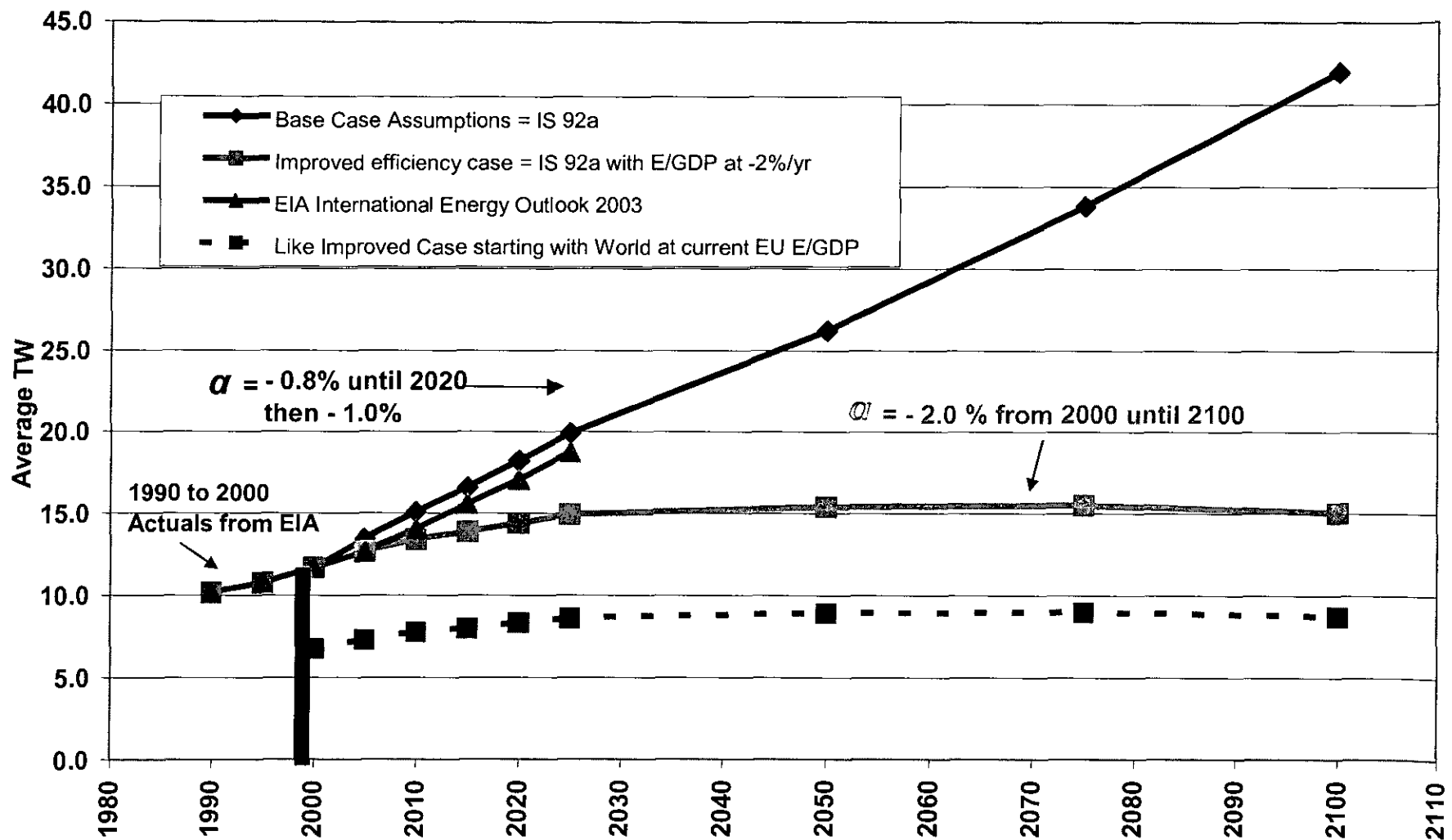
JUL 18 2005

**Missouri Public
Service Commission**

**Exhibit No. 34
Case No(s). E-6-2005-0328
Date 6-24-05 Rptr RF**

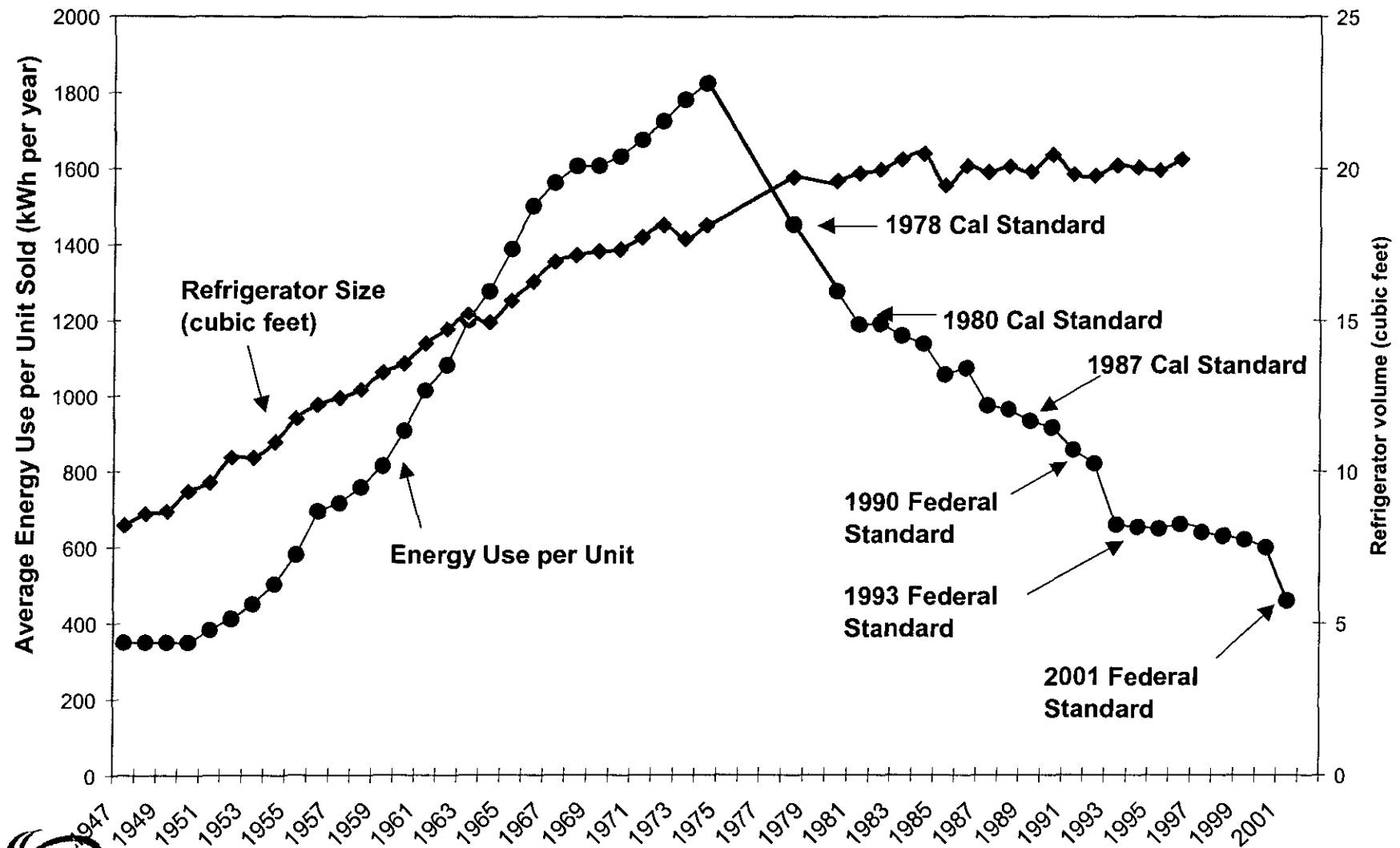
World Power Demand in IPCC Base Case, and Accelerated Efficiency

α = Annual change in E/GWP, E= Energy (1TW-year = 30 Quads), GWP=Gross World Product



United States Refrigerator Use v. Time

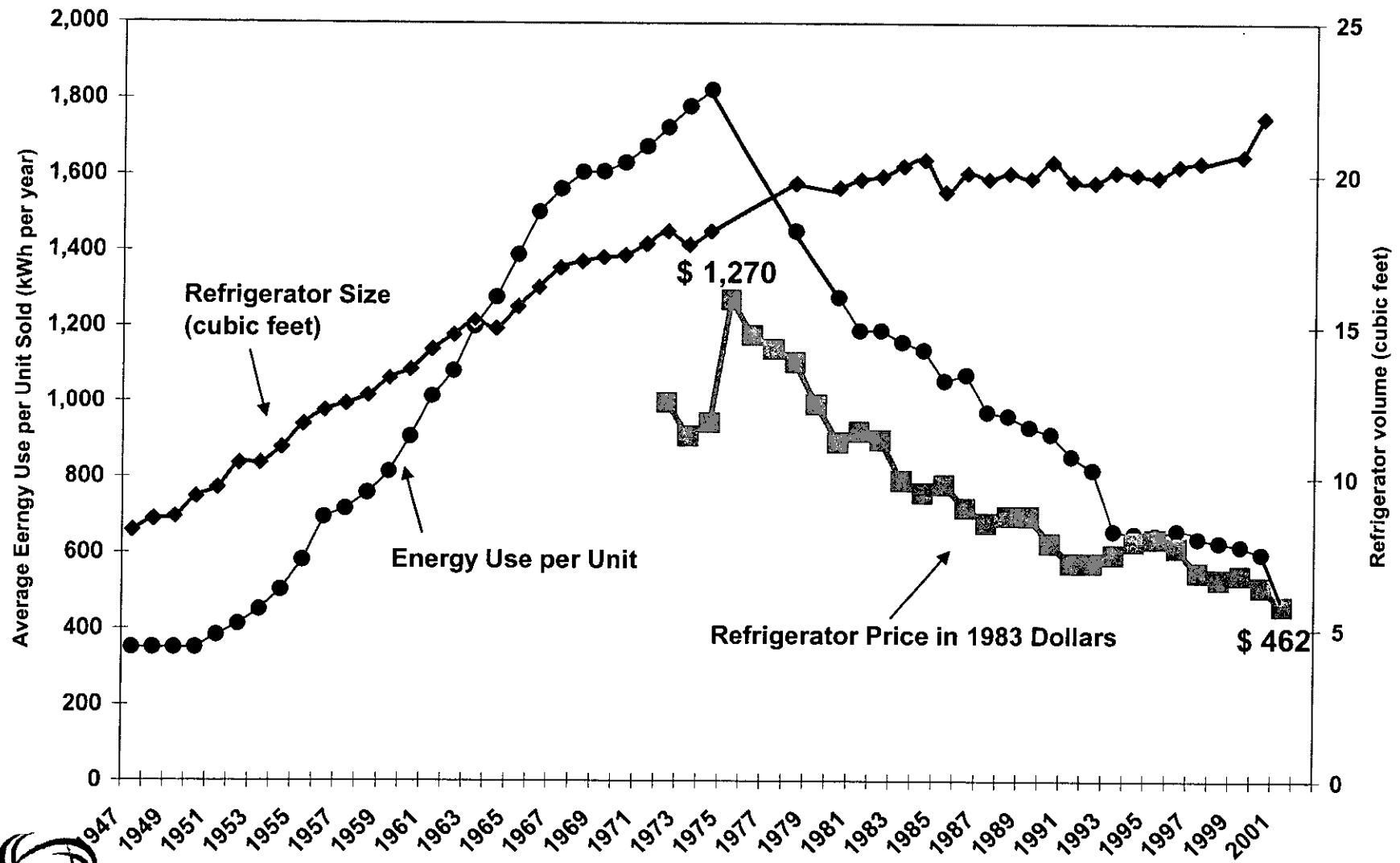
Annual drop from 1974 to 2001 = 5% per year



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United States Refrigerator Use v. Time



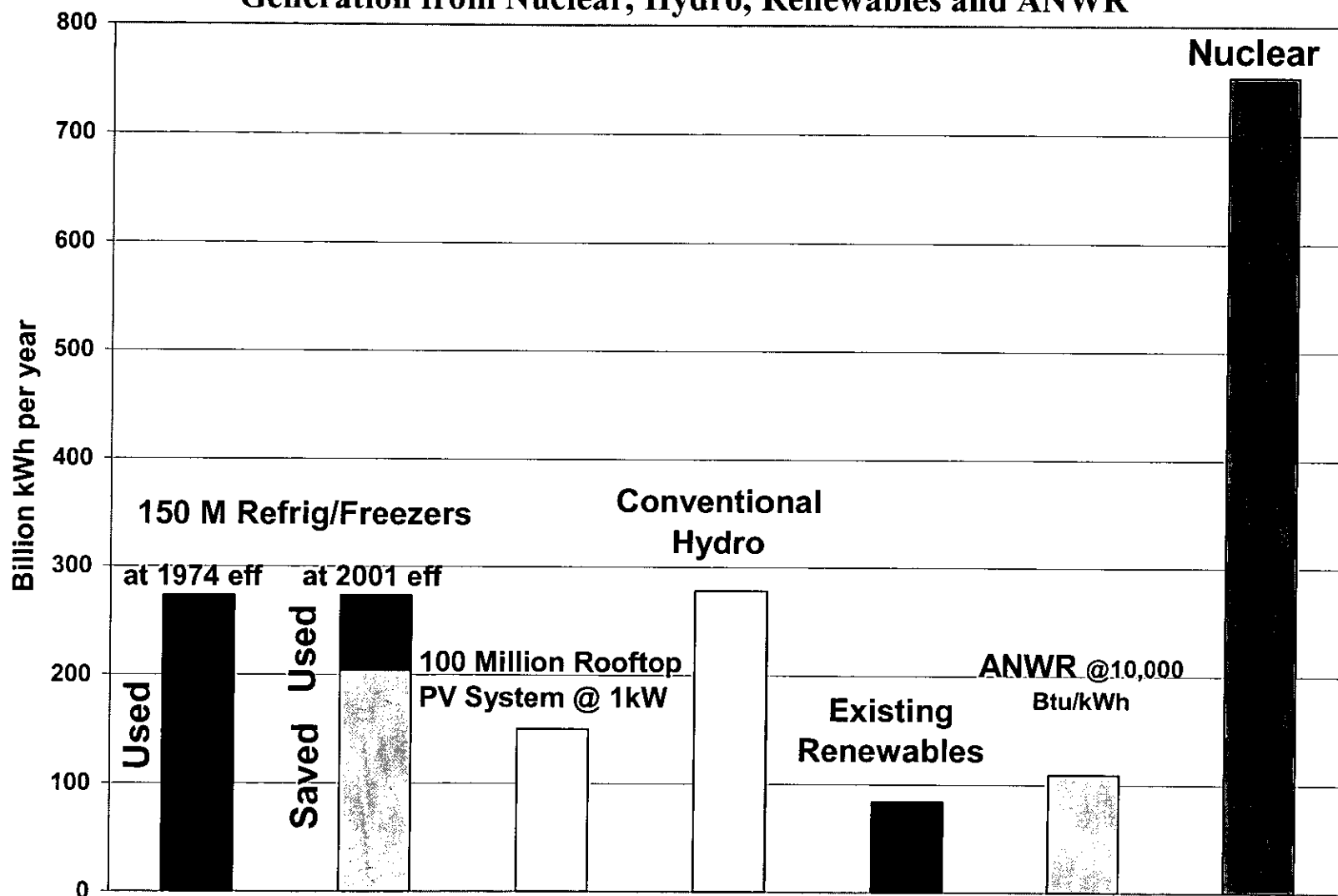
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Source: David Goldstein

Arthur Rosenfeld, page 4

Electricity Use of Refrigerators and Freezers in the US compared to Generation from Nuclear, Hydro, Renewables and ANWR

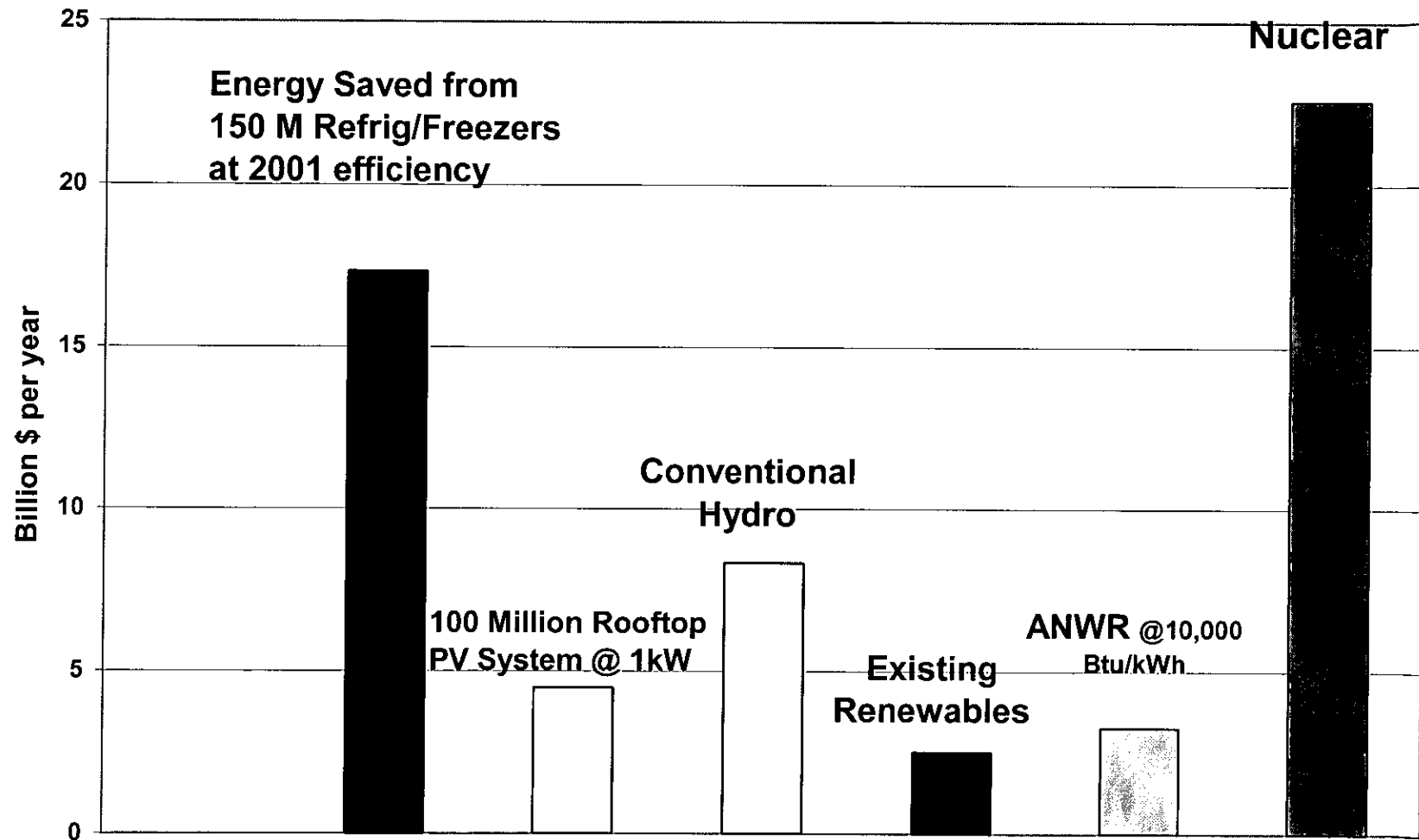


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The Value of Energy Saved and Produced

(production @ .03 and savings @ .085 \$/kWh)

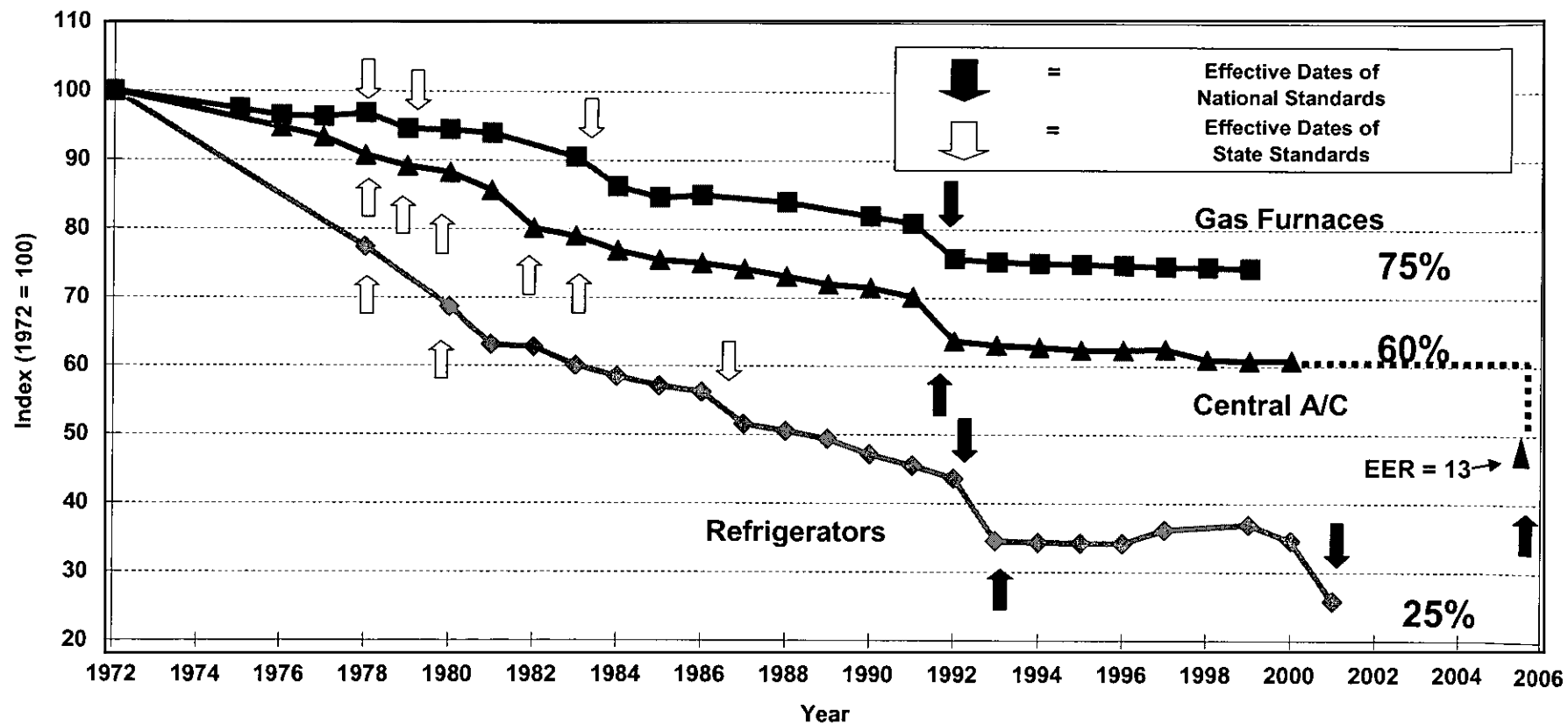


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Impact of Standards on Efficiency of 3 Appliances



Source: S. Nadel, ACEEE,
in ECEEE 2003 Summer Study, www.eceee.org

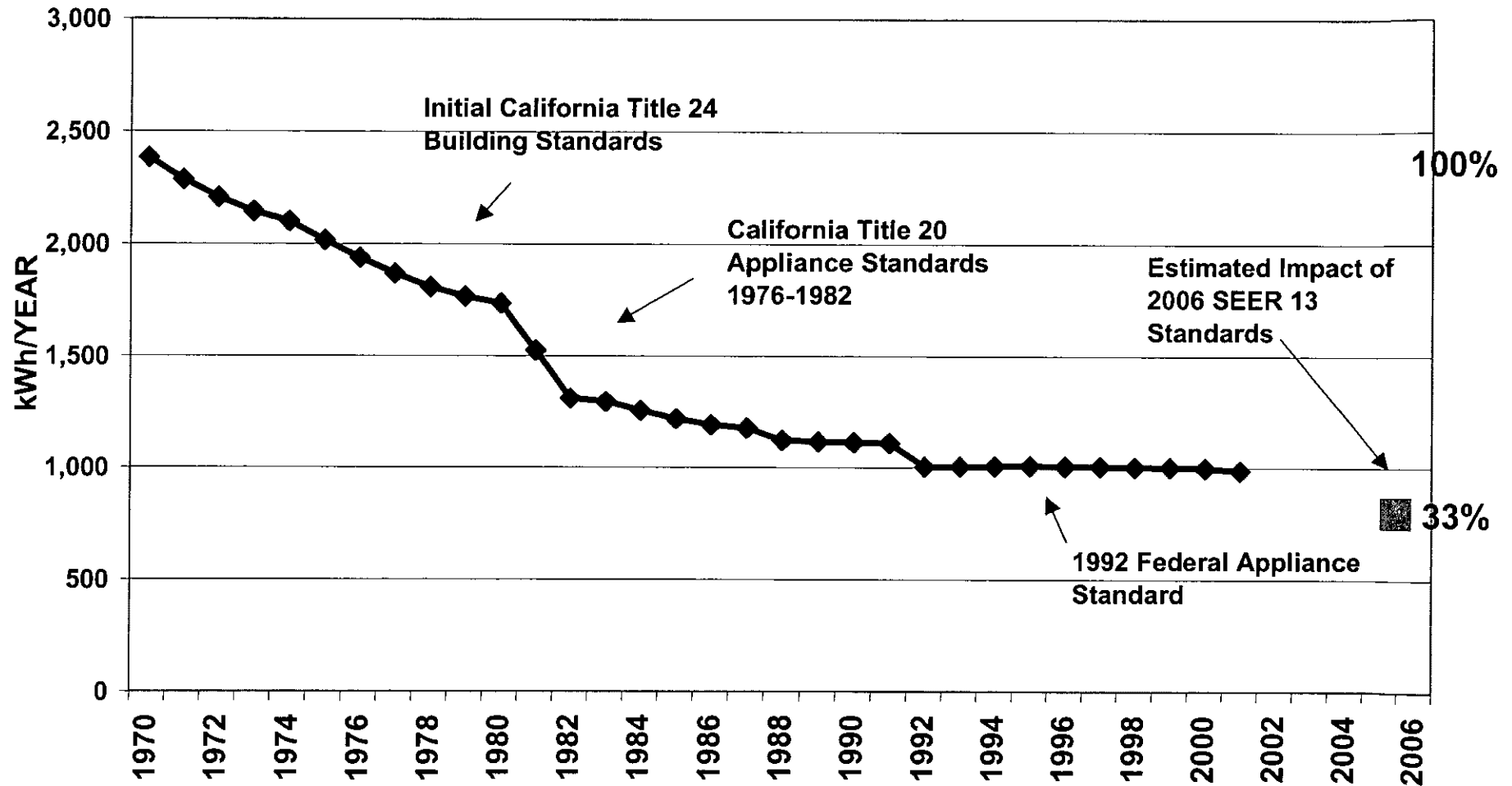


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Annual Usage of Air Conditioning in New Homes in California

Annual drop averages 4% per year



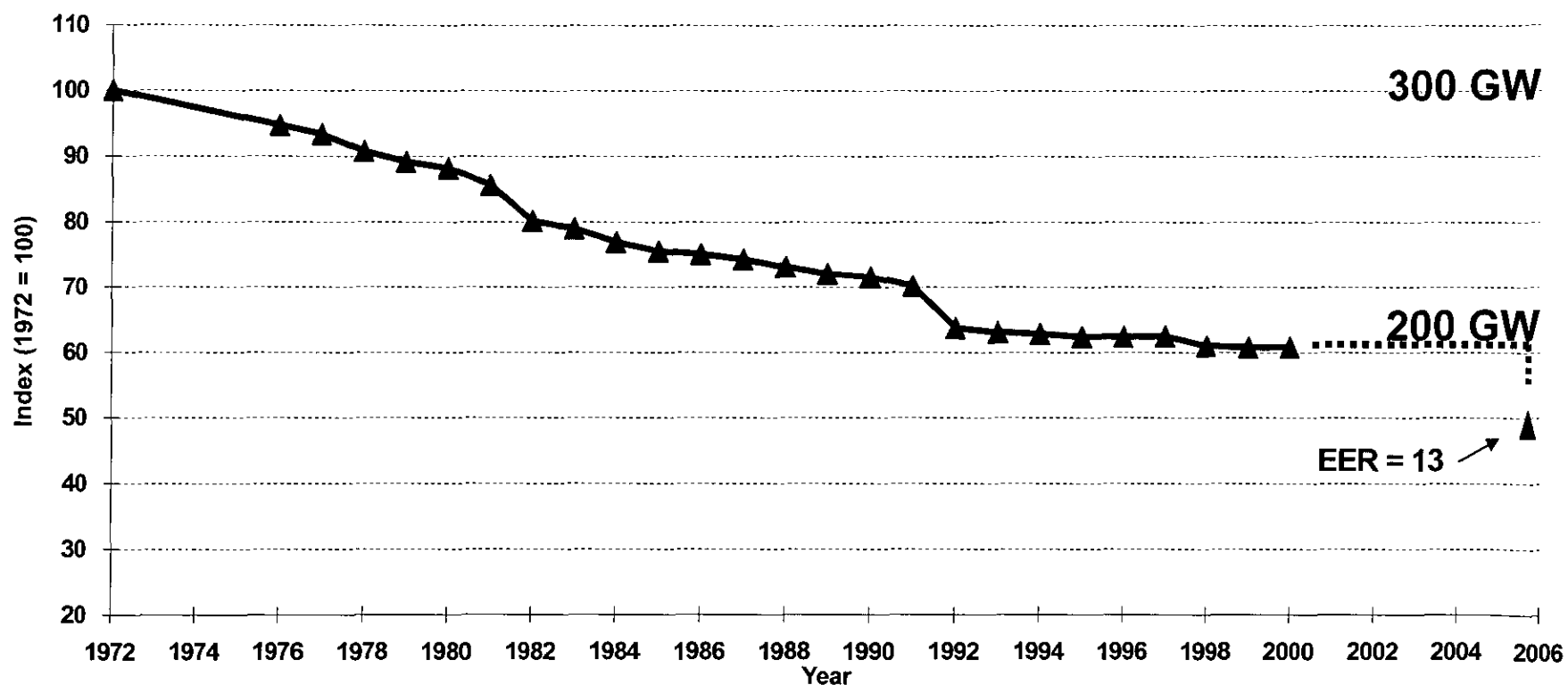
Source: CEC Demand Analysis Office



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Arthur Rosenfeld, page 8

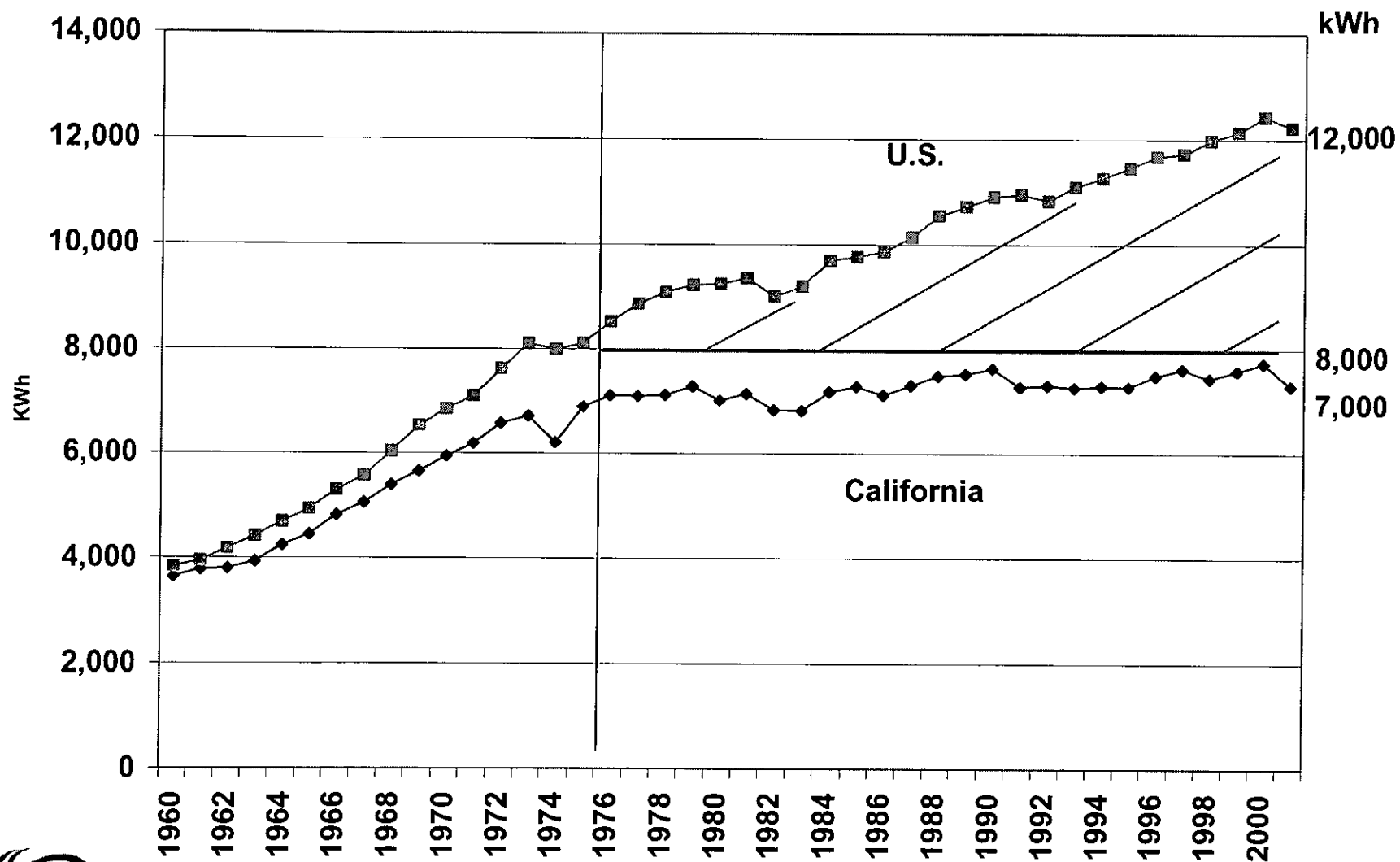
After Saturation (16 years) **Impact of Standards on Residential Central A/C** **and Roof Top A/C Units in the United States**



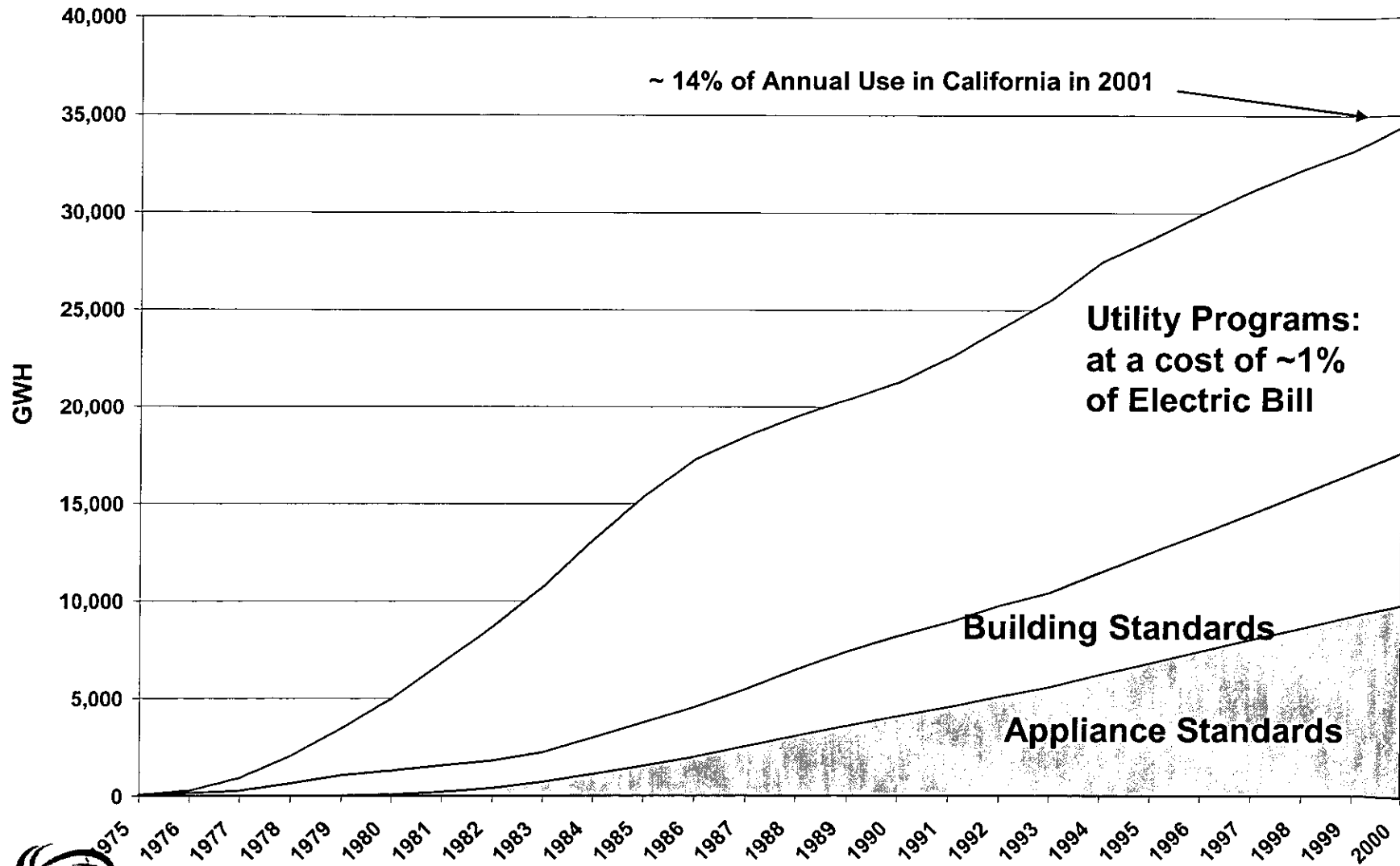
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Total Electricity Use, per capita, 1960 - 2001



GWH Impacts from Programs Begun Prior to 2001



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Public Interest Energy Strategies –CEC #100-03-12F

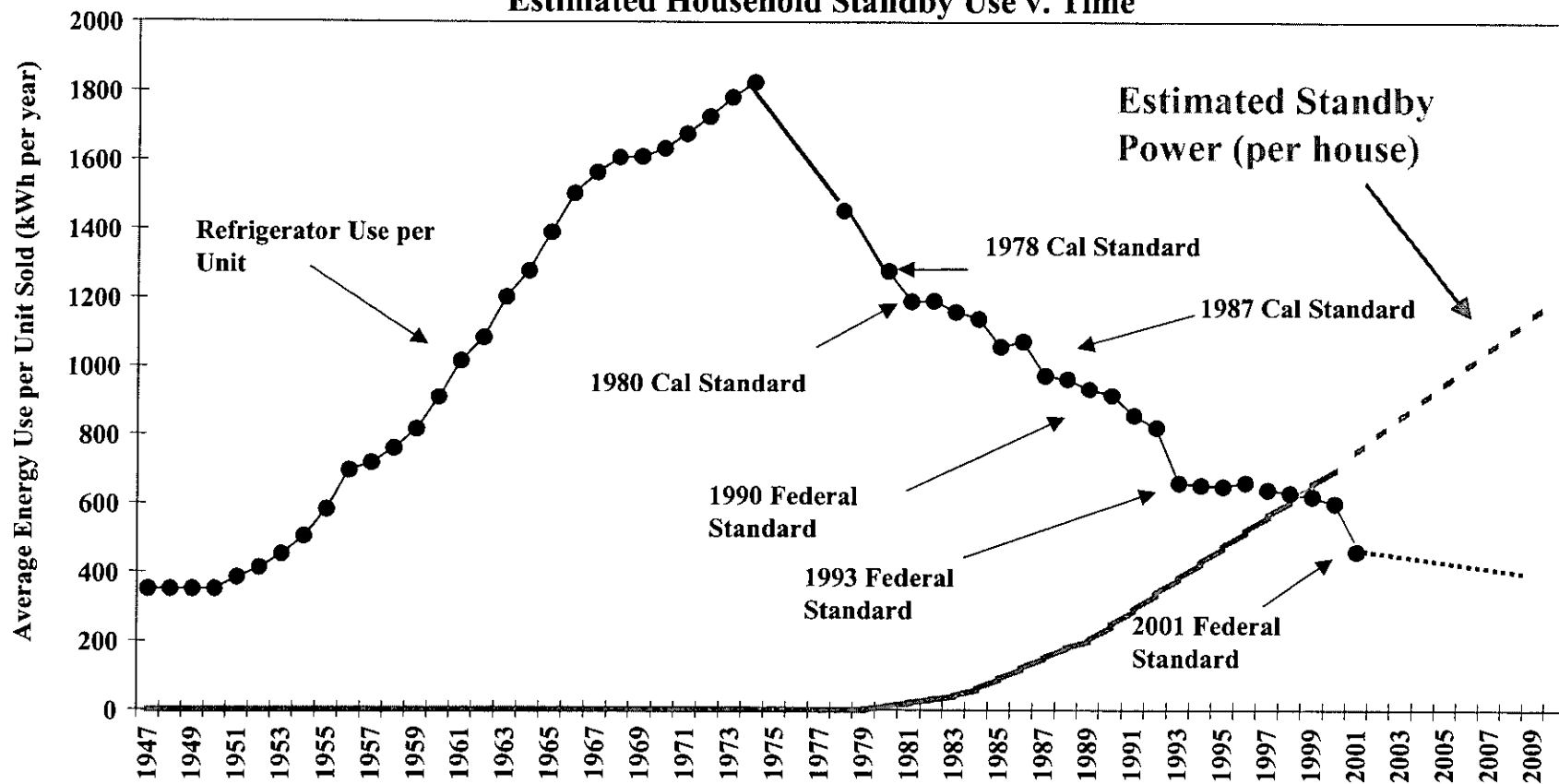
Arthur Rosenfeld, page 11

Costs and Pollution saved by avoiding a 50% expansion of Calif. Electric system.

- ◆ Avoiding half of Calif electricity avoids 18 M tons/year of Carbon, equivalent the getting 18 million cars off the road, along with their NO_x, CO, and particulate emissions.
- ◆ Calif annual electric bill in 2004 ~ \$32 B, so we've avoided ~\$16 B of bills, but net saving is only ~\$12B/year. Compare this with the \$15B Mar.2004 multi-year bond issue to cover the deficit.

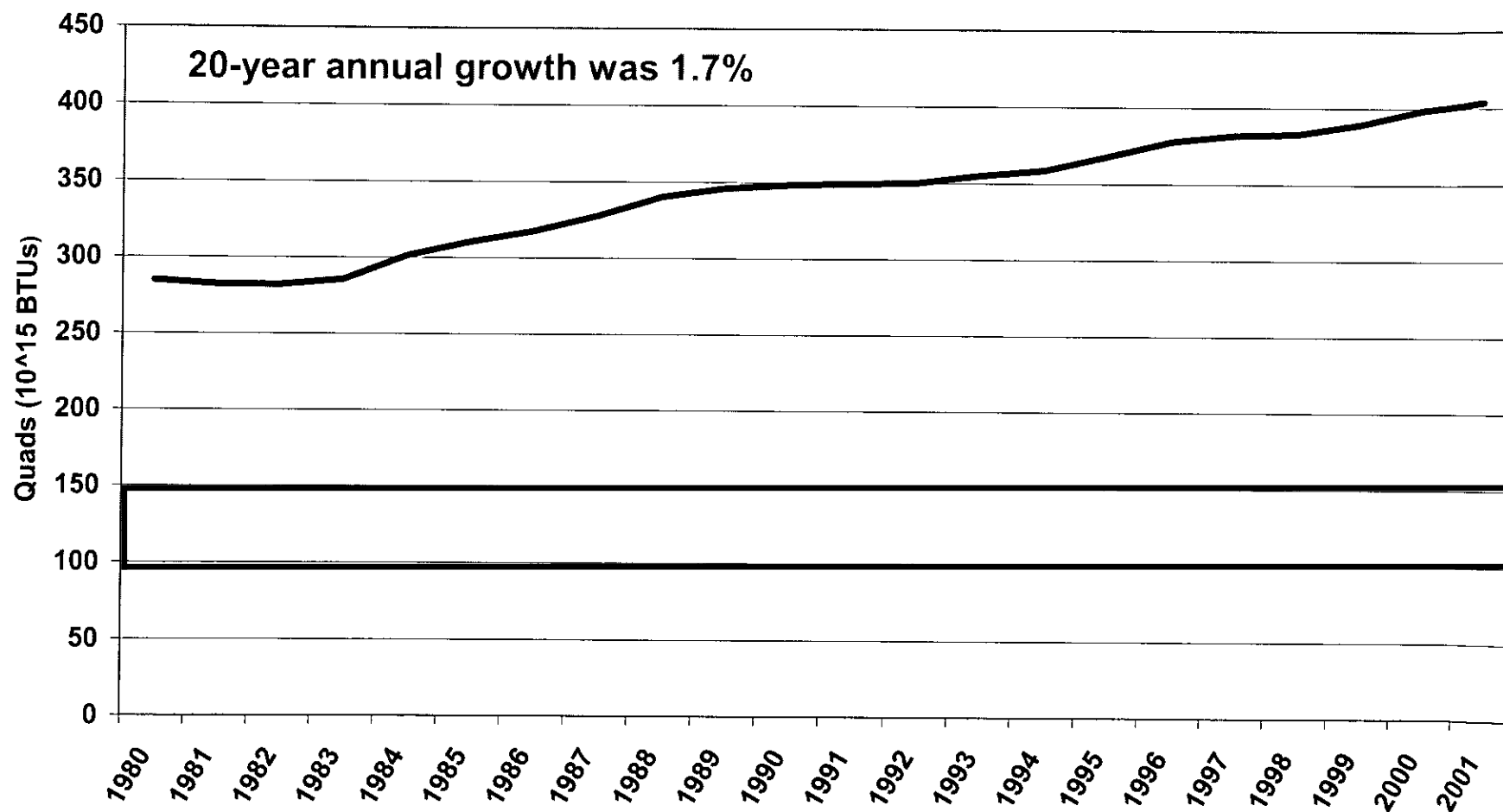


**United States Refrigerator Use (Actual) and
Estimated Household Standby Use v. Time**



World Primary Energy Consumption 1980 to 2001

Source: EIA



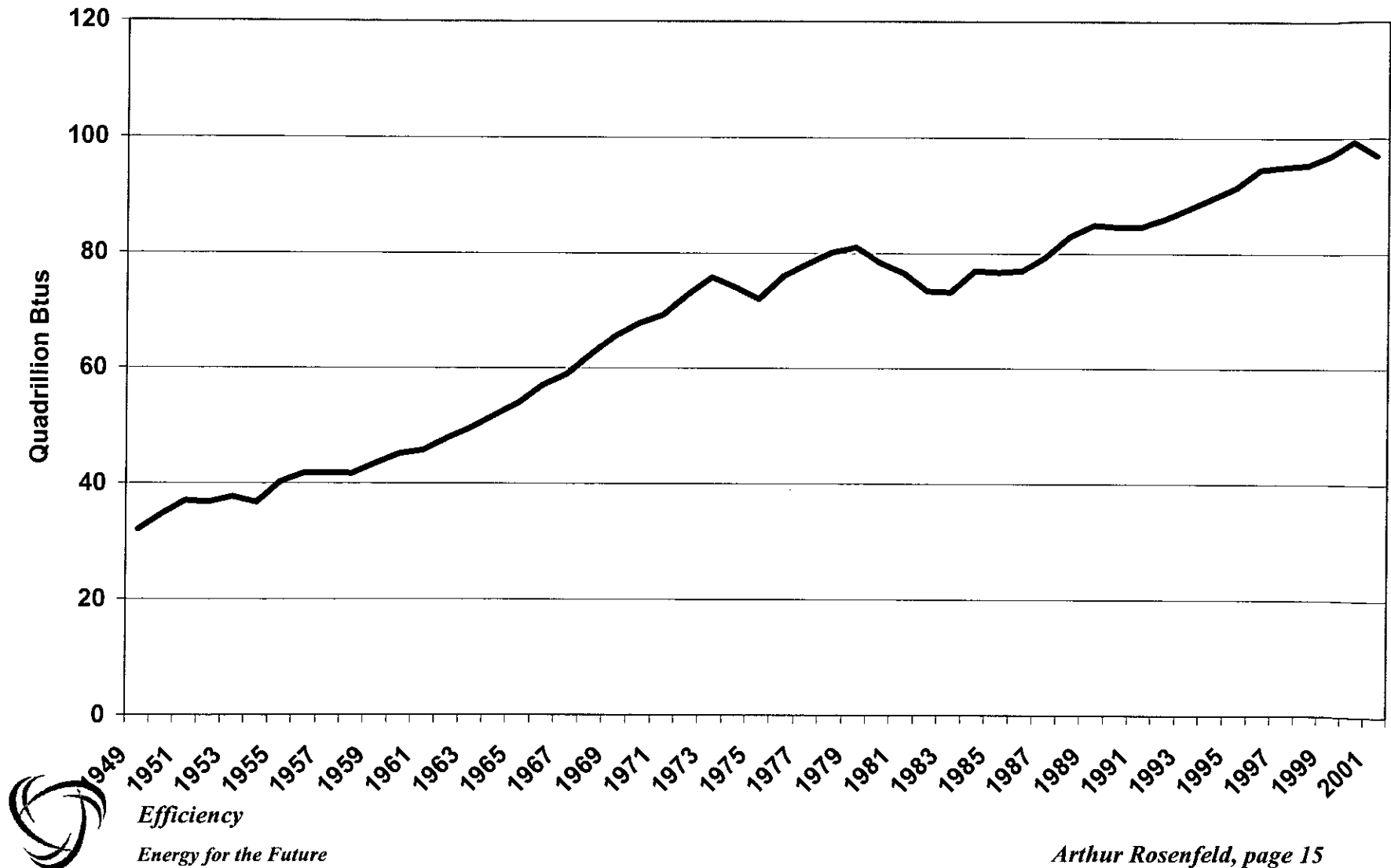
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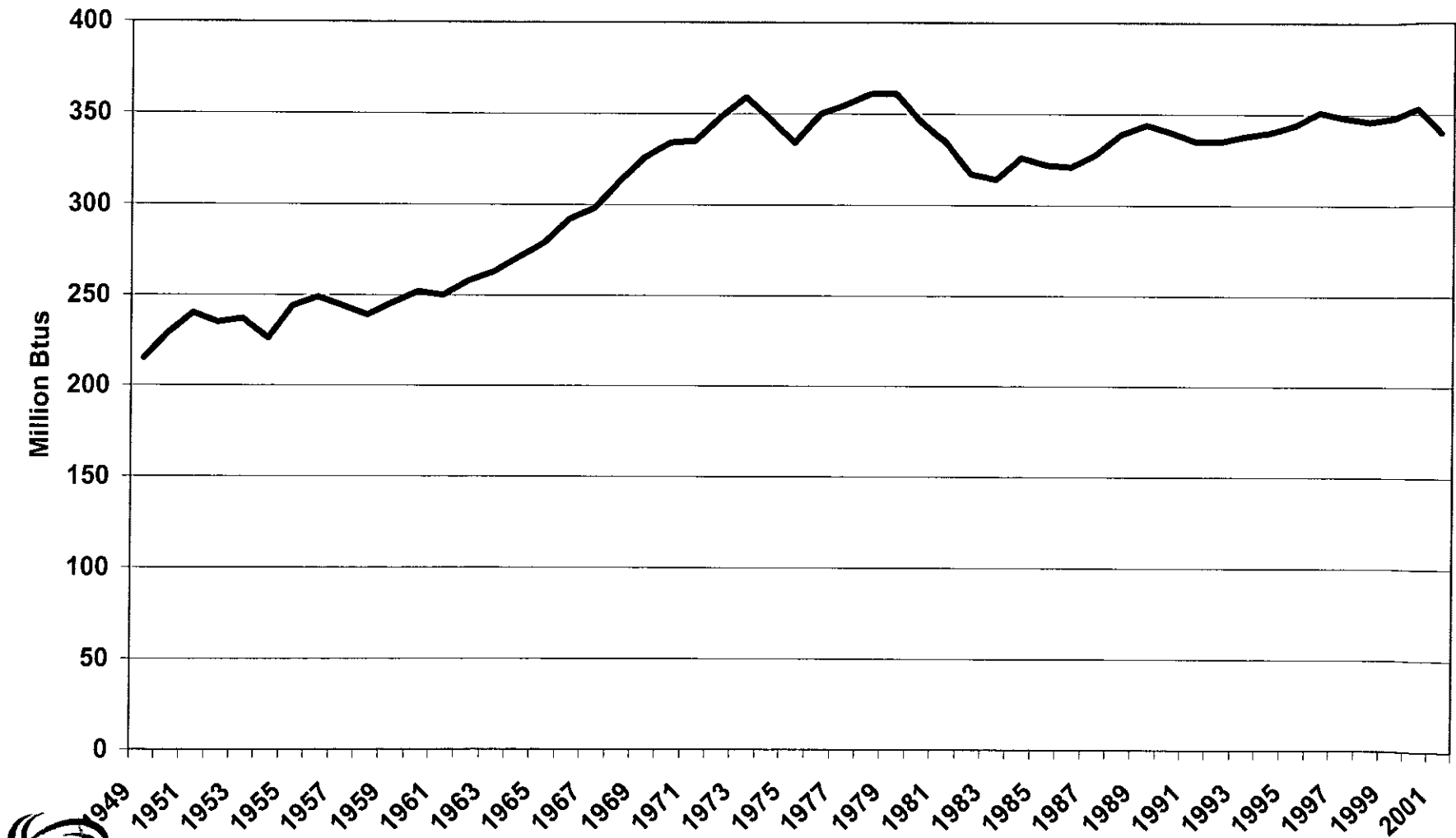
Arthur Rosenfeld, page 14

United States Energy Consumption 1949 to 2001

Source: Table 1.5 Annual Energy Review; data for 2001 is preliminary



United States
Energy Consumption Per Person 1949 to 2001
Source: Table 1.5 Annual Energy Review; data for 2001 is preliminary

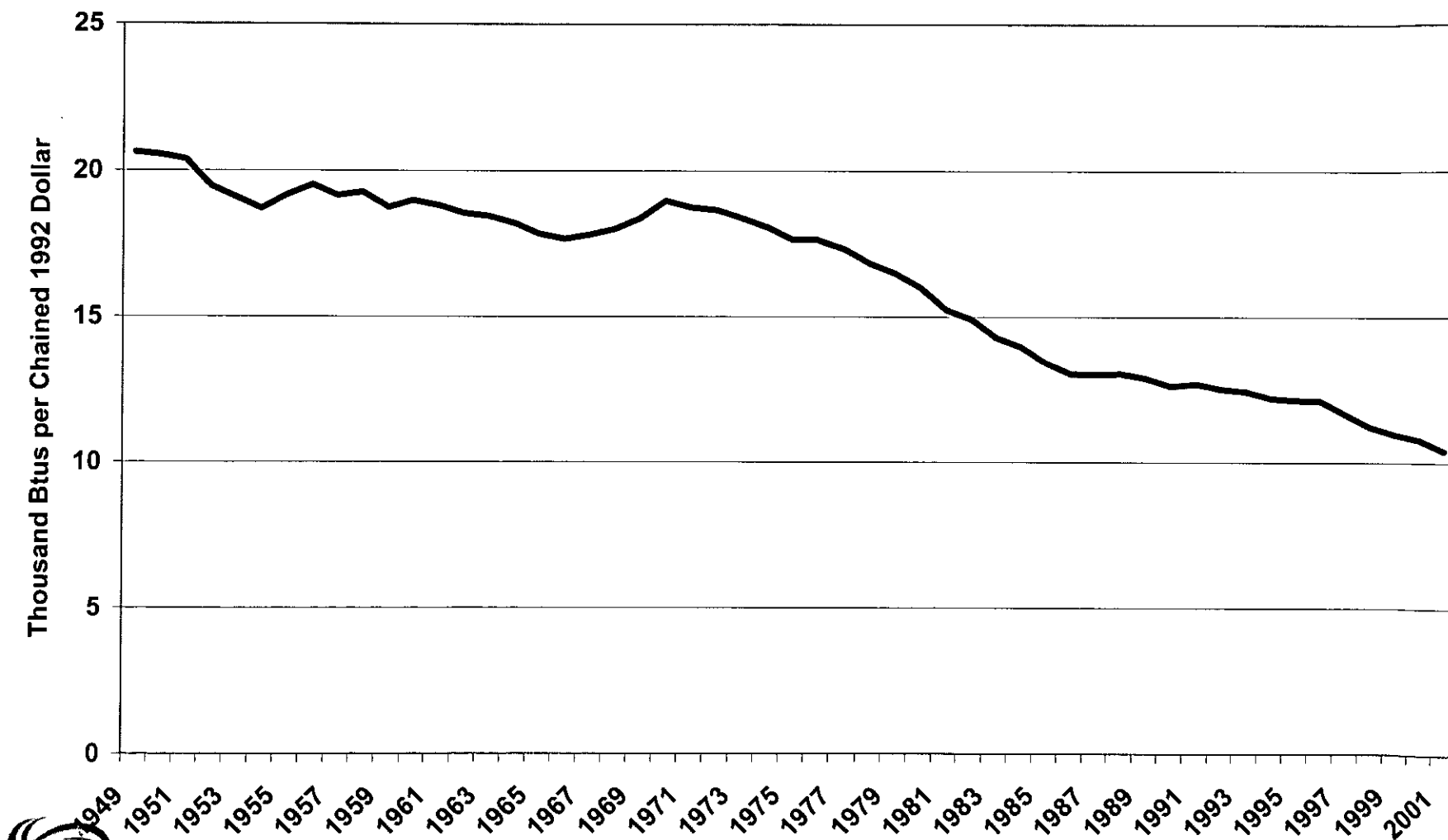


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United States

Energy Consumption Per \$ of Gross Domestic Product 1949-2001

Source: Table 1.5 Annual Energy Review; data for 2001 is preliminary



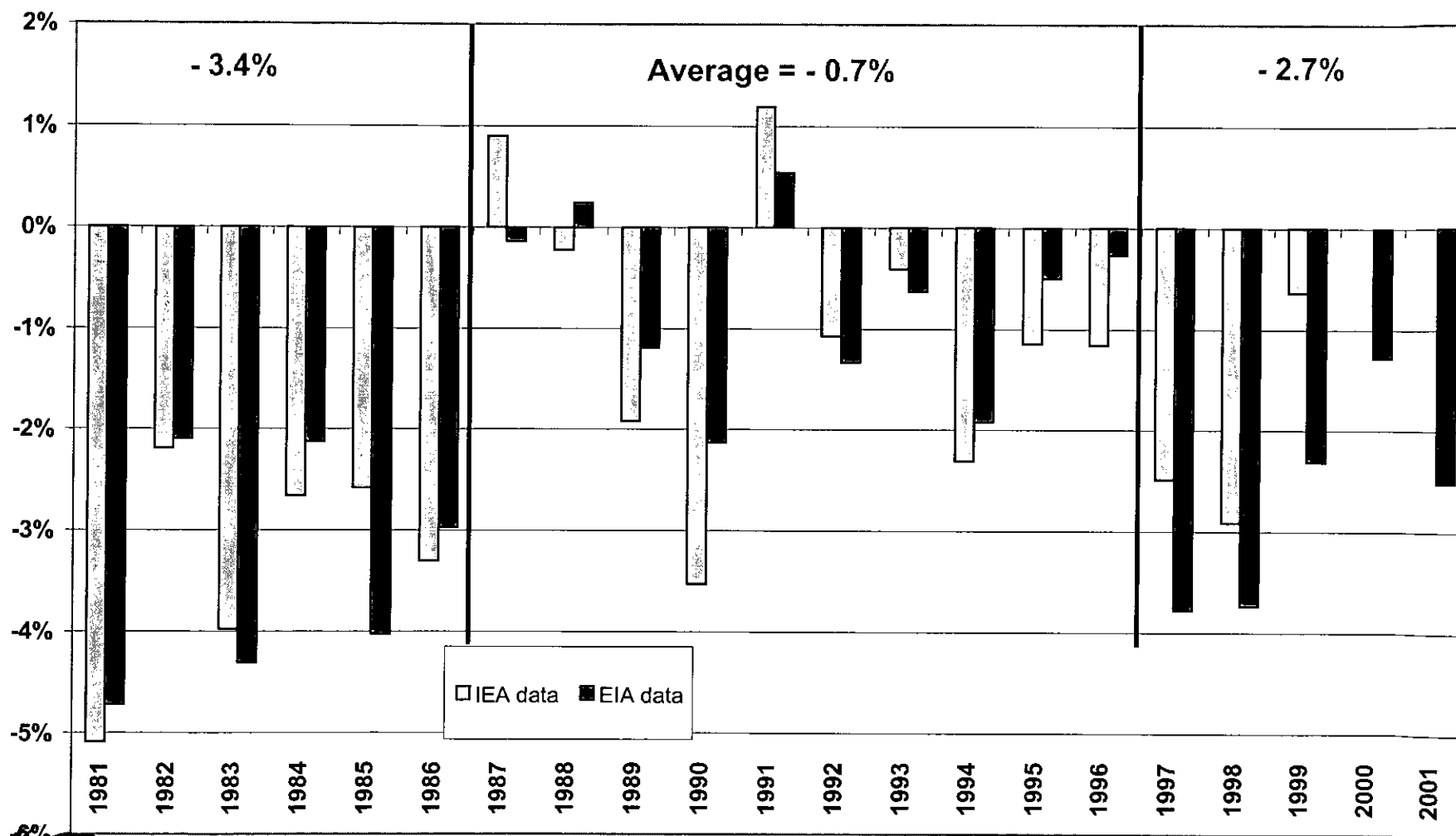
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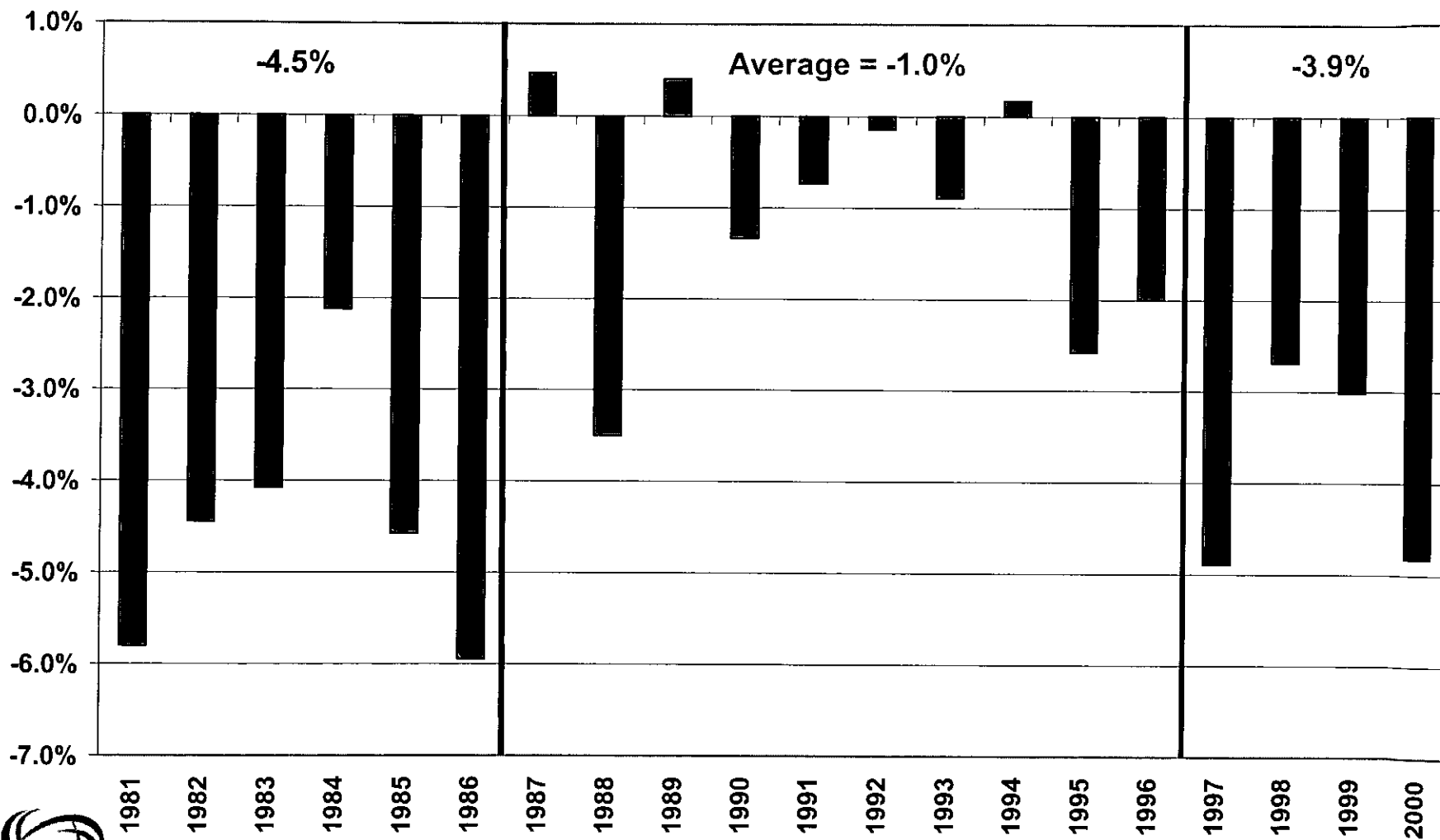
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Annual Rate of Change in Energy/GDP for the United States

International Energy Agency (IEA) and EIA (Energy Information Agency)

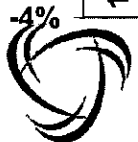
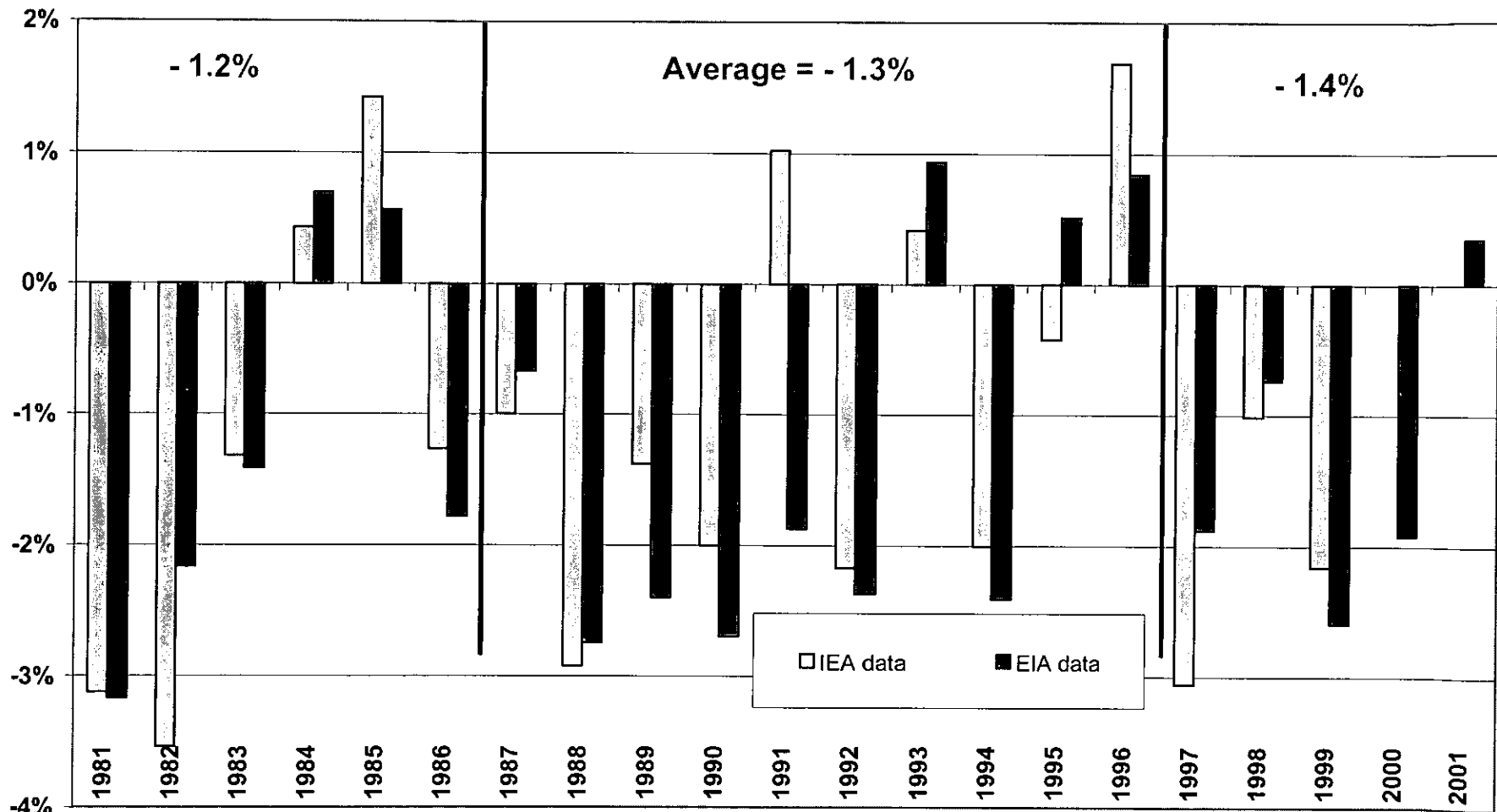


Annual Rate of Change in Energy/Gross State Product for California (Sources: EIA and California Department of Finance)

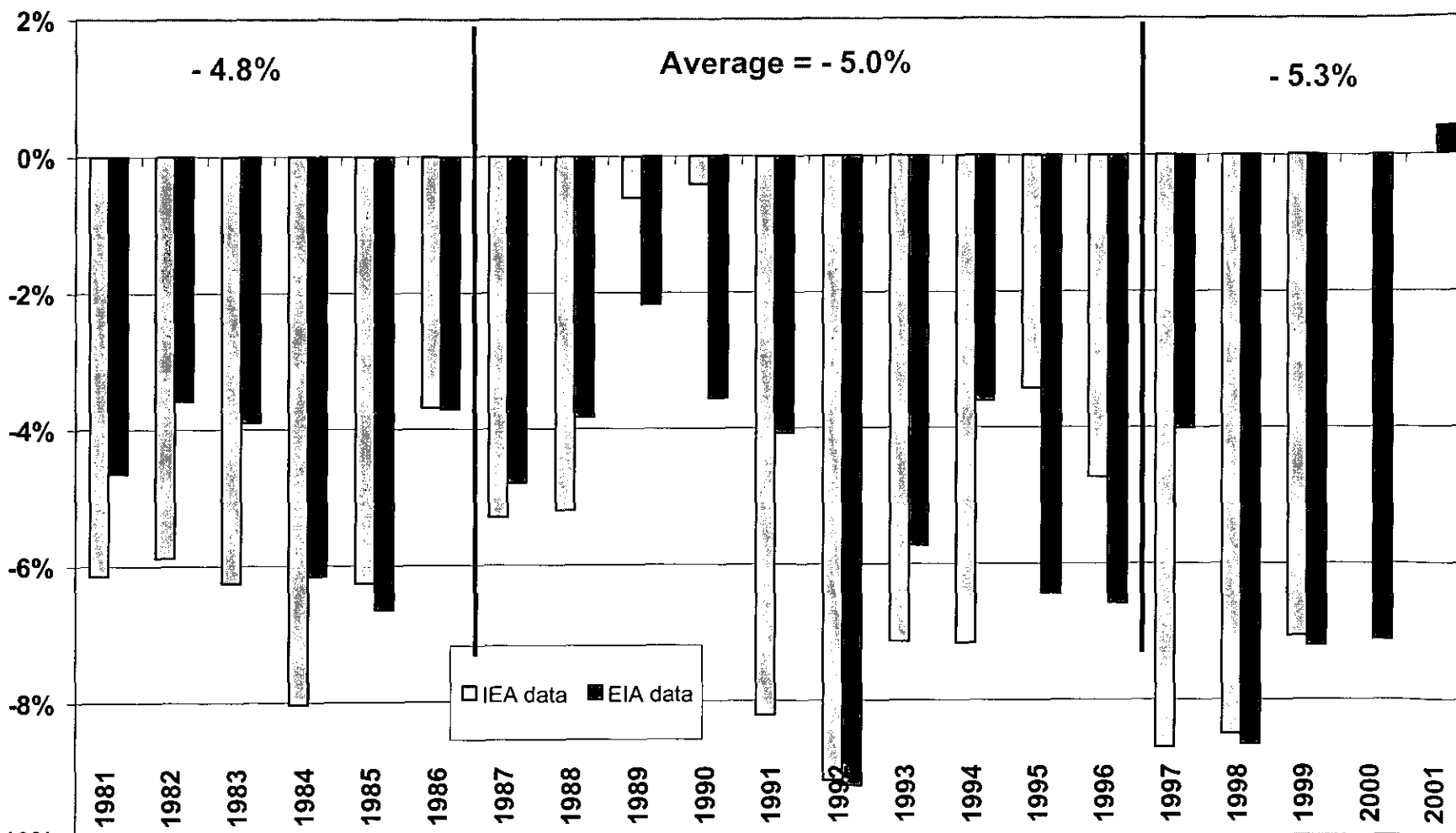


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Annual Rate of Change in Energy/GDP for Europe **IEA (Energy/Purchasing Power Parity) for European Union and** **Western Europe EIA (Energy/Market Exchange Rate)**

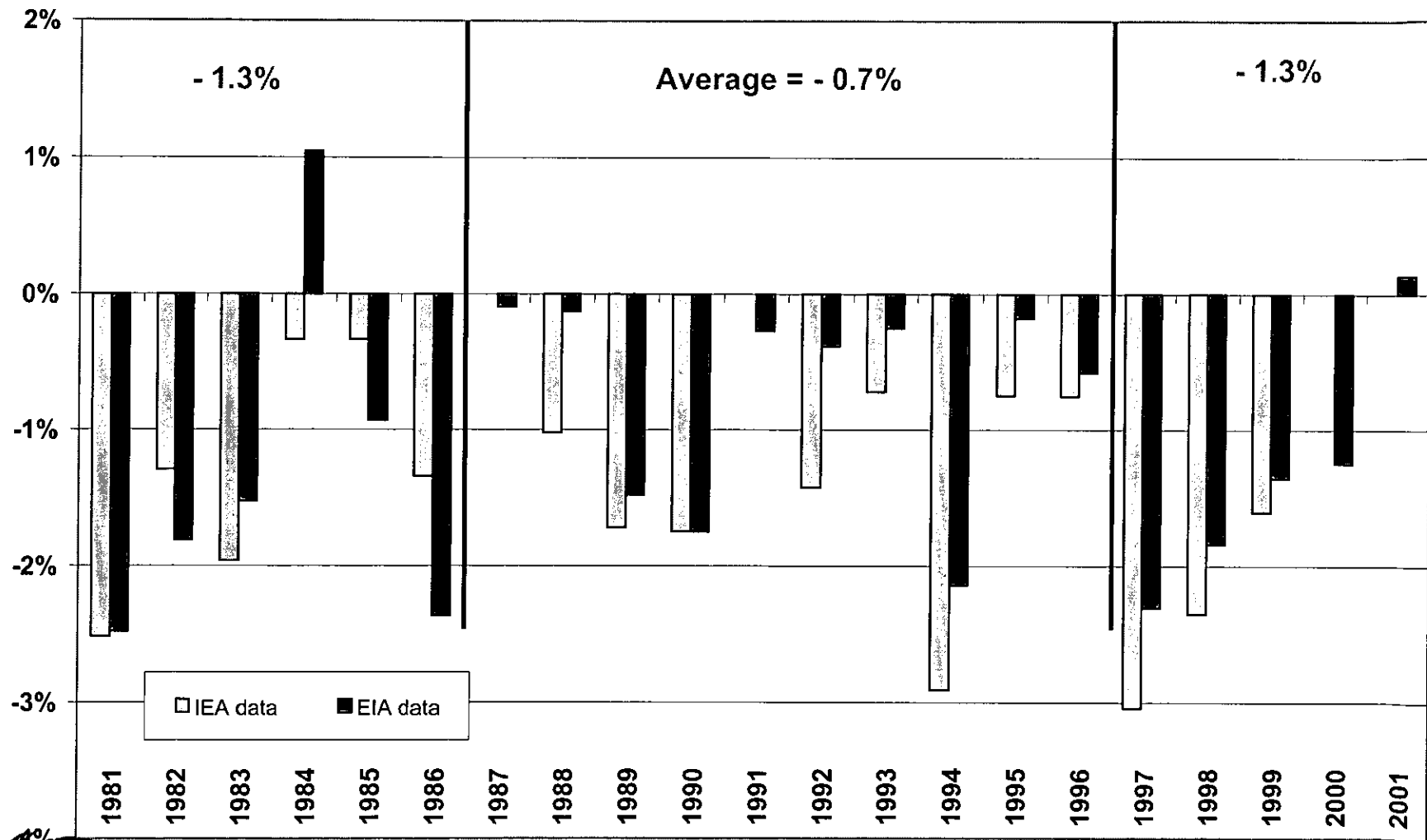


Annual Rate of Change in Energy/GDP for China **IEA (Energy/Purchasing Power Parity) and EIA (Energy/Market Exchange Rate)**

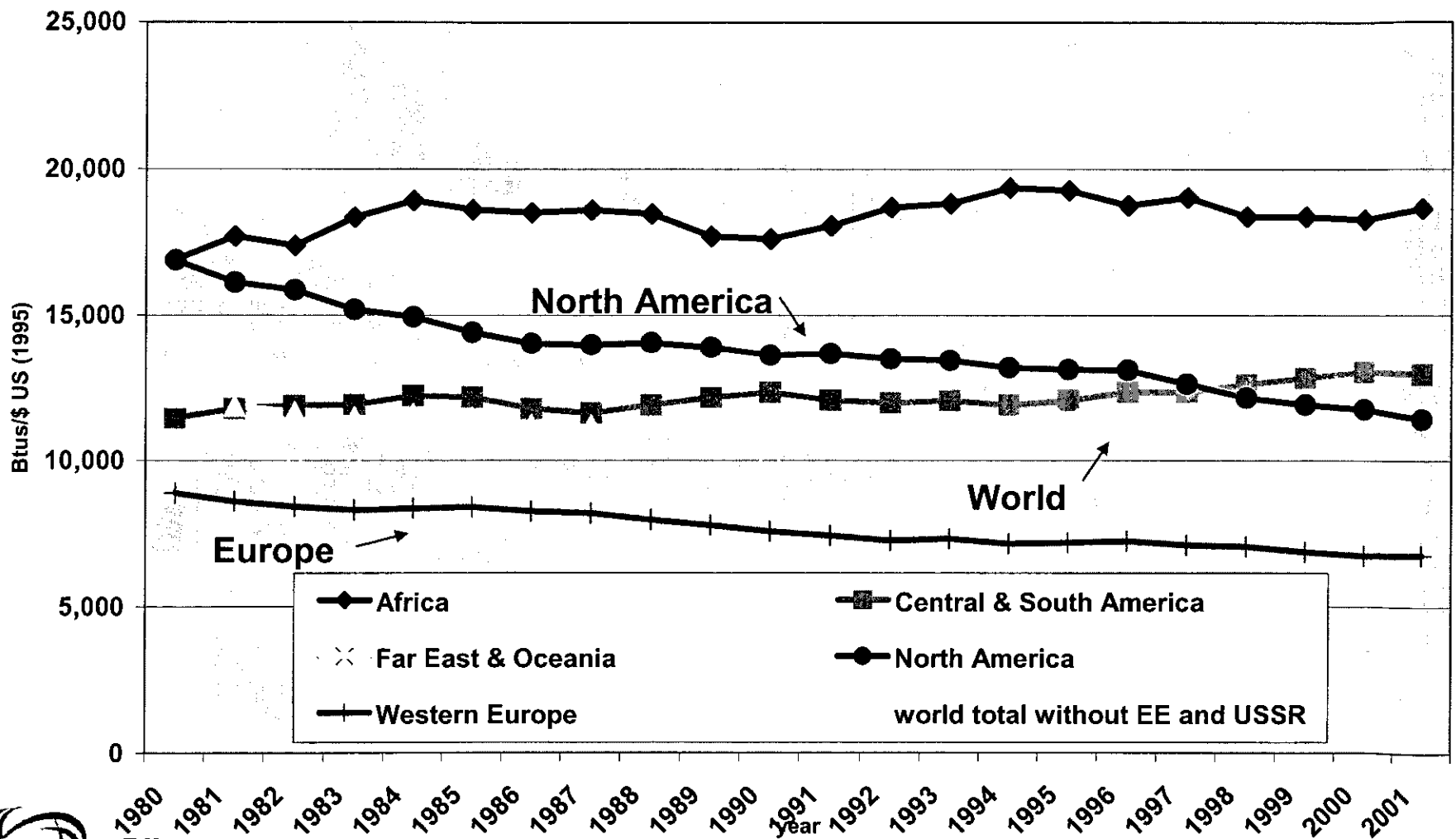


Annual Rate of Change in Energy/GDP for the World

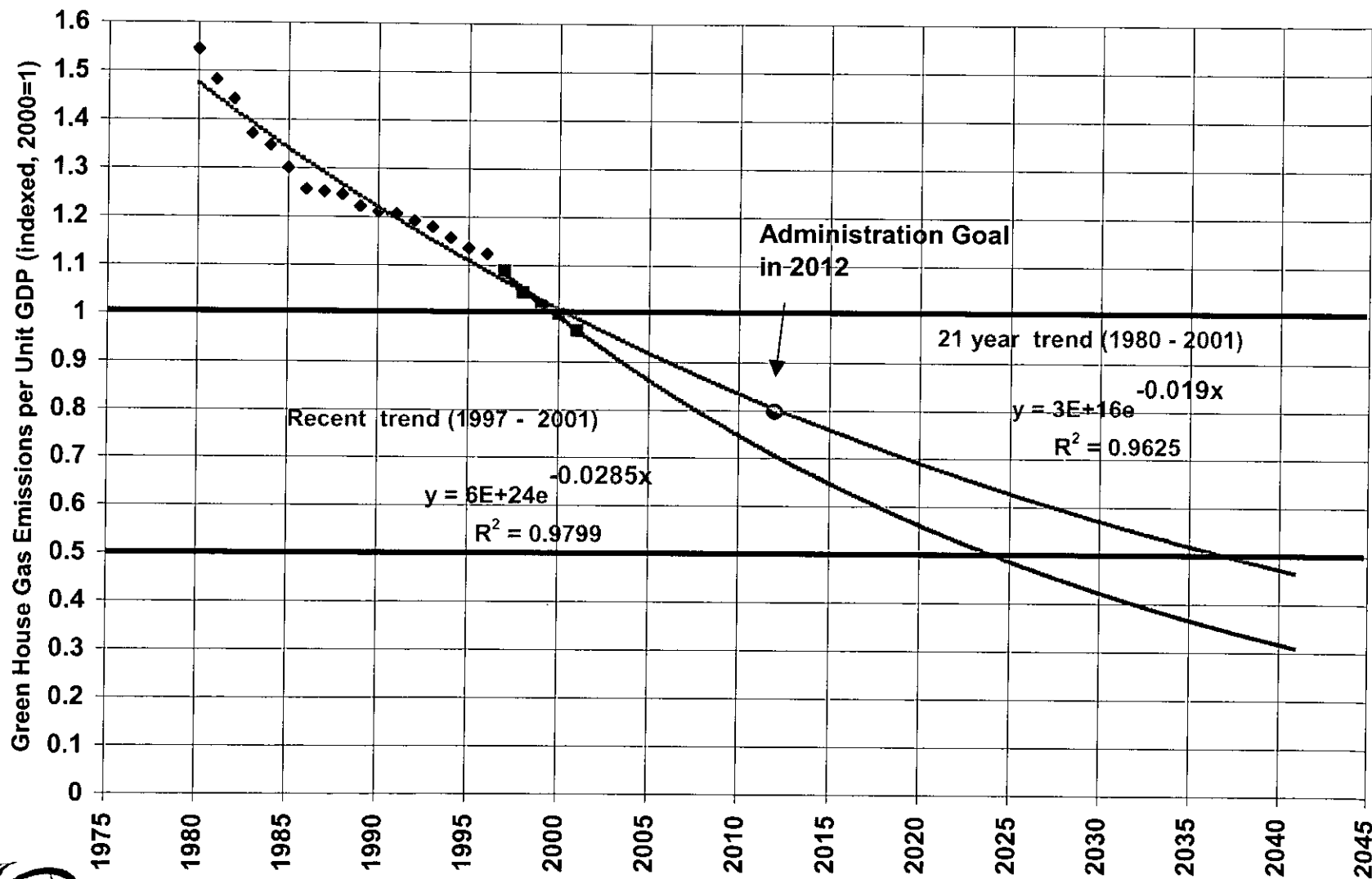
IEA (Energy/Purchasing Power Parity) and EIA (Energy/Market Exchange Rate)



Energy Intensity By Geographic Region 1980 to 2001
(Btus/\$US 1995) from EIA data



Green House Gas Intensity (GHG/GDP indexed, 2000=1)

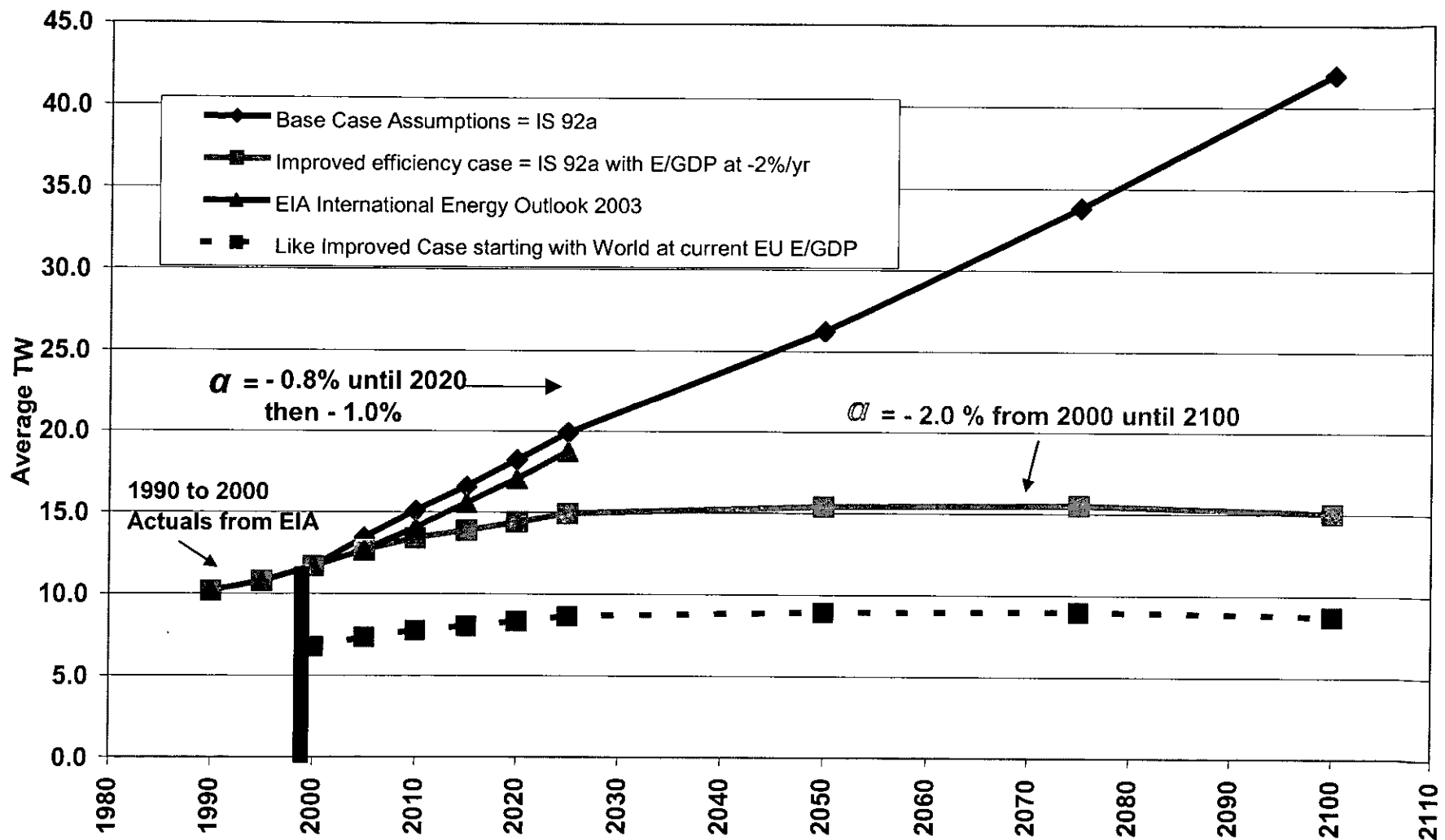


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World Power Demand in IPCC Base Case, and Accelerated Efficiency

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The Hype about Hydrogen

*Fact and Fiction in the
Race to Save the Climate*

JOSEPH ROMM

jromm@getf.org



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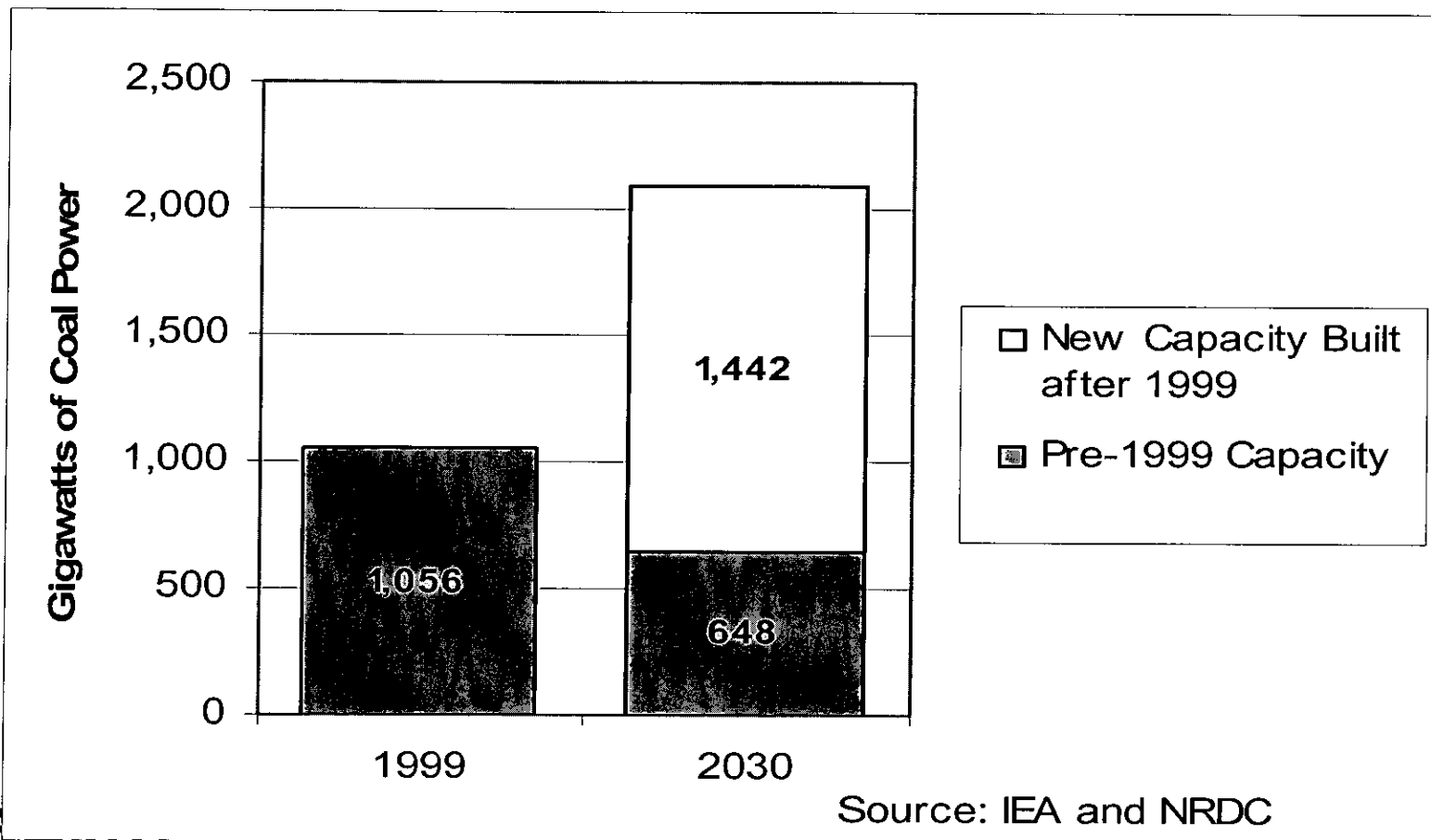
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The Hype About Hydrogen

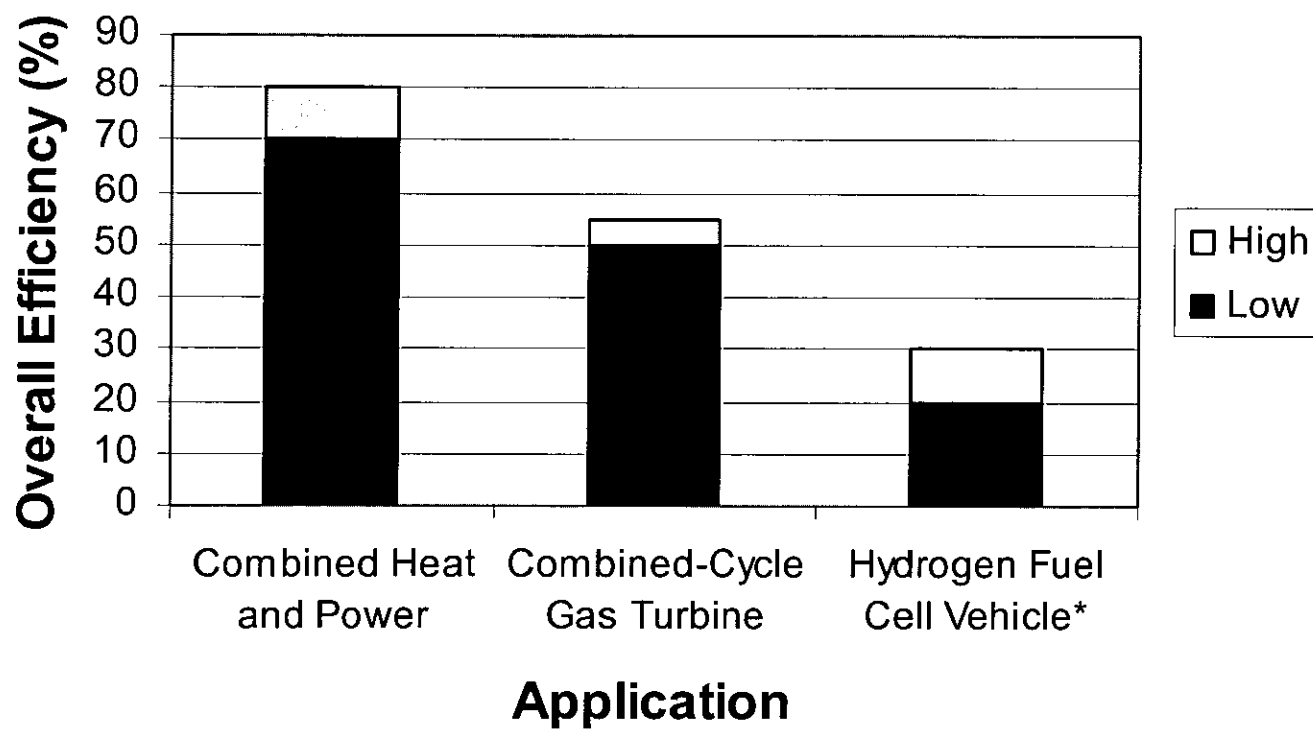
- ◆ Started as a primer
- ◆ Talked to 100 experts, looked at 100 studies
 - DOE Report: Research needs of H2 cars (9-03)
 - NRC Report on H2 cars (2-04)
 - APS Report on Hydrogen Initiative (3-04)
- ◆ Emerging consensus of independent analysts
 - Stationary fuel cells very promising (esp. high-temp)
 - For H2 cars as a climate solution, think post-2035



2/3 of 2030 Coal Plants not yet Built



Uses of Natural Gas



When can Hydrogen Cars Help Fight Global Warming?

- ◆ After “CO2 emissions from electricity generation are virtually eliminated....” (*Science*, 7/03)
- ◆ After “there is a surplus of renewable electricity.” (UK Study, 1/03)
- ◆ So, well past 2030, other strategies--such as efficiency & renewables--will likely be *much* more cost-effective reducing GHGs, probably by a factor of 10.



Prius is Tough to Beat

	Fuel Efficiency	Vehicle Efficiency	Overall Efficiency			
			0%	10%	20%	30%
Average 2004 Car	80%	18%	14%			
2004 Toyota Prius	80%	37%	30%			
Fuel Cell Vehicle*	20%-50%	50%	10%-25%			

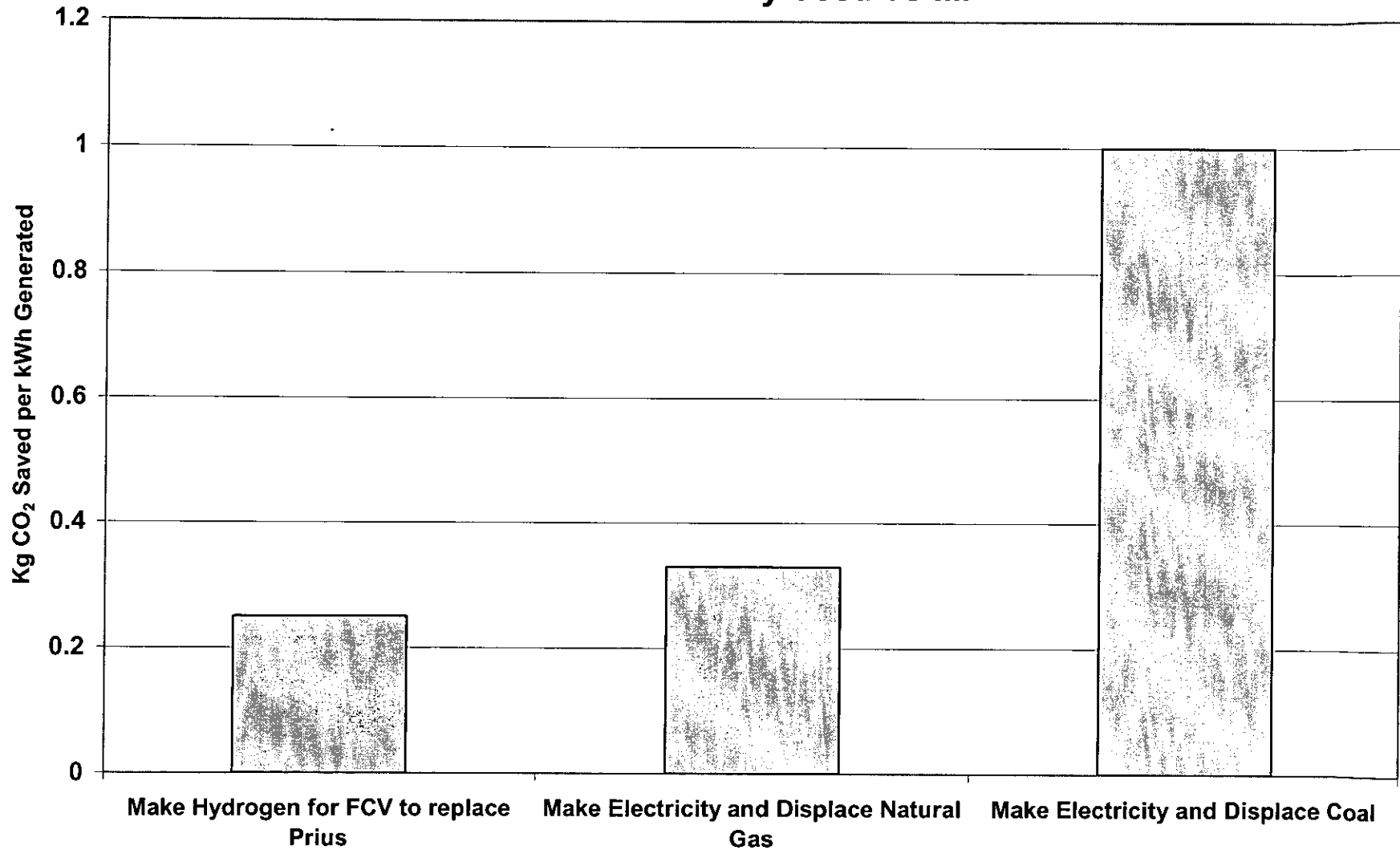


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Sources: Toyota, Argonne, CECS

Arthur Rosenfeld, page 31

Renewable Electricity Used To



Source : *The Hype About Hydrogen: Fact and Fiction in the Race to Save the Climate*, Joseph Romm, 2004

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Bottom Line I

- ◆ Continued R&D is important
 - Limited number of zero-CO₂ transport fuels
 - “Technical barriers can be overcome *ONLY* with high risk/high payoff basic research.” DOE 9-03
 - “It’s not a sure thing.” NRC panel member 2-04
- ◆ For serious \$\$\$ to H₂ cars and infrastructure, think post-2030.



Bottom Line II

- ◆ Don't base government policy or business investment on belief hydrogen cars will have commercial success in next two decades.
- ◆ First things first: Efficiency & renewables NOW
 - If we can achieve a clean energy revolution, that could enable hydrogen cars and NOT vice versa.

