

*From the Lab to the Marketplace:
The Role of California's Energy Policies*

*California Lighting and Technology Center
2nd Annual Forum
May 9-10, 2005*

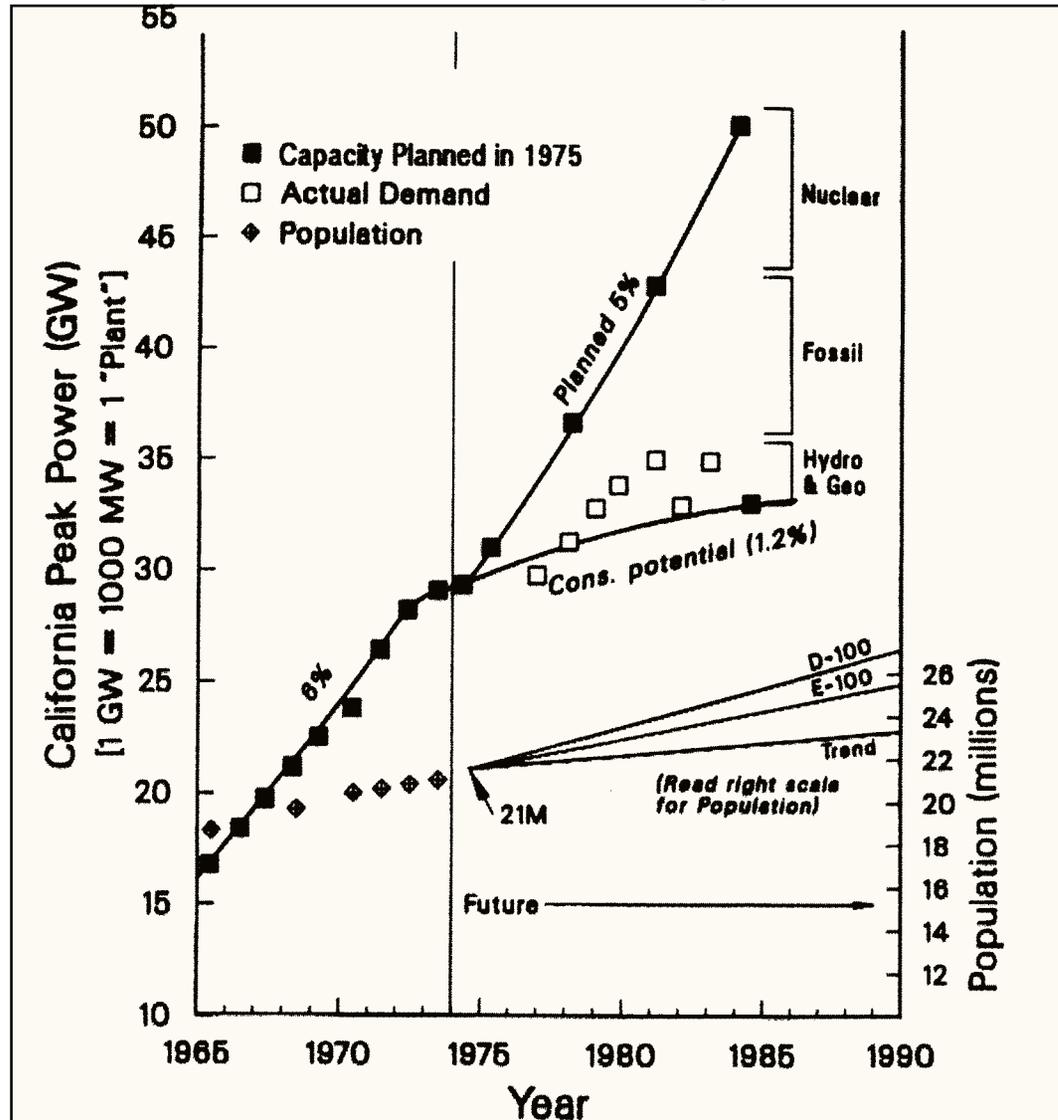
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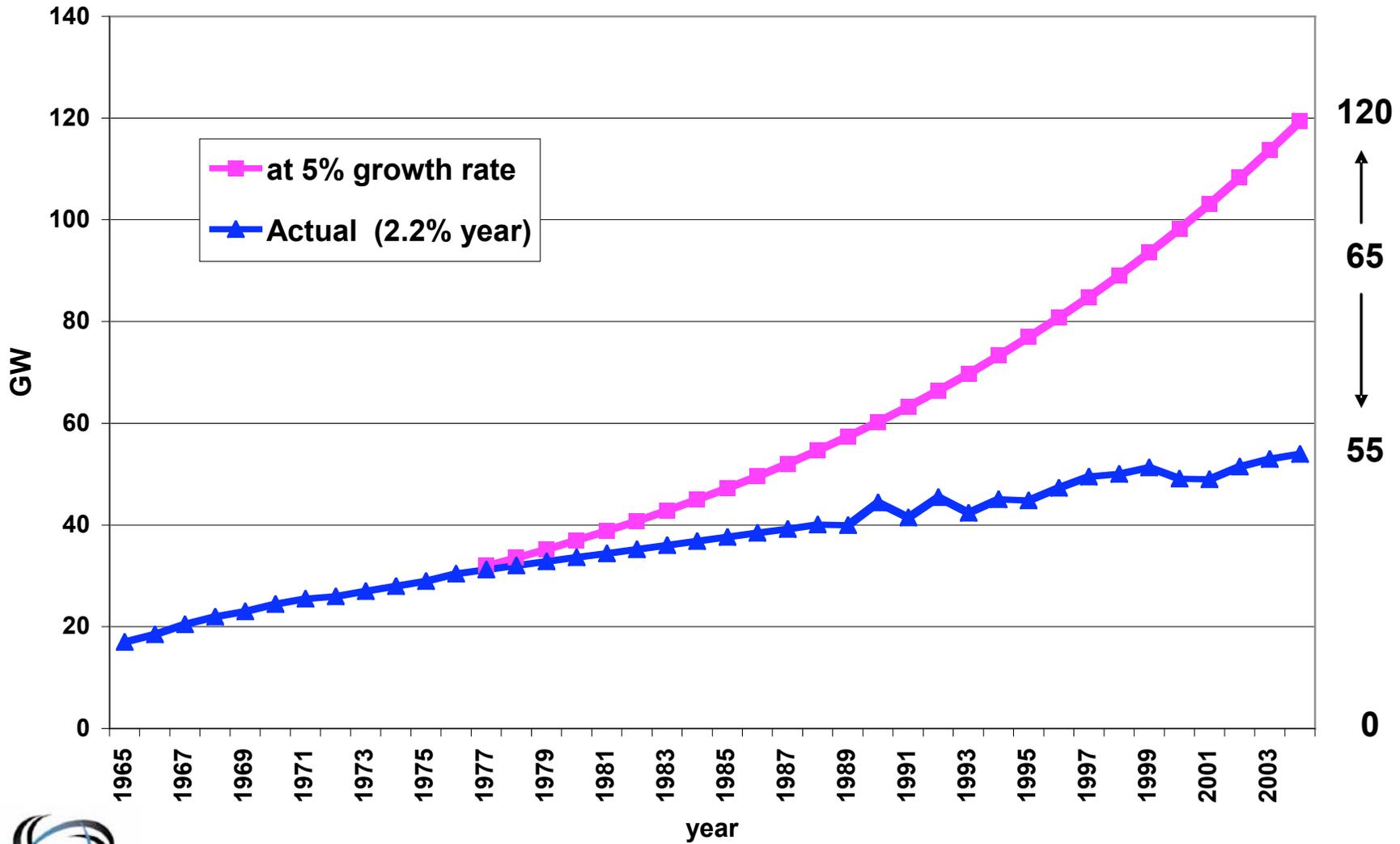
*Efficiency
Energy for the Future*

California Peak Power Demand: Planned in 1974, and Actual to 1984

Goldstein and Rosenfeld, at Calif. Energy Commission, Dec. 1975

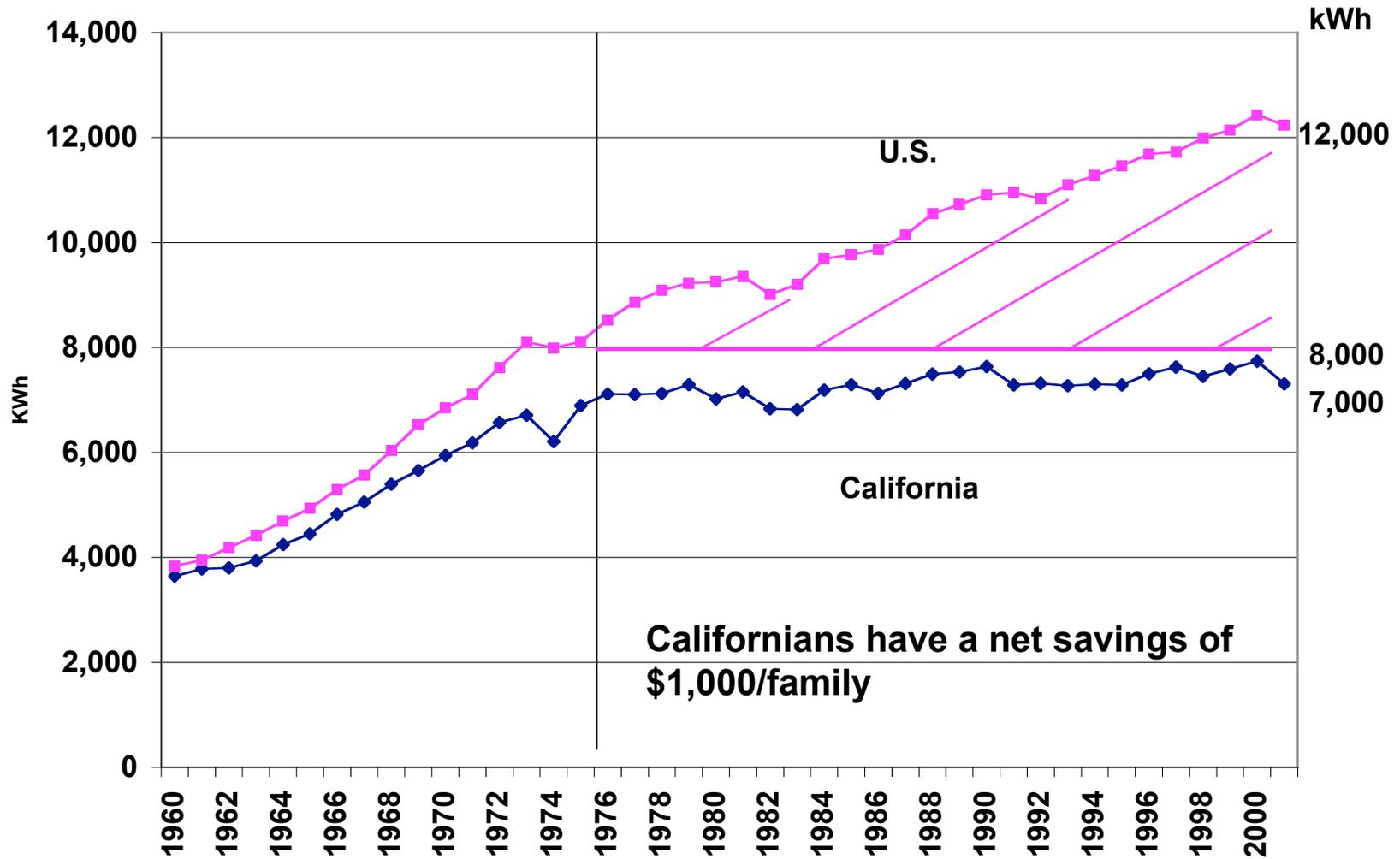


California Peak Demand 1965 - 2004



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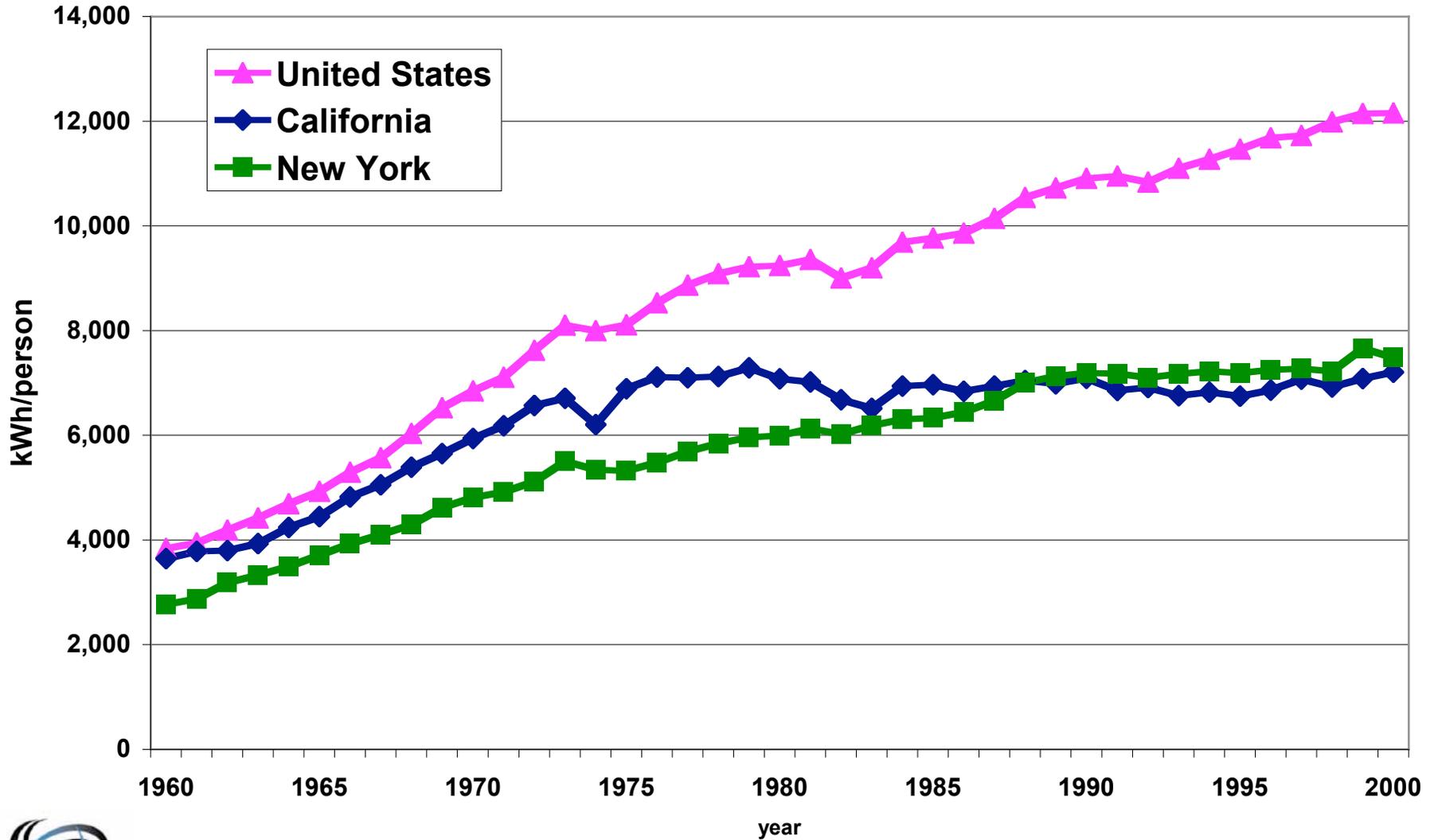
Total Electricity Use, per capita, 1960 - 2001



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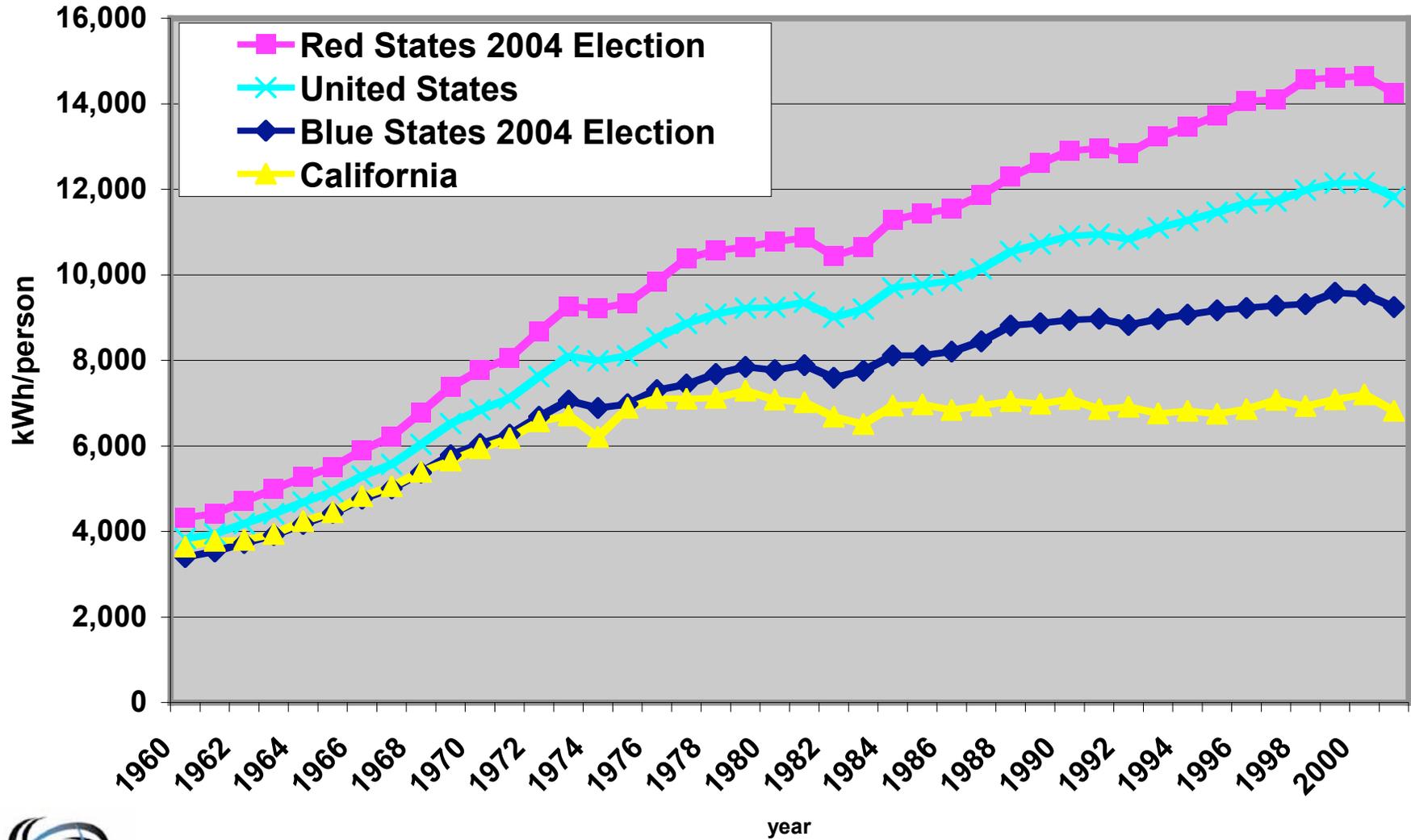
Per Capita Electricity Consumption

Source: http://www.eia.doe.gov/emeu/states/sep_use/total/csv/use_csv



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Per Capita Electricity Consumption

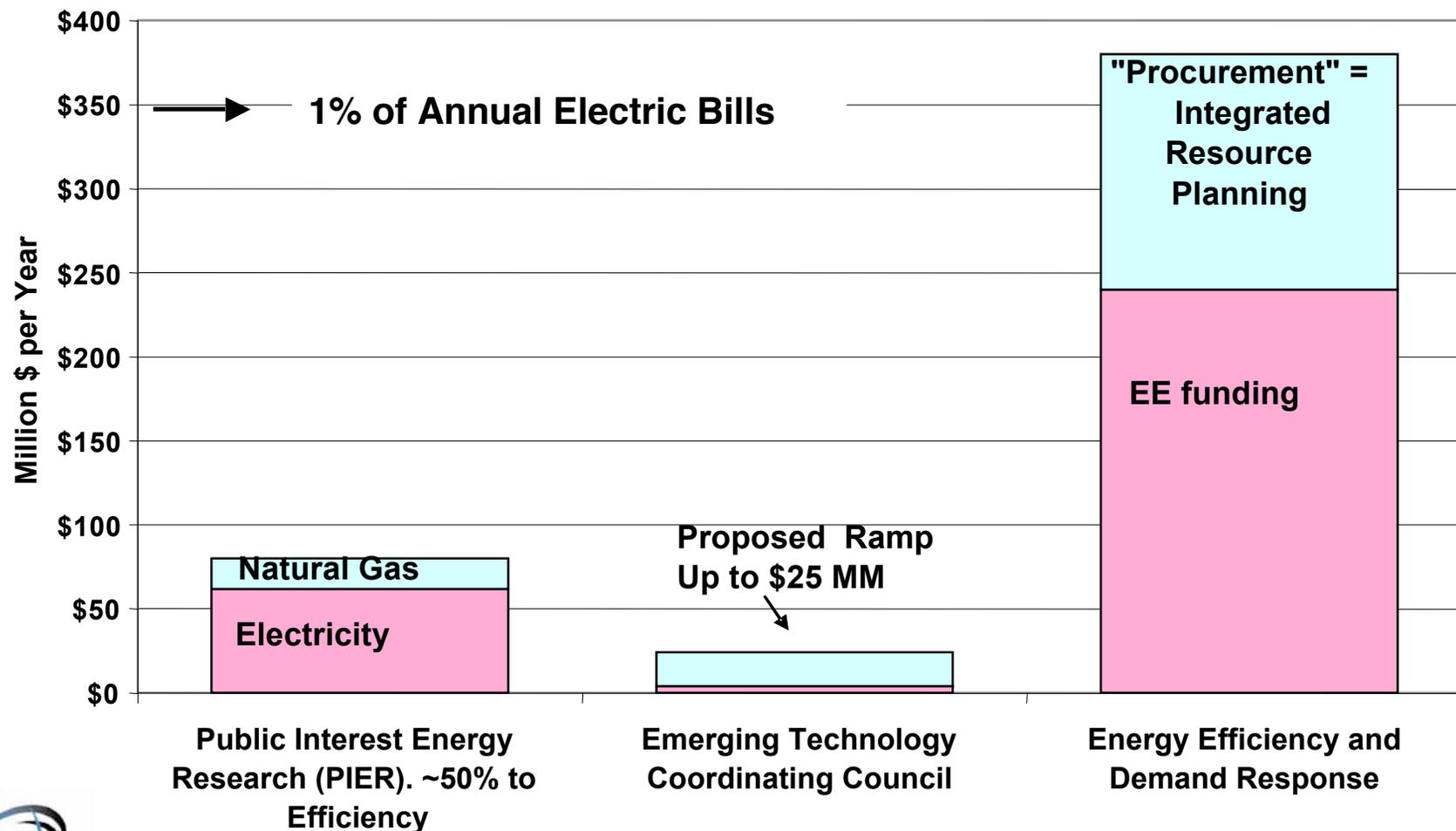


Virtues of a 15-Watt CFL (10,000 hour lifetime) Compared to Twelve 75-Watt Incandescent Bulbs

- ◆ First Cost for 1 CFL or 10 Incandescent Bulbs about the same: \$5.00
- ◆ Electricity consumption is very different:
 - 75 Watts – 15 Watts = 60 Watts x 10,000 hours = 600 kWh
- ◆ Money Savings:
 - 600 kWh x \$.12 per kWh = \$ 72.00
- ◆ Fuel Savings:
 - 600 kWh x 10,000 Btu/kWh = 6 Million Btus or ~ 1 barrel of petroleum
- ◆ Fuel Savings Example (using energy equivalence)
 - At 25 mph = 1,000 miles or SFO to Denver, one-way
 - At 50 mph (a new hybrid) = 2,000 miles or SFO to Denver and return



Public Goods and Procurement Funding for Efficiency

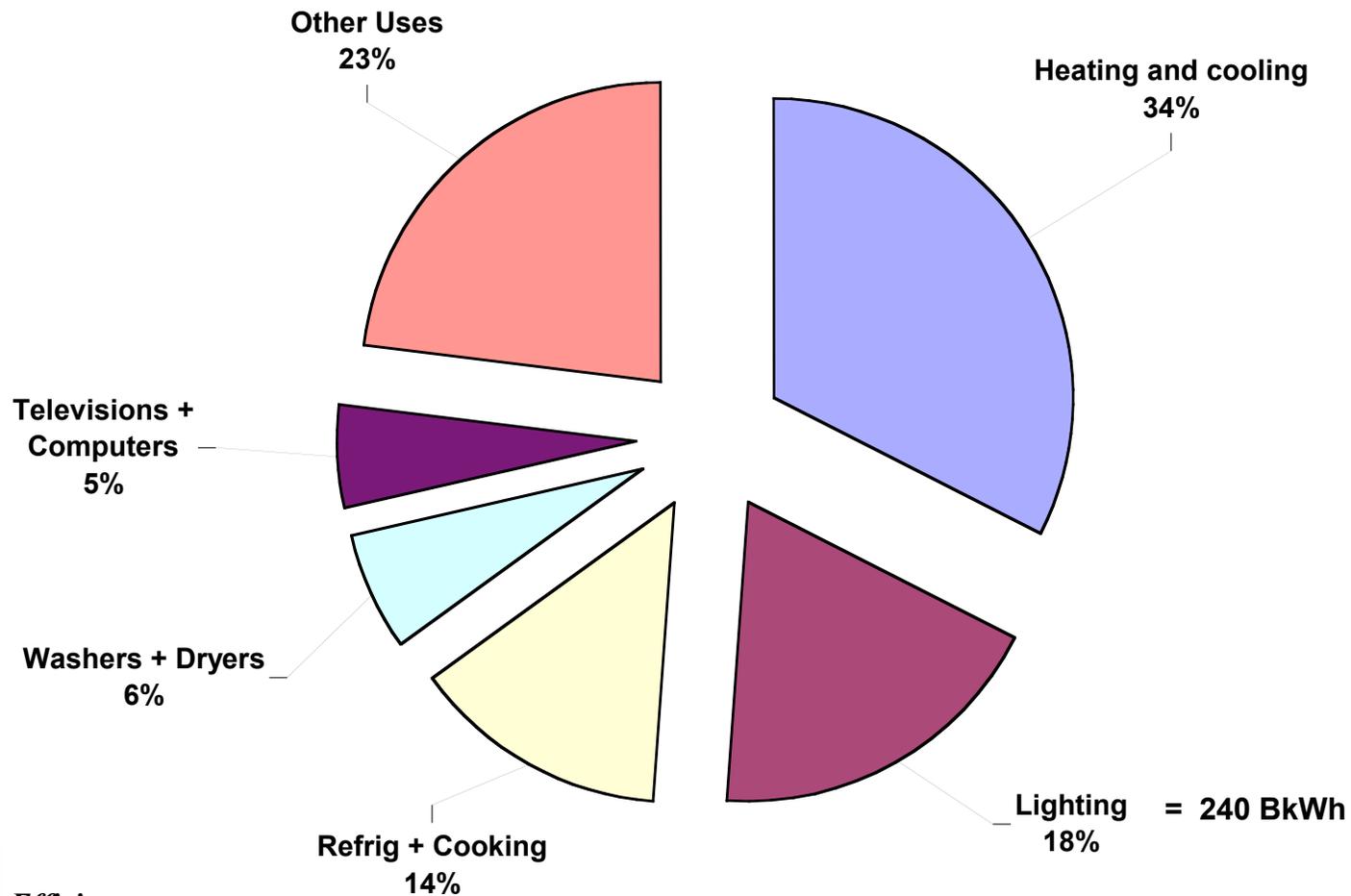


Now Turning Specifically to Lighting

- ◆ Lighting accounts for 6% of US energy use (2005 EIA Data)
- ◆ For comparison, ANWR is probably good for 1 – 1.5%

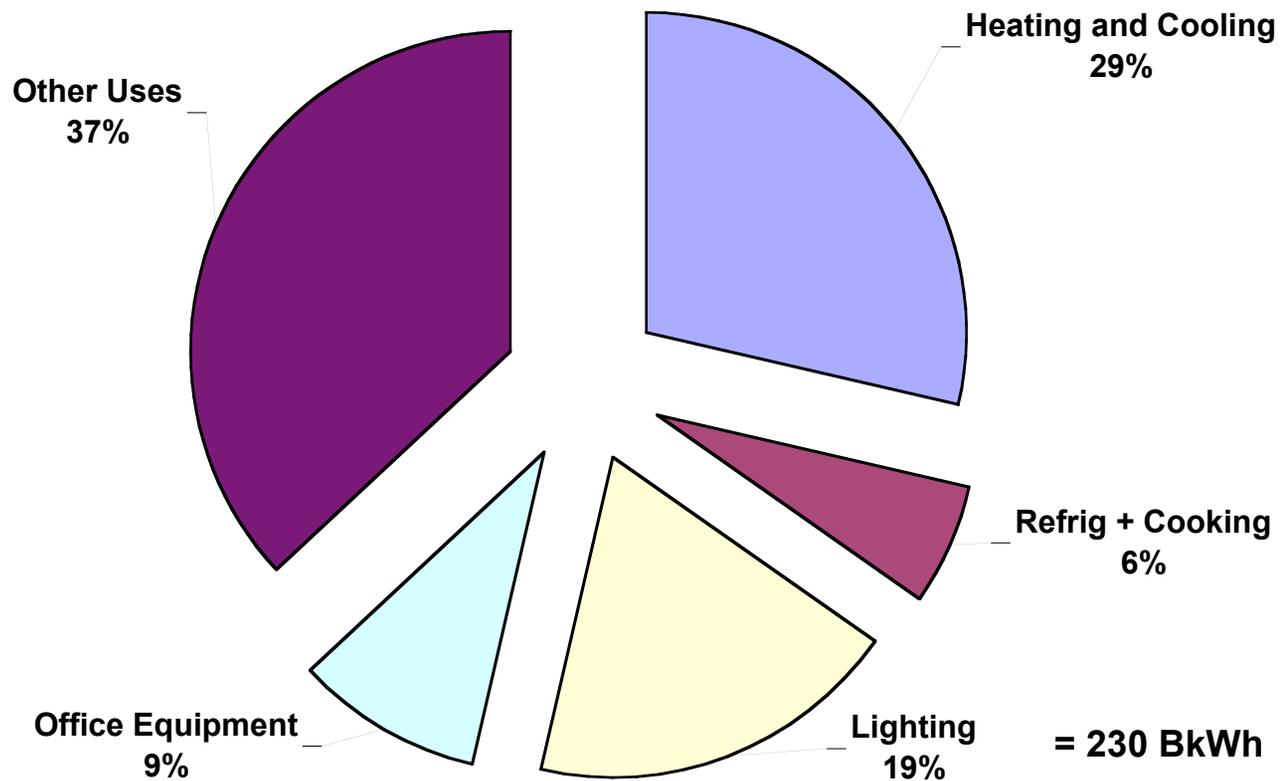


**End Uses as Percent of Electricity In Residential Sector
US from Annual Energy Outlook
US Residential Sales = 1,300 BkWh**

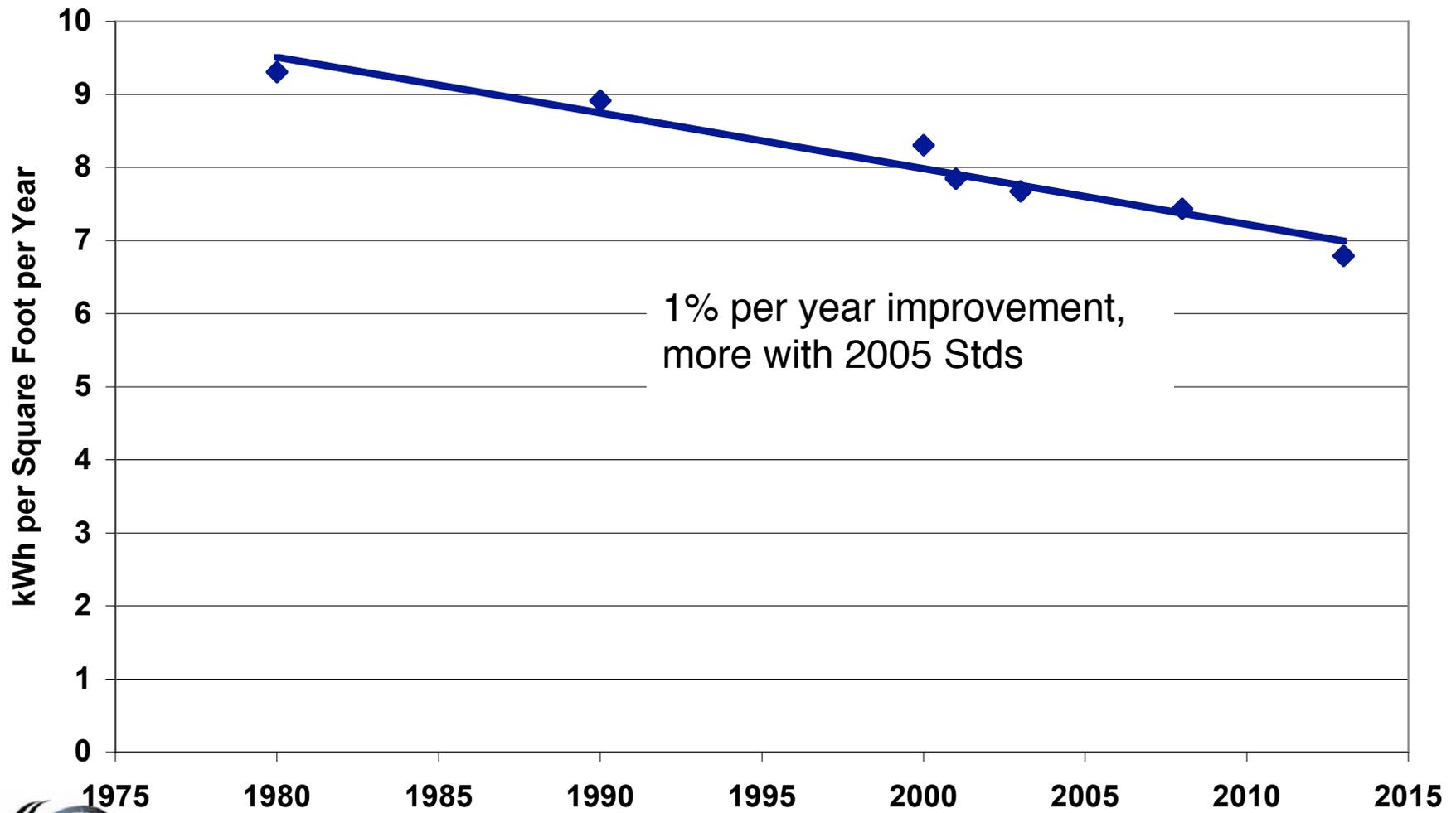


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**End Uses as Percent of Electricity In Commercial Sector
US from Annual Energy Outlook
US Commercial Sales = 1,230 BkWh**

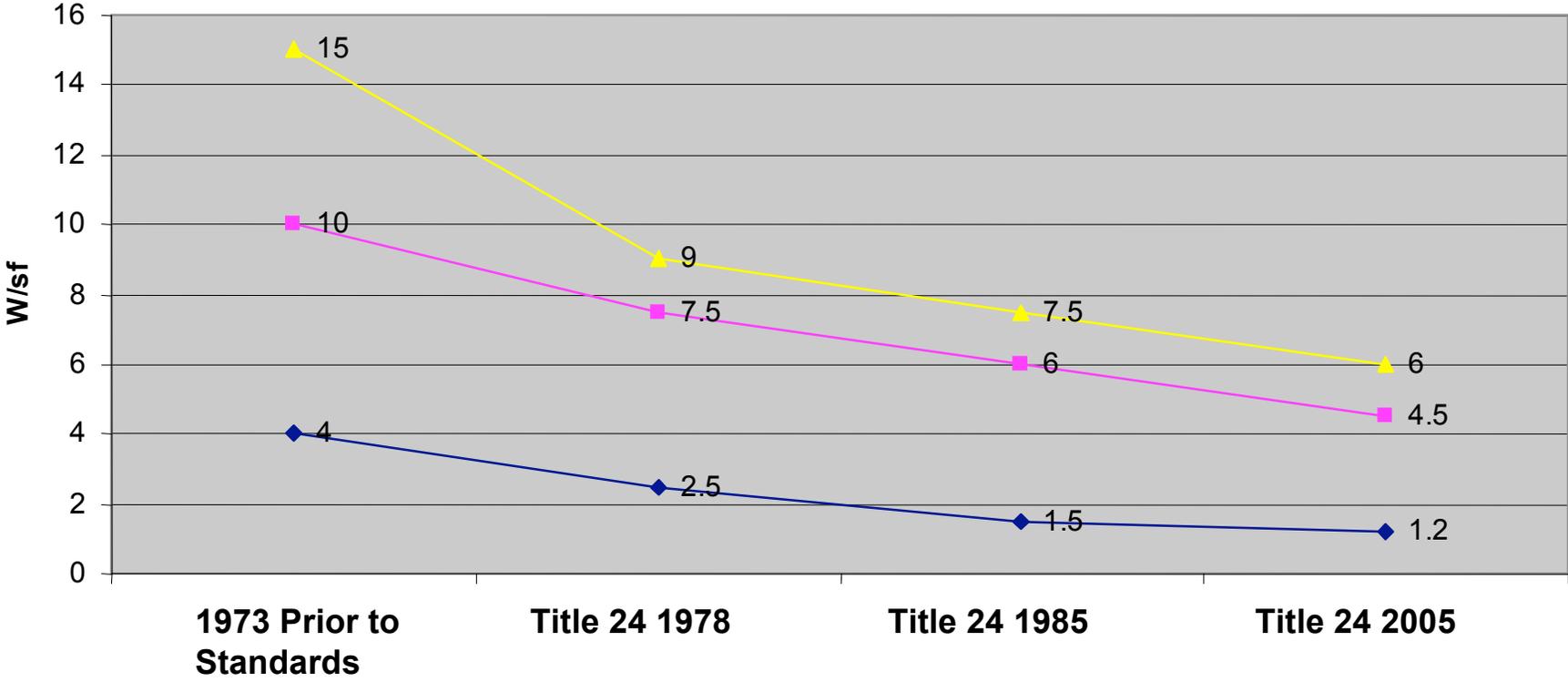


Average Consumption for Indoor Lighting Large Commercial Office Buildings -- SCE (Stds through 2001)



Commercial Lighting Power Density

Commercial Office Lighting Commercial Retail Lighting - low Commercial Retail Lighting - high



Title 24 Residential Lighting Impact

- ◆ Title 24 1978
~ **5-10%** lighting energy use saved
- ◆ Title 24 1985
~ **10-15%** of lighting energy use saved
- ◆ Title 24 2005
~ **20%** of lighting energy use saved



CFL Costs

- ◆ Costs of CFLs have dropped....
- ◆ \$15 to \$25 from ~1982 to ~1995
(little change)
- ◆ \$3 to \$10 today

Reference: ESource Lighting Atlas, 2005



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Electronic Ballast Costs

- ◆ Standard 2-lamp T8 Electronic Ballast
 - Early 1990's = \$35-\$40
 - Today = \$10 to \$15



Linear Fluorescent Costs

Table 7-6

Fluorescent lamp prices (1997)

These list prices are for four-foot lamps, based on case orders for GE lamps. Discounts below these prices are usually available.

Lamp type	Typical wholesale price per lamp (\$)
Energy saving 34W cool white T12	2.19
Energy saving high output cool white T12	9.17
Energy saving instant start cool white T12	10.27
70+ CRI T8	3.45
70+ CRI T12	4.78
80+ CRI T8	4.61
80+ CRI T12	9.74
Cathode cut-out T12	4.80

“Standard” T8 lamp

In 1997 cost \$4.61

In 2003 cost \$2.44

Reference: ESource Lighting Atlas, 1997 & 2005

Table 7-6: Fluorescent lamp prices, 2003

The table lists prices for General Electric (GE) standard and premium 4-foot T8 and T12 fluorescent lamps

Lamp	Catalog ID	Power (watts)	Initial lumens	CRI	Lifetime, rapid start (hours)	Low-mercury TCLP compliant	Price ^a (\$)
GE F40 Watt-Miser	F34T12/CW/RS/WM	34	2,650	60	20,000	No	4.56
GE F40 Ecolux TCLP Compliant	F34T12/CW/RS/WM/ECO	34	2,650	60	20,000	Yes	1.38
GE F40 Ecolux TCLP Compliant	F34T12/SP35/RS/WM/ECO	34	2,750	73	20,000	Yes	2.99
GE F40 Ecolux TCLP Compliant	F34T12/SPX35/RS/WM/ECO	34	2,900	82	20,000	Yes	12.37
GE T12 HO Rapid Start	F48T12/CW/HO	60	4,050	60	12,000	No	7.99
GE T12 HO Rapid Start	F48T12/SP35/HO	60	4,250	70	12,000	No	14.63
GE T12 HO Rapid Start	F48T12/SPX35/HO	60	4,350	82	12,000	No	19.49
GE T12 VHO Rapid Start	F48T12/CD/1500	110	6,200	60	10,000	No	14.46
GE Starcoat	F32T8/SP35	32	2,950	78	20,000	No	1.82
GE Starcoat	F32T8/SPX35	32	2,950	86	20,000	No	2.40
GE Starcoat XL Extra-Life	F32T8/XL/SP35	32	2,950	78	24,000	No	2.30
GE Starcoat XL Extra-Life	F32T8/XL/SPX35	32	2,950	86	24,000	No	3.14
GE T8 Ecolux TCLP Compliant	F32T8/SP35/ECO	32	2,950	78	20,000	Yes	1.81
GE T8 Ecolux TCLP Compliant	F32T8/SPX35/ECO	32	2,950	86	20,000	Yes	2.44
GE T8 Ecolux XL Extra-Life	F32T8/XL/SP35/ECO	32	2,950	78	24,000	Yes	2.25
GE T8 Ecolux XL Extra-Life	F32T8/XL/SPX35/ECO	32	2,950	86	24,000	Yes	3.05
GE T8 Watt-Miser	F32T8/SP35/IS/WM/ECO	30	2,950	82	15,000 ^b	Yes	2.99
GE Watt-Miser XL	F32T8/XL/SP35/WM/ECO	30	2,800	82	20,000 ^b	Yes	3.81

Notes: CRI = color rendering index; TCLP = Toxicity Characteristics Leaching Procedure.

a. Prices are for T12 lamps in boxes of 10 and T8 lamps in boxes of 30.

b. These lamps are recommended for operation on instant-start electronic ballasts only.

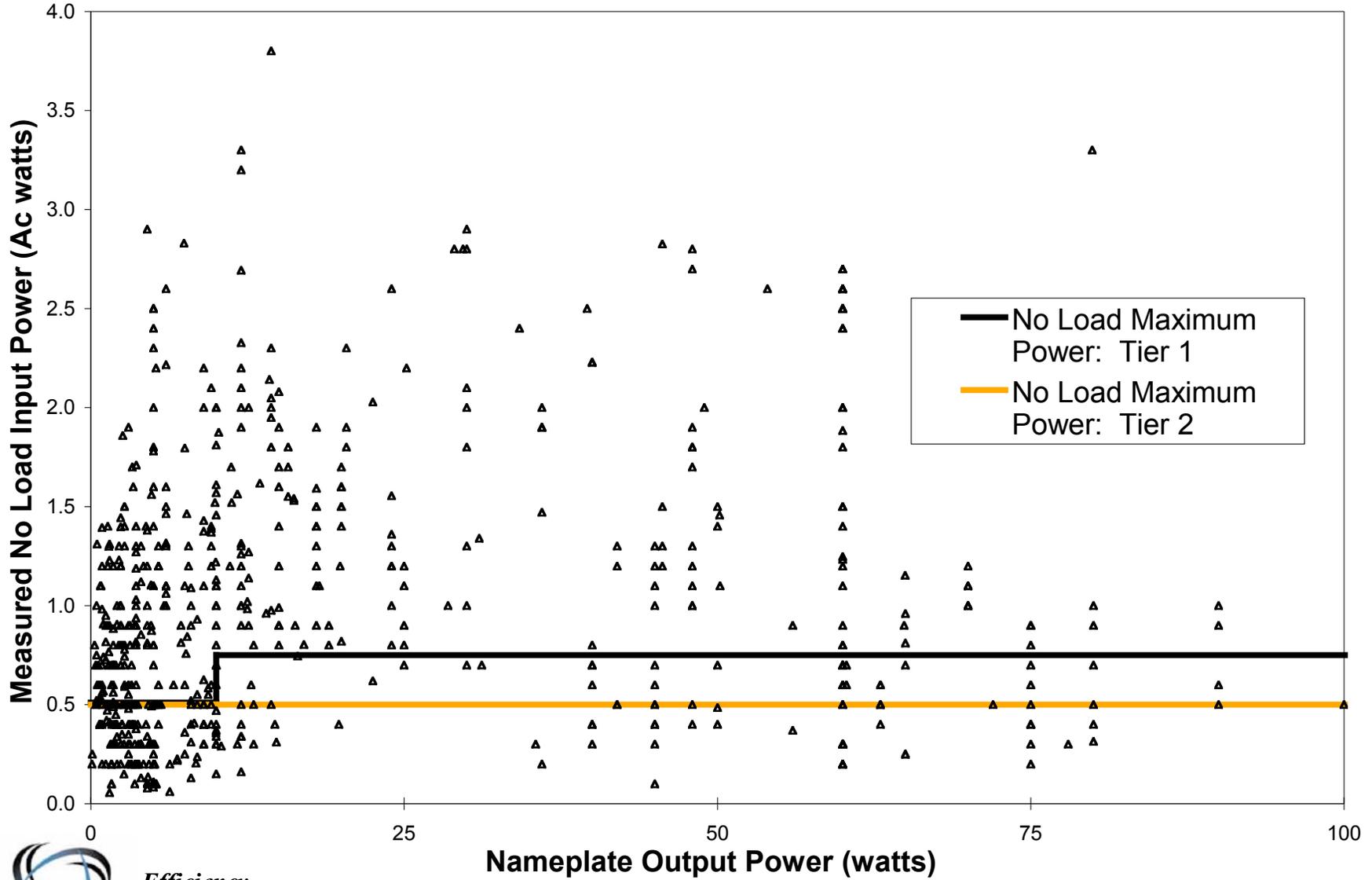
Source: Platts; prices from GE Supply [19]



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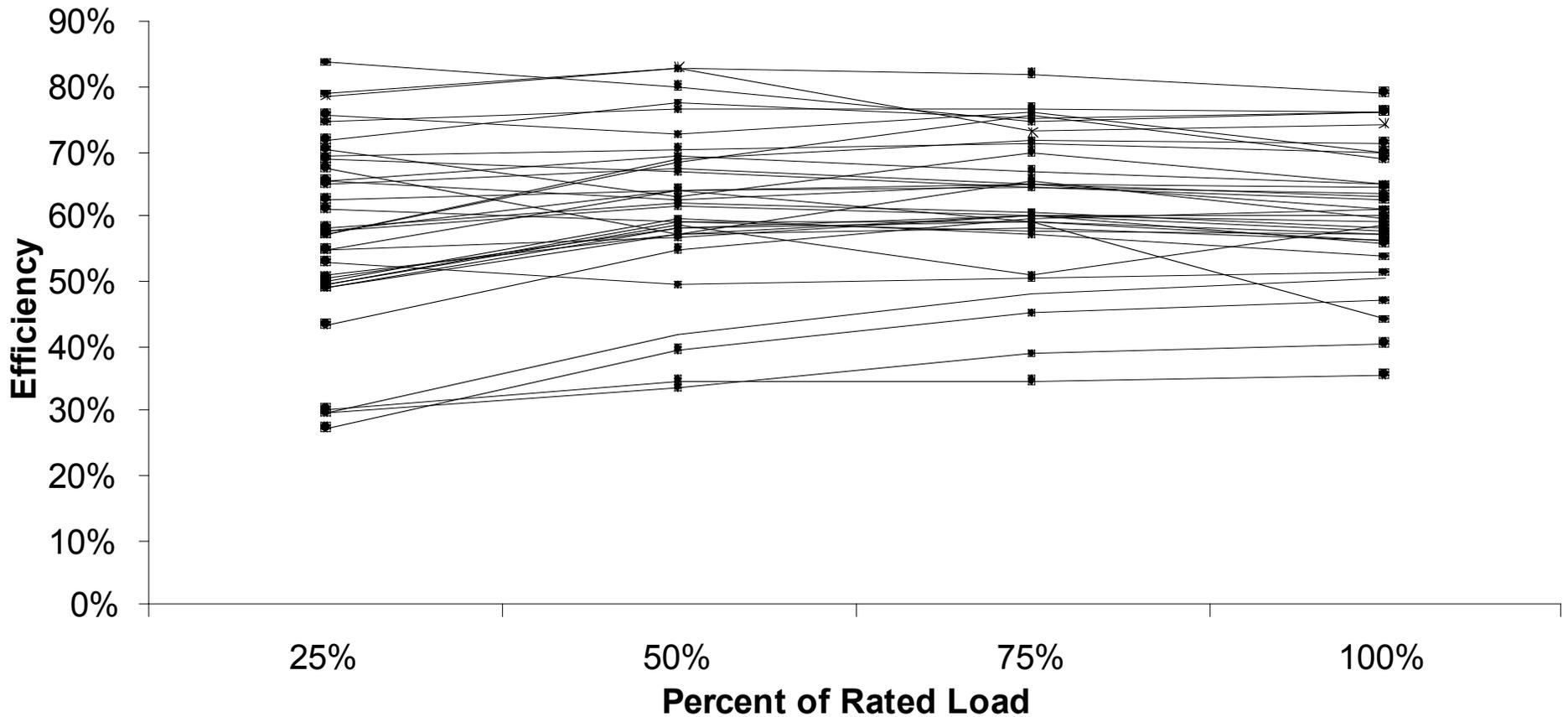
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No Load Standard

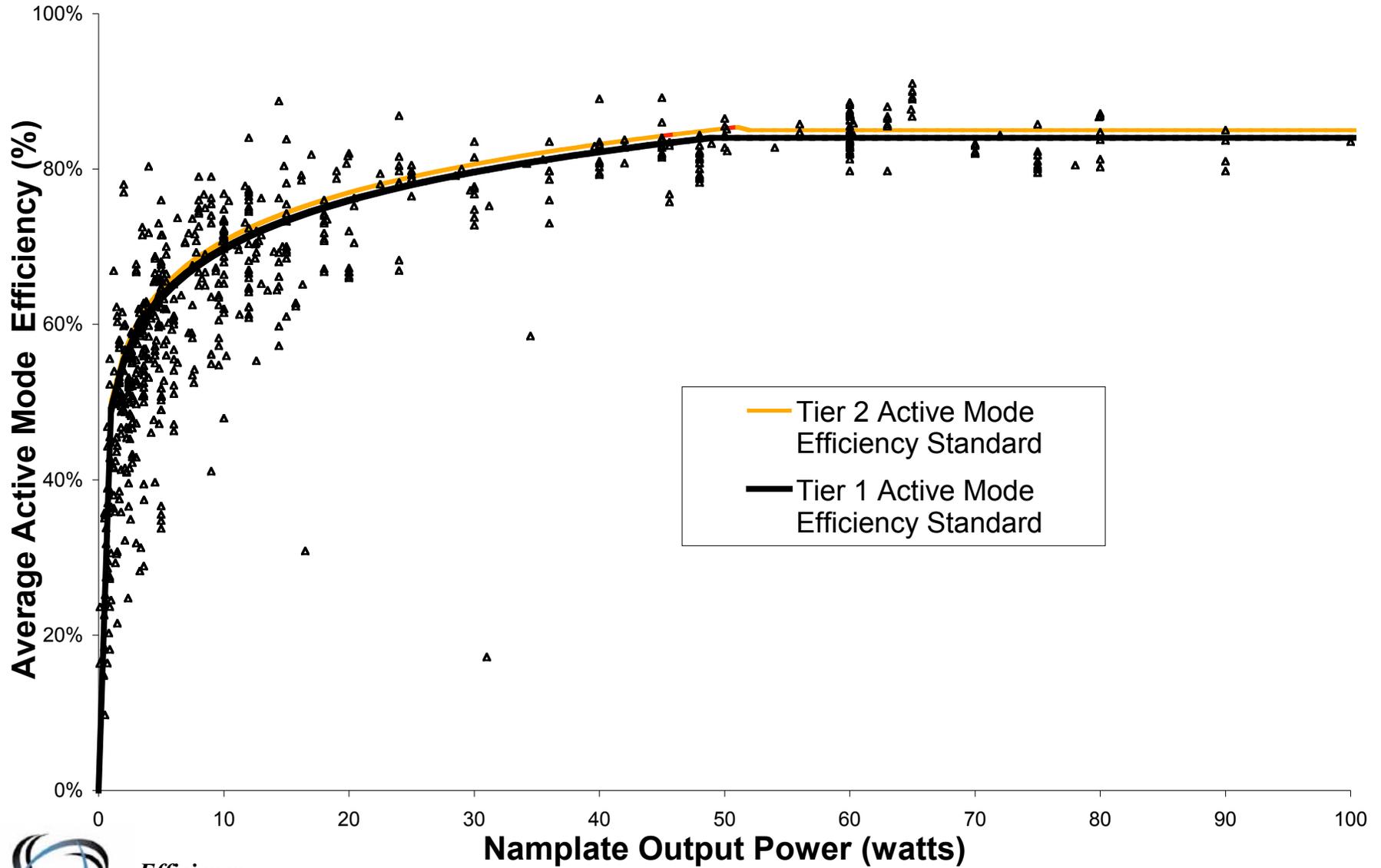


Efficiency Curves Show Wide Efficiency Spread

External Power Supply Efficiency Measurements (10 to <24 Watts)



Active Mode Standard

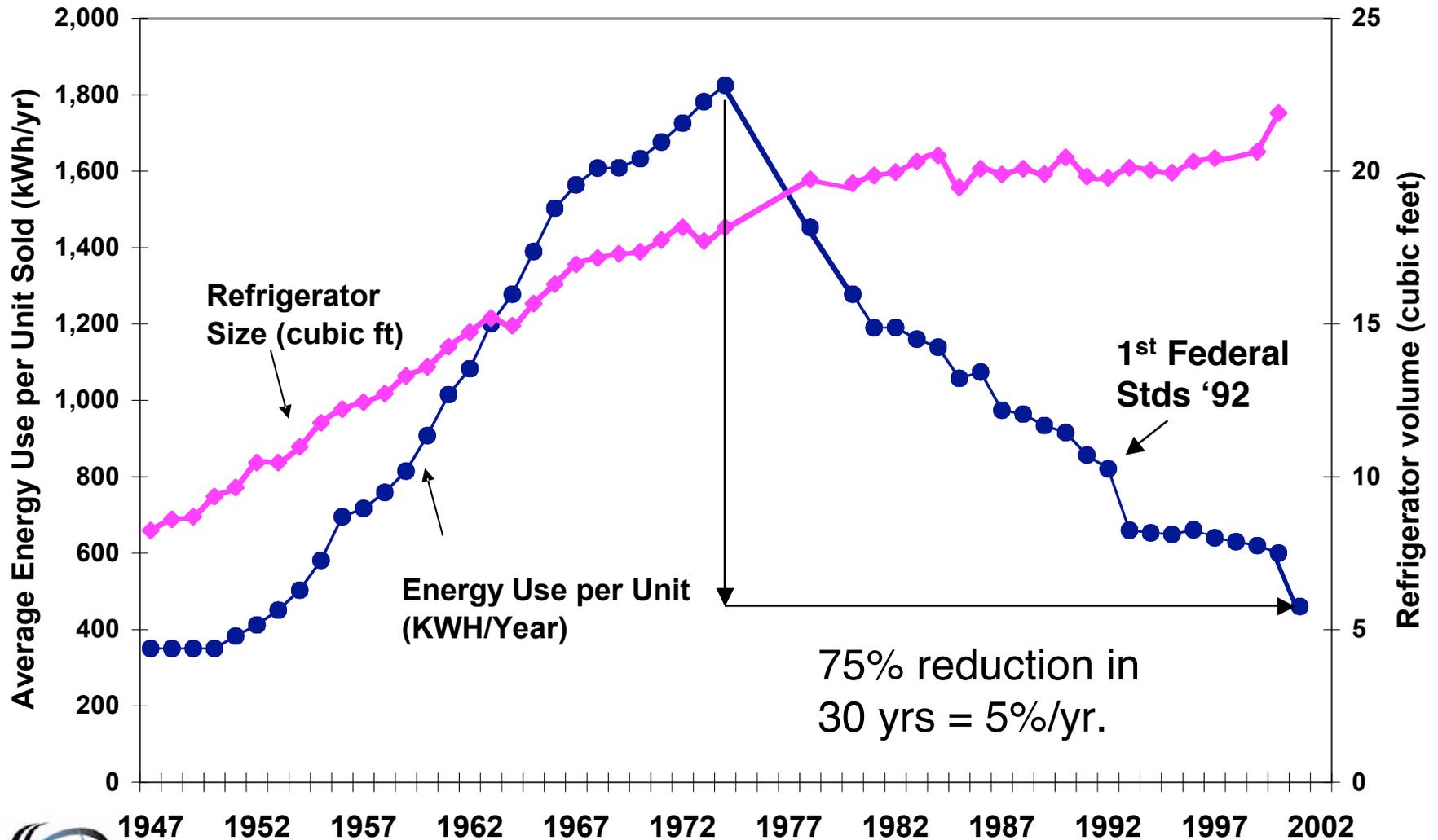


Let's Return to More General Energy Policy

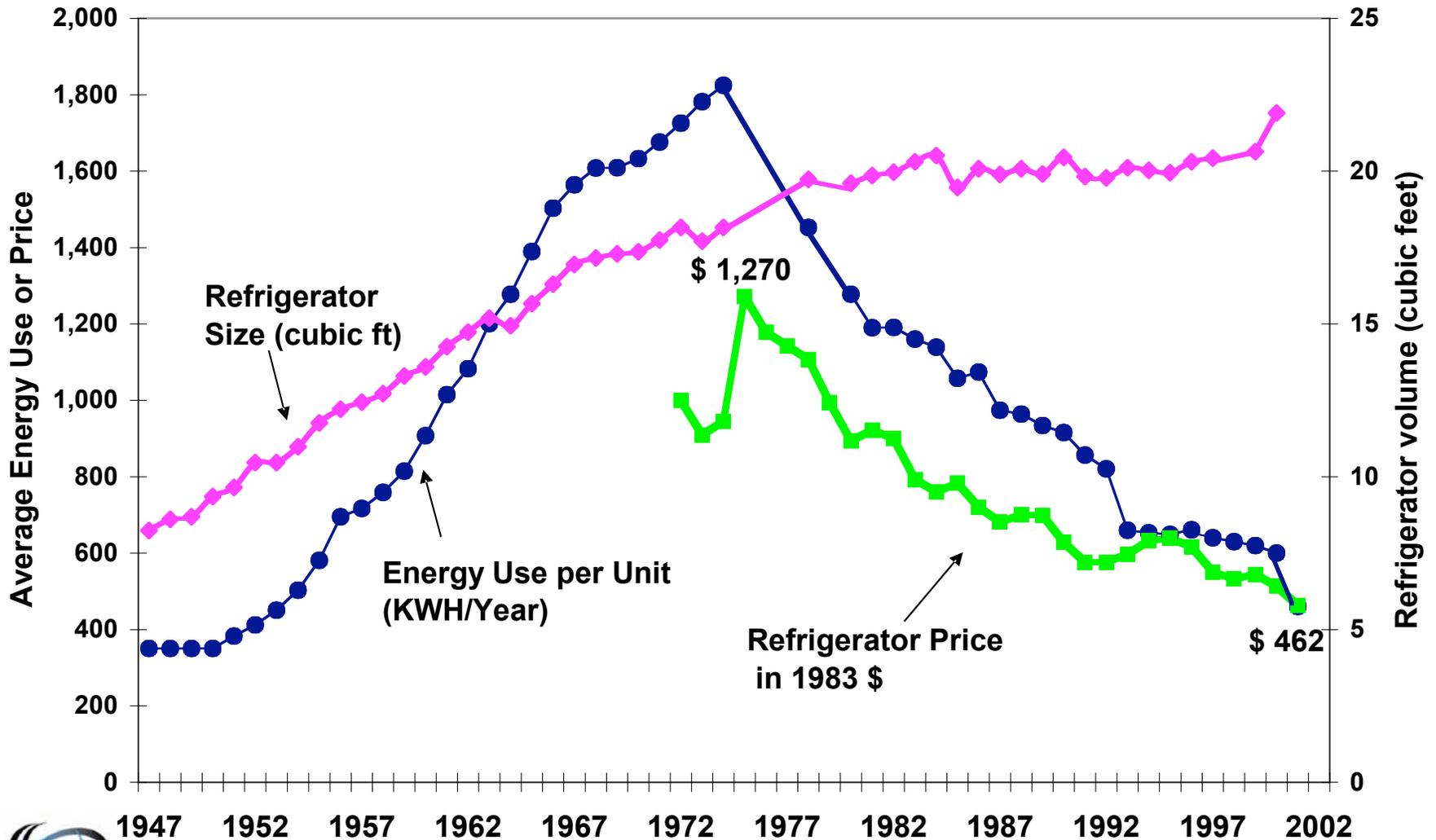


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United States Refrigerator Use v. Time



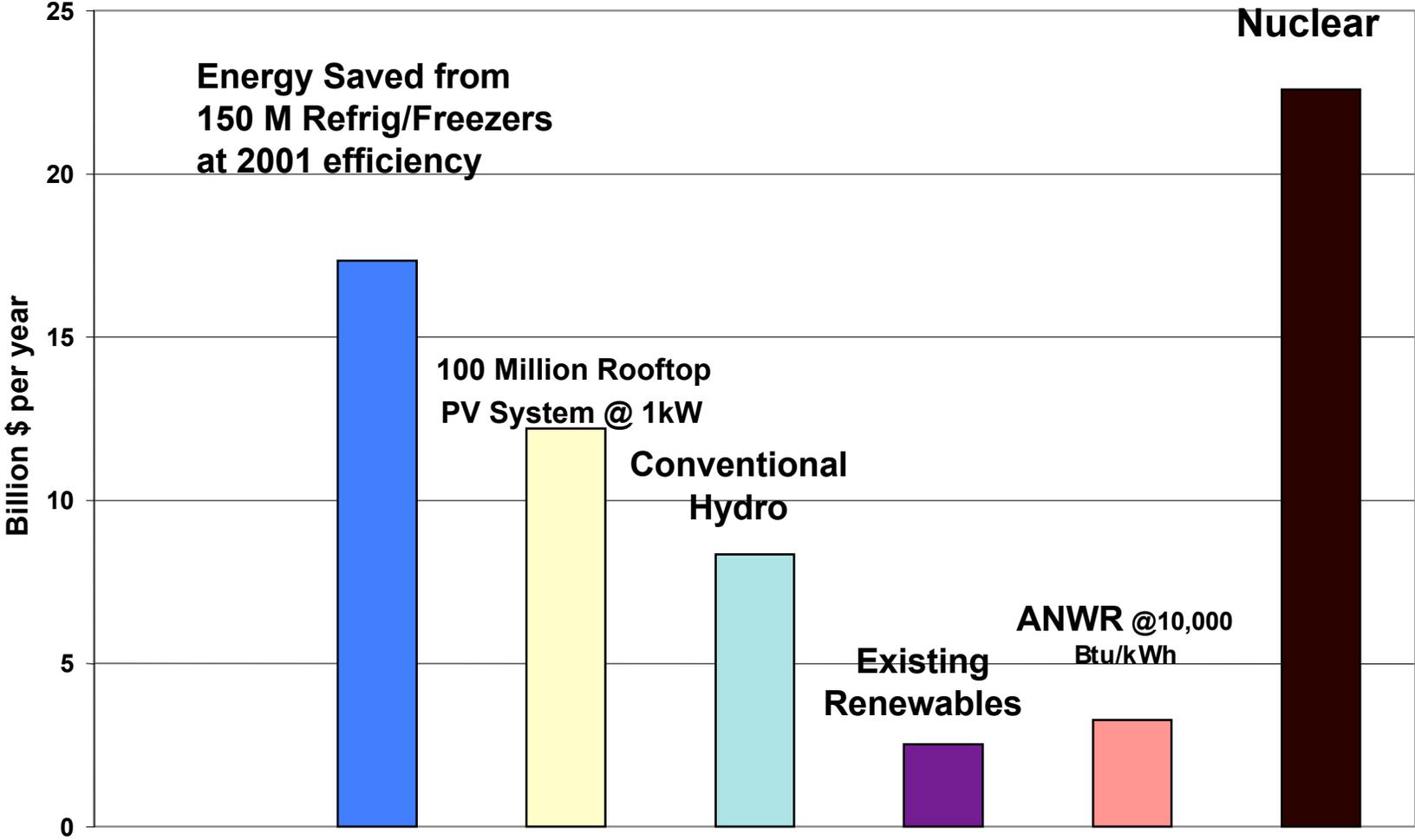
United States Refrigerator Use v. Time



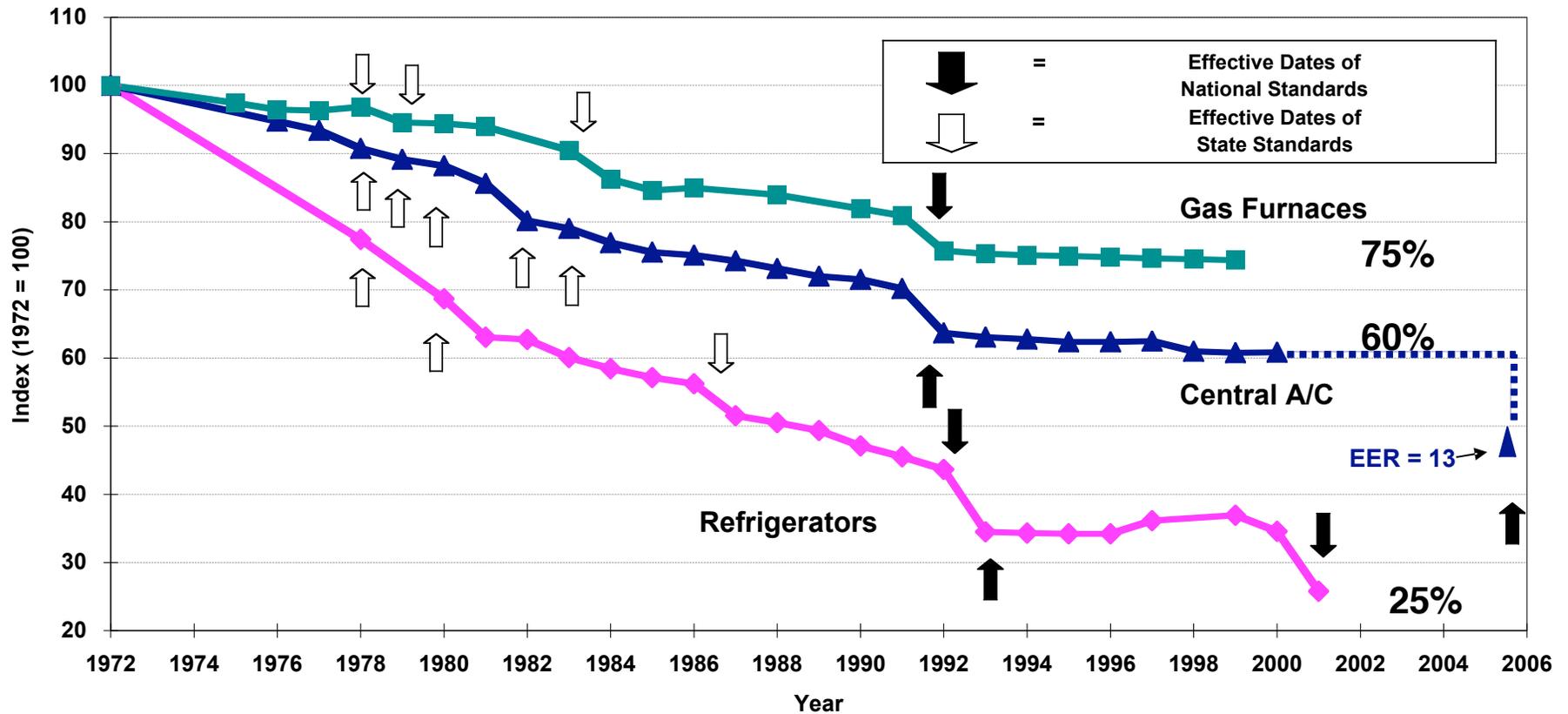
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Source: David Goldstein

The Value of Energy Saved and Produced
 (production @ .03 and savings @ .085 \$/kWh)



Impact of Standards on Efficiency of 3 Appliances



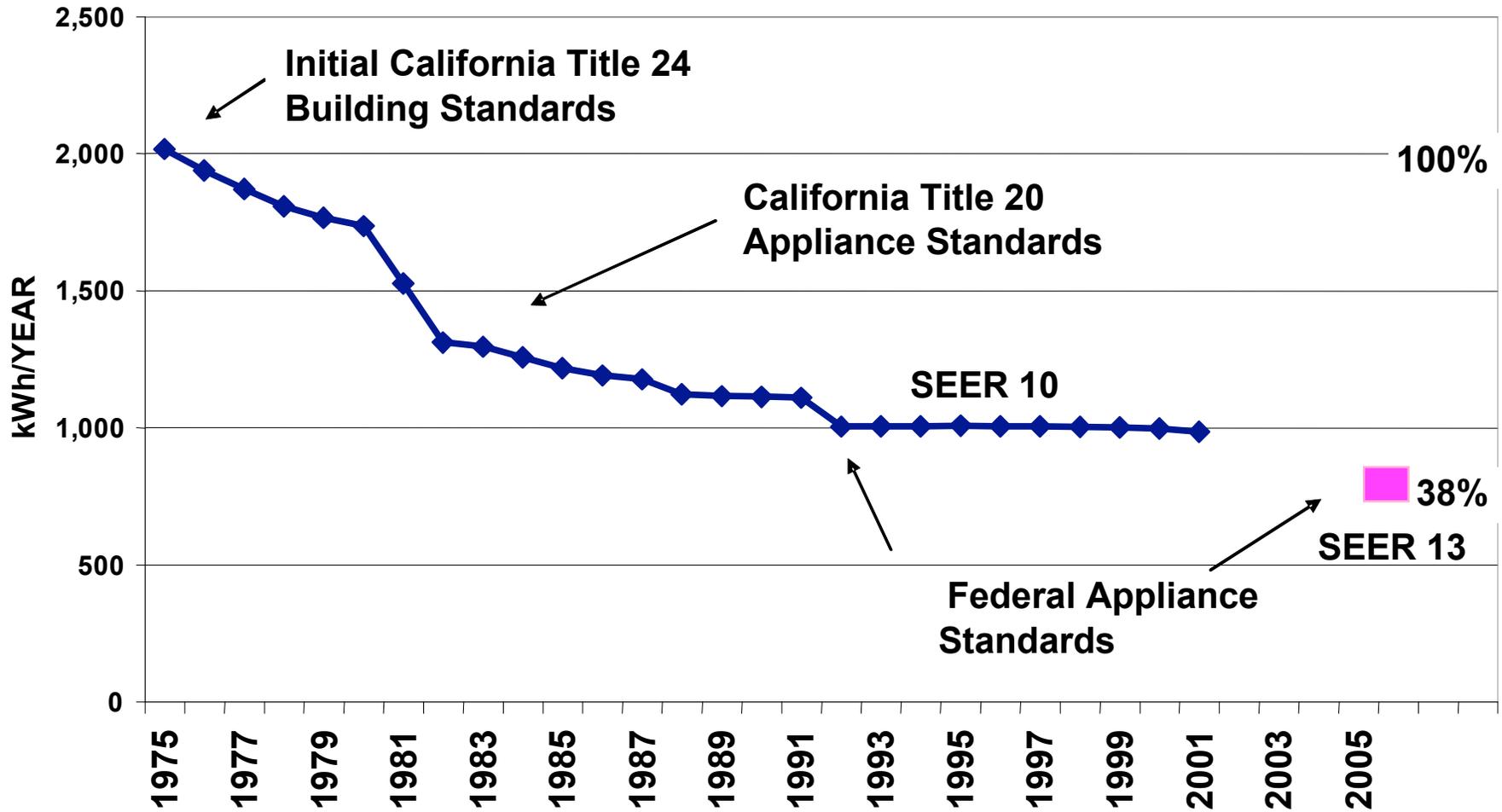
Source: S. Nadel, ACEEE,

in ECEEE 2003 Summer Study, www.eceee.org



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Annual Usage of Air Conditioning in New Homes in California
Average drop of 3% per year while House size grew 1.5% per year

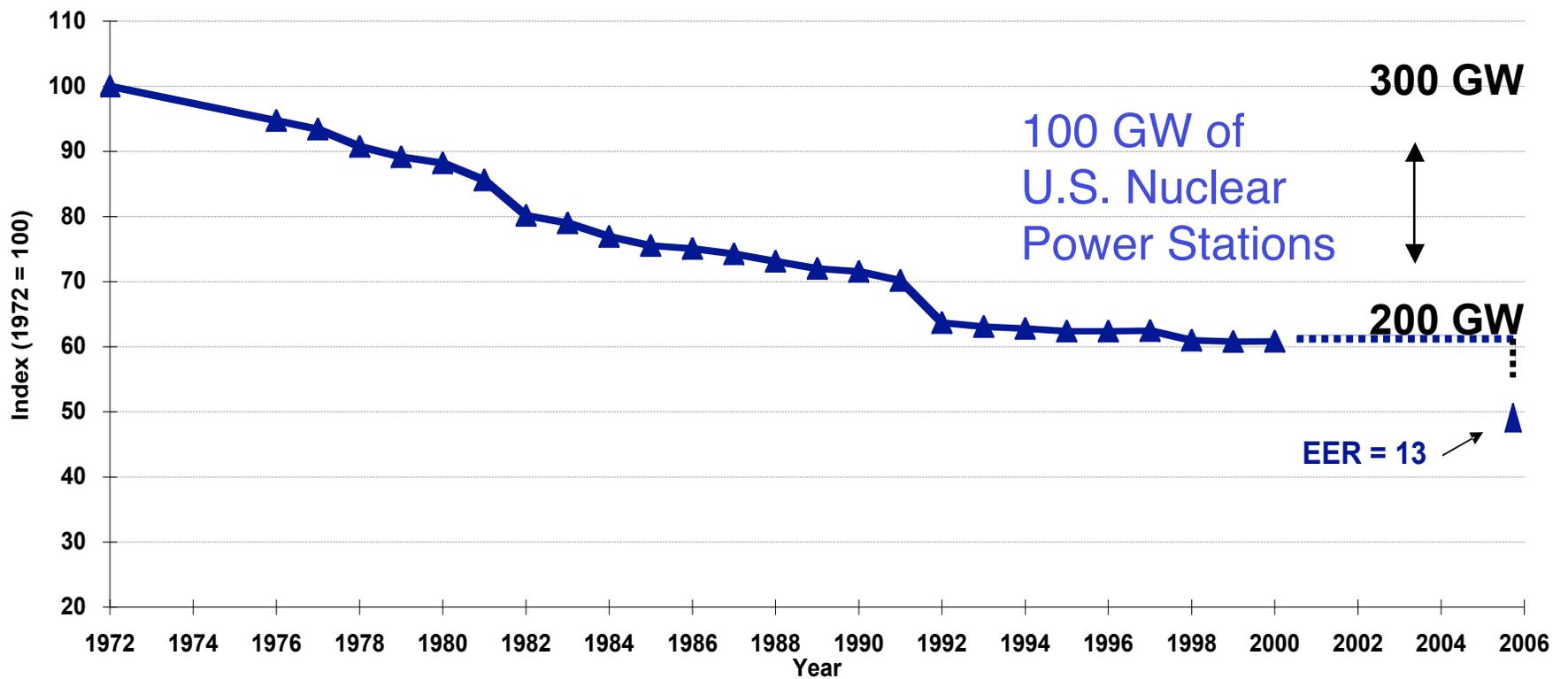


Source: CEC Demand Analysis Office

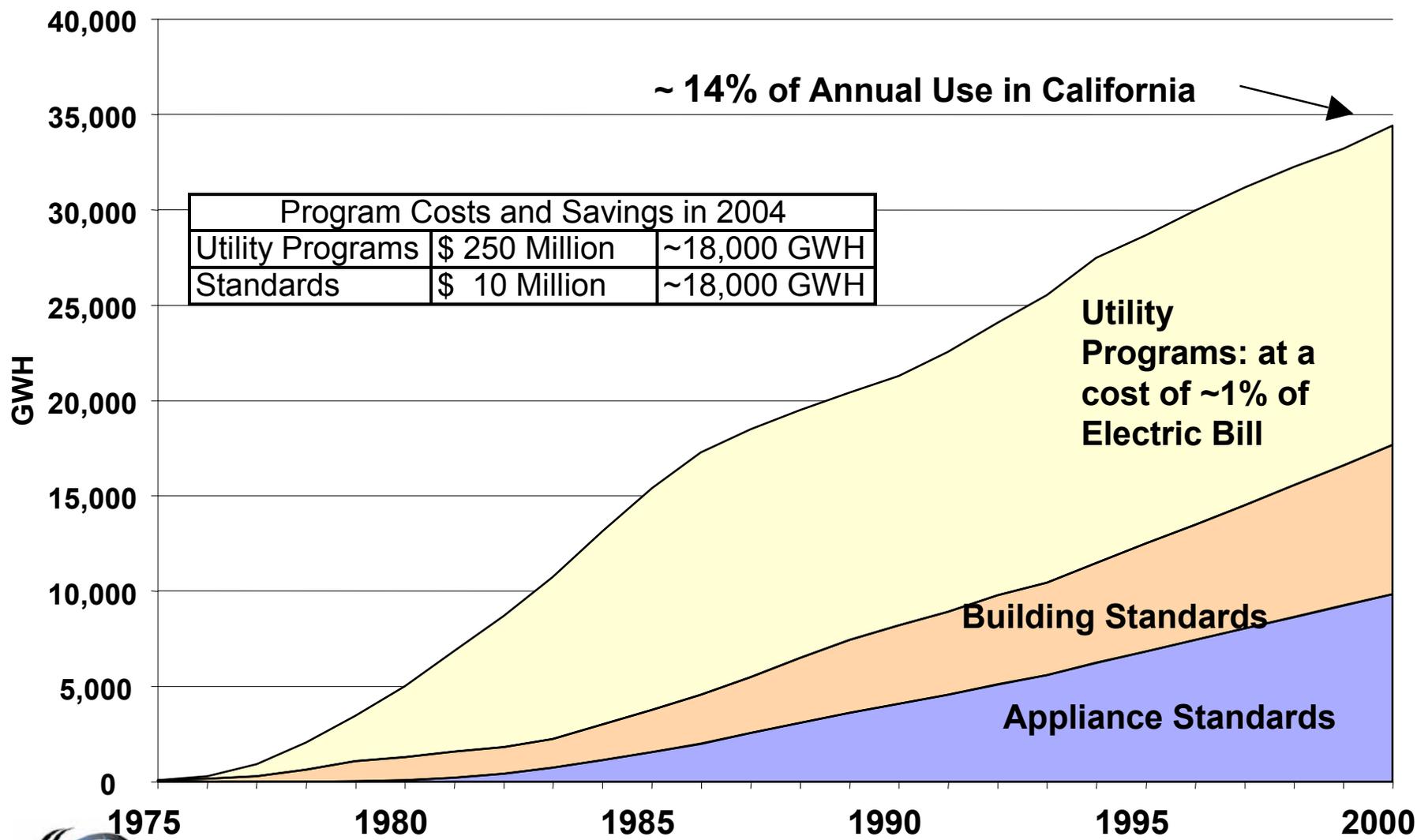


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After Saturation (16 years) Impact of Standards on Residential Central A/C and Roof Top A/C Units in the United States



GWh Impacts from Programs Begun Prior to 2001

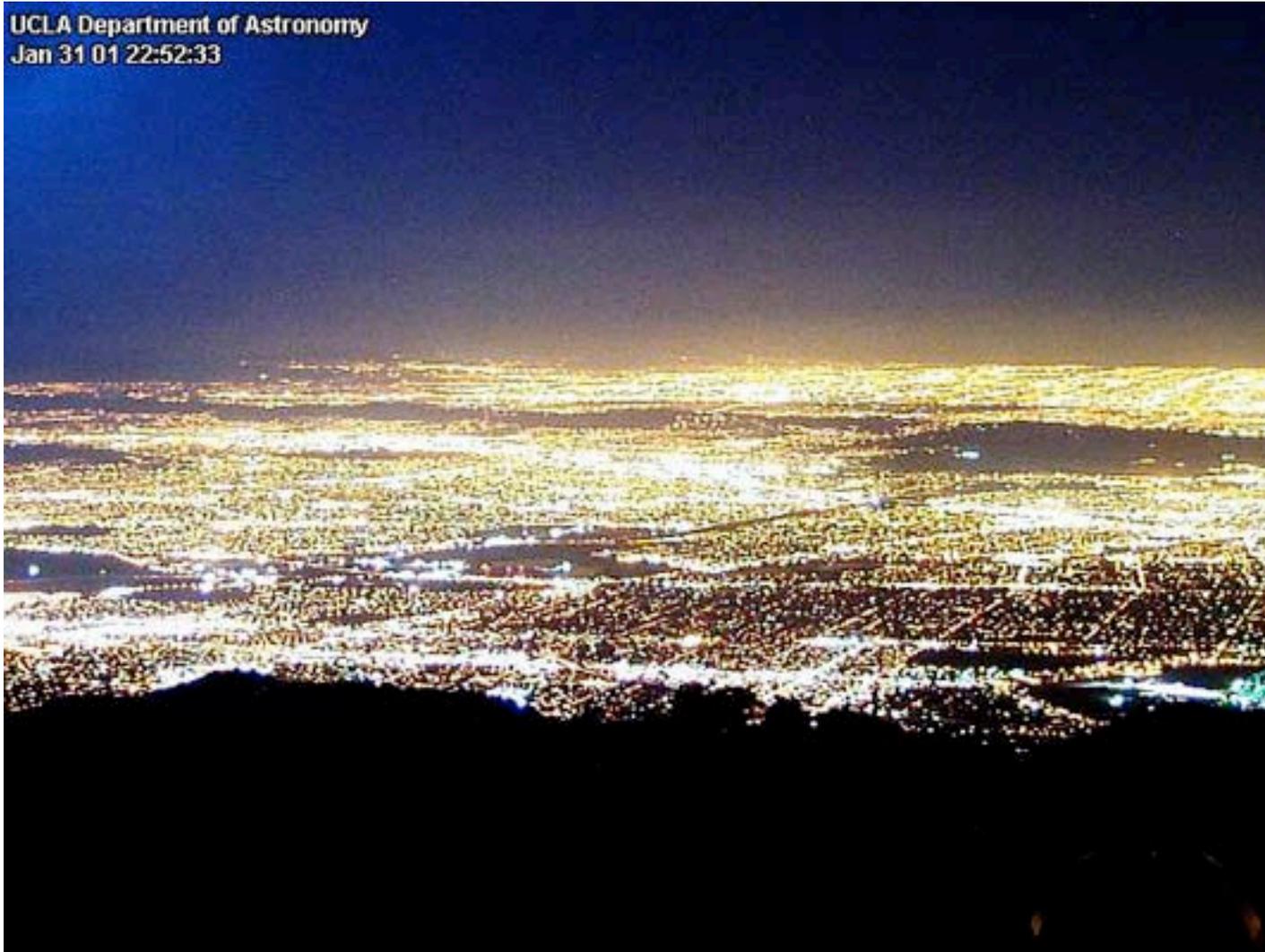


California's Continued Move Toward Efficiency

- ◆ Adopted a loading order for electricity with efficiency being first on the list
- ◆ The research community and industry continue to collaborate on innovative lighting developments
- ◆ The CEC will continue to provide R&D funding and to update Titles 20 and 24



UCLA Department of Astronomy
Jan 31 01 22:52:33



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Lighting Spilling Upwards



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