Energy Efficiency in AZ:
Potential Savings; Benefits and Costs; Policies and Programs

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Southwest Energy Efficiency Project (SWEEP)

- Public interest initiative promoting greater energy efficiency in AZ, CO, NV, NM, UT, and WY
- Founded in 2001, based in Boulder, CO
- Board of Directors includes utility, state government, national laboratory, and private sector representatives
- Funding provided by the Energy Foundation, Hewlett Foundation, U.S. Department of Energy, and the U.S. Environmental Protection Agency

www.swenergy.org

Outline of Presentation

- Definition of energy efficiency
- Problems of high load growth
- Potential for energy efficiency in AZ
- Proposal: what Arizona should do
- Examples of performance: energy savings, demand reductions, benefits and costs
  - Other states
  - SW and Arizona
- Policies, programs, and strategies
- Conclusions

Definition of Energy Efficiency

- Energy efficiency reduces the energy used by specific end-use devices and systems, typically without affecting the level of service and without loss of amenity.
- Energy savings and peak load reductions are achieved by substituting technically more advanced equipment, processes, or operational strategies to produce the same or an improved level of end-use service with less energy use.
- Opportunities in electricity and natural gas
- Adequate, economical, and reliable resource that has significant environmental benefits

Electricity Use in Arizona

- Electricity demand grew 3.9% per year on average in the 1990's; 2.5% for nation as a whole
- 45.6% of electricity provided by coal-fired power plants
- Electricity costs are 7% higher than national average
- Vast majority of recent and planned future growth in electric capacity is natural gas-fired

The Problems of High Load Growth

- Upward pressure on electricity & natural gas prices
- Creates power plant and transmission line siting controversies
- Pressure on already-stressed gas infrastructure
- Increases risk of power outages and diminishes electrical reliability
- Increases air pollution and other negative environmental impacts
- Increases water consumption
- Increases greenhouse gas emissions, contributing to global warming

SWEEP "New Mother Lode" Report: The Potential for Energy Efficiency

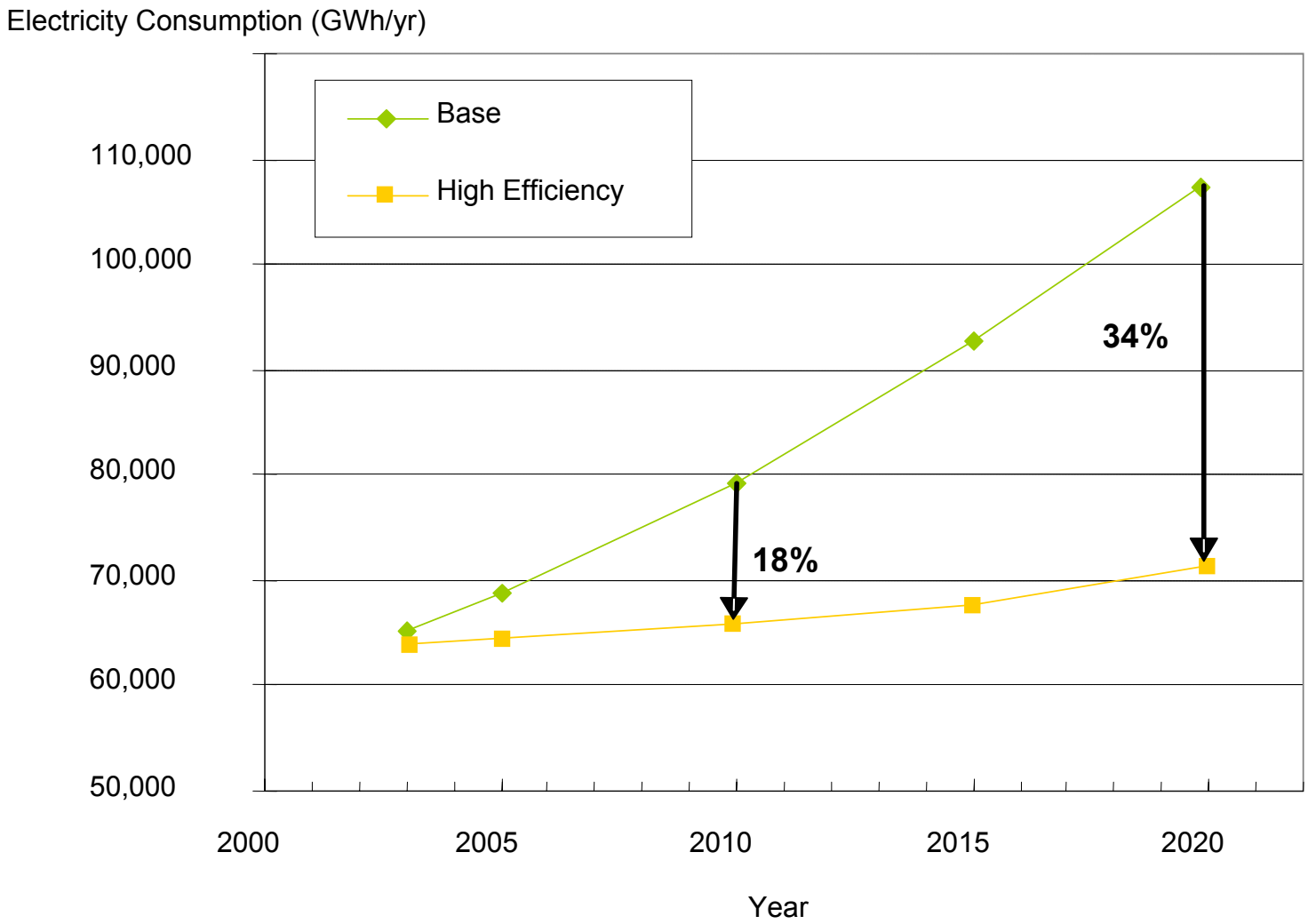
- **Base Scenario**

  Projects growth of electricity use assuming that current policies and trends are maintained, with demand growing 3.0% per year on average between 2003 and 2020.

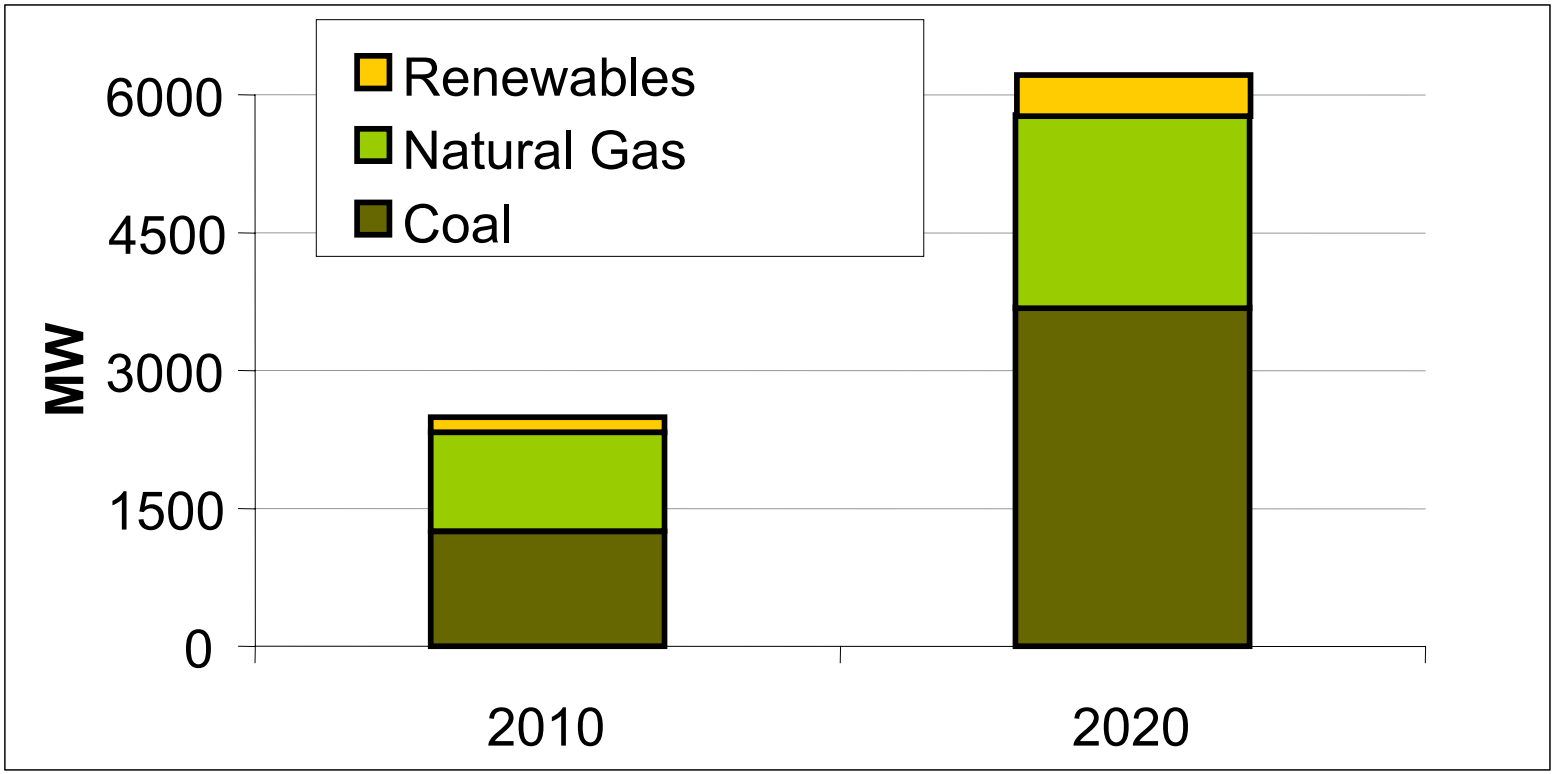
- **High Efficiency Scenario**

  Projects growth of electricity use assuming widespread adoption of cost-effective, commercially-available energy efficiency measures. Demand grows 0.7% per year between 2003 and 2020.

Electricity Consumption & Savings



Avoided New Power Capacity



Benefits of Higher Efficiency

- Electric sector and natural gas benefits:
  - avoided investment in power plants and T&D
  - reduced fuel, operating, and purch. power costs
  - reduced natural gas prices
- Reliability: reduced risk of power outages
- Prices: reduced price volatility, price spikes
- Macroeconomic benefits: jobs, income
- Environmental benefits:
  - reduced water consumption
  - reduced air pollutant and carbon emissions

The High Efficiency Scenario

Costs vs. electric sector and natural gas benefits
(billion $, cumulative during 2003-2020)

Sector	Energy Efficiency Costs	Electric Sector & Gas Benefits	Net Benefits	Benefit-Cost Ratio
Commercial	1.0	6.7	5.7	6.5
Residential	1.5	4.4	2.9	2.9
Industrial	0.7	2.6	1.9	3.8
Total	**3.3**	**13.8**	**10.5**	**4.2**

Savings can be achieved at an average cost of $0.02 per lifetime kWh saved.

The High Efficiency Scenario

Macroeconomic impacts

	Year	Net Change in Jobs	Change in Wage and Salary Compensation (Million $)
Arizona	2010	8,100	$180
	2020	24,100	$550
Region	2010	20,500	$450
	2020	58,400	$1,340

The High Efficiency Scenario

Water savings

	Year	Billion gallons per year	Number of households equivalent (assuming 500 gallons use per day)
Arizona	2010	9.0	49,200
	2020	22.4	122,400
Region	2010	24.7	136,600
	2020	61.6	338,800

The High Efficiency Scenario

Emissions reductions

Pollutant	2010		2020	
	Reductions	% Change	Reductions	% Change
Carbon (MMTCE)	3.3	20	7.6	36
SO_2 (thousand tons)	2.0	4	7.0	11
NO_x (thousand tons)	10.0	6	10.0	11
Mercury (tons)	0.05	6	0.11	12

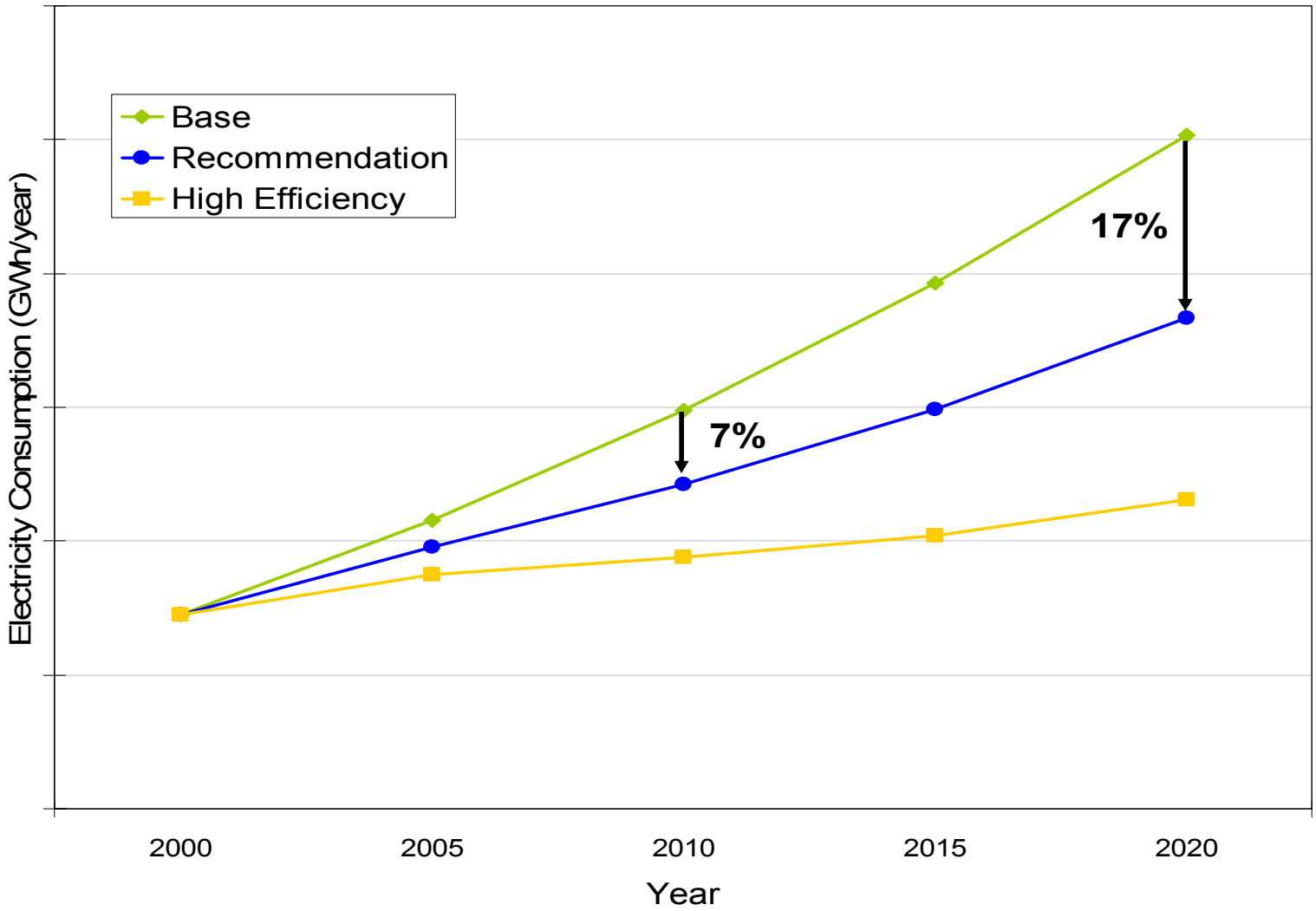
Major Results in Arizona by 2020

- Reduce total electricity consumption by 34% (by 18% by 2010)
- Reduce load growth from 3.0% to 0.7%
- Avoid 6,000 MW of new power capacity
- Save consumers and businesses $10.5 billion (net benefits, or benefits net of costs)
- Increase employment by 24,100 jobs
- Save 22.4 billion gallons of water per year
- Reduce SO_2 and NOx emissions by 11%
- Reduce carbon dioxide emissions by 36%

Key Policy Recommendations

- Adopt an Energy Efficiency Performance Standard and/or Systems Benefit Charge for programs
- Provide utilities/PAs with financial incentives to implement effective energy efficiency programs
- Upgrade building codes, support code implementation, and adopt product standards
- Promote highly efficient new buildings
- Adopt “best practices” in public sector energy management to lead by example
- Adopt utility rate, pricing, and market reforms
- Incorporate in air pollution control strategies

EE Programs Should Save 1% Per Year & Capture at Least Half of the Potential



SWEEP Recommendation for AZ

- Conduct a broad range of energy efficiency programs, with opportunities for all customers to participate in and benefit from programs
- Set goals to reduce electricity use by 1% per year (7% by 2010 and 17% by 2020)
- Capture 1/2 of the full cost-effective energy efficiency potential identified in the SWEEP "New Mother Lode" study by 2020
- Reduce load growth from 3% to less than 2%
- Fund at the level necessary to achieve goals - ~2 mills ($.002/kWh): APS, $48 M; TEP, $18 M

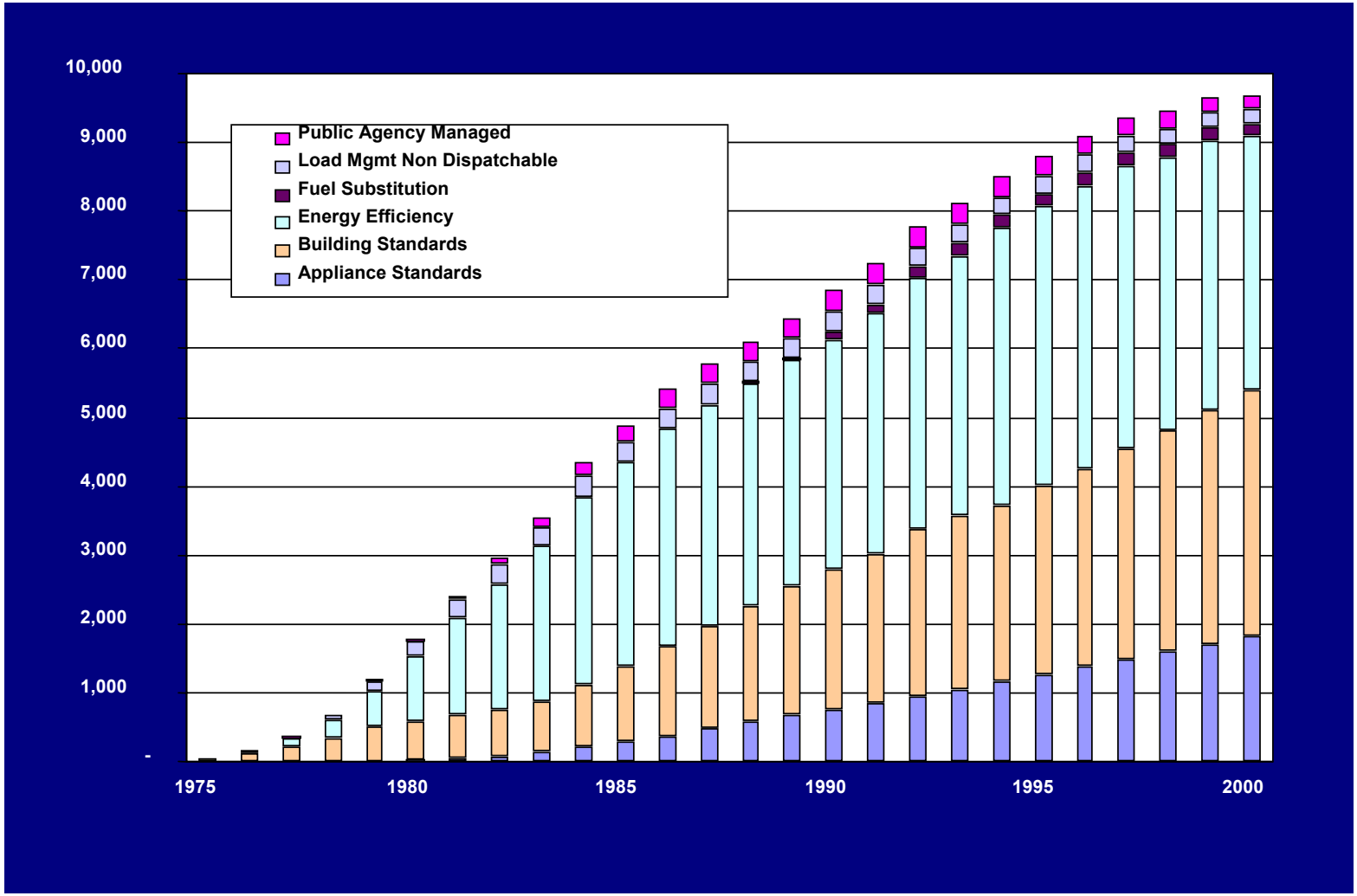
Challenge to Arizona Utilities:

Show us the savings!

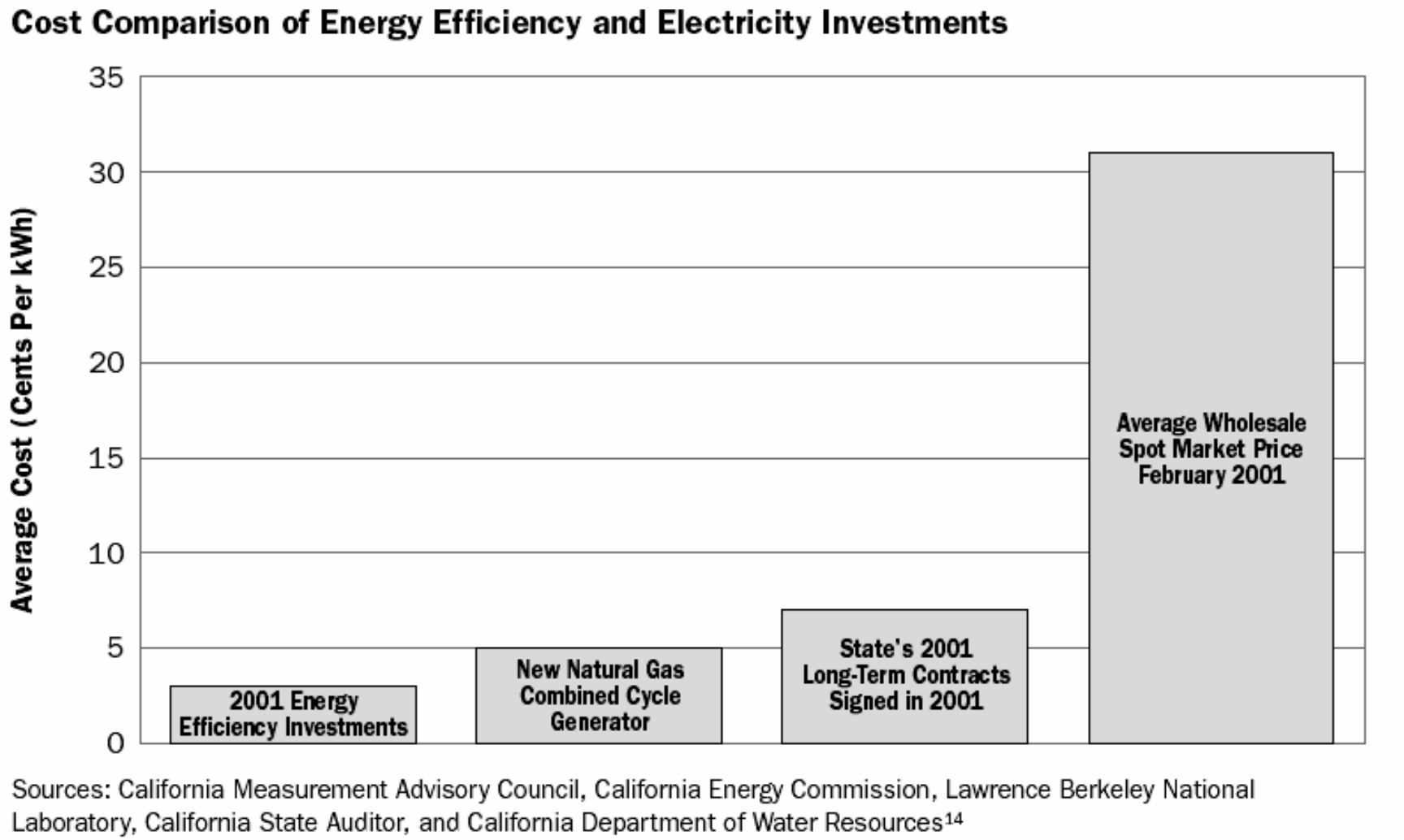
Performance in Other States

- A decade or more of measured savings and costs in New England, CA, PNW
- Connecticut, 2002: $87M on C&LM ($75M utility administered); 99 MW (52 from EE); $.02/lifetime kWh; annual savings equivalent to .83% of retail sales
- National Grid, MA, 2001: $64M on energy efficiency; 37 MW; $.024/lifetime kWh; annual energy savings equivalent to .99% of retail sales

California Peak Load Reductions 1975 – 2000 (MW)

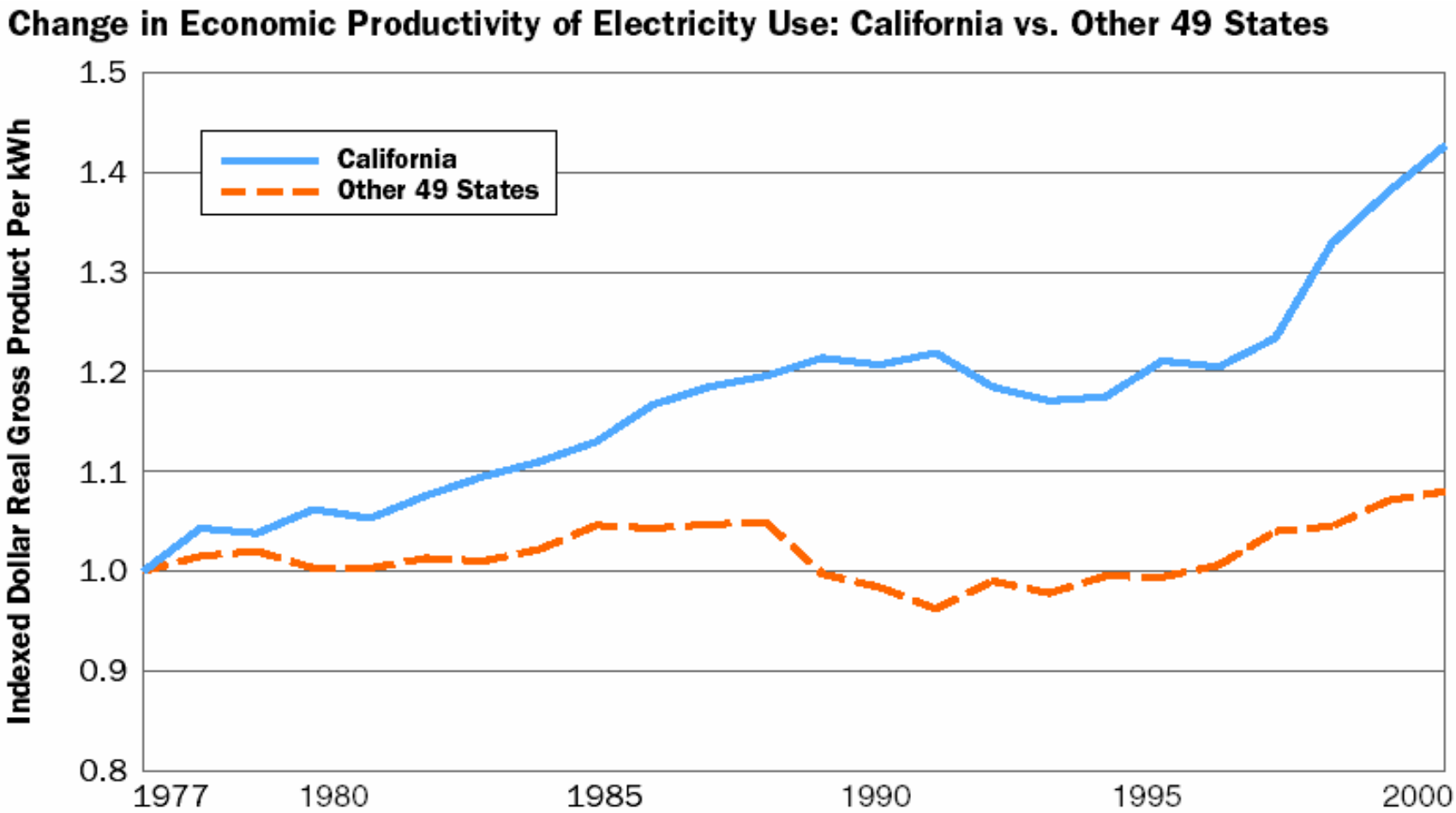


Cost Comparisons for California



From *Energy Efficiency Leadership in California: Preventing the Next Crisis*; Bachrach, Ardema, & Leupp; April 2003

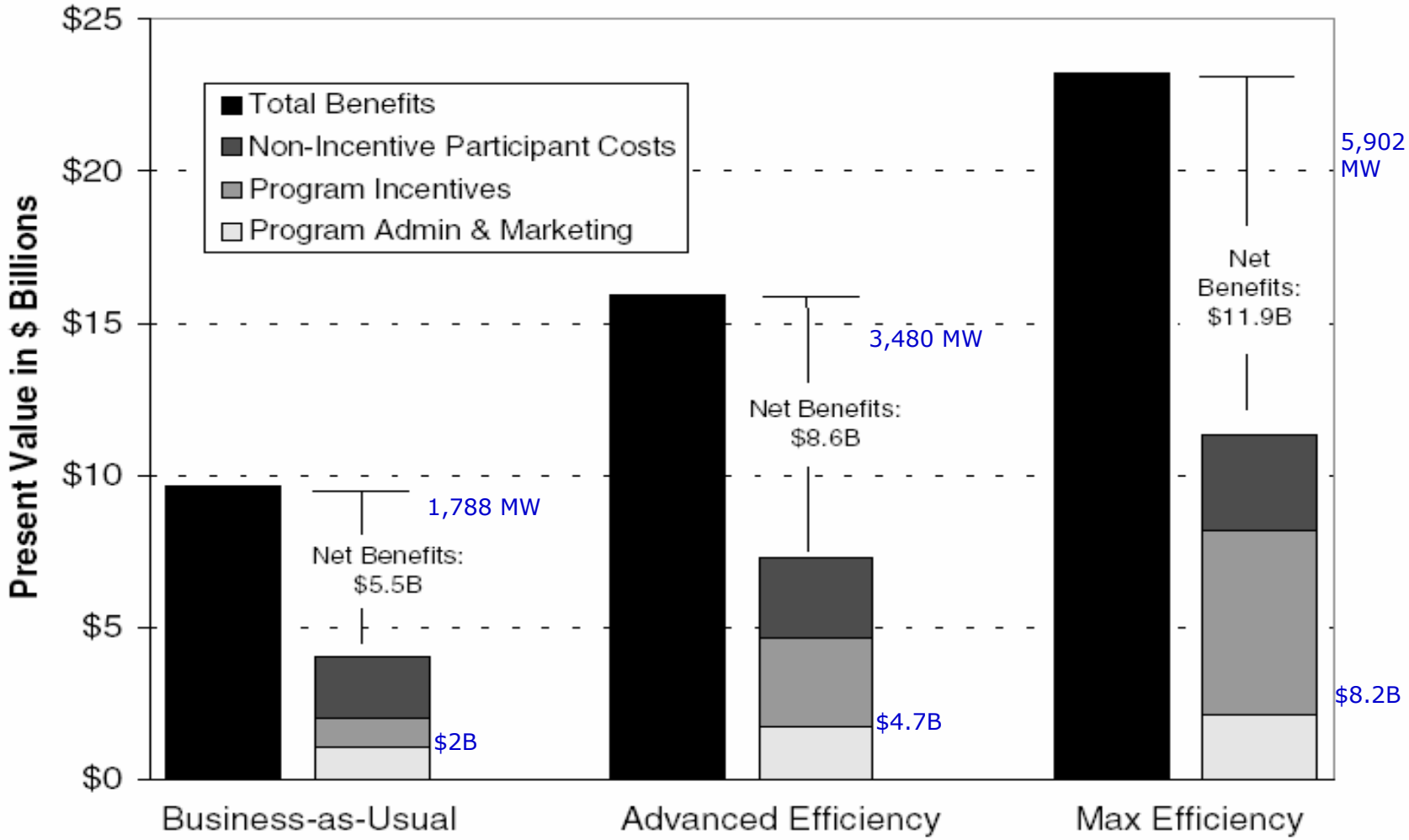
Economic Growth with Less Electricity



Sources: U.S. Bureau of Economic Analysis, U.S. Energy Information Administration, Edison Electric Institute, California Energy Commission

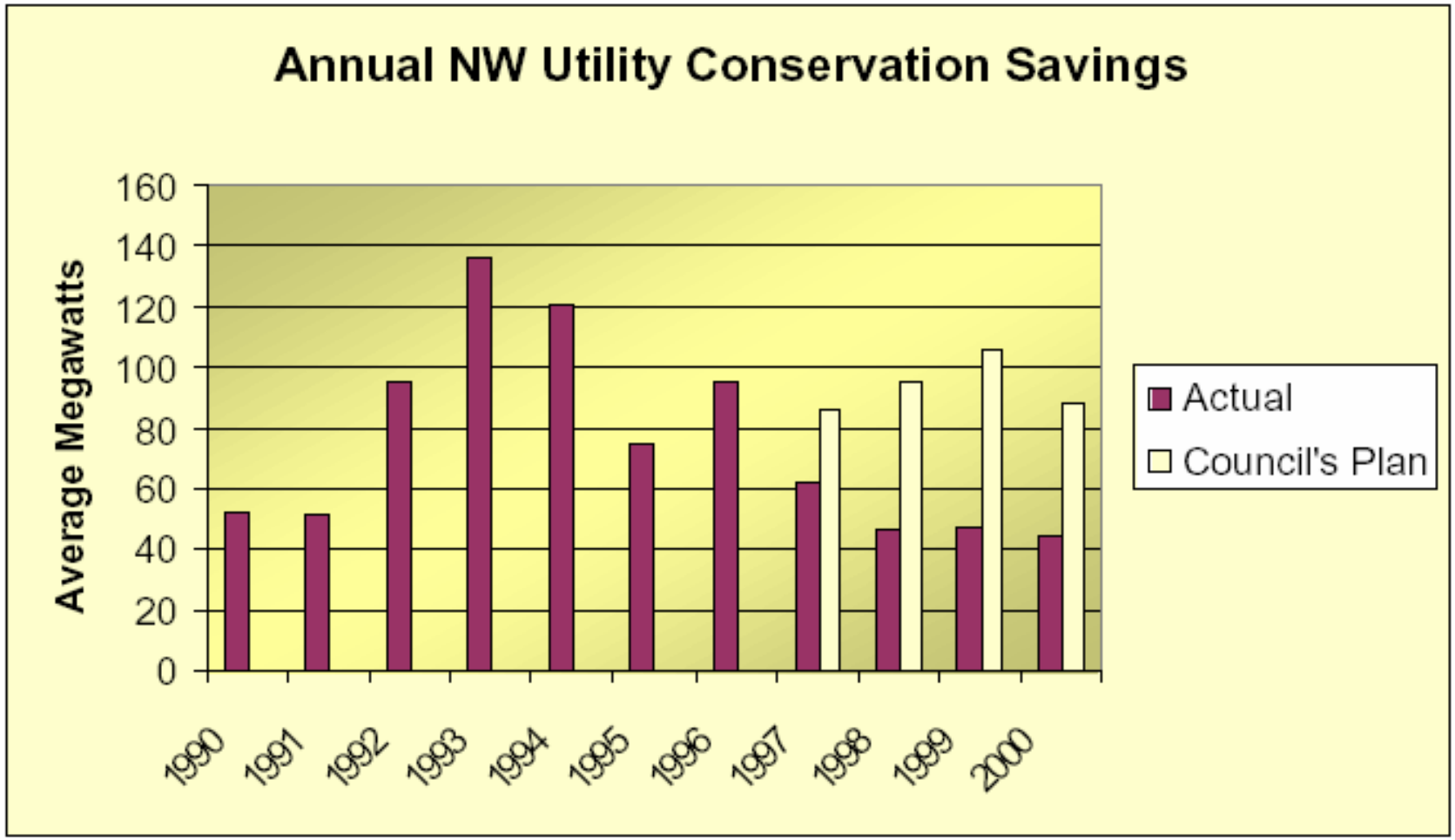
From *Energy Efficiency Leadership in California: Preventing the Next Crisis*; Bachrach, Ardema, & Leupp; April 2003

California Potential, 2002-2011

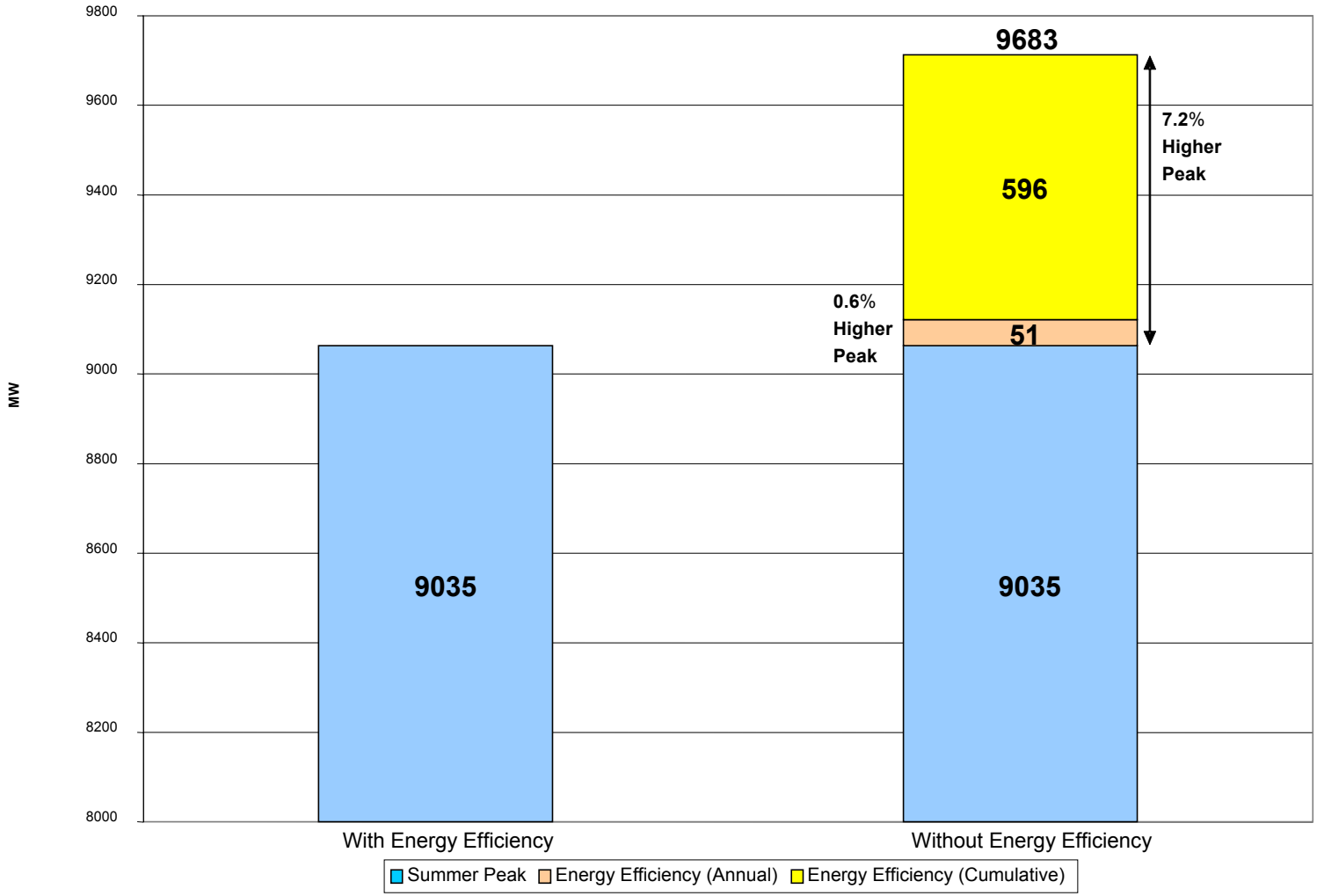


From *California's Secret Surplus: The Potential for Energy Efficiency;* Rufo and Coito; September 2002

Savings in the Pacific Northwest



MA Energy Efficiency Programs: Impact on 2000 Summer Peak



It's not just CA, NW, & New England

- Xcel, Colorado: Committed to achieving 124 MW peak demand reduction through DSM programs during 2001-05; 200 GWh/yr savings by 2005; spending $58 million over 5 years
- PacficCorp, Utah: Planning to spend $12-15 million on DSM in 2003, about $16-20 million in 2004 ($20 million is about 2% of revenues)
- Nevada Power/Sierra Pacific Power: Began spending $11.2 million per year on DSM programs in 2003 (about 0.5% of revenues). Estimated energy savings = 37.5 GWh/yr; estimated peak load reduction = 20 MW per program year (start up expenses in 2003)

It's not just CA, NW, & New England(2)

- Texas Energy Efficiency Performance Standard. EE goal requires that each utility acquire energy efficiency savings equivalent to at least 10% of its growth in demand. Utilities in Texas (both IOUs and municipals) are now spending around $100 million per year.
- Xcel, Minnesota: Well-funded DSM programs for over a decade. Spent $38.5 million on electricity conservation and load management programs in 2002 (2.25% of revenues). Reported energy savings = 266.6 GWh/yr, reported peak demand reduction = 121 MW.
- Ft. Collins, Colorado: Municipal utility set goals of reducing electricity use per capita 10% and peak demand per capita 15% by 2012.

Arizona Examples

- Residential new construction programs
  - System/performance testing HVAC approach
  - Contractor training, coordination with builders
  - Almost 7,000 EnergyStar homes in 2001; 26% of U.S.
  - 17.5 MW (at 2.5 kW savings per home)
  - 70% of SF homes in Tucson are in electric or gas program
  - Adoption of energy efficient building codes
- Commercial DSM programs, 1992-96
  - Lighting, motors, and HVAC
  - TEP: 20 MW and 78 annual GWh total for $6.7 M
- Green and LEED buildings

Principles for Efficiency Programs

- Customer value *and* system value
- Save energy and reduce peak load
- Capture environmental and economic benefits
- Address and reduce key market barriers
- "Market-driven" programs work *with* markets – leverage and build on natural market activity
- Identify key place for market intervention
- Capture lost opportunities in markets
- Given that there will be growth in Arizona, grow efficiently (not inefficiently)
- Increase the efficiency of standard practices
- Address both retrofit and new construction
- Ensure opportunities for all customers

Energy Efficiency Programs

- Commercial and industrial (C&I) construction – new construction, renovation, remodeling, and equipment replacement
- C&I lighting and HVAC systems
- C&I operations and maintenance
- Industrial processes, motors, and pumps
- Residential new construction
- Residential heating and cooling systems
- Residential appliances, lighting, and windows
- Energy efficiency, distributed energy resources (renewables, fuel cells, CH&P, DG), and demand response for load reductions and T&D constraints

Strategies: Tools in the Toolbox

- Promotion and marketing
- Consumer education
- Technical and design assistance
- Financial incentives (including rebates)
- Training for trade allies and vendors
- Coordination/initiatives with market actors in the distribution chain (manufacturers, distributors, retailers, builders, etc.)
- Product/service testing, RD&D
- Feedback on performance, market tracking

Example: C&I New Construction

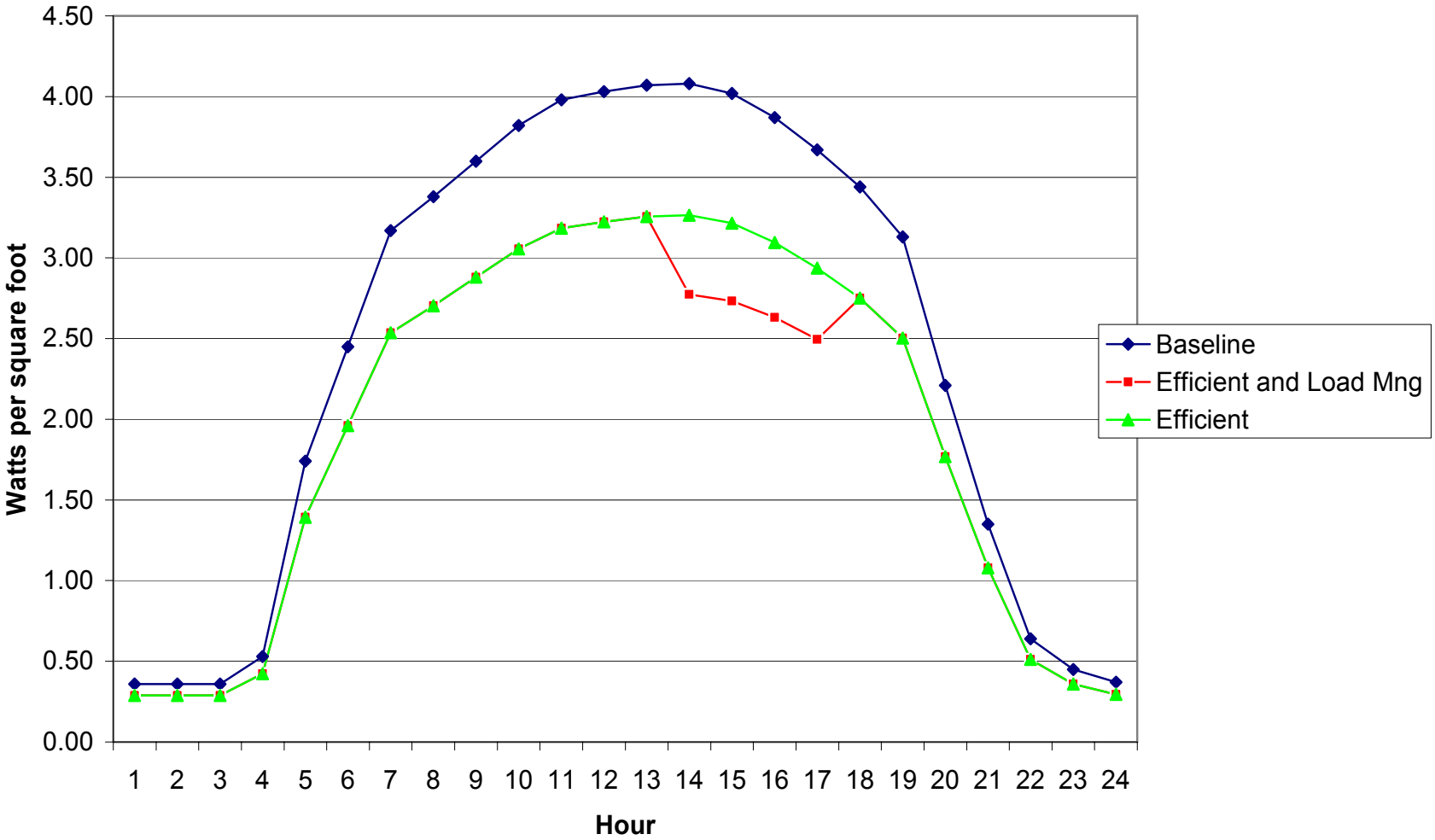
- Lead generation – early intervention
- Education for customers and developers
- Design assistance for design community
- Packaging for comprehensiveness
- Financial incentives
- Commissioning and QA
- Training
- Feedback on performance
- Market share tracking

Example: Financing and Technical Assistance for Schools & Small Businesses

- For customers lacking capital, expertise, and time to capture energy efficiency opportunities
- Vendor program – turnkey delivery, convenience
- Offer positive cash flow financing, with the financing paid off through energy savings
- Put the financing on the customer electricity bill
- Provide technical assistance to customers and referrals to qualified contractors
- Encourage comprehensive treatment of the buildings and facilities
- Offer a similar program for local governments

Energy Efficiency and Load Management

Combined Commercial Cooling and Lighting Loadshape with Efficiency and Load Management (Four-Hour Curtailment by 15%)



Conclusions

- More efficient electricity use can eliminate over two-thirds of load growth during 2003 – 2020
- Utility EE programs should save 1% of use
- Increasing energy efficiency is much more cost-effective than expanding supply and the infrastructure to support central station plants
- Energy efficiency provides consumer, economic, employment, and environmental benefits
- Policies and programs should be adopted to accelerate energy efficiency improvements – for electricity *and* natural gas

SWEEP:

Dedicated to More Efficient Energy Use in the Southwest

Resources available online at:

www.swenergy.org

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