

# Realizing the Potential of Energy Efficiency: Overcoming Barriers

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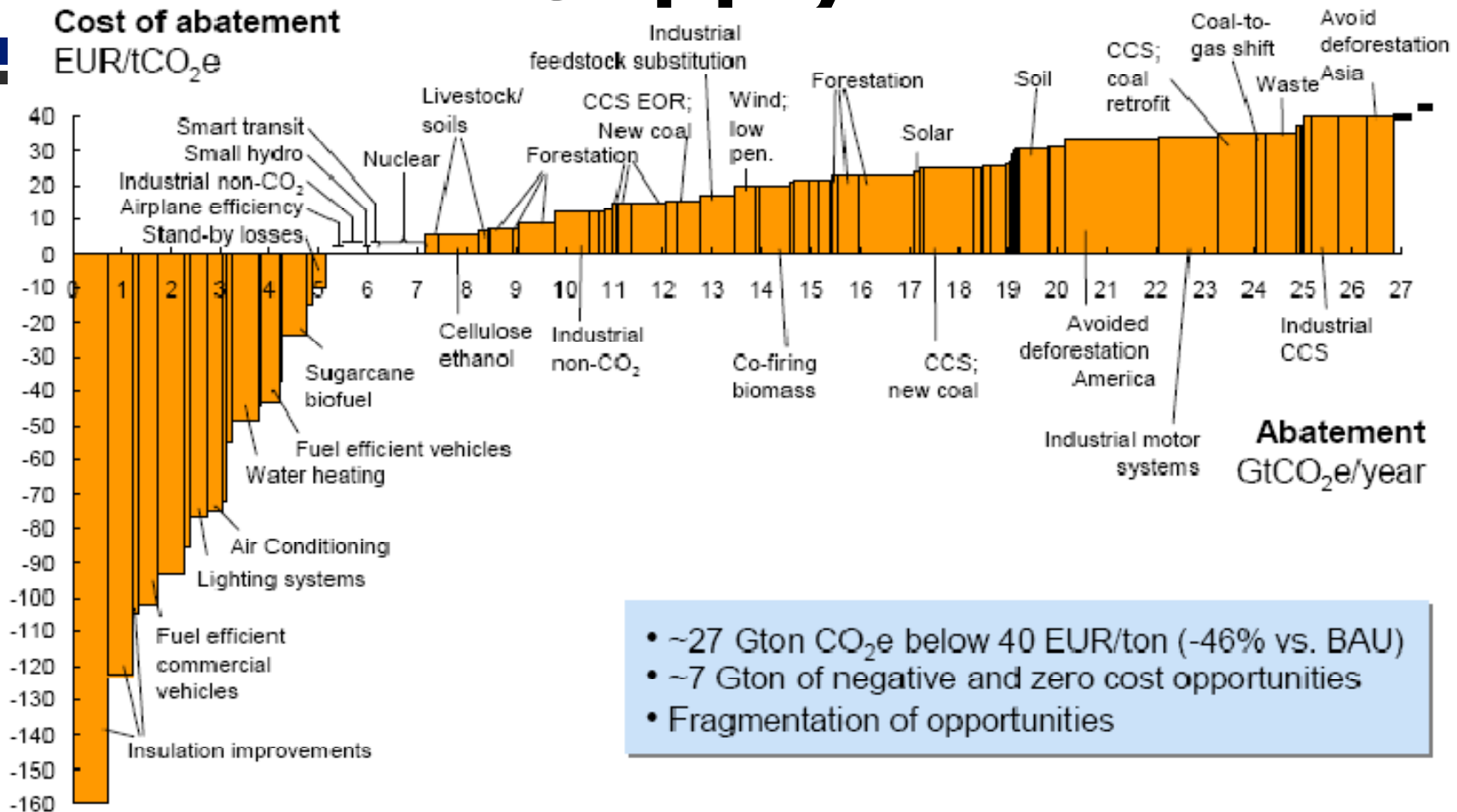
# The American Council for an Energy Efficient Economy (ACEEE)

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- Non-profit organization dedicated to advancing energy efficiency through research, programs and policies.
- Established in 1980
- Work mostly in U.S. but some work in Asia and South America
- Focus on End-Use Efficiency in Industry, Buildings, Utilities, Transportation, & National Policy
- Known for conferences, research reports and as a major contributor to energy-efficiency legislation in the U.S.

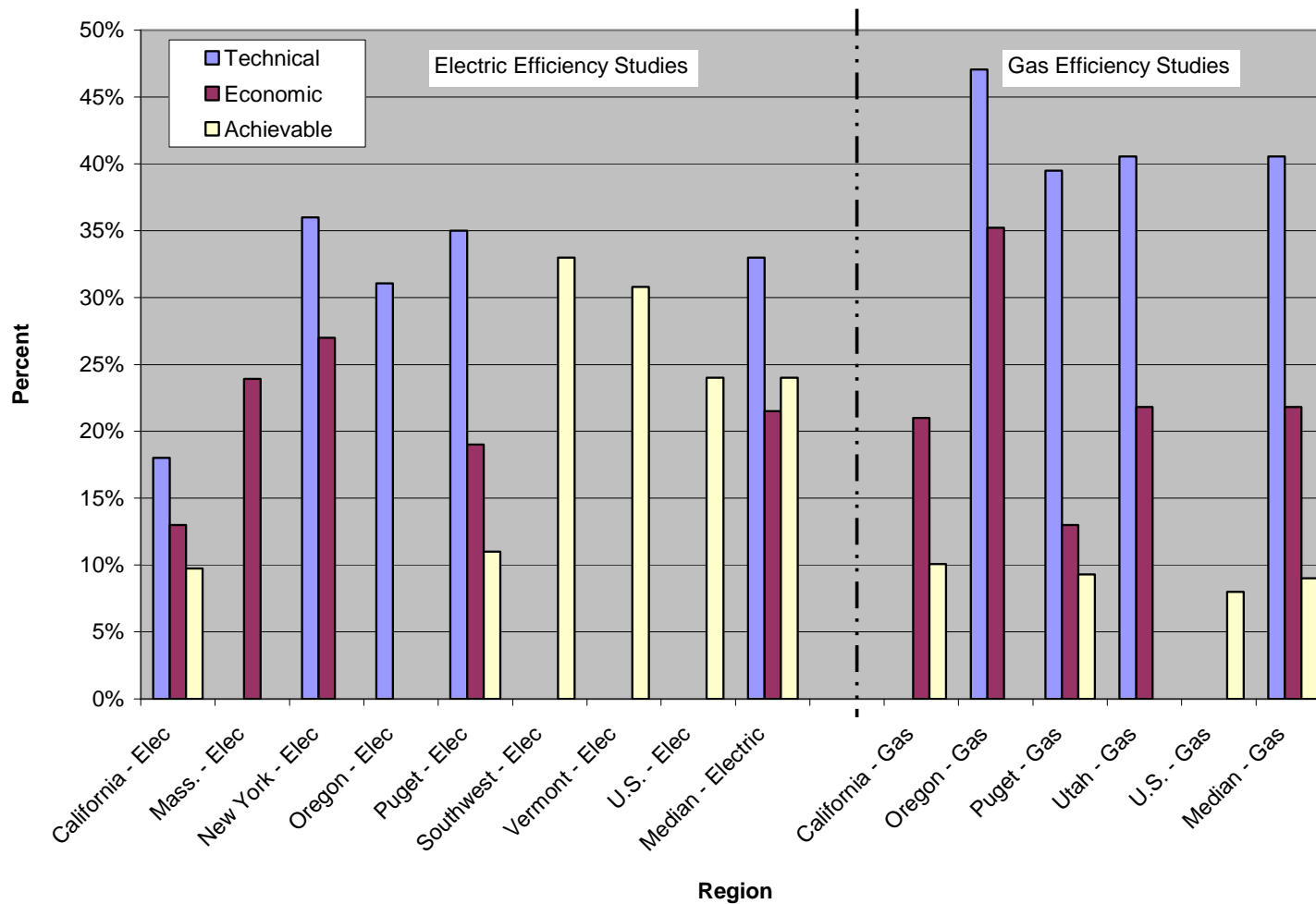


# Efficiency Compared to New Supply

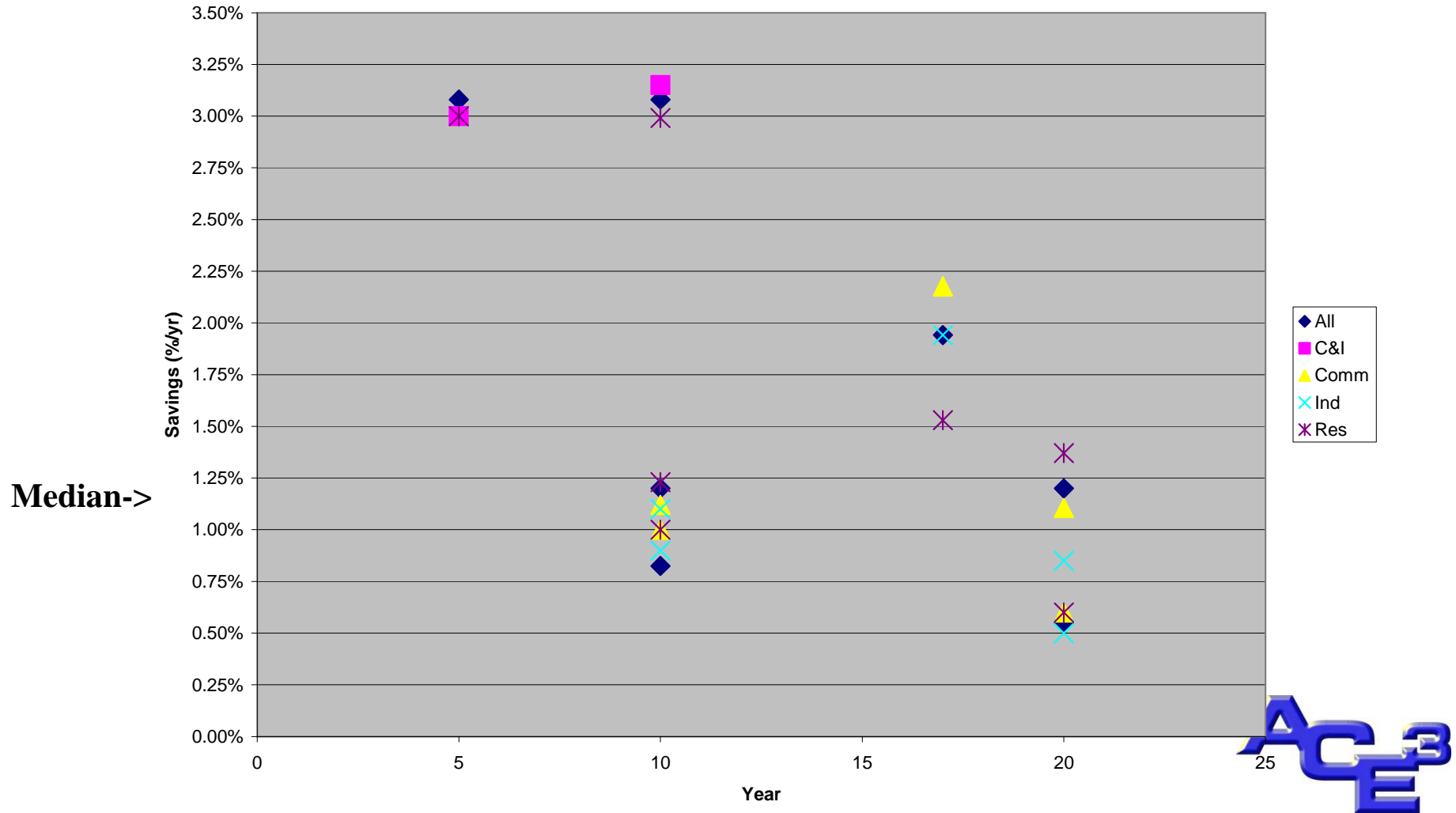


Analysis of CO<sub>2</sub> mitigation options prepared by Vattenfall, 2007.

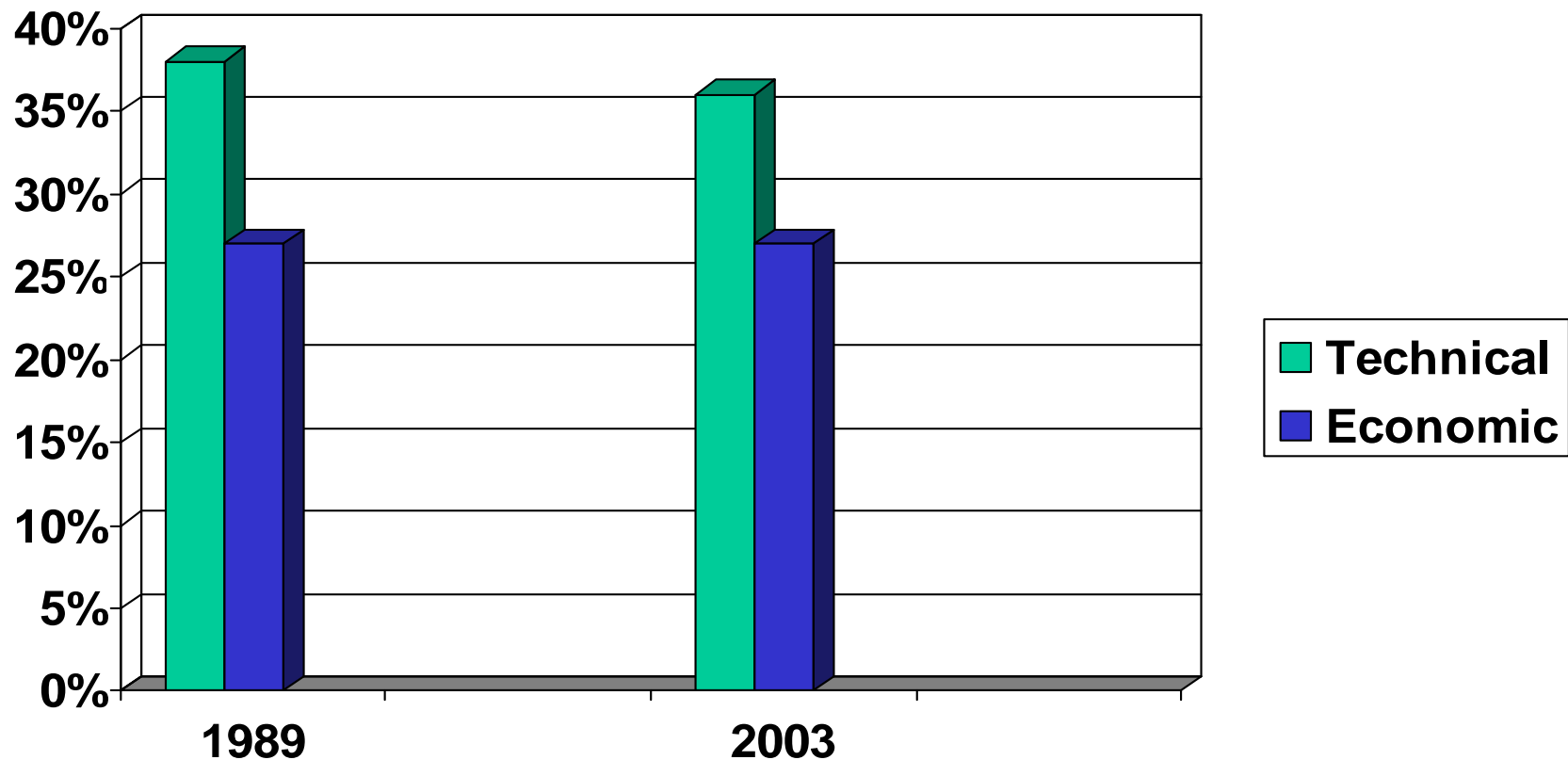
# Summary of the Different Potential Studies



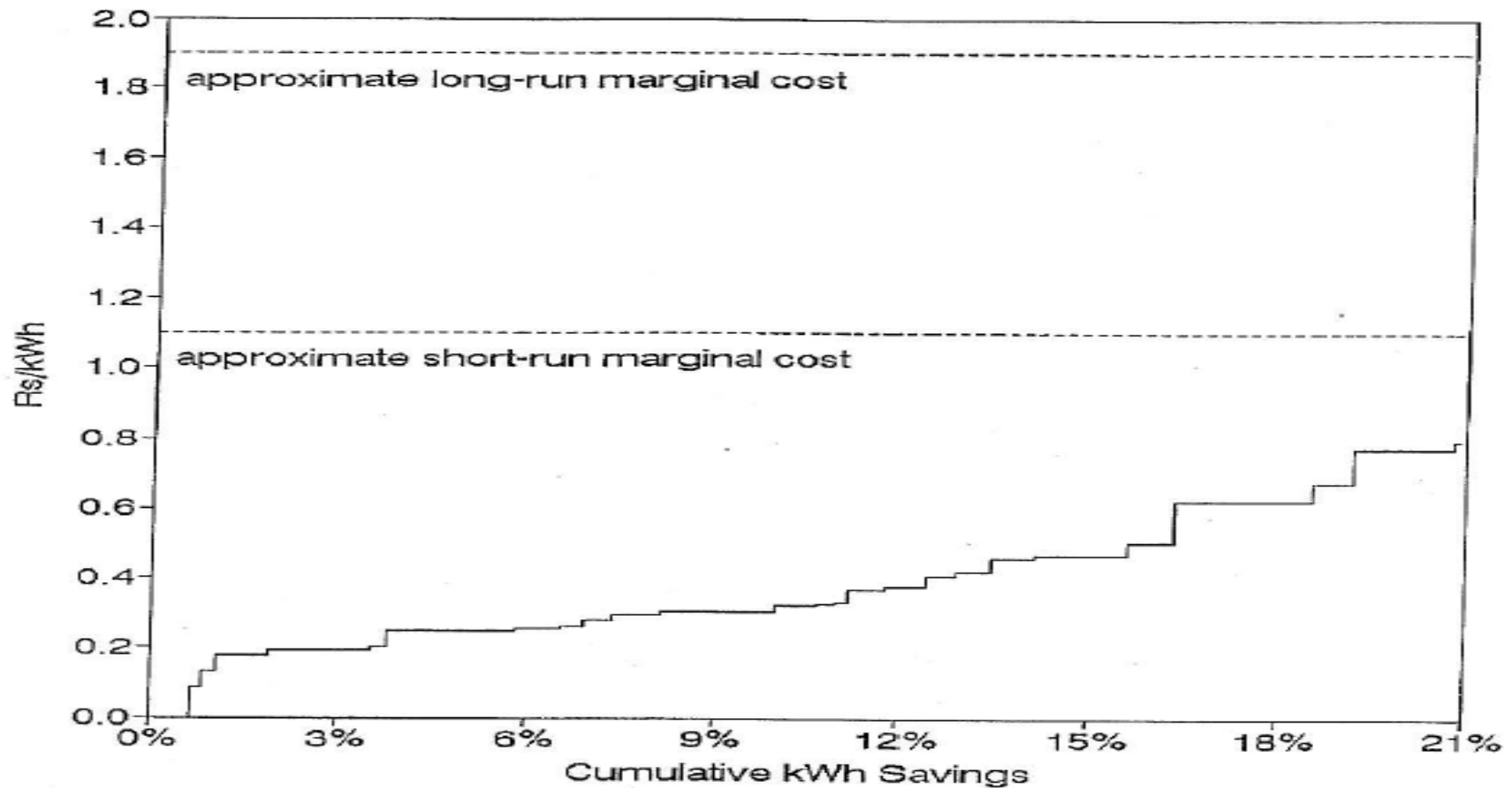
# Achievable Electric Potential/Year



# Comparison of Economic Potential in NYS – 1989 vs. 2003



# Conservation Potential In India



# Electric Efficiency Potential in India

Table 3-8. Measures with the Largest Energy and Demand Savings

Energy savings:	Savings as a % of 2004/05 Projected GWh Sales
Variable speed drives	2.22%
Motor rewinding, etc.	2.04%
High effic. new pumpsets	1.81%
Incand. to fluor. fixture	1.64%
Agrig pumpset rectification	1.59%
Electronic Ballast	1.49%
Meter agricultural pumpsets	0.80%
High efficiency motors	0.77%
Two-speed motors	0.76%
High effic. refrigerator	0.73%
Improved aluminum smelters	0.67%
TLD lamp	0.66%
Compact fluorescent lamp	0.66%
Moderate effic. refrig.	0.65%
Optimize industrial pumps	0.62%





# Barriers to Energy Efficiency Investments

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- Split incentives (landlords, builders, etc.)
- Lack of awareness/familiarity
  - Consumers
  - Suppliers and contractors
- Limited production, stocking, infrastructure
  - Particularly a problem with “panic purchases”
- High initial cost
  - Often packaged with extra “bells and whistles”
  - Extra mark-ups frequently added
  - Seek to recover development and marketing costs
- Reluctance to use an unproven technology; distrust of claims
- Reluctance to change established practices



# Policies to Address Barriers and Increase Energy Efficiency

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- Vehicle fuel economy standards
- Appliance and equipment standards
- Building codes
- Utility energy efficiency programs and savings targets
- Industrial requirements and technical assistance
- Combined heat and power systems
- Research, development & demonstration



# Vehicle Fuel Economy Requirements

Fuel efficiency standards for passenger vehicles (in miles per gallon)

France	By 2012	48.9	
Germany	By 2012	48.9	
Italy	By 2012	48.9	
United Kingdom	By 2012	48.9	
Japan	By 2015	46.9	
China	By 2009	35.8	
<b>United States</b>	<b>By 2020</b>	<b>35.0</b>	<b>(if bill passes)</b>
Australia	By 2010	34.4	
Canada	By 2010	34.1	
South Korea	By 2012	30.6	
<b>United States</b>	<b>Current standard</b>	<b>25.0</b>	

# Equipment Standards in the U.S.

## NAECA 1987

Refrigerator-freezers  
Freezers  
Room air conditioners  
Central AC & heat pumps  
Furnaces & boilers  
Water heaters  
Clothes washers  
Clothes dryers  
Dishwashers  
Ranges & ovens  
Direct-fired space heaters  
Pool heaters  
Fluorescent lamp ballasts

## EPAct 1992

Fluorescent lamps  
Incandescent reflector lamps  
Electric motors (1-200 hp)  
Commercial AC & HP  
Comm'l furnaces/boilers  
Comm'l water heaters  
Showerheads  
Faucet aerators  
Toilets  
Small electric motors\*

## EPAct 2005

Ceiling fan light kits  
Dehumidifiers  
Compact fluorescent lamps  
Torchiere lighting fixtures  
Large comm'l AC & HP  
Comm'l clothes washers  
Distribution transformers  
Exit signs  
Comm'l ice makers  
Comm'l refrigerators/freezers  
Mercury vapor lamp ballasts  
Traffic signals  
Pre-rinse spray valves  
Comm'l unit heaters  
Battery chargers\*  
Large comm'l refrigeration\*

## EISA 2007

Incandescent lamps  
Additional motors (e.g. large)  
Walk-in coolers and freezers  
Metal halide lighting fixtures  
External power supplies  
Furnace fans\*

\* DOE rulemakings. Only include rulemakings that are underway or completed.

Total of 51 products



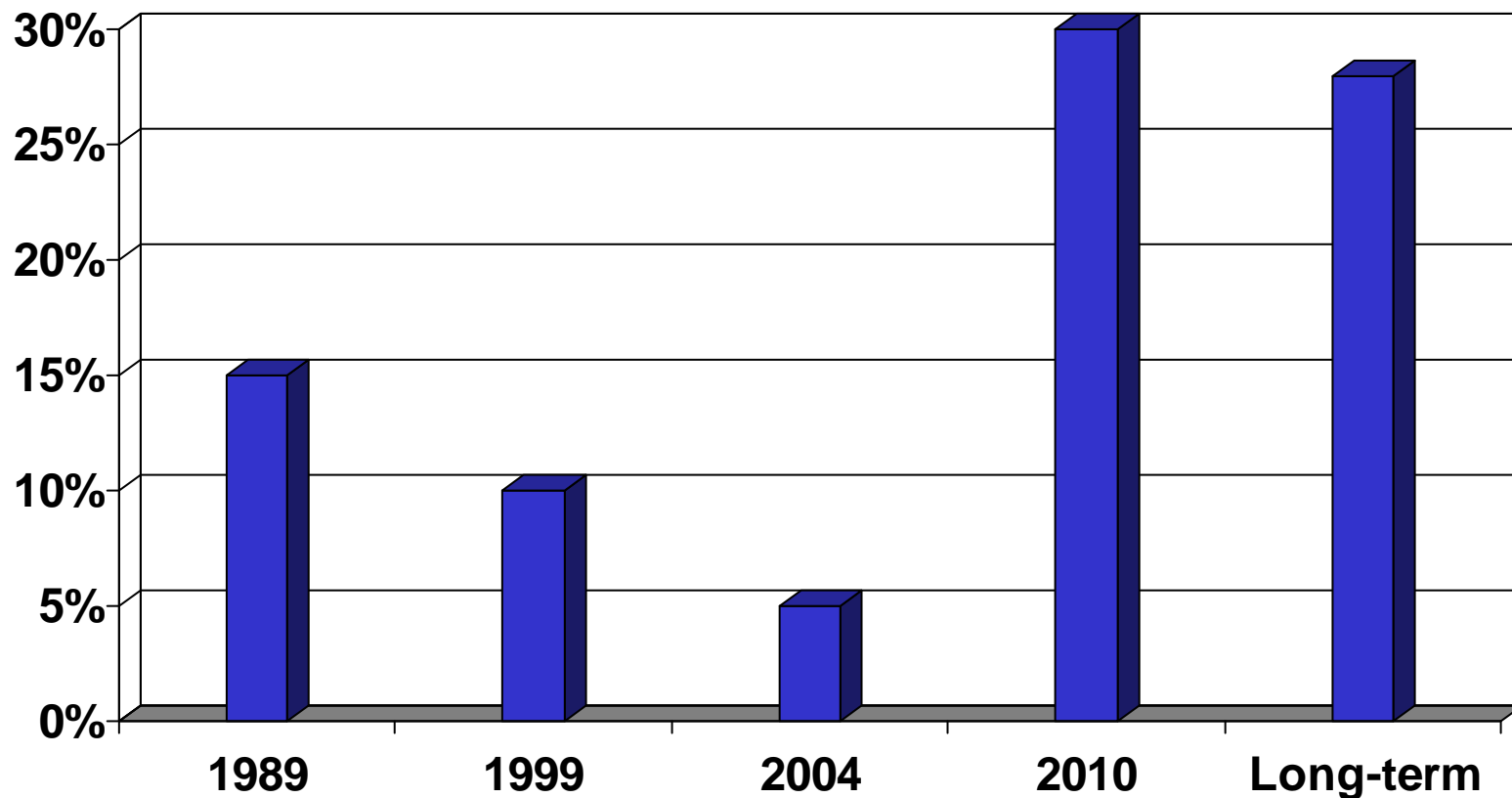
# Energy, Economic and Emissions Savings from U.S. Standards

Enact Year	Standards	Electricity savings (TWh/yr)			Primary energy savings (Quads/yr)			Peak load reductions (GW)			Carbon Reductions (MMT)			Net Benefit (\$Billion) Thru 2030
		2000	2010	2020	2000	2010	2020	2000	2010	2020	2000	2010	2020	
1987	NAECA	8.0	40.9	45.2	0.21	0.55	0.61	1.4	14.9	16.5	3.7	10.0	10.1	46.3
1988	Ballasts	18.0	22.8	25.2	0.21	0.27	0.29	5.7	7.1	7.9	4.4	5.0	5.0	8.9
1989&91	NAECA updates	20.0	37.1	41.0	0.23	0.43	0.47	3.6	6.9	7.7	4.8	8.1	8.1	15.2
1992	EPAAct (lamps, motors, etc)	42.0	110.3	121.9	0.59	1.51	1.67	10.1	26.2	28.9	11.8	27.5	27.9	84.2
1997	Refrigerator/freezer update	0.0	13.3	28.0	0.00	0.13	0.28	0.0	1.7	3.6	0.0	2.9	5.5	5.9
1997	Room Air Conditioner update	0.0	1.3	2.1	0.00	0.01	0.02	0.0	1.0	1.6	0.0	0.3	0.4	0.6
2000	Ballasts update	0.0	6.2	13.7	0.00	0.06	0.13	0.0	1.8	3.0	0.0	1.3	2.7	2.6
2001	Clothes Washer Update	0.0	8.0	22.6	0.00	0.11	0.28	0.0	1.3	6.1	0.0	2.2	5.4	15.3
2001	Water heater update	0.0	2.5	4.9	0.00	0.08	0.13	0.0	1.5	3.6	0.0	1.4	2.2	2.0
2001	Central AC&HP update	0.0	10.7	36.4	0.00	0.11	0.35	0.0	3.5	41.5	0.0	2.3	7.2	5.0
2005	EPAAct 2005	0.0	14.7	53.0	0.00	0.21	0.65	0.0	5.8	23.9	0.0	3.7	11.5	47.5
<b>TOTAL</b>		<b>88</b>	<b>268</b>	<b>394</b>	<b>1.2</b>	<b>3.5</b>	<b>4.9</b>	<b>21</b>	<b>72</b>	<b>144</b>	<b>25</b>	<b>65</b>	<b>86</b>	<b>234</b>
<b>% of projected U.S. use</b>		<b>2.5%</b>	<b>6.9%</b>	<b>9.1%</b>	<b>1.3%</b>	<b>3.1%</b>	<b>4.0%</b>	<b>2.8%</b>	<b>8.3%</b>	<b>15.1%</b>	<b>1.7%</b>	<b>3.6%</b>	<b>4.4%</b>	

Source: ACEEE, "Leading the Way", 2006



# Commercial Building Codes in U.S. (~% savings relative to prior code)



# Annual Utility Electricity Saving Targets in the U.S.

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<u>State</u>	<u>Target</u>	<u>Notes</u>
California	6.00%	Actual savings in 2001 (2/3 behavioral)
Illinois	2.00%	After 7 year ramp-up; subject to cost caps
New York	1.88%	15% by 2015; includes standards & codes
Vermont	1.75%	Approved plan for 2007-2008
New Jersey	1.54%	Legislation authorizes target of 20% in 2020
Minnesota	1.50%	2007 legislation; includes standards & code
Connecticut	~1.25%	C/I target of 1%, plus residential from PBF
California	1.40%	1st half of 2007, annualized
California	1.00%	10 year target; includes some codes & stds.

Also targets in U.K., Italy, France



# Industrial Policies

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- Industry a major energy consumer in most countries
- Should be able to improve energy productivity 2-3% per year
- Countries have used a variety of policies:
  - Energy management laws
  - Voluntary (and not so voluntary) targets
  - Tax incentives, grants





# Combined Heat & Power

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- In Denmark ~50% of power comes from CHP
- A result of 2-3 decades of persistent government and local policies
  - District heating networks
  - Government policies to address oil imports, expand the natural gas network, reduce greenhouse gas emissions
  - Economic incentives in taxes, subsidies, gas prices and electricity tariffs



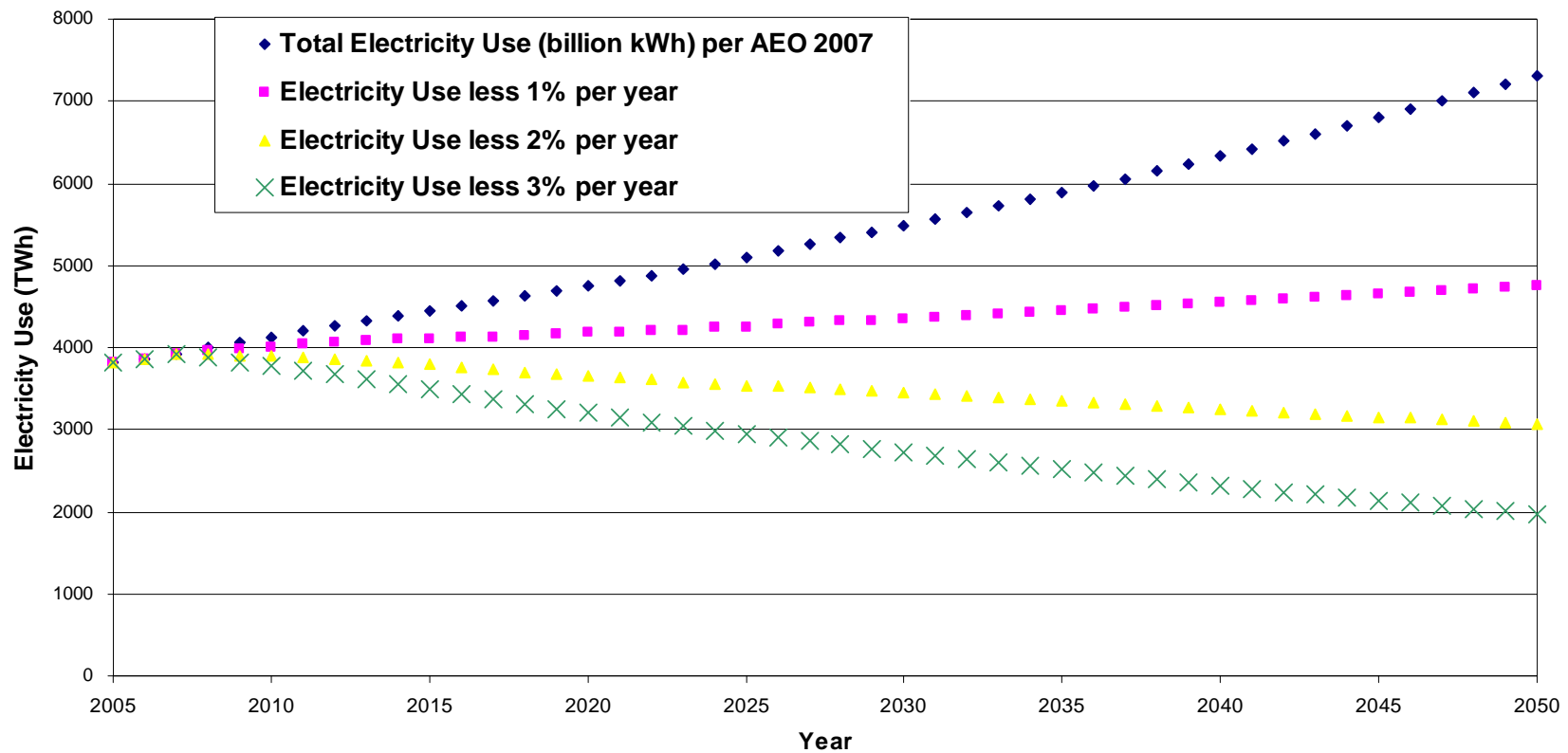
# Research, Development & Demonstration

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- President's Committee of Advisors on Science and Technology (U.S., 1997):
  - Past R&D expenditures have been very cost-effective and contributed to substantial energy savings.
  - Recommend that U.S. should double R&D expenditures, ramped in over a 5-year period
  - Estimate these investments can result in energy savings of 4-10 million barrels/day of oil equivalent by 2030



# Electricity Use as a Function of Annual Savings Rate



# Conclusions

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- Large opportunity for cost-effective energy savings
- Many barriers stand in the way
- A variety of policies can address these barriers and reduce use at least 1.5% per year (in the U.S.).
- To address global warming, even greater savings would be useful.

