

Seminar

NEW POLICY FOR NEW WEATHER
A SUSTAINABLE ENERGY UTILITY

DOE/EERE

Office of Planning, Budget, and Analysis

NREL

Strategic Energy Analysis and Applications Center

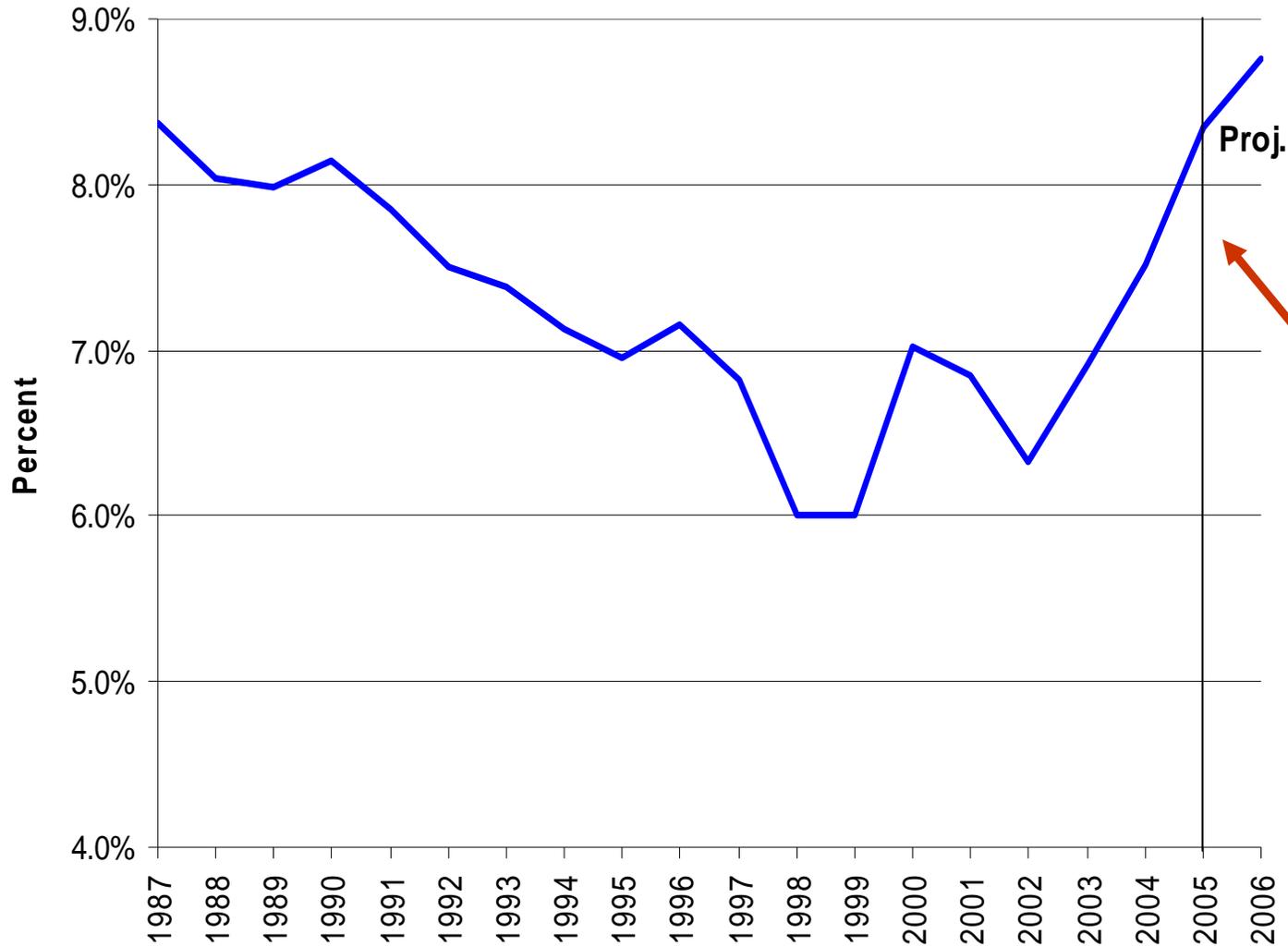
John Byrne

Center for Energy and Environmental Policy

University of Delaware

November 8, 2007

Energy Expenditures as % of US GDP



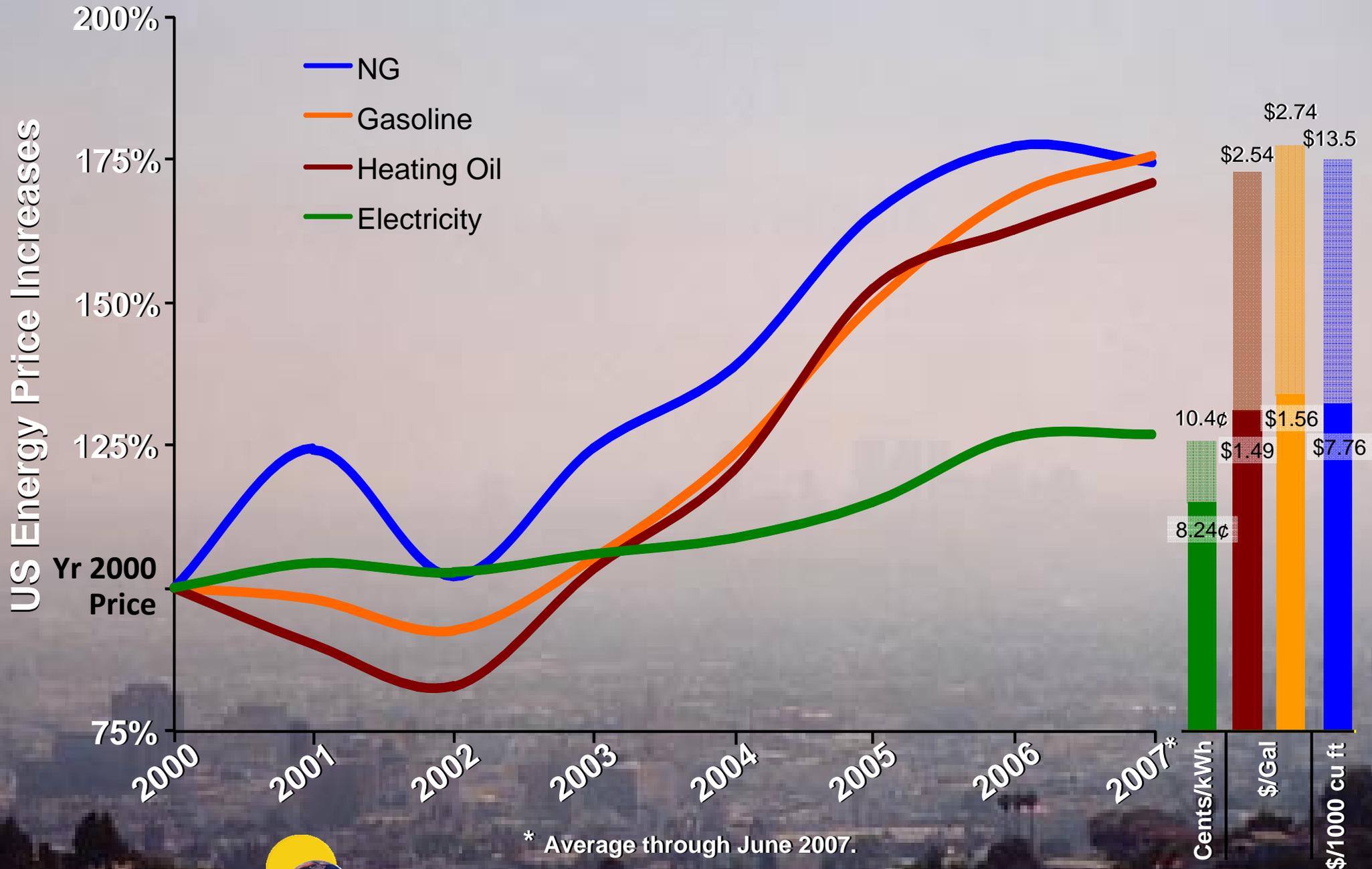
Source: EIA Annual Energy Outlook, February 2007

**8.8% of
GDP (est.)
in 2006**

**Highest
since 1987
[6.2% in
2002]**



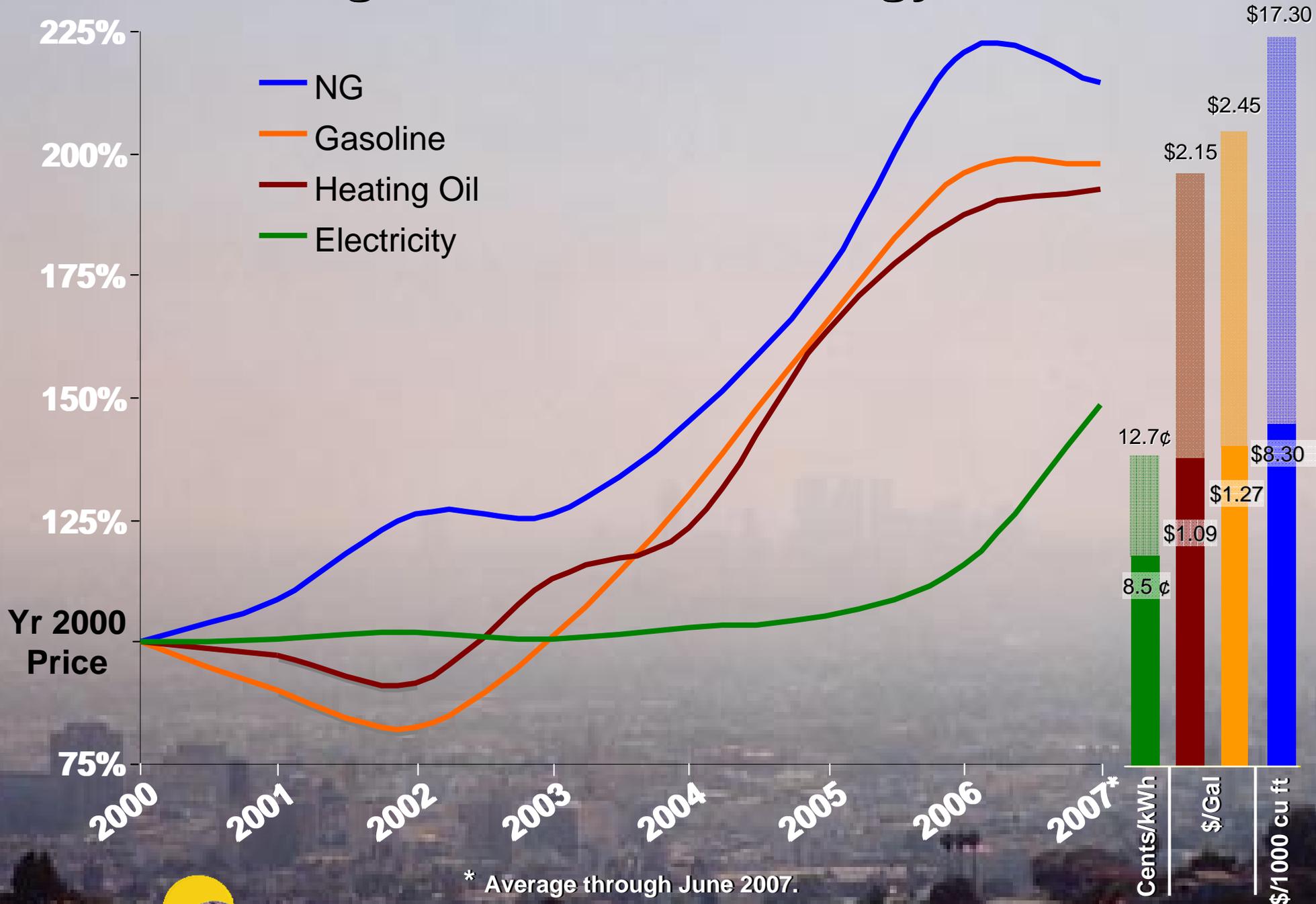
Climbing Conventional Energy Prices



* Average through June 2007.



Climbing Conventional Energy Prices

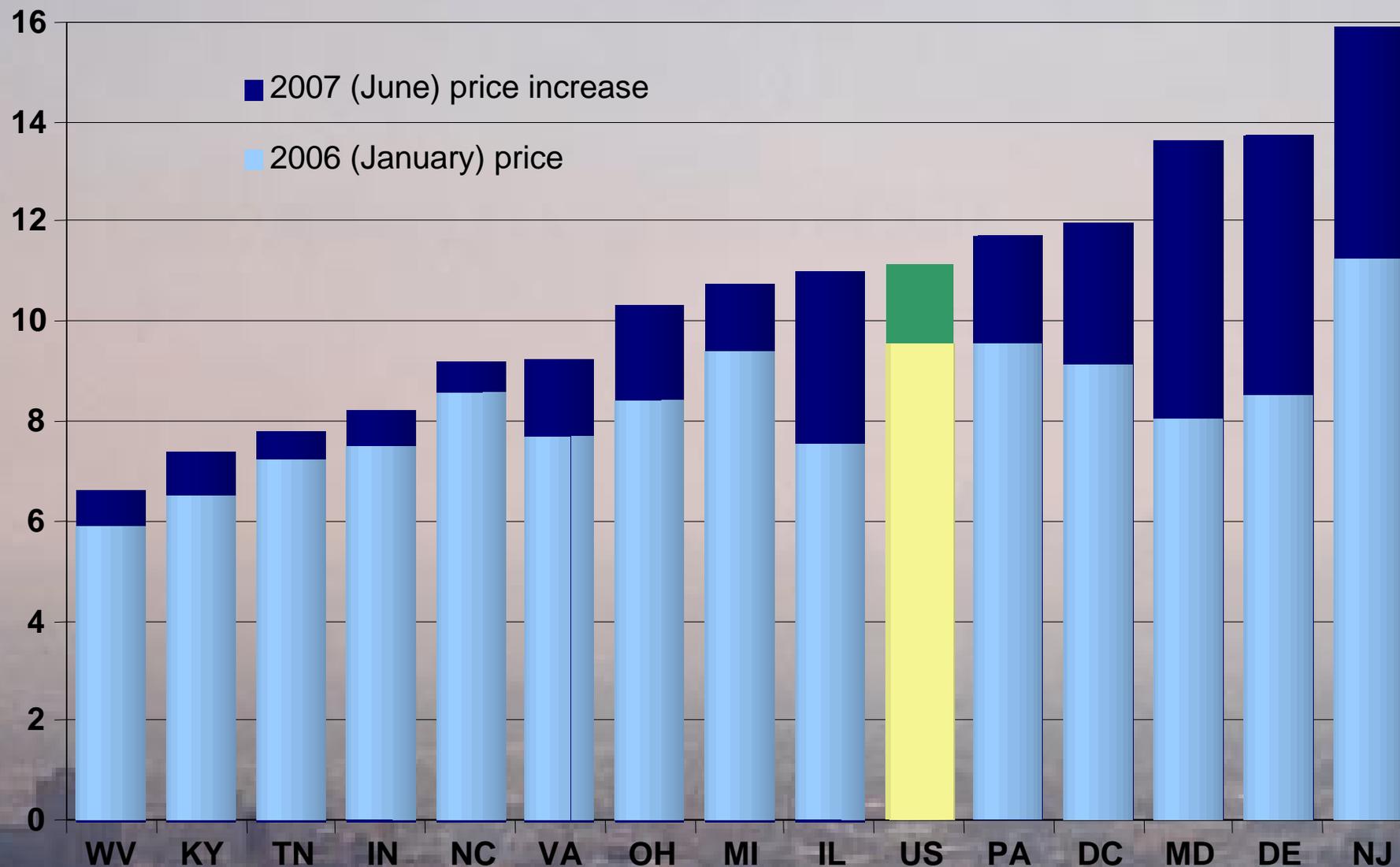


* Average through June 2007.



PJM Region

Residential Electricity Prices: Jan 2006 - July 2007

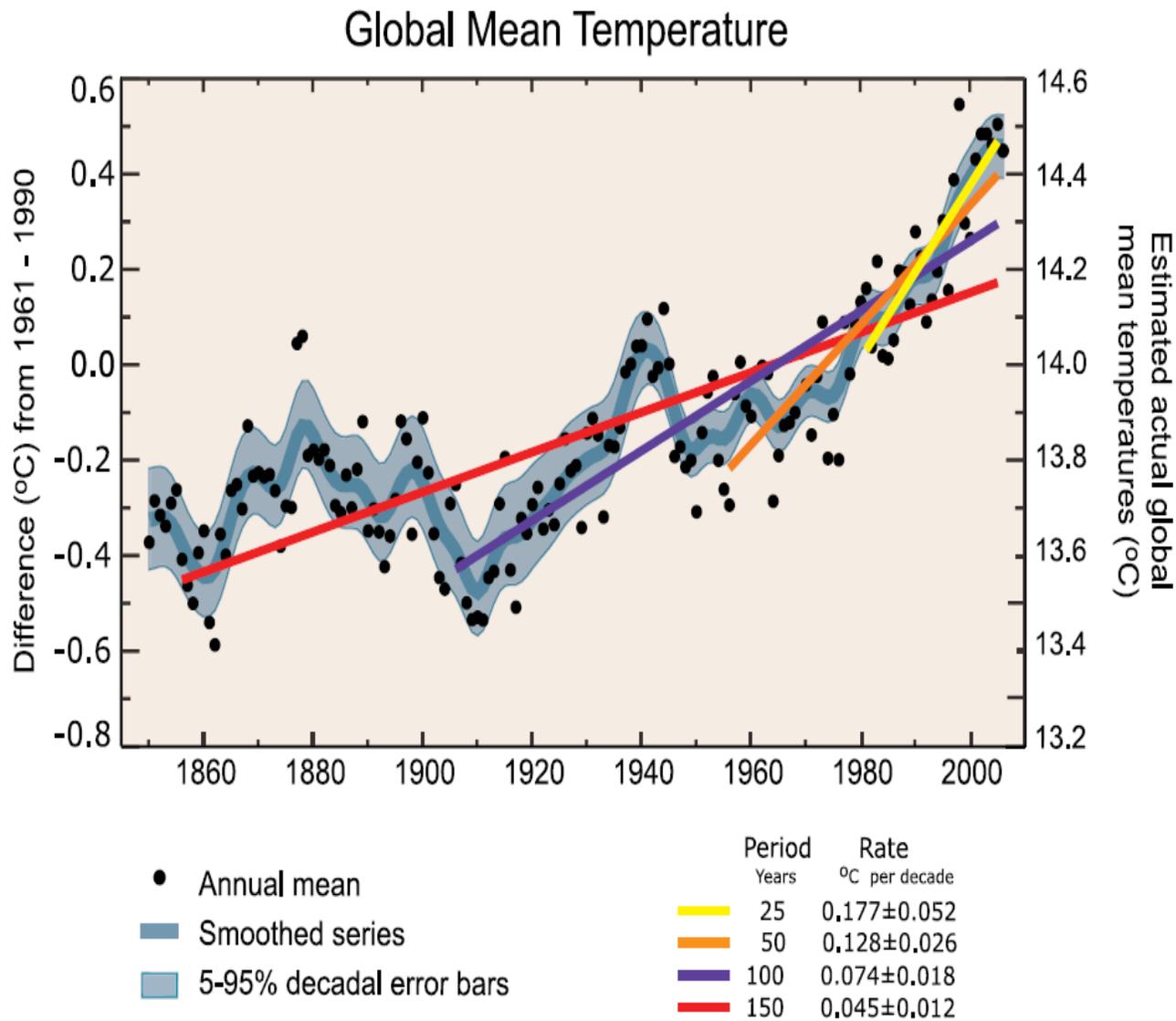


Source: EIA 2007. Average Price by State by Provider (EIA-861)



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Global Warming



- ◆ According to the 2007 IPCC report, mean global surface temperature has increased by 0.74°C over the last 100 years (1906-2005)
- ◆ 11 of the warmest years on record occurred during the past 12 yrs

Needed GHG Emissions Reductions to Stabilize Atmospheric Concentrations at Current Levels

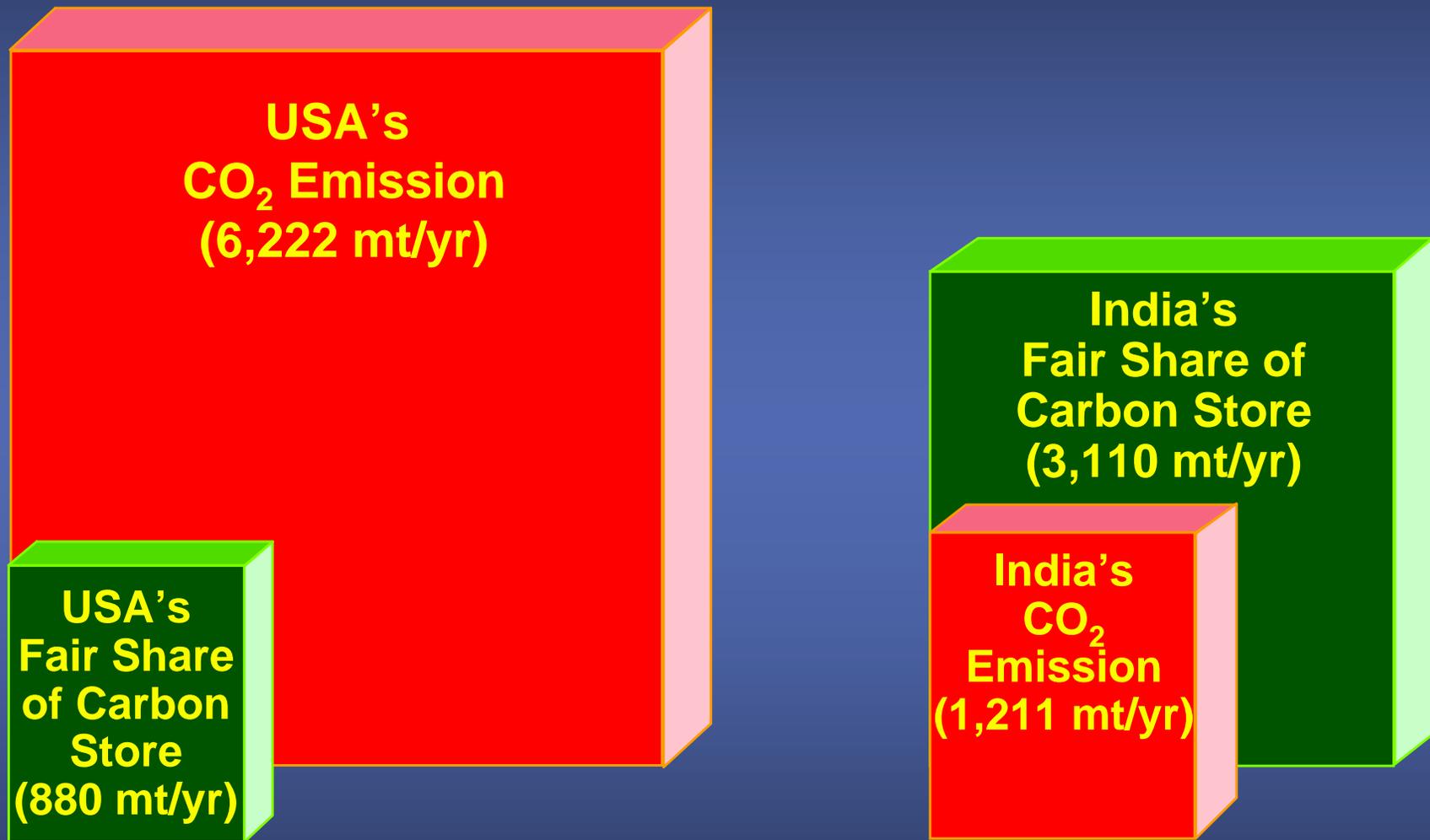
Carbon dioxide	> 60%
Methane	8 - 20%
Nitrous oxide	70 - 80%
CFC 11	70 - 75%
CFC 12	75 - 85%
HCFC 22	40 - 50%

Source: IPCC Second & Third Assessment Reports



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Actual CO₂ Emissions vs. Sustainable and Equitable Share of Carbon Store



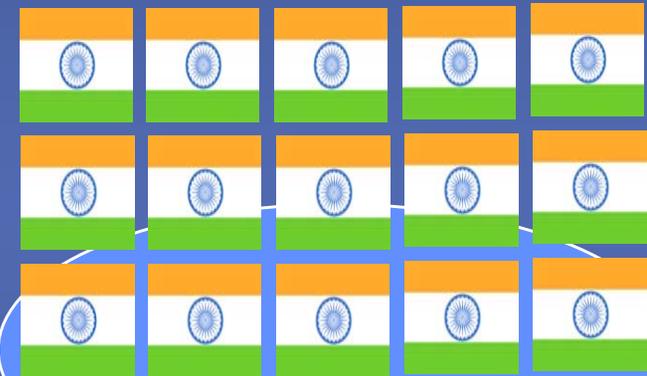
Sources: EIA (2006); BP Statistical Review of World Energy (2006).



Inequality of Use of the Carbon Store

1 American

19 Indians



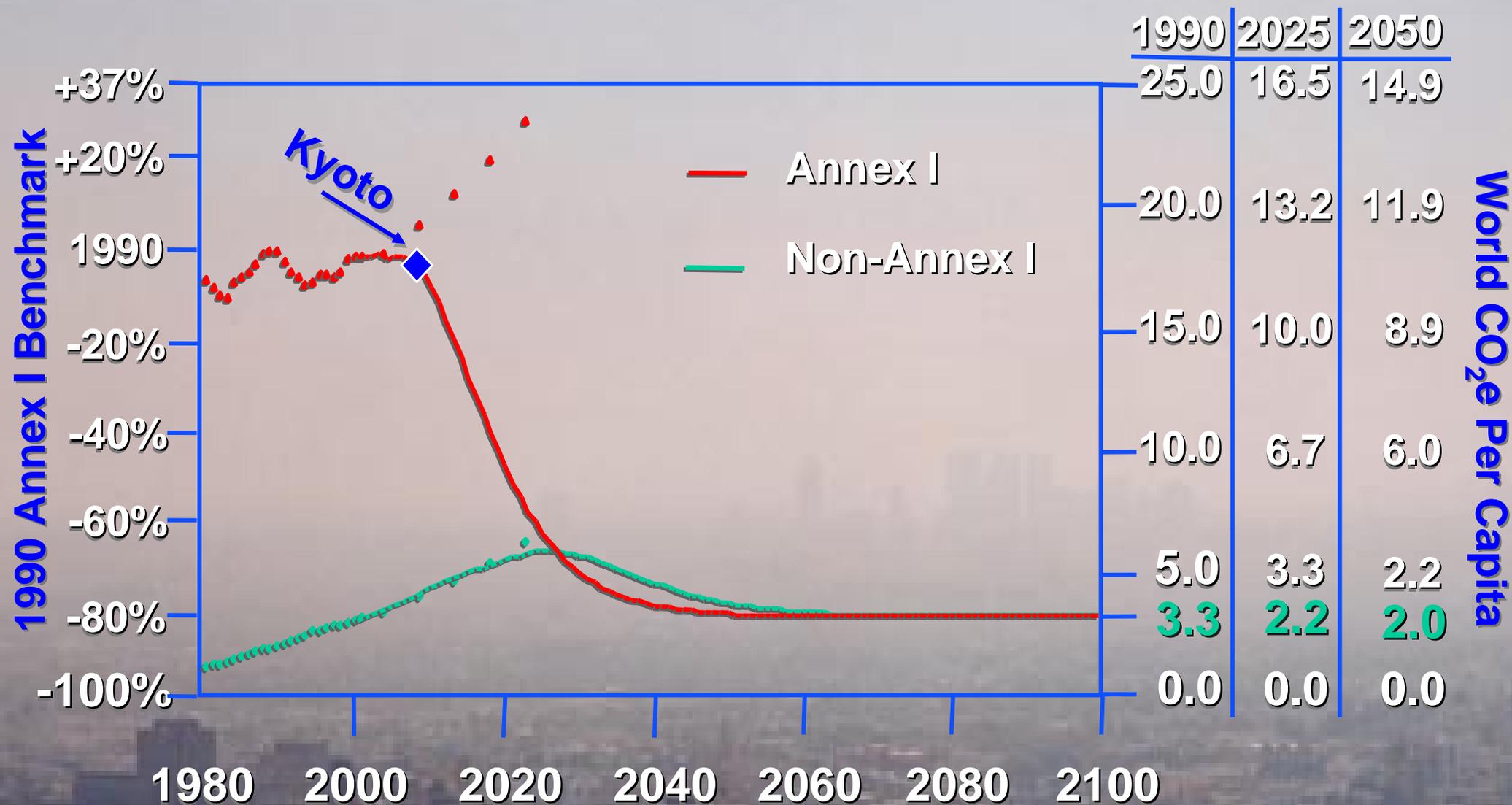
Source: EIA, 2006



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World GHG Emissions Reduction Scenario

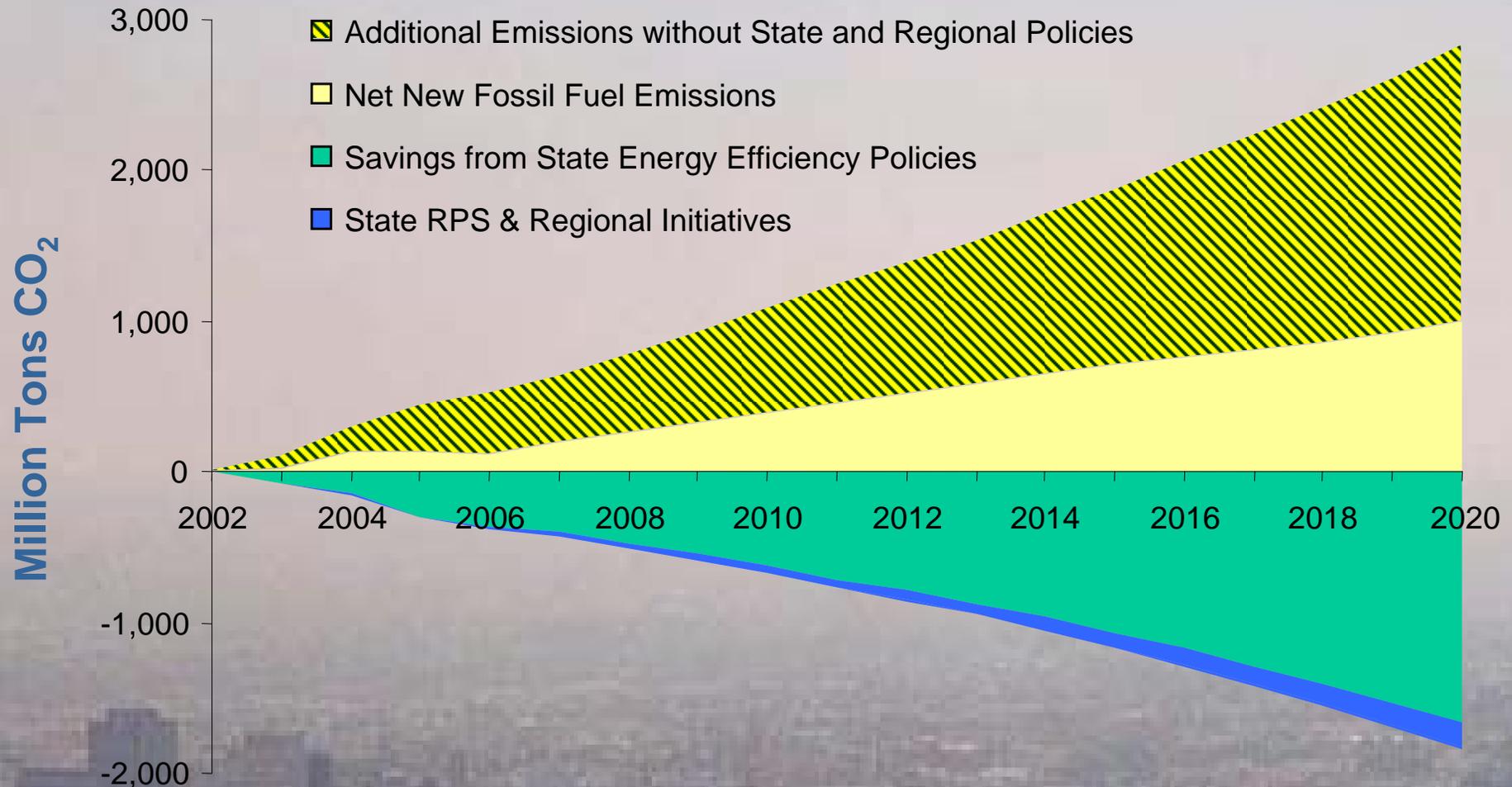
60% Reduction from World 1990 Levels by 2050



Source: Based on John Byrne et al (2004) "Reclaiming the atmospheric commons: Beyond Kyoto." In V.I. Grover (ed.), *Climate Change: Perspectives Five Years After Kyoto*. Chapter 21. Plymouth, UK: Science Publishers, Inc.



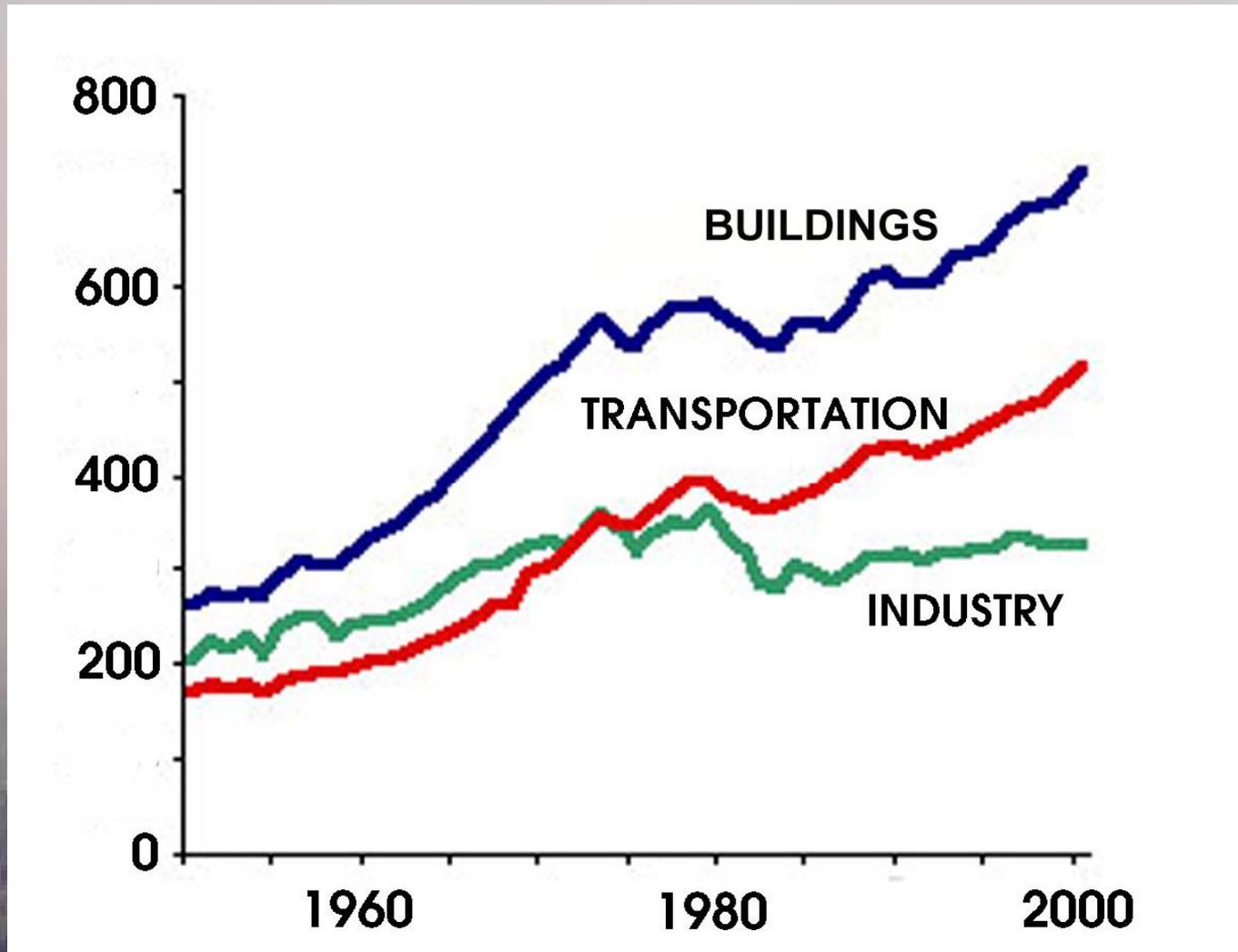
Estimated CO₂ Impacts of State & Local Policies & Programs



J. Byrne, K. Hughes, W. Rickerson and L. Kurdgelashvili (2007) "American policy conflict in the greenhouse: Divergent trends in federal, regional, state, and local green energy and climate change policy," *Energy Policy*

U.S. CO₂ Emissions by Sector (Million Metric Tons of Carbon)

Slide courtesy of Jesse Hensen, AIA, and Amy Hoagberg, CEM, Kyocera Solar



Source: Ed Mazria of Mazria Odems Dzurec

Chicago

Population: 2.8 million

- **CHICAGO GREEN ENERGY PARTNERSHIP**
 - 20% of City energy via renewables by 2010
 - \$800 million City-Utility Fund created
- **GREEN ROOFS – GREEN BUILDINGS**
 - 3 million sq. ft. of Green Roofs installed
 - All City buildings must meet LEED* Silver rating
 - * USGBC: Leadership in Energy and Environmental Design
- **HISTORIC BUNGALOWS INITIATIVE**
 - Rebates to install solar, geothermal and energy efficiency technologies in City's 80,000 bungalow homes

Note: In 1995, the City experienced a heat wave with high temperatures for the month of July in the range of 100-106 °F, resulting in 521 heat-related deaths. E. Klinenberg, *Heat Wave: A Social Autopsy of Disaster in Chicago* (2002)





San Francisco

Population: 777,000

- **CLIMATE ACTION PLAN**
 - 20% reduction from 1990 GHG emissions level by 2012
- **GREEN ENERGY BOND**
 - \$100 million bond for citizen investments in energy efficiency and renewables projects
- **EMERGING RENEWABLES PROGRAM**
 - Program covers 50% of a residential PV installation





SEU Task Force Members

LEADERSHIP

Senator Harris B. McDowell III, Chair

Dr. John Byrne, Co-Chair

Charlie Smisson, State Energy Coordinator

MEMBERSHIP (14)

4 State Senators

4 State Representatives

State Energy Coordinator

Delaware's Public Advocate

Executive Director, Peoples Settlement Association

(the oldest African- American community organization in DE)

Energy Policy Specialist, Delaware Nature Society

Legislative Analyst, Delaware State Senate Office

Director, CEEP, University of Delaware

SEU Research Team

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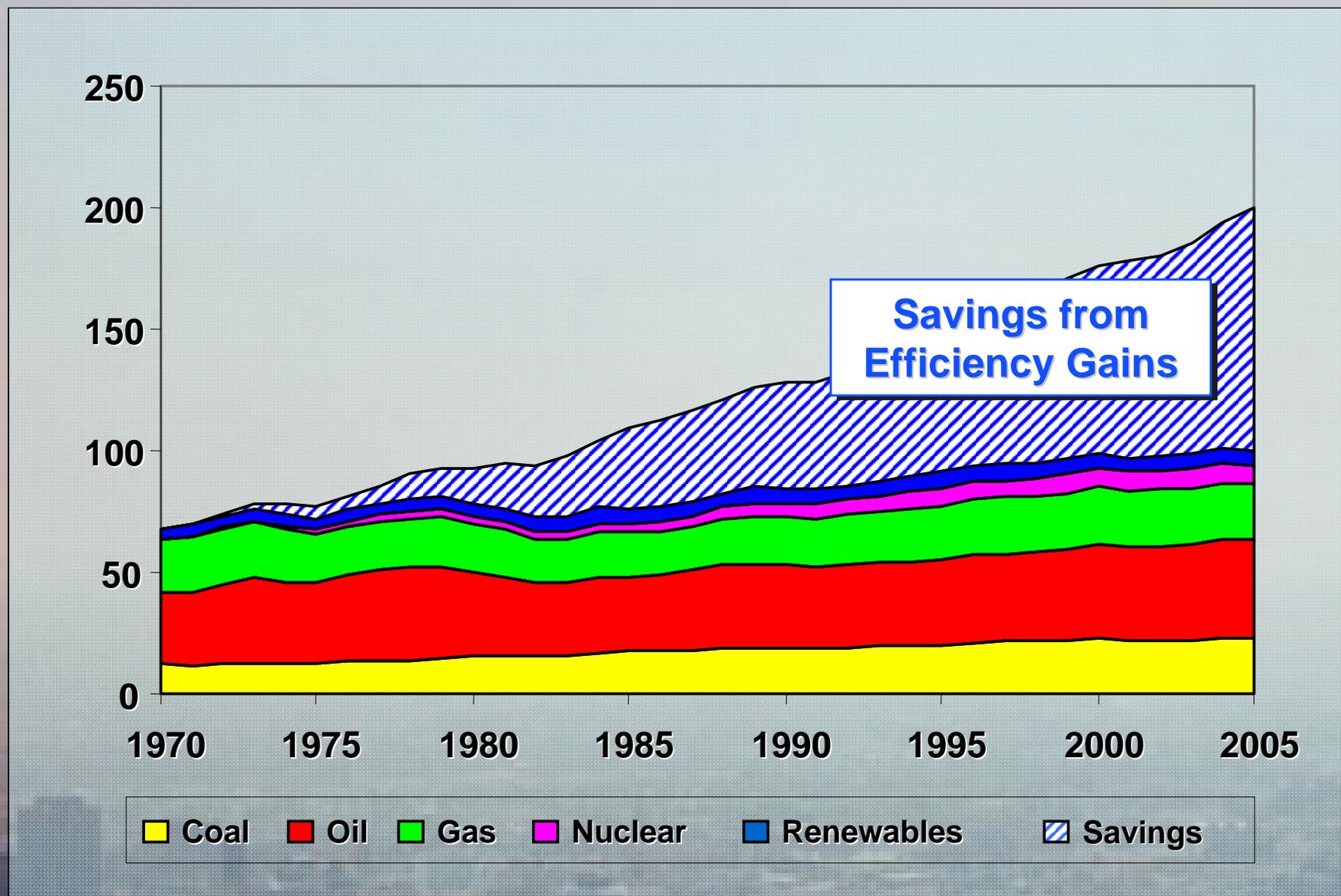
Jackson Schreiber

Ryan Harry

Eric Partyka



U.S. Energy Supply by Source (Quadrillion Btu)

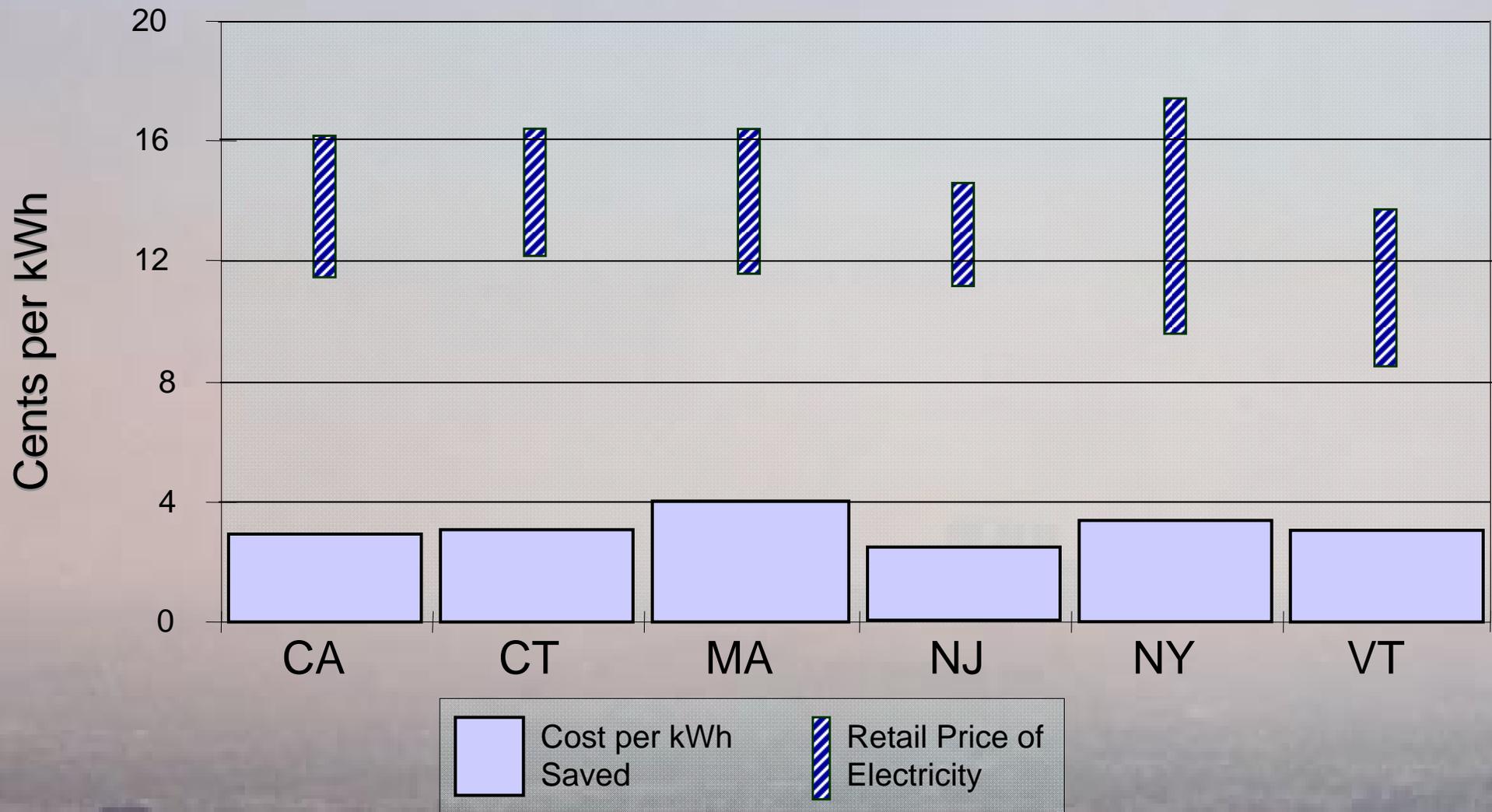


Note: Data from U.S. EIA, *Annual Energy Outlook* (2007)



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U.S. Cost per kWh Saved versus kWh Supplied



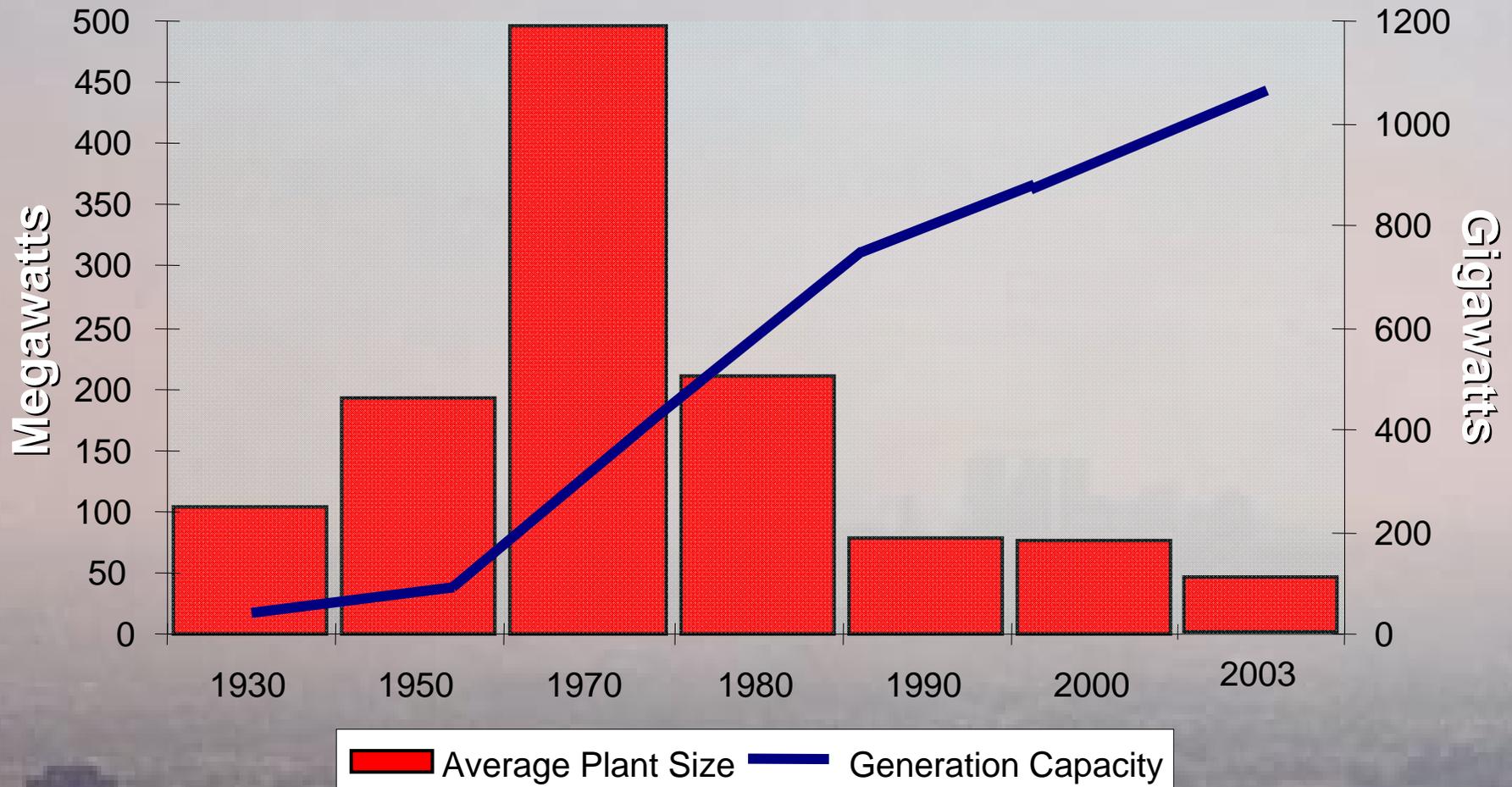
Source: Delaware Sustainable Energy Utility Task Force (2007)

http://www.seu-de.org/docs/Section_F.pdf http://www.seu-de.org/docs/Section_H.pdf and http://www.seu-de.org/docs/App_A.pdf



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U.S. Power Plant Capacity

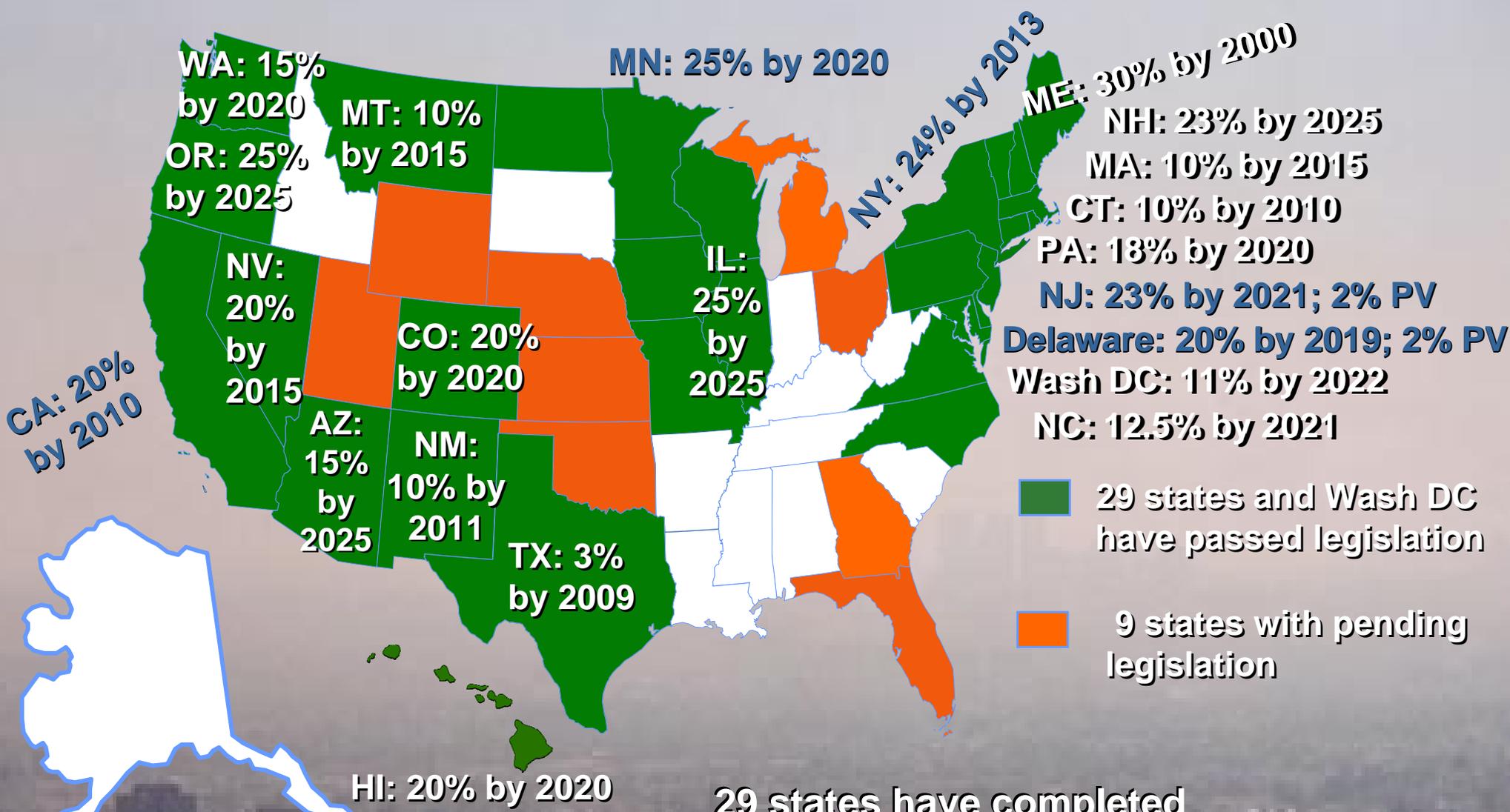


Sources: T. R. Casten (1995) *The Energy Daily* (September 7), Hirsh. 1999: 274; and *EIA Electric Power Annual* (1981, 1990, 2000, 2003)



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State Renewable Portfolio Standards in the U.S.



■ 29 states and Wash DC have passed legislation
■ 9 states with pending legislation

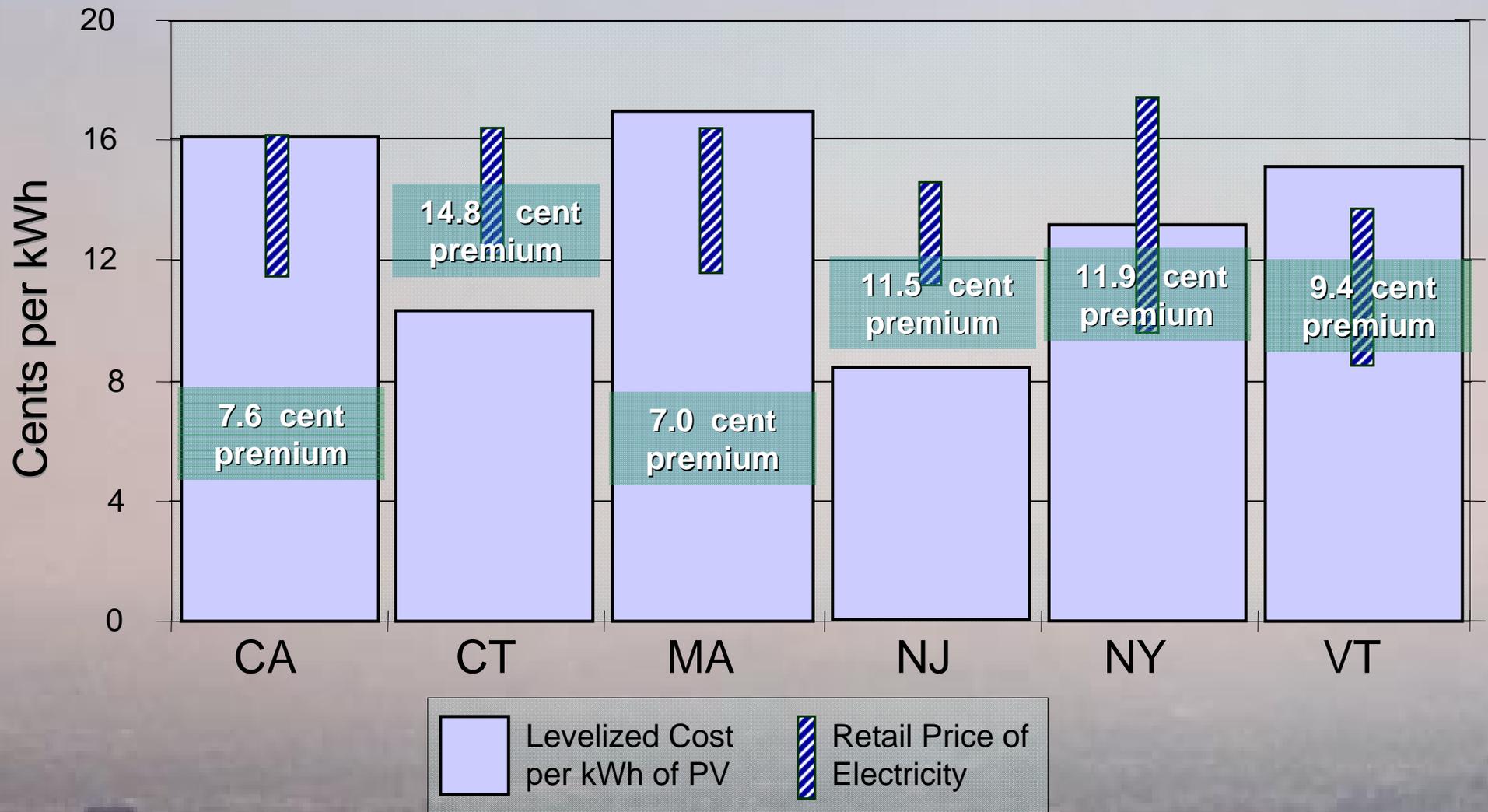
29 states have completed
 Climate Change Action Plans
<http://yosemite.epa.gov/oar/globalwarming.nsf/content/ActionsStateActionPlans.html>

Sources: CEEP Survey, 2007;
 DSIRE, 2007; UCS, 2007



Center for Energy and Environmental Policy

U.S. Cost per kWh Saved versus kWh Supplied



Source: Delaware Sustainable Energy Utility Task Force (2007)

[http://www.seu-de.org/docs/Section F.pdf](http://www.seu-de.org/docs/Section_F.pdf) [http://www.seu-de.org/docs/Section H.pdf](http://www.seu-de.org/docs/Section_H.pdf) and [http://www.seu-de.org/docs/App A.pdf](http://www.seu-de.org/docs/App_A.pdf)



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White Roof Coating Program

Energy Coordinating Agency (Philadelphia)

Approximately 440,000 row homes in Philadelphia, about nine in ten have black tar roofs

White roofs never get hotter than ~ 95° F

Black roofs can be hotter than 115° F



Solar Electric & Hot Water Systems *Energy Coordinating Agency (Philadelphia)*



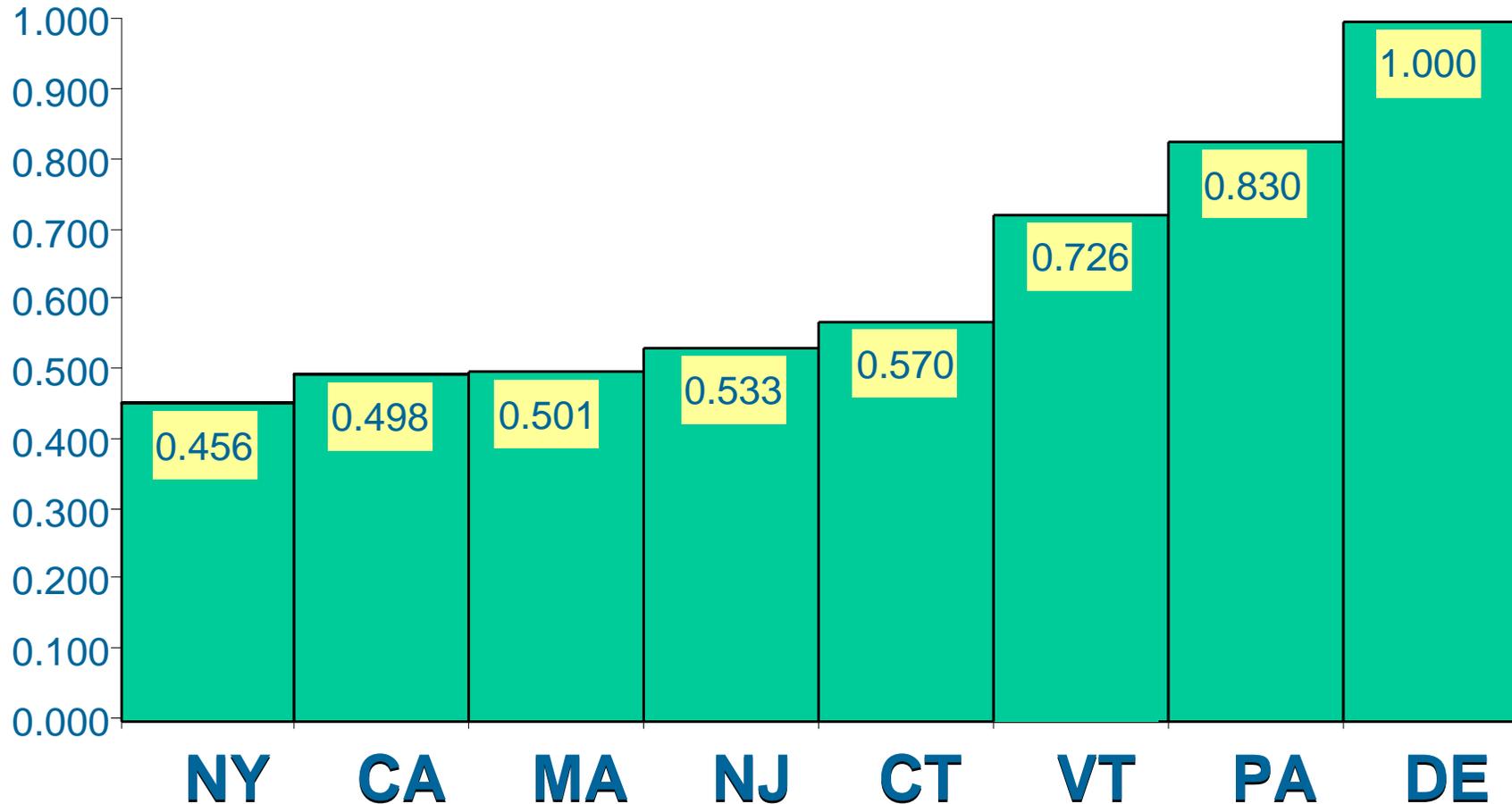
Energy Affordability



Center for Energy and Environmental Policy

DELAWARE – A PORTRAIT OF UNSUSTAINABILITY

Residential Sector Electricity Intensity



Sources: Sustainable Energy Utility Task Force (2007)

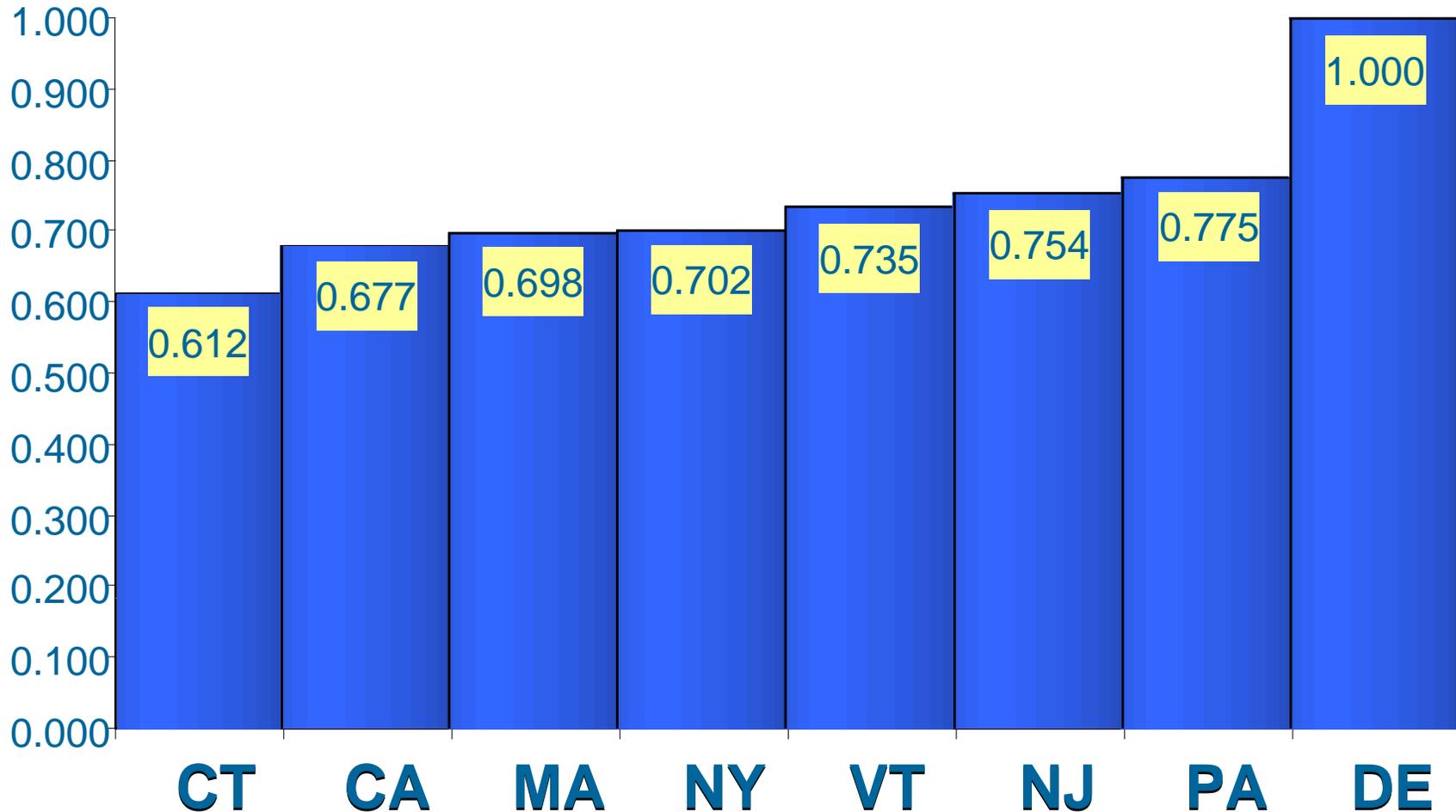
Available at: http://www.seu-de.org/docs/fina_report_brief.pdf

Statistical details available at:

http://www.seu-de.org/docs/IRP_submission_4-10-07.pdf (especially pp. 9-12).

DELAWARE – A PORTRAIT OF UNSUSTAINABILITY

Commercial Sector Electricity Intensity



Sources: Sustainable Energy Utility Task Force (2007)

Available at: http://www.seu-de.org/docs/fina_report_brief.pdf

Statistical details available at:

http://www.seu-de.org/docs/IRP_submission_4-10-07.pdf (especially pp. 9-12).

Energy Efficiency Development: Example of Efficiency Upgrades in Residential Electricity-Using Equipment

Year	Consumption (million MWh)	Participation Rate	Savings Target (million MWh)	Cost/Unit-Saved	Incremental Cost of		Implementation		Incentives & Implementation Costs
					High Efficiency Option	Public \$ for EE Incentives	Costs & Rate of Return for Contractors		
2008	4.425575976	0.03	0.039830184	\$0.030	\$1,194,906	\$1,075,415	\$268,854	\$1,344,269	
2009	4.474257312	0.035	0.046979702	\$0.035	\$1,644,290	\$1,479,861	\$369,965	\$1,849,826	
2010	4.523474142	0.04	0.05428169	\$0.040	\$2,171,268	\$1,737,014	\$434,254	\$2,171,268	
2011	4.573232358	0.04	0.054878788	\$0.040	\$2,195,152	\$1,756,121	\$439,030	\$2,195,152	
2012	4.623537914	0.043	0.059643639	\$0.045	\$2,683,964	\$1,878,775	\$469,694	\$2,348,468	
2013	4.674396831	0.044	0.061702038	\$0.045	\$2,776,592	\$1,943,614	\$485,904	\$2,429,518	
2014	4.725815196	0.046	0.06521625	\$0.045	\$2,934,731	\$2,054,312	\$513,578	\$2,567,890	
2015	4.777799163	0.052	0.074533667	\$0.048	\$3,577,616	\$2,504,331	\$626,083	\$3,130,414	
totals		0.33	0.457065957			\$14,429,443	\$3,607,361	\$18,036,803	
2016	4.830354954	0.05	0.072455324	\$0.048	\$3,477,856	\$2,434,499	\$608,625	\$3,043,124	
2017	4.883488859	0.045	0.0659271	\$0.048	\$3,164,501	\$2,215,151	\$553,788	\$2,768,938	
2018	4.937207236	0.04	0.059246487	\$0.050	\$2,962,324	\$2,073,627	\$518,407	\$2,592,034	
2019	4.991516516	0.035	0.052410923	\$0.050	\$2,620,546	\$1,834,382	\$458,596	\$2,292,978	
totals		0.5				\$22,987,102	\$5,746,775	\$28,733,877	

¹ Based on U.S. EIA State Energy Data System (SEDS) data.

² Based on survey of 6 'best practice' States. See SEU Task Force Briefing Book, Sections F-H. Available at: <http://www.seu-de.org/documents.html>

³ Survey of 6 'best practice' States indicates 30% savings can be expected from energy efficiency upgrades (multiplied by appropriate participation rate).

⁴ 100% rebate equal to the incremental cost of the high efficiency option (capped by size/capacity of the device in order not to encourage purchase of above-average equipment). Taken from 'best practice' State survey. See SEU Task Force Briefing Book, Sections F-H. Available at: <http://www.seu-de.org/documents.html>

Renewable Energy Development & Financing

	Year	Installed Capacity	Cummulative Capacity	Cummulative Electricity	REC Price (\$/MWh)	REC Sales (\$)	SEU Aggregation Fee	SEU REC Income (\$)
		From Rebate Program (kW)	From Rebate Program (kW)	From Rebate Program (MWh)				
PV RECs	2008	80	700	1,002.40	\$200	\$200,480	0.25	\$50,120
	2009	178	878	1,257.51	\$200	\$251,502	0.25	\$62,876
	2010	315	1,193	1,708.65	\$200	\$341,729	0.25	\$85,432
	2011	2,127	3,320	4,754.28	\$180	\$855,770	0.25	\$213,943
	2012	3,741	7,061	10,110.92	\$170	\$1,718,856	0.25	\$429,714
	2013	7,617	14,678	21,018.78	\$150	\$3,152,816	0.25	\$788,204
	2014	11,992	26,670	38,191.90	\$125	\$4,773,987	0.25	\$1,193,497
	2015	16,683	43,354	62,082.24	\$100	\$6,208,224	0.25	\$1,552,056
	Sub-totals		42,734				\$17,503,365	
	2016	20,778	64,131	91,836.00	\$75	\$6,887,700	0.25	\$1,721,925
	2017	27,332	91,463	130,975.58	\$50	\$6,548,779	0.25	\$1,637,195
	2018	39,679	131,143	187,796.12	\$50	\$9,389,806	0.25	\$2,347,452
	2019	43,897	175,039	250,656.51	\$25	\$6,266,413	0.25	\$1,566,603
Totals		174,419				\$46,596,063		\$11,649,016

	Year	Installed Capacity	Cummulative Capacity	Cummulative Electricity	REC Price (\$/MWh)	REC Sales (\$)	SEU Aggregation Fee	SEU REC Income (\$)
		From Rebate Program - Non-PV Renewables (MW)	From Rebate Program - Non-PV Renewables (MW)	From Rebate Program (non-PV RE) (MWh)				
Wind, Geothermal, Solar Thermal and Other RE RECs	2008	7	20	52,727.80	\$35	\$1,845,473	0.25	\$461,368
	2009	14	34	89,840.13	\$35	\$3,144,404	0.25	\$786,101
	2010	19	53	138,888.70	\$35	\$4,861,105	0.25	\$1,215,276
	2011	22	75	196,320.08	\$30	\$5,889,603	0.25	\$1,472,401
	2012	25	100	262,567.46	\$30	\$7,877,024	0.25	\$1,969,256
	2013	28	128	336,881.62	\$30	\$10,106,449	0.25	\$2,526,612
	2014	31	159	419,159.99	\$25	\$10,479,000	0.25	\$2,619,750
	2015	34	194	509,357.59	\$25	\$12,733,940	0.25	\$3,183,485
	Sub-totals		181				\$56,936,996	
	2016	38	231	607,964.26	\$20	\$12,159,285	0.25	\$3,039,821
	2017	40	272	713,611.87	\$15	\$10,704,178	0.25	\$2,676,044
	2018	51	323	848,383.90	\$15	\$12,725,759	0.25	\$3,181,440
	2019	56	379	995,389.84	\$10	\$9,953,898	0.25	\$2,488,475
Totals						\$102,480,117		\$25,620,029

Note: Installed capacity of PV systems is based on the proposed Solar Carveout to be submitted as an amendment to the State's current RPS policy. Installed capacity of non-PV renewable energy systems is based on the proposed upgrade of the RPS schedule, also to be submitted as an amendment to current policy.

Prepared for the Delaware Sustainable Energy Utility Task Force by the Center for Energy & Environmental Policy, University of Delaware.



New Direction – A Sustainable Energy Utility



By 2015

- ◆ Delaware residents and businesses cut conventional energy use by 30%:
ALL FUELS, ALL SECTORS
 - Utilize Market Transformation Rebate Programs: pay the incremental cost difference between standard and high-efficiency models
 - Double the Weatherization Program: support novel strategies such as ‘white roofs’ & partner with utilities and fuel companies to reduce arrears accounts
 - Create a Green Buildings Initiative: reward green renovations of existing buildings and provide incentives for new construction that contributes to Low/No Emissions Buildings
 - Adopt a Sustainable Transport Plan: promote High MPG, Low Carbon Vehicles; reward Employee Commute Planning; incent Carsharing

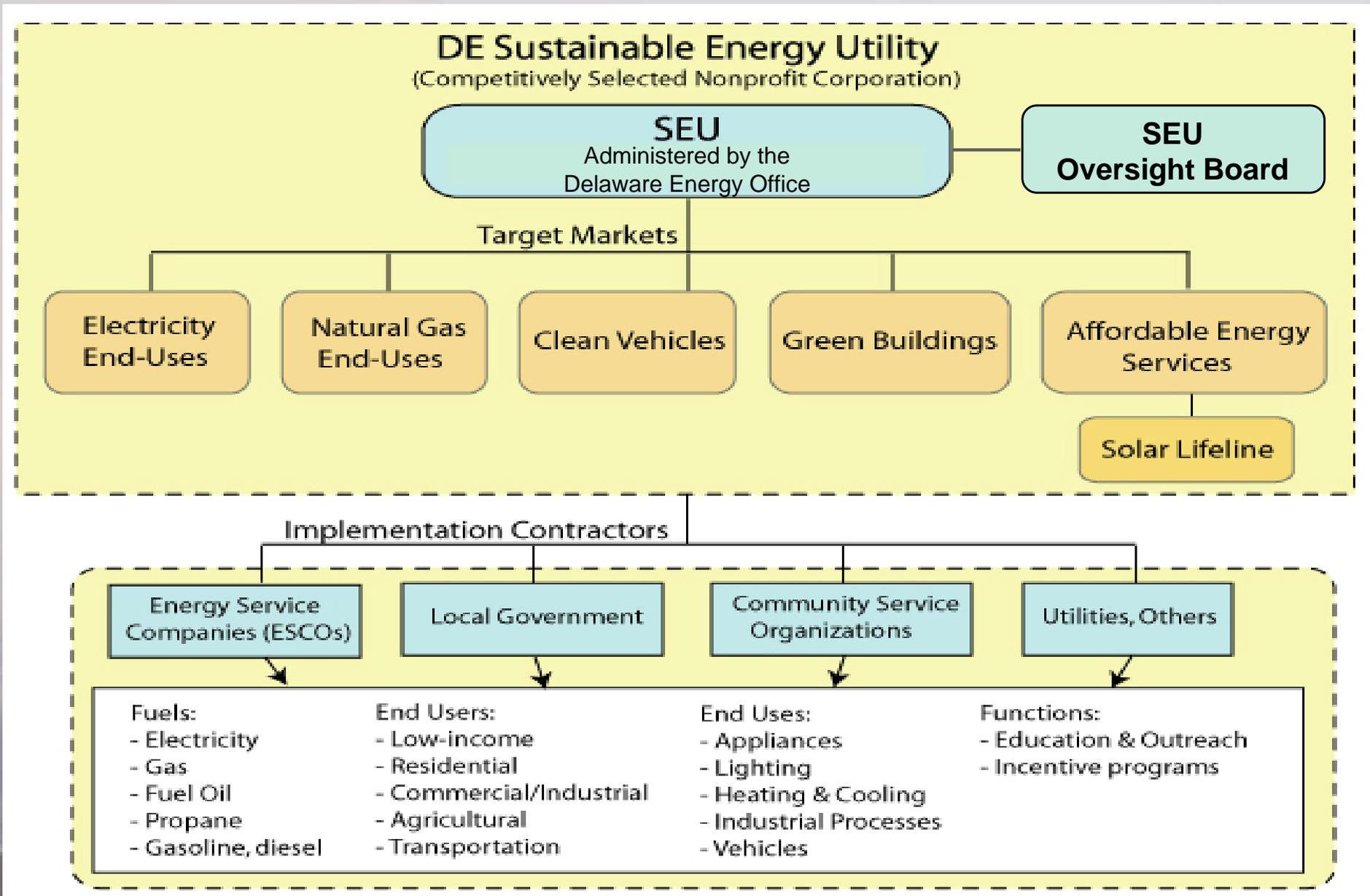
By 2019

- ◆ 20% of electricity serving the State to come from Renewable Energy
 - Upgrade the Renewable Portfolio Standard (RPS) to 20% by 2019
 - Include a Solar Carveout of 2% by 2019 with High-Value Solar RECs
 - Encourage a Renewable Energy Credits (RECs) Market, providing a revenue stream to customer-sited renewables

Both Goals = 25-30% reduction in Delaware's carbon footprint



New Direction – A Sustainable Energy Utility



SUSTAINABLE ENERGY POLICY MODELS

State/City	Energy Efficiency		Renewable Energy	Affordable Energy
	Electricity and Gas	All Other		
Delaware	<i>Sustainable Energy Utility</i>			
Massachusetts	Utilities (programs distinct)	N/A	MTC	DHCD (federal) and Utilities (state)
New Jersey	<i>New Jersey Clean Energy Program</i>	N/A	New Jersey Clean Energy Program	NJ Department of Human Services
Vermont	<i>Efficiency Vermont</i>	N/A	Department of Public Service	Department of Children and Families
Cambridge, MA	<i>Cambridge Energy Alliance</i>	Initially focused on electricity	CEA (initially focused on renewable electricity)	TBD



New Direction – A Sustainable Energy Utility



Funding an SEU

◆ **Green Energy Fund (GEF)**

Support Rebates for energy efficiency, customer-sited renewables, & affordable energy services from a Public Benefit Charge on all conventional fuel use (\$0.0003 /kWh equivalent)

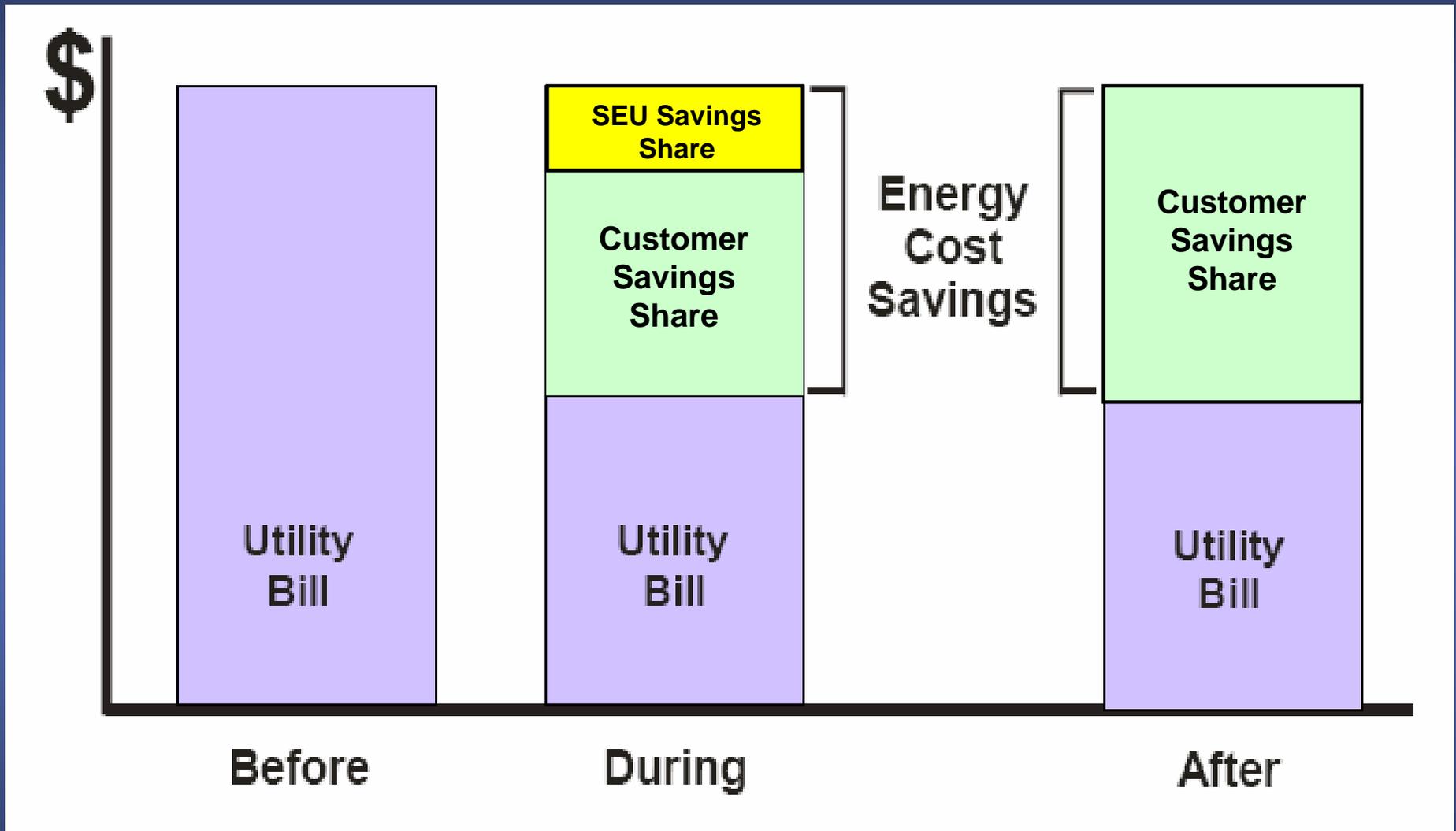
◆ **Sustainable Energy Bond**

Authorize \$30 million in Sustainable Energy Bonds that creates jobs, lowers energy bills and improve the environment

◆ **Reinvest through Shared Savings and RECs**

In return for assumption of initial capital cost of Sustainable Energy investments, sign agreements with participants to share savings (e.g., 33% for 5 years) and REC revenues (e.g., 25% for 8 years)

Performance Contracting



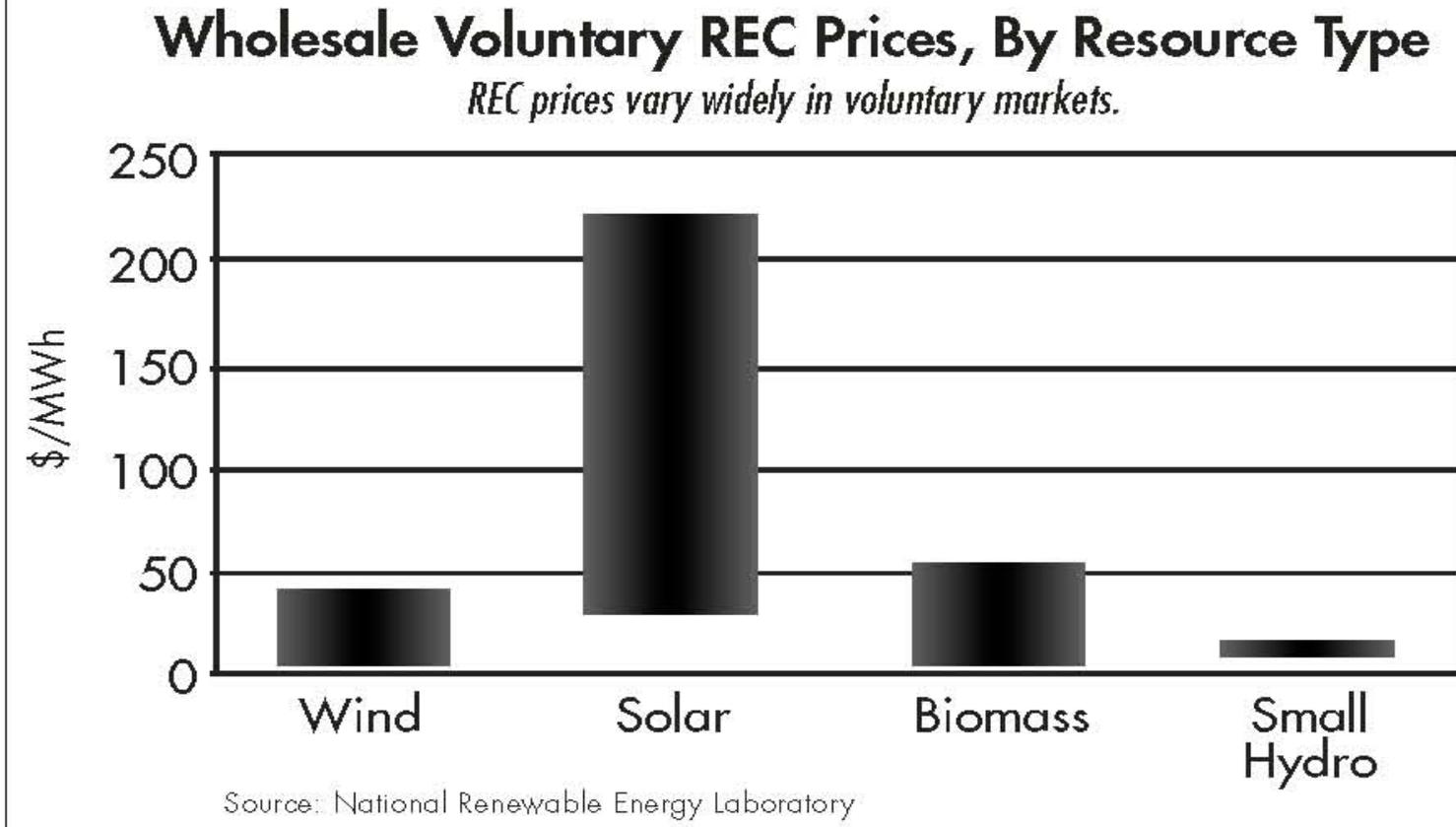
Source: King, 2003



Center for Energy and Environmental Policy

Renewable Energy Credits (RECs) Markets for Sustainable Energy

Figure 1



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SEU Cash Flow Detail

(not including Sustainable Energy Bond)

Year	Expenditures				Expenditure Totals	Revenues	Balance
	SEU Contract	SEU Program Costs (Rebates, Incentives, EM&V, etc.)	SEU / DEO Education & Marketing	Bonus Fund		SEU Revenues: 0.25RECs + 0.33SS (yrs 1-5) + GEF Revenues	Annual Cash Balance
2008	-\$800,000	-\$5,953,981	-\$300,000	-\$100,000	-\$7,153,981	\$3,140,411	-\$4,013,569
2009	-\$816,000	-\$8,823,059	-\$300,000	-\$175,000	-\$10,114,059	\$7,630,898	-\$2,483,161
2010	-\$832,320	-\$10,520,922	-\$300,000	-\$192,962	-\$11,846,205	\$12,864,141	\$1,017,936
2011	-\$848,966	-\$17,429,788	-\$261,447	-\$288,291	-\$18,828,492	\$19,219,402	\$390,910
2012	-\$865,946	-\$21,628,684	-\$432,574	-\$392,609	-\$23,319,812	\$26,173,902	\$2,854,090
2013	-\$909,243	-\$32,364,351	-\$647,287	-\$664,624	-\$34,585,505	\$33,231,192	-\$1,354,313
2014	-\$954,705	-\$38,569,611	-\$771,392	-\$759,003	-\$41,054,712	\$37,950,155	-\$3,104,557
2015	-\$1,002,440	-\$42,212,500	-\$844,250	-\$841,412	-\$44,900,602	\$42,070,590	-\$2,830,012
Sub-totals	-\$7,029,621	-\$177,502,896	-\$3,856,950	-\$3,413,900	-\$191,803,367	\$182,280,690	-\$9,522,677
2016	-\$1,052,562	-\$41,052,588	-\$821,052	-\$937,295	-\$43,863,498	\$46,864,759	\$3,001,262
2017	-\$1,105,191	-\$44,887,443	-\$897,749	-\$1,020,003	-\$47,910,386	\$51,000,162	\$3,089,776
2018	-\$1,160,450	-\$45,173,259	-\$903,465	-\$1,068,534	-\$48,305,708	\$53,426,697	\$5,120,989
2019	-\$1,218,473	-\$42,744,016	-\$854,880	-\$1,123,466	-\$45,940,835	\$56,173,305	\$10,232,470
Totals	-\$11,566,296	-\$351,360,203	-\$7,334,096	-\$7,563,199	-\$377,823,794	\$389,745,614	\$11,921,820

SEU Prospectus

		SEU Bond Debt Service							Net SEU Revenue (after Debt Service & Bond Retirement)	SEU Bottom Line
Year	Net SEU Revenues (before Debt Service)	Tax Exempt Bond Floats	Annual Interest Cost for Bond 1 (Yield = 5.20%)	Annual Interest Cost for Bond 2 (Yield = 5.0%)	Annual Interest Cost for Bond 3 (Yield = 4.90%)	Annual Interest Cost for Bond 4 (Yield = 4.90%)	Bond Management	Debt Totals	SEU Balance + Bond Interest Cost + Bond Principal	Cumulative Cash Flow
2008	-\$4,013,569	Bond 1: 5 yr Maturity Yield = 5.20% \$7,700,000	-\$400,400				-154,000	-\$554,400	\$3,132,031	\$3,132,031
2009	-\$2,483,161		-\$400,400					-\$400,400	-\$2,883,561	\$248,469
2010	\$1,017,936	Bond 2: Yield = 5.00% \$0	-\$400,400	\$0			\$0	-\$400,400	\$617,536	\$866,006
2011	\$390,910	Bond 3: Yield = 4.90% \$0	-\$400,400	\$0	\$0		\$0	-\$400,400	-\$9,490	\$856,515
2012	\$2,854,090	Bond 4: 8 yr Maturity Yield = 4.90% \$15,300,000	-\$400,400	\$0	\$0	-\$749,700	-\$306,000	-\$1,456,100	\$8,997,990	\$9,854,505
2013	-\$1,354,313			\$0	\$0	-\$749,700		-\$749,700	-\$2,104,013	\$7,750,492
2014	-\$3,104,557			\$0	\$0	-\$749,700		-\$749,700	-\$3,854,257	\$3,896,235
2015	-\$2,830,012			\$0	\$0	-\$749,700		-\$749,700	-\$3,579,712	\$316,523
Sub-totals	-\$9,522,677		-\$2,002,000	\$0	\$0	-\$2,998,800	-460,000	-\$5,460,800	\$316,523	
2016	\$3,001,262			\$0	\$0	-\$749,700		-\$749,700	\$2,251,562	\$2,568,084
2017	\$3,089,776			\$0	\$0	-\$749,700		-\$749,700	\$2,340,076	\$4,908,161
2018	\$5,120,989			\$0	\$0	-\$749,700		-\$749,700	\$4,371,289	\$9,279,450
2019	\$10,232,470			\$0	\$0	-\$749,700		-\$749,700	-\$5,817,230	\$3,462,220
Totals	\$11,921,820		-\$2,002,000	\$0	\$0	-\$5,997,600	-460,000	-\$8,459,600	\$3,462,220	

*** Revenue Assumptions**

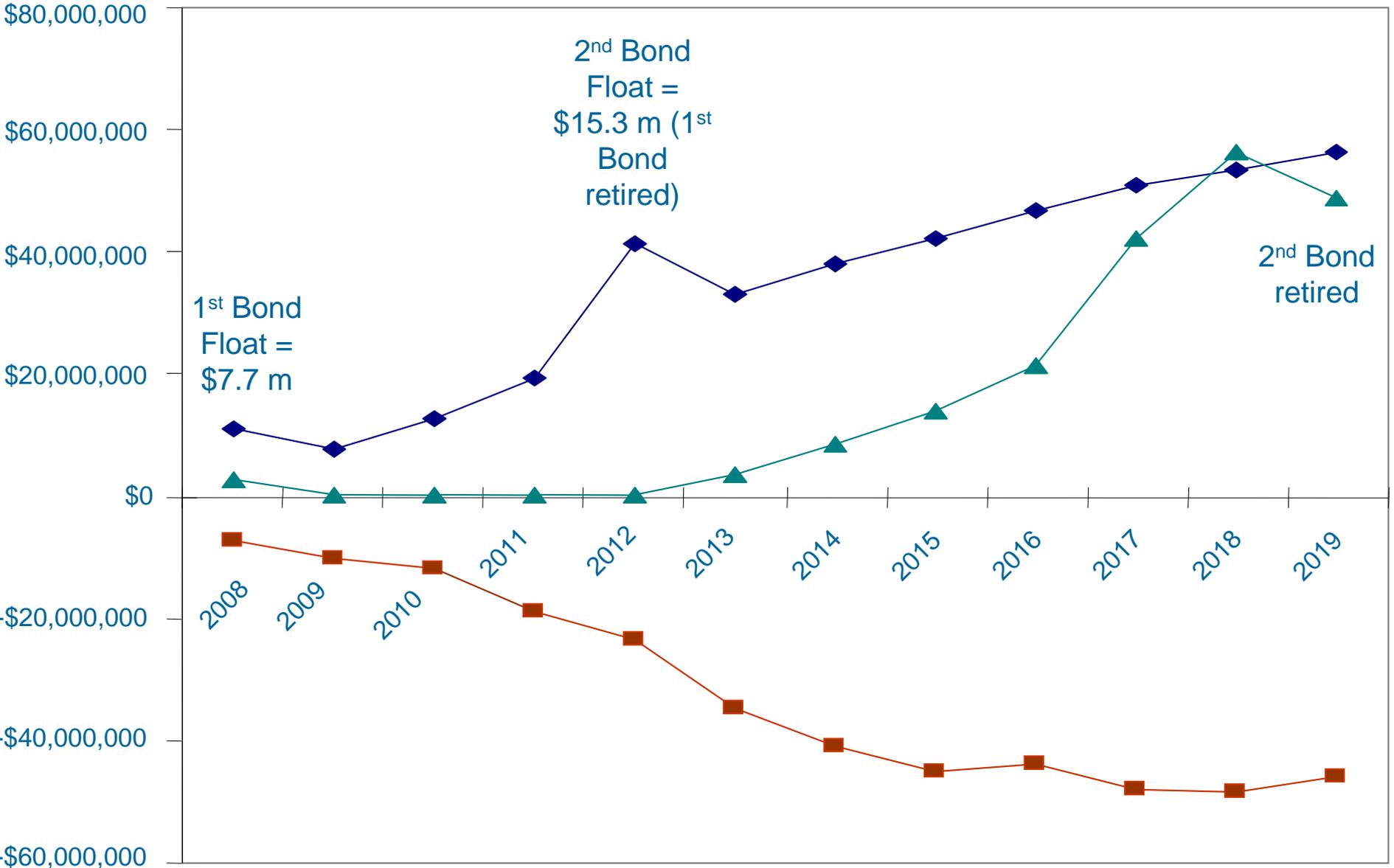
\$25 million in Sustainable Energy Special Purpose Revenue Bonds are authorized.

GEF mill rate is doubled.

REC revenues are based on declining price schedule.

All Bond Interest	-\$7,999,600
Total Bond Float	\$23,000,000

SEU Annual Costs, Revenues & Cash Balance



**Major Banking Group with Extensive
Bond Management Experience
reviewed the SEU pro forma and
concluded it is financeable by a private
activity bond at high investment grade.**



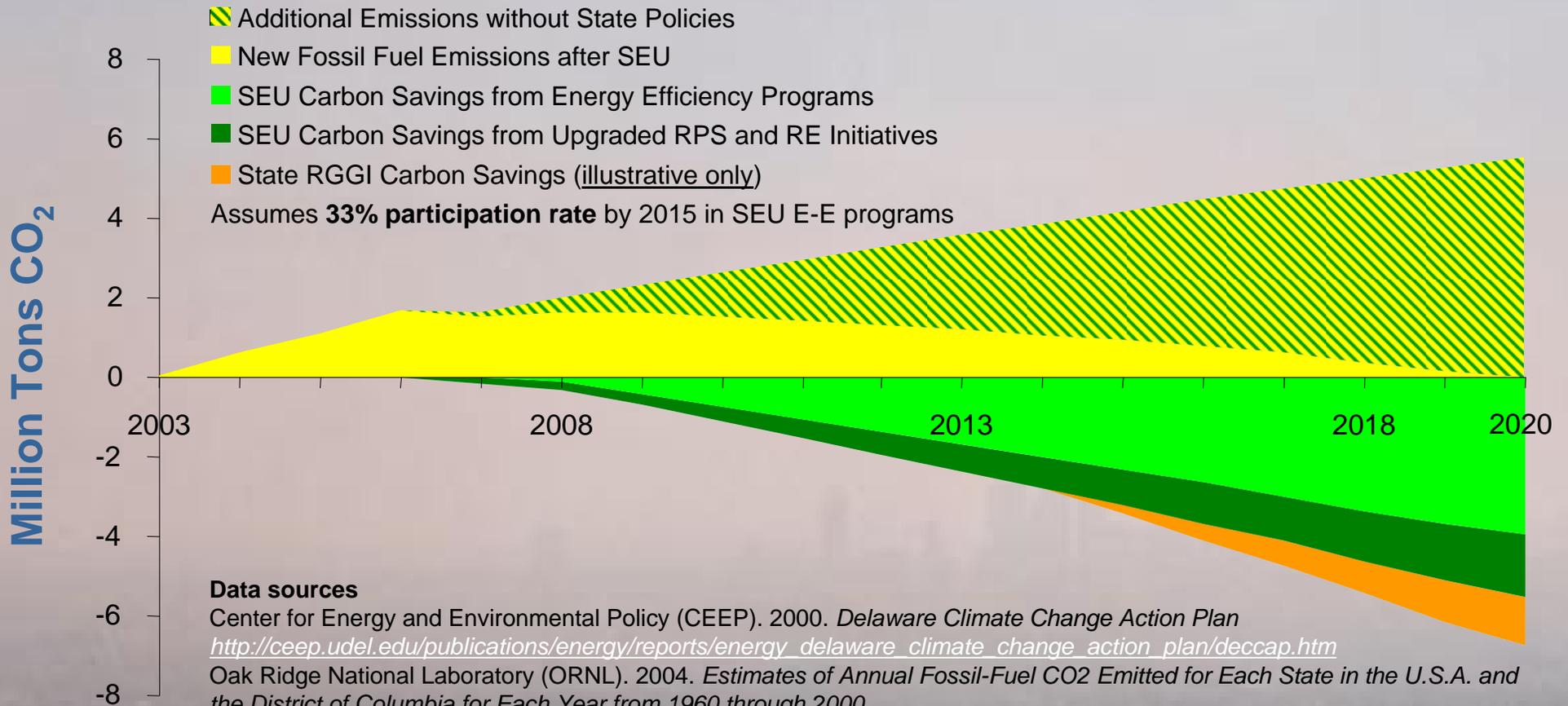
Policy Agenda



- ◆ **Create the Delaware Sustainable Energy Utility**
 - An incentive-based institution that utilizes performance contracting
 - Offers one-stop, comprehensive sustainable energy services to all
 - Uses bonds to invest \$30 million in a Sustainable Energy Future
 - Super Majority 3/4th Vote Required:
 - ☞ *Senate (Democratic Party majority): 19-1*
 - ☞ *House (Republican Party majority): Unanimous vote in favor*
- ◆ **Renewable Portfolio Standard (RPS)**
 - Upgrade to proven 'best practice': 20% by 2019
 - Add 2% Solar Carveout
- ◆ **Green Energy Fund (GEF)**
 - Double GEF mill rate to support renewables & energy efficiency
 - Cost to the average residential customer = ~ 18 cents per month
- ◆ **Net Metering Standards**
 - Enable commercial & industrial customers to generate up to 2 MW
 - Enable residential customers to generate up to 25 kW
 - Net meter customer generation at full retail rates (including generation and T&D)

Delaware Sustainable Energy Utility

Our Best Environmental Policy



Data sources

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http://ceep.udel.edu/publications/energy/reports/energy_delaware_climate_change_action_plan/deccap.htm

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<http://www.eia.doe.gov/emeu/states/seds.html>

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The Regional Greenhouse Gas Initiative (RGGI). 2007. *Regional Greenhouse Gas Initiative*

http://www.rggi.org/docs/mou_12_20_05.pdf

Estimates prepared for the Sustainable Energy Utility Task Force by the Center for Energy & Environmental Policy, University of Delaware.



**November 6, 2006
FOR IMMEDIATE RELEASE**

Councilmember Mary M. Cheh Introduces Landmark Energy Bill

Councilmember Cheh introduced landmark legislation today to create a sustainable energy utility that will launch energy efficiency and renewable energy programs in the District. “The Clean and Affordable Energy Act of 2007 will bring the District to the fore as one of the leading cities tackling climate change,” said Cheh. The District’s sustainable utility proposal is based on successful models already in place in **Delaware**, Vermont, Oregon, and New Jersey.

Sustainable Energy Utility

Website: <http://www.seu-de.org/>

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