Economic Opportunity in Climate Action

The Economic Benefits of Climate Action

Pocantico Conference Center

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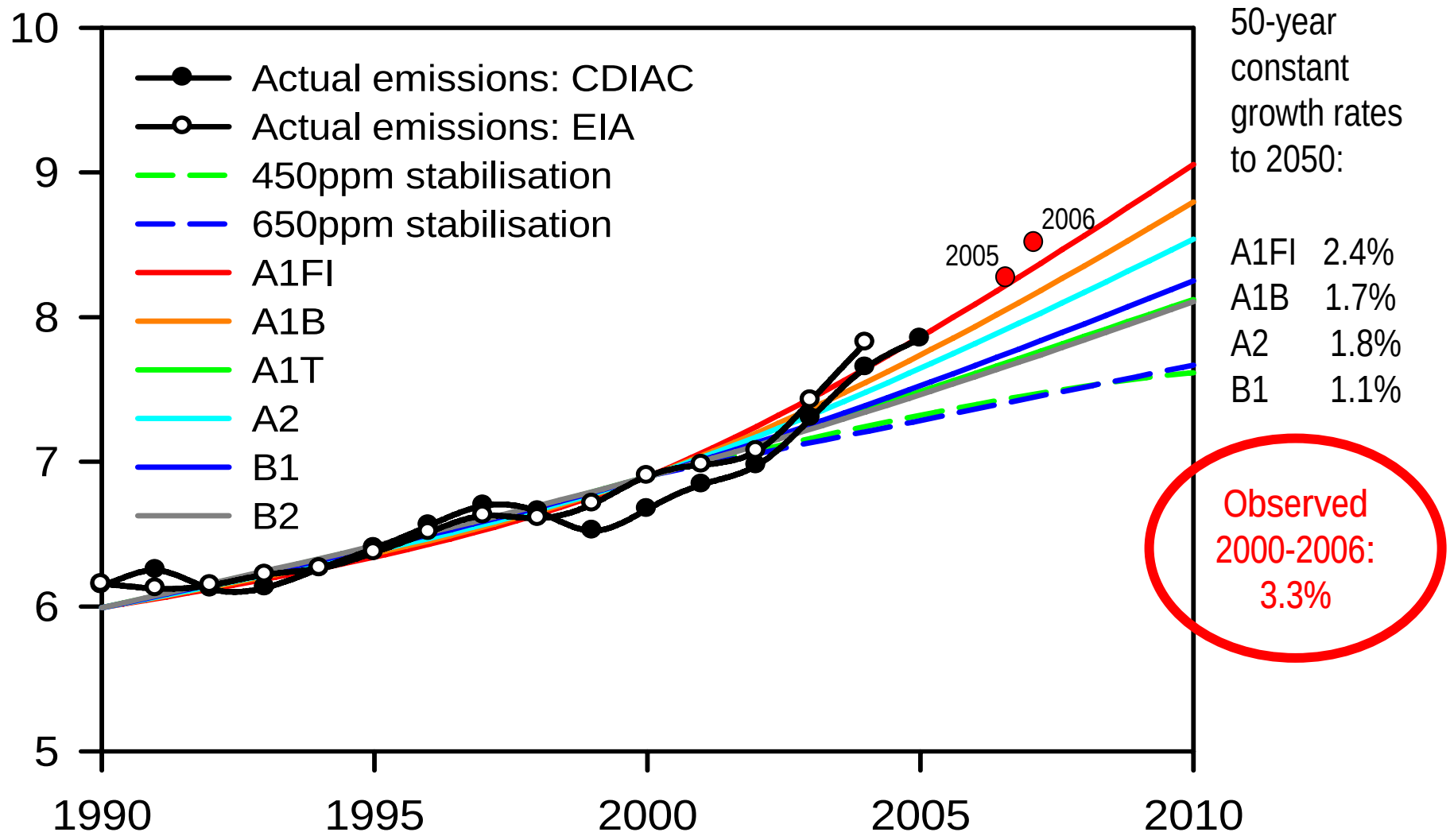
Global Carbon Project: GHG Emissions Trajectory



Raupach et al. 2007, PNAS

Global Carbon Project: Conclusions

Since 2000:

- The growth of carbon emissions from fossil fuels has tripled compared to the 1990s, exceeding the predictions of the highest IPCC scenarios.
- Atmospheric CO_2 has grown at 1.9 ppm per year (vs. ~1.5 ppm over last 30 years)
- The carbon intensity of the world's economy has stopped decreasing (after 100 years of doing so).
- The efficiency of natural sinks has decreased by 10% over the last 50 years -- and will continue to do so in the future (=> the longer we wait, the larger the cuts needed to stabilize atmospheric CO_2).
- All of these changes characterize a carbon cycle that is generating stronger climate forcing and sooner than expected.

Why Are States Leading on Climate?

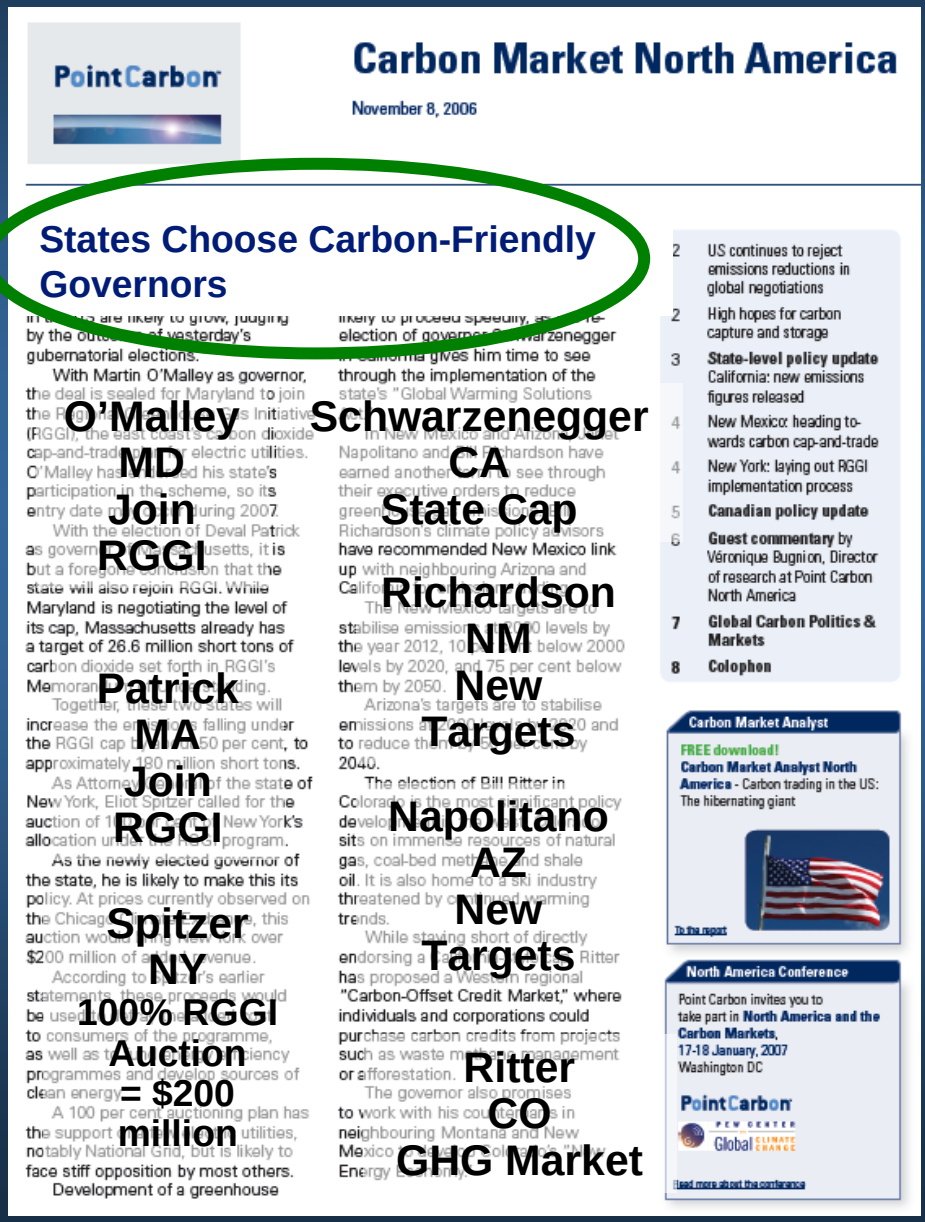
- States have always led
  - **Origin of innovative approaches ("Laboratories")**
  - **Where consensus is built and conflicts resolved**
  - **Where implementation really happens ("Proving Ground")**
  - **Prior lead-by-example success (Acid Rain, toxics, Hg, cars, etc.)**
- Proactive
  - **See economic opportunity**
    - **Get head start on technological opportunities and markets**
    - **Get savings, productivity, security, and health co-benefits**
  - **See political opportunity**
  - ***Gretsky: "Skate to where the puck is going to be."***
- Precautionary
  - **Want to avoid severe climate impacts & risks**
  - **Know climate policy is coming; want to shape it favorably**
  - **Are significant GHG emitters**
  - ***Gough: "If you're not at the table, you're on the menu."***

States Consistently Shape Federal Policy

*More "**pioneers**" than "laboratories"; where real policy gets hammered out:*

State Action	When	*Corresponding Federal Action*	When
State Acid Rain Laws	1985	*Federal Acid Rain Program*	*1990*
State Air Toxics Laws	1987	*Federal Air Toxics Program*	*1990*
State NOx Trading (OTC)	1995	*Federal NOx SIP Call*	*2004*
State Mercury Laws	1998-2002	*Federal CAMR Rule*	*2005*
State RPS Laws	1997-2007	*Federal RPS Law*	*Introduced*
State "4-P" Laws for Power Plants	1997-2002	*Federal "4-P" Law*	*Introduced*
Statewide GHG Reduction Laws	2003-2006	*Federal GHG Reduction Law*	*Introduced*
State GHG Reductions from Vehicles	2002	*Federal Vehicle GHG Standards*	*?*

Political Benefits Are Increasingly Clear



PointCarbon

Carbon Market North America

November 8, 2006

States Choose Carbon-Friendly Governors

by the outcome of yesterday's gubernatorial elections.

With Martin O'Malley as governor, the deal is sealed for Maryland to join the RGGI, the east coast's carbon dioxide cap-and-trade for electric utilities. O'Malley has signalled his state's participation in the scheme, so its entry date is set during 2007.

With the election of Deval Patrick as governor of Massachusetts, it is but a foregone conclusion that the state will also rejoin RGGI. While Maryland is negotiating the level of its cap, Massachusetts already has a target of 26.6 million short tons of carbon dioxide set forth in RGGI's Memorandum of Understanding.

Together, these two states will increase the emissions falling under the RGGI cap by 150 per cent, to approximately 180 million short tons.

As Attorney General of the state of New York, Eliot Spitzer called for the auction of 100% of New York's allocation under the RGGI program.

As the newly elected governor of the state, he is likely to make this its policy. At prices currently observed on the Chicago Climate Exchange, this auction would bring New York over $200 million of annual revenue.

According to Governor's earlier statements, these proceeds would be used to provide rebates to consumers of the programme, as well as to fund efficiency programmes and develop sources of clean energy.

A 100 per cent auctioning plan has the support of some utilities, notably National Grid, but is likely to face stiff opposition by most others.

Development of a greenhouse

likely to proceed speedily, as the re-election of governor Schwarzenegger in California gives him time to see through the implementation of the state's "Global Warming Solutions

In New Mexico and Arizona, Governors Napolitano and Bill Richardson have earned another term to see through their executive orders to reduce greenhouse gas emissions. Richardson's climate policy advisors have recommended New Mexico link up with neighbouring Arizona and California

The New Mexico targets are to stabilise emissions at 2000 levels by the year 2012, 10 per cent below 2000 levels by 2020, and 75 per cent below them by 2050.

Arizona's targets are to stabilise emissions at 2000 levels by 2020 and to reduce them by 50 per cent by 2040.

The election of Bill Ritter in Colorado is the most significant policy development. Colorado sits on immense resources of natural gas, coal-bed methane and shale oil. It is also home to a ski industry threatened by climate warming trends.

While staying short of directly endorsing a cap-and-trade, Ritter has proposed a Western regional "Carbon-Offset Credit Market," where individuals and corporations could purchase carbon credits from projects such as waste methane management or afforestation.

The governor also promises to work with his counterparts in neighbouring Montana and New Mexico [illegible] Energy Economy

O'Malley MD Join RGGI

Schwarzenegger CA State Cap

Richardson NM New Targets

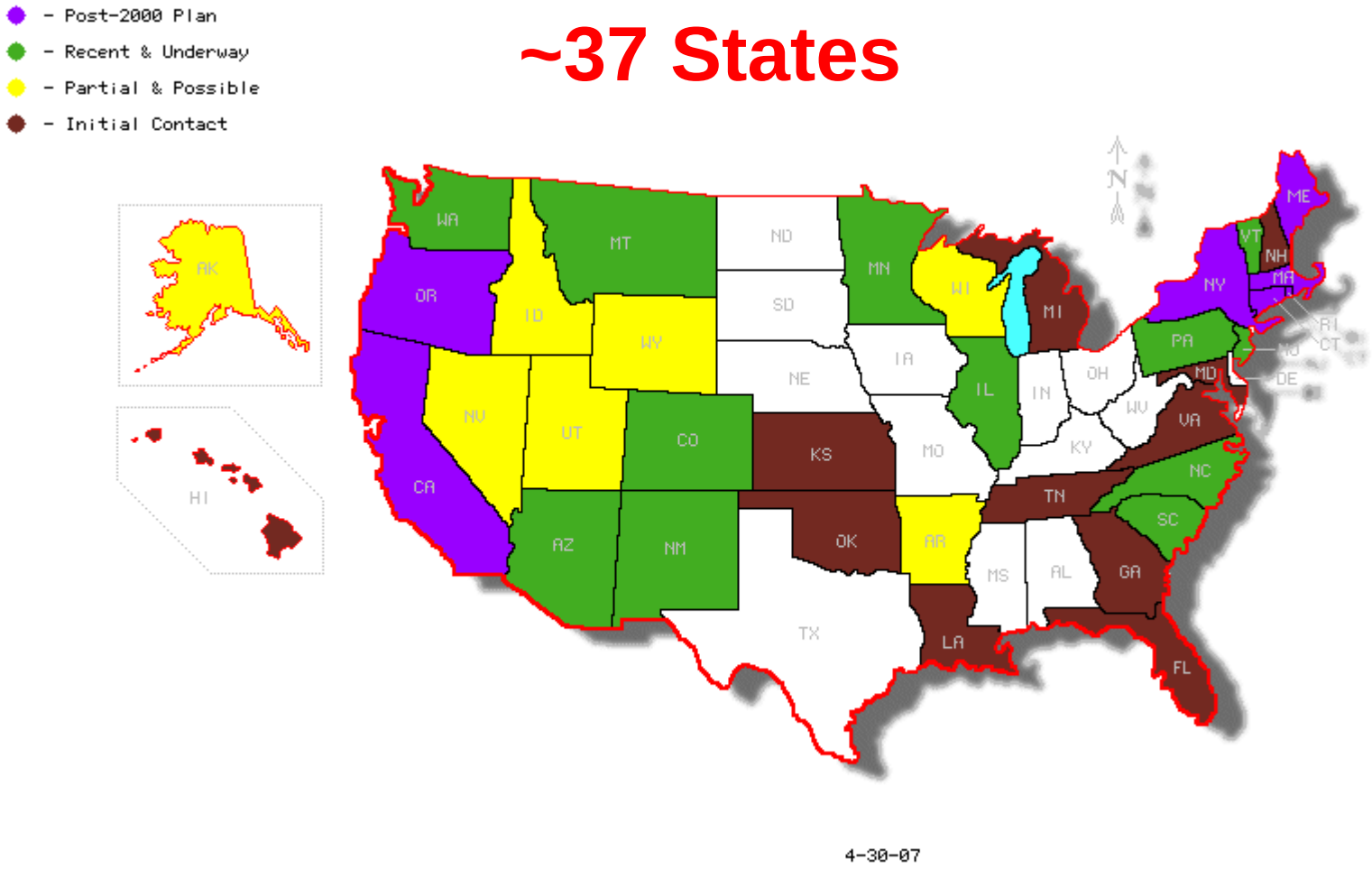
Patrick MA Join RGGI

Napolitano AZ New Targets

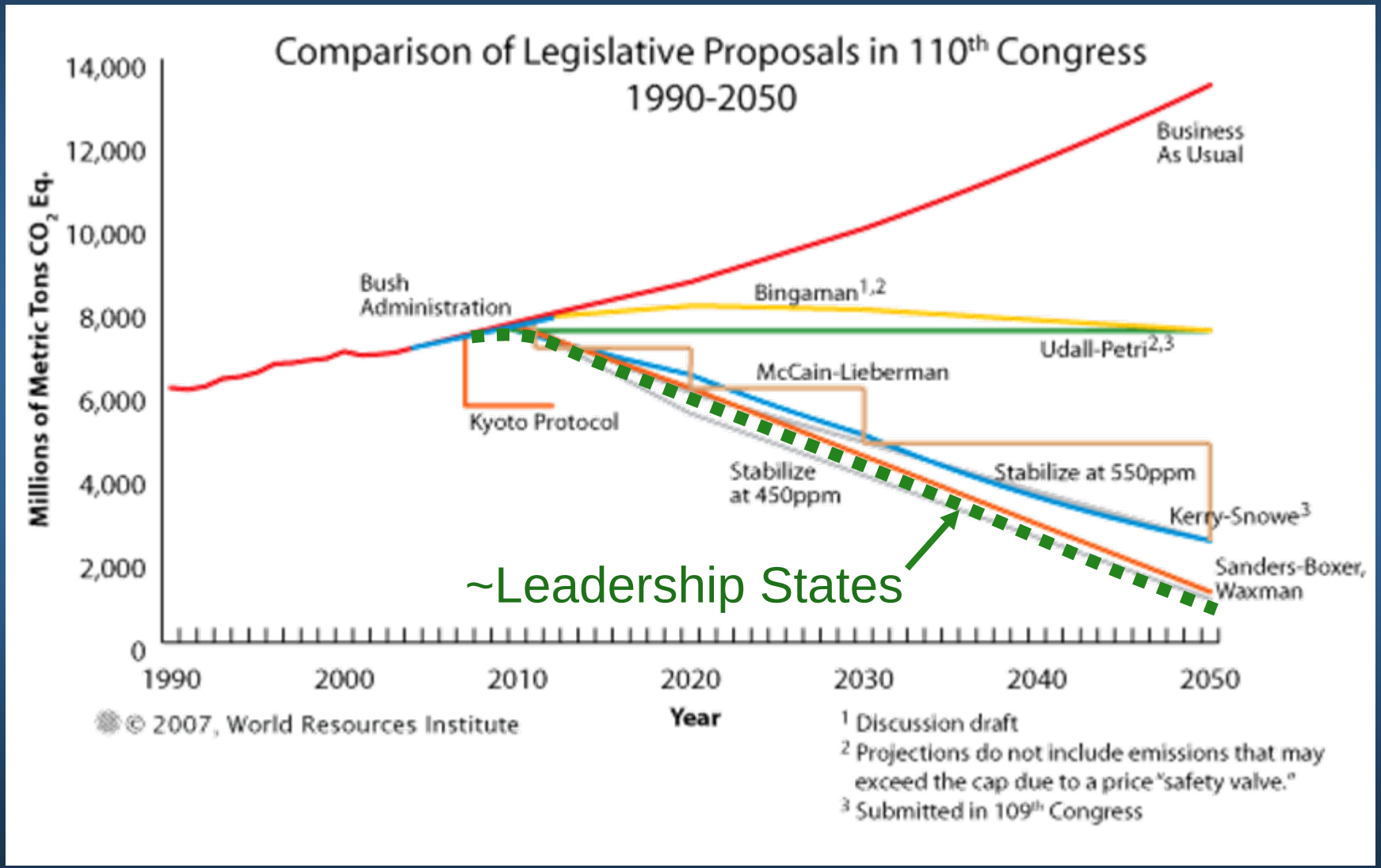
Spitzer NY 100% RGGI Auction = $200 million

Ritter CO GHG Market

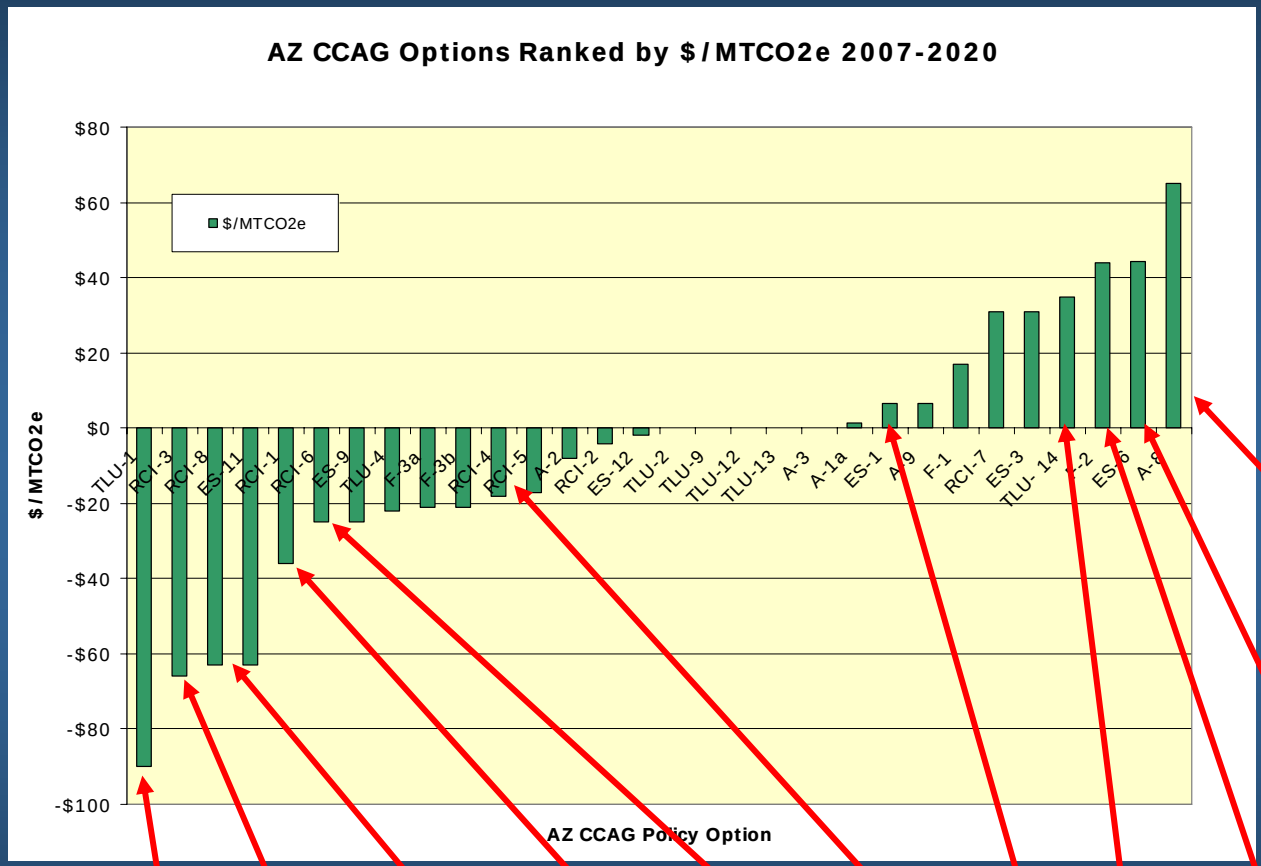
Comprehensive Climate Plans



Comparison to National Bills



GHG Reduction Strategies



Clean Cars

Appliance Efficiency Standards

Electricity Pricing

DG & CHP

DSM

Building Codes

RPS

Truck Speed Limit

Increase Reforestation

Carbon Intensity Targets

Reduce Land Conversion

State Climate Plan Results

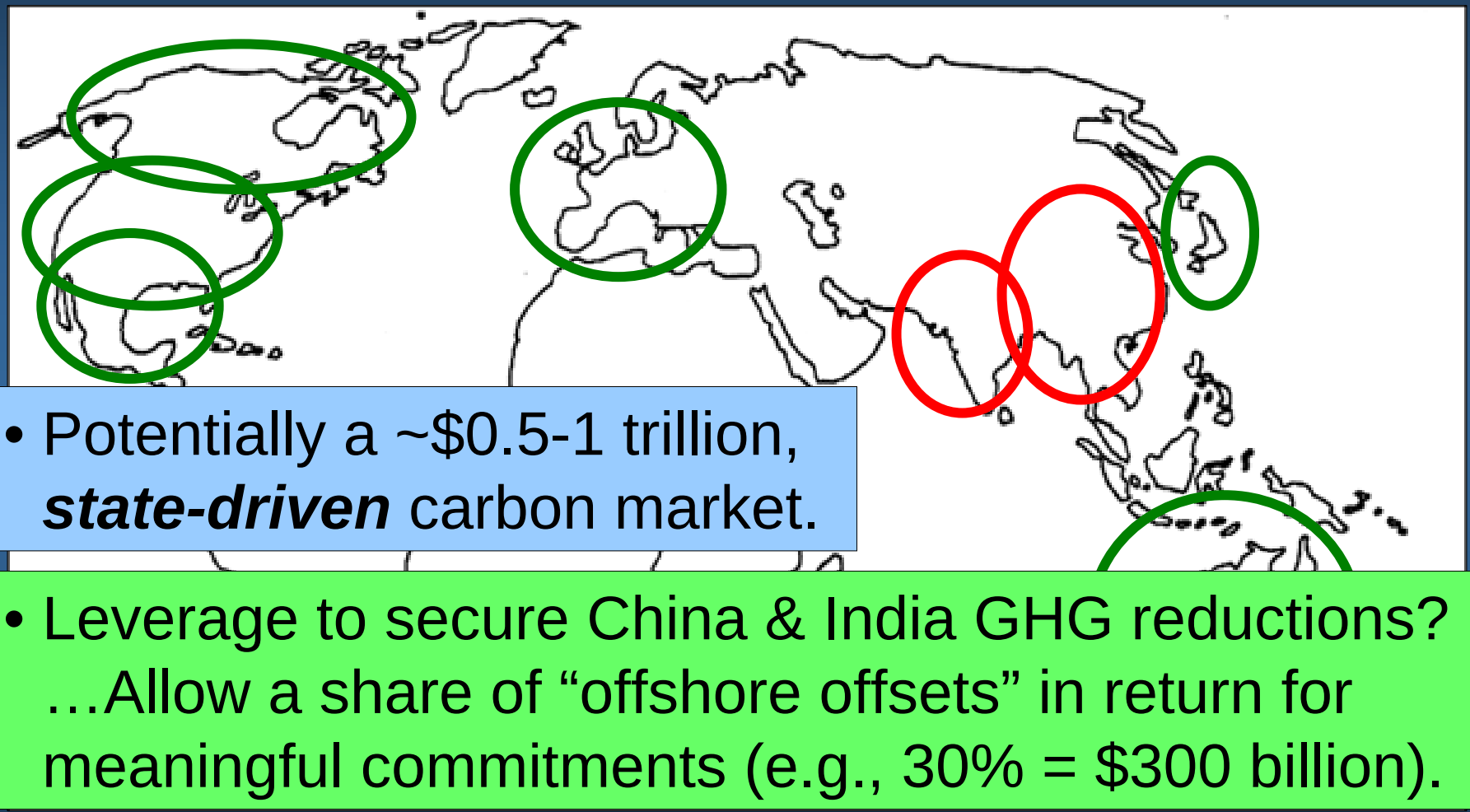
State	End Date	Policy Options	Degree of Unanimity	Amount of GHG Reductions	Overall NPV Cost or Savings	Jobs Impact
AZ	2006	49	92%	• 2000 level by 2020 • Half 2000 level by 2040	$5.5 billion savings 2007-2020	285,000
CA	2008	n/a	n/a	• AB-32: 1990 level by 2020	AB-32 $4 billion savings	AB-32 83,000
CO	2007	70	87%	• 37% below projected emissions by 2020	~$3 billion savings 2007-2020	Not assessed
CT	2005	55	High	• 1990 level by 2010 • 10% below 1990 level by 2020	Net Savings	Not assessed
ME	2004	54	High	• 1990 level by 2010 • 10% below 1990 level by 2020	Net Savings	Not assessed
MT	2007	54	98%	• 1990 level by 2020	$78 million savings 2007-2020	Not assessed
NC	2007	56	85%	• 47% below projected emissions by 2020	$7.5 billion savings 2007-2020	In process
NM	2006	69	97%	• 2000 level by 2012 • 10% below 2000 level by 2020	$2.2 billion savings 2007-2020	Not assessed
VT	2007	37	86%	• 25% below 1990 level by 2012 • 50% below 1990 level by 2028	$1.3 billion savings 2007-2028	Not assessed

National Emulation of States' Actions

Potential US in 2020	% of National Gap	Sample Cost/Cost Savings	M Tons GHG	Total Savings (Best Guess)
Energy Efficiency and Conservation	~24%	-$10 to -$30	555	-$11 Billion
Clean and Renewable Energy	~24%	$7 to $21	565	$8 Billion
Transportation and Land Use Efficiency	~36%	-$32 to -$36	831	-$28 Billion
Agriculture and Forestry Conservation	~6%	-$1 to -$5	132	-$0.4 Billion
Waste Management, Industrial Processes, and Other	~11%	?	246	?
Additional Federal Actions	(~6-18%)	?	264	?
Total			***~2,500***	***-$31 Billion +***

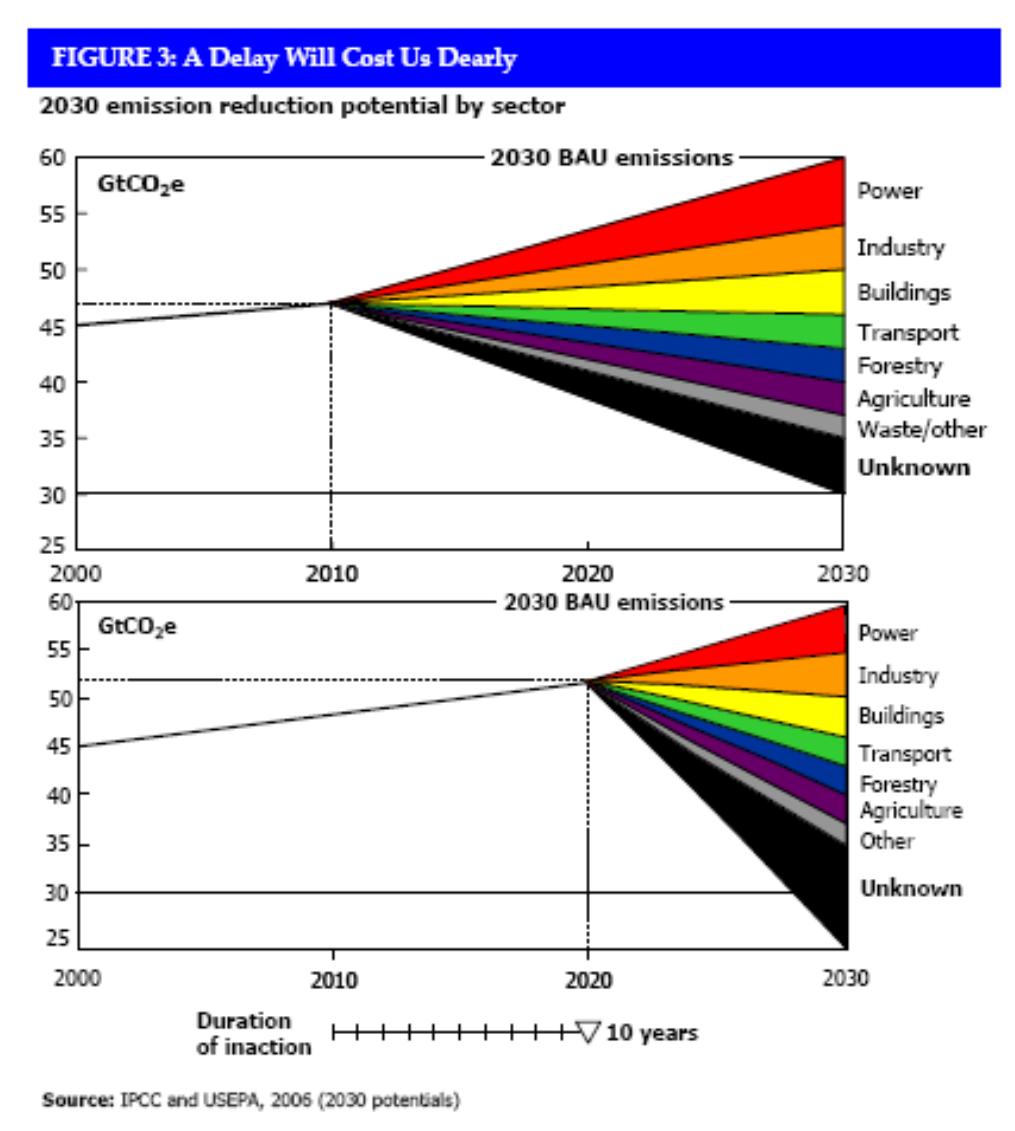
NPV 2007-2020: –$117 Billion

Potential Global Link-Up?



- Potentially a ~$0.5-1 trillion, ***state-driven*** carbon market.
- Leverage to secure China & India GHG reductions? …Allow a share of "offshore offsets" in return for meaningful commitments (e.g., 30% = $300 billion).
- States might succeed where Kyoto has not.

Delay Increases Difficulty

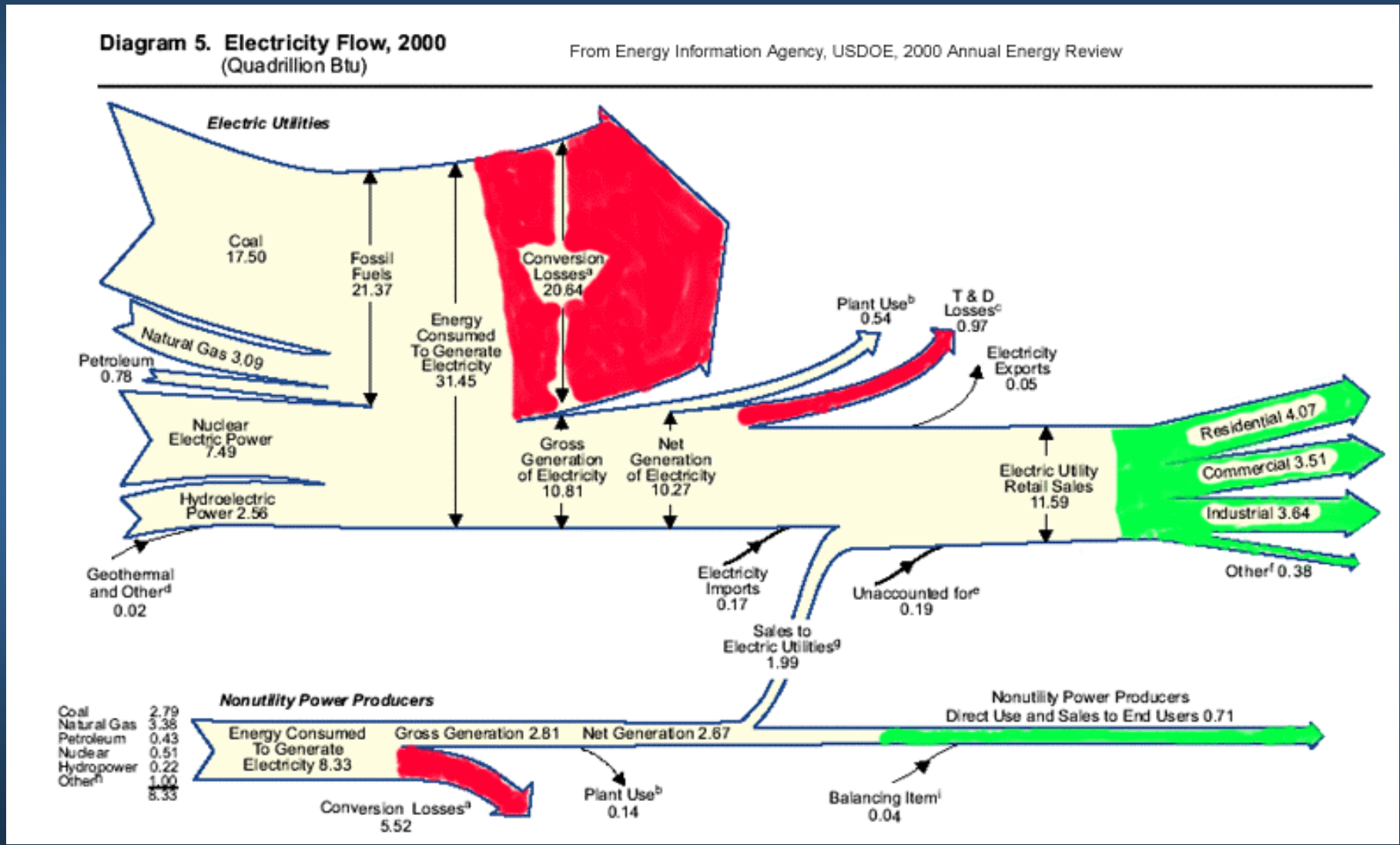


California Environmental Associates, *Design to Win*, 2007

Three problems:

1. Problem gets 5 GTCO2e worse
2. "Wedges" are smaller and reduce less, so reductions from "Unknown" sources must double.
3. The effort required to achieve required reductions (i.e., slope of the line) will be twice as hard.

We waste more energy than Japan uses…



Economic Impact of EE in Florida

Table ES-2. Economic Impact on the State of Florida of Expanded Energy Efficiency

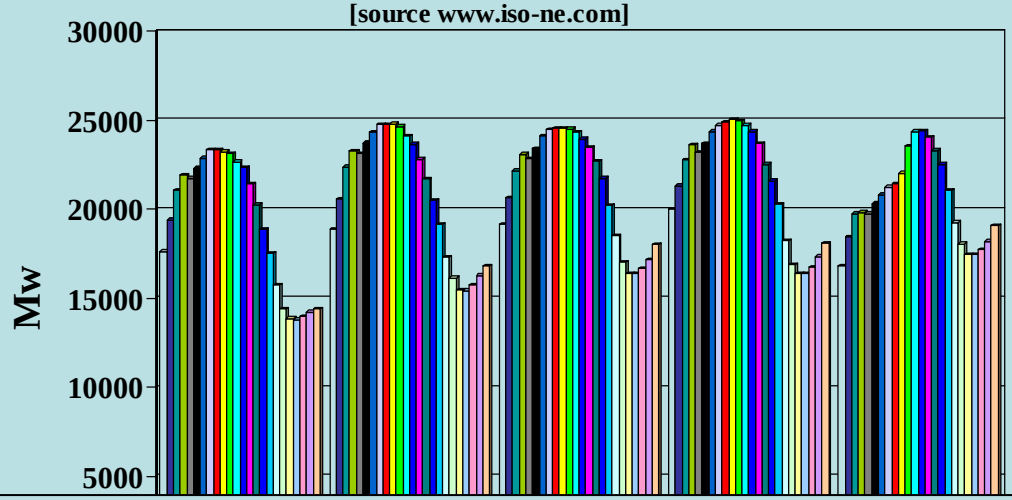
Financial Impacts (Millions of $2004)	2008	2013	2018	2023
Annual Consumer Outlays	1	1,585	2,172	2,584
Annual Electricity Savings	3	1,174	2,679	4,674
Electricity Supply Cost Adjustment	(1)	(894)	(1,867)	(2,975)
Net Consumer Savings	3	484	2,375	[illegible]
Net Cumulative Energy Savings	2	840	8,652	28,250
Macroeconomic Impacts	**2008**	**2013**	**2018**	**[illegible]**
Jobs (Actual)	(33)	366	7,557	14,264
Wages (Million $2004)	(2)	(168)	(62)	64
GSP (Million $2004)	(4)	(1,134)	(1,857)	(2,745)
Estimate of Avoided Emissions *	**2008**	**2013**	**2018**	**2023**
SO_2 (thousand short tons)	0.0	5.9	10.8	16.3
NO_x (thousand short tons)	0.0	3.7	6.7	10.9
CO_2 (million metric tons)	0.0	11.1	21.8	37.1

* Note: Emissions are based on average emission rates.

ACEEE, *Potential for Energy Efficiency and Renewable Energy to Meet Florida's Growing Energy Demands*, June 2007.

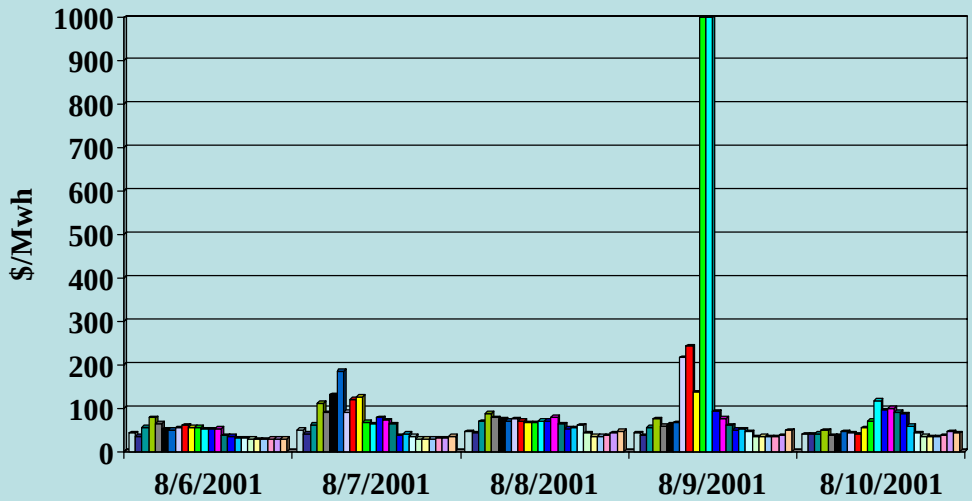
ISO-NE Load

[source www.iso-ne.com]

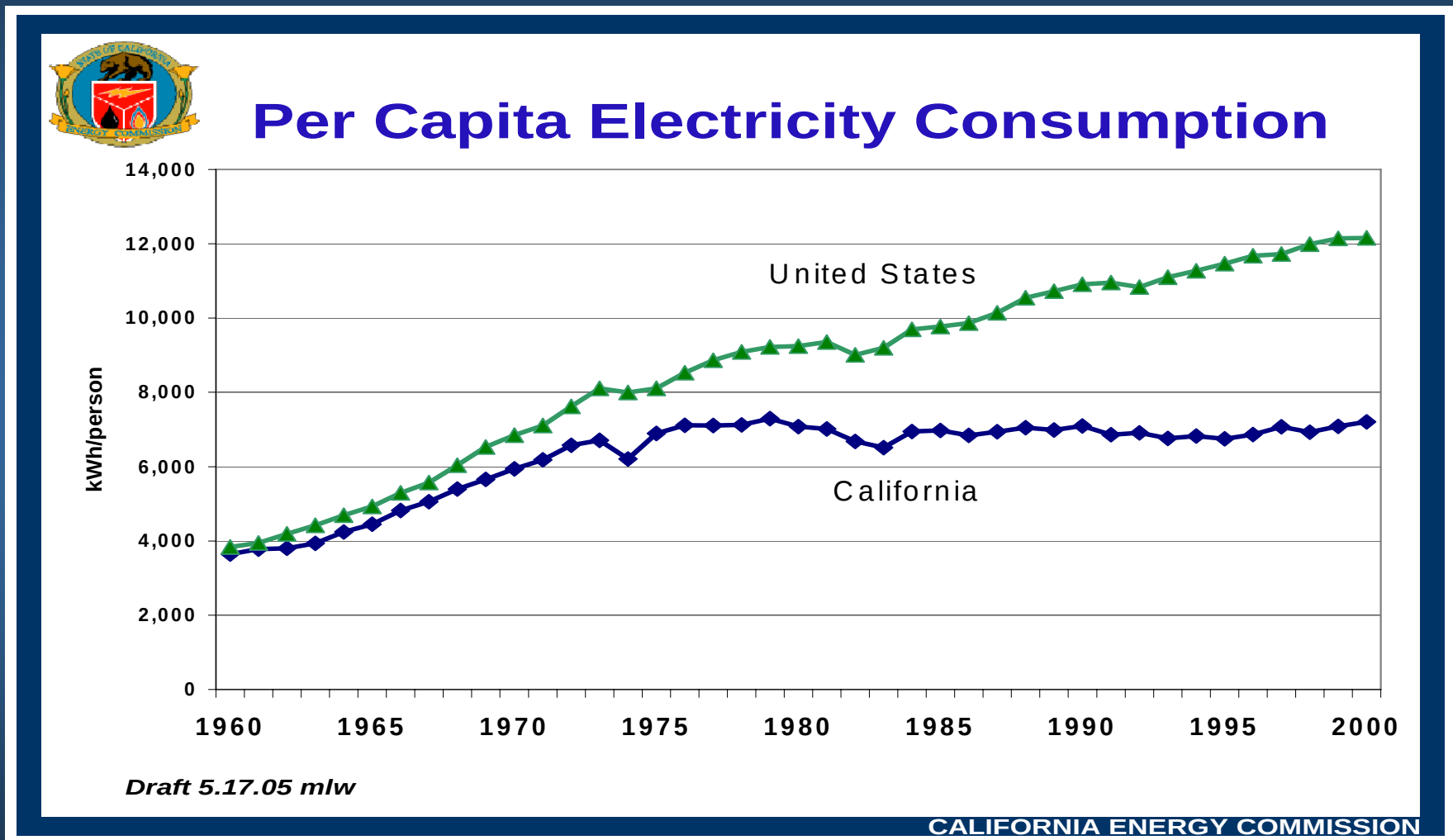


Hourly Bids ISO-NE

[source www.iso-ne.com]



California – It's Already Working



Energy Supply & Jobs

Scenarios (to meet 20% of current US electricity demand)	Construction, Manufacturing, Installation	O&M and Fuel Processing	Total Jobs	Ratio Over "BAU"
1. 20% RPS by 2020 85% biomass, 14% wind, 1% PV	52,533	111,136	163,669	1.89
2. 20% RPS by 2020 60% biomass, 37% wind, 3% PV	85,008	91,436	176,444	2.04
3. 20% RPS by 2020 40% biomass, 55% wind, 5% PV	111,879	76,139	188,018	2.18
4. Fossil Fuels as Usual to 2020 50% coal, 50% natural gas	22,711	63,657	86,369	1.00
5. 20% Gas Intensive by 2020 100% natural gas	22,023	61,964	83,897	0.97

a) "Across a broad range of scenarios, the renewable energy sector generates more jobs than the fossil fuel-based energy sector per unit of energy delivered (i.e., per average megawatt)."

b) "Supporting renewables within a comprehensive energy policy that includes EE and sustainable transportation will yield far greater employment benefits than supporting 1-2 of these sectors separately."

c) More effort => more jobs.

Source: Daniel Kammen et al, UC Berkeley, Putting Renewables to Work, April 2004.

Economics 101: Factors of Production

Factor	BAU	EE/RE
Man (Labor)	–	+
Machine (Capital)	+	–
Material (Raw Material)	+	–
Method (Technology)	–	+
Energy Security	–	+
Regulatory Certainty	–	+
Quality / Time-to-Market	–	+
“Ecosystem Services”	–	+

Economic Opportunity

Climate change is “a tectonic force that [will] change the economic landscape; firms that recognize early, and respond imaginatively and constructively will create
thereb

US clean-tech investment:
2005 – ~$1.5 billion
20
20

International carbon market:
2005 – $12 billion
200
200

U.S. energy sector investment (now through 2030): ~$21 trillion

Energy will be the “largest economic opportunity this century.”
John Doerr, Venture Capitalist (Google, Amazon)

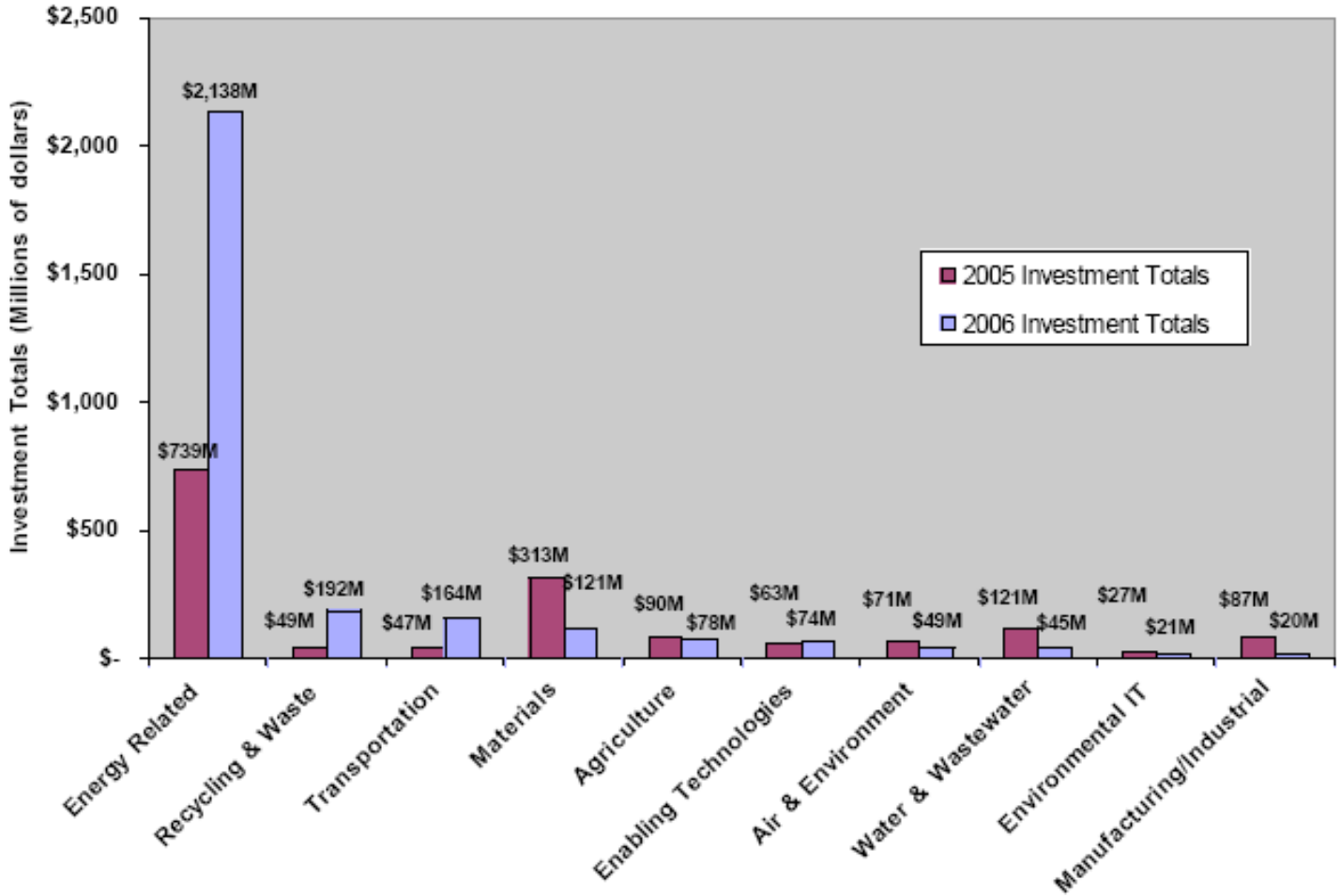
Economic Opportunity

The bolder proposition we should be considering:

Climate policy as a path to economic development and job growth

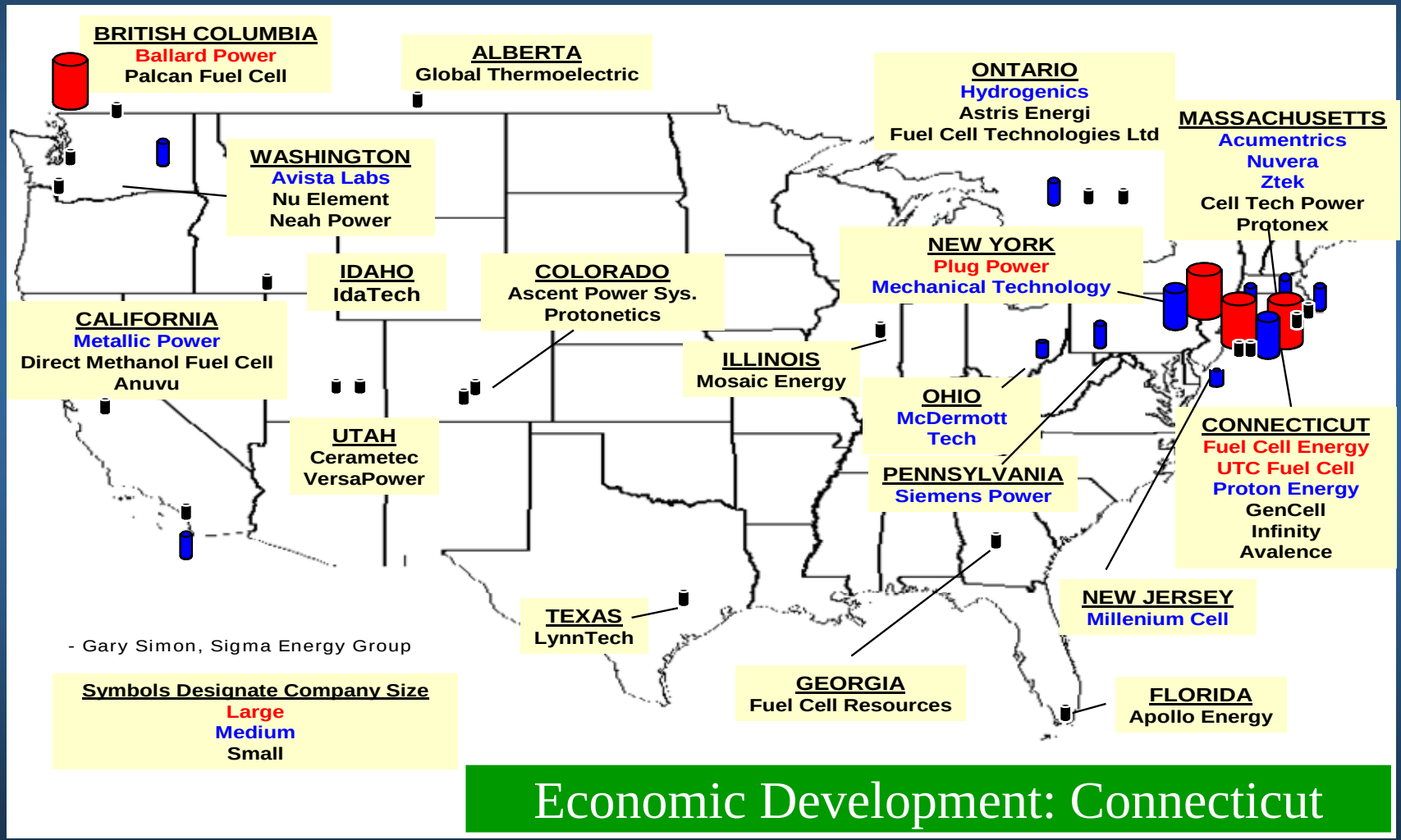
Cleantech Venture Investments by Sector

Figure 1.1 *North American Cleantech Venture Capital Investments by Industry Segment, 2005-2006 (Millions of dollars)*



E2/Cleantech Venture Network, *Cleantech Venture Capital: How Public Policy Has Stimulated Private Investment*, May 2007.

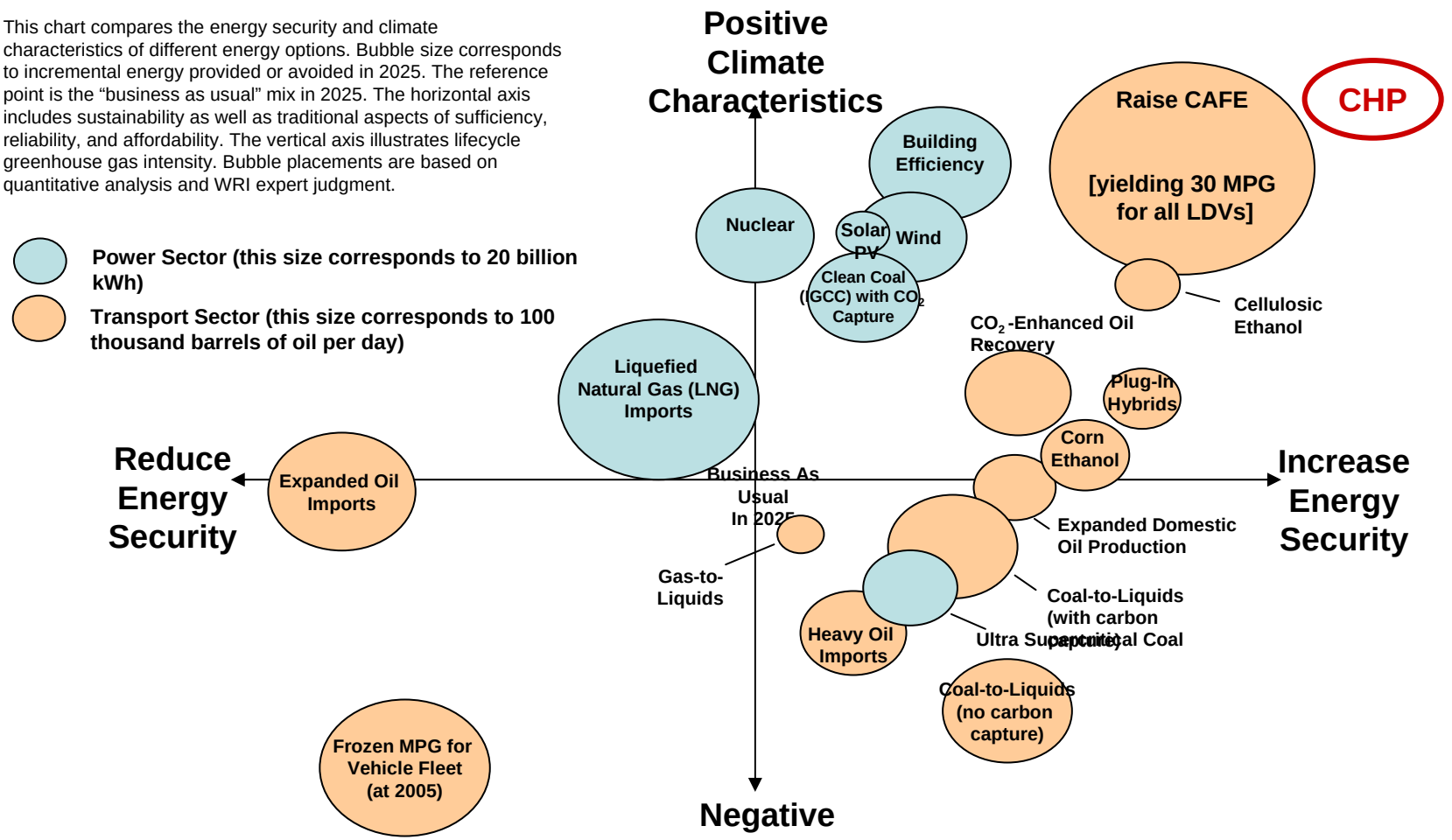
Future Economy: *Fuel Cell Technology in North America*



Economic Development: Connecticut

Climate and Security

This chart compares the energy security and climate characteristics of different energy options. Bubble size corresponds to incremental energy provided or avoided in 2025. The reference point is the "business as usual" mix in 2025. The horizontal axis includes sustainability as well as traditional aspects of sufficiency, reliability, and affordability. The vertical axis illustrates lifecycle greenhouse gas intensity. Bubble placements are based on quantitative analysis and WRI expert judgment.



Revised 6/14/2007

For specific details on the assumptions underlying the options on this chart, go to www.wri.org/usenergyoptions

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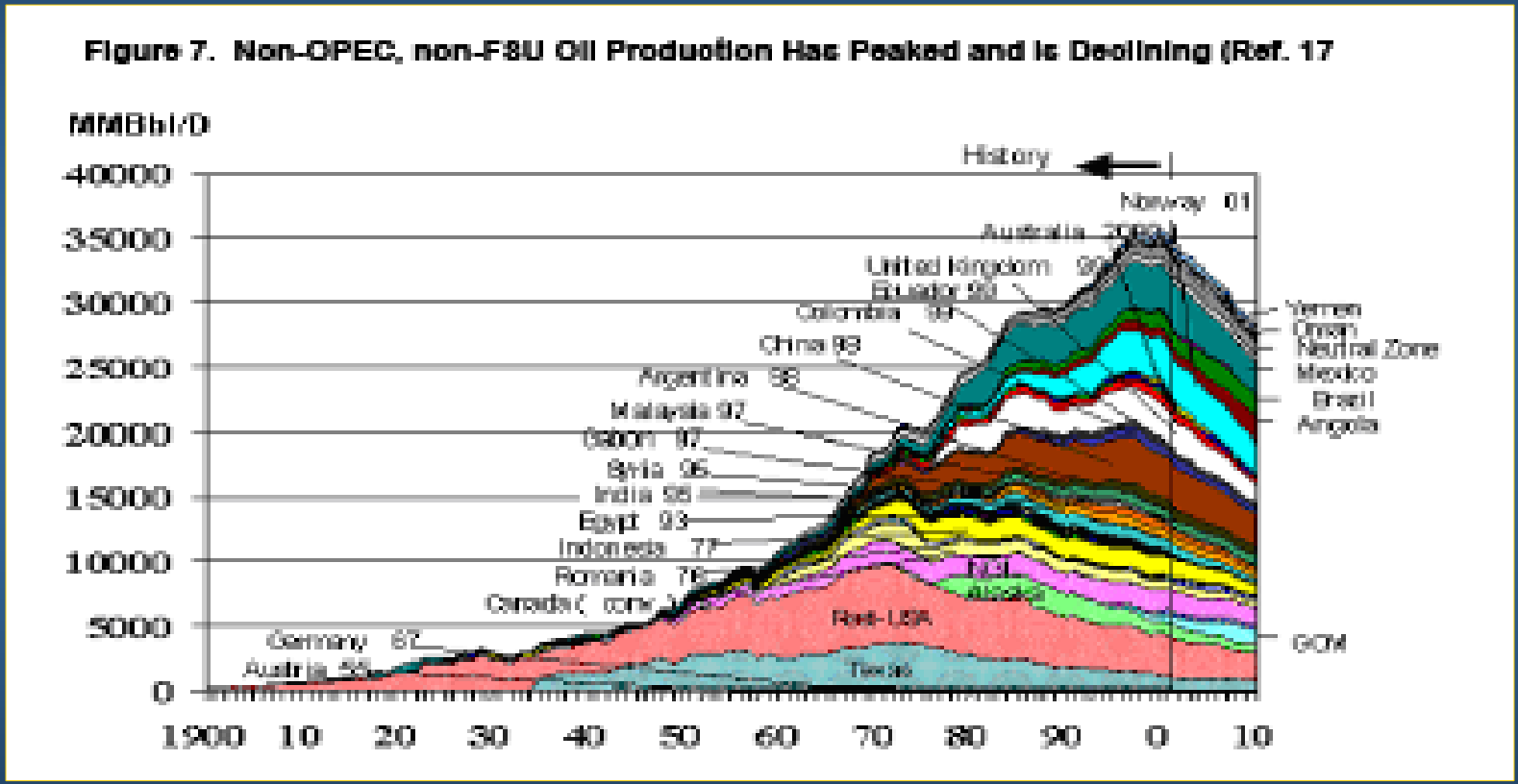
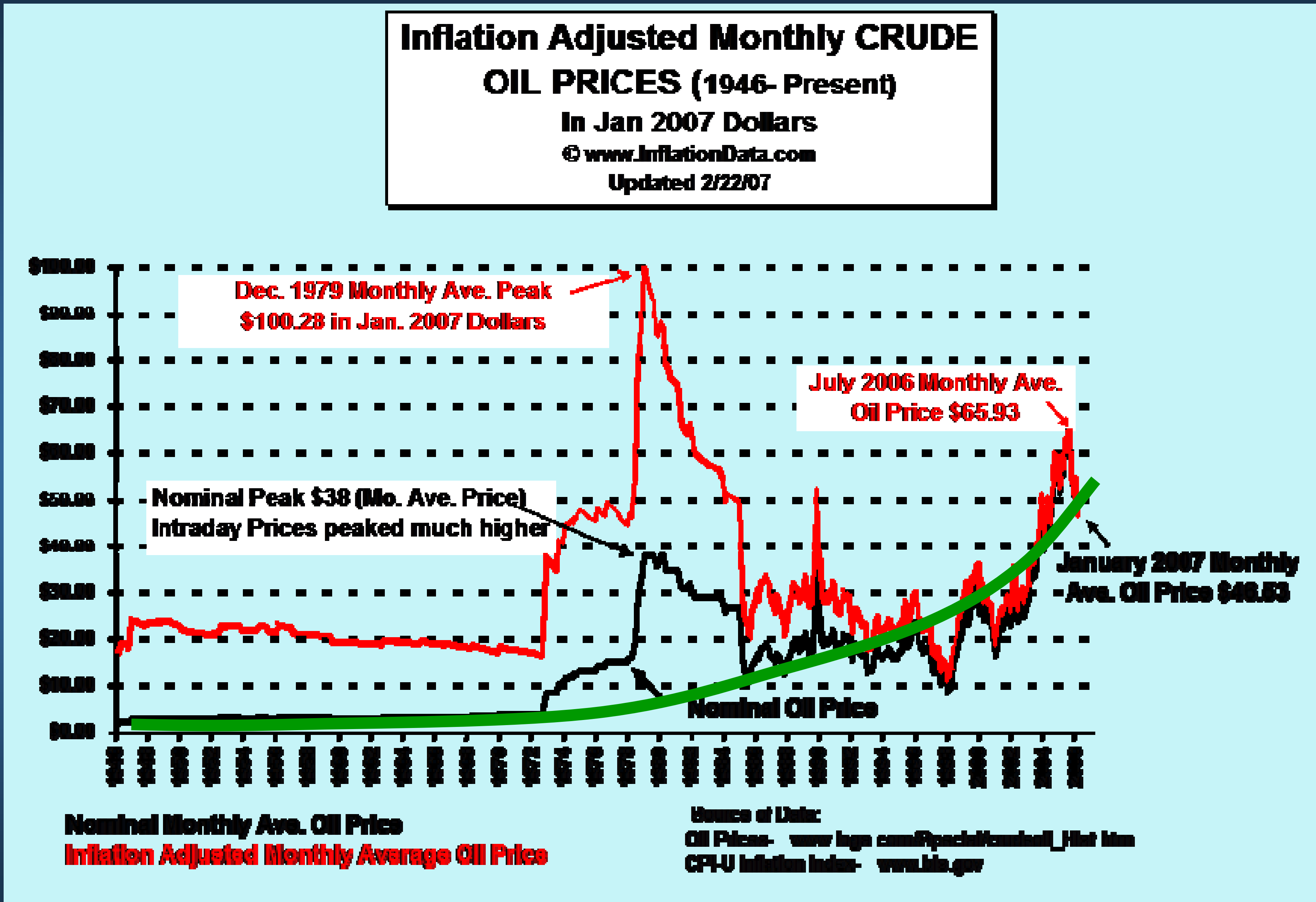
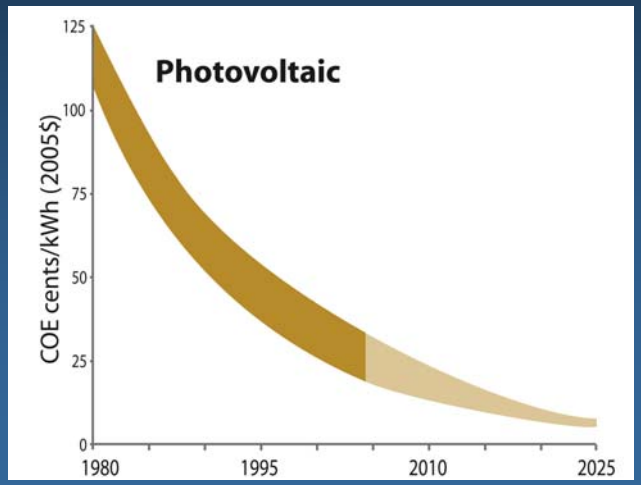
Non-OPEC Hubbert's Peak is Here

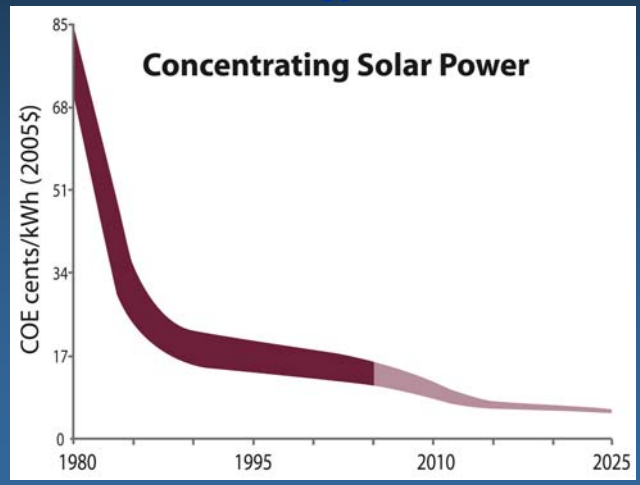


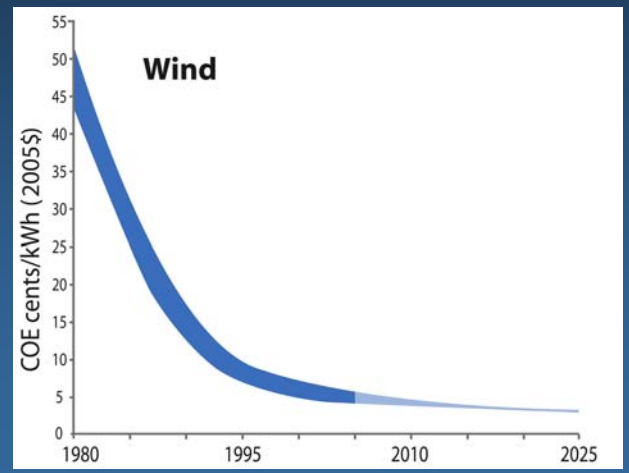

Inflation Adjusted Monthly CRUDE OIL PRICES (1946- Present)
In Jan 2007 Dollars
© www.InflationData.com
Updated 2/22/07
Dec. 1979 Monthly Ave. Peak
$100.28 in Jan. 2007 Dollars
July 2006 Monthly Ave.
Oil Price $65.93
Nominal Peak $38 (Mo. Ave. Price)
Intraday Prices peaked much higher
January 2007 Monthly
Nominal Oil Price
Nominal Monthly Ave. Oil Price
Inflation Adjusted Monthly Average Oil Price
Source of Data:
CPI-U Inflation Index- www.bls.gov

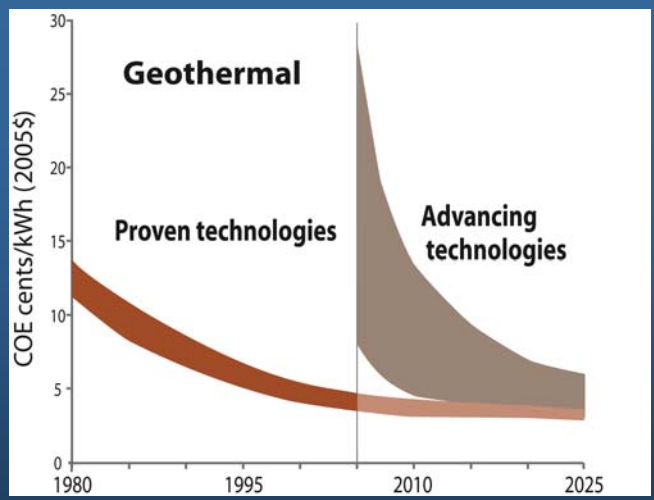
Renewable Energy Cost Trends

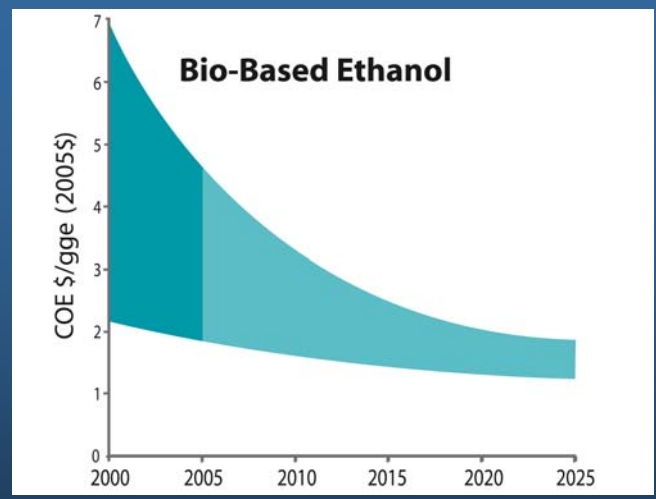
Levelized cost of energy in constant 2005$[1]







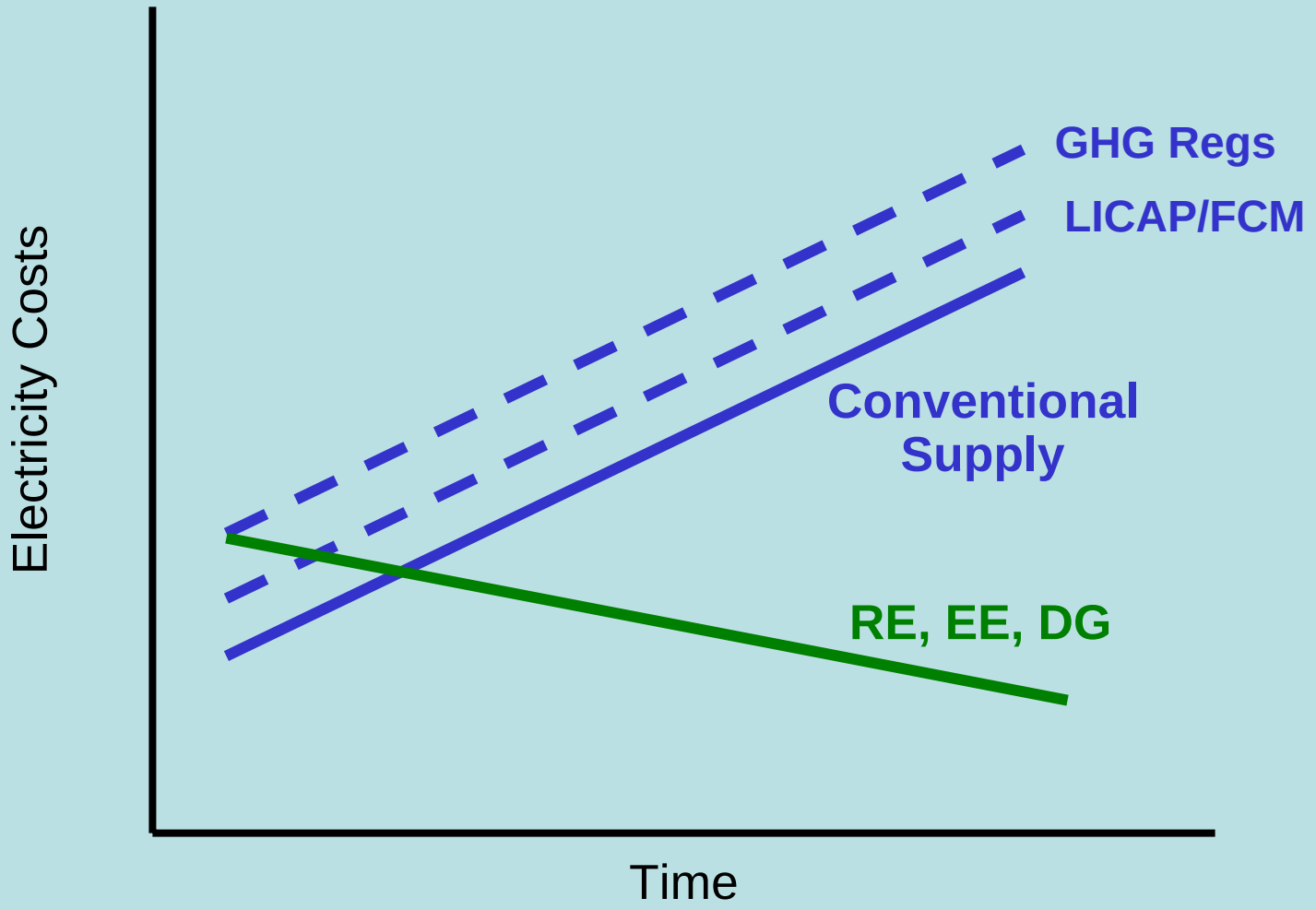




Source: NREL Energy Analysis Office (www.nrel.gov/analysis/docs/cost_curves_2005.ppt)

[1]These graphs are reflections of historical cost trends NOT precise annual historical data. DRAFT November 2005

Which is the Wiser Path?



International Competitiveness

Renewable Energy and Energy Efficiency:

Economic Drivers for the 21st Century

Roger Bezdek, Principal Investigator,
Management Information Services, Inc.
for the
American Solar Energy Society

Renewable energy and energy efficiency reduce the risks associated with fuel price volatility and can facilitate an industrial boom, create millions of jobs, foster new technology, and revitalize the manufacturing sector.

From: Worldwatch Institute [mailer@worldwatch.org] Sent: Wed 11/14/2007 7:12 PM
To: kcolburn@symbioticstrategies.com
Cc:
Subject: New Report on Renewable: Which Country is Poised to Lead?

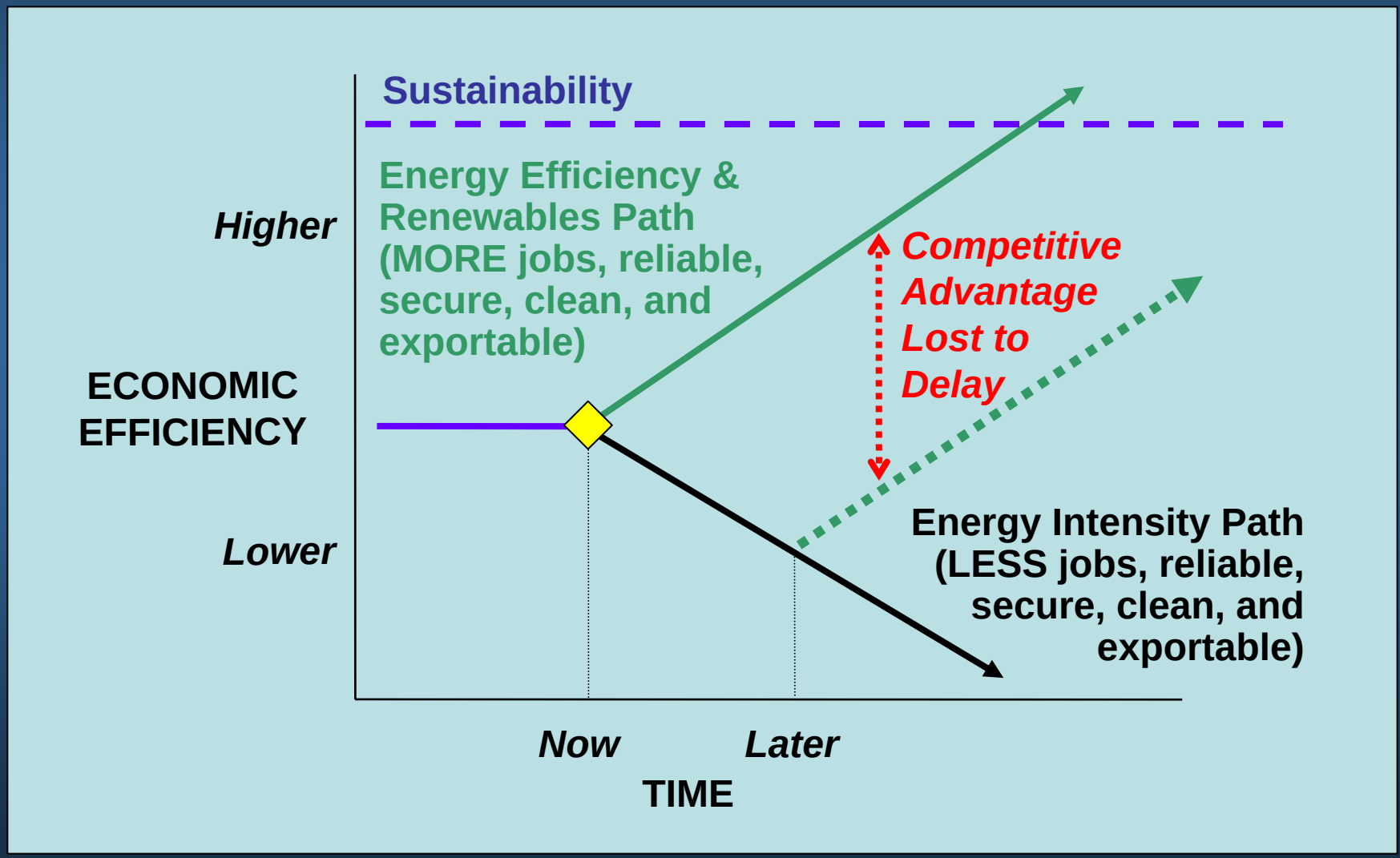
China on Pace to Become Global Leader in Renewables

If China's commitment to diversifying its energy supply and becoming a global leader in renewables manufacturing persists, renewable energy could provide over 30 percent of the nation's energy by 2050. This is the major conclusion of *Powering China's Development: The Role of Renewable Energy*, written by Beijing-based researcher Eric Martinot, a Worldwatch senior fellow, and Li Junfeng, Vice Chair of China's Renewable Energy Society in Beijing.

"A combination of policy leadership and entrepreneurial savvy is leading to spectacular growth in renewable energy, increasing its share of the market for electricity, heating, and transport fuels," said Martinot. "China is poised to become a leader in renewables manufacturing, which will have global implications for the future of the technology."

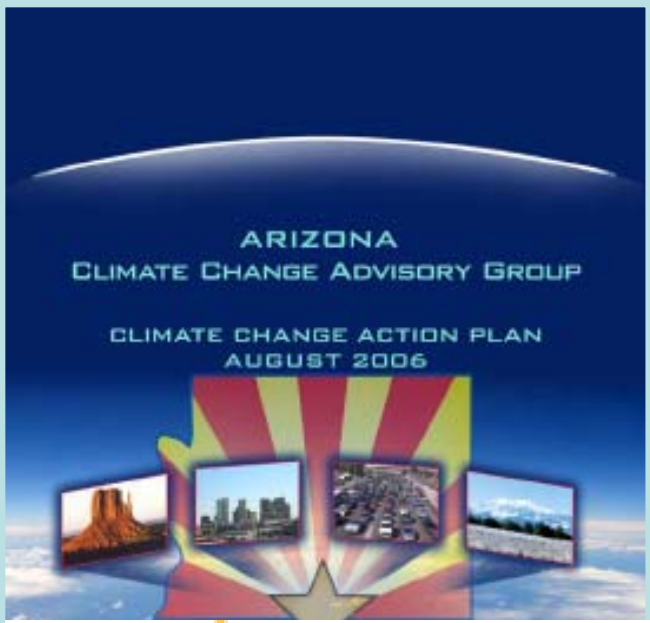
More than $50 billion was invested in renewable energy worldwide in 2006, and China is expected to invest over $10 billion in new renewables capacity in 2007, second only to Germany.

Old or New Energy Path?



Energy Opportunity is the Third Industrial Revolution

www.azclimatechange.us



CCAG Recommended Policy Options, by Quantified Cost Per Ton GHG Removed

Cost savings are shown below the axis. Net costs are shown above the axis.

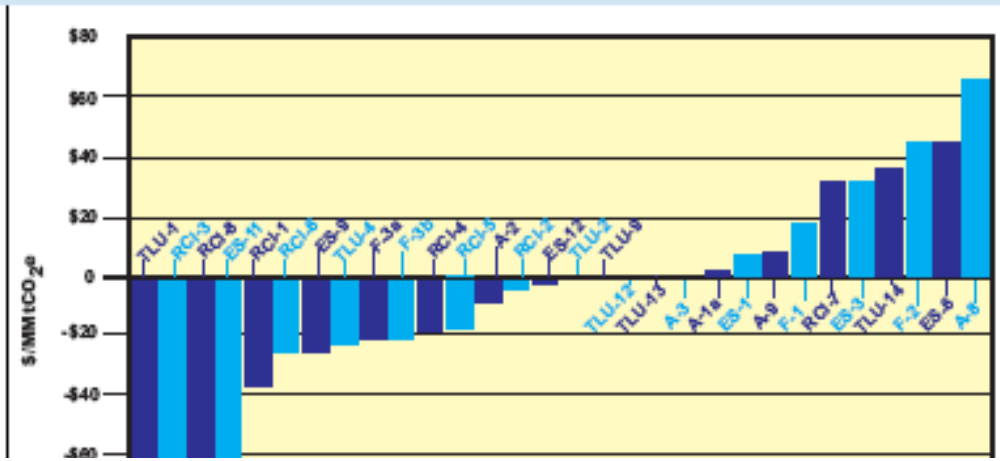


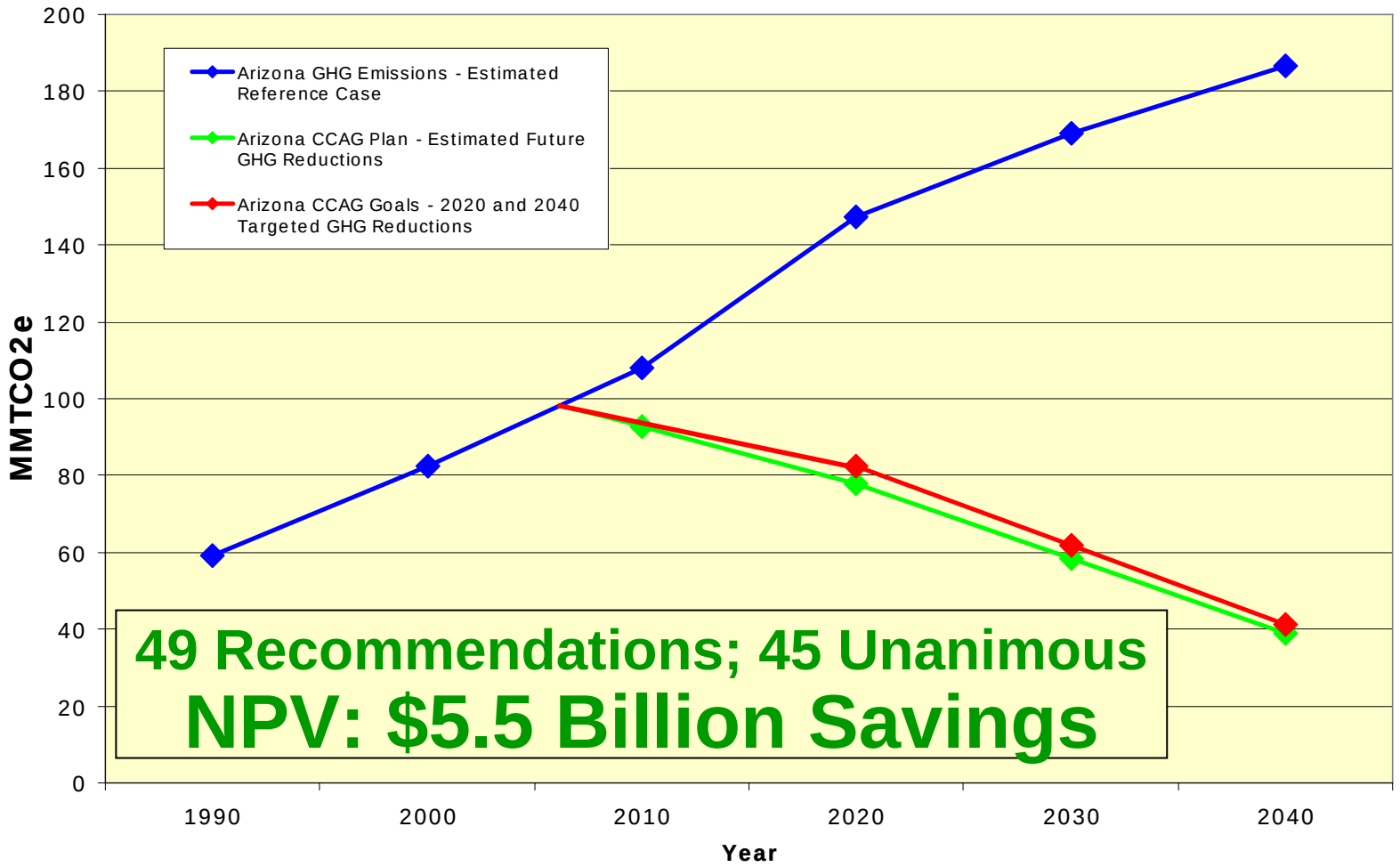
Table 1-3 Totals

Total of all CCAG Options with Adjustments for Overlap (Detailed data may be found in the Tables presented in Chapters 4-8 and the Appendi	2010 Annual GHG Reduction ($MMtCO_2e$)	2020 Annual GHG Reduction ($MMtCO_2e$)	2007-2020 Cumulative Reduction ($MMtCO_2e$)
	15.4	69.4	485.4*

+285,000 jobs

The Center for Climate Strategies (CCS) has calculated overall net economic cost savings from the CCAG's policy option recommendations of more than $5.5 billion from 2007-2020. The CCS also has calculated that the average cost for each ton of GHGs removed would be -$12.74, meaning that there would be a net econmic cost savings of $12.74 for each ton of GHGs removed.[15]

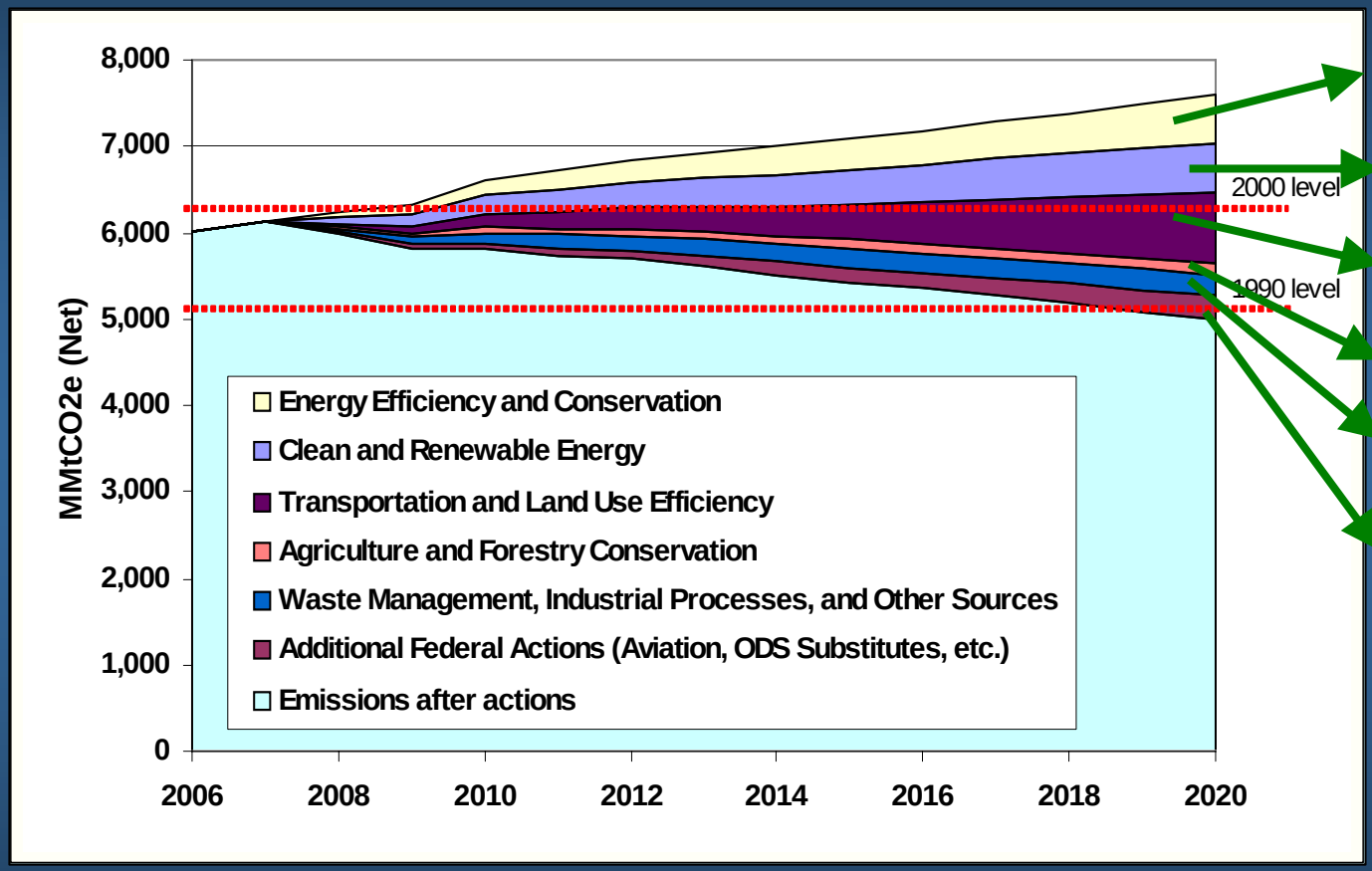
Arizona – Climate Plan Results



Similar Results in Other States…

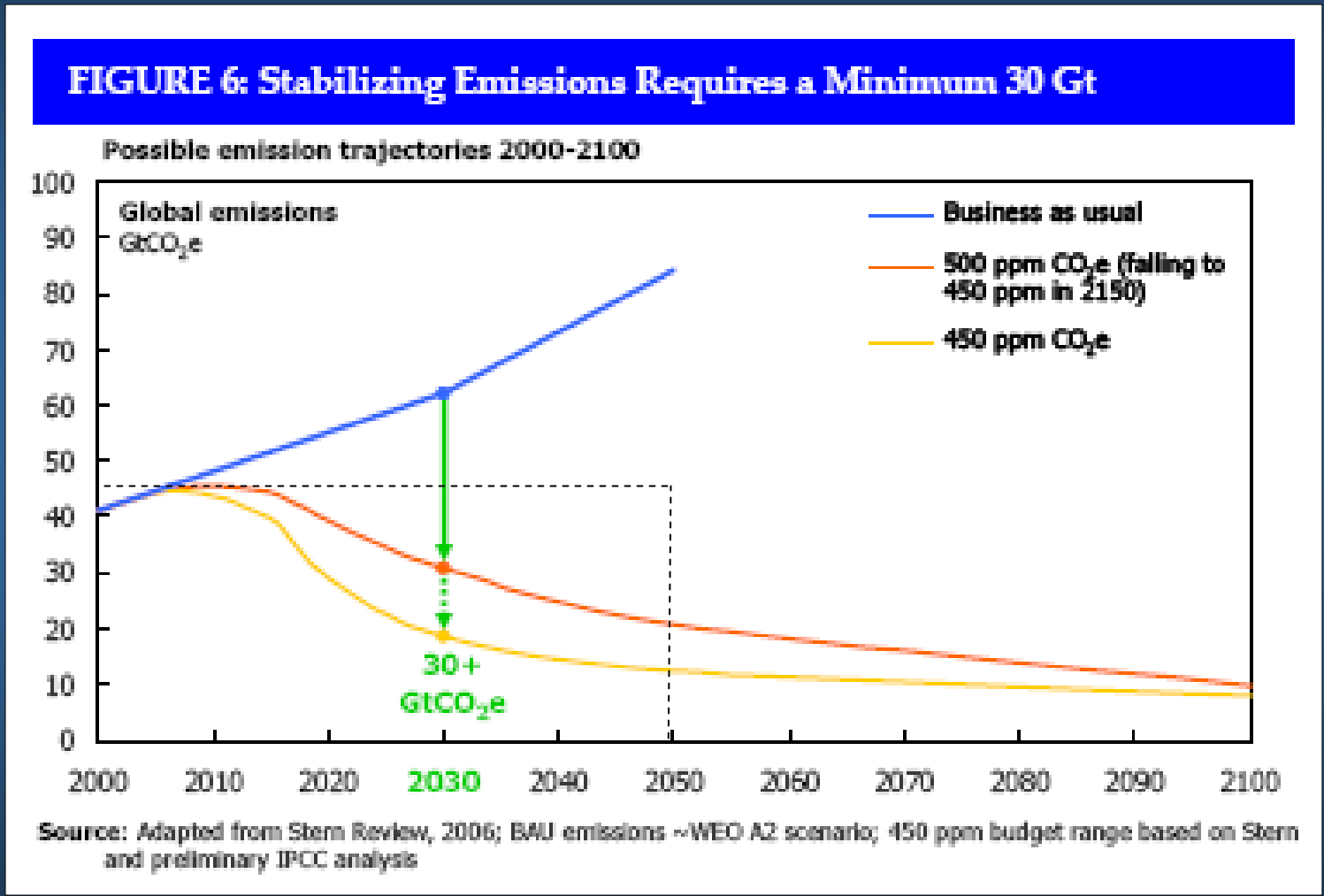
- **69 Recommendations; 67 Unanimous**
- **NPV: $2.1 Billion Savings**
- **Reductions exceeded Governor's goals.**

Leadership States' "Wedges"



% of Gap	Sample Cost
~24%	-$10 to -$30
~24-30%	$7 to $21
~20-36%	-$32 to -$36
~6-9%	-$1 to -$5
~11-18%	?
~6-18%	?

The Task is Daunting…



California Environmental Associates, *Design to Win*, 2007

It'll Cost a Lot If We Don't Act…

**Climate Change –
the Costs of Inaction**

Repo

HM TREASURY

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Stern Review on the economics of climate change

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30 October 2006

Stern Review on the Economics of Climate Change

Pub

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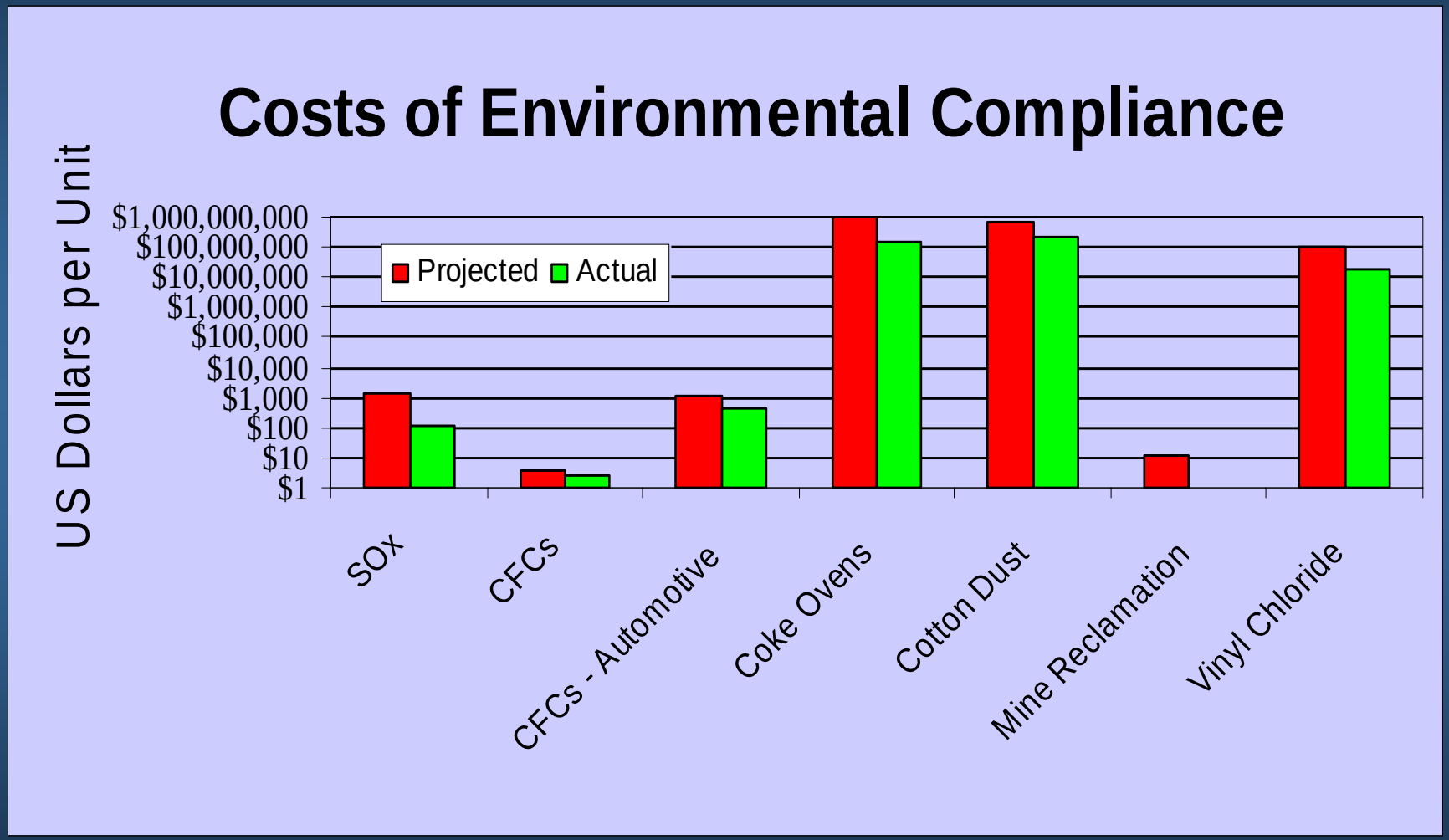
Cost to act: ~1% global GDP.

Cost of not acting: 5-20% of global GDP by mid-century.

…Will It Cost a Lot If We Do?

Prior Experience with Regulatory Costs



Note that the scale is exponential!

THE 'CL

COMPANY	SECTOR	CARBON FOOTPRINT	REDUCTIONS / ACHIEVEMENTS
3M	Chemicals	14 million tonnes CO2e in 2004.[1]	Reduced GHG emissions by approx. 37% between 1990 and 2004. 62% improvement in energy efficiency between 1973 and 2004.[2]
ABN AMRO	Banking	366,293 tonnes CO2 (internal emissions 2004).[3]	Reduced worldwide direct CO2 emissions by 4.3%, and indirect emissions by 9% between 2003 and 2004.[4]
AEP	Energy and Utilities	147 million tonnes CO2e in 2004.[5]	Reduced CO2e emissions by 13% between 2000 and 2004.[6]
ALCAN	Metals and Mining (Aluminium)	39.6 million tonnes CO2e emissions in 2004 (includes emissions of all facilities owned by Alcan).[7]	Alcan reduced direct and indirect GHG emissions by 15% between 1990 and 2003. Pechiney (Alcan aquisition in 2003) reduced direct GHG emissions by 18% between 1990 and 2003.[8]
ALCOA	Metals and Mining (Aluminium)	34.1 million tonnes of CO2e globally in 2004.[9]	Reduced PFC emissions by 80%, and achieved 26% reduction in GHG emissions between 1990 and 2003.[10]
ALLIANZ	Insurance	Direct and indirect CO2 emissions were 570,000 tonnes in 2003.[11]	27% reduction in CO2 emissions (kg/employee/year) between 2000 and 2003.[12]
AMCOR	Industrial Manufacturing	Not documented	Annual reduction in GHG emissions by 60,000 tonnes through energy efficiency. Amcor Australasia reduced energy use per unit of production 20% between 2002 and 2004.[13]
BAA	Transportation Services	436,052 tonnes CO2 in 2005.[14]	Reduced CO2 emissions per passenger by 44% between 1997 and 2004. Sourcing 17% of electricity from UK Climate Change Levy exempt sources in 2005.[15]
BASF	Chemicals	29.5 million tonnes of CO2 in 2004.[16]	Reduced absolute GHG emissions by 36% between 1990 and 2002.[17]
BAYER	Chemicals	5.6 million tonnes of CO2 in 2004.[18]	63% reduction in direct emissions between 1990 and 2004.[19]
BP	Energy and Utilities (Oil and Gas)	Direct and indirect emissions of 91.6 million tonnes CO2e in 2004 Emissions from use of BP's hydrocarbon products totalled 1.4 billion tonnes CO2 in 2004.[20]	Met GHG reduction target in 2001, nine years ahead of schedule.[21] Between 2001 and 2004, energy and flare reduction projects contributed a further 4 million tonnes of GHG reductions.[22] Absolute reduction in emissions of 14% between 1998 and 2004.[23]
BT	Telecommunications Services	822,697 tonnes CO2e in 2004/05.[24]	Reduced energy related CO2 emissions by 71% between 1991 and 2004. Supplying 56% of UK electricity requirements through low carbon and renewable energy sources.[25]
CANON	Consumer Products Manufacturing	714,784 tonnes CO2 (internal emissions). 1.1 million tonnes CO2 (use of product) in 2004.[26]	74% reduction in non-CO2 GHGs between 1990 and 2003 (SF6, HFC, PFC). 38% reduction from 1990 CO2 emissions per unit of production.[27]
CATERPILLAR	Industrial Manufacturing	To be released by EPA Climate Leaders next year.	Reduced direct GHG from facilities by 35% between 1990 and 2005 in the US.[28]
CINERGY	Energy and Utilities	58.2 million tonnes CO2 emissions in 2004.[29] In 2003 Cinergy's core operations accounted for about 1% of worldwide GHG emissions.[30]	7.5% reduction in emissions between 2002 and 2004.[31]
DEUTSCHE BAHN	Transportation Services (Government Owned)	7.4 million tonnes CO2 (2002).[32]	25% reduction in emissions by 2002 on 1990 levels.[33] Producing 15% of energy from renewables.[34]
DEUTSCHE TELEKOM	Telecommunications Services	259,049 tonnes CO2 emissions in 2003 (in Europe).[35]	Reduced direct emissions 43% between 1995 and 2002.[36]
DOW	Chemicals	27.3 million tonnes CO2e in 2004.[37]	Reduced total direct CO2e emissions by 22%. Reduced energy intensity by 21% between 1994 and 2005.[38]

Making Money Using Less Energy

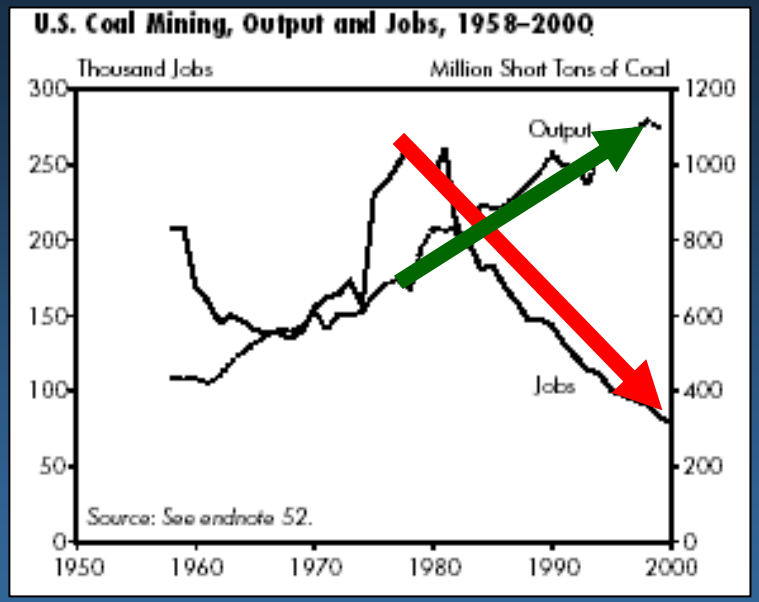
- Dupont:
  - 69% GHG cut 1990-2005; saved $2 billion
- IBM:
  - 65% GHG cut 1990-2005; saved $791 million
- BP:
  - 18% GHG cut 1998-2001; saved $650 million
- Alcoa:
  - 25% GHG cut 1990-2003; saved $100 million
- 3M:
  - 35% GHG cut 1995-2005; saved $200 million since 1973
- Dow, UTC, Johnson & Johnson, Intel, Kodak, British Telecom, etc. A similar list for cities…
- *"Nobody has lost money undertaking climate action."– Northrop*

Employment & Energy Supply: Renewables Favor Environment AND Jobs

Germany, Electricity Market Share, 1998			
Generation Source	Generation Market Share	Jobs Supported	Jobs per 1% Market Share
Wind	1.2%	15,000	12,500
Nuclear	33%	38,000	1,152
Coal	26%	80,000	3,077

Source: *Working for the Environment*, Worldwatch Institute, Working Paper 152, September 2000.

Are We Wedding Ourselves to Energy Technologies of the Past...



Mining Employment in Selected Countries, 1988–97

Country	1988	1997	Change
	(thousands)		(percent)
China[1]	8,320	8,510	+ 2.3
India[2]	1,049	1,100	+ 4.9
Ukraine	856	635	- 25.8
Brazil[3]	824	710	- 13.8
South Africa[4]	733	562	- 23.3
United States	713	592	- 17.0
United Kingdom	187	65	- 65.2
France	88	52	- 40.9

Note: Includes coal- and metals-mining and oil and gas extraction jobs. [1]Employment peaked at 9.25 million in 1993. [2]Data are for 1988 and 1996. [3]Data are for 1992 and 1996. [4]Data are for 1988 and 1993.

Output and Employment Changes in Selected Industries

Industry	Country	Time Period	Output Change	Employment Change
			(percent)	
Oil & gas production	United States	1980–99	– 28[1]	– 52
Oil refining	United States	1980–99	+ 16	– 38
Chemicals	European Union	1990–98	+ 25	– 14
Electricity generation	Germany	1991–98	+ 5	– 25
Primary metals processing	United States	1979–99	+ 15	– 40
Steel	European Union, North America, Japan, and four others[2]	1974–99	– 0.6	– 21
Forest products	Sweden	1980–99	+ 17	– 50

[1]Decline in oil production; natural gas production dipped just slightly. [2]Other countries included are Brazil, South Africa, South Korea, Australia.

Source: *Working for the Environment*, Worldwatch Institute, Working Paper 152, September 2000.

TABLE 5

Job Impact Findings, Selected Studies on Climate Policy

Country	Policy Change	Years	Carbon Reduction (million tons)	Employment Gain (net number of jobs)
Austria	Cogeneration, energy efficiency, renewables, alternative transportation	1997–2005	70	+ 12,200
Austria	Biomass, higher taxes on fossil fuels	1997–2005	20	+ 30,000
Denmark	Greater natural gas use, district heating, co-generation, energy efficiency, renewables; total energy consumption stable	1996–2015	82	+ 16,000
Germany	Boosting efficiency, phasing out nuclear power, less oil and coal use, renewables to account for 10 percent of primary energy	1990–2020	518	+ 208,000
Kingdom	generation, efficiency, and renewables technologies	2010		
European Union	Installation of high-performance double-pane windows in 60 percent of dwellings	10-year period	940	+ 126,000
United States	Improved efficiency in transportation, industry, power generation, buildings	1990–2010	188	+ 870,000

Source: See endnote 83.

United States | Improved efficiency in transportation, industry, power generation, buildings | 1990–2010 | 188 | + 870,000

…Or to the Energy Technologies of the Future?

Source: *Working for the Environment*, Worldwatch Institute, Working Paper 152, September 2000.

Who are the Luddites?

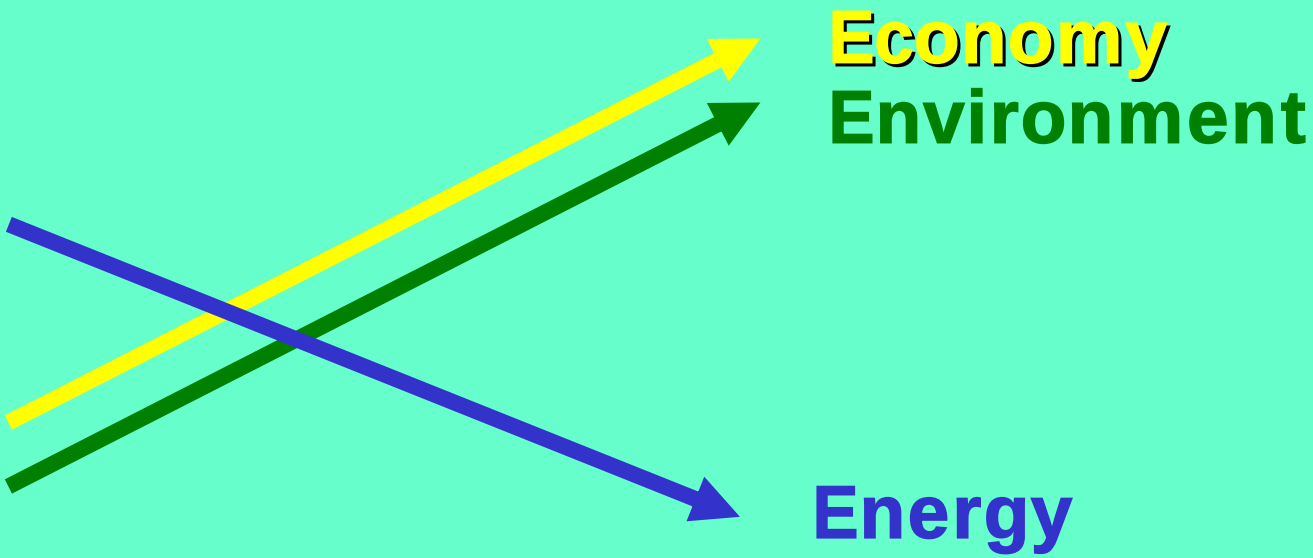
- 2025: 2/3 of U.S. coal capacity > 50 years old.
- NH's youngest fossil plant > 30
- Using 30-50 year old:
  - Telephone technology?
  - Computer technology?
  - Automotive & aircraft technology?
  - Materials, construction, manufacturing?
  - Internet?

Evidence of an Economic Sea Change

- *ACEEE:* Energy/GDP ***fell*** 42% from 1970-1999
- *Global Business **Competitiveness** – It's not simply about power cost anymore…*
  - ***Power Quality*** (e.g., semiconductor manufacturers)
  - ***Reliability and Vulnerability***
    - Bank of Omaha – Chose fuel cells
    - Blackouts (CA 2000, Northeast, EU, etc.)
  - ***Dollar Cost Savings*** that energy efficiency provides
  - ***Triple Bottom Line*** – Basis of financial performance and international competitiveness is changing
  - ***Economic opportunity:*** "Who will own the patents?"

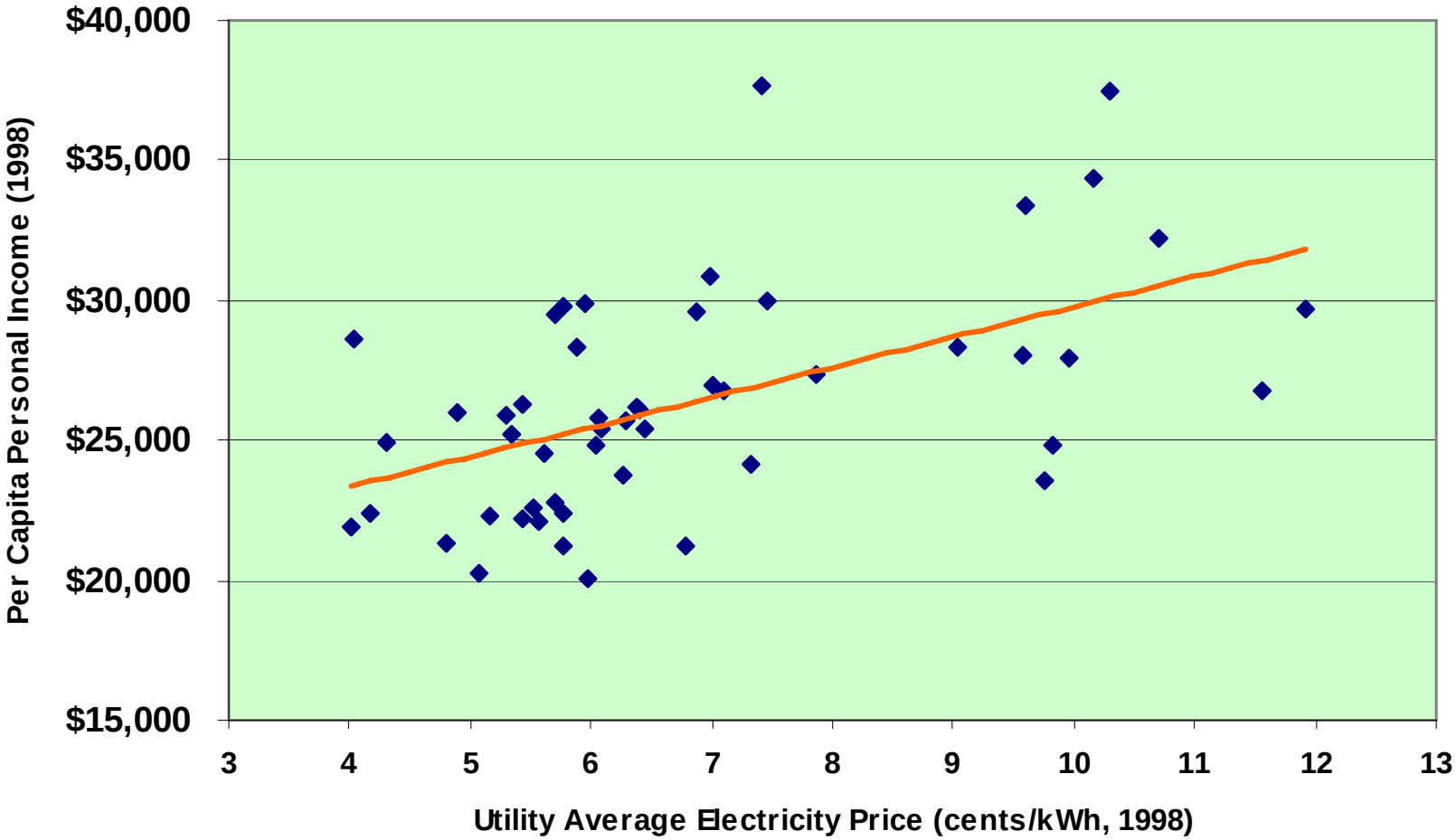
An Economic Sea Change is Underway

New Paradigm:



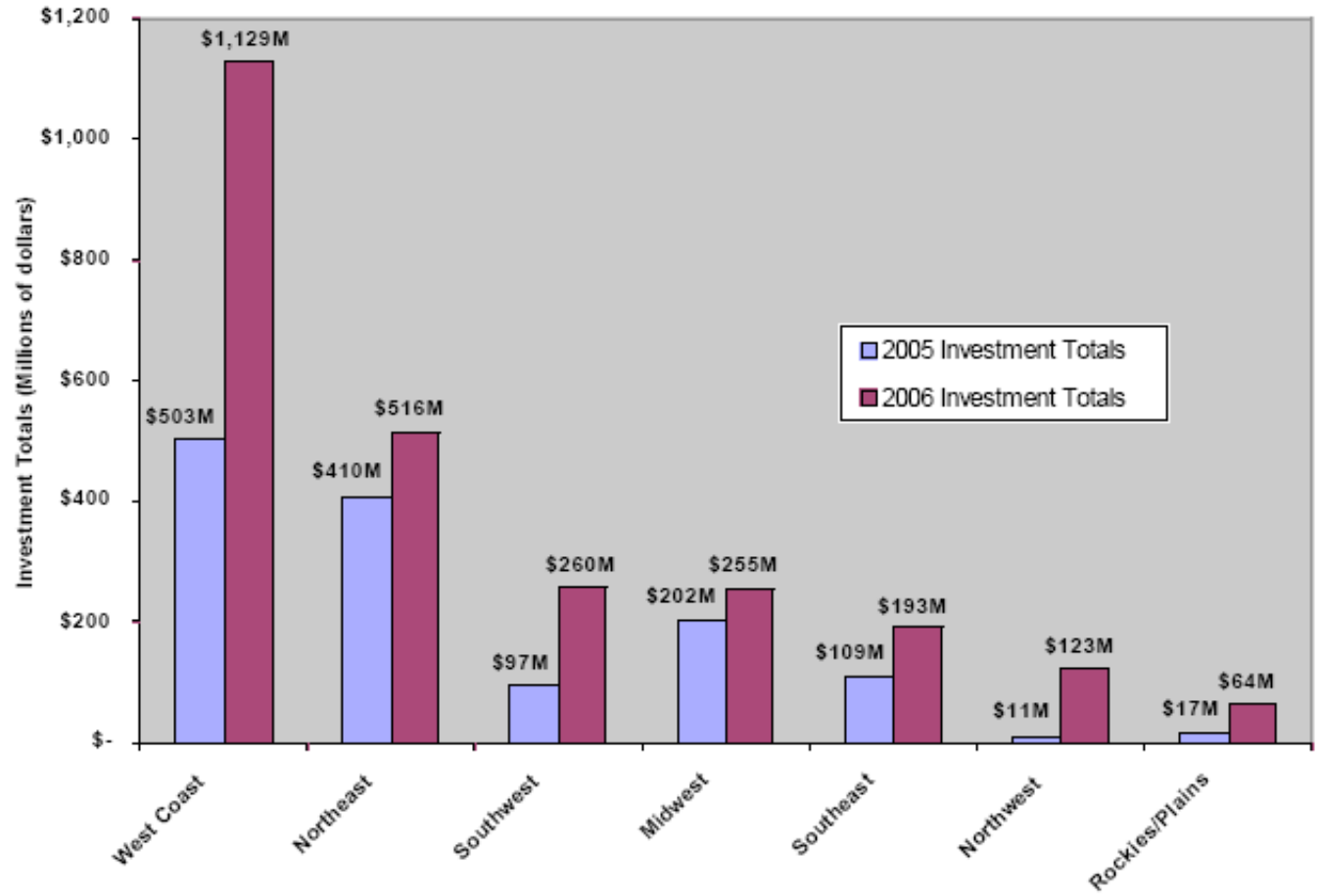
Per Capita Personal Income versus Utility Average Electricity Price for the 50 States and Washington, DC

(Data Sources: US Department of Commerce, Bureau of Economic Analysis
US Energy Information Administration)



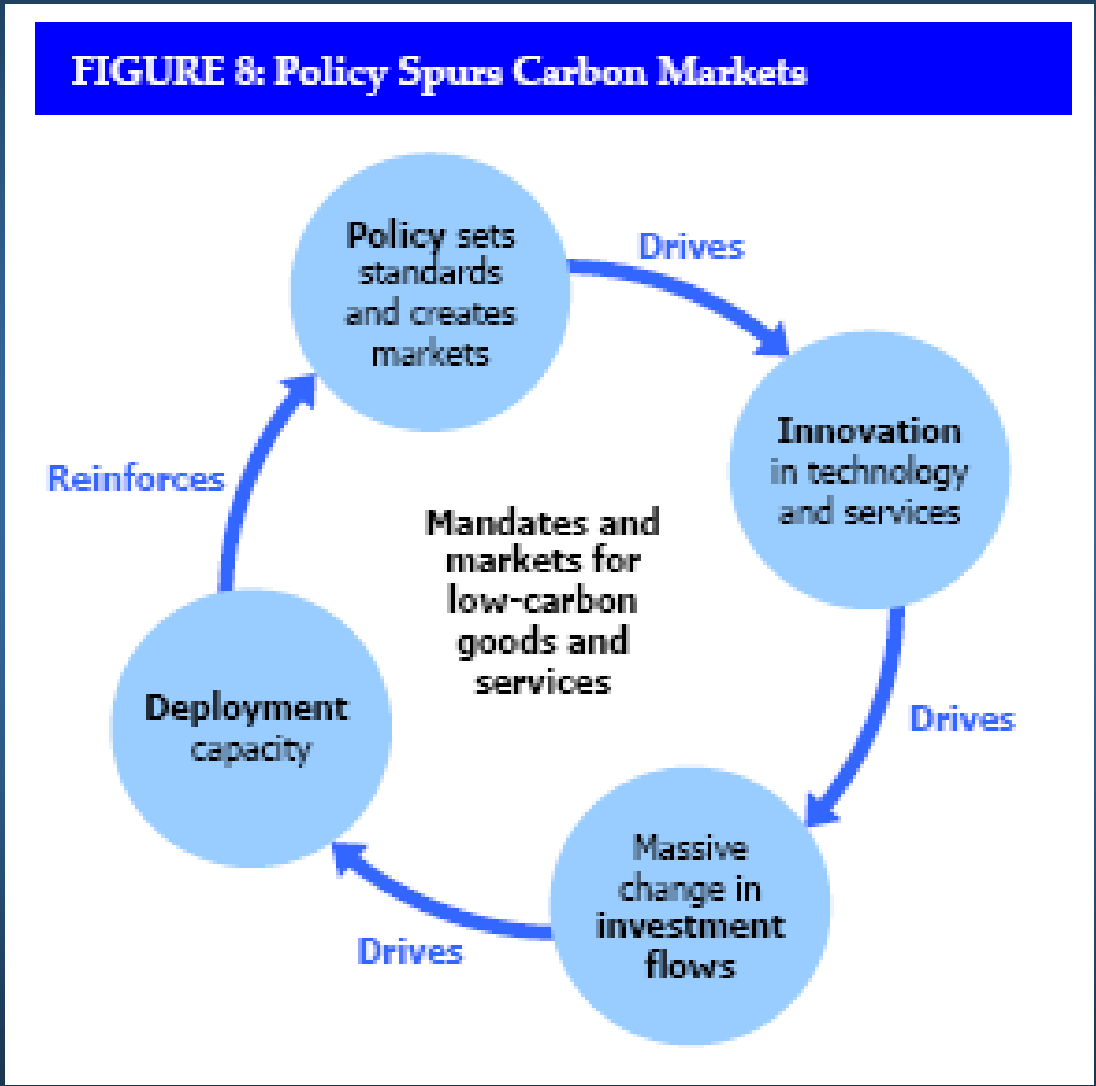
Cleantech Venture Investments by Region

Figure 1.2 ***U.S. Cleantech Venture Capital Investments by Region, 2005-2006 (Millions of dollars)***



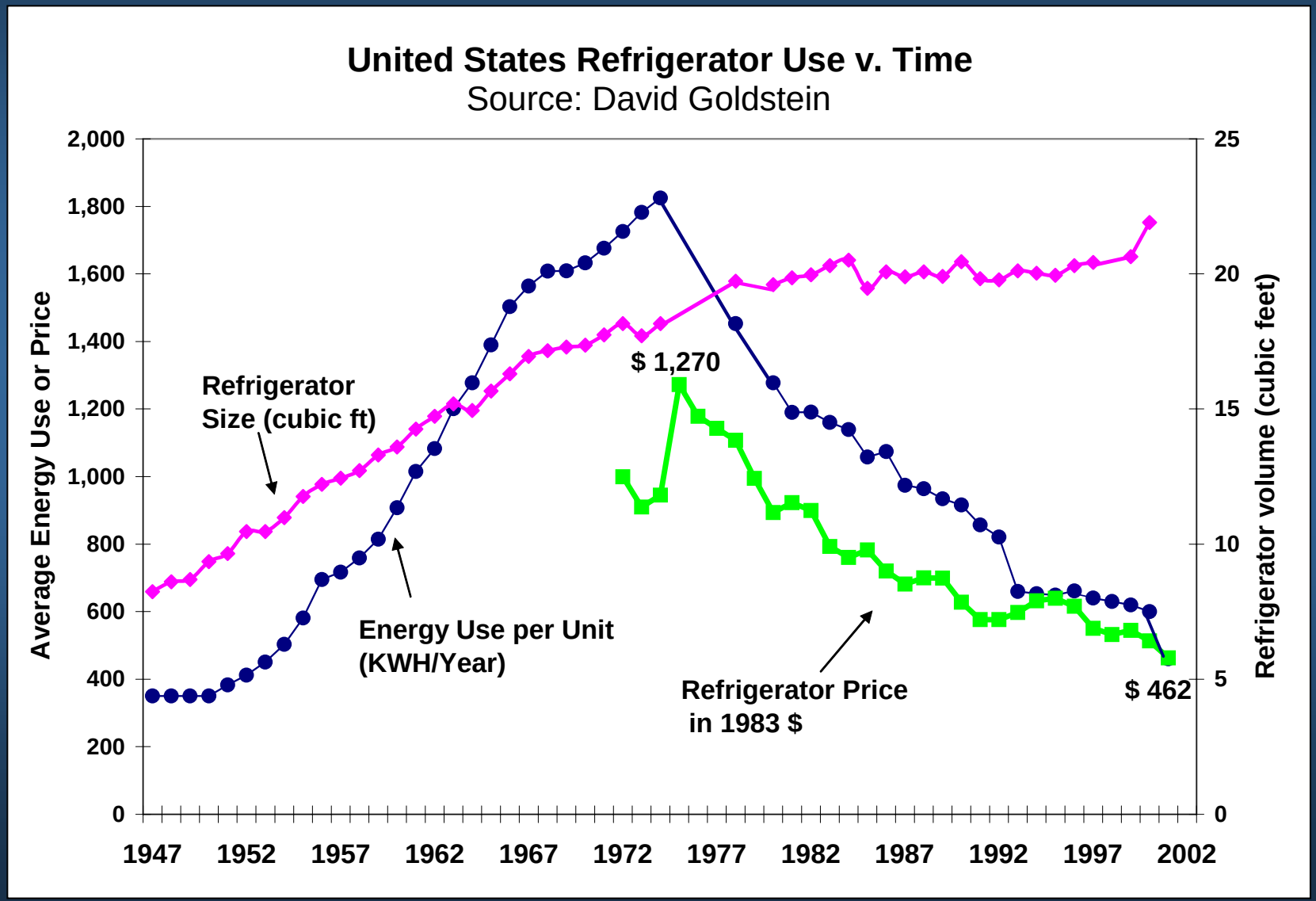
E2/Cleantech Venture Network, *Cleantech Venture Capital: How Public Policy Has Stimulated Private Investment*, May 2007.

Upward Policy Spiral

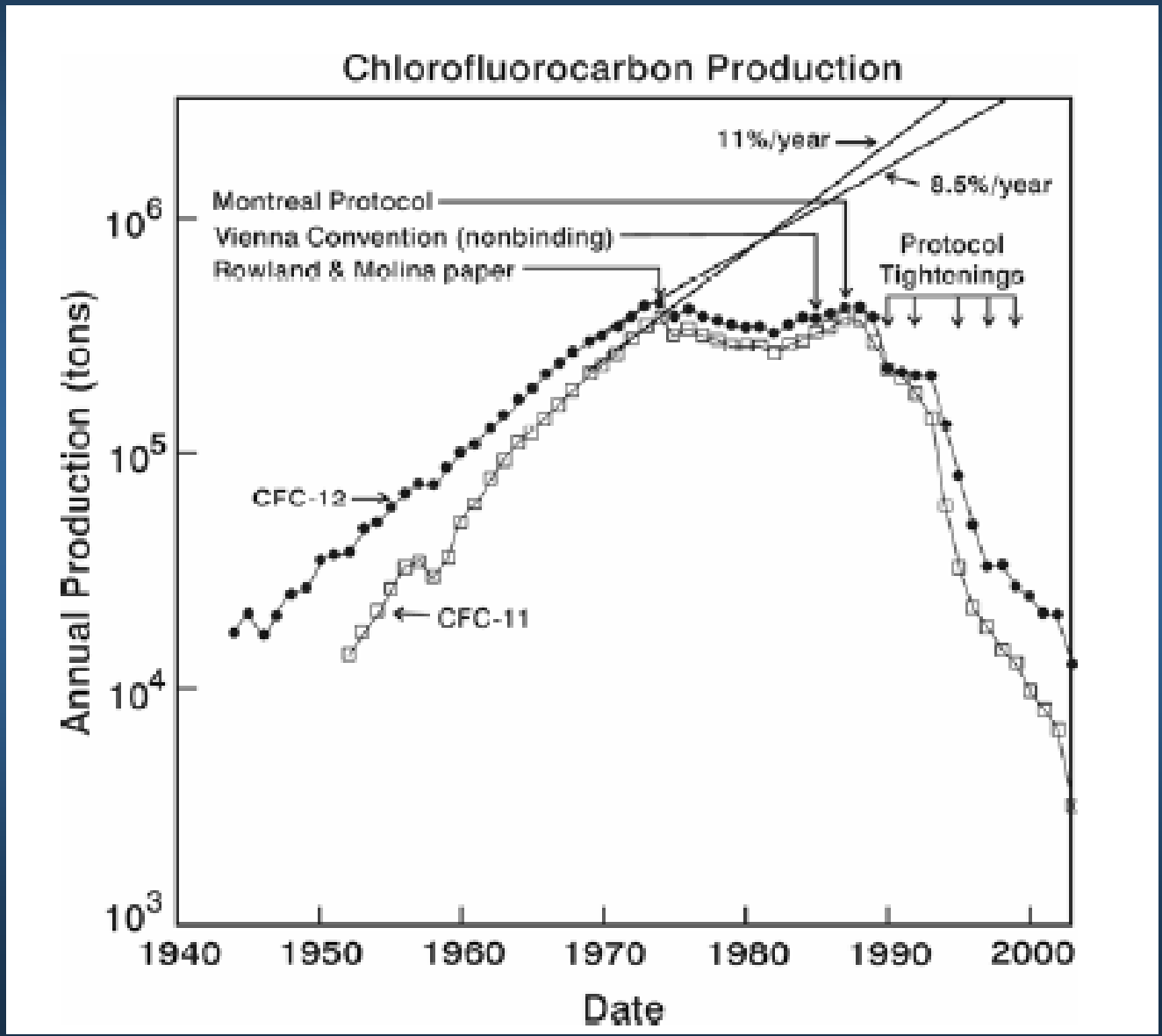


California Environmental Associates, *Design to Win*, 2007

Policy Matters!



It Can Be Done…



New Hampshire has a special opportunity to “connect the dots”

“Skate to where the puck is going to be.” – Gretsky

What Will Our Future Be?

Our Decisions Today Will Shape Tomorrow

Source: W. Eugene Smith, *The Family of Man Exhibition*