Regulating Carbon: Cap-and Trade Architecture

Frederick Weston
St. Paul, Minnesota
14 January 2008

The Regulatory Assistance Project

50 State Street, Suite 3
Montpelier, Vermont USA 05602
Tel: 802.223.8199
Fax: 802.223.8172

27 Penny Lane
Cedar Crest, New Mexico USA 87008
Tel: 505.286.4486
E-Fax: 773.347.1512

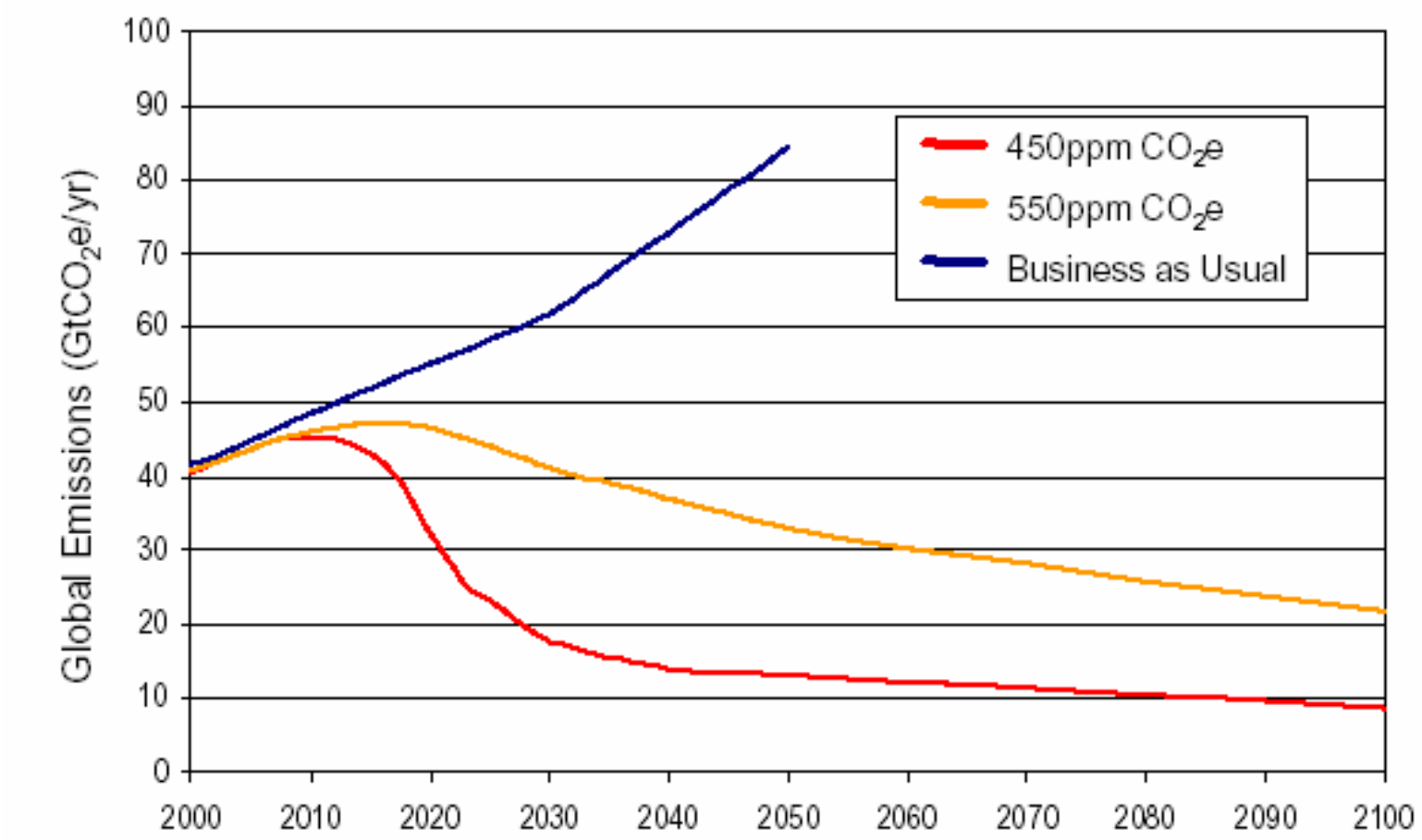
110 B Water St.
Hallowell, Maine USA 04347
Tel: 207.623.8393
Fax: 207.623.8369

Website: *http://www.raponline.org*

The Regulatory Assistance Project

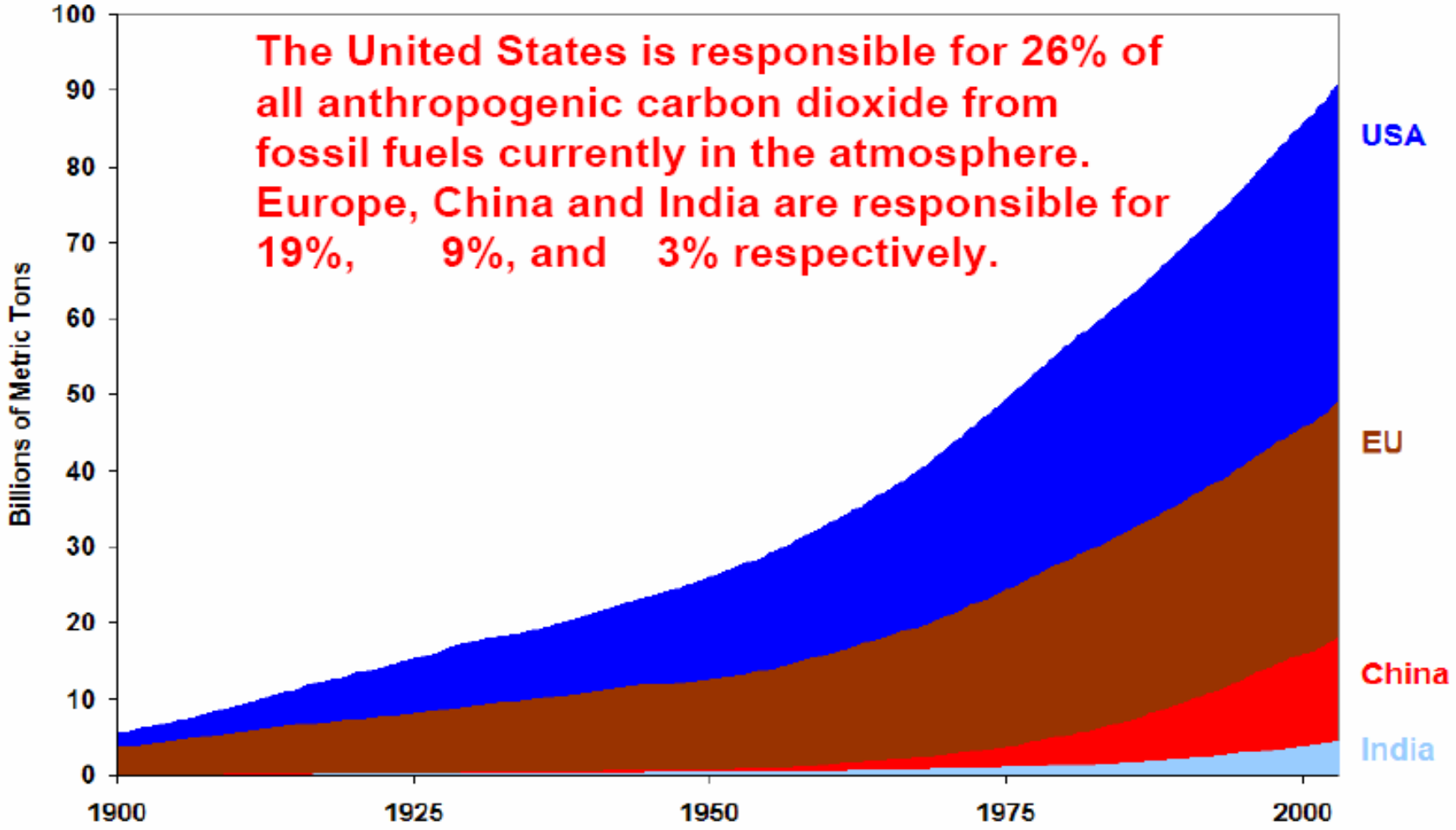
- RAP is a non-profit organization providing technical and educational assistance to government officials on energy and environmental issues. RAP is funded by US DOE & EPA, several foundations, and international agencies. We have worked in 40+ states and 16 nations.

Paths to Emissions Stabilization

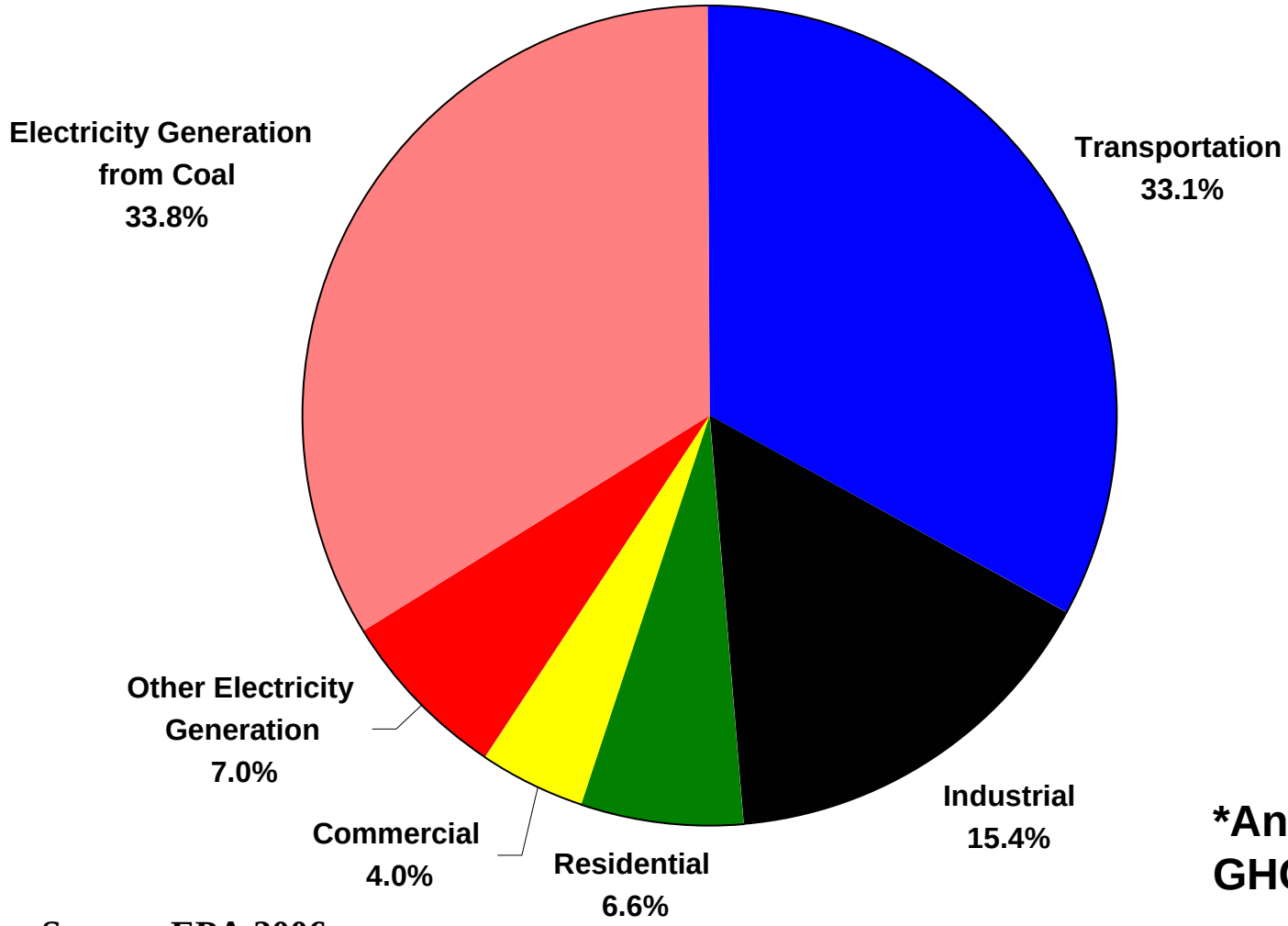


Source: *Stern Review*, United Kingdom, 2006

Why the US must act



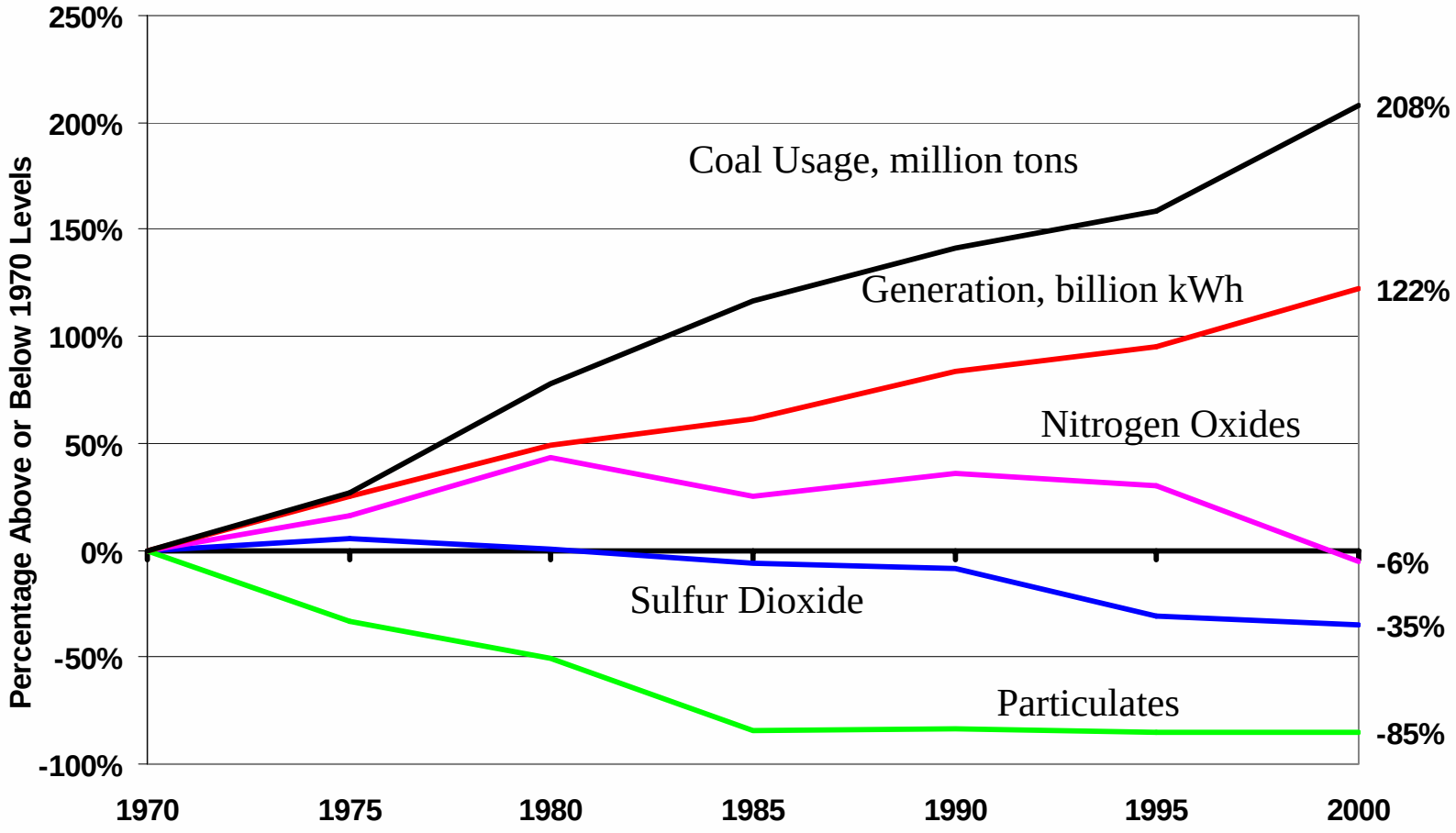
Electricity is 41% of US energy-related GHG emissions*



Source: EPA 2006

*And 34% of all US GHG emissions

Coal Use Triples, Emissions Down
1/3: Where's Carbon?



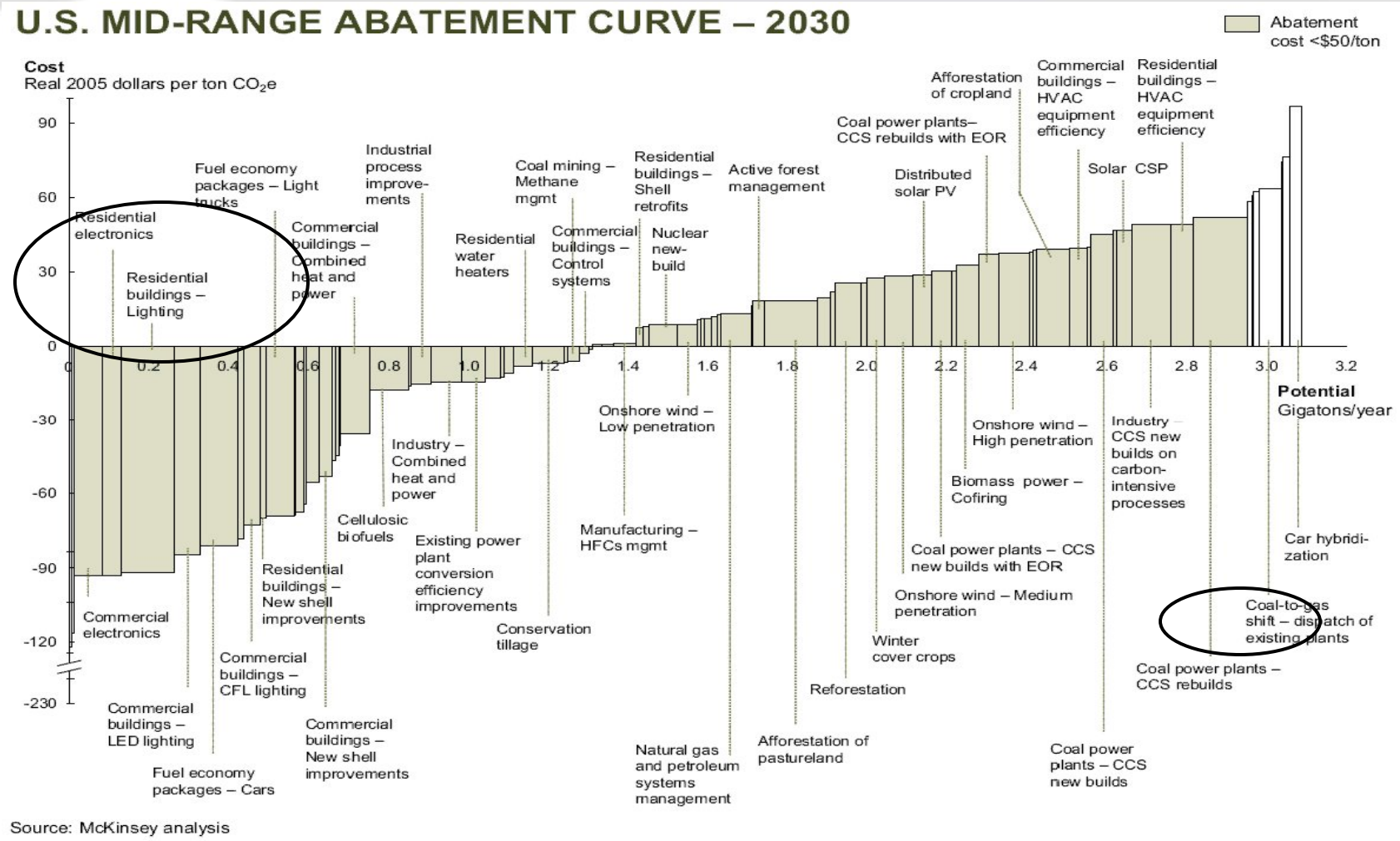
Where will power sector reductions come from?

1. Reduce demand – energy efficiency
2. "Environmental dispatch" of existing generators
3. Shut down the worst units
4. Add clean generation

For each opportunity, ask:

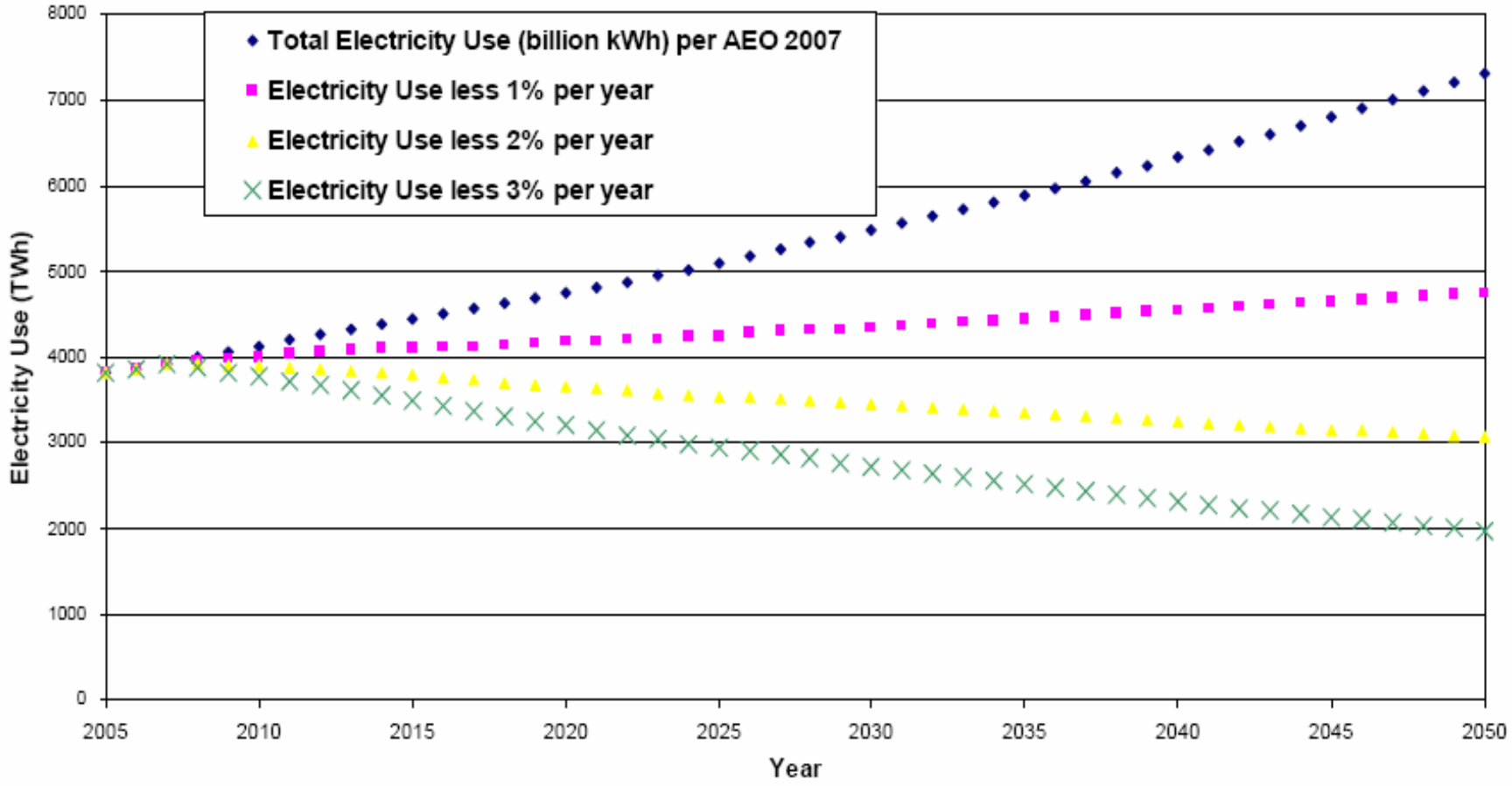
1. **How many tons will it avoid?**
2. **How much will it cost consumers per ton ?**
3. **What tools get the best results on #1 & #2 ?**

US Carbon reduction – efficiency costs less



Source: McKinsey analysis

Saving even 1% per year makes a huge difference

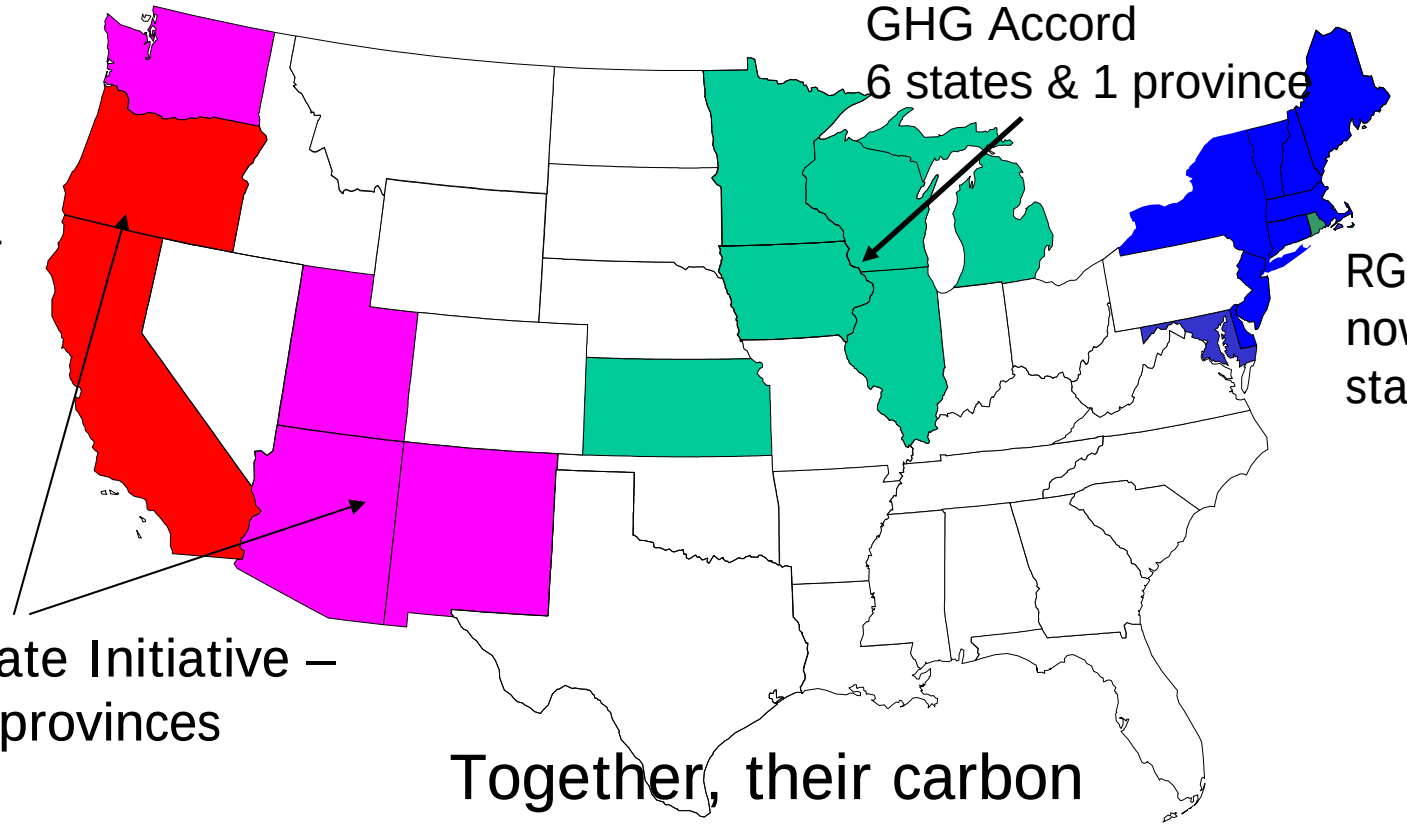


Steve Nadel, ACEEE October 2007

Choosing the best “point of regulation”

- Where in the chain of commerce should we place the obligation to reduce emissions ?
- Different structures for different industries
- Which is best for the power sector?

State and Regional Power Sector Carbon Regimes



Together, their carbon profiles exceed those of most nations.

Which tools for the power sector ?

A. Cap and trade options

1. Generator-side cap and trade

- Free allocation of allowances to generators
- Auction of allowances – generators buy them

2. Load-side cap and trade

- Free allocation of allowances to LSEs for consumers

B. Non-cap options

3. Portfolio Management policies only (no cap/trade) such as:

- Energy efficiency programs inc. EEPS
- Renewable Portfolio Standard (RPS)
- Carbon Emissions Standard or Emissions Portfolio Standard (EPS)

4. Carbon tax (on generators or “upstream,” on fuel)

What is Cap-and-Trade?

- Set a fixed limit on *overall* emissions, not each single source, declining over time
- Create a new kind of currency (tradable allowances) for quantities of emissions
  - "Carbon credits are just another form of money"
- Require the entities at the "point of regulation" (producers or consumers) to retire allowances to match "their" emissions in each time period
- Allocate allowances
  - Sell or give away for free?
- Permit trades in an allowance market
- Examples: US acid rain and NOx programs

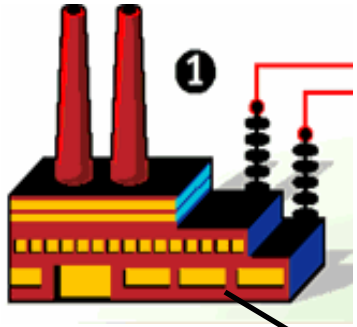
What is the best point of regulation in the power system?

"Upstream" at mines, wellheads

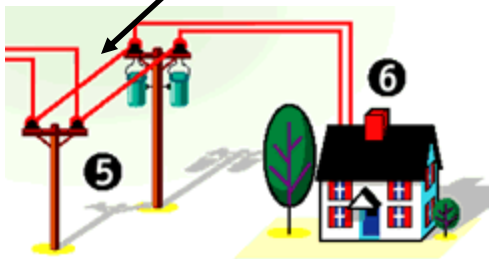
Mid-stream at generation

Midstream at load-serving entities

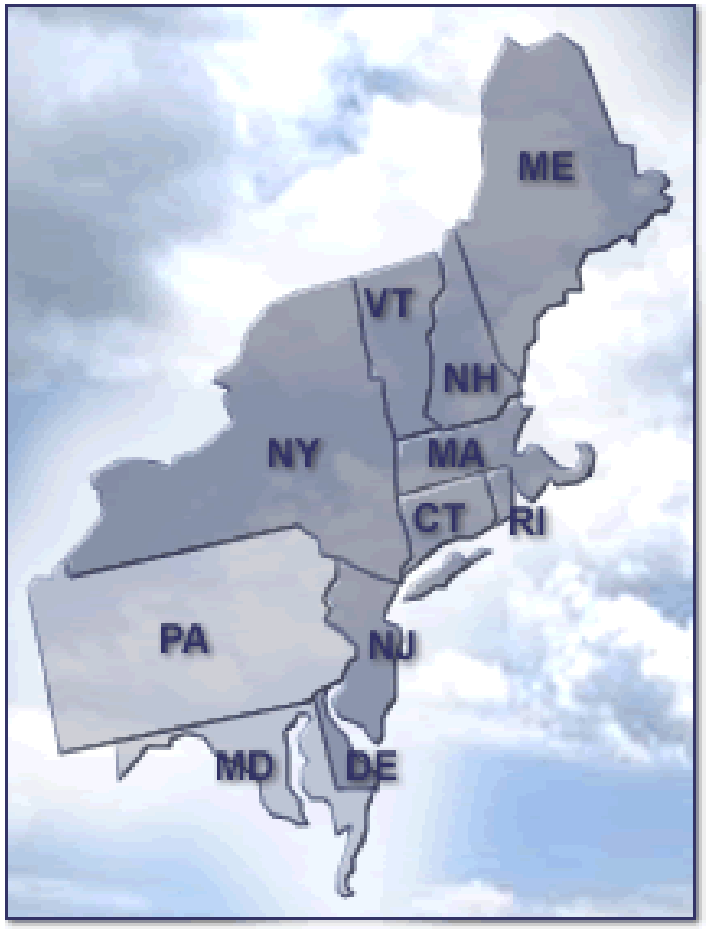
Downstream at customer locations



Load-serving entity/ Portfolio manager

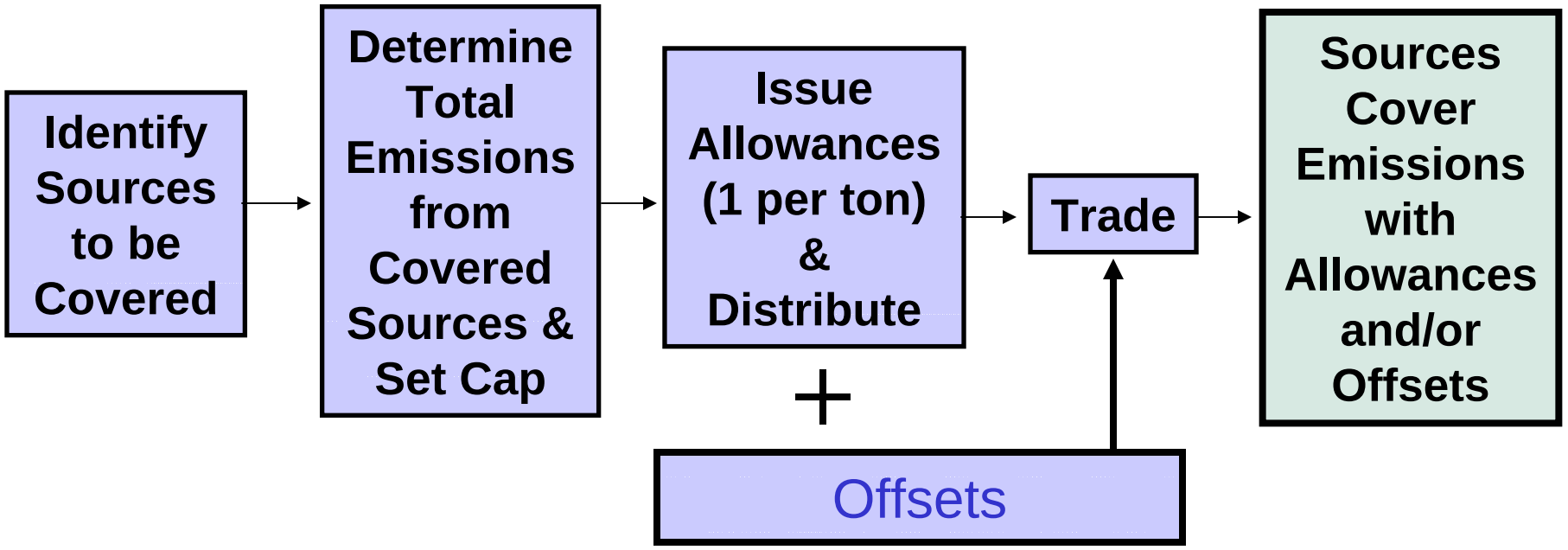


Regional Greenhouse Gas Initiative



- Regional cap on power sector GHG emissions
- MOU signed by governors in 2005 and 2007
- Model Rule approved
- State-by-state adoption 2007, 2008
- Regional auction under development
- Launch 2009
- Cap, reduce GHGs by 10% by 2019

Elements of the RGGI Cap-and-Trade Program



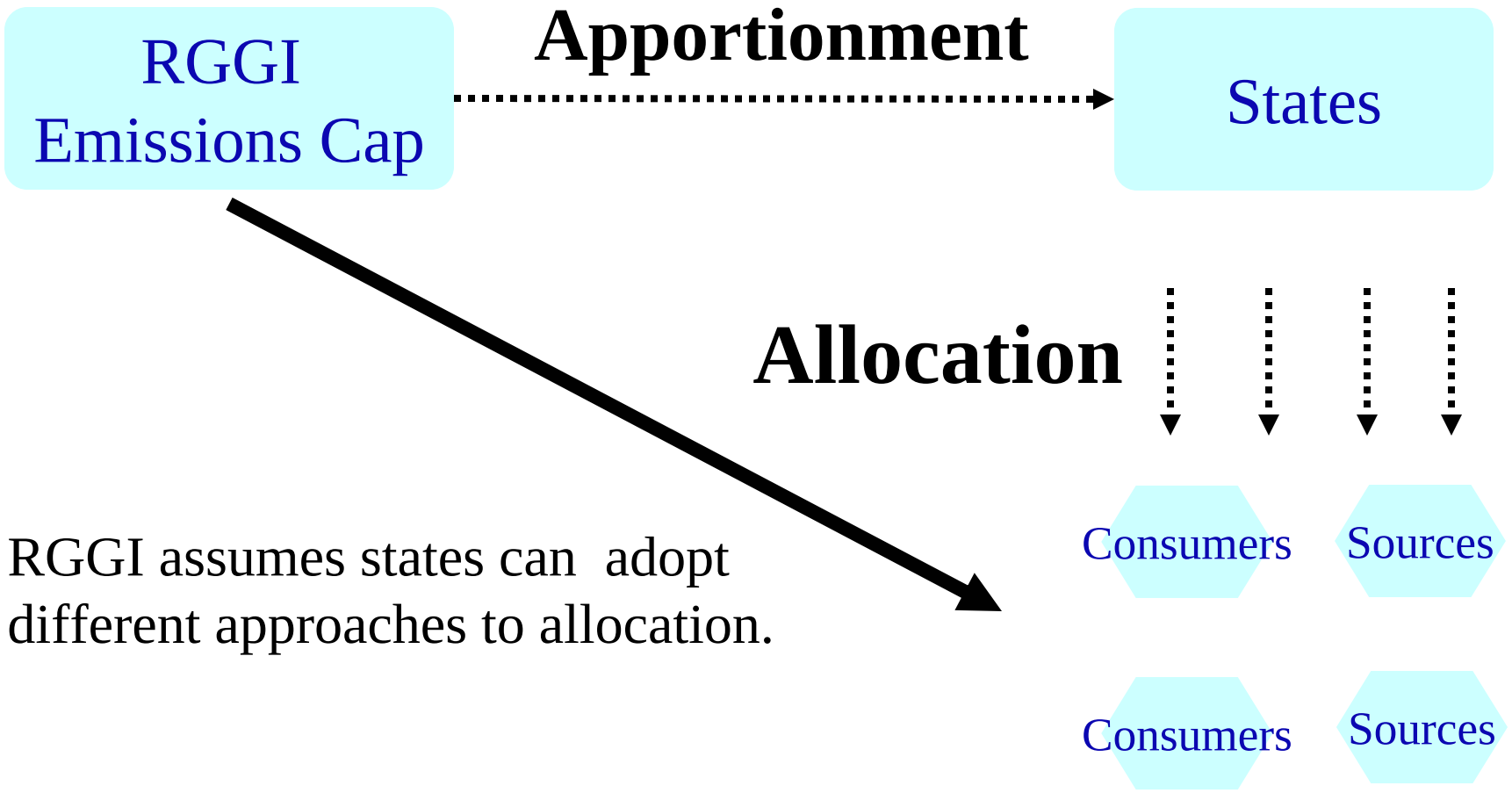
RGGI Program Elements

- **Coverage:** Power Plants of 25 Megawatts+
- **Cap levels: Stabilize** Emissions 2009 through 2015; **Reduce 10%** by 2019.
- **Allocation:** Each state has a budget, and **allocates** credits
- **3-Year compliance** periods
- **Offsets:** Generators can earn offsets from off-sector reductions
- **"Safety valve"** program if prices rise too much
- **Leakage:** Problem still to be addressed
- **Review** of Program in 2012.
- **Legal note**: There is no "RGGI government" – in reality, it's a set of reciprocity agreements

RGGI Topic 1: Cap Structure

- **Power sector only** – to set a framework for possible expansion (compare to CA)
- **Generator-side cap** (unlike CA and OR)
- **Larger plants only** (25MW+)
- Issues in selection of **baseline period**
- **Basic goal**: Cap level, then reduce 10%
- How stringent is this really?

Initial Distribution of Allowances



RGGI assumes states can adopt different approaches to allocation.

RGGI Topic 2: Apportioning Allowances Among the States

Percent of Total RGGI Cap

State	Emissions RGGI Units 2000	Heat Input RGGI Units 2000	Fossil Generation RGGI Units 2000	All Generation 1999-2001 Avg.	Total Consumption 1999-2001 Avg.	Population 2000	Gross State Product 1999-2001 Avg.
Connecticut	9.6%	9.2%	8.3%	9.6%	8.9%	8.1%	9.1%
Delaware	5.8%	4.8%	3.1%	2.0%	3.2%	1.9%	2.1%
Massachusetts	17.6%	19.4%	18.1%	12.2%	15.1%	15.1%	15.8%
Maine	3.0%	3.2%	2.3%	4.8%	3.5%	3.0%	2.1%
New Hampshire	4.2%	3.3%	2.7%	4.8%	3.0%	2.9%	2.6%
New Jersey	10.3%	8.7%	15.7%	18.1%	20.9%	20.0%	20.1%
New York	46.7%	47.2%	46.1%	44.5%	41.5%	45.1%	45.1%
Rhode Island	2.4%	4.0%	3.6%	2.1%	2.2%	2.5%	2.0%
Vermont	0.4%	0.3%	0.2%	1.8%	1.6%	1.4%	1.0%

Source: Derek Murrow, Environment Northeast, "Apportioning the Regional Cap Among States: Allocation Options and Equitable Solutions" RGGI Allocation Workshop, Boston, October, 14, 2004

RGGI Topic 3: Flexibility Devices

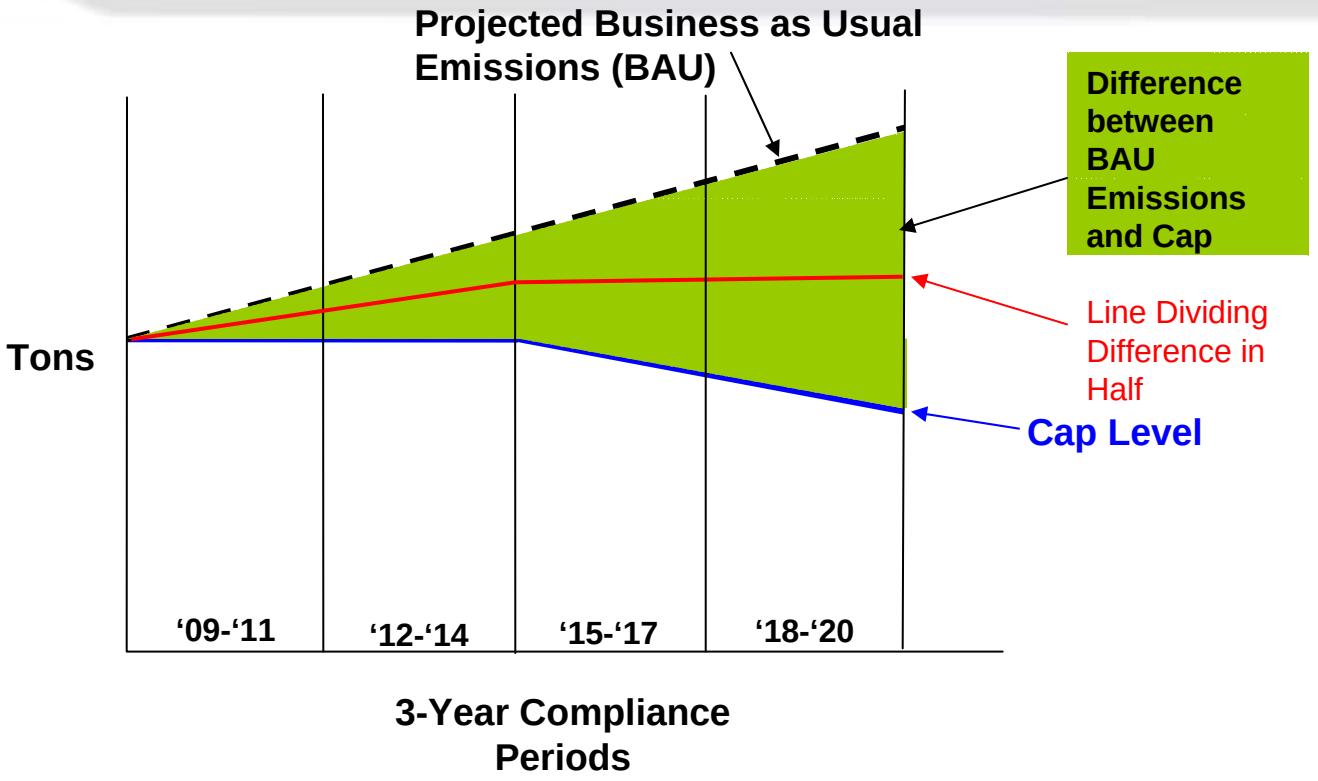
- Three-year compliance period
- Banking allowed – but not “borrowing”
- Offsets permitted
- “Safety Valve” provisions
- Note: Leakage will be a backdoor safety valve unless it is dealt with

Flexibility -- Offsets

- **Offsets—project-based reductions:**
  - Types:
    - Natural Gas, Propane, Heating Oil Efficiency
    - Land to Forest
    - Landfill Gas Capture & Combustion
    - Methane Capture from Animal Operations
    - SF_6 Leak Prevention
    - Leak Detection in Natural Gas Distribution
  - Geographic Extent:
    - Anywhere in the United States
    - Offsets from Outside RGGI States 2:1 Discount
  - Limit on Use:
    - Each Source may "**cover" up to 3.3%** of its total reported emissions

Offsets Limit

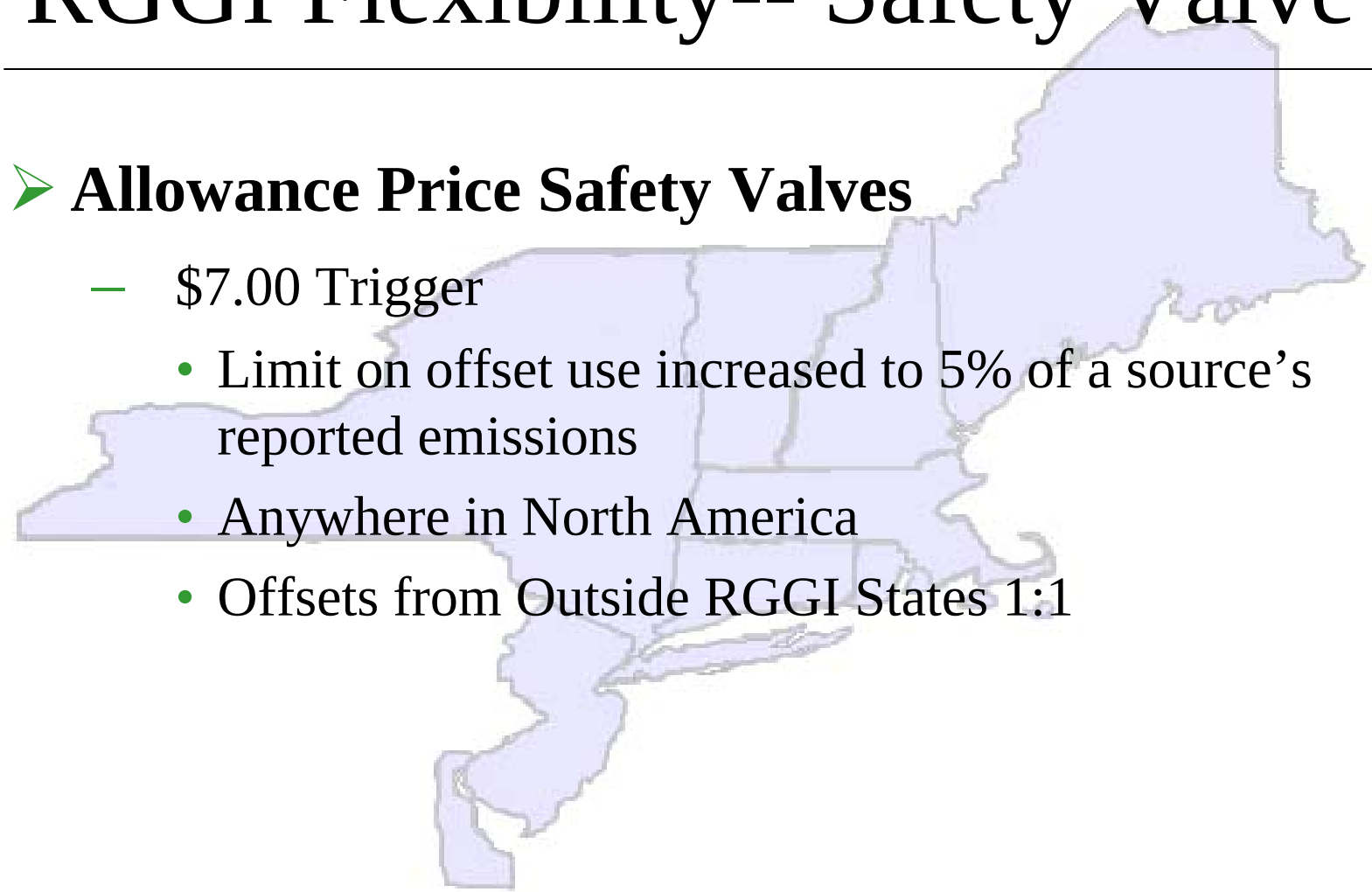
3.3% of generator compliance= about 50% of total program reductions



Limit derived based on 50% of projected emission reduction requirement

RGGI Flexibility-- Safety Valve

- **Allowance Price Safety Valves**
  - $7.00 Trigger
    - Limit on offset use increased to 5% of a source's reported emissions
    - Anywhere in North America
    - Offsets from Outside RGGI States 1:1



RGGI –Safety Valve (2)

- **Allowance Price Safety Valves (Cont'd)**
  - $10.00 Trigger
    - Compliance Period extended for 1 year for up to 3 years (Maximum 6-year compliance period).
  - $10.00 Trigger—2 Consecutive Years
    - Limit on use of offsets increased to 20% of a source's reported emissions
    - Offsets may come from anywhere in North America, or from recognized international trading regimes.
- **Should there also be a floor price?**
  - Some advocates now urging this

RGGI Topic 4: Lessons on Allowance Allocations

- The Acid Rain program design – smokestack-based, free allocations based on historic emissions – is not the best design for a carbon cap/trade system for the power sector. GHG situation is different:
  - The best low cost solutions are not at individual smokestacks
  - Nor in the fuel supply – we don't have low-carbon coal
  - Power markets, utility structures have changed
- C&T should be designed to achieve the greatest GHG reductions at lowest cost
- Allocation policy is crucial to attaining this goal
- Energy Efficiency is not a "collateral energy policy;" it is **the key to success** of power-sector carbon programs.
- Cap-and-trade programs CAN be designed to support cleaner portfolios and efficiency services.

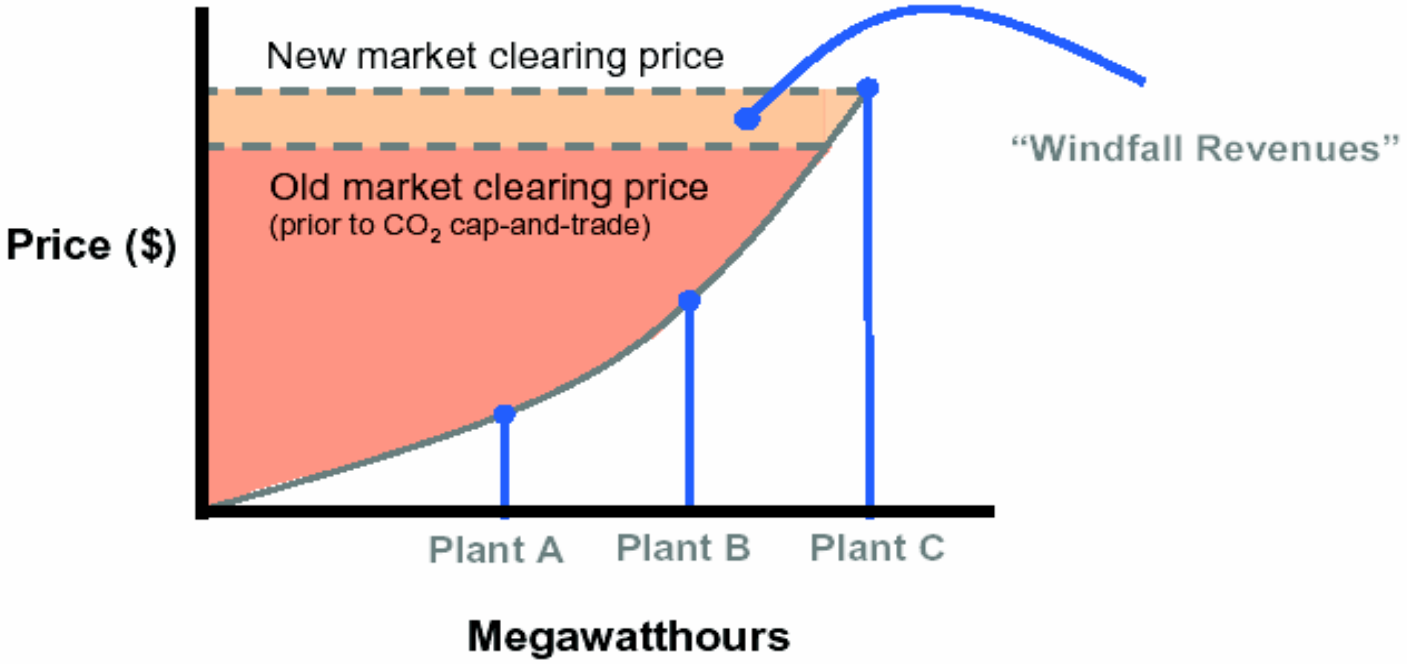
Architectural Mistakes: Three Wrong Assumptions

- 1. Generators lose money under carbon cap and trade, so designers must give them allowances for free
- 2. Just manage pollution, price increases and demand elasticity will deliver needed efficiency
- 3. “Allocation is just distributional”—Initial allocation won’t affect program cost to consumers

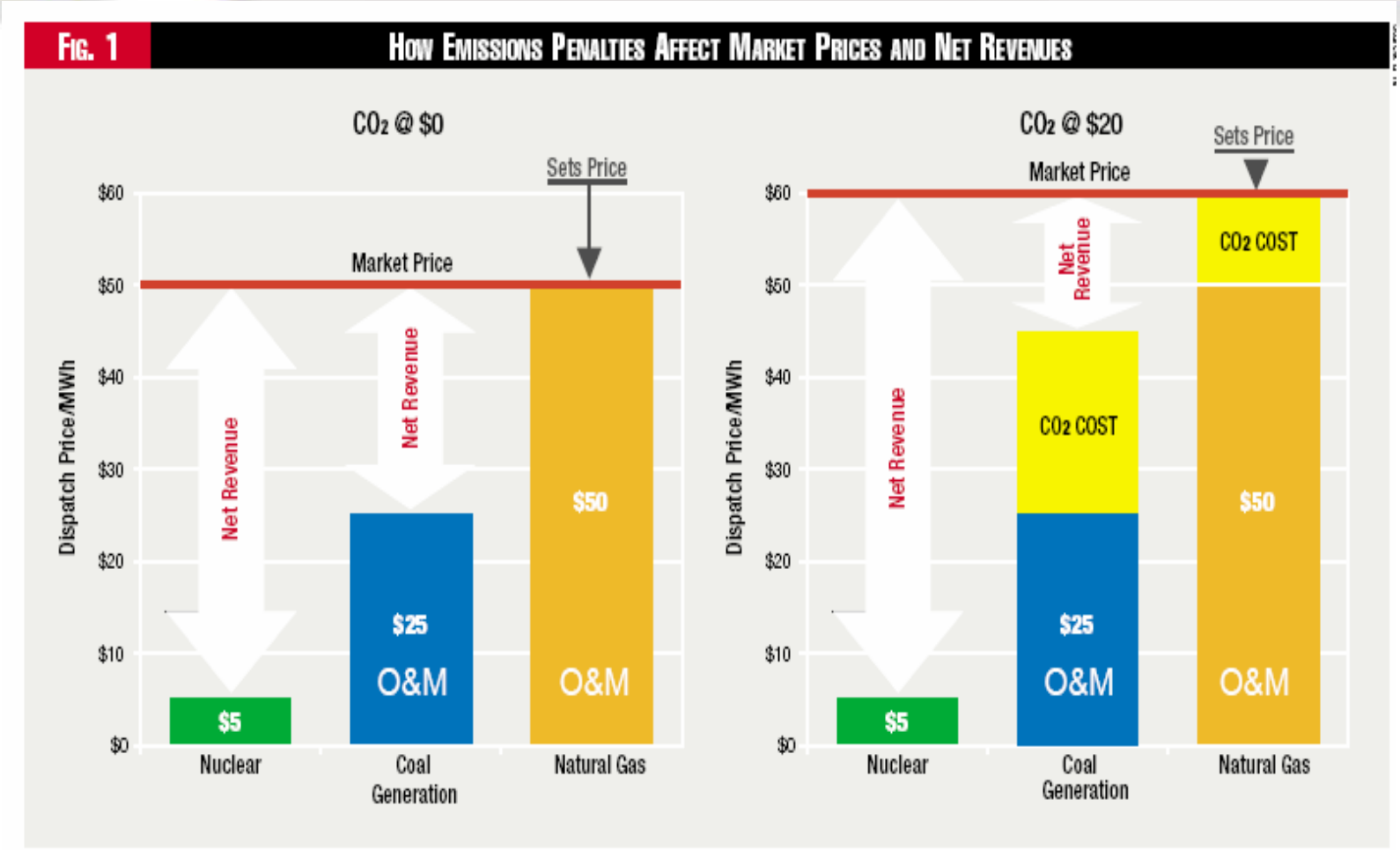
Reality #1: Most generators make money with free historic allocation

Theoretical representation of "windfall revenues"

A fossil unit on the margin increases the market clearing price (i.e., the price paid to all generating units dispatched) to reflect the cost of CO_2 compliance



Why Emission Charges Can Raise Prices Without Changing Dispatch or Emissions



Source: "The Change in Profit Climate" -- Public Utilities Fortnightly May 2007 --Victor Niemeyer, EPRI

Reality #2: Efficiency programs are more powerful than price increases

- Economic theory: just raise the price of power
- DSM reality: ***Programs*** are needed to surmount market barriers to efficiency
- **$ spent through programs will deliver 5x or more the efficiency savings of $ spent in higher prices**
- Key conclusion: Build efficiency support into program architecture
- BUT: Generators don't deliver efficiency
- Who has relationships with customers?

What does it cost to avoid a ton of electric CO_2?*

Resource option	CO_2 intensity (tons/MWh)	Cost per MWh	Cost per ton avoided
Coal	.92/MWh	$40	NA
Gas	.45/MWh	$55+	$30+
New Nuclear	big debate	$70+ to ??	$30 to +??
Wind	low	$75	$38
PV	low	$180+	$152+
Efficiency	low	$30	**(-$11)**

**Generation cost data (except nuclear) from EPRI ("Generation Technologies in a Carbon-constrained World," 2005, assuming gas at $6MMbtu); EE data from Efficiency Vermont. For the point made here the precise numbers are not critical.*

The Effect of Doubling EE Spending in the RGGI States

- Extensive modeling of RGGI found that:
  - Carbon credit prices drop 25%
  - The need for new fossil capacity drops 33%
  - Customer bills drop 5% to 12%
  - And – even greater EE investments would yield greater savings

Reality #3: Carbon credit allocation can mobilize EE

- Key point: A carbon program that directly mobilizes end-use efficiency **will cost less and achieve more** than one that focuses only on smokestacks.
- Two new techniques can tap the carbon value of efficiency and renewables:
  - **Consumer allocation (RGGI region)**
  - **Load-side cap and trade (California and Oregon)**

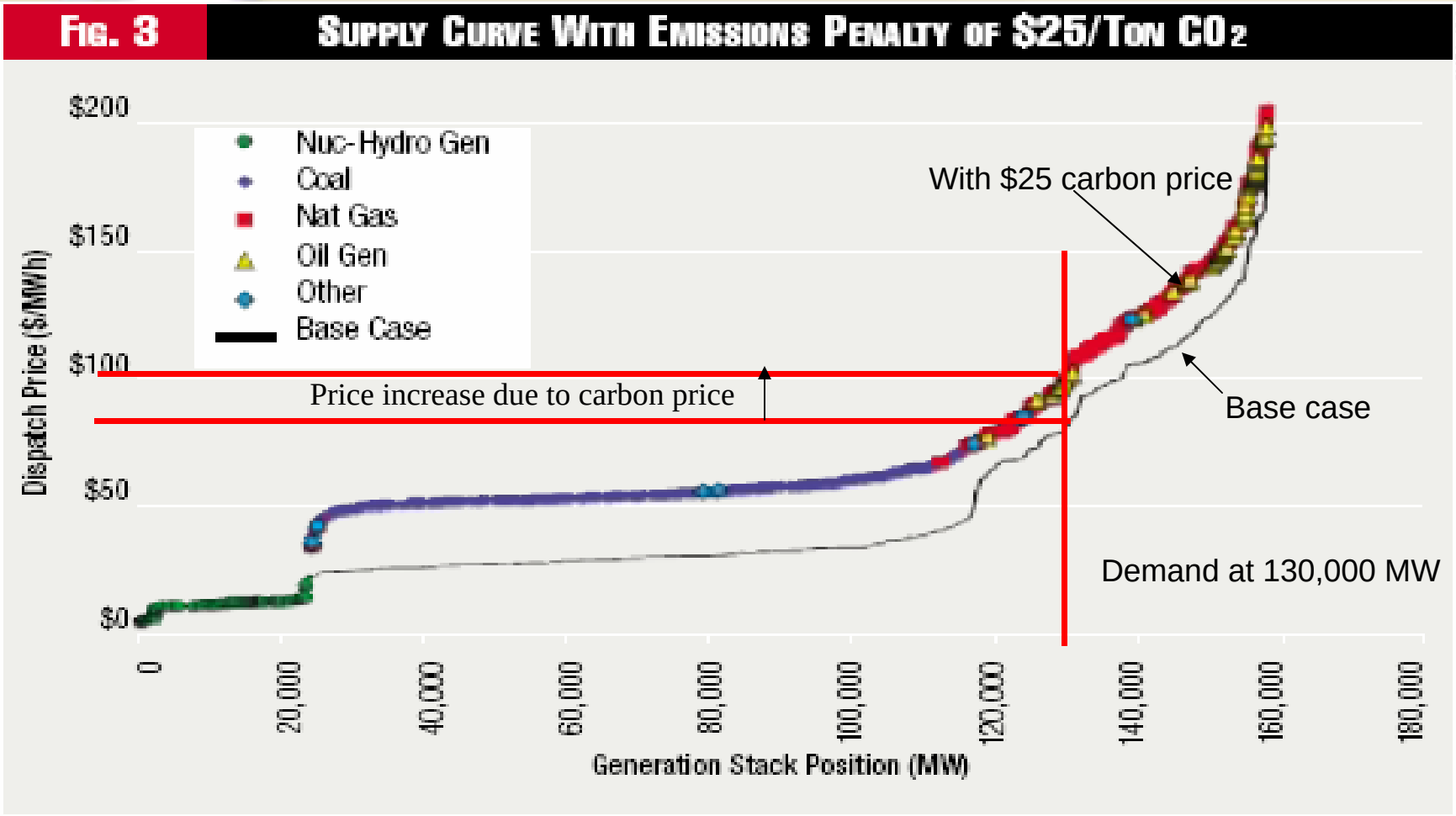
The RGGI Approach: The Consumer Allocation

- Allocate up to100% of initial credits to consumer representatives (e.g., distribution utilities, Efficiency Utility)
  - RGGI MOU - state minimum commitment is 25%
  - Most states have adopted 100% (or nearly 100%) consumer allocation requirements
- Generators need to purchase allowances, recycling the windfall revenue BACK to consumers
- PUCs supervise use of the $$ for benefit of consumers
- **Best result: focus these $ on investments that lower carbon (EE &RE)**
- Results: lower cost-per-ton avoided, lighter macro-economic impact
  - Quicker progress in reducing GHG emissions

Why auctions and carbon taxes create “high cost” tons

- Carbon price must be very high to save many tons (for gas to displace coal, etc.)
- Fossil units almost always set the clearing price
- Short-term clearing price provides the benchmark for longer-term and bilateral contracts
- SO: Carbon penalty on sellers raises prices generally
- Inframarginal rent a/k/a “windfall gains” to generators paid for by consumers
- Lesson: If improperly designed, a *carbon market* can impose very large costs on ratepayers through the *power market*
  - The carbon market will be big, but the power market is much, much bigger

Carbon taxes and auctions to sources can increase wholesale power prices with little effect on dispatch or emissions



Source: "The Change in Profit Climate: How will carbon-emissions policies affect the generation fleet?"
Victor Niemeyer, (EPRI) -- Public Utilities Fortnightly May 2007 <some captions, demand and price lines added>

Gen-side carbon costs can increase wholesale power prices with little effect on dispatch and emissions

- In ECAR-MAIN (Upper Midwest, coal-heavy) a carbon charge of $25/ton would raise wholesale power prices $21/MWH.
  - "Even a CO_2 value of $50/ton would produce only a 4% reduction in regional emissions given the current generation mix."
- In ERCOT (Texas, gas-heavy) "when gas is selling for around $8MMbtu, even a CO_2 value of $40/ton produces little emissions reduction" from the existing mix.
- Thus, the most important tools to reduce emissions are new long-term investments
  - Portfolio management by LSEs is the more direct and less costly means of acquiring these new investments

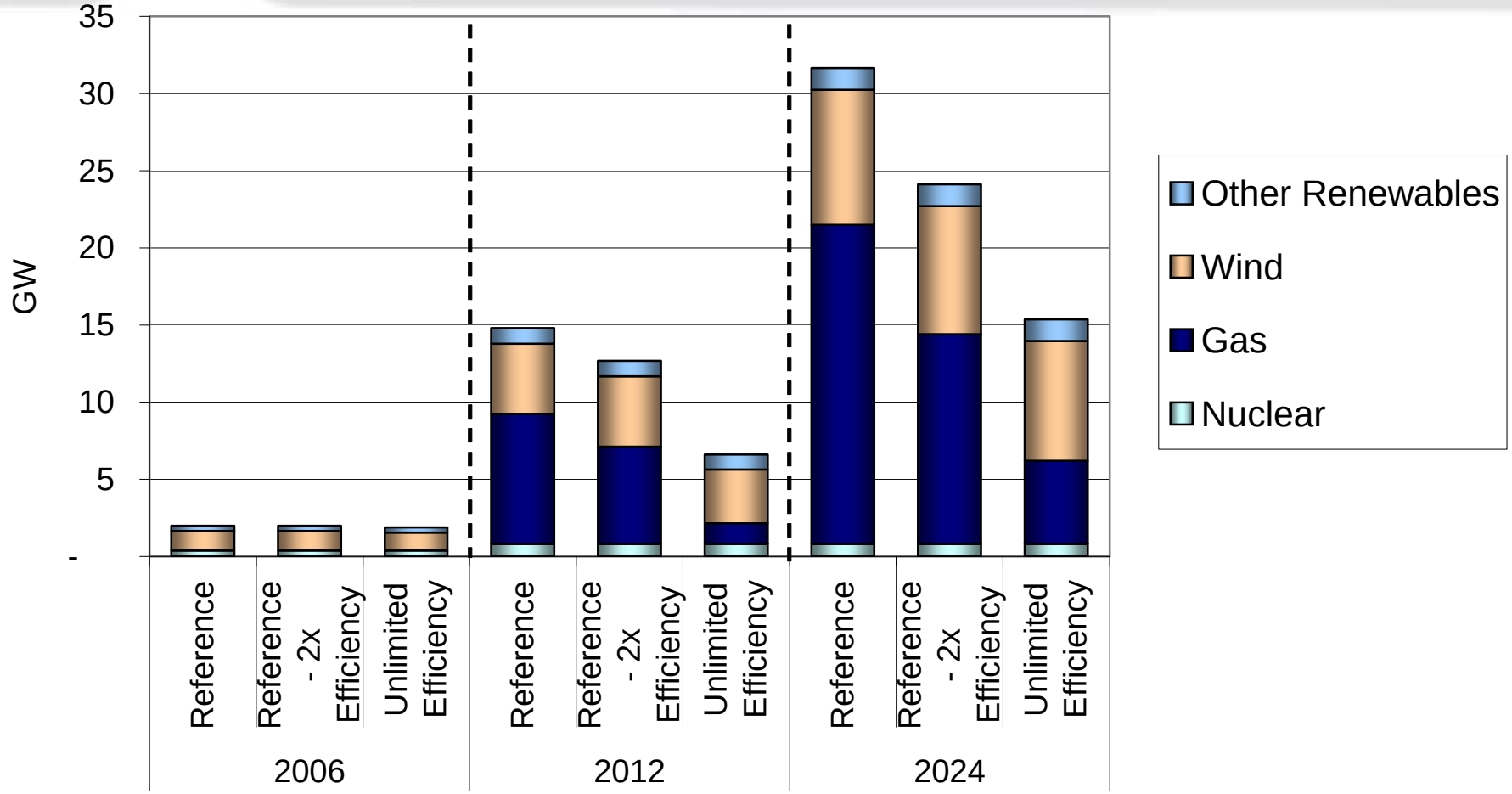
Source: "The Change in Profit Climate: How will carbon-emissions policies affect the generation fleet?" Victor Niemeyer, (EPRI) -- Public Utilities Fortnightly, May 2007

Carbon taxes and price increases will have minimal effect on demand

RGGI Topic 5: Projected Impacts

- Two types of modeling:
  - IPM Models run by ICF, on the power grid and operations;
  - REMI – regional macro-economic impacts.
- Using natural gas price projections widely accepted by industry analysts, regional average retail price increases range from 0.3% to 0.6% in 2015, across all rate classes.
- Even under a “high gas price” scenario using gas prices that are higher than mainstream analysts expect, projected retail electricity price impacts range from 1.7% to 3.2% in 2015, across all rate classes.

RGGI Cumulative Capacity Additions



RGGI Topic 6: The Problem of Leakage

- "Leakage" = Net new carbon emissions associated with increased imports of power into RGGI states from generators NOT part of the cap system
- Issues: Undermines program attainment; competitive disadvantage to local generation in favor of remote generation
- This is RGGI's unfinished business
- Working group now studying the issue

Options for Dealing with Leakage

- Watch and wait – do nothing now
- Complementary policies only – EE, RPS, etc.
- Measure, but don't cap: e.g.,Carbon performance standards, Carbon adders
- Count and account later – regional or state level
- Count & cap – assign responsibility to LSEs

How much leakage is too much?

- This is a judgment call for RGGI Principals
- One way to look at it (back-of-envelope math):
  - RGGI *total reduction* is ~55 million tons 2009-2019 (more if BAU is the baseline, less if early reduction credits and other exemptions grow)
  - RGGI total MWH sales (7 states) will rise from about 275 to 380 million MWH per year
  - 5.5 million tons per year /300 million MWH = 1.8%
  - SO: New coal imports equal to 1.8% of total regional sales each year could erase 100% of the actual reductions sought by RGGI

An Alternative California & Oregon: Load-Side Cap-and-Trade

- Basic rule: LSEs must own and retire credits to cover the emissions associated with their sales to retail customers.
  - A “carbon budget” for the utility portfolio manager.
- How?
  - Measure historic emissions associated with electricity serving the state (or region) –
    - All sources, wherever located -- both in-program and imports
  - Set “hard” emissions caps to lower impact in stages
  - Distribute allowances (“carbon credits”) to LSEs
  - LSEs must retire credits to match their portfolio of sources
  - EE and low-carbon sources reduce credit needs
  - It’s market-based: LSEs can trade credits with other sectors, earn offset credits, etc.

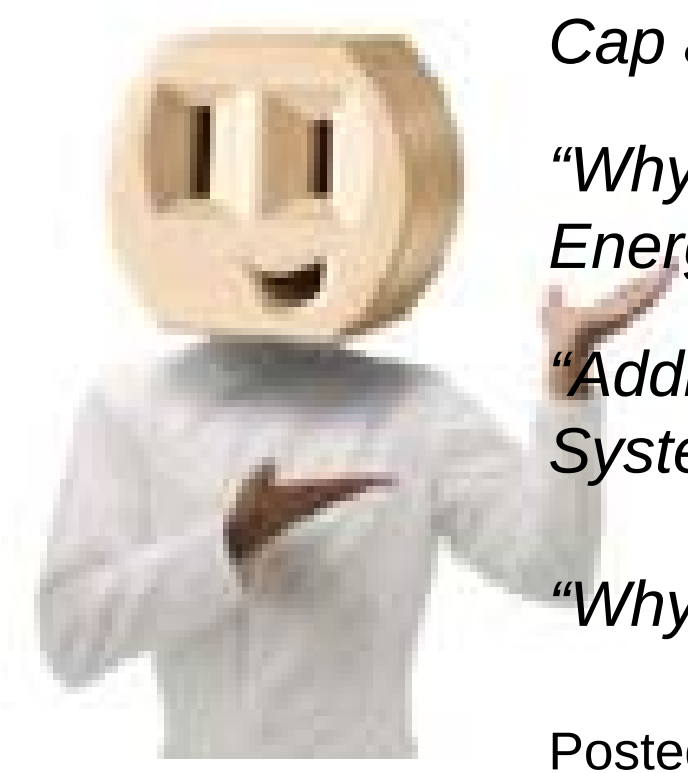
Advantages of a Load-Side Cap

- **Lower societal costs**: directly promotes end-use efficiency, the lowest-cost low-carbon resource
- **Lower consumer costs**: Lower cost to power consumers per ton reduced
- **Environmental**: lower consumer cost permits deeper GHG reductions over time
- **Political**: Avoids most windfall gains to generators without the cost, revenue diversion and political consequences of a multi-billion $ auction

Federal Cap-and-Trade: Some Thoughts for States

1. The art of cap and trade design is evolving – RGGI, EU TS, Oregon, California are taking new approaches and learning from implementing older ones
2. RGGI consumer allocation, and CA and Oregon load-side caps are major innovations, not previously expected – will such experimentation be extended or cut off?
3. Will EPA (or DOE) install a single national cap design for the power sector in every state?
   - Or will states have choices as in State Implementation Plans?
4. How will allocation be handled? Like New York (100% auction) or like California (100% to LSEs) or like ….?
5. Can states reduce MORE than the national average without just releasing additional allowances for use in other states?
6. Issues of federal preemption and state flexibility are critical and very challenging.

For more information…



"Another Option for Power Sector Carbon Cap and Trade Systems – Allocating to Load"
(May 2004)

"Why Carbon Allocation Matters – Issues for Energy Regulators" *(March 2005)*

"Addressing Leakage in a Cap-and-Trade System: Treating Imports as Sources"
(November 2006)

"Why A Load-Based Cap?"
(March 2007, with Julie Fitch, CPUC)

Posted at www.raponline.org

Email questions to *rapweston@aol.com*