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Developing an Emissions Trading Program for Regional Haze

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Overview

- Background and Objectives
- Potential Gains from Emissions Trading
- Lessons from Experience with Emissions Trading
- Key Elements of an Emissions Trading Program for Regional Haze
- Next Steps

Background and Objectives

Background

- **NERA Economic Consulting**
  - **Firm of about 500 professionals with 10 offices in U.S. and six offices abroad**
  - **Extensive experience assisting public and private groups with regard to emissions trading programs, including Acid Rain, RECLAIM, NOX SIP Call and most recently EU program for CO2**
- **Regional Haze Regulations**
  - **EPA Proposed Rule provides regulatory framework and guidelines for BART**
  - **EPA supports use of a regional trading program instead of source-by-source BART determination**

Presentation Objectives

1. **Clarify emissions trading and the nature of its potential gains**
2. **Provide lessons from experience in previous emissions trading programs**
3. **Outline the major features of a trading program for regional haze**
   - **Note that we do not consider how the overall cap/budget should be set**
4. **Identify next steps in deciding whether to pursue the emissions trading option**

Potential Gains from Emissions Trading

What is Emissions Trading?

- **Flexibility to find and to choose the lowest cost means for reducing emissions**
- **Allows plants to transfer emission reductions from relatively high cost plants to lower cost plants**
- **Works only when costs differ among plants**
- **Assumes requirement to reduce emissions and effective enforcement**

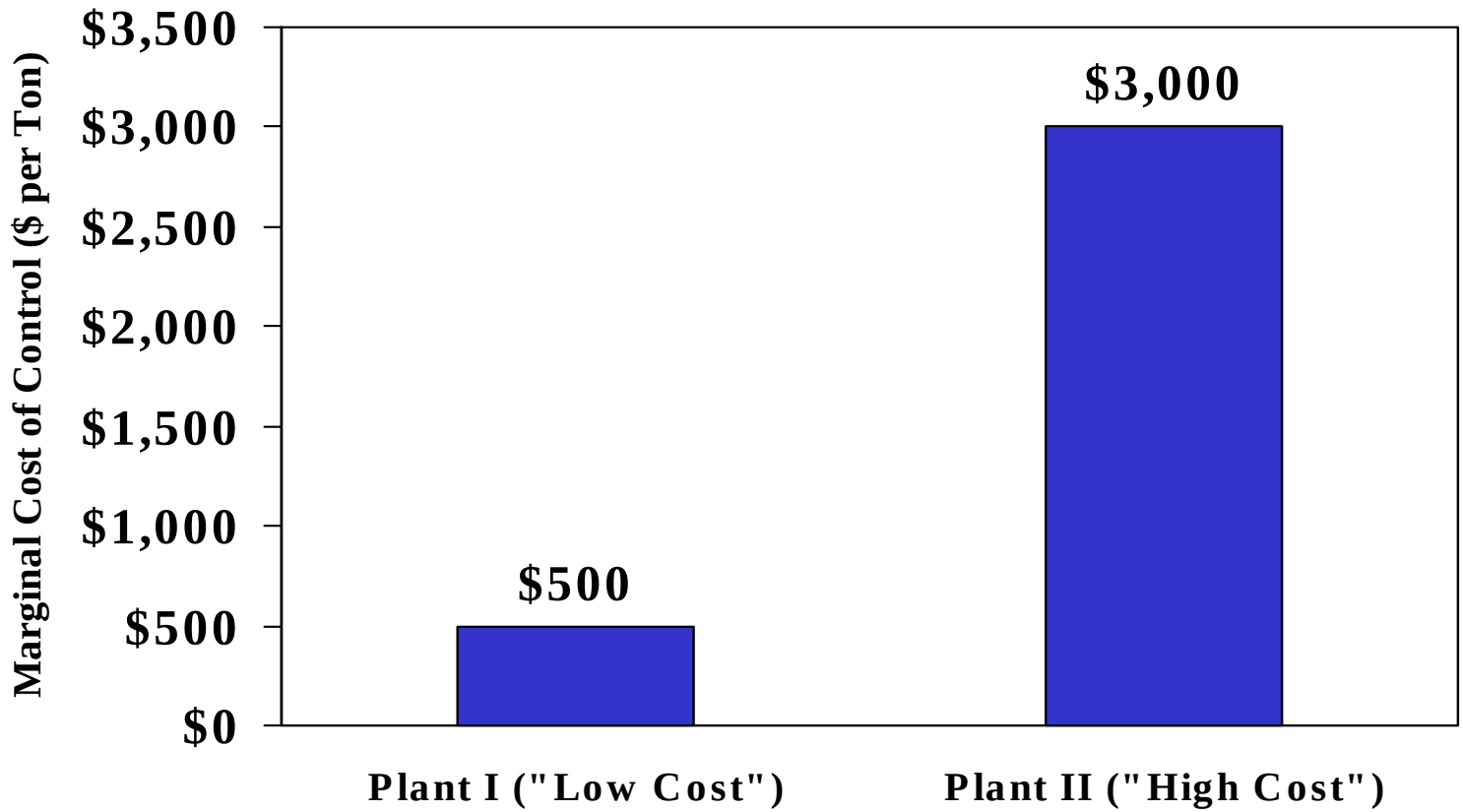
Potential Environmental and Economic Gains from Emissions Trading

- **Environmental gains**
  - **Emission budget must achieve greater visibility progress than BART**
  - **“Cap” provides greater certainty that the visibility progress actually will take place**
- **Economic gains**
  - **Cost savings from trading (relative to uniform “command-and-control” approach)**
  - **Dynamic incentives to develop cost-effective technologies**

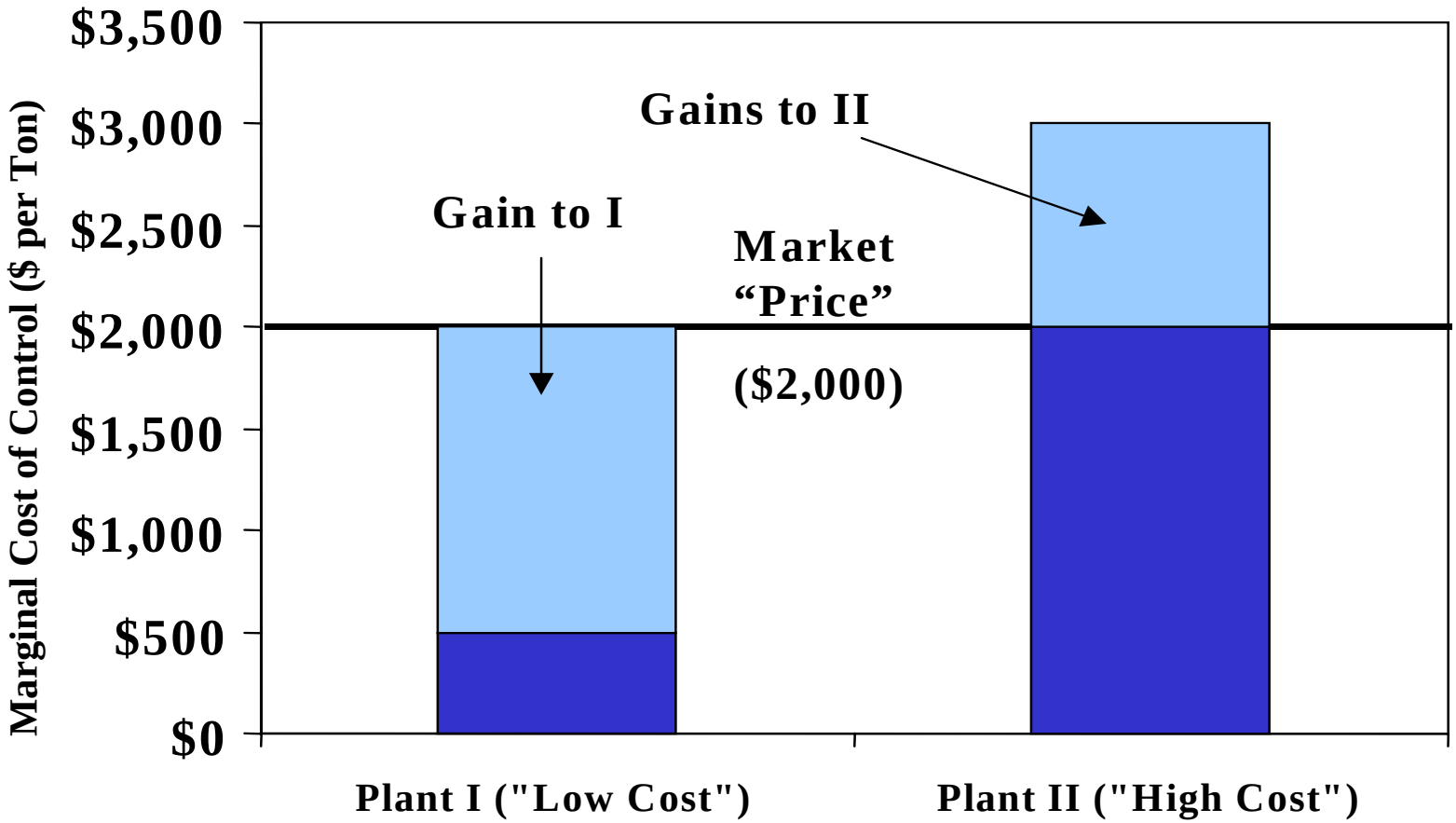
Potential Cost Savings from Flexibility Under Emissions Trading

- **Each facility has three major options**
  1. **Reduce to level set by initial allocation ("standard")**
  2. **Reduce more and sell allowances**
  3. **Reduce less and buy allowances**
- **The additional options (2 and 3) translate into lower overall cost of meeting the cap**
  - **Key reason: facilities differ in the marginal costs of reducing emissions**

Marginal Cost of Meeting a Hypothetical Standard at Two Plants



Gains to Plants from Trade of a Single Emission Allowance



Gains are Shared Among Sellers ("low cost") and Buyers ("high cost")

- **Buyer of allowance gains $1,000**
  - Face higher costs of control
  - Gain $1,000 from buying allowance ($2,000) rather than reducing ($3,000)
- **Seller of allowance gains $1,500**
  - Have lower costs of control
  - Gain $1,500 from selling allowance ($2,000) that only costs $500 to "produce"
- **Sum: Overall gain of $2,500 split between buyer and seller**
  - Full trading is more complicated; but this simple example illustrates the basic nature of the gains and their split between buyers and sellers

Lessons from Experience with Emissions Trading

Three Major Emissions Trading Programs Reviewed

1. **SO_2 Allowance Trading (Acid Rain Program)**
   - **Most prominent program**
2. **RECLAIM NO_x and SO_2 Trading Programs**
   - **Illustrate how to include multiple sectors**
3. **Northeast NO_x Budget Program**
   - **Illustrates how to include multiple states**

Note: all are "cap-and-trade" programs

- **Other trading programs include credit-based programs and emissions averaging programs.**

Acid Rain Trading Program

- **Best known emission trading program**
- **Widely regarded as success and prototype for other programs**
- **Program to reduce SO2 emissions from existing electric generating plants**
- **Passed in 1990 Clean Air Act Amendments**

Basic Elements of Acid Rain Trading Program

- **National cap on SO2 emissions from electric generating plants**
- **Phase 1: 1995-1999**
  - **Cap reduced emissions by 3.5 million tons per year**
  - **263 largest emitters**
- **Phase 2: 2000-**
  - **Cap reduced emissions by about 9 million tons per year**
  - **Covers virtually all generating units**

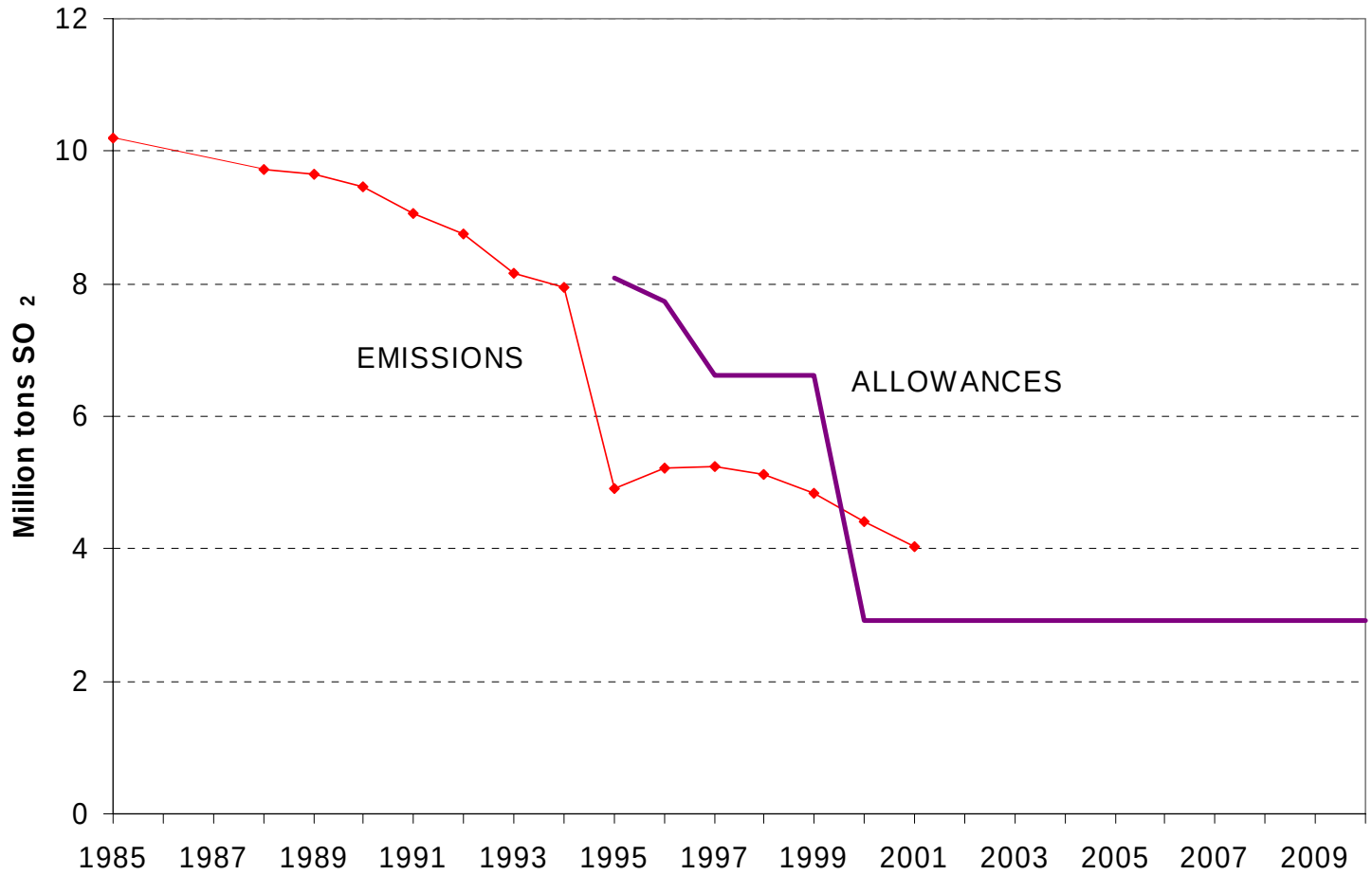
Considerable Concerns When Program Developed

- **Cost savings may not materialize**
  - Regulated utilities incentives?
  - Allowances not “property right”
  - EPA oversight?
- **Environmental effects may be perverse**
  - Adverse effects on the Northeast
  - No constraints on trading
- **Administrative costs may be excessive**
  - Experience with EPA ET programs
  - New program

Concerns Not Borne Out in Experience

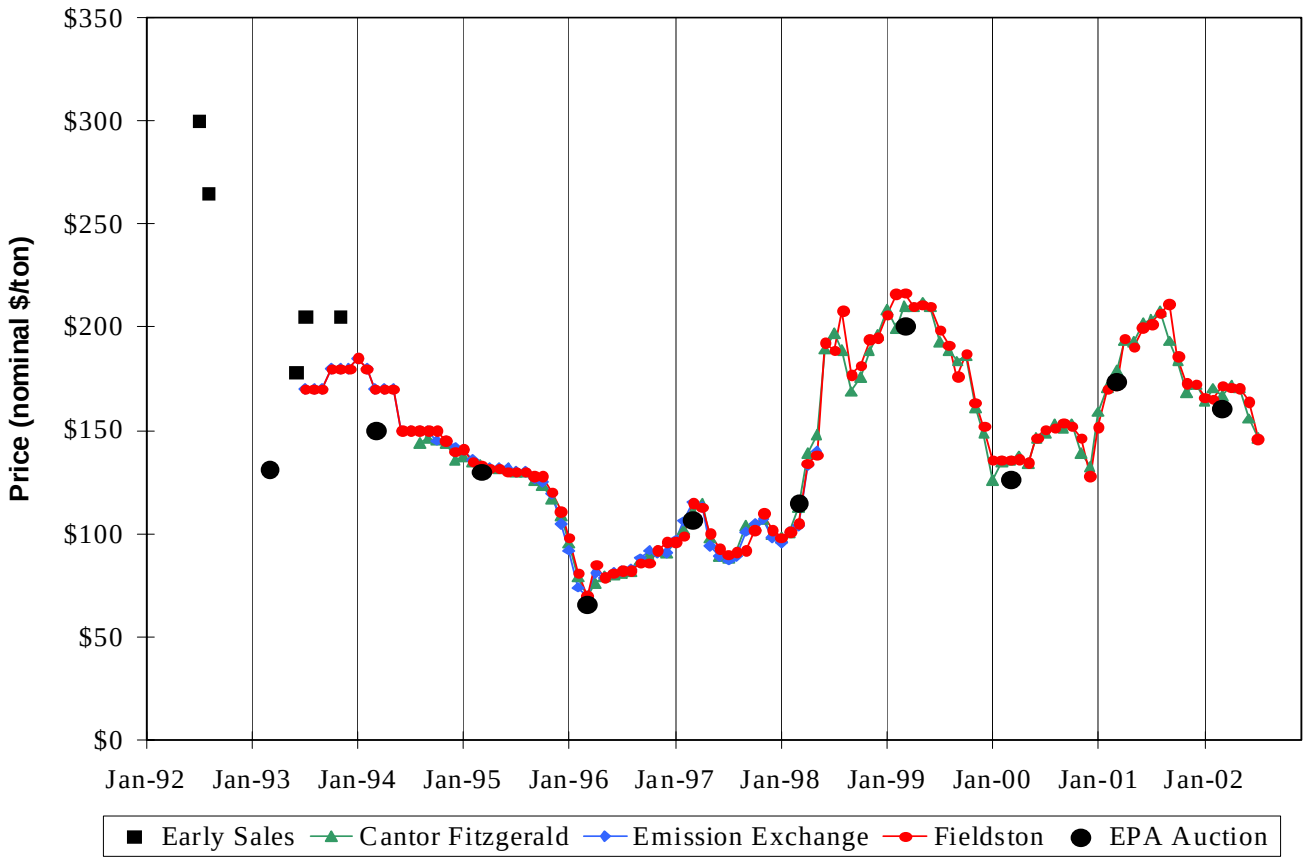
- **Active Market for SO2 Allowances**
  - **Generators did trade allowances**
  - **Restructuring in some states helped**
- **Banking Substantial in Phase 1**
  - **Use of scrubbers lead to "overcontrol"**
- **Environmental performance not perverse**
  - **Modeling suggests no increase in Northeast air pollution due to trading**
- **Administrative costs not excessive**
  - **Evidence suggests costs of setting up and administering the program have been modest**

Accelerated Reductions through Banking for Acid Rain Phase I Units



Prices for SO_2 Allowances Show an Efficient Market

SO_2 Allowance Prices 1993-2003



Acid Rain Trading Estimated to Reduce Cost by About 50 Percent

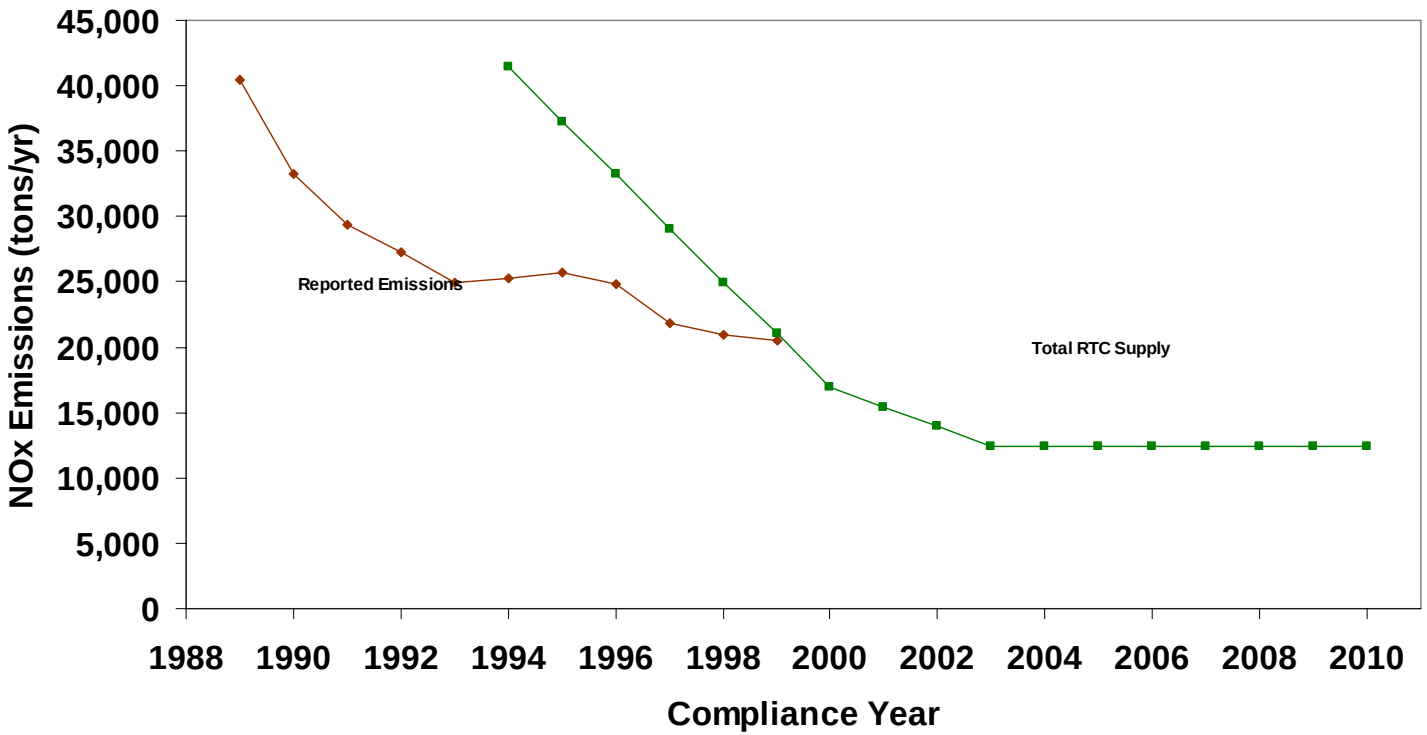
- **Estimating cost savings complicated**
  - **Equivalent "command and control" regulations?**
- **MIT careful study including all sources of cost savings**
  - **Spatial flexibility in Phase 1 and Phase 2**
  - **Temporal flexibility (banking)**
- **Some evidence of overcontrol in Phase 1 that reduced savings somewhat**

RECLAIM Program in Los Angeles

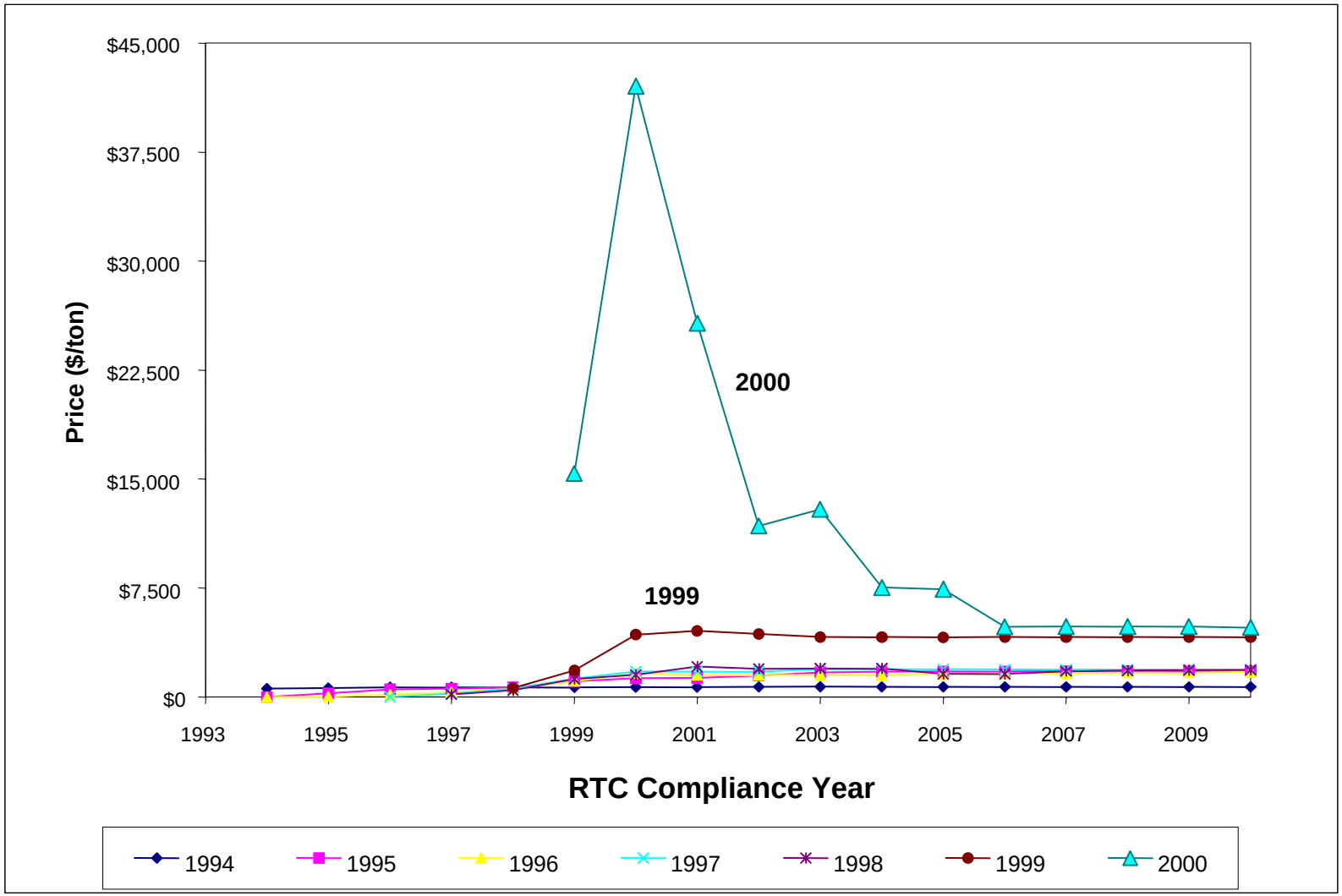
- **Cap-and-trade program developed at the same time as national acid rain program**
- **More complex than acid rain trading**
  - **NOx and SO2**
  - **Many sectors, not just electric generators**
  - **Two trading zones, coastal and inland**
  - **Detailed allocation formulas**
- **Did not include banking, creating problems in 2000 when prices increased substantially**

NOx Emissions and RECLAIM Trading Credits (RTCs) Over Time

RECLAIM NO_X Emissions and RTC Supply, 1994-2000 (tons/year)



Dramatic Increase in RTC NOx Prices in 2000



High NOx Prices Triggered Backstop Provision

- **Price exceeded "trigger price" of $15,000 per ton**
- **White Paper to evaluate causes**
- **Major cause: increased demand by electric generation sources**
- **Cost-effective control options exist (e.g., SCR) but cannot be installed quickly**

2001 Changes in RECLAIM

- **Power plants separated temporarily from RECLAIM**
- **Power plants pay mitigation fee**
  - **$15,000 per ton**
  - **Fees used to reduce emissions**
- **Power plants must submit compliance plans**
- **Temporary credit programs for mobile and area sources**

Lessons from RECLAIM Experience in 2000

- **Uncertainty over allowance prices under cap-and-trade program**
- **Mitigation fee similar to "safety valve" recommended to avoid price spikes**
- **Prices have declined and compliance plans have been submitted**
- **Too early to determine full effects of the changes**

Northeast NOx Budget Program

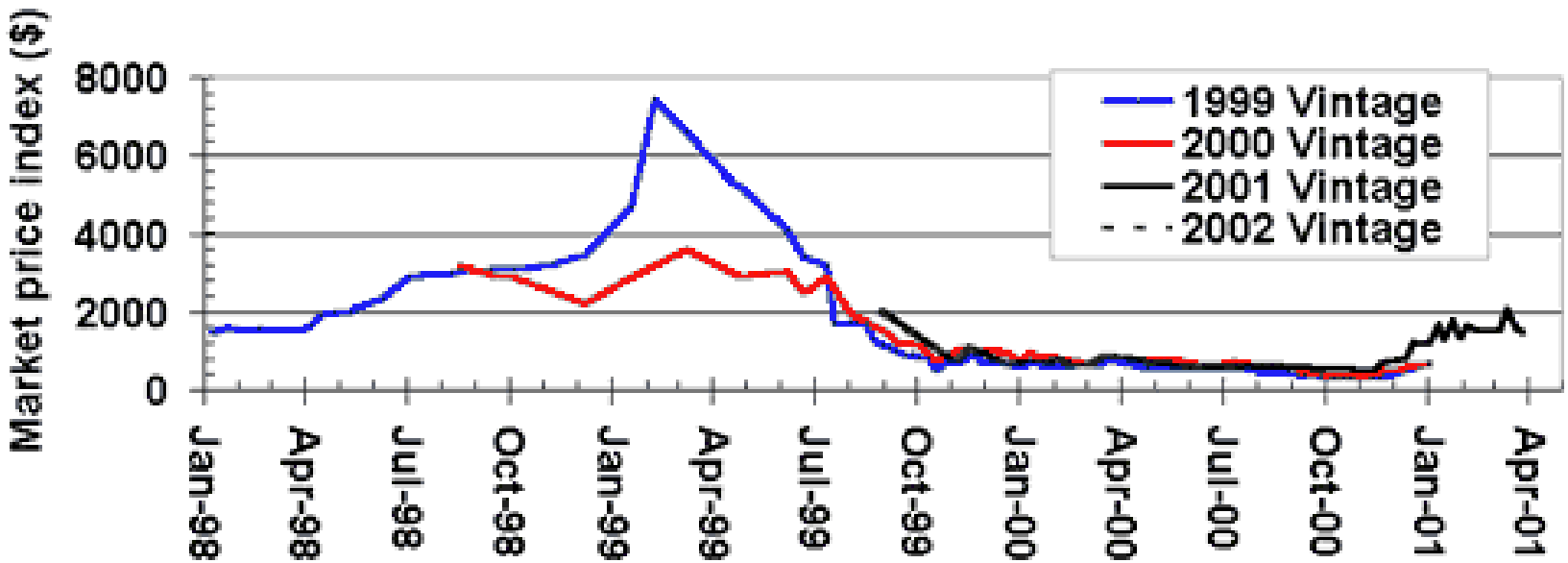
- **Provide cap-and-trade flexibility to reduce NOx**
  - **Power plants**
  - **Other large stationary sources**
- **Covers summer (May-September) emissions**
- **Three phases, two with caps**
  - **Phase 2: 55-65 percent reduction**
  - **Phase 3: 65-75 percent reduction**
- **Requirements differ within the region**

Implementation by Individual States

- **EPA Model Rule**
  - **Provides template for trading program**
  - **Allocation by states**
  - **Banking permitted, but use of banked emissions limited ("flow control")**
- **Considered different requirements for different days within the summer**
  - **No practical option**

NO_x OTC Prices Have Varied Considerably

Market Price Index for the OTC NOx Budget Program



Early History Suggests NOx Budget Achieving Goals

- **Cost savings**
  - Estimated at 30 percent
- **Market participation high**
  - Eight states participated
  - 15 percent of allowanced traded
- **Environmental performance good**
  - Emissions reduced
  - No evidence of “wrong-way trades”

Lessons from Emissions Trading Experience Can be Put in Five Categories

1. **Economic performance**
2. **Environmental performance**
3. **Initial allocation and "equity"**
4. **Trading flexibility with banking**
5. **Enforcement and monitoring**

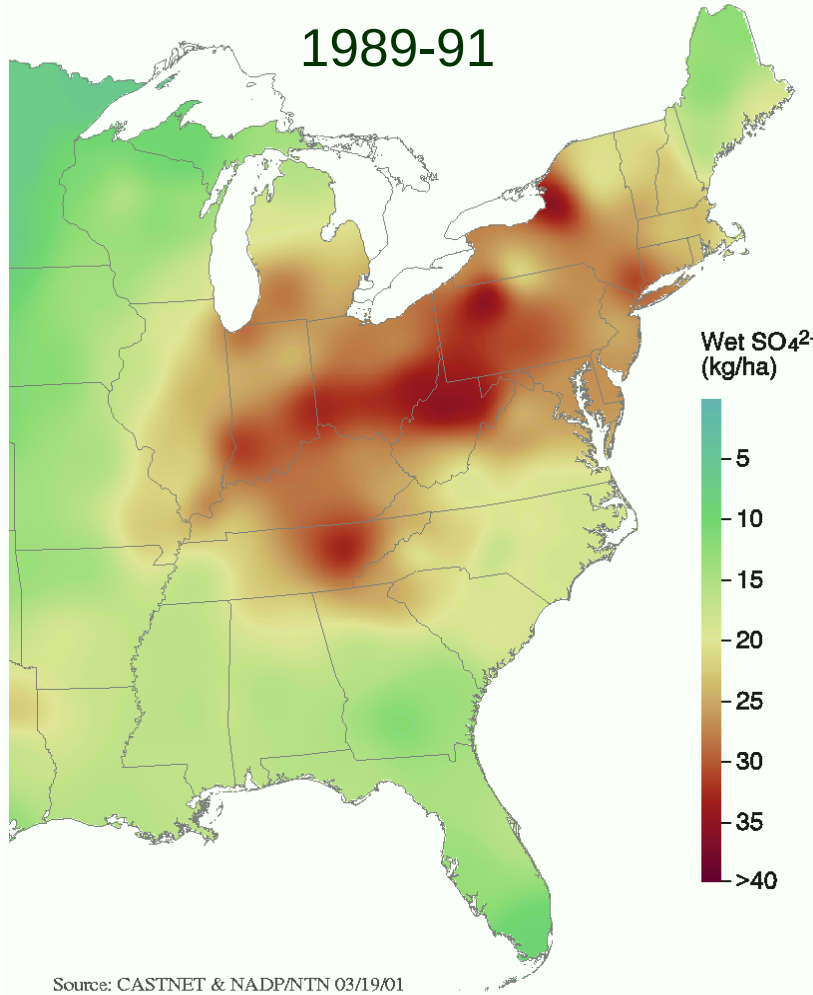
Lesson 1: Economic Performance

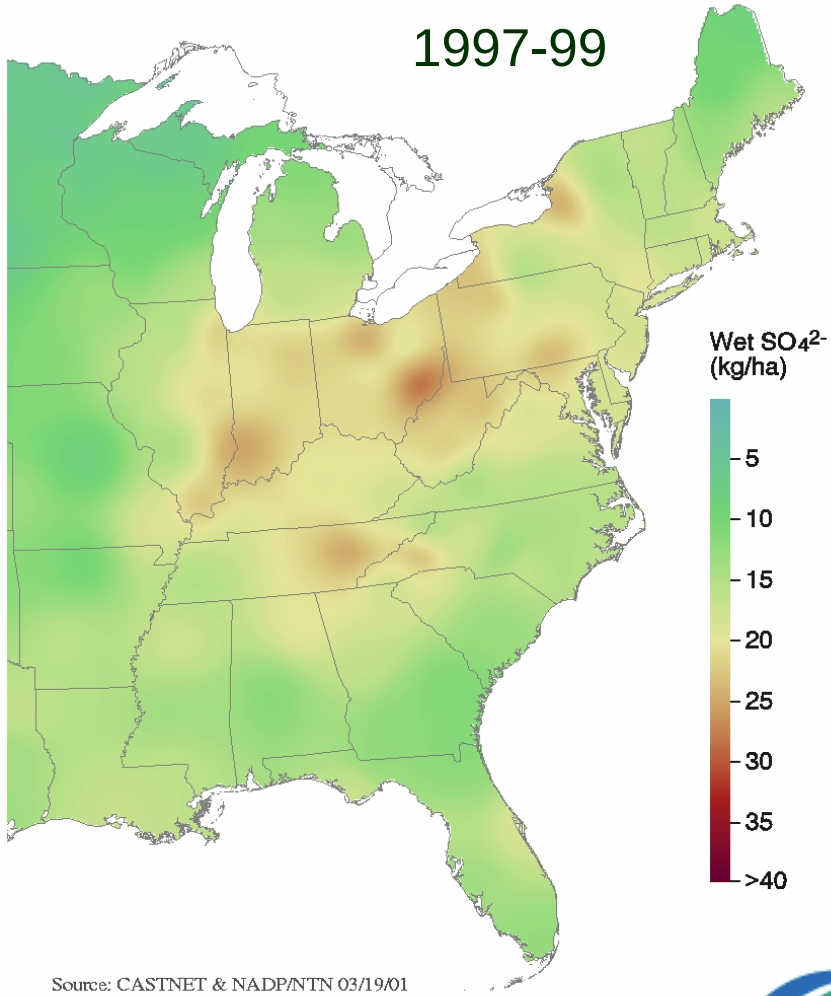
- **Cap-and-trade programs have lowered the cost of meeting environmental goals**
  - **Best evidence is ≈ 50% cost savings in SO_2 acid rain program (relative to no trading)**
- **Significant trading in other programs implies cost savings**
- **Evidence of some impetus for technological innovation (e.g., scrubber technology)**
- **No evidence of excessive administrative costs**

Lesson 2: Environmental Performance

- **Trading has *enhanced*—not compromised—achievement of environmental goals**
- **Automatic "offset" for high-cost situations instead of relaxed emissions standards**
- **Banking accelerates emission reductions**
- **Flexibility facilitates consensus on demanding environmental goals**

Monitored reductions in wet sulfate deposition due to the Acid Rain Program





Lesson 3: Initial Allocation and Equity Concerns

- **Clear allocations critical to success**
  - **Must know "where you start"**
  - **Allow for efficient markets to develop**
- **Contentious and difficult because allowances have substantial value**
- **Many different allocation methods applied, but without perceptible effect on economic or environmental performance**
- **Allowance allocation can address equity and political concerns that arise in adoption and implementation**

Lesson 4: Trading Flexibility with Banking

- **Temporal flexibility is undervalued but important**
- **Provides incentive for early reductions in phased-in programs**
- **Provides flexibility in dealing with source-specific adjustment costs and unexpected cost shocks**
- **RECLAIM's NO_x experience illustrates importance of temporal trading**

Lesson 5: Enforcement and Monitoring

- **Environmental integrity critical to success**
- **Accurate emissions monitoring**
  - **Continuous emissions monitors (CEMs) for large sources**
  - **Flexibility for lower cost options for smaller sources (RECLAIM)**
- **Significant penalties for cheating**
  - **Provide for "true up" period**

Summary: Key Lessons from Experience with Emissions Trading

1. **Emissions trading has been successful in reducing the cost of meeting emissions targets**
2. **Emissions trading has enhanced achievement of environmental gains**
3. **Acceptable initial allocations can be set without impairing cost saving and environmental objectives**
4. **Banking has played a major rule in improving the economic and environmental performance of emissions trading**
5. **Accurate monitoring and enforcement are critical to the integrity of the programs**

Prominent Successes Mean that Emissions Trading Has Become the Norm

- **CAIR**
  - Provides for interstate cap-and-trade programs for NOx and SO2
- **Mercury Rule**
  - Provides for interstate cap-and-trade program for mercury
  - Caveat: concern for “hot spots” in potential litigation
- **EU Emissions Trading Scheme**
  - Establishes a EU-wide cap-and-trade program for CO2

Key Elements of an Emissions Trading Program for Regional Haze

Application of Emissions Trading to Regional Haze

- **Successful examples suggest emissions trading is a promising approach**
- **But, details matter!**
- **Need to consider specific features of a program for regional haze**
  - **Specific elements identified and organized**
  - **Likely performance relative to technology-oriented approach for all relevant sources**
  - ***Note: the presentation does not consider the level of the cap, but rather how to design and implement a trading program to achieve whatever cap is ultimately set***
- **Existing information**
  - **EPA preamble in final Regional Haze rule (July 1999)**
  - **Western Regional Air Partnership (WRAP) backstop Market Trading Proposal (August 2003)**
  - **CENRAP Emissions Trading Subgroup (February 2005)**

Trading Features Can Be Put into Three Broad Categories

1. **Threshold Features**
   - Facilities included
   - States included
   - Opt-in possibilities
   - Cap/budget and timing
2. **Design Features**
   - Initial allocation
   - Trading rules
   - "Hot spots" Trigger
   - Banking
   - Safety valve
3. **Implementation Features**
   - Monitoring/reporting
   - Tracking/registry
   - True-up period
   - Compliance
   - Enforcement/Penalties
   - Program audit

Facilities Included

- **BART-eligible sources**
  - 26 specific source categories listed under CAA
  - Constructed/placed in operation between August 1962 and August 1977 and potential to emit 250 tons or more of visibility-impairing pollutant
- **Non-BART-eligible sources**
  - Sources included to achieve "reasonable progress"
  - E.g., WRAP includes facilities with SO2 emissions 100+ tons (subject to case-by-case review) and new sources with potential to emit 100+ tons
  - Caveat: accurate measurement/tracking necessary
- **Caveat: inclusion not required if installed BART and/or source included in CAIR**
  - But,
    - Emission requirements can be more stringent than BART
    - CAIR does not apply to facilities in Western states

States Included

- **States to be included**
  - **Cost savings greater with more states**
  - **Some elements (e.g., allocation) can differ among states**
  - **Geographic differences among sources more important with larger trading area**
- **Use of "model rule" can reduce the administrative costs to states of participating**

Opt-In Possibilities

- **Opt-in candidates**
  - Beyond those included specifically (BART-eligible and linked to "reasonable progress" requirement)
  - Should influence regional haze to be considered
- **Gains from allowing opt-in**
  1. Environmental gains if require "contribution to the environment" to opt in
     - Caveat: want to avoid "anyway reductions," i.e., reductions that would have occurred without opt-in
  2. Cost saving gains from introduction of additional credits

Cap/Budget and Timing

- **Emission cap/budget is limit on total emissions for sources in the program**
  - Set separately for each state, with total cap depending upon which states participate
  - Many technical and legal issues related to setting the cap and determining its timing (including "progress" milestones)
- **Technical considerations include**
  - BART technologies and effectiveness
  - Growth projections
  - Emissions/dispersion modeling
- **Legal considerations include**
  - EPA forthcoming response to court remand related to 2002 American Corn Growers v. EPA decision invalidating EPA method of determining BART
  - WRAP response to February 2005 CEED v. EPA decision declaring WRAP determination of cap invalid under *American Corn*
- **Level and timing of overall cap are important considerations but they are not the focus of this presentation**

Initial Allocation

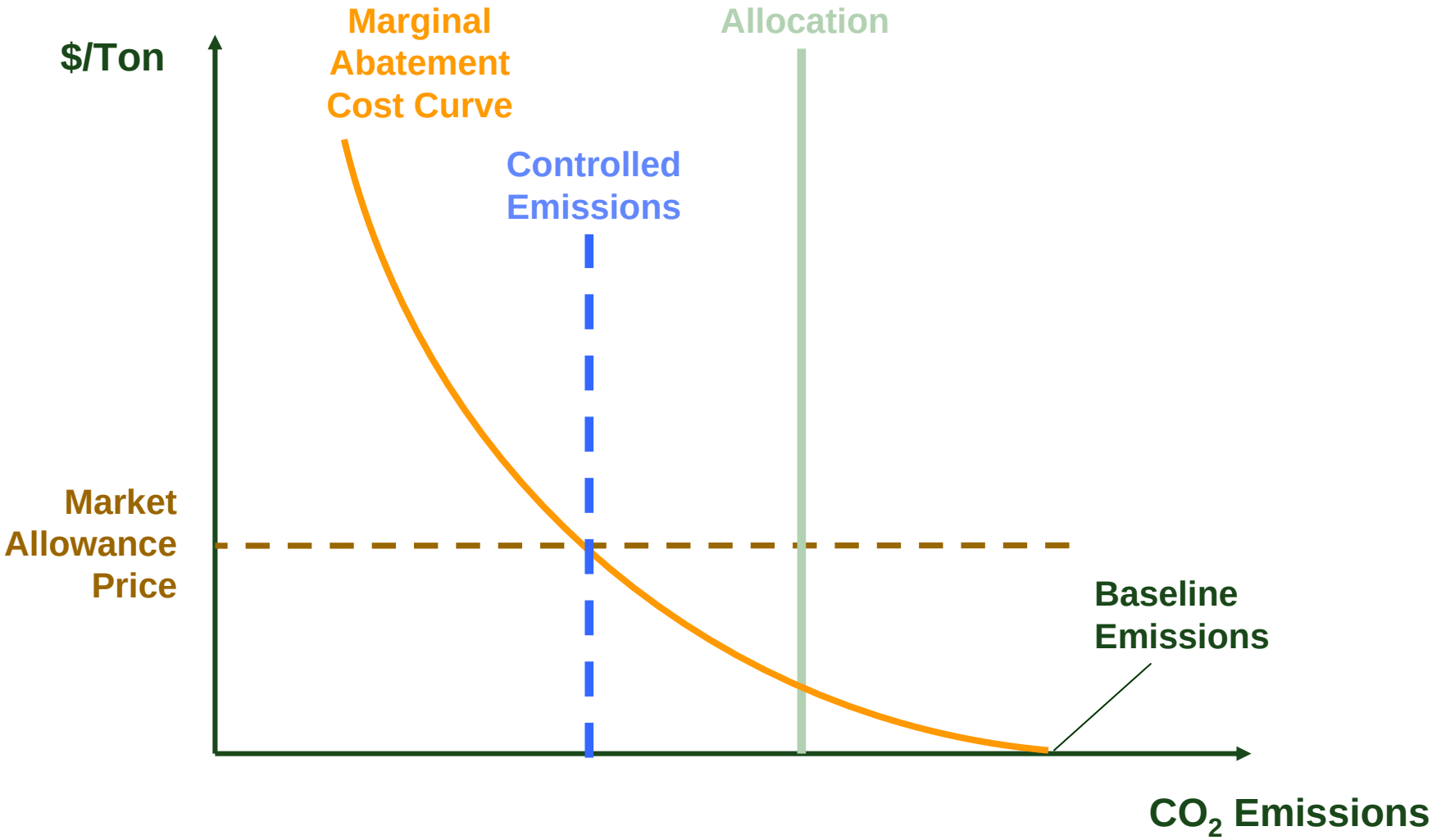
- **Typically the most contentious element**
  - Allocation of shares of fixed cap a "zero sum game"
  - But sometimes confused with setting overall cap (e.g., controversies in Europe over Member State NAPs)
- **State leeway to determine for in-state facilities**
  - Different formulas among states generally do not affect the success (e.g., cost savings) of the program
  - Some complications *could* affect program performance (e.g., new source set asides, updating)
- **Following slides provide information on:**
  1. Basic choices
  2. Difference between facility allocation and control decision
  3. Set asides and early action credits
  4. Other complications related to allocations

Basic Allocation Choices

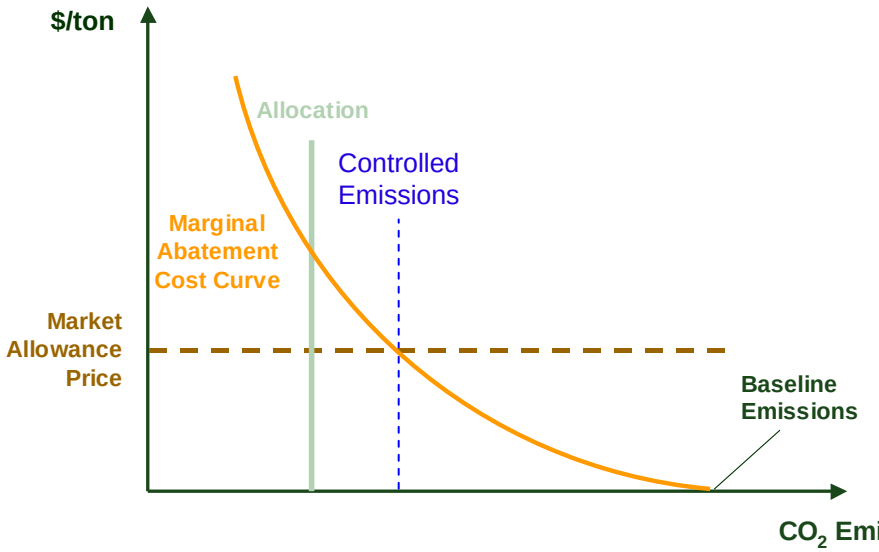
- **The table below summarizes basic allocation alternatives**

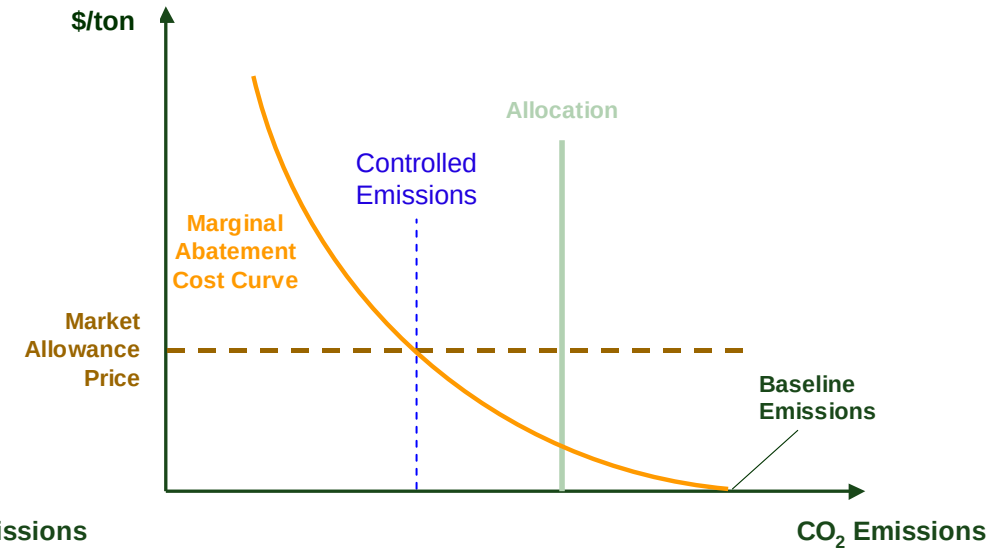
Basic Allocation Type	☐ **Free** ☐ Non-updated ☐ Updating	☐ **Auctioning** ☐ Maximum 5% ☐ Other	
Metric Used	☐ Emissions ☐ Fuel or other Inputs	☐ Product Output ☐ Capacity	
Years Used	☐ 1998 ☐ 2001	☐ 1999 ☐ 2002	☐ 2000 ☐ Other Years
Specific Data/ Formula	☐ Single Year	☐ Average	☐ Max

Framework for Considering Incentives for Firms to Control



Why Grandfathered Allocations Don't Affect Firm Decisions on Emission Control





- **Two different allocation levels…**
  - **…but facility emissions levels are the same**
- **Note, however, that the distributional effects are very different!**

Set Asides and Early Action Credits

- **Set asides**
  - Take some of the cap and use for specific circumstances
  - Frequently used for new sources
    - WRAP includes a new source set-aside for both new sources and for existing sources that increase their capacity
  - Does not affect the overall cap, but does decrease the number of allowances allocated to direct participants
- **Early action credits**
  - Provide allowances for reductions before the cap-and-trade program begins
    - WRAP includes early reduction bonus allowances (below floor established in the plan) from 2003 to the program trigger year
  - Early action credits create banked allowances that can be used to meet requirements
  - Increases the overall cap (when the program takes effect)
  - Procedures need to be developed to ensure that the credits represent "real reductions," i.e., reductions from business-as-usual emissions

Additional Allocation Issues

Various other issues can arise in determining the initial allocation of allowances

- **Allocations to non-emitters**
  - E.g., "indirect emissions", "Sky Trust"
- **Relationship to other programs**
  - Renewable programs, energy efficiency programs
- **Changes over time in allocation choices**
  - E.g., shift in percentage of auctioned allowances
- **Other changes tied to allocations**
  - E.g., Public Utility Commission decisions on electricity rates and "opportunity costs" of using "free" allowances

Trading Rules

- **Inter-pollutant trading**
  - Tentatively not allowed in WRAP
  - Possibility if equivalence (visibility effects) can be determined
- **Trading across states/geography**
  - Consider whether to include geographic differences (e.g., trading ratios depending on distance from Class I areas)
  - Caveats:
    - (1) need to keep system relatively simple to avoid high transactions costs (and no trading)
    - (2) Overlay of state-specific controls may be better means of dealing with hot spots than restrictions or trading ratios
- **Interaction with CAIR**
  - Co-mingling of trading programs?

"Hot Spots" Trigger

- Related to geographic restrictions on trading
- Trigger mechanism for source-specific BART if visibility at a particular Class 1 area is exceeded
  - "Certification of impairment" by federal land manager or state if visibility goals not met
  - Existing element in EPA's 1980 rulemaking provides precedent for this approach
- Trigger would constrain the market and thus potentially reduces cost savings
  - Useful to clarify need for source-specific BART as soon as possible
  - Mechanisms for early warning include public meetings to share information on possible concerns early in the implementation (WRAP)

Banking

- **Allows facilities to use excess allowances to cover emissions in future years**
  - **Provides environmental/economic gains**
- **Flow controls possible**
  - **Limits number of banked allowances that can be used on 1:1 basis**
  - **Beyond limit, some ratio required (e.g., 2:1)**
  - **WRAP prohibits use of banked allowances for final compliance year (2018)**
- **Consider whether flow controls necessary to avoid excessive emissions in a single year**

Safety Valve

- **Represents a maximum value for the price per ton**
  - **Set to provide protection against unlimited allowance prices, which can exceed the value of reductions**
  - **Revenue can be used to obtain emission reductions elsewhere (e.g., South Coast Clean Air Investment Fund)**
- **Allows for increases in emissions beyond the cap**
  - **Caveat: if revenues used to acquire emission reduction credits**
- **Differs from penalty**
  - **Set on basis of "value" of emission reductions**
  - **No civil liability/onus attached to exceedences**
- **Differs from "trigger review"**
  - **E.g., South Coast RECLAIM sets price of $15,000 per ton, which triggers a review of the program**

Monitoring

- **Monitoring actual emissions can be done with different techniques but different costs**
  - Continuous emission monitors (CEMs), most costly
  - Mass balance
  - Fuel meters
- **Required monitoring techniques**
  - Useful to allow less costly techniques for smaller sources
  - E.g., WRAP allows for some flexibility for non-Part 75 sources
- **Monitoring Plan**
  - Clarify method and accuracy of monitoring information
  - Subject to initial certification and recertification to validate accuracy
- **Substitute data procedures**
  - Required to provide for missing/invalid data
  - Typically require use of maximum concentration/flow rate values

Reporting

- **Account Representative**
  - Selection of Account Representative with authority to submit legally binding information
- **Quarterly and annual emissions reports**
  - Include information on emissions and allowances held/used
  - Submitted within period (e.g., 30 days of end of quarter or compliance year
- **Allowance Transfers**
  - Submit relevant information on purchases/sales (e.g., serial numbers, names, dates)
  - Use of allowances banked in previous years
- **Compliance Report**
  - Submit within certain period (e.g., 60 days) to show that allowances held are equal to or greater than emissions

Tracking/Registry

- **Tracking system for ownership and transactions**
- **Registry to provide information on emission allowances held by individual facilities subject to the cap-and-trade program**
  - **Include opt-in sources**

True Up Period

- **Provide period after the compliance year to allow for purchases/sales**
- **Typically 60-90 days**
- **Avoids end-of-year problems**
  - **Inadvertent non-compliance**
  - **Run up (or run down) in price because of excess of buyers (or sellers)**

Compliance

- **Basic requirement: hold allowances (by end of true-up period) equal to or greater than total emissions (as monitored/reported)**
- **Based upon data provided to program administrator**
  1. **Monitoring data**
  2. **Compliance account balance**
- **Allowances (serial numbers) retired based upon relevant emissions**

Enforcement/Penalties

- **Net debit (after true up) triggers penalties**
  - **Emissions greater than allowances held**
- **Penalties can include two types**
  1. **"Make up" debits with some ratio (e.g., 2:1)**
  2. **Financial penalty (e.g., $5,000 per ton)**
- **Recorded/enforced by agency administering the program**
  - **Could involve civil liability**

Program Audit

- **Program reviews/audits provide opportunities to review performance**
  - **Environmental performance**
  - **Administrative considerations**
  - **Cost savings achieved**
- **Caveat: audit should not "second guess" technology/control choices**
  - **Interference with market choices would undermine the trading program**
- **Part of ongoing effort to make sure that "performance equals promise"**


Net Cash From Purchase
Allowance Payments
Central Co
Energy-related CO2
Sulfur dioxide

Next Steps

Next Steps

1. **Consider any general issues/concerns with use of emissions trading for regional haze**
   - Any general concerns?
   - Issues left out?
2. **Develop background information for the specific region**
   - Distribution of sources and potential for "hot spots"
   - Number/characteristics of relevant sources
   - Likely cost-effectiveness variations (and thus gains from emissions trading)
   - Likely monitoring/administrative costs (relative to BART/other controls)
3. **Develop evidence to decide whether emissions trading would be desirable**
   - Likely visibility protection
   - Likely cost savings
   - Likely administrative costs (or savings)

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