



# New Mexico CCAG TWG Cap & Trade Seminar

June 28, 2006

9:00 am – 1:00 pm



# Today's Agenda

- 9:00-9:30 am INITIAL ITEMS
  - Call to order, roll call, review of agenda
  - Review April 26 CCAG decision on Cap & Trade options
  - Review objectives for this seminar
- 9:30-11:30 am EDUCATION SESSION
  - What Cap & Trade is, how it works, experience to date
  - Key issues in design and implementation
  - Modeling a GHG Cap & Trade program
  - Q&A and Discussion
- 11:30 am–12:00 pm LUNCH (on your own)
- 12:00-12:45 pm SPECIFICATION SESSION
  - Inputs to the Multi-State GHG Permit Trading Model
  - Outputs from the model
  - Development of model inputs & outputs
- 12:55-1:00 pm CALL TO THE PUBLIC; ANNOUNCEMENTS

# Initial Items

- Call to order, roll call, agenda review
- Review April 26 CCAG decision on Cap & Trade policy options
- Review objectives for this seminar:
  - Enhance understanding of Cap & Trade generally, and modeling GHG Cap & Trade specifically
  - Develop inputs for and outputs from CCAG modeling

# Education Session (1)

- What is Cap & Trade
- How does Cap & Trade work
- Results and experience to date
- Why GHGs are well suited to Cap & Trade
- Early GHG Cap & Trade approaches
  - EU ETS, CCX, RGGI

# Education Session (2)

- Key issues in designing and implementing a Cap & Trade program
  - GHG reporting & reconciliation capacity
  - Geographic coverage; source/sector coverage; cap level(s); timing
  - Early reductions; Banking/borrowing; Offsets; Safety valves; Price caps
  - Allowance allocation approaches

# Education Session (3)

- Modeling GHG Cap & Trade
  - Joint modeling and consensus building
  - Testing data sources, methods, assumptions
- Outputs provided by modeling
  - GHG reductions
  - Cost per ton
  - Aggregate cost
  - Sensitivity analysis
- Inputs needed for modeling:
  - Coverage (by states, sectors)
  - Reference case GHG emissions (by states, sectors)
  - Targets & timetables (by states, sectors)
  - Cost curves (by states, sectors)
  - Other design specifics

# Rose-Zhang Permit Trading Model

- Purpose: Simulate basic features of cap & trade systems (and related policy refinements) to determine emission & cost implications
  - Extensive prior applications (Global, EU, US regions, RGGI)
  - Flexible & transparent framework
  - Readily accommodates data refinements & updates
  - Readily accommodates simple & complex designs

# R-Z Model Features

- Based on sound economic principles
- Main inputs (for each entity)
  - emission levels
  - marginal mitigation costs
  - initial permit allocations
- Main outputs (for each entity)
  - pre-trading mitigation costs
  - post-trading mitigation costs
  - permit purchases/sales (volume & value)
  - permit price

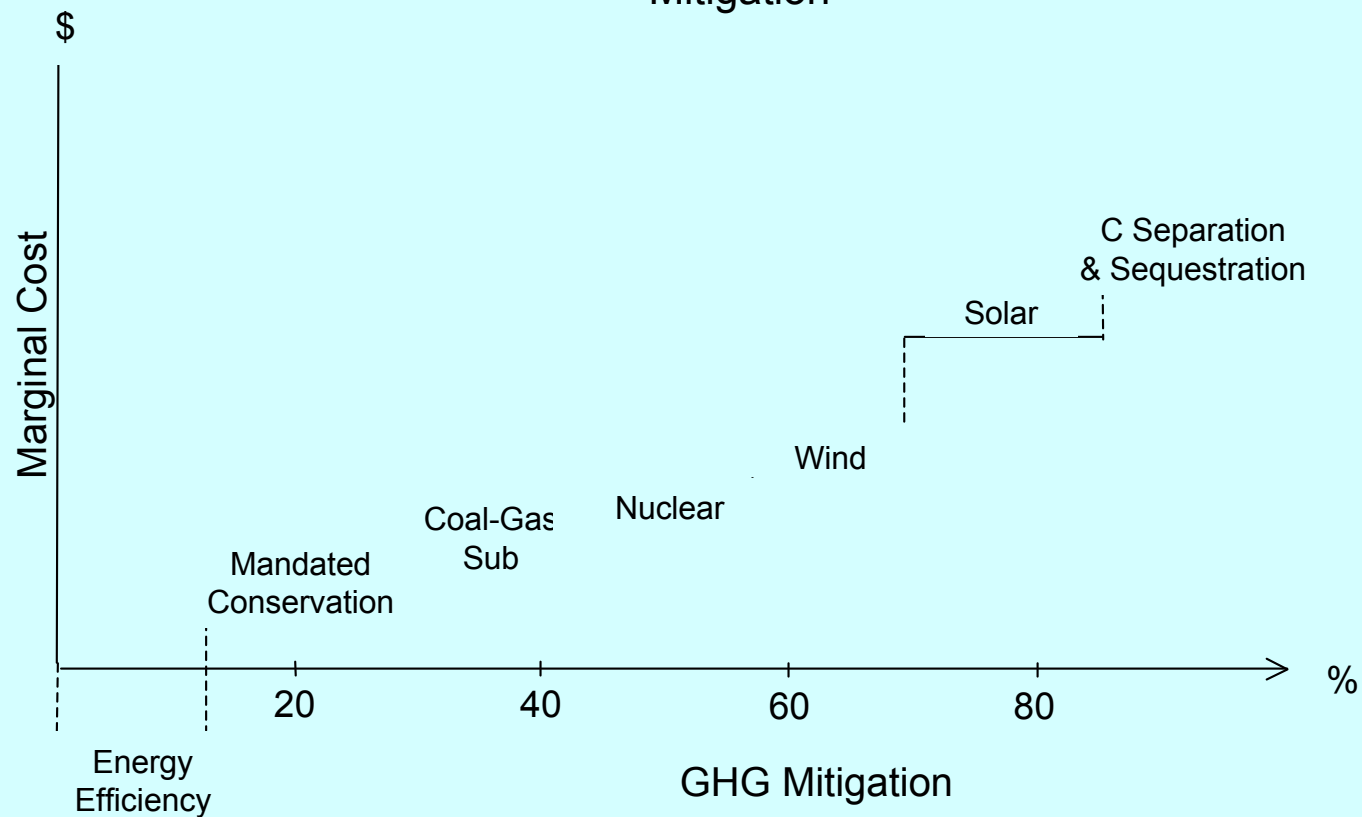
# Evaluation Of Permit Trading Flexibility

(All entries represent departure from CO2 mitigation only unless otherwise indicated)

| Study/Application               | How  | What   | Where  |
|---------------------------------|--|--|--|
| Rose-Oladosu (2002)<br>U.S.     | Sequestration<br>Permit price 64%<br>lower                 | Methane<br>Permit price 23%<br>lower                         |  |
| Stevens-Rose (2002)<br>Global   |  |  | Global trading<br>Cost savings 85%   |
| Springer (2003)<br>Global       |  | Methane and<br>nitrous oxide<br>Permit price 25-49%<br>lower | From Annex I trading to<br>global trading<br>Average permit price 67%<br>Lower |
| Zhang (2004)<br>Global          |  |  | From Annex I trading to<br>global trading<br>Permit price 76 - 79%<br>lower    |
| Akimoto et al. (2004)<br>Global | Sequestration<br>CO <sub>2</sub> shadow price<br>32% lower |  |  |
| IPCC (2001)<br>Global           |  |  | Global trading<br>Marginal abatement costs<br>29 - 78% lower                   |
| Rose-Zhang (2004)<br>U.S.       |  |  | National trading<br>Cost savings 41%   |

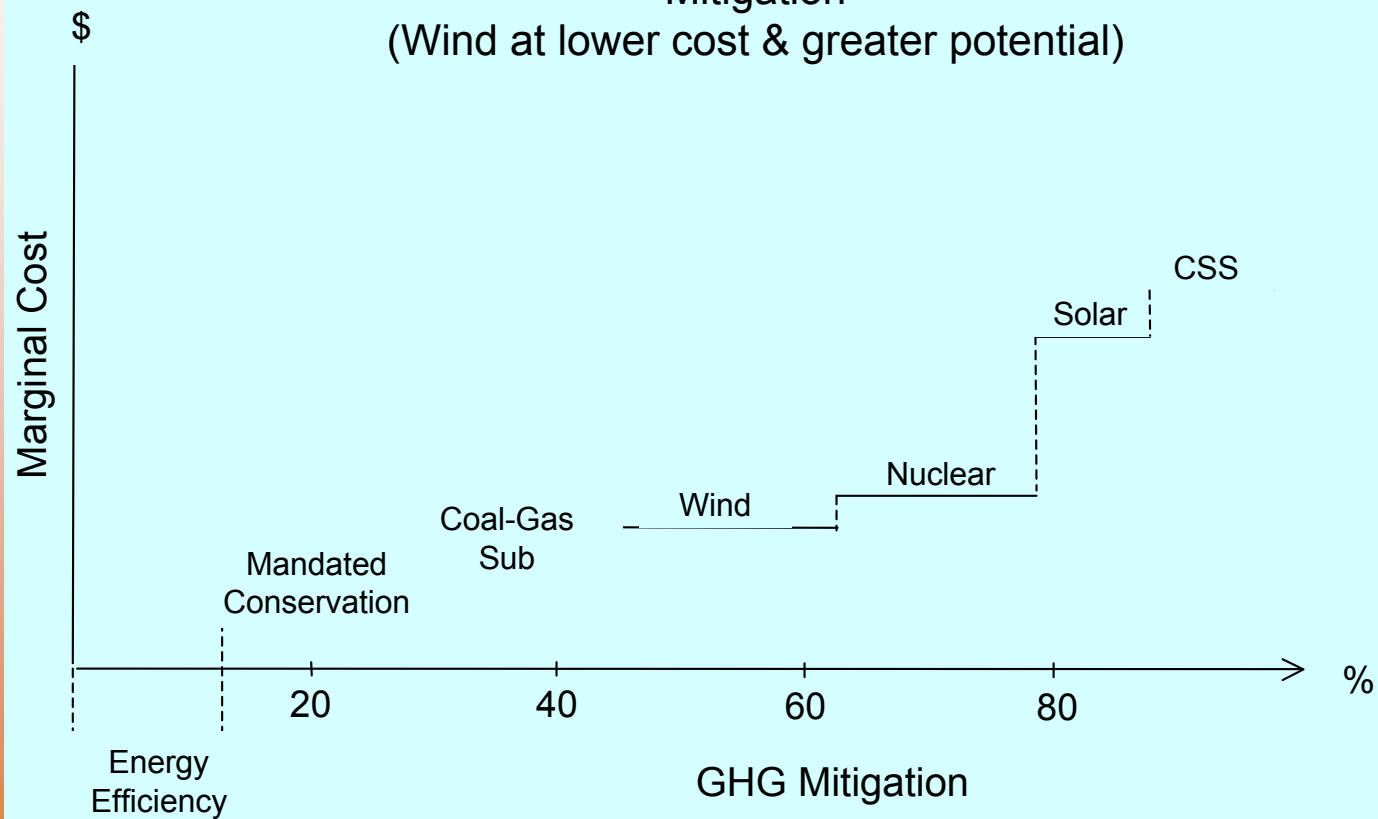
# Sample Cost Curve

Figure 1. Marginal Costs of GHG Mitigation



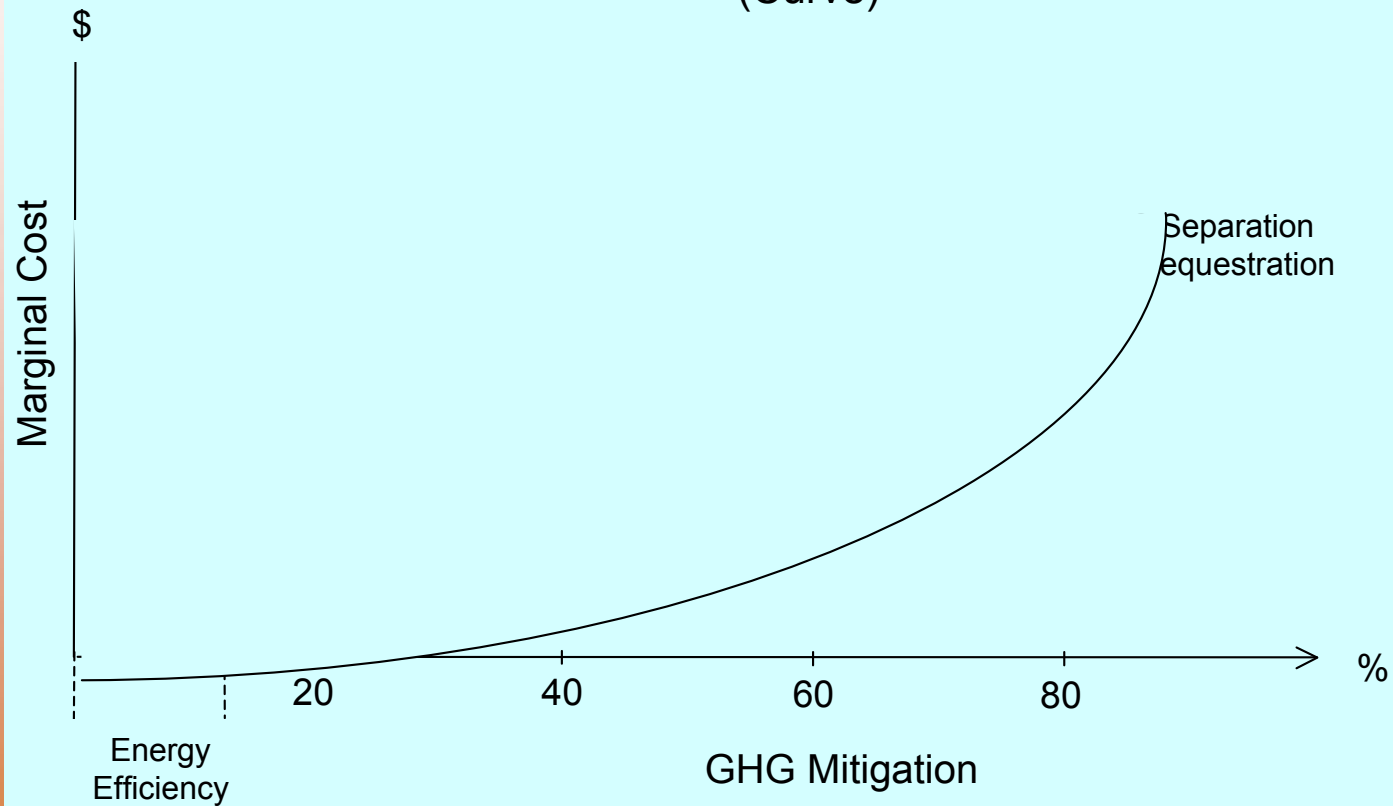
# Sample Cost Curve

Figure 2. Marginal Costs of GHG Mitigation  
(Wind at lower cost & greater potential)



# Sample Cost Curve

Figure 3. Marginal Costs of GHG Mitigation (Curve)



# Sample Outputs

**TABLE 2. COST OF ACHIEVING 1990 CARBON EMISSIONS CAPS IN YEAR 2010: RGGI STATES**  
(million \$2004)

| State | Before Trading<br>Mitigation Cost | After Trading   |              |          |
|-------|-----------------------------------|-----------------|--------------|----------|
|       |                                   | Mitigation Cost | Trading Cost | Net Cost |
| CT    | 396                               | 550             | -169         | 381      |
| MA    | 968                               | 1,001           | -33          | 968      |
| ME    | 385                               | 139             | 180          | 319      |
| NH    | 176                               | 169             | 7            | 176      |
| RI    | 81                                | 121             | -44          | 77       |
| VT    | 62                                | 62              | -4           | 62       |
| NY    | 2,211                             | 2,758           | -579         | 2,178    |
| NJ    | 1,434                             | 1,283           | 147          | 1,430    |
| DE    | 323                               | 143             | 143          | 286      |
| MD    | 1,085                             | 686             | 348          | 1,034    |
| Total | 7,125                             | 6,916           | 0            | 6,916    |

Permit Price = \$69.13/tC

# Sample Outputs

**TABLE 3. COST OF ACHIEVING 1990 CARBON EMISSIONS CAPS IN YEAR 2010:  
RGGI STATES PLUS PENNSYLVANIA (million \$2004)**

| State | Before Trading<br>Mitigation Cost | After Trading   |              |          |
|-------|-----------------------------------|-----------------|--------------|----------|
|       |                                   | Mitigation Cost | Trading Cost | Net Cost |
| CT    | 396                               | 785             | -466         | 319      |
| MA    | 968                               | 1,434           | -517         | 917      |
| ME    | 385                               | 205             | 150          | 356      |
| NH    | 176                               | 242             | -70          | 172      |
| RI    | 81                                | 172             | -110         | 62       |
| VT    | 62                                | 92              | -33          | 59       |
| NY    | 2,211                             | 3,935           | -2,006       | 1,925    |
| NJ    | 1,434                             | 1,848           | -444         | 1,404    |
| DE    | 323                               | 209             | 103          | 312      |
| MD    | 1,085                             | 997             | 88           | 1,082    |
| PA    | 6,945                             | 2,336           | 3,308        | 5,644    |
| Total | 14,074                            | 12,251          | 0            | 12,251   |

Permit Price = \$84.77/tC

# Sample Outputs

**TABLE 5. SUMMARY OF PERMIT TRADING RESULTS**

| Case              | Permit Price (\$/tC) | Largest Seller (\$ million) | Largest Buyer (\$ million) | Largest Gainer <sup>a</sup> (\$ million) | PA Gain <sup>a</sup> (%) |
|-------------------|----------------------|-----------------------------|----------------------------|--|--------------------------|
| RGGI + PA         | 84.77                | NY 2,006                    | PA 3,308                   | PA 1,301                                 | PA 19                    |
| RGGI + PA (MP)    | 82.09                | NY 1,734                    | PA 2,673                   | PA 1,353                                 | PA 19                    |
| RGGI+EU+PA        | 87.43                | NY 2,285                    | PA 3,271                   | PA 1,199                                 | PA 17                    |
| RGGI - MA/RI + PA | 87.45                | NY 2,305                    | PA 3,266                   | PA 1,193                                 | PA 17                    |
| N. Central + PA   | 156.13               | IL 5,155                    | WV 4,331                   | WV 6,013                                 | PA 0 <sup>b</sup>        |
| Western + PA      | 99.87                | CA 5,867                    | PA 2,986                   | WY 5,248                                 | PA 11                    |
| NC + W + PA       | 105.87               | CA 7,144                    | IN 4,375                   | WV 7,496                                 | PA 9                     |

<sup>a</sup>Refers to difference between Net Cost Before Trading and Net Cost After Trading.

<sup>b</sup>Less than 0.5 percent.

# Sample Outputs

APPENDIX TABLE A. BASIC DATA FOR RGGI STATES

| State | Emissions<br>in 1990<br>(million tC) | Emissions<br>in 2010<br>(million tC) | Autarkic Marginal<br>Mitigation Cost<br>(\$2004 per tC) | Gross State Product<br>in 2000<br>(\$2004 million) |
|-------|--------------------------------------|--------------------------------------|---|--|
| CT    | 10.63                                | 14.60                                | 57.39   | 175,268  |
| MA    | 21.98                                | 30.19                                | 67.89   | 306,390  |
| ME    | 4.98                                 | 6.82                                 | 119.71  | 39,264   |
| NH    | 3.86                                 | 5.29                                 | 71.04   | 51,288   |
| RI    | 2.28                                 | 3.13                                 | 55.20   | 39,059   |
| VT    | 1.41                                 | 1.94                                 | 67.96   | 19,617   |
| NY    | 55.80                                | 76.65                                | 61.11   | 864,149  |
| NJ    | 30.06                                | 41.29                                | 73.52   | 386,898  |
| DE    | 4.61                                 | 6.34                                 | 108.28  | 40,315   |
| MD    | 18.81                                | 25.84                                | 88.89   | 200,292  |
| PA    | 69.94                                | 96.07                                | 153.06  | 432,396  |

# Policy Refinements

- Production-based vs. Consumption-based allocation
- Economic sector (emitter) disaggregation
- Offsets
- Flexibility
  - how (e.g., sequestration)
  - what (e.g., CO<sub>2</sub>, methane, nitrous oxides, SFCs)
  - where (e.g., alternative configurations of states)
  - when (e.g., permit banking & borrowing)

# Potential Permit Trading Anomalies

- Participants as a whole gain from flexibility
- However, individual states may not because new entrants:
  - may raise the permit price
  - may undercut existing states' permit sales
  - may be able to exercise monopoly power
  - may increase inequities

# Modeling Specification Session

- Reminder: Purpose is a CCAG scoping assessment, not drafting rules
- Modeling Input Decisions:
  - Coverage of states and sectors
  - Reference case GHG emissions for states and sectors
  - Targets & timetables for states and sectors
  - Cost curves for states and sectors
  - Production vs. consumption design, other specifics

# Next Steps

- Developing model inputs for CCAG scoping assessment
  - Straw proposals from ES/RCI TWG members
  - Assess feasibility of developing modeling data and assumptions
  - Approval of proposed modeling scenarios by CCAG
  - Generate and review draft results in TWGs
  - Iterate if needed and as possible in TWGs and CCAG

# Call to the Public, Announcements