RGGI
Electricity Sector Modeling Results
*Updated Reference, RGGI Package and Sensitivities*

September 21, 2005

ICF Consulting
Outline

- RGGI Reference Case: New v. Old
  - Changes
  - Results
- RGGI Policy Scenarios
  - RGGI Package Scenario
  - Package Scenario with US/Canada Policies
- RGGI High Emissions Cases
  - RGGI High Emissions Package Scenario
- RGGI Low Emissions Cases
  - RGGI Low Emissions Package Scenario
RGGI Reference Case
New v. Old
New v. Old Reference Case - Changes

Three categories of changes were made to the original February RGGI Reference Case to arrive at the updated August Reference Case:

- Assumptions updates to take advantage of more recent fuel market projections.
  - The change increased 2006 gas prices relative to the original Reference Case and resulted in mid- to long-term gas prices (2010-2024) averaging 7.5% higher ($4.89/MMBtu vs. $4.55/MMBtu, in year 2003 dollars).

- Near-term calibration measures to bring 2006 model projections more in-line with recent market experience
  - Near term oil/gas steam generation in New York and the RGGI region has been calibrated to approximate recent historical levels.
  - Transmission flows more closely represent 5-year average historical levels in the near-term.

- Capacity market adjustments
  - More closely represent New York’s upstate capacity market.
RGGI Generation Mix
New Reference v. Old Reference

Net Imports
Other Renewables
Wind
Other
Oil/Gas
Gas
Coal
Nuclear
CO$_2$ Emissions
New Reference v. Old Reference

Million Tons


Old Ref
New Ref
Note: Net imports have been adjusted to account for losses and now represent the actual energy served by imports.
RGGI Package Scenario
compared to updated Reference Case
Package Scenario

The Package Scenario presented here is based on the new RGGI Reference Case and includes the following:

• **CO₂ Policy** – Phased-in cap to 2020

• **Offsets** – Combined RGGI and CDM Offset Curves, Limited to 50% of Required Reductions

• **End Use Efficiency** – Technology costs, load shapes, load factors, and potential supply by sector are based on data provided by ACEEE. Program costs to implement measures are based on average of RGGI states’ actual expenditures through 2004 to implement public benefit programs. The Package Scenario assumes that current levels of annual state expenditures for public benefit programs continue through 2025.

The Package Scenario with US and Canada national carbon policies adds the following:

• US policy assumes stabilization at projected 2015 levels starting in 2015

• Canada policy assumes stabilization at projected 2008 levels starting in 2008
RGGI Generation Mix in 2024

- Net Imports
- Other Renewables
- Wind
- Other
- Oil/Gas
- Gas
- Coal
- Nuclear

TWh

Reference
Package
Package + Fed
CO₂ Allowance Prices

- **Package**
- **Package + Fed**

![Graph showing CO₂ Allowance Prices from 2006 to 2024](image_url)
NOTE: Energy prices represent wholesale market prices and include annualized capacity prices. Note that the RGGI Package Scenario assumes that current levels of annual state expenditures for public benefit programs continue through 2025. While these types of programs cause lower wholesale prices by reducing electricity demand, they are paid for by consumers through a line item charge at the retail level, and are therefore not reflected in the wholesale price changes shown above. Current retail electricity prices already include the annual costs of these programs.

While the modeling assumes that end-use energy efficiency is implemented entirely by public benefit programs, it is recognized that energy efficiency could also be implemented by actions such as appliance standards and building codes that do not require state funding and could possibly be done at lower costs.
Note: Net imports have been adjusted to account for losses and now represent the actual energy served by imports.
Package Scenario Cumulative CO₂ Reductions
RGGI and Eastern Interconnect/Canada

Strategic Carbon Fund
Offsets
On System Reductions

Million Tons CO₂

2015
In RGGI
In EI + Canada

2021
In RGGI
In EI + Canada
RGGI Package Scenario compared to *High Emissions Cases*
RGGI Cumulative Capacity Additions by 2024
RGGI Generation Mix in 2024

The chart illustrates the generation mix in TWh for different scenarios in 2024:
- **Reference Package**: Net Imports, Other Renewables, Wind, Other, Oil/Gas, Gas, Coal, Nuclear.
- **Package**: Similar categories as Reference but with slight variations.
- **High Emission**: Increased contributions from Oil/Gas and Coal, with reduced Nuclear.
- **High Emission + Package**: Combines the High Emission and Package scenarios.
CO₂ Emissions Trajectories

![Graph showing CO₂ emissions trajectories over time with different scenarios: Reference, Package, High Emission, and High Emission + Package. The graph illustrates the projected emissions in million tons from 2006 to 2024.]
CO₂ Allowance Prices

![Graph showing CO₂ Allowance Prices](image)

- **Package**
- **High Emission + Package**
Change in RGGI Average Annual Energy Prices

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RGGI Net Imports

![Graph showing RGGI Net Imports over years from 2006 to 2024. The graph compares different scenarios: Reference, Package, High Emission, and High Emission + Package. The y-axis represents TWh, and the x-axis represents years from 2006 to 2024.](image-url)
Cumulative CO₂ Reductions by 2015
RGGI and Eastern Interconnect/Canada

- Strategic Carbon Fund
- Offsets
- On System Reductions

Million Tons CO₂

In RGGI
In EI + Canada
Package
High Emission + Package

0 100 200 300 400 500 600 700 800
Cumulative CO$_2$ Reductions by 2021
RGGI and Eastern Interconnect/Canada

- Strategic Carbon Fund
- Offsets
- On System Reductions
Package Scenario with US/Canada Policies
**CO₂ Allowance Prices**

The graph shows the CO₂ allowance prices from 2006 to 2024. The prices are categorized into three packages:

- **High Emission + Package + Fed**
- **Package**
- **High Emission + Package**

The prices are indicated in dollars per ton ($/Ton) and the years are marked on the x-axis, while the y-axis represents the price. The prices appear to increase over time for all three packages.
Change in RGGI Average Annual Energy Prices

NOTE: Energy prices include annualized capacity prices.
RGGI Low Emissions Cases
RGGI Load Growth Comparison

- 1x Reference
- 2x Reference
All Economic

Efficiency
Net Energy For Load

TWh

2006 2012 2024
RGGI Cumulative Capacity Additions

- GW

- Other Renewables
- Wind
- Gas
- Nuclear

- Reference
- Reference 2x Efficiency All Economic Eff
- Reference 2x Efficiency All Economic Eff
- Reference 2x Efficiency All Economic Eff

- 2006
- 2012
- 2024

- 35
- 30
- 25
- 20
- 15
- 10
- 5
- 0
CO₂ Emissions
RGGI Net Imports

Reference
Reference - 2x Efficiency
All Economic Eff
Package Scenario with 2x Efficiency Assumption
CO₂ Allowance Prices

![Graph showing CO₂ Allowance Prices from 2006 to 2024. The graph compares two packages: Package + 2x Efficiency and Package. The x-axis represents years from 2006 to 2024, and the y-axis represents $/Ton. The prices show a steady increase over the years.](image-url)
CO$_2$ Emissions

- Reference
- Package
- Package + 2x Efficiency

Chart showing CO$_2$ emissions from 2006 to 2024 in million tons.
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Cumulative CO₂ Reductions by 2015
RGGI and Eastern Interconnect/Canada

- Strategic Carbon Fund
- Offsets
- On System Reductions

Million Tons CO₂

In RGGI
In EI + Canada
Package

In RGGI
In EI + Canada
Package + 2x Efficiency