RGGI
Electricity Sector Modeling Results
*RPS Sensitivity & Very High Emissions Reference and Package Cases*

October 26, 2005

ICF Consulting
Outline

- RGGI Reference Case with 50% RPS Sensitivity
- RGGI Very High Emissions Reference Case
- RGGI Very High Emissions Reference and Package Cases
- RGGI Very High Emissions Package Cases & Standard Package Case
RGGI Reference Case with 50% RPS Sensitivity
RPS Sensitivity Overview

➢ The Reference Case 50% RPS Sensitivity Case includes two changes to the Reference Case:

• The RPS generation requirement is set to 50% of Reference Case levels in every year;
• The RGGI states can generate no more than that 50% level, even if incremental renewable builds would be economic; and
• Renewable capacity additions in New Hampshire are limited to 85 MW cumulatively in 2010 with no additional capacity permitted beyond 2010.
RGGI Capacity Additions
Reference v. Reference w/ 50% RPS

- 2006
- 2012
- 2024

GW

Reference
Ref - 50% RPS
Reference
Ref - 50% RPS
Reference
Ref - 50% RPS

Other Renewables
Wind
Gas
Nuclear
RGGI Emissions
Reference v. Reference w/ 50% RPS

Million Tons

Reference
Ref - 50% RPS
NOTE: Energy prices as shown here include annual capacity payments spread over hours of the year.
RGGI Net Imports
Reference v. Reference w/ 50% RPS
RGGI Very High Emissions Reference Case
compared to
Reference & High Emissions Reference Cases
Very High Emissions Case Overview

The Very High Emissions Reference Case is based on the 50% RPS Reference Case above and assumes:

- Sustained $11/MMBtu Henry Hub natural gas prices throughout the time horizon;
- Coal builds allowed in RGGI;
- As in the 50% RPS Case, renewables generation in RGGI constrained at the 50% RPS levels, even when otherwise economic; and
- Limited renewable builds in New Hampshire.

The results of the Very High Emissions Reference Case are compared below to the RGGI Reference Case and the High Emissions Reference Case (with $7/MMBtu sustained gas prices).
RGGI Emissions

- Reference
- Ref+Hi EMS
- Ref+Very Hi EMS

Million Tons

RGGI Energy Prices

NOTE: Energy prices as shown here include annual capacity payments spread over hours of the year.
RGGI Very High Emissions Reference & Package Cases
Three policy scenarios were run off of the Very High Emissions Reference Case. In each of these cases, the Package was defined as:

- CO₂ cap phasing from stabilization at current levels beginning in 2008 to 10% below current levels in 2020;
- Offsets limited to 50% of required reductions (Very High Reference emissions minus cap levels) in each year; and
- Sustained efficiency investment at “1x” levels (except in “with CBA” cases, as described below).

The three Very High Emissions Package Cases were:

- Package without CBA – assumes Package requirements above without any adjustment made for funds dedicated to CBA;
- Package with CBA – assumes same as above with 25% of allocation value dedicated to incremental energy efficiency investment; and
- Package with CBA with unlimited offsets at $6.50/ton – assumes same as Package with CBA case except that an unlimited number of offsets are available for $6.50/ton, effectively providing a backstop to the CO₂ allowance price. (NOTE: CBA value in this case differs from that above because of different CO₂ allowance price trajectories.)
RGGI Capacity Additions

[Bar chart showing capacity additions for different years (2006, 2012, 2024) and scenarios (VHiEmis Ref, VHiEmis Pkg w/o CBA, VHiEmis Pkg w/ CBA, VHiEmis Pkg w/ CBA w/ 6.50 backstop). The chart includes categories for GW Other Renewables, Wind, Gas, Coal, and Nuclear.]
RGGI Emissions

Million Tons

- VHiEmis Ref
- VHiEmis Pkg w/o CBA
- VHiEmis Pkg w/ CBA
- VHiEmis Pkg w/ CBA w/ 6.50 backstop
RGGI CO$_2$ Allowance Prices

- VHiEmis Pkg w/o CBA
- VHiEmis Pkg w/ CBA
- VHiEmis Pkg w/ CBA w/ 6.50 backstop

$/Ton

RGGI Energy Prices

NOTE: Energy prices as shown here include annual capacity payments spread over hours of the year.
RGGI Net Imports

TWh

- VHiEmis Ref
- VHiEmis Pkg w/o CBA
- VHiEmis Pkg w/ CBA
- VHiEmis Pkg w/ CBA w/6.50 backstop
RGGI Very High Emissions Package Cases compared to Package Case
RGGI CO₂ Prices

- Package
- VHiE mis Pkg w/o CBA
- VHiE mis Pkg w/ CBA
- VHiE mis Pkg w/ CBA w/ 6.50 backstop

$/Ton

$0 $2 $4 $6 $8 $10 $12 $14 $16 $18 $20

RGGI Energy Prices

NOTE: Energy prices as shown here include annual capacity payments spread over hours of the year.
Change in RGGI Energy Prices Relative to Related Reference Cases

% Change from Related Reference Case

- Package (Ref.)
- Package (High Ems Ref.)
- Package (V High Ems Ref.)
RGGI Emissions

Graph showing the emissions over time from 2006 to 2024, with lines representing different scenarios such as Reference, VHiEmis Ref, Package, VHiEmis Pkg w/o CBA, VHiEmis Pkg w/ CBA, and VHiEmis Pkg w/ CBA w/6.50 backstop.
RGGI Net Imports

![Graph showing RGGI Net Imports over time with various packages and their respective emissions levels.]
RGGI Annual Offsets

- Package
- VHiEmis Pkg w/o CBA
- VHiEmis Pkg w/ CBA
- VHiEmis Pkg w/ CBA w/6.50 backstop

Million Tons

RGGI Cumulative Offsets

- Package
- VHiEmis Pkg w/o CBA
- VHiEmis Pkg w/ CBA
- VHiEmis Pkg w/ CBA w/ 6.50 backstop

Million Tons

2015 Cumulative CO$_2$ Reductions
RGGI and Eastern Interconnect/Canada
2021 Cumulative CO$_2$ Reductions
RGGI and Eastern Interconnect/Canada

Million Tons

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<tr>
<th>Package</th>
<th>Offsets</th>
<th>On System Reductions</th>
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<td>RGGI</td>
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<td>900</td>
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<tr>
<td>EI &amp; Canada</td>
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<td>850</td>
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<td>300</td>
<td>600</td>
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<td>VHIEmis Pkg w/ CBA</td>
<td>250</td>
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<tr>
<td>VHIEmis Pkg w/ CBA w/6.50 backstop</td>
<td>250</td>
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