DRAFT 2016 RGGI Program Review: CPP Reference Cases & Modeling Scenarios

June 17, 2016

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DRAFT 2016 CPP Reference Cases
Assumptions Updates

• The following slides present select projections from two Clean Power Plan (CPP) Reference Cases and five cap decline policy scenarios that RGGI specified for evaluation.

• Projections are based on assumptions in place as of May 27, 2016.

• These projections are draft and may change as ICF makes refinements based on review and input by the States.

• Both CPP Reference Cases assume the CPP in states outside of RGGI.

• CPP Reference Case New and Existing (CPP N+E) places mass-based goals in non-RGGI states for existing sources and the new sources complement.

• CPP Reference Case Existing (CPP E) places CPP mass-based goals in non-RGGI states for existing sources and proposed EPA leakage set-aside.
## DRAFT 2016 CPP Reference Cases Assumption Updates

<table>
<thead>
<tr>
<th>Assumption</th>
<th>CPP New and Existing (N+E)</th>
<th>CPP Existing (E)</th>
</tr>
</thead>
<tbody>
<tr>
<td>RGGI Cap</td>
<td>2020 cap extended through end of modeling horizon</td>
<td></td>
</tr>
<tr>
<td>Cost Containment Reserve (CCR)</td>
<td>10 million tons available in each year through end of modeling horizon</td>
<td></td>
</tr>
<tr>
<td>CCR Trigger Price</td>
<td>Trigger price rising at 2.5% annually through end of modeling horizon</td>
<td></td>
</tr>
<tr>
<td>Offsets</td>
<td>Offsets allowed up to 3.3% of compliance through end of modeling subject to minimum allowance price availability assumption</td>
<td></td>
</tr>
<tr>
<td>RGGI Trading</td>
<td>Trading of RGGI allowances among RGGI states</td>
<td></td>
</tr>
<tr>
<td>Banking</td>
<td>Unlimited banking across the modeling horizon</td>
<td></td>
</tr>
<tr>
<td>CPP Goals</td>
<td>States outside of RGGI subject to mass based goals covering existing and new sources</td>
<td>States outside of RGGI subject to mass based goals covering existing sources and proposed leakage set-aside</td>
</tr>
<tr>
<td>CPP Trading</td>
<td>Trading zones outside RGGI</td>
<td></td>
</tr>
</tbody>
</table>
• Rest of the assumptions for both cases are the same as those previously presented and discussed with stakeholders with the following exceptions:
  • Offsets available at CO₂ allowances price of $13 in 2017 and rising to $22.60 in 2021 and $25 in 2022. After 2022 the prices increases 2.5% per year thereafter.
  • NY CES implementation updated for consistency with the Clean Energy Standard Cost Study Base Case.
  • NY 2015-2018 firm renewable capacity updated.
  • Addition of NY firm renewable imports from Ontario and Quebec.
  • Costs for new wind and solar updated to NREL 2016.
  • Biomass fuel costs updated to NREL 2016 average value.
  • CPP representation shifted to zone approach (see next slide).
### DRAFT 2016 CPP Cap Decline Scenario

#### Assumptions Summary

<table>
<thead>
<tr>
<th>Assumption</th>
<th>2.5% 2024 (E)</th>
<th>2.5% 2024 (N+E)</th>
<th>2.5% Cap</th>
<th>5% Cap</th>
<th>5% Cap CCR</th>
</tr>
</thead>
<tbody>
<tr>
<td>RGGI Cap</td>
<td>Cap declines 2.5% from 2021-2024</td>
<td>Cap declines 2.5% from 2021-2024</td>
<td>Cap declines 2.5% post-2020</td>
<td>Cap declines 5% post-2020</td>
<td>Cap declines 5% post 2020, Post-2020 cap adjusted for 50 million (50 M) CCR allowances</td>
</tr>
<tr>
<td>CCR Quantity</td>
<td>No CCR allowances available throughout modeling horizon</td>
<td>10 million (10 M) available each year through 2020; two CCR quantities available each year post-2020</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CCR Trigger Price</td>
<td>N/A</td>
<td></td>
<td>Two CCR prices 1st CCR price increases by $2.00 each year; 2nd CCR price is 50% higher than 1st</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Offsets</td>
<td>No offsets available throughout the modeling horizon</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td>RGGI Trading</td>
<td>Trading of RGGI allowances among RGGI states</td>
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<td></td>
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</tr>
</tbody>
</table>
Assumed RGGI CO$_2$ Caps

- RGGI Cap (CPP Ref)
- 2.5% Cap Decline 2024
- 2.5% Cap Decline
- 5% Cap Decline

Million Tons CO$_2$

- 2016
- 2017
- 2018
- 2019
- 2020
- 2021
- 2022
- 2023
- 2024
- 2025
- 2026
- 2027
- 2028
- 2029
- 2030
- 2031
DRAFT 2016 Scenario Policy 5% Cap CCR: CCR Assumptions

- 10 million (10M) CCR allowances available each year from 2016-2020
- Two quantities of CCR are available post-2020:
  - 1\textsuperscript{st} CCR trigger price is $8 in 2016 & increases $2 each year (nominal $)
  - Quantity available at 1\textsuperscript{st} trigger price approx. 1/3 less than current 10 M CCR*
  - 2\textsuperscript{nd} CCR trigger price is 50% higher than 1\textsuperscript{st} CCR trigger
  - A maximum of 11.7M total CCR allowances available each year

<table>
<thead>
<tr>
<th>Year</th>
<th>Quantity 1 (Per Year)</th>
<th>Quantity 2 (Per Year)</th>
<th>Trigger 1 (Nominal $)</th>
<th>Trigger 2 (Nominal $)</th>
<th>Trigger 1 (Constant) ($2012)</th>
<th>Trigger 2 (Constant) ($2012)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2016-2020</td>
<td>10M</td>
<td>N/A</td>
<td>$8 rising to $16</td>
<td>N/A</td>
<td>$7.4 rising to $13.4</td>
<td>N/A</td>
</tr>
<tr>
<td>2021-2031</td>
<td>7M</td>
<td>4.7 M</td>
<td>$18 rising to $38</td>
<td>$27 rising to $57</td>
<td>$14.7 rising to $24.2</td>
<td>$22 rising to $36.3</td>
</tr>
</tbody>
</table>

*Bullet updated 6/23/2016 to correct inconsistency with chart value (7M), originally said “Quantity available at 1\textsuperscript{st} trigger price is 1/3 of current 10M CCR.”
IPM Model Design

• The following projections were developed using the Integrated Planning Model (IPM), the same model used by EPA in analyzing power sector impacts of environmental regulation.

• Models are schematic representations that are used to project trends.

• Model design features will impact projected results.

• One key feature of IPM is that it optimizes across the time horizon of the analysis, so it will act in the near-term in response to long-term requirements and costs.

• This optimization has two implications for the projections:
  • The projections assume that any allowance bank is exhausted within the timeframe of the analysis.
  • Projections in the near term including generation, emissions, and allowance pricing, can be a function of projections in later years of the analysis.
RGGI Cumulative Capacity Additions

- The chart shows the distribution of capacity additions and retirements across firmly planned (“Firm”) and model-projected (“Economic”) types.
• The chart shows the distribution of capacity additions and retirements by capacity type.
The chart shows generation by type and net imports for the RGGI states.
The chart shows projected CO₂ emissions from RGGI-affected sources.

Emissions exceed the RGGI Cap when allowances are withdrawn from the bank or purchased at the CCR trigger price.

Note: Model assumes that any allowance bank is fully exhausted in 2031.
The chart shows projected CO₂ emissions from RGGI-affected sources.

Emissions exceed the RGGI Cap when allowances are withdrawn from the bank or purchased at the CCR trigger price.

Note: Model assumes that any allowance bank is fully exhausted in 2031.
The chart shows projected CO$_2$ emissions from RGGI-affected sources. Emissions exceed the RGGI Cap when allowances are withdrawn from the bank or purchased at the CCR trigger price.
The chart shows projected CO₂ emissions from RGGI-affected sources.

Emissions exceed the RGGI Cap when allowances are withdrawn from the bank or purchased at the CCR trigger price.

Note: Model assumes that any allowance bank is fully exhausted in 2031.
## RGGI Emissions (Million of Tons)

<table>
<thead>
<tr>
<th>Case</th>
<th>Cumulative Emissions</th>
<th>Average Emissions, 2016-2031</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2016-2021</td>
<td>2022-2031</td>
</tr>
<tr>
<td>CPP Ref N+E</td>
<td>498</td>
<td>797</td>
</tr>
<tr>
<td>CPP Ref E</td>
<td>506</td>
<td>783</td>
</tr>
<tr>
<td>2.5% 2024 (E)</td>
<td>488</td>
<td>723</td>
</tr>
<tr>
<td>2.5% 2024 (N+E)</td>
<td>478</td>
<td>733</td>
</tr>
<tr>
<td>2.5% Cap (N+E)</td>
<td>460</td>
<td>698</td>
</tr>
<tr>
<td>5% Cap (N+E)</td>
<td>418</td>
<td>609</td>
</tr>
<tr>
<td>5% Cap CCR (N+E)</td>
<td>434</td>
<td>635</td>
</tr>
<tr>
<td><strong>CPP Goals</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>(Aggregate for RGGI States)</strong></td>
<td><strong>850</strong></td>
<td><strong>690</strong></td>
</tr>
</tbody>
</table>

CPP Goals (Aggregate for RGGI States)

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The chart shows the projected CO$_2$ emissions relative to the cap and the use of banked allowances and CCR allowances used for compliance.
• The chart shows the projected CO₂ emissions relative to the cap and the use of banked allowances and CCR allowances used for compliance.
The chart shows the projected CO₂ emissions relative to the cap and the use of banked allowances for compliance.
• The chart shows the projected CO₂ emissions relative to the cap and the use of banked allowances for compliance.
CO₂ Emission Reductions
2.5% Cap Decline (E+N)

- The chart shows the projected CO₂ emissions relative to the cap and the use of banked allowances for compliance.
• The chart shows the projected CO₂ emissions relative to the cap and the use of banked allowances for compliance.
CO₂ Emission Reductions
5% Cap Decline CCR (E+N)

- The chart shows the projected CO₂ emissions relative to the cap and the use of banked allowances for compliance.
RGGI Firm Power Prices

- The chart shows the projected RGGI average annual firm (energy + capacity) prices in constant 2012 dollars.
RGGI Allowance Prices

- The chart shows the projected RGGI allowance prices in constant 2012 dollars.
**CO₂ Allowance and Trigger Prices**

*5% Cap Decline CCR (E+N)*

- The chart shows the allowance prices and CCR trigger prices in the 5% Cap CCR case.

![Chart showing CO₂ allowance and trigger prices](chart.png)