EPA Modeling of International Offsets

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GTSP Workshop

5/26/10
International Offsets in Proposed Climate Legislation

- International offsets are one of the most important cost containment features of both the House passed American Clean Energy and Security Act of 2009 (H.R. 2454), and the Clean Energy Jobs and American Power Act of 2009 (S. 1733).
- Both H.R. 2454 and S. 1733 allow over one billion tons of international offsets annually.
- Estimates of the cost and availability of international offsets are one of the most important factors determining estimates of the cost of these bills.
- Assumptions about the market for international offsets can have a major impact on the estimated costs of a bill.
Demand for International GHG Abatement
International Reference GHG Emissions

- **Group 1**
  - Canada
  - Western Europe
  - Japan
  - Australia, NZ

- **Group 2**
  - Former Soviet Union
  - Eastern Europe
  - China
  - Southeast Asia
  - Korea
  - India
  - Middle East
  - Africa
  - Latin America

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Supply of International GHG Abatement
Mitigation Categories and Data Sources for International MAC Curves

<table>
<thead>
<tr>
<th>Mitigation Category</th>
<th>Data Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH\textsubscript{4} from landfills</td>
<td>US EPA (2006)</td>
</tr>
<tr>
<td>CH\textsubscript{4} from coal mines</td>
<td>US EPA (2006)</td>
</tr>
<tr>
<td>CH\textsubscript{4} from the natural gas sector</td>
<td>US EPA (2006)</td>
</tr>
<tr>
<td>CH\textsubscript{4} from the oil sector</td>
<td>US EPA (2006)</td>
</tr>
<tr>
<td>N\textsubscript{2}O from adipic acid production</td>
<td>US EPA (2006)</td>
</tr>
<tr>
<td>N\textsubscript{2}O from nitric acid production</td>
<td>US EPA (2006)</td>
</tr>
<tr>
<td>CH\textsubscript{4} &amp; N\textsubscript{2}O from livestock manure management</td>
<td>US EPA (2006)</td>
</tr>
<tr>
<td>CH\textsubscript{4} from livestock enteric fermentation</td>
<td>US EPA (2006)</td>
</tr>
<tr>
<td>CH\textsubscript{4}, N\textsubscript{2}O, &amp; soil carbon from paddy rice</td>
<td>US EPA (2006)</td>
</tr>
<tr>
<td>N\textsubscript{2}O &amp; soil carbon from cropland</td>
<td>US EPA (2006)</td>
</tr>
<tr>
<td>International forest carbon sequestration</td>
<td>Sohngen &amp; Mendelsohn (2006)</td>
</tr>
<tr>
<td>International energy related CO\textsubscript{2}</td>
<td>Clarke et al (2007)</td>
</tr>
</tbody>
</table>

• For each of these mitigation categories, MAC curves are generated for groups of countries: group 1, consisting of Annex I countries excluding the United States, is assumed to adopt market-based emissions policies immediately; and group 2, consisting of non-Annex I countries, is assumed to adopt market-based emissions policies in 2025.
MAC Curve Adjustment Process

- An adjustment process is applied to the mitigation information from these models to represent the amount of abatement that would actually be available to the market either as an offset purchase or under a foreign market-based emissions policy.
- For most mitigation categories, each mitigation option within each mitigation category was evaluated and a determination was made if it should be eligible to provide abatement from a country with a market-based emissions policy, and if it should be eligible to provide abatement from a country without a market-based emissions policy.
- CH$_4$ from the natural gas sector, and the CH$_4$ from the oil sector:
  - a 50% reduction was applied for international regions assumed to have a market-based emissions policy
  - a 75% reduction was applied for the periods before a market-based emissions policy is assumed to be in place.
- For international energy related CO$_2$ emissions
  - no adjustment was made for international regions assumed to have a market-based emissions policy
  - a 90% reduction was applied for the periods before 2020 in countries where a market-based emissions policy is not assumed to be initially in place, and a 75 percent is applied between 2020 and the year in which a market-based emissions policy is assumed to be adopted.
- These adjustments were meant to take into account the difficulties in measuring, monitoring, and verifying offset reductions in countries without a market-based greenhouse gas emissions policy, as well as the lack of a clear market signal that the allowance price in the model run assumes.
2020 and 2050 Marginal Abatement Cost Curve Comparisons

Group 1 CO2
Group 1 Forest Carbon
Group 1 Non-CO2
Group 2 CO2
Group 2 Forest Carbon
Group 2 Non-CO2
Energy-Related CO$_2$ MAC Curves

Group 1

Group 2

$\$/tCO$_2$e

$\$/tCO$_2$e

MtCO$_2$e

MtCO$_2$e

2015

2020

2030

2040

2050

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Non-CO$_2$ MAC Curves

Group 1

Group 2

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Forest Carbon Sequestration MAC Curves

Group 1

Group 2

$\text{tCO}_2\text{e}$

MtCO$_2$e

MtCO$_2$e

2015
2020
2030
2040
2050

$0$

$50$

$100$

$150$

$200$

$0$

$5,000$

$10,000$

$15,000$

$20,000$

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Market for International GHG Abatement
International Supply & Demand of GHG Abatement

The Effect of Alternative International Reference Emissions Projections
International Supply & Demand of GHG Abatement
The Effect of Early Adoption of Group 2 GHG Emissions Caps

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International Supply & Demand of GHG Abatement

The Effect of No Group 2 Action on Climate Policy
### International Supply & Demand of GHG Abatement

#### With and Without REDD

<table>
<thead>
<tr>
<th>Year</th>
<th>Core</th>
<th>No REDD</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
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<tr>
<td>2020</td>
<td><img src="chart.png" alt="Graph" /></td>
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<tr>
<td>2030</td>
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<tr>
<td>2040</td>
<td><img src="chart.png" alt="Graph" /></td>
<td><img src="chart.png" alt="Graph" /></td>
</tr>
<tr>
<td>2050</td>
<td><img src="chart.png" alt="Graph" /></td>
<td><img src="chart.png" alt="Graph" /></td>
</tr>
</tbody>
</table>

Legend:
- **Group 1 CO2**
- **Group 2 CO2**
- **Group 1 Other Non-CO2**
- **Group 2 Other Non-CO2**
- **Group 1 F-Gases**
- **Group 2 F-Gases**
- **Total Demand**
- **Group 1 Abatement Demand**
- **Group 2 Abatement Demand**
- **US Int'l Offset & Set-Aside Demand**

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IGEM 2012 – 2050 Cumulative Covered U.S. GHG Emissions & Abatement

International GHG Market Sensitivities

<table>
<thead>
<tr>
<th>Covered GHG Abatement % Change From H.R. 2454 Scenario</th>
<th>Domestic Offsets % Change From H.R. 2454 Scenario</th>
<th>International Offsets % Change From H.R. 2454 Scenario</th>
<th>Allowance Price % Change From H.R. 2454 Scenario</th>
</tr>
</thead>
<tbody>
<tr>
<td>14.6</td>
<td>10.9</td>
<td>15.4</td>
<td>69.7</td>
</tr>
<tr>
<td>69.7</td>
<td>51.1</td>
<td>81.7</td>
<td>33%</td>
</tr>
<tr>
<td>73.7</td>
<td>24.7</td>
<td>17.4</td>
<td>67%</td>
</tr>
<tr>
<td>81.7</td>
<td>14.6</td>
<td>18.6</td>
<td>-33%</td>
</tr>
<tr>
<td>86.0</td>
<td>9.1</td>
<td>20.7</td>
<td>0%</td>
</tr>
<tr>
<td>93.0</td>
<td></td>
<td></td>
<td>-100%</td>
</tr>
</tbody>
</table>

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IGEM 2012 – 2050 Cumulative Covered U.S. GHG Emissions & Abatement

International Offset Availability Sensitivities

<table>
<thead>
<tr>
<th>Covered GHG Abatement</th>
<th>Domestic Offsets</th>
<th>International Offsets</th>
<th>Covered GHG Allowances (Cap)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Covered GHG Abatement % Change From H.R. 2454 Scenario</td>
<td>Domestic Offsets % Change From H.R. 2454 Scenario</td>
<td>International Offsets % Change From H.R. 2454 Scenario</td>
<td>Allowance Price % Change From H.R. 2454 Scenario</td>
</tr>
<tr>
<td>69.7</td>
<td>70.7</td>
<td>72.5</td>
<td>84.5</td>
</tr>
<tr>
<td>14.6</td>
<td>14.8</td>
<td>15.2</td>
<td>18.2</td>
</tr>
<tr>
<td>28.3</td>
<td>26.1</td>
<td>11.1</td>
<td>20.7</td>
</tr>
<tr>
<td>132.2</td>
<td>132.2</td>
<td>132.2</td>
<td>132.2</td>
</tr>
</tbody>
</table>

H.R. 2454 10 Yr Delay 20 Yr Delay 30 Yr Delay No Int'l Delayed Int'l Offsets Availability to the U.S. No Int'l Offsets
IGEM 2012 – 2050 Cumulative Covered U.S. GHG Emissions & Abatement

Cap Level and Exogenous Offset Sensitivities

Covered GHG Abatement
Domestic Offsets
International Offsets
Covered GHG Allowances (Cap)

Covered GHG Abatement % Change From H.R. 2454 Scenario
Domestic Offsets % Change From H.R. 2454 Scenario
International Offsets % Change From H.R. 2454 Scenario
Allowance Price % Change From H.R. 2454 Scenario

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Conclusion

• International offsets are one of the most important cost containment features of both H.R. 2454 and S. 1733
  – Both of these bills potentially allow the use of over one billion tons of international offsets each year.

• Estimates of the cost and availability of international offsets are one of the most important factors determining estimates of the cost of these bills.

• Assumptions about available sources of greenhouse gas abatement, reference case greenhouse gas emissions, and climate policies in other countries can have major impacts on the estimated cost of a bill.

• This highlights the importance of future research:
  – to update and improve estimates of marginal abatement cost curves for international sources of greenhouse gas abatement;
  – revisit the difference in greenhouse gas abatement potential from countries with market-based climate policies versus abatement in the form of offsets or sectoral credits from countries without market-based climate policies;
  – continually update reference greenhouse gas emissions projections;
  – and represent the broad range of climate policies that could be adopted in the future.