



Evaluation of Offsets Supply and Potential Demand

This memorandum provides a preliminary analysis of the projected availability and costs of offsets eligible pursuant to the December 20, 2005 RGGI Memorandum of Understanding (MOU). This analysis utilizes data from national evaluations of offsets supply and cost, and presents this data in the context of the draft eligibility criteria applied to offsets in RGGI.¹ The projected supply of offsets is also compared to the potential demand for offsets, as provided in the Staff Working Group (SWG) analysis used to support the recommendation of a quantitative limit for offset agreed to in the RGGI MOU. An overview is also provided of the projected availability and cost of offsets that was used as an input to the RGGI IPM energy modeling analysis. The analysis supporting this memorandum is included in an accompanying spreadsheet, “GHG Supply Curves”, available at http://www.rggi.org/docs/ghg_supply_curves_5_1_06.xls.

Note that this analysis assumes a nine-state program.² The SWG will be evaluating the impact of recent changes to the geographic scope of the program and will provide an update to this analysis when available.

Overview: Program Context

From a practical standpoint, the RGGI offsets component is a flexibility mechanism that provides a measure of insurance against high allowance prices. By allowing a wider range of technical options outside the electric power sector to be used to achieve emissions reductions, compliance costs will be lowered.

However, offsets projects present financing and transaction cost issues that may impact the market price of offsets. Offsets projects require an up-front investment in a project that is expected to provide a revenue stream of emissions credits over time. Projects also require detailed monitoring and verification to ensure the validity of claimed emissions reductions. As a result, low allowance prices, such as those projected for RGGI, may present a modest incentive for developing offsets projects in the near term.

At the same time, low allowance prices would also demonstrate that there is a limited need for offsets in order for RGGI sources to meet compliance obligations.

¹ While this analysis evaluates potential offsets supply at different carbon revenue levels, it does not project a market price for offsets, or the amount of offsets that may be utilized by regulated sources for compliance

² Assumes the original states that negotiated the MOU ultimately implement the program. Of these states, Massachusetts and Rhode Island declined to sign the MOU in December 2005. Subsequently, legislation was signed in Maryland in April 2006 that would require the state to become a full participant in RGGI by mid-2007.

Even assuming low allowance prices, other factors may encourage offset project development, such as:

- Banking of offsets in expectation of higher future allowance prices (risk hedging), either under RGGI or an expected future national program
- Use of RGGI offsets program by other mandatory or voluntary greenhouse gas programs (RGGI requirements would guarantee high quality offsets for use in other markets)

Higher allowance prices, or the expectation of higher future prices, would present attractive opportunities for project developers. This would spur the development of larger volumes of offsets projects and moderate the RGGI allowance price over time due to an increase in the availability of allowances.

Projected Offsets Demand and Availability

The fundamentals of RGGI program design point to a limited need for offsets in order to comply with the program, coupled with significant temporal flexibility that will allow sources to bank offsets to meet future compliance needs.

The RGGI cap and emission reduction schedule is modest. RGGI modeling projections indicate that the need for offsets in the near term will likely be limited, even when employing conservative assumptions. RGGI program design provides sources with the ability to bank offsets allowances to meet future obligations. Sources are also provided with the ability to bank emissions reductions achieved through offsets prior to the start of the program, during the 2006-2008 period.

Evaluation of Potential Demand for Offsets

Applying the business-as-usual emissions trend at the cap start point³ in 2009 results in the following annual need for offsets (assumes offsets are needed to meet 50% of avoided emissions required to meet the RGGI cap)⁴:

- Compliance Period #1(2009-2011): 0.6 million short tons
- Compliance Period #2 (2012-2014): 2.2 million short tons
- Compliance Period #3 (2015-2017): 5.3 million short tons
- Compliance Period #4 (2018-2020): 11.5 million short tons

Estimated Offset Supply: IPM Modeling

RGGI modeling estimated an annual offsets supply in the nine-state RGGI region of more 6.8 million tons of CO₂ equivalent at less than \$2/ton in 2010, based on constructed supply curves for the RGGI region.⁵ Due to data limitations, the

³ This assumes that the cap is binding at the beginning of the 2009 compliance period. That is, emissions in the region are equal to the cap start point in 2009.

⁴ Assumes a nine-state RGGI program ultimately implemented. For a more detailed explanation, see "Analysis Supporting Offsets Limit Recommendation", available at http://www.rggi.org/docs/offsets_limit_5_1_06.pdf.

⁵ Available supply is generally comparable for all years in the analysis period, with only modest changes in supply and cost over time. See "Offsets: IPM Modeling Assumptions" for details, available at http://www.rggi.org/docs/offsets_modeling_11_14_05.pdf).

modeling only assumed the availability of a subset of the available offsets provided for in the MOU:

- Landfill Gas: 6.4 million short tons CO₂e at \$1.24/ton
- Sulfur Hexafluoride (SF₆): 0.45 million short tons CO₂e at \$1.54/ton
- Afforestation: 0.17 million short tons CO₂ at \$10/ton
- CDM credits (unlimited, subject to 50% quantitative limit as applied in IPM modeling⁶) available at \$6.50/ton

Estimated Offset Supply: RGGI MOU

Based on the estimates outlined above and the expanded scope of offsets afforded through the RGGI MOU, 16 million tons of CO₂ equivalent are projected in 2010 at a cost of \$2/ton or less.⁷

U.S. Potential for Short-Listed Offsets (Non-RGGI Region)

This preliminary analysis estimates the available supply and cost of a subset of national offsets eligible under the RGGI MOU. This analysis relied upon available national studies of offsets availability. The SWG applied certain restrictions to the projected supply in these national analyses, based in part on the eligibility requirements outlined in the draft RGGI model rule.

Key adjustments to the data include the following:

- Application of a minimum \$1/ton cost for all offsets to account for transaction costs and as an acknowledgement that all offsets will have a market price, unless projects are developed by a regulated source. This addresses the fact that a number of supply curves project available supply at a negative cost, indicating that the project employed has a positive net present value.
- Application of the 2:1 out-of-region discount applied to offsets that are generated outside of the RGGI states.⁸ This discount was applied by reducing the assumed available supply by 50% and doubling the assumed cost per ton.
- Application of an assumed 50% discount to assumed available supply to account for the employment of additionality criteria. This assumes that 50% of the projected tonnage is excluded as a proxy for projects determined to be ineligible under the RGGI offsets provisions.

Summary of Projected U.S. Availability (Non-RGGI Region)

An analysis of the projected national availability in 2010 for four of the six offsets types eligible under the RGGI MOU is provided below. These aggregate

⁶ See "Offsets: IPM Modeling Assumptions", available at http://www.rggi.org/docs/offsets_modeling_11_14_05.pdf.

⁷ This estimate does not include potential supply from the following categories: natural gas/oil end-use energy efficiency, natural gas transmission and distribution, or international carbon currencies.

⁸ Assumes original nine-state program.

estimates of available national supply (excluding estimated supply in the RGGI region) are considered conservative, as they do not include available supply from natural gas/oil offsets or natural gas transmission and distribution offsets. The supporting analysis is provided in the accompanying spreadsheet, "GHG Supply Curves".⁹

Total Projected Supply:

- 9.2 million short tons CO₂e annually (at \$2/ton)
- 16.4 million short tons CO₂e annually (at ≤ \$5.45/ton)

Subtotals:

- Landfill Gas: 6.6 million metric tons CO₂e annually (at \$2/ton)
- Agricultural Methane: 1.3 million metric tons CO₂e annually (at \$2/ton)
- Sulfur Hexafluoride (SF₆): 0.4 million metric tons CO₂e annually (at \$2/ton)
- Afforestation: 6.6 million metric tons CO₂ annually (at \$5.45/ton)

Detailed Projections

Landfill Gas:

Data Source: U.S. EPA, Addendum to the U.S. Methane Emissions 1990-2020: 2001 Update for Inventories, Projections, and Opportunities for Reductions, 2001.

Source Data:

- 8.1 MMTCE in 2010 at \$0/ton¹⁰

SWG Adjustments:

- 26.4 million metric tons CO₂e at \$0/ton in 2010
Assumptions: conversion from MMTCE and exclusion of tonnage assumed available in RGGI region.
- 13.2 million metric tons CO₂e at \$2/ton
Assumptions: includes market price/transaction cost adjustment and 2:1 out-of-region discount.
- 6.6 million metric tons CO₂e at \$2/ton
Assumptions: includes the above adjustments and 50% discount of available tonnage to account for additionality issues.

⁹ Available at http://www.rggi.org/docs/ghg_supply_curves_5_1_06.xls.

¹⁰ A \$0/ton break-even price indicates that a project has a positive net present value without utilizing carbon revenue.

Agricultural Methane (Anaerobic Digesters):

Data Source: U.S. EPA, *Addendum to the U.S. Methane Emissions 1990-2020: 2001 Update for Inventories, Projections, and Opportunities for Reductions*, 2001.

Source Data:

- 1.5 MMTCE in 2010 at \$0/ton

SWG Adjustments:

- 5.4 million metric tons CO₂e at \$0/ton in 2010
Assumptions: conversion from MMTCE and exclusion of tonnage assumed available in RGGI region.
- 2.7 million metric tons CO₂e at \$2/ton
Assumptions: includes minimum market price/transaction cost adjustment and 2:1 out-of-region discount.
- 1.3 million metric tons CO₂e at \$2/ton
Assumptions: includes the above adjustments, and 50% discount of available tonnage to account for additionality issues.

Sulfur Hexafluoride (SF₆):

Data Source: U.S. EPA, *U.S. High GWP Gas Emissions 1990-2010: Inventories, Projections, and Opportunities for Reductions*, EPA 000-F-97-000, June 2001.

Source Data:

- 0.6 MMTCE in 2010 at \$0/ton

SWG Adjustments:

- 1.8 million metric tons of CO₂e at \$0/ton
Assumptions: conversion from MMTCE and exclusion of tonnage assumed available in RGGI region.
- 0.9 million metric tons of CO₂e at \$2/ton
Assumptions: includes market price/transaction cost adjustment and 2:1 out-of-region discount.
- 0.4 million metric tons of CO₂e at \$2/ton
Assumptions: includes the above adjustments and 50% tonnage discount to account for additionality issues.

Afforestation

Data Source: Schneider and McCarl, "The Potential of U.S. Agriculture and Forestry to Mitigate Greenhouse Gas Emissions: An Agricultural Sector Analysis," Working Paper 02-WP 300, Center for Agriculture and Rural Development, Iowa State University, May 2002.

Source Data:

- 4 MMTCE in 2010 (assumed) at \$10/ton

SWG Adjustment:

- 13.3 million metric tons CO₂ at \$2.73/ton
Assumptions: conversion from MMTCE and exclusion of tonnage assumed available in RGGI region.
- 6.6 million metric tons CO₂ at \$5.45/ton
Assumptions: includes 2:1 out-of-region discount.

Data Source: U.S. Department of Agriculture, Economic Research Service, *Economics of Sequestering Carbon in the U.S. Agricultural Sector*, Technical Bulletin Number 1909, 2004.

Source Data:

- 5.4 MMTCE in 2010 at \$10/ton

SWG Adjustments:

- 19.7 million metric tons CO₂ at \$6.82/ton
Assumptions: converted from MMTCE and exclusion of tonnage assumed available in RGGI region.
- 9.9 million metric tons CO₂ at \$13.64/ton
Assumptions: includes 2:1 out-of-region discount.

Annual In-Region Offsets Availability: IPM Modeled Supply (2010)

The projections of available offset supply used in the RGGI IPM energy modeling is described below. A comprehensive narrative of the offsets modeling projections used in RGGI IPM modeling is available at http://www.rggi.org/docs/offsets_modeling_11_14_05.pdf

Total Nine-State RGGI Availability

- 6.8 million short tons CO₂e annually (< \$2/ton)
- 7 million short tons CO₂e annually (≤ \$10/ton)
- Unlimited CDM certified emissions reductions assumed available at \$6.50 short ton¹¹ (note that offsets limit still applied to total offsets that may be used)

¹¹ CDM CERs are available in metric ton increments; price was not adjusted to a short-ton basis. This was viewed as a conservative assumption.

Detailed Projections (2010)

Landfill Gas:

- 6.4 million short tons CO₂e at \$1.71/ton
Assumptions: market price/transaction cost adder applied; available tonnage discounted by 50% to account for additionality issues.

Source: Regionally adjusted EPA national supply curves and SWG adjustments (see “Offsets: IPM Modeling Assumptions” document available at http://www.rggi.org/docs/offsets_modeling_11_14_05.pdf)

Sulfur Hexafluoride (SF₆):

- 0.45 million short tons CO₂e at \$1.54/ton
Assumptions: market price/transaction cost adder applied; includes 75% discount of ConEdison tonnage to account for electricity transmission and distribution infrastructure issues.

Source: Regionally adjusted EPA national supply curves and SWG adjustments (see “Offsets: IPM Modeling Assumptions” document available at http://www.rggi.org/docs/offsets_modeling_11_14_05.pdf)

Afforestation:

- 0.17 million short tons CO₂ at \$10/ton

Source: Neil Sampson, Potential for Agricultural and Forestry Carbon Sequestration in the RGGI Region,” unpublished, Pew Center on Global Change, 2004. See “Offsets: IPM Modeling Assumptions” document available at http://www.rggi.org/docs/offsets_modeling_11_14_05.pdf .