

Regional Greenhouse Gas Initiative

an Initiative of the Northeast and Mid-Atlantic States of the U.S.

CO₂ Emissions from Electricity Generation and Imports in the Regional Greenhouse Gas Initiative: 2012 Monitoring Report

August 11, 2014

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The Regional Greenhouse Gas Initiative (RGGI) is a cooperative effort of Northeast and Mid-Atlantic states to reduce emissions of carbon dioxide (CO₂), a greenhouse gas that causes global warming.

RGGI, Inc. is a non-profit corporation created to provide technical and administrative services to the states participating in the Regional Greenhouse Gas Initiative.

Executive Summary

This report, the fourth report in a series of annual monitoring reports, summarizes data for the period from 2005 through 2012, for electricity generation, electricity imports, and related carbon dioxide (CO₂) emissions for the nine states¹ that participated in the Regional Greenhouse Gas Initiative (RGGI) second control period. These monitoring reports were called for in the 2005 RGGI Memorandum of Understanding (MOU) in response to expressed concerns about the potential for the RGGI CO₂ Budget Trading Program to result in “emissions leakage²”.³ This report for 2012 is the first of the annual monitoring reports to review the data as a 9-state program after withdrawal of the New Jersey⁴ from the program. A comparative 10-state data set similar to previous iterations of this report can be found in Appendix E.

In the Northeast and Mid-Atlantic states, CO₂ emissions from the regional electric power sector are a function of highly dynamic wholesale electricity markets. The cost of compliance with the RGGI CO₂ Budget Trading Program is only one of multiple factors that influence the dispatch of electric generation, and resulting CO₂ emissions, through the operation of these markets. As a result, this report presents data without assigning causality to any one of the factors influencing observed trends.

The observed trends in electricity demand, net electricity imports, and electricity generation from multiple categories of generation sources (including electricity imports), show there has been no significant change in CO₂ emissions or the CO₂ emission rate (pounds of CO₂ per megawatt hour or lb CO₂/MWh) from total non-RGGI electric generation serving load in the nine-state RGGI region during the period of the RGGI program, 2010 – 2012.

Summary of Results

Electric Load (Demand for Electricity) and Generation

- For 2010 to 2012, the annual average electricity load in the nine-state RGGI region was 11.1 million MWh less than the average 2006 to 2008 electricity load, about a 2.9% reduction.

¹ The “nine-state RGGI region” consists of Delaware, Connecticut, Maine, Maryland, Massachusetts, New Hampshire, New York, Rhode Island, and Vermont.

² “Emissions leakage” is the concept that compliance with the RGGI CO₂ Budget Trading Program, and the incorporation of related CO₂ compliance costs by electric generators that are subject to the program, could result in a shift of electricity generation from CO₂-emitting sources that are subject to RGGI to CO₂-emitting sources that are not subject to RGGI.

³ The Memorandum of Understanding called for monitoring electricity imports into the RGGI participating states commencing from the start of the RGGI CO₂ Budget Trading Program and reporting the results of such monitoring on an annual basis beginning in 2010.

⁴ New Jersey withdrew its agreement to the RGGI Memorandum of Understanding effective January 1, 2012. See http://www.rggi.org/docs/Documents/NJ-Statement_112911.pdf.

- For 2010 to 2012, the annual average total electric generation in the nine-state RGGI region (fossil and non-fossil) decreased by 21.3 million MWh, or 6.4 percent, from the 2006 to 2008 average.
- For the 2012 calendar year, a comparison of the total electricity load in the nine-state RGGI region, to the annual average during the base period of 2006 to 2008, shows a decrease of 14.3 million MWh, or 3.7 percent.
- For the 2012 calendar year, a comparison of the total electric generation in the nine-state RGGI region (fossil and non-fossil) to the annual average during the base period of 2006 to 2008 shows a decrease of 26.9 million MWh, or 8.1 percent.

Non-RGGI Emissions and Generation

- The monitoring results indicate that CO₂ emissions from non-RGGI electric generation did not increase in 2010 to 2012 relative to the base period of 2006 to 2008. The decrease in emissions from non-RGGI in-region electric generation offsets the slight increase in emissions related to electric generation from imports into the 9-state RGGI region.
- A comparison of the 2010 through 2012 annual average to the base period of 2006 to 2008 annual average shows the total electric generation from all non-RGGI electric generation sources serving load in the 9-state RGGI region increased, by 9.3 million MWh, an increase of 4.4 percent.
 - A comparison of the 2010 to 2012 average to the base period of the 2006 to 2008 average shows CO₂ emissions from all non-RGGI electric generation sources serving load in the nine-state RGGI region decreased by 933.0 thousand short tons of CO₂, or 2.1 percent.
 - A comparison of the 2010 to 2012 average to the base period of the 2006 to 2008 average shows the CO₂ emission rate for this category of electric generation decreased by 26.1 lb CO₂/MWh, or 6.2 percent.
- The monitoring results do not show a significant change of annual CO₂ emissions related to either net electricity imports into the nine-state RGGI region or from small fossil fuel-fired electric generators in the nine-state RGGI region that are not subject to state CO₂ Budget Trading Program regulations in the three years of the program of 2010 through 2012.

RGGI Emissions and Generation

- A comparison of the 2010 to 2012 average to the base period of the 2006 to 2008 average shows the electric generation from RGGI-affected electric generation sources decreased by 18.8 million MWh, or 10.6 percent.
 - A comparison of the 2010 to 2012 average to the base period of the 2006 to 2008 average shows CO₂ emissions from RGGI electric generation sources decreased by 35.1 million short tons of CO₂, or 25.4 percent.
 - A comparison of the 2010 to 2012 average to the base period of the 2006 to 2008 average shows the CO₂ emissions rate for RGGI electric generation sources decreased by 261 lb CO₂/MWh, or 16.7 percent.
- When the 2012 calendar year is compared to the annual average for the baseline period of 2006 to 2008, the results similarly show a reduction in electric generation and CO₂ emissions from RGGI electric generation sources.

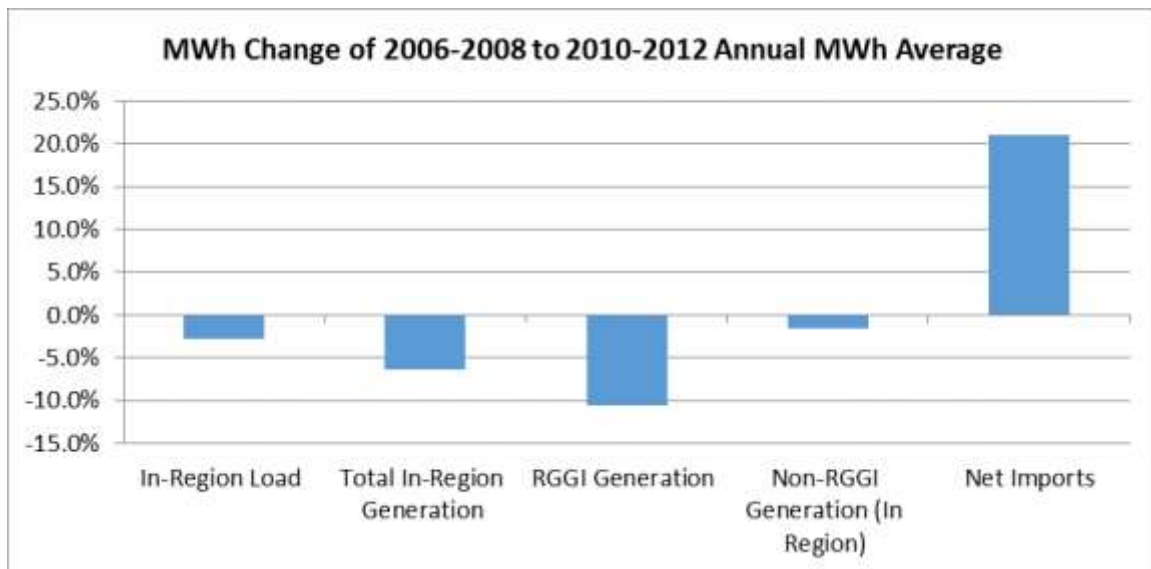


Figure 1. Comparison of percentage changes in electricity load and generation MWhs serving the 9-state RGGI Region from 2010 through 2012 to the base period of 2006 to 2008 for the 9-state RGGI Region.⁵

⁵ Corresponding changes in MWhs are detailed in Section VI Monitoring Results.

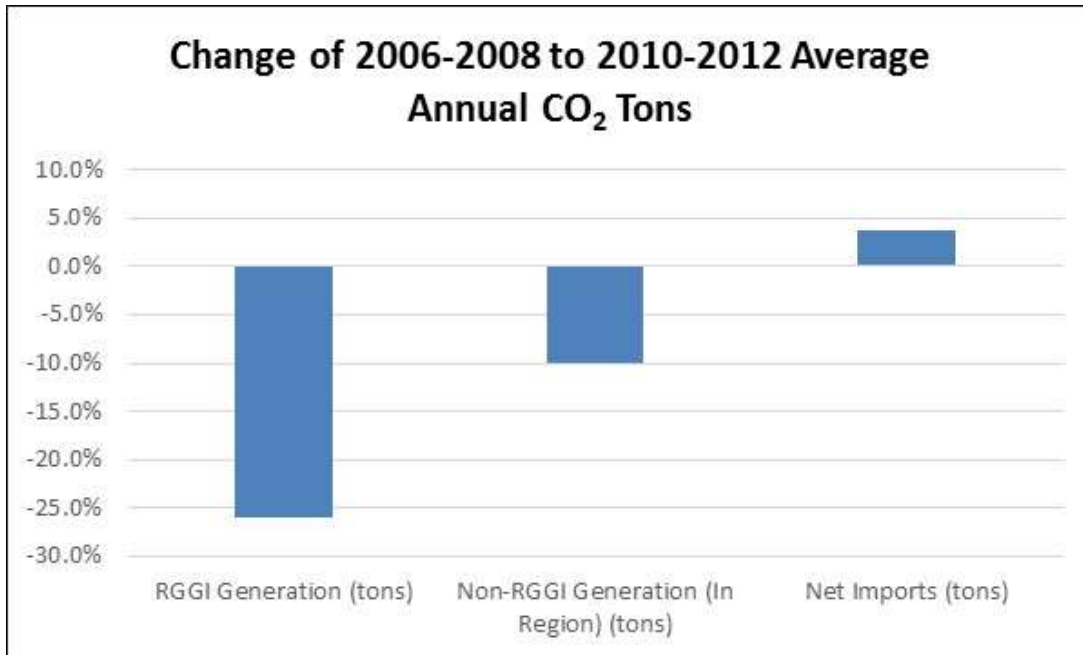


Figure 2. Comparison of percentage changes in generation CO₂ tons serving the 9-state RGGI Region from 2010 to 2012 to the base period of 2006 to 2008 for the 9-state RGGI Region.

Monitoring Approach

The data summarized track electricity generation and imports in each of the three independent system operator (ISO) regions fully or partially subject to the RGGI CO₂ Budget Trading Program (ISO-New England – “ISO-NE”, New York ISO – “NYISO”, and PJM). The data track total MWhs of electricity used to serve electric load in each ISO (or portion of an ISO subject to RGGI in the case of PJM) and the actual or estimated related CO₂ emissions. For each ISO, data are tracked for the following categories:

- **RGGI-Affected Generation**: Electric generation and CO₂ emissions for electric generation units subject to a CO₂ allowance compliance obligation under a state CO₂ Budget Trading Program.
- **Non-RGGI Generation**: Total electricity generation (MWh), CO₂ emissions, and lb CO₂/MWh emission rate for all non-RGGI electric generation serving electric load in the nine-state RGGI region (includes both in-region electric generation and net electricity imports).
- **Non-RGGI In-Region Generation**: Electric generation and CO₂ emissions for electric generation units located in the nine-state RGGI region that are not subject to a CO₂ allowance compliance obligation

(e.g., generators under 25 megawatts electrical (MWe) capacity and non-fossil fuel-fired electric generators).

- Net Imports: Net electricity imports from adjacent control areas (or portion of a control area) outside the nine-state RGGI region and CO₂ emissions related to these net imports

Conclusions

The monitoring results show there has been no significant change in average annual CO₂ emissions from non-RGGI electric generation during the three years of RGGI program operation, 2010 through 2012, compared to the average annual CO₂ emissions during 2006 to 2008.

Given that the monitoring results presented in this report do not address causality, the results should be evaluated in context with market dynamics. The monitoring results for 2010 through 2012 are consistent with market dynamics given the relatively modest CO₂ allowance prices evident in these three years of the program (with CO₂ allowance auction clearing prices ranging from \$1.86 to \$2.07). These modest CO₂ allowance prices resulted in CO₂ compliance costs on a per MWh basis that were likely lower than the aggregate price signal of mitigating market factors discussed in this report that would advantageously limit emissions leakage.

I. Background

This annual report summarizes monitoring data for electricity generation and imports in the nine-state RGGI region, and related CO₂ emissions for the period from 2005 through 2012. This monitoring was called for in the 2005 RGGI MOU in response to expressed concerns about the potential for the nine RGGI CO₂ Budget Trading Programs⁶ to result in “emissions leakage”.⁷ The monitoring approach that was used to compile the data summarized in this report was specified in a March 2007 report from the RGGI Staff Working Group, *Potential Emissions Leakage and the Regional Greenhouse Gas Initiative (RGGI): Evaluating Market Dynamics, Monitoring Options, and Possible Mitigation Mechanisms*.⁸ This report for 2012 is the first of the annual monitoring reports to review the data as a 9-state program after New Jersey’s⁹ withdrawal from the program in 2012. A comparative 10-state data set similar to previous iterations of this report can be found in Appendix E.

The report provides data for evaluating CO₂ emissions related to electricity generation and imports in the nine-state RGGI region. The report tracks trends in electricity demand, net electricity imports, electricity generation from multiple categories of generation sources (including electricity imports), and the CO₂ emissions related to these categories of electric generation. The report should not be used to draw definitive conclusions about whether or not CO₂ emissions leakage has occurred, as it does not address the causes of changes in electricity generation and related CO₂ emissions among different categories of electric generation serving load in the nine-state RGGI region. This report is only an analysis of CO₂ emissions and does not speak to other greenhouse gases.

II. Monitoring Approach

The data summarized in this report track electricity generation and electricity use in each of the three ISO regions fully or partially subject to the RGGI CO₂ Budget Trading Program. The data track all MWh of electricity used to serve electric load in each ISO (or portion of an ISO subject to RGGI in the case of PJM), the actual or estimated CO₂ emissions (in short tons of CO₂) related to the generation of this electricity, and the associated lb CO₂/MWh emission rate.¹⁰

⁶ RGGI is comprised of state CO₂ Budget Trading Programs. Under each of these state programs, a regulated power plant must hold CO₂ allowances equal to its emissions to demonstrate compliance at the end of a three-year control period. CO₂ allowances are issued by participating states in a finite amount, or “budget”, resulting in a regional cap on CO₂ emissions from the electric generation sector in the RGGI region. Regulated power plants are fossil fuel-fired electric generating units with an electric generation capacity of 25 megawatts (MWe) or greater.

⁷ Specifically, the Memorandum of Understanding called for monitoring electricity imports into the RGGI participating states commencing from the start of the RGGI CO₂ Budget Trading Program and reporting the results of such monitoring on an annual basis beginning in 2010.

⁸ The report also specified requested changes that were made to generator attribute tracking systems for ISO-NE and PJM to facilitate RGGI monitoring. The report is available at http://www.rggi.org/docs/il_report_final_3_14_07.pdf

⁹ New Jersey withdrew its agreement to the RGGI Memorandum of Understanding effective January 1, 2012. See http://www.rggi.org/docs/Documents/NJ-Statement_112911.pdf.

¹⁰ Throughout this report, references to “electric generation” and “electric load” include only that portion of electric generation or electric load dispatched or served through the regional transmission system administered by ISOs and

For each year 2005 through 2012, the following categories of data are presented for the nine-state RGGI region as well as each ISO:

- **RGGI-Affected Generation:** Electric generation (MWh), CO₂ emissions (short tons), and lb CO₂/MWh emission rate for electric generators subject to the RGGI CO₂ Budget Trading Program. This category is limited to electric generating units subject to a CO₂ allowance compliance obligation under state CO₂ Budget Trading Program regulations.¹¹
- **Non-RGGI Generation:** Total electricity generation (MWh), CO₂ emissions, and lb CO₂/MWh emission rate for all non-RGGI electric generation serving electric load in the nine-state RGGI region (includes both in-region electric generation and net electricity imports).¹² In addition to total non-RGGI generation, data for the following subcategories of non-RGGI generation are also presented:
 - **Non-RGGI In-Region Generation:** Electric generation and CO₂ emissions for electric generation units located in the nine-state RGGI region that are not subject to a CO₂ allowance compliance obligation (e.g., generators under 25 megawatts electrical (MWe) capacity and non-fossil fuel-fired electric generators).
 - **Net Imports:** Net electricity imports (MWh) from adjacent control areas and CO₂ emissions and lb CO₂/MWh emission rate related to these net imports.¹³

III. Summary of Monitoring Results

tracked by individual ISOs. This excludes most electric generation output and electric load typically referred to as “behind-the-meter”, which refers to electric generation that is not dispatched by ISOs and electric load met through on-site electric generation facilities (e.g., industrial cogeneration and other smaller distributed generation resources, such as combined heat and power and solar photovoltaics). The electric generation MWh output that is not included in the monitoring results includes the portion of electric generation output used on-site, if an electric generating unit supplies only a portion of its output to the ISO grid, or all electric generation output, if an electric generating unit supplies no electricity to the ISO grid. However, note that behind-the-meter electric generators eligible for credit under state renewable portfolio standards typically voluntarily report electric generation to the PJM Generation Attribute Tracking System (GATS) and NE-ISO Generation Information System (GIS), which are discussed in Section V. Methodology. These behind-the-meter electric generators that report to PJM GATS and ISO-NE GIS are included in the monitoring results.

¹¹ For the purposes of this report, this category does not include electric generators that may be subject to a state CO₂ Budget Trading Program regulation, or portion of such regulation, but that are not subject to a CO₂ allowance compliance obligation that requires the generator to submit CO₂ allowances equivalent to its CO₂ emissions. For example, under Maryland’s CO₂ Budget Trading Program regulations, certain industrial cogenerators may be subject to alternative CO₂ compliance obligations under certain conditions in lieu of submission of CO₂ allowances.

¹² In practice, this category includes MWh and related CO₂ emissions from all electric generation serving load in the RGGI region, after subtracting out electric generation and related CO₂ emissions from electric generation units subject to a RGGI CO₂ allowance compliance obligation. For ISO-NE and NYISO, the “RGGI region” represents the full ISO footprint. For PJM, the “RGGI region” represents the two-state portion of PJM subject to the RGGI CO₂ Budget Trading Program in 2012 (Delaware, and Maryland).

¹³ For individual ISOs, net imports represent actual annual net electricity flows between ISOs, as reported by the ISOs. For PJM, net electricity imports represent inferred transfers of electricity from the non-RGGI geographic portion of PJM into the RGGI geographic portion of PJM.

Monitoring results are summarized below for the nine-state RGGI region. Results are presented in detail for the nine-state RGGI region, as well as for each individual ISO, under Section VI – Monitoring Results.

Electric Load (Demand for Electricity) and Generation

- For 2010 to 2012, the annual average electricity load in the nine-state RGGI region was 11.1 million MWh less than the average 2006 to 2008 electricity load, or 2.9 percent.
- For 2010 to 2012, the annual average total electric generation in the nine-state RGGI region (fossil and non-fossil) decreased by 21.3 million MWh, or 6.4 percent from the 2006-2008 average.
- For calendar year 2012, a comparison of the electricity load in the nine-state RGGI region to the annual average for the base period of 2006 to 2008, shows a decrease of 14.3 million MWh, or 3.7 percent.
- For calendar year 2012, a comparison of the total electric generation in the nine-state RGGI region (fossil and non-fossil) to the annual average for the base period of 2006 to 2008 shows a decrease of 26.9 million MWh, or 8.1 percent.

Non-RGGI Emissions and Generation

- A comparison of the 2010 to 2012 annual average to the base period of 2006 to 2008 annual average shows the total electric generation from all non-RGGI electric generation sources serving load in the 9-state RGGI region increased, by 9.3 million MWh, an increase of 4.4 percent.
- The monitoring results indicate that CO₂ emissions from non-RGGI electric generation did not increase in 2010 through 2012 relative to the base period of 2006 to 2008. The decrease in emissions from non-RGGI in region electric generation offsets the slight increase in emissions related to electric generation from imports into the 9-state RGGI region.
 - A comparison of the 2010 to 2012 annual average to the base period of the 2006 to 2008 annual average shows CO₂ emissions from all non-RGGI electric generation sources serving load in the nine-state RGGI region decreased by 933.0 thousand short tons of CO₂, or 2.1 percent.
 - A comparison of the 2010 to 2012 annual average to the base period of the 2006 to 2008 annual average shows the CO₂ emission rate for this category of electric generation decreased by 26.1 lb CO₂/MWh, or 6.2 percent.

- The monitoring results do not show an increase of annual 2012 CO₂ emissions related to either net electricity imports into the nine-state RGGI region or from small fossil fuel-fired electric generators in the nine-state RGGI region that are not subject to state CO₂ Budget Trading Program regulations compared to the annual average during base period of 2006 to 2008.

RGGI Emissions and Generation

- A comparison of the 2010 to 2012 annual average to the base period of the 2006 to 2008 annual average shows the electric generation from RGGI-affected electric generation sources decreased by 18.8 million MWh, or 10.6 percent.
 - A comparison of the 2010 to 2012 annual average to the base period of the 2006 to 2008 annual average shows CO₂ emissions from RGGI electric generation sources decreased by 35.1 million short tons of CO₂, or 25.4 percent.
 - A comparison of the 2010 to 2012 annual average to the base period of the 2006 to 2008 annual average shows the CO₂ emissions rate for RGGI electric generation sources decreased by 261 lb CO₂/MWh, or 16.7 percent.
- When the 2012 calendar year is compared to the annual average during the baseline period of 2006 to 2008, the results similarly show a reduction in electric generation and CO₂ emissions and CO₂ emissions rate from RGGI electric generation sources.

IV. Evaluation of Monitoring Data

This section addresses issues considered in evaluation of the monitoring data, including the selection of base periods for comparison of data and general monitoring limitations.

Selection of a Base Period

In this report, 2010 through 2012 monitoring data is compared to data from the base period, of the three-year period of 2006 through 2008. Conditions may change significantly during a base period and influence conclusions. This was the case with the electric power sector in the nine-state RGGI region during the period 2005 through 2008, the years immediately preceding the start of the RGGI program in 2009, which saw changes in wholesale electricity prices and in underlying market dynamics, such as electricity demand and relative fuel prices.

These changes influenced electric generator dispatch and resulted in very significant changes in electric power sector CO₂ emissions in the nine-state RGGI region during the 2005 to 2008 timeframe.

During the period from 2000 through 2012, 2005 had the second highest CO₂ emissions for electric generators that met the applicability criteria of the RGGI CO₂ Budget Trading Program, and the highest CO₂ emissions since 2001. As a result, this year was dropped as a point of comparison, considering the very significant subsequent drop in CO₂ emissions in subsequent years. The period of 2006 through 2008 was selected the base period to provide a three-year point of comparison that is comparable to the three-year compliance periods of the RGGI program. For 2009, 2010, and 2011 data comparisons were made to the base period for the ten-state region, please see the CO₂ Emissions from Electricity Generation and Imports in the 10-State Regional Greenhouse Gas Initiative: 2009, 2010, and 2011 Monitoring Reports.¹⁴ New York Control Area (NYCA) data from years 2005-2011 was adjusted and corrected by New York State Department of Public Service (NYSDPS) to account for previous year's misclassifications of certain generators in 2011 Monitoring Report. The conclusions of the reports in 2009 and 2010 were not affected by these adjustments and corrections.

Key Metrics

A key metric presented in this report that may provide a preliminary indication of *potential* emissions leakage, or a lack thereof, is electric generation and related CO₂ emissions from all non-RGGI affected electric generation that serves electric load in the nine-state RGGI region. This includes electric generation in the nine-state RGGI region from electric generating units that are not subject to a CO₂ allowance compliance obligation under a state CO₂ Budget Trading Program (e.g., small fossil units not subject to RGGI or non-fossil units not subject to RGGI), as well as net imports of electricity into the nine-state RGGI region. If CO₂ emissions leakage were to occur, it would manifest as an increase in CO₂ emissions from this category of non-RGGI electric generation, assuming all other factors that impact electricity system dispatch and CO₂ emissions, such as electricity demand, relative fossil fuel prices, and wholesale electricity prices, did not change. As a result, an increase in CO₂ emissions from this category of electric generation in a year subsequent to implementation of RGGI, relative to a baseline prior to the implementation of RGGI, could be an indicator of *potential* CO₂ emissions leakage.

General Limitations

¹⁴ Reports available at http://www.rggi.org/docs/Documents/Elec_monitoring_report_11_09_14.pdf, http://www.rggi.org/docs/Documents/Elec_Monitoring_Report_12_07_30_Final.pdf, and http://www.rggi.org/docs/Documents/Elec_monitoring_report_2011_13_06_27.pdf.

It should be emphasized that this report does not provide indicators of CO₂ emissions leakage, but merely tracks electricity generation and imports and related CO₂ emissions in the RGGI region for 2010 through 2012 relative to baseline years prior to implementation of the RGGI program. Changes in these data over time may point to potential CO₂ emissions leakage as a result of the RGGI CO₂ Budget Trading Program, or a lack thereof, but may also be the result of wholesale electricity market and fuel market dynamics unrelated to the RGGI program.

The data and analysis in this Monitoring Report do not take into account the full lifecycle of sources of fuel. For example, the direct emissions of CO₂ and the lb CO₂/MWh emission rates from non-RGGI non-fossil fuel units in this report do not reflect the biomass lifecycle carbon reduction of atmospheric CO₂ levels resulting from uptake of CO₂ from the atmosphere as a result of forest and biomass growth. Likewise for municipal solid waste combustors, direct emissions of CO₂ are presented with no analysis of the lifecycle of the components of the waste. The analysis of lifecycle reductions and contributions of fuels used in non-RGGI non-fossil fuel units is not within the scope of this report and this report does not provide indicators of total atmospheric reductions or contributions from the fuels used in non-RGGI non-fossil fuel units.

This report cannot draw definitive conclusions about whether or not CO₂ emissions leakage has occurred, as it does not address the causes of shifts in electricity generation and related CO₂ emissions among different categories of electric generation serving load in the nine-state RGGI region. However, the results demonstrate that there has been no significant change in CO₂ emissions or lb CO₂/MWh emission rate from non-RGGI electric generation during the years of RGGI program operation, 2010 through 2012, compared to an annual average during 2006 – 2008.

Determining whether CO₂ emissions leakage has occurred requires the evaluation of a hypothetical counterfactual – the amount of CO₂ emissions from non-RGGI electric generation that would occur, assuming there is no shift in electric generation to CO₂-emitting non-RGGI electric generators as a result of the implementation of the RGGI CO₂ Budget Trading Program (i.e., assuming no CO₂ emissions leakage).

In theory, an increase in CO₂ emissions or CO₂ emission rate from non-RGGI electric generation as compared to a historical baseline year could occur in a scenario in which CO₂ emissions leakage does not occur. Conversely, leakage could theoretically occur in a scenario in which CO₂ emissions and CO₂ emission rate for non-RGGI electric generation *decreased* as compared to a historical baseline year, if such emissions would have decreased further under a hypothetical counterfactual where no CO₂ emissions leakage occurs.

Given that the monitoring results presented in this report do not address causality, the results should be evaluated in context with market dynamics. The monitoring results for 2010 through 2012 are consistent with market dynamics given relatively modest CO₂ allowance prices evident in 2010 through 2012 that result in CO₂ compliance costs on a dollar per MWh basis that are likely lower than the aggregate dollar per MWh price signal of mitigating market factors discussed in this report that would be expected to impede emissions leakage. Considering these factors, with modest CO₂ allowance prices, no net market dynamic driving emissions leakage would be expected to occur.

V. Methodology

Data Sources

For ISO-NE and PJM, the data presented are primarily from the NEPOOL Generation Information System (GIS) and PJM Generation Attribute Tracking System (GATS),¹⁵ supplemented by ISO electricity import/export data, and CO₂ emissions data for RGGI-affected electric generation from the RGGI CO₂ Allowance Tracking System (RGGI COATS) for 2010 to 2012 and emissions statement data reported to state environmental agencies in the RGGI participating states for 2005-2008. For non-RGGI electric generation, CO₂ emissions are based on CO₂ emissions for individual electric generation facilities in the NE GIS and PJM GATS tracking systems.

A summary of data sources for ISO-NE and PJM is provided in Appendix A.

For NYISO, MWh data were compiled by the NYSDPS from NYISO data (MWh generation data) and PJM and Hydro Quebec data (MWh electricity net import data). This MWh data was supplemented by CO₂ emissions data compiled by the New York State Department of Environmental Conservation (NYSDEC). 2009 - 2012 CO₂ emissions data for RGGI-affected electric generation units were taken from RGGI COATS and 2005-2008 CO₂ emissions data for these units were compiled from NYSDEC emissions statement program data. CO₂ emissions data for fossil fuel-fired electric generation units that are non-RGGI affected were taken or extrapolated from reports compiled by NYSDEC. A summary of data sources for NYISO is provided in Appendix A.

For each ISO, CO₂ emissions related to net electricity imports from each adjacent control area¹⁶ are the product of a lb CO₂/MWh emission rate and the

¹⁵ These ISO tracking systems track every MWh of electric generation for each electric generator that participates in the ISO wholesale market. Modifications were made to both systems at the request of the RGGI Staff Working Group to facilitate the tracking presented in this report. (See Staff Working Group, *Potential Emissions Leakage and the Regional Greenhouse Gas Initiative (RGGI): Evaluating Market Dynamics, Monitoring Options, and Possible Mitigation Mechanisms*, pp. 18-26; available at http://www.rggi.org/docs/il_report_final_3_14_07.pdf.) These systems do not fully capture the portion of electric generation that is "behind the meter" and used to serve on-site electric load (e.g., MWh supplied from industrial cogeneration to meet on-site industrial electricity load).

¹⁶ For PJM, this represents inferred imports from the non-RGGI geographic portion of PJM.

reported MWh of net imports. The CO₂ emission rate for electricity imports is based on the system average CO₂ emission rate for the respective exporting adjacent control area.¹⁷ For ISO-NE and NYISO, net electricity imports are based on actual flow data for electricity transfers between adjacent control areas.¹⁸ For PJM, net electricity imports are inferred and represent “transfers” of electricity from the non-RGGI geographic portion of PJM into the RGGI geographic portion of PJM (Delaware and Maryland). This data is compiled from PJM GATS, which reports data for both the non-RGGI and RGGI geographic portions of PJM. Inferred net imports are based on total MWh load in the RGGI geographic portion of PJM minus total electric generation in the RGGI geographic portion of PJM. Any shortfall in generation relative to load is assumed to be met through an inferred “import” of electricity from the non-RGGI geographic portion of PJM into the RGGI geographic portion of PJM.¹⁹

When aggregating individual ISO net import data, the reported regional net imports of electricity and related CO₂ emissions from net imports presented in this report represent net imports from adjacent regions not subject to the RGGI CO₂ Budget Trading Program. Some of the individual ISO net import subtotals represent net imports from another ISO (or portion of an ISO) that is also subject to the RGGI CO₂ Budget Trading Program. In order to avoid inappropriate double counting of MWh and related CO₂ emissions, the net import subtotals from adjacent ISOs (or portion of ISO) subject to the RGGI CO₂ Budget Trading Program were not included when rolling up the individual ISO data into regional summary totals, as the electricity and CO₂ emissions represented by these net imports are included in the electric generation subtotals for each ISO. In rolling up total regional net imports, NYISO net imports from PJM represent a prorated portion of total net imports from PJM that are assumed to originate from the non-RGGI geographic portion of PJM. For each year, this proration is based on the percentage of total PJM MWh generation that occurred in the non-RGGI geographic portion of PJM. (See next subsection for further discussion.)

Monitoring Limitations

The monitoring approach used in this report is subject to certain inherent limitations. These limitations primarily involve tracking for the PJM ISO, as well as how net exports from PJM to NYISO are addressed when rolling up ISO-specific data into regional totals for the nine-state RGGI region.

¹⁷ This assumes that power transferred originates in the adjacent control area and is delivered for use in the receiving control area. This assumption does not account for the wheeling of power through control areas.

¹⁸ The exception is net import data from Hydro Quebec into NYISO, which represents net scheduled electricity imports. Scheduled flows are those flows that are scheduled at an ISO interface for a defined period, while actual flows are the metered flows at an ISO interface for a defined period. Differences between the two can arise from transactions scheduled on contract paths that do not fully correspond to the physical paths on which the electricity related to the transaction actually flows.

¹⁹ For PJM, this category of data does not technically represent an import of electricity, as PJM is dispatched as a single control area.

For ISO-NE and NYISO, net electricity import data is based on the tracking of actual electricity flows between adjacent control areas.²⁰ This type of tracking is not possible for the RGGI portion of PJM, as PJM is dispatched as a single control area, and electricity flows between geographic subsets of PJM on a state-by-state basis are not available. As a result, “electricity imports” into the two-state RGGI portion of PJM (Delaware and Maryland) from the rest of PJM must be inferred.

This also means that net electricity exports from the non-RGGI portion of PJM into NYISO cannot be determined based on actual electricity flows, as the actual monitored flows of electricity between PJM and NYISO do not allow for a differentiation between these two geographic subsets of PJM. As a result, certain assumptions must be made in order to prorate the portion of net exports from the non-RGGI portion of PJM into NYISO. For this report, this proration is based on the annual percentage of electric generation in the non-RGGI portion of PJM for a respective reporting year, as a percentage of total PJM generation for that year. The actual monitored net electricity flows from PJM into NYISO are multiplied by this percentage to derive an estimate of net electricity exports from non-RGGI PJM into NYISO. These assumed flows may not be fully representative of the actual electric generation source of net exports from non-RGGI PJM into NYISO.

A more modest monitoring limitation involves the electric generation data tracked by the three ISOs. ISO tracking does not include electric generation that is not dispatched into the ISO.²¹ This typically involves the portion of industrial cogeneration of electricity used on-site at industrial facilities as well as smaller distributed combined heat and power and renewable energy generation (sometimes referred to as “behind-the-meter” generation).

²⁰ The exception is net import data from Hydro Quebec into NYISO, which represents net scheduled electricity imports.

²¹ This includes most electric generation and electric load typically referred to as “behind the meter”, which refers to electric generation that is not dispatched by ISOs and electric load met through on-site electric generation facilities (e.g., industrial cogeneration and other smaller distributed generation resources, such as combined heat and power and solar photovoltaics). However, behind-the-meter electric generators eligible for credit under state renewable portfolio standards typically voluntarily report electric generation to the PJM Generation Attribute Tracking System (GATS) and NE-ISO Generation Information System (GIS). MWh data for these behind-the-meter electric generators that report to PJM GATS and ISO-NE GIS are included in the monitoring results. CO₂ emissions data for behind-the-meter electric generation that is RGGI-affected are also included in this report. In addition, only electricity output from cogeneration facilities is reported by ISOs, meaning that the average lb CO₂/MWh emission rate for all reporting years in this report is for electricity generation dispatched to the ISO grid only and does not account for behind-the-meter MWh output or useful steam output from cogeneration facilities.

VI. Monitoring Results

Monitoring results are provided below for the full nine-state RGGI region. These results provide a compilation of data from each ISO fully or partially subject to the RGGI CO₂ Budget Trading Program: ISO-NE, NYISO, and PJM. For PJM, monitoring data is compiled for the two-state portion of PJM affected by RGGI (Delaware and Maryland). Monitoring data for each ISO is presented in Appendix B.

Monitoring results for the 9-state RGGI region for 2005 through 2012 are summarized below in Table 1 and Figures 2 through 5.²²

Table 1. 2005 – 2012 Monitoring Summary for 9-State RGGI Region

	MWh								tons CO ₂								lb CO ₂ /MWh							
	2005	2006	2007	2008	2009	2010	2011	2012	2005	2006	2007	2008	2009	2010	2011	2012	2005	2006	2007	2008	2009	2010	2011	2012
Electricity Demand																								
Total In RGGI	393,135,125	384,993,562	391,243,211	383,034,165	368,848,273	378,723,230	375,309,279	372,082,306	202,392,475	186,400,850	189,415,317	170,909,452	145,623,807	160,224,626	144,568,405	133,768,273	1030	968	968	892	790	846	770	719
Net Imports - from Ontario to NY	1,898,020	3,672,282	2,637,442	6,162,902	6,463,657	3,872,635	3,318,681	5,749,461	460,286	769,120	610,529	1,154,884	712,496	554,950	475,569	823,900	485	419	463	375	220	287	287	287
Net Imports - from Quebec to NY & NE	7,375,317	8,982,749	11,912,292	15,141,014	17,065,805	13,549,209	18,681,204	22,312,689	32,520	49,509	118,179	33,380	56,435	29,871	33,772	40,337	9	11	20	4	7	4	4	4
Net Imports - from New Brunswick to NE	1,620,000	1,047,000	896,000	1,285,000	1,569,000	737,000	846,000	643,000	846,443	508,967	438,526	718,150	984,101	410,264	410,324	311,866	1045	972	979	1118	1254	1113	970	970
Net Imports - from non-RGGI PJM to NY	6,967,235	8,837,899	9,452,157	9,917,356	7,760,904	11,489,286	10,452,544	7,926,652	4,460,362	5,484,024	5,801,823	5,999,390	4,381,845	6,656,944	5,952,203	4,287,069	1280	1241	1228	1210	1129	1159	1139	1082
Net Imports - from non-RGGI PJM to RGGI PJM	31,878,151	30,716,157	28,944,540	28,386,914	33,089,871	35,142,720	34,250,993	34,442,085	20,408,108	19,059,750	17,766,431	17,172,335	18,682,706	20,361,849	19,504,235	18,627,737	1280	1241	1228	1210	1129	1159	1139	1082
Total Net Imports - from All Adjoining ISOs	49,738,723	53,256,087	53,842,431	60,893,186	65,949,237	64,790,850	67,549,422	71,073,887	26,207,718	25,871,369	24,735,489	25,078,139	24,817,583	28,013,877	26,376,103	24,090,909	1054	972	919	824	753	865	781	678
Electricity Generation																								
RGGI-Affected Units	186,747,917	175,006,362	185,936,729	170,552,364	151,406,757	165,483,896	157,544,937	152,145,642	159,287,880	139,924,128	145,789,425	129,374,761	105,958,243	116,053,938	101,456,734	92,212,271	1706	1599	1568	1517	1400	1403	1288	1212
Non-RGGI Fossil Fuel-Fired Units	13,470,422	12,878,596	11,431,101	7,405,729	6,621,598	6,920,343	6,815,348	10,417,967	10,309,984	10,134,399	8,443,421	4,662,824	4,263,698	5,355,842	5,401,761	6,459,299	1531	1574	1477	1259	1288	1548	1585	1240
Non-Fossil Fuel-Fired Units	143,309,339	144,088,563	140,249,677	144,034,126	145,330,499	142,317,557	144,941,142	141,089,579	6,586,892	10,470,954	10,446,982	11,793,728	10,584,284	10,800,970	11,333,807	11,005,795	92	145	149	164	146	152	156	156
All Non-RGGI Units	156,779,761	156,967,159	151,680,778	151,439,855	151,952,097	149,237,900	151,756,490	151,507,546	16,896,876	20,605,352	18,890,403	16,456,552	14,847,982	16,156,812	16,735,567	17,465,094	216	263	249	217	195	217	221	231
All Units	343,396,401	331,737,475	337,400,780	322,140,979	302,899,036	313,931,380	307,759,857	301,007,419	176,184,756	160,529,481	164,679,828	145,831,312	120,806,225	132,210,749	118,192,302	109,677,364	1026	968	976	905	798	842	768	729
Summary Data																								
Non-RGGI Generation Serving Load in ISO (Non-RGGI Generation within ISO + Net Imports)	206,518,484	210,223,246	205,523,209	212,333,041	217,901,334	214,028,750	219,305,912	222,581,433	43,104,595	46,476,722	43,625,892	41,534,691	39,665,564	44,170,689	43,111,671	41,556,002	417	442	425	391	364	413	393	373

²² Note that reported regional net imports of electricity represent net imports from adjacent control areas (or portion of a control area) not subject to the RGGI CO₂ Budget Trading Program. As a result, the net electricity imports and related CO₂ emissions as reported in tabular summaries for each ISO provided in Appendix B do not add up to the reported total regional net imports and related CO₂ emissions. This is because some of the individual ISO net import subtotals represent net imports from another ISO that is also subject to the RGGI CO₂ Budget Trading Program. In order to avoid inappropriate double counting of MWh and related CO₂ emissions, these net import subtotals were not included when rolling up the individual ISO data into regional summary totals, as the electricity and CO₂ emissions represented by these net imports are included in the electric generation subtotals for each ISO.

The monitoring results indicate that from 2010 through 2012, total average annual electric generation from all non-RGGI electric generation serving load in the nine-state RGGI region increased, by 9.3 million MWh, an increase of 4.4 percent, from the average annual generation from the benchmark period of 2006 to 2008. In a comparison of the 2010 to 2012 annual average to the 2006 to 2008 base period annual average, the CO₂ emissions from this category of electric generation decreased by 933.0 thousand short tons of CO₂, a reduction of 2.1 percent, and the CO₂ emission rate decreased by 26.1 lb CO₂/MWh, a reduction of 6.2 percent. (See Figures 3, 4, and 5.)

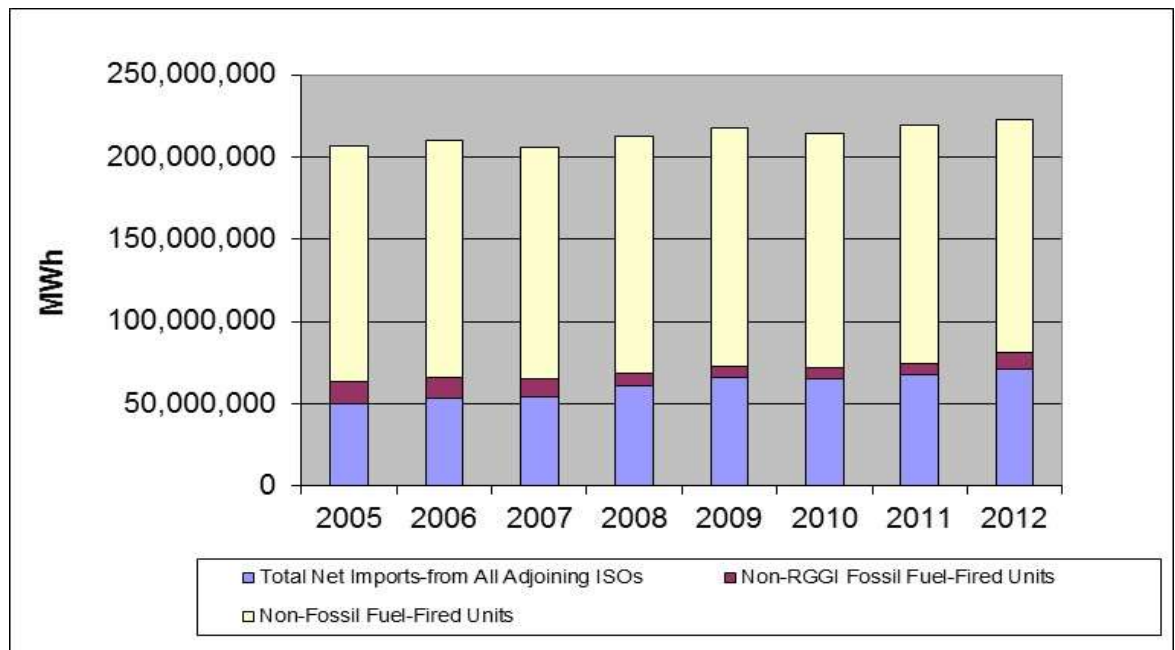


Figure 3. Non-RGGI Generation Serving Load in RGGI Region (MWh)

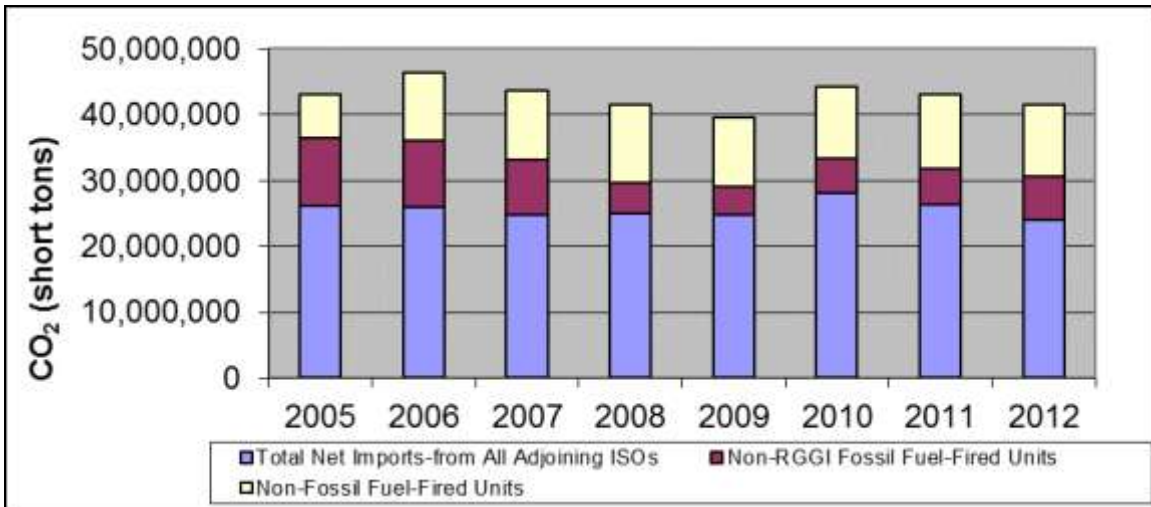


Figure 4. CO₂ Emissions from Non-RGGI Generation Serving Load in RGGI Region (short tons CO₂)

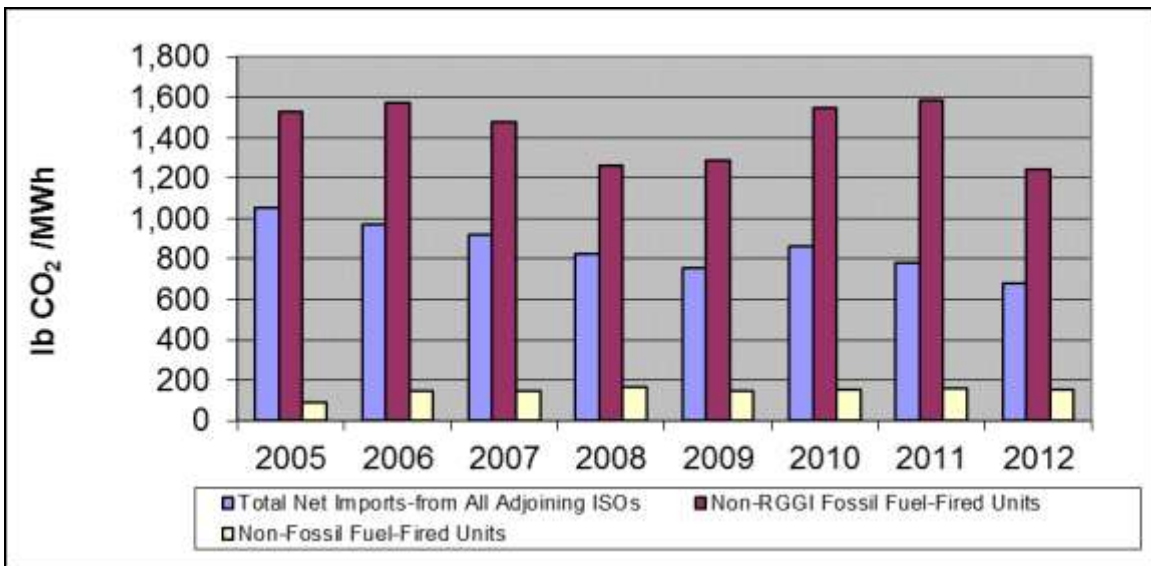


Figure 5. CO₂ Emission Rate for Non-RGGI Generation Serving Load in RGGI Region (lb CO₂/MWh)

The 2010 to 2012 annual average electricity load in the 9-state RGGI region decreased by 11.1 million MWh, or 2.9 percent, from the 2006 to 2008 base period annual average. In total, electric generation in the nine-state RGGI region (fossil and non-fossil) decreased by 21.3 million MWh, or 6.4 percent, from the base period annual average.

Electric generation from RGGI-affected generation decreased by 18.8 million MWh during this period, or 10.6 percent, and CO₂ emissions from RGGI-affected generation decreased by 35.1 million short tons, or 25.4 percent. The

CO₂ emission rate of RGGI-affected electric generation decreased by 261 lb CO₂/MWh, a decrease of 16.7 percent. Electric generation from non-RGGI generation sources located in the 9-state RGGI region decreased by 2.5 million MWh, or 1.6 percent, during this period, and CO₂ emissions from this category of electric generation decreased by 1.9 million short tons, a reduction of 10.0 percent. The CO₂ emission rate of non-RGGI electric generation located in the nine-state RGGI region decreased by 20 lb CO₂/MWh, a reduction of 8.4 percent.

Average annual net electricity imports into the 9-state RGGI region increased by 11.8 million MWh, or 21.1 percent, from the 2010 to 2012 average compared to the 2006 to 2008 base period annual average. CO₂ emissions related to these net electricity imports increased by 932.0 thousand short tons, or 3.7 percent²³, during this period, indicating a reduction in the average CO₂ emission rate of the electric generation supplying these imports of 130 lb CO₂/MWh, a reduction of 14.4 percent. (See Figures 6 and 7.)

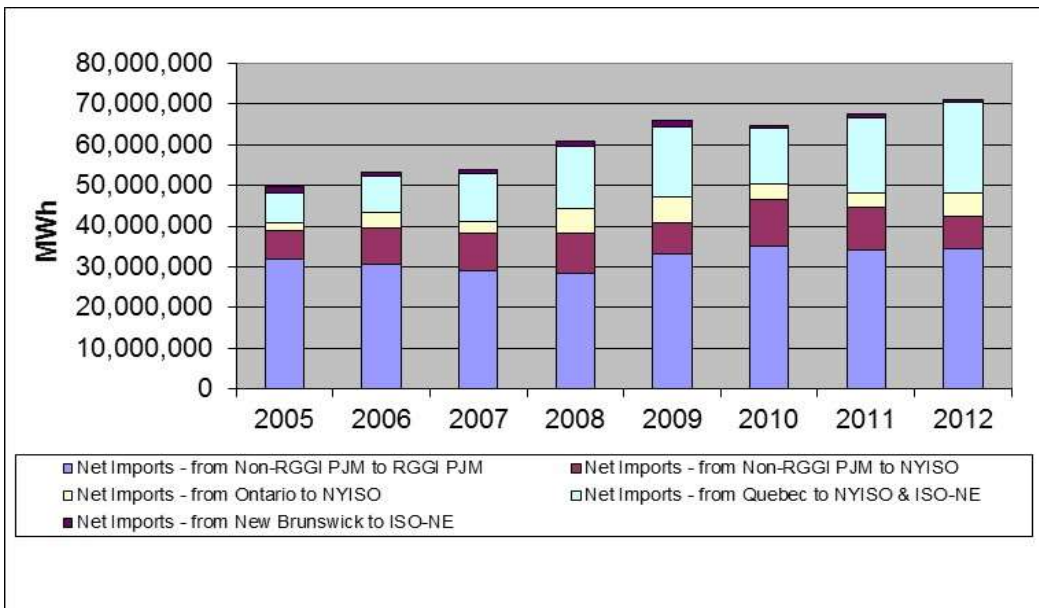


Figure 6. Net Electricity Imports to 9-State RGGI Region (MWh)

²³ An increase in CO₂ emissions related to net electricity imports was not seen in earlier reports for 2010 and 2011 with the 10-state data, 10-state data through 2012 can be found in Appendix E. For both the 9-state and 10-state data sets CO₂ emissions related to net electricity imports for 2012 saw a decrease in emissions as compared to 2010 and 2011.

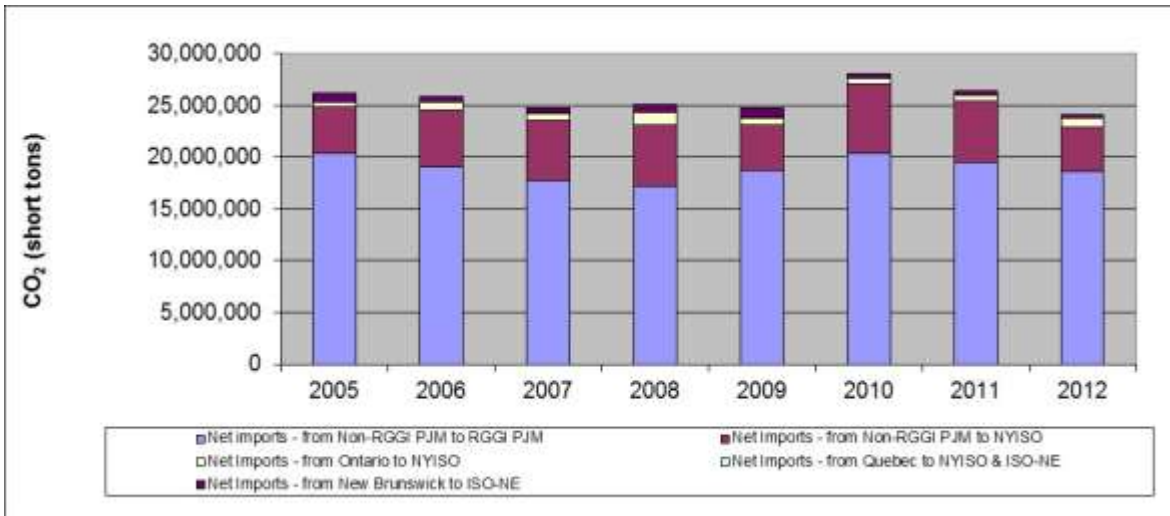


Figure 7. CO₂ Emissions Related to Net Electricity Imports to 9-State RGGI Region (short tons CO₂)

Compared to the annual average during a multi-year 2006 – 2008 base period, 2012 total electricity load in the nine-state RGGI region decreased by 14.3 million MWh, or 3.7 percent. Compared to the 2006 – 2008 annual average, total electric generation in 2012 in the nine-state RGGI region decreased by 26.9 million MWh, or 8.1 percent.

Compared to the annual average during a multi-year 2006 – 2008 base period, 2012 electric generation from RGGI-affected generation decreased by 25.0 million MWh, or 14.1 percent, and CO₂ emissions from RGGI-affected generation decreased by 46.1 million short tons of CO₂, or 33.4 percent. The CO₂ emission rate of RGGI-affected electric generation decreased by 349 lb CO₂/MWh, a reduction of 22.4 percent. Compared to the 2006 – 2008 annual average, 2012 electric generation from non-RGGI generation sources located in the nine-state RGGI region decreased by 1.9 million MWh, or 1.2 percent, and CO₂ emissions from this category of electric generation decreased by 1.2 million short tons, a reduction of 6.4 percent. The CO₂ emission rate of non-RGGI electric generation located in the nine-state RGGI region decreased by 12 lb CO₂/MWh, a reduction of 5.1 percent.

Compared to the annual average during a multi-year 2006 – 2008 base period, 2012 net electricity imports into the nine-state RGGI region increased by 15.1 million MWh, or 26.9 percent. CO₂ emissions related to these net electricity imports decreased by 1.1 million short tons of CO₂, or 4.5 percent, during this period, indicating a decrease in the average CO₂ emission rate of the electric generation supplying these imports of 227 lb CO₂/MWh, a reduction of 25.1 percent.

VII. Discussion

In the context of the multiple market factors outlined below that influence dispatch of electric generation, CO₂ allowance costs in 2009 through 2012, the first four years of RGGI operation, were relatively modest compared to other electric generation cost components that impact wholesale electricity prices. This modest carbon price signal is consistent with monitoring data in this report that indicate a modest net increase in CO₂ emissions for non-RGGI electric generation in the annual average of 2010 to 2012 compared to the annual average during 2006 to 2008.

Across the three ISOs subject to RGGI, CO₂ allowance costs accounted for 0.2 percent to 2.2 percent of the average all-in wholesale electricity price in 2012.²⁴ Wholesale prices fell steadily between 2010 and 2012. While CO₂ allowance costs represented a modest component of wholesale electricity prices, wholesale prices dropped significantly from 2008 to 2009 in each of the three ISOs subject to RGGI. The wholesale electricity price reduction was primarily due to a reduction in natural gas prices and a reduction in electricity demand. Higher fuel prices in 2010, coupled with increased economic activity and hot weather led to an increase in wholesale prices in 2010 relative to 2009. Average electricity prices decreased in 2011 relative to 2010, primarily due to a decrease in natural gas prices and mild winter temperatures in late 2011.²⁵ This decline in electricity prices continued through 2012 as the price of natural gas continued to fall and temperatures remained mild through the winter.

A number of market drivers have changed dramatically during the 2005 through 2012 monitoring timeframe. This includes changes in relative fossil fuel prices (prices for natural gas, coal, and oil), electricity demand, and the

²⁴ For 2012, the average all-in wholesale electricity price was \$48.55/MWh for PJM, \$42.93/MWh for ISO-NE, and \$45.28/MWh for NYISO (energy only) (See ISO-NE Selectable Wholesale Load Cost Data; NYISO, *Power Trends 2013*, p. 18; Monitoring Analytics, *2012 State of the Market Report for PJM*, Section 1, Introduction, p. 15). The CO₂ allowance component is based on a 2012 average CO₂ allowance spot price of \$1.93 per CO₂ allowance (See Potomac Economics, *Annual Report on the Market for RGGI CO₂ Allowances: 2010* p. 14). For PJM, the CO₂ allowance component of the Locational Marginal Price (LMP) for 2012 was \$0.09 per MWh (See Monitoring Analytics, *2012 State of the Market Report for PJM*, Section 2, Energy Market, Part 1, p. 79). ISO-NE and NYISO do not report the CO₂ allowance component of wholesale electricity prices. Both the New England and New York analyses used a 2012 average CO₂ allowance spot price of \$1.93 as a starting point for deriving a CO₂ allowance wholesale price component. The ISO-NE CO₂ allowance wholesale price component was calculated by assuming an aggregate oil/natural gas unit is the marginal unit, with a CO₂ emission rate of 0.450 short tons of CO₂ per MWh (see *2012 New England Electric Generator Air Emissions Report, January 2014, Table 1-2*). The NYISO CO₂ allowance wholesale price component was calculated by assuming that a natural gas plant is the marginal unit, with a 2010 fleet average heat rate of 8731 Btu per kWh and a CO₂ emission rate of 117 pounds per MMBtu. For both ISO-NE and NYISO, the CO₂ emission rate of the assumed marginal unit was used to translate the annual average spot price for CO₂ allowances (\$1.93) into a dollar per MWh value. For ISO-NE, this resulted in an average CO₂ allowance wholesale price component of approximately \$0.87 per MWh. For NYISO, this resulted in an initial average CO₂ allowance wholesale price component of \$0.99 per MWh. Since ISO-NE imports from Canada are not subject to RGGI and associated with a wholesale CO₂ allowance price component, the ISO-NE initial \$0.87 per MWh wholesale CO₂ allowance price component is reduced to \$0.78 to account for the electricity imported from these areas, about 10.6% of the load. Since Canada and Pennsylvania are not RGGI participating jurisdictions, electricity imported into NYISO from these areas is not assumed to be associated with a CO₂ allowance wholesale price component in NYISO. Therefore, the initial \$0.99 per MWh CO₂ allowance wholesale price component for NYISO was reduced to \$0.67 to account for the amount of marginal electricity imported from these areas.

²⁵ See, for example, Monitoring Analytics, *2011 State of the Market Report for PJM*, Section 1, Introduction; Potomac Economics, *2011 State of the Market Report New York ISO*, pp. ii-iv; ISO New England Internal Market Monitor, *2011 Annual Markets Report*, May 2011, pp. 1-2.

availability of different types of electric generation capacity with differing CO₂ emissions profiles. An analysis of these changes, and their estimated impact on CO₂ emissions in the 10-state RGGI region from 2005 to 2009, was completed by the New York State Energy Research and Development Authority (NYSERDA).²⁶

The dynamics of a competitive wholesale electricity market could drive emissions leakage if they provide a sufficient net financial incentive to shift electric generation to units not subject to CO₂ regulation. The extent of this impact is likely to depend, at least in part, on the market value of CO₂ allowances (and the related \$/MWh CO₂ costs incorporated into bids by generators subject to the RGGI CO₂ Budget Trading Program) in relation to other economic factors associated with the generation and delivery of electricity. These factors include locational marginal pricing (LMP), which includes both transmission congestion charges and line loss costs, standard transmission pricing, relative fuel prices, natural gas supply and costs which can be influenced by pipeline constraints, and relative heat rates of generation units.²⁷ Reliability constraints also play a role in determining the dispatch of electric generation units to the extent that units supply needed generation capacity and ancillary services in a specified region or location on the electricity grid.

A key factor impacting the potential for emissions leakage is the relative cost of electric generation inside and outside the RGGI region (both with and without the incorporation of CO₂ allowance costs), and the relationship of this cost differential with physical transmission capability, the all-in market costs of inter-region power transmission, and the market impacts of transferring significant incremental amounts of power into the RGGI region. The dynamic and highly specific nature of market factors and physical constraints that may cause or mitigate emissions leakage make both a retrospective analysis and future projections of emissions leakage difficult. The factors that may result in emissions leakage are likely to be both temporally and geographically specific, given the dynamic operation of the electric power system.

Locational marginal pricing (LMP) can be expected to affect the market response to the imposition of a CO₂ allowance cost adder to generation in the RGGI region. LMP is based on the principle that the generation of power has different values at different points in the electric power network. LMP is the cost of supplying the last MWh of generation dispatched at a specific location, which reflects transmission constraints and the marginal cost of generation units. Market participants utilize finite transmission resources, and transfers of power in a region can impact the local generation economics in that area, due to the physics of the electric transmission network. Transmission “congestion” occurs when available, low-cost electric generation supply cannot be delivered to the

²⁶ New York State Energy Research and Development Authority (NYSERDA), Relative Effects of Various Factors on RGGI Electricity Sector CO₂ Emissions: 2009 Compared to 2005, November 2010; available at http://www.rggi.org/docs/Retrospective_Analysis_Draft_White_Paper.pdf.

²⁷ Heat rate is a measure of electric generator energy efficiency, represented as Btu of fuel input per kWh of electricity output.

demand location due to transmission network limitations. When electricity from the least-cost electric generation source in a region cannot be delivered to electricity load in a transmission-constrained area, higher cost units in this constrained area are dispatched to meet that load. The result is that the wholesale price of electricity in the constrained area is higher than in the unconstrained area due to a combination of electricity demand, transmission limitations, and the marginal cost of local generation.

If the cost of RGGI CO₂ compliance on a per MWh basis is lower than the aggregate per MWh price signal of mitigating market factors, which are discussed below, no net market dynamic driving emissions leakage would be expected to occur. This net market signal would be a function of the relationship between the generation cost differential due to RGGI CO₂ compliance and the all-in market cost of transferring incremental power into the RGGI region or shifting generation to other unregulated smaller fossil fuel-fired generation sources within the RGGI region. Market factors that may impact the economics of importing incremental power in response to a CO₂ allowance price signal include²⁸:

- *Existing Generator Economics* – Including a CO₂ compliance cost into the generation costs of an individual electric generator may make that generator uneconomic relative to a competitor. However, whether this occurs depends on the operating costs of each electric generator, both with and without CO₂ compliance costs. Key factors that influence electric generator operating costs include fuel prices, generator heat rate (Btu of fuel input per kWh of electric generation output), and allowance costs for air pollutants (nitrogen oxides (NO_x), sulfur dioxide (SO₂), and CO₂). As a result, inclusion of a CO₂ allowance cost must be sufficient to supplant any preexisting generator cost differentials in order to shift generation from a RGGI source to a non-RGGI source.
- *Existing Locational Generation Price Differentials* – Differential LMPs between regions represent the presence of transmission constraints and line losses that require the dispatch of higher priced electric generation in a certain region. Electricity demand, in particular, can have a large impact on LMPs in a specific region. For example, in 2012 the real-time average LMP by jurisdiction in DE and MD was \$2.46 per MWh above the average PJM LMP, indicating the presence of existing transmission congestion and line losses.²⁹
- *Congestion Charges* – Congestion charges and the standard cost of transmitting electricity may make significant incremental imports into the

²⁸ Some of these factors may also impact the economics of shifting dispatch to smaller in-region fossil fuel-fired electric generation in the nine-state RGGI region that is not subject to regulation of CO₂.

²⁹ Monitoring Analytics, *2012 State of the Market for PJM, 2012*; Section 2, Energy Market pp. 77 and Appendix C pp. 77.

RGGI region uneconomic as a response to a modest generation price differential resulting from RGGI CO₂ allowance costs. As an example, in PJM, power transmission is subject to congestion charges, which are based on the difference between LMPs at the source (generator location, or “generator bus”) and LMPs at the sink (electric distribution utility location, or “load serving entity (LSE) bus”). Thus, in addition to standard transmission charges, entities importing power into the RGGI region would need to pay congestion charges based on the differential between LMPs in the uncapped non-RGGI region where the generator is located and LMPs in the capped RGGI region where the electricity is delivered.³⁰

- *Line loss charges* – The greater the distance that electricity is transmitted, and as more power is transmitted through a power line, the greater the loss of the power initially put into the line, based on the physics of the electricity transmission network. As a result, the costs of transmission line-losses impact the economics of importing power. For example, in PJM line losses are accounted for in the calculation of LMP through the application of a line loss “penalty factor.” If the dispatch of an electric generator would result in an increase in system line losses in a certain location, a positive penalty factor is applied to the generator’s bid into the wholesale market, making the unit look less economically attractive to dispatch.³¹
- *Long-Term Contracts* – Other factors, such as existing long-term power purchase agreements, can be expected to mitigate emissions leakage.

VIII. Conclusions

This report presents data and trends for electricity generation, imports and related CO₂ emissions without assigning causality to any one of the factors influencing observed trends in electricity generation and related CO₂ emissions among different categories of electric generation serving load in the 9-state RGGI region. The results demonstrate that there has been no significant change in CO₂ emissions or CO₂ emission rate (lb CO₂/MWh) from non-RGGI electric generation serving load in the nine-state RGGI region during the years of RGGI program operation, 2010 to 2012. If emissions leakage were to occur, it would manifest through an increase in CO₂ emissions from this aggregate category of non-RGGI electric generation, assuming all other factors that impact electric generator dispatch and CO₂ emissions, such as electricity demand, relative fossil fuel prices, and wholesale electricity prices, did not change.

³⁰ As an example, the congestion component of the 2012 average day-ahead, load weighted LMP in the Delmarva Power & Light zone (Delaware and Maryland) zone of PJM was \$1.64 per MWh. For the Baltimore Gas & Electric zone (Maryland), the congestion component was \$2.69 per MWh. See, Monitoring Analytics, 2012 *State of the Market for PJM*, 2012; Appendix G, Table G-2, p. 422.

³¹ As an example, the line loss component of the 2012 average day-ahead, load weighted LMP in the Delmarva Power & Light (Delaware and Maryland) zone of PJM was \$1.45 per MWh. Similarly, for the Baltimore Gas & Electric zone (Maryland), the line loss component of LMP was \$1.47 per MWh. See, Monitoring Analytics, 2012 *State of the Market for PJM*, 2012; Appendix G, Table G-2, p. 422.

Given that the monitoring results presented in this report do not address causality, the results should be evaluated in context with market dynamics. The monitoring data for 2010 through 2012, which show no increase from the base period of 2006 to 2008 in CO₂ emissions from non-RGGI electric generation serving electricity load in the nine-state RGGI region, are consistent with expectations, given the relatively modest CO₂ allowance prices evident in 2009 through 2012. The average CO₂ allowance price in 2010 through 2012 represented approximately 2.2 percent or less of the average wholesale electricity price in the three ISOs fully or partially subject to RGGI. The monitoring results are consistent with market dynamics given the modest CO₂ allowance prices that result in CO₂ compliance costs on a per MWh basis. The RGGI allowances prices are likely lower than the aggregate per MWh price signal of mitigating market factors discussed in this report that would counter emissions leakage. Considering these factors, with modest CO₂ allowance prices, no net market dynamic driving emissions leakage would be expected to occur.

This report is the fourth in a series of annual monitoring reports, as called for in the 2005 RGGI MOU. This continued monitoring is warranted because both electricity market drivers and non-market drivers that impact CO₂ emissions have shifted dramatically from year to year during the 2005 to 2012 time period evaluated in this report. Ongoing monitoring will further evaluate changes in market and non-market drivers that impact CO₂ emissions related to electricity generation and imports in the RGGI region.

Appendix A. 9-state ISO Monitoring Sources

Table 2. Summary of Data Sources for ISO-NE

Code	Monitoring Category Associated with Data Elements at Right	MWh	CO ₂ lb/MWh	CO ₂ Tons
Electricity Demand (Annual)				
A-1	Total Electricity Use in ISO-NE	ISO-NE ¹	CO ₂ tons divided by MWh	Sum of A-3 and B-5
A-2	Net Electricity Imports - from New York	ISO-NE ¹	B-5	MWh multiplied by CO ₂ /MWh
A-2	Net Electricity Imports - from Quebec	ISO-NE ¹	Environment Canada ³	MWh multiplied by CO ₂ /MWh
A-2	Net Electricity Imports - from New Brunswick	ISO-NE ¹	Environment Canada ³	MWh multiplied by CO ₂ /MWh
A-3	Total Net Electricity Imports - from All Adjoining ISOs	ISO-NE ¹	CO ₂ tons divided by MWh	Sum of A-2s
Electricity Generation (Annual)				
B-1	RGGI-Affected Units	NEPOOL-GIS ²	CO ₂ tons divided by MWh	State reported data for 2005-2008; RGGI COATS for 2009 to 2012. ⁴ Includes only sources subject to a state CO ₂ Budget Trading Program CO ₂ allowance compliance obligation. Does not include biomass-derived CO ₂ emissions.
B-2	Non-RGGI Units (Fossil Fuel-Fired; <25MW)	NEPOOL-GIS ²	CO ₂ tons divided by MWh	NEPOOL-GIS ²
B-3	Non-RGGI Units (Non-Fossil Fuel-Fired)	NEPOOL-GIS ²	CO ₂ tons divided by MWh	NEPOOL-GIS ²
B-4	All Non-RGGI Units (Fossil and Non-Fossil)	Sum of B-2 and B-3	CO ₂ tons divided by MWh	Sum of B-2 and B-3
B-5	All Units	ISO-NE ¹	CO ₂ tons divided by MWh	Sum of B-1 and B-4

Table Notes:

- ISO-NE, Historical Data Reports, "Net Energy and Peak Load by Source" (Annual Summary). Available at <http://www.iso-ne.com/markets/hstdata/rpts/net_eng_peak_load_src/index.html>.
- NEPOOL Generation Information System. Available at <<http://www.nepoolgis.com>>.
- Environment Canada, *National Inventory Report 1990–2011: Greenhouse Gas Sources and Sinks in Canada*, Environment Canada, April 15, 2013. In Part 3, see Table A13-5 "Electricity Generation and GHG Emission Details for New Brunswick"; Table A13-6 "Electricity Generation and GHG Emission Details for Quebec". Available at <http://unfccc.int/national_reports/annex_i_ghg_inventories/national_inventories_submissions/items/7383.php>. Note that New Brunswick emission factors for every year and Quebec emission factors for 2010 and 2011 were updated, as compared to the previous year's report.
- Historical 2005 – 2008 CO₂ emissions data reported by RGGI participating states compiled from CO₂ emissions data reported to U.S. EPA pursuant 40 CFR Part 75 and from CO₂ emissions and fuel use data reported to state emissions statement programs. Historical 2005 – 2008 CO₂ emissions data is available at <http://www.rggi.org/historical_emissions>. 2009 through 2012 CO₂ emissions data is from data reported to the RGGI CO₂ Allowance Tracking System (RGGI COATS), available at <<http://www.rggi-coats.org>>.

Table 3. Summary of Data Sources for NYISO

Code	Monitoring Category Associated with Data Elements at Right	MWh	CO ₂ lb/MWh	CO ₂ Tons
Electricity Demand (Annual)				
A-1	Total Electricity Use in NYISO	Sum of A-3 and B-5	CO ₂ tons divided by MWh	Sum of A-3 and B-5
A-2	Net Electricity Imports - from Hydro Quebec	Hydro Quebec ¹	Environment Canada ⁶	MWh multiplied by CO ₂ /MWh
A-2	Net Electricity Imports - from ISO-NE	ISO-NE ²	ISO-NE system average ⁷	MWh multiplied by CO ₂ /MWh
A-2	Net Electricity Imports - from Ontario	Ontario Independent Electricity System Operator ³	Environment Canada ⁶	MWh multiplied by CO ₂ /MWh
A-2	Net Electricity Imports - from PJM	PJM Annual State of the Market Report ⁴	PJM GATS ⁸	MWh multiplied by CO ₂ /MWh
A-3	Total Net Electricity Imports - from All Adjoining ISOs	Sum of A-2s	CO ₂ tons divided by MWh	Sum of A-2s
Electricity Generation (Annual)				
B-1	RGGI-Affected Units	NYDPS Calculation ⁵	CO ₂ tons divided by MWh	State reported data for 2005-2008; RGGI COATS for 2009 to 2012 ⁹ Includes only sources subject to a state CO ₂ Budget Trading Program CO ₂ allowance compliance obligation.
B-2	Non-RGGI Units (Fossil Fuel-Fired; < 25 MW)	NYDPS Calculation ⁵	CO ₂ tons divided by MWh	NYSDEC Emissions ^{Report 10, 11}
B-3	Non-RGGI Units (Non-Fossil Fuel-Fired)	NYDPS Calculation ⁵	CO ₂ tons divided by MWh	NYSDEC Emissions Report ¹¹
B-4	All Non-RGGI Units (Fossil and Non-Fossil)	Sum of B-2 and B-3	CO ₂ tons divided by MWh	Sum of B-2 and B-3
B-5	All Units	Sum of B-1 and B-4	CO ₂ tons divided by MWh	Sum of B-1 and B-4

Table Notes:

- Hydro Quebec response to information request.
- ISO-NE, Historical Data Reports, "Net Energy and Peak Load by Source" (Annual Summary). Available at <http://www.iso-ne.com/markets/hstdata/rpts/net_eng_peak_load_src/index.html>.
- Ontario IESO response to information request.

4. Monitoring Analytics, *State of the Market for PJM* (2005 through 2012 reports).
5. NYDPS calculation based on MWh for each generator reported by NYISO and assignment of each generator to appropriate monitoring classification.
6. Environment Canada, *National Inventory Report 1990–2011: Greenhouse Gas Sources and Sinks in Canada*, Environment Canada, April 15, 2013. In Part 3, see Table A13-6 “Electricity Generation and GHG Emission Details for Quebec”; Table A13-7 “Electricity Generation and GHG Emission Details for Ontario”. Available at <http://unfccc.int/national_reports/annex_i_ghg_inventories/national_inventories_submissions/items/7383.php> Note that Ontario emission factors for and Quebec emission factors 2010 and 2011 were updated, as compared to the previous year’s report.
7. Calculated average, based on Row B-5 in Table 2 above.
8. PJM Generation Attribute Tracking System, accessible at <http://www.pjm-eis.com>.
9. Historical 2005 – 2008 CO₂ emissions data reported by RGGI participating states compiled from CO₂ emissions data reported to U.S. EPA pursuant 40 CFR Part 75 and from CO₂ emissions and fuel use data reported to state emissions statement programs. Historical 2005 – 2008 CO₂ emissions data is available at <http://www.rggi.org/historical_emissions>. 2009 through 2012 CO₂ emissions data is from data reported to the RGGI CO₂ Allowance Tracking System (RGGI COATS), available at <<http://www.rggi-coats.org>>.
10. MWh and CO₂ emissions data include Linden Cogeneration, units 005001 – 009001, and for 2012 only Bayonne Energy Center, units CTG1 – CTG8, as these units are physically located in New Jersey, but dispatch electricity into NYISO.
11. NYDPS calculation based on NYSDEC emissions data and other state data.

Table 4. Summary of Data Sources for RGGI PJM

Code	Monitoring Category Associated with Data Elements at Right	MWh	CO ₂ lb/MWh	CO ₂ Tons
	Electricity Demand (Annual)			
A-1	Total Electricity Use in RGGI PJM	Sum of A-3 and B-5	CO ₂ tons divided by MWh	Sum of A-3 and B-5
A-2	Net Electricity Imports - from Non-RGGI PJM	PJM GATS ¹	PJM GATS ¹	MWh multiplied by CO ₂ /MWh
A-2	Net Electricity Imports - from NYISO	PJM Annual State of the Market Report ²	B-5	MWh multiplied by CO ₂ /MWh
A-3	Total Net Electricity Imports - from All Adjoining ISOs	Sum of A-2s	CO ₂ tons divided by MWh	Sum of A-2s
	Electricity Generation (Annual)			
B-1	RGGI-Affected Units	PJM GATS ¹	CO ₂ tons divided by MWh	State reported data for 2005-2008; RGGI COATS for 2009 through 2012. Includes only sources subject to a state CO ₂ Budget Trading Program CO ₂ allowance compliance obligation; does not include Maryland LIESA sources; does not include Linden Cogeneration units 005001-009001. ^{3,4}
B-2	Non-RGGI Units (Fossil Fuel-Fired; < 25 MW)	PJM GATS ¹	CO ₂ tons divided by MWh	PJM GATS ¹
B-3	Non-RGGI Units (Non-Fossil Fuel-Fired)	PJM GATS ¹	CO ₂ tons divided by MWh	PJM GATS ¹
B-4	All Non-RGGI Units (Fossil and Non-Fossil)	Sum of B-2 and B-3	CO ₂ tons divided by MWh	Sum of B-2 and B-3
B-5	All Units	Sum of B-1 and B-4	CO ₂ tons divided by MWh	Sum of B-1 and B-4

Table Notes:

1. PJM Generation Attribute Tracking System, accessible at <<http://www.pjm-eis.com>>.
2. Monitoring Analytics, *State of the Market for PJM* (2005 through 2011 reports) at http://www.monitoringanalytics.com/reports/PJM_State_of_the_Market/2012.shtml.
3. Historical 2005 – 2008 CO₂ emissions data reported by RGGI participating states compiled from CO₂ emissions data reported to U.S. EPA pursuant 40 CFR Part 75 and from CO₂ emissions and fuel use data reported to state emissions statement programs. Historical 2005 – 2008 CO₂ emissions data is available at <http://www.rggi.org/historical_emissions>. 2009 through 2012 CO₂ emissions data is from data reported to the RGGI CO₂ Allowance Tracking System (RGGI COATS), available at <<http://www.rggi-coats.org>>.
4. MWh and CO₂ emissions data do not include Maryland Limited Industrial Exemption Set-aside (LIESA) sources. LIESA sources for 2009, 2010, 2011, and 2012 include Severstal Sparrows Point LLC and Luke Paper Company. LIESA sources refer to certain industrial cogenerators under Maryland’s CO₂ Budget Trading Program regulations that are subject to alternative CO₂ compliance obligations under certain conditions in lieu of submission of CO₂ allowances.

Appendix B. ISO-Specific Monitoring Results

Detailed monitoring results for ISO-NE, NYISO, and the RGGI portion of PJM are presented below.³²

ISO-NE

Monitoring results for ISO-NE for 2005 through 2012 are summarized below in Table 5 and Figures 8 through 12.

Table 5. 2005 – 2011 Monitoring Summary for ISO-NE

	MWh							Tons CO ₂							Lb CO ₂ /MWh									
	2005	2006	2007	2008	2009	2010	2011	2012	2005	2006	2007	2008	2009	2010	2011	2012	2005	2006	2007	2008	2009	2010	2011	2012
Electricity Demand																								
Total in ISO	138,174,000	134,243,000	136,869,000	134,000,000	128,801,000	131,956,000	130,752,000	129,590,000	64,207,040	58,342,696	58,439,751	53,249,752	48,230,332	51,118,586	46,547,135	43,187,793	929	869	854	795	749	712	712	667
Net Imports - from NY ISO	-115,000	-877,000	-2,477,000	-1,529,000	-3,031,000	-4,412,000	-2,262,000	-1,073,000	-55,282	-398,599	-1,118,781	-651,589	-1,229,274	-1,833,018	-881,419	-396,832	961	909	903	852	811	831	779	740
Net Imports - from Quebec	4,792,000	6,023,000	7,727,000	9,495,000	10,826,000	9,214,000	11,558,000	13,077,000	21,129	33,196	76,658	20,933	35,801	20,313	20,894	23,640	9	11	20	4	7	4	4	4
Net Imports - from New Brunswick	1,620,000	1,047,000	896,000	1,285,000	1,569,000	737,000	846,000	643,000	846,443	508,967	438,526	718,150	984,101	410,264	410,324	311,866	1,045	972	979	1,118	1,254	1,113	970	970
Total Net Imports - from All Adjoining ISOs	6,297,000	6,193,000	6,146,000	9,251,000	9,363,000	5,539,000	10,142,000	12,648,000	812,290	143,564	-603,597	87,494	-209,372	-1,402,441	-450,200	-61,325	258	46	-196	19	-45	-506	-89	-10
Electricity Generation																								0
RGGI-Affected Units	77,439,814	70,911,131	75,345,502	70,591,734	65,426,926	71,314,622	69,466,788	62,481,082	54,223,939	47,783,423	49,434,978	44,508,400	38,815,561	41,682,538	35,469,318	31,357,869	1,400	1,348	1,312	1,261	1,187	1,169	1,021	1,004
Non-RGGI Fossil Fuel-Fired Units <25MW	94,304	75,137	64,598	152,110	627,311	908,731	1,139,223	1,408,663	37,197	42,415	47,105	98,880	374,282	875,835	1,030,383	1,133,530	789	1,129	1,458	1,300	1,193	1,928	1,809	1,609
Non-RGGI Fossil Fuel-Fired Units >=25MW	5,953,312	5,212,883	4,419,405	2,484,119	2,095,712	2,195,189	2,206,681	5,082,341	4,054,743	3,565,819	2,744,219	1,734,332	1,810,538	2,406,571	2,516,545	3,104,311	1,362	1,368	1,242	1,396	1,728	2,193	2,281	1,222
Non-Fossil Fuel-Fired Units	48,520,847	52,086,895	51,110,222	51,372,277	51,746,869	52,787,874	49,338,878	50,615,683	5,078,871	6,807,476	6,817,046	6,820,646	7,439,324	7,556,082	7,981,091	7,653,408	209	261	267	266	288	286	324	302
All Non-RGGI Units	54,568,463	57,374,915	55,594,225	54,008,506	54,469,892	55,891,794	52,684,782	57,106,687	9,170,811	10,415,709	9,608,370	8,653,859	9,624,143	10,838,488	11,528,018	11,891,249	336	363	346	320	353	388	438	416
All Units	131,877,000	128,050,000	130,723,000	124,749,000	119,437,000	126,416,000	120,610,000	116,942,000	63,394,750	58,199,133	59,043,348	53,162,258	48,439,704	52,521,026	46,997,336	43,249,118	961	909	903	852	811	831	779	740
Summary Data	6,047,616	5,288,020	4,484,003	2,636,229	2,723,023	3,103,920	3,345,904	6,491,004	4,091,940	3,608,234	2,791,324	1,833,213	2,184,820	3,282,406	3,546,928	4,237,841	1,353	1,365	1,245	1,391	1,605	2,115	2,120	1,306
Non-RGGI Generation Serving Load in ISO (Non-RGGI Generation within ISO + Net Imports = (B-2 + B-3) + A-3)	60,865,463	63,567,915	61,740,225	63,259,506	63,832,892	61,430,794	62,826,782	69,754,687	9,983,101	10,559,273	9,004,773	8,741,353	9,414,771	9,436,047	11,077,818	11,829,924	328	332	292	276	295	307	353	339

³² The tons of CO₂ emitted and the lb of CO₂/MWh emission rates in this report do not represent total lifecycle reductions or contributions of greenhouse gases. Such analysis is outside the scope of this report.

The monitoring results indicate that when the 2010 to 2012 annual average is compared to the 2006 to 2008 base period annual average, total electric generation from all non-RGGI electric generation serving load in ISO-NE increased by 1.8 million MWh, an increase of 2.9 percent. When the 2006 to 2008 base period annual average is compared to the 2010 to 2012 annual average, CO₂ emissions from this category of electric generation increased by 1.3 million short tons of CO₂, an increase of 14.3 percent, and the CO₂ emission rate increased by 33 lb CO₂/MWh, an increase of 10.9 percent. (See Figures 8, 9, and 10.)

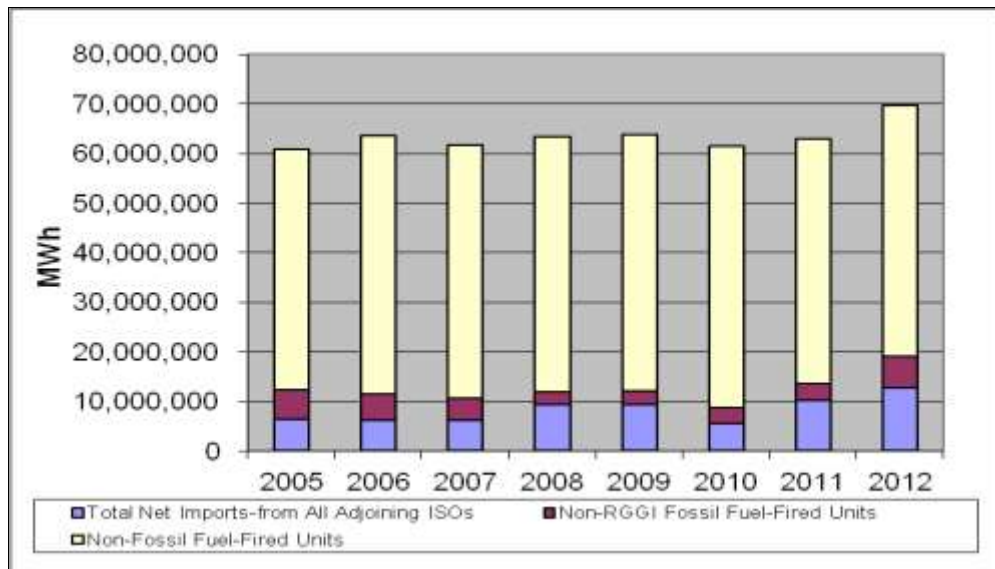


Figure 8. Non-RGGI Generation Serving Load in ISO-NE (MWh)

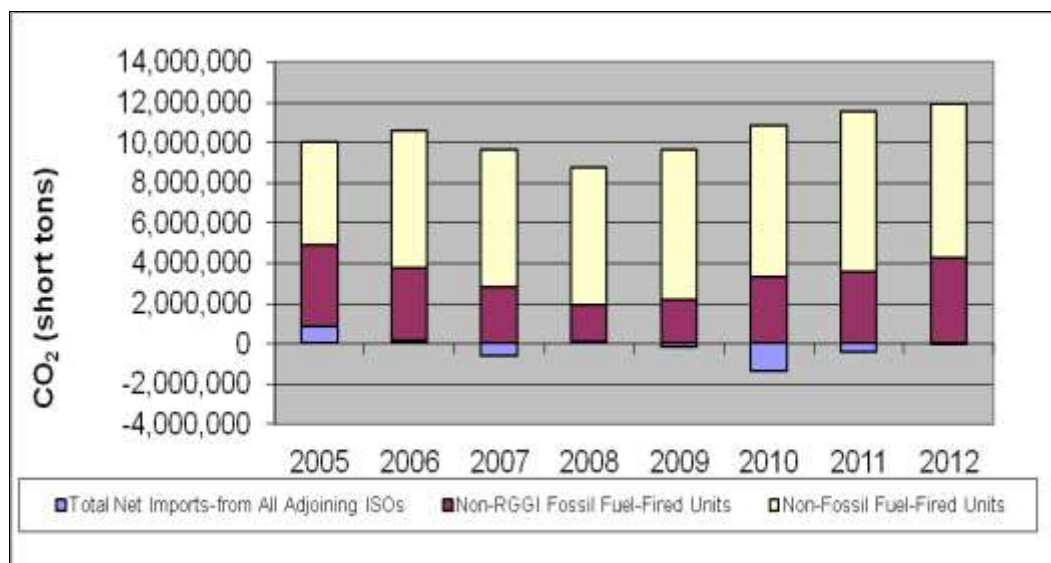


Figure 9. CO₂ Emissions from Non-RGGI Generation Serving Load in ISO-NE (short tons CO₂)

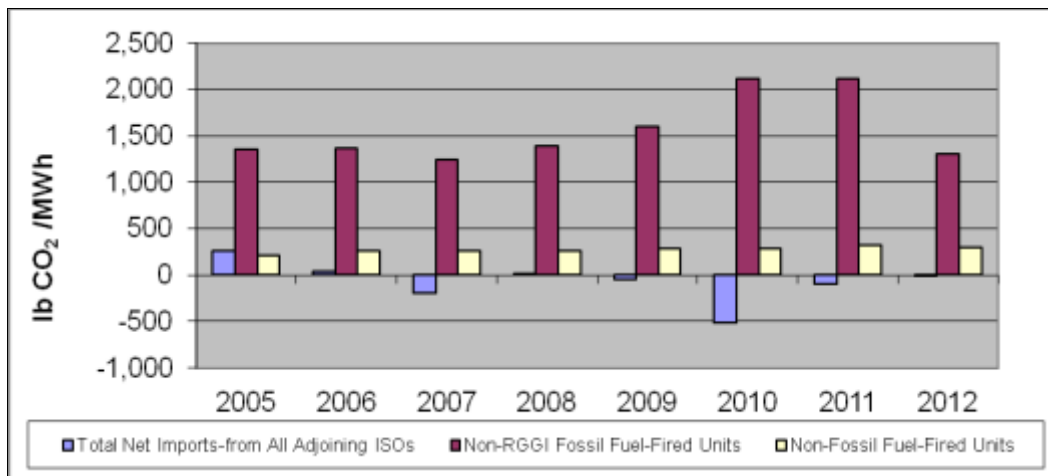


Figure 10. CO₂ Emission Rate for Non-RGGI Generation Serving Load in ISO-NE (lb CO₂/MWh)

The annual average electricity load in ISO-NE decreased by 4.3 million MWh, or 3.2 percent for 2010 to 2012 as compared to the annual average from the baseline period of 2006 to 2008. In total, electric generation (fossil and non-fossil) in ISO-NE decreased by 5.0 million MWh, or 3.9 percent, when comparing the 2006 to 2008 annual average to the 2010 to 2012 annual average.

Electric generation from RGGI-affected generation in ISO-NE decreased by 4.5 million MWh during this period, or 6.3 percent, and CO₂ emissions from RGGI-affected electric generation in ISO-NE decreased by 11.1 million short tons of CO₂, or 23.4 percent. The CO₂ emission rate of RGGI-affected electric generation decreased by 242 lb CO₂/MWh, a reduction of 18.5 percent. Electric generation from non-RGGI electric generation sources located in ISO-NE decreased by 431.5 thousand MWh, or 0.8 percent, during this period, and CO₂ emissions from this category of electric generation increased by 1.9 million short tons of CO₂, an increase of 19.5 percent. The CO₂ emission rate of non-RGGI electric generation located in ISO-NE increased by 71 lb CO₂/MWh, an increase of 20.7 percent.

Net electricity imports into ISO-NE increased by 2.2 million MWh, or 31.2 percent, when comparing the base period annual average from 2006 to 2008 to the annual average from 2010 to 2012. CO₂ emissions related to these net electricity imports decreased by 513.8 thousand short tons of CO₂, or 413.8 percent, during this period.³³ The CO₂ emission rate of the electric generation

³³ ISO-NE net exports to NYISO doubled from 2008 to 2009, and increased again in 2010. Negative values for MWh and CO₂ tons indicate that more MWh were exported than imported. As a result, the increase in net exports to NYISO in 2009 and 2010 increased the amount of CO₂ emissions debited from the ISO-NE net import total, resulting in a negative CO₂ emissions value for total CO₂ emissions related to total net electricity imports in 2009 and 2010 for ISO-NE. In 2012, the effect continues with a negative value for CO₂ emissions reflecting exports to New York. In 2008, CO₂ emissions related

supplying these imports decreased by 157.9 thousand lb CO₂/MWh, a decrease of 361.2 percent.

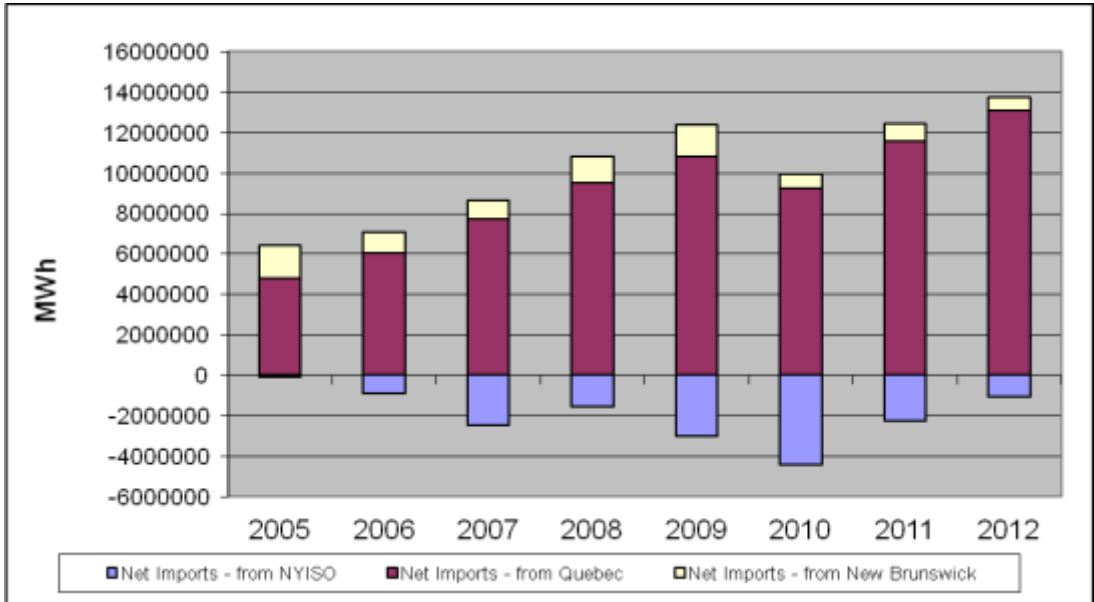


Figure 11. Net Electricity Imports to ISO-NE (MWh)

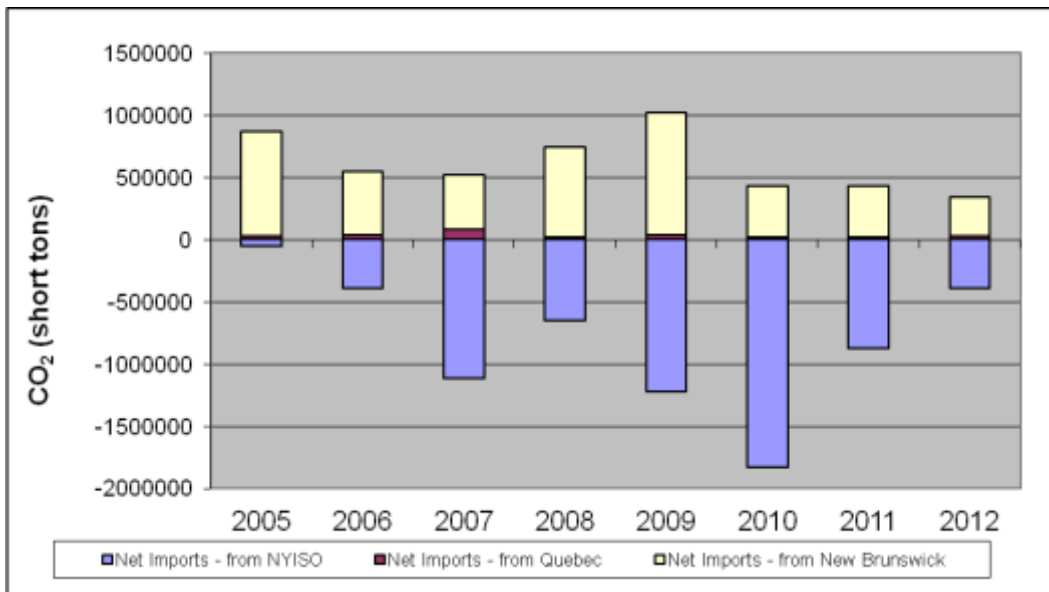


Figure 12. CO₂ Emissions Related to Net Electricity Imports to ISO-NE (short tons CO₂)

to net imports of electricity to ISO-NE were 651,589 short tons of CO₂; in 2009, 2010, 2011, and 2012 CO₂ emissions related to net imports of electricity to ISO-NE were -1,229,274, -1,833,018, 881,419, and 396,832 short tons of CO₂, respectively, representing the assignment of an increased amount of CO₂ emissions to NYISO for tracking purposes.

Compared to the annual average during a multi-year base period of 2006 to 2008, electric generation in 2012 from all non-RGGI electric generation sources serving load in ISO-NE increased by 6.9 million MWh, an increase of 11.0 percent. Compared to the 2006 to 2008 annual average, 2012 CO₂ emissions from this category of electric generation increased by 2.4 million short tons of CO₂, an increase of 25.4 percent, and the CO₂ emission rate increased by 39 lb CO₂/MWh, an increase of 13.0 percent.

Compared to the annual average during a multi-year 2006 to 2008 base period, 2012 total electricity load in ISO-NE decreased by 5.4 million MWh, or 4.0 percent. Compared to the 2006 to 2008 annual average, 2012 total electric generation in ISO-NE decreased by 8.4 million MWh, or 6.5 percent.

Compared to the annual average during a multi-year 2006 to 2008 base period, 2012 electric generation from RGGI-affected generation in ISO-NE decreased by 9.8 million MWh, or 13.6 percent, and CO₂ emissions from RGGI-affected generation in ISO-NE decreased by 15.9 million short tons of CO₂, or 33.6 percent. The CO₂ emission rate of RGGI-affected electric generation decreased by 303 lb CO₂/MWh, a reduction of 23.2 percent. Compared to the 2006 to 2008 annual average, 2012 electric generation from non-RGGI generation located in ISO-NE increased by 1.4 million MWh, or 2.6 percent, and CO₂ emissions from this category of electric generation increased by 2.3 million short tons of CO₂, an increase of 24.4 percent. The CO₂ emission rate of non-RGGI electric generation located in ISO-NE increased by 73 lb CO₂/MWh, an increase of 21.4 percent.

Compared to the annual average during a multi-year 2006 to 2008 base period, 2012 net electricity imports into ISO-NE increased by 5.5 million MWh, or 75.7 percent. CO₂ emissions related to these net electricity imports declined by 62.9 thousand short tons of CO₂, or 50.6 percent during this period. The CO₂ emission rate of the electric generation supplying these imports declined by 34 lb CO₂/MWh, a reduction of 77.8 percent.

NYISO

Monitoring results for NYISO for 2005 through 2011 are summarized below in Table 6 and Figures 12 through 15.

Table 6. 2005 – 2011 Monitoring Summary for NYISO

	MWh								Tons CO2								Lb CO2/MWh							
	2005	2006	2007	2008	2009	2010	2011	2012	2005	2006	2007	2008	2009	2010	2011	2012	2005	2006	2007	2008	2009	2010	2011	2012
Electricity Demand																								
Total Annual Electricity Load in NYISO	164,783,642	166,654,413	169,932,177	168,646,767	160,565,962	164,282,144	163,818,485	163,689,994	74,759,661	69,804,817	71,574,903	63,039,863	48,467,068	55,481,277	48,343,654	44,873,627	907	838	842	748	604	675	590	548
Net Imports - from Quebec	2,583,317	2,959,749	4,185,292	5,646,014	6,239,805	4,335,209	7,123,204	9,235,689	11,390	16,313	41,521	12,447	20,635	9,557	12,877	16,696	9	11	20	4	7	4	4	4
Net Imports - from ISO-NE	115,000	877,000	2,477,000	1,529,000	3,031,000	4,412,000	2,262,000	1,073,000	55,282	398,599	1,118,781	651,589	1,229,274	1,833,018	881,419	396,832	961	909	903	852	811	831	779	740
Net Imports - from Ontario	1,898,020	3,672,282	2,637,442	6,162,902	6,463,657	3,872,635	3,318,681	5,749,461	460,286	769,120	610,529	1,154,884	712,496	554,950	475,569	823,900	485	419	463	375	220	287	287	287
Net Imports - from PJM	7,604,000	9,559,000	10,225,000	10,690,000	8,331,000	12,305,000	11,150,000	8,408,800	4,912,184	5,983,934	6,349,725	6,520,900	4,736,174	7,179,968	6,389,108	4,212,809	1,292	1,252	1,242	1,220	1,137	1,167	1,146	1,002
Total Net Electricity Imports	12,200,337	17,068,031	19,524,734	24,027,916	24,065,462	24,924,844	23,853,885	24,466,950	5,439,142	7,167,966	8,120,556	8,339,821	6,698,578	9,577,493	7,758,973	5,450,237	892	840	832	694	557	769	651	446
Electricity Generation																								
Annual Electric Generation - RGGI-Affected Units	67,835,907	66,864,341	71,336,352	64,620,511	56,246,945	62,527,452	59,098,130	61,313,672	62,718,683	53,638,129	55,717,151	48,348,177	37,861,408	42,113,171	37,137,382	35,417,901	1,849	1,604	1,562	1,496	1,346	1,347	1,257	1,155
Annual Electric Generation - Non-RGGI Fossil Fuel-Fired Units	7,029,219	7,322,844	6,648,463	4,618,782	3,750,738	3,686,768	3,252,477	3,736,023	5,933,822	6,319,357	5,430,598	2,676,684	1,931,753	1,944,024	1,683,269	2,008,494	1,688	1,726	1,634	1,159	1,030	1,055	1,035	1,075
Annual Electric Generation - Non-Fossil Fuel-Fired Units	77,718,179	75,399,197	72,422,628	75,379,558	76,502,817	73,143,080	77,613,993	74,173,349	668,014	2,679,365	2,306,598	3,675,181	1,975,329	1,846,589	1,764,030	1,996,995	17	71	64	98	52	50	45	54
Annual Electric Generation - All Non-RGGI Units	84,747,398	82,722,041	79,071,091	79,998,340	80,253,555	76,829,848	80,866,470	77,909,372	6,601,836	8,998,722	7,737,196	6,351,865	3,907,082	3,790,613	3,447,299	4,005,489	156	218	196	159	97	99	85	103
Total Annual Electric Generation - All Units	152,583,305	149,586,382	150,407,443	144,618,851	136,500,500	139,357,300	139,964,600	139,223,044	69,320,519	62,636,851	63,454,347	54,700,042	41,768,490	45,903,784	40,584,681	39,423,389	909	837	844	756	612	659	580	566
Summary CO₂ Emissions and MWh Data																								
Annual CO ₂ Emissions from Non-RGGI Generation Serving Load in ISO (Non-RGGI Generation within ISO + Net Imports)	96,947,735	99,790,072	98,595,825	104,026,256	104,319,017	101,754,692	104,720,355	102,376,322	12,040,978	16,166,688	15,857,752	14,691,686	10,605,660	13,368,106	11,206,272	9,455,726	248	324	322	282	203	263	214	185

The monitoring results indicate that the 2010 to 2012 annual average compared to the 2006 to 2008 base period annual average, total electric generation from all non-RGGI electric generation serving load in NYISO increased by 2.1 million MWh, an increase of 2.1 percent. From the 2006 to 2008 base period annual average to the 2010 to 2012 annual average, CO₂ emissions from this category of electric generation decreased by 4.2 million short tons of

CO₂, a decrease of 27.2 percent, and the CO₂ emission rate decreased by 88.5 lb CO₂/MWh, a decrease of 28.6 percent. (See Figures 12, 13, and 14.)

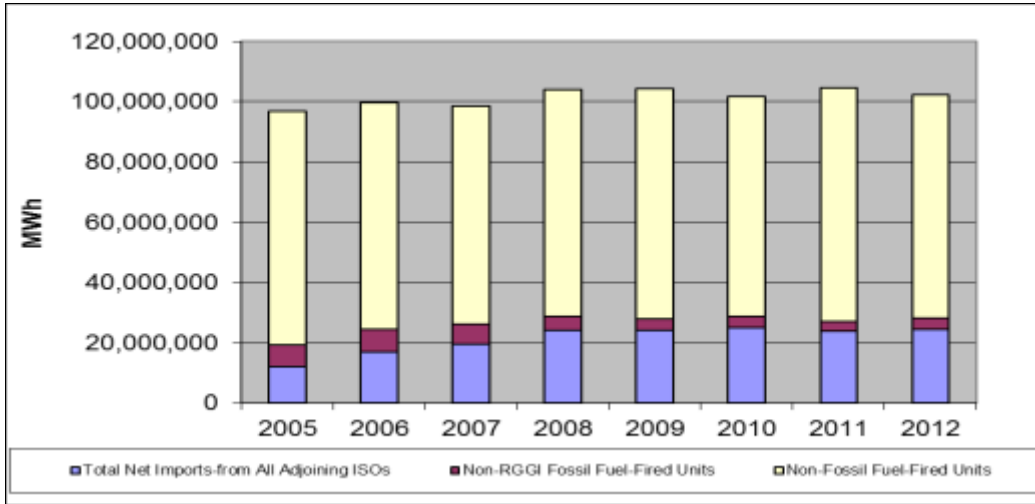


Figure 13. Non-RGGI Generation Serving Load in NYISO (MWh)

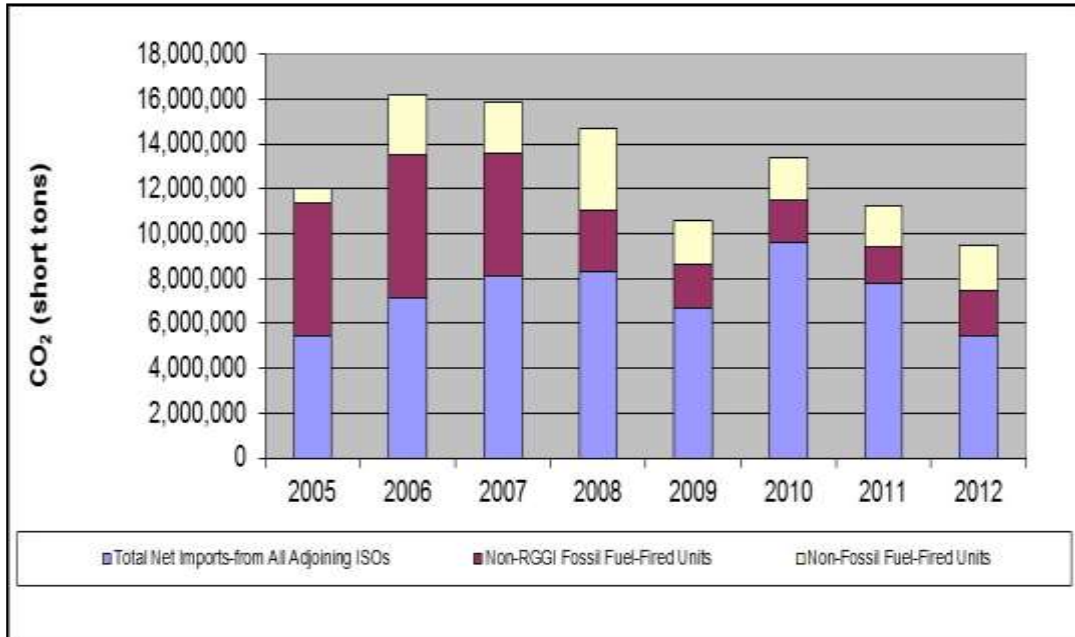


Figure 14. CO₂ Emissions from Non-RGGI Generation Serving Load in NYISO (short tons CO₂)

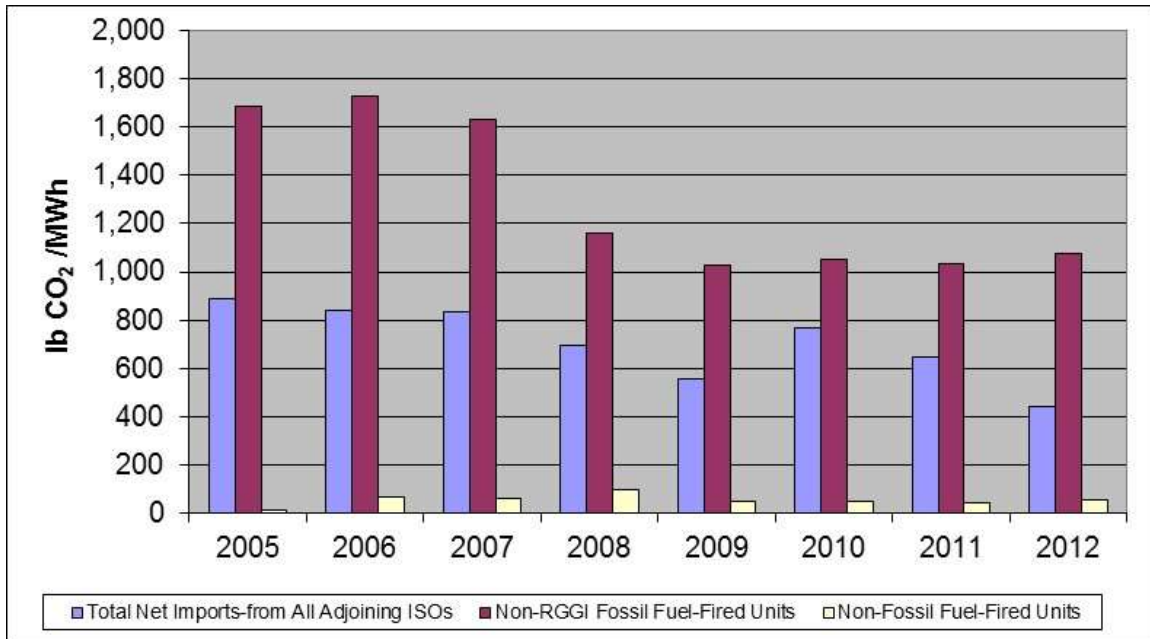


Figure 15. CO₂ Emission Rate for Non-RGGI Generation Serving Load in NYISO (lb CO₂/MWh)

The annual average electricity load in NYISO decreased by 4.5 million MWh, or 2.7 percent for 2010 to 2012 as compared to the annual average from the baseline period of 2006 to 2008. In total, electric generation (fossil and non-fossil) in NYISO decreased by 8.7 million MWh, or 5.9 percent, when comparing the 2006 to 2008 annual average to the 2010 to 2012 annual average.

Electric generation from RGGI-affected generation in NYISO decreased by 6.6 million MWh during this period, or 9.8 percent, and CO₂ emissions from RGGI-affected electric generation in NYISO decreased by 14.3 million short tons of CO₂, or 27.3 percent. The CO₂ emission rate of RGGI-affected electric generation decreased by 301 lb CO₂/MWh, a reduction of 19.4 percent. Electric generation from non-RGGI electric generation sources located in NYISO decreased by 2.1 million MWh, or 2.6 percent, during this period, and CO₂ emissions from this category of electric generation decreased by 3.9 million short tons of CO₂, a decrease of 51.3 percent. The CO₂ emission rate of non-RGGI electric generation located in NYISO decreased by 95 lb CO₂/MWh, a decrease of 49.9 percent.

Net electricity imports into NYISO increased by 4.2 million MWh, or 20.8 percent, when comparing the base period annual average from 2006 to 2008 to the annual average from 2010 to 2012. CO₂ emissions related to these net electricity imports decreased by 280.5 thousand short tons of CO₂, or 3.6 percent, during this period. The CO₂ emission rate of the electric generation supplying these imports decreased by 167.1 lb CO₂/MWh, a decrease of 21.2 percent. (See figures 16 and 17).

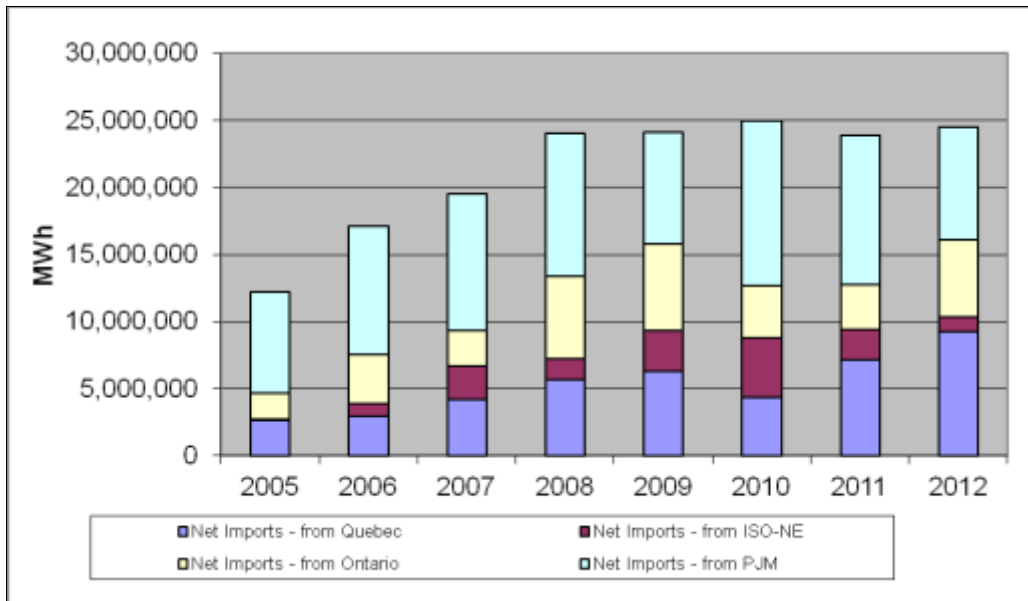


Figure 16. Net Electricity Imports to NYISO (MWh)

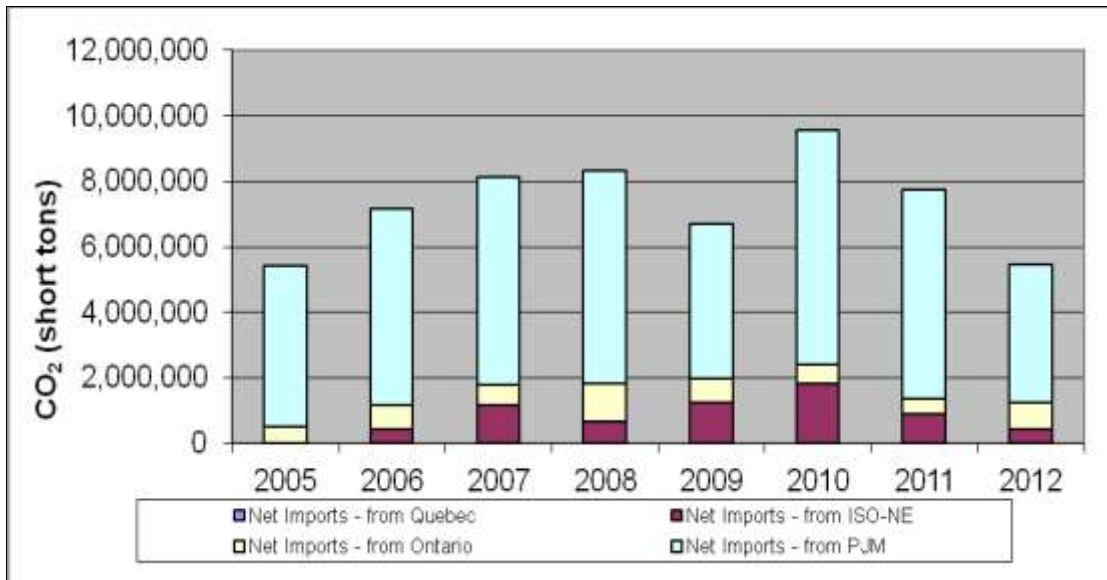


Figure 17. CO₂ Emissions Related to Net Electricity Imports to NYISO (short tons CO₂)

Compared to the annual average during a multi-year base period of 2006 to 2008, electric generation in 2012 from all non-RGGI electric generation sources serving load in NYISO increased by 1.6 million MWh, an increase of 1.6 percent. Compared to the 2006 to 2008 annual average, 2012 CO₂ emissions from this category of electric generation decreased by 6.1 million short tons of CO₂, a reduction of 39.3 percent, and the CO₂ emission rate decreased by 124.2 lb CO₂/MWh, a reduction of 40.2 percent.

Compared to the annual average during a multi-year 2006 to 2008 base period, 2012 total electricity load in NYISO decreased by 4.7 million MWh, or 2.8 percent. Compared to the 2006 to 2008 annual average, total electric generation in 2012 in NYISO decreased by 9.0 million MWh, or 6.1 percent.

Compared to the annual average during a multi-year 2006 to 2008 base period, 2012 electric generation from RGGI-affected generation in NYISO decreased by 6.3 million MWh, or 9.3 percent, and CO₂ emissions from RGGI-affected generation in NYISO decreased by 17.1 million short tons of CO₂, a reduction of 32.6 percent. The CO₂ emission rate of RGGI-affected electric generation decreased by 399 lb CO₂/MWh, a reduction of 25.7 percent. Compared to the 2006 to 2008 annual average, 2012 electric generation from non-RGGI generation located in NYISO decreased by 2.7 million MWh, or 3.3 percent, and CO₂ emissions from this category of electric generation decreased by 3.7 million short tons of CO₂, a reduction of 48.0 percent. The CO₂ emission rate of non-RGGI electric generation located in NYISO decreased by 88 lb CO₂/MWh, a reduction of 46.1 percent.

Compared to the annual average during a multi-year 2006 to 2008 base period, 2012 net electricity imports into NYISO increased by 4.3 million MWh, or 21.1 percent. CO₂ emissions related to these net electricity imports decreased by 2.4 million short tons of CO₂, or 30.8 percent. The CO₂ emission rate of the electric generation supplying these imports decreased by 343 lb CO₂/MWh, a reduction of 43.5 percent.

PJM (RGGI Portion)

Monitoring results for PJM for 2005 through 2012 are summarized below in Table 7 and Figures 18 through 22. Note that for PJM, the data presented below is for the RGGI geographic portion of PJM (Delaware and Maryland referred to below as “RGGI PJM”). Net “imports” represent inferred flows of electricity from the non-RGGI geographic portion of PJM (Non-RGGI PJM) to the RGGI geographic portion of PJM (RGGI PJM) to make up for shortfalls in electric generation relative to total electricity load for this subset of PJM.³⁴

Table 7. 2005 – 2011 Monitoring Summary for RGGI PJM

	MWh								Tons CO2								Lb CO2 /MWh							
	2005	2006	2007	2008	2009	2010	2011	2012	2005	2006	2007	2008	2009	2010	2011	2012	2005	2006	2007	2008	2009	2010	2011	2012
Electricity Demand																								
Total Annual Electricity Load in ISO	90,177,482	84,096,149	84,442,034	80,387,398	79,481,311	82,485,086	80,738,794	78,802,312	63,407,937	58,224,181	59,369,215	54,585,448	48,909,286	53,575,513	49,662,062	45,342,236	1,406	1,385	1,406	1,358	1,231	1,299	1,230	1,151
Net Imports - from Non-RGGI PJM	31,878,151	30,716,157	28,944,540	28,386,914	33,089,871	35,142,720	34,250,993	34,442,085	20,408,108	19,059,750	17,766,431	17,172,335	18,682,706	20,361,849	19,504,235	18,627,737	1,280	1,241	1,228	1,210	1,129	1,159	1,139	1,082
Net Imports - from NYISO	-636,765	-721,101	-772,843	-772,644	-570,096	-815,714	-697,456	-482,148	-469,658	-529,065	-579,349	-555,899	-371,449	-572,275	-452,458	-290,358	1,475	1,467	1,499	1,439	1,303	1,403	1,297	1,204
Total Net Electricity Imports - from All Adjoining ISOs	31,241,386	29,995,056	28,171,697	27,614,270	32,519,775	34,327,006	33,553,537	33,959,937	19,938,450	18,530,684	17,187,082	16,616,436	18,311,256	19,789,574	19,051,778	18,337,379	1,276	1,236	1,220	1,203	1,126	1,153	1,136	1,080
Electricity Generation																								
Annual Electric Generation - RGGI-Affected Units	41,472,196	37,230,890	39,254,875	35,340,119	29,732,886	31,641,822	28,980,019	28,350,888	42,345,258	38,502,576	40,637,296	36,518,184	29,281,274	32,258,228	28,850,034	25,436,501	2,042	2,068	2,070	2,067	1,970	2,039	1,991	1,794
Annual Electric Generation - Non-RGGI Fossil Fuel-Fired Units	393,587	267,732	298,635	150,718	147,837	129,655	216,967	190,940	284,222	206,808	221,499	152,927	147,125	129,412	171,564	212,964	1,444	1,545	1,483	2,029	1,990	1,996	1,581	2,231
Annual Electric Generation - Non-Fossil Fuel-Fired Units	17,070,313	16,602,471	16,716,827	17,282,291	17,080,813	16,386,603	17,988,271	16,300,547	840,007	984,113	1,323,338	1,297,901	1,169,631	1,398,299	1,588,686	1,355,392	98	119	158	150	137	171	177	166
Annual Electric Generation - All Non-RGGI Units	17,463,900	16,870,203	17,015,462	17,433,009	17,228,650	16,516,258	18,205,238	16,491,487	1,124,229	1,190,921	1,544,837	1,450,828	1,316,756	1,527,711	1,760,250	1,568,356	129	141	182	166	153	185	193	190
Total Annual Electric Generation - All Units	58,936,096	54,101,093	56,270,337	52,773,128	46,961,536	48,158,080	47,185,257	44,842,375	43,469,487	39,693,497	42,182,133	37,969,012	30,598,030	33,785,939	30,610,284	27,004,857	1,475	1,467	1,499	1,439	1,303	1,403	1,297	1,204
Summary CO₂ Emissions and MWh Data																								
Annual CO ₂ Emissions from Non-RGGI Generation Serving Load in ISO (Non-RGGI Generation within ISO + Net Imports)	48,705,286	46,865,259	45,187,159	45,047,279	49,748,425	50,843,264	28,980,019	28,350,888	21,062,679	19,721,605	18,731,919	18,067,264	19,628,012	21,317,285	28,850,034	25,436,501	865	842	829	802	789	839	1,991	1,794

³⁴ This data is compiled from PJM GATS, which reports data for both the non-RGGI and RGGI geographic portions of PJM. Inferred net imports are based on total MWh load in the RGGI geographic portion of PJM minus total electric generation in the RGGI geographic portion of PJM. Any shortfall in generation relative to load is assumed to be met through an inferred “import” of electricity from the non-RGGI geographic portion of PJM into the RGGI geographic portion of PJM.

The monitoring results indicate that the 2010 to 2012 annual average compared to the 2006 to 2008 base period annual average, total electric generation from all non-RGGI electric generation serving load in PJM increased by 5.3 million MWh, an increase of 11.6 percent. From the 2006 to 2008 base period annual average to the 2010 to 2012 annual average, CO₂ emissions from this category of electric generation increased by 1.8 million short tons of CO₂, an increase of 9.8 percent, and the CO₂ emission rate decreased by 13.9 lb CO₂/MWh, an decrease of 1.7 percent. (See Figures 18, 19, and 20.)

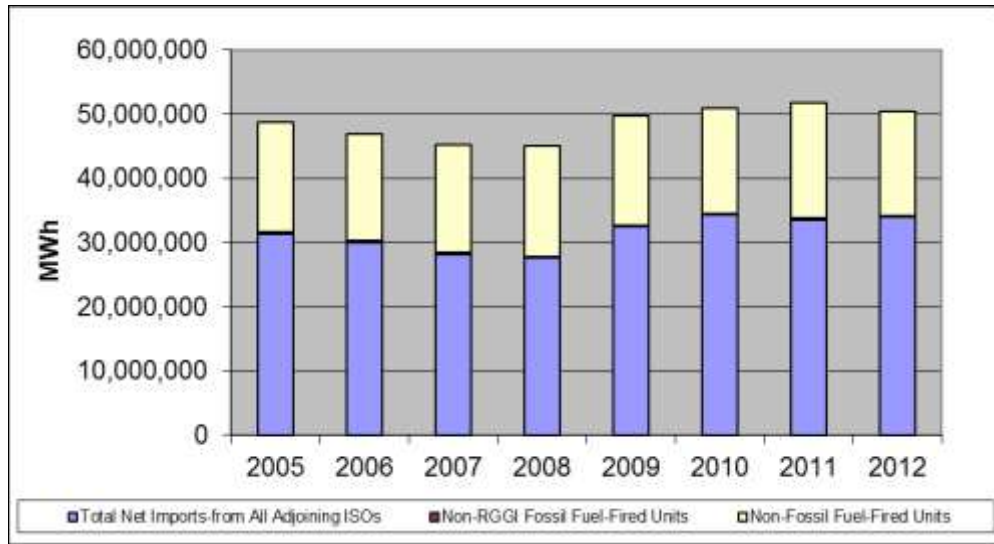


Figure 18. Non-RGGI Generation Serving Load in RGGI PJM (MWh)

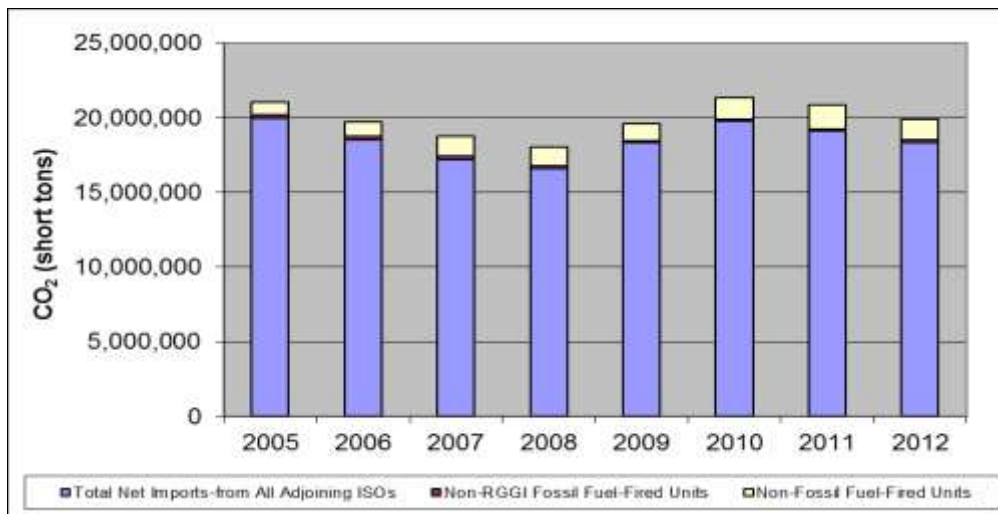


Figure 19. CO₂ Emissions from Non-RGGI Generation Serving Load in RGGI PJM (short tons CO₂)

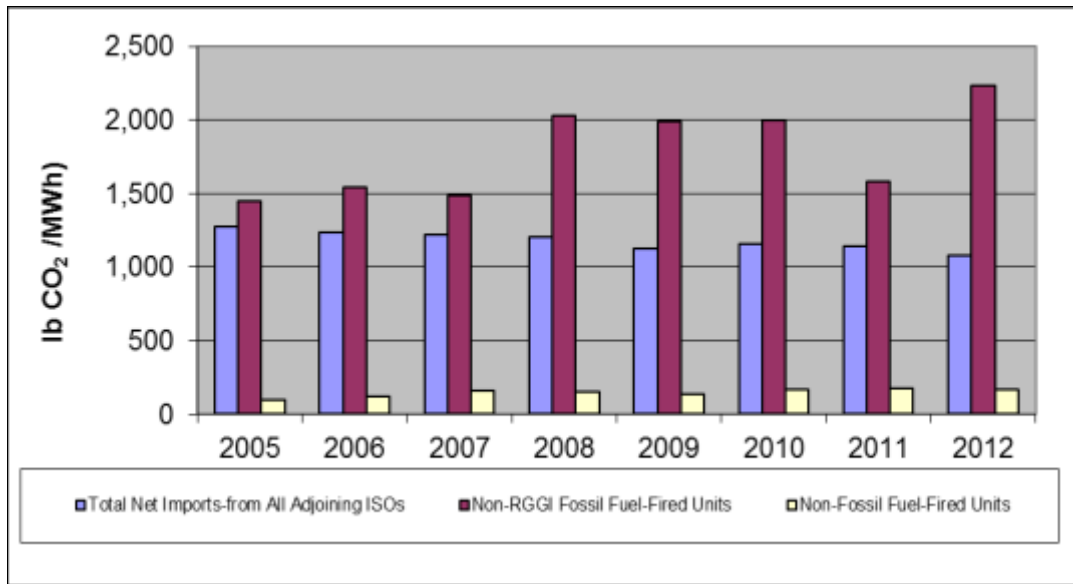


Figure 20. CO₂ Emission Rate for Non-RGGI Generation Serving Load in RGGI PJM (lb CO₂/MWh)

The annual average electricity load in PJM decreased by 2.3 million MWh, or 2.8 percent for 2010 to 2012 as compared to the annual average from the baseline period of 2006 to 2008. In total, electric generation (fossil and non-fossil) in PJM decreased by 7.7 million MWh, or 14.1 percent, when comparing the 2006 to 2008 annual average to the 2010 to 2012 annual average.

Electric generation from RGGI-affected generation in PJM decreased by 7.6 million MWh during this period, or 20.4 percent, and CO₂ emissions from RGGI-affected electric generation in PJM decreased by 9.7 million short tons of CO₂, or 25.2 percent. The CO₂ emission rate of RGGI-affected electric generation decreased by 127 lb CO₂/MWh, a reduction of 6.1 percent. Electric generation from non-RGGI electric generation sources located in PJM decreased by 35.2 thousand MWh, or 0.2 percent, during this period, and CO₂ emissions from this category of electric generation increased by 223.2 thousand short tons of CO₂, an increase of 16.0 percent. The CO₂ emission rate of non-RGGI electric generation located in PJM increased by 26 lb CO₂/MWh, an increase of 16.2 percent.

Net electricity imports into PJM increased by 5.4 million MWh, or 18.7 percent, when comparing the base period annual average from 2006 to 2008 to the annual average from 2010 to 2012. CO₂ emissions related to these net electricity imports increased by 1.6 million short tons of CO₂, or 9.3 percent, during this period. The CO₂ emission rate of the electric generation supplying these imports decreased by 96.9 lb CO₂/MWh, a decrease of 7.9 percent. (See Figures 21 and 22.)

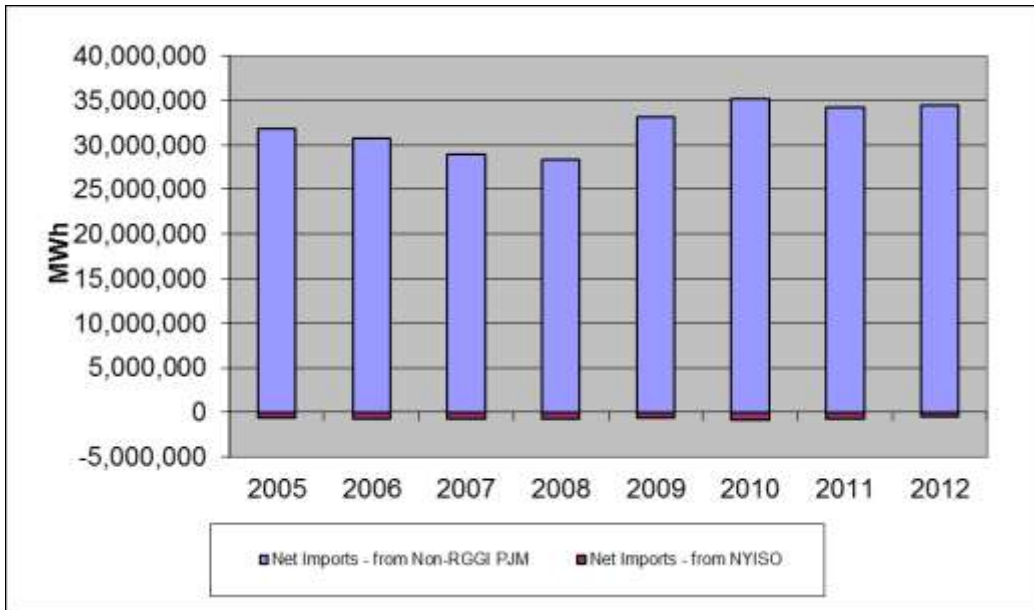


Figure 21. Net Electricity Imports to RGGI PJM (MWh)

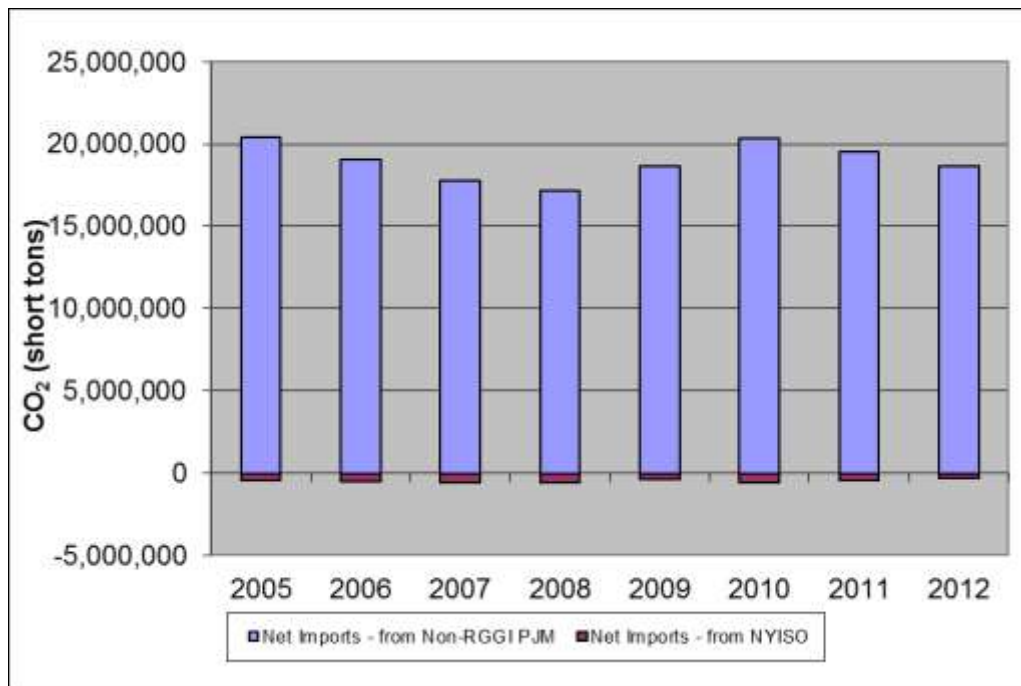


Figure 22. CO₂ Emissions Related to Net Electricity Imports to RGGI PJM (short tons CO₂)

Compared to the annual average during a multi-year base period of 2006 to 2008, electric generation in 2012 from all non-RGGI electric generation

sources serving load in RGGI PJM increased by 4.8 million MWh, an increase of 10.4 percent. Compared to the 2006 to 2008 annual average, 2012 CO₂ emissions from this category of electric generation increased by 1.1 million short tons of CO₂, an increase of 5.6 percent, and the CO₂ emission rate decreased by 35 lb CO₂/MWh, a reduction of 4.3 percent.

Compared to the annual average during a multi-year 2006 to 2008 base period, 2012 total electricity load in RGGI PJM decreased by 4.2 million MWh, or 5.0 percent. Compared to the 2006 to 2008 annual average, total electric generation in RGGI PJM decreased by 9.5 million MWh, or 17.5 percent.

Compared to the annual average during a multi-year 2006 to 2008 base period, 2012 electric generation from RGGI-affected generation in RGGI PJM decreased by 8.9 million MWh, or 23.9 percent, and CO₂ emissions from RGGI-affected generation in RGGI PJM decreased by 13.1 million short tons of CO₂, or 34.0 percent. The CO₂ emission rate of RGGI-affected electric generation decreased by 274 lb CO₂/MWh, a reduction of 13.2 percent. Compared to the 2006 to 2008 annual average, 2012 electric generation from non-RGGI generation located in RGGI PJM decreased by 614.7 thousand MWh, or 3.6 percent, and CO₂ emissions from this category of electric generation increased by 172.8 thousand short tons of CO₂, an increase of 12.4 percent. The CO₂ emission rate of non-RGGI electric generation located in RGGI PJM increased by 27 lb CO₂/MWh, an increase of 16.6 percent.

Compared to the annual average during a multi-year 2006 to 2008 base period, 2012 net electricity imports into RGGI PJM increased by 5.4 million MWh, or 18.8 percent. CO₂ emissions related to these net electricity imports increased by 892.6 thousand short tons of CO₂, or 5.1 percent, during this period, indicating a reduction in the average CO₂ emission rate of the electric generation supplying these imports of 140 lb CO₂/MWh, a reduction of 11.5 percent.

Appendix C. Monitoring Trends

Detailed monitoring trends for the 9-State RGGI Region, ISO-NE, NYISO, and the RGGI portion of PJM are presented in Tables 8 through 11. The tables summarize the comparison between the 2006 to 2008 base period and the three years of program operation, 2010 to 2012.

9-State RGGI Region

Table 8. Monitoring Trends for 9-State RGGI Region

	Non-RGGI Generation			RGGI Generation			Imports			Total Non-RGGI Generation (ISO + Net Imports)		
	MWh	CO2 Emissions	lb CO2/MWh	MWh	CO2 Emissions	lb CO2/MWh	MWh	CO2 Emissions	lb CO2/MWh	MWh	CO2 Emissions	lb CO2/MWh
2006-2008	153,362,597	18,650,769	243	177,165,152	138,362,771	1,561	55,997,235	25,228,332	905	209,359,832	43,879,102	419
2010-2012	150,833,979	16,785,824	223	158,391,492	103,240,981	1,301	67,804,720	26,160,296	775	218,638,698	42,946,121	393
Difference	-2,528,619	-1,864,945	-20	-18,773,660	-35,121,790	-261	11,807,485	931,964	-130	9,278,866	-932,981	-26
% change	-1.6%	-10.0%	-8.4%	-10.6%	-25.4%	-16.7%	21.1%	3.7%	-14.4%	4.4%	-2.1%	-6.2%
	In-Region Generation (MWh)		Total In-Region Load (MWh)									
2006-2008	330,527,749		386,423,646									
2010-2012	309,225,470		375,371,605									
Difference	-21,302,279		-11,052,041									
% change	-6.4%		-2.9%									

	Non-RGGI Generation			RGGI Generation			Imports			Total Non-RGGI Generation (ISO + Net Imports)		
	MWh	CO2 Emissions	lb CO2/MWh	MWh	CO2 Emissions	lb CO2/MWh	MWh	CO2 Emissions	lb CO2/MWh	MWh	CO2 Emissions	lb CO2/MWh
2006-2008	153,362,597	18,650,769	243	177,165,152	138,362,771	1,561	55,997,235	25,228,332	905	209,359,832	43,879,102	419
2012	151,507,546	17,465,094	231	152,145,642	92,212,271	1,212	71,073,887	24,090,909	678	222,581,433	41,556,002	373
Difference	-1,855,051	-1,185,675	-12	-25,019,510	-46,150,501	-349	15,076,652	-1,137,424	-227	13,221,601	-2,323,099	-46
% change	-1.2%	-6.4%	-5.1%	-14.1%	-33.4%	-22.4%	26.9%	-4.5%	-25.1%	6.3%	-5.3%	-10.9%
	In-Region Generation (MWh)		Total In-Region Load (MWh)									
2006-2008	330,527,749		386,423,646									
2012	303,653,188		372,082,306									
Difference	-26,874,561		-14,341,40									
% change	-8.1%		-3.7%									

ISO-NE

Table 9. Monitoring Trends for ISO-NE

	Non-RGGI Generation			RGGI Generation			Imports			Total Non-RGGI Generation (ISO + Net Imports)		
	MWh	CO2 Emissions	lb CO2/MWh	MWh	CO2 Emissions	lb CO2/MWh	MWh	CO2 Emissions	lb CO2/MWh	MWh	CO2 Emissions	lb CO2/MWh
2006-2008	55,659,215	9,559,313	343	72,282,789	47,242,267	1,307	7,196,667	-124,180	-44	62,855,882	9,435,133	300
2010-2012	55,227,754	11,419,252	414	67,754,164	36,169,908	1,065	9,443,000	-637,989	-202	64,670,754	10,781,263	333
Difference	-431,461	1,859,939	71	-4,528,625	-11,072,358	-242	2,246,333	-513,809	-157	1,814,872	1,346,130	33
% change	-0.8%	19.5%	20.7%	-6.3%	-23.4%	-18.5%	31.2%	413.8%	361.2%	2.9%	14.3%	10.9%
	In-Region Generation (MWh)		Total In-Region Load (MWh)									
2006-2008	127,942,004		135,037,333									
2010-2012	122,981,918		130,766,000									
Difference	-4,960,086		-4,271,333									
% change	-3.9%		-3.2%									

	Non-RGGI Generation			RGGI Generation			Imports			Total Non-RGGI Generation (ISO + Net Imports)		
	MWh	CO2 Emissions	lb CO2/MWh	MWh	CO2 Emissions	lb CO2/MWh	MWh	CO2 Emissions	lb CO2/MWh	MWh	CO2 Emissions	lb CO2/MWh
2006-2008	55,659,215	9,559,313	343	72,282,789	47,242,267	1,307	7,196,667	-124,180	-44	62,855,882	9,435,133	300
2012	57,106,687	11,891,249	416	62,481,082	31,357,869	1,004	12,648,000	-61,325	-10	69,754,687	11,829,924	339
Difference	1,447,472	2,331,936	73	-9,801,707	-15,884,397	-303	5,451,333	62,854	34	6,898,805	2,394,790	39
% change	2.6%	24.4%	21.4%	-13.6%	-33.6%	-23.2%	75.7%	-50.6%	-77.8%	11.0%	25.4%	13.0%
	In-Region Generation (MWh)		Total In-Region Load (MWh)									
2006-2008	127,942,004		135,037,333									
2012	119,587,769		129,590,000									
Difference	-8,354,235		-5,447,333									
% change	-6.5%		-4.0%									

NYISO

Table 10. Monitoring Trends for NYISO

	Non-RGGI Generation			RGGI Generation			Imports			Total Non-RGGI Generation (ISO + Net Imports)		
	MWh	CO2 Emissions	lb CO2/MWh	MWh	CO2 Emissions	lb CO2/MWh	MWh	CO2 Emissions	lb CO2/MWh	MWh	CO2 Emissions	lb CO2/MWh
2006-2008	80,597,157	7,695,928	191	67,607,068	52,567,819	1,554	20,206,894	7,876,114	789	100,804,051	15,572,042	309
2010-2012	78,535,230	3,747,800	96	60,979,751	38,222,818	1,253	24,415,226	7,595,568	622	102,950,456	11,343,368	220
Difference	-2,061,927	-3,948,127	-95	-6,627,317	-14,345,001	-301	4,208,333	-280,547	-167	2,146,405	-4,228,674	-88
% change	-2.6%	-51.3%	-49.9%	-9.8%	-27.3%	-19.4%	20.8%	-3.6%	-21.2%	2.1%	-27.2%	-28.6%
	In-Region Generation (MWh)		Total In-Region Load (MWh)									
2006-2008	148,204,225		168,411,119									
2010-2012	139,514,981		163,930,208									
Difference	-8,689,244		-4,480,911									
% change	-5.9%		-2.7%									

	Non-RGGI Generation			RGGI Generation			Imports			Total Non-RGGI Generation (ISO + Net Imports)		
	MWh	CO2 Emissions	lb CO2/MWh	MWh	CO2 Emissions	lb CO2/MWh	MWh	CO2 Emissions	lb CO2/MWh	MWh	CO2 Emissions	lb CO2/MWh
2006-2008	80,597,157	7,695,928	191	67,607,068	52,567,819	1,554	20,206,894	7,876,114	789	100,804,051	15,572,042	309
2012	77,909,372	4,005,489	103	61,313,672	35,417,901	1,155	24,466,950	5,450,237	446	102,376,322	9,455,726	185
Difference	-2,687,785	-3,690,439	-88	-6,293,396	-17,149,918	-399	4,260,056	-2,425,877	-343	1,572,271	-6,116,316	-124
% change	-3.3%	-48.0%	-46.1%	-9.3%	-32.6%	-25.7%	21.1%	-30.8%	-43.5%	1.6%	-39.3%	-40.2%
	In-Region Generation (MWh)		Total In-Region Load (MWh)									
2006-2008	148,204,225		168,411,119									
2012	139,223,044		163,689,994									
Difference	-8,981,181		-4,721,125									
% change	-6.1%		-2.8%									

RGGI-PJM

Table 11. Monitoring Trends for RGGI-PJM

	Non-RGGI Generation			RGGI Generation			Imports			Total Non-RGGI Generation (ISO + Net Imports)		
	MWh	CO2 Emissions	lb CO2/MWh	MWh	CO2 Emissions	lb CO2/MWh	MWh	CO2 Emissions	lb CO2/MWh	MWh	CO2 Emissions	lb CO2/MWh
2006-2008	17,106,225	1,395,529	163	37,275,295	38,552,685	2,068	28,593,674	17,444,734	1,220	45,699,899	18,840,263	825
2010-2012	17,070,994	1,618,772	190	29,657,576	28,848,254	1,941	33,946,827	19,059,577	1,123	51,017,821	20,678,349	811
Difference	-35,230	223,244	26	-7,617,718	-9,704,431	-124	5,353,152	1,614,843	-96	5,317,922	1,838,086	-14
% change	-0.2%	16.0%	16.2%	-20.4%	-25.2%	-6.1%	18.7%	9.3%	-7.9%	11.6%	9.8%	-1.7%
	In-Region Generation (MWh)		Total In-Region Load (MWh)									
2006-2008	54,381,519		82,975,194									
2010-2012	46,728,571		80,675,397									
Difference	-7,652,949		-2,299,796									
% change	-14.1%		-2.8%									

	Non-RGGI Generation			RGGI Generation			Imports			Total Non-RGGI Generation (ISO + Net Imports)		
	MWh	CO2 Emissions	lb CO2/MWh	MWh	CO2 Emissions	lb CO2/MWh	MWh	CO2 Emissions	lb CO2/MWh	MWh	CO2 Emissions	lb CO2/MWh
2006-2008	17,106,225	1,395,529	163	37,275,295	38,552,685	2,068	28,593,674	17,444,734	1,220	45,699,899	18,840,263	825
2012	16,491,487	1,568,356	190	28,350,888	25,436,501	1,794	33,959,937	18,337,379	1,080	50,451,424	19,905,735	789
Difference	-614,738	172,827	27	-8,924,407	-13,116,185	-274	5,366,263	892,645	-140	4,751,525	1,065,472	-35
% change	-3.6%	12.4%	16.6%	-23.9%	-34.0%	-13.2%	18.8%	5.1%	-11.5%	10.4%	5.7%	-4.3%
	In-Region Generation (MWh)		Total In-Region Load (MWh)									
2006-2008	54,381,519		82,975,194									
2012	44,842,375		78,802,312									
Difference	-9,539,144		-4,172,882									
% change	-17.5%		-5.0%									

Appendix D. Concept of “Emissions Leakage”

“Emissions leakage” is the concept that the RGGI CO₂ compliance obligation and related CO₂ compliance costs for electric generators could result in a shift of electricity generation from CO₂-emitting sources subject to the RGGI CO₂ Budget Trading Program to CO₂-emitting sources not subject to RGGI. Key to this concept is that the cause of such a shift would be due to the RGGI CO₂ Budget Trading Program, rather than other factors that influence electric power sector CO₂ emissions. The concept of emissions leakage presumes that an increase in electricity production costs for certain electric generators due to RGGI CO₂ compliance costs would be the driver of changes in the operation of the electric power system that result in an increase in CO₂ emissions from electric generation that is not subject to the RGGI CO₂ Budget Trading Program.

Factors that Influence Electric Generator Dispatch and CO₂ Emissions

In the Northeast and Mid-Atlantic, electric generation is deregulated and subject to competitive wholesale electricity markets. In the simplest terms, wholesale electricity markets are used to determine which power plants run to meet electricity demand and determine the wholesale price of electricity. Electric generators bid into day-ahead and real-time auctions for generation supply, in which the lowest priced plants are selected one by one until electricity demand is met. The last plant selected, or “dispatched,” to meet demand is referred to as the marginal unit, and sets the wholesale clearing price. A number of elements factor in to the bid offers made by individual electric generators, including fuel prices, operation and maintenance costs, and environmental compliance costs. For this latter category, certain environmental compliance costs are represented by the market value of emissions allowances, such as CO₂, NO_x, and SO₂ allowances. The market value of these emission allowances influences the production costs of individual electric generators in a similar manner as fuel costs, and therefore play a role in influencing the dispatch of electric generators and the wholesale market clearing price of electricity.

In addition to the production costs of electric generators, such as natural gas supply and costs which can be influenced by pipeline constraints, the dispatch of electric generators and wholesale electricity prices are also influenced by electricity demand and electricity transmission constraints. Since electricity cannot be stored, it must be delivered instantaneously to where it is needed. In locations where electric demand is high, transmission capability may be constrained, meaning that electric generation has different values in different areas – because the lowest cost electric generation cannot always be delivered to where it is needed based on transmission limitations. As a result, wholesale electricity prices also differ by location, a concept referred to as locational marginal pricing.

All of the above, including production costs, market factors, and physical limitations, impact the dispatch of electric generation, and related CO₂ emissions, through a highly dynamic wholesale electricity market.

The concept of emissions leakage assumes a scenario in which only a subset of CO₂-emitting electric generators are subject to a CO₂ allowance requirement.³⁵ As a result, certain electric generators are subject to an additional production cost – the cost of CO₂ allowances – that is not faced by other CO₂-emitting electric generators. In theory, this could result in a shift in electric generation to emitting units that do not face a CO₂ compliance cost. If such a shift results in an increase in CO₂ emissions from electric generation as a whole, such an increase is referred to as emissions leakage.

If emissions leakage were to occur, it would result from an increase in dispatch (and related CO₂ emissions) from: (a) in-region non-RGGI units (i.e., small fossil fuel-fired units in the nine-state RGGI region with a capacity less than 25 MWe, which are not subject to RGGI); (b) electric generation outside the nine-state RGGI region (represented as electricity imports); or (c) a combination of the two, both of which are referred to in this report as “non-RGGI generation”.

³⁵ The nine-state RGGI region does not completely align with the geographic footprint of wholesale electricity markets in the greater Northeast and Mid-Atlantic region, and electric power can flow across multiple wholesale markets in North America.

Appendix E. 10 State Data

The analysis below includes New Jersey as a RGGI member, thereby recreating the original 10-state participation in the RGGI program.

Aggregate RGGI Data

Table 12 10-State ELECTRICITY DEMAND AND GENERATION

2006-2008 COMPARED TO 2010-2012

MWh	Demand Load	Non-RGGI Generation	RGGI Generation	Total In-Region Generation
Baseline: 2006-2008	470,974,186	183,910,392	203,712,944	387,623,336
2010-2012	455,747,684	182,532,387	187,026,191	369,558,578
Difference	-15,226,501	-1,378,005	-16,686,753	-18,064,758
Percent Change	-3.2%	-0.7%	-8.2%	-4.7%

2006-2008 COMPARED TO 2012

MWh	Demand Load	Non-RGGI Generation	RGGI Generation	Total In- Region Generation
Baseline: 2006-2008	470,974,186	183,910,392	203,712,944	387,623,336
2012	450,463,043	183,272,334	180,732,948	364,005,282
Difference	-20,511,143	-638,058	-22,979,996	-23,618,054
Percent Change	-4.4%	0.3%	-11.3%	-6.1%

Table 13 10-State NON-RGGI AND RGGI GENERATION

2006-2008 COMPARED TO 2010-2012

	Non-RGGI Generation			RGGI Generation		
	MWh	CO ₂ Emissions	lb CO ₂ /MWh	MWh	CO ₂ Emissions	lb CO ₂ /MWh
Baseline: 2006-2008	183,910,392	17,205,745	187	203,712,944	158,876,166	1,560
2010-2012	182,532,387	16,128,023	177	187,026,191	120,824,766	1,290
Difference	-1,378,005	-1,077,721	-10	-16,686,753	-38,051,400	-270
Percent Change	-0.7%	-6.3%	-5.5%	-8.2%	-24.0%	-17.3%

2006-2008 COMPARED TO 2012

	Non-RGGI Generation			RGGI Generation		
	MWh	CO ₂ Emissions	lb CO ₂ /MWh	MWh	CO ₂ Emissions	lb CO ₂ /MWh
Baseline: 2006-2008	183,910,392	17,205,745	187	203,712,944	158,876,166	1,560
2012	183,272,334	17,306,637	189	180,732,948	108,329,238	1,199
Difference	-638,058	100,892	2	-22,979,996	-50,546,929	-361
Percent Change	0.3%	0.6%	1.0%	-11.3%	-31.8%	-23.1%

Table 14 2005 – 2012 Monitoring Summary for 10-State RGGI Region³⁶

	MWh								tons CO2								lb CO2/MWh								
	2005	2006	2007	2008	2009	2010	2011	2012	2005	2006	2007	2008	2009	2010	2011	2012	2005	2006	2007	2008	2009	2010	2011	2012	
Electricity Demand																									
Total in RGGI	480,362,390	469,584,886	477,090,574	466,247,097	448,024,418	461,285,678	455,494,331	450,463,043	245,169,071	224,913,893	228,282,271	206,488,413	175,321,644	193,741,555	173,805,197	162,362,850	1021	958	957	886	783	840	763	721	
Net Imports - from Ontario to NY	1,898,020	3,672,282	2,637,442	6,162,902	6,463,657	3,872,635	3,318,681	5,749,461	460,286	769,120	610,529	1,154,884	712,496	554,950	475,569	823,900	485	419	463	375	220	287	287	287	
Net Imports - from Quebec to NY & NE	7,375,317	8,982,749	11,912,292	15,141,014	17,065,805	13,549,209	18,681,204	22,312,689	32,520	49,509	118,179	33,380	56,435	29,871	33,772	40,337	9	11	20	4	7	4	4	4	
Net Imports - from New Brunswick to NE	1,620,000	1,047,000	896,000	1,285,000	1,569,000	737,000	846,000	643,000	846,443	508,967	438,526	718,150	984,101	410,264	410,324	311,866	1045	972	979	1118	1254	1113	970	970	
Net Imports - from non-RGGI PJM to NY	6,379,823	8,101,829	8,659,727	9,062,826	7,073,143	10,460,586	9,566,928	7,277,743	4,257,772	5,246,328	5,536,825	5,720,147	4,213,398	6,339,400	5,706,392	4,118,436	1335	1295	1279	1262	1191	1212	1193	1132	
Net Imports - from non-RGGI PJM to RGGI PJM	65,324,576	60,819,367	57,887,856	54,088,276	56,299,698	58,001,518	55,406,781	53,119,637	43,596,369	39,383,494	37,012,128	34,138,677	33,537,149	35,150,499	33,048,520	30,060,122	1335	1295	1279	1262	1191	1212	1193	1132	
Total Net Imports - from All Adjoining ISOs	82,597,736	82,623,227	81,993,317	85,740,018	88,471,303	86,620,948	87,819,594	89,102,530	49,193,389	45,957,417	43,716,188	41,765,239	39,503,579	42,484,984	39,674,577	35,354,661	1191	1112	1066	974	893	981	904	794	
Electricity Generation																									
RGGI-Affected Units	211,948,440	199,593,115	213,091,389	198,454,328	175,344,325	195,032,446	185,313,180	180,732,948	180,946,904	159,862,042	167,050,592	149,715,865	122,317,686	135,735,245	118,574,514	109,701,552	1707	1602	1568	1509	1395	1392	1280	1214	
Non-RGGI Fossil Fuel-Fired Units	9,456,126	8,853,355	7,444,927	3,520,886	2,960,649	3,369,448	3,698,562	6,984,245	8,073,191	8,202,959	6,531,324	2,786,884	2,432,792	3,558,591	3,863,630	4,792,244	1708	1853	1755	1583	1643	2112	2089	1372	
Non-Fossil Fuel-Fired Units	176,491,364	178,751,235	174,777,668	178,383,105	181,707,959	177,052,252	180,204,565	176,288,089	6,955,587	10,891,475	10,984,167	12,220,426	11,067,587	11,962,735	11,692,478	12,514,393	79	122	126	137	122	135	130	142	
All Non-RGGI Units	185,947,490	187,604,590	182,222,595	181,903,991	184,668,608	180,421,700	183,903,127	183,272,334	15,028,778	19,094,433	17,515,491	15,007,310	13,500,378	15,521,326	15,556,107	17,306,637	162	204	192	165	146	172	169	189	
All Units	397,764,653	386,961,659	395,097,257	380,507,079	359,553,115	374,663,730	367,674,737	361,359,513	195,975,682	178,956,476	184,566,083	164,723,174	135,818,064	151,256,571	134,130,621	127,008,189	985	925	934	866	755	807	730	703	
Summary Data																									
Non-RGGI Generation Serving Load in ISO (Non-RGGI Generation within ISO + Net Imports = (B-2 + B3) + A-3)	268,545,226	270,227,817	264,215,912	267,644,009	273,139,911	267,042,648	271,722,721	272,374,864	64,222,167	65,051,850	61,231,679	56,772,548	53,003,958	58,006,310	55,230,684	52,661,298	478	481	463	424	388	434	407	387	

³⁶ Adjustments and corrections to the data were made since the April 2013 release of *CO₂ Emissions from Electricity Generation and Imports in the Regional Greenhouse Gas Initiative: 2011 Monitoring Report*. The conclusions of the report were not affected by these adjustments and corrections.

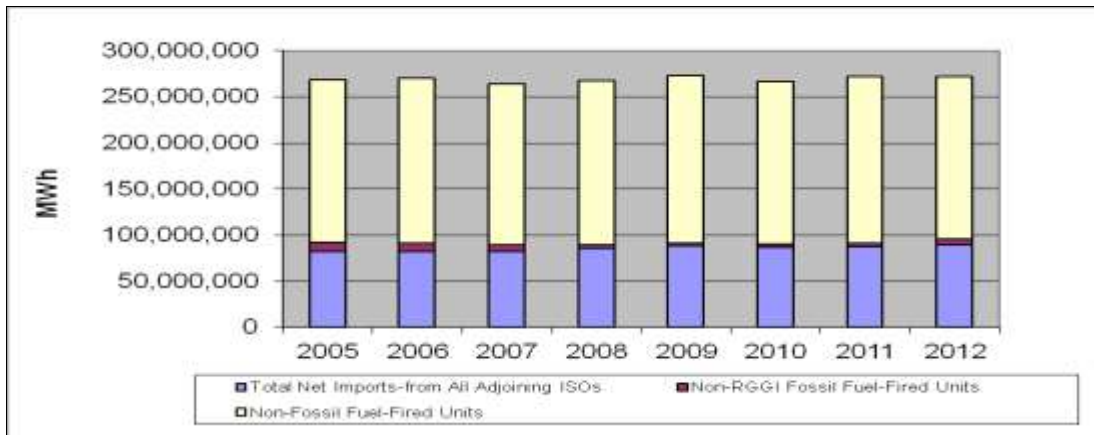


Figure 23 10-State Non-RGGI Generation Serving Load in RGGI Region (MWh)

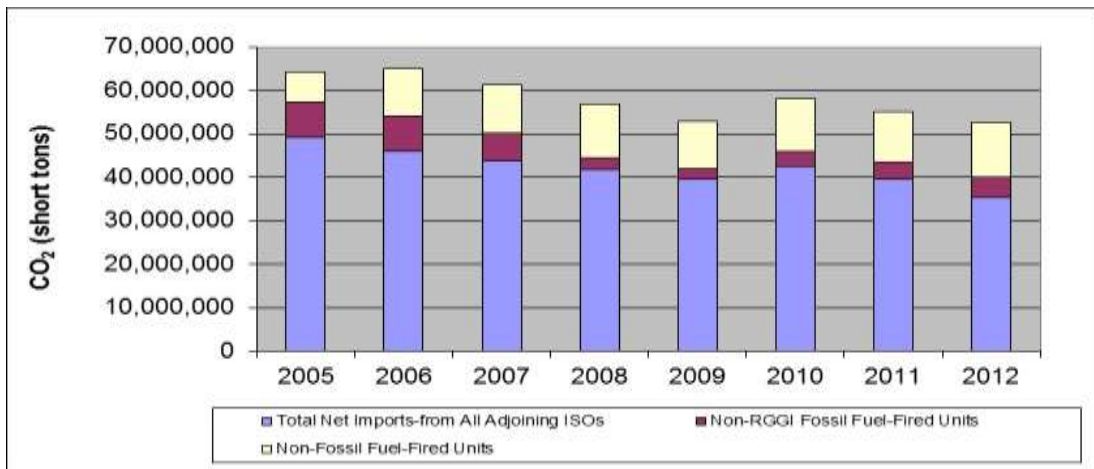


Figure 24 10-State CO₂ Emissions from Non-RGGI Generation Serving Load in RGGI Region (short tons CO₂)

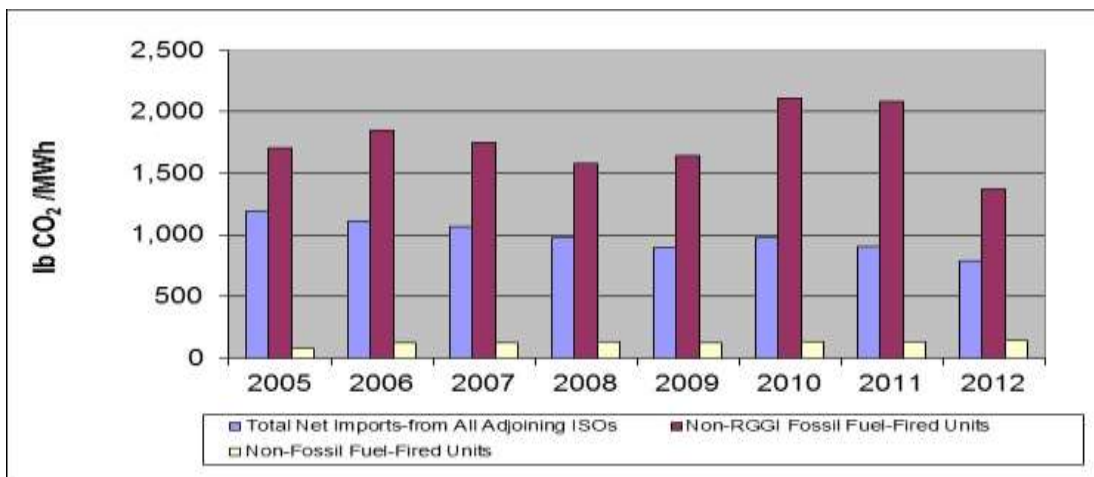


Figure 25 10-State CO₂ Emission Rate for Non-RGGI Generation Serving Load in RGGI Region (lb CO₂/MWh)

IMPORTS TO THE 10-STATE REGION

Table 15 10-State IMPORTS, 2006-2008 COMPARED TO 2010-2012

	MWh	CO2 Emissions	lb CO2/MWh
Baseline: 2006-2008	83,452,187	43,812,948	1,051
2010-2012	87,847,691	39,171,407	893
Difference	4,395,504	-4,641,540	-158
Percent Change	5.3%	-10.6%	-15.1%

Table 16 10-State IMPORTS, 2006-2008 COMPARED TO 2012

	MWh	CO2 Emissions	lb CO2/MWh
Baseline: 2006-2008	83,452,187	43,812,948	1,051
2012	89,102,530	35,354,661	794
Difference	5,650,343	-8,458,287	-257
Percent Change	6.8%	-19.3%	-24.5%

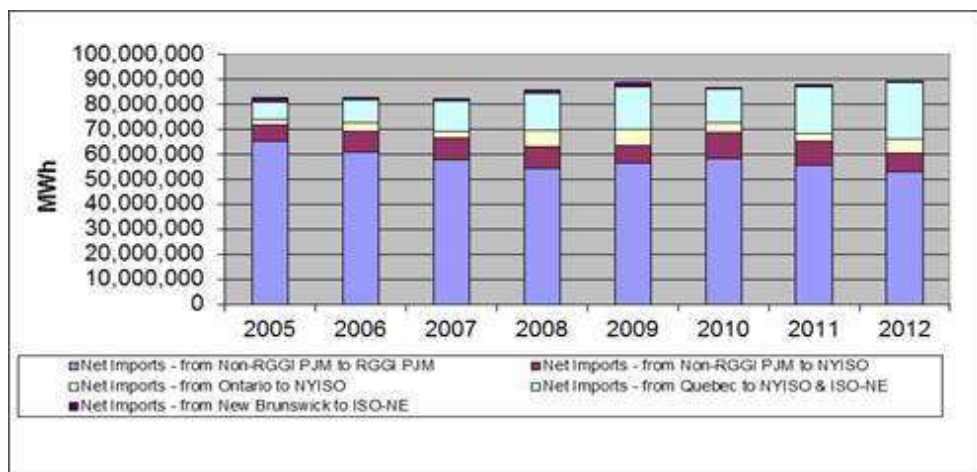


Figure 26 Net Electricity Imports to 10-State RGGI Region (MWh)

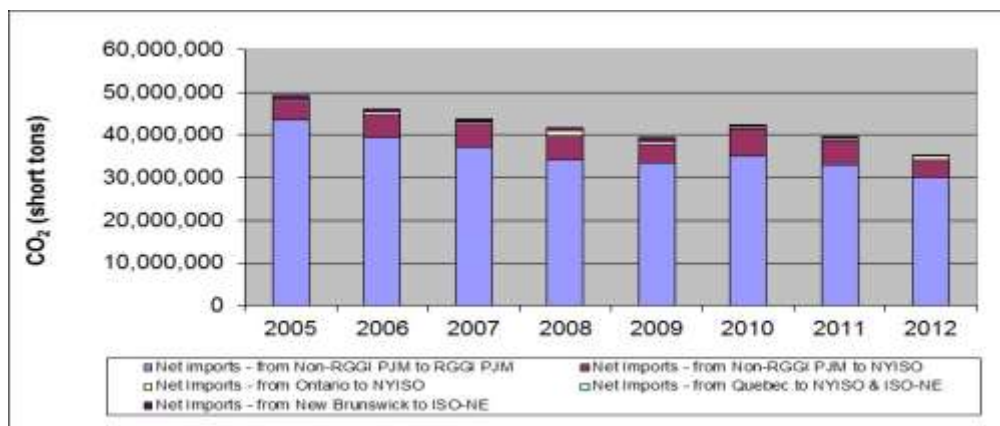


Figure 27 CO₂ Emissions Related to Net Electricity Imports to 10-State RGGI Region (short tons CO₂)

ISO-NE 10-STATE CHARTS AND TABLES:

*For ISO-NE there is no difference between the 9-state and 10-state data.

Table 17 2005 – 2012 Monitoring Summary for ISO-NE 10-State

	MWh										Tons CO2						Lb CO2 /MWh							
	2005	2006	2007	2008	2009	2010	2011	2012	2005	2006	2007	2008	2009	2010	2011	2012	2005	2006	2007	2008	2009	2010	2011	2012
Electricity Demand																								
Total in ISO	138,174,000	134,243,000	136,869,000	134,000,000	128,801,000	131,956,000	130,752,000	129,590,000	64,207,040	58,342,696	58,439,751	53,249,752	48,230,332	51,118,586	46,547,135	43,187,793	929	869	854	795	749	775	712	667
Net Imports - from NY ISO	-115,000	-877,000	-2,477,000	-1,529,000	-3,031,000	-4,412,000	-2,262,000	-1,073,000	-55,282	-398,599	-1,118,781	-651,589	-1,229,274	-1,833,018	-881,419	-396,832	961	909	903	852	811	831	779	740
Net Imports - from Quebec	4,792,000	6,023,000	7,727,000	9,495,000	10,826,000	9,214,000	11,558,000	13,077,000	21,129	33,196	76,658	20,933	35,801	20,313	20,894	23,640	9	11	20	4	7	4	4	4
Net Imports - from New Brunswick	1,620,000	1,047,000	896,000	1,285,000	1,569,000	737,000	846,000	643,000	846,443	508,967	438,526	718,150	984,101	410,264	410,324	311,866	1,045	972	979	1,118	1,254	1,113	970	970
Total Net Imports - from All Adjoining ISOs	6,297,000	6,193,000	6,146,000	9,251,000	9,363,000	5,539,000	10,142,000	12,648,000	812,290	143,564	-603,597	87,494	-209,372	-1,402,441	-450,200	-61,325	258	46	-196	19	-45	-506	-89	-10
Electricity Generation																								
RGGI-Affected Units	77,439,814	70,911,131	75,345,502	70,591,734	65,426,926	71,314,622	69,466,788	62,481,082	54,223,939	47,783,423	49,434,978	44,508,400	38,815,561	41,682,538	35,469,318	31,357,869	1,400	1,348	1,312	1,261	1,187	1,169	1,021	1,004
Non-RGGI Fossil Fuel-Fired Units <25MW	94,304	75,137	64,598	152,110	627,311	908,731	1,139,223	1,408,663	37,197	42,415	47,105	98,880	374,282	875,835	1,030,383	1,133,530	789	1,129	1,458	1,300	1,193	1,928	1,809	1,609
Non-RGGI Fossil Fuel-Fired Units >=25MW	5,953,312	5,212,883	4,419,405	2,484,119	2,095,712	2,195,189	2,206,681	5,082,341	4,054,743	3,565,819	2,744,219	1,734,332	1,810,538	2,406,571	2,516,545	3,104,311	1,362	1,368	1,242	1,396	1,728	2,193	2,281	1,222
Non-Fossil Fuel-Fired Units	48,520,847	52,086,895	51,110,222	51,372,277	51,746,869	52,787,874	49,338,878	50,615,683	5,078,871	6,807,476	6,817,046	6,820,646	7,439,324	7,556,082	7,981,091	7,653,408	209	261	267	266	288	286	324	302
All Non-RGGI Units	54,568,463	57,374,915	55,594,225	54,008,506	54,469,892	55,891,794	52,684,782	57,106,687	9,170,811	10,415,709	9,608,370	8,653,859	9,624,143	10,838,488	11,528,018	11,891,249	336	363	346	320	353	388	438	416
All Units	131,877,000	128,050,000	130,723,000	124,749,000	119,437,000	126,416,000	120,610,000	116,942,000	63,394,750	58,199,133	59,043,348	53,162,258	48,439,704	52,521,026	46,997,336	43,249,118	961	909	903	852	811	831	779	740
Summary Data	6,047,616	5,288,020	4,484,003	2,636,229	2,723,023	3,103,920	3,345,904	6,491,004	4,091,940	3,608,234	2,791,324	1,833,213	2,184,820	3,282,406	3,546,928	4,237,841	1,353	1,365	1,245	1,391	1,605	2,115	2,120	1,306
Non-RGGI Generation Serving Load in ISO (Non-RGGI Generation within ISO + Net Imports = (B-2 + B-3) + A-3)	60,865,463	63,567,915	61,740,225	63,259,506	63,832,892	61,430,794	62,826,782	69,754,687	9,983,101	10,559,273	9,004,773	8,741,353	9,414,771	9,436,047	11,077,818	11,829,924	328	332	292	276	295	307	353	339

NYISO 10-STATE CHARTS AND TABLES:

Table 18 2005 – 2012 Monitoring Summary for NYISO 10-State

	MWh								Tons CO ₂								Lb CO ₂ /MWh							
	2005	2006	2007	2008	2009	2010	2011	2012	2005	2006	2007	2008	2009	2010	2011	2012	2005	2006	2007	2008	2009	2010	2011	2012
Electricity Demand																								
Total Annual Electricity Load in NYISO	164,783,642	166,654,413	169,932,177	168,646,767	160,565,962	164,282,144	163,818,485	163,689,994	74,759,661	69,804,817	71,574,903	63,039,863	48,467,068	55,481,277	48,343,654	44,873,627	907	838	842	748	604	675	590	548
Net Imports - from Quebec	2,583,317	2,959,749	4,185,292	5,646,014	6,239,805	4,335,209	7,123,204	9,235,689	11,390	16,313	41,521	12,447	20,635	9,557	12,877	16,696	9	11	20	4	7	4	4	4
Net Imports - from ISO-NE	115,000	877,000	2,477,000	1,529,000	3,031,000	4,412,000	2,262,000	1,073,000	55,282	398,599	1,118,781	651,589	1,229,274	1,833,018	881,419	396,832	961	909	903	852	811	831	779	740
Net Imports - from Ontario	1,898,020	3,672,282	2,637,442	6,162,902	6,463,657	3,872,635	3,318,681	5,749,461	460,286	769,120	610,529	1,154,884	712,496	554,950	475,569	823,900	485	419	463	375	220	287	287	287
Net Imports - from PJM	7,604,000	9,559,000	10,225,000	10,690,000	8,331,000	12,305,000	11,150,000	8,408,800	4,912,184	5,983,934	6,349,725	6,520,900	4,736,174	7,179,968	6,389,108	4,212,809	1,292	1,252	1,242	1,220	1,137	1,167	1,146	1,002
Total Net Electricity Imports - (Sum of all A-2's)	12,200,337	17,068,031	19,524,734	24,027,916	24,065,462	24,924,844	23,853,885	24,466,950	5,439,142	7,167,966	8,120,556	8,339,821	6,698,578	9,577,493	7,758,973	5,450,237	892	840	832	694	557	769	651	446
Electricity Generation																								
Annual Electric Generation - RGGI-Affected Units (1)	71,936,054	70,961,783	75,388,500	68,520,047	59,911,945	66,092,652	62,225,030	64,761,272	65,041,240	55,637,919	57,693,658	50,239,607	39,697,514	43,926,714	38,686,919	37,095,505	1,808	1,568	1,531	1,466	1,325	1,329	1,243	1,146
Annual Electric Generation - Non-RGGI Fossil Fuel-Fired Units	2,929,072	3,225,402	2,596,315	719,246	85,738	121,568	125,577	288,423	3,611,265	4,319,567	3,454,091	785,254	95,647	130,481	133,732	330,889	2,466	2,678	2,661	2,184	2,231	2,147	2,130	2,294
Annual Electric Generation - Non-Fossil Fuel-Fired Units	77,718,179	75,399,197	72,422,628	75,379,558	76,502,817	73,143,080	77,613,993	74,173,349	668,014	2,679,365	2,306,598	3,675,181	1,975,329	1,846,589	1,764,030	1,996,995	17	71	64	98	52	50	45	54
Annual Electric Generation - All Non-RGGI Units	80,647,251	78,624,599	75,018,943	76,098,804	76,588,555	73,264,648	77,739,570	74,461,772	4,279,279	6,998,932	5,760,689	4,460,435	2,070,976	1,977,070	1,897,762	2,327,884	106	178	154	117	54	54	49	63
Total Annual Electric Generation - All Units	152,583,305	149,586,382	150,407,443	144,618,851	136,500,500	139,357,300	139,964,600	139,223,044	69,320,519	62,636,851	63,454,347	54,700,042	41,768,490	45,903,784	40,584,681	39,423,389	909	837	844	756	612	659	580	566
Summary CO₂ Emissions and MWh Data																								
Annual CO ₂ Emissions from Non-RGGI Generation Serving Load in ISO (Non-RGGI Generation within ISO + Net Imports = (B-2 + B-3) + A-2	92,847,588	95,692,630	94,543,677	100,126,720	100,654,017	98,189,492	101,593,455	98,928,722	9,718,421	14,166,898	13,881,245	12,800,256	8,769,554	11,554,563	9,656,735	7,778,121	209	296	294	256	174	235	190	157

NYISO ELECTRIC LOAD AND GENERATION

Table 19 10-State 2006-2008 COMPARED TO 2010-2012

MWh	Load	Non-RGGI Generation	RGGI-Generation	Total In-Region Generation
Baseline: 2006-2008	168,411,119	76,580,782	71,623,443	148,204,225
Baseline: 2010-2012	163,930,208	75,155,330	64,359,651	139,514,981
Difference	-4,480,911	-1,425,452	-7,263,792	-8,689,244
Percent Change	-2.7%	-1.9%	-10.1%	-5.9%

Table 20 10-State 2006-2008 COMPARED TO 2012

	Load	Non-RGGI Generation	RGGI-Generation	Total In-Region Generation
Baseline: 2006-2008	168,411,119	76,580,782	71,623,443	148,204,225
2012	163,689,994	74,461,772	64,761,272	139,223,044
Difference	-4,721,125	-2,119,010	-6,862,171	-8,981,181
Percent Change	-2.8%	-2.8%	-9.6%	-6.1%

NYISO NON-RGGI AND RGGI GENERATION

Table 21 10-State 2006-2008 COMPARED TO 2010-2012

	Non-RGGI Generation			RGGI Generation		
	MWh	CO2 Emissions	lb CO2/MWh	MWh	CO2 Emissions	lb CO2/MWh
Baseline: 2006-2008	76,580,782	5,740,019	150	71,623,443	54,523,728	1,522
Baseline: 2010-2012	75,155,330	2,067,572	55	64,359,651	39,903,046	1,239
Difference	-1,425,452	-3,672,447	-95	-7,263,792	-14,620,682	-282
Percent Change	-1.9%	-64.0%	-63.2%	-10.1%	-26.8%	-18.5%

Table 22 10-State 2006-2008 COMPARED TO 2012

	Non-RGGI Generation			RGGI Generation		
	MWh	CO2 Emissions	lb CO2/MWh	MWh	CO2 Emissions	lb CO2/MWh
Baseline: 2006-2008	76,580,782	5,740,019	150	71,623,443	54,523,728	1,522
2012	74,461,772	2,327,884	63	64,761,272	37,095,505	1,146
Difference	-2,119,010	-3,412,135	-87	-6,862,171	-17,428,223	-376
Percent Change	-2.8%	-59.4%	-58.2%	-9.6%	-32.0%	-24.7%

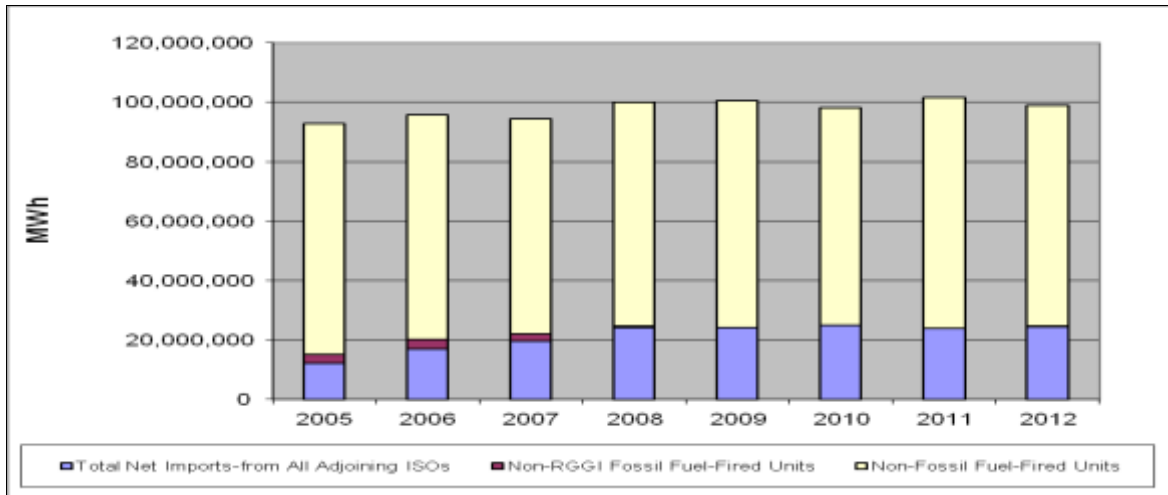


Figure 28 10-State Non-RGGI Generation Serving Load in NYISO (MWh)

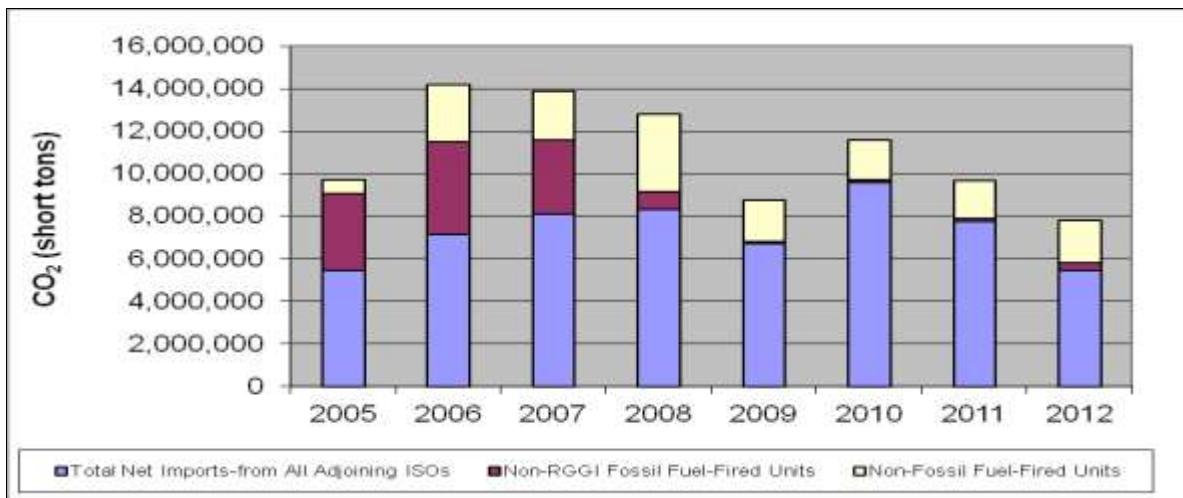


Figure 29 10-State CO₂ Emissions from Non-RGGI Generation Serving Load in NYISO (short tons CO₂)

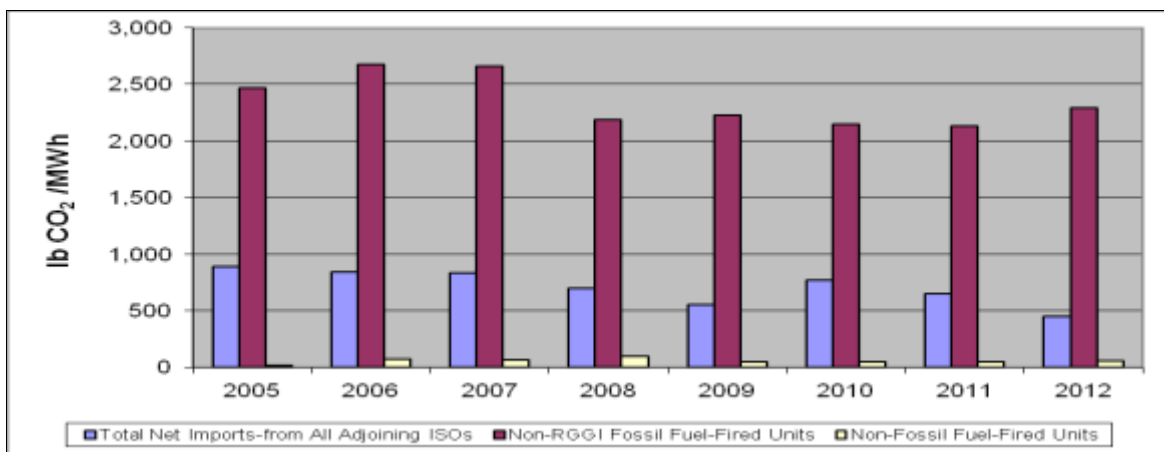


Figure 30 10-State CO₂ Emission Rate for Non-RGGI Generation Serving Load in NYISO (lb CO₂/MWh)

NYISO IMPORTS

Table 23 10-State 2006-2008 COMPARED TO 2010-2012

	MWh	CO2 Emissions	lb CO2/MWh
Baseline: 2006-2008	20,206,894	7,876,114	789
Baseline: 2010-2012	24,415,226	7,595,568	622
Difference	4,208,333	-280,547	-167
Percent Change	20.8%	-3.6%	-21.2%

Table 24 10-State 2006-2008 COMPARED TO 2012

	MWh	CO2 Emissions	lb CO2/MWh
Baseline: 2006-2008	20,206,894	7,876,114	789
2012	24,466,950	5,450,237	446
Difference	4,260,056	-2,425,877	-343
Percent Change	21.1%	-30.8%	-43.5%

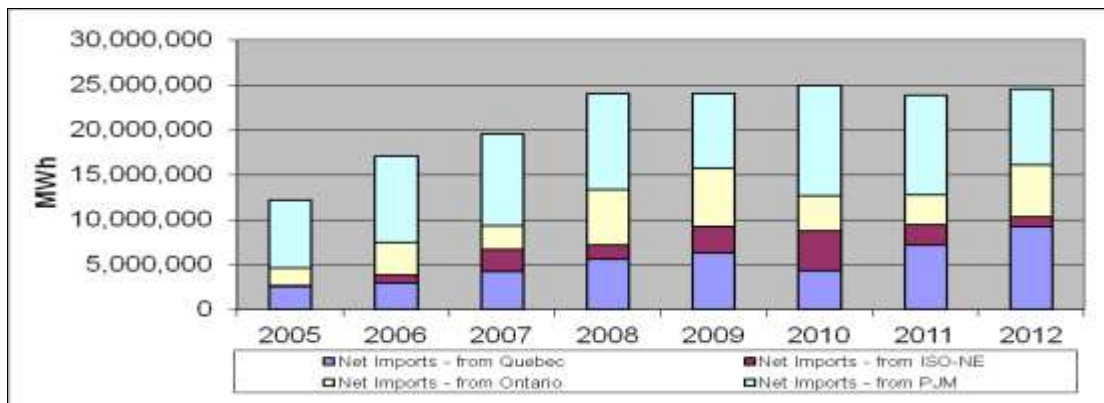


Figure 31 10-State Net Electricity Imports to NYISO (MWh)

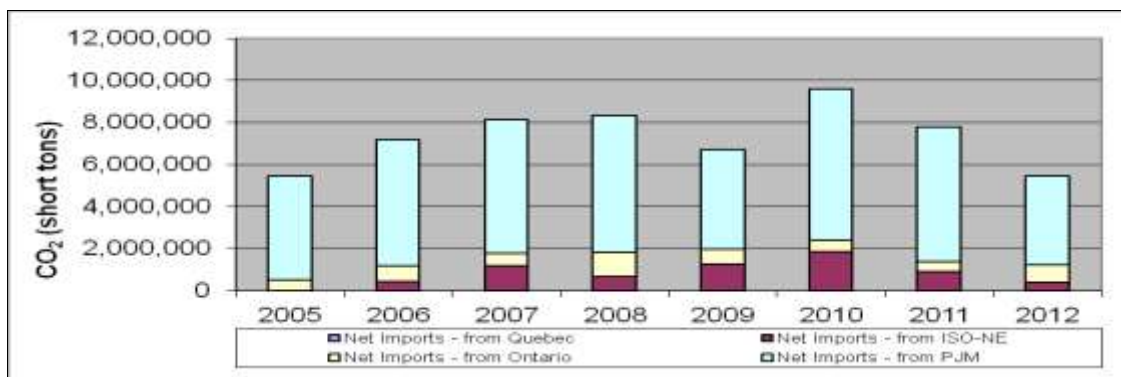


Figure 32 10-State CO₂ Emissions Related to Net Electricity Imports to NYISO (short tons CO₂)

PJM 10-STATE CHARTS AND TABLES:

Table 25 2005 – 2011 Monitoring Summary for RGGI PJM 10-State

	MWh								Tons CO ₂								Lb CO ₂ /MWh								
	2005	2006	2007	2008	2009	2010	2011	2012	2005	2006	2007	2008	2009	2010	2011	2012	2005	2006	2007	2008	2009	2010	2011	2012	
Electricity Demand																									
Total Annual Electricity Load in ISO	177,404,747	168,687,473	170,289,397	163,600,330	158,657,456	165,047,534	160,923,846	157,183,049	106,173,296	96,729,311	98,228,040	90,167,059	78,593,331	87,087,382	78,909,078	74,395,803	1,197	1,147	1,154	1,102	991	1,055	981	947	
Net Imports - from Non-RGGI PJM	65,324,576	60,819,367	57,887,856	54,088,276	56,299,698	58,001,518	55,406,781	53,119,637	43,596,369	39,383,494	37,012,128	34,138,677	33,537,149	35,150,499	33,048,520	30,060,122	1,335	1,295	1,279	1,262	1,191	1,212	1,193	1,132	
Net Imports - from NYISO	-1,224,177	-1,457,171	-1,565,273	-1,627,174	-1,257,857	-1,844,414	-1,583,072	-1,131,057	-683,486	-774,675	-852,476	-832,492	-553,688	-894,878	-688,046	0	1,117	1,063	1,089	1,023	880	970	869	0	
Total Net Electricity Imports - from All Adjoining ISOs	64,100,399	59,362,196	56,322,583	52,461,102	55,041,841	56,157,104	53,823,709	51,988,580	42,912,883	38,608,819	36,159,652	33,306,185	32,983,461	34,255,621	32,360,474	30,060,122	1,339	1,301	1,284	1,270	1,198	1,220	1,202	1,156	
Electricity Generation																									
Annual Electric Generation - RGGI-Affected Units	62,572,572	57,720,201	62,357,387	59,342,547	50,005,454	57,625,172	53,621,362	53,490,594	61,681,725	56,440,700	59,921,956	54,967,858	43,804,611	50,125,993	44,418,277	41,248,177	1,972	1,956	1,922	1,853	1,752	1,740	1,657	1,542	
Annual Electric Generation - Non-RGGI Fossil Fuel-Fired Units	479,438	339,933	364,609	165,411	151,888	143,960	227,081	204,818	369,986	275,158	285,909	168,417	152,325	145,704	182,970	223,514	1,543	1,619	1,568	2,036	2,006	2,024	1,611	2,183	
Annual Electric Generation - Non-Fossil Fuel-Fired Units	50,252,338	51,265,143	51,244,818	51,631,270	53,458,273	51,121,298	53,251,694	51,499,057	1,208,702	1,404,634	1,860,523	1,724,599	1,652,934	2,560,064	1,947,357	2,863,990	48	55	73	67	62	100	73	111	
Annual Electric Generation - All Non-RGGI Units	50,731,776	51,605,076	51,609,427	51,796,681	53,610,161	51,265,258	53,478,775	51,703,875	1,578,688	1,679,792	2,146,432	1,893,016	1,805,259	2,705,768	2,130,327	3,087,504	62	65	83	73	67	106	80	119	
Total Annual Electric Generation - All Units	113,304,348	109,325,277	113,966,814	111,139,228	103,615,615	108,890,430	107,100,137	105,194,469	63,260,413	58,120,492	62,068,388	56,860,874	45,609,870	52,831,761	46,548,604	44,335,681	1,117	1,063	1,089	1,023	880	970	869	0	
Summary CO₂ Emissions and MWh Data																									
Annual CO ₂ Emissions from Non-RGGI Generation Serving Load in ISO (Non-RGGI Generation within ISO + Net Imports = (B-2 + B-3) + A-2)	114,832,175	110,967,272	107,932,010	104,257,783	108,652,002	107,422,362	107,302,484	103,692,455	44,491,571	40,288,611	38,306,084	35,199,201	34,788,720	36,961,389	34,490,801	33,147,626	775	726	710	675	640	688	643	639	

Table 25 PJM ELECTRIC LOAD AND GENERATION

10-State 2006-2008 COMPARED TO 2010-2012

	Load	Non-RGGI Generation	RGGI Generation	Total In-Region Generation
Baseline: 2006-2008	167,525,733	51,670,395	59,806,712	111,477,106
Baseline: 2010-2012	161,051,476	52,149,303	54,912,376	107,061,679
Difference	-6,474,256	478,908	-4,894,336	-4,415,428
Percent Change	-3.9%	0.9%	-8.2%	-4.0%

10-State 2006-2008 COMPARED TO 2012

	Load	Non-RGGI Generation	RGGI Generation	Total In-Region Generation
Baseline: 2006-2008	167,525,733	51,670,395	59,806,712	111,477,106
2012	157,183,049	51,703,875	53,490,594	105,194,469
Difference	-10,342,684	33,480	-6,316,118	-6,282,637
Percent Change	-6.2%	0.1%	-10.6%	-5.6%

Table 26 PJM NON-RGGI AND RGGI GENERATION

10-State 2006-2008 COMPARED TO 2010-2012

	Non-RGGI Generation			RGGI Generation		
	MWh	CO2 Emissions	lb CO2/MWh	MWh	CO2 Emissions	lb CO2/MWh
Baseline: 2006-2008	51,670,395	1,906,413	74	59,806,712	57,110,171	1,910
Baseline: 2010-2012	52,149,303	2,641,200	102	54,912,376	45,264,149	1,646
Difference	478,908	734,786	28	-4,894,336	-11,846,023	-264
Percent Change	0.9%	38.5%	37.6%	-8.2%	-20.7%	-13.8%

10-State 2006-2008 COMPARED TO 2012

	Non-RGGI Generation			RGGI Generation		
	MWh	CO2 Emissions	lb CO2/MWh	MWh	CO2 Emissions	lb CO2/MWh
Baseline: 2006-2008	51,670,395	1,906,413	74	59,806,712	57,110,171	1,910
2012	51,703,875	3,087,504	119	53,490,594	41,248,177	1,542
Difference	33,480	1,181,091	46	-6,316,118	-15,861,994	-368
Percent Change	0.1%	62.0%	61.8%	-10.6%	-27.8%	-19.3%

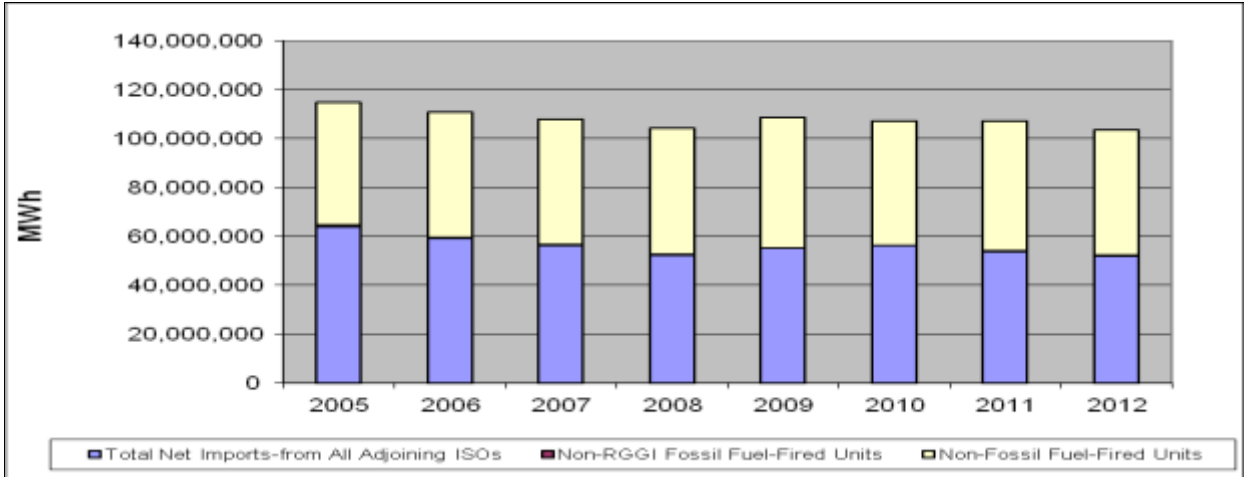


Figure 33 10-State Non-RGGI Generation Serving Load in RGGI PJM (MWh)

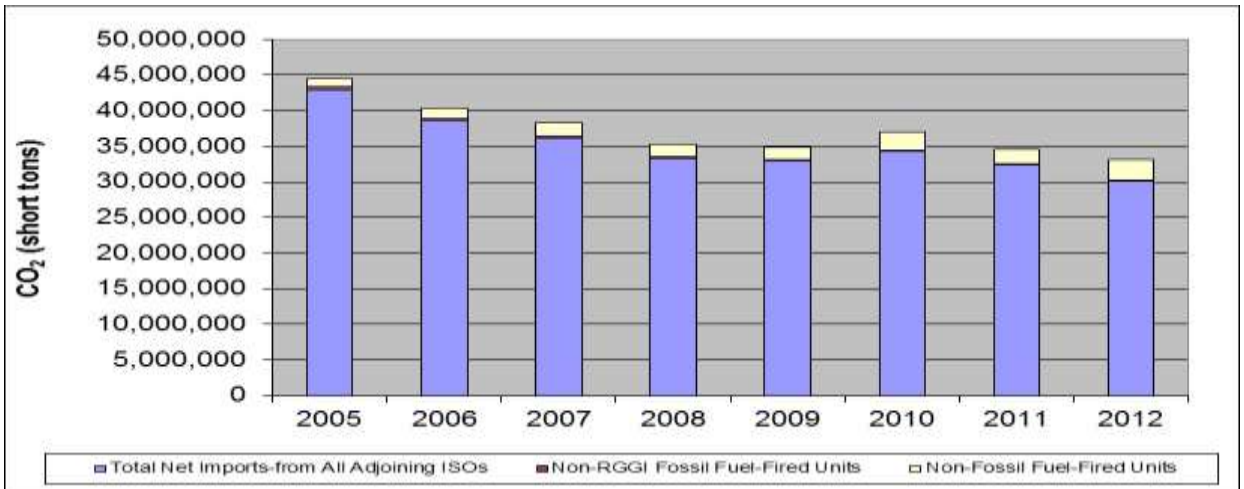


Figure 34 10-State CO₂ Emissions from Non-RGGI Generation Serving Load in RGGI PJM (short tons CO₂)

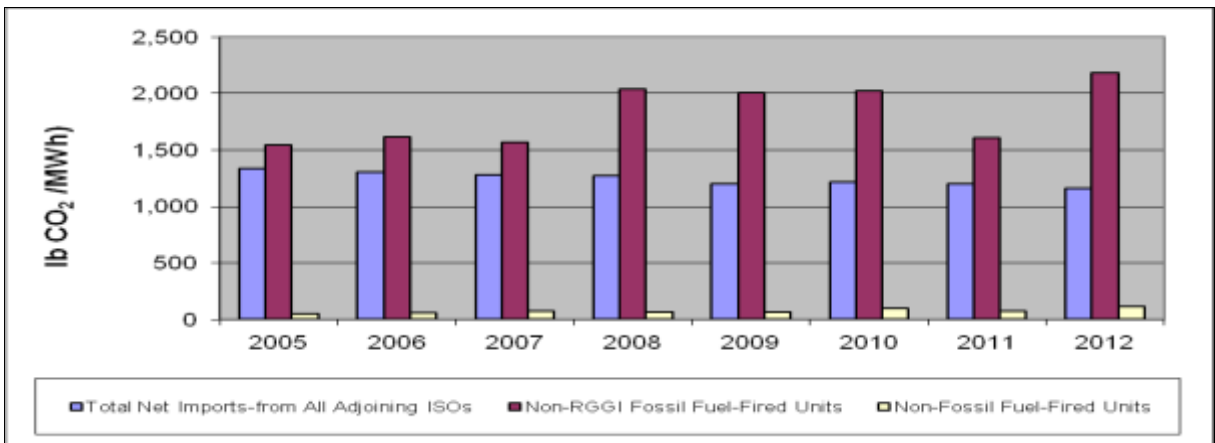


Figure 35 10-State CO₂ Emission Rate for Non-RGGI Generation Serving Load in RGGI PJM (lb CO₂/MWh)

Table 27 PJM IMPORTS

10-State IMPORTS, 2006-2008 COMPARED TO 2010-2012

	MWh	CO2 Emissions	lb CO2/MWh
Baseline: 2006-2008	56,048,627	36,024,885	1,285
Baseline: 2010-2012	53,989,798	32,225,406	1,193
Difference	-2,058,829	-3,794,480	-92
Percent Change	-3.7%	-10.5%	-7.1%

10-State IMPORTS, 2006-2008 COMPARED TO 2012

	MWh	CO2 Emissions	lb CO2/MWh
Baseline: 2006-2008	56,048,627	36,024,885	1,285
2012	51,988,580	30,060,122	1,156
Difference	-4,060,047	-5,964,763	-128
Percent Change	-7.2%	-16.6%	-10.0%

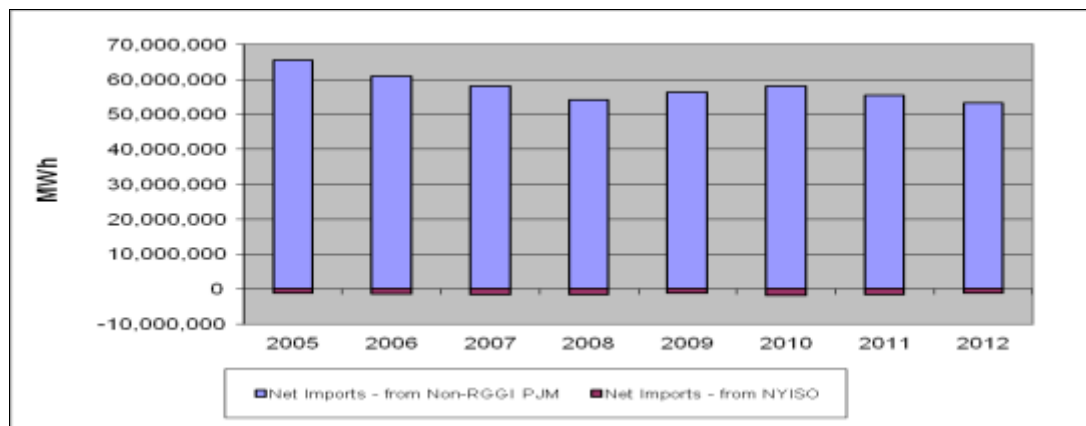


Figure 36 10-State Net Electricity Imports to RGGI PJM (MWh)

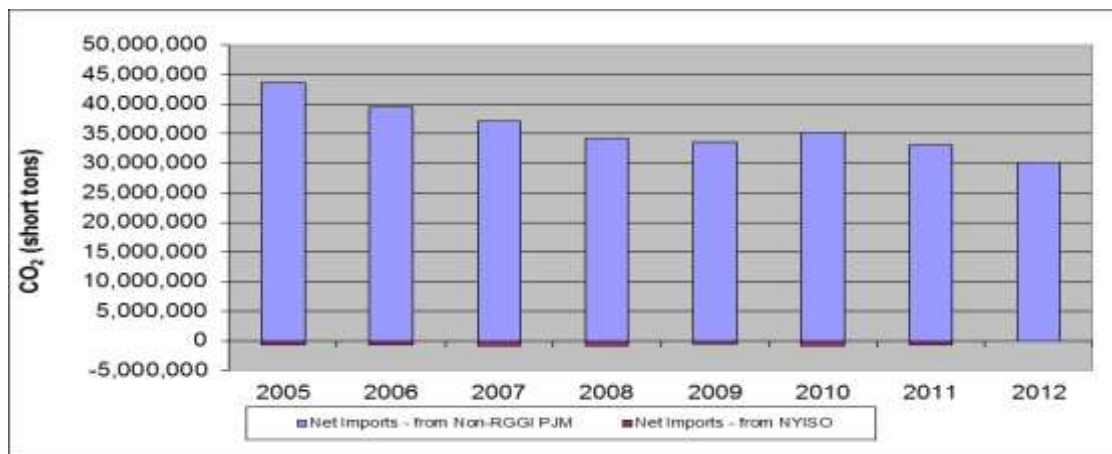


Figure 37 10-State CO₂ Emissions Related to Net Electricity Imports to RGGI PJM (short tons CO₂)

Monitoring Trends

Table 28 Monitoring Trends for 10-State RGGI Region

	Non-RGGI Generation			RGGI Generation			Imports			Total Non-RGGI Generation (ISO + Net Imports)		
	MWh	CO2 Emissions	lb CO2/MWh	MWh	CO2 Emissions	lb CO2/MWh	MWh	CO2 Emissions	lb CO2/MWh	MWh	CO2 Emissions	lb CO2/MWh
2006-2008	183,910,392	17,205,745	187	203,712,944	158,876,166	1,560	83,452,187	43,812,948	1,051	267,362,579	61,018,693	456
2010-2012	182,532,387	16,128,023	177	187,026,191	121,337,104	1,295	87,847,691	39,171,407	893	270,380,078	55,299,431	409
Difference	-1,378,005	-1,077,721	-10	-16,686,753	-37,539,063	-264	4,395,504	-4,641,540	-158	3,017,499	-5,719,262	-47
% change	-0.7%	-6.3%	-5.5%	-8.2%	-23.6%	-16.9%	5.3%	-10.6%	-15.1%	1.1%	-9.4%	-10.3%
	In-Region Generation (MWh)		Total In-Region Load (MWh)									
2006-2008	387,623,336		470,974,186									
2010-2012	369,335,227		455,747,684									
Difference	-18,064,758		-15,226,502									
% change	-4.7%		-3.2%									

	Non-RGGI Generation			RGGI Generation			Imports			Total Non-RGGI Generation (ISO + Net Imports)		
	MWh	CO2 Emissions	lb CO2/MWh	MWh	CO2 Emissions	lb CO2/MWh	MWh	CO2 Emissions	lb CO2/MWh	MWh	CO2 Emissions	lb CO2/MWh
2006-2008	183,910,392	17,205,745	187	203,712,944	158,876,166	1,560	83,452,187	43,812,948	1,051	267,362,579	61,018,693	456
2012	183,272,334	17,306,637	189	180,732,948	109,701,552	1,214	89,102,530	35,354,661	794	272,374,864	52,661,298	387
Difference	-638,058	100,892	2	-22,979,996	-49,174,615	-346	5,650,343	-8,458,287	-257	5,012,285	-8,357,394	-70
% change	-0.3%	0.6%	1.0%	-11.3%	-31.0%	-22.2%	6.8%	-19.3%	-24.5%	1.9%	-13.7%	-15.3%
	In-Region Generation (MWh)		Total In-Region Load (MWh)									
2006-2008	387,623,336		470,974,186									
2012	364,005,282		450,463,043									
Difference	-23,618,054		-20,511,143									
% change	-6.1%		-4.4%									

Monitoring Trends for 10-State ISO-NE

For ISO-NE there is no difference between the 9-state and 10-state data.

Table 29 Monitoring Trends for 10-State NYISO

	Non-RGGI Generation			RGGI Generation			Imports			Total Non-RGGI Generation (ISO + Net Imports)		
	MWh	CO2 Emissions	lb CO2/MWh	MWh	CO2 Emissions	lb CO2/MWh	MWh	CO2 Emissions	lb CO2/MWh	MWh	CO2 Emissions	lb CO2/MWh
2006-2008	76,580,782	5,740,019	150	71,623,443	54,523,728	1,522	20,206,894	7,876,114	789	96,787,676	13,616,133	281
2010-2012	75,155,330	2,067,572	55	64,359,651	39,903,046	1,239	24,415,226	7,595,568	622	99,570,556	9,663,140	194
Difference	-1,425,452	-3,672,447	-95	-7,263,792	-14,620,682	-282	4,208,333	-280,547	67	2,782,881	-3,952,993	-87
% change	-1.9%	-64.0%	-63.2%	-10.1%	-26.8%	-18.5%	20.8%	-3.6%	-21.2%	2.9%	-29.0%	-31.0%
	In-Region Generation (MWh)		Total In-Region Load (MWh)									
2006-2008	148,204,225		168,411,119									
2010-2012	139,514,981		163,930,208									
Difference	-8,689,244		-4,480,911									
% change	-5.9%		-2.7%									

	Non-RGGI Generation			RGGI Generation			Imports			Total Non-RGGI Generation (ISO + Net Imports)		
	MWh	CO2 Emissions	lb CO2/MWh	MWh	CO2 Emissions	lb CO2/MWh	MWh	CO2 Emissions	lb CO2/MWh	MWh	CO2 Emissions	lb CO2/MWh
2006-2008	76,580,782	5,740,019	150	71,623,443	54,523,728	1,522	20,206,894	7,876,114	789	96,787,676	13,616,133	281
2012	74,461,772	2,327,884	63	64,761,272	37,095,505	1,146	24,466,950	5,450,237	446	98,928,722	7,778,121	157
Difference	-2,119,010	-3,412,135	-87	-6,862,171	-17,428,223	-376	4,260,056	-2,425,877	-343	2,141,046.33	-5,838,012	-124
% change	-2.8%	-59.4%	-58.2%	-9.6%	-32.0%	-24.7%	21.1%	-30.8%	-43.5%	2.2%	-42.9%	-44.1%
	In-Region Generation (MWh)		Total In-Region Load (MWh)									
2006-2008	148,204,225		168,411,119									
2012	139,223,044		163,689,994									
Difference	-8,981,181		-4,721,125									
% change	-6.1%		-2.8%									

Table 30 Monitoring Trends for 10-State PJM

	Non-RGGI Generation			RGGI Generation			Imports			Total Non-RGGI Generation (ISO + Net Imports)		
	MWh	CO2 Emissions	lb CO2/MWh	MWh	CO2 Emissions	lb CO2/MWh	MWh	CO2 Emissions	lb CO2/MWh	MWh	CO2 Emissions	lb CO2/MWh
2006-2008	51,670,395	1,906,413	74	59,806,712	57,110,171	1,910	56,048,627	36,024,885	1,285	107,719,022	37,931,299	704
2010-2012	52,149,303	2,641,200	102	54,912,376	45,264,149	1,646	53,989,798	32,230,504	1,193	106,139,100	34,866,606	657
Difference	478,908	734,786	28	-4,894,336	-11,846,023	-264	-2,058,829	-3,799,480	-92	-1,579,921	-3,064,693	-47
% change	0.9%	38.5%	37.6%	-8.2%	-20.7%	-13.8%	-3.7%	-10.5%	-7.1%	-1.5%	-8.1%	-6.7%
	In-Region Generation (MWh)		Total In-Region Load (MWh)									
2006-2008	111,477,106		167,525,733									
2010-2012	107,061,679		161,051,476									
Difference	-4,415,428		-6,474,257									
% change	-4.0%		-3.9%									

	Non-RGGI Generation			RGGI Generation			Imports			Total Non-RGGI Generation (ISO + Net Imports)		
	MWh	CO2 Emissions	lb CO2/MWh	MWh	CO2 Emissions	lb CO2/MWh	MWh	CO2 Emissions	lb CO2/MWh	MWh	CO2 Emissions	lb CO2/MWh
2006-2008	51,670,395	1,906,413	74	59,806,712	57,110,171	1,910	56,048,627	36,024,885	1,285	107,719,022	37,931,299	704
2012	51,703,875	3,087,504	119	53,490,594	41,248,177	1,542	51,988,580	30,060,122	1,156	103,692,455	33,147,626	639
Difference	33,480	1,181,091	46	-6,316,118	-15,861,994	-368	-4,060,047	-5,964,763	-128	-4,026,567	-4,783,673	-65
% change	0.1%	62.0%	61.8%	-10.6%	-27.8%	-19.3%	-7.2%	-16.6%	-10.0%	-3.7%	-12.6%	-9.2%
	In-Region Generation (MWh)		Total In-Region Load (MWh)									
2006-2008	111,477,106		167,525,733									
2012	105,194,469		157,183,049									
Difference	-6,282,637		-10,342,684									
% change	-5.6%		-6.2%									

Appendix F. 10-State ISO Monitoring Sources

Summary of Data Sources for ISO-NE

10-State data sources are consistent with the 9-state data sources reported in Appendix A.

Table 31. Summary of 10-State Data Sources for NYISO

Code	Monitoring Category Associated with Data Elements at Right	MWh	CO ₂ lb/MWh	CO ₂ Tons
Electricity Demand (Annual)				
A-1	Total Electricity Use in NYISO	Sum of A-3 and B-5	CO ₂ tons divided by MWh	Sum of A-3 and B-5
A-2	Net Electricity Imports - from Hydro Quebec	Hydro Quebec ¹	Environment Canada ⁶	MWh multiplied by CO ₂ /MWh
A-2	Net Electricity Imports - from ISO-NE	ISO-NE ²	ISO-NE system average ⁷	MWh multiplied by CO ₂ /MWh
A-2	Net Electricity Imports - from Ontario	Ontario Independent Electricity System Operator ³	Environment Canada ⁶	MWh multiplied by CO ₂ /MWh
A-2	Net Electricity Imports - from PJM	PJM Annual State of the Market Report ⁴	PJM GATS ⁸	MWh multiplied by CO ₂ /MWh
A-3	Total Net Electricity Imports - from All Adjoining ISOs	Sum of A-2s	CO ₂ tons divided by MWh	Sum of A-2s
Electricity Generation (Annual)				
B-1	RGGI-Affected Units	NYDPS Calculation ⁵	CO ₂ tons divided by MWh	State reported data for 2005-2008; RGGI COATS for 2009 to 2012, EPA CAMD for Linden Sources in 2012 ^{9,10} . Includes only sources subject to a state CO ₂ Budget Trading Program CO ₂ allowance compliance obligation.
B-2	Non-RGGI Units (Fossil Fuel-Fired; < 25 MW)	NYDPS Calculation ⁵	CO ₂ tons divided by MWh	NYSDEC Emissions Report ¹¹
B-3	Non-RGGI Units (Non-Fossil Fuel-Fired)	NYDPS Calculation ⁵	CO ₂ tons divided by MWh	NYSDEC Emissions Report ¹¹
B-4	All Non-RGGI Units (Fossil and Non-Fossil)	Sum of B-2 and B-3	CO ₂ tons divided by MWh	Sum of B-2 and B-3
B-5	All Units	Sum of B-1 and B-4	CO ₂ tons divided by MWh	Sum of B-1 and B-4

Table Notes:

1. Hydro Quebec response to information request.
2. ISO-NE, Historical Data Reports, "Net Energy and Peak Load by Source" (Annual Summary). Available at <http://www.iso-ne.com/markets/hstdata/rpts/net_eng_peak_load_src/index.html>.
3. Ontario IESO response to information request.
4. Monitoring Analytics, *State of the Market for PJM* (2005 through 2012 reports).
5. NYDPS calculation based on MWh for each generator reported by NYISO and assignment of each generator to appropriate monitoring classification.
6. Environment Canada, *National Inventory Report 1990–2011: Greenhouse Gas Sources and Sinks in Canada*, Environment Canada, April 15, 2013. In Part 3, see Table A13-6 "Electricity Generation and GHG Emission Details for Quebec"; Table A13-7 "Electricity Generation and GHG Emission Details for Ontario". Available at <http://unfccc.int/national_reports/annex_i_ghg_inventories/national_inventories_submissions/items/7383.php> Note that Ontario emission factors for and Quebec emission factors 2010 and 2011 were updated, as compared to the previous year's report.
7. Calculated average, based on Row B-5 in Table 2 above.
8. PJM Generation Attribute Tracking System, accessible at <http://www.pjm-eis.com>.
9. MWh and CO₂ emissions data include Linden Cogeneration, units 005001 – 009001, as these units are physically located in New Jersey, but dispatch electricity into NYISO.
10. Historical 2005 – 2008 CO₂ emissions data reported by RGGI participating states compiled from CO₂ emissions data reported to U.S. EPA pursuant 40 CFR Part 75 and from CO₂ emissions and fuel use data reported to state emissions statement programs. Historical 2005 – 2008 CO₂ emissions data is available at <http://www.rggi.org/historical_emissions>. 2009 through 2012 CO₂ emissions data is from data reported to the RGGI CO₂ Allowance Tracking System (RGGI COATS), available at <<http://www.rggi-coats.org>>.
11. NYDPS calculation based on NYSDEC emissions data and other state data.

Table 32. Summary of 10-State Data Sources for RGGI PJM

Code	Monitoring Category Associated with Data Elements at Right	MWh	CO ₂ lb/MWh	CO ₂ Tons
Electricity Demand (Annual)				
A-1	Total Electricity Use in RGGI PJM	Sum of A-3 and B-5	CO ₂ tons divided by MWh	Sum of A-3 and B-5
A-2	Net Electricity Imports - from Non-RGGI PJM	PJM GATS ¹	PJM GATS ¹	MWh multiplied by CO ₂ /MWh
A-2	Net Electricity Imports - from NYISO	PJM Annual State of the Market Report ²	B-5	MWh multiplied by CO ₂ /MWh
A-3	Total Net Electricity Imports - from All Adjoining ISOs	Sum of A-2s	CO ₂ tons divided by MWh	Sum of A-2s
Electricity Generation (Annual)				
B-1	RGGI-Affected Units	PJM GATS ¹	CO ₂ tons divided by MWh	State reported data for 2005-2008; RGGI COATS for 2009 through 2012. EPA CAMD for NJ sources in 2012. Includes only sources subject to a state CO ₂ Budget Trading Program CO ₂ allowance compliance obligation; does not include Maryland LIESA sources;

				does not include Linden Cogeneration units 005001-009001. ^{3,4}
B-2	Non-RGGI Units (Fossil Fuel-Fired; < 25 MW)	PJM GATS ¹	CO ₂ tons divided by MWh	PJM GATS ¹
B-3	Non-RGGI Units (Non-Fossil Fuel-Fired)	PJM GATS ¹	CO ₂ tons divided by MWh	PJM GATS ¹
B-4	All Non-RGGI Units (Fossil and Non-Fossil)	Sum of B-2 and B-3	CO ₂ tons divided by MWh	Sum of B-2 and B-3
B-5	All Units	Sum of B-1 and B-4	CO ₂ tons divided by MWh	Sum of B-1 and B-4

Table Notes:

1. PJM Generation Attribute Tracking System, accessible at <<http://www.pjm-eis.com>>.
2. Monitoring Analytics, *State of the Market for PJM* (2005 through 2011 reports) at http://www.monitoringanalytics.com/reports/PJM_State_of_the_Market/2012.shtml .
3. Historical 2005 – 2008 CO₂ emissions data reported by RGGI participating states compiled from CO₂ emissions data reported to U.S. EPA pursuant 40 CFR Part 75 and from CO₂ emissions and fuel use data reported to state emissions statement programs. Historical 2005 – 2008 CO₂ emissions data is available at <http://www.rggi.org/historical_emissions>. 2009 through 2012 CO₂ emissions data is from data reported to the RGGI CO₂ Allowance Tracking System (RGGI COATS), available at <<http://www.rggi-coats.org>>.
4. MWh and CO₂ emissions data do not include Maryland Limited Industrial Exemption Set-aside (LIESA) sources. LIESA sources for 2009, 2010, 2011, and 2012 include Severstal Sparrows Point LLC and Luke Paper Company. LIESA sources refer to certain industrial cogenerators under Maryland's CO₂ Budget Trading Program regulations that are subject to alternative CO₂ compliance obligations under certain conditions in lieu of submission of CO₂ allowances