

RGGI Emissions Trends

January 2011



Emissions from power plants in the Regional Greenhouse Gas Initiative (RGGI) decreased in 2011 and likely fell to their lowest levels since the program launched in 2009. Based on data through the third quarter of 2011, ENE projects that total 2011 emissions are likely to have fallen slightly below the historic low in 2009.¹ Low emissions are a consequence of fuel-switching to natural gas, increased generation from non-emitting sources, stable electricity consumption, and – to a lesser extent – mild weather and weak economic conditions in the region. The persistence of these underlying conditions through RGGI’s first three years suggests a long-lasting structural change in the regional electric system that will keep emissions significantly below the existing cap level for the foreseeable future.

RGGI at a Glance:

- 10 States (ME, MA, NH, VT, RI, CT, NY, NJ, DE and MD)
- Applies to all fossil fuel-fired power plants 25 MW or greater
- Went into effect Jan 1, 2009
- 14th auction conducted on December 7, 2011
- Initial regional cap is 188 million tons CO₂
- Cap is two-phase:
 - Stabilization at initial level for 2009-2014.
 - 2.5% reduction per year 2015-2018 for total 10% reduction
- 3 year compliance period; first permits due 3/1/2012.

Summary of Key Findings:

- Emissions through the first three quarters of 2011 were 11% below emissions over the same period in 2010, and total **2011 emissions likely declined to around 34% below the RGGI cap.**
- Emissions have declined due to **decreasing generation from carbon-intensive fuel oil and coal, increasing generation from natural gas and renewables, and expanding energy efficiency programs.**
- Emissions have decreased without significant investment in new electric generation, indicating that **carbon pollution can be reduced at low cost within a market-based program like RGGI.**
- The persistence of low natural gas prices and increasing commitments to renewables and efficiency suggest that **emissions will remain below the current RGGI cap for the foreseeable future.**

Emissions Data

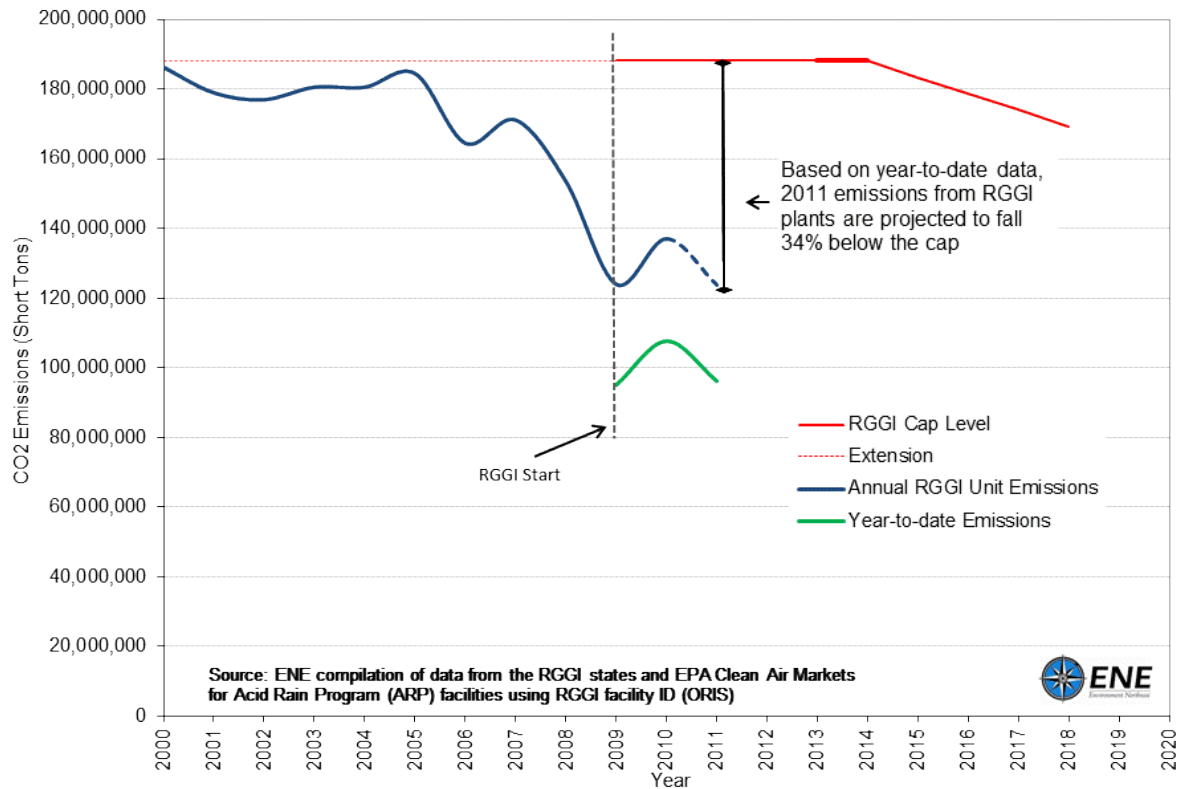
Carbon dioxide emissions from RGGI power plants in the first three quarters of 2011 totaled **96,127,957** tons, a 10.7% decrease from emissions over the first three quarters of 2010 (107,648,602 tons). Based on average fourth quarter emissions in 2009 and 2010, total 2011 emissions are projected to fall about 34% below the regional cap of 188,076,976 tons (Figure 1).

This analysis is based on emissions data made available by the RGGI member states and compiled by RGGI, Inc through the CO₂ Allowance Tracking System (RGGI-COATS).²

¹ Emissions data from power plants within the RGGI program is released publicly several months after the end of the reporting period, so this report projects 2011 emissions based on available data (through third quarter 2011).

² Emissions data available at: <https://rggi-coats.org/eats/rggi/>, “Public Reports”.

Figure 1: RGGI Facility Year-to-Date (YTD)³ CO₂ Emissions through 2011



Emissions Drivers

Carbon dioxide emissions from power plants in the RGGI program are determined by two main factors: 1) what source the electricity comes from; and 2) how much electricity is consumed. Each of these is determined by a number of sometimes interrelated drivers:

- **Sources of Electric Generation**

- *Energy Prices & Natural Gas Generation* – describing the impact of low-cost, lower-emissions natural gas on the regional electricity generation mix, including the near elimination of oil-fired electric generation from the regional system mix;
- *Non-Fossil Fuel Generation* – describing how increased generation from renewable and nuclear sources has decreased the utilization of fossil fueled plants; and
- *Imports* – describing the degree to which adding RGGI allowance costs to electricity prices has impacted power flows into the region.

- **Electricity Consumption**

- *Economic Conditions & Energy Efficiency* – describing the extent to which the recession and energy efficiency programs have decreased electric demand; noting that economic growth and emissions are not as closely linked as commonly assumed; and
- *Weather* – describing the impact of weather conditions, (largely air-conditioning) on electricity demand and emissions.

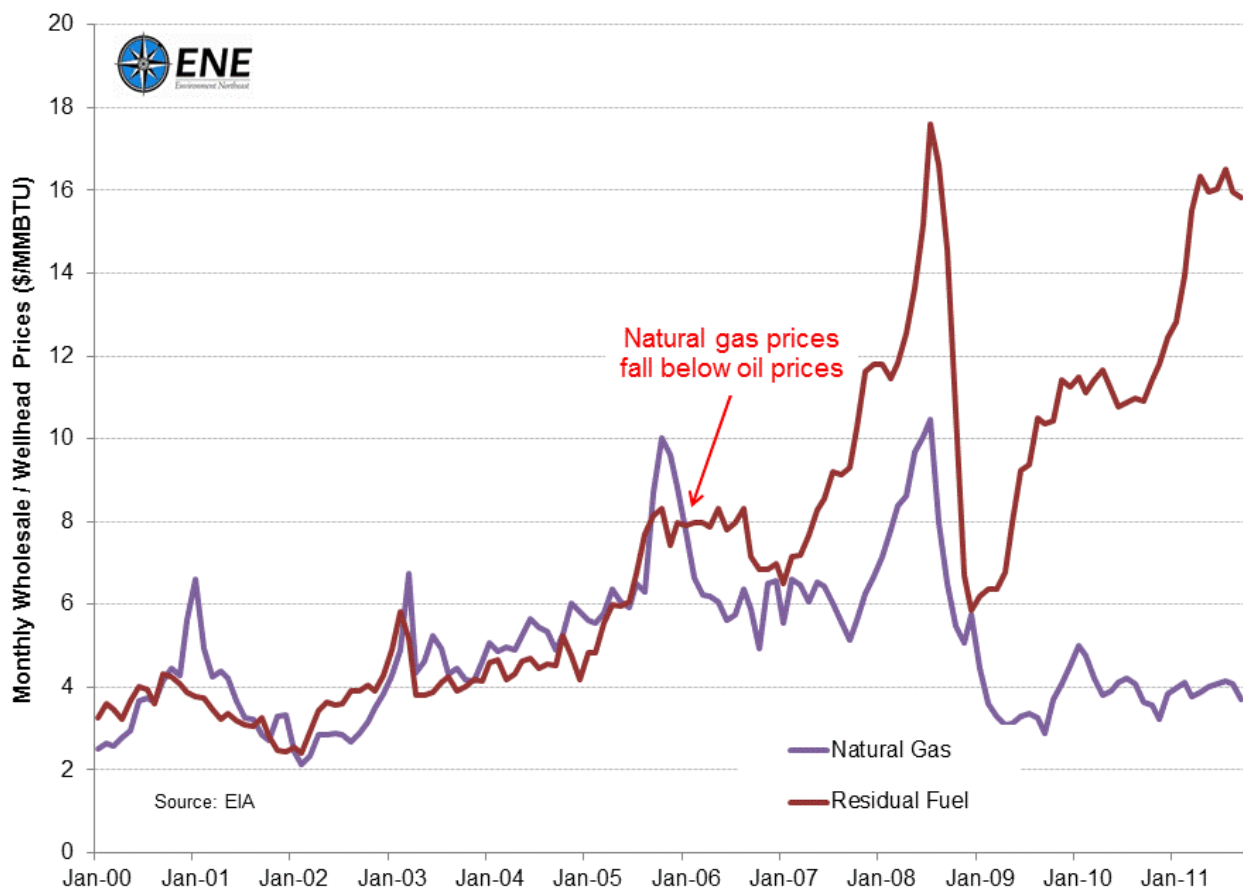
³ Throughout this report Year-to-Date data is based on latest available reporting, which varies between sources. Where relevant, date ranges are indicated on the y-axis.

Sources of Electric Generation

Energy Prices & Natural Gas Generation

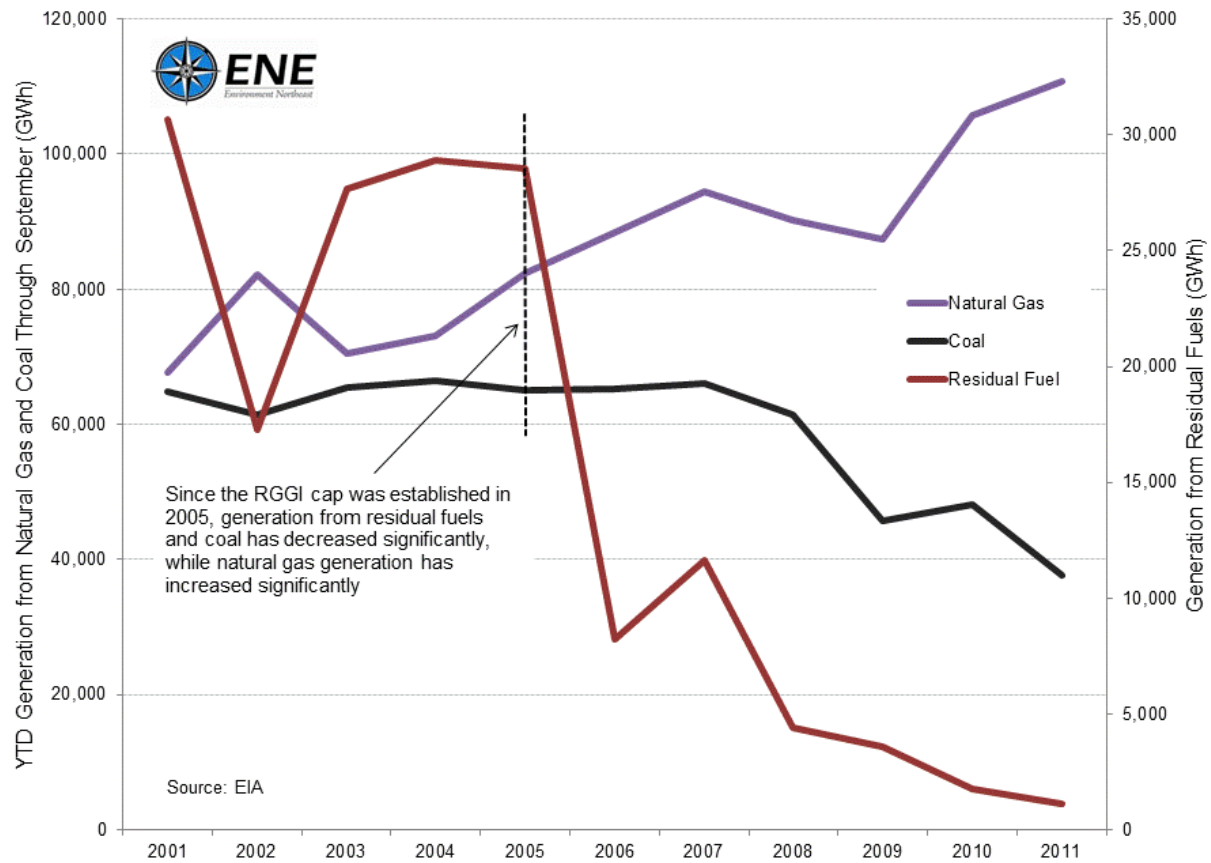
Electric sector emissions are largely determined by the type of fuel used to generate electricity, and increased utilization of low-emissions natural gas has decreased RGGI region emissions significantly. The relative prices of residual fuel and natural gas are particularly important in the RGGI region as significant capacity exists to generate power from either fuel, facilitating the utilization of whichever fuel is cheapest. For the majority of the past 6 years natural gas has been significantly lower priced (Figure 2).

Figure 2: National Spot Prices for Residual Fuel and Natural Gas



Low natural gas prices have led to decreased utilization of residual fuel and coal generation. (Coal prices vary across the region, but have generally increased since 2003, according to EIA.) In the RGGI region residual fuel generation in the first three quarters of 2011 was down 35% from 2010 levels and 96% from 2005 levels, while coal generation decreased 22% from 2010 levels and 42% from 2005 levels (Figure 3). Meanwhile, natural gas generation continued to increase in 2011, up 5% from 2010 levels and up 34% from 2005. Fuel switching from coal and oil to lower-carbon natural gas has had a significant impact on regional emissions. To produce the same amount of heat, natural gas emits 44% less carbon than coal and 33% less carbon than fuel oil,⁴ and natural gas plants are typically more efficient.⁵

Figure 3: RGGI Region YTD Electric Generation from Natural Gas, Coal and Residual Fuels



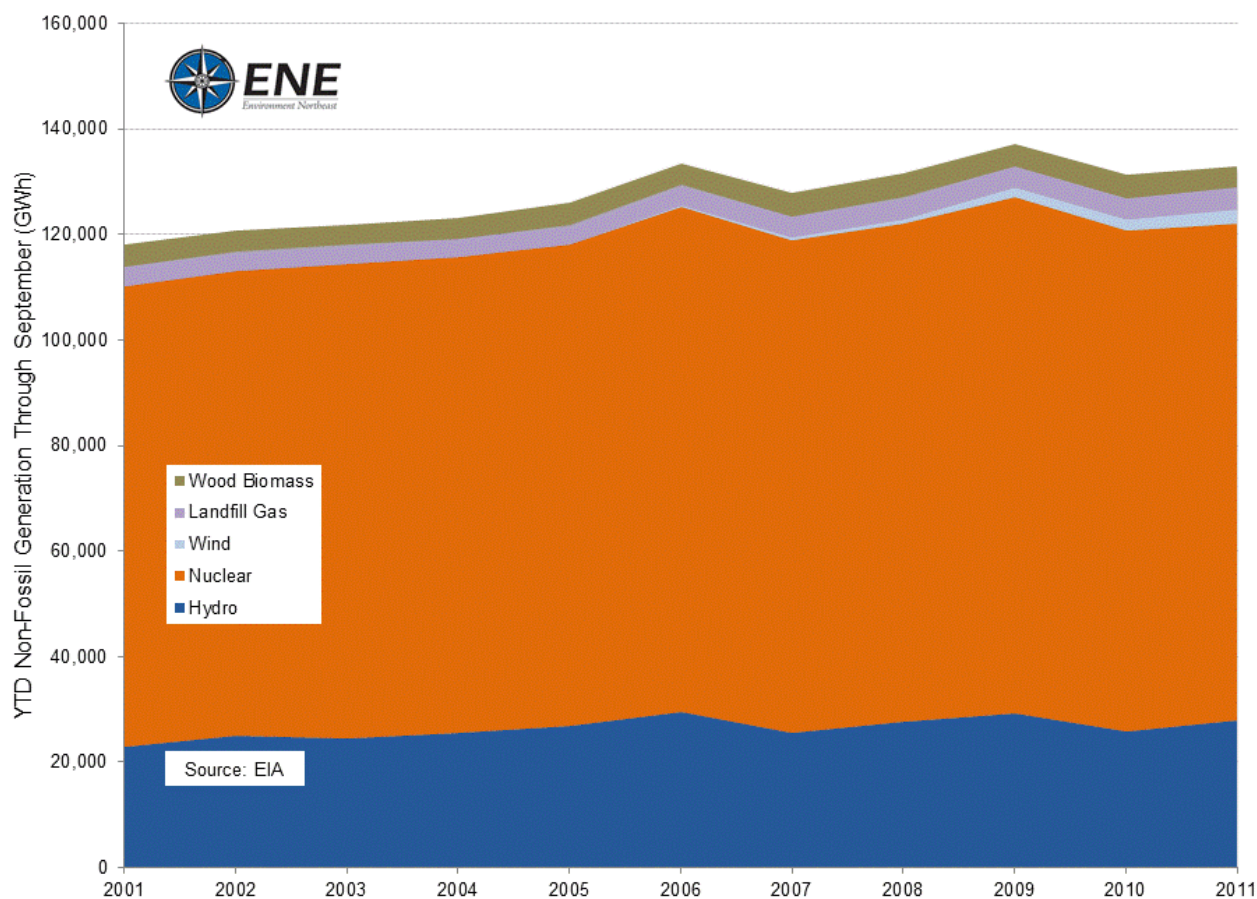
⁴ Carbon emissions factors for natural gas (117.0 lbs CO₂/MMBtu), residual fuel oil (173.7 lbs CO₂/MMBtu) and coal (210.0 lbs CO₂/MMBtu) from EIA: www.eia.doe.gov/oiaf/1605/excel/Fuel%20Emission%20Factors.xls

⁵ Note that natural gas direct stack emissions are much lower than coal and oil, but there is increasing concern about upstream GHG and other pollution from natural gas, which needs to be more thoroughly investigated and quantified.

Non-Fossil Fuel Generation

Non-fossil fuel electricity – including nuclear, hydro, wind, and other forms of renewable energy – is displacing fossil fuel generation and reducing emissions across the region. Data indicate that YTD non-fossil fuel generation increased 1.2% from 2010 to 2011, and has risen 5.4% since 2001 (Figure 4).

Figure 4: RGGI Region Electricity Production from Non-Fossil Sources



Between 2005 and 2011 YTD non-fossil generation in the RGGI region has increased by about 6,800 GWh of generation. Of this 6,800 GWh of new non-fossil generation, 2,670 GWh came from wind, 2,860 GWh came from nuclear uprates, and 480 GWh came from landfill gas. Hydro output also increased by 2,200 GWh in 2011, though it remained below the recent peak output of 29,400 GWh in 2006. The overall trends in recent years show that non-emitting generation is increasing, displacing fossil-based electricity and reducing emissions in the RGGI region.⁶

The expansion of non-emitting generation looks likely to continue in years ahead. The Federal Energy Information Administration (EIA) predicts that renewable and nuclear generation will continue to

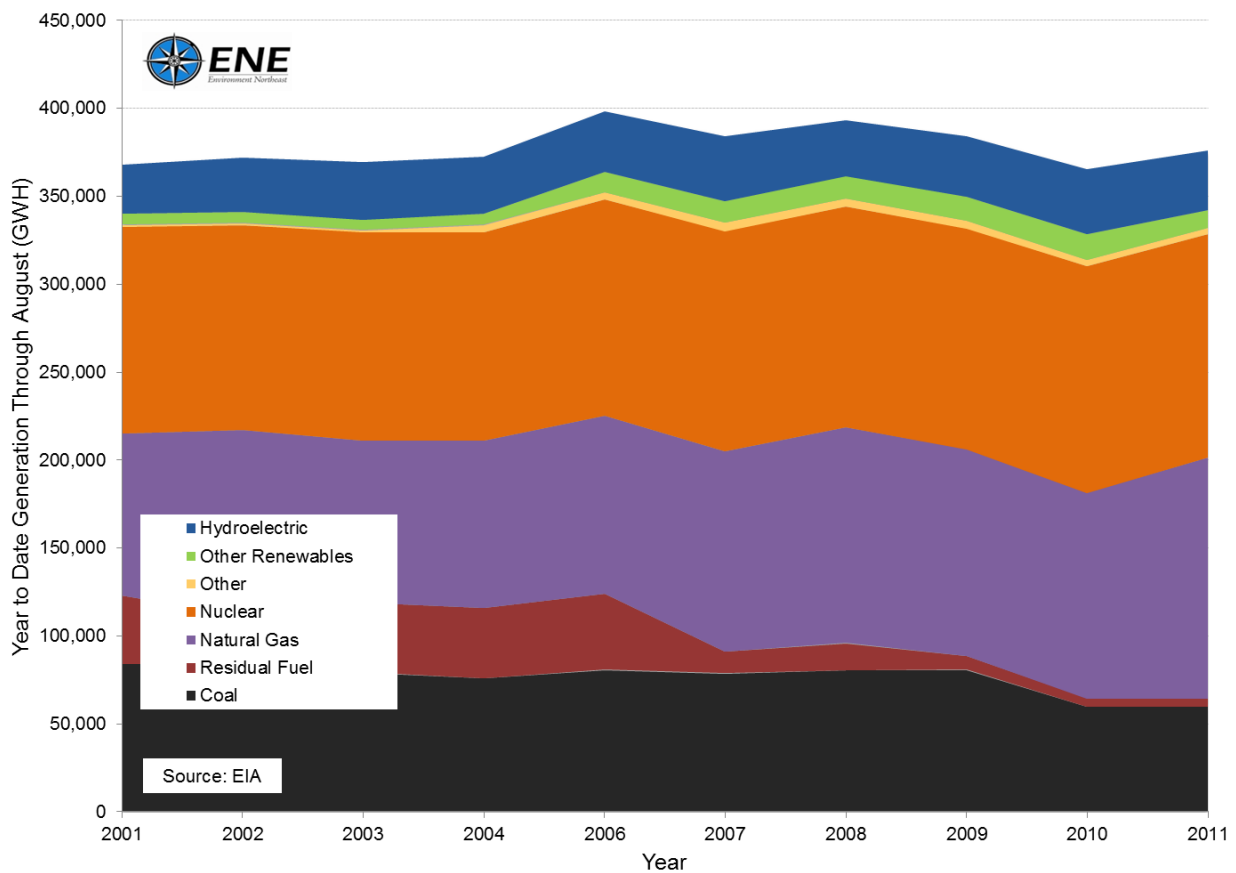
⁶ Based a weighted average of emissions intensity for oil and coal generation coming off line since 2005, in 2010 this non-emitting generation avoided approximately 6.8 million tons of CO₂ that would have been emitted to produce an equivalent amount of electricity from oil and coal.

increase nationwide in the near term, in addition to natural gas generation.⁷ Additionally, all 10 RGGI states have Renewable Portfolio Standards that require electric utilities to procure increasing quantities of renewable electricity, ensuring continuing growth of renewable generation in the region.⁸

Overall Generation Trends

Electric generation in the RGGI region has reduced in carbon intensity over the last 5 years, due to increased generation from natural gas, nuclear, and renewable sources and decreased output from higher-carbon coal and residual fuel plants (Figure 5). With the exception of steady, incremental growth in wind capacity and modest natural gas additions, this decline in electric sector emissions has occurred without the addition of significant new capacity or capital expenditures. This low-cost transition to lower regional emissions suggests that decreasing emissions may be far more cost-effective than commonly assumed.

Figure 5: RGGI YTD Generation by Fuel Type



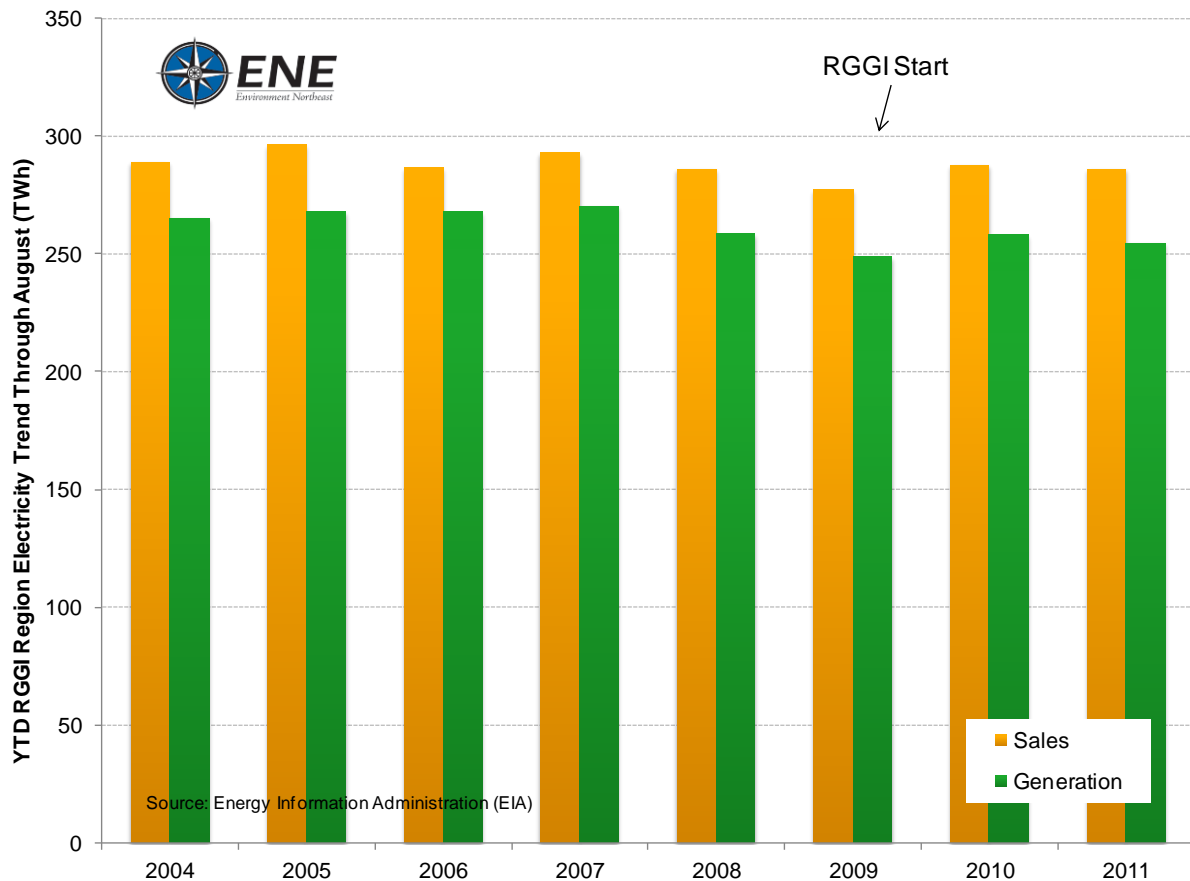
⁷ EIA, 2011, *Annual Energy Outlook 2011 Early Release Overview*, Available at: <http://www.eia.gov/forecasts/aeo/>

⁸ For additional information on State Renewable Energy Portfolios see the Department of Energy's EERE State Activities & Partnerships, Available at: http://apps1.eere.energy.gov/states/maps/renewable_portfolio_states.cfm

Electricity Imports and Emissions Leakage

The addition of RGGI allowance costs to electric generation prices does not appear to be causing significant leakage of emissions to generation sources outside of the RGGI region. Since RGGI began adding carbon costs to electricity prices on January 1, 2009, electricity sales region-wide have increased by 3.2%, while generation increased by 2.4%. Slight increases in power imports are driven by many factors including availability of transmission, plant maintenance, electric energy price differentials between regions⁹ and other factors, in addition to the modest costs for RGGI allowances. Since RGGI began imports and consumption have varied only slightly (Figure 6), and recent analysis by New York State Energy Research and Development Administration found RGGI allowances prices are not causing significant emissions leakage.¹⁰

Figure 6: RGGI Region YTD Electricity Sales vs. In-region Generation



⁹ For example, demand may be higher in one of two adjacent areas, leading to higher prices and economic incentives for plants to send electricity into the higher priced area.

¹⁰ See: http://rggi.org/docs/ProgramReview/LearningSession1/Presentation_James_Gallagher_NYISO.pdf

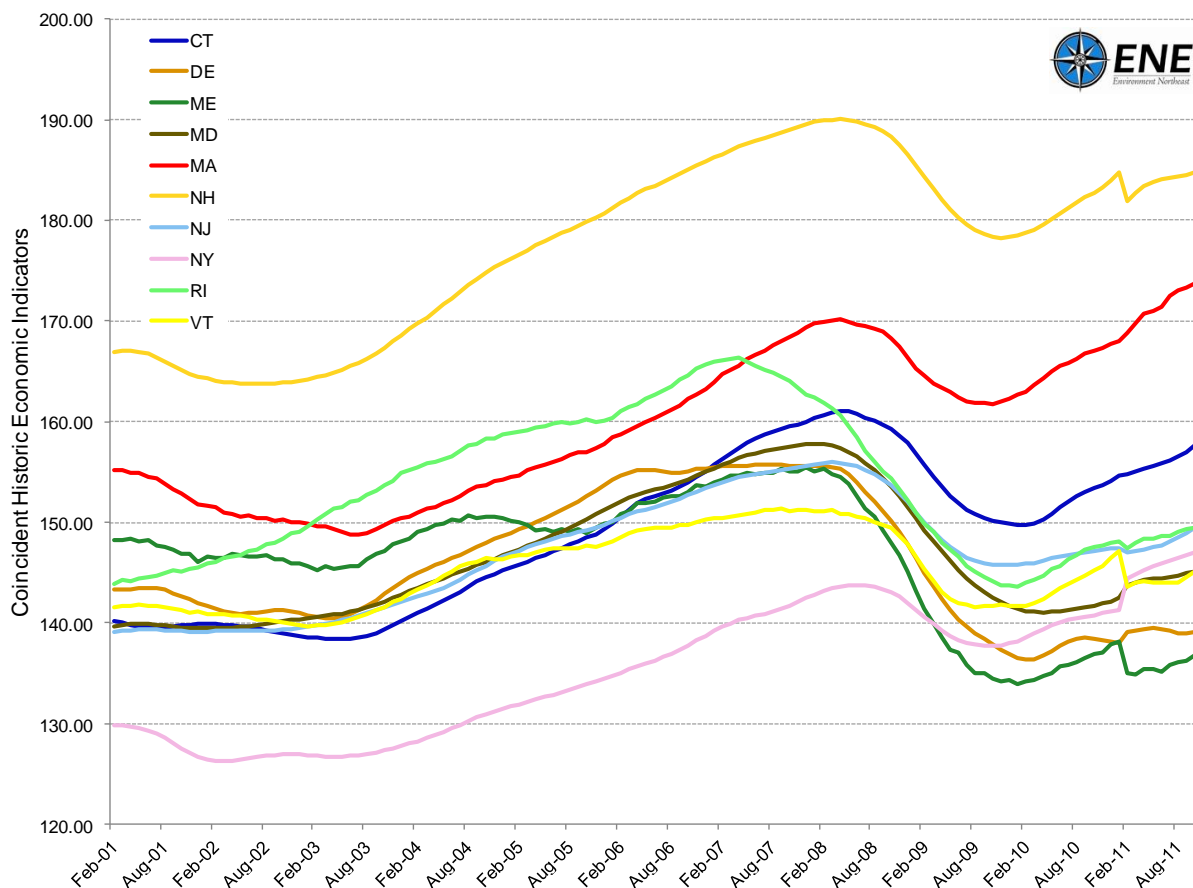
Electricity Consumption

Economic Conditions & Energy Efficiency

Economic growth and the efficiency with which energy is used are significant drivers of RGGI region emissions. Electricity demand has historically been tied to economic growth, with electricity consumption – and related emissions – increasing during periods of economic expansion, and decreasing in economic downturns. However, stable electricity demand during the early 2000s period of economic growth and increasing investments in energy efficiency suggests the link between economic growth and emissions may be weakening, and that emissions may remain low even as the economy recovers from its recent downturn.

The RGGI experience bears this out. RGGI region economies expanded for the majority of the last decade, with the economic downturn reversing this trend in 2008-2009 – as evidenced by coincident indexes from the Federal Reserve Bank of Philadelphia (Figure 7).¹¹

Figure 7: RGGI Region Economic Conditions (through October 2011)

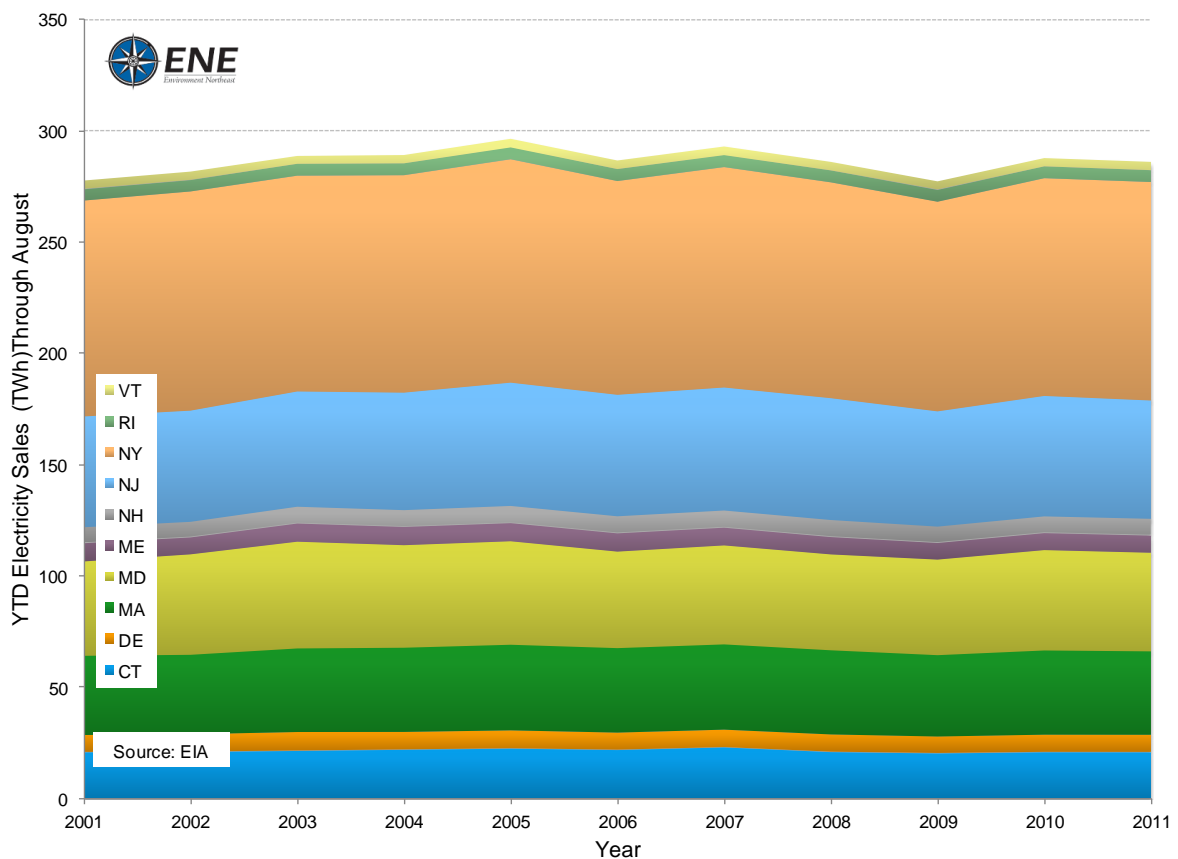


¹¹ See: <http://www.philadelphiafed.org/research-and-data/regional-economy/indexes/coincident/>

During the economic recovery from 2002-2005, electricity consumption increased only slightly, and remained stable until the economy slowed in 2008 (Figure 8). This suggests that improved energy efficiency of the economy and successful energy savings programs may have broken the link between economic growth and emissions growth. In the 10 RGGI states' investments in electric efficiency programs more than doubled from \$624 million in 2006 to \$1.45 billion in 2010,¹² with continuing increases planned. It is worth noting that over \$440 million in RGGI auction proceeds has been directed to efficiency programs in member states.¹³

Stable electricity consumption over the last decade and increasing investments in energy efficiency suggest that emissions are likely to remain low when the economy recovers, as demand is unlikely to increase significantly and low- or non-emitting generation continues to displace older, more emissions-intensive coal and oil generation in the region.

Figure 8: RGGI Electricity Consumption



¹² Annual energy efficiency reports from the Consortium for Energy Efficiency, see: <http://www.cee1.org/ee-pe/2010data.php3>

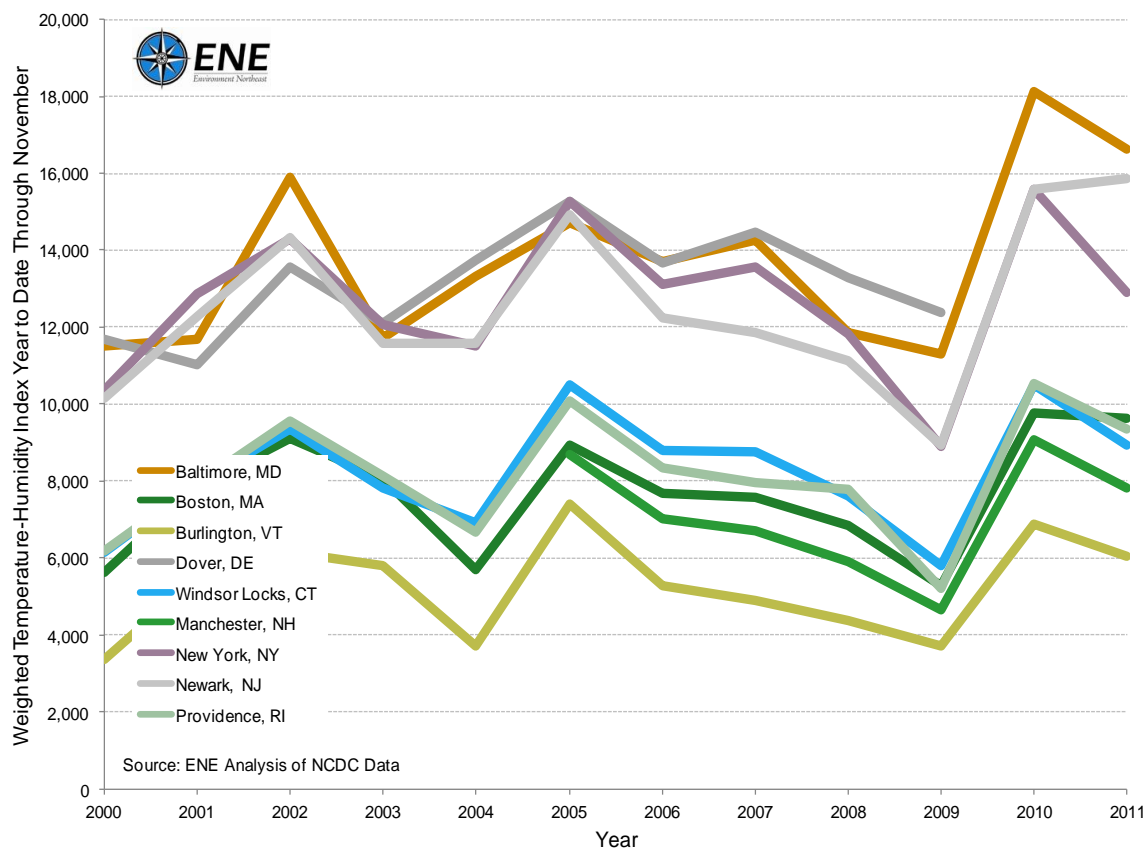
¹³ These investments save consumers \$1.1 billion in electricity costs and \$174 million in fossil fuel costs. Analysis Group report *The Economic Impacts of the Regional Greenhouse Gas Initiative on Ten Northeast and Mid-Atlantic States*, available at: <http://www.analysisgroup.com/RGGI.aspx>

Weather

Hot and humid summer weather leads to greater electricity consumption for air conditioning, and cold winter weather increases natural gas and heating oil consumption (only a small percentage of buildings in the region are heated with electricity). As home heating fuels are not covered under RGGI, ENE uses the temperature-humidity index (THI) to gauge the impacts of hot and humid weather on electricity consumption and emissions.

The summer of 2011 was less hot and humid than 2010, though the year-to-date THI in 2011 is higher than recent years (Figure 9).¹⁴ Cooler less humid weather in 2011 decreased demand for air conditioning from 2010 levels, thus decreasing electricity demand and emissions. It is worth noting that weather in 2011 produced a higher THI than in 2009, and even with this higher cooling load 2011 emissions are projected to fall below 2009 levels. This suggests that the increased demand is being met with low- and non-emitting sources, and the transition to cleaner sources of power is accelerating.

Figure 9: RGGI Weighted Temperature-Humidity Index



¹⁴ 2010 weather data from Delaware was unavailable at the time of publication.

Conclusion

Emissions from power plants in the RGGI program are projected to reach their lowest level since the programs launched in 2009 due to the accelerating transition to lower emitting and emissions free sources of power. Improved energy efficiency and growing investments in efficiency programs accelerate the transition, as lower demand is matched with cleaner sources of power. Fuel-switching to natural gas, increased non-emitting generation, and support for energy saving programs appear to be long-lasting, suggesting that lower emissions are here to stay for the foreseeable future.

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