STATE OF NEW JERSEY
DEPARTMENT OF ENVIRONMENTAL PROTECTION

Statewide Greenhouse Gas Emission Inventory for 2009

NJ Department of Environmental Protection:
Office of Sustainability and Green Energy
Office of Science

November 2012

2009 Update to New Jersey's Statewide Greenhouse Gas Emission Inventory

BACKGROUND

This report updates New Jersey's Statewide Greenhouse Gas Emission Inventory and presents statistics on greenhouse gas emissions for the biennial report pursuant to the Global Warming Response Act (N.J.S.A. 26:2C-43). It discusses greenhouse gas emissions estimates for the most current and complete data for New Jersey (2009), recent trends, and progress towards achieving the 2020 and 2050 greenhouse gas limits established by the State's Global Warming Response Act (GWRA).

New Jersey's first GHG inventory in response to the GWRA was finalized in November 2008 and included a 1990 estimate (baseline), estimated emissions for 2004 and projections out to 2020.[1] The first biennial report was completed in November 2009 and included estimated greenhouse gas emissions for 2005 through 2007.[2] The second biennial report was completed in May 2011 and included estimated greenhouse gas emissions for 2008.[3]

METHODS

As with previous statewide inventories, the inventory for 2009 is largely based on fuel use data obtained from the Energy Information Administration (EIA).[4,5] Details on methods used to estimate releases from these data are discussed in the report "New Jersey Greenhouse Gas Inventory and Reference Case Projections 1990-2020" (Inventory and Projections) dated November 2008.[6] Certain improvements were subsequently made to these methods and are discussed in the first and second biennial reports referenced above. Minor additional improvements to the methods made for the 2009 inventory are discussed herein.

The inventory for 2009 increases the 2006 baseline estimate by 0.2 million metric tons of carbon dioxide equivalent (MMTCO2e) based on a revised estimate of emissions of halogenated gases that reflects updated population data used to apportion U.S. emissions to New Jersey. This baseline adjustment is discussed further in Appendix A.

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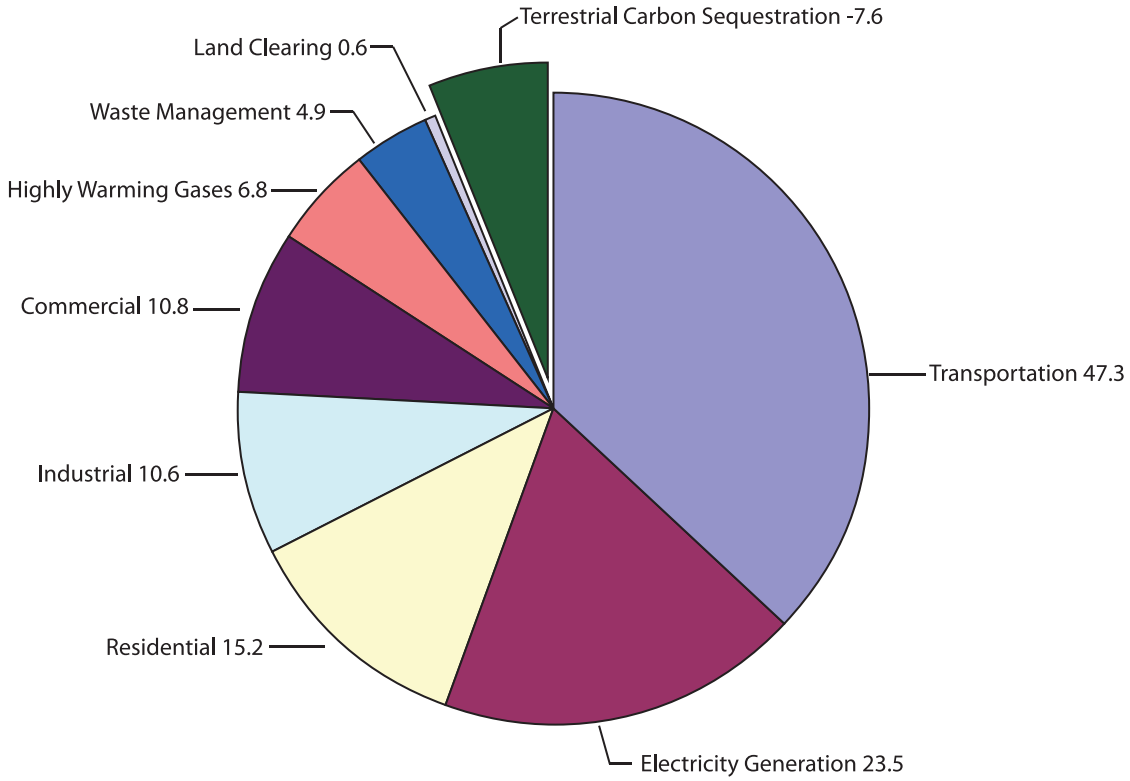
[1] New Jersey Greenhouse Gas Inventory and Reference Case Projections.
www.nj.gov/globalwarming/home/documents/pdf/20081031inventory-report.pdf
[2] New Jersey Statewide Greenhouse Gas Emissions Inventory Update: 2005, 2006, and 2007 Estimates.
www.nj.gov/dep/sage/docs/inventory-05-06-07.pdf
[3] Statewide Greenhouse Gas Emission Inventory for 2008.
www.nj.gov/dep/sage/docs/ghg-inventory2008.pdf
[4] **www.eia.doe.gov/emeu/states/state.html?q_state_a=nj&q_state=NEW%20JERSEY, downloaded on June 30, 2010.**
[5] **www.eia.doe.gov/oiaf/1605/coefficients.html**
[6] **www.nj.gov/globalwarming/home/documents/pdf/20081031inventory-report.pdf**

STATEWIDE GREENHOUSE GAS EMISSIONS FOR 2009

The most currently available statewide data covers emissions in 2009. In 2009, total Statewide estimated greenhouse gas emissions were 112.1million metric tons of carbon dioxide equivalent (MMTCO2e).[7] Figure 1 below presents the greenhouse gas emissions for each sector.

The top three sectors for greenhouse gas emissions remain transportation, electricity generation and combined fossil fuel use for residential, commercial and industrial facilities. Transportation continues to be New Jersey's largest source of greenhouse gas emissions, accounting for approximately 47.3 MMTCO2e, which is 42 percent of statewide greenhouse gas emissions. Electricity generation is New Jersey's second largest sector of greenhouse gas emissions, releasing approximately 23.5 MMTCO2e (~21 percent) of statewide emissions. Fossil fuel used in residential, industrial and commercial sectors mainly for heating had combined releases of 36.5 MMTCO2e, contributing 33 percent of statewide emissions.

Figure 1: Statewide Greenhouse Gas Emissions, 2009
Total emission 112.1 MMTCO2e



[7] "Carbon dioxide equivalent" represents the conversion of all emitted compounds, which includes methane and other gases, to the equivalent quantity of carbon dioxide using global warming potentials as discussed in the most recent report of the Intergovernmental Panel on Climate Change (IPCC). See IPPC AR4, 2007, Climate Change 2007: Working Group I: The Physical Science Basis, Technical Summary, Chapter TS 2.5, available at **www.ipcc.ch/publications_and_data/ar4/wg1/en/ts.html (accessed 5/9/12**).

Table 1: Estimated New Jersey Statewide Greenhouse Gas Emission Million Metric Tons Carbon Dioxide Equivalents

Sector	1990	2005	2006	2007	2008	2009	Notes
Commercial	10.7	10.8	9.2	10.6	10.2	10.8	
Industrial	19.8	17.3	16.3	15.9	13.9	10.6	
Residential	15.2	16.3	13.7	15.6	14.9	15.2	
Transportation							
on-road gasoline	28.9	38.0	38.1	39.0	38.2	37.3	
distillate (primarily on-road diesel)	5.6	10.8	10.8	11.4	9.9	7.9	
jet fuel	1.0	1.0	1.0	1.0	1.0	1.0	*1
residual (primarily marine)	1.0	0.9	0.8	0.8	0.8	0.8	*2
other	0.4	0.3	0.3	0.3	0.3	0.3	*2
Electricity							
In-state electric	12.4	19.8	18.5	22.7	19.1	15.0	*3
Imported electric	14.1	13.1	11.7	11.9	10.0	7.7	
MSW incineration	na	0.8	0.8	1.0	0.8	0.8	
Halogenated gases (ex. SF6)	0.0	3.0	3.2	3.2	3.3	3.4	
SF6	1.0	0.4	0.3	0.3	0.3	0.3	
Industrial non-fuel related	0.3	0.1	0.1	0.1	0.1	0.1	*4
Agriculture	0.6	0.5	0.5	0.5	0.5	0.5	*4
Natural gas T&D	2.5	2.4	2.6	2.6	2.6	2.5	
Landfills, in-state	11.7	3.6	3.5	3.5	3.4	3.3	
out-of-state	2.6	1.0	1.0	1.1	1.1	1.1	*8
industrial	1.1	0.3	0.2	0.2	0.2	0.2	
POTWs	0.2	0.2	0.2	0.2	0.2	0.2	*5
Released thru land clearing	0.6	1.7	1.7	1.7	1.1	0.6	*9
Total gross emissions, MMT	129.6	142.2	134.6	143.6	131.9	119.7	
Sequestered by forests	-4.0	-7.6	-7.6	-7.6	-7.6	-7.6	*7
Total net emissions MMT CO2eq	**125.6**	**134.7**	**127.0**	**136.0**	**124.4**	**112.1**	*6
Reference 1 is NJ GHG Inventory & Reference Case Projections 1990-2020, NJDEP, Nov. 2008							
All numbers are estimates; uncertainty of totals is likely in range of plus or minus 5 percent							
*1 set equal to 1 MMT in effort to account for in-state only							
*2 estimated to represent in-state only per methods of Ref. 1, assumed same 2005 thru 2009							
*3 1990 value from Ref. 1, includes MSW incineration.							
*4 2005 value from Ref. 1; 2006, 2007, 2008, 2009 assumed equal to 2005							
*5 earlier values have been adjusted; assumed equal to newly-calculated value for 2008 & 2009							
*6 See Appendix A for Baseline Adjustments for 1990 and 2006							
*7 assumed equal throughout 2005-2009 period							
*8 2009 value assumed same as 2008							
*9 value assumed less in 2008 and 2009 in proportion to decrease in number of building permits issued that year							

Notes to table 1: "MSW" stands for municipal solid waste, "SF6" stands for sulfur hexafluoride, "T&D" stands for transmission and distribution, "MMT" stands for million metric tons, "POTW" stands for Publicly Owned Treatment works, and "CO2eq" stands for carbon dioxide equivalents (see earlier note on carbon dioxide equivalents).

TRENDS AND PROGRESS TOWARDS 2020 AND 2050 LIMITS

This section briefly discusses recent trends in greenhouse gas emissions and progress toward achieving the 2020 and 2050 statewide greenhouse gas limits. Trends for specific sectors are discussed, including key related data for specific sectors, where appropriate.

Statewide Progress in meeting 2020 and 2050 limits

Table 1 above presents estimated statewide greenhouse gas emissions for 1990 (the 2020 limit) and 2005 through 2009. Statewide greenhouse gas emissions in 2009 decreased by approximately 12 MMTCO2e compared to 2008 emissions (a decrease of approximately 10 percent).

The Statewide greenhouse gas limit for 2020 is to stabilize emissions to levels seen in 1990, which is 125.6 MMTCO2eq. As in 2008, 2009 Statewide greenhouse gas emissions were under the 2020 limit.

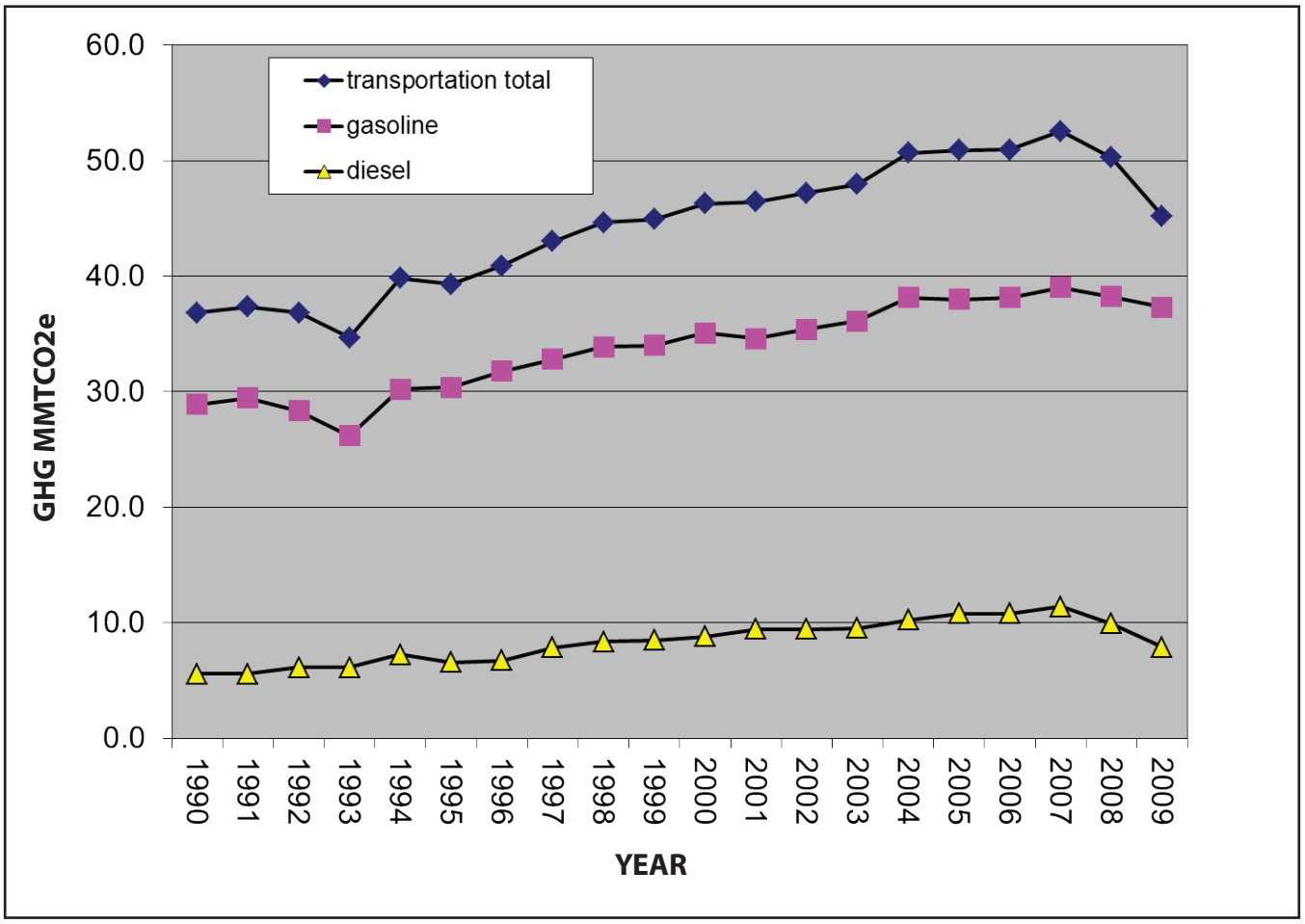
The Statewide greenhouse gas limit for 2050 is 80 percent less than the 2006 level of Statewide greenhouse gas emissions, or 25.4 MMTCO2e. To achieve this limit, greenhouse gas emissions must be reduced considerably, since the 2009 releases are 112.1 MMTCO2e, which is 86.7 MMTCO2e above the 2050 limit.

Transportation

Greenhouse gas releases from transportation remained the biggest contributor to Statewide greenhouse gas emissions; however, 2009 saw a continuation of the drop in transportation emissions that occurred in 2008. This drop is consistent with a decline in vehicle miles traveled (VMT) (Figures 2 and 3). Transportation releases decreased by approximately 5.1 MMTCO2e (10 percent) between 2008 and 2009. As shown in Figure 4, gasoline and diesel prices decreased over the same time period although they remained high compared to historical levels. Releases from the use of diesel fuel had the biggest reductions on an absolute and percentage basis with a decrease of 2 MMTCO2e (over 20 percent). Diesel reductions were likely impacted by decreases in freight movement in 2009 as a result of the overall economic slowdown nationally.[8] Motor gasoline had reductions of 0.9 MMTCO2e (2.4 percent).

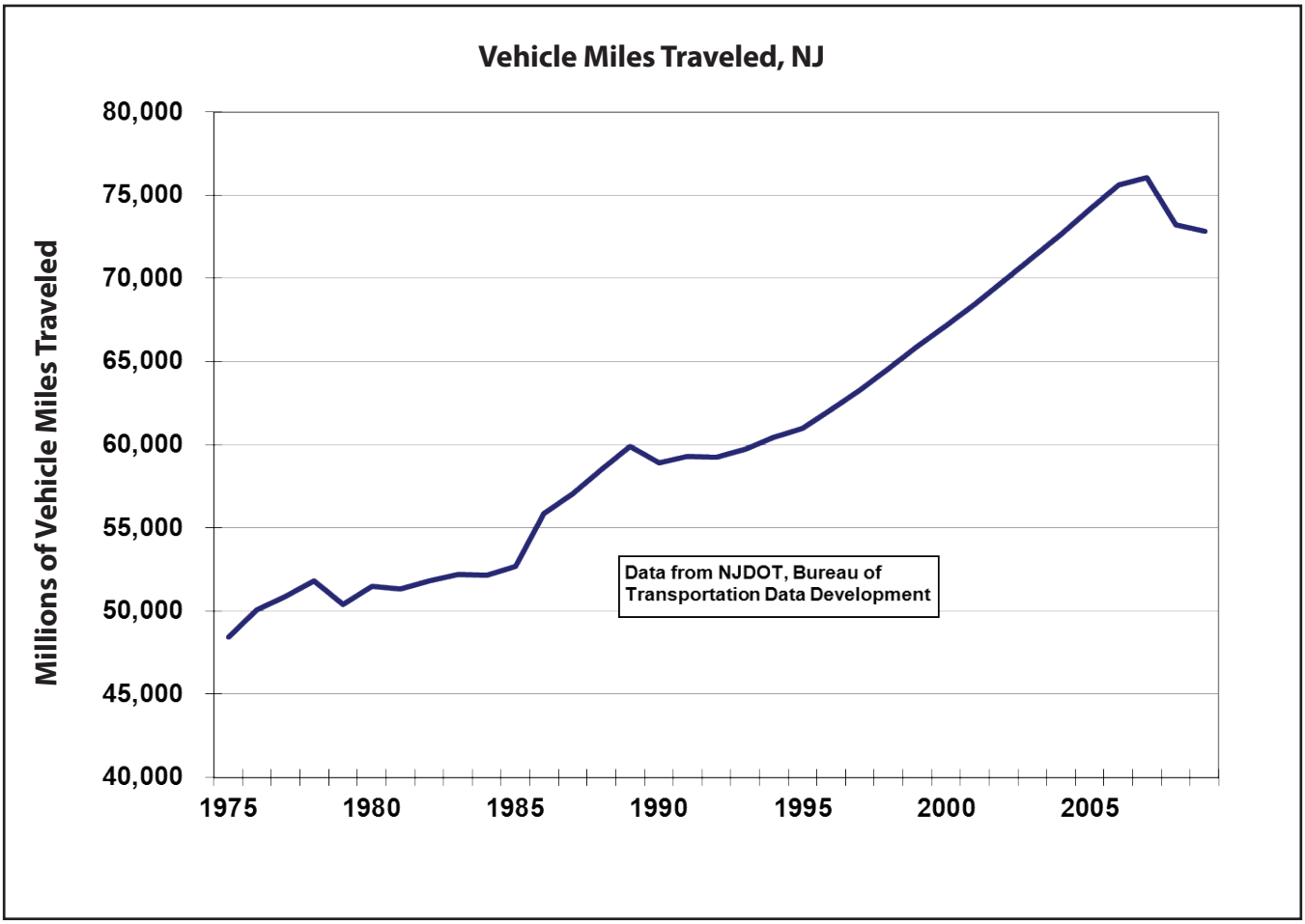
[8] **www.bts.gov/publications/americas_container_ports/2009/html/drop_in_container_throughput.html**

Figure 2: Estimated Transportation Sector Greenhouse Gas Releases 1990 – 2009 (MMTCO2e)[9]



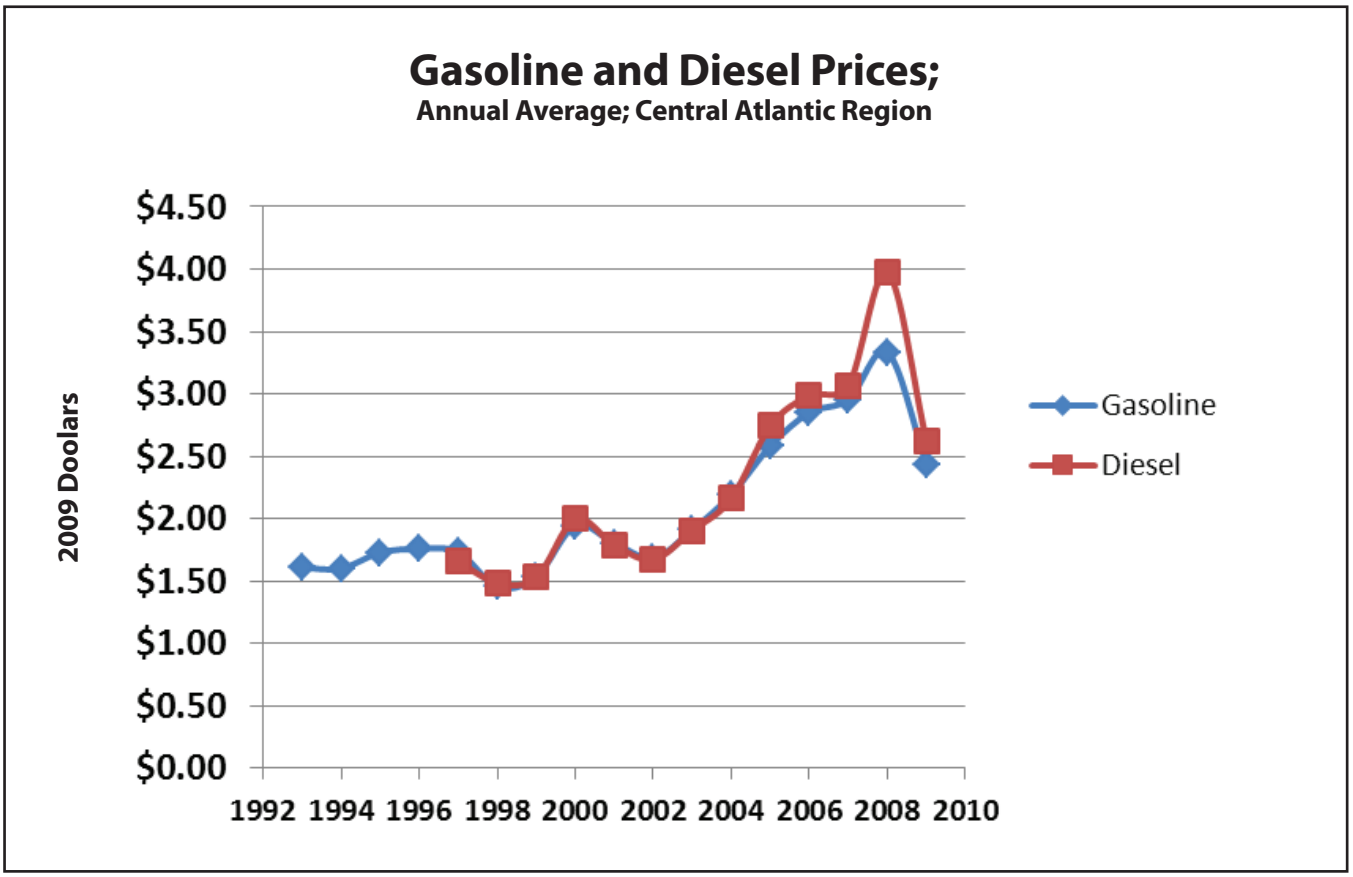
[9]Estimated by NJDEP using data from EIA State Energy Data System (SEDS)

Figure 3: Vehicle Miles Traveled 1990 – 2009[10]



[10] www.state.nj.us/transportation/refdata/roadway/pdf/hpms2008/prmvmt_08.pdf

Figure 4: Average Annual Gasoline and Diesel Prices Central Atlantic Region (2009 dollars per gallon)[11]



Electricity Generation

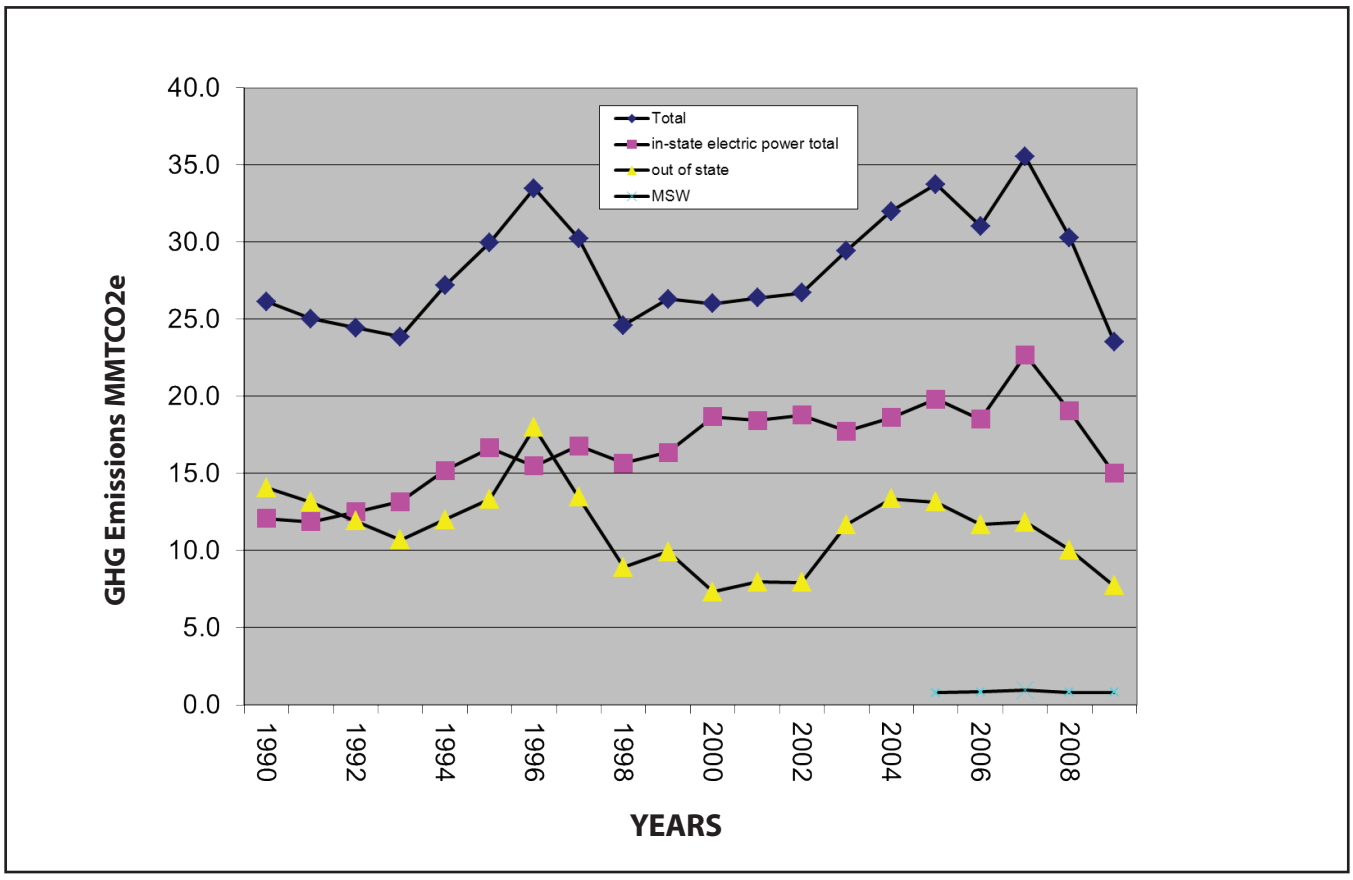
Electricity generation had the biggest reduction of any sector with a decrease of 6.7 MMTCO2e (22 percent) between 2008 and 2009. Both in-state generation and out-of-state generation saw similar reductions on a percentage basis (Figure 5). Total retail sales of electricity in New Jersey decreased by approximately 6 percent (Figure 6), which does not account for all the reduction. Other factors likely include changes in the mix of fuels used to generate electricity. On a BTU basis, the use of coal decreased by about 40 percent, while the use of natural gas decreased approximately 4 percent (Figure 7). The recent decrease in the price of natural gas is expected to accelerate the switch from coal to natural gas (Figure 8).

According to the State's 2011 Energy Master Plan, New Jersey's in-state generation was equivalent to about 75% of the State's 2010 total energy requirements. Nuclear plants generated the majority of that energy at over 50% of the State's total generation; with natural gas-fired plants provide about 38%, and coal-fired plants provide a little over 8% of the state's generation. This means that over one-half of that generation is produced from carbon-free sources, predominantly nuclear with a very small but growing solar and wind component.

[11] www.eia.gov/dnav/pet/pet_pri_gnd_dcus_r1y_a.htm

New Jersey solar installations now provide over 900 MW of installed capacity through more than 17,000 projects. New Jersey is currently 2nd in the nation for installed residential, commercial, and utility scale solar. In the first quarter of 2012, New Jersey installed 174 MW of solar energy; New Jersey is the only State other than California to have been ranked first in quarterly solar installations. The NJ solar industry was a victim of its own success in building-out beyond the scheduled Renewable Portfolio Standard (RPS) for solar. Legislative action was required to ensure its continued growth and Senate Bill S-1925 was signed into law by Governor Christie on July 23, 2012, which reinforced the Christie Administration's support for the solar industry and ratepayers through a temporary boost to the RPS and in cost-reduction measures during the overall term of the statutory program.

Figure 5: Estimated Greenhouse Gas Emissions from Electric Power Generation (1990-2009)[12]



[12]Estimated by NJDEP using data from EIA State Energy Data System (SEDS) and NJDEP Emissions Statement data

Figure 6: Total Retail Sales of Electricity in New Jersey (1990 – 2009)[13]

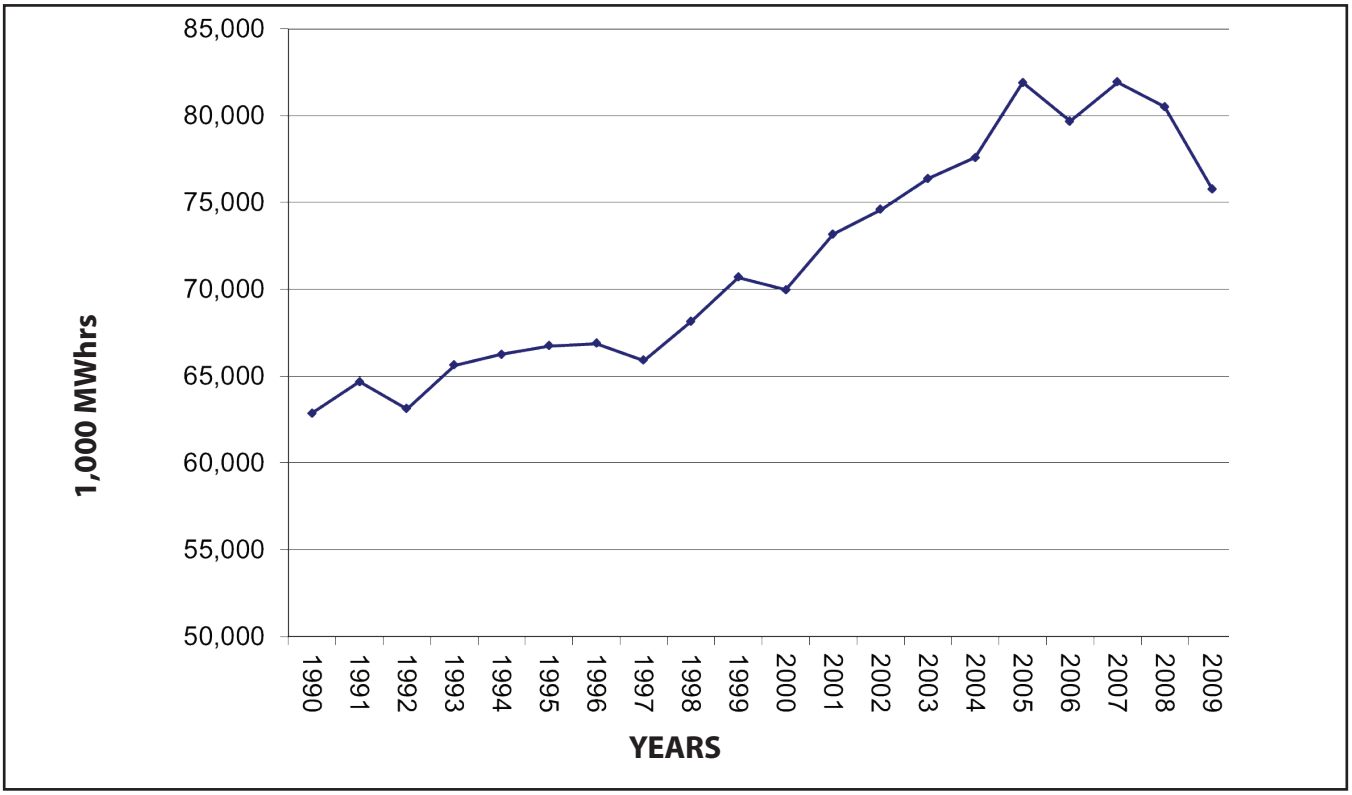
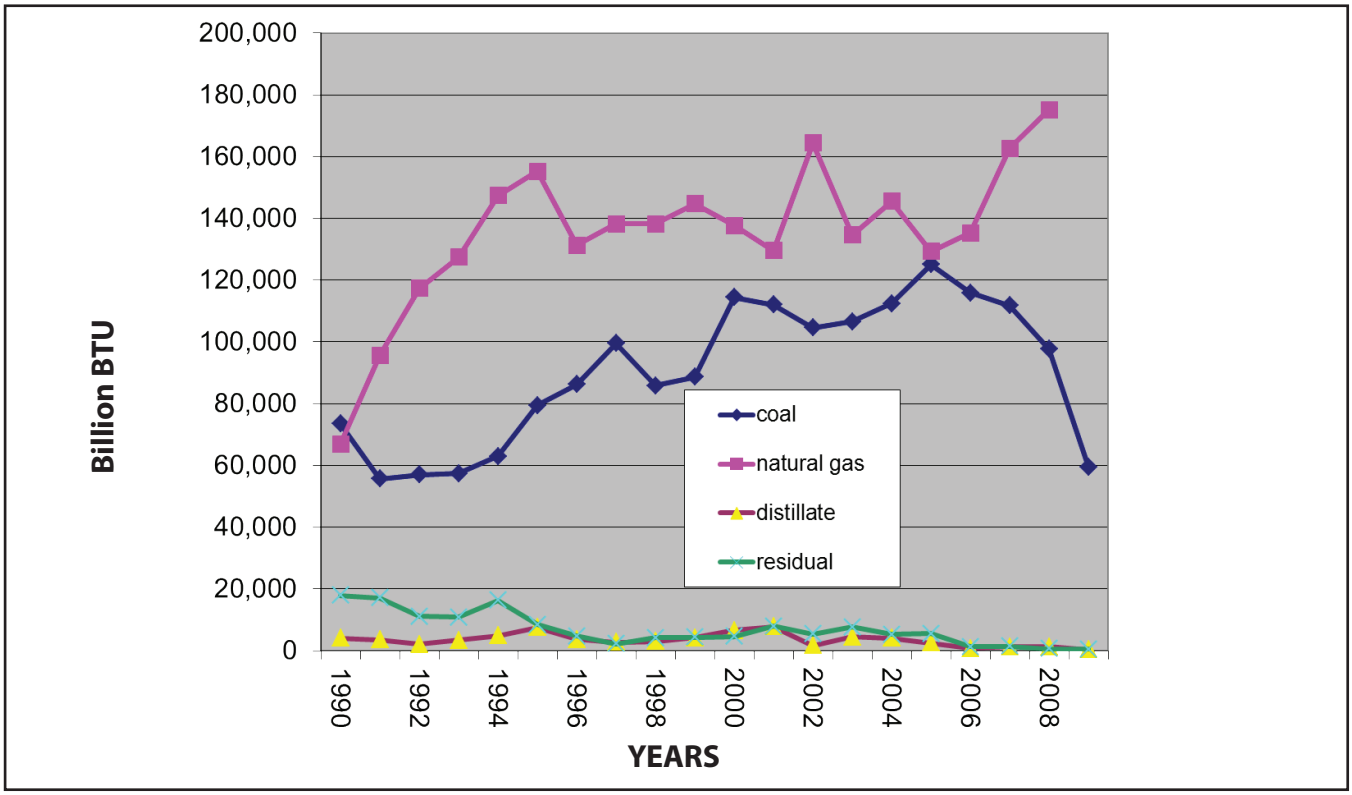
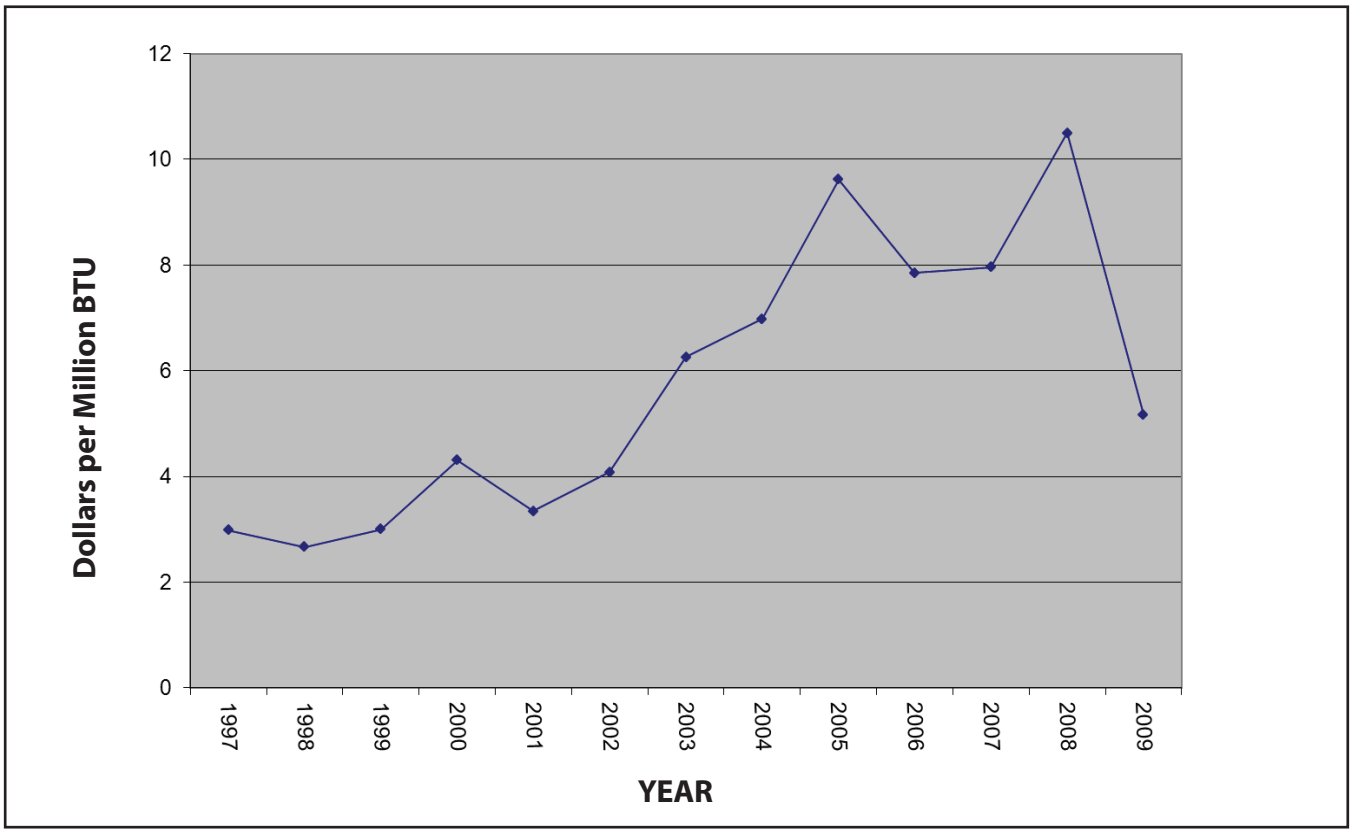


Figure 7: Fossil Fuel Use in Electric Power Generation (1990 – 2009)



[13] www.eia.doe.gov/cneaf/electricity/st_profiles/sept08nj.xls

Figure 8: Natural Gas Price for Electric Power Generation (1990 – 2009)[14]



Residential and Commercial

Greenhouse gas emissions from fuel use in the residential and commercial sectors combined increased by approximately 0.9 MMTCO2e (3.4%) between 2008 and 2009. It is not unusual for GHG emissions from these sectors to fluctuate from year to year. A major reason for such fluctuations is the weather. A significant portion of the fuel used in these sectors is for space heating and cooling; in years with relatively cool summers, less energy is consumed for air conditioning. In years with relatively warm winters, less energy is consumed for heating. Other significant uses are lighting, refrigeration, and cooking. Over the long term, consistent increases in the efficiency of lighting and appliances have offset increases in the number of residential and commercial buildings in the state, keeping the overall emissions from these sectors relatively constant.

Industrial

Greenhouse gas releases from the industrial sector decreased by approximately 3.3 MMTCO2e (24%). Industrial sector emissions are also subject to yearly fluctuations due to weather, but much of the recent decline in the emissions from this sector is likely due a decline in industrial activity in the state. One measure of this overall decline is the decline in manufacturing employment, which shrank from a total of 298,800 in 2008 to 266,300 in 2009.[15]

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[14] **http://tonto.eia.doe.gov/dnav/ng/ng_pri_sum_dcu_snj_a.htm**
[15] U.S. Bureau of Labor Statistics, 2012, **http://data.bls.gov/cgi-bin/dsrv**

Appendix A: Changes in Greenhouse Gas Inventory Data and Methods in 2009

In-State Electricity Generation and MSW incineration

There were no changes to this methodology in developing the for 2009 inventory. Please see the 2008 inventory documentation for a detailed description of the methodology used.

Out-of-State Landfills

There were no changes to this methodology in developing the 2009 inventory. Please see the 2008 inventory documentation for a detailed description of the methodology used.

POTWs

There were no changes to this methodology in developing the 2009 inventory. Please see the 2008 inventory documentation for a detailed description of the methodology used.

Sequestered by Forests and Other Land-Uses

The 2008 report indicated new estimates of carbon sequestration by forests and other land-uses (calculated based on updated NJDEP Land Use/Land Cover data made available in the last two years). The biomass and soil carbon densities were re-calculated based on this updated data. The 2009 inventory assumes no significant change in the overall land-use trends and thus carbon sequestration is estimated to remain substantially the same as estimated for 2008.

Land Clearing

The inclusion of "Land Clearing" in the New Jersey GHG Inventory is consistent with the methodology for GHG Inventory of the Intergovernmental Panel on Climate Change (IPCC) and also the national U.S. GHG Inventory generated by the U.S. Environmental Protection Agency (which also follows the IPCC methodology).

By definition, GHG Inventory tracks both "GHG Emissions" and "GHG Removals". The latter term means "removal of GHGs from the atmosphere" which involves, among others, terrestrial carbon sequestration (e.g., Forest Carbon Sequestration). This, in turn, is a function of "Land, Land-Use Change, and Forestry" (in IPCC and US GHG Inventory terminology). However, Land-Use Change also involves GHG emissions, for example, in the case of land conversion to settlements and other uses in the process of urbanization which occurs continuously and is associated with loss of vegetation and soil organic carbon (i.e., disturbing the balance of carbon stocks and flows). This is commonly referred to as "Land Clearing" in the New Jersey context. Its inclusion provides an accurate picture of the balance between the GHGs "emitted" and GHGs "removed" or "sequestered" with respect to land and land-use change in the State.

As for 2008, the 2009 inventory GHG emissions due to land clearing is also based on the updated NJDEP Land Use/Land Cover data, which accounts for new forest carbon density factors and the conversions to urban/developed land from major land-uses (forest, agriculture, wetland, and barren) for 1986-1995, 1995-2001, and 2002-2007. The updated data (discussed in detail in the documentation for the 2008 inventory) enables calculation of the biomass and soil carbon losses due to land use changes during these three time periods.

For 2009 inventory, an additional adjustment has been made. Besides the factor for soil carbon loss discussed above, another factor is involved in this estimate; the rate at which land is cleared for construction of buildings and related structures. Data on building permits were obtained from the NJ Department of Community Affairs.[16] Review of these data indicated that permit activity in 2008 was only about 64% of the 2005 through 2007 average, and for 2009 was about 36% of the 2005-2007 average. The quantity of carbon released through land clearing was thus proportionately reduced for 2008 and 2009.

Baseline Adjustments

No changes were made to the 1990 baseline estimate. One minor change was made to the baseline estimate for 2006; this was the result of a change in releases of halogenated gases (not including SF6). The halogenated gases estimate is based on apportionment of U.S. total releases, based on USEPA data, to New Jersey based on population. The New Jersey population estimate originally used for 2006 was corrected. Revision of this number changed the estimated release of halogenated gases for 2006 from 3.0 MMT to 3.2 MMT. This changes the 2006 total from 126.8 MMT to 127.0 MMT.

[16]Data sent to M.Aucott, NJDEP by John Lago, DCA, 6/15/2011.