Greenhouse Gas Emissions in New Jersey

Background

A greenhouse gas (GHG) is an atmospheric gas that slows the rate at which heat radiates into space, thus having a warming effect on the atmosphere. GHGs include water vapor, carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), chlorofluorocarbons (CFCs), hydrofluorocarbons (HFCs) and some other halogenated gases. Greenhouse gases in the atmosphere make the earth considerably warmer than it otherwise would be.[1]

Figure 1 illustrates the energy consumed in New Jersey by various fuel types in 2014, and the conversion to estimates of GHG emissions (as million metric tons of carbon dioxide equivalents, or $MMTCO_2e$).[2] This figure shows that approximately 97% of the State's GHG emissions are produced by the burning of fossil fuels. This figure also illustrates the fact that renewable (e.g., geothermal, wind, and solar) and/or zero to low GHG emission activities (e.g., nuclear power) do not significantly contribute to overall GHG emissions.

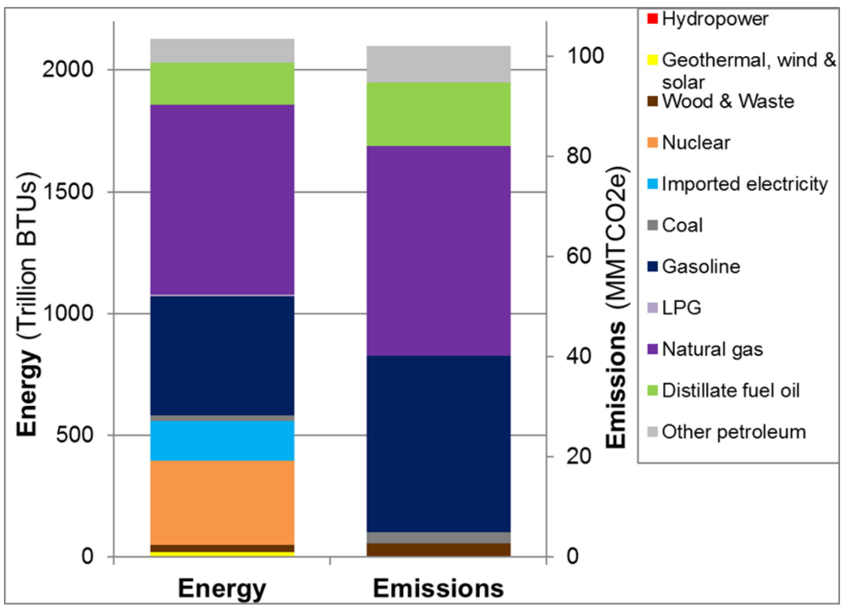

Figure 1: New Jersey's 2015* energy consumption and conversion to CO2 equivalent emissions.[7]

Goals

New Jersey's Global Warming Response Act (GWRA),[3] which was signed into law in July 2007, establishes limits for GHG emissions that are consistent with the degree of reduction that is estimated to be necessary at a global level. The New Jersey limit for 2020 is a quantity equal to 1990 emissions, and the limit for 2050 is a quantity equal to 80% below 2006 emissions.[4]

While New Jersey is meeting, or exceeding the goals set in the GWRA, an understanding of total emissions at a global level are necessary to better understand GHG emissions. The amount of CO_2 in the atmosphere is well-measured and was over 400 ppm in 2016.[5] In addition, the quantity of emissions of CO_2 and other GHGs can be estimated by fuel and land-use data. Approximately half of the CO_2 emitted to the atmosphere by anthropogenic activity each year remains in the atmosphere and the other half of what is emitted dissolves in the oceans or is taken up by plants or soils.[6,7] The ability of these pools to absorb CO_2 involves dynamic and complex processes, which means that, not only do different sinks absorb CO_2 at different rates, but that their ability to do so over time may become altered.[8]

Many climatologists suggest that the global atmospheric concentration of CO_2, increasing at roughly 2 ppm per year on average over the period 2006 - 2015,[9] must be held below a critical threshold level to avoid the potential for dangerous climate disruption. Hansen (2008) proposes a level close to 350 ppm would allow the preservation of a planet to which life on Earth is adapted.[10] The Intergovernmental Panel on Climate Change (IPCC) indicates that an emission scenario that would lead to a CO_2 equivalent concentration equal to or lower than 450 ppm would *likely* maintain warming to below a 2ºC increase relative to pre-industrial levels.[11] Under widely varying scenarios about future growth in current forecasted concentrations, 450 ppm will almost certainly be reached by 2040 without serious mitigation efforts.[12]

Excessive CO_2 emissions due to anthropogenic activity can cause an imbalance in the planet's natural ability to absorb or use CO_2, resulting in steadily increasing CO_2 concentrations. Concentrations of other greenhouse gases are rising as well. Atmospheric concentrations of CO_2 (approximately 404 ppm as of November 2016)[13] and CH_4 (approximately 1,843 ppb as of September 2016)[14] exceed the range over the last 800,000 years.[15] Global increases in CO_2 concentrations are due primarily to fossil fuel use, with land-use change providing another significant, but smaller, contribution.[16] The United States releases more than 6.5 billion metric tons of greenhouse gases each year.[17]

Status and Trends

The DEP has estimated New Jersey GHG emissions based on fuel consumption data obtained from the U.S. Department of Energy's Energy Information Administration (EIA)[18] and on other information, including estimated emissions of methane from indirect pipeline losses, highly warming gases (e.g. HFCs used as solvents and refrigerants), and carbon released from land clearing and sequestered through forest growth.

Estimated GHG emissions for major sector activities over time are shown in Figure 2.[18] While NJ's estimated GHG emissions have increased slightly in recent years, 2015 levels remain below the 2020 GWRA limit (which is equivalent to the 1990 level; Figure 2). To achieve the 2050 GWRA limit (of 80% below the 2006 value), NJ would need to reduce estimated GHG emissions by 78%, or about 2.2% per year on average, between 2014 and 2050.

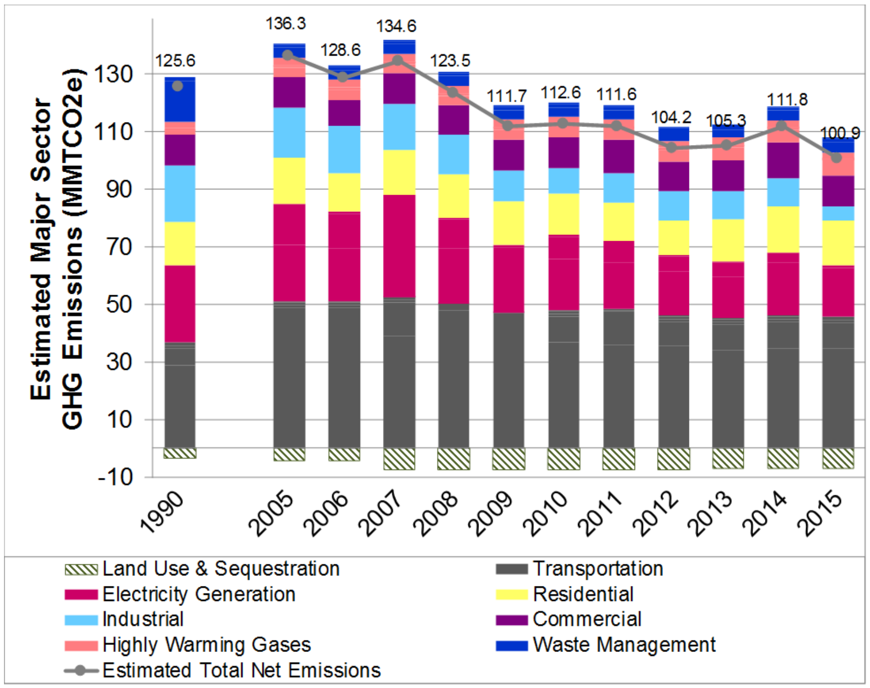

Figure 2: New Jersey's estimated GHG emissions by activity over time. "Estimated Total Net Emissions" considers net sequestration (carbon released thru land clearing + sequestered by forests and other land uses).

As illustrated in Figure 2, the category with greatest contribution to GHG emissions in New Jersey since 1990 has been in the on-road transportation sector. This is most likely due to an increase in vehicle miles traveled in NJ[19] despite a minor increase in the fuel efficiency of the overall U.S. motor vehicle fleet.[20] There was a consistent annual increase in vehicle miles traveled in NJ until 2008,[21] which coincided with a global economic downturn.

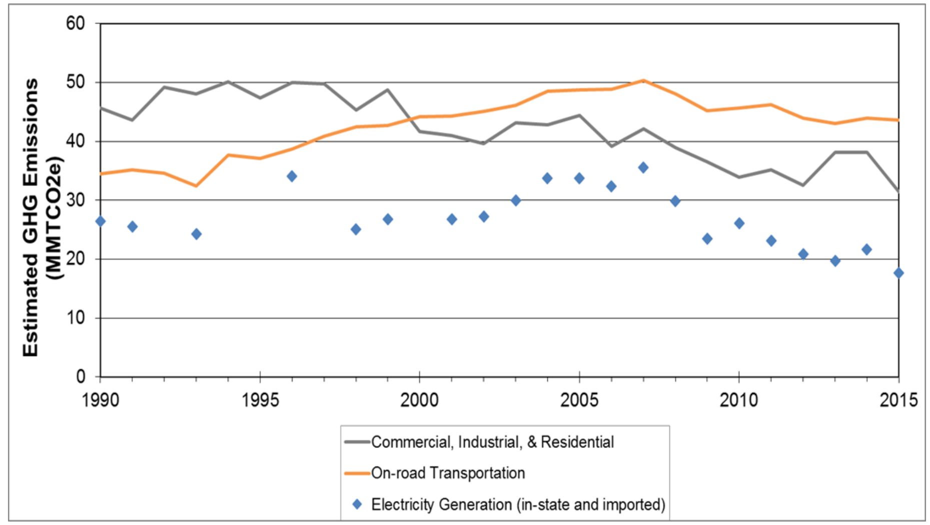

Figure 3: Estimated GHG emissions for New Jersey from 1990-2015 for three major categories. (1) ***(Note that, in contrast with the transportation sector displayed on Figure 2, the on-road transportation group in Figure 3 refers to motor gasoline consumed by the transportation sector only (i.e., U.S. EIA MSN code MGACB).***

The electricity generation sector's energy use has varied over the years (Figure 3). As described in the "Energy Use and Renewable Energy Sources" report in the DEP Environmental Trends series, recent patterns include the use of nuclear power and natural gas (a lower GHG source) and a reduction in the amount of coal and distillate fuel oil (relatively higher sources of GHGs) to produce electricity.

Figure 4 shows the GWRA limits compared with recent annual emissions estimates. Achievement of the 2050 emissions limit will require a degree of emissions reduction that is far more pronounced than will be necessary to achieve the 2020 limit (Figure 4).

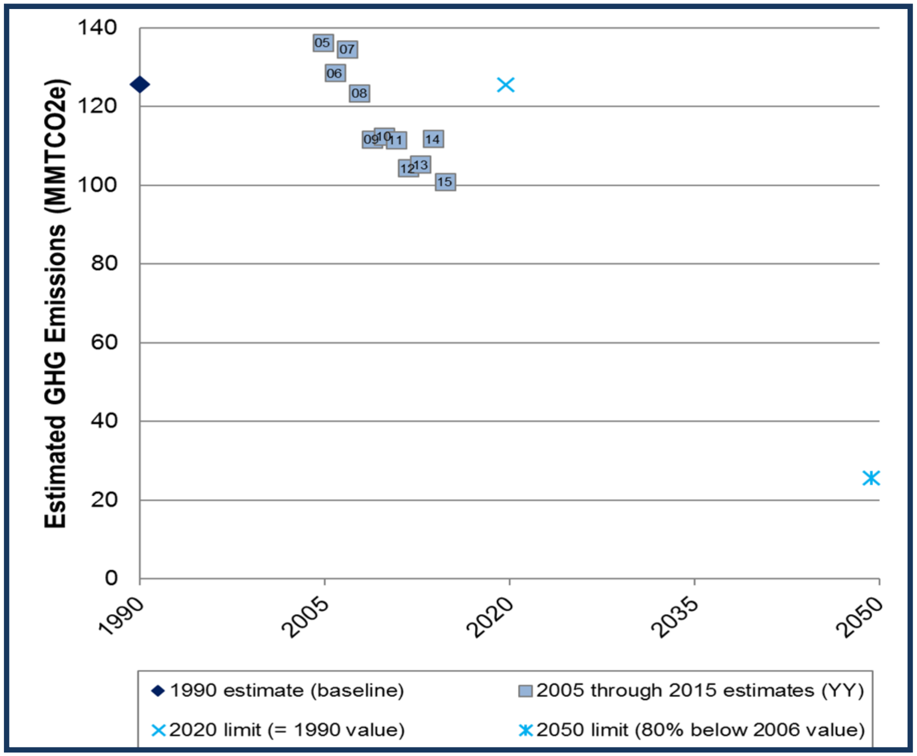

Figure 4: Estimated GHG emissions for New Jersey from 1990-2016 with targets shown for 2020 and 2050.
(*For the 2005-2015 estimates, "YY" in gray corresponds to two-digit year*).

Outlook and Implications

As noted above, New Jersey adopted the Global Warming Response Act, which establishes a limit for 2020 emissions to be equal to 1990 levels and a limit for 2050 emissions to be 80% below the 2006 level. Much of the reduction necessary to meet the goal is expected to be accomplished through the implementation of New Jersey's Energy Master Plan (EMP). The EMP was updated in 2015 and is available online.[22]

Other actions are expected to contribute to achievement of the necessary reductions. For example, steps are also being taken to lower emissions from motor vehicles, as described in the report, "Energy Use and Renewable Energy Sources" in the NJDEP Environmental Trends series.

- In January 2006, New Jersey adopted a Low Emission Vehicle (LEV) program modeled after California's LEV Program.[23] The program contains three components: vehicle emission standards, fleet-wide emission requirements, and a Zero Emission Vehicle (ZEV) sales requirement. The adoption of the LEV program ensures that vehicles designed to incrementally produce fewer GHG and criteria pollutant emissions over time will be available for purchase in New Jersey.

- On April 1, 2010, the U.S. EPA and the U.S. Department of Transportation jointly adopted federal motor vehicle GHG emission standards and related fuel economy standards for passenger cars, light-duty trucks, and medium-duty passenger vehicles, covering model years 2012 through 2016.[24] These rules required these vehicles to meet an estimated combined average emissions level of 250 grams of carbon dioxide per mile, equivalent to 35.5 miles per gallon (MPG) if the automobile industry elected to meet this carbon dioxide level solely through fuel economy improvements.

- On August 28, 2012, the U.S. Environmental Protection Agency and the U.S. Department of Transportation issued a joint Final Rulemaking to extend the National Program of harmonized greenhouse gas and fuel economy standards to model years 2017 through 2025 passenger vehicles.[25] The EPA released (on July 18, 2016) a draft Technical Assessment Report (TAR) finding that vehicle manufacturers are on track to meet current fuel economy and GHG reduction targets for 2025.[26] The final standards are projected to result in an average industry fleetwide level of 163 grams/mile of carbon dioxide (CO_2) in model year 2025, which is equivalent to 54.5 miles per gallon (mpg) if achieved exclusively through fuel economy improvements.

- The State has initiatives to encourage electric vehicle (EV) use. These initiatives include the Drive Green New Jersey initiative, a sales tax exemption on EV sales, grants, and an employer recognition element to encourage employers to purchase and install electric vehicle charging stations.[27]

The emission of greenhouse gases through the combustion of fossil fuels and other anthropogenic activities has been indicated as a contributor to the increased global temperatures currently being measured. Through inventory of these gases and effective management scenarios that reduce their presence, the State of New Jersey will continue to advance towards our goals of reducing these greenhouse gases.

More Information

For more information, visit the NJDEP's Office of Office of Air Quality, Energy & Sustainability (AQES):
http://www.nj.gov/dep/aqes/;

the State of New Jersey Board of Public Utilities' web site:
http://www.state.nj.us/bpu/;

U.S. EPA's Greenhouse Gas Emissions web site:
http://www.epa.gov/climatechange/emissions/index.html; and,

the U.S. Department of Energy, Energy Information Administration's site:
www.eia.doe.gov.

For more information about New Jersey's LEV and EV initiatives, visit: http://www.state.nj.us/dep/cleanvehicles/.

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