**Connecticut Greenhouse Gas Emissions Inventory**

This summary provides an overview of the state’s greenhouse gas (GHG) emissions from 1990 to 2015, the most recent year for which full data are available.[[1]](#footnote-1) The statewide GHG emission inventory is an important tool for tracking Connecticut’s progress toward the goals set by the Global Warming Solutions Act of 2008. This law set targets of reducing GHG emissions 10 percent below 1990 levels by 2020 and 80 percent below 2001 levels by 2050.

**Inventory Methodology**

A federal standard for economy-wide GHG accounting does not currently exist. In the absence of a federal standard, Connecticut DEEP is committed to continuous improvement of its accounting methodology. This includes identifying improvements in both the quality of data and methods utilized to calculate annual GHG emissions.

Like several states across the country that regularly perform economy-wide GHG inventories, Connecticut relies heavily on the U.S. Environmental Protection Agency’s State Inventory Tool (SIT). The tool calculates sector-by-sector GHG emissions based on numerous state-level data sets (e.g., number of gallons of fuel oil sold in CT), including energy-related data provided by the Energy Information Administration. EPA recommends that states employ their own data when these are likely to be more reliable than the tool’s default figures. CT’s inventory uses SIT default data, with three exceptions. First, beginning with the 2013 inventory, CT has drawn on solid-waste data collected by the Department of Energy and Environmental Protection’s municipal waste program. Second, because SIT data on land use, land use change, and forestry appear unreliable, they have not been included in the state’s recent inventories. The state aims to develop an alternative means to estimate GHG impacts of land use and forestry for use in preparing future inventories. Third, this analysis continues to present both a consumption and generation based accounting approach for the electricity sector from 1990 to 2015.

Based on best practices among states reporting state-wide GHG emissions, and reflecting the regional nature of the electric grid, the consumption-based accounting for the electric power sector was first applied in the 2013 inventory analysis. In prior GHG inventories, emissions from the electric power sector had been based entirely on direct emissions from the generation of electricity by power plants operating within the state. A consumption-based approach calculates emissions based on Connecticut’s share of electricity consumption in New England, using the emissions profile of the regional electric grid’s generation fuel mix.[[2]](#footnote-2)

**2015 GHG Emissions**

Using the consumption-based accounting approach for electricity, Connecticut’s economy-wide GHG emissions in 2015 were 44.5 million metric tons (MMT) of carbon dioxide equivalent (CO2e), 10.9 percent below 2001 levels.[[3]](#footnote-3) In comparison, emissions using the generation-based accounting approach were 43.4 MMT CO2e, 11.6 percent below 2001 levels.

The transportation sector continues to be the single largest source of emissions in the state, contributing 35 percent, principally from the use of fossil fuels in passenger cars and light trucks. These emissions have remained mostly stagnant since 1990, dropping by only 1.5 percent. Although national fuel economy standards have improved vehicle efficiency, the number of vehicle miles driven in Connecticut have increased, which is likely the contributing factor for not attaining greater emissions reductions in the transportation sector.[[4]](#footnote-4)[[5]](#footnote-5) Significantly reducing transportation emissions in the coming decades will require continued improvements in vehicle fuel economy for all class sizes, increased deployment of zero-emission vehicles, and through the utilization of strategies that reduce vehicle miles traveled.

Connecticut’s largest reduction since 1990 has occurred in the electric power sector —14.5 percent under consumption-based accounting and 25.4 percent under generation-based accounting. This reduction correlates with state and regional policies and programs that encourage investment in energy efficiency in homes and businesses, a shift from dirtier fossil fuels such as coil and oil to natural gas, and increased deployment of renewable energy sources.

Additional emissions reductions in this sector will come from further reducing reliance on oil and coal during periods of peak electricity demand, continual expansion of renewable energy, and mainstreaming of energy efficiency in homes, businesses, and industry. Based upon our consumption accounting methodology, a reduction in emissions will also come from adjusting the Renewable Portfolio Standard to sources with less GHG emissions.

When compared to the previous year’s emissions, electricity consumption and generation rose by 7 and 4 percent, respectively. As with the uptick in GHG emissions between 2013 and 2014, reasons for this increase in GHG emissions were primarily due to winter weather.

***Winter 2015***

January through March 2015 temperatures were well below average (Figure XX). Winter 2015 was one of the coldest on record for much of the Northeast US, particularly February (Figure XX2). Record-breaking snow depths were also observed during this winter, but as a whole, monthly precipitation averages were slightly below normal.

Figure XX. Connecticut monthly temperature anomaly from 1980-2018 for January, February and March. Temperature anomaly is the departure of detrended monthly means from 1980-2018 climatology in degrees Fahrenheit. Source: NOAA statewide Climate at a Glance (https://www.ncdc.noaa.gov/cag/).

In late December, early January an intense cold front originating along the US west coast, moved across the continent. Temperatures across the Northeast plummeted. This was followed by a “polar vortex” or a stalled/slow moving trough of a Rossby wave over the Northeastern US in mid/late January through mid-February. Typical conditions of a stalled polar vortex are cold and dry with strong winds. During this period, temperatures across the Northeast region were below average (Figure XX2). For many cities in Connecticut, this was the coldest February on record, and with a 16.1oF average temperature, the state average was record setting as well.

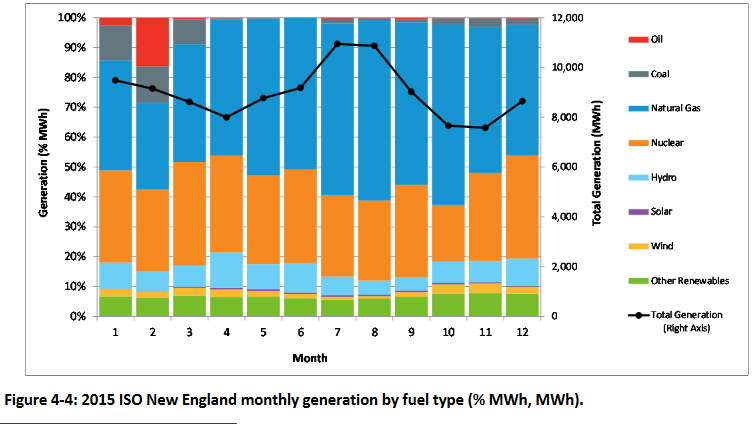
The conditions created by the “polar vortex”, and warmer than average Northern Atlantic sea surface temperature from a mild El Nino phase, helped spur 2 large snow events. These low pressure, high moisture systems developed along the east coast and were pulled into the polar vortex, resulting in intense snow storms on January 26-27th and February 14-15th. As these systems moved eastward off the coast, days following the snow storms were anomalously cold.[[6]](#footnote-6)

The February 1-2nd North American Blizzard also occurred during the 2015 winter but this system developed off the west coast of the US, depositing record snow amounts across the Midwest and into the Northeast. Parts of Massachusetts received up to 2 feet of snow.

Figure XX2. New England monthly temperature anomaly from 1980-2018 for February. Temperature anomaly is the departure of detrended monthly means from 1980-2018 climatology. Source: NOAA statewide Climate at a Glance (https://www.ncdc.noaa.gov/cag/).

For Connecticut over 78% of energy demand is met through use of natural gas, and demand for natural gas is highest when the weather is coldest. According to ISO-NE [[7]](#footnote-7) in mid/late February 2015, demand in the Northeast was the highest in recorded history. In the ISO-NE region, over 50% of the electricity generated is from natural gas-fueled resources. When demand is high, residential customers are guaranteed supply, but there is little left in the pipeline for electric generation needs. To meet non-residential electric generation needs, other sources of energy are used, particularly oil and coal resources, which emit more GHGs than natural gas.

The lowest monthly percentages of natural‐gas‐fired generation in 2015 for New England **(what term should be used? ISO-NE region, New England, Northeast?)** were in January, February, and March. These are also the months during which coal‐ and oil‐fired generation had a larger contribution. While nuclear and natural gas were the dominant fuels used to produce power in winter 2015, oil and coal resources were a large part of the fuel mix. This was especially true during February, the coldest month (put in figure number).



Emission factors for coal and oil (205-214 and 161-210 CO2 lb/MMBtu, respectively) are generally higher than emission factors for natural gas (177 CO2 lb/MMBtu). With January-March 2015 being much colder than average, and a larger percentage of higher CO2e fuels used, overall CO2 emissions for the state of Connecticut (and throughout Northeast region) were higher.

***Economy and Demographics***

In Connecticut, the carbon intensity of the economy remained the same as 2014 (an increase of less than 1/100th of a percentage). Even though emissions increased from 2014 to 2015, GDP rose 2% during that time period as well. GHG per GDP (lbsCO2e /million current dollars) was 0.44, a reduction of 55% relative to 1990. Connecticut’s 2015 per capita emissions were 27,835 pounds per person, well below the national average of 45,539 pounds per person.[[8]](#footnote-8) While the population has been in decline since 2014, 2015 GHG emissions had increased. The difference in GHG per capita relative to 1990 was -7 percent.

The shutdown of the 620-MW Vermont Yankee Nuclear power plant in December 2014 was another likely reason for emissions across the region being higher than in previous years. For the ISO-NE region, the % of energy supplied from nuclear sources dropped by 4% from 2014 to 2015.

***2016 GHG***

Total U.S. emissions decreased from 2015 to 2016 by 1.9%.[[9]](#footnote-9) The decrease in CO2 emissions from fossil fuel combustion was largely due to large scale substitution from coal to natural gas and other non-fossil energy sources in the electric power sector; and warmer winter conditions in 2016 resulting in a decreased demand for heating fuel in the residential and commercial sectors. This was also true for Connecticut, where winter temperatures were 5-6 degrees Fahrenheit above average.

**GHG Emission Reduction Strategies Currently Underway**

Connecticut is implementing a suite of complementary strategies to ensure that the state is on a course to achieve its near-term 2020 reduction goal. The range of GHG reduction actions include direct regulations, monetary and non-monetary incentives, market-based mechanisms, and recognition for voluntary actions.

The following programs, strategies, and policy initiatives are just a few examples of current efforts driving the state’s emissions down between now and 2020. These initiatives offer a foundational framework to build upon as additional strategies are developed to further reduce emissions beyond 2020.

***2017 Comprehensive Energy Strategy***

Connecticut will need to continue to scale investments that drive down GHG emissions in order to meet the ambitious requirements of the Global Warming Solutions Act, both in the near- and long-term (2020 and 2050), particularly in light of the updated 2013 Summary showing an uptick in 2013 emissions. The 2016 Comprehensive Energy Strategy will evaluate GHG mitigation options on all of these time horizons, and will emphasize any additional near term strategies that may be needed to ensure compliance with the 2020 goal.

***Energy Efficiency***

The Connecticut Energy Efficiency Fund supports a variety of programs that provide financial incentives to help Connecticut consumers reduce the amount of energy used in their homes and businesses. Investment in energy efficiency programs has doubled since 2013, implementing a key recommendation of the 2013 Comprehensive Energy Strategy. At this increased level of investment, expected lifetime GHG reductions from the state’s energy efficiency programs will be 3.2 MMTCO2e.

***Connecticut Hydrogen and Electric Automobile Purchase Rebate (CHEAPR)***

Through the CHEAPR program, DEEP offers rebates of up to $5,000 for Connecticut residents who purchase or lease a new eligible battery electric, plug-in hybrid electric, or fuel cell electric vehicle. In just over a year’s time, these rebates have supported purchases of more than 750 vehicles.7

***Zero Emission Vehicle (ZEV) Memorandum of Understanding***

Connecticut is one of seven states committed to putting 3.3 million ZEVs on the road by 2025. Connecticut is implementing the steps laid out in the Multi-State Action Plan which focuses on developing ZEV infrastructure and supporting policies, codes, and standards to advance the deployment of ZEVs. With the implementation of the revised travel provision, ZEV sales in Connecticut and other New England states are expected to increase beginning in 2017.8

***Renewable Portfolio Standard (RPS)***

The Malloy Administration has embraced the use of open, competitive procurements of renewables and large-scale hydropower through long-term contracts as the best way to secure investment in new clean generation at the least cost to the state’s ratepayers. A new, 20 MW solar facility in Sprague, CT, that was contracted under Section 6 of Public Act 13-303 is expected to come online in January 2017. Currently, DEEP is considering more than 100 bids submitted in two historic RFPs for clean energy projects of different size classes that could be selected for long-term contracts pursuant to Public Acts 13-303 and 15-107. Under those statutes, CT DEEP has the authority to contract for up to 4,250 GWh, or approximately 15% of the state’s electricity demand, from clean energy resources. Bid selections are expected in the fall of 2016, and winning projects must be online by 2020.

***Rooftop Solar Deployment***

The Connecticut Green Bank, established in 2011, has pioneered multiple programs to expand the deployment of rooftop solar photovoltaics (PV) in Connecticut, while driving down installed costs and ratepayer incentives. A program goal of installing 30 MW of rooftop solar PV under the Residential Solar Incentive Program was met in 2015, 8 years early. Public Act 15-194 requires the Connecticut Green Bank to offer incentives to support the deployment of 300 MW of residential solar by 2022. The Green Bank is partnering with the state’s electric utilities in the Solar Homes Renewable Energy Credit program to enable purchase of long-term contracts for Renewable Energy Credits produced from a homeowners’ solar system, making solar more accessible and affordable to ratepayers throughout the state.

***Shared Clean Energy Facilities***

Public Act 15-113 requires DEEP to establish a two-year pilot program for shared clean energy facilities, including solar, fuel cells, geothermal, hydroelectric and other renewables. Multiple customers will be able to contract a percentage or set amount of the electricity produced from these facilities. Projects selected in this pilot program must be online by 2019.

1. The Department of Energy and Environmental Protection (DEEP) greenhouse gas inventory relies in part on emissions data from U.S. EPA’s State Inventory Tool. EPA released data from January-December 2014 in February 2017. [↑](#footnote-ref-1)
2. For further explanation of the two methodological approaches, see the 2013 inventory report, http://www.ct.gov/deep/lib/deep/climatechange/2012\_ghg\_inventory\_2015/ct\_2013\_ghg\_inventory.pdf. [↑](#footnote-ref-2)
3. Emissions are reported in terms of carbon dioxide equivalence (CO2e). Carbon dioxide is the primary GHG. Emissions of other GHGs are expressed on the basis of their potential to contribute to global warming, relative to carbon dioxide’s potential. [↑](#footnote-ref-3)
4. The average fuel efficiency of U.S. light-duty vehicles (mpg) (calendar year) have increased 15% between 1990-2015. Bureau of Transportation Statistics. [↑](#footnote-ref-4)
5. Vehicle miles traveled have increased 24% from 1990-2015 in CT. CT Department of Transportation, “Transportation data set 8\_22\_18.” [↑](#footnote-ref-5)
6. The National Oceanic and Atmospheric Administration’s National Climate Data Center daily station summaries, 1990-2015. https://gis.ncdc.noaa.gov/maps/ncei/summaries/daily [↑](#footnote-ref-6)
7. 2015 ISO New England Electric Generator Air Emissions Report, prepared on 1-5-2016 . https://www.iso-ne.com/static-assets/documents/2017/01/2015\_emissions\_report.pdf [↑](#footnote-ref-7)
8. U.S. figure based on U.S. EPA, “Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2016 – Executive Summary,” https://www.epa.gov/sites/production/files/2018-01/documents/2018\_executive\_summary.pdf, p. ES-16. [↑](#footnote-ref-8)
9. U.S. figure based on U.S. EPA, “Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2016 – Executive Summary,” https://www.epa.gov/sites/production/files/2018-01/documents/2018\_executive\_summary.pdf [↑](#footnote-ref-9)