2018 Connecticut Greenhouse Gas Emissions Inventory

Connecticut Department of Energy and Environmental Protection

Background

For more than two decades, Connecticut has been in the forefront of regional, national, and international efforts to reduce emissions of the greenhouse gases (GHGs) that are driving the increasingly urgent global climate crisis. The **Global Warming Solutions Act (GWSA)**, enacted in 2008, established a requirement for the state to reduce the level of economy-wide GHG emissions 10 percent below 1990 levels by 2020, and 80 percent below 2001 levels by 2050. The GWSA was **amended in 2018** to add a mid-term target of 45 percent below 2001 levels by 2030.

The Connecticut Greenhouse Gas Emissions Inventory tracks the state's progress toward these targets. This summary report reviews Connecticut's GHG emissions trends for the years 1990 through 2018, which is the latest year for which full emissions data is available.[1] It reveals that the state is not on track to meet its 2030 and 2050 GWSA targets. Transportation-sector emissions remain a key obstacle to achieving the GWSA targets. And while modest reductions in residential sector emissions have been attained, emissions in the commercial and industrial sectors have increased since 1990. These results underscore the urgency of authorizing and implementing the emissions-reduction strategies recommended by the **Governor's Council on Climate Change (GC3)** in its **2018** and **2021** reports.

Highlights

Economy-wide emissions were 42.2 million metric tons (MMT) of carbon-dioxide equivalent (CO2e) in 2018 — a decrease of 7.3 percent since 1990 and 17.8 percent since 2001, although a slight increase over 2017 emissions. Emissions in 2018 indicate that the state is not on track to meet statutorily-required emissions reduction targets for 2020 and 2030.

Transportation-sector emissions in particular remained stubbornly high, despite significant historical improvements in fuel economy. In contrast with other major sectors –especially the electricity sector –transportation- sector emissions have risen since 1990, rather than fallen.

In 2018 as in previous years, the transportation, electricity, and residential sectors accounted for nearly three-fourths of Connecticut's GHG emissions.

Initiatives in these and other sectors must be substantially accelerated for Connecticut to meet its 2030 and 2050 GHG emissions-reduction goals.

[1] Connecticut's greenhouse gas inventory relies heavily on data sets compiled by the U.S. EPA and released annually in its State Inventory Tool (SIT). The latest SIT was released in 2020 and contains data necessary to produce this inventory through 2018. Data for 2019 are expected to be available in autumn 2021.

2018 Emissions Overview

In 2018, Connecticut emitted 42.2 million metric tons of carbon dioxide equivalent (MMTCO2e).[2] This is 7.3 percent below 1990 emission levels, 17.8 percent below 2001 emission levels, and 24 percent below the level reported in 2004, when Connecticut's emissions peaked. It is a 2.7 percent increase from levels reported in the 2017 inventory; and it exceeds the 2020 statutory goal by 2.9 percent (1.2 MMTCO2e).

Fig. 1 depicts total economy-wide emissions for the period 1990–2018 as calculated employing methodologies based on both Connecticut consumption of electricity and Connecticut generation of electricity. Both approaches for calculating electricity-sector emissions, as well as the underlying methodology for this inventory, are detailed in Appendix A. Fig. 2. shows changes in GHG emissions in each sector of the economy since 1990, while Table 1 shows sector-wide emissions for select years.

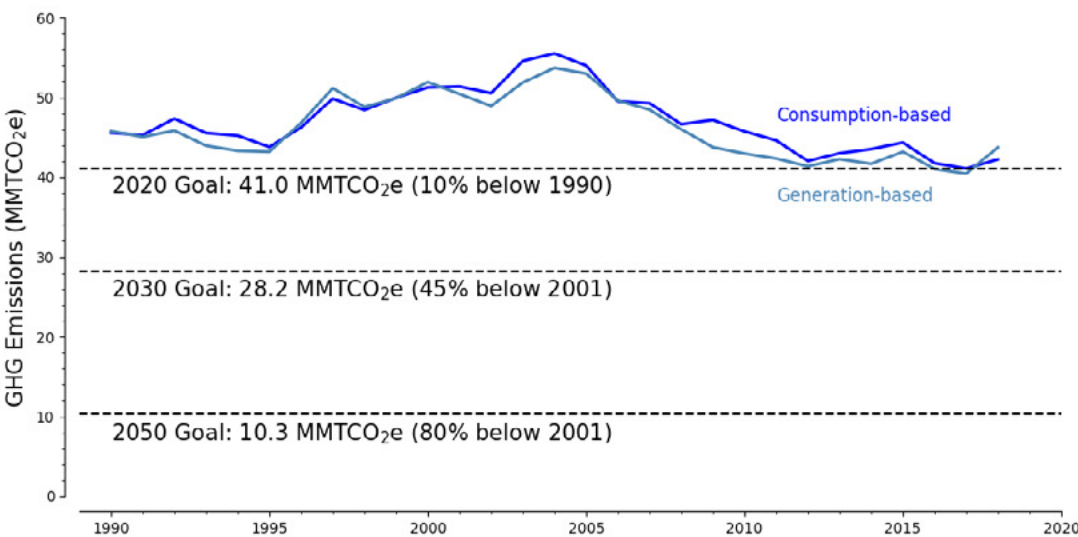## Connecticut Greenhouse Gas Emissions From 1990–2018

Fig. 1. Total economy-wide GHG emissions from Connecticut, 1990–2018. The figure reflects economy-wide results based on both consumption-based accounting for the electric sector (dark blue) and a generation-based calculation (light blue). Also shown are the state's statutory emissions-reduction goals for 2020, 2030, and 2050. The 2020 goal was met in 2017, however, emissions in 2018 were higher due primarily to increases in residential and commercial fossil fuel consumption.

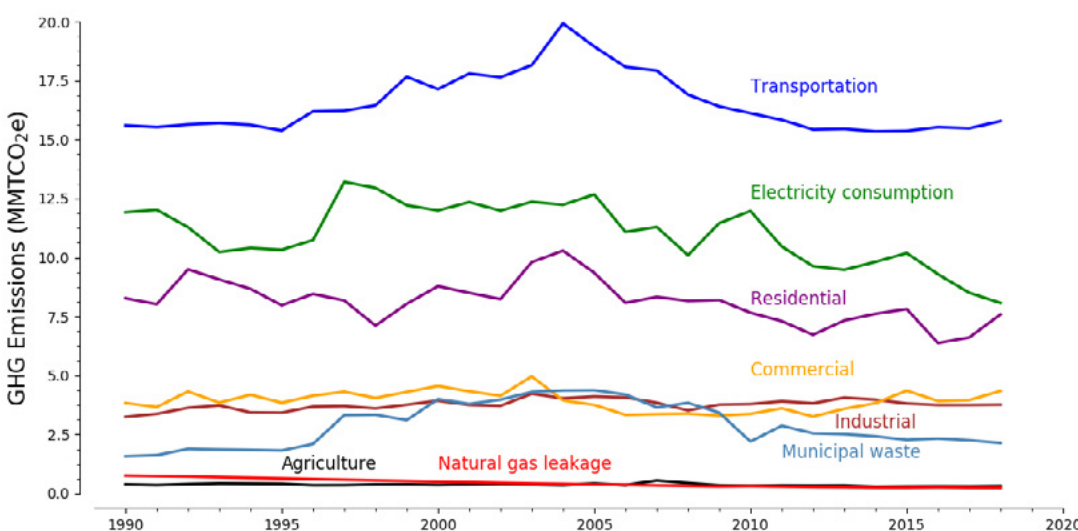## Connecticut Greenhouse Gas Emissions by Sector

Fig. 2. GHG emissions for CT broken down by economic sector. Transportation, by nearly a factor of two, is the largest emitter followed by electric power and residential consumption of fossil fuel. While emissions from electric consumption and landfill waste fell in 2018, emissions from most other parts of the economy increased with the residential sector experiencing the largest growth.

[2] GHG emissions are reported in terms of CO2e. Carbon dioxide is the primary GHG; and emissions of other gases covered in the inventory are expressed in terms of the equivalent amount of carbon dioxide according to the global warming potential of each gas.

Transportation Sector

In 2018, the transportation sector continued to be Connecticut's largest source of GHG emissions, primarily from the combustion of fossil fuels in vehicles. At 15.8 MMTCO2e, transportation emissions exceeded the combined emissions of the electricity and residential sectors, as shown in Fig. 3. National fuel-economy standards have improved vehicle efficiency markedly, with emissions per vehicle mile improving 16 percent since 1990. However, as shown in Fig. 4, the number of vehicles miles traveled (VMT) has increased even more rapidly in this period. The carbon footprint of each mile traveled has been reduced since 1990; however, in recent years this improvement has ceased (a pattern that is likely to continue as the average age of automobiles and trucks in operation in the United States continues to **increase**). As a consequence, Connecticut's 2018 transportation-sector emissions were higher than in 1990, by 1.3 percent.

Connecticut must enact policies to significantly reduce transportation emissions in order to meet the state's overall emission goals. The GC3's **2018** report determined that a 29 percent reduction in transportation GHG emissions from 2014 levels must be achieved in order to meet the GWSA 2030 target. Between 2014 and 2018, transportation sector emissions actually increased by 3 percent, which means that Connecticut will now need to reduce the sector's emissions by 32 percent (roughly 5 MMTCO2e) to achieve the GC3 target. This will require strategies to further improve fuel economy, especially by boosting adoption of zero-emission vehicles, along with strategies to reduce vehicle miles traveled.

In 2020, DEEP issued an **Electric Vehicle Roadmap** to accelerate adoption of electric vehicles (EVs). The Roadmap outlines policy and investment strategies to deploy electric-powered light-duty, medium-and heavy-duty vehicles, including school buses and freight trucks. As of June 2021, approximately 17,217 passenger EVs are **registered in Connecticut** –a small fraction of the 500,000 electric light-duty vehicles that the GC3 has projected the state would need in order to meet the 2030 GWSA targets. Electric medium-and heavy-duty vehicles entering the market in 2021 constitute an even smaller fraction of the number needed under a multi-state agreement. The state's EV rebate program (**CHEAPR**) is not adequately funded to spur adoption rapidly and equitably. Investing in new public transit systems, expanding the frequency and improving the accessibility of existing public transit services, and implementing transit-oriented development will enhance alternatives to single-occupant vehicle travel. Promoting ridesharing and improving the safety and accessibility of bike lanes and sidewalks to encourage active transportation is also critical to reduce VMT growth. The GC3's 2018 and **2021** reports recommended implementing the Transportation Climate Initiative (TCI), a regional program to cap transportation emissions and invest in clean transportation to cap emissions and provide the substantial, permanent funding necessary to support needed investment in these measures.

Electricity Sector

In 2018, electricity-sector emissions were down 32 percent since 1990 and 35 percent since 2001. This reduction was due to increased energy efficiency in businesses and homes and, especially, a continuing shift in the New England electric grid from carbon-intensive fuels such as petroleum and coal to less-carbon-intensive natural gas and zero-carbon renewables. The sector's emissions in 2018 were down 4.7 percent from 2017, even though somewhat warmer weather in 2018 increased electricity demand for air conditioning.

Power plants in Connecticut generated more electricity for the regional electric grid in 2018 than Connecticut ratepayers consumed. As other states in the region retire coal-fired generators, more of the region's electric power (and associated GHG emissions) will originate in Connecticut, such that the emissions associated with power generated in Connecticut will likely increase. At the same time, the emissions associated with the power consumed by Connecticut electric customers will decrease, due to the state's investment in energy efficiency and renewable generation (including offshore wind developed outside Connecticut). In the coming years, further divergence between emissions calculated on the basis of consumption and emissions calculated on the basis of generation is expected.
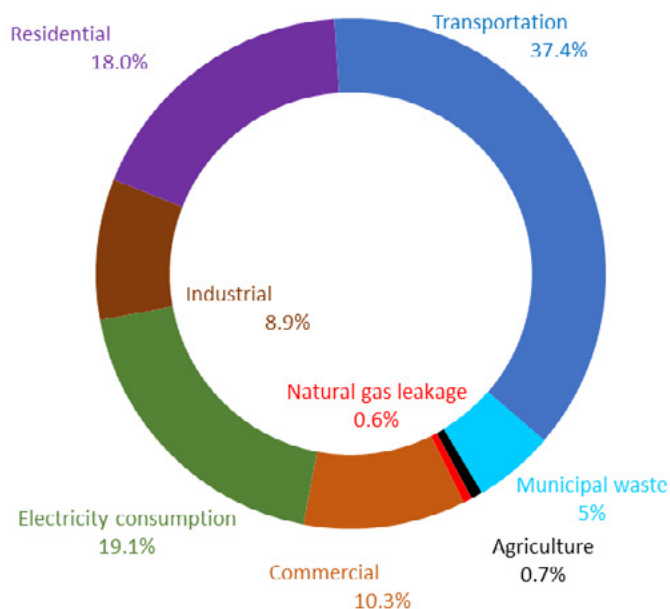
2018 Sector Emissions (Consumption Based)

Fig. 3. — Relative contribution of each economic sector to GHG emissions in 2018. The top three emission sectors account for nearly three-fourths of the state's 2018 emissions.

Statewide Emissions in MMTCO2e (Select Yrs)

YEAR	1990	2001	2004	2017	2018
Transportation	15.6	17.8	19.9	15.5	15.8
Electric Power					
Consumption	11.9	12.3	12.2	8.5	8.1
Generation	12.1	11.4	10.4	7.9	9.6
Residential	8.3	8.5	10.3	6.6	7.6
Industrial	3.2	3.7	4.0	3.6	3.8
Commercial	3.8	4.3	3.9	4.0	4.3
Municipal waste	1.6	1.7	4.4	2.0	2.1
Agriculture	0.38	0.33	0.35	0.24	0.32
Natural gas leakage	0.75	0.47	0.40	0.24	0.24
Generation based total	45.7	48.2	53.7	40.0	43.7
Consumption based total	45.5	49.2	55.5	40.6	42.2

Consumption-based accounting:
7% below 1990 levels | 14% below 2001 levels
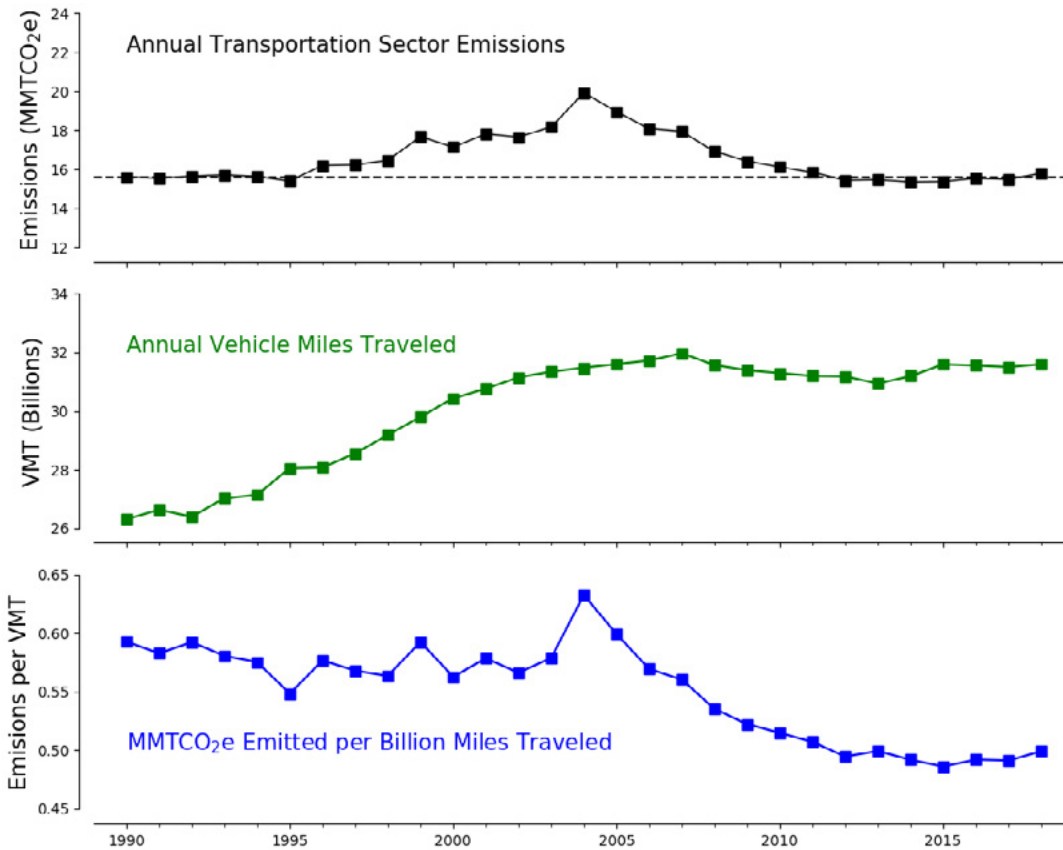
Impact of Vehicle Travel on GHG Emissions

Fig. 4. Top: total transportation sector GHG emissions from 1990–2018 The horizontal dashed line depicts 1990 emissions. Middle: annual vehicle miles traveled from 1990-2018. Bottom: GHG emissions per vehicle mile traveled in CT from 1990–2018 Despite progress in increasing fuel economy, the improvements in emissions per VMT are offset by the increase in total vehicular travel on Connecticut roads and highways and 2018 emissions slightly exceed 1990 levels. Source: CT DOT

Residential, Commercial, and Industrial Sectors

Together, emissions in the transportation, electricity, and residential sectors accounted for about three-fourths of Connecticut's GHG emissions. The modest increase in overall GHG emissions from 2017 to 2018 was largely the result of colder weather, which drove an increase in residential and commercial emissions from combustion of fossil fuel for heating. This included an 18 percent increase in emissions from residential use of fuel oil in 2018 (relative to 2017) and a 9.8 percent increase in emissions from use of natural gas. Commercial emissions increased 10.8 percent for use of natural gas and 6.6 percent for use of fuel oil. All of these increases are attributable to greater cold-weather heating demand than in the previous two years. (The impact of extreme weather is discussed further in Appendix B). In 2018, Connecticut experienced 5,744 heating degree days (see Fig. 5).[3]

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[3] Heating degree days and cooling degree days are defined as the difference between the median temperature on any given day (mid-point between the high and low temperature for the day) and 65 degrees F. A day with a median temperature of 60° F would result in 5 heating degree days, while a day with a median of 70° F would result in 5 cooling degree days.
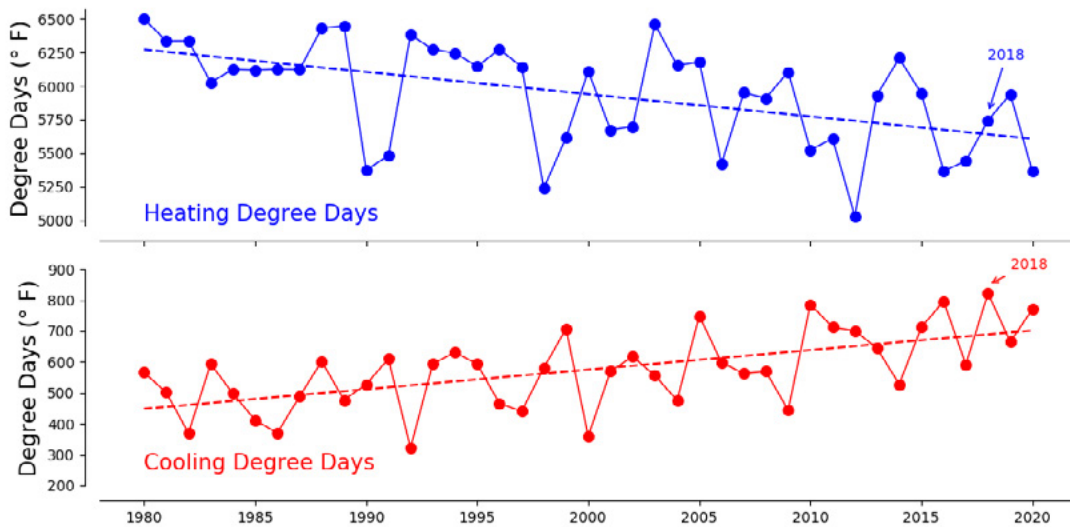
Annual Heating and Cooling Degree Days

Fig. 5. Heating degree days (blue) and cooling degree days (red), 1990–2020. In 2018, both heating and cooling degree days were higher than in the previous year, leading to more fossil fuel demand. Note that as Connecticut's climate changes, heating degree days are declining at approximately 16 Degree Days Fahrenheit per year since 1980, and cooling degree days are increasing on average of 6 Degree Days Fahrenheit annually since 1980. Source: NOAA National Centers for Environmental information, Climate at a Glance.

This was up 5.6 percent over 2017 and 7.0 percent over 2016, despite a long-term downward trend as Connecticut's climate warms.[4] Because most residential fossil fuel consumption is for space and water heating, electrification of home heating, decarbonization of thermal technologies, and improved weatherization in Connecticut's relatively old housing stock (as required by **Public Act 11-80**) will be critical to significantly reduce GHG emissions in this sector.

While residential emissions have decreased from the 1990 baseline, commercial and industrial emissions have risen and together account for a larger fraction of the state's emissions than the residential sector, highlighting the need for deep decarbonization efforts in these sectors. In 2018 energy-efficiency programs reduced annual carbon emissions by 138,000 metric tons across the residential, commercial, and industrial sectors. These programs must accelerate in order to further reduce emissions in these sectors.[5]

The GC3 in 2018 **called** for reducing GHG emissions from heating residential and commercial buildings 34 percent from 2014 to 2030. To that end, it **recommended** accelerating efforts to improve building efficiency and sharply increasing deployment of renewable thermal technologies, especially by moving thermal loads from fossil fuels to highly efficient heat pumps. The GC3 significantly expanded on these approaches in 2021 when it recommended suites of strategies to accelerate adoption of energy-conservation improvements, expand consumer education on zero-and low-carbon technologies, transition buildings to renewable thermal technologies, and improve the technical training of heating, ventilation, and air conditioning personnel. Because electricity generation is still largely dependent on combustion of fossil fuels, improvements in household and commercial energy efficiency have been essential to reducing fossil fuel consumption and their associated carbon emissions. Connecticut traditionally has relied heavily on improved lighting efficiency to cost-effectively realize such reductions. However, with highly efficient LEDs becoming the dominant form of residential and commercial lighting, attention is turning to improvements in mechanical equipment and building envelopes as essential sources of energy savings. In the long term, as electricity generation becomes more fully decarbonized, another key benefit of energy efficiency will be minimizing the cost of developing infrastructure for electricity generation, transmission, and distribution.

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[4] NOAA National Centers for Environmental information, Climate at a Glance: Statewide Time Series, published February 2021, https://www.ncdc.noaa.gov/cag/.

[5] See Energy Efficiency Board 2018 Programs and Operations Report, March 2019, https://www.energizect.com/file/5656/download?token=1UjsofHY.

Building a Low-Carbon Future for Connecticut

The GWSA requires the state to achieve ambitious economy-wide targets for GHG emission reductions, but it does not provide broad agency authority to promulgate regulations needed to achieve these targets. The Connecticut General Assembly has passed legislation over the years establishing regulatory authority for key decarbonization initiatives, such as the Regional Greenhouse Gas Initiative (RGGI) capping emissions from power plants; the state's Renewable Portfolio Standard and energy-efficiency programs; procurements of solar, offshore wind, nuclear, and other emission-free energy resources; and adoption of California emissions standards for passenger vehicles. These initiatives have been highly effective in helping to reduce GHG emissions, particularly in the electric sector. Nevertheless, the additional, significant GHG emission reductions that are necessary to achieve the GWSA 2030 target cannot be achieved unless the Connecticut General Assembly authorizes expanded investment and decarbonization programs.

Connecticut General Statutes Section 22a-200b requires that DEEP periodically develop "a schedule of recommended regulatory actions by relevant agencies, policies and other actions necessary to show reasonable further progress towards achieving the greenhouse gas emission levels specified in [the GWSA] section 22a-200a." These recommended actions have been developed with extensive stakeholder input through the Governor's Council on Climate Change and are included in the GC3 Phase 1 Report. That said, given the urgent need to achieve reductions in the transportation and buildings sectors, where emissions are still increasing, in this inventory we highlight the urgent need to adopt the following policy measures.

While GHG emissions reduction is the principal basis for the following recommendations, taking the recommended actions would also have many positive economic and public health benefits. Connecticut's **air quality is poor relative to the rest of the region**, and the state endures some of the highest levels of ozone pollution in the nation. The following actions would improve Connecticut's air quality and reduce the incidence of disease that inevitably accompanies continual poor air quality. Because the burden of Connecticut's poor air quality and climate change fall disproportionately on children, the elderly, and communities of color, the recommended actions are imperative for the state to honor its commitment to equity and environmental justice; and these considerations must be fully integrated in the design and execution of these actions to ensure that the benefits of reducing GHG emissions are realized fairly for all Connecticut residents. Further discussion of equity and additional benefits for each of these recommendations are explored in **GC3's Phase 1 Report**.

Reducing Transportation-Sector Emissions

1 **Establish a declining cap on allowable carbon emissions from the transportation sector via the Transportation and Climate Initiative Program (TCI-P).** The TCI-P will institute a declining cap on allowable carbon emissions from gasoline and on-road diesel fuel sold in participating jurisdictions and require suppliers to purchase carbon allowances for fuel sold. Auctions for allowances are projected to generate revenues up to $89 million in 2023 and as much as $117 million in 2032 — funds that will be reinvested in programs and infrastructure that reduce transportation-sector carbon emissions. These include programs to increase electric vehicle adoption and reduce vehicle miles traveled. The emissions cap will reduce carbon emissions from on-road transportation at least 26 percent between 2022 and 2032. TCI replicates the successful model of the RGGI. Recommended by the GC3; *requires legislative authorization.*

2 **Adopt more stringent emission standards for medium and heavy-duty vehicles.** Connecticut's adoption of California standards for passenger vehicles has been instrumental in improving the fuel efficiency and emissions profile of cars on the state's roads. Parallel authority to adopt California standards for larger vehicles is needed to extend this emissions reduction success to medium- and heavy-duty vehicles. Buses, light commercial trucks, single unit short haul trucks, and similar vehicles make up an increasing share of Connecticut vehicle emissions. Adopting California standards would set a target for zero-emission truck and bus sales for national truck manufacturers and require these companies to sell an increasing number of clean, zero-emission trucks within Connecticut. This would simultaneously help Connecticut reduce emissions of ozone – a key element of the state's air quality challenge – and address a significant source of GHG emissions. Recommended by the GC3; *requires legislative authorization.*

# Reducing Residential and Commercial Sector Emissions

1 **Enable municipalities to adopt "stretch" building code.** Numerous states have authorized municipalities to adopt stretch codes to improve building performance. Since Massachusetts developed its stretch code in 2009, 286 municipalities have voluntarily adopted it. In New York, municipalities can choose to adopt the **NYStretch Energy Code**, which is designed to save 10-12 percent in energy costs compared to the base code. Maine, Vermont, the District of Columbia, and Maryland also have some version of a stretch code. Adopting this approach in Connecticut would give municipalities the ability to require all new and substantially renovated buildings over 40,000 square feet to demonstrate energy use per square foot at least ten percent below the requirements of the State Building Code. This can be achieved by construction in accordance with a nationally accepted green building rating system that the Office of the State Building Inspector and the Codes and Standards Committee deem to provide the requisite efficiency improvement. Recommended by the GC3; *requires legislative authorization.*

2 **Mandatory building-energy-consumption reporting to potential homeowners and renters.** In Connecticut, the average single-family home has **$3,600 in energy costs annually**. This is the second-highest energy burden in the nation. Connecticut should join six other states in adopting a policy mandating energy-use disclosure during residential real estate sales and leases. Such an estimate may be obtained through the U.S. Department of Energy **Home Energy Score**. The Home Energy Score is available through the core services of the **Home Energy Solutions (HES)** and **HES-Income Eligible (HES-IE)** programs. It rates the energy efficiency of a home relative to others based on its structure and its heating, cooling, and hot water systems. It also provides an estimate of the home's annual energy costs, much like the fuel economy labeling that automobile dealers are required to provide. Requiring home sellers and landlords to provide data on the energy efficiency of their properties would allow buyers and tenants to make informed decisions and help homeowners and landlords better market their energy-efficiency upgrades in the real estate market. *Requires legislative authorization.*

Economy and Demographics

By 2018, economy-wide emissions per dollar of gross state product fell approximately 39 percent from the 1990 baseline (2012 dollars), reflecting long-term improvement in the carbon intensity of the state's economy. Emissions per capita were down 14.6 percent from 1990, to 11.8 metric tons of CO_2e. Emissions per capita are slightly higher in 2018 than in 2017 due to the slight increase in overall emissions (Fig. 6). Connecticut's per capita emissions remain low compared to overall **U.S. per capita emissions** of 16.6 MTCO2e.

Federal guidelines peg the **social cost of carbon** (the sum of key negative global economic impacts due to emission of greenhouse gases) at $51 per metric ton of CO_2 in 2020. By this standard, the social cost of Connecticut's statewide carbon emissions in 2018 was $2.4 billion dollars, about 0.9 percent of gross state product.

Fig. 6. The relationship between carbon emissions and the state economic output (top) and the emissions per person (bottom) from 1990–2018. The trend is an increasing decoupling of economic output with greenhouse gas emissions. Source: U.S. Census Bureau, U.S. Bureau of Economic Analysis.
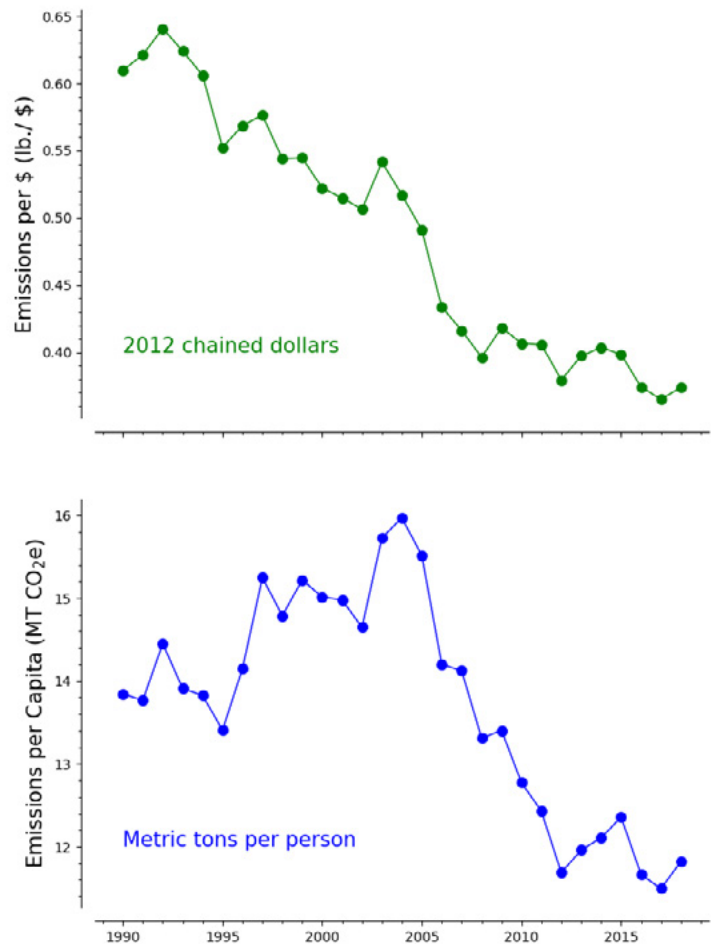
Scale and Pace of Change

Connecticut has evaluated decarbonization strategies to meet its statutory climate goals. The draft **Integrated Resources Plan** established that it was feasible to reach a zero-carbon electric supply by 2040 through multiple pathways. In 2019 Governor Lamont's **Executive Order No. 3** expanded the scope and responsibility of the GC3. It also added a mandate for the council to identify strategies to mitigate the most disruptive impacts of climate change as well as strategies to increase resilience in the face of the region's changing climate. The council's **2021 report** evaluated progress in implementing recommendations issued in 2018 and highlighted actions needed in the near term.

Connecticut has made important initial progress toward decarbonizing electricity generation and is preparing to make further steep reductions. Similarly, ambitious measures are needed to decarbonize the transportation and residential sectors. And even though roughly three-quarters of GHG emissions emanate from these top three emitting sectors, it is urgent that the state reduce emissions across other sectors of the economy as well. Rapid, sustained action across all sectors of the economy will be required for Connecticut to meet its climate goals.

Addendum: Proposed Change in Electricity-Sector Emissions Methodology

Recognizing that electricity is generated, distributed, and consumed via a regional grid, the GC3 **recommended** in March 2016 that DEEP employ a consumption-based methodology for calculating the electricity sector's contribution to the GHG inventory. Electricity generated in Connecticut is not necessarily used to satisfy demand within the state — indeed, Connecticut is a net exporter of electricity — and decisions on the need for and siting of new power plants are made primarily at the regional level. In order to provide a clearer picture of how the state's electricity demand contributes to regional emissions, DEEP adopted a consumption-based methodology beginning with the **2013 GHG inventory** (published in 2017).

DEEP has come to recognize that Connecticut's consumption-based methodology for calculating GHG emissions from the electric sector does not adequately account for energy associated with the **Renewable Portfolio Standard** (RPS), which requires an increasing annual percentage of Connecticut's electricity to be generated from resources defined by statute as "renewable." First, the methodology does not effectively account for increasing quantities of renewables or for the GHG emissions associated with some renewables (such as fuel cells and biomass). Second, Connecticut's methodology for counting emissions associated with the RPS does not effectively distinguish between biogenic emissions (associated with combustion of biological materials such as wood) and non-biogenic GHG emissions (associated with combustion of fossil fuels). In both cases, the methodology is inconsistent with best practice.

In light of these limitations, DEEP is considering the following modified approach to the consumption-based calculation of electricity-sector GHG emissions:

1. For each state in the ISO-NE region, count all Renewable Energy Credits (RECs) retired in a particular state as a reduction of that state's consumption.

2. Charge any GHG emissions associated with a REC to that state.

3. Calculate the regional emission factor as the ratio between (a) any emissions that are not associated with a retired REC and (b) the remaining electricity generation.

4. Calculate each state's electricity-sector GHG emissions as the sum of (a) any emissions associated with that state's retired RPS credits and (b) the product of the regional emission factor and that state's electric demand that is not associated with RECs.

Adopting this methodology for future inventories will allow DEEP to more accurately reflect emissions reductions realized by Connecticut's investment in zero-carbon emissions from the Millstone nuclear facility, the state's increasing procurement of renewable energy, and the state's phaseout of carbon-intensive biogenic sources of electricity. A consumption-based methodology that more accurately reflects each New England state's renewable energy profile will be consistent with the methodology DEEP employed in the IRP evaluating pathways toward sourcing 100 percent of Connecticut's electricity from zero-carbon sources by 2040. DEEP intends to solicit public feedback on this intended change in electricity-sector GHG accounting.

Appendix A: Methodology

Like most other U.S. states that regularly calculate economy-wide GHG emissions, DEEP relies largely on the Environmental Protection Agency's **State Inventory Tool (SIT)**. Based primarily on state-level data sets — e.g., the volume of gasoline or heating fuel oil sold in Connecticut — the SIT calculates GHG emissions from scores of distinct emissions sources and aggregates these emissions by economic sector.

EPA recommends that states utilize their own data sets when these are likely to be more accurate than the tool's default values. Accordingly, DEEP develops its own values for several components:

• To determine GHG emissions from landfill use, waste combustion, and wastewater, DEEP relies on data collected by its municipal waste program.

• To estimate GHG emissions from natural gas transmission, distribution, and leakage, DEEP uses data obtained from the Connecticut Public Utilities Regulatory Authority, the federal Pipeline and Hazardous Materials Safety Administration, and the Energy Information Administration.

• DEEP calculates electricity-sector GHG emissions in two ways: on the basis of in-state consumption of electricity from the regional grid; and on the basis of electricity generated within Connecticut.

The SIT data for land use, forestry, and land use change continues to yield unreliable results, so these data are not included in the 2018 inventory.

First applied to the 2013 inventory, the consumption-based approach for electric-sector GHG reporting reflects best practices among states that regularly report statewide GHG emissions and more accurately reflects the regional nature of the electric grid. (In inventories for years prior to 2013, DEEP reported emissions from the use of electric power only on the basis of direct emissions from power plants located in Connecticut.) Consumption-based accounting calculates GHG emissions based on Connecticut consumers' use of electricity produced throughout New England and delivered via the regional grid (i.e., the emissions are consistent with electric production dispatch).

The consumption-based approach for the electricity sector begins with annual electric load (consumption) data published by the Independent System Operator, New England (ISO-NE). DEEP then determines additional energy consumption associated with transmission losses, pumped hydroelectric, and behind-the-meter generation. The agency then calculates the New England regional emission factor – which reflects the regional fuel mix as well as GHG emissions associated with each power source for a particular year. Finally, the agency multiplies this factor by Connecticut's in-state usage in order to determine the amount of GHG emissions for which Connecticut is responsible.

DEEP is committed to continuously improving its GHG accounting methodology. This includes identifying improvements in both the quality of data as well as the methodology employed in calculating annual emissions.

Appendix B: Effect of Extreme Winter Weather

Extreme winter weather has a significant impact on emissions in the electricity, residential, and commercial sectors. The main reason residential and commercial emissions increased sharply in 2018 (relative to 2017) is a period of deep cold in the first week of January 2018 along with other relatively cold periods during April and November. Overall temperatures in the first quarter of the year were about 3.5° F warmer than normal; but during the first week of January, the U.S. east coast experienced a sustained period of extremely cold temperatures due to disruptions in the jet stream that allowed frigid Arctic air to penetrate to lower latitudes.

During extreme winter cold, homes and businesses consume more natural gas and fuel oil, and less natural gas is available for electricity generation, which in turn must rely on more carbon-intensive oil and coal. Excluding the January 2018 cold spell (which began in late December), oil and coal accounted for only 0.9 percent of the regional electric system generation mix in 2018, while natural gas accounted for **49 percent**. During the cold spell, the pattern was sharply different — oil and coal accounted for 34 percent of generation — and hourly electricity consumption was 18 percent higher than during the rest of January. Electricity demand in January as a whole was elevated, exceeded only in July and August when cooling demand is high. But because the fuel mix in January contained higher percentages of oil and coal, January emissions from electricity consumption were comparable to those in the months with higher demand.[6]
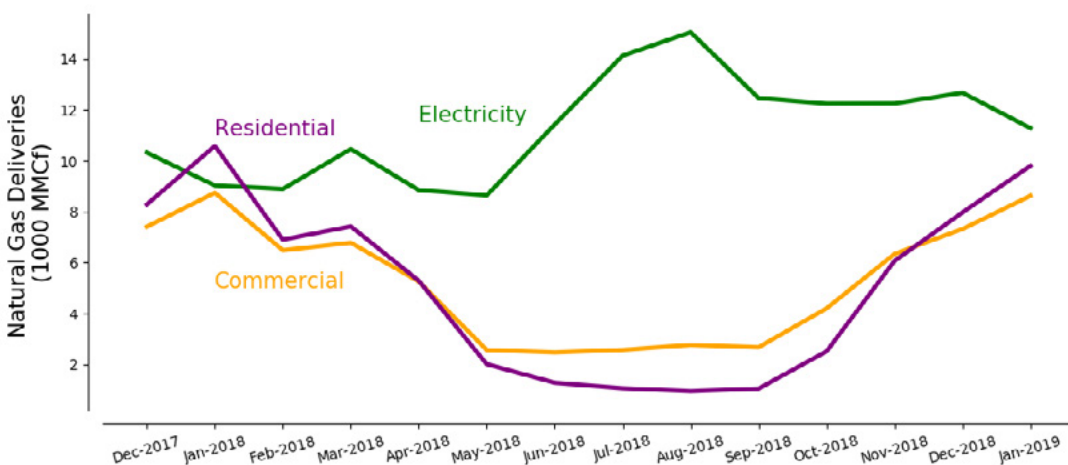

Natural Gas Deliveries by End Use

Fig. 7. Deliveries of natural gas to Connecticut in 2018 categorized by top end uses. Source: U.S. Energy Information Administration https://www.eia.gov/dnav/ng/hist/n3010ct2m.htm

Natural gas deliveries in 2018 were highest in January, with residential consumption to satisfy heating demand accounting for the highest share during the month (Fig. 7). Connecticut also experienced below-normal temperatures for sustained periods during April and November 2018, with several cities setting record low temperatures during the first two weeks of April. In April, Connecticut experienced 628 heating degree days — compared to 381 heating degree days the previous April — and natural gas deliveries for the month were nearly 50 percent higher than in April of 2017 and 40 percent higher than the same time in 2019.

The state also experienced a warmer-than-usual summer in 2018, with excessive cooling degree days requiring increased electricity usage to meet higher cooling demand. August brought 311 cooling degree days — 88 percent above average. As climate change makes summers hotter and heat waves more frequent, and as it may also make deep cold snaps more common and lengthy, the need for decarbonization of Connecticut's buildings becomes even more important.

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[6] Calculation based on monthly emission factors published in the ISO-NE 2018 air emissions report and generation published in the ISO-NE 2018 report of daily generation by fuel type.