

Community Greenhouse Gas Emissions Inventory



City of Albany, New York

Office of Sustainability

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City of Albany 2019 Community Greenhouse Gas Emissions Inventory

Measuring greenhouse gases and identifying their sources within Albany's city limits.

Introduction

Humanity has been sending greenhouse gases into the atmosphere since our ancestors first began cultivating fire. However, with the advent of the Industrial Revolution in the nineteenth century and its exponentially accelerated burning of wood, coal, and oil, humankind's emissions began to take on climate-altering proportions. Greenhouse gases such as carbon dioxide trap the sun's heat, preventing it from radiating back into space and therefore raising the planet's average global temperature — possibly by as much as nine degrees by the end of the century.¹ The rise in average global temperature since 1850 is predictably triggering a cascade of environmental, social, and economic crises.

The City of Albany began addressing climate change in 2005 with Mayor Jerry Jennings' signing of the U. S. Mayors' Climate Protection Agreement. Four years later, Albany first measured the City's greenhouse gas emissions. In 2012 Albany adopted a Climate Action Plan as part of the Albany 2030 comprehensive plan process. In part, that plan calls for a 40% reduction in emissions from 1990 levels by the year 2030. It has been a decade since the City last measured Albany's emissions, so in 2020 a new Community Greenhouse Gas Emissions Inventory was undertaken, measuring Albany's city-wide emissions in 2019.²

The results of this inventory show that the City of Albany generates approximately 1,166,127 metric tons of carbon dioxide equivalent³ every year — that's 12.1 tons of CO₂e per person every year. Albany's per capita carbon footprint is higher than the New York State average of 8.3 tons per person, and below the U.S. average of 15.5 tons.⁴

An overview of solutions to the twin problems of reversing climate change ('mitigation') and preparing for its impacts ('adaptation') is beyond the scope of this inventory. It is therefore recommended that Albany update its 2012 Climate Action Plan, including a thorough public engagement element. The process of drafting or revising a Climate Action Plan can raise the profile of climate issues within the community, educate community leaders about possible solutions, and provide a roadmap to meet the City's emissions reductions targets.

The next few years are critical if we are going to eliminate fossil fuels in time to avert the worst of many possible climate disasters. Albany can lay the groundwork now to play a leading role in global efforts to thrive in the coming era of unprecedented climate changes.

How Will the Climate Change in Albany?

It's hard to predict how the climate will change over a small area like a city or county. The models used by scientists can only track climate changes over large areas, like the northeast United States. For fifty years, however, changes in our region have been documented and tracked.

The greenhouse gases humanity has released into the atmosphere since the Industrial Revolution have been measurably warming the planet for decades. The average global temperature has increased by approximately 3° Fahrenheit since 1895, and is projected to increase another 3-10° F by 2080. Immediate widespread reductions in global emissions are needed to keep warming to the low end of that 3-10° F range.

The United Nations' Intergovernmental Panel on Climate Change (IPCC) reports that we have less than ten years to reduce emissions enough to keep global warming to under 3.0° F, which would already be a catastrophic level of warming. Even the temperature increases that are already 'baked in' by our past emissions will bring disastrous consequences worldwide. Climate change is already contributing to crises like wildfires, heatwaves, drought, storms, and war.

Temperature

The United States National Climate Assessment (NCA)⁵ projects temperatures in the northeast to increase 3.5° F by the year 2035. This would be, "the largest increase in the contiguous United States and would occur as much as two decades before global average temperatures reach a similar milestone."⁶

Increased temperatures will lead to more heat waves, forest fires, and a northward shift in ecological and agricultural zones. It will mean an increase in the number of infectious disease outbreaks as diseases move north into territory previously too cold for them. Cold snaps will become less common.⁷ There will be more floods, and the floods we get will be

more severe. High temperatures can exacerbate health problems, increase aggression and violence and strain the electrical grid. The impacts cascade.

An increase in average summer temperature in our area will be most harmful in cities, where large expanses of dark surface areas such as roads and rooftops absorb heat, creating an "urban heat-island effect." This makes cities like Albany significantly hotter than nearby rural or suburban areas with their more expansive shade tree cover and relative lack of pavement — in some cases a difference of almost 20 degrees.⁸ Urban heat islands also increase air pollution by creating smog, exacerbating respiratory illnesses such as asthma. The elderly, children and those who have underlying health issues are particularly at risk of heat-related ailments.

In Albany air quality is an equity issue. Those who live near the transportation hub of the South End, for instance, with its port, train, and truck traffic live with measurably worse air quality than do those in the more suburban neighborhoods in the western reaches of the city.⁹ Global warming combined with the heat island effect will only increase these health disparities.

Precipitation

Increases in temperature bring changes in the patterns of rain- and snow-fall. Precipitation has already increased 10% in the last century — by about 5 inches per year. An additional 5% to 20% increase in precipitation is predicted as we approach the year 2100. When it rains or snows over the coming century it will be increasingly in short heavy downpours rather than gentle, extended showers. There will be more precipitation in winter and spring than the northeast has been used to.

Increasing temperatures bring with them more frequent and more severe storms — precipitation from heavy storms has already increased 70% since 1958

in the northeast. More frequent and intense storms will bring more frequent and intense flooding in the lower-lying sections of Albany, punctuated by more frequent droughts in summer and fall.¹⁰

Sea Level Rise

Global warming causes sea level to rise in several ways. Warmer water takes up more space than cooler water, so when the greenhouse effect increases the oceans' temperature, sea levels rise. Warmer temperatures also means melting land ice found in mountain glaciers, Greenland, and Antarctica. All that water flows into the ocean, raising sea levels even further.

Global sea level has risen by a little more than one foot in the past hundred years due to global warming, with an additional rise of about 4 inches in the New York region due to ongoing glacial rebound.¹¹ Climate models for the Northeast call for about two more feet of sea level rise by 2050, and up to six feet by 2100.¹²

The Hudson River is an estuary, so its waters are connected directly to the sea, rising and receding with the tides. Sea level rise therefore also means river level rise for the Hudson.¹³ This will be most noticeable along the banks of the Hudson and the low-lying area at the mouth of the Normans Kill. Just south of Albany, about one third of Schodack Island State Park could be underwater, and sections of the Amtrak rail line as far south as Poughkeepsie would be vulnerable to flooding at high tide, possibly requiring elevation of the tracks.

In the coming decades, the City of Albany will get hotter and wetter (though also punctuated by more frequent droughts). Diseases will proliferate, the urban heat island effect will bake parts of Albany, and the Hudson River will swell. Along with communities worldwide, Albany can work to reduce this damage. But in order to reduce the City's emissions, we first need to know how much greenhouse gas Albany is responsible for.

Albany's Emissions^{14, 15}

Within the boundaries of the City of Albany, the city generates over a million metric tons of carbon dioxide equivalent every year — approximately 1,166,127 metric tons in 2019. Ninety percent of all citywide emissions come from three sources:

- 41% of emissions result from natural gas use, the largest source of emissions in the city.
- 37% of Albany's emissions come from transportation, mostly tailpipe emissions from passenger cars.
- 12% comes from electricity use, reflecting dirty energy coming from the grid — in other words power plants burning coal, oil, and more natural gas.

Looked at another way, gasoline vehicles (29.4%) and commercial use of natural gas (27.8%) generate the majority of our emissions (57.2%). Residential natur-

al gas use accounts for another 12.6%, just under half the emissions of the commercial gas sector.

The City of Albany generates approximately 1,166,127 metric tons of CO₂ every year — but is that a lot? According to the U.S. Environmental Protection Agency, we would need 1.4 million acres of mature forest to absorb that much carbon per year - or about 19 million tree seedlings grown for ten years.¹⁶ But how does Albany compare to the rest of the state and country? Dividing the total emissions (1,166,127 tons) by Albany's population (96,460) gives us 12.1 tons of carbon per person each year. As reported in 2019's New York State Greenhouse Gas Inventory,¹⁷ the state average per person emissions is 8.3 tons per year. That's one of the lowest state averages in the country, due in part to the relatively low emissions of public transit-dominated New York City. Although

Albany's per capita carbon footprint is higher than New York's average, it is also well below the U.S. average of 15.5 tons of carbon dioxide equivalent per person per year.¹⁸

Knowing how much greenhouse gas the Albany community generates every year is a key first step to

reducing emissions. Policies to reduce emissions can be measured against Albany's output to target reduction goals. As for how much we need to reduce our emissions and how fast, appropriate benchmarks for emissions reductions have already been identified.

Benchmarks

In the face of damage to both human society and planetary ecosystems, governments at all levels, from the United Nations to neighborhood associations, have begun working to both reverse the rate of global warming and adapt to the changes already inevitable.

There are three important sources for Albany to consider when setting greenhouse gas reductions goals:

- The first is the Intergovernmental Panel on Climate Change (IPCC), the United Nations' organization founded to, "provide policymakers with regular scientific assessments on climate change, its implications and potential future risks, as well as to put forward adaptation and mitigation options."¹⁹ The IPCC has reported that global emissions need to be reduced 45% by 2030 to avoid the worst effects of climate change.
- New York State has set a similar benchmark in the 2019 Climate Leadership and Community Preservation Act, requiring a 40% reduction from 1990 levels by 2030.
- The City of Albany set the same 40% reduction goal in its 2012 Climate Action Plan.

In 1988, the United Nations established the Intergovernmental Panel on Climate Change to bring scientists together from around the world in order to provide the best objective information on climate change. In 2018, the IPCC released a headline-grabbing report. Well known for both the reliability and the conservative estimates of their work, the IPCC's Special Report No. 15: Global Warming of 1.5° C [2.7° F] com-

pares a world where temperatures increase by 2.7 degrees (1.5° C) with a world 3.6 degrees (2° C) warmer. In short, in order to prevent the catastrophes awaiting us at 3.6° and higher, humanity must cut global emissions by at least 45% by the year 2030 — while also reducing emissions to zero by 2075.²⁰ That means cutting humanity's emissions in half in the next ten years, and eliminating the release of greenhouse gases within fifty. Jason Hickel of *Foreign Policy* put it bluntly, "It would be difficult to overstate how dramatic this trajectory [laid out by the IPCC] is. It requires nothing less than a total and rapid reversal of our present direction as a civilization."

New York State has already taken significant steps towards curtailing greenhouse gas emissions. In 2019, for example, Governor Andrew Cuomo signed the "Climate Leadership and Community Protection Act" into law, which set statewide benchmarks for emissions reductions, including:

- A 40% reduction in emissions from 1990 levels by 2030
- An 85% reduction in emissions from 1990 levels by 2050
- Requiring that 70% of the state's electricity be from renewables by 2030; and
- Requiring 100% of the state's electricity to have zero emissions by 2040.

These benchmarks meet and in some cases exceed the IPCC recommendations. Among the many policy implications of the CLCPA are:

- The creation of a statewide Climate Action Council, including working groups on a variety of areas climate change will impact.
- Electrifying transportation and buildings while powering them with renewable energy; and,
- Increasing funding for local government climate action.^{21, 22}

The law also recognizes the importance of environmental justice, with 35-40% of CLCPA funding targeted for historically disadvantaged communities.

Albany set a benchmark for emissions reductions in the 2012 Climate Action Plan. Like the CLCPA, Albany's plan calls for a 40% reduction in emissions from 1990 levels by 2030. Since the City does not have emissions numbers for 1990, a more recent target should be used, either the 2009 inventory or this 2019 inventory.

Conclusions

The longer we delay meaningful action to rein in climate change, the longer, more difficult, and more expensive the necessary changes will be. It is in the best interest of everyone, everywhere, to find the fastest, most effective ways to reduce greenhouse gas emissions.

But climate change has already begun. There are going to be some changes that already 'baked in'. Since the amount of carbon in the atmosphere is still growing, those devastating baked in climate disruptions will get worse over time. And if we don't do enough, they will effectively be permanent. Regardless of how fast we change course now, we will have to adapt to a different world in the years to come.

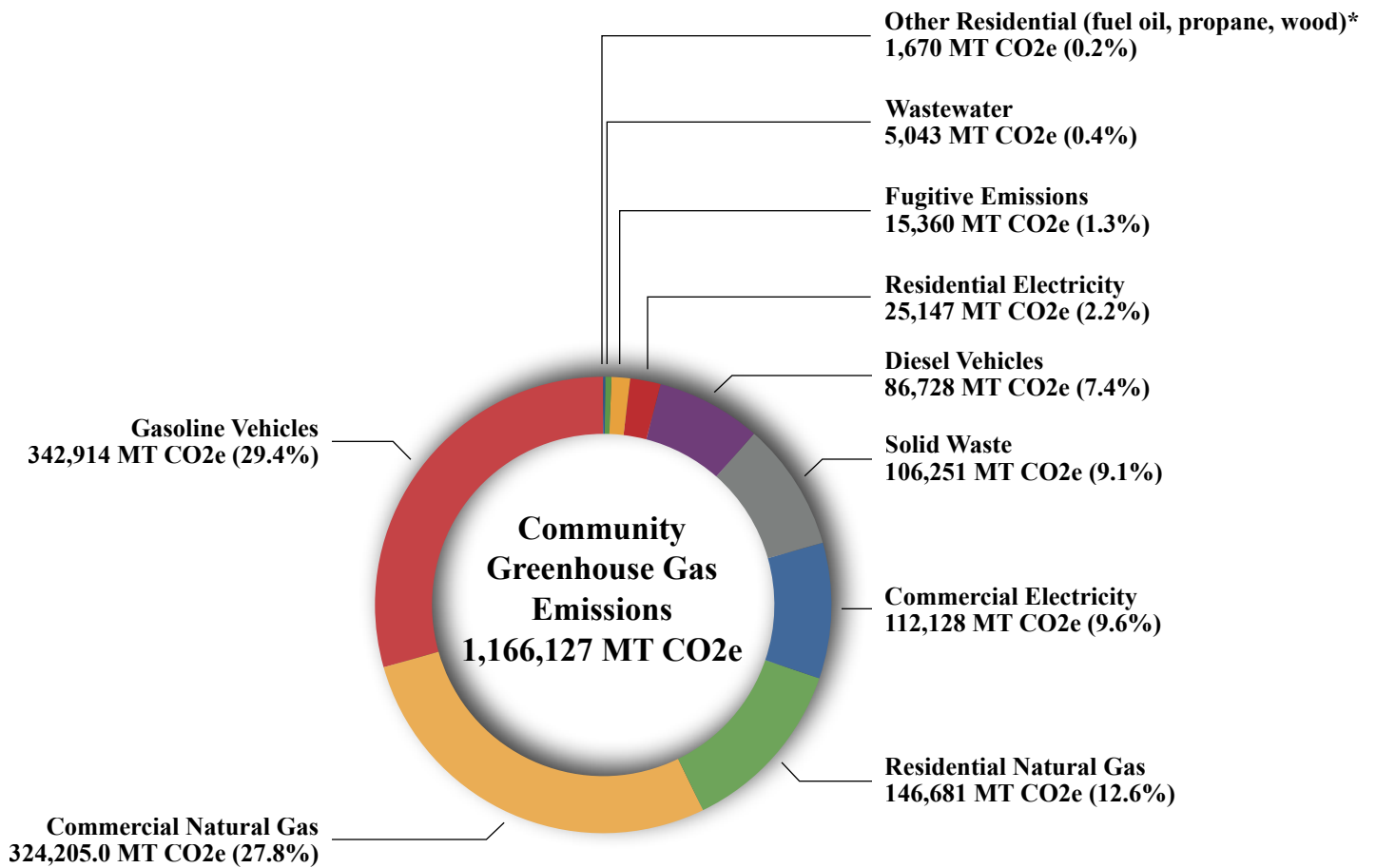
Local governments are a logical first place to look to make meaningful emissions reductions. They are also on the frontlines of inventing the adaptation measures we will have to come to terms with. Countless municipalities have undertaken greenhouse gas emissions inventories in an effort to be able to set benchmarks for emissions in specific sectors. Countless more have written Climate Action Plans to guide their climate policies. Those are the first steps towards enacting meaningful emission reductions and adaptation measures.

Albany began the process of mapping the extent of our carbon footprint in 2009 with city's first emissions inventory. A regional inventory done for the Capital Region in 2010 and another inventory of Albany's government operations in 2012 helped inform the drafting of a Climate Action Plan in 2012 as part of the Albany 2030 plan.

This study does not presume to describe the variety of the impacts climate change will have on the lives of the people of Albany, nor does it offer possible solutions. To fully explore what we can do about our collective carbon footprint requires conversations between stakeholders representing all aspects of the community.

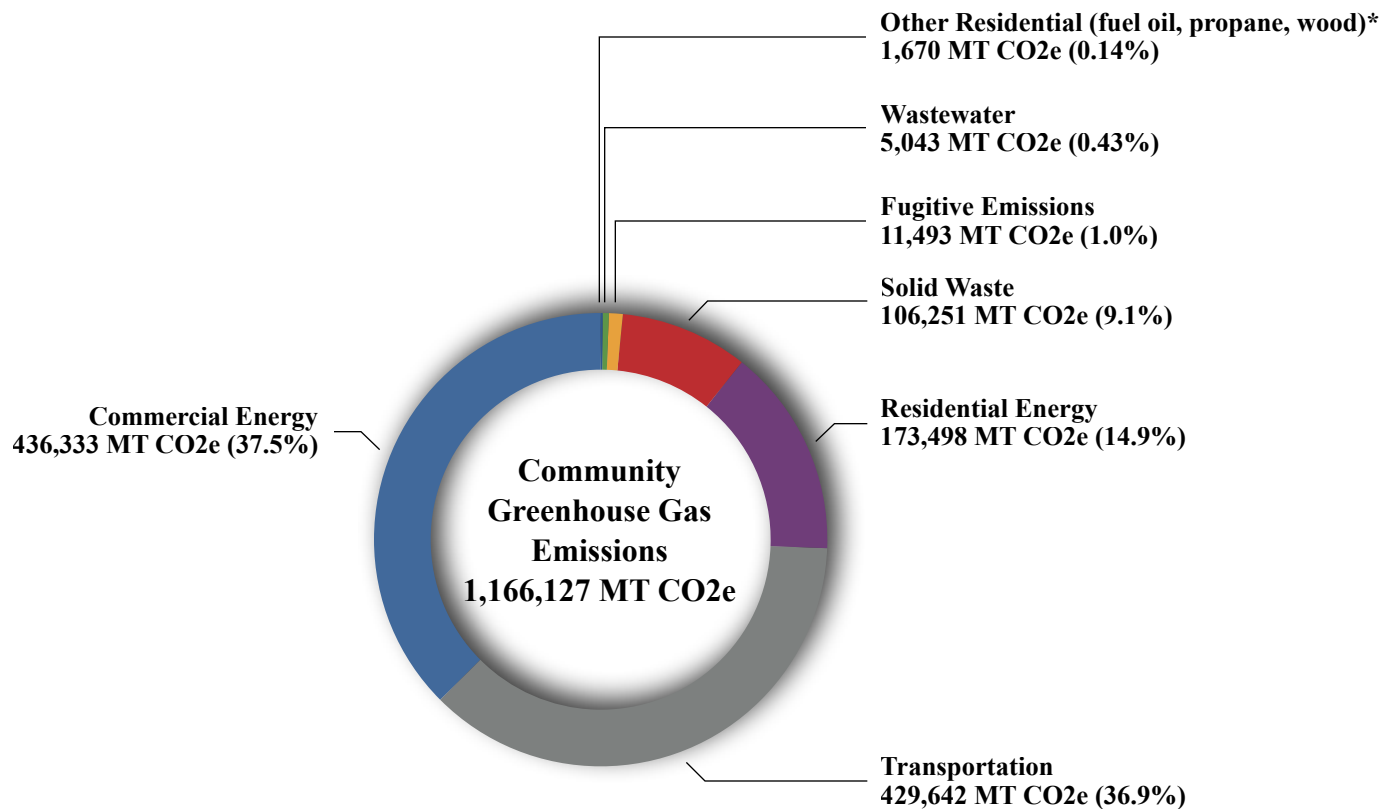
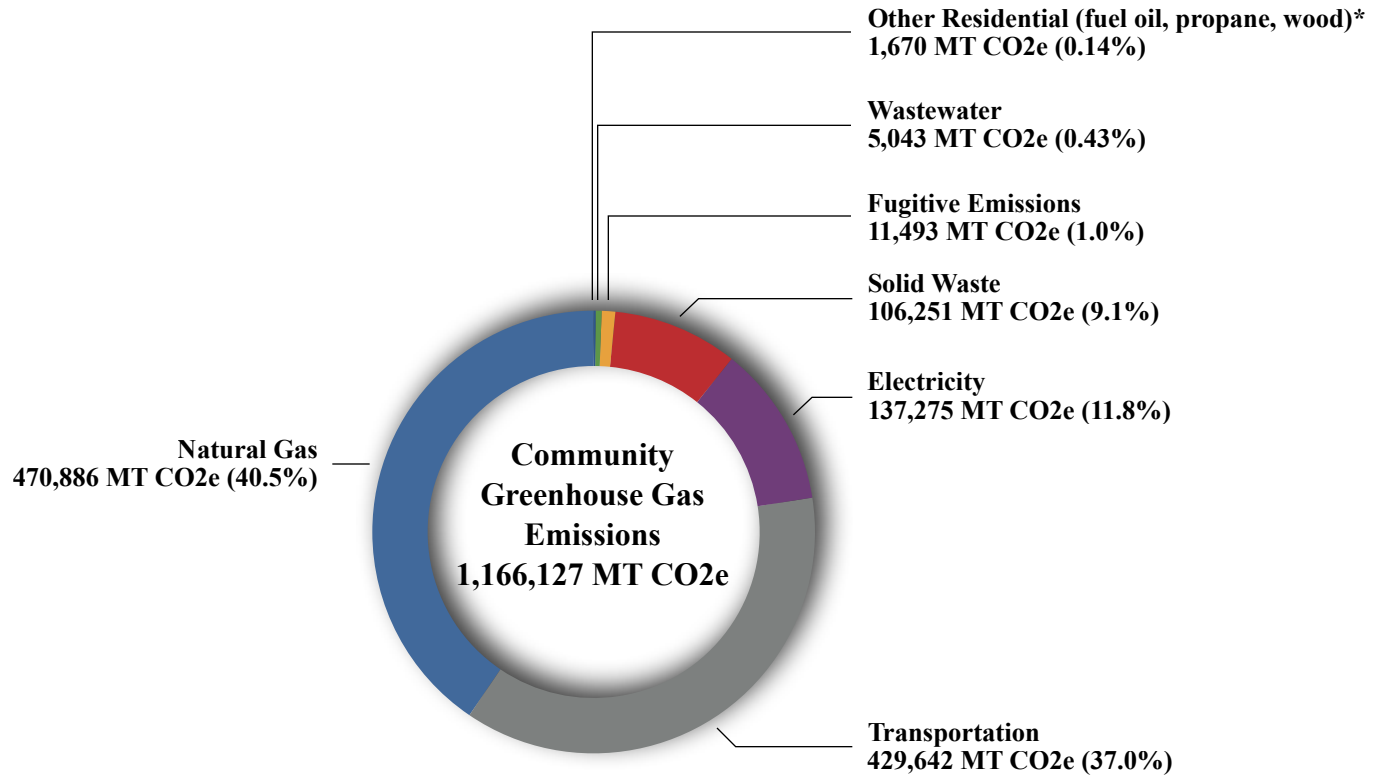
Because a comprehensive overview of climate solutions is beyond the scope of this project, it is recommended that Albany revisit its decade old Climate Action Plan. Revising that plan can give the people of Albany a blueprint for moving forward efficiently and effectively. The public engagement process involved also gives the extended community, including elected officials, the chance to discuss, assess, and promote the myriad ways that Albany can reduce its greenhouse gas emissions and adapt to the world that is now inevitable — and changing fast.

Inventory of Emissions

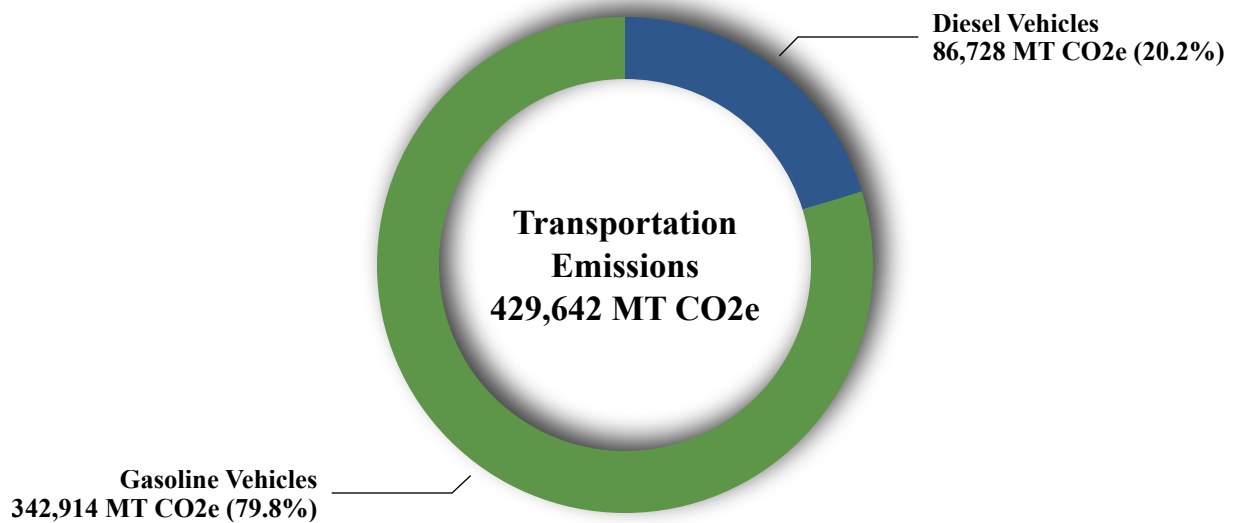
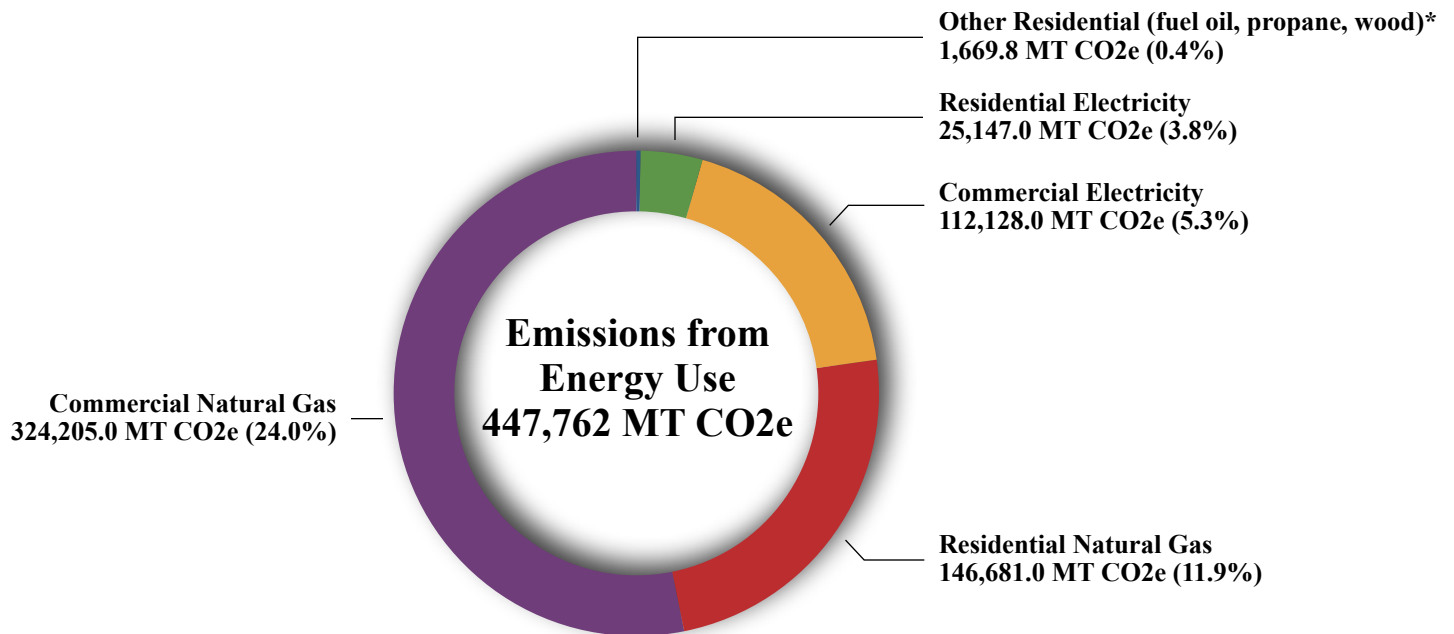


* No data available for commercial fuel oil, propane, or wood use.

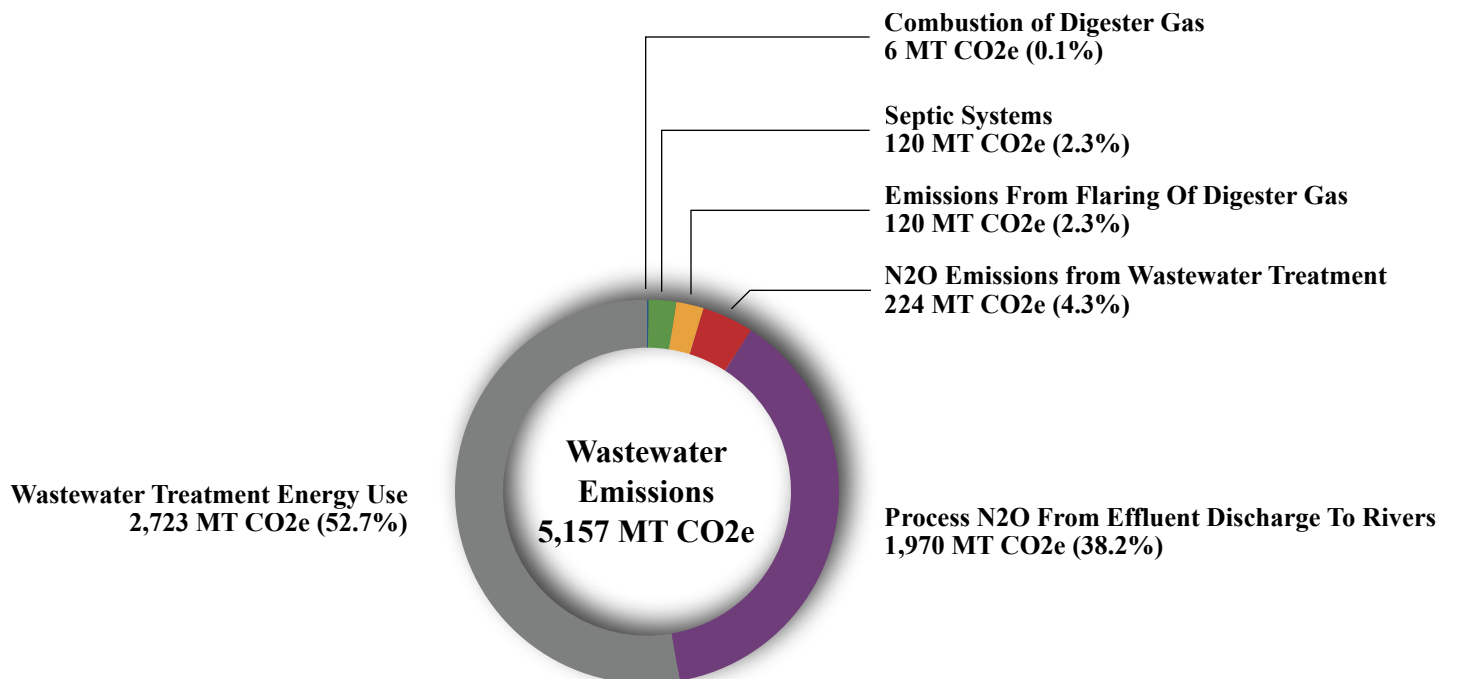
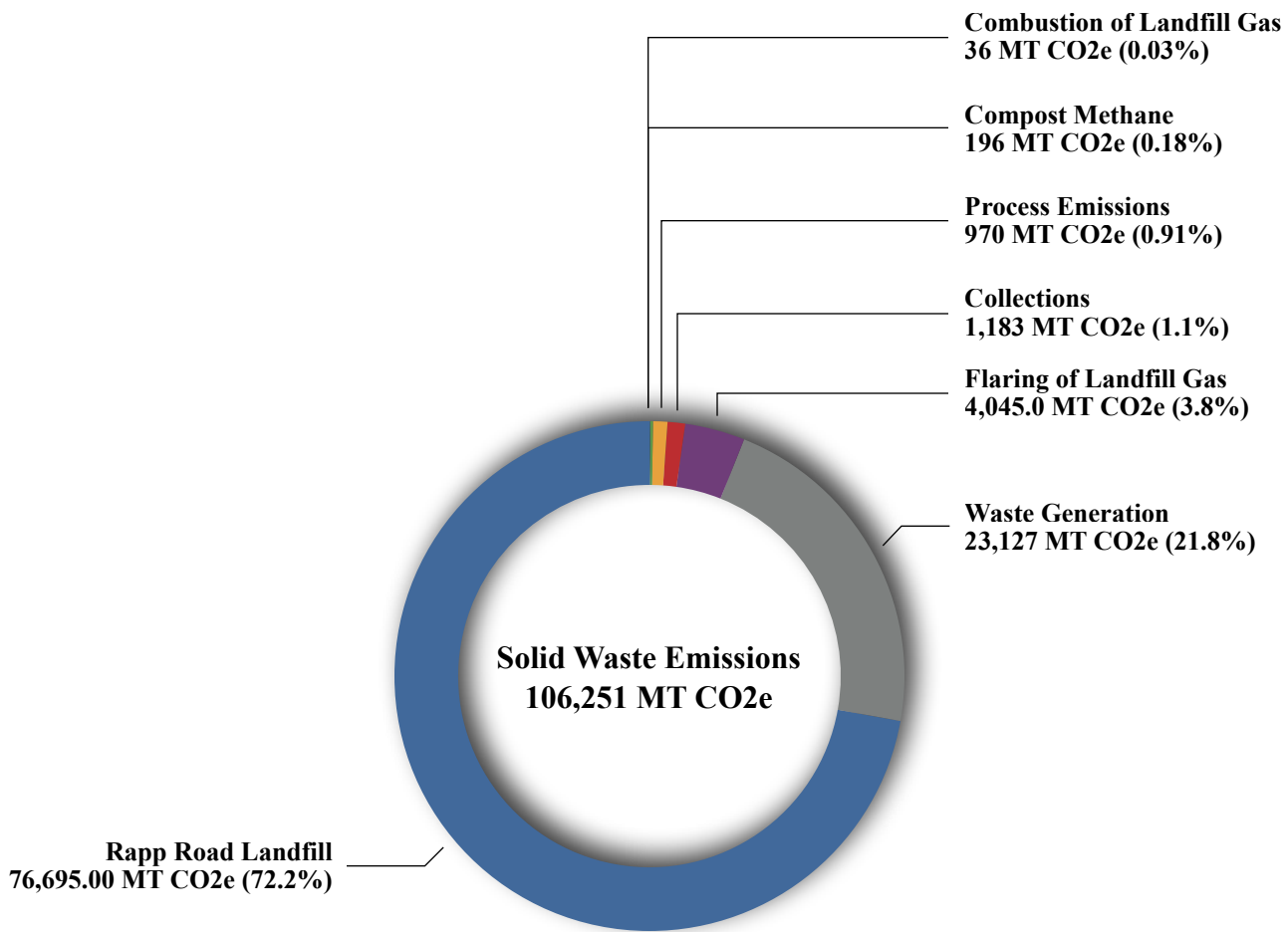
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Notes

- ¹ <https://www.nature.com/articles/d41586-020-01125-x>
- ² The results of this inventory were compiled from a variety of sources based on the standards set by Version 1.2 (2019) of the U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions developed by ICLEI: Local Governments for Sustainability and calculated using ICLEI's "ClearPath" online interface. A complete record of all data generated is available by request from the Mayor's Office of Energy and Sustainability.
- ³ Carbon dioxide is not the only greenhouse gas. The main greenhouse gases also include nitrous oxides, methane and chlorofluorocarbons. When reporting on greenhouse gas emissions, each gas's emissions is converted to its equivalent in carbon dioxide. Methane, for example, is 84 times stronger a greenhouse gas than carbon dioxide. So, one ton of methane going into the atmosphere is the equivalent of 84 tons of carbon dioxide being emitted.
- ⁴ <https://data.worldbank.org/indicator/EN.ATM.CO2E.PC?locations=US>
- ⁵ The fourth and most recent of which was published in the fall of 2018. The fifth NCA is being undertaken now.
- ⁶ Dupigny-Giroux, L.A., Mecray, E.L., Lemcke-Stampone, M.D., Hodgkins, G.A., Lentz, E.E., Mills, K.E., Lane, E.D., Miller, R., Hollinger, D.Y., Solecki, W.D., Wellenius, G.A., Sheffield, P.E., MacDonald, A.B., Caldwell, C. (2018) Northeast. In impacts, risks, and adaptation in the United States: Fourth National Climate Assessment, Volume II. U.S. Global Change Research Program, Washington, DC, USA, pp. 669–742. doi: 10.7930/NCA4.2018.CH18
- ⁷ Dupigny-Giroux, L.A., Mecray, E.L., Lemcke-Stampone, M.D., Hodgkins, G.A., Lentz, E.E., Mills, K.E., Lane, E.D., Miller, R., Hollinger, D.Y., Solecki, W.D., Wellenius, G.A., Sheffield, P.E., MacDonald, A.B., Caldwell, C. (2018) Northeast. In impacts, risks, and adaptation in the United States: Fourth National Climate Assessment, Volume II. U.S. Global Change Research Program, Washington, DC, USA, pp. 669–742. doi: 10.7930/NCA4.2018.CH18
- EPA. (2016). What climate change means for New York. Fact Sheet. EPA 430-F-16-034.
- Frankson, R., Kunkel, K., Champion, S., Stewart, B., Sweet, W., DeGaetano, A. T. (2017). New York State Climate Summary. *NOAA Technical Report NESDIS 149-NY*, 4 pp.
- ⁸ Vivek, S., Voelkel, J., Williams, J., and Hoffman, J. (2019). Integrating satellite and ground measurements for predicting locations of extreme urban heat. *Climate* 7, 5.
- ⁹ NYS Department of Environmental Conservation (2019). Albany South End community air quality study. New York State Department of Environmental Conservation, Division of Air Quality.
- ¹⁰ *ibid.*
- ¹¹ During the last ice age, the areas under the thickest of glacial ice in Canada sank under the weight of the ice, causing surrounding areas to rise slightly due to a lever effect; since the ice melted, Canada's land surface is still slightly rebounding upward and surrounding areas like New York are still slightly falling.
- ¹² NYS Department of Environmental Conservation. (2021). Observed and projected climate change in New York State: An overview.
- ¹³ Scenic Hudson has a good interactive sea level rise mapper which shows the effects of different amounts of sea level rise on the Hudson. You can find it at <https://scenichudson.maps.arcgis.com/apps/MapJournal/index.html?appid=3a3d0dc3884c4637ad0a51f4aa912189>
- ¹⁴ This inventory does not include all emissions from the Port of Albany or the railroads.

- ¹⁵ A community greenhouse gas emissions inventory was previously undertaken for 2009. That study, while it shows roughly the same amount of total emissions, differs from this one in several ways. The total emissions reported for electricity use, for example, was 441,764 metric tons of CO₂ equivalent (MT CO₂e) in 2009, while only 137,275 MT CO₂e in 2019. Clearly the amount of electricity use has not declined significantly in ten years. Conversely, emissions from transportation (emissions from cars, trucks, buses, etc.) were reported as 276,097 MT CO₂e in 2009, but 429,642 MT CO₂e in 2019.

A third source — the Capital District 2010 Regional Greenhouse Gas Inventory — puts Albany’s transportation emissions at 484,002 MT CO₂e per year. The Regional inventory also closely agrees (177,473 MT CO₂e) with this inventory’s total residential energy use (combining electric and natural gas) of 173,498 MT CO₂e.

The differences that exist between inventories can be explained in a variety of ways. The data sources used can change over time, as can the process of calculating emissions as the protocols used evolve over time. Different data sources would provide different final results. In the case of electricity, the gradually increasing percentage of clean energy in the upstate New York grid would reduce emissions over time while not affecting the total electricity used in the city. It is also possible that mistakes were made in the 2009, 2010 Regional, and/or 2019 inventories.

All three inventories agree on the basics: that the people of Albany collectively generate just over a million metric tons of CO₂ equivalent every year. This inventory puts that figure at 1,166,127 MT CO₂e in 2019.

- ¹⁶ <https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator>
- ¹⁷ New York State Energy Research and Development Authority (NYSERDA) (2019). New York State greenhouse gas inventory: 1990-2016 Final Report. Albany, NY.
- ¹⁸ <https://data.worldbank.org/indicator/EN.ATM.CO2E.PC?locations=US>
- ¹⁹ <https://www.ipcc.ch/>
- ²⁰ IPCC. (2018). Global warming of 1.5°C. Special Report No. 15. Summary for Policymakers. First Joint Session of Working Groups I, II, and III of the IPCC. 48th Session of the IPCC.
- ²¹ <https://www.nysenate.gov/legislation/bills/2019/s6599>
- ²² <https://www.nrdc.org/experts/miles-farmer/unpacking-new-yorks-big-new-climate-bill-primer-0>