

Danville, Virginia 2022 Greenhouse Gas Inventory

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Introduction

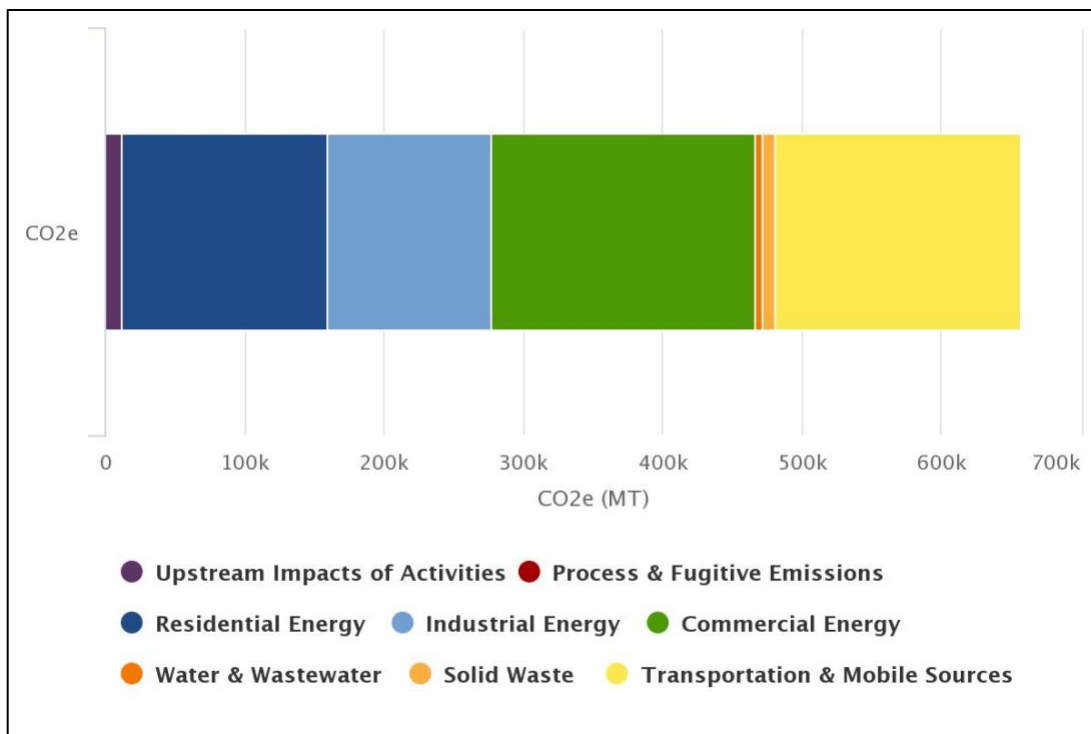
Danville, Virginia is located along the Virginia- North Carolina border. It has a population of approximately 42,215 and is home to Averett University. The leading economic sector is manufacturing.

Community Greenhouse Gas Inventory

A community Greenhouse Gas (GHG) Inventory quantifies greenhouse gas emissions produced within a specified community during a specified period. Sources of emissions are recorded and analyzed per each sector. Data collection from private and public organizations quantifies energy consumption and emissions. The sources of emissions quantified for the City of Danville's 2022 Greenhouse Gas Inventory include transportation, electricity consumption, natural gas consumption, non-utility fuel types (such as propane, kerosene, wood, coal, residual fuel oil, distillate fuel oil), solid waste, water and wastewater, Agricultural, Forestry, and Other Land Use, fugitive emissions, and grid loss.

Total Emissions

Across all sectors, Danville produced just over 650k metric tons of CO₂ equivalent (CO₂e) in 2022. Rather than comparing various greenhouse gases and their varying Global Warming Potentials (GWP), a CO₂e creates a standard measure to compare all GHGs across all sectors.



Electrical Data

a. Emission & Generation Integrated Database (eGRID)

To calculate emissions, Danville zip codes were entered into power profiler.com. There are two eGRID regions from which Danville receives electricity. RFCW provides most of the electricity and SRVC supplemented electricity. All emissions are assumed to result from the RFCW region, due to this region

providing most of the electricity. While eGRID regions do not always correlate with the locally purchased sources of electricity generation, they do give the most representative cross-section of *dispatched* generation associated with demand loads in their area. Thus, the carbon intensity of electricity generation is geographically associated with demand. All electrical consumption use was duplicated in both eGRID regions, with SRVC indicated as “Information Only”, to avoid double counting. The emissions produced by each region were recorded into a factor set for each 2021 SRVC and 2021 RFCW eGRID regions. 2021 eGRID data is the most current data available for the 2022 GHG inventory.

b. Residential, Commercial, and Industrial

Residential, Commercial, and Industrial electrical consumption data was provided by Danville Utilities for the Calendar year of 2022. Metered usage is the most accurate form of data to measure consumption. The electrical consumption was provided in kWh for each sector.

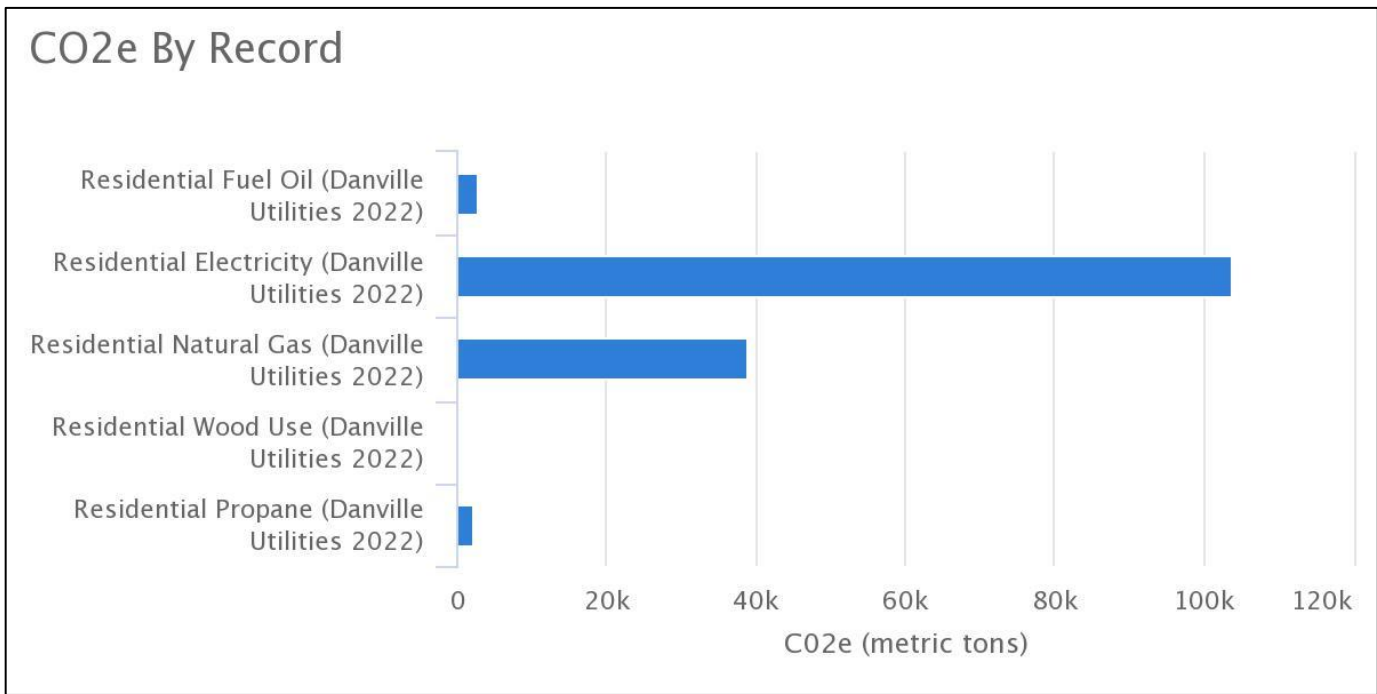


Figure 1: Residential Energy - 147,644 metric tons CO2e

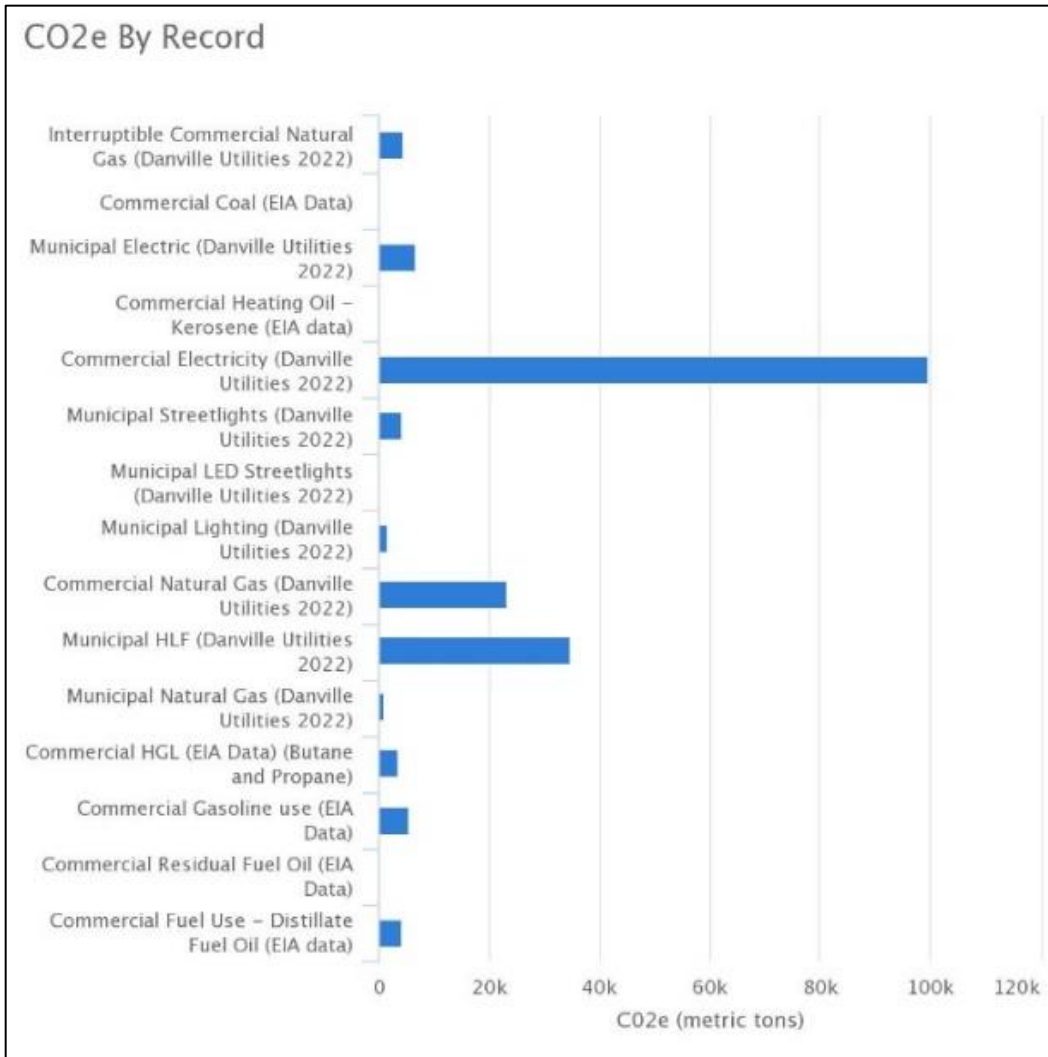


Figure 2: Commercial Energy 188,515 metric tons CO2e

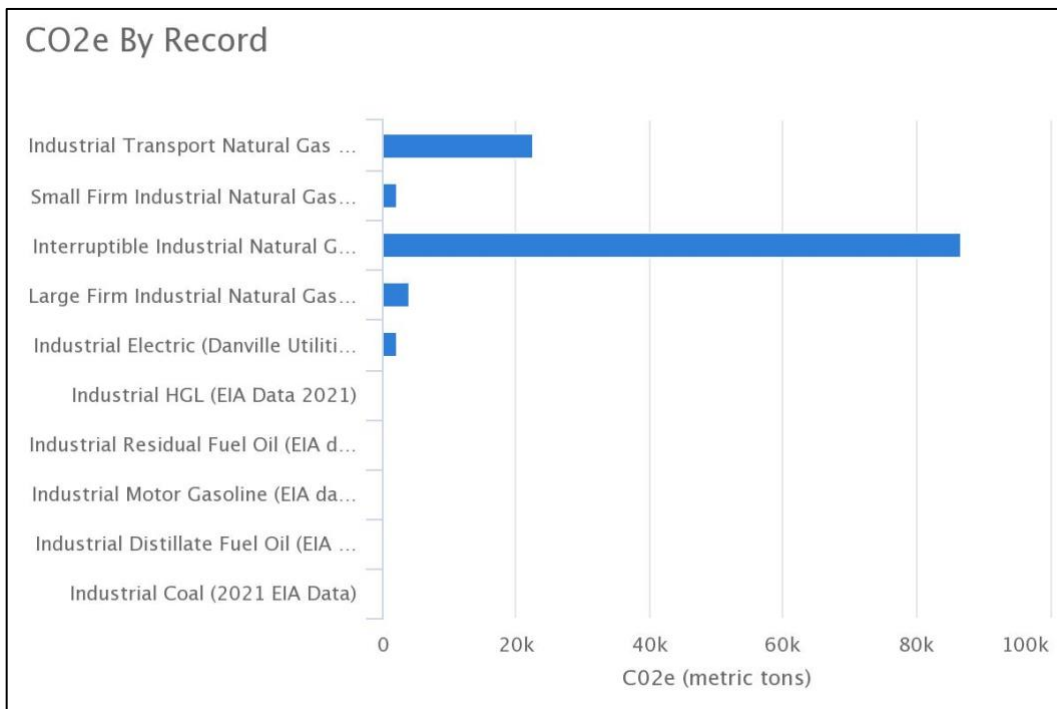


Figure 3: Industrial Energy- 117,524 metric tons CO2e

c. Municipal

The municipal sector had several categories, including LED Streetlight, Streetlights, HLF, and Lights. For each category under municipal, kWh consumption was input, and number of fixtures recorded (if available). Since there is no specific sector in ClearPath for Municipal Energy, all Municipal energy is placed under commercial. Note that the electricity used to treat potable water and water treatment was subtracted from municipal power consumption in order to prevent “double counting” the electricity consumed by the city. Those emissions are included under water and wastewater treatment, respectively.

Natural Gas

a. Residential and Commercial

Data for natural gas was provided by Danville Utilities in therms for each sector, residential, commercial, municipal, and industrial. For residential and commercial, data was simply input according to Danville Utilities’ measured consumption for the two sectors. Like electricity, the number of households which utilize natural gas was recorded in residential. The number of commercial businesses which utilize gas monthly was recorded as well. All information was input in the Emissions from Stationary Fuel Combustion.

b. Industrial

Industrial natural gas was categorized as Industrial Transport, Large Firm Industry, Small Firm Industry, and Interruptible Industry. The data was recorded for each category in therms, as reported by Danville Utilities. All information was input in the Emissions from Stationary Fuel Combustion.

c. Municipal

Municipal natural gas was reported by Danville Utilities, but the value was not just input into ClearPath. The quantity of natural gas used in water treatment for wastewater and potable waste treatment was deducted from the Municipal natural gas. This prevents “double counting” and overestimating natural gas use. All information was input in the Emissions from Stationary Fuel Combustion.

Non-Utility Fuel Use (Coal, Propane, Butane, Wood, Residual Fuel Oil, Distillate Fuel Oil)

a. Residential

Data from Danville Utilities natural gas consumption for residential households compared to 2020 US Census Bureau Household heating types to obtain data for non-utility fuels. Since this is federal level data, rather than measured or metered usage, there is potential for variation in CO₂e due to reporting and/or estimation errors. While more exact energy usage is not available as it is for utility-provided energy, the Census information *does* provide exact estimates for Danville.

b. Industrial and Commercial

2021 Energy Information Administration (EIA) data was obtained for Industrial Energy Consumption for the State of Virginia. 2020 State workforce data was compared to city workforce data. A ratio was created by comparing jobs distinguished as Industrial jobs for Virginia, to the City of Danville’s Industrial workforce. For each of the fuel types provided by the EIA, the ratio was applied, and assumed as Danville’s consumption. 2021 EIA is the most current data available for Industrial and Commercial Energy Consumption. Since this data is state level data, statistics could vary from true values. Since there is no accurate reporting for true consumption values for non-utility fuel types, these values are estimated based on Danville’s workforce size and characteristics.

c. FLIGHT- GoodYear Tire and Rubber

For facilities which emit more than 25,000 tons of CO₂, the EPA requires reporting to the Facility Level Information on Greenhouse gases Tool. GoodYear Tire and Rubber is the only facility within Danville boundaries which requires this reporting. Fuel oil #6 and natural gas was recorded for GoodYear Tire & Rubber but marked as information only as to no double count the data statistics created from 2021 EIA data. GoodYear Tire & Rubber reports this data to the EPA, which records the information in FLIGHT. The total 2022 CO₂e produced from GoodYear Tire & Rubber is 63,538 tons of CO₂e.

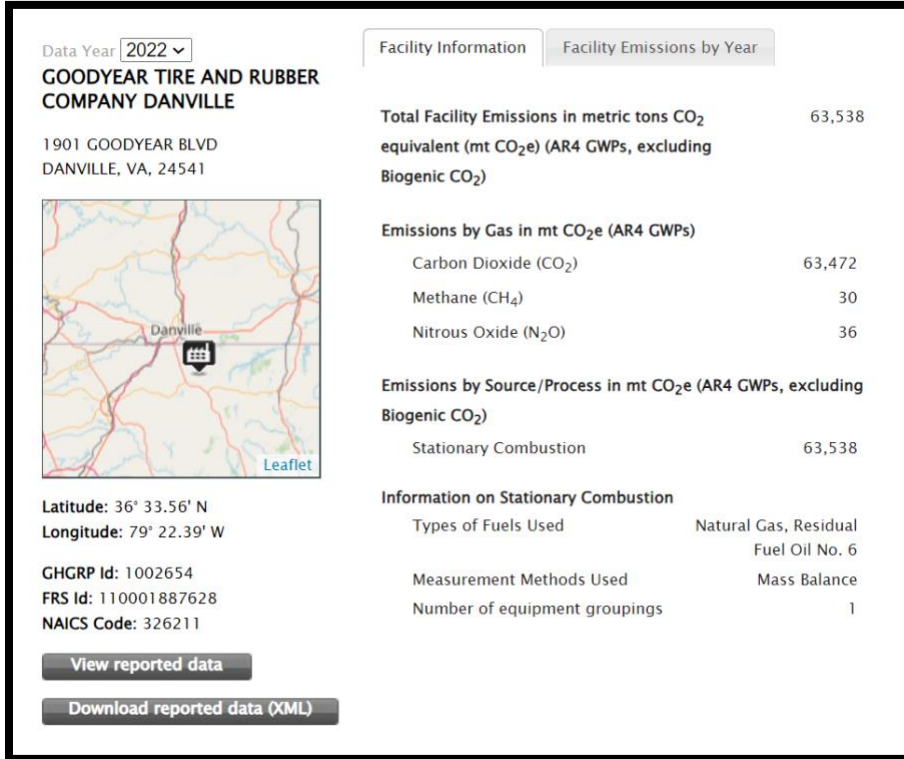


Figure 4. EPA FLIGHT data of GoodYear Tire & Rubber – 63,538 tons CO₂e

Transportation

- a. Virginia Department of Transportation (VDOT) provided Vehicle Miles Traveled (VMT) for 2021. This file included vehicle types and daily VMT within the City of Danville’s boundaries. Annual VMT data for each was input into the ClearPath calculator for On Road Transportation for each category listed below:
 - i. Passenger vehicles were assumed to be all motorcycles, passenger cars, two axle, four tire single unit vehicles, and two axle, six tire single unit trucks. It is assumed, all passenger vehicles are gasoline. Daily VMT for all passenger vehicles was aggregated, then multiplied by 365 to create an annual VMT figure.
 - ii. Freight vehicles are assumed to be three axle single unit trucks, four or more axle single unit trucks, four axle or fewer single trailers, five axle single trailers, and six or more axle single trailers. All freight is assumed to be diesel. All forms of freight vehicles were aggregated, then multiplied by 365 to create an annual VMT figure for Freight.
 - iii. Passenger buses were classified separately in the VDOT report. Daily VMT was multiplied by 365 to create an annual VMT figure for Passenger Buses.

All On Road Transportation calculators included Annual VMT for the year of 2021, travel type (passenger, freight, or passenger bus), and location (within Danville’s boundaries). A 2021 factor set was created based on U.S. Department of Transportation (DOT) fuel efficiencies for vehicle type groupings, including passenger vehicles, light duty vehicles, and heavy duty vehicles. The emissions were calculated based on the Annual VMT for each vehicle type within each category. Due to the

absence of exact measured annual VMT for each vehicle make/model, there are likely some slight errors in estimation.

- b. Emissions taken directly from EPA Nation Emission Inventory (NEI) tool for off road transportation for the year of 2020. This is the most current available data for the City of Danville's 2022 Community GHG Inventory. Exact and precise emissions are provided for Locomotives, Off-Road Gasoline vehicles, Off-Road Diesel vehicles, and other non-point emission sources. Data is provided by the EPA on a local level. Values for these emissions are not likely to vary from these reported values.
- c. Airplane data provided by Averett University. The data provided includes fuel types and quantity of fuel used.

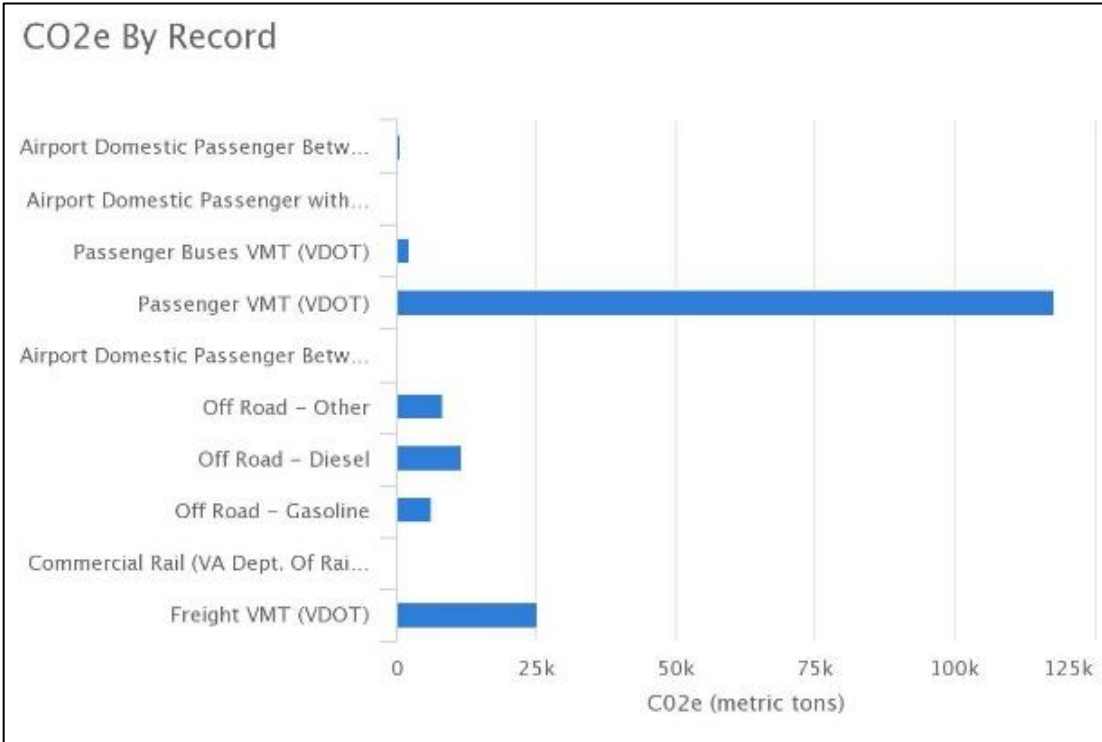


Figure 5: Transportation- 172,427 metric tons CO2e

Solid Waste

Pittsylvania County provided information on the characteristics of the landfill. First Piedmont Corporation provided the weight (tons) of Solid waste transported for Danville. The landfill was uncovered (wet), out of boundary, and did not collect methane. These characteristics were entered into ClearPath's Landfilled Waste Calculator which uses a first-order-of-decay (FOD), passive model of emissions determination. Public Works data was input as information only. The weight (in tons) was input into ClearPath and the composition of the waste was entered into a factor set. Both quantity and composition will determine emission. This only includes waste picked up by the city. There is missing data on industrial and commercial waste which is not picked up by the Danville Public Works.

Public Works provided information on weight (tons) of yard waste. The tons of yard waste were entered into the Biologic Treatment of Solid Waste (composting) calculator in Clear Path.

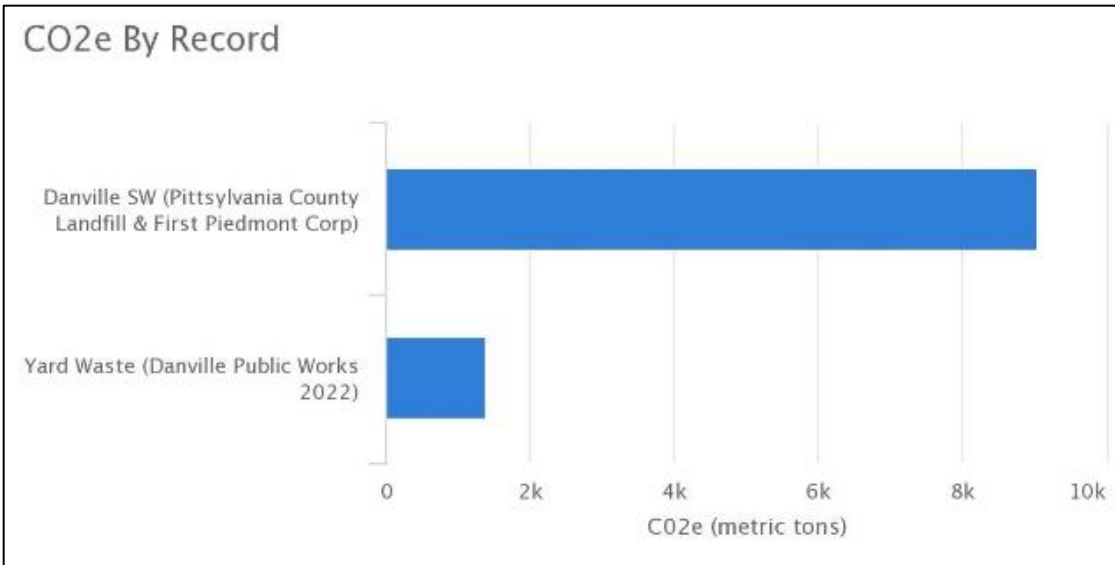


Figure 6: Solid Waste- 10,417 metric tons CO_{2e}

Wastewater and Potable Water

Potable Water and Wastewater characteristics, including electricity and natural gas required for the process was provided by Danville Utilities. kWh and therms reported from Danville Utilities was recorded in the Emissions from the Supply Potable Water, as well as gallons of water produced. Both values for natural gas and electricity were subtracted from the municipal records.

N₂O Effluent Discharge was calculated by entering data into Process N₂O from Effluent Discharge. Characteristics of wastewater facility provided by Danville Utilities. Water treatment was recorded as aerobic and no denitrification processes in place. Wastewater was treated within Boundaries.

Wastewater emissions from treatment were recorded by entering N₂O Emissions from Wastewater Treatment data. A ClearPath default value of 1.25 was used for Industrial Commercial Discharge Multiplier as the City of Danville treats wastewater for both commercial and industrial sectors.

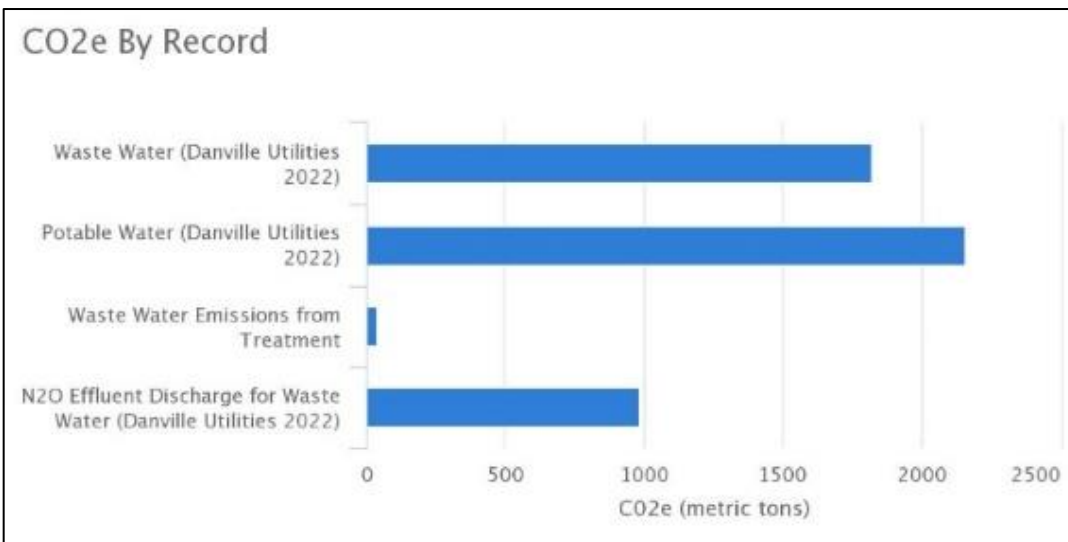


Figure 7: Wastewater and Potable Water- 4,997 metric tons CO_{2e}

Agriculture, Forestry, and Other Land Uses (AFOLU)

LEARN Tool obtained data for the City of Danville from 2013 to 2019. The change in forestry, grasslands, settlement over time was recorded. The change over time in forestry was then compared to the closest city available, Baltimore, MD. The PDF provided from the LEARN Tool provided changes in hectares for each type of forestry change, and CO2 emitted or sequestered. All AFLOU data is entered as “Information Only” for documentation purposes only.

Process & Fugitive Emissions

All of Danville’s natural gas was aggregated into one value, and across all sectors. This value was input into the Fugitive Emissions for Natural Gas calculator. Defaults for Leakage rate, Natural Gas density, % methane, and % carbon dioxide were all provided by ClearPath.

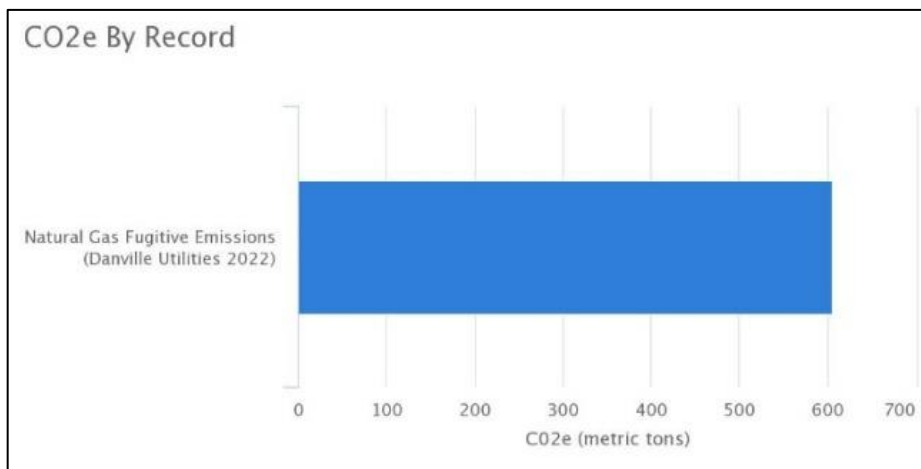


Figure 8: Process and Fugitive Emissions- 605 metric tons CO2e

Upstream Impacts of Activities

Each sector which provided electrical data was input into Upstream Impacts Used by the Community calculator. This included electricity consumption reported for residential, commercial, municipal, and industrial sectors. All separate electricity categories for municipal electric were also recorded. ClearPath default factor for Grid Loss was applied, and sector selected. Grid Loss is the electricity lost from transmission of electricity. Grid Loss is dependent upon quantity of electricity transmitted. The Grid Loss value used in ClearPath is 4.5%. This value was applied to the measured electrical usage provided by Danville Utilities.

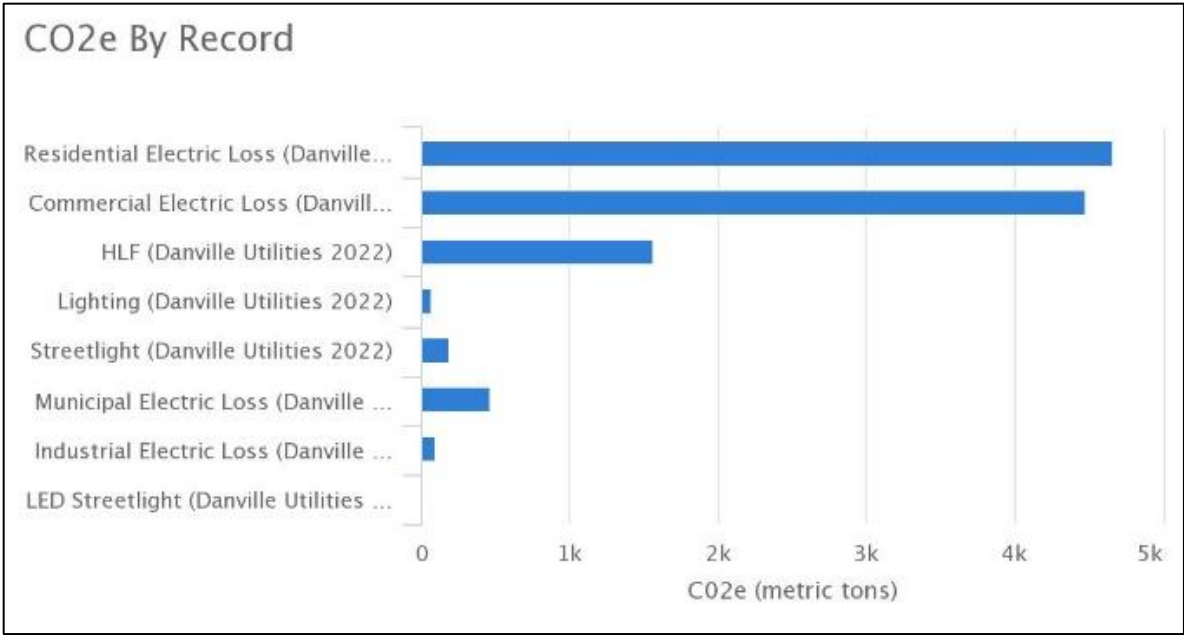


Figure 9: Upstream impacts of activities- 11,541 metric tons CO2e

Data Sources

Averett University Aeronautics Program

Energy Information Administration- Commercial Sector Energy Consumption

Energy Information Administration- Industrial Sector Energy Consumption

Environmental Protection Agency- Facility Level Information on Green House gases Tool (EPA FLIGHT)

Environmental Protection Agency- National Emissions Inventory (EPA NEI)

First Piedmont Corporation

Danville Utility Companies

Danville Public Works

EPA eGRID 2021

Pittsylvania County Landfill

Virginia Department of Transportation (VDOT) VMT 2021

PowerProfiler.com

U.S Census Bureau