Unitil

energy for life

INAUGURAL GREENHOUSE GAS EMISSIONS INVENTORY COMPANY OPERATIONS, CALENDAR YEAR 2019

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Executive Summary

Unitil is a small, investor-owned utility company which operates in New Hampshire, Maine, and Massachussetts. Unitil delivers, but does not generate, energy to nearly 200,000 customers. In 2019, Unitil released its inagural Sustainability Report, detailing its commitment to corporate sustainability. By quantifying Unitil's emissions from its operations, this greenhouse gas emissions inventory is an extension of the company's commitment.

This report is a greenhouse gas emissions inventory for the calendar year 2019 of Unitil's company operations. The report includes the 2019 emissions from seven of the company's operations: stationary fuel use, company fleet fuel use, gas pipeline fugitive emissions, purchased electricity, employee commuting, municipal standard waste treatment, and wastewater treatment. Several categories were not included in the 2019 inventory due to lack of data or time constraints which should be incorporated into future inventories. These categories include: contractor vehicle emissions, fugitive refrigerant emissions, and emergency generator emissions.

Data for each category was collected from various parties internal and external to Unitil on a building-to-building basis by availability. Emissions calculations and data management were completed with the University of New Hampshire's Sustainability Indicator Management Analysis Platform (SIMAP).

In the 2019 calendar year, total emissions from Unitil's operations amounted to **6146.33 metric tons of carbon dioxide equivalent**. Emissions by scope and category are shown in the following figures on page 4:

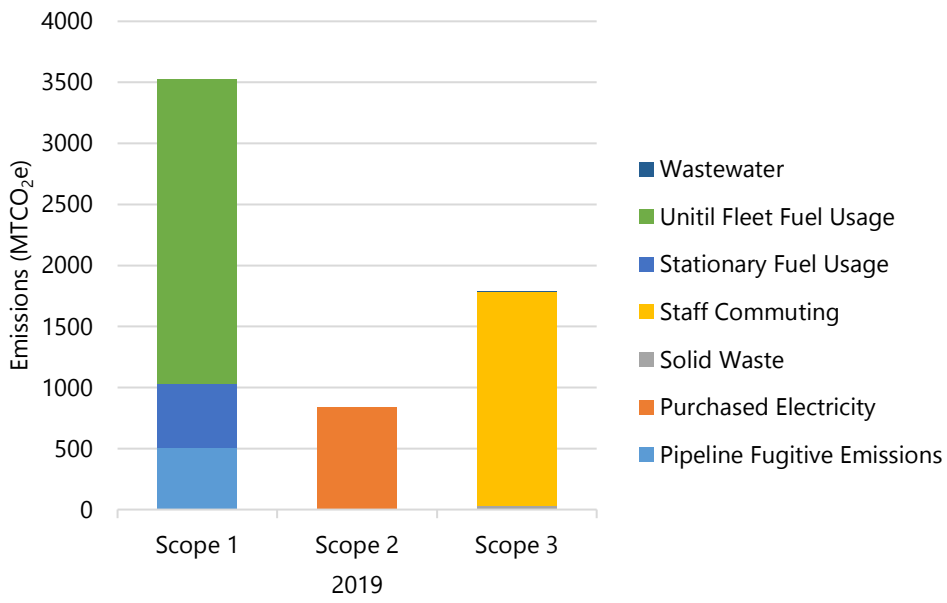


FIGURE 1: TOTAL 2019 EMISSIONS FROM UNITIL OPERATIONS BY SCOPE

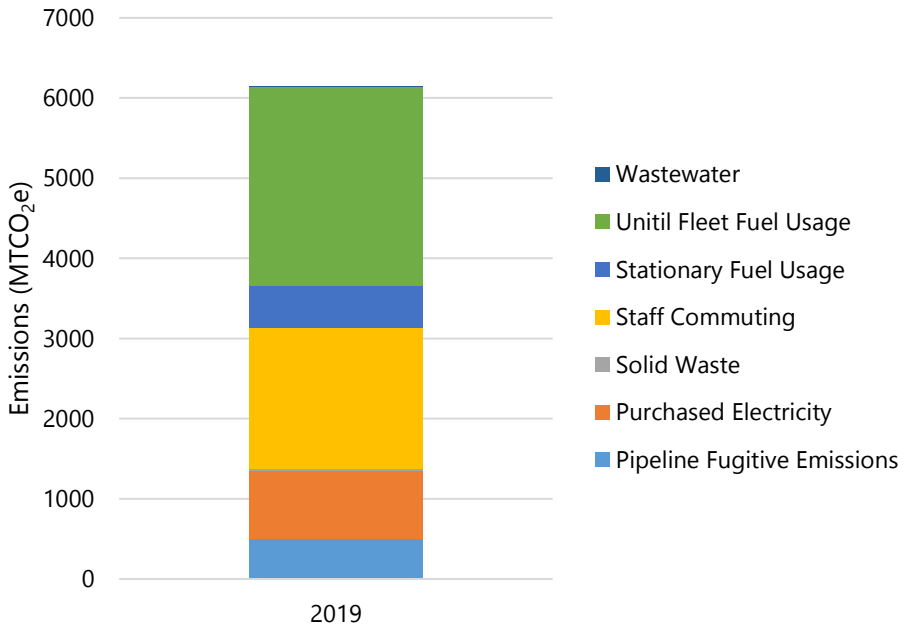


FIGURE 2: TOTAL 2019 EMISSIONS IN $MTCO_2E$ FROM UNITIL OPERATIONS BY CATEGORY

Introduction

Unitil is a New England based utility company that delivers electricity and natural gas to nearly 200,000 customers in New Hampshire, Maine, and Massachusetts. Unlike many utilities, Unitil does not own its power generation, and instead operates only as a distributor to its customers. As the United States' smallest investor-owned utility, Unitil is closely tied to the communities and investors with which it interacts and does business. Reflecting this close relationship is Unitil's public commitment to sustainable business practices, which it affirmed with its inaugural Sustainability Report, released in 2019.

Per the report**: "Our Mission is to safely and reliably deliver energy for life and provide our customers with affordable and sustainable energy solutions."**

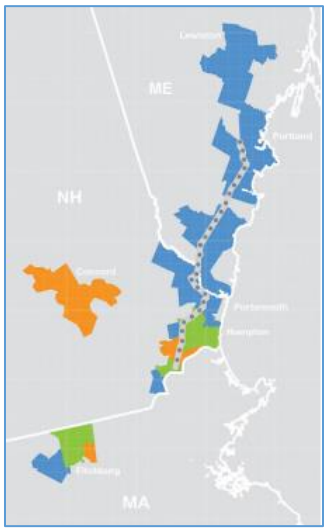


FIGURE 3: UNITIL SERVICE MAP

This commitment to internal and community sustainability starts from the ground up. This report, Unitil's inaugural Greenhouse Gas Emissions Inventory, is an extension of the goals put forward by the 2019 Sustainability Report. Accounting for the emissions associated with Unitil's operations is an essential step towards quantifying and understanding the company's environmental impact.

Understanding Corporate Greenhouse Gas Emissions Inventories

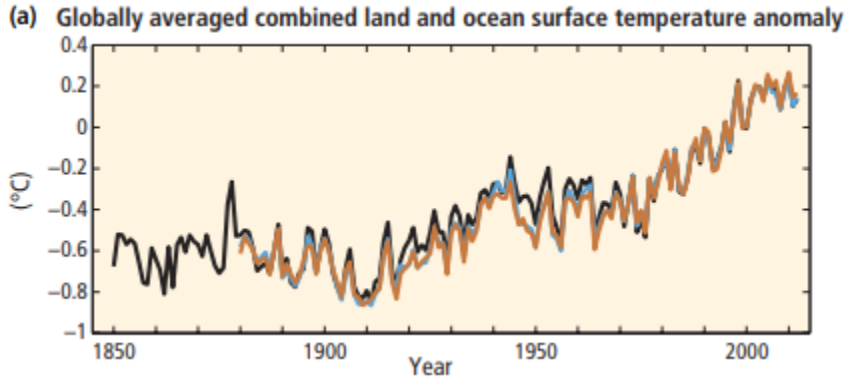
A corporate greenhouse gas (GHG) emissions inventory is an accounting of company operations which directly produce or are responsible for greenhouse gas emissions. A typical inventory focuses on company operations within one calendar or fiscal year, and is replicated annually. As businesses have different needs and practices, the range of operations which produce emissions is substantial and can vary significantly between companies. However, general operations such as stationary fuel use (natural gas, propane, fuel oil), electricity purchased from utilities, and waste generation, among others, are examples of common business practices and thus appear in many inventories.

Though they are driven by data, an important caveat to GHG emissions inventories is that they are always estimations; company operations which create emissions are complex, constantly changing, and are often not recorded or possible to measure accurately. Despite this, standardized methodologies and consistent practices for calculating emissions allow inventories to be meaningful representations of a company's emissions footprint.

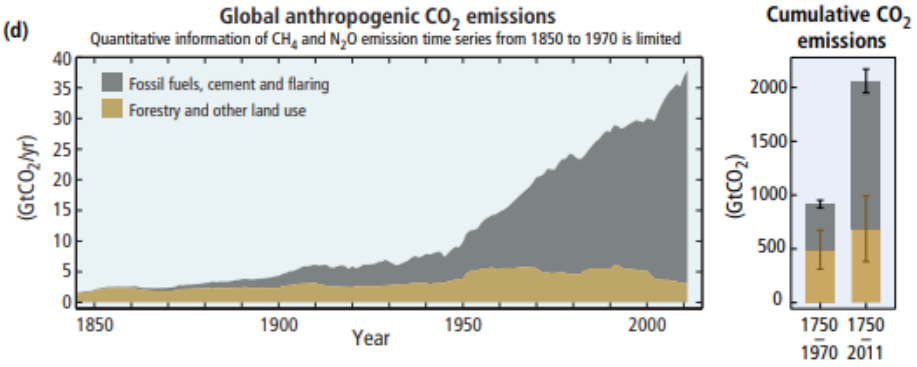
Environmental Significance of Greenhouse Gas Emissions Inventories

While greenhouse gas emissions inventories provide many internal benefits to companies that conduct them, there is broader significance to quantifying a company's emissions footprint for environmental concerns. The concerning effects of anthropogenic (originating from humans)

greenhouse gas emissions on local and global environments have been well-documented in recent years. The principal effect of anthropogenic GHG emissions is their contribution to climate change and increased global temperatures. From the Intergovernmental Panel on Climate Change's (IPCC) 2014 Climate Change Synthesis report: "**Anthropogenic greenhouse gas emissions have increased since the pre-industrial era, driven largely by economic and population growth, and are now higher than ever. This has led to atmospheric concentrations of carbon dioxide, methane and nitrous oxide that are unprecedented in at least the last 800,000 years. Their effects, together with those of other anthropogenic drivers, have been detected throughout the climate system and are extremely likely to have been the dominant cause of the observed warming since the mid-20th century."**



Climate change driven by our greenhouse gas emissions has caused a suite of negative effects to natural systems which stem from rising global temperatures. The global consequences of climate change include a greater prevalence of extreme weather events (hurricanes, tropical storms), increased drought and altered precipitation patterns, sea level rise, and complete loss of arctic sea ice (NASA). Consequences specific to Unitil's operating area in the Northeast include heat waves, heavier rainfall, and sea level rise which will severely damage New England's coastal communities and economies. A greater prevalence of storms will also threaten Unitil's core operations, increasing demand for emergency response and damaging company infrastructure at higher rates. Most significantly, these consequences will persist for decades, even centuries.



Per the IPCC: **"Human influence on the climate system is clear, and recent anthropogenic emissions of greenhouse gases are the highest in history. Recent climate changes have had widespread impacts on human and natural systems."**

Reversing the trend of increasing greenhouse gas emissions is critical for lowering human influence on climate change. The 2019 emissions inventory is a significant step; by understanding what company operations produce the greatest emissions, Unitil can take action to reduce its share of the emissions which are altering our environment in real time. As a small company with a people-centric mission, this is a natural priority. Unitil has a vested interest in taking action against the consequences of climate change that will drastically affect the people and communities to which it supplies energy.

Structure

GHG emissions inventories are divided into three "scopes," or distinct categories which account for emissions from different points on a company's chain of operations. The three scopes and their associated emissions are listed in the table below:

Scope	Definition	Example
1	Emissions from sources that are directly owned or controlled by the company.	Fuel use by company-owned vehicles
2	Emissions from the company's consumption of purchased electricity.	Electricity purchased for heating company buildings
3	Emissions that occur upstream or downstream of direct company operations but are caused by the company's operations.	Emissions from landfill waste treatment caused by waste generated at the company

TABLE 1: GHG EMISSIONS INVENTORY SCOPES, DEFINITIONS, AND EXAMPLES

The table below shows the categories included in the 2019 inventory, broken into the above scopes and their definitional boundaries:

Emission Source	Scope 1 Emission	Scope 2 Emission	Scope 3 Emission
Stationary Fuel Consumption	X		
Unitil Fleet Fuel Consumption	X		
Pipeline Fugitive Emissions	X		
Purchased Electricity		X	
Employee Commuting			X

Wastewater Treatment			X
Municipal Standard Waste (MSW) Treatment			X

TABLE 2: 2019 INVENTORY INCLUDED EMISSIONS CATEGORIES BY SCOPE

Methodology

This 2019 GHG emissions inventory for Unitil's company operations was developed using the University of New Hampshire's Sustainability Indicator Management Analysis Platform (SIMAP). SIMAP is a carbon accounting software used for creating and managing multiple GHG emissions inventories. SIMAP's methodology for calculating emissions aligns with the primary guidance for corporate emissions inventories from the Greenhouse Gas Protocol (GHG Protocol), a partnership between World Resources Institute (WRI) and the World Business Council for Sustainable Development (WBCSD).

Emissions Calculations

The emissions from a given business operation vary by the activity performed and how much activity was measured. However, all emissions calculations are based on the following formula:

Activity Data x Emissions Factor= Total Emissions

Activity data is the measured activity from the given operation, such as the total gallons of gasoline used by a vehicle in the inventory year. The emissions factor is an activity-specific representative value which relates the measured activity to its associated quantity of a pollutant. For example: the emissions factor for gasoline is 8.78 kg CO_2/ gallon. Multiplying the selected activity data by its associated emissions factor produces total emissions, which are communicated in metric tons of carbon dioxide equivalent ($MTCO_2e$).

SIMAP uses the most recent emissions factors from United States EPA and other sources which align with the GHG Protocol's methodology; for the 2019 inventory, SIMAP's "2019" version of emissions factors was used for calculations. A full list of emissions factors used by SIMAP for this inventory can be found in the appendix.

For the conversion of other emitted gases (CH_4 and N_2O) to CO_2e, SIMAP uses Global Warming Potential (GWP) values from the Intergovernmental Panel on Climate Change's Assessment Reports. Global Warming Potential values relate a quantity of one gas, such as methane, to its equivalent in carbon dioxide. GWP's from the most recent 5th Assessment Report (AR5) were selected in SIMAP for use in this inventory.

For emissions calculations for purchased electricity, SIMAP offers three choices: market-based, location-based, and custom fuel mixes. As all of Unitil's locations are located in the same market for purchased electricity, a market-based calculation was used for the 2019 inventory. Markets are defined by the EPA's eGRID database, which contains comprehensive environmental data on purchased electricity in regions throughout the United States. The NEWE (NPCC New England) eGRID subregion, which contained all tracked Unitil locations, was used for the 2019 inventory. Emissions for the NEWE eGRID subregion are 527.6 lbs of CO_2e per MWH, compared to the national average of 952.9 lbs of CO_2e per MWH.

Data Collection

Data for the 2019 inventory was collected from a variety of sources internal and external to Unitil. Data from internal sources was located in collaboration with Unitil Fleet and Facilities and was collected on a building-to-building basis by availability. Breakdowns of data collection for each emissions category are below:

Stationary Fuel Consumption

- Data on Unitil-supplied natural gas was collected from an internal COGNOS report system, meter numbers by location were provided by Sustainability. Non-Unitil supplied natural gas data was collected from 2019 utility invoices in Unitil's RMS Client.

Unitil Fleet Fuel Consumption

- Data for Unitil's fleet fuel consumption was provided by the contractor Merchants Fleet, a fleet management company. Merchants Fleet provided locations of vehicles and usage in gallons. Data for fuel type (gas or diesel) was provided by Fleet and Facilities. Vehicles were verified between sources by VIN.

Gas Delivery Fugitive Emissions:

- Data on fugitive methane emissions associated with Unitil's gas pipelines is already compiled for environmental compliance and was provided by the Environmental Health and Safety Manager.

Unitil Purchased Electricity:

- Data for Unitil-supplied electricity was collected from an internal COGNOS report system, meter numbers by location were provided by Sustainability. Non-Unitil supplied electricity usage data was collected from 2019 utility invoices in Unitil's RMS Client.

Employee Commuting:

- Data was collected through a 2019 commuting survey distributed to all members of the company email list. 172 responses were recorded over a two-week period, a 33% response rate, and were extrapolated to reflect a population of 519 employees.

Municipal Standard Waste:

- Data on municipal standard waste production was not available for the 2019 inventory. In light of this, waste scenarios were used to estimate several expected volumes of MSW. Several data points were needed for each location to complete waste scenarios. Information on dumpster yardage and pickup schedules was obtained from each building's Facilities Coordinator. Information on landfilled waste treatment was collected from company waste hauler account managers and the EPA's Landfill Methane Outreach Program (LMOP) Database.

Wastewater:

- Data for 2019 wastewater was collected from water invoices accessed in Unitil's RMS client. Information on wastewater treatment was collected from each municipality's website.

Due to a lack of readily accessible data and/or time constraints, several potential emissions categories were not included in the 2019 inventory. These categories are listed below, and should be assessed for future inventories.

- *Contractor Vehicle Emissions*: Unitil relies on contracted work throughout the year for a variety of maintenance and upkeep operations related to power delivery. Vehicle emissions from Unitil's contracted work (a Scope 3 emission) were not included in the 2019 inventory due to time restraints. Future inventories should incorporate these emissions by contacting major contractors for information on fuel usage under Unitil contract.
- *Emergency Generators:* Unitil's buildings are equipped with emergency generators, which use fuel in their operation. Generator fuel usage (a Scope 1 emission) was not tracked in the 2019 inventory due to time restraints. Future inventories should incorporate these emissions by contacting Unitil Fleet and Facilities for usage information.

Terminology

Since data for the 2019 inventory was largely collected on a building-to-building basis, representations of data in this inventory are separated by Unitil locations; Unitil locations are referred to by the city/town of the Unitil location they are associated with. As there are two locations in Concord, New Hampshire, they are distinguished by the abbreviations CAP and CSC, which refer to the Capital Division and the Customer Service Call Center, respectively.

The table below shows the names and respective addresses of all Unitil buildings referenced in this inventory:

Name Used in Inventory	Unitil Building Address
Concord (CAP)	1 McGuire Street, Concord, NH 03301
Concord (CSC)	5 McGuire Street, Concord, NH 03301
Fitchburg	285 John Fitch Highway, Fitchburg MA 01420
Hampton	6 Liberty Lane West Hampton, NH 03842
Kensington	114 Drinkwater Road Kensington, NH 03833
Lunenburg	357 Electric Ave, Lunenburg MA 01462
Lewiston	93 River Road, Lewiston, ME 04240
Portland	376 Riverside Industrial Parkway, Portland, ME 04101
Portsmouth	325 West Road, Portsmouth, NH 03801

TABLE 3: NAMES AND ASSOCIATED ADDRESSES OF UNITIL LOCATIONS IN 2019 INVENTORY

A list of commonly used abbreviations in the 2019 inventory can be found below:

- **GHG**: Greenhouse Gas
- **$MTCO_2e$**: Metric Tons of Carbon Dioxide Equivalent
- **kWh**: Kilowatt hour
- **MSW**: Municipal Standard Waste
- **CAP**: Refers to the Capital Division at Unitil's Concord location
- **CSC:** Refers to the Customer Service Call Center at Unitil's Concord location
- **GWP:** Global Warming Potential

Scope 1 Emissions

Scope 1 emissions are emissions which originate from assets directly owned or operated by the company. The 2019 inventory includes three categories of Scope 1 emissions: stationary fuel use, Unitil fleet fuel use, and fugitive emissions from Unitil's gas pipelines.

- Total Scope 1 Emissions in 2019 amounted to **3,522.98** metric tons of carbon dioxide equivalent.

Stationary Fuel Consumption

Stationary fuel consumption is classified as a Scope 1 emission, as it involves the use of fuels such as natural gas, fuel oil, and propane for heating or operation of stationary machinery in company-owned buildings. Unitil uses natural gas for heating its various facilities throughout New England, which is supplied from Unitil's own distribution. The exception to this is the Lunenburg location, where natural gas is delivered by an outside utility.

For company locations at which Unitil delivers its own natural gas, 2019 stationary fuel data was collected from an internal report system which retrieved monthly statements of natural gas use by individual meter numbers. Active meter numbers for each building were collected and used to access the appropriate usage data. For the company building in Lunenburg which purchased natural gas from an outside utility, 2019 data was collected from monthly invoices from the supplying utility, National Grid. Data from Unitil and National Grid was provided in therms, which was then used for emissions calculations. No natural gas use occurred in 2019 at company locations in Concord (Call Center and Capital) and Kensington, which are heated and cooled with electricity. Accordingly, the Concord and Kensington locations are not represented in the data below.

Findings:

- Natural gas was the only stationary fuel reported, and was used at five of the eight tracked Unitil locations in 2019. In 2019, total usage across locations amounted to 98,212 therms of natural gas (Table 4).
- Total 2019 emissions from stationary fuel use amounted to **522.45 metric tons of CO_2e** (Table 5), **8.5%** of total 2019 emissions.

The following figures and accompanying tables show 2019 data from stationary fuel use by location, as well as total associated emissions in metric tons of CO_2e broken out by location. Unitil locations are referred to by the city or town in which they operate.

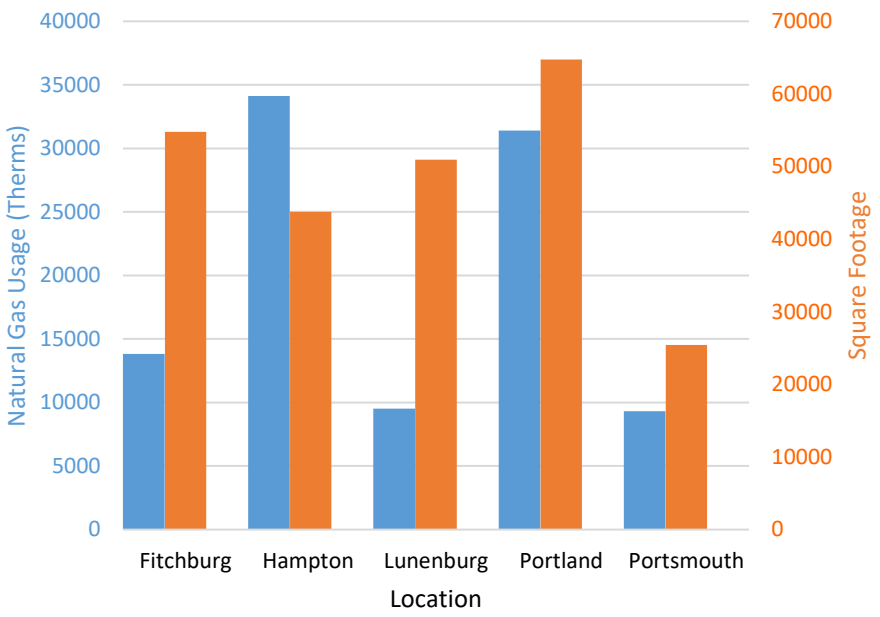


FIGURE 4: TOTAL NATURAL GAS USAGE IN THERMS AND SQUARE FOOTAGE BY UNITIL LOCATION, 2019

TABLE 4: BREAKDOWN OF STATIONARY FUEL USAGE BY TYPE AND UNITIL LOCATION WITH GRAND TOTAL, 2019

Unitil Location	Natural Gas Usage (Therms)	Building Square Footage
Fitchburg	13836	54772
Hampton	34132	43751
Lunenburg	9518	50953
Portland	31406	64759
Portsmouth	9320	25432
Total:	**98212**	

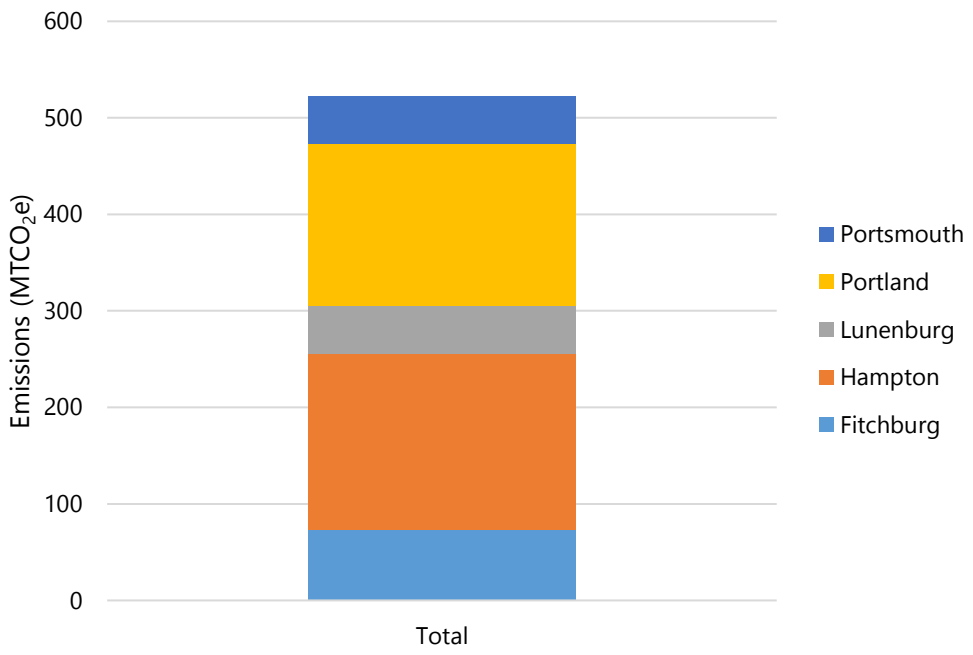


FIGURE 5: 2019 TOTAL EMISSIONS IN $MTCO_2E$ FROM STATIONARY FUEL USAGE (NATURAL GAS) AT UNITIL LOCATIONS

TABLE 5: BREAKDOWN OF NATURAL GAS USAGE AND ASSOCIATED EMISSIONS BY UNITIL LOCATION

Unitil Location	Natural Gas Usage (Therms)	NG Usage Emissions ($MTCO_2e$)
Fitchburg	13836	73.6
Hampton	34132	181.57
Lunenburg	9518	50.63
Portland	31406	167.07
Portsmouth	9320	49.58
Totals:	**98212**	**522.45**

Unitil Fleet Fuel Consumption

Emissions from fuel usage by a company's fleet are classified as Scope 1, as they originate from directly-owned assets. At locations which are responsible for energy delivery, Unitil relies on company vehicles to supervise and complete essential electric and gas operations, such as day-to-day operations, maintenance, and emergency response. Unitil's fleet is generally composed of light pickup trucks and vans for general use and heavy machinery for operations and maintenance, such as bucket trucks and diggers.

Individual vehicle information is tracked externally by the fleet management company Merchants Fleet, which provided the usage data from fuel cards and vehicle subsidiaries used in this inventory. The usage data which was used for emissions calculations was provided in gallons for each vehicle. Data for the fuel type (gas or diesel) of each vehicle was not provided by Merchants Fleet, but was obtained from an internal database provided by Unitil Fleet and Facilities.

Findings:

- In 2019, Merchants Fleet tracked usage data on 267 Unitil-owned vehicles. Tracked vehicles consumed 278,480 gallons of fuel (Table 1), combining gasoline and diesel usage. Gasoline was the primary fuel used at 227,009 gallons, while diesel usage was 51,471 gallons (Table 6).
- Total fleet emissions for 2019 amounted to **2493.79 metric tons of CO_2e** (Table 2), **40.57%** of total 2019 emissions.
- 2019 emissions from gasoline consumption totaled 1,970.18 metric tons of Carbon Dioxide Equivalent (CO_2e). Emissions from diesel consumption totaled 523.61 metric tons of CO_2e (Table 7).

The following graphs and accompanying tables show 2019 fuel usage broken down by subsidiary and fuel type (Figure 1), as well as the total associated emissions in CO_2e from fuel usage by subsidiary (Figure 2).

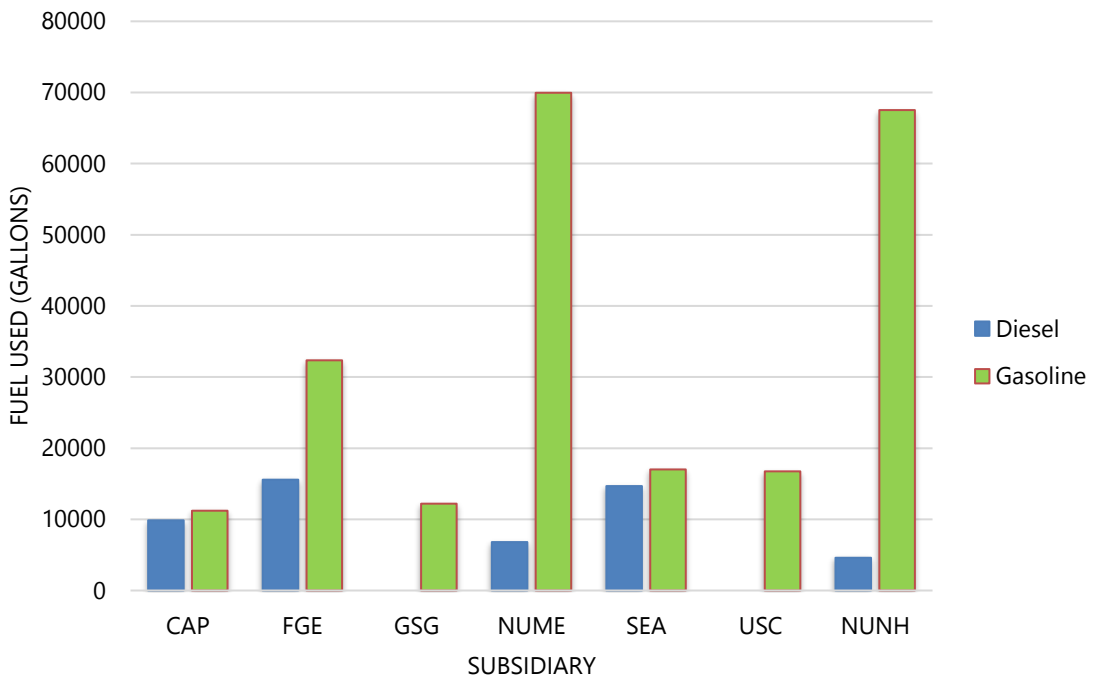


FIGURE 6: 2019 FUEL USAGE IN GALLONS OF UNITIL-OWNED VEHICLES BY TYPE AND SUBSIDIARY

TABLE 6: 2019 TOTAL FUEL USAGE OF UNITIL-OWNED VEHICLES WITH BREAKOUT BY FUEL TYPE

Subsidiary	Class 2 Vehicles	Class 3 Vehicles	Diesel (Gallons)	Gasoline (Gallons)	Combined (Gallons)
CAP	17	8	9841.93	11224.37	21066.3
FGE	37	20	15589.92	32349	47938.92
GSG	8	0	0	12187	12187
NU NH	51	10	4590.68	67538.01	72128.69
NUME	55	10	6793.08	69969.1	76762.18
SEA	22	9	14655.85	17004.94	31660.79
USC	20	0	0	16737.01	16737.01
Totals:	**210**	**57**	**51471.46**	**227009.43**	**278480.89**

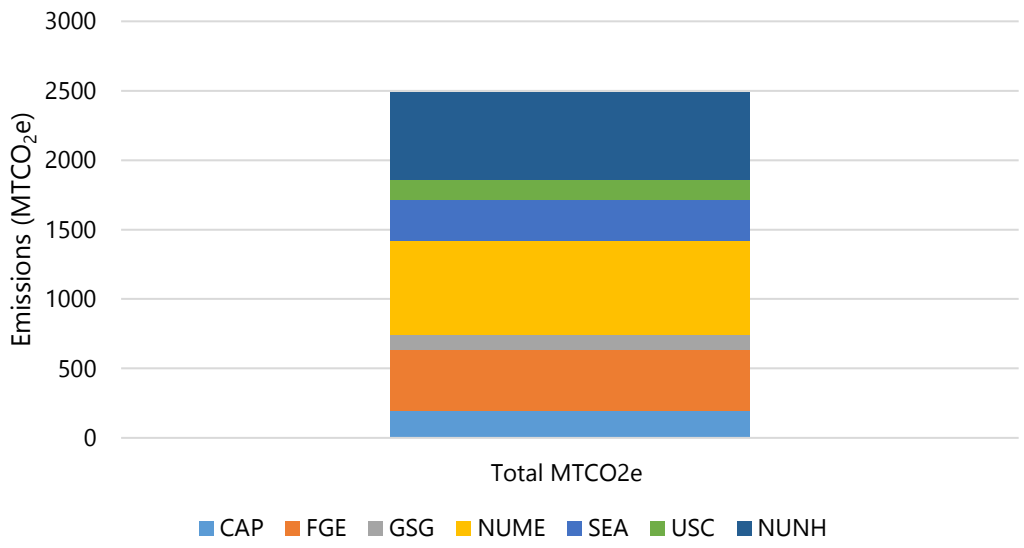


FIGURE 7: 2019 TOTAL EMISSIONS IN $MTCO_2E$ FROM FUEL USAGE (GASOLINE AND DIESEL) BY UNITIL-OWNED VEHICLES

TABLE 7: BREAKDOWN OF $MTCO_2E$ EMISSIONS BY SUBSIDIARY FOR DIESEL, GASOLINE, AND TOTAL.

Subsidiary	Diesel Emissions ($MTCO_2e$)	Gasoline Emissions ($MTCO_2e$)	Combined Emissions ($MTCO_2e$)
CAP	100.12	97.41	197.53
FGE	158.59	280.75	439.35
GSG	0	105.77	105.77
NUME	69.1	607.25	676.36
SEA	149.09	147.58	296.67
USC	0	145.26	145.26
NUNH	46.7	586.15	632.85
Totals:	**523.61**	**1970.18**	**2493.79**

Pipeline Fugitive Emissions

Fugitive emissions from gas delivery pipelines are a utility industry specific source of emissions, but are categorized as Scope 1 as they originate from company-owned equipment. Unitil delivers natural gas to 82,700 customers between its service areas in Maine, Massachusetts and New Hampshire. A common occurrence for gas delivery infrastructure, fugitive (unintended) emissions occur as natural gas travel through pipelines. Fugitive emissions are largely methane, and are calculated annually. 2019 pipeline fugitive emissions from gas delivery were provided by Tom Murphy, Manager of Unitil's Environmental Health and Services. Pipeline emissions are calculated annually for environmental compliance. Because fugitive emissions occur along Unitil's pipelines, only a total emissions figure is available.

Findings

- 2019 pipeline fugitive emissions were calculated at **506.74 metric tons of CO_2e** (Figure 8), **8.24%** of total 2019 emissions.
- 2019 pipeline fugitive emissions were down from 2018's emissions of 516.58 MT of CO_2e and 2017's 554.14 MT of CO_2e.

The following figure compares fugitive emissions in $MTCO_2e$ from Unitil's gas pipelines across three years of reporting.

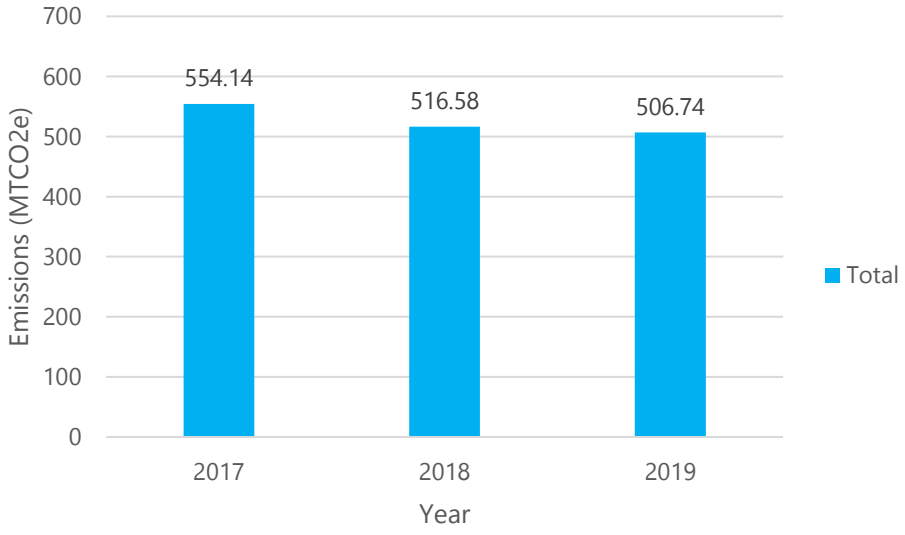


FIGURE 8: FUGITIVE EMISSIONS IN $MTCO_2E$ FROM UNITIL GAS DELIVERY PIPELINE, 2017-2019

Scope 2 Emissions

Scope 2 emissions are emissions associated with the purchase of electricity for company operations, which may be used for heating, cooling, lighting, or any other operations within the company. Many utilities generate electricity for their operations, which would classify emissions from electricity as Scope 1; however, Unitil is only responsible for energy delivery, and does not generate electricity. Accordingly, Unitil's purchased electricity is classified as Scope 2.

- Total Scope 2 Emissions in 2019 amounted to **838.42** metric tons of carbon dioxide equivalent.

Purchased Electricity

Purchased electricity for lighting, heating, cooling, or other operations is classified as a source of Scope 2 emissions. As a provider of electric power, Unitil has a unique position relating to "purchased" electricity. Similar to its delivery of natural gas to its operating locations, Unitil supplies electricity to all but one of its buildings. Though the electricity supplied by Unitil is not directly purchased, it is not generated by Unitil and is thus assumed to be a Scope 2 emission for this inventory.

2019 data for electricity supplied by Unitil was collected from an internal report system which retrieved monthly statements of electricity use by individual meter numbers. Active meter numbers for each building were collected and used to access the appropriate usage data. Six of the eight tracked locations received electricity from Unitil in 2019. The Portland and Portsmouth locations received electricity from the utilities Central Maine Power (CMP) and Eversource, respectively. 2019 usage data for the two locations was collected from monthly invoices provided by CMP and Eversource. Each electricity provider reported monthly usage in kWh, which was then used for emissions calculations. All locations tracked in this report received electricity delivery in 2019.

Findings:

- 2019 Electricity usage was tracked for eight Unitil locations. Total electricity usage across the locations amounted to 3,280,810.6 kWh (Table 8).
- Total 2019 emissions from purchased electricity amounted to **838.42 metric tons of CO_2e** (Table 9), **13.64%** of total 2019 emissions.

The following figures and accompanying tables show 2019 purchased electricity usage at Unitil locations in kWh (Figure 6) and total associated emissions from 2019 purchased electricity by Unitil location.

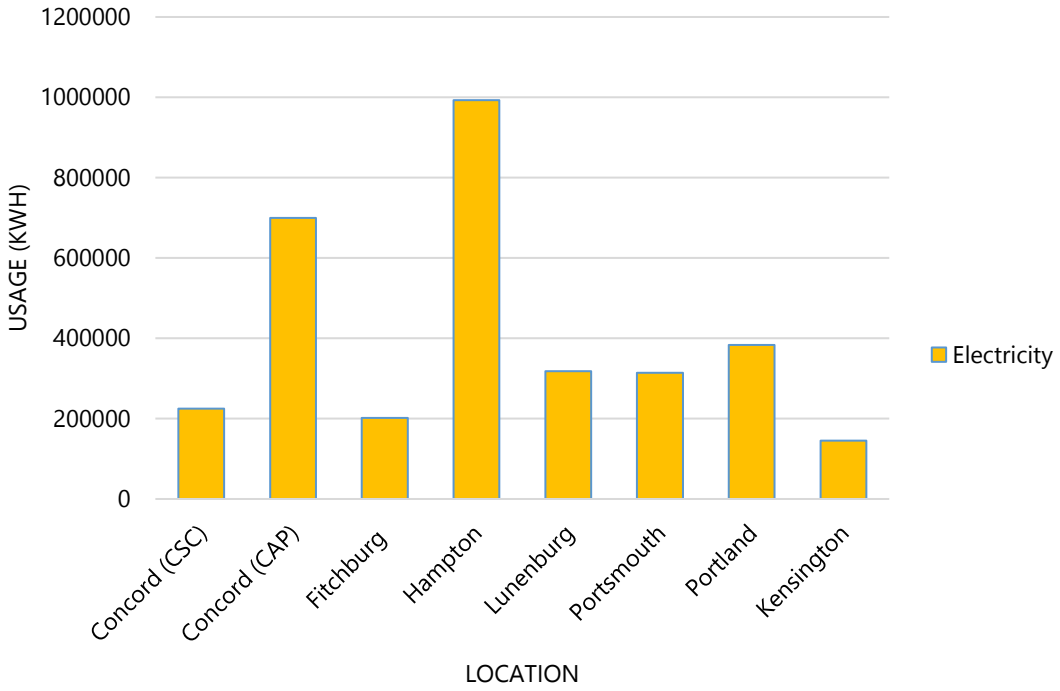


FIGURE 9: 2019 TOTAL ELECTRICITY USAGE IN KWH BY UNITIL LOCATION

TABLE 8: BREAKDOWN OF 2019 ELECTRICITY USAGE BY UNITIL LOCATION WITH GRAND TOTAL

Location	Electricity Usage (kWh)
Concord (CSC)	224888
Concord (CAP)	699732
Fitchburg	201788
Hampton	992640
Lunenburg	318420
Portsmouth	314160
Portland	383743
Kensington	145440
Total:	**3280811**

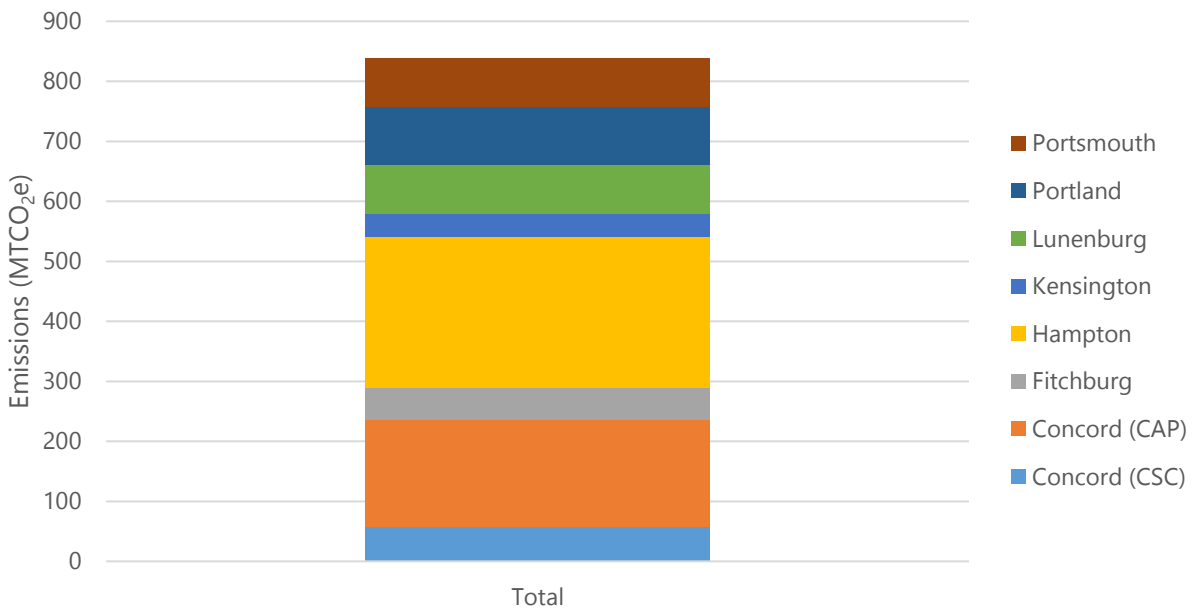


FIGURE 10: 2019 TOTAL EMISSIONS IN $MTCO_2E$ FROM PURCHASED ELECTRICITY AT UNITIL LOCATIONS

TABLE 9: BREAKDOWN OF 2019 ELECTRICITY USAGE BY LOCATION AND ASSOCIATED EMISSIONS WITH GRAND TOTALS

Location	Electricity Usage (kWh)	Electricity Usage Emissions ($MTCO_2e$)
Concord (CSC)	224888	57.47
Concord (CAP)	699732	178.82
Fitchburg	201788	51.57
Hampton	992640	253.67
Lunenburg	318420	81.37
Portsmouth	314159.6	80.28
Portland	383743	98.07
Kensington	145440	37.17
Totals:	**3280810.6**	**838.42**

Scope 3 Emissions

Scope 3 emissions are emissions which occur as a result of a company's operations, but are not from direct company sources. These emissions are often referred to as upstream and downstream emissions. The 2019 inventory includes three categories of Scope 3 emissions: municipal standard waste, wastewater, and employee commuting.

- Total Scope 3 Emissions in 2019 amounted to **1,784.93** metric tons of carbon dioxide equivalent.

Municipal Standard Waste (MSW)

Emissions from waste disposal are classified as Scope 3, as they occur downstream of the company's activities at landfills or other treatment centers where waste is deposited. For the 2019 inventory, municipal standard waste (everyday items such as packaging, food, bottles and cans) from Unitil's buildings was tracked. Seven of Unitil's locations received waste disposal services from various contractors in 2019; however, the two locations in Concord share a dumpster, and thus only six dumpsters were tracked in this inventory.

Findings:

Precisely measuring the amount of MSW from Unitil's buildings was not possible for this inventory, as neither the contractors used for waste hauling nor Unitil itself tracks the weight of waste pickups. Thus, a fill scenario matrix was created to estimate the total amount of MSW generated across Unitil's locations; different fill percentages were used to create a range of possible estimates for total MSW collected from Unitil's dumpsters. The variables used in the fill scenario are as follows:

- Building location
- Number of annual pickups (obtained from facilities coordinators)
- Dumpster Volume in cubic yards (yd^3, obtained from facilities coordinators)
- Average density of un-compacted commercial MSW (138 lbs/yd^3, obtained from EPA)

Fill Scenarios were calculated with the following equation:

(Annual Dumpster Pickups x Dumpster Volume (yd^3) x 138 lbs/yd^3) x Fill Percentage= ***Total MSW (lbs)***

Scenario Name	Dumpster Fill Percentage
Low Fill	25%
Medium Fill	50%
High Fill	75%
Maximum Fill	100%

TABLE 10: FILL SCENARIO NAMES AND ASSOCIATED FILL PERCENTAGES

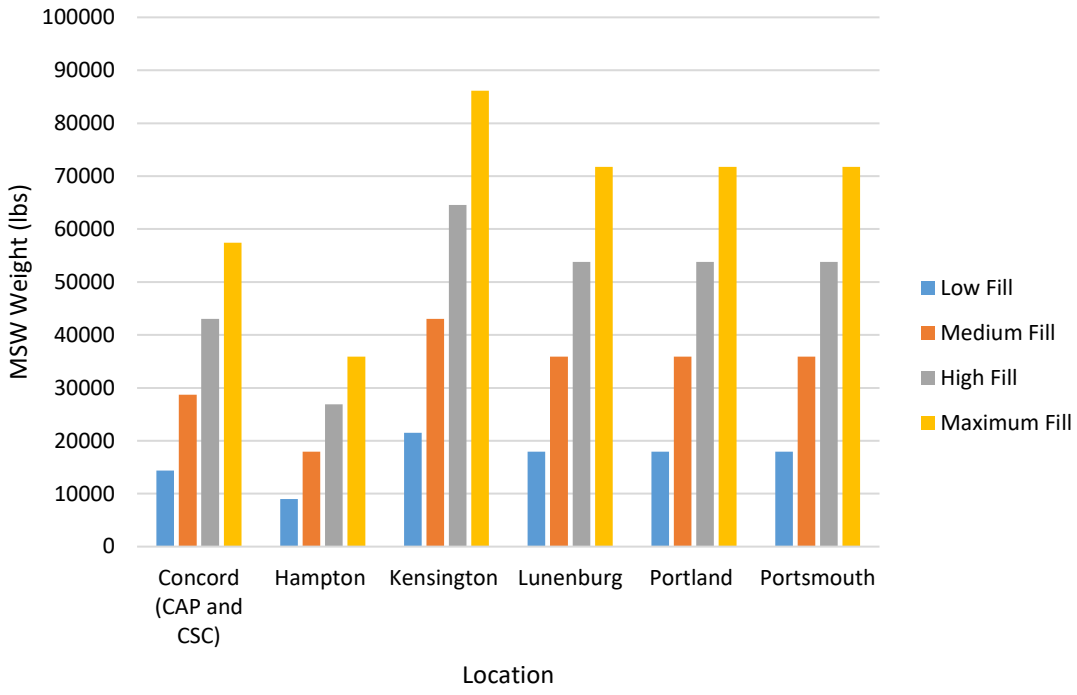


FIGURE 11: 2019 ESTIMATED TOTAL MSW GENERATION IN POUNDS AT UNITIL BUILDINGS, BY LOCATION WITH MULTIPLE FILL SCENARIOS

TABLE 11: 2019 FILL SCENARIO MATRIX FOR GENERATED MSW AT UNITIL LOCATIONS WITH ANNUAL PICKUPS, DUMPSTER VOLUMES, AND FILL SCENARIOS WITH GRAND TOTALS.

Assumption: Density of uncompacted commercial waste= 138lbs/cubic yard

Location	Pickups Per Year	Dumpster Volume (yd3)	Low Fill (lbs)	Medium Fill (lbs)	High Fill (lbs)	Maximum Fill (lbs)
Portland	52	10	17,940	35,880	53,820	71,760
Portsmouth	52	10	17,940	35,880	53,820	71,760
Lunenburg	52	10	17,940	35,880	53,820	71,760
Kensington	52	12	21,528	43,056	64,584	86,112
Concord (Combined CAP and CSC)	52	8	14,352	28,704	43,056	57,408
Hampton	26	10	8,970	17,940	26,910	35,880
		Totals:	**98,670**	**197,340**	**296,010**	**394,680**

Emissions calculations for MSW depend on how the waste is treated, such as in a methane recapture facility, incinerator, or landfill that creates refuse-derived fuel. Landfill locations were provided by waste contractors for five of the six tracked locations in the inventory, and waste treatment information for the indicated landfills was collected from the EPA's Landfill Methane Outreach Program (LMOP) Database. Due to the electricity generation from landfill gas at landfill locations for Concord, Kensington, and Hampton, emissions values for these locations' waste are negative. The waste hauler for the Lunenburg location was not able to provide a definite landfill location, and thus the treatment of Luneburg's waste was assumed to be methane recapture with gas flaring. **Emissions calculations for each fill scenario assume all dumpsters across locations are at identical fill percentages**.

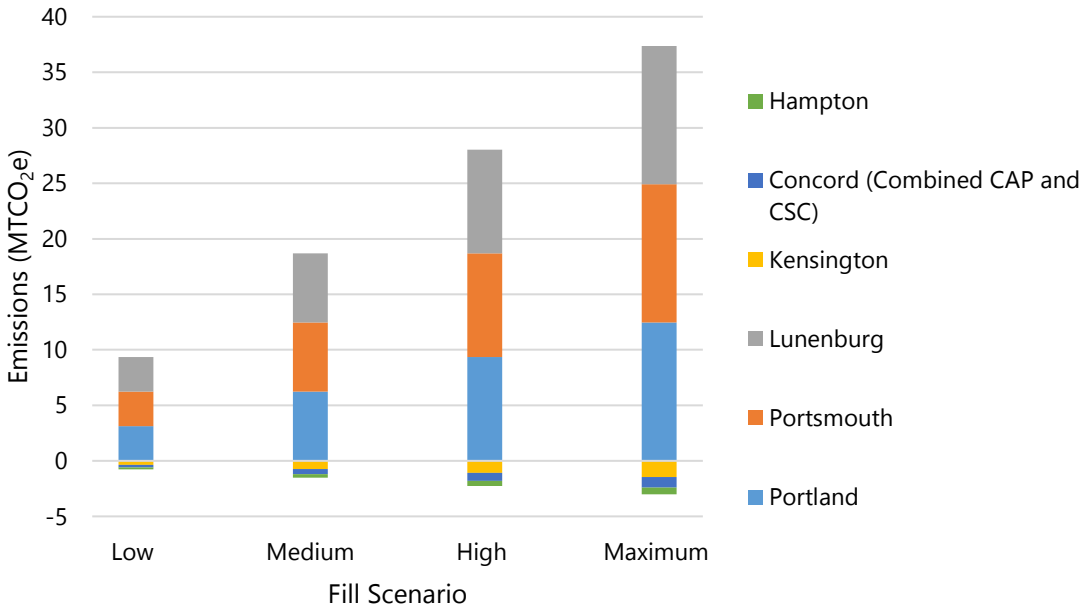


FIGURE 12: 2019 TOTAL EMISSIONS IN MTCO2E FROM MSW FROM UNITIL BUILDINGS BY FILL SCENARIO

TABLE 12: BREAKDOWN OF FILL SCENARIOS WITH ASSOCIATED EMISSIONS AND LANDFILL TREATMENTS

Location	Pickups Per Year	Dumpster Volume (yd^3)	Low Fill Emissions ($MTCO_2e$)	Medium Fill Emissions ($MTCO_2e$)	High Fill Emissions ($MTCO_2e$)	Maximum Fill Emissions ($MTCO_2e$)	Landfill Treatment
Portland	52	10	3.11	6.23	9.34	12.46	Methane Recapture, Flaring

Portsmouth	52	10	3.11	6.23	9.34	12.46	Methane Recapture, Flaring
Lunenburg	52	10	3.11	6.23	9.34	12.46	Methane Recapture, Flaring
Kensington	52	12	-0.36	-0.72	-1.08	-1.44	Methane Recapture, Electricity Gen
Concord (Combined CAP and CSC)	52	8	-0.24	-0.48	-0.72	-0.96	Methane Recapture, Electricity Gen
Hampton	26	10	-0.15	-0.3	-0.45	-0.6	Methane Recapture, Electricity Gen
		Totals:	**8.58**	**17.19**	**25.77**	**34.38**	

Wastewater

Emissions associated with the treatment of wastewater are classified as Scope 3, as they occur downstream of the company's operations at treatment facilities operated by municipalities or other companies. For the 2019 inventory, eight Unitil locations had metered water use; the Kensington location uses a leach field for water treatment, and usage is thus not tracked.

2019 water usage data was obtained from invoices from the various municipalities which provide water and wastewater treatment for Unitil's buildings. Invoices reported usage in ccf (centum cubic feet), which was then converted to gallons and used for emissions calculations. The emissions associated with wastewater also depend on the treatment of water once it arrives at a central treatment system. Treatment information was obtained from each municipality's website.

Findings:

- Eight Unitil locations were tracked for the 2019 inventory. Total water usage across the tracked Unitil locations amounted to 2,616,698 gallons (Table 13) in 2019.
- Total 2019 emissions from water usage and treatment amounted to **1.13 metric tons of CO_2e** (Table 14), **.02%** of total 2019 emissions.

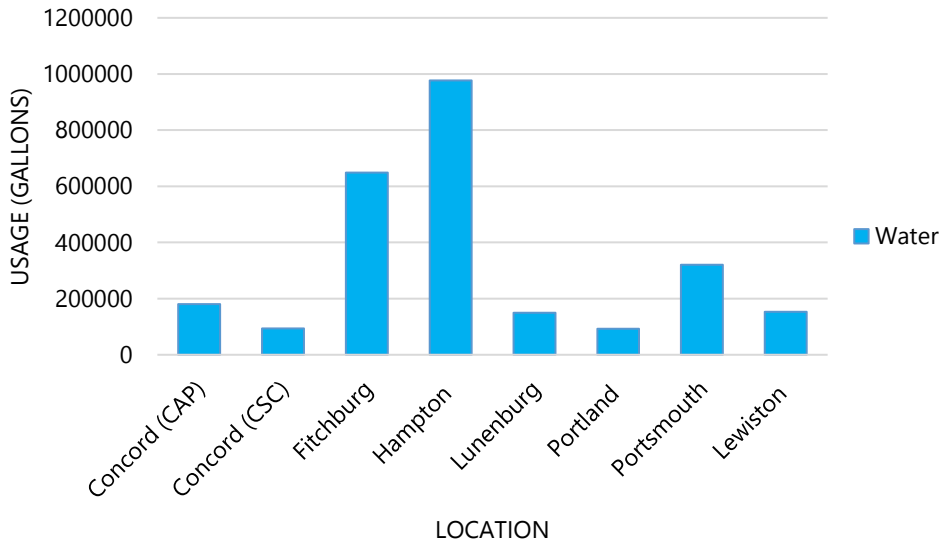


FIGURE 13: 2019 WATER USAGE DATA IN GALLONS BY UNITIL LOCATION

TABLE 13: BREAKDOWN OF 2019 WATER USAGE AT UNITIL LOCATIONS WITH WATER PROVIDERS

Location	Water Provider	Water Usage (Gallons)
Portland	City of Portland	92,752
Portsmouth	City of Portsmouth	320,892
Hampton	Town of Hampton	977,636
Concord (CSC)	City of Concord	94,248
Concord (CAP)	City of Concord	180,268
Fitchburg	City of Fitchburg	648,516
Lunenburg	Town of Lunenburg	149,465
Lewiston	Town of Lewiston	152,921
	Total:	**2,616,698**

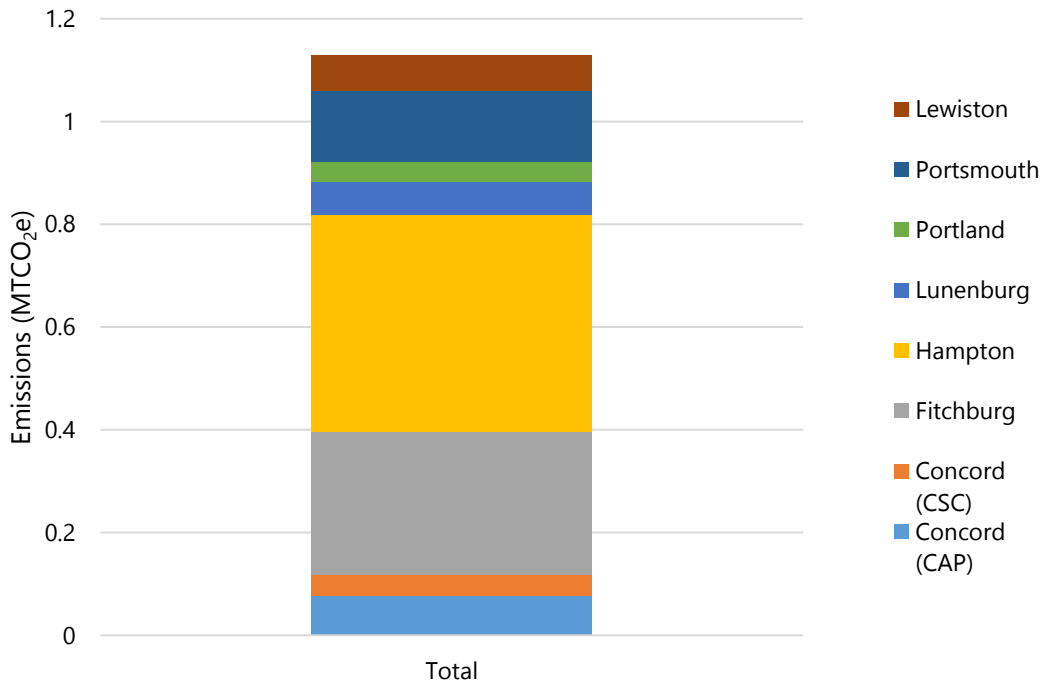


FIGURE 14: 2019 TOTAL EMISSIONS IN $MTCO_2E$ FROM WATER USE AT UNITIL LOCATIONS

TABLE 14: BREAKDOWN OF 2019 WATER USAGE AND ASSOCIATED EMISSIONS AT UNITIL LOCATIONS WITH RESPECTIVE WATER TREATMENT METHODS

Location	Water Treatment Provider	Water Treatment Method	Water Usage (Gallons)	Water Usage Emissions ($MTCO_2e$)
Portland	City of Portland	Central Treatment, Aerobic	92,752	0.04
Portsmouth	City of Portsmouth	Central Treatment, Aerobic	320,892	0.14

Hampton	Town of Hampton	Central Treatment, Aerobic	977,636	0.42
Concord (CSC)	City of Concord	Central Treatment, Aerobic	94,248	0.04
Concord (CAP)	City of Concord	Central Treatment, Aerobic	180,268	0.08
Fitchburg	City of Fitchburg	Central Treatment, Aerobic	648,516	0.28
Lunenburg	Town of Lunenburg	Central Treatment, Aerobic	149,465	0.06
Lewiston	Lewiston-Auburn Water Pollution Control Authority	Central Treatment, Anaerobic Digestion	152,921	0.07
		Totals:	**2,616,698**	**1.13**

Employee Commuting

Emissions from employee commuting are classified as Scope 3, as they do not originate from company-owned sources but are a result of company operations (i.e., employees must commute to work). Unitil's employees commute to company locations throughout New England, often to multiple locations on a regular basis.

Commuting data for the 2019 inventory was collected through an online commuting survey. The survey was voluntary and was sent to all employees on the company email list. The survey collected data on individual employees' average commuting distance in miles, type of transportation used for commuting, and to which Unitil location(s) they commuted. The survey received 172 responses during a two-week collection period, a 33% response rate. For entry in SIMAP, data was consolidated into three categories: One-way (5 commuting days would equal 10 one-way trips) trips per commuter per week, percentage of trips by transportation method, and miles per trip by transportation method; these values were obtained from averages of commuting survey data. A population of 519 employees and 48 annual work weeks were assumed, estimating 4 weeks of vacation, holiday, and sick leave per employee. Because of the prevalence of commuting to multiple Unitil locations, it was not possible to break out emissions by location for the 2019 inventory. Finally, a limitation of the 2019 estimated commuting emissions is a lack of accounting for electric vehicles in the commuting population.

Findings

- For an assumed population of 519 employees, total commuting mileage across Unitil locations was estimated at 4,883,670 miles (Table 15) in 2019. From the commuting survey's 172 responses, the average round-trip commute for Unitil employees was 40.53 miles.
- Unitil employees that responded to the commuting survey reported three types of transportation: automobile (drive alone), bicycle, and carpool.
- Total 2019 emissions from commuting were estimated at **1749.43 metric tons of CO_2e** (Table 15), **28.46%** of total 2019 emissions.

The following figure and table show the 2019 percentages of the three commuting methods in relation to total commuting trips, as well as total commuting miles for each method and associated commuting emissions in $MTCO_2e$

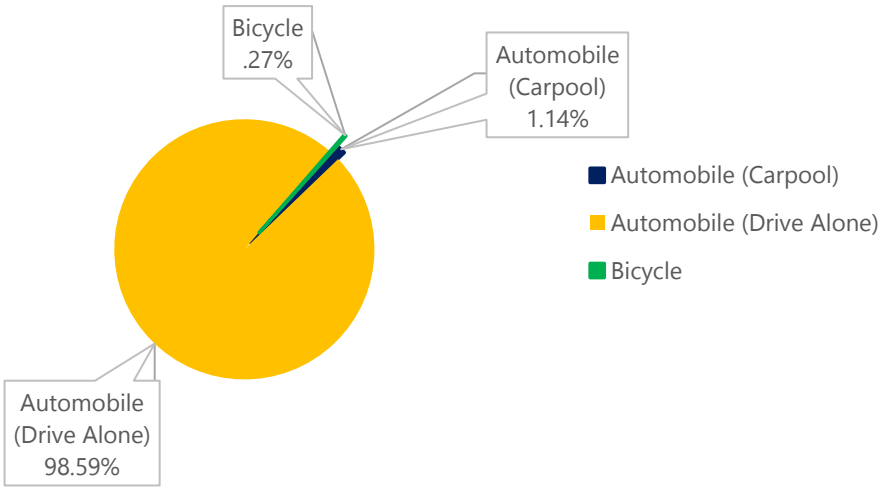


FIGURE 15: 2019 PERCENTAGES OF TOTAL COMMUTING TRIPS TO UNITIL LOCATIONS BY TRANSPORTATION METHOD

TABLE 15: 2019 BREAKDOWN OF COMMUTING TYPE BY PERCENTAGE OF TOTAL TRIPS, TOTAL COMMUTING MILES AND ASSOCIATED EMISSIONS IN $MTCO_2E$

Commuting Method	Percentage of Total Trips	2019 Total Commuting Miles	Commuting Emissions ($MTCO_2e$)
Automobile (Drive Alone)	98.59%	4,826,726	1739.87
Automobile (Carpool)	1.14%	53,029	9.56
Bicycle	.27%	3,915	0
	Totals:	**4,883,670**	**1749.43**

Recommendations

As the first report of its kind for Unitil, the 2019 inventory represents a baseline accounting of Unitil's operations emissions. Moving forward, the inventory can be improved upon in several key categories.

Consistent Methodology

For future iterations of the report, a consistent methodology should be the first priority; referencing the 2019 report, as well as re-establishing and maintaining contact with the internal and external parties which provide data for the inventory's categories will result in inventories which are comparable and meaningful in light of one another. Important to note is that methodologies should be re-examined and improved on, and any changes to emissions calculations or data collection should be communicated year-to-year.

Expanding and Improving the Inventory

Expanding the tracked emissions categories in future inventories is the second key priority. Due to time constraints and data availability, several categories such as contractor vehicle emissions, emergency generator emissions, and fugitive refrigerant emissions were not tracked. Adding these categories in future inventories will contribute to a more holistic review of Unitil's direct and up/downstream emissions. Efforts to collect data on these categories should start as soon as possible.

Emissions Reduction Strategies

Finally, data from the 2019 and future inventories should be used to inform or provide Unitil's emissions reduction strategies. Though the inventory can stand alone as a collection of company data, its information should be used to understand Unitil's greatest emissions sources so as to reduce them. As referenced earlier in this report, the negative environmental impacts of greenhouse gas emissions are diverse, human-caused, and urgent. As the first measurement of Unitil's contribution to these negative impacts, the 2019 inventory provides an opportunity to manage these emissions.

Conclusions

Unitil's inaugural greenhouse gas emission inventory tracked company operations data for the calendar year of 2019. Categories included in the 2019 inventory included stationary fuel use, the fuel use of Unitil's company fleet, fugitive methane emissions from natural gas delivery, electricity purchased at Unitil's locations, employee commuting, municipal standard waste from Unitil locations, and wastewater from Unitil locations. From these categories, total emissions for calendar year 2019 amounted to **6146.33 metric tons of carbon dioxide equivalent**.

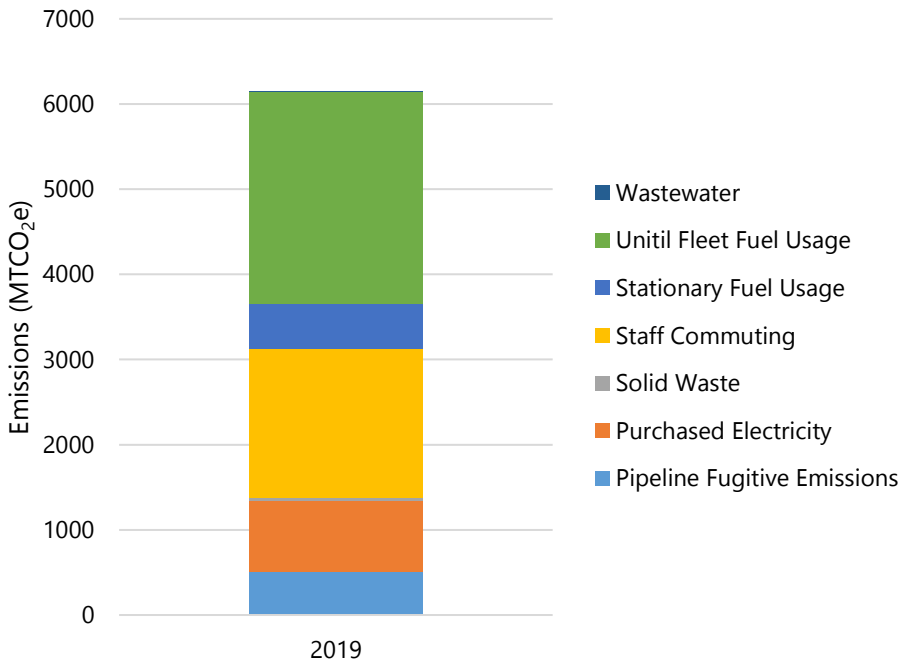


FIGURE 16: TOTAL 2019 EMISSIONS IN $MTCO_2E$ FROM UNITIL OPERATIONS BY CATEGORY

While the 2019 inventory marks a crucial step towards Unitil's commitment to sustainability, the value of such an inventory is determined by what is done with it. Looking to the future, additional inventories should be conducted annually, following the methodology established by the 2019 inventory and updating as needed. Future inventories should also be ambitious and forward-thinking; expanding the established categories to incorporate more emissions sources such as company food, business travel, fugitive refrigerant emissions, or a variety of other operations should be a central goal of future inventories. Finally, as inventories are completed in future years, comparisons between inventories should be of the highest priority. By comparing emissions between calendar years, Unitil will be able to understand how their operations are improving or worsening with respect to their environmental impact.

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Appendix

2019 Inventory Tables

Calendar Year	Scope	Source	CO2 (kg)	CO2 (MTCDE)	CH4 (kg)	CH4 (MTCDE)	N2O (kg)	N2O (MTCDE)	GHG MTCDE
2019	1	Stationary Fuel Usage	520,724	520.72	52	1.45	1	0.27	522.45
2019	1	Unitil Fleet Fuel Usage	2,472,288	2,472.29	107	2.99	70	18.51	2,493.79
2019	1	Pipeline Fugitive Emissions							506.74
2019	2	Purchased Electricity	830,670	830.67	122	3.42	16	4.34	838.42
2019	3	Staff Commuting	1,802,852	1,802.85	97	2.72	63	16.75	1,749.43
2019	3	Solid Waste (Maximum Fill)	0	0	1,227	34.36	0	0	34.36
2019	3	Wastewater	0	0	0	0.01	4	1.13	1.14
2019	3	T&D Losses	42,635	42.63	6	0.18	1	0.22	43.03

Calendar Year	Scope	GHG MTCDE
2019	1	3,522.98
2019	2	838.42
2019	3	1,784.93

Calendar Year	Gross MTCDE
2019	6146.33

AR5 Global Warming Potential Values

Chemical or Refrigerant	GWP
C2F6	11100
C3F8	8900
C4F10	9200
C5F12	8550
C6F14	7910
c-C3F6	9200
c-C4F8	9540
(CF2)4CH(OH)	13
(CF3)2CFOCH3	363
(CF3)2CHOCH3	14
(CF3)2CHOCHF2	2620
(CF3)2CHOH	182
CF3CF2CH2OH	42
(CF3)CH2OH	195
CF4	6630
CH3OCH3	1
CH4	28

CO2	1
FIC-1311	1
HCFC-22	1760
HCFE-235da2	491
HFC-125	3170
HFC-134	1120
HFC-134a	1300
HFC-143	328
HFC-143a	4800
HFC-152	16
HFC-152a	138
HFC-161	4
HFC-227ea	3350
HFC-23	12400
HFC-236cb	1210
HFC-236ea	1330
HFC-236fa	8060
HFC-245ca	716
HFC-245fa	858
HFC-32	677
HFC-365mfc	804
HFC-41	116
HFC-4310mee	1650
HFE-125	12400
HFE-134	5560
HFE-143a	523
HFE-227ea	6450
HFE-236ea2	1790
HFE-236fa	979
HFE-245cb2	654
HFE-245fa1	828
HFE-245fa2	812
HFE-254cb2	359
HFE-263fb2	1
HFE-329mcc2	3070
HFE-338mcf2	929
HFE-347mcc3	530
HFE-347-mcf2	854
HFE-356mec3	387
HFE-356pcc3	413
HFE-356pcf2	719
HFE-356pcf3	446
HFE-365mcf3	446
HFE-374pcf2	899
HFE-7100	421
HFE-7200	57
HG-01	2910
HG-10	5350
H-Galden 1040x	2820
N2O	265
NF3	16100
R-11	4600

R-404a	3943
R-407c	1624
R-408a	2430
R-410a	1923.5
R-414b	482
R-420a	1584
R-508b	11698
SF5CF3	17400
SF6	23500

Emissions Factors by Scope

Stationary Fuels

Fuel Type	CH4 kg/ mmbtu	CO2 kg/mmbtu	N2O kg/mmbtu	NOx kg/mmbtu
Natural Gas	0.00527528	53.02	0.000105506	0.03414929

Fleet Fuels

Fuel Type	CH4 kg/US gallon	CO2 kg/US gallon	N2O kg/US gallon	NOx kg/US gallon
Diesel Fleet	0.000029565	10.16375905	0.0000308	0.044588386
Gasoline Fleet	0.000463339	8.586184444	0.000300733	0.013441809

Purchased Electricity

Fuel Type	CH4 kg/kWh	CO2 kg/kWh	N2O kg/kWh	NOx kg/kWh
Electricity	3.71945E-05	0.253190518	4.98951E-06	0.000176

Commuting

Commuting Type	CH4 kg/vehicle mile	CO2 kg/vehicle mile	N2O kg/vehicle mile	NOx kg/vehicle mile
Automobile (Drive Alone)	0.000019244	0.356614905	0.0000125	0.000555519
Bicycle	0	0	0	0
Carpool	0.00000962	0.178307452	0.00000625	0.00027776

Wastewater

Treatment Type	CH4 kg/US gallon	CO2 kg/US gallon	N2O kg/US gallon	NOx kg/US gallon	Other Nitrogen kg/US Gallon
Aerobic	0	0	0.00000163	0	0.000142
Anaerobic	0.00034032	0	0.00000163	0	0.000142

Anaerobic Digestion	0.00000122	0	0.00000163	0	0.0000189

Municipal Standard Waste

Treatment Type	CH4 kg/short ton
CH4 Recovery and Electric Generation	-1.2
CH4 Recovery and Flaring	12.4