Providence, RI

2021

Inventory of Citywide Greenhouse Gas Emissions

Produced by the City of Providence Department of Sustainability

Contents

Section 1 Background

Introduction

Based on the findings of the Intergovernmental Panel on Climate Change (IPCC), human activities are changing the climate at an unprecedented rate. Studies have shown global averages increasing such as local sea levels, annual temperatures, and annual precipitation. As a coastal, urban community, Providence is highly vulnerable to the impacts of climate change and its possible long-term impacts on the local economy, environment, and human health.

The City of Providence is committed to reaching a goal of carbon neutrality by the year 2050. This commitment was emphasized in 2015 when the City joined the Compact of Mayors, the world's largest effort among mayors and city leaders to reduce greenhouse gas emissions, track progress, and prepare for the impact of climate change. An additional milestone was the City's 2019 Climate Justice Plan which laid the foundation for creating an equitable, low-carbon, and climate resilient future.

Inventory Protocol

By signing the compact, the City of Providence pledged to publicly report a GHG emissions inventory for the city consistent with Global Protocol for Community-scale Greenhouse Gas Inventories (GPC). The Department of Sustainability reports at the GPC BASIC level, which includes scope 1 and scope 2 emissions from stationery and transportation sources, as well as scope 1 and scope 3 emissions from waste.

Energy used by buildings and other stationary sources, Fugitive emissions from methane

On-road and some off-road transportation and public transportation

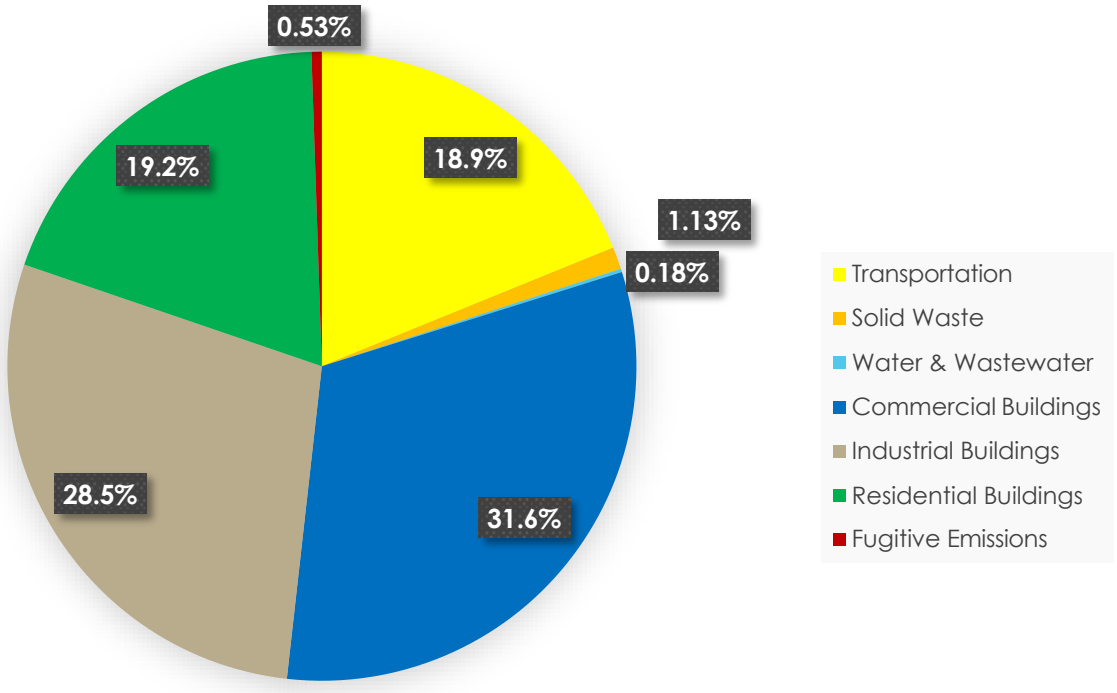
Solid waste and wastewater treatment

Emissions generated outside the city boundaries to produce goods or services used by residents

Our full methodology may be found in "Providence City-Wide GHG Inventory Handbook"

Section 2 Summary of Changes

Emissions Overview

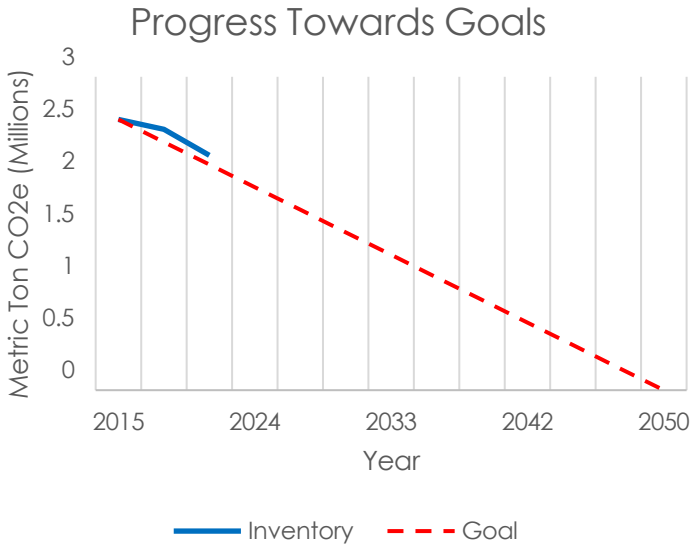


Providence residents and businesses have emitted about 2.2 million metric tons of CO_2e ($MMTCO_2e$) in 2021. The above pie graph breaks down the City's emissions by sector.

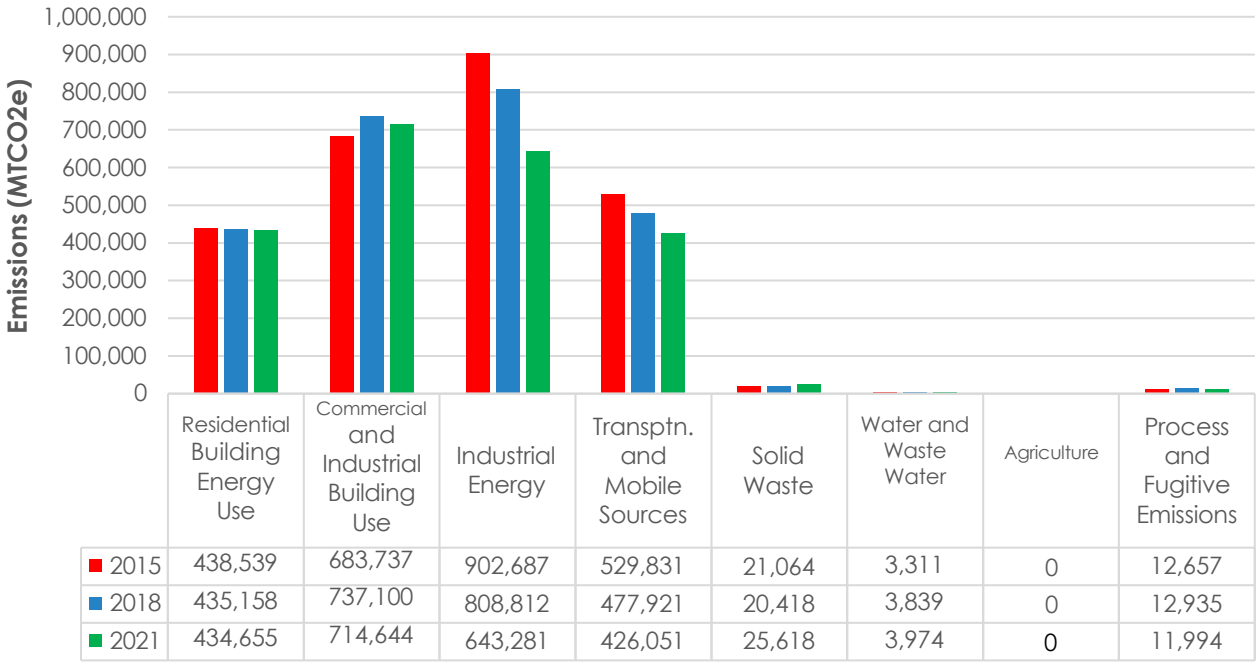
Carbon Dioxide (CO_2) emissions are the release of carbon dioxide into the atmosphere from human activities, such as the burning of fossil fuels.

Emissions have decreased **12.79%** since the 2015 baseline inventory.

The majority of those emission reductions (9.45%) occurred from 2018-2021. This period includes the time of COVID-19 shutdowns. We anticipate future inventories will show a rebound in emissions. Achieving the 2050 carbon neutrality goal will continue to require sustained investments.



Emissions by Sector



	Residential Building Energy Use	Commercial and Industrial Building Use	Industrial Energy	Transptn. and Mobile Sources	Solid Waste	Water and Waste Water	Agriculture	Process and Fugitive Emissions
2015	438,539	683,737	902,687	529,831	21,064	3,311	0	12,657
2018	435,158	737,100	808,812	477,921	20,418	3,839	0	12,935
2021	434,655	714,644	643,281	426,051	25,618	3,974	0	11,994

Inventory Sectors

The City of Providence first conducted an inventory in 2015 and uses this year as its baseline.

Altogether, residential, commercial and industrial energy use accounts for **79%** of city-wide emissions.

Residential buildings, water & wastewater, and fugitive emissions have remained relatively flat between all three inventories. A noticeable reduction has occurred in the industrial energy and transportation sources.

The industrial energy sector primarily represents Providence's major gas-powered power plant, Manchester Street Power Plant.

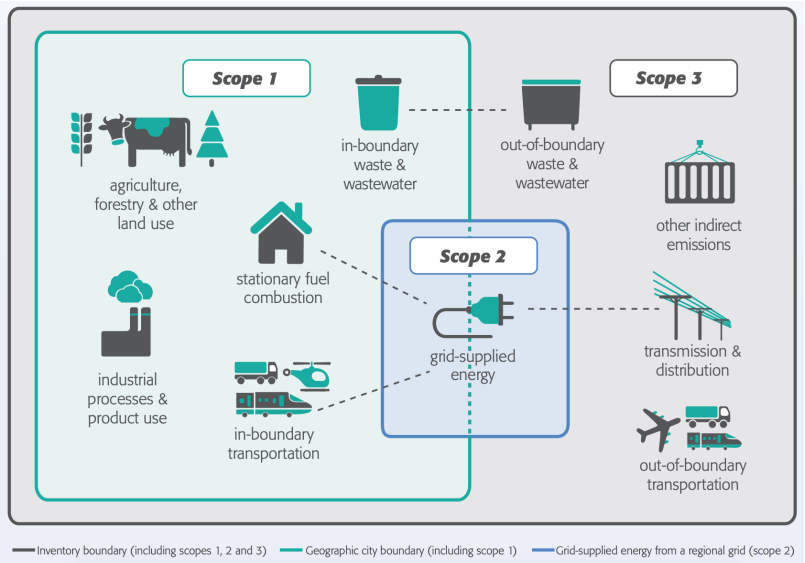
Emissions by Scope

To manage greenhouse gas emissions, it is useful to break them down by category. "Scopes" are a universal standard for measuring emissions by their source. Provided is a brief description of the different types of scopes as defined by the Global Protocol for Community-Scale Greenhouse Gas Emission Inventories (GPC).

Scope 1: GHG emissions from sources located within the city boundaries.

Scope 2: GHG emissions occurring because of the use of grid-supplied electricity, heat, steam, and/or cooling within the city boundary.

Scope 3: All other GHG emissions that occur outside the city boundary because of activities taking place within the city boundary.



Scope	Emissions (Metric Tons CO_2e)			Change 2015-2021	% Change 2015-2021
	2015	2018	2021		
Scope 1	2,184,796	1,945,450	1,726,242	- 458,554	- 20.99%
Scope 2	384,000	527,900	506,497	+ 122,497	+ 31.90%
Scope 3	23,032	22,835	27,480	+ 4,448	+ 19.31%
Total	**2,591,828**	**2,496,185**	**2,260,219**	**- 331,609**	**- 12.79%**

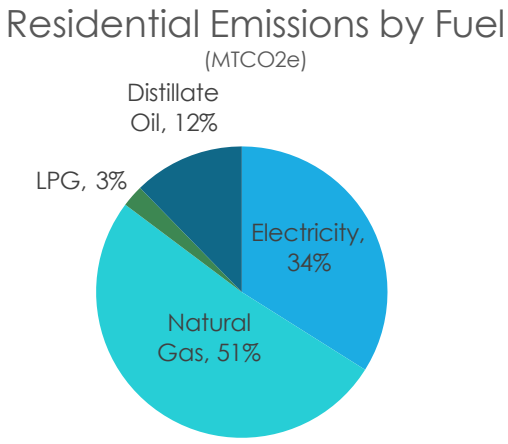
(2021 scope emissions)

Section 3 Results & Observations

Industrial energy takes up a large part of scope 1 emissions, predominantly coming from the emissions generated by the Manchester Street Power Station. Most of the scope 2 emissions come from commercial and industrial buildings, and almost all of scope 3 emissions come from solid waste, with little from waste & wastewater.

Residential Building Energy & Associated Emissions

Emissions from electricity use have increased by 48.4% since 2015 while both natural gas and distillate oil emissions have decreased by about 30,000 metric tons CO_2-e (MTCO2e) each.

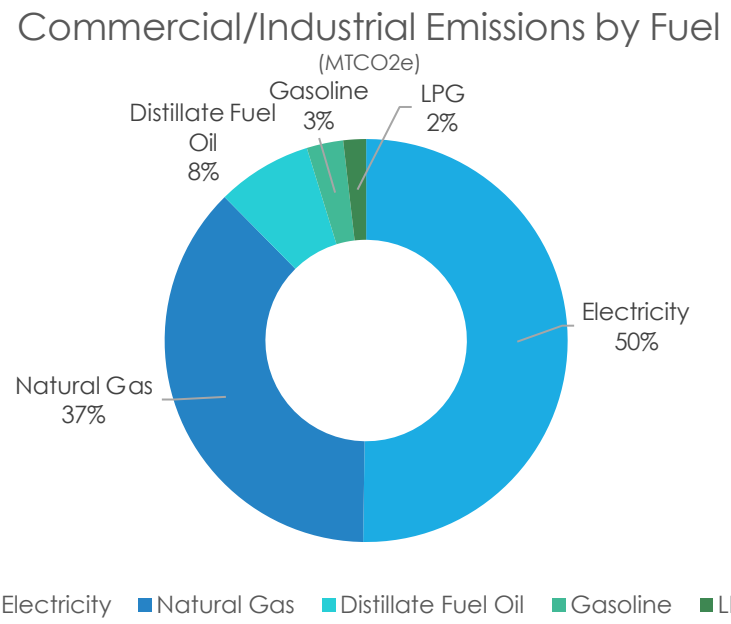


Since the 2018 inventory, natural gas emissions have gone down by 7.6%, however, it still accounts for over 50% of emissions from the residential buildings sector. Electricity use saw a small increase from 2018 to 2021, while distillate oil emissions increased by a significant 31.8% and accounting for an overall emissions total of 12%.

Without factoring in a cleaner grid or advancements in decarbonization related technologies, if the rate of change between 2018 and 2021 were realized year-to-year, Providence's residential building sector would not be on track to equal zero emissions by 2050. Total emissions have remained somewhat steady since the baseline.

Electricity and natural gas use data collected from RI Energy. Other fuel data collected from EIA SEDS (State Energy Data Systems).

Commercial & Industrial Building Energy & Associated Emissions



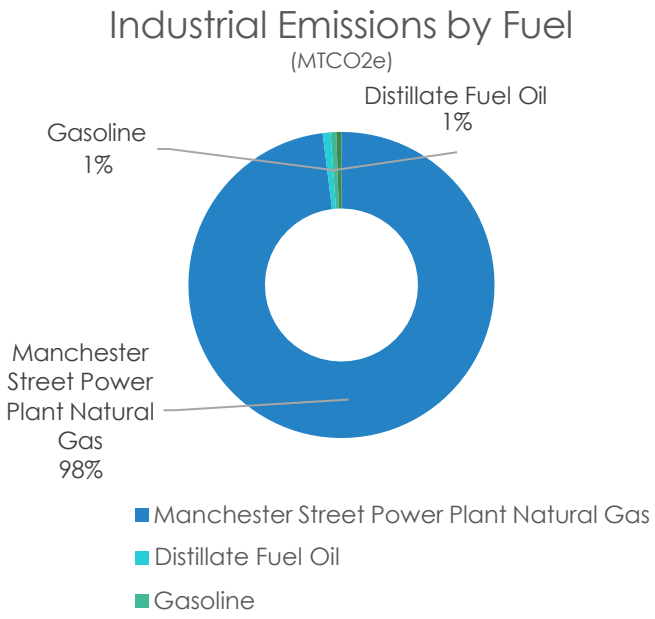
Since the baseline year of 2015, there has been a 26.1% increase in emissions from electricity for commercial & industrial building energy emissions and a 7.7% decrease in natural gas emissions.

Commercial and industrial buildings saw a 6% decrease in electricity emissions from 2018 to 2021 and a 7% decrease in natural gas emissions. Cumulatively, electricity and nature gas account for 87% of all emissions associated with commercial and industrial building energy use, as depicted in the above pie graph. Commercial residual fuel oil use and commercial LPG use both increased from 2018.

Without factoring in a cleaner grid or advancements in decarbonization related technologies, if the rate of change between 2018 and 2021 were realized year-to-year, Providence would not reach zero emissions in the commercial and industrial building sector by 2050.

Data collected from the Census Bureau from SEDS and LODES (LEHD Origin – Destination Employment Statistics).

Industrial Energy

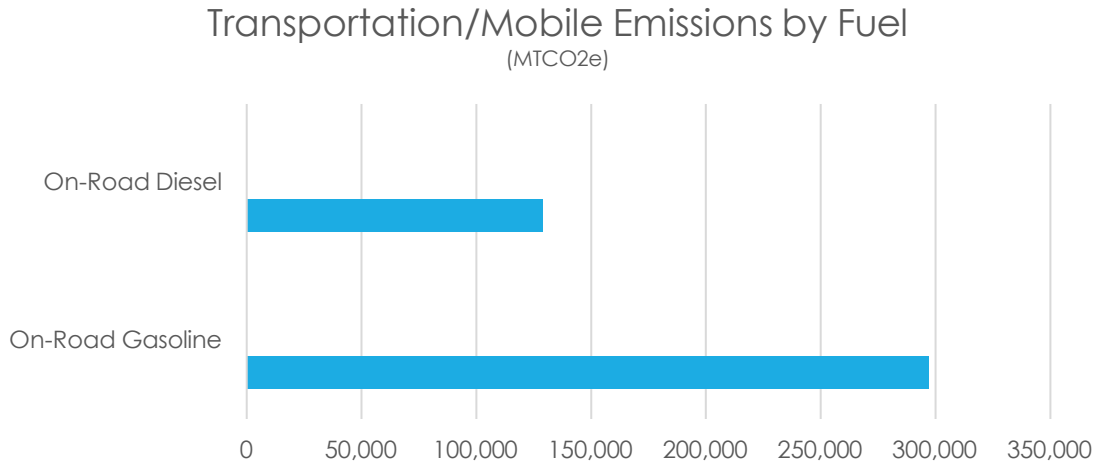


Manchester Street Power Plant has realized a major decrease in natural gas emissions, with a decrease of 25.5% from 2015 and an 18.5% decrease in emissions since 2018 from the power plant's natural gas emissions. However, natural gas still accounts for 98% of all emissions associated with the industrial energy sector.

Without factoring in a cleaner grid or advancements in decarbonization related technologies, if the rate of change between 2018 and 2021 were realized year-to-year, it would take Providence 12 years to reach zero emissions within this sector.

Data from the EPA's Greenhouse Gas Reporting Program (GHGRP) Facility Level Information on GHGs Tool (FLIGHT).

Transportation & Mobile Emissions



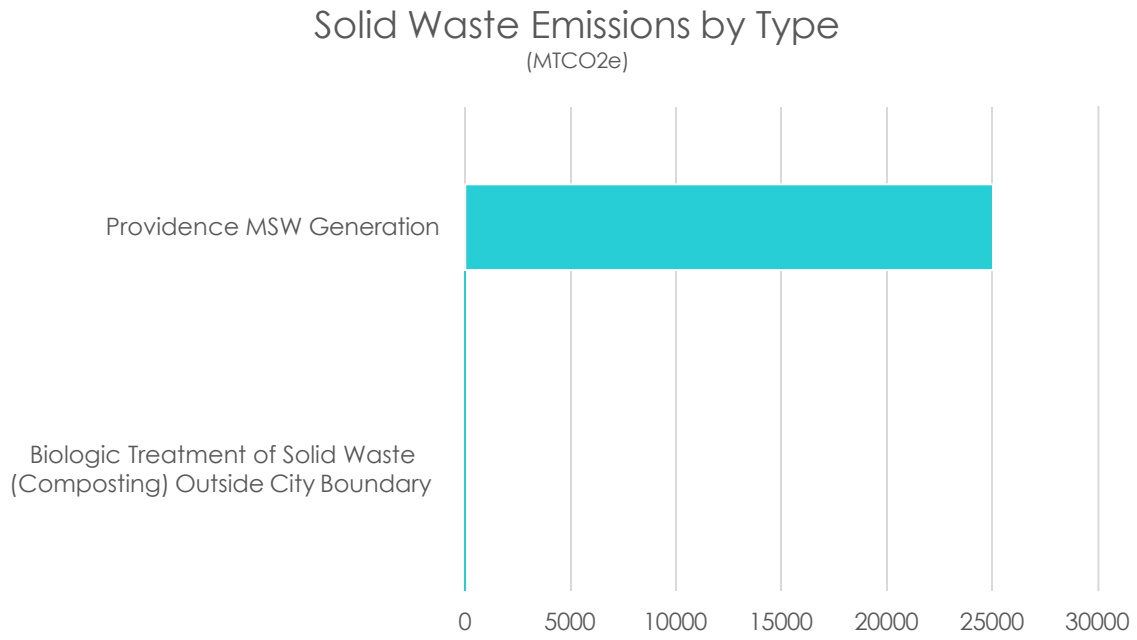
From 2015 to 2021, there was an approximate decrease of 22.8% in on-road gasoline emissions.

From 2018 to 2021, Providence realized a 16.5% decrease in on-road gasoline emissions.

Without factoring in a cleaner grid or advancements in decarbonization related technologies, if the rate of change between 2018-2021 were realized year-to year, it would take Providence about 27 years to reach zero emissions within this sector,

Data sourced from Google Environmental Insight Explorer (EIE).

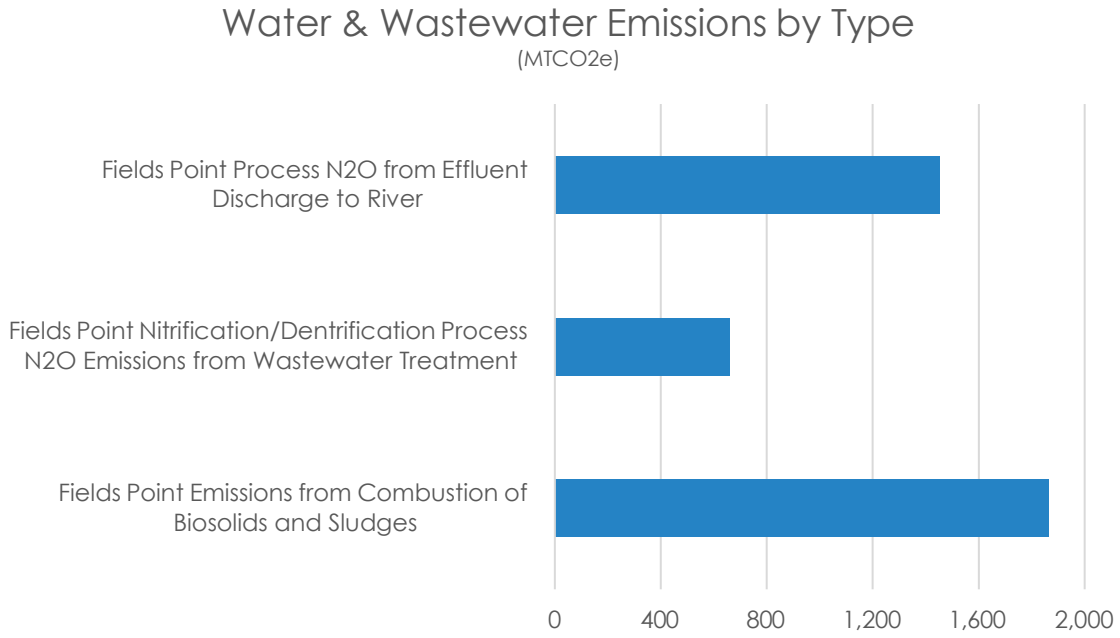
Solid Waste



From 2018 to 2021, Providence emitted 25,000 metric tons of CO_2-e from the disposal of solid waste materials. Emissions associated with Providence's municipal solid waste generation has increased by about 20.6% from 2015 and increased by about 25% since 2018. There has only been a slight decrease in emissions from biologic treatment from both 2015 to 2018 and 2018 to 2021.

Data sourced from the Rhode Island Resource Recovery Corporation (RIRRC).

Water & Wastewater

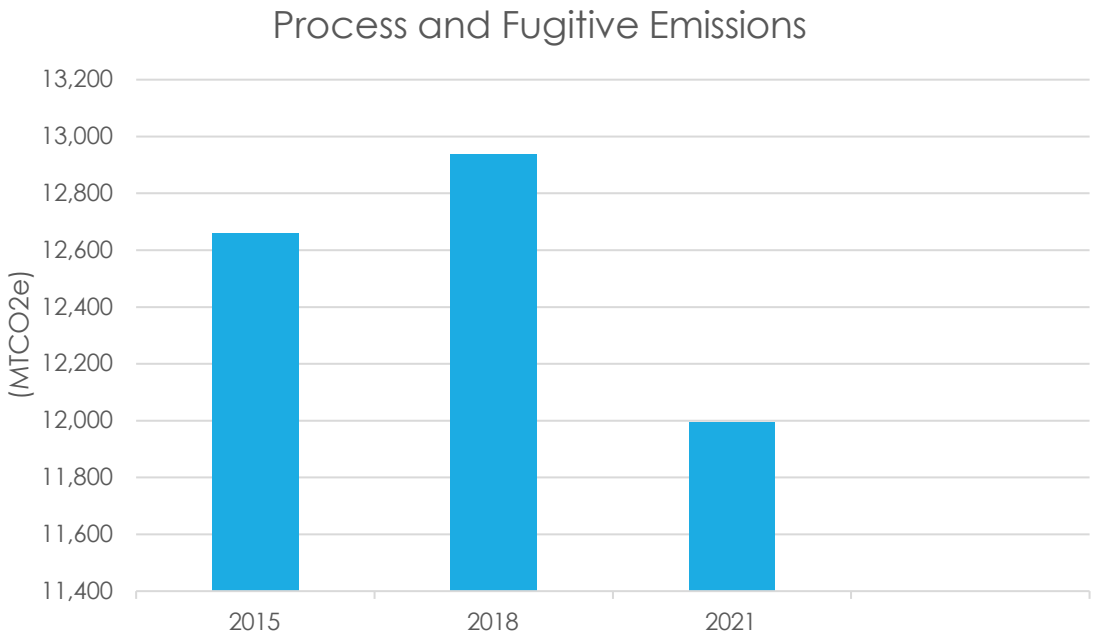


N_2O emissions from effluent discharge to river increased by 16.5% from 2015 to 2018 but increased by 80% from 2018 to 2021. N_2O emissions from nitrification/denitrification process from wastewater treatment increased by 7% and have remained relatively the same since 2015. There was a decrease in emissions from combustion of biosolids and sludges by 5.4% from 2015, and by 23% from 2018.

Overall waste and wastewater emissions have been increasing every inventory year since the baseline.

Data sourced from the Narragansett Bay Commission Field Point location.

Process & Fugitive



There has been a 5.2% decrease from 2015 to 2021 in process and fugitive emissions – emissions caused by leaky natural gas pipes – and a 7.3% decrease since 2018. The entirety of process and fugitive emissions was comprised of natural gas distribution.

Without factoring in a cleaner grid or advancements in decarbonization related technologies, if the rate of change between 2018 and 2021 were realized year-to-year, it would take Providence 39 years (2060) to reach zero emissions within this sector.

Data collected from RI Energy, total natural gas usage from the residential and commercial & industrial natural gas use.

Section 4 Appendix

Data/Methodology

The full methodology can be found in our 2021 Providence city-wide Greenhouse Gas Inventory Handbook.

The 2021 inventory was calculated following the US Community-Scale Track protocol using the International Council for Local Environmental Initiative's (ICLEI) Clear Path Software. A variety of both ICLEI and government data sets were utilized in the reporting of emission data. Default ICLEI factor sets were utilized to provide ClearPath with conversions and other figures which may be shared between multiple records in one or several inventories of the same year. Each inventory category comes with a preset series of "calculators." Calculators are tools that represent records, they allow you to input different types of information and, using built in methods and information provided in factor sets, calculate emissions. These calculators/records are used to represent a specific source or type of emissions.

The following factor sets were utilized:

Transportation - ICLEI provides a default factor set each inventory year, data was obtained from the EPA GHG Emission Factors Hub and the Federal Highway Administration's Highway Statistics.

Grid Electricity - For each inventory year, ClearPath requires emissions outputs rates for grid electricity production. For previous inventories, Providence has used data from the EPA's Emissions & Generation Resource Integrated Database (eGRID).

Waste Characterization - For each inventory year, ClearPath requires a breakdown of Municipal Solid Waste Generation by material. Sets have been sourced specifically from the EPA's Advancing Sustainable Materials Management Facts and Figures Report.

This inventory is a community-wide inventory encompassing all of Providence, a government wide inventory using the same methodology will be conducted for 2024 and future years. The city of Providence will bring this community-wide inventory methodology into alignment with the US DOE reporting protocols, as well as with our regional partner, PowerOptions who serves as the City's sustainability consultant and manages its energy management information platform, so that all three greenhouse gas reports can give different levels of analysis using the same methodology.