Washoe County Climate Action Plan

FEBRUARY 2025

03

The Community GHG Inventory

This Climate Action Plan Community GHG Inventory is one segment of a four-part Climate Action Plan:

01

The Climate Action Plan Introduction

provides foundational information about the characteristics of Washoe County, the local impacts of climate change and the community benefits expected from this plan. It also explains Washoe County's climate commitments, its authority, its implementation plans, and the vision for this plan.

02

The Washoe County Operations Climate Action Plan (COCAP)

provides data about GHG emissions data that result from County Operations, including fleet, buildings, and waste. It also includes a list of actions the County can implement to reduce its emissions.

→ **03**

YOU ARE HERE

The Community GHG Inventory

provides GHG emissions data for Community activities in the County across sectors such as Transportation, Building Energy, and Waste. It also provides details about the methodology for calculating the community-wide GHG emissions.

04

The Community Climate Action Plan (CAP)

defines actions that can help us protect our local climate, improve public health, and reduce risks associated with increased greenhouse gas (GHG) emissions, which trap heat in Earth's atmosphere.

Sustainability Division

Brian Beffort, Sustainability Manager
Emily Stapleton, Fuse Corps Executive Fellow

Table of Contents

Introduction from the Washoe County Commission Chair

Dear Washoe County Neighbors,

Major changes in Washoe County's climate require a responsible and rapid response. Our region is particularly vulnerable to a changing climate, The Reno area is the fastest-warming metro in the country, with direct impacts to public health and the environment. We all experience this in our everyday lives when we cannot work or play outside on certain high-temperature or smoke days, when insurance is hard to obtain or extremely expensive due to fire or flood risk, when our electric and food bills increase. We can all do something to fight climate change on a local level, and I am so proud that Washoe County is responding to this critical risk with the County's Climate Action Plan for both County Operations and Community-Wide.

Washoe County is committed to addressing inequalities in climate change impacts, particularly among Low Income and Disadvantaged Communities (LIDACs), ensuring that greenhouse gas emission-reduction solutions prioritize equity and racial justice. These temperature changes and related weather events like wildfire, flooding, and drought will have a significant impact on our residents, visitors, infrastructure, and economy. This Plan is the continuation of our commitment to reduce our region's contribution to climate change (i.e., greenhouse gas emissions, or GHGs) and prepare for its impacts. Evaluating County operations was a necessary first step for the County to lead in sustainability, resilience and climate action.

Community members contributed 500+ survey responses and provided input at dozens of events across the county and online. Many shared their stories, their concerns, their questions, and their expectations with us as we developed the Plan, input that will guide implementation.

Washoe County, the Board of Commissioners, and our strategic partners are committed to executing this plan quickly and equitably. With our shared future in mind, we hope each of you will join us in supporting the Plan and by taking action for a better planet in your own lives. I am so excited to implement this plan for a better more resilient future for my daughter and all the children in our community.

Sincerely,

Alexis Hill

Chair, Washoe Board of County Commissioners

Washoe County's mission, vision, and guiding principles

MISSION (why we exist as an organization)

Working together regionally to provide and sustain a safe, secure, and healthy community.

VISION (a concrete picture of the future)

Washoe County will be the social, economic and policy leadership force in Nevada and the western United States.

GUIDING PRINCIPLES

We approach our work by putting first our community responsibility to:

- **Support and represent the people we serve.** Elevate the quality of life so our community is a great place for everyone to live, regardless of means. We support and believe in diversity, inclusivity, and accessibility to all.
- **Be forward thinking.** We will make decisions that are future looking, support economic diversification and are financially sustainable.
- **Protect our natural resources.** Be caretakers of the environment so we preserve our region for future generations.
- **Collaborate within and across the County.** Nurture and strengthen collaboration regionally with citizens, community organizations, nonprofits, business, and government agencies.
- **Commit to digital delivery.** Drive a fundamental change through the value chain of County services by continuing digital delivery of services and processes where the outcomes for citizens and staff are improved.
- **Reduce redundancies and non-value adds.** Reduce non-value add steps in the process. Stop non-essential services by deconstructing and reconstructing where we can.
- **Show up as "One County" externally and internally.** Promote the idea that we are "One County" instead of independent entities, while also celebrating the uniqueness of each department.

Strategic Objectives

Washoe County focuses our work in the following categories:

Fiscal Sustainability

- Restore fiscal stability from impacts of COVID-19 pandemic
- Long-term sustainability
- Efficient delivery of regional services

Economic Impacts

- Meet the needs of our growing community
- Support a thriving community
- Plan for expanded wastewater & storm water

Vulnerable Populations

- Address homelessness with a regional approach
- Expand appropriate housing options across community
- Coordination between agencies & communication of programs

Innovative Services

- Leverage technology to streamline and automate
- Strengthen our culture of service
- Promote experimentation and innovation

Washoe County's goal to reduce greenhouse gas emissions to net-zero by 2050 supports the County's Strategic Objective: Economic Impacts; Support a thriving community. Our Net-Zero goal – and the County's Sustainability program overall – supports all the above Strategic Objectives and Goals.

Learn more here about **Washoe County's Strategic Objectives with Performance Reports on our progress.**

Acknowledgments

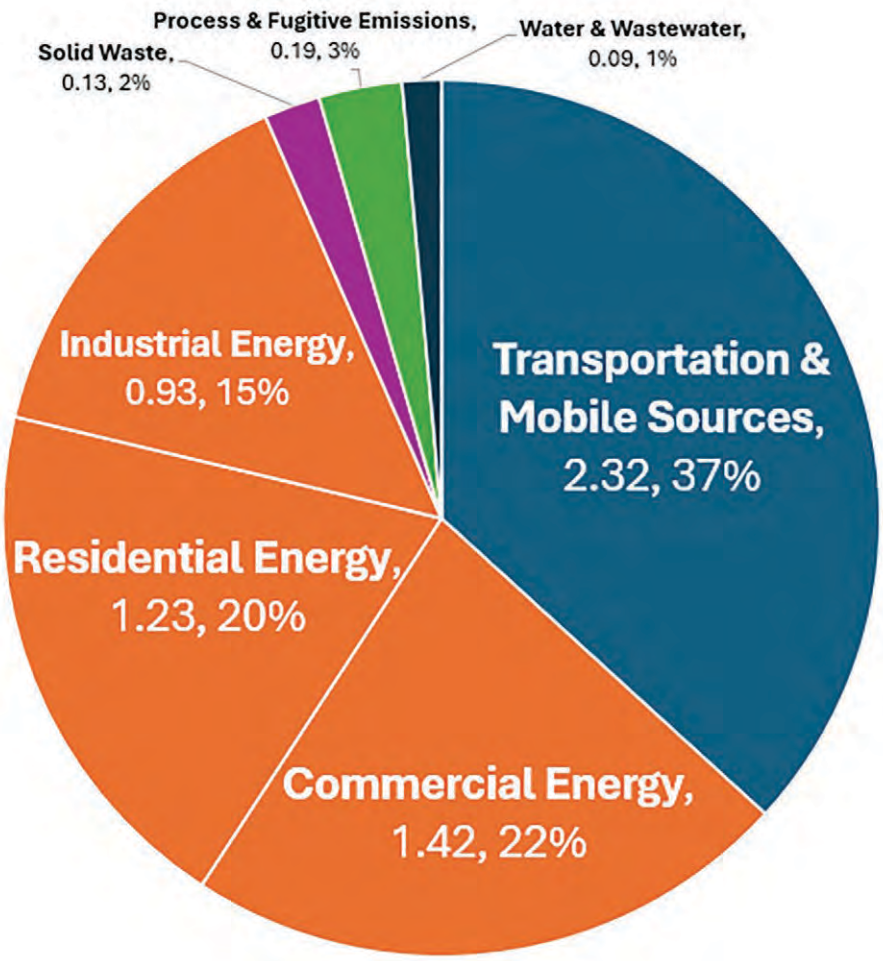
The Washoe County Community Emissions Reduction Plan was developed by the Office of the County Manager, Sustainability Division, with support from a Fuse Corps Executive Fellow. Development of the plan would not have been possible without leadership from the County Manager's Office and collaboration across county and regional agencies. A list of local specialists who provided operations data for 2021 Washoe County Inventory is in **Appendix 1.**

A. Executive Summary

2021 Community-wide GHG emissions

Total community wide greenhouse gas (GHG) emissions for Washoe County in 2021 were 6.32 million metric tons (MMT) carbon dioxide equivalent (CO_2e). 37% of emissions come from Transportation, 22% from Commercial Energy, 20% from Residential Energy, 15% from Industrial Energy, 2% from Solid Waste, 3% from Process & Fugitive Emissions, 1% from Water & Wastewater, and less than 1% from Agriculture, Forestry, and Other Land Use (AFOLU). This inventory includes emissions for City of Reno, City of Sparks, and Unincorporated Washoe County. It was calculated using ICLEI's Clearpath software, and it uses 100-year global warming potentials (GWPs) from the Intergovernmental Panel on Climate Change (IPCC)'s 6th Assessment Report (AR).

2021 Washoe County Community Emissions (MMT CO2e)



2021 Washoe County Community Emissions (MMT CO2e)

Sector	MMT CO2e	% CO2e
Transportation & Mobile Sources	2.32	37%
Commercial Energy	1.42	22%
Residential Energy	1.23	20%
Industrial Energy	0.93	15%
Solid Waste	0.13	2%
Process & Fugitive Emissions	0.19	3%
Water & Wastewater	0.09	1%
Agriculture	0.002	<1%
Total	**6.32**	**100%**

From 2008 to 2021, community-wide emissions increased 4% from 6.09 MMT CO2e to 6.32 MMT CO2e. See **Appendix 4** for 2008 total emissions and for a comparison between the 2008, 2014, and 2021 data.

Several elements of analysis have changed in the 14 years between the writing of the 2008 report in 2010 and the writing of the 2021 report in 2024. Operators' ability to retrieve and report data has improved. State and federal data sources have expanded. The science of GHG warming potentials and associated factor sets has improved. The US Community Protocol for GHG inventories has evolved. The quality of GHG analysis has thus improved with time. Previous years' data still provides valuable point-in-time snapshots, though these differences in methodology, data quality, and data inputs cause variability in data outputs. Because of ongoing improvement of data and methods, an in-depth comparison between the most recent 2014 inventory provides the best insights about changes in emissions in our region.

The community-wide inventory in 2014 measured 4.52 MMT CO2e. About half of the 1.80 MMT CO2e difference between 2014 and 2021 comes from direct emissions growth (0.84 MMT CO2e), and the rest comes from improvements in methodology (0.96 MMT CO2e). These methodology improvements include the addition of nonroad transportation (~0.50 MMT CO2e), the expansion of "point source" stationary fuels such as motor gasoline to Industrial Energy (0.30 MMT CO2e), and the addition of Fugitive Emissions (0.19 MMT CO2e).

When the key methodology differences between the 2014 and 2021 inventories are removed, the "direct growth," or "apples to apples" comparison between the two inventories is an 18% increase, from 4.52 MMT CO2e to 5.33 MMT CO2e.

Comparison of emissions (MMT CO2e), 2014 to 2021: total vs. "direct" change

Sector	2014 Total	2021 Total	% Total change	MMT CO2 change due to Methods	2021 Total w/o Method Change	% "Direct" Change
Transportation	1.46	2.32	60%	0.50	1.83	26%
Commercial energy	1.28	1.42	11%	0	1.42	11%
Residential energy	1.28	1.23	(3%)	0	1.23	(3%)
Industrial energy	0.25	0.93	266%	0.30	0.63	148%
Solid Waste	0.20	0.13	(33%)	0	0.13	(33%)
Process & Fugitive	0.00	0.19	-	0.19	0	n/a
Water & Wastewater	0.03	0.09	202%	0	0.09	202%
Agriculture	0.03	0.002	-	(0.03)	0	0%
TOTAL	**4.52**	**6.32**	**40%**	**0.96**	**5.33**	**18%**

GHG Emissions, compared with GDP and Population growth

The "apples to apples" emissions growth of 18% between 2014 and 2021 shows slower emissions growth than economic growth, which increased 29% over the same time period. While emissions need to decrease instead of increase to reach a Net Zero goal, a slower rate of emissions growth compared with economic growth is a better outcome than emissions matching or exceeding GDP growth.

Washoe County Population, GDP, and Emissions Comparison: 2014 to 2021

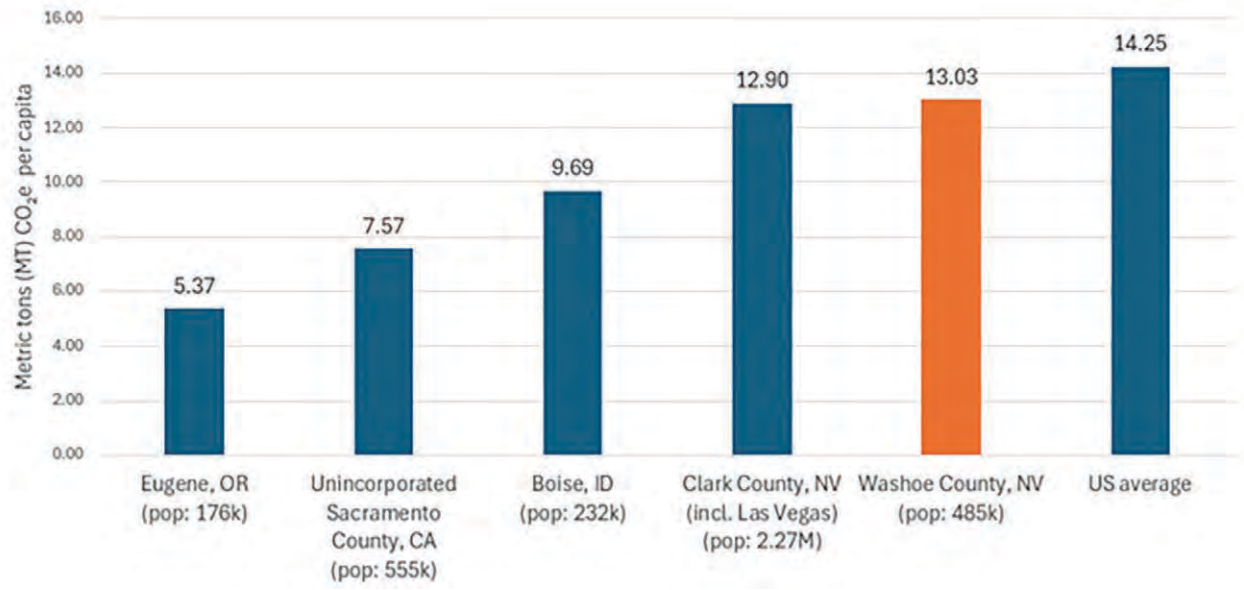
Category	2014	2021	% change
Gross Domestic Product (GDP) *in thousands chained (2017 dollars)*	$ 23,682,755	$30,542,848	29%
GHG Emissions (MMT) - total	4.52	6.32	40%
GHG Emissions (MMT) – apples:apples, "direct" growth	4.52	5.35	18%
Population	436,797	485,113	11%
Per Capita GHG	10.34	13.03	26%
Per Capita GHG – apples:apples, "direct" growth	10.34	11.04	7%

Sources: population: NV State Demographer, GDP: US Bureau of Economic Analysis

Per capita emissions increased 26% from 2014 (10.34 MT CO2e) to 2021 (13.03 MT CO2e). After removing methodology-related emissions increases, per capita emissions increased 7%, from 10.34 to 11.04 MT CO2e. This 7% "apples to apples" increase is lower than the 11% population increase over the same time frame. Similar to GDP growth comparisons, a slower rate of methodology-adjusted emissions growth is favorable to emissions matching or exceeding population growth. However, to reach net zero, overall emissions and per capita emissions must both decrease, even as the population may increase.

Washoe County's per capita emissions of 13.03 MT CO2e in 2021 were lower than the national average of 14.25 MT CO2e per capita emissions, though higher than other Mountain West cities like Eugene, OR (5.37 MT CO2e), Unincorporated Sacramento County, CA (7.57 MT CO2e), Boise, ID (9.69 MT CO2e), or Clark County, NV (12.90 MT CO2e), where Las Vegas is located. Different jurisdictions may use different inventory tools and methodologies, so these numbers are directionally informative, but they are not exact comparisons.

2021 Washoe County Per Capita GHG Emissions compared with Mountain West and US average



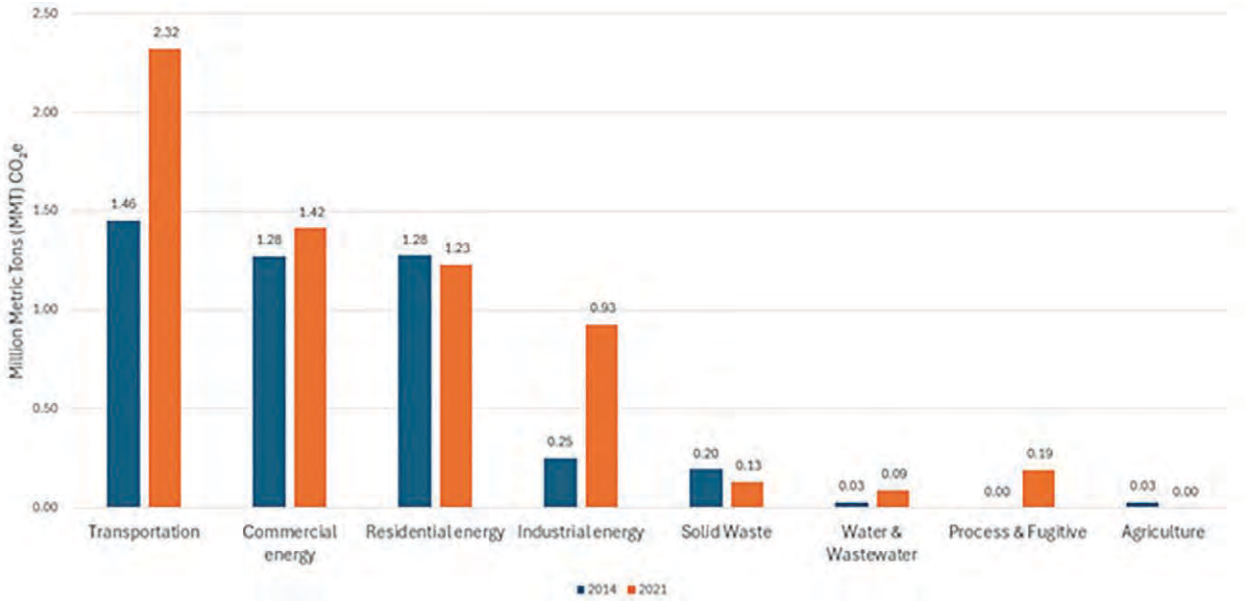
Per capita annual MT CO2e in the Mountain West

Jurisdiction	MT CO2e	Population
Eugene, OR	5.37	176,000
Unincorporated Sacramento County, CA	7.57	555,000
Boise, ID	9.69	232,000
Clark County, NV (incl. Las Vegas)	12.90	2,270,000
Washoe County, NV	13.03	485,000
US average	14.25	-

Comparisons by sector between 2014 and 2021 inventories

The chart below shows differences by sector that caused Washoe County's Community-wide emissions to increase 40% from 4.52 MMT CO2e in 2014 to 6.32 MMT CO2e in 2021.

Comparison of emissions (MMT CO2e), 2014 to 2021



Comparison of emissions (MMT CO2e), 2014 to 2021: change analysis

Sector	2014 Total	2021 Total	Change: Total	% of Total	Change: Methods	Change: Direct	% of Direct
Transportation	1.46	2.32	0.87	45%	0.50	0.37	39%
Commercial energy	1.28	1.42	0.14	7%	0	0.14	15%
Residential energy	1.28	1.23	(0.04)	-	0	(0.04)	-
Industrial energy	0.25	0.93	0.68	35%	0.30	0.38	40%
Solid Waste	0.20	0.13	(0.07)	-	0	(0.07)	-
Water & Wastewater	0.03	0.09	0.06	3%	0	0.06	6%
Process & Fugitive	0.00	0.19	0.19	10%	0.19	0	-
Agriculture	0.03	0.002	(0.03)	-	(0.03)	0	-
TOTAL (net)	**4.52**	**6.32**	**1.80**	**-**	**0.96**	**0.84**	**-**
increase			**1.94**	**100%**	**0.99**	**0.95**	**100%**
reduction			**(0.14)**		**(0.03)**	**(0.11)**	

Table note: "% of total" indicates the percent of total emissions *growth* that each sector causes. "% of direct" indicates the percent of "apples to apples" emissions *growth* by sector. These figures are different than % of Total.

Almost half of the increased emissions in Washoe County came from the Transportation sector, which had 60% more emissions in 2021 than 2014 (+0.87 MMT CO2e). Most of this difference (+0.50 MMT CO2e) is because Nonroad transportation is included in the 2021 inventory but was not calculated in 2014. The largest amount of direct emissions growth came from on-road diesel emissions, which grew 0.38 MMT CO2, or 4 times larger (0.12 to 0.50 MMT CO2e). Emissions from aviation grew 0.13 MMT, doubling from 0.12 to 0.25 MMT CO2e. On-road VMT and corresponding emissions decreased 0.14 MMT CO2e between 2014 – 2021 (1.17 to 1.03 MMT CO2e). However, some of the differences in both gasoline and diesel on-road numbers could be a result of different data sources for vehicle miles traveled (VMT) data in the 2014 inventory (RTC Washoe) versus the 2021 inventory (Google Environmental Insights Explorer).

Total Energy emissions also increased between 2014 and 2021, by 28% (0.77 MMT CO2e). Industrial energy is the largest contributor to the sector's growth, with emissions growing 2.5 times, or 0.68 MMT CO2e, between 2014-2021 (0.25 to 0.93 MMT CO2e). Almost half of that increase (0.30 MMT CO2e) comes from methodology improvements related to calculations of emissions from stationary energy sources like fuel oil, natural gas, propane, motor gasoline. The remainder (0.38 MMT CO2e) comes from direct emissions increases of 0.35 MMT CO2e from increased electricity use and 0.03 MMT CO2e from increased natural gas use. Commercial energy grew more modestly at 11%, with a total increase of 0.14 MMT CO2e, mostly from increased electricity emissions (+0.07 MMT CO2e) and natural gas emissions (+0.06 MMT CO2e). Some of the large difference between Industrial and Commercial emissions growth between 2014 to 2021 may be due, in part, to NV Energy customer classifications of industrial and commercial customers in data exports between the two inventories, as some Industrial Energy was included in the Commercial figure in 2014. Emissions nevertheless increased in both sectors in 2021.

Residential energy, meanwhile, showed a 4% (0.04 MMT CO2e) decrease in emissions between 2014 and 2021. Notably, residential electricity use grew 26% from 1.3 to 1.7 MWh, but emissions decreased 20% from 0.72 to 0.58 MMT CO2e. This is largely due to the NV Energy's cleaning of the electrical grid. A Sustainability Report is not available for 2014, but NV Energy's 2017 report shows an "emissions intensity" of 930 pounds per megawatt hour (lbs / MWh). This had decreased to 729 lbs / MWh by 2021. These improvements, perhaps coupled with individual household behavior changes (e.g. increased use of smart thermostats, turning off lights, etc) outpaced the increased electricity demand that likely came with 12% growth in new housing, over this time. Commercial energy shows the same effect: a 41% increase in energy use (2.3 to 3.2 MWh), but only a 7% increase in emissions, from 1.01 to 1.06 MMT CO2e.

Solid waste emissions decreased 33% between 2014 and 2021 (0.20 to 0.13 MMT CO2e), through the sector has a small amount of total emissions, so the 0.07 MMT CO2e emissions savings has a modest impact on overall emissions. Landfilled waste in Washoe County shrank almost 50% between inventories, from 571,663 tons in 2014 to 300,775 tons in 2021. This change in landfilled tonnage may be attributable to evolving data calculation methods and / or improved recycling rates. The 2014 inventory reported a recycling rate of 37.5%, while rates as of 2024 were as high as 97% for single family. The recycling rate for multi-family homes was 54.5% and for commercial accounts was 9.5%.

Water and wastewater emissions tripled between the 2014 and 2021 inventory from 0.03 to 0.09 MMT CO2e, though—similar to Solid Waste—the overall amount of emissions is very low compared with the rest of the inventory. Some of the additional emissions (0.01 MMT CO2e)

came from the inclusion of providers that were not included in the 2014 inventory, including the Incline Village General Improvement District (GID), Great Basin Water Company, Sun Valley GID, and Gerlach GID, as well as the addition of the impact of septic tanks. The Truckee Meadows Water Authority (TMWA) is included in both inventories and still provides >92% of the water to the community in Washoe County. TMWA's reported population-served of 444,182 in 2021 was almost exactly the same as the population served in 2014, with only a 5% increase in millions of gallons delivered (27.9 million in 2021). Likewise, wastewater volume only increased 6% between 2014 to 2021, to 13 million gallons of water processed. Neither of these services scaled proportionally to the 11% population growth during this time.

The 2021 inventory measures Process & Fugitive Emissions, which were not included in the 2014 report. After Transportation (0.87 MMT CO2e) and Industrial Energy (0.68 MMT CO2e), this sector has the largest contribution (0.19 MMT CO2e) to overall emissions increase between 2014 – 2021. That said, these cause a small percentage (3%) of overall emissions. Washoe County does not have reportable process emissions. Fugitive emissions in Washoe County from the distribution of natural gas as well as uses such as electric power systems, fire extinguishing, refrigeration, aerosols, foams and solvents.

And finally, emissions from Agriculture remained very small in 2021 (<1% of total emissions). Agricultural emissions appear to have decreased in 2021, but that is because the USCP "optional" category of Livestock is not included in the 2021 inventory. despite its inclusion in 2014. Livestock emissions are likely similar to the very small (0.03 MMT) amount recorded in the 2014 inventory. The Agriculture section of this inventory includes only the emissions from electricity used to serve agricultural needs. Sequestration, or carbon removals, are calculated as part of this inventory (see section E8, AFOLU), but the USCP does not require the -0.05 MMT net CO2e removals be added to gross / total emissions for a "net" total emissions number.

A detailed table with GHG sources and CO2e emissions by sector for 2021 is below. A full comparison of 2021 data with 2014 data is in **Appendix 5**.

Table of 2021 Washoe County Community GHG Sources and Emissions

2021 emissions by Fuel or Source: Transportation

Org providing data	Type	Fuel or Source	2021 Usage	Usage Unit	2021 Emissions (MT CO2e)
Google EIE	On Road	Gasoline	2,677,846,997	VMT	1,034,447
Google EIE	On Road	Diesel	347,968,818	VMT	499,772
EPA NEI	Nonroad	Diesel	-	-	387,405
EPA NEI	Nonroad	Gasoline	-	-	90,949
EPA NEI	Nonroad	LPG	-	-	15,158
EPA NEI	Nonroad	CNG	-	-	1,796
RNO Airport	Ground Ops	Diesel	87,846	Gallons	905
RNO Airport	Ground Ops	Gasoline	70,937	Gallons	628
Reno-Stead Airport	Ground Ops	Diesel	5,013	Gallons	52
Reno-Stead Airport	Ground Ops	Gasoline	1,704	Gallons	15
RNO Airport	Commercial (Passenger)	Jet Kerosene	14,948,972	Gallons	146,246
RNO Airport	Freight	Jet Kerosene	4,926,489	Gallons	48,196
RNO Airport	General Aviation	Jet Kerosene	4,074,471	Gallons	39,861
RNO Airport	General Aviation	Aviation Gas	155,118	Gallons	1,294
Reno-Stead					
Airport	General Aviation	Jet Kerosene	488,146	Gallons	4,776
Reno-Stead					
Airport	General Aviation	Aviation Gas	99,619	Gallons	831
RNO Airport	Air National Guard (ANG)	Jet Kerosene	842,075	Gallons	8,238
EPA NEI	Rail, Commercial	Diesel	-	-	23,113
EPA NEI	Rail, Passenger	Diesel	-	-	702
EPA NEI	Water, Pleasure Craft	Gasoline	-	-	14,903
EPA NEI	Water, Pleasure Craft	Diesel	-	-	3,616

2021 emissions by Fuel or Source: Transportation (Continued)

Org providing data	Type	Fuel or Source	2021 Usage	Usage Unit	2021 Emissions (MT CO2e)
RTC Washoe	Buses	Electric	1,020,784	kWh	338
RTC Washoe	Buses	Bio-diesel	568,890	Gallons	1
RTC Washoe	Regional Connector Bus (Carson City)	Electric	250,159	kWh	72
RTC	Paratransit and Flexride	Gasoline	13,504	Gallons	122
RTC	Paratransit and Flexride	CNG	179,175	Gallons	118
Transportation Total					**2,323,551**

Table of 2021 Washoe County Community GHG Sources and Emissions

2021 emissions by Fuel or Source: Commercial Energy

Org providing data	Type	Fuel or Source	2021 Usage	Usage Unit	2021 Emissions (MT CO2e)
NV Energy	Commercial	Electricity	3,217,822	MWh	1,065,100
NV Energy	Municipal	Electricity	54,895	MWh	18,170
SVEC	Commercial	Electricity	65	MWh	19
PSREC	Commercial	Electricity	57	MWh	16
NV Energy	Commercial	Natural Gas	51,617,010	Therms	274,516
SW Gas	Commercial	Natural Gas	1,738,311	Therms	9,246
NV Energy	Commercial	LPG	39,772	Therms	2,528
EIA	Commercial	Fuel Oil	356,535	MMBtu	26,281
EIA	Commercial	Propane (HGL)	307,917	MMBtu	19,430
EIA	Commercial	Wood	64,825	MMBtu	632
Commercial Energy Total					**1,415,938**

Table of 2021 Washoe County Community GHG Sources and Emissions

2021 emissions by Fuel or Source: Residential Energy

Org providing data	Type	Fuel or Source	2021 Usage	Usage Unit	2021 Emissions (MT CO2e)
NV Energy	Residential	Electricity	1,748,938	MWh	578,899
PSREC	Residential	Electricity	4,882	MWh	1,414
SVEC	Residential	Electricity	44	MWh	13
NV Energy	Residential	Natural Gas	105,955,133	Therms	563,504
SW Gas	Residential	Natural Gas	8,171,381	Therms	43,458
NV Energy	Residential	LPG	221,669	Therms	14,092
EIA	Residential	Propane (HGL)	405,268	MMBtu	24,184
EIA	Residential	Fuel oil	52,861	MMBtu	3,694
EIA	Residential	Wood	370,027	MMBtu	3,384
Residential Energy Total					**1,232,642**

Table of 2021 Washoe County Community GHG Sources and Emissions

2021 emissions by Fuel or Source: Industrial

Org providing data	Type	Fuel or Source	2021 Usage	Usage Unit	2021 Emissions (MT CO2e)
NV Energy	Industrial	Electricity	1,598,279	MWh	529,031
NV Energy	Industrial	Natural Gas	19,039,233	therms	101,050
EIA	Industrial	Fuel Oil	3,511,184	MMBtu	258,056
EIA	Industrial	Propane (HGL)	161,434	MMBtu	10,152
EIA	Industrial	Motor Gasoline	464,122	MMBtu	31,131
EIA	Industrial	Wood	20,179	MMBtu	41
Industrial Energy Total					**929,461**

Table of 2021 Washoe County Community GHG Sources and Emissions

2021 emissions by Fuel or Source: Solid Waste

Org providing data	Type	Fuel or Source	2021 Usage	Usage Unit	2021 Emissions (MT CO2e)
WM	Waste	Waste Generated	300,775	Tons	130,466
WM	Flaring	Landfill Gas	261,858,830	Cubic ft / yr	28
WM	Combustion	Landfill Gas	380,450,265	Cubic ft / yr	0.53
Solid Waste Total					**130,495**

Table of 2021 Washoe County Community GHG Sources and Emissions

2021 emissions by Fuel or Source: Water & Wastewater (Water)

Org providing data	Type	Fuel or Source	2021 Usage	Usage Unit	2021 Emissions (MT CO2e)
TMWA	Potable Water	Electricity	65,183,869	kWh	28,126
TMWA	Potable Water	Natural Gas	123,170	MMBtu	included
in elec. #	Combustion	Landfill Gas	380,450,265	Cubic ft / yr	0.53
IVGID	Potable Water	Electricity	3,932,368	kWh	1,311
IVGID	Potable Water	Natural Gas	1,761	kWh	included in elec. #
Great Basin Water Co	Potable Water	Electricity	1,346,223	kWh	446
Sun Valley GID	Potable Water	Electricity	517,390	kWh	205
Sun Valley GID	Potable Water	Natural Gas	6,271	MMBtu	included in elec. #
Gerlach GID	Potable Water	Electricity	15,712	kWh	15
Gerlach GID	Potable Water	Propane	1,872	therms	included in elec#
TMWRF	Energy Use	Electricity	25,268,000	kWh	8,483
TMWRF	Combustion	Digester Gas	385,920	scf/day	19
TMWRF	Flaring	Digester Gas	184,320	scf/day	35,075
TMWRF	Wastewater Treatment	Nitrification / Denitrification	363,000	people	867

2021 emissions by Fuel or Source: Water & Wastewater (Water) (Continued)

Org providing data	Type	Fuel or Source	2021 Usage	Usage Unit	2021 Emissions (MT CO2e)
TMWRF	Effluent	Nitrification	216	Kg N / day	169
TMWRF	Wastewater Treatment	Methanol	8.9	MT CH3OH / day	3,563
Washoe County	Energy Use	Electricity	8,754,862	kWh	2,898
Washoe County	Wastewater Treatment	Nitrification / Denitrification	26,717	people	64
Washoe County	Effluent	Nitrification	155	Kg N / day	121
Reno Stead WRF	Energy Use	Electricity	5,071	kWh	1,795
Reno Stead WRF	Energy Use	Natural Gas	22,323	therms	Included in elec. #
Reno Stead WRF	Wastewater Treatment	Nitrification / Denitrification	28,000	people	67
Reno Stead WRF	Effluent	Nitrification	41	Kg N / day	32
IVGID	Energy Use	Electricity	1,698,637	kWh	636
IVGID	Energy Use	Natural Gas	14,829	therms	included in elec. #
Gerlach GID	Energy Use	None	125	people	0
Septic	Fugitive Emissions	Methane	0.09	Kg BOD5 / day	6,783
Water & Wastewater Total					**90,655**

Table of 2021 Washoe County Community GHG Sources and Emissions

2021 emissions by Fuel or Source: Process & Fugitive Emissions

Org providing data	Type	Fuel or Source	2021 Usage	Usage Unit	2021 Emissions (MT CO2e)
listed above	Fugitive	Natural Gas	188,150,339	therms	34,741
EPA	Fugitive	Refrigeration	-	-	106,453
EPA	Fugitive	Non-MDI Aerosols	-	-	15,614
EPA	Fugitive	Electric Power Systems	-	-	14,150
EPA	Fugitive	Foams	-	-	13,455
EPA	Fugitive	Solvents	-	-	3,027
EPA	Fugitive	MDI Aerosols	-	-	2,455
EPA	Fugitive	Fire Extinguishing	-	-	3,776
Process & Fugitive Emissions Total					**193,669**

Table of 2021 Washoe County Community GHG Sources and Emissions

2021 emissions by Fuel or Source: Agricultural

Org providing data	Type	Fuel or Source	2021 Usage	Usage Unit	2021 Emissions (MT CO2e)
NV Energy	Energy Use	Electric	7,368,753	kWh	2,439
PSREC	Energy Use	Electric	96,139	kWh	28
Agricultural Total					**2,467**

TOTAL GROSS EMISSIONS: 6,318,880

Table of 2021 Washoe County Community GHG Sources and Emissions

2021 emissions by Fuel or Source: Agriculture, Forestry, and Other Land Use

Org providing data	Type	Fuel or Source	2021 Usage	Usage Unit	2021 Emissions (MT CO2e)
ICLEI	Trees outside of Forests	Emissions	9	hectares	523
ICLEI	Trees outside of Forests	Removals	4,433	hectares	-43,360
ICLEI	Undisturbed Forests	Removals	36,255	hectares	-31,046
ICLEI	Non-Forest to Forest	Removals	2,469	hectares	-2,913
ICLEI	Forest Disturbances	Emissions	7,019	hectares	10,570
ICLEI	Forest to Grassland	Emissions	605	hectares	15,352
ICLEI	Forest to Other	Emissions	6	hectares	1,245
ICLEI	Forest to Wetland	Emissions	798	hectares	1,112
ICLEI	Forest to Settlement	Emissions	60	hectares	701
ICLEI	Forest to Cropland	Emissions	0.1	hectares	0
Forests & Trees Total					**-47,816**

TOTAL EMISSIONS, WITH SEQUESTRATION: 6,271,064

B. Climate in Washoe County

Washoe County has a diverse population covering 6,540 square miles of urban, suburban, and rural land. 485,113 people lived in Washoe County in 2021, with 264,318 people living in Reno, Washoe County's largest urban area, and 107,489 people living in Sparks, the second largest urban area. Almost 113,306 people lived in Unincorporated Washoe County.

Reno is the fastest-warming metro in the US. Warming winter temperatures have resulted in more precipitation falling as rain instead of snow, which has caused declining snowpack in the Sierra Nevada. Predominant drought conditions are projected to be punctuated by more intense storms. In Nevada and elsewhere in the American West, wildfires are becoming more frequent and hotter, destroying homes, forests, and choking our region with dangerous smoke, sometimes intensely. To read more about the impacts of a changing climate in Washoe County, visit the **Introduction** to this Climate Action Plan.

According to FEMA's climate risk map, Washoe County's climate risk is designated "Relatively High," making Washoe County one of the two most vulnerable counties in NV and one of the most vulnerable counties nationwide as well. See Figure 1.

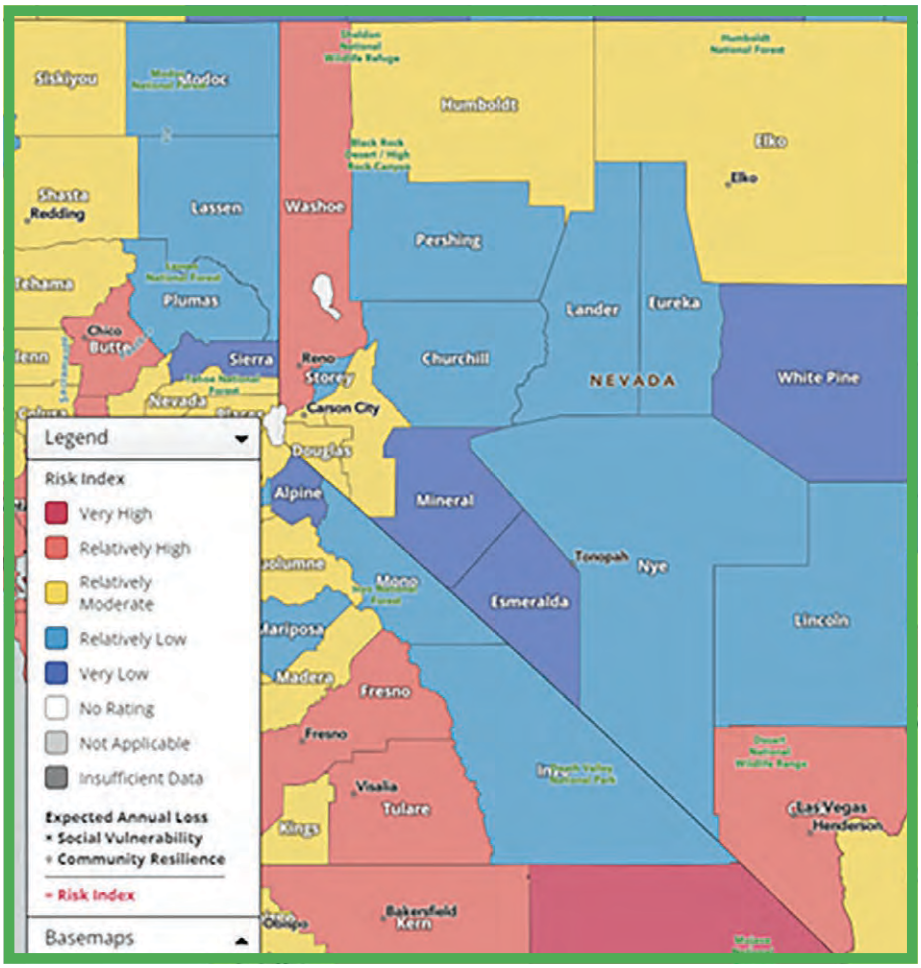


Figure 1: The State of Nevada on FEMA's Climate Risk Map. Source: FEMA National Risk Index

C. What are GHG Emissions, and why is Washoe County measuring them?

What are GHG Emissions?

Naturally occurring gases dispersed in the atmosphere determine the Earth's climate by trapping solar radiation. This phenomenon is known as the greenhouse effect.

This greenhouse effect causes global average surface and lower atmospheric temperatures to rise, threatening the safety, quality of life, and economic prosperity of global communities. Although the natural greenhouse effect is needed to keep the earth warm, a human-enhanced greenhouse effect with the rapid accumulation of greenhouse gases (GHGs) in the atmosphere leads to too much heat and radiation being trapped. See Figure 2.

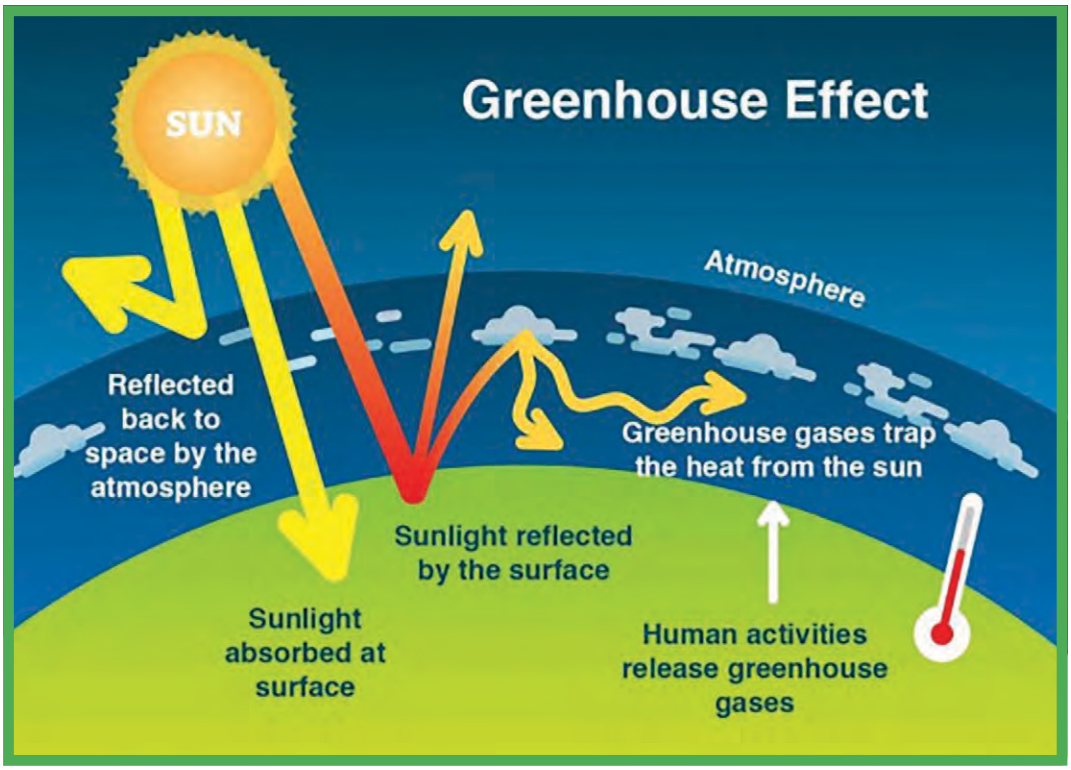


Figure 2: The Greenhouse Effect. Some of the sun's rays are absorbed by Earth's surface, some are reflected back into space, and greenhouse gases trap some in the atmosphere, warming the climate.

The Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report confirms that human activities have unequivocally caused an increase in the carbon emissions that are warming our planet. The most significant contributor to carbon dioxide and other greenhouse gases into the atmosphere is the burning of fossil fuels for transportation, electricity generation and other purposes. This Community-wide GHG Inventory measures the contribution of these human activities in Washoe County to the warming climate.

Why Measure Community GHG Emissions? Washoe County, like many other governments around the world, has committed to measuring and reducing greenhouse gas emissions

(GHGs) in its community. A Community GHG inventory estimates the quantity of GHG emissions and removals associated with community sources and activities taking place during a chosen analysis year. The inventory can then be used for many purposes, such as informing climate action planning, communicating with the public, and tracking GHGs over time.

In 2019, the State of Nevada Legislature passed Senate Bill 254, establishing GHG reduction targets, and by conducting this inventory, Washoe County is supporting State of Nevada efforts by adopting the same ambitious emission reduction targets:

- 28 percent by 2025
- 45 percent by 2030
- Net-zero by 2050

Further, Washoe County designated a goal to Reduce GHG Emissions in its April 2022 ***Washoe County Green Recovery Plan***. Two of the strategies under this goal include: 1) Conduct a community-wide GHG inventory to monitor and report progress, and 2) Establish GHG reduction targets that align with state and federal targets.

D. GHG Inventory methodology

GHGs Three greenhouse gases are included in this inventory: carbon dioxide (CO2), methane (CH4), and nitrous oxide (N2O). Many charts in this report represent emissions in "carbon dioxide equivalent" (CO_2e) values, calculated using the Global Warming Potentials for methane and nitrous oxide from the IPCC 6th Assessment Report. Global Warming Potentials (GWPs) are the warming effect of an emission of 1kg of each gas relative to that of CO2.

100 year Global Warming Potentials (GWPs)

Greenhouse Gas	Global Warming Potential
Carbon Dioxide (CO2)	1
Methane (CH4)	21
Nitrous Oxide (N2O)	290

Source: page XXI of the IPCC 6th Assessment

US Community Protocol Washoe County used the ClearPath Climate Planner tool to calculate 2021 community-wide GHG emissions. ClearPath is produced and supported by the non-profit ICLEI, "Local Governments for Sustainability." Washoe County also used earlier versions of Clearpath for its 2008 and 2014 inventories. See 2008 and 2014 inventory summary results in **Appendix 4.**

The 2021 inventory follows the U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions, Version 1.2, published July 2019, which aligns with the Global Protocol for Community-Scale Greenhouse Gas (GHG) Inventories. As local governments continue to join the climate protection movement, the need for a standardized approach to quantify GHG emissions is essential. The US Community Protocol (USCP) represents a national standard in guidance to help U.S. local governments develop effective community GHG emissions inventories. It establishes reporting requirements for all community GHG emissions inventories, provides detailed accounting guidance for quantifying GHG emissions

associated with a range of emission sources and community activities, and provides a number of optional reporting frameworks to help local governments customize their community GHG emissions inventory reports based on their local goals and capacities.

Boundary The community "boundary" includes the entirety of Washoe County: Reno, Sparks, and Unincorporated Washoe County. Data from the total population of Washoe County is included in this inventory, as has been the case for previous inventories.

Baseline year Washoe County has established a "baseline year" of 2021. This means that the County's GHG reduction goals of 28 percent by 2025, 45 percent by 2030, and Net Zero 2050 will be measured in comparison to the data in this inventory. Per the Paris Agreement, 2005 is typically recommended as the baseline year for measuring emissions reductions. However, data collection and GHG collection methodology has vastly improved over the past 20 years, so Washoe County is baselining against 2021 instead.

Government Operations Emissions Inventory Washoe County has also conducted a detailed **County Operations GHG Inventory for 2021**. The government operations inventory is a subset of the community, as shown in Figure 3. For example, data on commercial energy use by the community include energy consumed by municipal buildings, and community vehicle-miles-traveled estimates include miles driven by municipal fleet vehicles.

Figure 3: Relationship of Community and Government Operations Inventories

Sources and Activities

Communities contribute to greenhouse gas emissions in many ways. Two central categorizations of emissions are used in the community inventory: 1) GHG emissions that are produced by "sources" located within the community boundary, and 2) GHG emissions produced as a consequence of community "activities."

Source	Activity
Any physical process inside the jurisdictional boundary that releases GHG emissions into the atmosphere.	The use of energy, materials, and / or services by members of the community that result in the creation of GHG emissions.

By reporting on both GHG emissions sources and activities, local governments can develop and promote a deeper understanding of GHG emissions associated with their communities. A purely source-based emissions inventory could be summed to estimate total emissions released within the community's jurisdictional boundary. In contrast, a purely activity-based emissions inventory could provide perspective on the efficiency of the community, even when the associated emissions occur outside the jurisdictional boundary. The division of emissions into sources and activities replaces the scopes framework (Scope 1, 2, and 3) that is used in government operations inventories, but that does not have a clear definition for application to community inventories.

Input Data for this Inventory Local utility operators provided data to Washoe County for this analysis, and the list of these specialists and their agencies are listed in **Appendix 1**. Some other data comes from federal databases from, for example, the Environmental Protection Agency (EPA), or other agencies. Data sources are listed in sector descriptions.

Quantification Methods

GHG emissions can be quantified in two ways:

1. Measurement-based methodologies refer to the direct measurement of GHG emissions (from a monitoring system) emitted from a flue of a power plant, wastewater treatment plant, landfill, or industrial facility.
2. Calculation-based methodologies calculate emissions using activity data and emission factors. To calculate emissions accordingly, the basic equation below is used:

Activity Data x Emission Factor = Emissions

Most emissions sources in this inventory are quantified using calculation-based methodologies. Activity data refers to the relevant measurement of energy use or other GHG-generating processes such as fuel consumption by fuel type, metered annual electricity consumption, and annual vehicle miles traveled.

Known emission factors are used to convert energy usage or other activity data into associated quantities of emissions. Emissions factors are usually expressed in terms of emissions per unit of activity data (e.g. lbs CO2/kWh of electricity). For this inventory, calculations were made using ICLEI's ClearPath Climate Planner tool.

Emissions generating activities

In ClearPath, the five basic emissions generating activities are included in the analysis:

1. **Use of Electricity by the community** Power plant emissions associated with generating electricity used within the jurisdictional boundary of the community, regardless of the location of the electricity generation facility.
2. **Use of Fuel in Residential and Commercial Stationary Combustion Equipment** Combustion emissions associated with fuels used in residential and commercial stationary applications (e.g., natural gas used in boilers and furnaces) within the jurisdictional boundary of the community, excluding fuels used for production of electricity or district energy.
3. **On-Road Passenger and Freight Motor Vehicle Travel** Emissions associated with transportation fuels used by on-road passenger and freight motor vehicles.
4. **Use of Energy in Potable Water and Wastewater Treatment and Distribution** Emissions associated with energy used in the treatment and delivery of potable water used in the community and in the collection and treatment of wastewater used in the community, regardless of the location of the water and wastewater infrastructure.
5. **Generation of Solid Waste by the Community** End-of-life emissions (i.e., projected future methane emissions) associated with disposal of waste generated by members of the community during the analysis year, regardless of disposal location or method.

The community inventory also includes:

- Wastewater treatment processes
- Off-road, rail, and aviation travel
- Process & fugitive emissions from natural gas distribution

The table below lists the Required, Recommended, and Optional Community-wide Inventory inputs from the US Community Protocol. The following sections have detailed descriptions of Washoe County community operations by sector as well as explanations of the methodology for calculating GHGs for each activity.

Inputs into the 2021 GHG Washoe County Inventory

Residential Energy	USCP	In Inventory
Emissions from Grid Electricity	Required	X
Emissions from Stationary Fuel Combustion	Required	X

Commercial Energy	USCP	In Inventory
Emissions from Grid Electricity	Required	X
Emissions from Stationary Fuel Combustion	Required	X

Industrial Energy	USCP	In Inventory
Emissions from Grid Electricity	Required	X
Emissions from Stationary Fuel Combustion	Required	X

Transportation & Mobile Sources	USCP	In Inventory
On Road Transportation	Required	X
Aviation Travel	Recommended	X
Emissions from Public Transit	Recommended	X
Rail Transportation	Recommended	X
Water Transportation	Recommended	X
Emissions from Off Road Vehicles	Recommended	X
Active Transportation	Indicator Only	no

Solid Waste	USCP	In Inventory
Landfilled Waste	Required	X
Combustion of Solid Waste Generated by the Community	Required	n/a
Emissions from Flaring of Landfill Gas	-	X
Biologic Treatment of Solid Waste (Composting)	-	n/a
Emissions from Combustion of Landfill Gas	-	X

Inputs into the 2021 GHG Washoe County Inventory (Continued)

Water & Wastewater	USCP	In Inventory
Emissions from the Supply of Potable Water	Recommended	X
Emissions from Wastewater Treatment Energy Use	Recommended	X
Emissions from the Combustion of Digester Gas	Recommended	X
Emissions from Flaring of Digester Gas	Recommended	X
Process N2O Emissions from Wastewater Treatment	Recommended	X
Emissions from the Supply of Potable Water	Recommended	X
Emissions from Wastewater Treatment Energy Use	Recommended	X
Emissions from the Combustion of Digester Gas	Recommended	X
Emissions from Flaring of Digester Gas	Recommended	X
Process N2O Emissions from Wastewater Treatment	Recommended	X
Process N2O from Effluent Discharge to River, Ocean, or Deep Well Injection	Recommended	X
Emissions from Combustion of Biosolids and Sludges	-	n/a
CO2 Emissions from the Use of Fossil Fuel Derived Methanol	-	X
Fugitive Emissions from Septic Systems	-	X

Process & Fugitive Emissions	USCP	In Inventory
Fugitive Emissions from Natural Gas Distribution	Recommended	X
Hydrofluorocarbon & Refrigerant Emissions	-	X
Fugitive Emissions from Oil and Gas Production and Processing	-	n/a
Fugitive Emissions from Mining, Processing, Storage, and Transportation of Coal	-	n/a

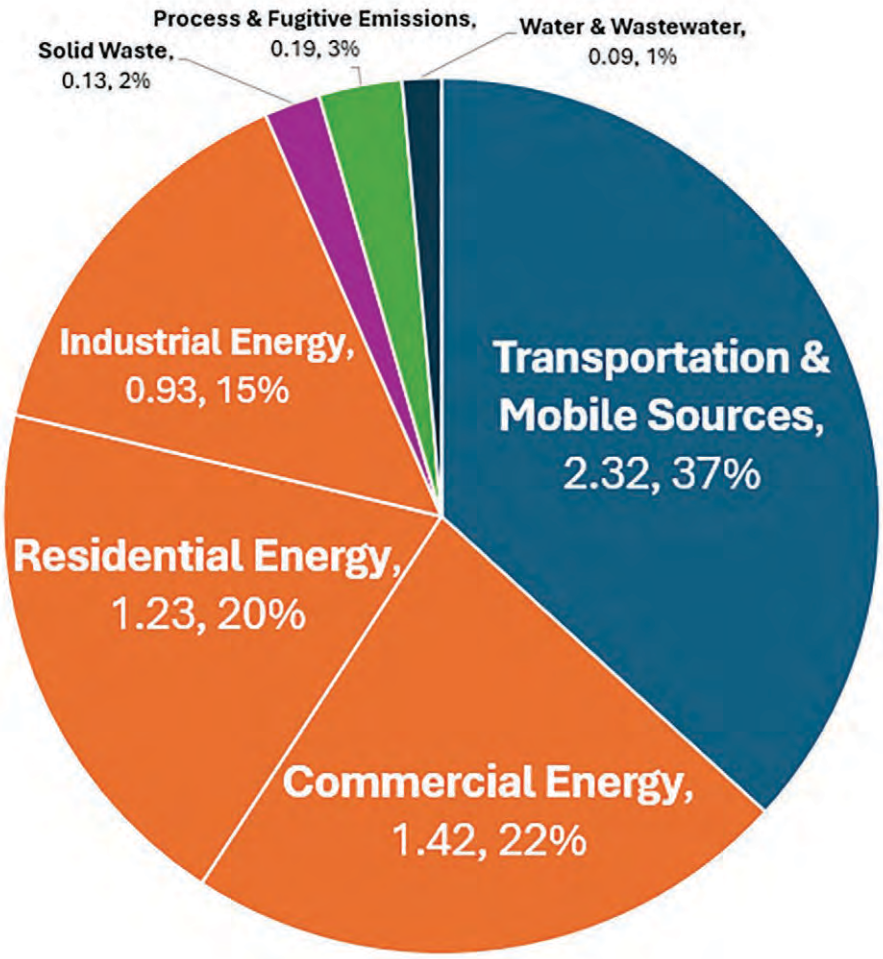
AFOLU	USCP	In Inventory
Emissions and Removals from Forests	Recommended	X
Emissions and Removals from Trees Outside of Forests	Recommended	X
Emissions from Livestock Agricultural Soils	Optional	no
Emissions from Livestock Enteric Fermentation	Optional	no
Emissions from Livestock Manure Management	Optional	no
Emissions from Crop Agriculture	Optional	no
Emissions from Grid Electricity	-	X
Emissions from Stationary Fuel Combustion	-	n/a

E. GHG Inventory results by sector

2021 Community-wide GHG emissions

Total community wide greenhouse gas (GHG) emissions for Washoe County in 2021 were 6.32 million metric tons (MMT) carbon dioxide equivalent (CO2e). 37% of emissions come from Transportation, 22% from Commercial Energy, 20% from Residential Energy, 15% from Industrial Energy, 2% from Solid Waste, 3% from Process & Fugitive Emissions, 1% from Water & Wastewater, and less than 1% from Agriculture, Forestry, and Other Land Use (AFOLU). This inventory includes emissions for City of Reno, City of Sparks, and Unincorporated Washoe County. It was calculated using ICLEI's Clearpath software, and it uses 100-year global warming potentials (GWPs) from the Intergovernmental Panel on Climate Change (IPCC)'s 6th Assessment Report (AR).

2021 Washoe County Community Emissions (MMT CO2e)



Community-wide GHG emissions by sector, 2021

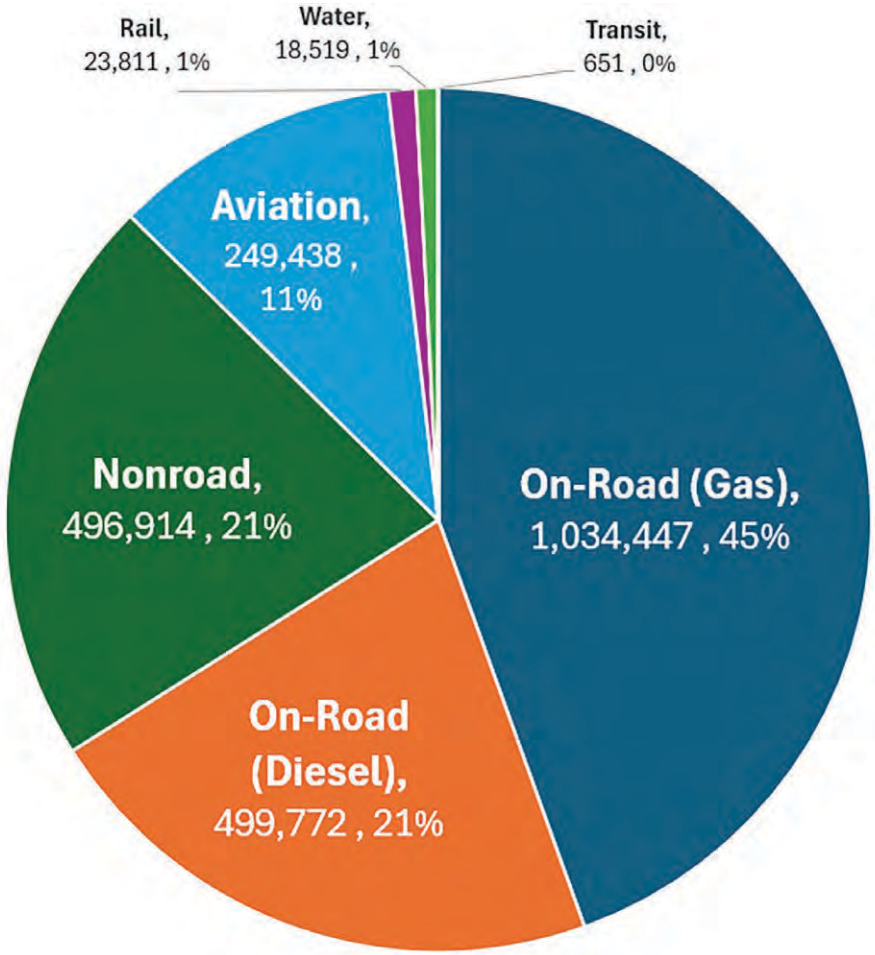
Sector	MMT CO2e	Percent
Transportation & Mobile Sources	2.32	37%
Commercial Energy	1.42	22%
Residential Energy	1.23	20%
Industrial Energy	0.93	15%
Solid Waste	0.13	2%
Process & Fugitive Emissions	0.19	3%
Water & Wastewater	0.09	1%
Total	**6.32**	**100%**

E1. Transportation Emissions

(1) Transportation Summary

The Transportation sector causes 2.32 MMT of CO2e, or 37% of emissions in Washoe County. It is the largest USCP emissions sector. On-road vehicles cause 45% of the County's transportation emissions, followed by nonroad—primarily construction vehicles—that cause 21% of the emissions. Aviation causes 11% of emissions. Rail (1%) and Water (1%) are responsible for the remainder, with a negligible amount of emissions (651 MT CO2e) coming from Transit.

2021 Washoe County Transportation Sector Emissions (MMT CO2e)



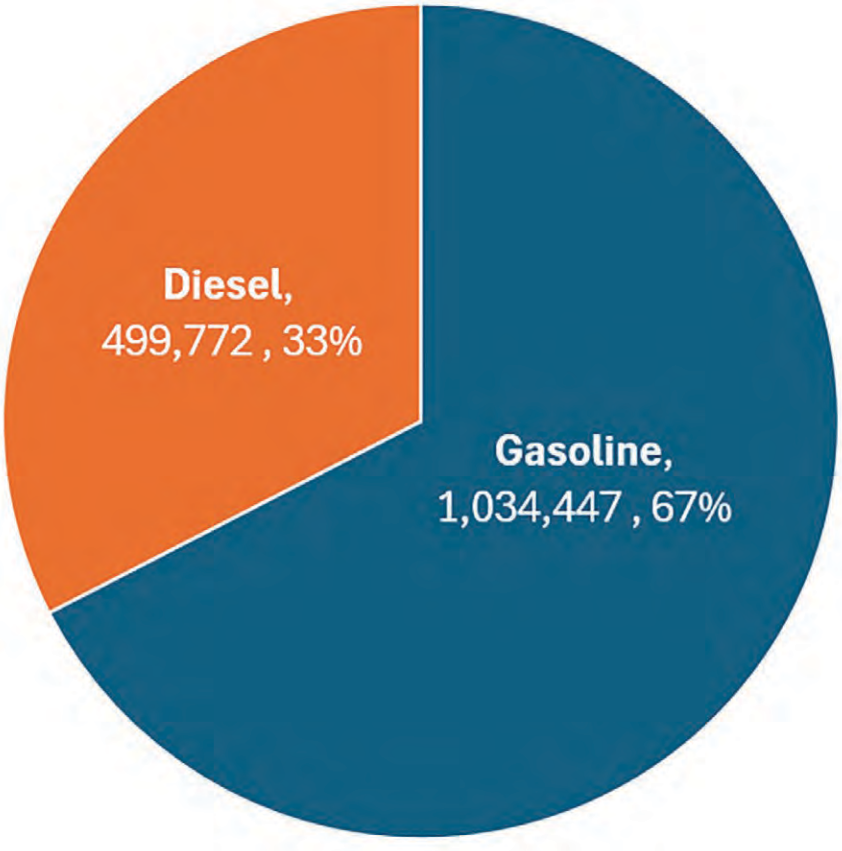
Washoe County Transportation Sector Emissions, 2021

Category	MMT CO2e	MT CO2e	% CO2e
On-Road (Gas)	1.03	1,034,447	45%
On-Road (Diesel)	0.50	499,772	22%
Nonroad	0.50	496,914	21%
Aviation	0.25	249,432	11%
Rail	0.02	23,811	1%
Water	0.02	18,519	1%
Transit	0.00	651	0%
TOTAL	**2.32**	**2,323,551**	**100%**

(2) On Road Transportation (USCP Required)

1.53 MMT of CO2e | 67% of Transportation Emissions | 25% of overall emissions

Sources of MT CO2e for On Road Transportation



Sources of MT CO2e for On Road Transportation

Fuel	MT CO2e	Percent of On Road
Gasoline	1,034,447	67%
Diesel	499,772	33%
TOTAL	**1,534,219**	**100%**

Definition: "On-road vehicles are designed for transporting people, property or material on common or public roads, thoroughfares, or highways. This category includes vehicles such as buses, cars, trucks, motorcycles, on-road waste collection and transportation vehicles (e.g. compactor trucks), etc. Most vehicles burn liquid or gaseous fuel in internal combustion engines. The combustion of these fuels produces CO2, CH4, and N2O, often referred to collectively as tailpipe emissions. Increasingly, electric or hybrid vehicles can also be charged at stations within or outside the city."

Roads in Washoe County Washoe County has more than 5,700 lane miles of roads, grouped into three categories. First, the Nevada Department of Transportation (NDOT) manages approximately 1,396 lane miles of state roads in Washoe County, including two Interstate Routes (I-80, I-580), two US Routes (US 395, US 395A), and 16 State Routes. Second, the Regional Transportation Commission (RTC) and the local jurisdictions share responsibility for approximately 1,047 lane miles of the Regional Road Network. This includes 662 lane miles in Reno, 254 lane miles in Sparks, and 131 lane miles in Unincorporated Washoe County. Third, local jurisdictions manage approximately 3,293 lane miles of Local Roads, which are all roads other than state roads, regional roads, and private roads that are located within the local jurisdictions. There are 1,061 lane miles in Reno, 484 lane miles in Sparks, and 1,631 lane miles in Unincorporated Washoe County.

GHG Inventory Methodology Vehicle Miles Traveled (VMT) information comes from Google's Environmental Insights Explorer (EIE) tool. This tool provides In-Boundary, Inbound, and Outbound VMT. In-Boundary trips begin and end within Washoe County. Inbound trips begin outside of Washoe County and end inside Washoe County. Outbound trips begin inside Washoe County and end outside Washoe County. "GPC Distance" represents an Origin-Destination VMT Model, compliant with the Global Protocol for Community-Scale Greenhouse Gas Inventories (GPC). The values represent 100% of all in-boundary transportation and 50% cross-boundary transportation (inbound and outbound).

The inventory data does not include trips that pass through—but do not stop in—Washoe County. Although these trips are not included in the GPC protocol, they, too, contribute to emissions, and are included in other government agency calculations related to emissions. For reference, the NV Department of Transportation (DOT) calculated 3,988,225,465 total vehicle miles traveled (VMT) using a different methodology. This number is 32% higher than the VMT number used for the calculation in this inventory, 3,025,816,742 VMT.

2021 Vehicle Miles Traveled in Washoe County

travel_ bounds	trips	full_distance_ km	gpc_distance_ km	distance (miles)	% miles
IN-BOUNDARY	381,146,498	2,918,510,126	2,918,510,126	1,813,478,110	60%
INBOUND	24,904,503	1,958,397,072	979,198,536	608,445,760	20%
OUTBOUND	24,799,551	1,943,742,748	971,871,374	603,892,872	20%
TOTAL	**430,850,552**	**6,820,649,946**	**4,869,580,036**	**3,025,816,742**	**100%**

The inventory then uses the National Default Vehicle Mix to designate VMT by vehicle type and fuel type. ICLEI gets this mix from the **EPA's State Inventory and Projection tool**. The dataset does not specifically include Electric Vehicles (EVs) or nonstandard fuels. For this inventory, we did not manually enter EV estimates, as the number of EVs in Washoe County is not easily accessible, and even **the number of EVs statewide was only 17,400 vehicles**, or 0.70% of the 2.4M vehicles registered in the entire state of Nevada. In this inventory, we assume that energy use for charging electric vehicles is included in residential and commercial energy calculations. And we expect the technology for tracking and calculating electric vehicle and nonstandard fuel use will improve in future inventories as vehicles that use these technologies become more prevalent.

National Vehicle Mix – Vehicle Types

Fuel Type	Gas	Diesel
% Passenger	75%	4%
% Light-Duty	24%	8%
% Heavy-Duty	0%	88%
% Motorcycle	1%	0%

The National Default Vehicle Mix also indicates the percent of VMT traveled by gas (88.5%) and diesel (11.50%) vehicles. Of the 3,025,815, 817 VMT traveled in Washoe County in 2021, drivers traveled 2,677,846,998 miles in gasoline vehicles, and 347,968,819 miles in diesel vehicles.

National Vehicle Mix - VMT by fuel

Fuel Type	Washoe County VMT	VMT %
Gas	2,677,846,998	88.50%
Diesel	347,968,819	11.50%
Total	**3,025,815,817**	**100%**

Finally, the inventory applies the 2021 US National Defaults factor set (updated 2023) to the trip data to calculate emissions. This factor set comes from the EPA.

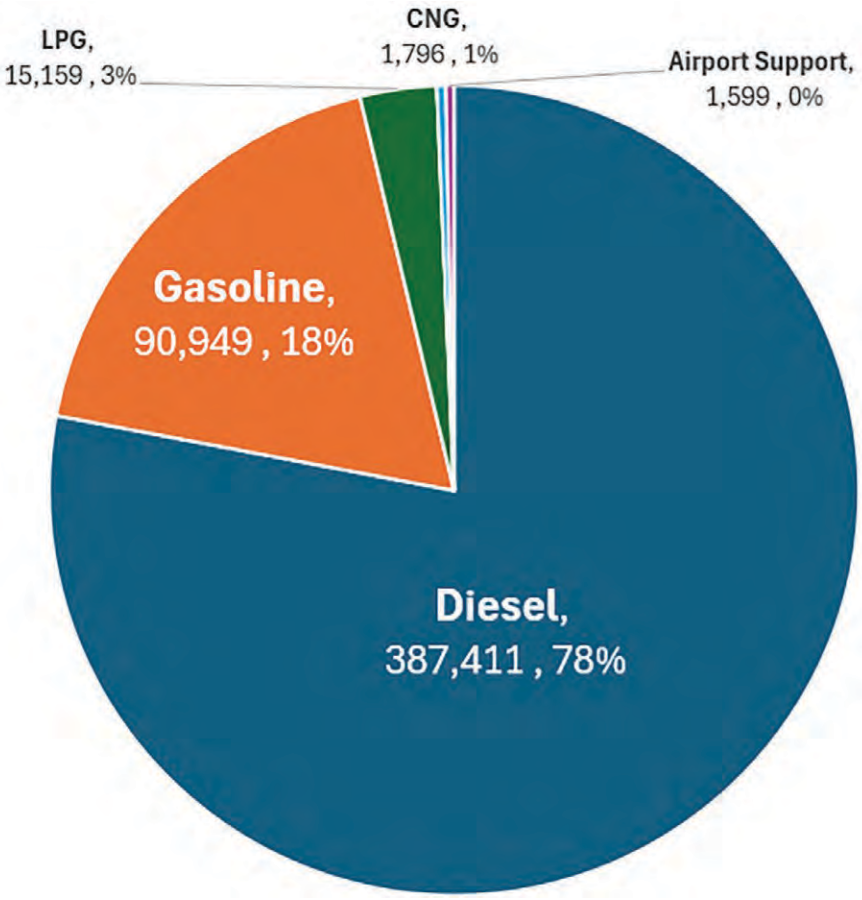
2021 US National Defaults (updated 2023) - fuel efficiency

Vehicle Type	Fuel Economy (MPG)	g CH4 / mi	g N2O / mi
Gas Passenger Vehicle	25.3	0.0084	0.0069
Gas Light Truck	18.2	0.0117	0.0087
Gas Heavy Truck	5.383557	0.0719	0.0611
Gas Transit Bus	18.2	0.0117	0.0087
Gas Para Transit Bus	18.2	0.0117	0.0087
Gas Motorcycle	44	0.0084	0.0069
Electric Vehicle	n/a	n/a	n/a
Diesel Passenger Vehicle	25.3	0.0005	0.001
Diesel Light Truck	18.2	0.001	0.0015
Diesel Heavy Truck	6.561615	0.0051	0.0048
Diesel Transit Bus	18.2	0.001	0.0015
Diesel Para Transit Bus	18.2	0.001	0.0015
Diesel Motorcycle	44	0.0005	0.001

(3) Nonroad Vehicles (USCP Recommended)

0.50 MMT of CO2e | 21% of Transportation Emissions | 8% of overall emissions

Sources of MT CO2e for Nonroad Transportation



Sources of MT CO2e for Nonroad Transportation

Fuel	MT CO2e	Percent of Nonroad
Diesel	387,411	78%
Gasoline	90,949	18%
LPG	15,159	3%
CNG	1,796	1%
Airport Support	1,599	0%
TOTAL	**496,914**	**100%**

Definition: "Off-road vehicles are those designed or adapted for travel on unpaved terrain. This category typically includes all-terrain vehicles, landscaping and construction equipment, tractors, bulldozers, amphibious vehicles, snowmobiles and other off-road recreational vehicles…Emissions from off-road transportation activities within transportation facility premises such as airports, harbors, bus terminals, and train stations" are also included.

Nonroad Vehicles in Washoe County Almost all the diesel emissions in Washoe County come from construction equipment. The remainder of all fuel use comes from commercial equipment, industrial equipment, lawn & garden equipment, and recreational equipment.

Methodology The inventory utilizes "mobile nonroad" data from the EPA's National Emissions Inventory (see **Appendix 6** for data description). The NEI provides carbon dioxide (CO2), methane (CH4), and nitrous oxide (N2O) emissions for off-highway vehicle diesel, gasoline, liquefied petroleum gas (LPG), and compressed natural gas (CNG). The Clearpath software applies global warming potentials for methane and nitrous oxide are applied, then emissions are summed with CO2 to produce CO2e values.

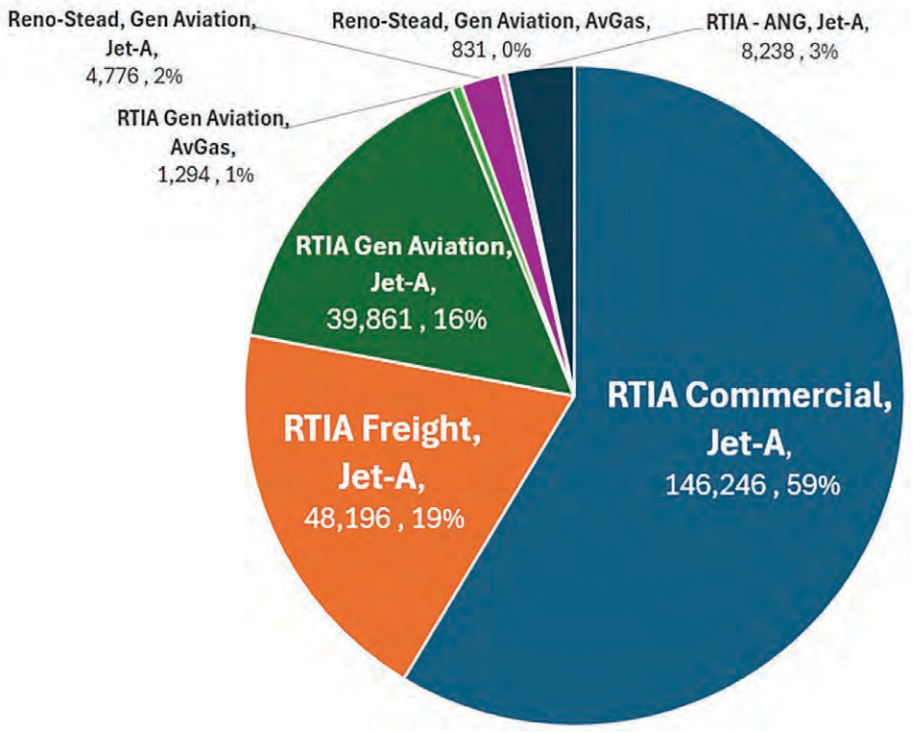
Nonroad emissions (tons) from EPA's NEI data

Fuel Type	Emissions: Carbon Dioxide (CO2)	Emissions: Methane (CH4)	Emissions: Nitrous Oxide (N2O)
Mobile - Nonroad Equipment - Diesel	426,827.20	7.87	N/A
Mobile - Nonroad Equipment - Gasoline	98,001.02	82.85	N/A
Mobile - Nonroad Equipment - LPG	16,678.82	1.10	N/A
Mobile - Nonroad Equipment - CNG	1,664.01	11.61	N/A

(4) Aviation Travel (USCP Recommended)

0.25 MMT of CO2e | 11% of Transportation Emissions | 4% of overall emissions

Sources of MT CO2E from Aviation



Sources of MT CO2E from Aviation

Location, Use	Fuel	MT CO2e	Percent
RTIA, Commercial	Jet-A	146,241	59%
RTIA, Freight	Jet-A	48,196	19%
RTIA, Gen Aviation	Jet-A	39,861	16%
RTIA, Gen Aviation	AvGas	1,294	1%
Reno-Stead, Gen A	Jet-A	4,776	2%
Reno-Stead, Gen A	AvGas	831	0%
RTIA – ANG	Jet-A	8,238	3%
TOTAL		**249,441**	**100%**

Definition: "Civil aviation, or air travel, includes emissions from airborne trips occurring within the geographic boundary (e.g., helicopters operating within the city) and emissions from flights departing airports that serve the city."

Aviation in Washoe County

Reno-Tahoe International Airport (RTIA; airport code RNO), located 4 miles southeast of Reno's central business district, is the primary airport that serves Washoe County. As defined by the Federal Aviation Administration, (FAA), RNO is a medium hub commercial airport. It served over 1.8M passengers across 11 different airlines in calendar year 2021 and was the 63rd

busiest commercial airport in the United States. In 2022, commercial cargo carriers FedEx, United Parcel Service (UPS), and DHL transported more than 147 million pounds of air cargo through RNO. General aviation flights also operate out of RNO, including Flight School, small aircraft, and helicopter operations.

Reno-Stead Airport (RTS) is a general aviation facility located 11 miles northwest of the central business district that is home to approximately 200-based aircraft. Hundreds of aircraft also utilized RTS for the Reno Air Races, an air racing and air show event held from September 15 – 19, 2021. The Reno Tahoe Airport Authority (RTAA) operates both RTIA and Reno-Stead.

Air National Guard (ANG) flights also operate out of both RTIA and RTS. This inventory includes data for ANG operations at RTIA, but the Reno-Stead ANG had not provided 2021 data before this inventory was published.

We also did not receive data from **Spanish Springs Airport**. Data from both the Reno-Stead ANG and Spanish Springs Airport should be included in future inventories.

Methodology The inventory calculates emissions related to the amount of fuel loading that takes place within Washoe County. "Jet A" jet fuel is the most commonly used fuel for commercial (passenger) and freight aviation. "AvGas," or aviation gas, is frequently used in general aviation. The USCP recommends separating international flights from domestic flights. However, RTIA has only one daily international flight to Guadalajara, Mexico, and the fuel for those flights is included in the domestic total since total fuel use is small.

2021 Fuel Use by Aviation Type

Airport	Aviation Type	Fuel Type	Gallons of Fuel
RTIA	Commercial (Passenger)	Jet Kerosene	14,948,972
RTIA	Freight	Jet Kerosene	4,926,489
RTIA	General Aviation	Jet Kerosene	4,074,471
RTIA	General Aviation	Aviation Gasoline	155,118
Reno-Stead	General Aviation	Jet Kerosene	488,146
Reno-Stead	General Aviation	Aviation Gasoline	99,619
ANG - RTIA	ANG	Jet Kerosene	842,075
ANG - Reno-Stead	ANG	Jet Kerosene	not received
TOTAL			**10,585,918**

This inventory applies emissions factors to the gallons of fuel that are filled in Washoe County. Jet A is more emissions-intensive than AvGas, per the table below.

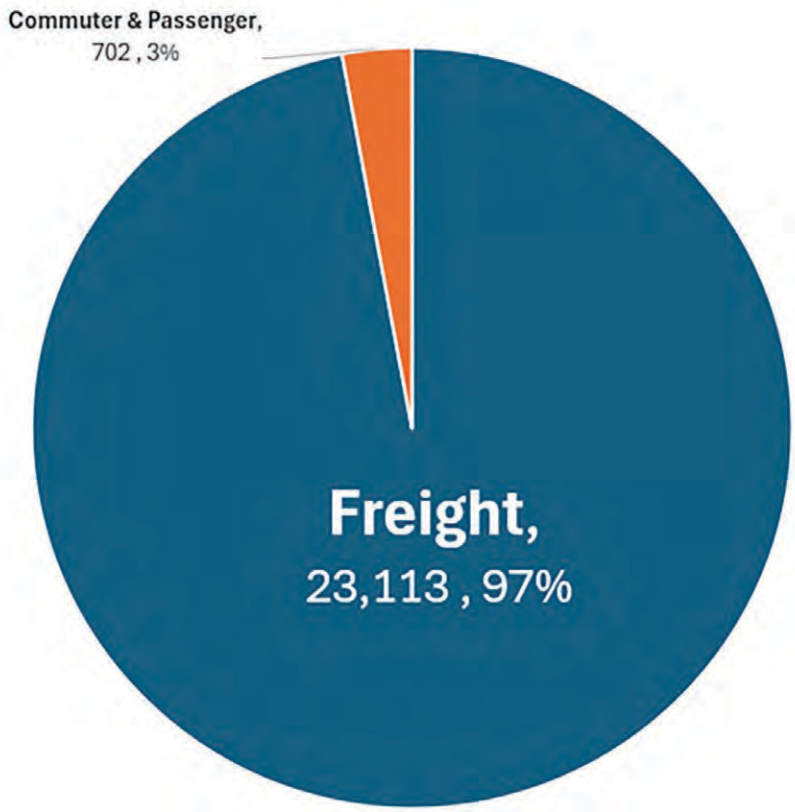
Emissions Factors for Aviation

Greenhouse Gas	Jet A	AvGas
CO2 (kg / gallon)	9.75	8.31
CH4 (g / gallon)	0.41	0.36
N2O (g / gallon)	0.08	0.07

(5) Rail Transportation (USCP Recommended)

0.02 MMT of CO2e | 1% of Transportation Emissions | <1% of overall emissions

Sources of MT CO2e from Rail Transportation



Sources of MT CO2e from Rail Transportation

Rail Type	MT CO2e	Percent
Freight	23,113	97%
Commuter & Passenger	702	3%
Total	**23,815**	**100%**

Definition: Railways can be used to transport people and goods, and are powered by a locomotive, which typically uses energy through combustion of diesel fuels or electricity (known as electric traction).

Rail in Washoe County According to the 2021 Nevada State Rail Plan, the Union Pacific Railroad (UPRR) operates east-west rail corridors in both northern and southern Nevada. BNSF Railway (BNSF) has trackage rights on nearly three-quarters of UPRR's Nevada trackage. The two-route northern Nevada corridor serves Reno and connects with Salt Lake City and Denver to the east and with Sacramento and the San Francisco area to the west. Amtrak operates once-a-day passenger rail service in each direction across this northern Nevada corridor; I-80 generally parallels the rail lines in this corridor. See Figure 4 for a map of the Nevada State rail network.

2020 Nevada State Rail Plan: Existing Nevada Rail Network

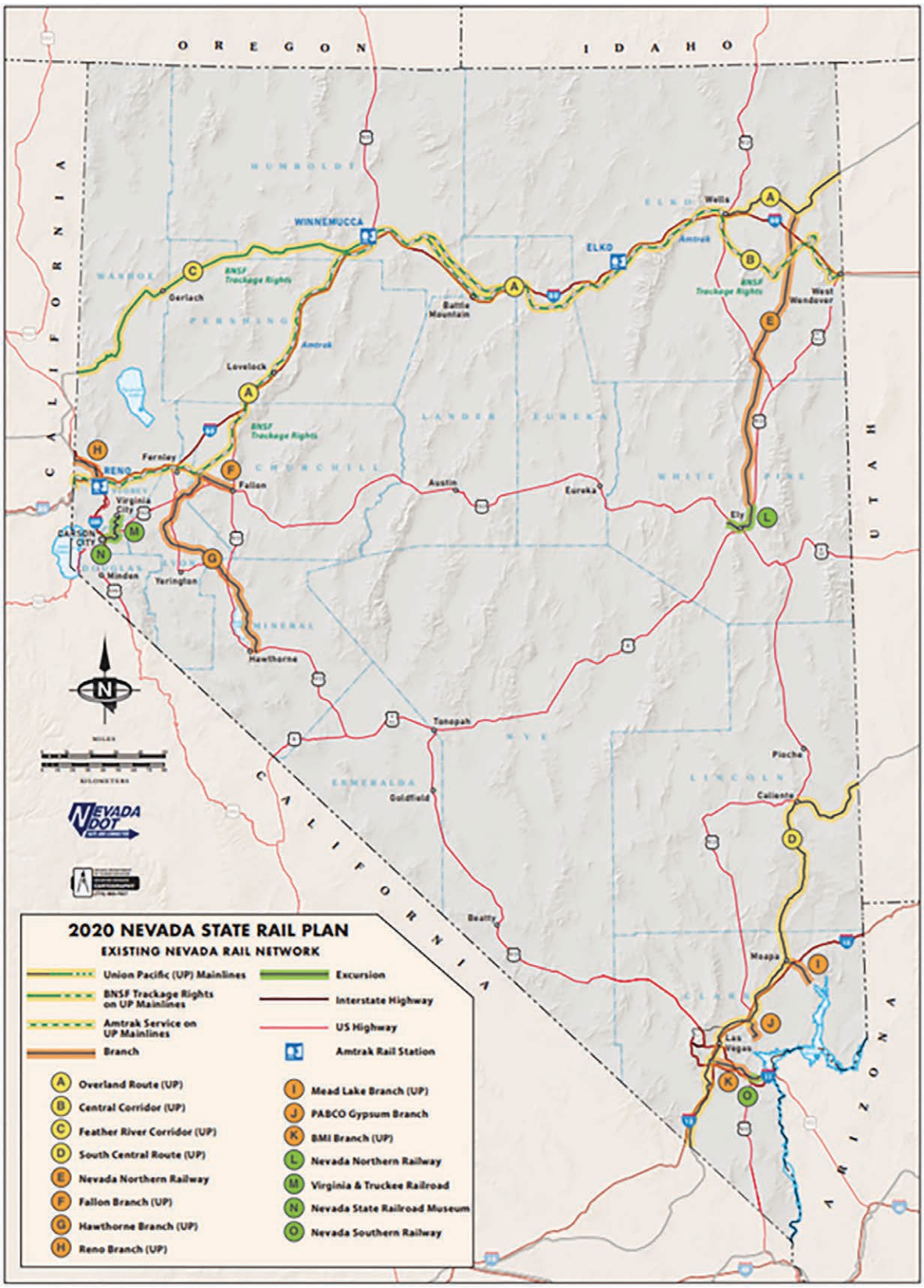


Figure 4: Nevada State Rail Plan Map (2020) Source: ***Nevada DOT***

Methodology The inventory utilizes "mobile nonroad" data from the EPA's National Emissions Inventory (see **Appendix 6** for data description). The NEI provides carbon dioxide (CO2), methane (CH4), and nitrous oxide (N2O) emissions for line-haul locomotives, both Class I + Class II/III Operations (freight) and Commuter Lines and Passenger Trains. The Clearpath software applies global warming potentials for methane and nitrous oxide, then emissions are summed with CO2 to produce CO2e values.

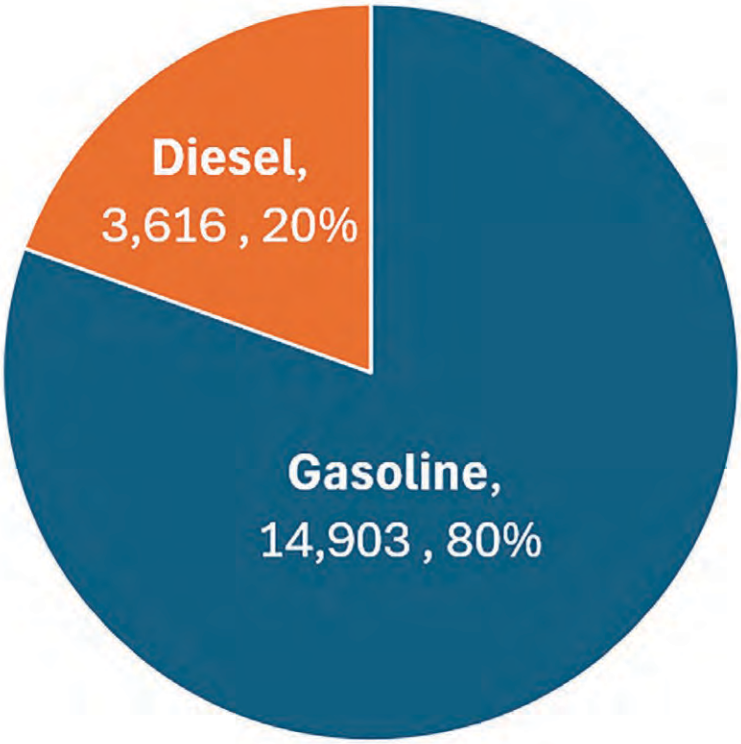
Rail emissions (tons) from EPA's NEI data

Rail Type	Emissions: Carbon Dioxide (CO2)	Emissions: Methane (CH4)	Emissions: Nitrous Oxide (N2O)
Mobile - Locomotives - Class I/ II/III Operations (Freight)	25,265.23	1.83	0.59
Mobile - Locomotives - Passenger Trains (Amtrak)	724.38	0.05	0.02
Mobile - Locomotives - Commuter	n/a	n/a	n/a

(6) Water Transportation (USCP Recommended)

0.02 MMT of CO2e | 0.8% of Transportation Emissions | <1% of overall emissions

Sources of MT CO2e from Water Transportation



Sources of MT CO2e from Water Transportation

Fuel Type	MT CO2e	Percent
Gasoline	13,903	80%
Diesel	3,616	20%
Total	**18,519**	**100%**

Definition: Water transportation includes ships, ferries, and other boats operating within the city boundary, as well as marine-vessels whose journeys originate or end at ports within the city's boundary but travel to destinations outside of the city.

Water Transportation in Washoe County Washoe County is land-locked, so it has no emissions from commercial marine vessels. Emissions come from gasoline and diesel fueling of pleasure craft that are operated on one of the County's 50 lakes. The largest lakes in the county include 125,000-acre Pyramid Lake, which is fully within Nevada's boundary, and 193-square-mile Lake Tahoe, whose northeast corner is in Washoe County. The southeast shores of Lake Tahoe touch Carson City and Douglas County, Nevada, and the western and southern shores are in Placer and El Dorado Counties, California.

Methodology The inventory utilizes "mobile nonroad" data from the EPA's National Emissions

Inventory (see **Appendix 6** for data description). The NEI provides carbon dioxide (CO2), methane (CH4), and nitrous oxide (N2O) emissions for both gasoline and diesel-powered mobile pleasure craft. The Clearpath software applies global warming potentials for methane and nitrous oxide, then emissions are summed with CO2 to produce CO2e values.

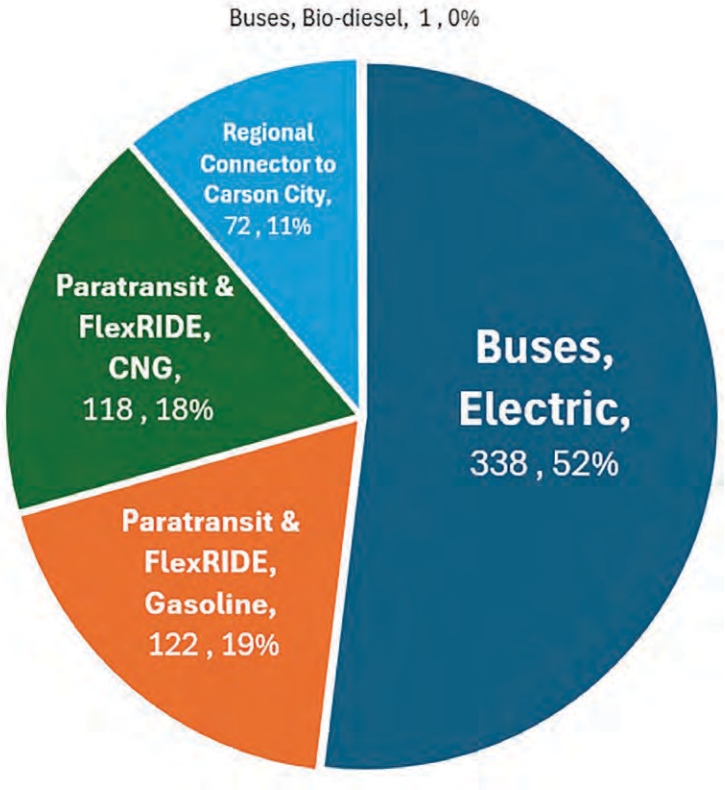
Water transportation emissions from EPA's NEI data

Water Craft Type	Emissions (Tons): Carbon Dioxide (CO2)	Emissions (Tons): Methane (CH4)	Emissions (Tons): Nitrous Oxide (N2O)
Mobile - Pleasure Craft - Gasoline	16,015.91	15.15	N/A
Mobile - Pleasure Craft - Diesel	3,986.42	0.12	N/A
Mobile - Commercial Marine Vessels	-	N/A	N/A

(7) Public Transport (USCP Recommended)

0.001 MMT of CO2e | 0.03% of Transportation Emissions | <1% of overall emissions

Sources of MT CO2e from Public Transport



Sources of MT CO2e from Public Transport

Transit Type	Fuel	MT CO2e	Percent
Buses	Electric	338	52%
Paratransit, Flexride	Gasoline	122	19%
Paratransit, Flexride	CNG	118	18%
Regional Connector to Carson City	Electric	72	11%
Buses	Biodiesel	1	0%
TOTAL		**651**	**100%**

Definition: Public transport vehicles such as vans and buses are “on-road” vehicles. Data for public transport comes directly from the local transport operator, RTC Washoe, and thus is reported in a separate section of this inventory.

Public Transport in Washoe County Public Transport is managed by the Regional Transportation Commission (RTC) of Washoe County. RTC offers five types of service: RTC RIDE, RTC ACCESS, FlexRIDE On-Demand service, REGIONAL CONNECTOR, and Vanpool. See examples of vehicle types in Figures 5 and 6. RTC RIDE is a fixed route bus service in Reno and Sparks. In RTC’s fiscal year (FY) 2022 (July 2021 – June 2022), RTC RIDE had a fleet

of 65 buses and 22 routes, including two bus rapid transit (BRT) routes, the Virgina Line and Lincoln Line. In calendar year 2021, customers took 4.4M rides on RTC RIDE. RTC ACCESS is a paratransit service that provides door-to-door, prescheduled transportation for people who meet the eligibility criteria of the Americans with Disabilities Act (ADA). In FY2022, RTC had 46 vans in the ACCESS fleet, and customers took 130,899 trips. FlexRIDE is curbside-to-curbside transit service available in select areas of Sparks / Spanish Springs, Somersett / Verdi, South Meadows, and North Valleys. In FY2022, Flexride delivered over 51,000 trips. The REGIONAL CONNECTOR is the intercity commuter service between Reno and Carson City, which has 5 stops and runs three morning and three afternoon round trips on weekdays. In calendar year 2021, customers took 14,890 trips on this service. Finally, RTC subsidizes vanpool, which is a transportation alternative for groups of 4 to 14 people who share similar commute patterns. A commuter van is driven by one of the members of the group and passengers are picked up and dropped off at agreed upon locations and times.

Figure 5: RTC RIDE and Regional Connector

Figure 6: RTC ACCESS and FlexRIDE

Methodology: RTC RIDE buses and the Regional Connector bus to Carson City started running on 100% alternative fuels as of 2021. The Carson City Regional Connector was electric, and **the RTC RIDE fleet was a combination** of one-third electric buses and two-thirds hybrid electric / biodiesel buses, capable of running 35% of the time in all-electric mode. **RTC added 17 new hybrid buses** to its fleet in February 2021. RTC ACCESS and Flexride vehicles use either gasoline or compressed natural gas (CNG).

The inventory uses NV Energy's 2021 grid emissions factor to calculate emissions for electric vehicles. See section **E2, Energy Emissions** to learn more about this approach. To calculate the GHG impact of bio-diesel, gasoline, or compressed natural gas (CNG) the inventory uses the 2021 US National Defaults (updated 2023).

The table below shows energy use by fuel type for RTC Washoe's services.

Energy Use by Fuel Type for RTC Washoe's services, 2021

Vehicle	Fuel Type	Fuel	Unit	MT Co2e
Buses	Electric	1,020,784	kWh	338
Regional Connector	Electric	250,159	kWh	118
Buses	Biodiesel	568,890	Gallons	1
ACCESS, FLEXride	CNG	179,175	Gallons	118
ACCESS, FLEXride	Gasoline	13,504	Gallons	122
TOTAL	**Electric**	**1,270,943**	**kWh**	**456**
TOTAL	**Biodiesel**	**568,890**	**Gallons**	**1**
TOTAL	**CNG**	**179,175**	**Gallons**	**118**
TOTAL	**Gasoline**	**13,504**	**Gallons**	**122**

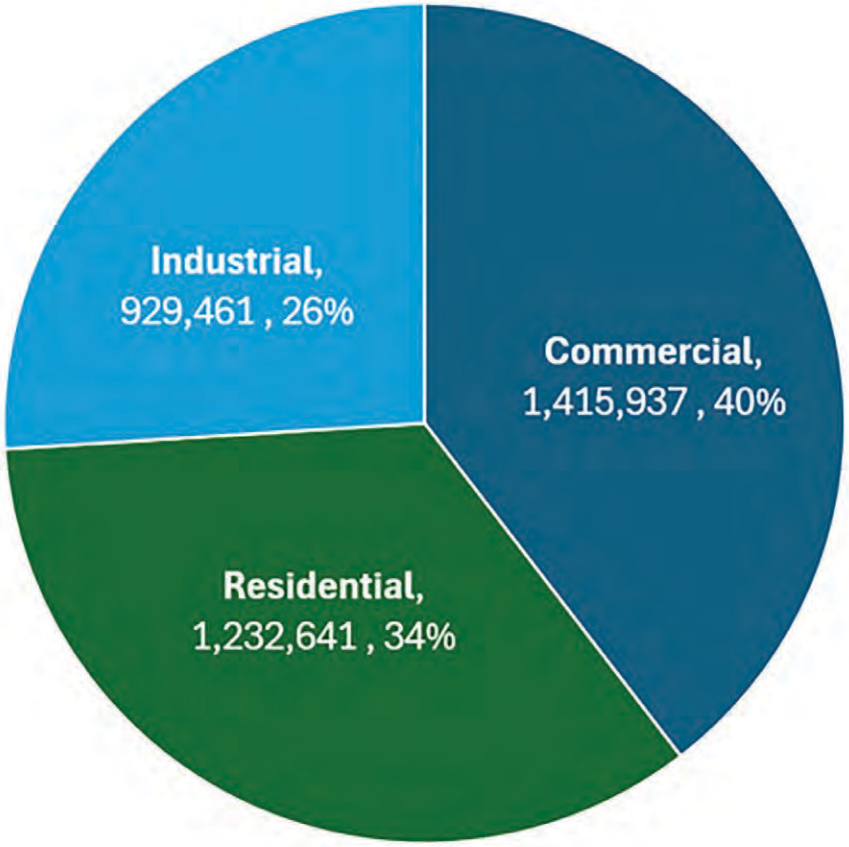
And finally, RTC Washoe reported 196,038 gallons of gasoline used for its vanpool. Using the National Default factor sets for fuel, this program creates 1,721 MT CO2e, the largest source of emissions for an RTC-managed program. However, the vanpool passenger van trips are included in Google's EIE "On Road" data, described above, so these emissions are not included as part of the Public Transit emissions.

E2. Energy Emissions Methodology

(1) Energy Summary

The Energy (Buildings) sector causes 3.58 MMT of CO2e, or 57% of emissions in Washoe County. When Commercial, Residential, and Industrial energy use are added together, Energy emissions from Buildings are the largest sector. Taken individually, as defined by the USCP, Commercial (22%), Residential (20%), and Industrial Energy (15%) are the second, third, and fourth largest sources, respectively, following Transportation (37%).

MT CO2e by Energy Sector

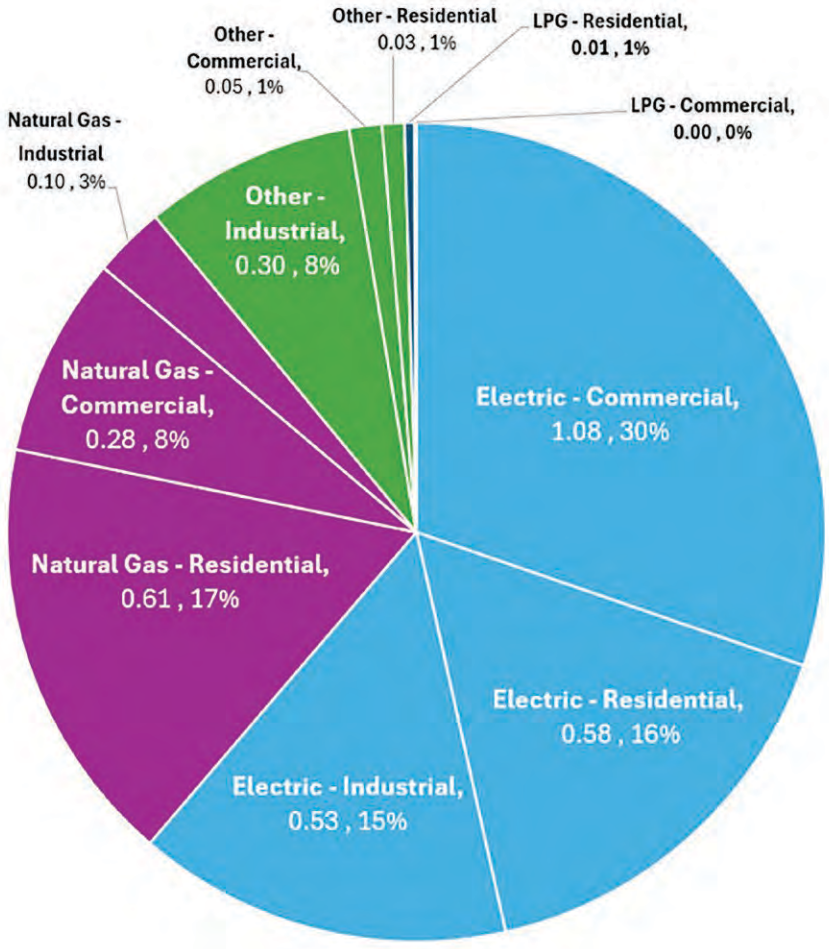


Energy Emissions by Sector

Sector	MT CO2e	Percent
Commercial	1,415,937	40%
Residential	1,232,641	34%
Industrial	929,461	26%
TOTAL	**3,578,039**	**100%**

Sixty-one percent of the emissions from energy come from electric power, and 28% comes from natural gas, less than 1% comes from Liquefied petroleum gas (LPG), and 11% comes from other fuel sources such as distillate fuel oil, hydrocarbon gas liquids (HGL), or wood.

MMT CO2e by Energy Type and Sector



Breakdown of energy use by type and sector in Washoe County, 2021

Energy Type	Sector	MMT Co2e	% of total
Electric	Commercial	1.08	31%
Electric	Residential	0.58	16%
Electric	Industrial	0.53	15%
Natural Gas	Residential	0.61	17%
Natural Gas	Commercial	0.28	8%
Natural Gas	Industrial	0.10	3%
Other	Industrial	0.30	8%
Other	Commercial	0.05	1%
Other	Residential	0.03	1%
LPG	Residential	0.01	0%
LPG	Commercial	0.00	0%
TOTAL		**3.58**	**100%**

(2) Energy Providers in Washoe County

In Washoe County, NV Energy is the main provider of both electricity and natural gas. **NV Energy serves** 1.3 million statewide electric customers and 50 million tourists annually across a 45,703-square-mile service territory that stretches north to south across Nevada from Elko to Clark County. See Figure 7 for a map of the service area.

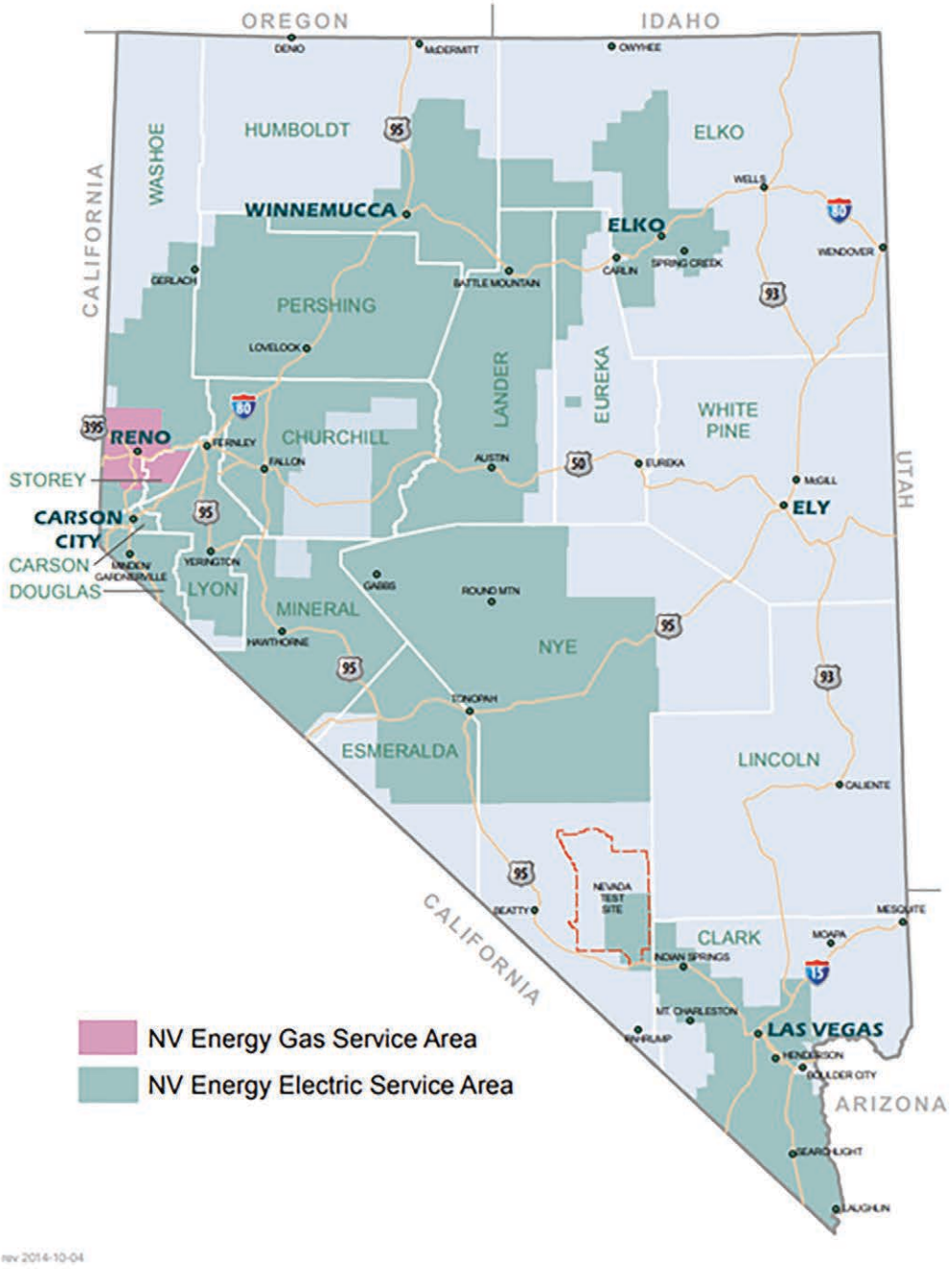


Figure 7: NV Energy's service area

NV Energy provides electric power to Washoe County from four company-owned power plants in Northern Nevada: Clark Mountain Combustion Turbines (132 MW), Fort Churchill Generating Station (226 megawatts / MW), Frank A. Tracy Generating Station (753 MW), and North Valmy Generating Station (261 MW). North Valmy is a coal-fueled, steam-electric generating plant, and the other three are fueled by natural gas or, in some cases, diesel oil. As of 2023, NV Energy announced plans for North Valmy to switch to a natural gas plant by 2025. Together, NV Energy's plants can produce more than 1,500 megawatts (MW) of electricity. As a reference point, one megawatt is equivalent to the power required to serve about 600 households. NV Energy relies on a combination of power generated at company-owned plants and electricity purchased from other utilities and independent power producers, including several geothermal, solar, and wind plants located in Nevada.

Southwest Gas provides natural gas to a small area in the Washoe Valley in the southern part of the County. Southwest Gas serves more than 2 million customers across Nevada, Arizona, and portions of California. See Figure 8.

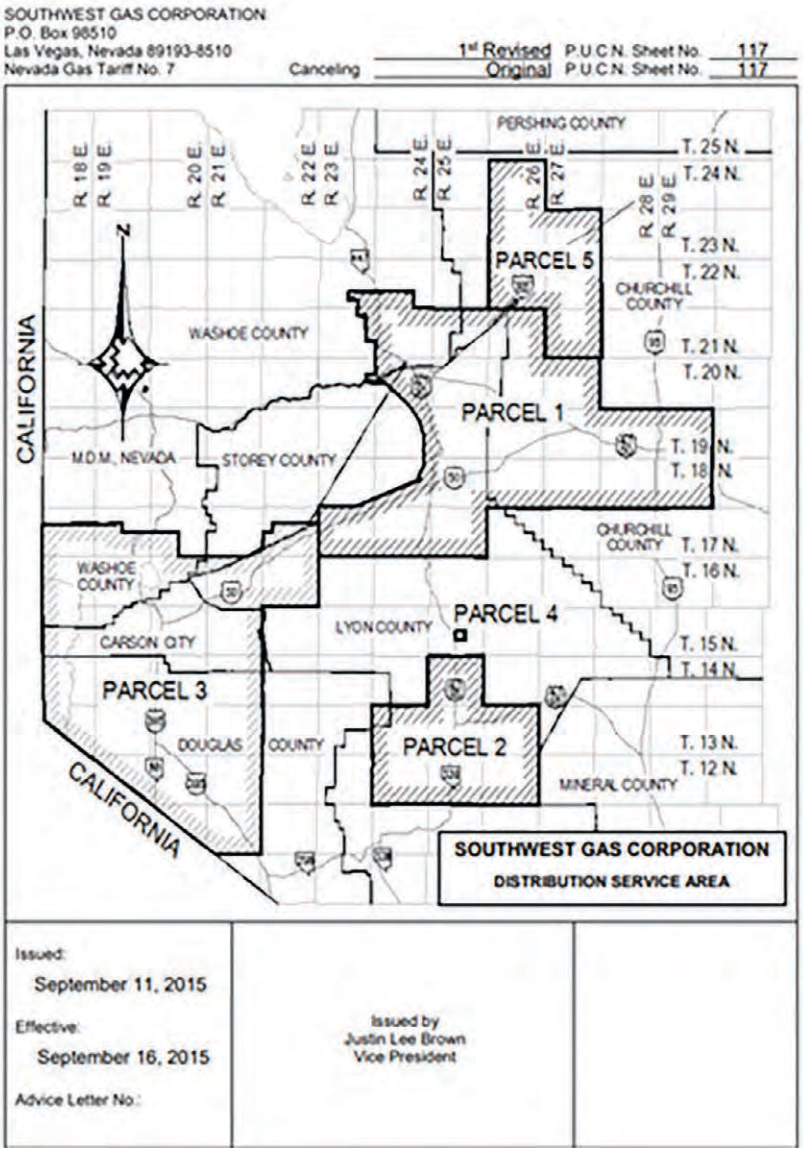
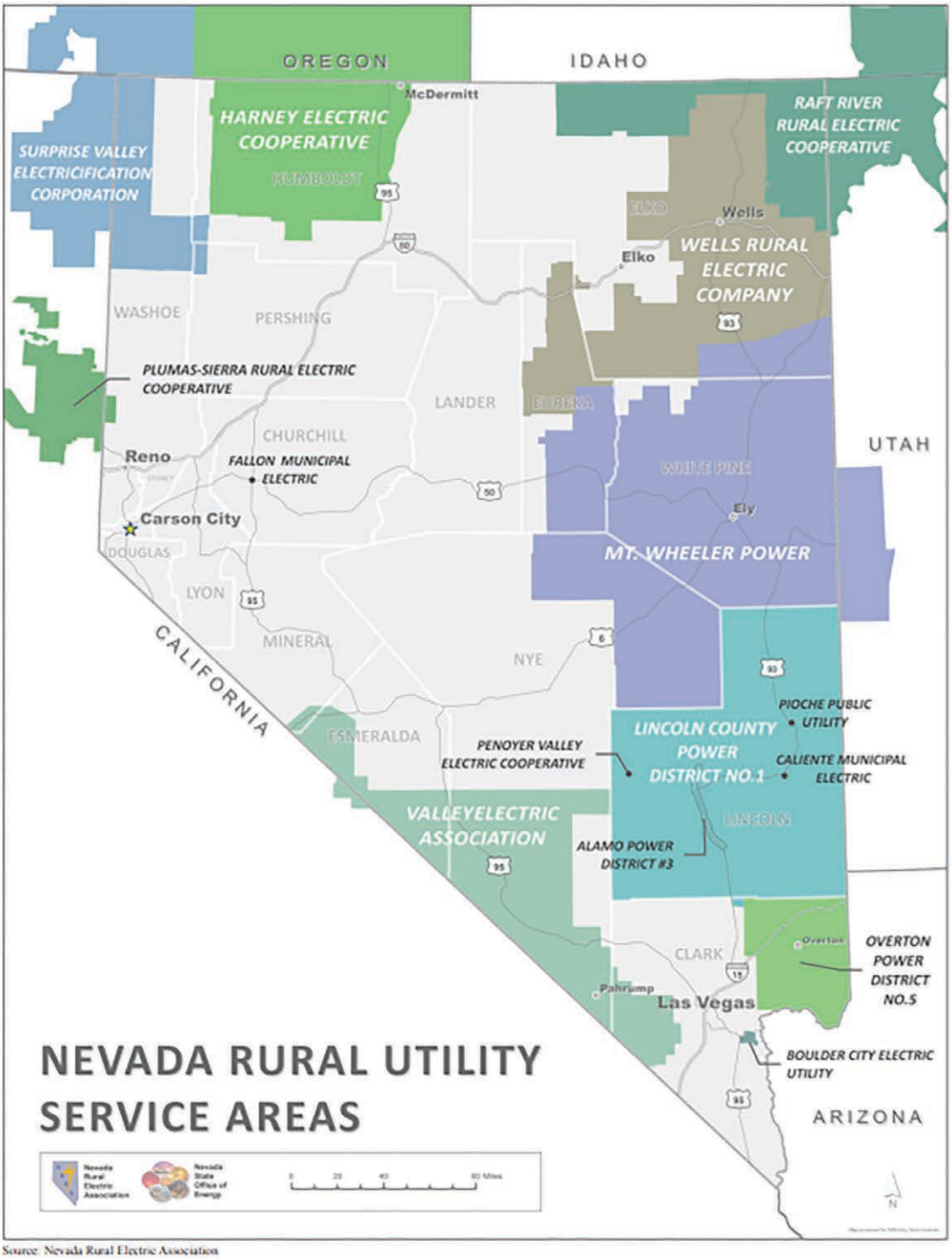


Figure 8: Southwest Gas service area map for Nevada

Finally, two electric cooperatives provide electricity to rural parts of the County. See a map of coverage areas in Figure 9.



Source: Nevada Rural Electric Association

Figure 9: Public Utilities Commission (PUC) NV Rural Utility Service Areas

Surprise Valley Electrification Corporation (SVEC) serves rural Washoe County communities north of Gerlach, all the way north to the Oregon border and west to the California border. SVEC is a non-profit rural electric cooperative owned by those it serves. Individuals receiving electric service from Surprise Valley Electric are member owners of the cooperative. SVEC also serves communities in Nevada, Oregon, and California.

Plumas-Sierra Rural Electric Cooperative (PSREC) serves a small rural area just north of Cold Springs. PSREC is consumer-owned and not-for-profit. Any revenue beyond PSREC expenses is eventually returned to members in the form of capital credit payments. PSREC also serves three counties in California: Plumas, Sierra, and Lassen.

For definitions of customer types at four utilities, see **Appendix 7**.

(3) Methodology for Energy Calculations

Electricity In its 2021 Sustainability Report, NV Energy reported an Emissions Intensity of .331 MT / Net MWh for its combined Owned Generation (electricity generated at NV Energy plants) and Purchased Power (electricity generated by 3rd parties and sold to NV Energy). This number is converted to pounds / net megawatt hour (lbs / net MWh) and multiplied with the kWh usage.

NV Energy CO2e Intensity, 2021

Emissions Intensity Category	Value	Unit
Total Owned + Purchased Generation (CO2e) Emissions Intensity (MT / Net MWh)	0.331	MT / MWh
1 metric ton to pounds conversion	2204.62262	lbs
Total Owned + Purchased Generation (CO2e) Emissions Intensity (lbs / Net MWh)	729.7300872	lbs / MWh

Natural gas use is reported in therms, and the inventory applies the following factor set, based on EPA guidance, to calculate associated emissions.

Natural Gas Emissions Factors

Greenhouse Gas	Emissions Factor (Kg / MMBTu)
CO2	53.02
CH4	0.005
N2O	0.0001

Liquefied petroleum gas is also reported in therms, and the inventory applies the following factor set:

Liquefied Petroleum Gas (LPG) Emissions Factors

Greenhouse Gas	Emissions Factor (Kg / MMBTu)
CO2	62.98
CH4	0.010870
N2O	0.0010870

Other stationary fuels (e.g. bottled gas, fuel oil, or wood) Some residents and businesses use other forms of stationary fuel, for energy. These types of fuel include bottled gas, fuel oil, or wood. Bottled gas includes bottled, tank, or liquefied petroleum (LP) gas, to include propane. Fuel oil includes kerosene. To determine the use of these stationary fuels in Washoe County, this inventory uses Nevada State Energy Data from the US Energy Information Administration (EIA) (e.g. Residential data).

2021 NV Statewide Stationary Energy Use (MMBtu / kWh)

Sector	Distillate Fuel Oil	HGL	Kerosene	Motor Gasoline	Residual Fuel Oil	Wood
Residential	300,000	2,300,000	0	0	0	2,100,000
Commercial	2,200,000	1,900,000	0	n/a	0	400,000
Industrial	17,400,000	800,000	0	2,300,000	0	100,000

Because this data is available at the state level, it must be downscaled from the Nevada population and economy to Washoe County's population and economy. To determine the number of households using these kinds of fuel in Washoe County, this inventory uses the United States Census Bureau's American Community Survey (ACS), segment **S2504**: Physical Housing Characteristics for Occupied Housing Units (5 year estimates). To determine the number of businesses using these kinds of fuel in Washoe County, this inventory uses The United States Census Bureau's **OnTheMap** tool, to calculate Industrial and Commercial jobs by location. See **Appendix 8** for a full list of jobs by category.

2021 Households, Commercial Jobs, and Industrial Jobs

Area	Households	Commercial Jobs	Industrial Jobs
Nevada	1,141,952	923,779	287,028
Washoe County	188,878	149,709	57,920
Washoe County %	17%	16%	20%

The inventory then applies the following factor set to these energy uses, based on EPA sources.

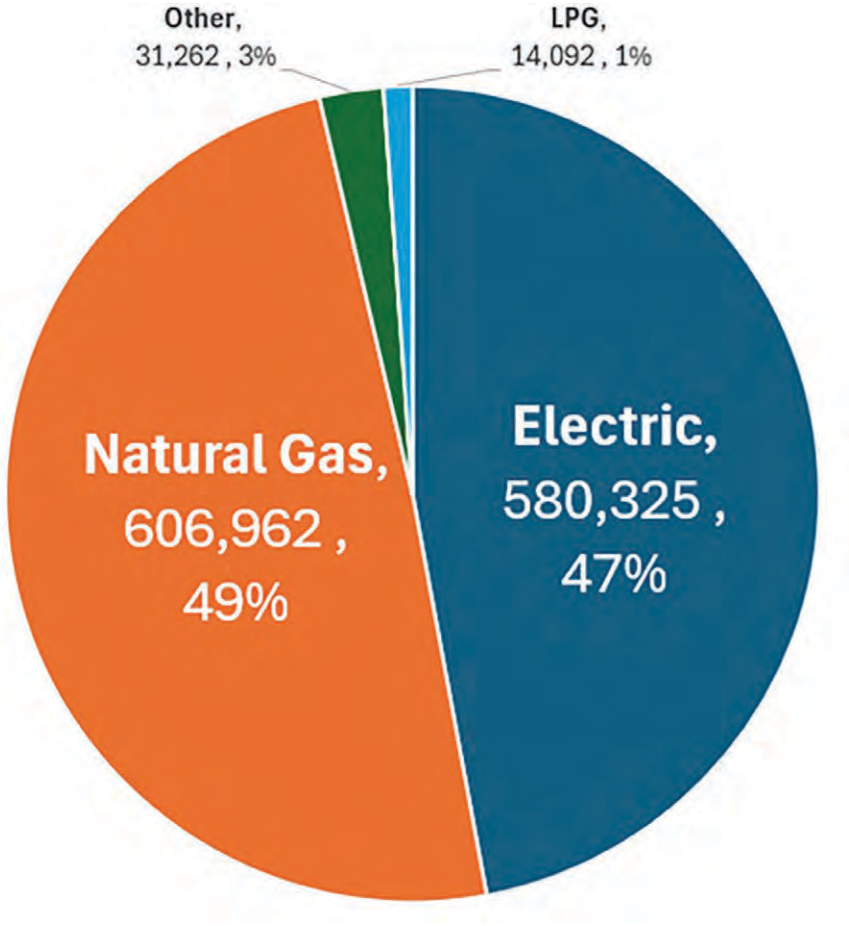
Emissions Factors: Other Stationary Fuels (kg / MMBtu)

GHG	Distillate Fuel Oil	HGL	Kerosene	Motor Gasoline	Residual Fuel Oil	Wood
CO2	73.96	62.98	n/a	0.06683	n/a	93.8
CH4	0.010870	0.010870	n/a	0.000003	n/a	0.316
N2O	.00072464	0.0010870	n/a	0.0000006	n/a	0.0042

E3. Energy Emissions - Residential

1.23 MMT of CO2e | 34% of Energy (Building) Emissions | 20% of overall emissions

MT CO2e by Energy Type for the Residential Sector



MT CO2e by Energy Type for the Residential Sector

Energy Type	MT CO2e	Percent
Electric	580,325	47%
Natural Gas	608,141	50%
Other	31,511	3%
Liquefied Petroleum Gas (LPG)	14,092	1%
TOTAL	**1,232,642**	**100%**

Definition: All emissions from energy use in households.

Residential Energy Use in Washoe County – Electricity

Washoe County residential customers used 1,753,864 MW of electricity in 2021. NV Energy delivered 1,748,938 MW to 210,138 residential customers, Plumas Sierra Rural Electric Cooperative delivered 4,882 MW to 416 customers, and Surprise Valley Electrification Corp delivered 44 MW to 4 households.

Residential Electric Use in Washoe County, 2021

Residential Electric	MT CO2e	kWh	MW
NV Energy - Residential Electric	578,899	1,748,938,174	1,748,938
Plumas Sierra Rural Electric Cooperative	1,414	4,882,314	4,882
Surprise Valley Electrification Corp	13	43,586	44
TOTAL	**580,325**	**1,753,864,074**	**1,753,864**

Residential Energy Use in Washoe County – Natural Gas

Washoe County residential customers used 115,519,384 therms of natural gas in 2021. NV Energy delivered 107,348,003 therms to 169,787 residential customers. Southwest Gas delivered 8,171,381 therms to 8,397 residential customers.

Residential Natural Gas Use in Washoe County, 2021

Residential Natural Gas	MT CO2e	Therms
NV Energy - Residential NG	564,683	106,176 ,831
SW Gas - Residential NG	43,458	8,171,381
TOTAL	**608,141**	**115,519,384**

Residential Energy Use in Washoe County – Liquefied Petroleum Gas (LPG)

NV Energy delivered 221,669 therms of LPG to residential customers in 2021.

Residential Energy Use in Washoe County – Other Stationary Fuel Combustion

The Energy Information Administration (EIA) provides **statewide MMBtu generation from alternate stationary energy types**, to which the inventory applies a "total households" ratio of 16.54% to calculate Washoe County's share of these emissions.

Residential Sector Energy Consumption Estimates, 2021

House Heating fuel type	Million Btu (MMBtu), Nevada	Million Btu (MMBtu), Washoe County
Bottled, tank, or liquefied petroleum (LP) gas, including propane	2,300,000	380,418
All other fuels, including wood	2,100,000	347,338
Distillate fuel oil	300,000	49,620

Future inventories may incorporate data from the American Community Survey Data (ACS S2504), which has specific ratios by fuel type.

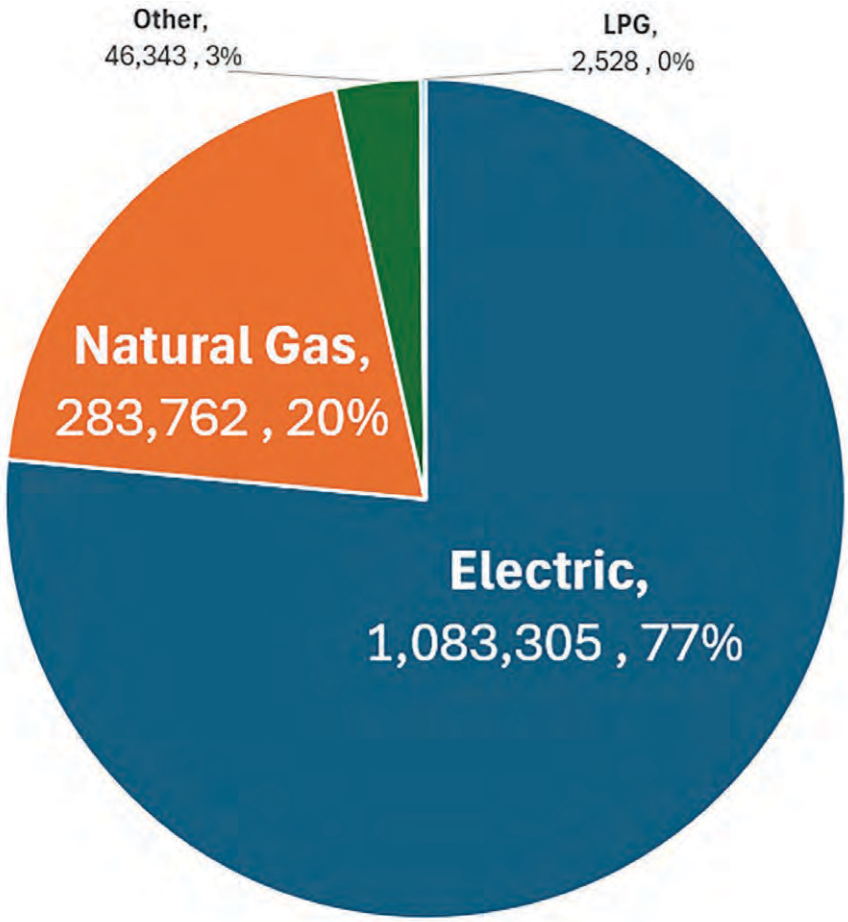
Count of homes in Washoe County and Nevada using alternate fuel types, 2021

House Heating fuel type	# of Nevada homes using fuel type	# of Washoe County homes using fuel type	Of homes in NV using fuel type: % in Washoe County
Bottled, tank, or liquefied petroleum (LP) gas, including propane	30,489	6,818	22%
All other fuels, including wood	24,937	4,324	17%
Fuel oil, kerosene, etc.	6,243	3,879	62%

E4. Energy Emissions - Commercial

1.42 MMT of CO2e | 40% of Energy (Building) Emissions | 22% of overall emissions

MT CO2e by Energy Type for the Commercial Sector



MT CO2e by Energy Type for the Residential Sector

Fuel Type	MT CO2e	Percent
Electric	1,083,305	77%
Natural Gas	283,762	20%
Other	46,343	3%
Liquified Petroleum Gas (LPG)	2,528	0%
TOTAL	**1,415,937**	**100%**

Definition: Commercial and institutional buildings and facilities provide public services for community needs, including safety, security, communications, recreation, sport, education, health, public administration, religious, cultural, and social. This includes commercial buildings and establishments, such as retail outlets, shopping complexes, office buildings; institutional buildings, such as schools, hospitals, police stations, government offices; and facilities, such as street lighting on highways, secondary roads and pedestrian areas, parking, mass transit,

docks, navigation aids, fire and police protection, and public recreation areas. Water supply, waste collection and treatment (including drainage) are calculated separately, per the USCP.

Commercial Energy Use in Washoe County – Electricity

Washoe County commercial customers used 3,272,854 megawatts (MW) of electricity in 2021. NV Energy delivered 3,272,732 megawatts (MW) of electricity to 32,762 commercial customers and 1,405 government (municipal) customers in 2021. Surprise Valley Electrification Corp delivered 65 MW to 6 commercial customers, and Plumas Sierra delivered 57 MW to 7 commercial customers.

Government (municipal) energy usage is included in the Commercial sector for NV Energy's data. To avoid double-counting with the Water and Wastewater sector, this inventory has removed the total reported Water and Wastewater kWh (107,066,420) from NV Energy's reported Municipal Electric kWh (161,977,037). The Municipal remainder (54,910,653) is reported below.

Commercial Electricity Use in Washoe County, 2021

Commercial Electric	MT CO2e	kWh	MW
NV Energy - all Commercial Electric	1,083,275	3,272,732,775	3,272,732
NV Energy - Commercial Electric	1,065,100	3,217,822,122	3,217,822
NV Energy - Municipal Electric	18,175	54,910,653	54,910
Surprise Valley Electrification Corp - Commercial	19	65,284	65
Plumas Sierra Rural Electric Cooperative - Commercial	16	56,624	57
TOTAL	**1,083,311**	**3,272,854,683**	**3,272,854**

Commercial Energy Use in Washoe County – Natural Gas

Washoe County commercial customers used 53,395,093 therms of natural gas in 2021. NV Energy delivered 51,656,782 therms to 14,144 commercial customers, and Southwest Gas delivered 1,738,311 therms to 600 commercial customers.

Commercial Natural Gas Use in Washoe County, 2021

Commercial Natural Gas	MT CO2e	Therms
NV Energy - Commercial Natural Gas	274,827	51,656,782
Southwest Gas - Commercial Natural Gas	9,246	1,738,311
TOTAL	**284,073**	**53,395,093**

Commercial Energy Use in Washoe County – Liquefied Petroleum Gas (LPG)

NV Energy delivered 2,528 therms of LPG to commercial customers in 2021.

Commercial Energy Use in Washoe County – Other Stationary Fuel Combustion

The Energy Information Administration (EIA) provides statewide MMBtu generation from alternate stationary energy types, to which the inventory applies a ratio of 16.21% for commercial jobs based on US Census Bureau jobs data to calculate Washoe County's share of these emissions. See **Appendix 8** for a full jobs count list.

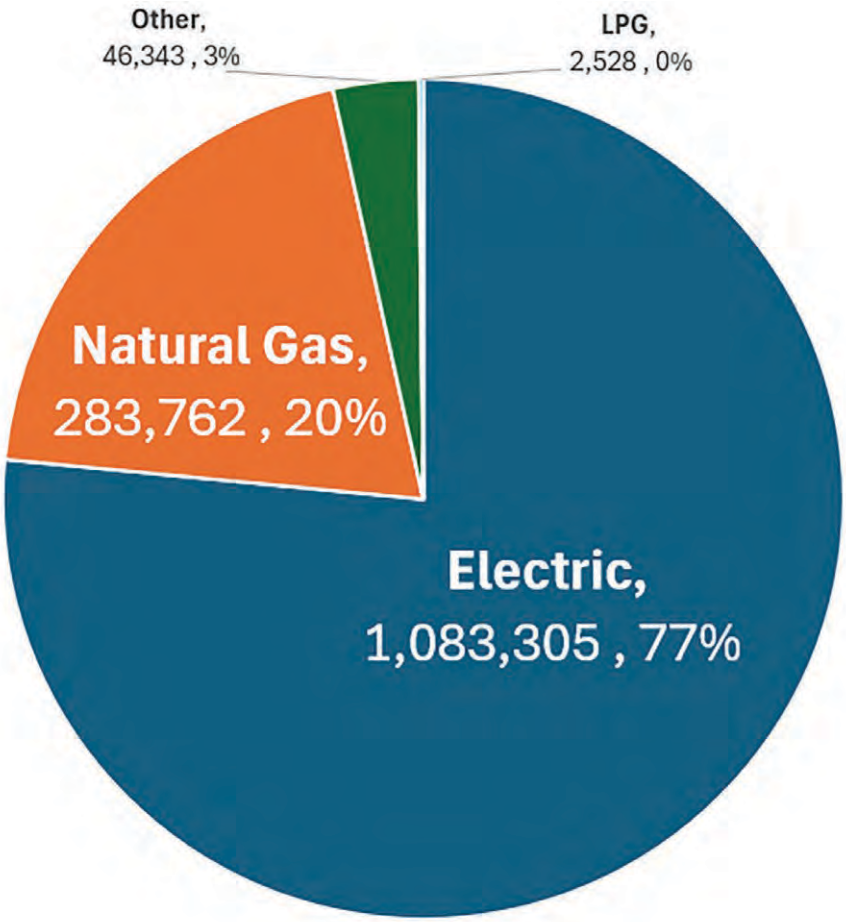
Commercial Sector Energy Consumption Estimates, 2021

House Heating fuel type	Million Btu (MMBtu), Nevada	Million Btu (MMBtu), Washoe County
Bottled, tank, or liquefied petroleum (LP) gas, including propane	1,900,000	307,917
All other fuels, including wood	400,000	64,825
Distillate fuel oil	2,200,000	356,535

E5. Energy Emissions - Industrial

1.42 MMT of CO2e | 40% of Energy (Building) Emissions | 22% of overall emissions

MT CO2e by Energy Type for the Commercial Sector



MT CO2e by Energy Type for the Industrial Sector

Fuel Type	MT CO2e	Percent
Electric	529,031	57%
Other	299,380	32%
Natural Gas	101,050	11%
TOTAL	**929,461**	**100%**

Definition: This sector includes energy use in manufacturing industries and construction activities. Fuel combustion occurs in stationary equipment, including boilers, furnaces, burners, turbines, heaters, incinerators, engines, flares, etc.

Industrial Energy use in Washoe County - Electric

NV Energy delivered 1,598,279 MW of electricity to 170 industrial customers in 2021.

Industrial Electricity Use in Washoe County, 2021

Industrial Electric	MT CO2e	kWh	MW
NV Energy - Industrial Electric	529,031	1,598,279,379	1,598,279

Industrial Energy use in Washoe County – Natural gas

NV Energy delivered 19,039,233 therms of natural gas to large commercial (industrial) customers in 2021. Southwest Gas did not report any Industrial natural gas customers.

Industrial Natural Gas Use in Washoe County, 2021

Industrial Natural Gas	MT CO2e	Therms
NV Energy - Industrial Natural Gas	101,050	19,039,233

Industrial Energy Use in Washoe County – Other Stationary Fuel Combustion

The Energy Information Administration (EIA) provides statewide MMBtu generation from alternate stationary energy types, to which the inventory applies a ratio of 20.18% for industrial jobs based on US Census Bureau jobs data to calculate Washoe County's share of these emissions. See **Appendix 8** for a full jobs count list.

Industrial Sector Energy Consumption Estimates, 2021

House Heating fuel type	Million Btu (MMBtu), Nevada	Million Btu (MMBtu), Washoe County
Bottled, tank, or liquefied petroleum (LP) gas, including propane	800,000	161,434
All other fuels, including wood	100,000	20,179
Distillate fuel oil	17,400,000	3,511,184
Industrial Motor Gasoline	2,300,000	464,122

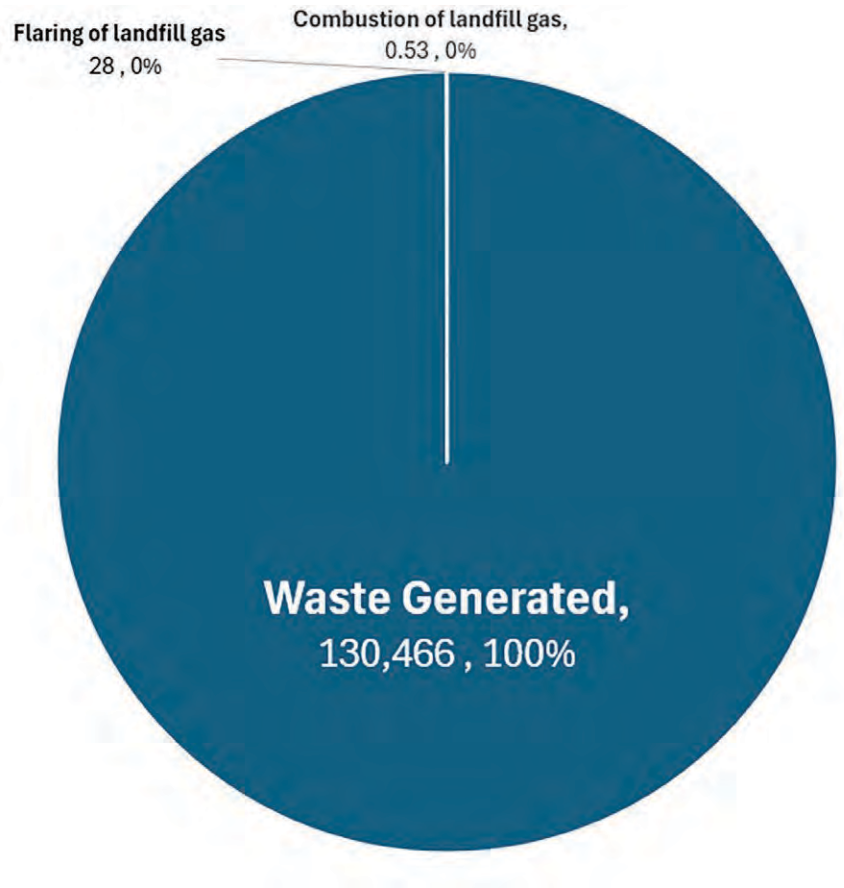
E6. Solid Waste Emissions

0.13 MMT of CO2e | 2% of overall emissions

(1) Solid Waste Summary

The Solid Waste sector causes 0.13 MMT of CO2e, or 2% of emissions in Washoe County. Almost 100% of the emissions come from actual waste generated, with the remainder coming from flaring of landfill gas and the combustion of landfill gas, which generates energy that is sent back to the grid.

CO2e emissions from Solid Waste in Washoe County



MT CO2e by Activity for Solid Waste

Activity	MT CO2e	Percent
Waste generated	130,466	100%
Flaring of landfill gas	28	0%
Combustion of landfill gas	0.53	0%
TOTAL	**130,495**	**100%**

Definition: Municipal Solid Waste (MSW) is waste collected by municipalities or other local authorities. MSW typically includes: food waste, garden and park waste, paper and cardboard, wood, textiles, disposable diapers, rubber and leather, plastics, metal, glass and other materials (e.g., ash, dirt dust, soil, electronic waste).

(2) Solid Waste Management in Washoe County

Waste Management (WM) provides waste removal services for all of Washoe County, including Unincorporated areas, Reno, and Sparks. **WM provides** weekly curbside trash pick-up and bi-weekly curbside recycling pick-up for residents. Trash and recycling service is provided to businesses as needed. In 2024 WM reported 37,718 residential customers in Unincorporated Washoe County, 32,722 in the City of Sparks, and 72,592 in City of Reno. They also reported serving 493 businesses in Unincorporated Washoe County, 1,879 in the City of Sparks, and 4,987 in the City of Reno.

Most trash in Washoe County passes through one of WM's three transfer stations: the Commercial Row Transfer Station (Reno), the Stead Transfer Station (Reno), or the Incline Village transfer station. The Commercial Row, Stead, and Incline Village transfer stations receive trash from 1) WM's collection trucks, or 2) self-hauling customers.

Figure 10: The tipper empties trash into Lockwood Landfill; image from WM

WM transfer trucks then take the trash to **Lockwood Regional Landfill**, a fully permitted class I municipal solid waste landfill located about 10 miles east of Reno in Storey County, Nevada. The site encompasses approximately 3,200 acres of open land with the landfill occupying approximately 555 acres. When transfer trucks filled with trash arrive at Lockwood Landfill, they pull onto a "tipper" which lifts the entire trailer dumping trash into an open cell (see Figure 10). Only one cell is active at a time. A compactor moves back and forth over the loose trash until it is tightly compacted and takes up the least amount of space possible. The trash is covered every evening with a layer of soil, alternative daily cover (inert material such as glass or chipped tires) and possibly a tarp. Covering the trash is required to reduce odors, discourage scavenging wildlife and reduce flies and other vectors from entering or escaping the material.

Figure 11: Example of an enclosed LFG flare, from **EPA website**

As the trash decomposes, it produces methane. This methane is collected in pipes so that it can be vented, burned, and used as an energy source. See Figure 11 for an example. Given Nevada's arid climate, leachate (garbage juice) pooling in the landfill is uncommon. However, Lockwood has a natural clay liner that prevents seepage into groundwater. As the landfill is expanded, the lowest levels are built with a composite liner to contain any potential leachate or other unwanted material from escaping.

WM also collects recyclable materials from residents and businesses. Recyclable materials are taken to the Eco Center

Material Recycling Facility (MRF) on E. Commercial Row in Reno for cleaning and sorting before being transported to a facility in Sacramento, California for a secondary sort. Paper, cardboard, tin, and plastic is baled to be sold as commodities. Glass collected in Northern Nevada is diverted from the Eco Center MRF to Lockwood Landfill where it is used as alternative daily cover. Because recycled items will be reused, no carbon emissions are associated with them, and they are not included in this inventory.

(3) Solid Waste Emissions in Washoe County

Greenhouse gas emissions occur throughout the lifecycle of waste management.

Waste Generated First, the waste generated by a community creates emissions, regardless of where it is disposed. In 2021, Washoe County generated 300,775 tons of waste. When MSW is first deposited in a landfill, it undergoes an aerobic (with oxygen) decomposition stage when little methane is generated. Then, typically within less than 1 year, anaerobic conditions are established and methane-producing bacteria begin to decompose the waste and generate methane. The landfill methane collection scenario is important to calculations in this inventory because methane is a potent greenhouse gas **at least 28 times more effective than CO_2 at trapping heat** in the atmosphere over a 100-year period, per IPCC assessment report AR6. The landfill methane collection scenario at Lockwood is "typical," per the table below.

Landfill methane collection scenario

Scenario	0%	50%	75%	82.50%	90%
Worst-case	Yrs 0 - 4	Yrs 5 – 9	Yrs 10 - 14	Years 15 to one year before final cover	Final cover
Typical	Yrs 0 - 1	Yrs 2 - 4	Yrs 5 - 14	Years 15 to one year before final cover	Final cover
Aggressive	Yr 0	Yrs .5 - 2	Yrs 3 - 14	Years 15 to one year before final cover	Final cover
California Regulatory	Yr 0	Yr 1	Yrs 2 - 7	Years 8 to 1 year before final cover (85%)	Final cover

The wetter the landfill content, the more GHG emissions. The landfill moisture content at Lockwood is "dry," with **Storey County receiving 19 inches of rain per year, on average**.

Precipitation Categories

Category	Annual inches
Dry	< 20
Moderate	20 - 40
Wet	> 40

To identify waste types in the landfill, this inventory uses data from a 2018 Waste Composition and Characterization Analysis of hand-sorted materials at WM transfer stations (Incline, Stead, and Sage) in spring and fall of 2018. Recyclable items are not pulled from transfer station waste as part of standard operating procedure.

2018 spring / fall waste characterization: (Incline, Stead, and Sage transfer stations)

148 Samples, Visual Sort	Mean	Standard Deviation	Lower	Upper
1. Dry Recoverable Fiber	11.9%	14%	10%	14%
2. PET	1.3%	1%	1%	1%
3. HDPE	.8%	1%	1%	1%
4. Film Plastic	5.9%	5%	5%	7%
5. Mixed Plastics	5.4%	4%	5%	6%
6. Glass	2.5%	5%	2%	3%
7. Aluminum	0.6%	1%	1%	1%
8. Mixed Ferrous (Tin & Salvage)	2.2%	3%	2%	3%
9. Mixed Non-Ferrous (Salvage)	0.9%	3%	0%	1%
10. Inerts	1.7%	4%	1%	2%
11. Hazardous Waste	0.1%	1%	0%	0%
12. E-Waste	0.3%	2%	0%	1%
13. Textiles	3.2%	6%	2%	4%
14. Organics	55.7%	21%	53%	59%
a. Yard Waste	15.3%	19%	13%	18%
b. Food Waste	22.6%	17%	20%	25%
c. Clean Wood	3.4%	8%	2%	5%
d. Treated/Painted Wood	2.6%	7%	2%	4%
e. Wet/Contaminated Fiber	10.9%	8%	10%	12%
f. Rubber	0.2%	1%	0%	0%
g. Allocated Organics	0.6%	5%	0%	1%
15. Fines (<2” Items)	1.6%	4%	1%	2%
16. Other	6.1%	11%	5%	8%

The data shows that 67.6% of material thrown in the trash is “Organics” (55.7%) or “Dry Recoverable Fiber” (11.9%). Dry Recoverable Fiber is defined as “All clean dry fiber, including cardboard (old corrugated cardboard), chip board (cereal / shoe box), office paper, junk mail, and shredded paper that is readily recoverable using current waste / recycling processing technology.” Definitions for all categories are listed in **Appendix 9**.

Organic materials cause greenhouse gas emissions, and the inventory calculates emissions for those items only. The Waste Characterization categories do not exactly match Clearpath categories, so they are instead mapped as follows. Rubber (0.2%) and Allocated Organics (0.6%) are not included in the calculation.

Mapping to Clearpath from Waste Characterization

Clearpath Waste Type	Inventory %	Relationship to Waste Characterization
Newspaper	0.0%	Not in "fiber" definitions
Office Paper	7.6%	One third of 22.8% dry + wet fiber
Corrugated Cardboard	7.6%	One third of 22.8% dry + wet fiber
Magazines / Third Class Mail	7.6%	One third of 22.8% dry + wet fiber
Food Scraps	22.6%	Full "food waste" number
Grass	5.10%	One third of 15.3% yard waste
Leaves	5.10%	One third of 15.3% yard waste
Branches	5.10%	One third of 15.3% yard waste
Dimensional Lumber	6.0%	Sum of clean and treated / painted wood
TOTAL	**66.7%**	

The Inventory then applies a factor set from EPA's **WARM (Waste Reduction Model) tool**, version 15.

2021 Factor Set for Waste (MT CH_4 / wet short ton)

Waste Type	Factor
Newspaper	0.0420
Office Paper	0.1556
Corrugated Cardboard	0.1048
Magazines / Third Class Mail	0.0476
Food Scraps	0.0648
Grass	0.0228
Leaves	0.0260
Branches	0.0580
Dimensional Lumber	0.0068

Combustion and flaring of landfill gas Next, the disposal of landfill gases causes emissions. In a **typical landfill operation**, landfill gas (LFG) is extracted from landfills using a series of wells and a blower / flare (or vacuum) system. The image in Figure 12 shows a technician checking a gas well at Lockwood landfill. This system directs the collected gas to a central point where it can be processed and treated depending upon the ultimate use for the gas. From this point, the gas can be flared or beneficially used in an LFG energy project. Lockwood Landfill emits 1,652,673,700 cubic feet / year of landfill gas. Since 28% of waste in the landfill comes from Washoe County, ~642,309,095 cubic feet / year are related to Washoe County Operations. Of that gas, 41% (261,858,830 cubic feet / year) is flared, and 59% (380,450,265 cubic feet / year)

is combusted to generate grid electricity. Methane (CH_4) makes up 52% of the landfill gas, and 99.96% of that methane is destroyed in this process. The inventory applies standard emissions factors to the small remainder of methane as well as the flared gas.

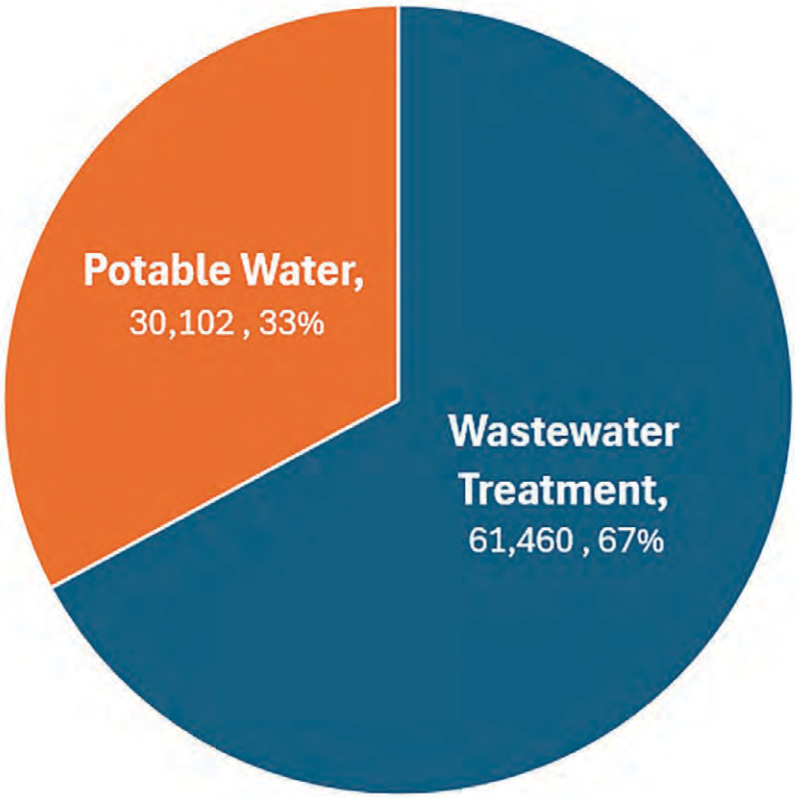
Figure 12: A technician checks a gas well at Lockwood landfill. (WM photo)

E7. Water & Wastewater Emissions

(1) Water & Wastewater Summary

The Water & Wastewater sector causes 0.09 MMT of CO2e, or 1% of emissions in Washoe County. Potable (drinkable) water causes one third of emissions in this category (0.03 MMT), and wastewater causes two thirds of emissions in this category (0.06 MMT).

MT CO2e for Potable Water and Wastewater Treatment in Washoe County



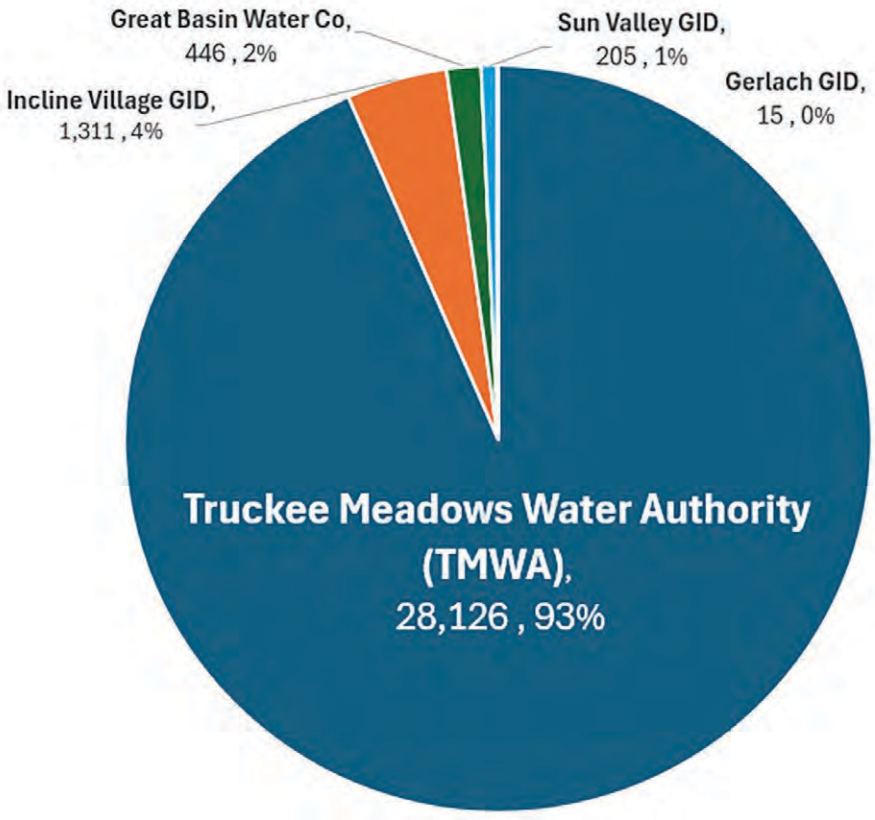
Wastewater Treatment and Potable Water, MT CO2e by Service

Activity	MT CO2e	Percent
Wastewater Treatment	61,460	67%
Potable Water	30,102	33%
TOTAL	91,562	100%

(2) Emissions from the Supply of Potable Water Operations in Washoe County (USCP Recommended)

0.03 MMT of CO2e | 33% of Water & Wastewater Emissions | <1% of overall emissions

Sources of MT CO2e for Potable Water Operations



Potable Water, MT CO2e by Operator

Activity	MT CO2e	Percent
Truckee Meadows Water Authority (TMWA)	28,126	93%
Incline Village GID	1,311	4%
Great Basin Water Co	446	2%
Sun Valley GID	205	1%
Gerlach GID	15	0%
TOTAL	**30,102**	**100%**

Definition of Potable Water Operations Potable Water Operations deliver clean drinking water to members of the community.

Potable Water in Washoe County Four operators provide potable water to the Washoe County community. Truckee Meadows Water Authority (TMWA) is a not-for-profit, community-owned water utility serving more than 440,000 residents. Great Basin Water Company is a private water and wastewater utility provider delivering services to over 20,000 residential and commercial customers in the Cold Springs, Spanish Springs in Washoe County as well

as Spring Creek (Elko County), and Pahrump (Nye County) communities. Finally, two General Improvement Districts (GIDs) provide water to their residents: Incline Village and Sun Valley. Incline Village GID is chartered to provide water, sewer, trash, and recreation services for the communities of Incline Village and Crystal Bay, Nevada in unincorporated Washoe County. Sun Valley GID is chartered to provide water, sewer, garbage, and recreation services throughout the community. The District owns and maintains an estimated 100 miles of water mains, 120 miles of sewer mains, two sewer vaults, several pressure reducing vaults and pumping stations, and nine water storage water tanks. The Gerlach GID provides water, disposal, and sewer services to the 125 residents of the community. For more about GIDs in Nevada, see the Glossary in **Appendix 2**. Together, these four operators process 30,076 million gallons of water each year.

Volume of Potable Water and Population Served, by Operator

Operator	Volume (million gallons / yr)	Population
Truckee Meadows Water Authority (TMWA)	27,915	444,182
Incline Village GID	861	9,799
Great Basin Water Co	664	11,167
Sun Valley GID	636	21,178
Gerlach GID	16.3	125
Total	**30,092**	**486,451**

GHG Inventory Methodology Emissions for potable water production are calculated based on electricity and natural gas use, as documented in **E2 Energy Methodology**. Operators' energy use is listed below. In the Commercial Energy sector of this inventory, potable water GHG energy usage values are subtracted from the utility-provided total energy-use numbers to avoid double-counting.

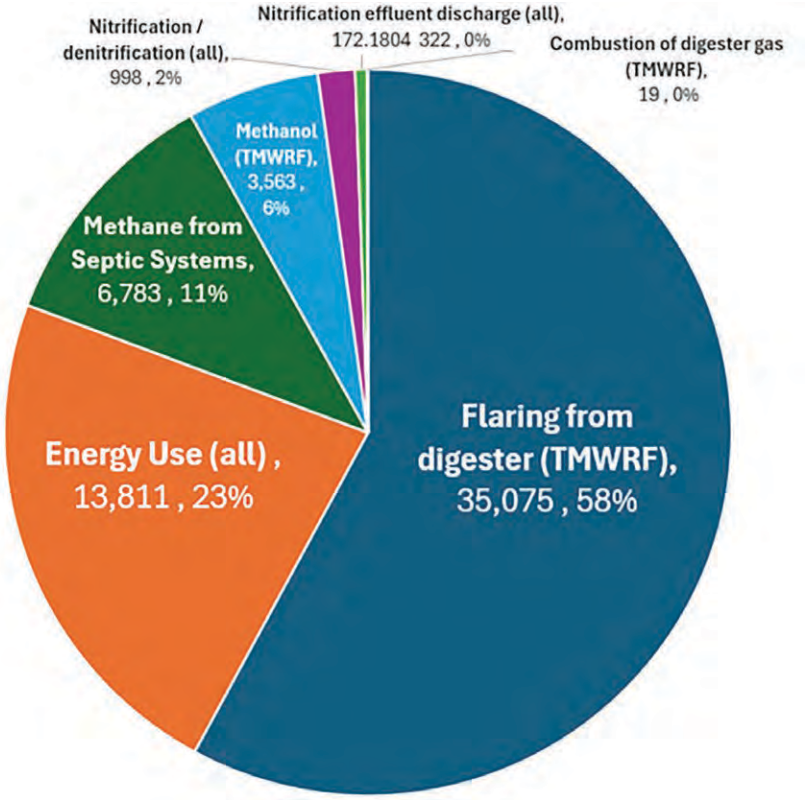
Potable Water Energy Use

Operator	Electricity (kWh)	Natural Gas (MMBtu)
Truckee Meadows Water Authority	65,183,869	123,170
Incline Village GID	3,932,368	1,761
Great Basin Water Co	1,346,223	0
Sun Valley GID	517,390	6,271
Gerlach GID	15,712	1,872
Total	**70,995,562**	**133,074**

(3) Emissions from Wastewater Operations in Washoe County

0.06 MMT of CO2e | 67% of Water & Wastewater Emissions | <1% of overall emissions

Sources of MT CO2e for Wastewater Operations



Wastewater, MT CO2e by Source

Activity	MT CO2e	Percent
Flaring from digester (TMWRF)	35,075	57%
Energy use (all operators)	13,811	22%
Methane from septic systems	7,672	12%
Methanol (TMWRF)	3,563	6%
Nitrification / Denitrification (all operators)	998	2%
Nitrification effluent Discharge (all operators)	322	<1%
Combustion of digester gas	19	<1%
TOTAL	**61,460**	**100%**

Definition Wastewater, per the EPA, includes water that has constituents of human and / or animal metabolic (related to converting food and drink to energy in the body) wastes and water that has residuals from cooking, cleaning and / or bathing.

Wastewater Management in Washoe County Five organizations process wastewater in Washoe County. Truckee Meadows Water Reclamation Facility (TMWRF), has a permitted

capacity of 44 million gallons / day. That capacity is shared between the cities of Reno and Sparks and portions are leased to the Sun Valley General Improvement District and Washoe County. Current flows into the facility average 30 million gallons / day. The facility (see an image in Figure 13) is located in the City of Sparks, which serves as the operating authority. City of Reno directs major capital improvements, and a Joint Coordinating Committee (JCC) includes representatives from Sparks, Reno, Washoe County, and Sun Valley General Improvement District (GID). TMWRF serves the central Truckee Meadows, including areas within the City of Reno, the City of Sparks, the Sun Valley General Improvement District, and portions of Washoe County that are within the Truckee Meadows and the Spanish Springs Valley. The sewer system transports wastewater flows from the Truckee Meadows Valley, Spanish Springs Valley, Sun Valley, Verdi / Truckee Canyon, and portions of the Golden Valley and Lemmon Valley hydrographic (river) basins.

Figure 13: TMWRF facility, via TMWRF website

The **Reno-Stead Water Reclamation Facility (RSWRF)** is a wastewater treatment and water reclamation facility meeting the latest design standards, instrumentation and process control technology, and energy and manpower efficiency to treat up to 2 million gallons per day of raw sewage, in compliance with stringent public health and water quality discharge standards. In 2021, RSWRF's capacity was approximately 2 million gallons per day. The facility planned to expand its capacity to 4 million gallons per day by 2023. A large portion of the water recycled at RSWRF flows to Swan Lake, where it supports the Swan Lake Nature Study. During the irrigation season, recycled water from RSWRF is also used for irrigation at North Valleys Regional Park / Sports Complex, Sierra Sage Golf Course, The Lakes Apartments, and Mayor's Park. RSWRF also has a Truck Fill Station in Reno for recycled water service customers.

The **Washoe County Community Services Department Utility Team** provides wastewater treatment to approximately 16,000 customers including some urban areas in Reno and Sparks. The Utility treats an average of 5 million gallons of wastewater per day at three regional wastewater plants and manages the recovery of reclaimed water and biosolids from these waste streams. The three regional wastewater plants are South Truckee Meadows Water Reclamation Facility (STMWRF), Cold Springs Water Reclamation Facility (CSWRF), and Lemmon Valley Water Reclamation Facility (LVWRF).

Incline Village GID Wastewater Reclamation Facility receives an average of 1.3 million gallons of wastewater daily. The collection and export system for wastewater includes: 100 miles of sewer pipelines, 18 pumping stations, a half million-gallon storage tank, and a twenty-mile export pipeline taking treated effluent water out of the Tahoe Basin for final disposal. The wastewater treatment plant processes and disinfects wastewater using conventional biological treatment processes and solids handling facilities. The wastewater treatment process from start to finish takes approximately 15 hours. The solids removed from the process are sent to Bentley Ranch for composting with other organic material. The export pipeline transports the plant's secondary treated effluent to the IVGID wetlands in Douglas County.

The Gerlach GID has a small treatment plant south of the town. Influent waste flows through two, 1.4 acre facultative ponds in series, then empties into an evaporation basin. Nominal capacity is 20,000 gallons per day. In a facultative system, no energy is used.

And finally, some households and businesses, usually in suburban and rural areas, do not receive direct service from centralized wastewater treatment plants. These buildings depend on **septic systems** to treat and dispose relatively small volumes of wastewater. Septic systems treat wastewater from household plumbing fixtures (toilet, shower, laundry, etc) through both natural and technological processes, typically beginning with solids settling in a septic tank, and ending with wastewater treatment in the soil via the drainfield. This inventory estimates the population served by septic systems (57,472) by subtracting the operator-reported population served by wastewater treatment plants (427,641) from the 2021 NV State Demographer's population statistic (485,113).

Volume of water treated and population, by Wastewater Treatment Operator

Operator	Volume of water treated (million gallons / yr)	Population served
TMWRF	10,436	363,000
Washoe County	1,481	26,717
Reno Stead	649	28,000
Incline Village GID	360	9,799
Gerlach GID	5	125
Septic	-	57,472
TOTAL	**12,931**	**485,113**

How wastewater treatment plants work Wastewater treatment plants clean sewage and water so they can be returned to the environment. First, large and small debris is removed. Next, organic matter, including carbon and nitrogen, is broken down and removed. Then, the wastewater is treated to remove phosphorus, nitrogen, and other nutrients, and it is disinfected. Finally, the solid sludge is treated and sent to landfill, and the clean water is returned to the environment.

Truckee Meadows Water Reclamation Facility (TMWRF) describes its specific process on its **website**: "TMWRF is a biological nutrient removal plant that uses separate nitrification and denitrification processes for nitrogen removal and biological and chemical processes for phosphorus removal. Reclaimed water is discharged to the Truckee River or is pumped to effluent (treated wastewater) reuse sites throughout the region. Solids are thickened, anaerobically digested, dewatered and hauled to the local landfill for disposal. The methane gas produced by solids digestion is used to generate the hot water which is used to heat many TMWRF's buildings as well as run a 988 kilowatt cogeneration engine which reduces power costs for the facility by roughly 1/3."

GHG Inventory Methodology

Wastewater emissions come from different stages of the treatment process. First, the energy used to run the facilities causes emissions. Second, emissions come from the processes of combusting (burning) and flaring wastewater gases. Third, emissions come from the process of removing nitrogen from the water. And fourth, combustion of solid waste causes emissions. Not all facilities in Washoe County use all of these processes.

Inventory inputs for Wastewater Treatment

Emissions Category	TMWRF	Washoe County	Reno Stead	Incline Village	Gerlach GID
Energy use, kWh	25,628,000	8,754,862	5,071	1,698,637	0
Energy use, therms	0	0	22,232	14,829	0
Digester	**TMWRF**	**Washoe County**	**Reno Stead**	**Incline Village**	**Gerlach GID**
Does the facility have a digester?	Yes, anaerobic	Yes, aerobic	No	No	No
Combustion: volume of gas produced by the digester and combusted each day (scf / day)	385,920	-	-	-	-
Percent of methane (CH4) in digester gas	51.12%	-	-	-	-
Flaring: volume of gas produced by the digester and flared each day (scf / day)	184,320	-	-	-	-
Destruction efficiency of CH4	unmonitored	-	-	-	-
Nitrification / denitrification	**TMWRF**	**Washoe County**	**Reno Stead**	**Incline Village**	**Gerlach GID**
Does the facility use nitrification / denitrification?	Yes	Yes	Yes	No	No
Daily nitrogen load (N load) from effluent discharge (kg N/day)	216	155	41	-	-
Nitrogen removal	**TMWRF**	**Washoe County**	**Reno Stead**	**Incline Village**	**Gerlach GID**
Is methanol used for nitrogen removal?	Yes	No	No	No	No
Daily methanol load (MT methanol used / day)	8.9	-	-	-	-
Solids Disposal	**TMWRF**	**Washoe County**	**Reno Stead**	**Incline Village**	**Gerlach GID**
Are solids combusted?	No	No	No	No	No

Energy Use methodology Emissions for wastewater processes are calculated based on electricity and natural gas use, using the factor sets documented in **E2, Energy Methodology**. Operators' energy use is listed above. To avoid double-counting, this inventory subtracts reported wastewater GHG energy use data from the utility-provided total energy-use data in the **Commercial Energy** section of this report.

Digester methodology Digestion is a process through which bacteria break down organic matter. This process is used on biosolids that are removed from wastewater.

Anaerobic digestion happens in the absence of oxygen in a vessel called a reactor. The process produces two outputs: biogas and digestate. Biogas is composed of a large percentage (50-75%) of methane (CH4) as well as carbon dioxide (CO2), hydrogen sulfide (H2S), water vapor, and trace amounts of other gases. Digestate is the residual material left after the digestion process. It is composed of liquid and solid portions.

Aerobic digesters, which operate in the presence of oxygen, produce non-combustible carbon dioxide gas, not methane. This process can also produce products like nitrate and phosphate.

TMWRF uses an anaerobic digester, and Washoe County uses an aerobic digester. Reno Stead, Incline Village, and Gerlach do not have digesters.

TMWRF combusts (burns) its methane gas (51%) and flares the remainder of the gas (49%). The exact methane destruction efficiency is not monitored, so this inventory assumes a destruction efficiency of 99.96%. The inventory uses the methane (CH4) emissions factor (0.0032 kg / MMBtu) and nitrogen emissions factor (0.00063 kg / MMBtu) to estimate the GHG impact of processing these gases. TMWRF recovers energy from this process and sends that energy to the electric grid; the facility uses heat from the process on-site.

Nitrification / denitrification methodology Nitrification and denitrification are processes used to clean wastewater. Nitrification is the biological oxidation (adding of oxygen) of ammonia (NH3) or ammonium (NH4+) in wastewater to create nitrite (NO2, then NO3). Denitrification is the process in which nitrate (NO3) is converted into nitrogen gas (N2) that goes back into the atmosphere, instead of polluting sensitive waterways. This inventory uses the emissions factor of 7 grams of N2O / person for the nitrification / denitrification process. The inventory then uses the N2O emissions factor of 0.005 kg N2O / kg N to measure the GHG impact of the daily nitrogen load in wastewater effluent. "Nitrogen load" is the amount of nitrogen discharged into a water body during a time period.

Methanol methodology Some wastewater treatment plants use methanol to assist with nitrogen removal. Methanol (CH3OH) is a type of alcohol that functions as a carbon source to accelerate the biodegradation of nitrogen. TMWRF is the only plant in Washoe County that uses methanol, and it uses 8.9 metric tons / day. This inventory applies an emissions factor of 1.096 CO2.

Solids Disposal methodology Some wastewater treatment plants combust their biosolids, causing emissions. None of the facilities in Washoe County do this. All of the biosolids are landfilled, and those emissions are captured in section **E6, Solid Waste**.

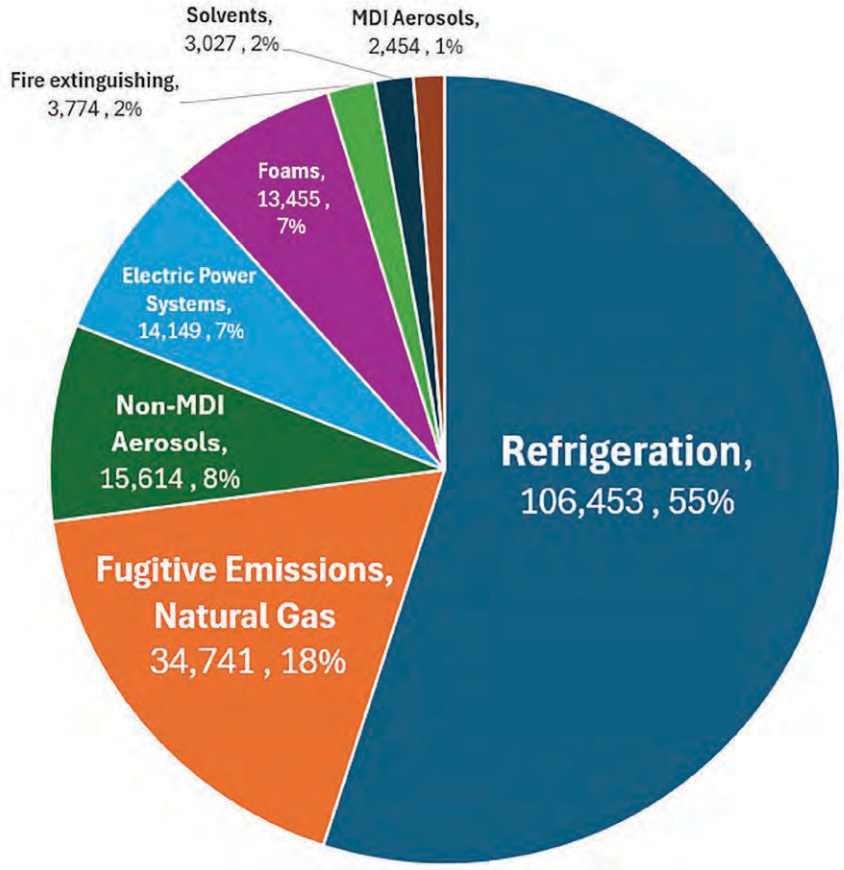
Septic – Fugitive Methane emissions methodology This inventory calculates methane emissions from septic users. Using population data, the inventory applies a methane generation rate of 0.09 kg BOD5 / person / day. "BOD" stands for "biochemical oxygen demand," and BOD5 is an indirect measure of the biodegradable organic material present in water. The inventory then applies the methane emissions factor of 0.048213 MT CH4 / daily kg BOD5.

E8. Process & Fugitive Emissions

1. Process & Fugitive Emissions Summary

Process and Fugitive emissions cause 0.19 MMT of CO2e, or 3% of emissions in Washoe County. Process emissions make up 0.0% (0.00 MMT) and fugitive emissions make up 100% (0.00 MMT) of this category, with Refrigeration 65% being the largest source of fugitive emissions (56%), followed by fugitive emissions from the distribution of natural gas (18%).

MT CO2e for Process and Fugitive Emissions in Washoe County, 2021



Fugitive Emissions in Washoe County, 2021

Fugitive Emission	MT Co2E	MMT CO2e
Refrigeration - HFC125	44,602	0.0446
Refrigeration - HFC134a	28,647	0.0286
Refrigeration - HFC143a	27,409	0.0274
Refrigeration - HFC32	5,400	0.0054
Refrigeration - HFC236fa	390	0.0004
Refrigeration - Other HFC	5	0.0000
Total Refrigeration	**106,453**	**0.1065**
Fugitive emissions from Natural Gas	34,741	0.0347
Total Natural Gas	**34,741**	**0.0347**
Non-MDI Aerosols - HFC134a	9,056	0.0091
Non-MDI Aerosols - Other HFC	6,558	0.0066
Total Non-MDI Aerosols	**15,614**	**0.0156**
Electric Power Systems, SF6 - Commercial	7,104	0.0071
Electric Power Systems, SF6 - Residential	3,686	0.0037
Electric Power Systems, SF6 - Industrial	3,359	0.0034
Total Electric Power Systems	**14,149**	**0.0141**
Foams - Other HFC	10,456	0.0105
Foams - HFC134a	2,999	0.0030
Total Foams	**13,455**	**0.0135**
Fire extinguishing - Other HFC	2,531	0.0025
Fire extinguishing - HFC236fa	824	0.0008
Fire extinguishing - HFC125	272	0.0003
Fire extinguishing - CF4	72	0.0001
Fire extinguishing - HFC23	43	0.0000
Fire extinguishing - Other PFC	32	0.0000
Total Fire Extinguishing	**3,774**	**0.0038**
Solvents - Other HFC	3,027	0.0030
Solvents - Other PFC	0	0.0000
Total Solvents	**3,027**	**0.0030**
MDI Aerosols - HFC134a	1,420	0.0014
MDI Aerosols - Other HFC	1,034	0.0010
Total MDI Aerosols	**2,454**	**0.0025**
Total Fugitive Emissions	**193,667**	**0.1937**

Definition of Process and Fugitive Emissions: Process emissions result from physical or chemical processing rather than from fuel combustion. Examples include emissions from manufacturing cement, aluminum, adipic acid, ammonia, etc.

Fugitive emissions are not physically controlled but result from the intentional or unintentional release of GHGs. They commonly arise from the production, processing, transmission, storage and use of fuels or other substances, often through joints, seals, packing, gaskets, etc. Examples include HFCs from refrigeration leaks, SF6 from electrical power distributors, and CH_4 from solid waste landfills.

2. Process and Fugitive emissions in Washoe County Washoe County does not produce significant Process emissions. Heavy industrial processes cause Process emissions, and according to the **EPA's Facility Level Information on Green House gases Tool (FLIGHT)**, no buildings in Washoe County are classified as a) large emitters, directly emitting 25,000 metric tons of CO2e or more per year, or b) suppliers of certain products that would result in GHG emissions if released, combusted, or oxidized.

There are two primary sources of Fugitive emissions. First, the natural gas production and distribution system leaks methane, a potent greenhouse gas. Second, fluorinated gases escape from industrial applications including refrigeration and air conditioning equipment, solvent cleaning, foam production, sterilization, fire extinguishing, and aerosols. These gases include hydrofluorocarbons (HFCs) and perfluorocarbons (PFCs). **Sulfur hexafluoride (SF6)** is another fluorinated gas that utilities use in electric power systems for voltage electrical insulation, current interruption, and other uses in the transmission and distribution of electricity. It is the most potent greenhouse gas known to-date; over a 100-year period, SF6 is 24,300 times more effective at trapping infrared radiation than an equivalent amount of CO2.

3. Fugitive Emissions Methodology

For fugitive greenhouse gases from the transmission of natural gas, this inventory applies a leakage rate of 0.3% to the total quantity of natural gas used in Washoe County in 2021 (188,150,339 therms). This inventory assumes 93.4% of the leakage is methane (CH4) and 1% of the leakage is carbon dioxide (CO_2). It also assumes natural gas density is 0.8 kilograms per cubic meter (kg/m^3) and the natural gas energy density is 1,028 btu/scf.

For fugitive fluorinated gases, this inventory uses **the EPA's fluorinated gas measurement for Nevada** and applies a Washoe County population ratio to the statewide number. The inventory applies **global warming potentials (GWPs) from the IPCC's 6th assessment** to these values.

100-year Global Warming Potentials from the IPCC's 6th Assessment (AR6)

GHG	Global Warming Potential
HFC236fa	8,690
HFC125	3,740
CF4 (PFC-14)	7,380
HFC23	14,600

GHG	Global Warming Potential
HFC134a	1,530
HFC143a	5,810
HFC32	771
SF6	24,300

E9. Agriculture, Forestry, and Other Land Use (AFOLU)

The AFOLU sector causes 0.002 MMT of CO2e, less than 1% of emissions in Washoe County. Of the "Required" emissions categories in the USCP Inventory standard, 100% of the emissions come from electricity that powers agricultural businesses.

MT CO2e for Agricultural Emissions in Washoe County

Definition Emissions and removals from the Agriculture, Forestry and Other Land Use (AFOLU) sector are produced through a variety of pathways, including livestock (enteric fermentation and manure management), land use and land use change (e.g., forested land being cleared for cropland or settlements), and aggregate sources and non-CO2 emissions sources on land (e.g., fertilizer application and rice cultivation).

Agriculture, Forestry, and Land Use (AFOLU) Methodology

The ICLEI US Community Protocol (USCP) suggests 5 types of AFOLU data: 1) emissions from energy use 2) emissions and removals from forests, 3) emissions and removals from trees outside of forests, 4) emissions from livestock, and 5) emissions from crop agriculture.

Emissions from energy use are included in this inventory. The USCP requests agricultural energy use to be in the AFOLU category instead of "Commercial" or "Industrial" energy. Both NV Energy and Plumas Sierra Rural Electric Company (PSREC) supply energy to agricultural customers, and that energy use is included in the AFOLU sector, using the same energy methodology and factor sets explained in section E2, Energy Methodology.

USCP says data types 2 and 3 are "Recommended." This inventory calculates these figures using ICLEI's Land Emissions and Removals Navigator (LEARN) tool. A longer discussion of

trees and forests is included in the next section. The USCP standard calls for a "gross" GHG emissions calculation that does not include the "net" impact of sequestration (removal of CO2 from the atmosphere). So both emissions and removals from land use are described below, but neither emissions nor removals are included in the final GHG count for Washoe County.

Data types 4 and 5 are USCP "Optional." This inventory does not calculate emissions from livestock (data type 4) because these emissions were small in the 2014 inventory (0.0281MMT CO2e). Similar emissions in 2021 would account for less than 1% of the total 2021 GHG emissions in Washoe County. We assume the livestock figures did not change much between 2014 and 2021. The inventory also does not calculate data from crop agriculture (data type 5). Out of 1,693,762 hectares of land in Washoe County, only 2,187 hectares—less than 1% of total land—is cropland. The previous 2014 inventory also did not calculate emissions from cropland.

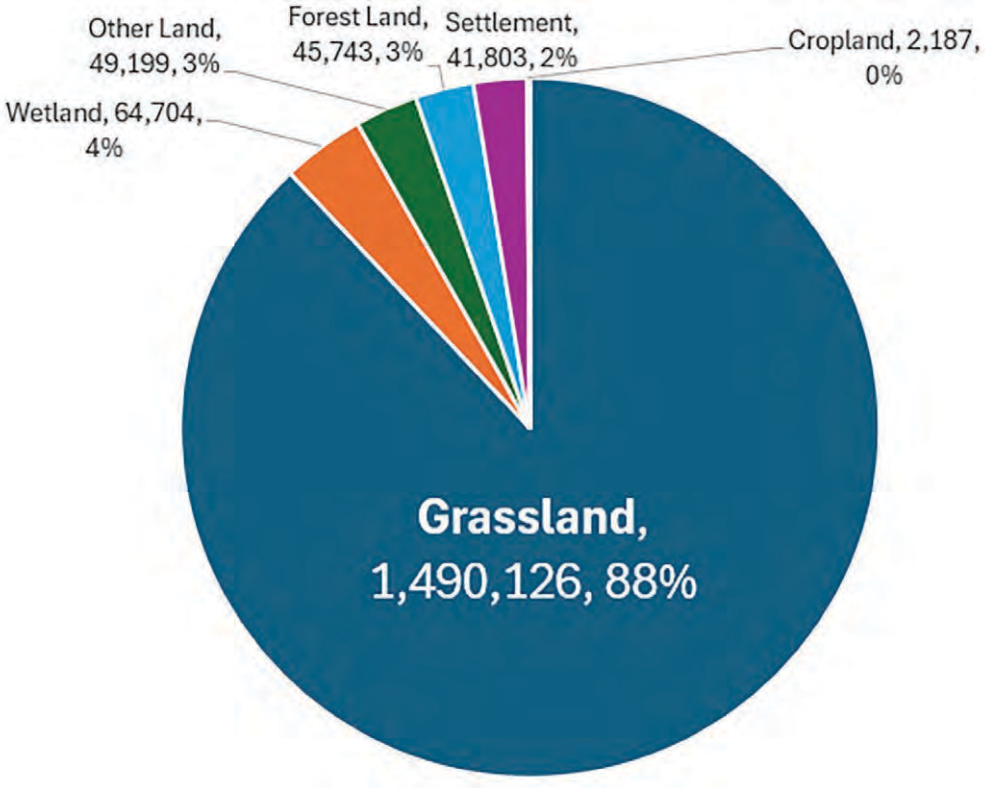
Trees, Forests, and Land Use in Washoe County

Unlike other sectors, different types of land use not only emit GHGs, but they can also remove CO2 from the atmosphere through photosynthesis, the process by which plants convert light energy into the chemical energy necessary to help them grow. Forests and trees play a key role in regulating the planet's climate.

ICLEI's proprietary LEARN tool uses point-in time data from the US Geological Survey's (USGS) National Land Cover Database (NLCD) to provide snapshots of estimated land use emissions and removals data by calculating land cover changes between 2013 and 2019.

Grassland is, by far, the most common land use type in Washoe County. In 2019, grassland covered 1,490,126 hectares, or 88% of Washoe County. See a map of land use types in Figure 14.

Land cover (hectares) in Washoe County from the National Land Cover Database, 2019



Land Cover Subcategories, with 2019 size in hectares (ha):

Grassland (1,490,126 ha)		
Shrub, scrub	Grassland / herbaceous (herbs)	Pasture / hay
1,214,376	274,039	1,712

Wetland (64,704 ha)	
Open water	Emergent herbaceous wetlands
58,021	6,683

Other Land (49,199 ha)	
Barren land	Perennial ice / snow
6,817	0

Forest Land (45,743 ha)			
Evergreen forest	Woody wetlands	Mixed forest	Deciduous (sheds leaves yearly)
38,923	5,157	1,443	220

Settlement / Developed (41,803 ha)			
Medium intensity	Low intensity	Open space	High intensity
14,108	13,331	7,547	6,817

Cropland (2,187 ha)
Cultivated crops
2,187

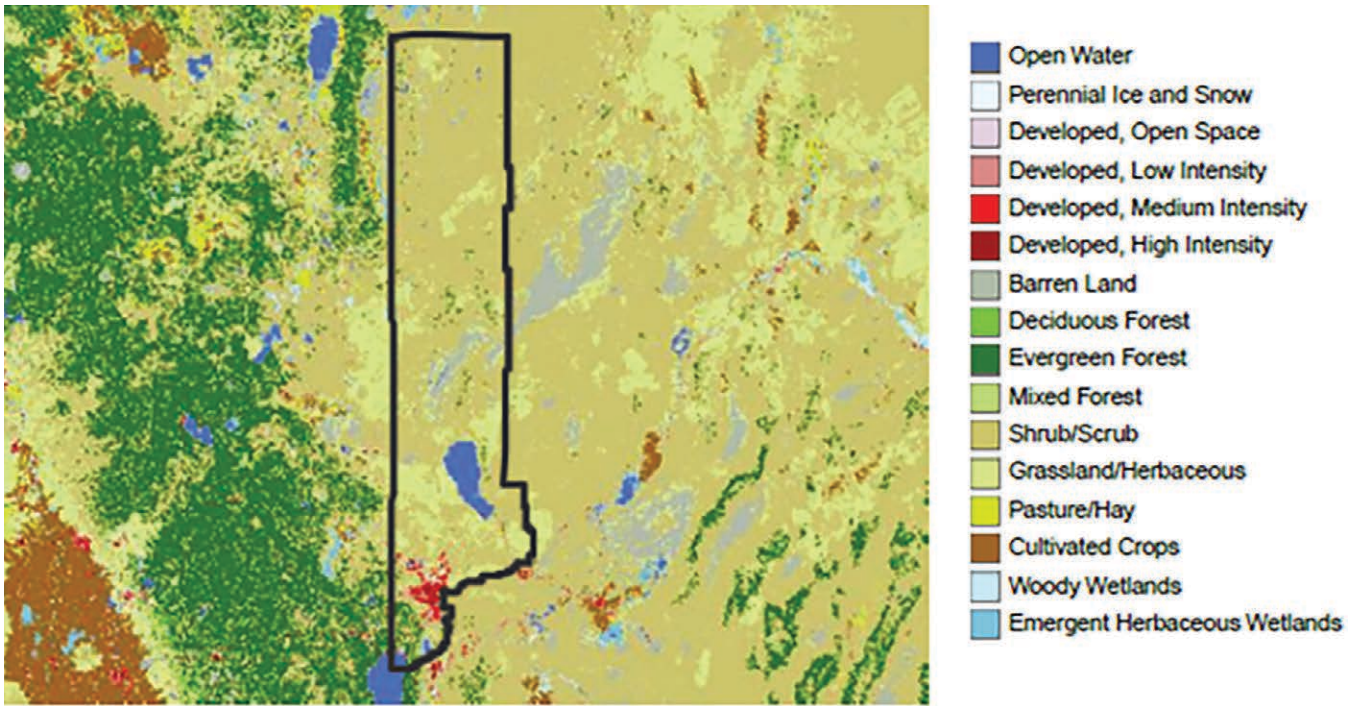


Figure 14: Land cover in Washoe County from the National Land Cover Database, 2019

Some modest changes in land use occurred between 2013 and 2019, and the inventory uses these land use changes to calculate GHG emissions and removals. See **Appendix 10** for a full land use change matrix.

GHG Emissions and Removals from Land Use changes, 2013 to 2019

Type	Land Use	2013 to 2019 value (ha)	removals factor (t C / ha)	emissions factor (t C / ha)	annual GHG emissions (MT CO2e/ yr)
Forest Change	"forest to..."	1,469	-	-	18,410
Deforestation	to grassland	605	-	41	15,352
Deforestation	to other	6	-	37	1,245
Deforestation	to wetland	798	-	2	1,112
Deforestation	to settlement	60	-	19	701
Deforestation	to cropland	0	-	4	0
Reforestation	**-**	**2,469**	**-**	**-**	**-2,913**
-	non-forest to forest	2,469	-0.32	-	-2,913
Forest - Remaining	**-**	**43,274**	**-**	**-**	**-20,476**

GHG Emissions and Removals from Land Use changes, 2013 to 2019 (Continued)

Type	Land Use	2013 to 2019 value (ha)	removals factor (t C / ha)	emissions factor (t C / ha)	annual GHG emissions (MT CO2e/ yr)
Undisturbed	-	36,255	-0.23	-	-31,046
Disturbed	Total	7,019	-	-	10,570
-	Insect	6,734	-	29.01	-
-	Harvest / Other	190	-	0.62	-
-	Fire	95	-	54.51	-
Trees Outside of Forest	**-**	**4,433**	**-**		**-42,837**
Tree canopy loss	-	9	-	78.2	523
Canopy maintained / gained	-	4,433	-2.66	-	-43,360
GHG Emissions	**-**	**-**	**-**	**-**	**29,503**
GHG Removals	**-**	**-**	**-**	**-**	**-77,319**
Net GHG Balance	**-**	**-**	**-**	**-**	**-47,816**

On net, between 2013 – 2019, forests and trees removed more emissions (-77,319 MT CO2e / year) than were caused by land use changes (29,503 MT CO2e / year). More land was reforested (2,469 ha) than deforested (1,469 ha). Most of the reforestation came from grassland to forest (~2,400 ha), followed by wetland to forest (~100 ha). Most of the deforestation was from forest to wetland (~800 ha), and forest to grassland (~600 ha). Tree canopy loss was only 2 ha per year, with most of the loss going to grassland (~1.55 ha / year), followed by wetland (0.2 ha / year) and settlement (0.05 ha / year).

While forest data covers the time period 2013 – 2019 in the NLCD, tree canopy data captures 2011 – 2016. Over this time period, Washoe County had an average of 4,442 ha of tree canopy outside of forests, representing nearly 0.3% tree canopy in these areas. An image of Washoe County's 2016 tree canopy is shown in Figure 15.

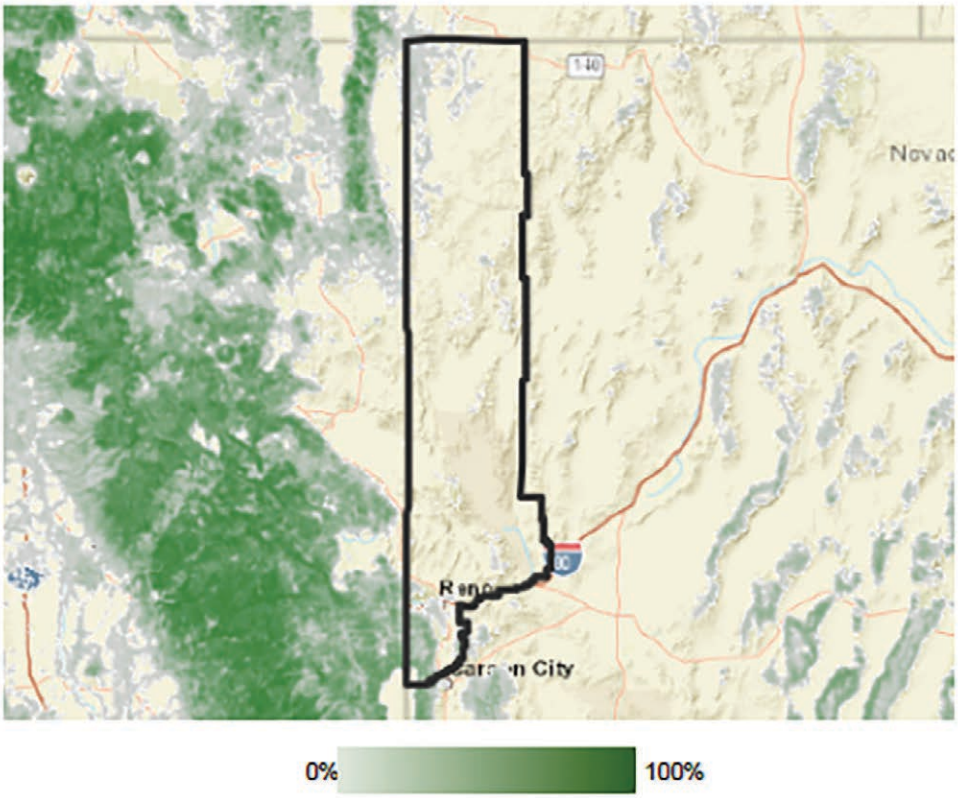


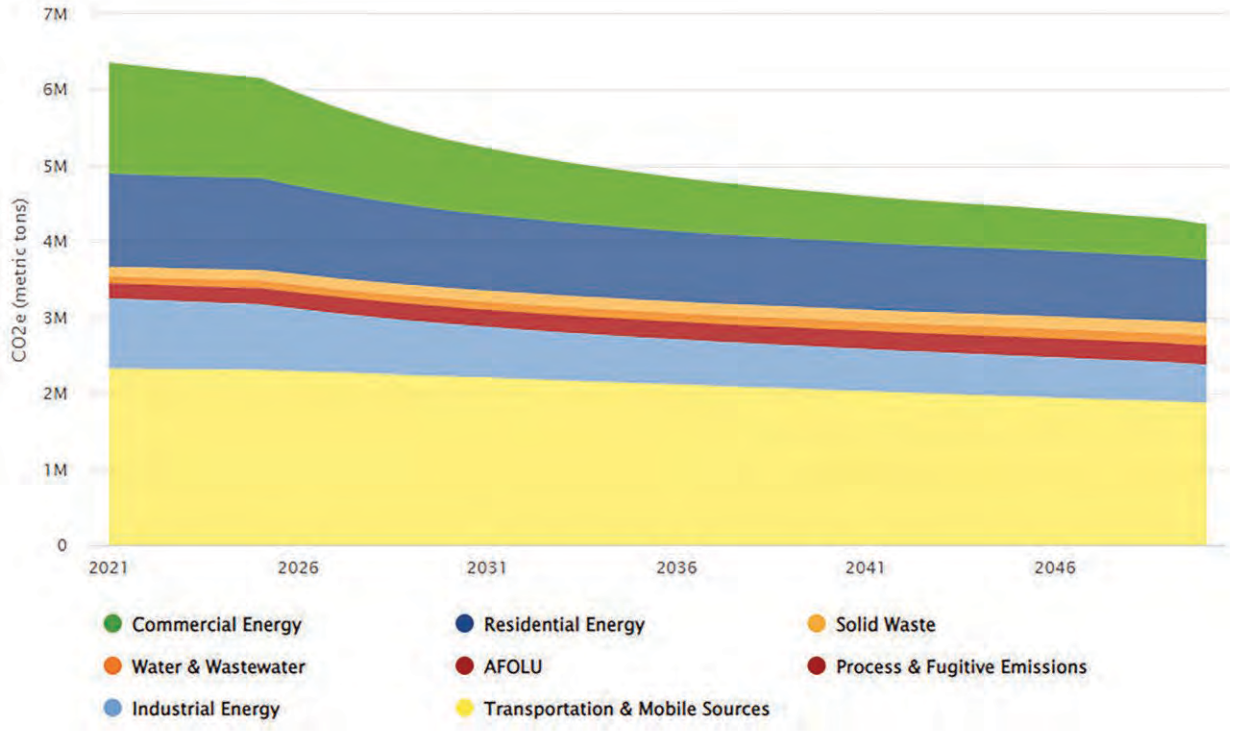
Figure 15: Washoe County tree canopy, 2016. Source: NLCD

Total GHG emissions for Washoe County across all sectors could be reduced if additional forests / trees are added to its land base, and / or if tree losses are reduced further.

F. Community-wide GHG emissions forecast

Washoe County's 2021 community-wide (GHG) inventory includes emissions from activities and sources that took place within the County during the calendar year. Using the 2021 GHG inventory as a baseline, Washoe County's "Business as Usual" forecast estimates that—instead of achieving Net Zero 2050—the County will create 4.23 MMT CO2e emissions in 2050 if it does not take mitigation actions.

"Business as Usual" 2050 CO2e Forecast (MMT)



The table below shows estimated emissions by sector in 5-year intervals. The table header abbreviations are as follows: T&MS, Transportation and Mobile Sources; RE, Residential Energy; CE, Commercial Energy; IE, Industrial Energy; SW, Solid Waste; W&W, Water & Wastewater; P&F, Process & Fugitive; AFOLU, Agriculture, Forestry, and Other Land Use.

Community-wide GHG "Business As Usual" forecast through 2050 (MMT CO2e)

Year	T&MS	RE	CE	IE	SW	W&W	P&F	AFOLU	TOTAL
2021	2.32	1.23	1.42	0.93	0.13	0.09	0.19	0.00	6.32
2025	2.31	1.21	1.32	0.87	0.14	0.10	0.21	0.00	6.16
2030	2.23	1.02	0.93	0.69	0.15	0.11	0.22	0.00	5.34
2035	2.14	0.94	0.74	0.60	0.15	0.12	0.23	0.00	4.91
2040	2.05	0.89	0.63	0.56	0.16	0.12	0.23	0.00	4.65
2045	1.96	0.87	0.56	0.53	0.16	0.13	0.24	0.00	4.46
2050	1.88	0.83	0.37	0.50	0.17	0.13	0.25	0.00	4.23

Methodology

The "Business as Usual" forecast incorporates two elements: 1) growth in Washoe County, and 2) "carbon intensity," based on legislated standards.

First, for Washoe County growth inputs, the forecast uses the consensus forecast from Truckee Meadows Regional Planning Agency (TMRPA)'s 2024 Regional Plan, which estimates population and employment growth through 2044. This inventory applies the 2043 to 2044 growth rates to get estimates through 2050.

Washoe County Growth Forecasts

Year	Population	Employment
2021	485,113	316,833
2025	520,826	328,215
2030	546,734	341,111
2035	568,506	352,655
2040	588,016	365,626
2045	606,009	378,794
2050	624,099	392,239

The forecast applies population growth rates to most Transportation sources as well as to Residential Energy, Solid Waste, Water & Wastewater, and Process and Fugitive Emissions. The forecast applies job growth rates to on-road diesel and utility Transportation sources as well as Commercial Energy, Industrial Energy, and AFOLU.

Second, for "carbon intensity" inputs, the inventory applies two legislated standards, the Nevada State Renewable Portfolio Standard (RPS) and federal Corporate Average Fuel Economy (CAFE) Standards. First adopted by the Nevada Legislature in 1997, the RPS sets the percentage of electricity sold each year by providers of electric service to Nevada customers that must come from renewable energy (biomass, geothermal energy, solar energy, waterpower, and wind) or energy efficiency measures. In 2019 Nevada Legislature (Senate Bill 358) modified the RPS by increasing the percentage of electricity sold each year to Nevadans that must come from renewable energy or energy efficiency measures. Electric service providers must increase renewable energy at the scheduled rate until it reaches 50% in 2030:

- 22% in 2020
- 24% in 2021
- 29% in 2022 and 2023
- 34% in 2024 through 2026
- 42% in 2027 through 2029
- 50% in 2030 and each year thereafter

The Nevada State Senate Bill 358 also states a goal of 100% carbon-free resources by 2050. This forecast uses the actual carbon intensity from NV Energy's 2021 Sustainability report, then estimates future carbon intensities at a declining rate that approaches 0 by 2050. This forecast uses "Total Owned + Purchased Generation of CO2e Emissions Intensity (MT / Net

MWh)," excluding generation associated with Renewable Energy Certificates (RECs) that were not retained. The forecast converts metric tons (MT) per net megawatt (MWh) to pounds (lbs). Carbon intensity estimates from NV Energy, the largest provider of electrical power in Washoe County, would increase future forecast accuracy.

Estimated carbon intensity of electricity

Year	Estimated lbs carbon / net MWh
2021	729.7
2025	604.3
2030	325.7
2035	192.3
2040	113.6
2045	62.7
2050	0

The forecast applies estimated RPS-informed carbon intensity to the following sectors: Transportation, Residential Energy, Commercial Energy, Industrial Energy, and AFOLU.

The forecast uses **CAFE standards** for carbon intensity estimates in the Transportation sector. First enacted by Congress in 1975, the purpose of CAFE is to reduce energy consumption by increasing the fuel economy of cars and light trucks. The CAFE standards are fleet-wide averages that must be achieved by each automaker for its car and truck fleet, each year, since 1978. This forecast uses a default transportation carbon intensity growth rate of -0.018 through 2050. The EPA regularly reviews CAFE standards. An example table of fuel efficiency standards is below (source: **US Department of Energy Alternative Fuels Data Center**)

Vehicle Fuel Efficiency (CAFE) Requirements by Year (miles per gallon)

Year	Passenger Cars	Light-Duty Trucks
2021	43.70	31.30
2022	43.70	31.30
2023	43.70	31.30
2024	49.20	35.10
2025	53.40	38.20
2026	59.40	42.40
2027	60.00	42.60
2028	61.20	42.60
2029	62.50	43.50
2030	63.70	44.30
2031	65.10	45.20

The forecast applies estimated CAFE-informed carbon intensity to the Transportation sector.

This “Business as Usual” forecast does not incorporate any additional GHG emissions reduction efforts. The Community Climate Action Plan has a list of actions to mitigate, or reduce, CO2e emissions in Washoe County. Future forecasts will include scenarios that estimate the GHG reduction potential of these actions.

G. Next steps: Working together as a community to reduce GHGs

To meet its GHG reduction goals of 28 percent by 2025, 45 percent by 2030, and Net Zero 2050, Washoe County is implementing mitigation actions recommended in its **Community Climate Action Plan**. The on-road transportation sector, as well as commercial and residential energy sectors, are top priorities, given that, together, they make up 79% Washoe County's total emissions (On-Road Transportation, 26%; Commercial Energy, 22%; Residential Energy, 20%).

Washoe County also encourages the operators in this plan to adopt Net Zero 2050 commitments and to create their own Climate Action Plans to reach this goal. Several operators have already taken meaningful steps toward Net Zero 2050. NV Energy, for example, has committed to **the updated Renewable Portfolio Standard (RPS)** from the Nevada Legislature's State Bill 358 (2019), ensuring the percentage of electricity sold each year to Nevadans that comes from renewable energy or energy efficiency measures is 50% by 2030. RTC Washoe has had a 100% clean energy bus fleet since 2021. Reno Tahoe International Airport (RTIA) **publishes annual Sustainability reports** for its own operations. (The airlines themselves are responsible for fuel choices). And Waste Management intends to introduce a new yard waste service at Lockwood landfill in 2025.

To measure emissions reduction progress against the baseline year of 2021, Washoe County plans to conduct GHG inventories at intervals of 3-5 years, as ICLEI recommends. The detailed methodology section of this report, as well as notes and attached data files in the ClearPath Climate Planner tool will help Washoe County complete a future inventory consistent with this one.

Washoe County will align with ICLEI's framework and methodology for local governments (see Figure 16) to identify and reduce greenhouse gas emissions:

1. Conduct an inventory and forecast of local greenhouse gas emissions;
2. Establish a greenhouse gas emissions Science-Based Target;
3. Develop a climate action plan for achieving the emissions reduction target;
4. Implement the climate action plan; and,
5. Monitor and report on progress.

Figure 16: ICLEI Climate Mitigation Milestones

This report represents the completion of ICLEI's Climate Mitigation Milestone One and provides a foundation for future work to reduce greenhouse gas emissions in Washoe County.

APPENDICES

Appendix 1. Contributors

Thank you to all the organizations and individuals who provided data for this Inventory. We have a clear picture of County-wide emissions thanks to you.

List of Specialists who provided data for 2021 Washoe County Inventory

Sector	Organization	Name	Title
Transportation	Reno-Tahoe International Airport (RTIA)	Todd Welty	Environmental Program Manager
Transportation	Reno / Stead Airport	Todd Welty	Environmental Program Manager
Transportation	Reno NV Air National Guard (ANG) at RTIA	Yvonne Downs	NVANG, 152 AW Environmental Manager
Transportation	Regional Transportation Commission (RTC) Washoe	Sai Sun	Transit Planner
Energy	NV Energy (Electric and Natural Gas)	Billie Augustine	Government & Business Account Advisor
Energy	NV Energy (Natural Gas)	Leif Dworzan	Energy Analyst
Energy	Southwest Gas	Adam Schochat	Manager, Engineering
Energy	Plumas-Sierra Rural Electric Cooperative (PSREC)	Kaitlyn Beever	Executive Assistant
Energy	Surprise Valley Electrification Corp (SVEC)	Joseph Johnson	Controller
Solid Waste	Waste Management	Kendra Kostelecky	Northern Nevada Contract Compliance
Solid Waste	Waste Management	Jillian Hillenbrand	Environmental Protection Specialist
Potable Water	Truckee Meadows Water Authority (TMWA)	Shawn Stoddard	Senior Resource Economist
Potable Water	Incline Village General Improvement District (GID)	James Youngblood	Utilities Superintendent

List of Specialists who provided data for 2021 Washoe County Inventory (Continued)

Sector	Organization	Name	Title
Potable Water	Great Basin Water Co. (Spanish Springs and Cold Springs)	Mark Rohus	Regional Manager
Potable Water	Sun Valley General Improvement District (GID)	Brad Bakle	Public Works Director
Wastewater	Truckee Meadows Water Reclamation Facility (TMWRF)	Casey Mentzer	Plant Manager
Wastewater	Washoe County	Alan Jones	Sr. Licensed Engineer
Wastewater	Reno Stead Water Reclamation Facility (RSWRF)	Robert Zoncki	Facility Supervisor
Wastewater	Incline Village GID	James Youngblood	Utilities Superintendent
Wastewater	Gerlach GID	Russell Bierle	Public Works Supervisor

Appendix 2. Glossary

These terms from ICLEI's US Community Protocol, unless otherwise noted.

Activity Refers to a community use activity (or activities), which is defined as the use of energy, materials, and/or services by members of the community that result in the creation of GHG emissions either directly (e.g., use of household furnaces and vehicles with internal combustion engines) or indirectly (e.g., use of electricity created through combustion of fossil fuels at a power plant, consumption of goods and services whose production, transport and/or disposal resulted in creation of GHG emissions directly or indirectly).

Activity Data Data on the magnitude of a human activity resulting in emissions taking place during a given period of time. Data on energy use, fuel used, miles traveled, input material flow, and product output are all examples of activity data that might be used to compute GHG emissions.

Annual A frequency of once a year; unless otherwise noted, annual events such as reporting requirements will be based on the calendar year.

Anthropogenic emissions GHG emissions that are a direct result of human activities or are the result of natural processes that have been affected by human activities.

Analysis year The single year timeframe for which GHG emissions are being quantified and reported. Typically, the analysis year refers to when the emissions occur, but in some cases it refers to when the activity occurs (e.g., future emissions resulting from disposal of waste in the analysis year).

Base year emissions GHG emissions in chosen year against which a community's emissions are compared over time.

Biochemical oxygen demand (BOD_5) The oxygen used in meeting the metabolic needs of aerobic microorganisms in water rich in organic matter (as water polluted with sewage).

Biofuel Fuel made from biomass, including wood and wood waste, sulphite lyes (black liquor), vegetal waste (straw, hay, grass, leaves, roots, bark, crops), animal materials/waste (fish and food meal, manure, sewage sludge, fat, oil and tallow), turpentine, charcoal, landfill gas, sludge gas, and other biogas, bioethanol, biomethanol, bioETBE, bioMTBE, biodiesel, biodimethylether, fischer tropsch, bio oil, and all other liquid biofuels which are added to, blended with, or used straight as transportation diesel fuel.

Boundaries GHG emission accounting and reporting boundaries for a community have two dimensions, in-boundary and trans-boundary. In-boundary emissions are GHG emissions released within the jurisdictional boundary of a community. Examples include GHG emissions

from natural gas combustion in household furnaces and gasoline combustion in motor vehicles driven on roads within the community's jurisdictional boundary. Trans-boundary emissions are GHG emissions occurring outside the jurisdictional boundary of a community as a result of activities occurring within the community boundary (see "Trans-boundary Emissions" for more details). Note: community boundaries are distinct from boundaries as defined in the Local Government Operations Protocol in which a boundary can have several dimensions, i.e., organizational, operational, and geographic. Those latter boundaries determine which emissions are accounted for and reported by the local governmental entity.

British thermal unit (Btu) The quantity of heat required to raise the temperature of one pound of water by one degree Fahrenheit at about 39.2 degrees Fahrenheit.

Carbon dioxide (CO_2) The most common of the six primary GHGs, consisting of a single carbon atom and two oxygen atoms, and providing the reference point for the GWP of other gases. (Thus, the GWP of CO2is equal to 1.)

Carbon footprint The total volume of GHG emissions caused by a community, organization, event, product, or person.

Carbon sink A biological system or other natural environment, such as a forest or a body of water, that absorbs more carbon dioxide from the atmosphere than it releases.

Carbon dioxide equivalent (CO_2e) The universal unit for comparing emissions of different GHGs expressed in terms of the GWP of one unit of carbon dioxide.

Community Community traditionally refers to residents, businesses, industries, and government co-located within a jurisdictionally defined area.

Community use activities Use of energy, materials, and services by all members of the community that result in the creation of GHG emissions either directly (e.g., use of household furnaces and vehicles with internal combustion engines) or indirectly (e.g., use of electricity created through combustion of fossil fuels at a power plant, consumption of goods and services whose production, transport and/or disposal resulted in creation of GHG emissions directly or indirectly). Also see "Use" defined below.

Double counting Two or more reporting entities taking ownership of the same emissions or reductions, or the same reporting entity counting the same emissions twice.

Emission factor A unique value for determining an amount of a GHG emitted on a per unit activity basis (for example, metric tons of CO2 emitted per million Btus of coal combusted, or metric tons of CO2 emitted per kWh of electricity consumed).

Entity Any business, corporation, institution, organization, government agency, etc., recognized under U.S. law and comprised of all the facilities and emission sources delimited by the organizational boundary developed by the entity, taken in their entirety.

Facility Any property, plant, building, structure, stationary source, stationary equipment or grouping of stationary equipment or stationary sources located on one or more contiguous or adjacent properties, in actual physical contact or separated solely by a public roadway or other public right-of way, and under common operational or financial control, that emits or may emit any greenhouse gas.

Fossil fuel A fuel, such as coal, oil, and natural gas, produced by the decomposition of ancient (fossilized) plants and animals.

Fugitive emissions Emissions that are not physically controlled but result from the intentional or unintentional release of GHGs. They commonly arise from the production, processing, transmission, storage and use of fuels or other substances, often through joints, seals, packing, gaskets, etc. Examples include HFCs from refrigeration leaks, SF6 from electrical power distributors, and CH4 from solid waste landfills.

General Improvement District (GID) An entity that provides county and municipal governments in the State of Nevada with a financing tool flexible enough and capable enough to finance a variety of infrastructure projects designed to encourage private sector investment in property-based projects. The governing body responsible for the creation and administration of the GID may collect property tax revenues from the GID and issue debt for a wide range of projects ranging from the development and maintenance of cemeteries, swimming pools, streets, alleys, curbs, gutters and sidewalks to the furnishing of fencing, facilities needed for the protection from fire and the control and eradication of noxious weeds. (Source: **UNR Extension School**)

Global warming potential (GWP) The ratio of radiative forcing (degree of warming to the atmosphere) that would result from the emission of one mass-based unit of a given GHG compared to one equivalent unit of carbon dioxide (CO2) over a given period of time.

Greenhouse gas emissions (GHGs) Greenhouse gas emissions are gases that trap heat in the atmosphere. Some greenhouse gases such as carbon dioxide occur naturally and are emitted into the atmosphere through natural processes and human activities. Other greenhouse gases are created and emitted solely through human activities. The principal greenhouse gases that enter the atmosphere because of human activities are carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O), and fluorinated gases (hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride).

GHG emission sources and associated activities GHG emission sources are any physical process or activity that releases GHG emissions into the atmosphere. Examples of emission

sources include: vehicle exhaust from combustion of gasoline, furnace exhaust from the combustion of natural gas, power plant exhaust from the combustion of coal for the production of electricity, fugitive emissions from leaking refrigerants, and methane emissions from a landfill. Activities associated with GHG emission sources are human activities that result in the production of GHG emissions. An example is electricity use, which requires the generation of electricity at a power plant that may produce a quantity of GHG emissions in the process of generating the electricity.

Hydrofluorocarbons (HFCs) One of the six primary GHGs, a group of manmade chemicals with various commercial uses (e.g., refrigerants) composed of one or two carbon atoms and varying numbers of hydrogen and fluorine atoms. Most HFCs are highly potent GHGs with 100-year GWPs in the thousands.

In-boundary emissions GHG emissions released within the jurisdictional boundary of a community. Examples include GHG emissions from natural gas combustion in household furnaces and gasoline combustion in motor vehicles driven on roads within the community's jurisdictional boundary.

Intergovernmental Panel on Climate Change (IPCC) International body of climate change scientists. The role of the IPCC is to assess the scientific, technical and socio-economic information relevant to the understanding of the risk of human-induced climate change (**www.ipcc.ch**).

Inventory A comprehensive, quantified list of a community's or organization's GHG emissions and sources.

Inventory boundary An imaginary line that encompasses the GHG emissions included in the inventory. It results from the chosen organizational and operational boundaries.

Kilowatt hour (kWh) The electrical energy unit of measure equal to one thousand watts of power supplied to, or taken from, an electric circuit steadily for one hour. (A Watt is the unit of electrical power equal to one ampere under a pressure of one volt, or 1/746 horsepower.)

Liquid petroleum gas (LPG) A group of hydrocarbon-based gases derived from crude oil refining or natural gas fractionation. They include propane, propylene, normal butane, butane, butylene, isobutene A-14 and isobutylene. For convenience of transportation, these gases are liquefied through pressurization.

Methane (CH_4) One of the six primary GHGs, consisting of a single carbon atom and four hydrogen atoms, possessing a GWP of 21, and produced through the anaerobic decomposition of waste in landfills, animal digestion, decomposition of animal wastes, production and distribution of natural gas and petroleum, coal production, and incomplete fossil fuel combustion.

Metric ton (MT) Common international measurement for the quantity of GHG emissions, equivalent to about 2,204.6 pounds or 1.1 short tons.

Mobile combustion Emissions from the combustion of fuels in transportation sources (e.g., cars, trucks, buses, trains, airplanes, and marine vessels) and emissions from off-road equipment such as what is used in construction, agriculture, and forestry. A piece of equipment that cannot move under its own power, but that is transported from site to site (e.g., an emergency generator) is a stationary, not a mobile, combustion source.

Natural gas A naturally occurring mixture of hydrocarbons (e.g., methane, ethane, or propane) produced in geological formations beneath the earth's surface that maintains a gaseous state at standard atmospheric temperature and pressure under ordinary conditions.

Nitrous oxide (N_2O) One of the six primary GHGs, consisting of two nitrogen atoms and a single oxygen atom, possessing a GWP of 310, and typically generated as a result of soil cultivation practices, particularly the use of commercial and organic fertilizers, fossil fuel combustion, nitric acid production, and biomass burning.

Operator The entity having operational control of a facility or other entity.

Paris Agreement A legally binding international treaty on climate change. It was adopted by 196 Parties at the UN Climate Change Conference (COP21) in Paris, France, in 2015. Its overarching goal is to hold "the increase in the global average temperature to well below 2°C above pre-industrial levels" and pursue efforts "to limit the temperature increase to 1.5°C above pre-industrial levels." (Source: **United Nations Climate Change**)

Perfluorocarbons (PFCs) One of the six primary GHGs, A group of man-made chemicals composed of one or two carbon atoms and four to six fluorine atoms, containing no chlorine. Originally introduced as alternatives to ozone depleting substances, PFCs have few commercial uses and are typically emitted as by-products of industrial and manufacturing processes. PFCs have very high GWPs and are very long-lived in the atmosphere.

Process emissions Emissions from physical or chemical processing rather than from fuel combustion. Examples include emissions from manufacturing cement, aluminum, adipic acid, ammonia, etc.

Propane A normally straight chain hydrocarbon that boils at -43.67 degrees Fahrenheit and is represented by the chemical formula C3H8.

Science-Based Targets Calculated climate goals, in line with the latest climate science, that represent your community's fair share of the ambition necessary to meet the Paris Agreement commitment of keeping warming below 1.5°C. To achieve this goal, the Intergovernmental Panel on Climate Change (IPCC) states that we must reduce global emissions by 50% by 2030

and achieve climate neutrality by 2050. Equitably reducing global emissions by 50% requires that high-emitting, wealthy nations reduce their emissions by more than 50%.

Scope(s) Scopes are used in the context of reporting on GHG emissions associated with individual organizational entities (e.g., the operations of a business or local government). In that context, the scopes framework can be used to categorize direct (scope 1) emissions (e.g., smoke stacks or tailpipes that release emissions within an organizational boundary), indirect energy-related (scope 2) emissions (e.g., the use of purchased or acquired electricity, heating, cooling, or steam regardless of where the energy is generated), and other indirect (scope 3) emissions not covered in scope 2 (e.g., upstream and downstream emissions from the extraction and production of purchased materials and fuels).

The Community Protocol does not use scopes as a framework for categorizing emissions in community inventories because the organization-related definitions of scopes do not translate to the community scale in a manner that is applicable, clear, and valuable.

Short ton (ton) Common measurement for a ton in the U.S. and equivalent to 2,000 pounds or about 0.907 metric tons.

Source(s) Any physical process or activity that releases GHG emissions into the atmosphere (e.g., vehicle exhaust from combustion of gasoline, furnace exhaust from the combustion of natural gas, power plant exhaust from combustion of coal for the production of electricity).

Standard cubic foot (scf) The amount of gas that would occupy a volume of one cubic foot if free of combined water at standard conditions.

Stationary combustion Emissions from the combustion of fuels to produce electricity, steam, heat, or power using equipment (boilers, furnaces, etc.) in a fixed location.

Sulfur hexafluoride (SF_6) One of the six primary GHGs, consisting of a single sulfur atom and six fluoride atoms, possessing a very high GWP of 23,900, and primarily used in electrical transmission and distribution systems.

Therm A measure of one hundred thousand (105) Btu.

Use Putting into action or service energy, water, materials, or services. In this Protocol, the term “use” is not the same as “consumption”. The term “use” refers to any and all use, by all potential users of energy, water, materials, or services, while “consumption” is a subset of “use”, limited to the use of resources - typically purchased - by “consumers”. “Consumers”, in turn, are usually limited to just households and governments, and not businesses, although a subcategory of business expenses (described in Chapter 3.4.7 Consumption-Based Emissions) are sometimes also included in “consumption”. In the language of this Protocol, businesses, governments, and households all “use” electricity, but only governments and

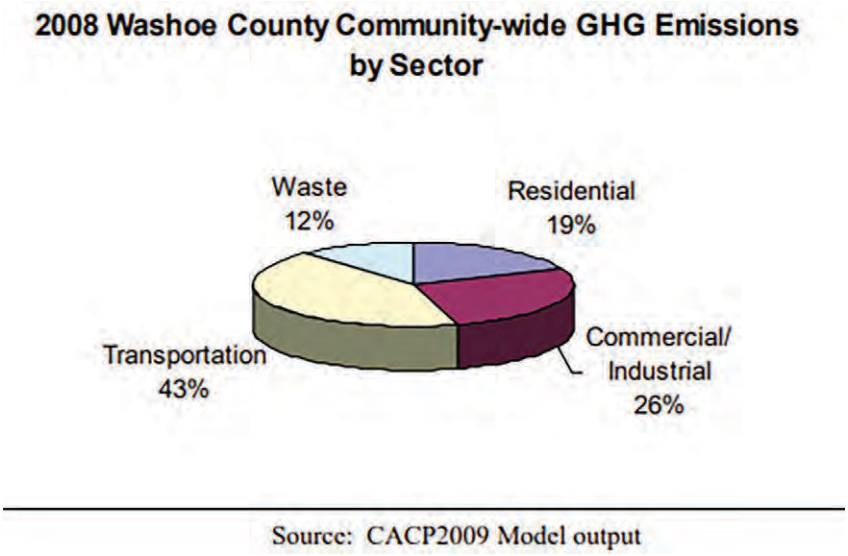
households “consume” electricity, since businesses use it to create products and services for consumers. For households and governments, “consumption” and “use” of electricity are the same. Although “use” and “consumption” are often used interchangeably in common speech, this distinction is important when it comes to accounting and reporting of consumption-based emissions. For more details on these distinctions, see Appendix I – Consumption-based Emission Activities and Sources.

Appendix 3. Abbreviations and acronyms

Btu	British thermal unit(s)
CH_4	methane
CO_2	carbon dioxide
CO_2e	carbon dioxide equivalent
EF	emissions factor
EIA	United States Energy Information Administration
EPA	United States Environmental Protection Agency
g	gram(s)
GHG	greenhouse gas
GPC	Global Protocol for Community-Scale Greenhouse Gas Emissions
GRP	General Reporting Protocol
GWP	Global Warming Potential
HFC	hydrofluorocarbon
IPCC	Intergovernmental Panel on Climate Change
kg	kilogram(s)
kWh	kilowatt-hour(s)
lb(s)	pound(s)
LFG	landfill gas
LPG	liquefied petroleum gas
MMBtu	one million British thermal units
mpg	miles per gallon
MSW	municipal solid waste
MT	metric ton(s)
MMT	million metric tons
MWh	megawatt-hour(s)
PFC	perfluorocarbon
SF_6	sulfur hexafluoride
VMT	vehicle miles traveled
WARM	U.S. EPA's Waste Reduction Model
WTE	waste-to-energy
WWTP	wastewater treatment plant

Appendix 4. Total emissions from 2008 and 2014 Community-wide Inventories

The **Community-Wide GHG Inventory from 2008** reported total emissions of 6.09 MMT CO2E, with Transportation causing 43% of emissions, Commercial / Industrial Energy 26%, Residential Energy 19%, and Waste 12%.

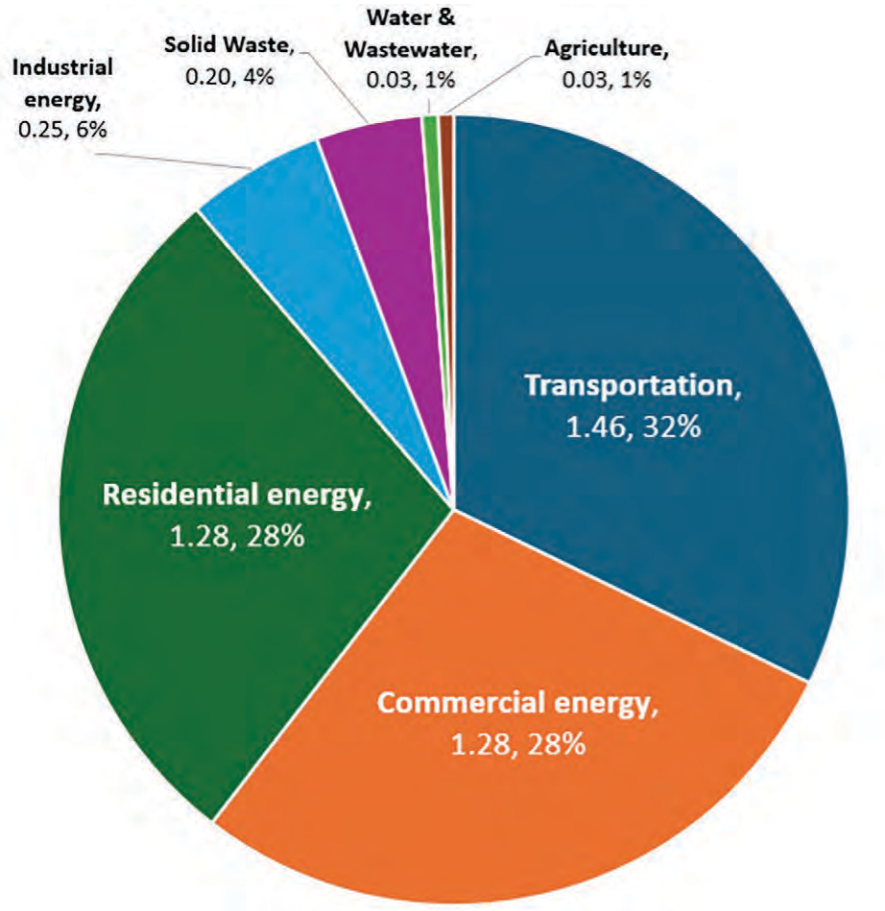


Washoe County Community Emissions Summary 2008

Sector	CO2e (MT)	% of Total
Transportation	2,605,371	43%
Residential Energy	1,155,619	19%
Commercial / Industrial Energy	1,612,383	26%
Waste	720,028	12%
TOTAL	**6,093,401**	**100%**

The **Community-Wide GHG Inventory from 2014** reported total emissions of 4.516 MMT CO2E. Transportation caused 32% of emissions, Residential Energy 28%, Commercial Energy 28%, Industrial Energy 6%, Solid Waste 4%, Water & Wastewater 1%, and Agriculture 1%.

2014 Washoe County Community-wide GHG Emissions by Sector



Washoe County Community Emissions Summary, 2014

Sector	CO2e (MT)	% of Total
Transportation	1,455,397	32%
Residential Energy	1,277,392	28%
Commercial Energy	1,275,550	28%
Industrial Energy	253,922	6%
Solid Waste	195,051	4%
Water & Wastewater	30,472	1%
Agriculture	28,196	1%
TOTAL	**4,515,980**	**100%**

The table below shows a comparison of emissions by sector from 2008, 2014, and 2021. Several elements of analysis have changed in the 13 years between 2008 and 2021. Operators' ability to retrieve and report data has improved. State and federal data sources have expanded. The science of GHG warming potentials and associated factor sets has improved. The US Community Protocol for GHG inventories has evolved. The quality of GHG analysis has thus improved with time. Previous years' data still provides valuable point-in-time snapshots, though the differences in methodology, data quality, data inputs, and data inputs cause variability in the data outputs.

2008 – 2014 – 2021 CO2e comparison by sector (MMT CO2e)

Sector	2008	2014	2021	'08-21%	'08-21 MMT	'14-21%	'14-21 MMT
Transportation	2.61	1.46	2.32	-11%	-0.28	60%	0.87
Commercial	1.61	1.28	1.42	-12%	-0.19	11%	0.14
Residential	1.16	1.28	1.23	7%	0.08	-3%	-0.04
Industrial	0.00	0.25	0.93	n/a	0.00	266%	0.68
Solid Waste	0.72	0.20	0.13	-82%	-0.59	-33%	-0.07
Water & Wastewater	0.00	0.03	0.09	n/a	0.00	202%	0.06
Process & Fugitive	0.00	0.00	0.19	n/a	0.00	n/a	0.19
Agriculture	0.00	0.03	0.00	n/a	0.00	-91%	-0.03
Total (MMT CO2e)	6.09	4.52	6.32	4%	0.23	40%	1.80
Population (NV State Demographer)	426,966	436,797	485,113	14%	-	11%	-
Per Capita Emissions (MT CO2e)	14.27	10.34	13.03	-9%	-	26%	

As noted in the previous table, the 2014 and 2021 inventories include data from additional fields, preventing an "apples to apples" comparison between the total GHG numbers for the three inventories. To assist in comparative analysis, the table below shows line-item comparisons to 2014 and 2021 of usage data and emissions data for all fields included in the 2008 inventory.

"Apples to apples" comparison of 2008, 2014, and 2021 Inventory usage and emissions (MT CO2e) data

Type	Fuel or Source	2008 Usage	2014 Usage	2021 Usage	Unit	2008 CO2e	2014 CO2e	2021 CO2e
On-Road	Gasoline	-	3,153,538,462	2,677,846,997	VMT	2,025,044	1,171,675	1,034,447
On-Road	Diesel	-	124,177,808	347,968,818	VMT	499,021	116,748	499,772
Nonroad	Gasoline	-	no data	-	Gallons	198	no data	90,949
Passenger RTIA	Jet Kerosene	-	28,077,281	14,948,972	Gallons	47,935	115,618	146,246
Rail, Comm	Diesel	-	2,827,241	-	Gallons	29,045	29,142	23,110
Rail, Pass	Diesel	-	76,070	-	Gallons	804	784	702
Transpor-tation	**TOTAL**	**-**	**-**	**-**		**2,602,047**	**1,455,397**	**2,323,551**

Type	Fuel or Source	2008 Usage	2014 Usage	2021 Usage	Unit	2008 CO2e	2014 CO2e	2021 CO2e
Commercial	Electricity	2,862,688	2,282,107	3,217,822	MWh	1,178,072	1,013,061	1,065,100
Commercial	Natural Gas	70,734,406	42,064,472	53,355,321	Therms	376,279	223,678	283,762
Commercial	LPG	0	No data	39,772	Therms	19,811	No data	2,528
Commercial	Fuel Oil	0	16,965	356,535	MMBtu	1,843	1,245	26,281
Commercial	Kerosene	0	319,555	none	MMBtu	34,699	24,226	none
Commercial	**TOTAL**	**-**	**-**	**-**	**-**	**1,610,704**	**1,262,210**	**1,377,671**

Type	Fuel or Source	2008 Usage	2014 Usage	2021 Usage	Unit	2008 CO2e	2014 CO2e	2021 CO2e
Residential	Electricity	1,389,642	1,384,243	1,748,938	MWh	571,875	720,265	578,899
Residential	Natural Gas	99,309,151	90,629,880	114,126,514	Therms	528,285	481,923	606,962
Residential	LPG	-	not collected	221,669	Therms	28,217	No data	14,092
Residential	Propane (HGL)	-	484,849	405,268	MMBtu	195	29,675	24,184
Residential	Kerosene	-	70,948	not in data	-	4,043	5,378	no data
Residential	Fuel oil	-	496,510	49,620	MMBtu	23,004	36,437	3,694
Residential	**TOTAL**	**-**	**-**	**-**	**-**	**1,155,619**	**1,273,678**	**1,227,831**

Type	Fuel or Source	2008 Usage	2014 Usage	2021 Usage	Unit	2008 CO2e	2014 CO2e	2021 CO2e
Industrial	LPG	-	no data	no data	0	1,138	no data	no data
Industrial	Fuel Oil	-	4,979	3,511,184	MMBtu	540	364	258,056
Industrial	**TOTAL**	**-**	**-**	**-**	**-**	**1,678**	**364**	**258,056**

Type	Fuel or Source	2008 Usage	2014 Usage	2021 Usage	Unit	2008 CO2e	2014 CO2e	2021 CO2e
Waste	Waste Generated	889,251	571,662	300,775	Tons	720,028	185,679	130,466
Waste	**TOTAL**	**-**	**-**	**-**	**-**	**720,028**	**185,679**	**130,466**

Type	Fuel or Source	2008 Usage	2014 Usage	2021 Usage	Unit	2008 CO2e	2014 CO2e	2021 CO2e
TOTAL emissions	2008 line items only	-	-	-	-	6,090,076	4,117,328	5,317,575
Emissions Growth	2008 line items only	-	-	-	2008 to...	n/a	-31%	-13%
Emissions Growth	2008 line items only	-	-	-	2014 to...	n/a	n/a	27%
Population	-	-	-	-	-	426,966	436,797	485,113
Per Capita Emissions	2008 line items only	-	-	-	-	14.26	9.56	10.96
TOTAL emissions	complete inventories	-	-	-	-	6,093,401	4,515,980	6,318,880
Per Capita Emissions	complete inventories	-	-	-	-	14.27	10.34	13.03

The following table summarizes some differences in the inclusion of line-item data fields between the 2008, 2014, and 2021 inventories. The addition of these data fields accounts for some of the emissions increases in segments of the 2014 and 2021 inventories.

Summary of data fields that did not appear in the 2008 inventory

Sector	Sub-sector	2008	2014	2021
Transportation	Nonroad	No	No	Yes
Transportation	Air Freight	No	Yes	Yes
Transportation	General Aviation	No	Yes	Yes
Transportation	Water Travel	No	No	Yes
Transportation	Transit	No	Yes	Yes
Industrial Energy	-	No	Yes	Yes
Water & Wastewater	-	No	Yes	Yes
Process & Fugitive	-	No	No	Yes
Agriculture	-	No	Yes	Yes

Appendix 5. Comparison of 2014 and 2021 emissions data for Washoe County

Comparison of 2014 and 2021 emissions data for Washoe County

Transportation	Fuel or Source	2014 Usage	2021 Usage	Usage Unit	2014 Emissions (MT CO2e)	2021 Emissions (MT CO2e)	% change
On-road	Gasoline	3,153,538,462	2,677,846,997	VMT	1,171,675	1,034,447	-12%
On-road	Diesel	124,177,808	347,968,818	VMT	116,748	499,772	328%
Nonroad	Diesel	not collected	-	-	no data	387,405	n/a
Nonroad	Gasoline	not collected	-	-	no data	90,949	n/a
Nonroad	LPG	not collected	-	-	no data	15,158	n/a
Nonroad	CNG	not collected	-	-	no data	1,796	n/a
Nonroad – RNO Ground	Diesel	72,748	87,846	Gallons	743	905	22%
Nonroad – RNO Ground	Gasoline	64,495	70,937	Gallons	571	628	10%
Nonroad – R/S Ground	Diesel	5,549	5,013	Gallons	57	52	-9%
Nonroad – R/S Gound	Gasoline	3,750	1,704	Gallons	33	15	-55%
Commercial (Passenger) - RTIA	Jet Kerosene	28,077,281	14,948,972	Gallons	115,618	146,246	26%
Freight - RTIA	Jet Kerosene	No data	4,926,489	Gallons	Incl above	48,196	n/a
General Aviation - RTIA	Jet Kerosene	No data	4,074,471	Gallons	Incl above	39,861	n/a
General Aviation – RTIA	Aviation Gas	129,255	155,118	Gallons	463	1,294	179%
General Aviation – R/S	Jet Kerosene	128,929	488,146	Gallons	1,235	4,776	287%
General Aviation – R/S	Aviation Gas	70,288	99,619	Gallons	586	831	42%
ANG - RTIA	Jet Kerosene	No data	842,075	Gallons	No data	8,238	n/a
Rail, Commercial	Diesel	2,827,241	-	Gallons	29,142	23,110	-21%
Rail, Passenger	Diesel	76,070	-	Gallons	784	702	-10%
Water, Pleasure Craft	Gasoline	not collected	-	-	no data	14,903	n/a

Comparison of 2014 and 2021 emissions data for Washoe County (Continued)

Transportation	Fuel or Source	2014 Usage	2021 Usage	Usage Unit	2014 Emissions (MT CO2e)	2021 Emissions (MT CO2e)	% change
Water, Pleasure Craft	Diesel	not collected	-	-	no data	3,616	n/a
Buses – RTC Washoe	Electric	VMT calc	1,020,784	kWh	0.21	338	n/a
Buses – RTC Washoe	Bio-diesel	VMT calc	568,890	Gallons	No data	1	n/a
Buses – RTC Washoe	Diesel	VMT calc	None	Gallons	6,265	None	n/a
Regional Connector Bus (Carson City)	Electric	Incl above	250,159	kWh	Incl above	72	n/a
Paratransit and Flexride	Gasoline	No data	13,504	Gallons	No data	122	n/a
Paratransit and Flexride	CNG	No data	179,175	Gallons	81	118	46%
Transportation Total	**-**	**-**	**-**	**-**	**1,455,397**	**2,323,551**	**60%**

Comparison of 2014 and 2021 emissions data for Washoe County

Commercial Energy	Fuel or Source	2014 Usage	2021 Usage	Usage Unit	2014 Emissions (MT CO2e)	2021 Emissions (MT CO2e)	% change
Commercial – NV Energy	Electricity	2,282,107	3,217,822	MWh	1,013,061	1,065,100	5%
Municipal – NV Energy	Electricity	Incl. in Comm	54,911	MWh	Included	18,170	n/a
Commercial - SVEC	Electricity	Not collected	65	MWh	No data	19	n/a
Commercial - PSREC	Electricity	Not collected	57	MWh	No data	16	n/a
Commercial – NV Energy	Natural Gas	42,064,472	51,617,010	Therms	223,678	274,516	23%
Commercial – SW Gas	Natural Gas	No data	1,738,311	Therms	No data	9,246	n/a
Commercial – NV Energy	LPG	No data	39,772	Therms	No data	2,528	n/a
Commercial	Fuel Oil	16,965	356,535	MMBtu	1,245	26,281	2011%
Commercial	Kerosene	319,555	None	MMBtu	24,226	None	n/a
Commercial	Propane (HGL)	217,955	307,917	MMBtu	13,340	19,430	46%
Commercial	Wood	No data	64,825	MMBtu	No data	632	n/a
Commercial Energy Total	**-**	**-**	**-**	-	**1,275,550**	**1,415,938**	11%

Comparison of 2014 and 2021 emissions data for Washoe County

Residential Energy	Fuel or Source	2014 Usage	2021 Usage	Usage Unit	2014 Emissions (MT CO2e)	2021 Emissions (MT CO2e)	% change
Residential – NV Energy	Electricity	1,384,243	1,748,938	MWh	720,265	578,899	-20%
Residential - PSREC	Electricity	Not collected	4,882	MWh	No data	1,414	n/a
Residential - SVEC	Electricity	Not collected	44	MWh	No data	13	n/a
Residential – NV Energy	Natural Gas	90,629,880	105,955,133	Therms	481,923	563,504	17%
Residential – SW Gas	Natural Gas	Not collected	8,171,381	Therms	No data	43,458	n/a
Residential – NV Energy	LPG	Not collected	221,669	Therms	No data	14,092	n/a
Residential	Propane (HGL)	484,849	405,268	MMBtu	29,675	24,184	-19%
Residential	Kerosene	70,948	Not in data		5,378	No data	n/a
Residential	Fuel oil	496,510	49,620	MMBtu	36,437	3,694	-89%
Residential	Wood	338,819	370,027	MMBtu	3,715	3,384	-9%
Residential Energy Total	**-**	**-**	**-**	-	**1,277,392**	**1,232,642**	**-4%**

Comparison of 2014 and 2021 emissions data for Washoe County

Industrial Energy	Fuel or Source	2014 Usage	2021 Usage	Usage Unit	2014 Emissions (MT CO2e)	2021 Emissions (MT CO2e)	% change
Industrial – NV Energy	Electricity	Incl. in Comm	1,598,279	MWh	174,390	529,031	203%
Industrial – NV Energy	Natural Gas	14,771,470	19,039,233	Therms	78,399	101,050	29%
Industrial	Fuel Oil	4,979	3,511,184	MMBtu	364	258,056	70795%
Industrial	Propane (HGL)	12,549	161,434	MMBtu	765	10,152	1227%
Industrial	Motor Gasoline	No data	464,122	MMBtu	No data	31,131	n/a
Industrial	Wood	No data	20,179	MMBtu	No data	41	n/a
Industrial	Kerosene	28	No data		2	No data	n/a
Industrial Energy Total	**-**	**-**	**-**	-	**253,922**	**929,461**	**266%**

Comparison of 2014 and 2021 emissions data for Washoe County

Solid Waste	Fuel or Source	2014 Usage	2021 Usage	Usage Unit	2014 Emissions (MT CO2e)	2021 Emissions (MT CO2e)	% change
Waste	Waste Generated	571,662	300,775	Tons	185,679	130,466	-30%
Flaring	Landfill Gas	530,000,000	261,858,830	Cubic ft / yr	No data	28	n/a
Combustion	Landfill Gas	522,000,000	380,450,265	Cubic ft / yr	185	0.53	-100%
Solid Waste Total	**-**	**-**	**-**	**-**	**195,051**	**130,495**	**33%**

Comparison of 2014 and 2021 emissions data for Washoe County

Water & Wastewater (Water)	Fuel or Source	2014 Usage	2021 Usage	Usage Unit	2014 Emissions (MT CO2e)	2021 Emissions (MT CO2e)	% change
TMWA	Electricity	48,066,256	65,183,869	kWh	10,408	28,106	170%
TMWA	Natural Gas	No data	123,170	MMBtu	Incl above	included in elec. #	n/a
IVGID	Electricity	No data	3,932,368	kWh	No data	1,311	n/a
IVGID	Natural Gas	No data	1,761	kWh	No data	included in elec. #	n/a
Great Basin Water Co	Electricity	No data	1,346,223	kWh	No data	446	n/a
Sun Valley GID	Electricity	No data	517,390	kWh	No data	205	n/a
Sun Valley GID	Natural Gas	No data	6,271	MMBtu	No data	included in elec. #	n/a
Gerlach GID	Electricity	No data	15,712	kWh	No data	15	n/a
Gerlach GID	Propane	No data	1,872	Therms	No data	included in elec. #	n/a
Energy Use - TMWRF	Electricity	30,800,000	25,268,000	kWh	No data	8,483	n/a
Combustion – TMWRF	Digester Gas	498,240	385,920	scf/day	0.0000244	19	n/a
Flaring – TMWRF	Digester Gas	No data	184,320	scf/day	No data	35,075	n/a
Wastewater Treatment TMWRF	Nitrification / Denitrification	330,000	363,000	people	16,026	867	-95%
Effluent - TMWRF	Nitrification	185	216	Kg N / day	No data	169	n/a
Wastewater Treatment - TMWRF	Methanol	8.8	8.9	MT CH3OH / day	3,963	3,563	-10%

Comparison of 2014 and 2021 emissions data for Washoe County

Water & Wastewater (Water)	Fuel or Source	2014 Usage	2021 Usage	Usage Unit	2014 Emissions (MT CO2e)	2021 Emissions (MT CO2e)	% change
Energy Use – WCounty	Electricity	No data	8,754,862	kWh	No data	2,898	n/a
Wastewater Treatment - Washoe County	Nitrification / Denitrification	No data	26,717	people	No data	64	n/a
Effluent - WCounty	Nitrification	No data	155	Kg N / day	74	121	64%
Energy Use – RSWRF	Electricity	1,459,200	5,071	kWh	No data	1,795	n/a
Energy Use - RSWRF	Natural Gas	32,183	22,323	therms	No data	Included in elec. #	n/a
Wastewater Treatment Reno Stead WRF	Nitrification / Denitrification	No data	28,000	people	No data	67	n/a
Effluent – RSWRF	Nitrification	No data	41	Kg N / day	No data	32	n/a
Energy Use – IVGD	Electricity	No data	1,698,637	kWh	No data	636	n/a
Energy Use – IVGD	Natural Gas	No data	14,829	therms	No data	included in elec. #	n/a
Energy Use – Gerlach	None	No calc	125	people	No data	0	n/a
Fugitive - Septic	Methane	No calc	0.09	Kg BOD5 / day	No data	6,783	n/a
Water & Wastewater Total	-	-	-	-	**30,472**	**90,655**	**198%**

Comparison of 2014 and 2021 emissions data for Washoe County

Process & Fugitive Emissions	Fuel or Source	2014 Usage	2021 Usage	Usage Unit	2014 Emissions (MT CO2e)	2021 Emissions (MT CO2e)	% change
Fugitive	Natural Gas	No data	188,150,339	therms	No data	34,741	n/a
Fugitive	Refrigeration	No data	-	-	No data	106,453	n/a
Fugitive	Non-MDI Aerosols	No data	-	-	No data	15,614	n/a
Fugitive	Electric Power Systems	No data	-	-	No data	14,150	n/a
Fugitive	Foams	No data	-	-	No data	13,455	n/a
Fugitive	Solvents	No data	-	-	No data	3,027	n/a
Fugitive	MDI Aerosols	No data	-	-	No data	2,455	n/a
Fugitive	Fire Extinguishing	No data	-	-	No data	3,776	n/a
Process & Fugitive Emissions Total	**-**	**-**	**-**	**-**	**No data**	**193,669**	**n/a**

Comparison of 2014 and 2021 emissions data for Washoe County

Agricultural (Energy and Livestock)	Fuel or Source	2014 Usage	2021 Usage	Usage Unit	2014 Emissions (MT CO2e)	2021 Emissions (MT CO2e)	% change
Energy Use – NV Energy	Electric	No data	7,368,753	kWh	No data	2,439	n/a
Energy Use - PSREC	Electric	No data	96,139	kWh	No data	28	n/a
Livestock	Dairy cow	No data	-	Dairy cows	13,097	No calc	n/a
Livestock	Beef cow	No data	-	Beef cows	13,985	No calc	n/a
Livestock	Horse	No data	-	Horses	1,114	No calc	n/a
Agricultural Total	**-**	**-**	**-**		**28,196**	**2,467**	**-91%**

TOTAL GROSS EMISSIONS	Fuel or Source	2014 Usage	2021 Usage	Usage Unit	2014 Emissions (MT CO2e)	2021 Emissions (MT CO2e)	% change
TOTAL GROSS EMISSIONS	**-**	**-**	**-**	**-**	**4,516,000**	**6,318,880**	**40%**

Comparison of 2014 and 2021 emissions data for Washoe County

Agriculture, Forestry, and Other Land Use (Forests & Trees)	Fuel or Source	2014 Usage	2021 Usage	Usage Unit	2014 Emissions (MT CO2e)	2021 Emissions (MT CO2e)	% change
Trees outside of Forests	Emissions	No data	9	Hectares	No data	523	n/a
Trees outside of Forests	Removals	No data	4,433	Hectares	No data	-43,360	n/a
Undisturbed Forests	Removals	No data	36,255	Hectares	No data	-31,046	n/a
Non-Forest to Forest	Removals	No data	2,469	Hectares	No data	-2,913	n/a
Forest Disturbances	Emissions	No data	7,019	Hectares	No data	10,570	n/a
Forest to Grassland	Emissions	No data	605	Hectares	No data	15,352	n/a
Forest to Other	Emissions	No data	6	Hectares	No data	1,245	n/a
Forest to Wetland	Emissions	No data	798	Hectares	No data	1,112	n/a
Forest to Settlement	Emissions	No data	60	Hectares	No data	701	n/a
Forest to Cropland	Emissions	No data	0.1	Hectares	-	-	-
Forests & Tress Total	**-**	**-**	**-**	**-**	**No data**	**-47,816**	**n/a**

TOTAL NET EMISSIONS (with Sequestration)	Fuel or Source	2014 Usage	2021 Usage	Usage Unit	2014 Emissions (MT CO2e)	2021 Emissions (MT CO2e)	% change
TOTAL NET EMISSIONS (with Sequestration)	-	-	-	-	**No data**	**6,271,064**	**n/a**

Appendix 6. Description of "Nonroad" Transportation sources

Source: **EPA's National Emissions Inventory**

The U.S. EPA's National Emissions Inventory (NEI) is a nationwide compilation of air pollutant emission estimates. Pollutants included in the NEI are criteria air pollutants (CAPs), precursors to CAPs, and hazardous air pollutants (HAPs). In addition, the NEI houses emission estimates for greenhouse gases (GHGs) for select sectors. Currently, the NEI is compiled on 3-year cycles, with the 2020 NEI being the most recent release. Staff at the EPA collaborates with state, local, and tribal (SLT) air agencies to estimate emissions for each NEI, with additional data coming from other programs, such as the Toxics Release Inventory (TRI) and the Greenhouse Gas Reporting Program (GHGRP). Emission estimates are compiled within the Emission Inventory System (EIS) and subsequently selected using a hierarchical approach to generate a complete inventory. **Additional information on the latest NEI release can be found here**.

Emission sources in the NEI are consolidated into four data categroies: onroad mobile, nonroad mobile, nonpoint, and point. Onroad mobile sources include emissions from motorized vehicles that normally operate on public roadways. This includes passenger cars, motorcycles, minivans, sport-utility vehicles, light-duty trucks, heavy-duty trucks, and buses. The sector includes emissions generated from parking areas, emissions from short-duration idle during pickups / deliveries, emissions from vehicles when they start, and emissions while the vehicles are moving. The sector also includes "hoteling emissions, which refers to the time spent idling in a diesel long-haul combination truck during federally mandated rest periods of long-haul trips.

The mobile nonroad equipment data category includes all mobile source emissions that do not operate on roads, excluding commercial marine vehicles, railways, and aircraft. These sources included included in this category are construction, agriculture, industrial, lawn & garden (commercial and residential), commercial, logging, railroad support (excluding locomotives), recreational vehicles, recreational marine (pleasure craft, excluding commercial marine vessels; CMVs), and underground mining.

The nonpoint emissions category includes biogenic emissions, fires (wildfires, prescribed burning, and agricultural field burning), and all other stationary sources that aren't covered in the point category. These sources are all reported at the county-level, though some sources such as shipping lanes and ports are more finely resolved to the county / shape identifier (ID) (polygon) level. In addition, some nonroad mobile sources, such as trains and commercial marine vessels, reside within the nonpoint data category.

The point source emissions category is composed of individual facilities, usually at specific latitude / longitude coordinates, rather than as county or tribal aggregates. These facilities include large energy and industrial sites, such as electric generating utilities (EGUs), portland cemet manufacturing plats, petroleum refineries, natural gas compressor stations, and facilities that manufacture pulp and paper, automobiles, machinery, chemicals, fertilizers, pharmaceuticals, glass food products, and other products. Additionally, smaller point sources are included voluntarily by some SLT agencies, and can include small facilities such as crematoria, dry cleaners, and gas stations. The point source data category also includes emissions from the landing and take-off portions of aircraft operations, the ground support equipment at airports, and locomotive emissions within railyards.

Appendix 7. Definitions of customer types from energy utilities

NV Energy customer descriptions are in their **Definitions** document.

- **Commercial or General Service** - Service to Customers engaged in selling, warehousing, or distributing a commodity, in some business activity or in a profession, or in some form of economic or social activity (offices, stores, clubs, hotels, etc.) and for purposes that do not come directly under another classification of service.
- **Governmental Entities** - An agency or instrumentality of a government, including without limitation, the State of Nevada or an agent or instrumentality of the State of Nevada and a political subdivision of the State of Nevada or of any other government or an agency or instrumentality of a political subdivision of the State of Nevada or of any other government.
- **Residential Service** - Service to Customer provided for residential purposes only in a single family dwelling or building, or in an individual flat or apartment in a multiple family dwelling or building or portion thereof occupied as the home of one or more individuals.
- **Industrial Service** - Service to Customers engaged in a process which creates or changes raw or unfinished materials into another form or product (Factories, mills, machine shops, miles, oil wells, refineries, pumping plants, creameries, canning or packing plants, etc.; i.e., in extractive, fabricating, or processing activities.
- **Irrigation Pumping Service** - Electric service used for irrigation or agricultural drainage purposes which is metered separately and billed under the applicable schedule.

NV Energy Customer Classification details

#	Question	Answer
a	Are buildings assigned based on metering rates? If so, please describe by category:	See NV Energy Rate Schedules.
b	Are multifamily apartment buildings classified as residential or commercial?	Yes, see definition above.
c	How are large users such as hospitals or universities classified?	Commercial
d	How are municipal/institutional (public-owned) buildings categorized?	Government
e	Is transit vehicle energy use included? If so, in which category?	See NV Energy Rate Schedules.
f	Are agricultural buildings included external from the agricultural category?	yes
g	Are wastewater treatment facilities included? If so, in which category?	See NV Energy Rate Schedules.

Southwest Gas customer descriptions are as follows:

- **Commercial customers** - A customer who is engaged primarily in the sale of goods or services including institutions and local, state, and federal government agencies for uses other than those involving manufacturing or electric power generation.
- **Residential customers** - A house, apartment, townhouse or any other permanent residential unit that is used as a permanent home.
- **Industrial customers** - A customer who is engaged primarily in process which creates or changes raw or unfinished materials into another form or product.
- **Agricultural customers** - Irrigation pumping customers for use as fuel in internal combustion engines for pumping water for agricultural irrigations.

SW Gas Customer Classification Details

#	Question	Answer
a	Are buildings assigned based on metering rates?	No, buildings are not based on metering rates.
b	Are multifamily apartment buildings classified as residential or commercial?	Multifamily apartment buildings are classified as commercial when identified as a location at which more than one dwelling unit receives the benefits of a natural gas service through a single meter including, without limitation.
c	How are large users such as hospitals or universities classified?	Large users such as hospitals and universities are classified as commercial customers.
d	How are municipal/institutional (public-owned) buildings categorized?	Southwest Gas does not have a unique customer classification for municipal/
e	Is transit vehicle energy use included? If so, in which category?	Transit vehicle energy falls under the compressed natural gas customer class. There were no such customers served by Southwest Gas in 2021, in Washoe County.
f	Are agricultural buildings included external from the agricultural category?	Agricultural buildings maybe categorized under the Industrial customer class. No such customer were served during 2021.
g	Are wastewater treatment facilities included? If so, in which category?	Wastewater treatment facilities are included under the Industrial customer class. However, there were no such customer served by Southwest Gas in 2021, in Washoe County.

Surprise Valley Electric Company

Surprise Valley Electric Company does not currently assign building types.

SVEC Customer Classification Details

#	Question	Answer
a	Are buildings assigned based on metering rates? If so, please describe by category:	No buildings assigned.
b	Are multifamily apartment buildings classified as residential or commercial?	No apartment buildings as customers.
c	How are large users such as hospitals or universities classified?	No such large users.
d	How are municipal/institutional (public-owned) buildings categorized?	No municipal/institutional customers or buildings.
e	Is transit vehicle energy use included? If so, in which category?	No transit vehicle energy customers.
f	Are agricultural buildings included external from the agricultural category?	All agricultural usage aggregated per meter.
g	Are wastewater treatment facilities included? If so, in which category?	No wastewater treatment facilities customers.

Plumas-Sierra Rural Electric Co-Op

PSREC assigns building types to each category based on its **rate classes**

PSREC Customer Classification Details

#	Question	Answer
a	Are buildings assigned based on metering rates? If so, please describe by category:	Yes
b	Are multifamily apartment buildings classified as residential or commercial?	N/A
c	How are large users such as hospitals or universities classified?	N/A
d	How are municipal/institutional (public-owned) buildings categorized?	Commercial
e	Is transit vehicle energy use included? If so, in which category?	N/A
f	Are agricultural buildings included external from the agricultural category?	No
g	Are wastewater treatment facilities included? If so, in which category?	N/A

Appendix 8. Commercial and Industrial jobs in Washoe County, 2021

Commercial and Industrial Jobs in Washoe County, 2021 per North American Industry Classification System (NAICS)

NAICS Industry	Sector	Nevada	Washoe County	% Washoe County
Accommodation and Food Services	Commercial	217,183	22,519	10.37%
Retail Trade	Commercial	136,187	23,263	17.08%
Health Care and Social Assistance	Commercial	134,476	25,597	19.03%
Administration & Support, Waste Management and Remediation	Commercial	82,937	15,213	18.34%
Educational Services	Commercial	81,797	16,482	20.15%
Professional, Scientific, and Technical Services	Commercial	62,105	12,263	19.75%
Public Administration	Commercial	50,924	7,543	14.81%
Finance and Insurance	Commercial	38,758	6,016	15.52%
Other Services (excluding Public Administration)	Commercial	29,561	5,797	19.61%
Management of Companies and Enterprises	Commercial	25,892	3,361	12.98%
Arts, Entertainment, and Recreation	Commercial	25,253	4,419	17.50%
Real Estate and Rental and Leasing	Commercial	24,000	4,340	18.08%
Information	Commercial	14,706	2,896	19.69%
TOTAL COMMERCIAL	**Commercial**	**923,779**	**149,709**	**16.21%**
Construction	Industrial	91,864	17,233	18.76%
Transportation and Warehousing	Industrial	79,717	16,357	20.52%
Manufacturing	Industrial	56,739	13,141	23.16%
Wholesale Trade	Industrial	36,056	9,536	26.45%
Mining, Quarrying, and Oil and Gas Extraction	Industrial	13,234	223	1.69%
Utilities	Industrial	4,777	812	17.00%
Agriculture, Forestry, Fishing and Hunting	Industrial	4,641	618	13.32%
Total Industrial	**Industrial**	**287,028**	**57,920**	**20.18%**
TOTAL	**Total**	**1,210,807**	**207,629**	**17.15%**

Source: United States Census Bureau's OnTheMap tool

Appendix 9. Definitions of Solid Waste material categories

Definitions of Material Categories from 2018 Waste Composition and Characterization Analysis, written by Sloan Vazquez McAffee Municipal Solid Waste Advisors

Category	Definition
Dry Recoverable Fiber	All clean dry fiber, including carboard (OCC), chip board (cereal / shoe box), office paper, junk mail, and shredded paper that is readily recoverable using current waste / recycling processing technology.
PET UBC's	PET plastic (#1) used beverage containers
HDPE	All readily identifiable HDPE, including UBC's, five-gallon pails, laundry baskets, trash cans, toys, et al
Film Plastic	All film plastic from t-shirt bags to large garbage bags and painters' tarps
Mixed Plastics	All readily identifiable plastics except PET, HDPE, and Film
Glass	CRV and plate (window) glass
Aluminum UBC's	All aluminum beverage containers, primarily CRV
Mixed Ferrous	Tin cans, steel (pots, pans, construction material, shelving, etc.)
Mixed Non-Ferrous	Aluminum windows and doors, folding lawn chairs, stainless steel fixtures, brass hardware, copper pipe, et al.
Inerts	Dirt, rock, sand, brick, tile, ceramic, concrete, et al.
Hazardous Waste	Pesticide, insecticide, paint, solvents, oil, cleaning solutions, et al
E-waste	All items that operate via AC current or battery
Textiles	Clothing, bedding, carpet, towels, rags, et al
Organics	Yard / garden waste, food waste, clean wood, painted / treated wood, wet contaminated fiber, rubber
Wet Contaminated Fiber	Fiber that has been soiled and is not marketable as a post-consumer fiber grade, and fiber that would disintegrate during the mechanical sorting process (screens and / or air classification) making it non-recoverable with fiber products
Fines	Materials that fall through the 2" lattice on the sort table. Depending upon the source of the sample, the fines may be heavy in organic and inert materials, or in glass shards and small fiber (shred). The organic / inert fines are produced from unprocessed MSW or from "dirty" materials recycling facility (MRF) operations. The glass / fiber fines are produced from "clean," or single-stream recycling processing plants.
Other	These materials are not readily recoverable as any of the other commodity / products. They are generally represented by items that are comprised of more than one material and cannot be readily, economically separated and recovered.

Source: Two season waste composition and characterization analysis (July 2018)

Appendix 10. Land Use Change matrices, 2013 to 2019

2019: Top 2013: Left	Forest Land	Cropland	Grassland	Wetland	Settlement	Other Land	Total
Forest Land	43,274	0.1	605	798	60	6	44,743
Cropland	0	1,540	15	5	20	0	1,579
Grassland	2,332	639	1,489,166	3,148	1,319	1,405	1,498,008
Wetland	136	8	120	60,114	26	22	60,426
Settlement	0.3	0	2	0	40,375	0	40,377
Other Land	0.8	0	219	640	3	47,767	48,630
Total	45,743	2,187	1,490,126	64,704	41,803	49,199	0

Simplified land cover change matrix for 2013 to 2019. All areas in hectares.

2019: Top 2013: Left	Forest Land	Crop-land	Grass-land	Wet-land	Settle-ment	Other Land	Total
Forest Land	43,274	0.1	605	798	60	6	44,743
Cropland	0	1,540	15	5	20	0	1,579
Grassland	2,332	639	1,489,166	3,148	1,319	1,405	1,498,008
Wetland	136	8	120	60,114	26	22	60,426
Settlement	0.3	0	2	0	40,375	0	40,377
Other Land	0.8	0	219	640	3	47,767	48,630
Total	**45,743**	**2,187**	**1,490,126**	**64,704**	**41,803**	**49,199**	**0**

Detailed Land Cover Change Matrix

Land Cover Change Matrix

Table 2. Full NLCD land cover change matrix for 2013 to 2019. All areas are in hectares.

2019: Top 2013: Left	Deciduous Forest	Evergreen Forest	Mixed Forest	Woody Wetlands	Cultivated Crops	Pasture/Hay	Grassland/Herbaceous	Shrub/Scrub	Open Water	Emergent Herbaceous Wetlands	Developed, Open Space	Developed, Low Intensity	Developed, Medium Intensity	Developed, High Intensity	Barren Land	Perennial Ice/Snow	Total
Deciduous Forest	101	0.3	0	0	0	0	0	0.8	0	0	0	0	0	0	0	0	102
Evergreen Forest	0	37,224	0.5	0.2	0	0	420	178	15	0.4	8	2	0.8	0.4	4	0	37,853
Mixed Forest	0	0	1,238	0	0	0	0	0.1	0.2	0	0	0	0	0	0	0	1,238
Woody Wetlands	0	0	0	4,610	0.1	0	1	4	446	336	11	11	18	9	2	0	5,449
Cultivated Crops	0	0	0	0	1,540	10	0.5	4	0	5	4	13	3	0.3	0	0	1,579
Pasture/Hay	0	0	0	0.3	28	1,656	0	0.6	0.4	21	4	3	5	1	0	0	1,721
Grassland/Herbaceous	0	21	0.5	83	8	10	191,623	33,981	1,978	35	46	16	29	11	710	0	228,542
Shrub/Scrub	118	1,576	204	329	603	35	81,727	1,180,133	839	274	434	268	318	194	695	0	1,267,745
Open Water	0	2	0	10	1	0.1	83	31	53,641	38	1	0.8	0.5	0.2	5	0	53,813
Emergent Herbaceous Wetlands	0	0.2	0	124	7	0	3	3	498	5,937	8	6	6	4	17	0	6,612
Developed, Open Space	0	0.2	0	0	0	0	0	0.1	0	0	7,033	84	398	68	0	0	7,580
Developed, Low Intensity	0	0.3	0	0	0	0	0	0.7	0	0	0	12,928	208	175	0	0	13,312
Developed, Medium Intensity	0	0	0	0	0	0	0	0.6	0	0	0	0	13,131	26	0	0	13,157
Developed, High Intensity	0	0	0	0	0	0	0	0.5	0	0	0	0	0	6,328	0	0	6,329
Barren Land	0	0	0	0.8	0	0	181	38	604	37	0.9	0.5	0.7	0.4	47,767	0	48,630
Perennial Ice/Snow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	220	38,923	1,443	5,157	2,187	1,712	274,039	1,214,376	58,021	6,683	7,547	13,331	14,108	6,817	49,199	0	0