



Greenhouse Gas Summary Report

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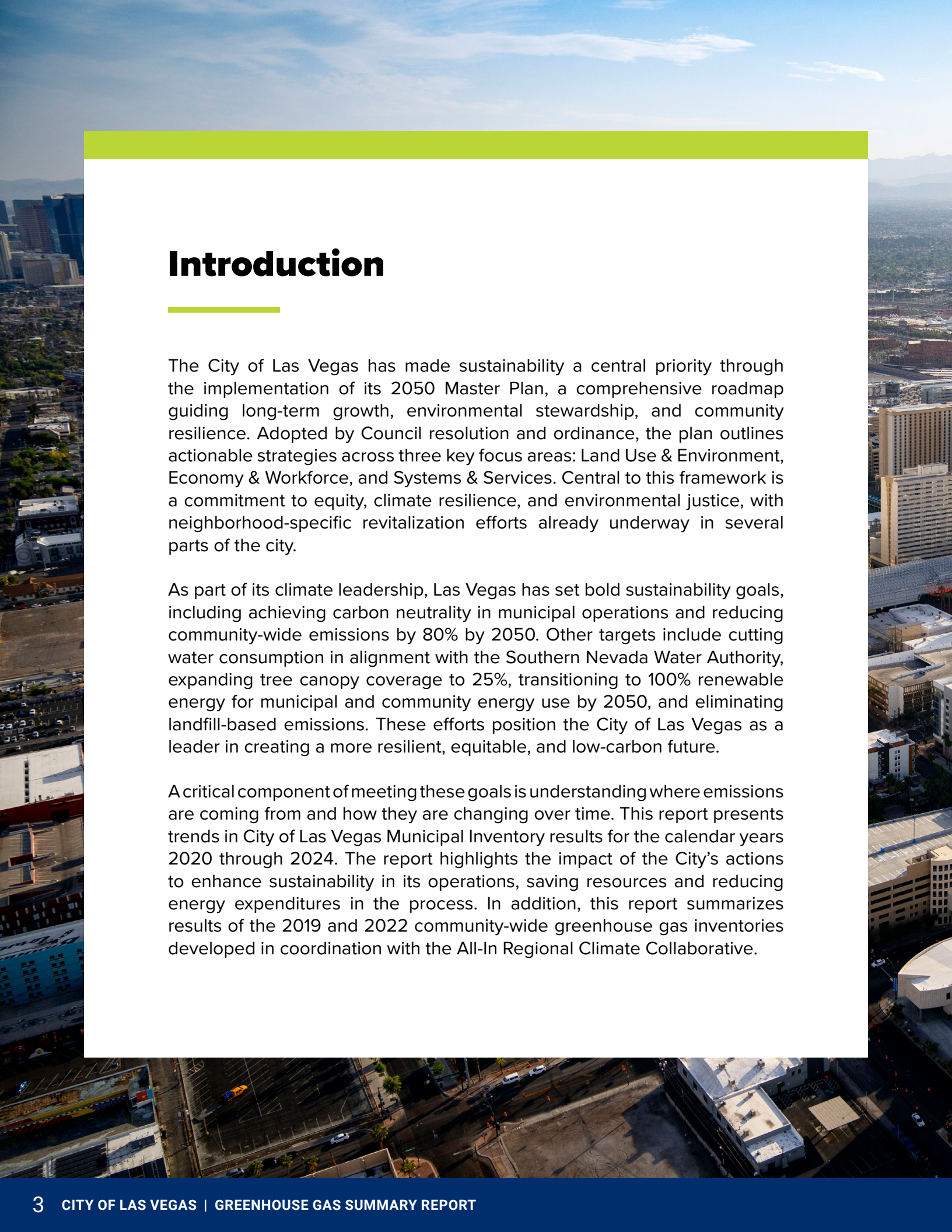
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An aerial photograph of Las Vegas, showing a mix of urban development, including high-rise hotels, commercial buildings, parking lots, and streets with vehicles. The city extends towards the horizon under a clear blue sky with some light clouds.

Introduction

The City of Las Vegas has made sustainability a central priority through the implementation of its 2050 Master Plan, a comprehensive roadmap guiding long-term growth, environmental stewardship, and community resilience. Adopted by Council resolution and ordinance, the plan outlines actionable strategies across three key focus areas: Land Use & Environment, Economy & Workforce, and Systems & Services. Central to this framework is a commitment to equity, climate resilience, and environmental justice, with neighborhood-specific revitalization efforts already underway in several parts of the city.

As part of its climate leadership, Las Vegas has set bold sustainability goals, including achieving carbon neutrality in municipal operations and reducing community-wide emissions by 80% by 2050. Other targets include cutting water consumption in alignment with the Southern Nevada Water Authority, expanding tree canopy coverage to 25%, transitioning to 100% renewable energy for municipal and community energy use by 2050, and eliminating landfill-based emissions. These efforts position the City of Las Vegas as a leader in creating a more resilient, equitable, and low-carbon future.

A critical component of meeting these goals is understanding where emissions are coming from and how they are changing over time. This report presents trends in City of Las Vegas Municipal Inventory results for the calendar years 2020 through 2024. The report highlights the impact of the City's actions to enhance sustainability in its operations, saving resources and reducing energy expenditures in the process. In addition, this report summarizes results of the 2019 and 2022 community-wide greenhouse gas inventories developed in coordination with the All-In Regional Climate Collaborative.



Municipal GHG Inventory Results

From the operation of fleet vehicles to waste generation, to providing wastewater treatment services, electricity use is a significant component of the City of Las Vegas municipal operations Greenhouse Gas (GHG) inventory. A major component of any GHG inventory is the emissions associated with the use of electricity, and there are multiple perspectives for how that accounting is performed. The City of Las Vegas’ municipal operations all reside within the AZNM eGRID region for electricity supply¹. In addition, the City’s electricity utility, NV Energy, has supplies the City with 100% renewable electricity by retiring renewable energy credits on the City’s behalf. In order to maintain full awareness of the GHG outcomes resulting from City investment in energy conservation or efforts to shift energy away from direct fossil fuel use, the GHG footprint of the City was evaluated through the following two perspectives: The location-based approach, which focuses on physical qualities of grid electricity, highlights the potential for GHG reduction through electricity conservation. A market-based approach around purchased renewable energy reveals both the potential impact of a fully renewable electricity supply as well as the remaining share of emissions that need to be addressed through other actionsthat target non-electric sources.

Location-Based Inventory Results

Overall, there was a 4% reduction, approximately ~3,300 MTCO₂e, from 2020 to 2024 in Municipal GHG emissions when using the location-based emission factors. The majority of reductions can be explained by the decrease in emissions intensity of the regional electricity grid. Even though electricity use in buildings increased by 3% between 2020 and 2024, the cleaner grid led to a 9% reduction in associated GHGs (~3,000 MTCO₂e). Similarly, the 2% reduction in electricity used for streetlights and traffic signals coupled with a cleaner grid led to a 14% reduction in associated GHGs (~1,900 MTCO₂e). This trend is illustrated in Figure 1 below where emissions have been declining more quickly than the reductions in electricity use.

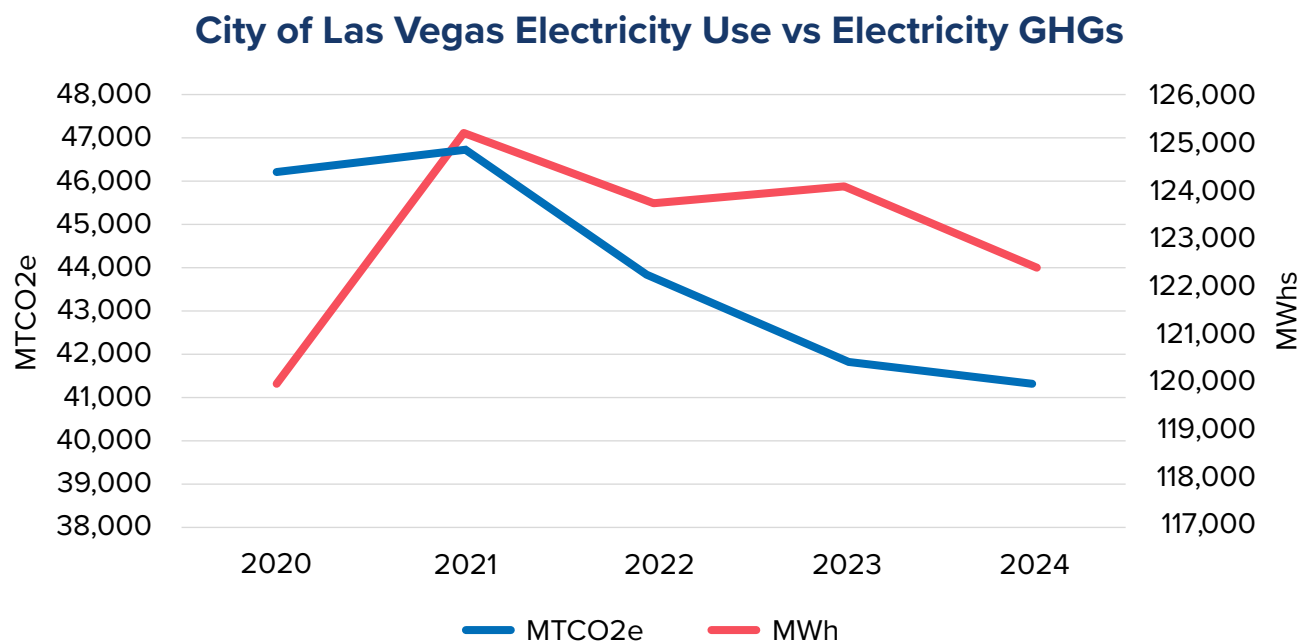


Figure 1. 2020-2024 Municipal Electricity Use vs GHG Emissions

Additionally, there was an 8% decrease in natural gas use in buildings, accounting for an additional reduction of ~460 MTCO₂e. On the other hand, there were some sectors that had an increase in total emissions, including solid waste and vehicle fleet. There was a 13% increase in solid waste landfilled, which caused an increase of ~1,600 MTCO₂e. Also, a 27% increase in gallons of gasoline used for the vehicle fleet resulted in an increase of ~660 MTCO₂e. Despite these setbacks, the overall emissions have seen a steady decline since 2021 as shown in Figure 2.

2020-2024 Municipal GHG Inventories by Sector (Location-Based EFs)

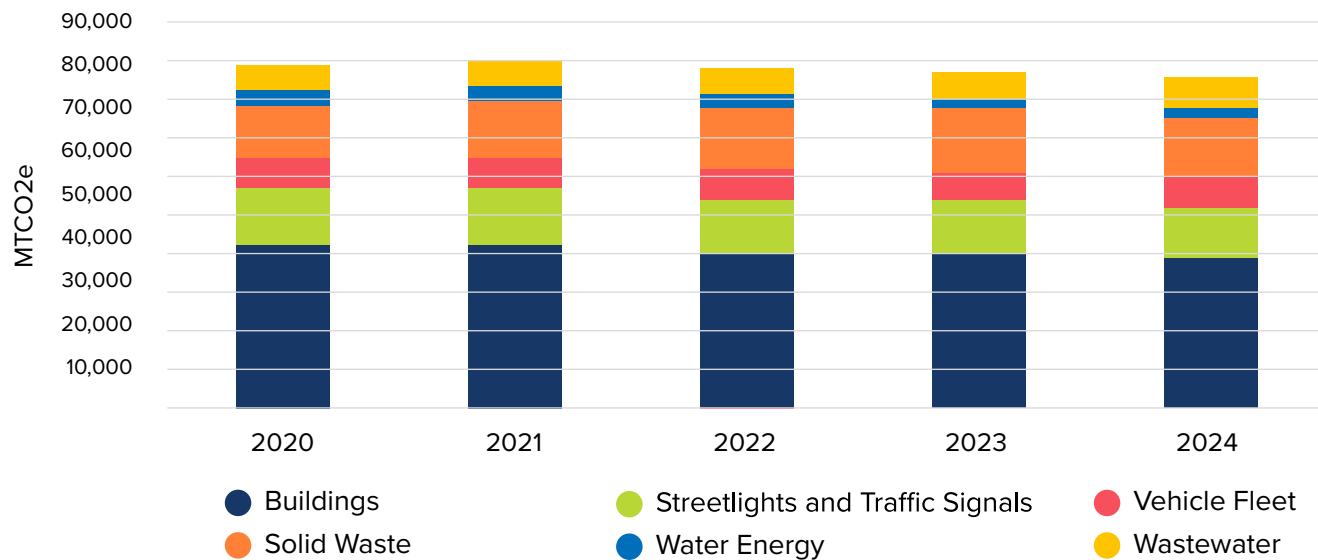


Figure 2. 2020-2024 Municipal GHG Inventories by Sector (Location-Based Electricity Emissions Factors)

Sector & Source	2020	2021	2022	2023	2024	'20-'24 #Change	'20-'24 %Change
Buildings	38,758	38,498	36,667	36,689	35,282	(3,476)	-8.97%
Electricity	32,938	33,805	31,548	30,208	29,918	(3,020)	-9.17%
Natural Gas	5,820	4,693	5,119	6,481	5,365	(456)	-7.83%
Streetlights and Traffic Signals	13,313	12,931	12,205	11,648	11,387	(1,927)	-14.47%
Electricity	13,313	12,931	12,205	11,648	11,387	(1,927)	-14.47%
Vehicle Fleet	6,986	7,221	7,309	7,260	7,571	585	8.38%
Gasoline	2,462	2,536	2,650	2,737	3,125	663	26.95%
Diesel	1,727	1,850	1,901	1,860	1,832	105	6.08%
Biodiesel	2,796	2,835	2,759	2,663	2,613	(183)	-6.55%
Solid Waste	12,015	13,152	13,714	14,142	13,619	1,604	13.35%
Waste Landfilled	12,015	13,152	13,714	14,142	13,619	1,604	13.35%
Water Energy	3,462	3,544	3,128	2,686	2,994	(468)	-13.53%
Electricity	3,462	3,544	3,128	2,686	2,994	(468)	-13.53%
Wastewater	6,161	6,410	6,371	6,420	6,584	423	6.87%
Process Emissions	1,430	1,509	1,522	1,544	1,559	129	9.03%
Fugitive Emissions	3,778	3,987	4,020	4,079	4,120	341	9.03%
Digester Gas	953	914	829	797	905	(47)	-4.96%
Total	80,696	81,755	79,393	78,844	77,437	(3,258)	-4.04%

Table 1. 2020-2024 Municipal GHGs (MTCO₂e) by Sector & Source (Location-Based Electricity Emissions Factors)

Market-Based Inventory Results

Between 2020 and 2024, municipal GHG emissions calculated using market-based emissions factors increased from 34,444 to 36,133 MTCO₂e. Unlike the location-based inventory, which showed a 4% decrease due to a cleaner electricity grid, the market-based inventory reveals a 5% increase in emissions over the same period. The location-based method uses regional electricity grid emissions data, which reflects a growing share of renewable energy feeding into the grid. In contrast, the market-based method assumes that municipal electricity is emissions-free, so progress in grid decarbonization is not reflected. As a result, the increase in total emissions as seen in Figure 3 is almost entirely driven by annual changes in the direct use of fossil fuels.

This upward trend in the market-based inventory is primarily driven by increases in the vehicle fleet and solid waste sectors. Emissions from the vehicle fleet rose 8% from 6,986 MTCO₂e in 2020 to 7,571 MTCO₂e in 2024, with significant growth in gasoline and biodiesel use. Landfilled solid waste also grew 12% from 12,015 to 13,619 MTCO₂e, reflecting higher waste volumes. Meanwhile, emissions from wastewater treatment increased 7% from 6,161 to 6,584 MTCO₂e over the five-year period. These changes underscore that, when electricity-related emissions are held constant or removed (as in the market-based approach), activity trends in fuel use and waste management become the primary drivers of municipal emissions, highlighting important areas for future mitigation strategies. The City of Las Vegas has also invested significantly in energy conservation projects that have reduced its use of grid electricity and delivered financial savings to the City. However, when using a market-based approach the value of GHG reduction of energy conservation is omitted to avoid double counting. Under a market-based approach, the only way to drive reduction in emissions will be begin shifting away from direct fossil fuel use.

2020-2024 Municipal GHG Inventories by Sector (Market-Based EFs)

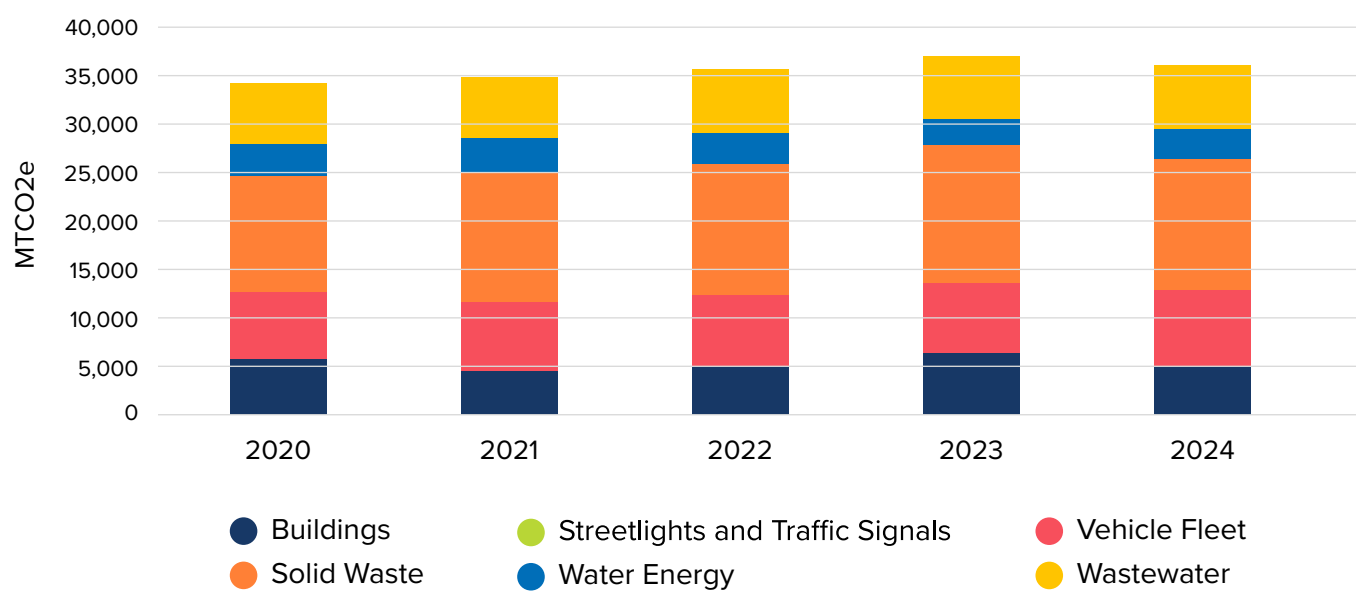


Figure 3. 2020-2024 Municipal GHG Inventories by Sector (Market-Based Electricity Emissions Factors)

Sector & Source	2020	2021	2022	2023	2024	20v24 #Change	20v24 %Change
Buildings	5,820	4,693	5,119	6,481	5,365	-456	-7.83%
Electricity	-	-	-	-	-	-	-
Natural Gas	5,820	4,693	5,119	6,481	5,365	-456	-7.83%
Streetlights and Traffic Signals	-	-	-	-	-	-	-
Electricity	-	-	-	-	-	-	-
Vehicle Fleet	6,986	7,221	7,309	7,260	7,571	585	8.38%
Gasoline	2,462	2,536	2,650	2,737	3,125	663	26.95%
Diesel	1,727	1,850	1,901	1,860	1,832	105	6.08%
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Fugitive Emissions	3,778	3,987	4,020	4,079	4,120	341	9.03%
Digester Gas	953	914	829	797	905	-47	-4.96%
Total	34,444	35,020	35,641	36,988	36,133	1,689	4.90%

Table 2. 2020-2024 Municipal GHGs (MTCO₂e) by Sector & Source (Market-Based Electricity Emissions Factors)

Impacts of Actions

Energy Efficiency Investment

The City has completed a number of meaningful energy efficiency projects in recent years, particularly focused on lighting upgrades across municipal infrastructure. Since 2019, projects that have received incentives from NV Energy have collectively saved approximately 3,398,205 kWh per year. 92% of these savings have come from lighting upgrades in parks, streetlights, buildings, and parking garages. These projects have significantly reduced GHG emissions while lowering operational costs. Building lighting projects alone have saved the City an estimated \$1,050,524 in energy costs between 2019 and 2024. However, the focus on lighting retrofits, while impactful, has left more complex but potentially higher-impact building efficiency opportunities largely unaddressed. While there may have been small incremental improvements in efficiency within municipal buildings through regular maintenance and equipment replacement, there have not been any rebate-qualifying efficiency projects focused on building weatherization or mechanical systems since 2017. This suggests there is untapped opportunity for comprehensive building efficiency upgrades, particularly in the areas of operations where additional reductions in GHGs will come from. To maximize long-term savings and support the City's carbon neutrality goals, reinvesting the energy cost savings from lighting projects into deeper energy retrofits for municipal buildings will be essential.



Park Lighting Upgrades

Electricity Saved from Efficiency Projects (2019 - 2024)

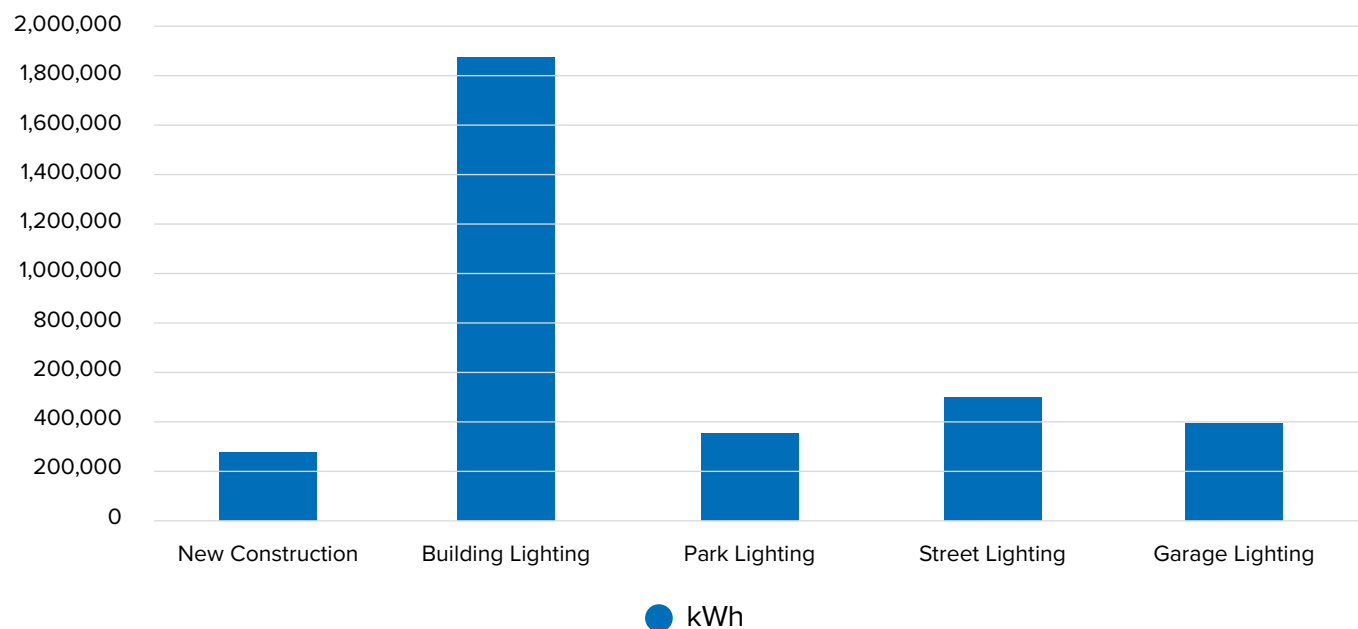
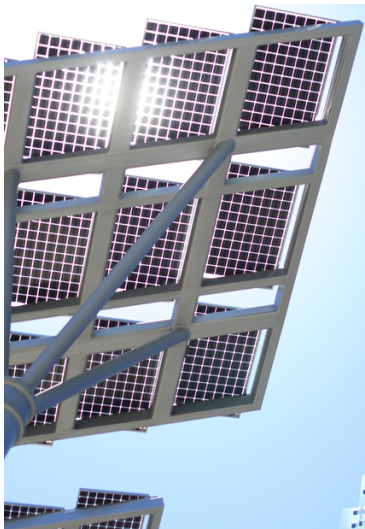


Figure 4. 2019-2024 Electricity Saved from Efficiency Project

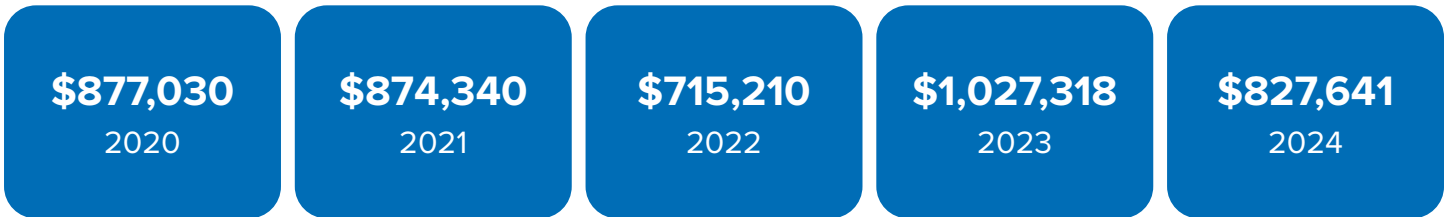
Solar Generation

The City’s investment in solar generation has delivered notable financial benefits and emissions reductions over the past several years. By reducing overall demand for electricity, these systems have helped lower energy costs across municipal operations. In 2024 alone, these savings accounted for roughly 7% of the City’s total electricity costs. The WPCF Plant is the City’s top solar energy producer, generating an average of 6,502 MWh annually from 2020-2024, more than any other municipal facility. Across all sites, solar systems generated an average of 3,750 MTCO2e in avoided emissions per year over the same period. These results underscore the valuable role that solar plays in reducing both emissions and costs.



Solar Trees at City Hall

Avoided costs from solar:



Cost Savings from Solar and Efficiency Projects

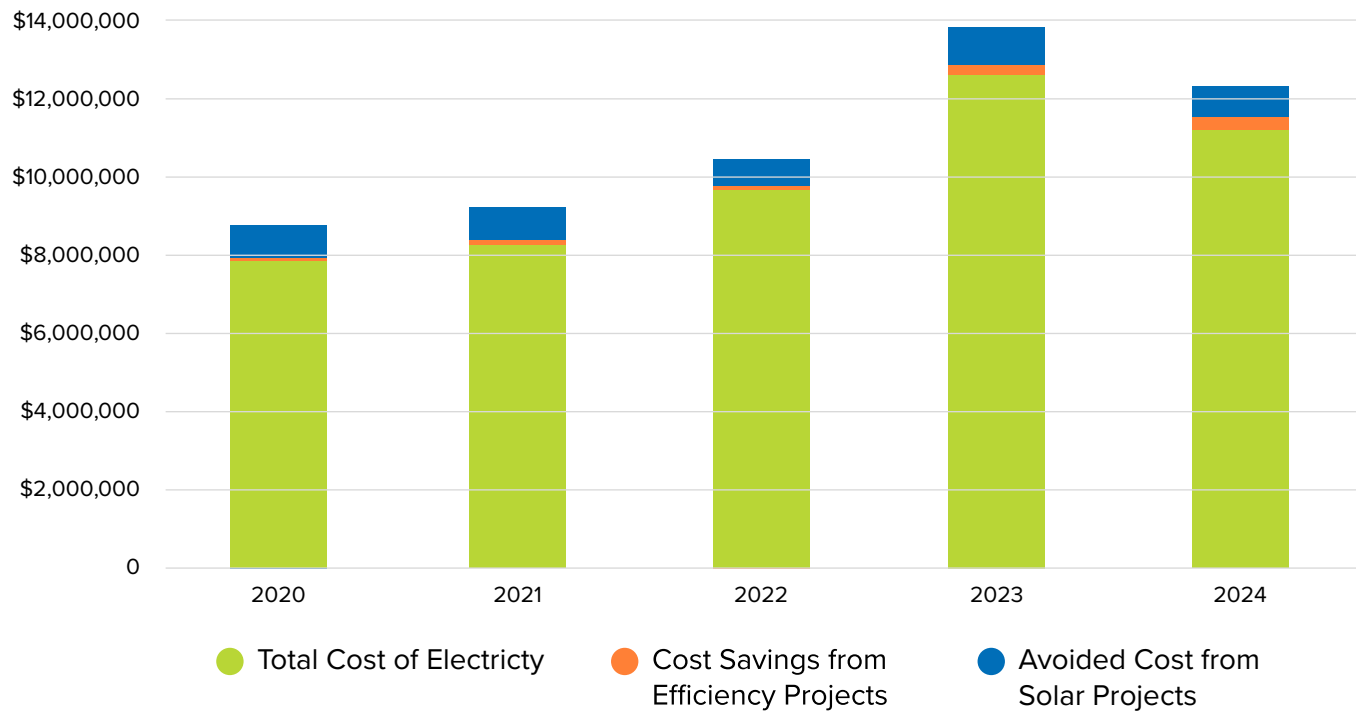


Figure 5. Cost Savings from Solar and Efficiency Projects

Water Pollution Control Facility, Biogas Utilization

Solar is not the only source of renewable energy that the City of Las Vegas produces. The Water Pollution Control Facility uses anaerobic digestion to stabilize and reduce the mass of wastewater biosolids that must be disposed of. This process also produces biogas that can be burned in place of natural gas needed in the wastewater treatment process. Since 2020, the amount of energy that the plant can provide for itself has far exceeded what needs to be purchased.

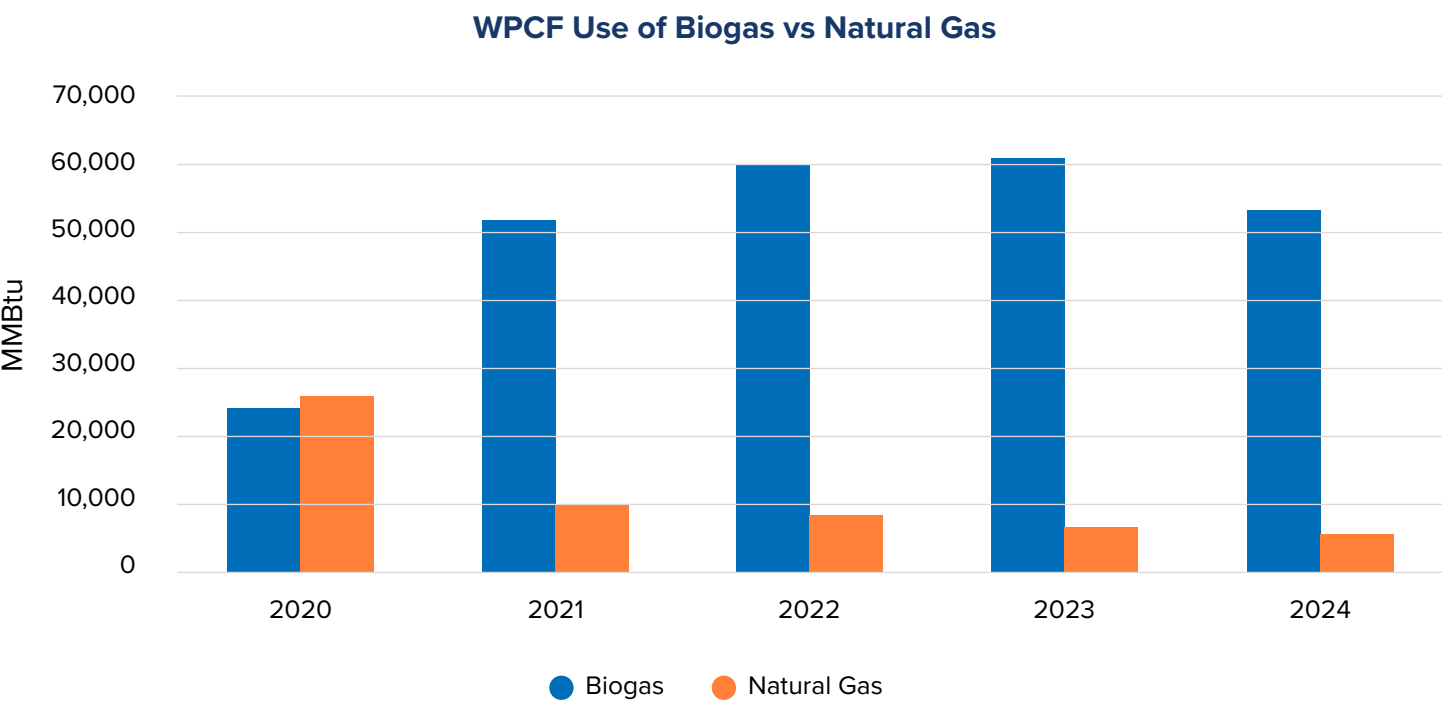


Figure 6. Water Pollution Control Facility Use of Biogas vs Natural Gas

Since 2020, biogas use has displaced over 250,000 MMBtu of natural gas and avoided over 13,000 MTCO₂e. This also avoided over \$16,000 in direct fuel costs.

While there are practical limitations for how biogas can be used onsite, there is much greater potential. In 2024, only 23% of the biogas produced was used beneficially, with the remainder being flared. As the demand for all types of clean energy grows, new opportunities for battery-paired electricity generation, vehicle fuels, or even green hydrogen may become viable options to allow the city to capitalize on this resource. The City also has the opportunity to acquire Portfolio Energy Credits for biogas utilization assuming approval by the Public Utilities Commission of Nevada.



Las Vegas Water Pollution Control Facility

Renewable Portfolio Standard Compliance and Opportunities

Actively participating in renewable energy provides multiple opportunities for the City of Las Vegas to both reduce emissions while generating non-tax revenue. Nevada’s Renewable Portfolio Standard (RPS) sets the minimum percentage of electricity that must come from renewable sources each year. The standard increases gradually over time, requiring 34% renewable energy through 2026, 42% from 2027 to 2029, and reaching 50% by 2030.



Hoover Dam

As a Member Agency of the Southern Nevada Water Authority, the City of Las Vegas must meet the RPS standards for the electricity it uses in water and wastewater utilities. The City of Las Vegas currently meets its RPS requirements through a combination of dedicated solar generation from select solar energy systems that are not net-metered, along with hydroelectric power allocations from Hoover Dam that are distributed to SNWA Member Agencies. For every megawatt-hour of renewable energy generated, the City earns Portfolio Energy Credits (PECs), which are used to demonstrate compliance with the RPS. Las Vegas has consistently produced more PECs than needed and sells the excess to the Southern Nevada Water Authority (SNWA), helping other agencies meet their RPS obligations. The City has received a total revenue of nearly \$600,000 since 2020 for the sale of these PECs. As the compliance requirements for the RPS becomes gradually tighter, there is a high likelihood that the market price for excess PECs will increase and therefore provide additional revenue for the City.

While the Renewable Portfolio Standard requirements are currently set to hold steady for 2030 and beyond, it is likely Nevada will take steps in the future to tighten this requirement, further supporting the need for additional investment in renewables. Even without that requirement, the demand for clean energy will continue to rise and any excess credits could be a growing revenue source for the City. In addition to the financial benefits, the clean energy revolution is the largest contributing factor in reducing city-wide emissions.

Across the portfolio of actions that the City of Las Vegas has taken to reduce energy use and invest in renewables, energy expenditures were down by over \$1.3 million in 2024. To bring further benefit to the community, the City could pursue biogas and additional hydropower allocation from the Parker-Davis Dam remarketing project.

2024 Sustainability-Driven Cost Savings



\$828,000

Solar Production



\$251,000

Solar Credits



\$301,000

Energy Efficiency



\$16,000

Biogas Utilization

\$1,396,000 Total

Community GHG Inventory Results

The City of Las Vegas is also working towards reduction of greenhouse gases throughout the community, in alignment with many of the principles established in the 2050 Master Plan. Through participation in the *All-In Clark County* Regional Climate Collaborative, the City has established two recent benchmarks of community-wide emissions. These inventories typically lag in the years for which complete data is available. The most recent is for 2022 with results summarized below.

2022 GHG Inventory Results

The 2022 Community Greenhouse Gas Inventory results indicate total emissions of 5,037,707 MTCO₂e. The largest source of emissions is the buildings sector, which accounts for 51.18% of total community emissions, followed by on-road transportation at 44.38%. Other contributing sectors include solid waste (4%), water treatment and delivery (1%), and wastewater treatment (less than 1%). These results highlight that the majority of community emissions stem from energy use in buildings and vehicle travel, indicating key areas for targeted emissions reduction strategies. Las Vegas's greenhouse gases make up 19% of the emissions from all of Clark County.

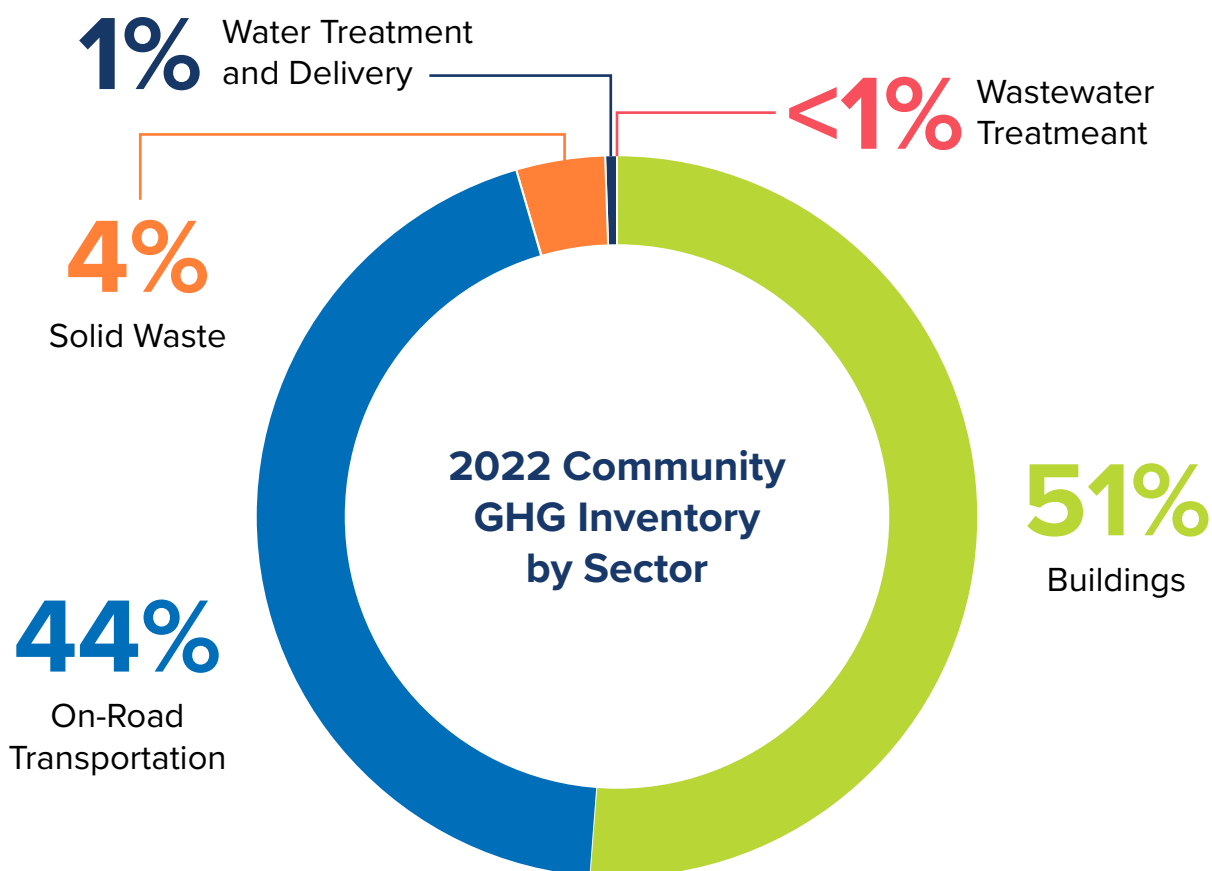


Figure 7. 2022 Community GHG Inventory by Sector

2019 vs 2022 GHG Inventory Comparison

Between 2019 and 2022, the community achieved an overall 6% reduction in GHG emissions, approximately 322,000 MTCO₂e, with per capita emissions dropping from 8.10 to 7.64 MTCO₂e. Residential building emissions declined by 13% (~233,000 MTCO₂e), largely due to a 19% reduction in residential natural gas use. Similarly, commercial building emissions dropped 12% (~145,000 MTCO₂e), reflecting a 12% reduction in commercial natural gas use. This drop is likely due to weather conditions, as 2022 was significantly warmer in the winter with 14% fewer heating degree days².

In contrast, emissions from on-road transportation rose slightly (0.98%), adding roughly 22,000 MTCO₂e due to increased vehicle miles traveled per capita and population growth. Between 2020 and 2022, the share of battery-electric vehicles in Las Vegas rose steadily from 0.52% to 1.45% and plug-in hybrid electric vehicles increased from 2.10% in 2020 to 2.7% by 2022. Without the increased share of electric vehicles, emissions from the sector would have been over 4,200 MTCO₂e higher.

Other changes included a 20% increase in emissions from landfilled waste (~30,000 MTCO₂e) and a 15% reduction in emissions from energy used in potable water treatment and delivery. This decline occurred because of higher amounts of renewable energy in the regional grid mix, despite electricity use in this sector rising by 3.64%.

Cleaner electricity was by far the biggest influence on reducing community-wide emissions from Las Vegas. While electricity use across residential and commercial sector rose 9% in 2022 compared to 2019, the GHGs associated with electricity fell by 12%. This adds up to community-wide reduction of over 258,000 MTCO₂e. This dramatic improvement at the community level underscores the importance for the City of Las Vegas to continue advancing the goals of the Renewable Portfolio Standard.

Community-scale inventory results are summarized in Figure 8 and with greater detail in Table 3 below.

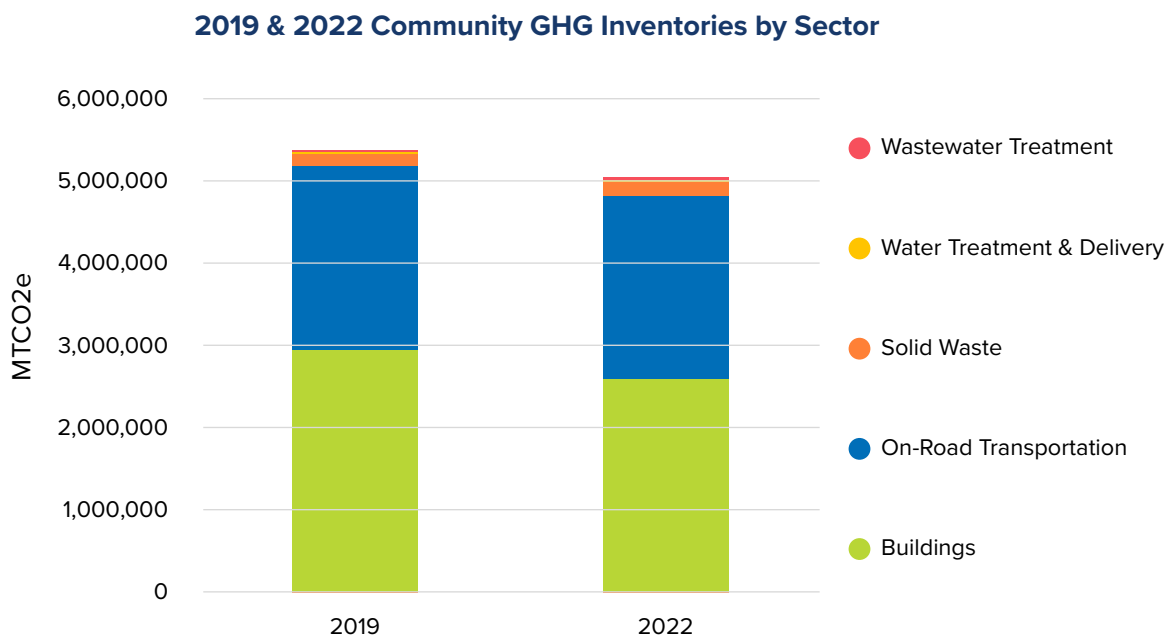


Figure 8. 2019 & 2022 Community GHG Inventories by Sector

Las Vegas Community Scale GHG Inventory 2019 -2022 Comparision

Sector & Source	Unit	2019	2022	% Change
Building Energy	MMBtu	30,903,156	30,321,024	-1.9%
	MTCO2e	2,946,570	2,578,293	-12.5%
Electricity	MMBtu	17,556,751	19,065,125	8.6%
	MTCO2e	2,233,320	1,975,223	-11.6%
Natural Gas	MMBtu	13,295,241	11,029,609	-17.0%
	MTCO2e	710,599	589,912	-17.0%
Other Fuels	MMBtu	51,164	226,290	342.3%
	MTCO2e	2,651	13,158	396.3%
On-Road Transportation	VMT	4,726,450,068	4,880,169,937	3.3%
	MTCO2e	2,213,872	2,235,615	1.0%
Gasoline / Diesel / Compressed Natural Gas	VMT	4,708,604,827	4,806,349,396	0.3%
	MTCO2e	2,211,720	2,227,664	-0.2%
Electricity	VMT	17,845,241	73,820,541	313.7%
	MTCO2e	2,151	7,951	269.6%
Solid Waste (Republic Services)	Tons	200,836	237,810	18.4%
	MTCO2e	160,508	190,058	18.4%
Water Treatment and Delivery Electricity (LVVD / SNWA)	MMBtu	241,287	250,066	3.6%
	MTCO2e	30,692	25,907	-15.6%
Wastewater Treatment	NA	NA	NA	0.0%
	MTCO2e	7,850	7,834	-0.2%
Process Emissions	Population	651,319	659,236	1.2%
	MTCO2e	5,500	5,567	1.2%
Septic Systems	Population	4,880	5,112	4.8%
	MTCO2e	1,348	1,412	4.8%
Flared Digester Gas	SCF	291,969,426	246,227,102	-15.7%
	MTCO2e	996	840	-15.7%
Beneficial Digester Gas	SCF	38,393,328	92,022,055	139.7%
	MTCO2e	6	15	139.7%
Total	MTCO2e	5,359,492	5,037,707	-6.00%

Table 3. Las Vegas Community-Scale Activity and GHG Summary by Sector & Source

It should be noted that all of the City of Las Vegas municipal operations are included within the community-wide total. Some items are visible in both inventories, like wastewater treatment, but buildings and fleet are mixed in with community-wide energy and VMT. City of Las Vegas operations make up about 2% of community-wide emissions.

Recommendations

The City of Las Vegas has made measurable progress in reducing greenhouse gas emissions across both community-wide and municipal operations, despite continued population growth, development, and climate-related challenges. The data show that cleaner energy sources on the grid, local investments in solar generation, and lighting efficiency upgrades are reducing the operational costs to the city while driving progress to reduce total GHGs. However, rising emissions in sectors like transportation, solid waste, and municipal fuel use indicate that ongoing action is needed to stay on track with the City's ambitious climate goals. By expanding data collection, improving emissions accounting practices, and prioritizing deeper efficiency and electrification efforts, Las Vegas can build on its progress and continue to lead in sustainability and resilience planning.

1

Expand Energy Efficiency Efforts Beyond Lighting Projects

To date, most municipal energy efficiency efforts have focused on lighting upgrades. While these are valuable, they represent only a portion of potential energy savings. By improving data collection on municipal building performance through benchmarking, the City will be better equipped to identify additional opportunities that offer deeper energy and emissions reductions. In particular, savings from high-return projects like lighting efficiency should be reinvested in more challenging projects such as those focused on building heating and cooling systems.

2

Improve Quality and Relevance of Purchased Renewable Energy Credits

The City currently purchases RECs that may be outdated or sourced from regions outside of its local grid, which limits their effectiveness in representing real, additional renewable energy impacts. Transitioning to RECs that meet the World Resources Institute Scope 2 Quality Criteria—such as being recent, from the same geographic market, and associated with new renewable generation—would ensure that the City's market-based emissions accounting more accurately reflects meaningful climate action and supports the development of clean energy within the region.

3

Develop Additional Renewable Energy Projects

The demand for renewable energy is only going to grow and there are ample opportunities for the City of Las Vegas to stay on the leading edge and capitalize on the solar resource that is available in the region.

There are opportunities to further utilize available biogas at the Water Pollution Control Facility to generate renewable electricity and retain Portfolio Energy Credits to maximize the financial return available. Projects that pair renewables with battery storage will have additional opportunities to generate financial returns when responding to peak electricity demand events while contributing to the resilience of the overall electrical grid that the region depends on.

Wherever possible the City of Las Vegas should acquire renewable energy allocations it qualifies to receive such as those from the Parker-Davis dam project.

4 **Pursue Electrification of the City Vehicle Fleet**

Battery electric vehicles are making a substantial impact on the emissions profile of the larger Las Vegas Community and there are good options for incorporating these vehicle types into municipal operations. As the city explores this option, a forward-looking strategy that plans for future capabilities in vehicle-to-grid, 2-way charging could give the city another tool in managing electricity costs.

5 **Establish a Formal Benchmarking Program for Municipal Energy Use**

While the City has been tracking energy usage across municipal operations for years, we do not have sophisticated tools or a formal system in place to do so, nor to do analysis on a facility-by-facility level. Implementing a benchmarking program would allow the City to monitor energy consumption across facilities, identify buildings with unusually high usage, and prioritize opportunities for efficiency improvements. With standardized tracking, the City can better assess performance over time, set reduction targets, and support data-driven decision-making for capital planning and retrofits.

6 **Continue Collaboration with Regional Partners**

The All-In Regional Climate Collaborative (RCC) has been an important driver of information sharing and coordination of local governments in the region. As the RCC continues to mature, activities like joint-procurement could help drive down initial investment costs in projects.

7 **Continue to drive GHG reduction across the Las Vegas community**

Two immediate actions the City of Las Vegas can take to bring down community-wide emissions are to 1) implement a commercial building benchmarking ordinance to drive investment in building efficiency, and 2) implement an EV charging ordinance to ensure the community can accommodate the shift the electric vehicles.

The 2050 Master Plan spelled out numerous energy, water, and waste related GHG reduction strategies. These should be continuously updated and pursued to keep pace with the rapidly evolving landscape of GHG reduction opportunities.

Endnotes

- 1 US EPA. eGRID Subregion Maps. <https://www.epa.gov/egrid/maps>
- 2 Heating Degree Day Comparison of 2019 against 2022 for Weather Station NLVX (North Las Vegas Airport) obtained from: <https://www.weatherdatadepot.com/degree-day-comparison>. Last Accessed 5/26/2025.



Las Vegas 2022 Community GHG Inventory Methodology Report

Prepared by Kim Lundgren Associates

May 2025

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Methods and Data Sources

The data used to generate regional GHG emissions estimates were drawn from sources that capture activity data from multiple sectors across the county. This inventory uses 100-year horizon Global Warming Potential values from the IPCC 5th Assessment Report.¹ Except where noted, this inventory follows methods and emissions factors sourced from the US Community Protocol² and aligns with the reporting conventions defined by the Global Protocol for Community Scale Emissions Inventories (GPC).³ While these documents define best practices and principles to follow, they do not always cover every nuance of local conditions and data availability.

Buildings

Electricity

Activity Data: Electricity generated and used for residential and non-residential facilities was sourced from NV Energy. Activity data included metered electricity use stratified by end-use sector. Usage associated with Water Pumping operations was excluded from the Buildings sector as they were allocated to the [Water Treatment & Delivery](#) sector.

Raw activity data for residential, small commercial, and large commercial end-uses were adjusted for the estimated electricity used for electric vehicles. The electricity associated with EVs was subtracted from the original electricity usage provided by NV Energy. Methods for estimating EV use are detailed in the [On-Road Vehicles: EVs](#) section of this report. It was assumed that 80% of EV usage was Residential and 20% Commercial. The Commercial allocation was split between Small and Large Commercial end-uses. The remaining electricity use is used as the input data for the electricity calculations for the Buildings sector.

Data Source	Data Type	Categorization
NV Energy	Electricity Consumption	Residential, small commercial, large commercial, streetlights, distribution only SVC, municipal
EPA eGRID ⁴	Electricity Grid Emissions Factors	AZNM Region

¹ Intergovernmental Panel on Climate Change, "Climate Change 2014: Synthesis Report," Fifth Assessment (2014). https://archive.ipcc.ch/pdf/assessment-report/ar5/syr/SYR_AR5_FINAL_full_wcover.pdf

² ICLEI – Local Governments for Sustainability USA, "U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions," Version 1.1 (2013). <https://icleiusa.org/us-community-protocol/>

³ Greenhouse Gas Protocol, "Global Protocol for Community-Scale Greenhouse Gas Inventories: An Accounting and Reporting Standard for Cities," Version 1.1 (2014). https://ghgprotocol.org/sites/default/files/standards/GPC_Full_MASTER_RW_v7.pdf

⁴ U.S. Environmental Protection Agency, "eGRID Summary Tables 2022," (2024). https://www.epa.gov/system/files/documents/2024-01/egrid2022_summary_tables.pdf

Methodology

- Obtain electricity consumption data per end-use from NV Energy.
- Subtract out electricity usage associated with non-building end-uses (e.g., electric vehicles, water treatment & delivery).
- Multiply electricity consumption (MWh) per end-use by eGRID emissions factors to estimate CO₂, CH₄, and N₂O emissions.
- Aggregate estimates to Residential, Commercial, and Municipal end-use sectors.

Natural Gas

Activity Data: Natural gas used for residential and non-residential facilities was sourced from Southwest Gas (SWG). Activity data included metered natural gas use stratified by end-use sector. Usage associated with Water Pumping operations was excluded from the Buildings sector as this was allocated to the [Water Treatment & Delivery](#) sector. Reported use of Compressed Natural Gas (CNG) was also excluded from the Buildings sector and allocated to the [Transportation](#) sector, as all CNG is assumed to be used for CNG vehicles.

SWG classifies large volume users that purchase gas on the market and use SWG to transport their gas under the “Transportation” customer class. To qualify for transportation service under the Nevada tariff, annual usage must be at least 180,000 therms. Due to customer privacy rules, clearly allocating “Transportation” gas to end-uses is problematic. It is possible that some share of this gas is not consumed within Las Vegas at all.

At the same time, it is known that there are several natural gas power plants and other large combustion processes that would qualify as “Transportation” customers, identifiable through the EPA Facilities-Level Information on Greenhouse Gases Tool (FLIGHT) application and e-GRID plant level files. For virtually every grid-connected power plant in the United States located at a facility with at least a 1 MW combined nameplate capacity, eGRID provides a detailed emissions profile including input emissions rates. Natural gas combustion used for electricity generation was collected for each power plant located in Las Vegas from eGRID data.

Due to the likely significant overlap between the two data sources but lacking a clear way to allocate the emissions perfectly, the SWG “Transportation” class was omitted from the inventory and supplemented with eGRID data to avoid double counting. All emissions associated with natural gas combustion in power plants are excluded from the inventory GHG total and should be taken as informational items only.

Data Source	Data Type	Categorization
Southwest Gas	Natural Gas Consumption	Residential, commercial, industrial
EPA eGRID ⁵	Natural Gas Consumption	Natural gas used for electricity generation at power plants
EPA GHG Emission Factors Hub ⁶	Emissions Factors for Stationary Combustion of Natural Gas	N/A

⁵ U.S. Environmental Protection Agency, “eGRID2022 Data File,” (2024).

https://www.epa.gov/system/files/documents/2024-01/egrid2022_data.xlsx

⁶ U.S. Environmental Protection Agency, “Archived 2024 GHG Emissions Factors Hub,” (2024).

<https://www.epa.gov/system/files/documents/2024-02/ghg-emission-factors-hub-2024.pdf>

Methodology

- Obtain natural gas consumption data per end-use from Southwest Gas.
 - Exclude usage associated with water treatment & delivery and CNG vehicles to avoid double counting with the transportation and water energy sectors.
 - Exclude usage associated with the “Transportation” customer class as natural gas used for power generation should be supplemented with eGRID data.
- Obtain natural gas used for electricity generation for each power plant located in Las Vegas from EPA eGRID.
- Multiply natural gas consumption by EPA emissions factors to estimate CO₂, CH₄, and N₂O emissions.
- Aggregate estimates to activity associated with Residential, Commercial, and Industrial buildings, as well as the Power Generation sector.
 - Exclude emissions related to power plants from the inventory total; treat as an informational item only.

Fugitive Natural Gas

Activity Data: The reported MTCH₄ emitted from Southwest Gas Nevada’s distribution services in 2022 was divided by the volume of natural gas delivered, both sourced from EPA FLIGHT records, to estimate a regional methane leakage rate from natural gas consumption.

Fugitive natural gas emissions were based on the estimated regional leakage rate applied to natural gas used in buildings and power plants. See the [Buildings – Natural Gas](#) section in this report for more details on natural gas activity data.

Data Source	Data Type	Jurisdiction	Categorization
EPA Facility Level Information on Greenhouse Gases Tool (FLIGHT) ⁷	Natural gas delivered by Southwest Gas in 2022	Regional	N/A
	MTCH ₄ emitted from Southwest Gas Nevada’s distribution services in 2022	Regional	N/A

Methodology

- Obtain the total volume of natural gas delivered by Southwest Gas Nevada in 2022 and the associated MTCH₄ emitted from EPA’s FLIGHT database.
- Divide reported emissions by the volume of natural gas to estimate a regional methane leakage rate.
- Multiply natural gas consumption per end-use by the estimated methane leakage rate to estimate emissions.
- Aggregate estimates to activity associated with Residential, Commercial, and Industrial buildings, as well as the Power Generation sector.
 - Exclude emissions related to power plants from the inventory total; treat as an informational item only

⁷ U.S. Environmental Protection Agency, “Facility Level Information on Greenhouse Gases Tool (FLIGHT),” Facility Detail: Southwest Gas (2024).
<https://ghgdata.epa.gov/ghgp/service/facilityDetail/2022?id=1006639&ds=E&et=&popup=true>

Fuel Oil

Activity Data: The average energy use intensity (MMBtu per square foot) for oil-heated homes in Las Vegas – sourced from the NREL ResStock Energy Use Saving Shapes (EUSS) dataset – was multiplied by the average household size (square feet) – derived from the Clark County Property Tax Assessor Database – to determine average annual household energy use (MMBtu per household) for oil-heated homes.

This estimated annual household energy use intensity was applied to the number of oil-heated homes in Las Vegas – sourced from the American Community Survey – to estimate total fuel oil consumption in residential buildings.

Data Source	Data Type	Categorization
NREL ResStock EUSS TMY3 2022.1 ⁸	Average Energy Use Intensity of Oil-Heated Households	Filtered to single-family attached and detached units in Nevada
U.S. Census Bureau, ACS 5-Year Estimates Table B25040 ⁹	Count of Houses by Fuel Type	Oil-heated housing units in Las Vegas
Clark County Property Tax Assessor Database	Average Square Feet of Residential Units	N/A
EPA GHG Emission Factors Hub ¹⁰	Emissions Factors for Stationary Combustion of Distillate Fuel Oil #2	N/A

Methodology

- Obtain the number of households with fuel oil heating in Las Vegas from the U.S. Census Bureau American Community Survey.
- Derive the average household size (square feet) from the Clark County Property Tax Assessor Database.
- Determine the energy use intensity (MMBtu per square feet) of households heated with fuel oil using the NREL ResStock EUSS TMY3 2022.1 Release filtered to Nevada, and single-family attached and detached units.
- Multiply the ResStock-derived energy use intensity (MMBtu per square foot) by the average household size (square feet) to determine the average energy use per oil-heated household.
- Multiply the regional energy use intensity (MMBtu per household) by the count of homes using fuel oil heating in Las Vegas.
- Multiply fuel oil consumption by EPA emissions factors to estimate CO₂, CH₄, and N₂O emissions.
- All emissions are categorized as Residential.

⁸ National Renewable Energy Laboratory, "ResStock End Use Savings Shapes," TMY3 2022.1 Release (2022). <https://resstock.nrel.gov/datasets>

⁹ U.S. Census Bureau, "American Community Survey 5-Year Estimates Subject Table B25040: House Heating Fuel," (2024). <https://data.census.gov/table/ACSDT5Y2022.B25040?q=b25040&q=050XX00US32003>

¹⁰ U.S. Environmental Protection Agency, "Archived 2024 GHG Emissions Factors Hub," (2024). <https://www.epa.gov/system/files/documents/2024-02/ghg-emission-factors-hub-2024.pdf>

Propane

Activity Data: The average energy use intensity (MMBtu per square foot) for propane-heated homes in Las Vegas – sourced from the NREL ResStock Energy Use Saving Shapes (EUSS) dataset – was multiplied by the average household size (square feet) – derived from the Clark County Property Tax Assessor Database – to determine average annual household energy use (MMBtu per household) for propane-heated homes.

This estimated annual household energy use intensity was applied to the number of propane-heated homes in Las Vegas – sourced from the American Community Survey – to estimate total propane consumption in residential buildings.

Data Source	Data Type	Categorization
NREL ResStock EUSS TMY3 2022.1 ¹¹	Average Energy Use Intensity of Propane-Heated Households	Filtered to single-family attached and detached units in Nevada
U.S. Census Bureau, ACS 5-Year Estimates Table B25040 ¹²	Count of Houses by Fuel Type	Propane-heated housing units in Las Vegas
Clark County Property Tax Assessor Database	Average Square Feet of Residential Units	N/A
EPA GHG Emission Factors Hub ¹³	Emissions Factors for Stationary Combustion of Propane	N/A

Methodology

- Obtain the number of households with propane heating in Las Vegas from the U.S. Census Bureau American Community Survey.
- Derive the average household size (square feet) from the Clark County Property Tax Assessor Database.
- Determine the energy use intensity (MMBtu per square feet) of households heated with propane using the NREL ResStock EUSS TMY3 2022.1 Release filtered to Nevada, and single-family attached and detached units.
- Multiply the ResStock-derived energy use intensity (MMBtu per square foot) by the average household size (square feet) to determine the average energy use per propane-heated household.
- Multiply the regional energy use intensity (MMBtu per household) by the count of houses using propane heating in Las Vegas.
- Multiply propane consumption by EPA emissions factors to estimate CO₂, CH₄, and N₂O emissions.
- All emissions are categorized as Residential.

¹¹ National Renewable Energy Laboratory, "ResStock End Use Savings Shapes," TMY3 2022.1 Release (2022). <https://resstock.nrel.gov/datasets>

¹² U.S. Census Bureau, "American Community Survey 5-Year Estimates Subject Table B25040: House Heating Fuel," (2024). <https://data.census.gov/table/ACSDT5Y2022.B25040?q=b25040&q=050XX00US32003>

¹³ U.S. Environmental Protection Agency, "Archived 2024 GHG Emissions Factors Hub," (2024). <https://www.epa.gov/system/files/documents/2024-02/ghg-emission-factors-hub-2024.pdf>

Wood

Activity Data: Wood used for heating in residential buildings was estimated by applying an average energy use intensity, assumed to be equivalent to propane-heated households detailed in the section above, to the number of wood-heated homes in Las Vegas – sourced from the American Community Survey.

Data Source	Data Type	Categorization
U.S. Census Bureau, ACS 5-Year Estimates Table B25040 ¹⁴	Count of Houses by Fuel Type	Wood-heated housing units in Las Vegas
Michigan State University, Standard Hardwood Heat Equivalent ¹⁵	MMBtu per Cord of Hardwood	N/A
Wisconsin Department of Natural Resources, Cordwood Weight Conversion Factors ¹⁶	Cord to Ton Conversion Factor	N/A
EPA GHG Emission Factors Hub ¹⁷	Emissions Factors for Stationary Combustion of Wood	

Methodology

- Obtain the number of households with wood heating in Las Vegas from the U.S. Census Bureau American Community Survey.
- Estimate the regional average energy use per household intensity from propane data ([see section above](#)).
- Multiply the regional energy use intensity (MMBtu per household) by the count of houses using wood heating in Las Vegas to estimate wood-related energy use (MMBtu).
- Multiply estimated MMBtu by Michigan State University's estimated MMBtu per Cord of Hardwood (20 MMBtu per cord) and the Wisconsin Department of Natural Resources' reported cord to ton conversion factor (2.9) to estimate total short tons of wood consumed.
- Multiply wood consumption (short tons) by EPA emissions factors to estimate CH₄ and N₂O emissions.
 - CO₂ emissions from this source are considered biogenic and are excluded from total emissions.
- All emissions are categorized as Residential.

¹⁴ U.S. Census Bureau, "American Community Survey 5-Year Estimates Subject Table B25040: House Heating Fuel," (2024).

<https://data.census.gov/table/ACSDT5Y2022.B25040?q=b25040&q=050XX00US32003>

¹⁵ Mike Schira, "How Much Heat Energy Is In Firewood?" Michigan State University Extension, March 2, 2014, https://www.canr.msu.edu/news/how_much_heat_energy_is_in_firewood

¹⁶ Wisconsin Department of Natural Resources, "Cordwood Weight Conversion Factors," Timber Sale Handbook (2022).

https://dnr.wisconsin.gov/sites/default/files/topic/TimberSales/GNA_WeightConversionFactors.pdf

¹⁷ U.S. Environmental Protection Agency, "Archived 2024 GHG Emissions Factors Hub," (2024).

<https://www.epa.gov/system/files/documents/2024-02/ghg-emission-factors-hub-2024.pdf>

Transportation

On-Road Vehicles: Gasoline, Diesel, EVs

On-Road transportation is among the most complex sectors to account for. Complete accounting requires the combination of many different sources of data, especially to supplement top-down sources that cover all GHG generating activities with some specific detail on the uptake of electric vehicles.

Activity Data: The primary activity data used in this sector is vehicle miles traveled (VMT) which is sourced from the NDOT Annual Vehicle Miles of Travel report.¹⁸ This source provides a reliable measure of total activity within Clark County that is mostly likely to be consistently available going forward.

Moving from activity data to calculated GHGs involves stepwise allocation:

- 1) Allocate Countywide VMT to Jurisdictions and F-Type roadway classifications based on NDOT traffic segments.
- 2) Allocate VMT by F-Type Classifications to vehicle type distribution based on MOVES model defaults.
- 3) Allocate VMT by Vehicle Type to fuel type distribution, based on FHWA Nevada Statistics
- 4) Adjust passenger vehicles to account for electricity use
- 5) Estimate fuel use with on-road average fuel economies for each vehicle class.
- 6) Calculate GHGs.

Allocation of VMT to Jurisdiction and F-Type Classifications

This process involves the use of GIS. For the preparation of the CCAP, GIS data processing was performed using the open source QGIS software suite, however these steps should be repeatable in other software.

It should be noted that the process described here is imperfect. The basis for allocations is NDOT Road Segment data layers. Alternative data sources could have included the Regional Transportation Demand Model (TDM) produced by the Regional Transportation Commission of Southern Nevada. While the TDM produces spatially disaggregated results, model outputs do not reflect the location of vehicle activity as it happened, which may be critical for detecting specific changes as the built environment of the region continues to evolve.

GIS-Based Allocation Process

Classification of segments by jurisdiction poses some issues. Traffic segments from NDOT are just line geometries, they have no “width”. This creates some challenges with the classification of road based on intersections with jurisdiction boundaries or when a road defines the boundary

¹⁸ Nevada Department of Transportation, “AVMT Reports,” Annual Vehicle Miles Traveled (2024). <https://www.dot.nv.gov/doing-business/about-ndot/ndot-divisions/planning/roadway-systems/annual-vehicle-miles-of-travel>

between communities. Classification requires first buffering segments and then clipping to the jurisdiction. As this is an allocation procedure for a relatively small number of segments, a simple procedure will be less error prone when repeating in the future. Because vehicle miles traveled are calculated on segment lengths, any process that alters the geometry has the potential of introducing errors. Thus, the allocation procedure devised here is to calculate the **relative share** of VMT by jurisdiction-matched road segments and apply those shares to allocate total VMT, rather than adding up VMT from the adjusted segments. This approach guarantees that total VMT for Clark County will align with NDOT Annual reports of vehicle miles traveled.

GIS Process Steps:

The following process was performed on HPMS records of AVMT by roadway segment. The process was performed in QGIS software, but should be repeatable with any other suitable GIS application.

Step 1: Simplify the Jurisdiction boundaries and eliminate unincorporated "County Islands" within each municipality.

Step 2: Clip statewide AVMT segments to Clark County boundary.

Step 3: Add a custom "County Segment" ID to number all the clipped segments. This is value will be useful for checking duplicates later.

Step 4: Add a 10ft buffer to the segment layer. Choose flat ends to ensure that the new segments do not extend lengthwise and are cleanly separated at jurisdiction boundary intersections.

Step 5: Export features to save them as a polygon with expanded area by the buffer.

Step 6: Split segments on intersections with the jurisdiction perimeter layer using the QGIS "Split with Lines" function.

Step 7: Add geometries to create a new area measurement of the buffered segment.

Step 8: Export segments attributes for post processing.

Step 9: The final step of the process is to develop a relative share distribution of AVMT by each road functional classification within each jurisdiction. These relative shares will be used to allocate the final countywide VMT to each jurisdiction by functional classification to enable stratification by an appropriate vehicle class mix for the roadway type.

Shares should be calculated using the sum of AVMT by jurisdiction and functional classification. For segments which cross boundaries, the geometry attributes added in Step 7 can be used to calculate the share of the VMT from that segment that are allocated to each jurisdiction after the split.

The end result of this procedure is a distribution of AVMT by jurisdiction and road-type functional class. These values can be further stratified by vehicle and fuel type combinations for GHG estimation.

Step 10: For each jurisdiction, allocate VMT by functional classification to a vehicle type distribution. The distribution used in the 2022 CCAP Inventory mirrored the original distribution used in the 2019 baseline inventory. Conversations with Clark County Air Quality staff confirmed that there was not an updated distribution since that analysis was performed. Future inventory updates should check to see if there are updated vehicle distributions used in other air quality reports where alignment is desirable.

One additional classification step is for Unincorporated Clark County to distinguish between the urban and rural types of distribution. This split was determined by weighted AVMT on urban vs rural segments for the Unincorporated Clark County area. All segments allocated to one of the incorporated municipalities were classified as urban.

Step 11: Allocate VMT by vehicle class to fuel types based on the distribution provided by FHWA, Highway Stats, Table VM-2 for 2021, as these were best available reference data. The shares used provide relative distribution of gasoline vs diesel at the level of light-duty passenger, light-duty trucks, and heavy-duty trucks.

Step 12: Disaggregate light-duty passenger vehicles to battery electric and plug in hybrid vehicles. Shares of these vehicles were determined from registration data obtained by Clark County Department of Environmental Services from the Nevada Registry of Motor Vehicles. A simple percentage share of these vehicles relative to all other registered passenger vehicles was applied to allocate passenger vehicles to these additional classes.

Step 13: Estimate fuel use: Fuel use associated with VMT from each vehicle classification was estimated using default miles per gallon ratings for each. Fuel source splits for plug-in hybrid vehicles assumed a 35% share of battery power, following examples by US Department of Energy Alternative Data Fuels Center¹⁹

Step 14: GHGs from fuels used by each vehicle class were estimated using standard emissions factors from the EPA Emissions Factors Hub.²⁰

On-Road Vehicles: CNG

Activity Data: Compressed natural gas (CNG) used for the Regional Transportation Commission (RTC) of Southern Nevada's transit vehicles – sourced from the U.S. Department of Transportation National Transit Database – was subtracted from the total volume of CNG delivered in Clark County – sourced from Southwest Gas – to determine the amount of CNG used in private on-road vehicles. The relative proportion of on-road diesel vehicle mileage per

¹⁹ U.S. Department of Energy, "Data Sources and Assumptions for the Electricity Sources and Fuel-Cycle Emissions Tool," Alternative Fuels Data Center, (2025).

https://afdc.energy.gov/vehicles/electric_emissions_sources.html

²⁰ U.S. Environmental Protection Agency, "Archived 2024 GHG Emissions Factors Hub," (2024).

<https://www.epa.gov/system/files/documents/2024-02/ghg-emission-factors-hub-2024.pdf>

jurisdiction was applied to the countywide CNG use to allocate usage at the jurisdiction level. See the section above for more information on the diesel vehicle estimations.

Data Source	Data Type	Jurisdiction	Categorization
Southwest Gas	Compressed Natural Gas Consumption	Boulder City, Henderson, Las Vegas, Mesquite, North Las Vegas, Uninc. Clark County	CNG Use per Jurisdiction
U.S. Department of Transportation. National Transit Database Annual Data View ²¹	Fuel and Energy Consumption by Agency	Regional Transportation Commission of Southern Nevada	Reported CNG Use for the RTC of Southern Nevada
EPA GHG Emission Factors Hub ²²	Emissions Factors for Stationary Combustion of Natural Gas	National	N/A

Methodology

- Obtain the volume of CNG delivered in Clark County from Southwest Gas.
- Obtain the volume of CNG used by the Regional Transportation Commission of Southern Nevada from the U.S. Department of Transportation's National Transit Database.
- Subtract the amount of CNG used by RTC transit vehicles from the Southwest Gas total. The remaining CNG is assumed to be used in private on-road vehicles.
- Determine the relative proportion of on-road diesel vehicle mileage per jurisdiction and apply it to total CNG use to allocate usage on a jurisdiction level.
 - [See the section above](#) for more information on diesel vehicle mileage estimation methods.
- Multiply CNG used in Las Vegas by EPA emissions factors to determine CO₂, CH₄, and N₂O emissions.

Transit: CNG & Biodiesel

Activity Data: Compressed natural gas (CNG) used in the Regional Transportation Commission (RTC) of Southern Nevada's transit vehicles were obtained from the U.S. Department of Transportation National Transit Database.

Counts of relative annual transit stops in each jurisdiction located within Clark County – obtained from the RTC General Transit Feed Specification (GTFS) Database – were used to allocate biodiesel and CNG usage at the jurisdiction level. The GTFS data includes the number of trips per week for each service line, the number of stops per service line, and the

²¹ U.S. Department of Transportation, "2022-2023 NTD Annual Data – Fuel and Energy," National Transit Database (2024). https://data.transportation.gov/Public-Transit/NTD-Annual-Data-View-Fuel-and-Energy-by-Agency-wwem-ata9/about_data?no_mobile=true

²² U.S. Environmental Protection Agency, "Archived 2024 GHG Emissions Factors Hub," (2024). <https://www.epa.gov/system/files/documents/2024-02/ghg-emission-factors-hub-2024.pdf>

latitude/longitude of the stop locations. The spatial data of the stops were mapped to the jurisdiction boundaries in GIS to assign the relative count of annual stops in Las Vegas.

Data Source	Data Type	Jurisdiction	Categorization
U.S. Department of Transportation. National Transit Database Annual Data View ²³	Fuel and Energy Consumption by Agency	Regional Transportation Commission of Southern Nevada	Reported Biodiesel and CNG Use for the RTC of Southern Nevada
Regional Transportation Commission of Southern Nevada. General Transit Feed Specification Data ²⁴	Annual Bus Stops by Jurisdiction	Countywide	Relative share of annual bus stops per jurisdiction
EPA GHG Emission Factors Hub ²⁵	Emissions Factors for Stationary Combustion of Natural Gas	National	N/A
	Emissions Factors for Mobile Combustion of Diesel	National	Emissions Factors specific to Heavy-Duty Vehicles

Methodology

- Obtain the volume of biodiesel and CNG used by the Regional Transportation Commission of Southern Nevada from the U.S. Department of Transportation's National Transit Database.
- Obtain annual transit stop data from the Regional Transportation Commission of Southern Nevada's General Transit Feed Specification (GTFS) database.
 - Total the number of trips per week and the number of stops per trip for each service line. Scale up to annual number of stops.
 - Use the spatial data included in the GTFS files to map the number of annual stops to each jurisdiction in GIS.
- Determine the number of transit stops in Las Vegas and apply the relative share to appropriate biodiesel and CNG use on a jurisdiction level.
- Multiply biodiesel and CNG use in Las Vegas by EPA emissions factors to determine CO₂, CH₄, and N₂O emissions.
 - The diesel factor for CO₂ was reduced by 5% to account for the B5 biodiesel blend.

²³ U.S. Department of Transportation, "2022-2023 NTD Annual Data – Fuel and Energy," National Transit Database (2024). https://data.transportation.gov/Public-Transit/NTD-Annual-Data-View-Fuel-and-Energy-by-Agency-wwem-ata9/about_data?no_mobile=true

²⁴ Regional Transportation Commission of Southern Nevada, "General Transit Feed Specification Data," General Transit Feed Specification Information. <https://hub-rtcnsnv.opendata.arcgis.com/pages/gtfs>

²⁵ U.S. Environmental Protection Agency, "Archived 2024 GHG Emissions Factors Hub," (2024). <https://www.epa.gov/system/files/documents/2024-02/ghg-emission-factors-hub-2024.pdf>

Solid Waste

Landfilled Waste

Activity Data: Total tons of residential waste collected across Henderson, Las Vegas, North Las Vegas, and Unincorporated Clark County sent to landfill was obtained from Republic Services. The reported total residential waste landfilled was allocated to each jurisdiction based on population. Note that while this sector is called residential, it does not reflect contributions from multifamily structures that are not included within any of the franchise agreements that exist between Republic Services and local governments in Clark County. Note, commercial waste data was not available on a jurisdictional basis and is therefore omitted from the Las Vegas inventory.

Methane generation rates for landfilled waste are based on the EPA WARM model default for mixed municipal solid waste (MSW). Collection efficiencies under the EPA WARM aggressive collection landfill scenario were applied to the default rates to determine the emissions factors for waste landfilled at sites with gas capture systems.

Data Source	Data Type	Jurisdiction	Categorization
Republic Services	Residential MSW Collected for Landfill	Regional Total Including: Henderson, Las Vegas, North Las Vegas, Uninc. Clark County	Residential
EPA Waste Reduction Model (WARM) ²⁶	CH ₄ Yield for Solid Waste Components	National	Mixed MSW
	MSW Collection Efficiency by Landfill Moisture Condition with Landfill Gas Recovery for Energy	National	Aggressive Collection Landfill Scenario

Methodology

- Obtain total tons of residential waste collected in Clark County from Republic Services.
 - Allocate residential waste on a jurisdiction level based on population.
- Obtain the MTCO_{2e} emissions factor for Mixed MSW from the EPA Waste Reduction Model (WARM). Divide MTCO_{2e} per wet short ton by 21 to determine MTCH₄ per wet short ton.
 - WARM emissions factors are based on the IPCC AR4 Global Warming Potential (GWPs). This inventory uses the IPCC AR5 GWPs, so a conversion is needed to ensure consistency.
- Obtain the collection efficiency for Mixed MSW under the “Aggressive Collection Landfill Scenario” from the EPA WARM documentation.
 - Apply the collection efficiency to the MTCH₄ per wet short ton factor to determine the rate of emissions for landfills with landfill gas collection systems.

²⁶ U.S. Environmental Protection Agency – Office of Resource Conservation and Recovery, “Documentation for Greenhouse Gas Emission and Energy Factors Used in the Waste Reduction Model (WARM): Management Practices Chapters,” (2023). https://www.epa.gov/system/files/documents/2024-01/warm_management_practices_v16_dec.pdf

- Multiply residential landfill tonnages for Las Vegas by the MTCH_4 per wet short ton factor for landfills with gas capture to estimate emissions.

Water Treatment & Delivery

Electricity

Activity Data: Electricity used for wastewater treatment plant energy and potable water pumping in Las Vegas was obtained from the Silver State Energy Association (SSEA). Additional electricity used for water delivery, not captured in the SSEA data, was obtained from NV Energy.

Data Source	Data Type	Categorization
Silver State Energy Association (SSEA)	Electricity Consumption	Water Pumping and Wastewater Treatment Plant Energy
NV Energy	Electricity Consumption	Water Pumping (not captured by SSEA)
EPA eGRID ²⁷	Electricity Grid Emissions Factors	AZNM Region

Methodology

- Obtain electricity used for water pumping and wastewater treatment plant energy in Las Vegas from the Silver State Energy Association and NV Energy.
- Multiply electricity consumption (MWh) per end-use by eGRID emissions factors to estimate CO₂, CH₄, and N₂O emissions.

²⁷ U.S. Environmental Protection Agency, "eGRID Summary Tables 2022," (2024).
https://www.epa.gov/system/files/documents/2024-01/egrid2022_summary_tables.pdf

Wastewater

Wastewater Treatment Plants: Process & Fugitive Emissions

Activity Data: Las Vegas' population for 2022 was obtained from the Clark County Department of Comprehensive Planning. Annual visitor volumes for Las Vegas were also estimated with data obtained from the Las Vegas Convention and Visitors Authority (LVCVA). Monthly totals of hotel rooms available and occupancy rates, tracked by LVCVA, were multiplied to estimate the average number of visitors – assuming an average of 2 persons per hotel room.

Process N₂O emissions were estimated using Equation WW.7 from the U.S. Community Protocol: Appendix F where population served is multiplied by the factor for high nitrogen loading of commercial discharge (1.25) and the emissions factor for a wastewater treatment plant (WWTP) with nitrification/denitrification (7).

Fugitive N₂O emissions were estimated using Equation WW.12 (alt) from the U.S. Community Protocol: Appendix F where population served is multiplied by the factor for commercial discharge (1.25), the average daily nitrogen load per person (0.026), the nitrogen uptake for aerobic systems (0.05), the daily amount of BOD₅ produced per person (0.09), the emissions factor for river discharge (0.005), the molecular weight ratio of N₂O to N₂ (1.57), and the fraction of nitrogen removed from the WWTP with nitrification/denitrification (0.7).

Data Source	Data Type	Categorization
Clark County Department of Comprehensive Planning	Population	N/A
Las Vegas Convention and Visitors Authority (LVCVA). Tourism Tracker ²⁸	Visitor Volumes	Hotel Room Inventory and Hotel/Motel Occupancy Rate
ICLEI U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions. ²⁹	Emissions Factors for Wastewater Treatment Plants with Nitrification/Denitrification	N/A
	Emissions Factors for Effluent Discharge to Rivers and Estuaries	N/A

Methodology

- Obtain Las Vegas' resident population from the Clark County Department of Comprehensive Planning.
- Obtain the total number of hotel rooms and monthly hotel room occupancy rates for Las Vegas from the LVCVA Tourism Tracker.

²⁸ Las Vegas Convention and Visitors Authority (2022), "LVCVA Tourism Tracker," (2025).

<https://www.lvcva.com/research/?tab=tourism-tracker#tab-container>

²⁹ ICLEI – Local Governments for Sustainability USA, "U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions," Version 1.1, Appendix F (2013). <https://icleiusa.org/us-community-protocol/>

- Multiply total available rooms, occupancy rates, and an assumed 2 persons per room rate to estimate the monthly visitation population.
 - Average the monthly values to estimate the total visitors' population per jurisdiction for any given time in the year.
- Total the resident and visitor populations to determine the total population in Las Vegas served by a WWTP with nitrification/denitrification.
- Use the population-based Equation WW.7 from the U.S. Community Protocol to estimate process N₂O emissions from wastewater treatment plants with nitrification/denitrification.
- Use the population-based Equation WW.12 from the U.S. Community Protocol to estimate fugitive N₂O emissions from effluent discharge to rivers and estuaries.

Septic Systems: Fugitive Emissions

Activity Data: The number of households served by septic systems in Las Vegas – obtained from Clark County building records – was multiplied by average household size in Las Vegas – obtained from U.S. Census Bureau American Community Survey – to estimate population on septic.

Data Source	Data Type	Categorization
Clark County Building Department	Count of Households with Septic Systems	N/A
U.S. Census Bureau. American Community Survey 5-Year Estimates Subject Table S1101 ³⁰	Average Household Size	N/A
ICLEI U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions. ³¹	Emissions Factors for Septic Systems	N/A

Methodology

- Obtain the number of households in Las Vegas on septic from the Clark County Building Department.
- Multiply the count of septic systems by the Las Vegas average household size – sourced from the American Community Survey Subject Table S1101 – to estimate the population on septic.
- Use the population-based Equation WW.11 alt from the U.S. Community Protocol to estimate fugitive CH₄ emissions from septic systems.

³⁰ U.S. Census Bureau, "American Community Survey 5-Year Estimates Subject Table S1101: Households and Families," (2024). <https://data.census.gov/table/ACSST1Y2023.S1101?q=household%20size>

³¹ ICLEI – Local Governments for Sustainability USA, "U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions," Version 1.1, Appendix F (2013). <https://icleiusa.org/us-community-protocol/>

Digester Gas

Activity Data: Standard cubic feet of biogas utilized for energy and flared at the Las Vegas wastewater treatment plant (WWTP) was obtained from the Clark County Division of Air Quality (CCDAQ). Calculations for digester gas for beneficial use include biogas used to power the boilers and engines at the WWTP. Calculations for the incomplete combustion of digester gas include biogas flared at the North and South flare columns of the WWTP.

Data Source	Data Type	Categorization
Clark County Division of Air Quality (CCDAQ)	Volume of Utilized and Flared Biogas	N/A
ICLEI Local Government Operations Protocol ³²	Emissions Factors for the Incomplete Combustion of Digester Gas	N/A
EPA GHG Emission Factors Hub ³³	Emissions Factors for the Stationary Combustion of Landfill Gas	N/A

Methodology

- Obtain the volume of biogas flared and the volume of biogas utilized for energy at the Las Vegas wastewater treatment plant from the Clark County Division of Air Quality.
- Use Equation 10.2 from the Local Government Operations Protocol for GHG Inventories to estimate CH₄ emissions from flared biogas.
- Multiply the volume of biogas utilized for energy by EPA emissions factors to estimate CH₄ and N₂O emissions.
 - CO₂ emissions from this source are considered biogenic and are excluded from total emissions.

³² ICLEI – Local Governments for Sustainability USA, "Local Government Operations Protocol for the Quantification and Reporting of Greenhouse Gas Emissions Inventories," Version 1.1 (2010).
https://s3.amazonaws.com/iclei-usa-resources/lgo_protocol_v1_1_2010-05-03.pdf

³³ U.S. Environmental Protection Agency, "Archived 2024 GHG Emissions Factors Hub," (2024).
<https://www.epa.gov/system/files/documents/2024-02/ghg-emission-factors-hub-2024.pdf>

Industrial Processes and Product Use (IPPU)

SF6 and HFCs

Activity Data: Due to limitations on local data availability, SF6 and HFC emissions were downscaled from the Nevada statewide 2021 GHG emissions inventory based on population, obtained from the Clark County Department of Comprehensive Planning. SF6 and HFC emissions reflect the Electric Power Transmissions & Distribution Systems and the ODS Substitutes line items in the statewide inventory.

Data Source	Data Type	Jurisdiction	Categorization
Clark County Department of Comprehensive Planning	Population	Las Vegas	N/A
Nevada Statewide Greenhouse Gas Emissions Inventory and Projections ³⁴	MTCO ₂ e from Electric Power T&D and ODS Substitutes	Statewide	N/A

Methodology

- Obtain MTCO₂e emitted from Electric Power Transmissions & Distribution Systems (SF6) and ODS Substitutes (HFCs) from the Nevada Statewide GHG Inventory.
- Allocate statewide emissions for both SF6 and HFCs to Las Vegas based on relative population – obtained from the Clark County Department of Comprehensive Planning.
 - Emissions from the IPPU sector are excluded from the GHG inventory total and should be used as informational items only.

³⁴ Nevada Division of Environmental Protection, "Nevada Statewide Greenhouse Gas Emissions Inventory and Projections, 1990-2043," (2023). https://ndep.nv.gov/uploads/air-pollutants-docs/ghg_report_2023.pdf



Las Vegas 2022 Municipal GHG Inventory Methodology Report

Prepared by Kim Lundgren Associates

May 2025

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Overview

The data used to generate municipal greenhouse gas (GHG) emissions estimates were drawn from sources that capture activity data from multiple sectors across the City's operations. This inventory uses 100-year horizon Global Warming Potential values from the IPCC 5th Assessment Report.¹ Except where noted, this inventory aligns with the methods, emissions factors, and reporting conventions defined by the Local Government Operations Protocol.² While these documents define best practices and principles to follow, they do not always cover every nuance of local conditions and data availability.

Facilities & Infrastructure

Electricity

Activity Data: Electricity used for municipal buildings was sourced from the City's Office of Sustainability. Activity data included metered electricity use, provided by Nevada Energy (NVE), stratified by building type and NVE's power classification. Usage associated with streetlights, traffic signals, and other outdoor lighting was excluded from the Facilities & Infrastructure sector as they were allocated to the [Streetlights & Traffic Signals](#) sector.

The calculation of electricity related emissions was performed in two ways to reflect both the mix of energy sources procured by Nevada Energy (market-based approach) and by the blend of eGRID factors for the AZNM region (location-based approach). This dual calculation is to both acknowledge NVE's efforts to accelerate the transition of its portfolio to non-emitting sources, while also recognizing the actual regional grid carbon intensity.

¹ Intergovernmental Panel on Climate Change, "Climate Change 2014: Synthesis Report," Fifth Assessment (2014). https://archive.ipcc.ch/pdf/assessment-report/ar5/syr/SYR_AR5_FINAL_full_wcover.pdf

² ICLEI – Local Governments for Sustainability (2010). Local Government Operations Protocol, For the Quantification and Reporting of Greenhouse Gas Emissions Inventories. Version 1.1. https://s3.amazonaws.com/iclei-usa-resources/lgo_protocol_v1_1_2010-05-03.pdf

It should be noted that the factors used for the NVE supply do not conform with the “Scope 2 Quality Criteria” established by the GHG Protocol Scope 2 Guidance³ issued by the World Resources Institute. The values resulting from the market-based approach should be used as an illustration of the transition towards a clean electricity supply, where NVE can move to retire RECs and other market instruments to eventually make verifiable claims.

Data Source	Data Type	Years Available
Las Vegas Office of Sustainability	Electricity Consumption	2020-2024
EPA eGRID ⁴	Electricity Grid Emissions Factors (AZNM Region)	2020-2023*
Nevada Energy	Market-Based Electricity Emissions Factors	2020-2024

*EPA eGRID emissions factors were only available up to 2023. The 2023 factors were applied to 2024 activity data to estimate emissions.

Methodology

- Obtain electricity consumption data for municipal buildings from the Las Vegas Office of Sustainability.
- Multiply electricity consumption by EPA eGRID AZNM region emissions factors to estimate CO₂, CH₄, and N₂O emissions under the location-based approach.
- Multiply electricity consumption by Nevada Energy’s emissions factors to estimate CO₂, CH₄, and N₂O emissions under the market-based approach.
 - The results from the market-based approach should be used as information items only.

Natural Gas

Activity Data: Natural gas used for municipal buildings was sourced from the City’s Office of Sustainability. Activity data included metered natural gas use, provided by Southwest Gas (SWG), stratified by building type and SWG’s power classification.

Data Source	Data Type	Years Available
Las Vegas Office of Sustainability	Natural Gas Consumption	2020-2024

³ World Resources Institute. Greenhouse Gas Protocol: GHG Protocol Scope 2 Guidance.

<https://ghgprotocol.org/sites/default/files/2023-03/Scope%20%20Guidance.pdf>

⁴ U.S. EPA (2024). Historical eGRID Data: Summary Tables. <https://www.epa.gov/egrid/historical-egrid-data>

EPA GHG Emissions Factors Hub ⁵	Emissions Factors for Stationary Combustion of Natural Gas	2020-2024
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Methodology

- Obtain natural gas consumption data for municipal buildings from the Las Vegas Office of Sustainability.
- Multiply natural gas consumption by EPA emissions factors for stationary combustion of natural gas to estimate CO₂, CH₄, and N₂O emissions.

⁵⁵ U.S. Environmental Protection Agency, "Archived 2024 GHG Emissions Factors Hub," (2024).
<https://www.epa.gov/system/files/documents/2024-02/ghg-emission-factors-hub-2024.pdf>

Streetlights & Traffic Signals

Electricity

Activity Data: Electricity used for streetlights, traffic signals, and other outdoor lighting was sourced from the City’s Office of Sustainability. Activity data included metered electricity use, provided by Nevada Energy (NVE), stratified by NVE’s power classification.

The calculation of electricity related emissions was performed in two ways to reflect both the mix of energy sources procured by Nevada Energy (market-based approach) and by the blend of eGRID factors for the AZNM region (location-based approach). This dual calculation is to both acknowledge NVE’s efforts to accelerate the transition of its portfolio to non-emitting sources, while also recognizing the actual regional grid carbon intensity.

It should be noted that the factors used for the NVE supply do not conform with the “Scope 2 Quality Criteria” established by the GHG Protocol Scope 2 Guidance⁶ issued by the World Resources Institute. The values resulting from the market-based approach should be used as an illustration of the transition towards a clean electricity supply, where NVE can move to retire RECs and other market instruments to eventually make verifiable claims.

Data Source	Data Type	Years Available
Office of Sustainability	Electricity Consumption	2020-2024
EPA eGRID ⁷	Electricity Grid Emissions Factors (AZNM Region)	2020-2023*
Nevada Energy	Market-Based Electricity Emissions Factors	2020-2024

*EPA eGRID emissions factors were only available up to 2023. The 2023 factors were applied to 2024 activity data to estimate emissions.

Methodology

- Obtain electricity consumption data for municipal streetlights, traffic signals, and other outdoor lighting from the Las Vegas Office of Sustainability.
- Multiply electricity consumption by EPA eGRID AZNM region emissions factors to estimate CO₂, CH₄, and N₂O emissions under the location-based approach.

⁶ World Resources Institute. Greenhouse Gas Protocol: GHG Protocol Scope 2 Guidance. <https://ghgprotocol.org/sites/default/files/2023-03/Scope%20%20Guidance.pdf>

⁷ U.S. EPA (2024). Historical eGRID Data: Summary Tables. <https://www.epa.gov/egrid/historical-egrid-data>

- Multiply electricity consumption by Nevada Energy's emissions factors to estimate CO₂, CH₄, and N₂O emissions under the market-based approach.
 - The results from the market-based approach should be used as information items only.

Vehicle Fleet

Gasoline

Activity Data: Gasoline used by the municipal vehicle fleet was sourced from the City's Office of Sustainability. Activity data included fuel consumption stratified by the individual vehicle/equipment ID.

At the time of the inventory, complete records on the mileage of vehicles were not available. As such, there is no record of how the fuels are being used across different vehicles and equipment, which is required information to estimate CH₄ and N₂O emissions. The omission of these gases is considered "de minimis" for this purpose.

Data Source	Data Type	Years Available
Las Vegas Office of Sustainability	Gasoline Consumption	2020-2024
EPA GHG Emissions Factors Hub ⁸⁸	Emissions Factors for Mobile Combustion of Gasoline in Light-Duty Trucks	2020-2024

Methodology

- Obtain gasoline consumption data for the municipal vehicle fleet from the Las Vegas Office of Sustainability.
- Multiply gasoline consumption by EPA emissions factors for mobile combustion of gasoline in light-duty trucks to estimate CO₂ emissions.

Diesel

Activity Data: Diesel used by the municipal vehicle fleet was sourced from the City's Office of Sustainability. Activity data included fuel consumption stratified by the individual vehicle/equipment ID.

At the time of the inventory, complete records on the mileage of vehicles were not available. As such, there is no record of how the fuels are being used across different vehicles and equipment, which is required information to estimate CH₄ and N₂O emissions. The omission of these gases is considered "de minimis" for this purpose.

Data Source	Data Type	Years Available
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⁸⁸ U.S. Environmental Protection Agency, "Archived 2024 GHG Emissions Factors Hub," (2024).
<https://www.epa.gov/system/files/documents/2024-02/ghg-emission-factors-hub-2024.pdf>

Las Vegas Office of Sustainability	Diesel Consumption	2020-2024
EPA GHG Emissions Factors Hub ⁹	Emissions Factors for Mobile Combustion of Diesel in Medium- and Heavy-Duty Trucks	2020-2024

Methodology

- Obtain diesel consumption data for the municipal vehicle fleet from the Las Vegas Office of Sustainability.
- Multiply diesel consumption by EPA emissions factors for the mobile combustion of diesel in medium- and heavy-duty trucks to estimate CO₂ emissions.

Biodiesel

Activity Data: Biodiesel used by the municipal vehicle fleet was sourced from the City's Office of Sustainability. Activity data included fuel consumption stratified by the individual vehicle/equipment ID.

At the time of the inventory, complete records on the mileage of vehicles were not available. As such, there is no record of how the fuels are being used across different vehicles and equipment, which is required information to estimate CH₄ and N₂O emissions. The omission of these gases is considered "de minimis" for this purpose.

Data Source	Data Type	Years Available
Las Vegas Office of Sustainability	Biodiesel Consumption	2020-2024
EPA GHG Emissions Factors Hub ¹⁰	Emissions Factors for Mobile Combustion of Diesel in Medium- and Heavy-Duty Trucks	2020-2024

Methodology

- Obtain biodiesel consumption data for the municipal vehicle fleet from the Las Vegas Office of Sustainability.
- Multiply biodiesel consumption by EPA emissions factors for the mobile combustion of diesel in medium- and heavy-duty trucks to estimate CO₂ emissions.

⁹⁹ U.S. Environmental Protection Agency, "Archived 2024 GHG Emissions Factors Hub," (2024). <https://www.epa.gov/system/files/documents/2024-02/ghg-emission-factors-hub-2024.pdf>

¹⁰¹⁰ U.S. Environmental Protection Agency, "Archived 2024 GHG Emissions Factors Hub," (2024). <https://www.epa.gov/system/files/documents/2024-02/ghg-emission-factors-hub-2024.pdf>

- The diesel factor for CO₂ was reduced by 5% to account for the B5 biodiesel blend.

Solid Waste

Landfilled Waste

Activity Data: At the time of this inventory, measured tonnages of waste collected for landfill from municipal sites were not available. Activity data included collection schedules and pick-up frequencies for each of the City’s accounts with Republic Services. The bin volumes, collection frequencies, and an assumed rate of 75% bin capacity were multiplied to determine the total yards of waste sent to landfill.

Yards of waste was converted to pounds using the EPA factor for Municipal Solid Waste (commercial – uncompacted).¹¹ Pounds of waste were then converted to annual tonnages per standard conversion factors.

Data Source	Data Type	Years Available
Las Vegas Office of Sustainability	MSW Collection Schedules	2020-2024
California EPA: Integrated Waste Management Board ¹²	Waste Characterization of Large Office Buildings	2005
U.S. EPA Waste Reduction Model (WARM)	CH ₄ Yield for Solid Waste Components	N/A
	MSW Collection Efficiency by Landfill Moisture Condition with Landfill Gas Recovery (Aggressive Collection Landfill Scenario)	N/A

Methodology

- Obtain the collection schedules for all municipal accounts from the City’s Office of Sustainability.
- Multiply bin volume, bin count, weekly pick-up frequency, and an assumed rate of 75% capacity to determine weekly yards of waste collected. Scale up results to an annual level.
- Convert annual yards collected to pounds using the EPA’s factor for MSW (138).
- Obtain the MTCO_{2e} emissions factors for all solid waste components from the EPA Waste Reduction Model (WARM). Divide MTCO_{2e} per wet short ton by 21 to determine MTCH₄ per wet short ton for each material type.

¹¹ U.S. EPA (2016). Volume-to-Weight Conversion Factors. https://www.epa.gov/sites/default/files/2016-04/documents/volume_to_weight_conversion_factors_memorandum_04192016_508fnl.pdf

¹² California EPA: Integrated Waste Management Board (2006). Targeted Statewide Waste Characterization Study: Waste Disposal and Diversion Findings for Selected Industry Groups. Table 16. <https://www2.calrecycle.ca.gov/Publications/Details/1184>

- WARM emissions factors are based on the IPCC AR4 Global Warming Potential (GWPs). This inventory uses the IPCC AR5 GWPs, so a conversion is needed to ensure consistency.
- Obtain the collection efficiency for Mixed MSW under the “Aggressive Collection Landfill Scenario” from the EPA WARM documentation.
- Apply the collection efficiency factors to the $MTCH_4$ per wet short ton factors to determine the rate of emissions per material type sent to landfills with gas collection systems.
- Obtain the waste characterization for large office buildings from the California EPA.
- Multiply the modified post-collection-efficiency $MTCH_4$ per wet short ton factors to the relative share of tonnages by material type for large office buildings to determine the characterization-weighted methane generation rates for each material.
- Sum the characterization-weighted methane generation rates to determine a total methane generation factor for the City’s municipal waste sent to landfill.
- Multiply the tons of waste sent to landfill by the methane generation factor to estimate CH_4 emissions.

Water Use

Electricity

Activity Data: Water delivered to municipal buildings was sourced from the City’s Office of Sustainability. Activity data included metered water use, provided by the Las Vegas Valley Water District (LVVWD), stratified by building type.

Associated electricity use was estimated by applying Southern Nevada Water Authority’s (SNWA) estimated power demand to pump, treat, and deliver water (6.76 MWh per million gallons) to the volume of water consumed.

Data Source	Data Type	Years Available
Las Vegas Office of Sustainability	Water Consumption	2020-2024
Southern Nevada Water Authority (SNWA)	Estimated Power Demand to Pump, Treat, and Move Water	2022
EPA eGRID ¹³	Electricity Grid Emissions Factors (AZNM Region)	2020-2023*

*EPA eGRID emissions factors were only available up to 2023. The 2023 factors were applied to 2024 activity data to estimate emissions.

Methodology

- Obtain gallons of water used at municipal facilities from the City’s Office of Sustainability.
- Multiply gallons consumed by SNWA’s estimated power demand (6.76 MWh per million gallons) to estimate associated electricity demand.
- Multiply electricity consumption by EPA eGRID AZNM region emissions factors to estimate CO₂, CH₄, and N₂O emissions under the location-based approach.

¹³ U.S. EPA (2024). Historical eGRID Data: Summary Tables. <https://www.epa.gov/egrid/historical-egrid-data>

Wastewater Treatment

Wastewater Treatment Plant: Process & Fugitive Emissions

Activity Data: The City owns and operates the Las Vegas wastewater treatment plant (WWTP). As such, all emissions associated with the facility are included in the municipal inventory. Emissions were determined on a population-basis. Las Vegas' population for 2022 was obtained from the Clark County Department of Comprehensive Planning.

Process N₂O emissions were estimated using Equation WW.7 from the U.S. Community Protocol: Appendix F where population served is multiplied by the factor for high nitrogen loading of commercial discharge (1.25) and the emissions factor for a wastewater treatment plant (WWTP) with nitrification/denitrification (7).

Fugitive N₂O emissions were estimated using Equation WW.12 (alt) from the U.S. Community Protocol: Appendix F where population served is multiplied by the factor for commercial discharge (1.25), the average daily nitrogen load per person (0.026), the nitrogen uptake for aerobic systems (0.05), the daily amount of BOD₅ produced per person (0.09), the emissions factor for river discharge (0.005), the molecular weight ratio of N₂O to N₂ (1.57), and the fraction of nitrogen removed from the WWTP with nitrification/denitrification (0.7).

Data Source	Data Type	Years Available
Clark County Department of Comprehensive Planning	Population	2020-2024
ICLEI U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions. ¹⁴	Emissions Factors for Wastewater Treatment Plants with Nitrification/ Denitrification	N/A
	Emissions Factors for Effluent Discharge to Rivers and Estuaries	N/A

Methodology

- Obtain Las Vegas' resident population from the Clark County Department of Comprehensive Planning.
- Use the population-based Equation WW.7 from the U.S. Community Protocol to estimate process N₂O emissions from wastewater treatment plants with nitrification/denitrification.

¹⁴ ICLEI – Local Governments for Sustainability USA, "U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions," Version 1.1, Appendix F (2013). <https://icleiusa.org/us-community-protocol/>

- Use the population-based Equation WW.12 from the U.S. Community Protocol to estimate fugitive N₂O emissions from effluent discharge to rivers and estuaries.

Digester Gas

Activity Data: Standard cubic feet of biogas utilized for energy and flared at the Las Vegas wastewater treatment plant (WWTP) was obtained from the City’s Department of Public Works. Calculations for digester gas for beneficial use include biogas used to power the boilers and engines at the WWTP. Calculations for the incomplete combustion of digester gas include biogas flared at the North and South flare columns of the WWTP.

Data Source	Data Type	Years Available
Las Vegas Department of Public Works	Volume of Utilized and Flared Biogas	2020-2024
ICLEI Local Government Operations Protocol ¹⁵	Emissions Factors for the Incomplete Combustion of Digester Gas	N/A
EPA GHG Emission Factors Hub ¹⁶	Emissions Factors for the Stationary Combustion of Landfill Gas	N/A

Methodology

- Obtain the volume of biogas flared and the volume of biogas utilized for energy at the Las Vegas wastewater treatment plant from the City’s Department of Public Works.
- Use Equation 10.2 from the Local Government Operations Protocol for GHG Inventories to estimate CH₄ emissions from flared biogas.
- Multiply the volume of biogas utilized for energy by EPA emissions factors to estimate CH₄ and N₂O emissions.
 - CO₂ emissions from this source are considered biogenic and are excluded from total emissions.

¹⁵ ICLEI – Local Governments for Sustainability USA, “Local Government Operations Protocol for the Quantification and Reporting of Greenhouse Gas Emissions Inventories,” Version 1.1 (2010).

https://s3.amazonaws.com/iclei-usa-resources/lgo_protocol_v1_1_2010-05-03.pdf

¹⁶ U.S. Environmental Protection Agency, “Archived 2024 GHG Emissions Factors Hub,” (2024).

<https://www.epa.gov/system/files/documents/2024-02/ghg-emission-factors-hub-2024.pdf>

Additional Calculations

Cost Savings Analysis

The City has completed a number of meaningful energy efficiency projects and has increased their investment in on-site solar generation. In addition to the GHG reduction analysis, the cost savings of these projects were quantified to demonstrate the impact of the City's actions. The methodology for the cost savings analysis is detailed below.

Determining the Price of Electricity

Methodology

- Review NV Energy's Nevada Power Company Electric Rate Schedules for Commercial Customers (Q1 2022 – Q2 2025)¹⁷ to identify electricity rates by customer class.
- Obtain the "Electric Consumption, all kWh, per kWh" rates for the following categories:
 - General Service (GS)
 - Large General Service-1 (LGS-1)
 - Large General Service-2 (LGS-2)
 - Large General Service-3 (LGS-3)
- Apply the flat per-kWh rates for GS and LGS-1 directly, as no time-of-use differentiation is included.
- For LGS-2 and LGS-3, calculate a weighted average rate based on Time-of-Use (TOU) pricing periods. Use the following breakdown of annual hours to weight each TOU rate:

TOU Period	Duration	Number of Days	Hours per Day	Hours Share
Winter	October 1 – May 31	242	24	0.66575
Summer On-Peak	June 1 – September 30 (3:01–9:00 p.m.)	122	6	0.08356
Summer Off-Peak	June 1 – September 30 (all other hours)	122	18	0.25068

¹⁷ NV Energy, "Southern Nevada Rate Schedule Archive" (2025). <https://www.nvenergy.com/about-nvenergy/rates-regulatory/electric-schedules-south-archive>

- Multiply each TOU rate by its respective share of annual hours to compute a weighted average TOU rate for LGS-2 and LGS-3.
- Average the quarterly rates to generate an annual electricity cost estimate for each customer category.

Cost Savings from Efficiency Projects

Methodology

- Categorize efficiency projects by type: New Construction, Retrofit, Building Lighting, Park Lighting, Street Lighting, and Garage Lighting.
- Obtain annual kWh savings for each project from 2019 to 2024.
- Assign the appropriate rate category to each project based on its type and location: General Service (GS), Large General Service-1 (LGS-1), Large General Service-2 (LGS-2), or Street Lighting (SL).
- Apply electricity rates to calculate annual cost savings for each project from the year of installation through 2024.
 - For projects completed in 2019, apply savings for each year from 2019 to 2024.
 - For projects completed in later years, apply savings starting from the year of completion through 2024.
 - Note that the average electricity rates from 2022–2024 were used for earlier years (2019–2021) due to unavailable historical rate data.
- Multiply the annual kWh savings by the applicable rate to determine yearly cost savings.
- Sum annual savings across all projects to calculate total cost savings for each year from 2019 to 2024.

Avoided Costs from Solar Generation

Methodology

- Collect annual solar generation and electricity consumption data for each facility from 2020 to 2024.
- For each facility, compare solar generation to electricity usage:
 - If electricity usage exceeded solar generation, assign the solar generation value as the self-supplied electricity.

- If solar generation exceeded electricity usage, assign the electricity usage value as the self-supplied electricity.
- Calculate total self-supplied electricity from solar for each facility and year.
- Apply average General Service (GS) electricity rates to estimate cost savings:
 - Use annual average GS rates for 2022–2024.
 - Apply the 2022–2024 average GS rate to 2020 and 2021, due to unavailable historical data.
- Multiply the self-supplied electricity by the applicable GS rate to determine annual cost savings per facility.
- Aggregate savings across all facilities to calculate total annual savings.
- Compare total savings to total electricity costs to determine the percentage of avoided costs due to solar generation.

