

**DATE:** May 30, 2023

**TO:** Council Sustainability Committee

**FROM:** Danielle Lee, Chief Sustainability and Resiliency Officer

**VIA:** Audrey Seymour Ramberg, Assistant City Manager

**SUBJECT:** **Final 2020 and Preliminary 2021 Community Greenhouse Gas Emissions Inventories**

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**RECOMMENDATION**

Recommend the City Council accept the Final 2020 and Preliminary 2021 Community Greenhouse Gas Emissions Inventories.

**BACKGROUND**

On November 3, 2009, the City Council adopted voluntary greenhouse gas (GHG) reduction targets for the community with initial targets for 2012, 2015, 2020, and 2050. These targets set an absolute reduction in total emissions below a baseline year of 2005. The targets were developed and adopted in response to the Global Warming Solutions Act of 2006 (Assembly Bill 32), which requires California to reduce Statewide GHG emissions. Subsequently, through the City's Climate Protection Roadmap, the City Council adopted interim targets at five-year intervals between 2020 and 2050 to track the City's progress more closely.

Between September 2017 and June 2018, the City convened the Environmental Sustainability Task Force 2 (ESTF-2), an advisory body of appointed community members who lived or worked in Mountain View, to evaluate whether current sustainability plans and goals should be modified based on new technologies and processes for addressing climate change. ESTF-2 produced a Final Report with recommendations to reduce the City's GHG emissions through 2030, including recommended changes to the GHG reduction targets. Staff assessed these recommendations to verify assumptions and estimates and presented the results to Council on December 4, 2018. On March 19, 2019, the City Council directed staff to evaluate the ESTF-2 recommended changes to the City's reduction targets. On December 3, 2019, Council adopted revised GHG reduction targets for the years 2025 to 2050 that decline by a constant annual percentage (\_\_\_% from the year prior) rather than a constant amount of metric tons of carbon dioxide equivalent (MT CO<sub>2</sub>e) each year. Table 1, below, shows Mountain View's revised current, communitywide GHG reduction targets.

**Table 1: Community GHG Reduction Targets**

<b>Year</b>	<b>Reduction Target</b> (below 2005 baseline levels)
<b>2005</b>	N/A
<b>2012</b>	5%
<b>2015</b>	10%
<b>2020</b>	15% to 20%
<b>2025</b>	33%
<b>2030</b>	47%
<b>2035</b>	59%
<b>2040</b>	68%
<b>2045</b>	75%
<b>2050</b>	80%

Attachment 1 presents the Council-approved GHG reduction targets as a percentage of 2005 emissions and as absolute emissions levels. On April 12, 2020, the City Council passed a resolution for Mountain View to become a carbon-neutral city by 2045. To achieve carbon neutrality, this would mean that in addition to achieving the adopted 2045 GHG reduction target of 75% below 2005 levels, Mountain View would balance any remaining GHG emissions with carbon sequestration projects (such as planting trees or restoring wetlands) or carbon offsets. Following a referral from Council to the Council Sustainability Committee (CSC), at CSC meetings on April 19, 2022 and June 22, 2022, staff presented the implications for accelerating Mountain View's adopted carbon-neutrality target year. The CSC approved the proposed hybrid approach, which would entail completing targeted analysis to develop a road map for carbon neutrality by 2035, exploring opportunities to build partnerships and leverage private financing, and developing an approach to address residual emissions that remain after the carbon-neutrality target year. As part of the discussion, staff recommended that the City focus on the decarbonization of buildings and transportation by 2035 as the primary strategy toward achieving accelerated carbon neutrality.

### **Current Sustainability Action Plan**

On October 22, 2019, Council adopted the Sustainability Action Plan 4 (SAP-4) for Fiscal Year 2019-20 through Fiscal Year 2021-22 to serve as the City's continued plan for strategic investment in sustainability. Among its 81 new actions and 79 already-approved actions, SAP-4 contains both smaller projects that provide near-term GHG reductions and larger infrastructure projects that will provide significant long-term GHG reductions. The SAP-4 actions are organized around 27 high-level goals in the transportation, energy, land use, zero waste, water, parks and ecosystems, and core sustainability sectors. These goals highlight the synergies among different actions across City departments and recognize the broad array of interdependent policies and

programs needed to achieve the City's sustainability goals. An update on SAP-4 implementation was provided to the City Council on May 11, 2021 and to the CSC on December 1, 2021. The second agenda item for the May 30, 2023 CSC meeting is an update on the status of SAP-4 and recommendations for modifications to remaining actions, including the development of a Decarbonization Strategy for Mountain View.

## **ANALYSIS**

### **Inventory Methodology**

Conducting a communitywide GHG inventory involves measuring energy used, water consumed, solid waste produced, and wastewater generated by residential and nonresidential activities in the City. Staff then calculates MT CO<sub>2</sub>e resulting from these activities. For mobile-source emissions, such as transportation and off-road equipment, where measured data is not available, staff uses standardized GHG-accounting methodologies to estimate emissions at the County level and then adjusts them to a City scale.

All of Mountain View's GHG inventories have been prepared using a national standard developed by the ICLEI—Local Governments for Sustainability (formerly International Council for Local Environmental Initiatives). This standard, the U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions (the Protocol), establishes reporting requirements and accounting guidance for quantifying GHG emissions. Staff used the Protocol to examine emissions in five sectors: energy use, transportation (on-road vehicles), waste, water (potable water use and wastewater treatment), and off-road mobile sources (construction and commercial/industrial equipment).

Although the Protocol provides a common framework for calculating community emissions, any GHG inventory represents an estimate that is subject to change as better data and calculation methodologies become available. Global warming potentials represent one set of metrics subject to change over time and are used to convert the quantity of methane and nitrous oxide emissions to MT CO<sub>2</sub>e. When conducting the preliminary 2020 inventory, staff updated the emissions in recent inventories (2017, 2018, and 2019) based on the global warming potential data from the Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report, which reflects the best available science. Previously, inventories have used the IPCC Second Assessment, which specified a lower global warming potential for methane and a higher warming potential for nitrous oxide. Updates based on the new global warming potentials had minimal impacts on overall emissions, increasing 2017, 2018, and 2019 emissions by less than 1%. The emissions from the early inventories (2005, 2012, and 2015) continue to be based on the IPCC Second Assessment since these early inventories were calculated by consultants and are more difficult to update.

The Protocol does not fully account for life-cycle emissions from food, air travel, and purchased goods and services, which are accounted for in a Consumption-Based Emissions Inventory (CBEI). Community inventories and CBEIs are intended to address different emissions sources and to inform different decision-making processes; thus, a CBEI is a complement to, but not a replacement for, a traditional community inventory. In response to community interest, staff analyzed the possibility of using a CBEI in Mountain View and presented this analysis to Council on December 3, 2019. As stated in that report, staff does not recommend conducting ongoing City-level CBEIs for Mountain View due to: (1) the challenges in obtaining necessary and accurate data; (2) the staff time and expense involved; and (3) the fact that a CBEI would not account for the impact of initiatives in Mountain View. For more information on CBEIs, see the December 3, 2019 Council report entitled "[Community Greenhouse Gas Accounting, Reduction Targets, and Carbon Neutrality.](#)"

### **2020 and 2021 Community Greenhouse Gas Emissions Inventory Results**

Since Mountain View now conducts community GHG inventories annually, staff has begun presenting a preliminary inventory to Council before all data is available. Receiving Census Bureau data and final emissions factors for electricity can take up to 1-1/2 years. A preliminary 2020 community inventory was presented to the City Council on April 12, 2022, estimating emissions at 448,063 MT CO<sub>2</sub>e. As shown in Table 2, the final calculation of 2020 emissions came in slightly lower.

Table 2 provides the Final 2020 and Preliminary 2021 GHG emissions and compares them to the target level for that year, the 2005 baseline, and the 2025 and 2030 reduction targets.

**Table 2: Results of Final 2020 and Preliminary 2021 Community GHG Inventories**

<b>GHG Inventory</b>	<b>Total Emissions (MT CO<sub>2</sub>e)</b>	<b>Percent Above/Below Target Level</b>	<b>Percent Above/Below 2005 Baseline</b>	<b>Percent Reduction Needed to Reach 2025 Target</b>	<b>Percent Reduction Needed to Reach 2030 Target</b>
Final 2020*	446,073	-26.33%	-36.64%	0%**	16.35%
Preliminary 2021	478,419	-20.06%	-32.05%	1.40%	22.00%

\* *Percent Above/Below Target Level is based on upper end of target range.*

\*\* *Final 2020 emission levels were 5.75% below the 2025 target, in part due to a temporary reduction in activities due to the COVID-19 pandemic.*

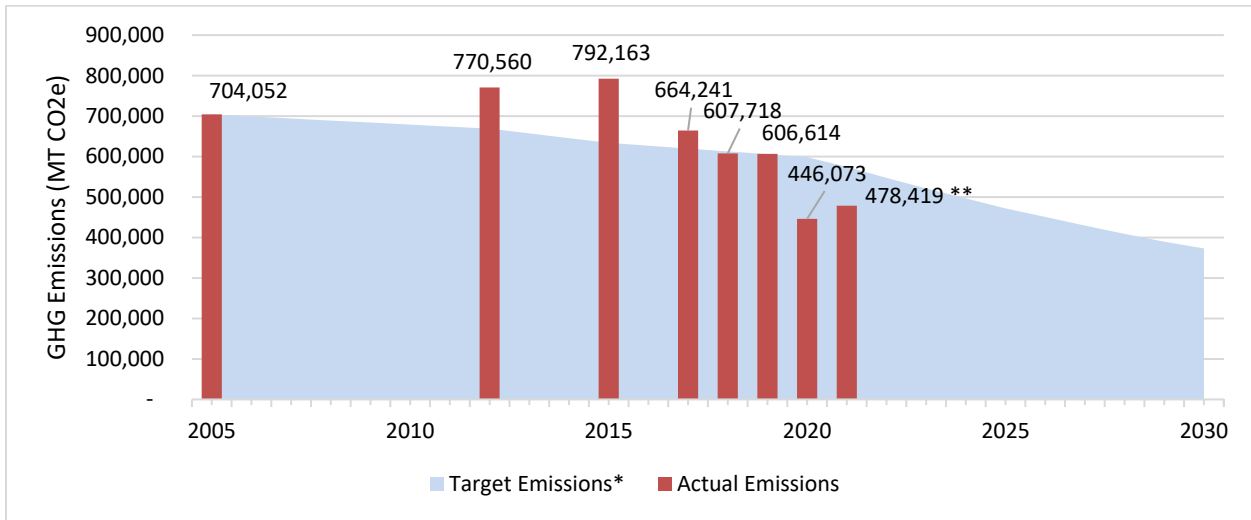
Emissions declined in 2020 and remained below 2005 baseline inventory levels. The Preliminary 2021 inventory shows emissions rising to 7% above 2020 levels. Preliminary 2021 emissions are

20% below the reduction target for 2021 (as interpolated between the set targets for 2020 and 2025) and 1% above the target for 2025. To reach the 2030 reduction target of 47%, Mountain View will need to reduce its emissions another 105,270 MT CO<sub>2</sub>e (22%).

Final 2020 GHG emissions were lower than estimated in the preliminary 2020 inventory (448,063 MT CO<sub>2</sub>e), largely due to updated communitywide employee counts for Mountain View. The Preliminary Inventory used 2019 data for employee counts, which was the most recent data available at the time. The Final Inventory uses employee counts from 2021 because the Census Bureau does not release one-year estimates for the American Community Survey for 2020. The employee counts for 2021 were lower than 2019, resulting in lower estimates for emissions from passenger and light-duty vehicles.

Final 2020 emissions from electricity, water demand, and wastewater treatment were higher than estimated in the Preliminary Inventory due to updated emission factors for PG&E. The emission factor for 2020 (160.1 pounds (lbs.) CO<sub>2</sub>e/MWh) was higher than for 2019 (2.98 lbs. CO<sub>2</sub>e/MWh), which was used as proxy in the Preliminary Inventory. Final 2020 emissions from off-road mobile equipment were also higher than originally estimated because the California Air Resources Board (CARB) has discontinued the tool used for previous inventories and released a new tool, EMFAC2021, which includes more equipment categories.

Figure 1 provides the results of the City's community GHG inventories compared to the GHG reduction targets through 2030. For interim years, staff has interpolated reduction targets on a linear path between official adopted targets. As shown in Table 2, final 2020 emissions were 26% below the adopted target of 598,446 MT CO<sub>2</sub>e. Preliminary 2021 emissions were 20% below the interpolated target of 574,429 MT CO<sub>2</sub>e and 1% above the 2025 target of 471,716 MT CO<sub>2</sub>e. *The emission increases between 2020 and 2021 were largely due to an increase in vehicle miles traveled (VMT).*

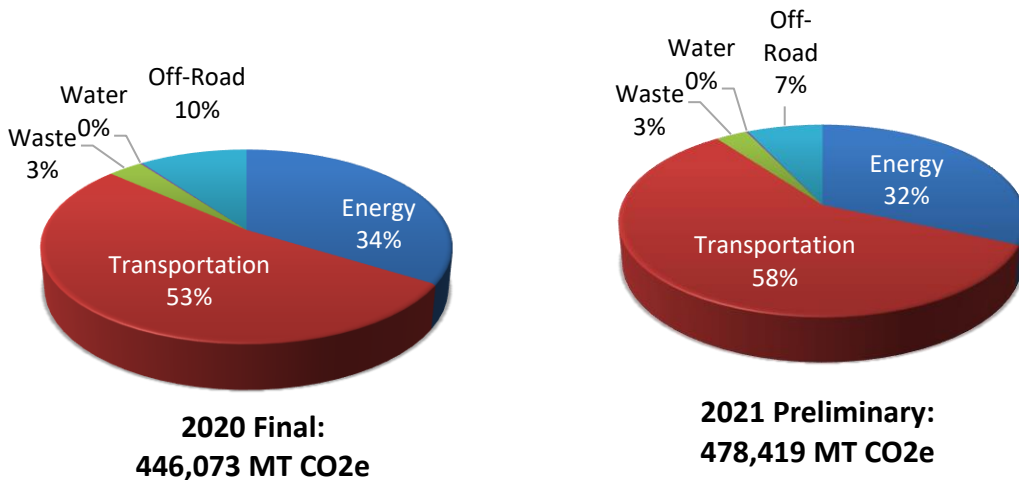


**Figure 1: Community GHG Emissions and Reduction Targets, 2005 Through 2030**

\*Chart shows the upper limit of target range.

\*\*2021 emissions are preliminary.

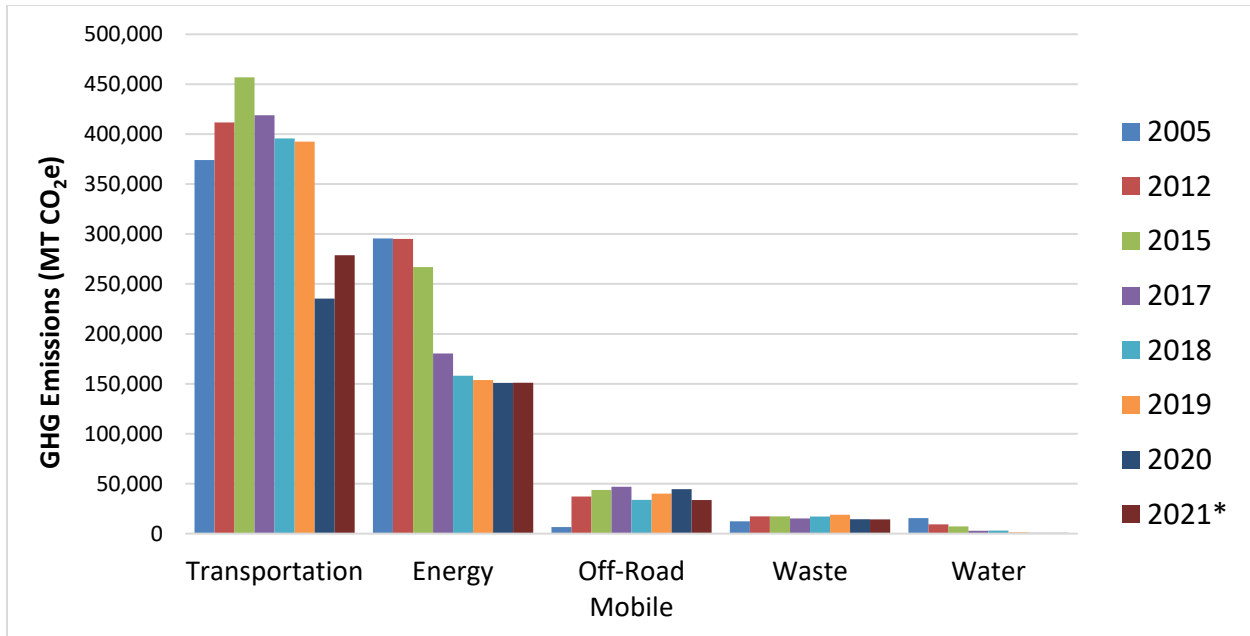
Figure 2 shows a breakdown of 2020 and 2021 GHG emissions by sector. Transportation and energy remained the two largest emissions sources in 2020 and 2021. While overall emissions increased 7% from 2020 to 2021, the percentage of emissions remained similar for waste and water. In 2021, the percentage of emissions from energy, transportation, and off-road mobile sources shifted slightly, largely due to higher emissions from on-road transportation and lower emissions from off-road mobile equipment.



**Figure 2: Final 2020 and Preliminary 2021 Community GHG Emissions by Sector**

Figure 3 provides GHG emissions by sector for each inventory year from 2005 to 2021 (see Attachment 2 for a full breakdown of emissions). Most emissions reductions between 2015 and

2021 came from the transportation and energy sectors, driven by cleaner sources of electricity, more efficient and cleaner-fuel vehicles, and lower VMT per capita.



**Figure 3: Comparison of Community GHG Emissions by Sector, 2005 Through 2021**

*\*2021 emissions are preliminary.*

The following section presents an analysis of 2020 and 2021 GHG emissions by sector. Except for data for 2005, charts in this section provide GHG estimates based on a methodology consistent with the most recent inventories, with some corrections made to prior inventory GHG estimates.

- Transportation:** Emissions from on-road vehicles declined 36% from their peak in 2017 to their preliminary 2021 emissions level. The total emissions of previous inventories in this sector have been updated using CARB's newly released tool, referred to as EMFAC2021, to match the emissions estimate of 2020 and 2021, as previous inventories had used EMFAC2017. Estimated per-capita VMT for the service population (resident population plus number of employees) declined from 18.1 miles per day in 2019 to 12.36 miles per day in 2020, and slightly increased to 15 miles per day in 2021. Higher vehicle fuel-efficiency standards and an increase in the number of electric vehicles (EVs) have also contributed to the overall emissions decrease between 2015 and 2021.

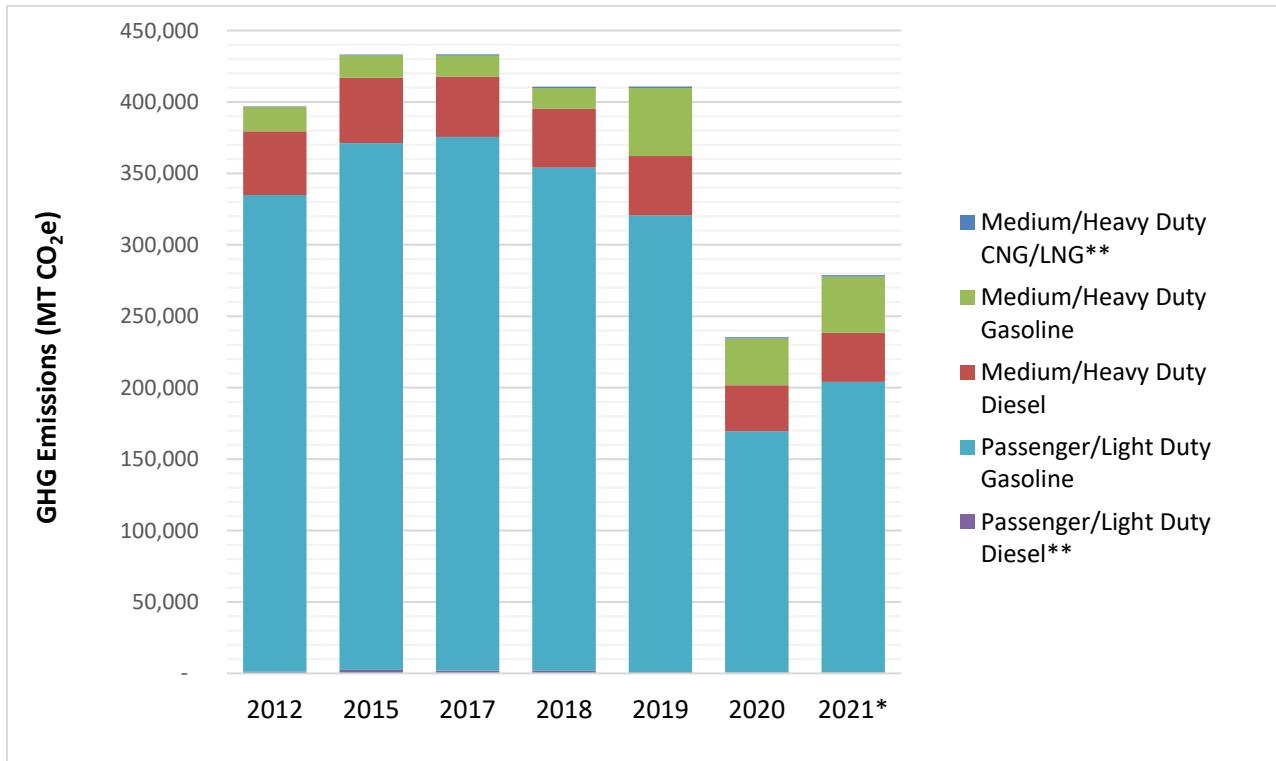
The significant decrease in VMT between 2019 and 2020 was largely due to shelter-in-place orders and decreased activity associated with the COVID-19 pandemic. Between 2020 and 2021, VMT increased 22%, reflecting a partial return of employees to workplaces as well as a mode shift toward motor vehicles, in part due to transit hesitancy. On December 1, 2021

and June 22, 2022, staff presented analyses of pandemic travel patterns to the Council Sustainability Committee. These analyses discussed traffic data provided by the Caltrans Performance Measurement System (PeMS) for the U.S. 101 freeway in Mountain View. The data indicated that traffic volumes in the vicinity of Mountain View dropped to approximately 60% of typical levels in April 2020 and rebounded to about 80% of typical levels by summer 2020, 90% by summer 2021, and 95% by fall 2021.

The Citywide VMT estimates used in the inventories are calculated with a travel demand model that uses many inputs on land use and population changes. An updated travel demand model was not available for 2020 or 2021, so a reduction factor based on Caltrans traffic data was applied to the 2018 per-capita VMT to estimate on-road vehicle emissions for the final 2020 and preliminary 2021 Inventories. Staff plans to work with a consultant to develop an updated travel model or improve other data sources to estimate VMT for future inventories.

As shown in Figure 4, gasoline-powered passenger vehicles and light-duty trucks continue to generate most of the City's transportation-related emissions. The City can further reduce these emissions by supporting transit-oriented development, walkable neighborhoods, travel by nonvehicular modes, telecommuting, and the transition to cleaner vehicles. These strategies provide additional community benefits, including better air quality, safer streets, a vibrant downtown, and improved health.



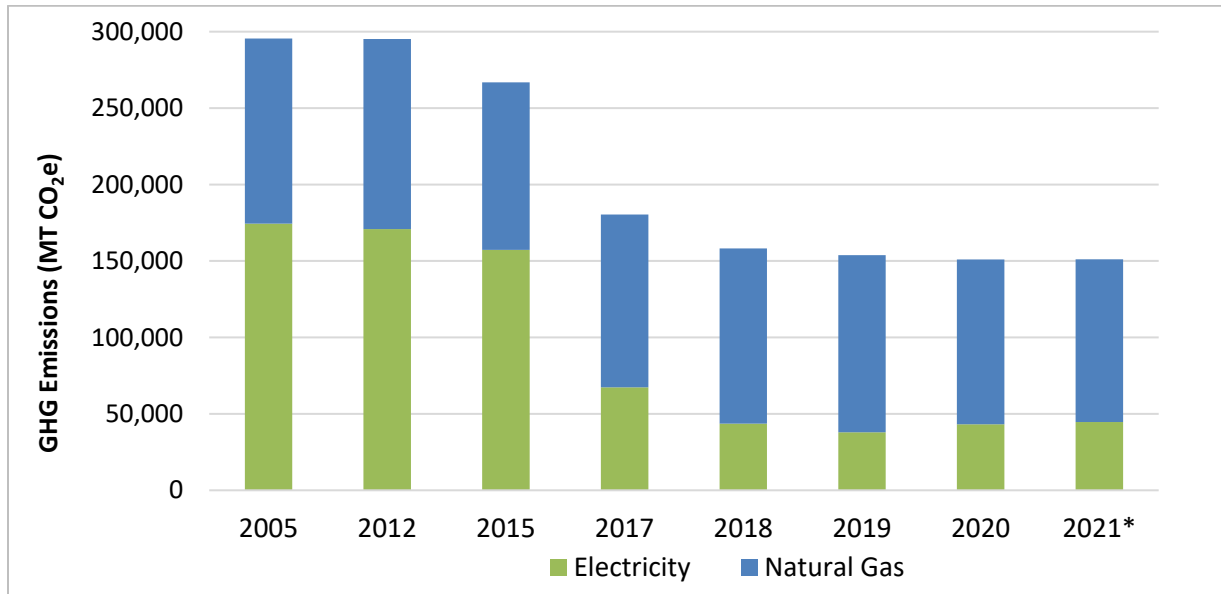


**Figure 4: Transportation Emissions by Vehicle and Fuel Type, 2012 Through 2021**

\* 2021 emissions are preliminary.

\*\* Emissions from Medium/Heavy-Duty CNG/LNG and Passenger/Light-Duty Diesel are too low to register on this chart.

- Energy:** With the transition of nearly all the community’s electricity accounts to Silicon Valley Clean Energy (SVCE), natural gas comprises the majority of 2021 energy sector emissions at 70%. The City’s GHG-reduction strategy focuses on reducing natural gas use by encouraging electrification of commercial and residential buildings.



**Figure 5: Residential and Nonresidential Energy Emissions, 2005 Through 2021**

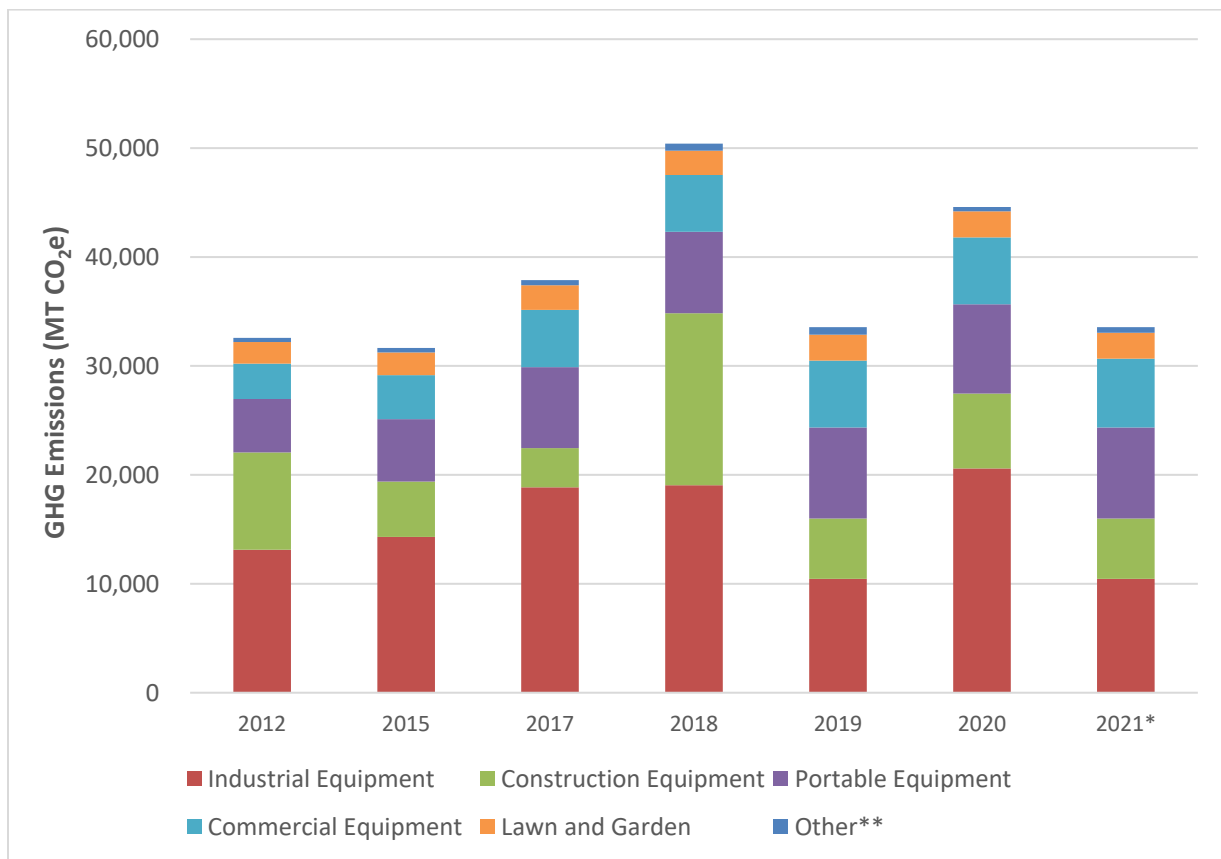
\* 2021 emissions are preliminary.

Clean electricity from SVCE drove the majority of Mountain View’s energy sector and overall emissions reductions between 2015 and 2021. SVCE began providing carbon-free electricity in Mountain View in April 2017 and currently provides electricity to around 96.4% of residential and commercial customers in its service territory previously served by PG&E.

The City Council’s December 13, 2022 readoption and expansion of the 2019 Reach Codes to require all-electric construction for new residential and commercial buildings ensures that new development will not increase natural gas emissions. The 2022 Reach Code removed an exception for fire pits and fireplaces for all building types and increased EV charging requirements for certain building types. On April 18, 2023, the Council Sustainability Committee also directed staff to assess the feasibility of additional programs and policies to reduce natural gas emissions, including an appliance replacement policy, expanding the definition of major renovation in the City’s Reach Code and pursuing neighborhood-scale electrification opportunities.

Due to customer confidentiality constraints, the City was unable to obtain a detailed breakdown of electricity usage by energy service provider (PG&E, SVCE, or Direct Access) for 2020 or 2021 or of natural gas usage by sector (residential or nonresidential) for 2021. However, SVCE was able to provide the City with the aggregate emissions from both residential and nonresidential electricity use and total natural gas usage. The 2021 Preliminary Inventory also uses PG&E’s emissions factor from the 2021 Power Content Label, which is not yet official.

- Off-Road Mobile:** Figure 6 shows off-road mobile equipment emissions from construction, commercial, industrial, lawn and garden, portable, and other equipment. These emissions are estimated by downscaling County-level data provided by CARB’s new tool, EMFAC2021, as the tool used for previous inventories was discontinued. Staff downscaled County-level emissions data by using three scale factors: the ratio of new housing permits (to calculate construction equipment emissions), the households’ ratio (to calculate lawn and garden equipment emissions), and the jobs ratio (to calculate commercial, industrial, and other equipment emissions). The City’s estimated off-road emissions are, therefore, correlated with the amount of housing construction, job growth, and population growth in Mountain View. The Preliminary 2021 Inventory uses the 2020 jobs ratio data because it is the most recent data available from the Census Bureau.

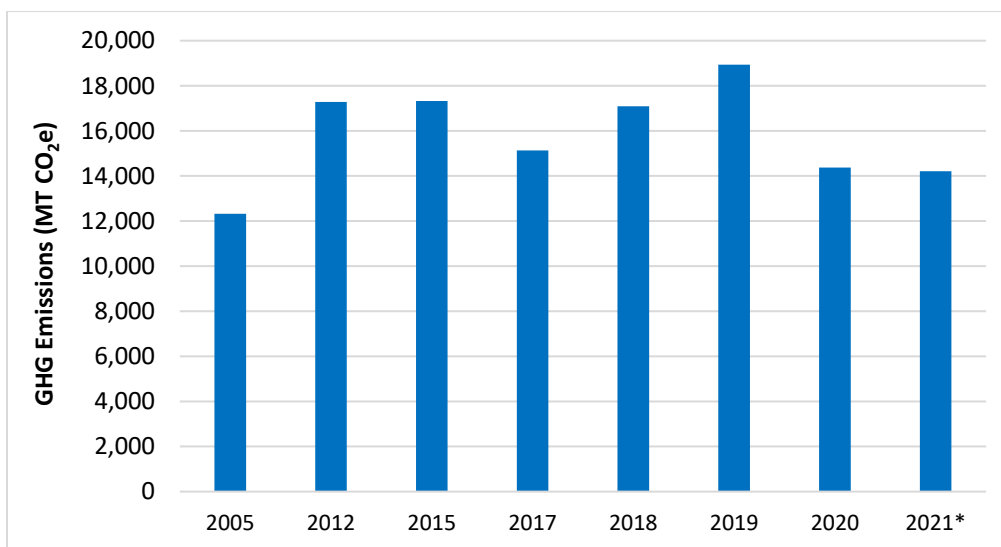


**Figure 6: Off-Road Mobile Emissions, 2005 through 2021**

\* 2021 emissions are preliminary.

\*\* Other includes emissions from forestry and recreational equipment as well as pleasure and commercial harbor craft.

- **Waste:** Solid waste emissions are dependent on both the total amount of solid waste sent to landfills and the percentage of organic material in the waste stream. Organic material, such as yard trimmings, food scraps, and food-soiled paper, is the primary contributor of emissions from solid waste due to the release of methane as these materials decompose.

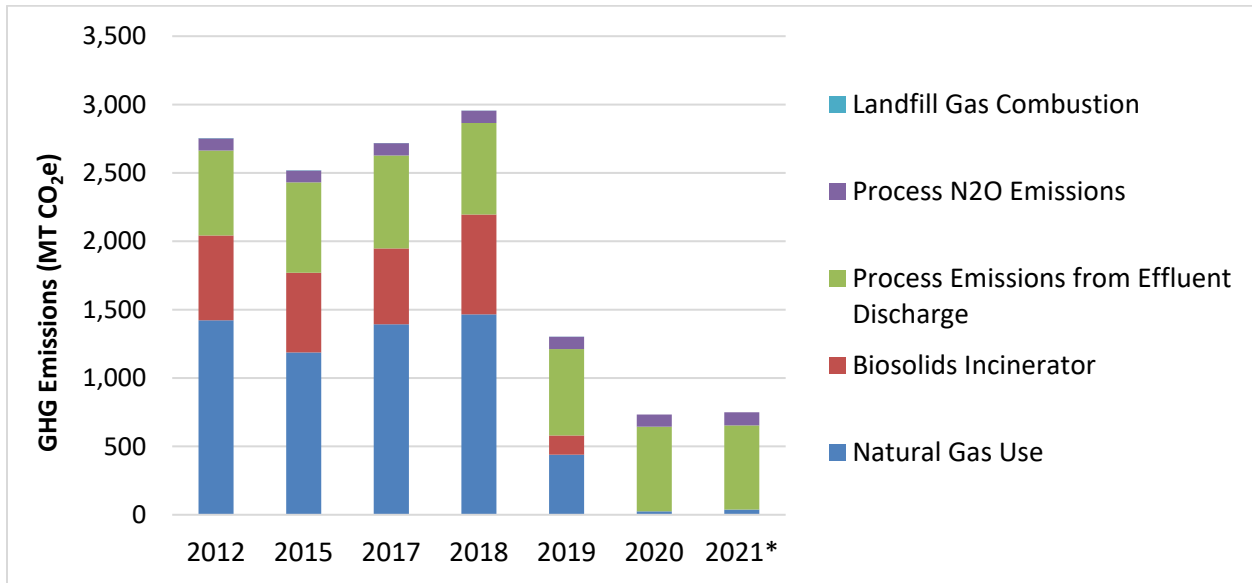


**Figure 7: Solid Waste Emissions, 2005 through 2021**

\* 2021 emissions are preliminary.

As shown in Figure 7, solid waste emissions dropped between 2019 and 2020 and remained at a similar level in 2021 due to a significant decrease in the amount of landfilled waste. This is likely a result of business closures and shelter-in-place orders during the COVID-19 pandemic. The 2017-2021 inventories use the same 2017 waste characterization study data to estimate the percentage of organic material sent to landfill after trash has been sorted at the SMaRT<sup>®</sup> Station. Therefore, these inventories do not capture any additional organic-waste diversion from the City's residential food scraps collection program, implemented in July 2017 and expanded to multi-family residences in 2021. The impact of these programs will be reflected in future inventories.

- **Water:** This sector includes emissions from the energy used to treat wastewater and extract, convey, treat, and distribute potable water. Wastewater treatment contributes over 95% of emissions from the water sector. Figure 8 shows the estimated wastewater emissions from 2012 through 2020. These emissions rose between 2015 and 2018 due to an increase in the volume of wastewater being treated, which correlates with an increase in potable water use.



**Figure 8: Wastewater Emissions, 2012 through 2021**

*\*2021 emissions are preliminary.*

As shown in Figure 8, natural gas use at the Palo Alto Regional Water Quality Control Plant (RWQCP) contributed most of the wastewater emissions from 2012 to 2018. While the City of Palo Alto purchases carbon offsets for its natural gas use, there are still emissions associated with the on-site combustion of natural gas since inventory calculation protocols do not consider offsets as reducing local emissions. In 2019, the incinerators at the RWQCP were decommissioned, decreasing natural gas use significantly. The RWQCP transitioned to trucking biosolids off-site to processing facilities where they are converted into fertilizers and other beneficial products. As a result, emissions from wastewater treatment decreased by 55% between 2018 and 2019. In 2020, the first year that no biosolids were incinerated at RWQCP, emissions from wastewater treatment dropped another 44%, and then increased slightly in 2021.

Emissions associated with potable water use remain low as the water supply for Mountain View is primarily gravity-fed and requires very little energy. Emissions from potable water use increased significantly between 2019 and 2020 due to an increase in PG&E’s emissions factor and then decreased by 50% due to a slight decrease in the volume of water delivered. Increased conservation efforts would reduce emissions from potable water use and wastewater treatment.

### **Characterizing Per Capita Emissions**

While Mountain View has experienced overall residential and employee growth since 2005, the Citywide employee population dropped by 33% between 2019 and 2021, likely a result of increased telecommuting during the COVID-19 pandemic. Although the service population has increased since 2005, per capita emissions have decreased overall, although they saw a slight uptick in 2021.

**Table 3: Community GHG Emissions Relative to Population and Employment**

	2005	2019	2020	2021	% Change 2005-2021	% Change 2020-2021
<b>Total Emissions (MT CO<sub>2</sub>e)</b>	704,054	606,614	446,073	478,419 <sup>1</sup>	-32.05%	7.25%
<b>Population/Employment</b>						
Residential <sup>2</sup>	70,629	81,639	82,173	83,128	17.70%	1.16%
Employees <sup>3</sup>	54,071	101,965	68,151 <sup>4</sup>	68,151	26.04%	0.00%
Service Population <sup>5</sup>	124,700	183,604	150,324	151,279	21.31%	0.64%
<b>Per-Capita Emissions (MT CO<sub>2</sub>e)</b>						
Per Service Population	5.65	3.30	2.97	3.16	-44.03%	6.57%

<sup>1</sup> 2021 emissions are preliminary.

<sup>2</sup> State of California Department of Finance, E-5 Population and Housing Estimates for Cities, Counties, and the State, 2021, <https://dof.ca.gov/forecasting/demographics/estimates/e-5-population-and-housing-estimates-for-cities-counties-and-the-state-2020-2023/>.

<sup>3</sup> U.S. Census Bureau, American Community Survey One-Year Estimates—Table B08604, 2021, <https://data.census.gov/table?q=B08604>.

<sup>4</sup> The Final 2020 inventory uses 2021 employee counts because data for 2020 is not available.

<sup>5</sup> Service population is calculated by adding the resident population to the number of employees.

Service population growth does not necessarily result in an increase in GHG emissions. Addressing the jobs-housing imbalance can reduce emissions by decreasing commuting distances for many employees. Furthermore, the types of initiatives that will continue to reduce per-capita emissions (e.g., creating more walkable and “complete” neighborhoods, expanding bicycle infrastructure, and improving the Community Shuttle), also positively impact quality of life through improved air quality, reduced congestion, and increased access to convenient, safe, and affordable transportation options.

### **FISCAL IMPACT**

There is no fiscal impact associated with adopting the Final 2020 and Preliminary 2021 Community GHG Inventories.

## **CONCLUSION**

The Final 2020 and Preliminary 2021 Inventories show emissions decreasing significantly below 2019 levels, primarily due to decreases in VMT during the COVID-19 pandemic. While the Final 2020 Inventory indicated the City had achieved its 2025 reduction target, the Preliminary 2021 Inventory shows emissions increasing by 11% between 2020 and 2021, suggesting that VMT reductions achieved during the COVID-19 pandemic are unlikely to continue long-term. It is important to continue to implement programs and policies to accelerate this emissions reduction trend, given the additional 22% reduction needed to achieve the 2030 target. Continuing to conduct annual GHG inventories will allow the City to track its progress and evaluate the effectiveness of GHG-reduction measures.

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- Attachments:
1. Community Greenhouse Gas Emissions Reduction Targets and Levels, 2005 through 2050
  2. Total Community Greenhouse Gas Emissions by Sector and Subsector, 2005 through 2021