DATE: March 11, 2024

TO: Council Sustainability Committee

FROM: Director of Public Works

SUBJECT 2022 Greenhouse Gas Emissions Inventory

RECOMMENDATION

That the Council Sustainability Committee (CSC) reviews and comments on this report.

SUMMARY

The Council-adopted General Plan includes greenhouse gas (GHG) emission reduction targets for the Hayward community. This report provides the results of the calendar year 2022 inventory and compares it to the previous eight inventories. Table 1 summarizes the emissions totals for six sectors – electricity, natural gas, transportation (includes public transit), off-road vehicles, waste, and water and wastewater. Emissions are displayed in metric tons of carbon dioxide equivalent (MTC02e). The table shows that as of 2022, emissions have been reduced by 37.3% since 2005.

As the largest contributor to community GHG emissions, trends in on-road transportation highly impact the inventory. Following the decrease in transportation emissions due to the COVID-19 pandemic in 2020, staff expected emissions to increase in 2021 and 2022 as restrictions eased and pre-pandemic activities resumed. Despite 2022 being the first full year without pandemic-related restrictions, total emissions from 2021 to 2022 only increased by 0.2% from 37.5% to 37.3% above 2005 levels. The relatively consistent emissions between 2021 and 2022 could be attributed to a shift towards increased hybrid and remote work following the pandemic.

Table 1: GHG Emissions by Sector (MT C02e)

	2005	2010	2015	2019	2020	2021	2022	% Change from 2005
Electricity	185,536	165,172	141,814	12,467	23,038	35,844	29,313	-84.2%
Natural Gas	189,995	191,526	176,803	176,649	166,334	168,917	170,495	-10.3%
Transportation	529,317	458,988	450,925	420,995	309,168	345,905	346,081	-33.5%
Off-Road Vehicles	14,889	17,004	27,267	24,287	31,352	25,040	31,695	112.8%
Waste	50,924	38,338	38,148	46,187	34,628	32,011	32,141	-36.8%
Water and wastewater	4,718	4,314	3,471	2,706	2,516	2,201	1,939	-58.9%
Total	**975,379**	**884,079**	**838,428**	**683,291**	**567,036**	**609,918**	**611,677**	**37.3%**
Hayward Population	140,530	143,921	155,753	163,965	161,808	160,081	159,800	13.7%
Total Emissions/ Capita	**6.9**	**6.1**	**5.4**	**4.3**	**3.5**	**3.8**	**3.9**	**-43.5%**

BACKGROUND

The last report on the City's GHG emissions, presented to the CSC in September 2023[1] showed that Hayward's emissions were reduced by 37.5% from 2005 to 2021. This was an increase from 2020 when emissions were reduced to 41.8% of 2005 levels, much of which was due to the COVID-19 pandemic. The dip in 2020 emissions and subsequent increase in 2021 can be attributed to the return to increased transportation and community activities as pandemic restrictions eased. This report and previous reports can be found on the City website[2].

The City of Hayward's General Plan Policy NR-2.4 sets the following GHG emissions reduction targets.

> *NR-2.4: Community Greenhouse Gas Reduction*
>
> The City shall…reduce community-based GHG emissions by 20 percent below 2005 baseline levels by 2020, 30 percent below 2005 baseline emissions levels by 2025, 55 percent below 2005 baseline emissions levels by 2030, and work with the community to develop a plan that may result in the reduction of community-based GHG emissions to achieve carbon neutrality by 2045.

To track compliance with these targets, the City began conducting community GHG emissions inventories every five years, starting with 2005 as the baseline year. Starting

[1] CITY OF HAYWARD - Meeting of Council Sustainability Committee on 9/11/2023 at 5:30 PM (legistar.com)
[2] Climate Action Plan | City of Hayward - Official website (hayward-ca.gov)

with the 2017 inventory, the City has conducted inventories annually. All eight inventories use the U.S. Community Protocol methodology to calculate GHG emissions. The U.S. Community Protocol methodology is an industry-standard used by local governments to account for and report on GHG emissions in a standardized method.

Over the past fifteen years, organizations have continuously refined and updated the models that are used to estimate emissions to provide more accurate information. In response, staff recalculates emissions with the new modeling across all the inventories. As a result, the emissions totals in this report may not match the numbers from previous reports.

DISCUSSION

This report outlines the 2022 inventory, which shows total emissions were reduced by 37.3% below 2005 levels and shows no significant increase or decrease in emissions from the previous year. As shown in Table 2, Hayward met its goal of 20% below 2005 levels by 2020 two years early by achieving a reduction of 21.6% in 2018. In 2020, Hayward outpaced its 2025 emission reduction goal of 30% below the 2005 baseline when it achieved a 41.8% emission reduction. However, the large decreases in emissions in 2019 to 2020 were attributed to the COVID-19 pandemic impacts on community-wide activities and staff predicted that emissions would likely increase in 2021 as pandemic-related restrictions eased. Community-wide emissions did increase by 7% from 2020 to 2021, and while staff predicted emissions would continue to rise over the next few years as transportation activity increases, emissions only increased by 0.2% from 2021 to 2022 to an overall reduction of 37.3% from the 2005 baseline.

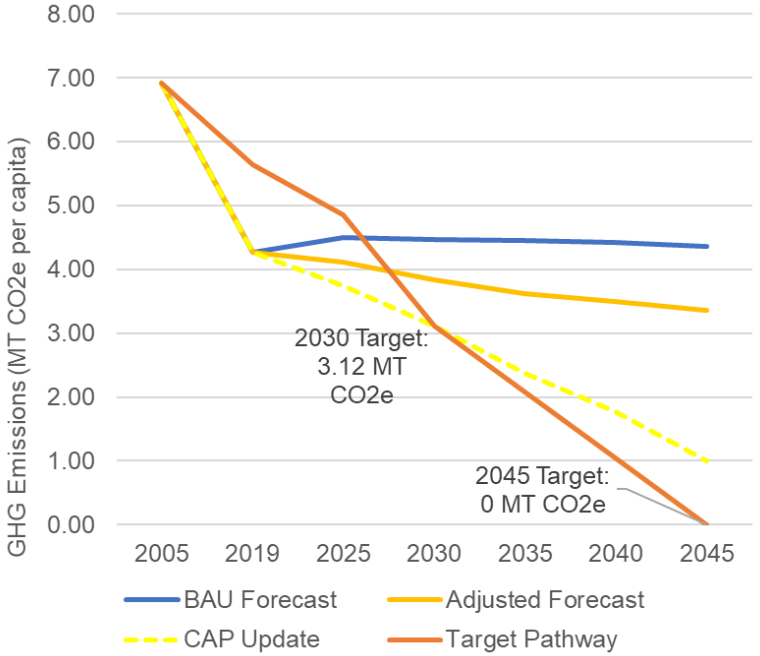
In January 2024, the 2024 Climate Action Plan (CAP) was adopted by Council as an amendment to the 2040 General Plan. It builds upon the 2014 CAP to include specific actions and measures to reduce GHG emissions in alignment with state and national goals. Additionally, the 2024 CAP projects future per capita emissions that are contingent on the successful implementation of all CAP measures. Adhering closely to the CAP's recommended projects and timeline for each action would set Hayward on a pathway to reducing carbon emissions by 55% by 2030. Table 2 (below) shows historical per capita emissions as well as the 2030 goal of achieving per capita emissions at or below 3.12 MT CO2e.

Table 2: GHG Emission Reduction Goals and Actual Emission Reductions

Year	Overall Emissions Goal	Actual Reduction	Per Capita Goal	Actual Per Capita Emissions (MT CO2e)
2005	Baseline	N/A	Baseline	6.9
2018		21.6%		4.7
2019		25.7%		4.3
2020	20%	41.8%		3.5
2021		37.5%		3.8
2022		**37.3%**		**3.9**
2025	30%			
2030	55%		3.12	
2045	Carbon neutrality		Carbon neutrality	

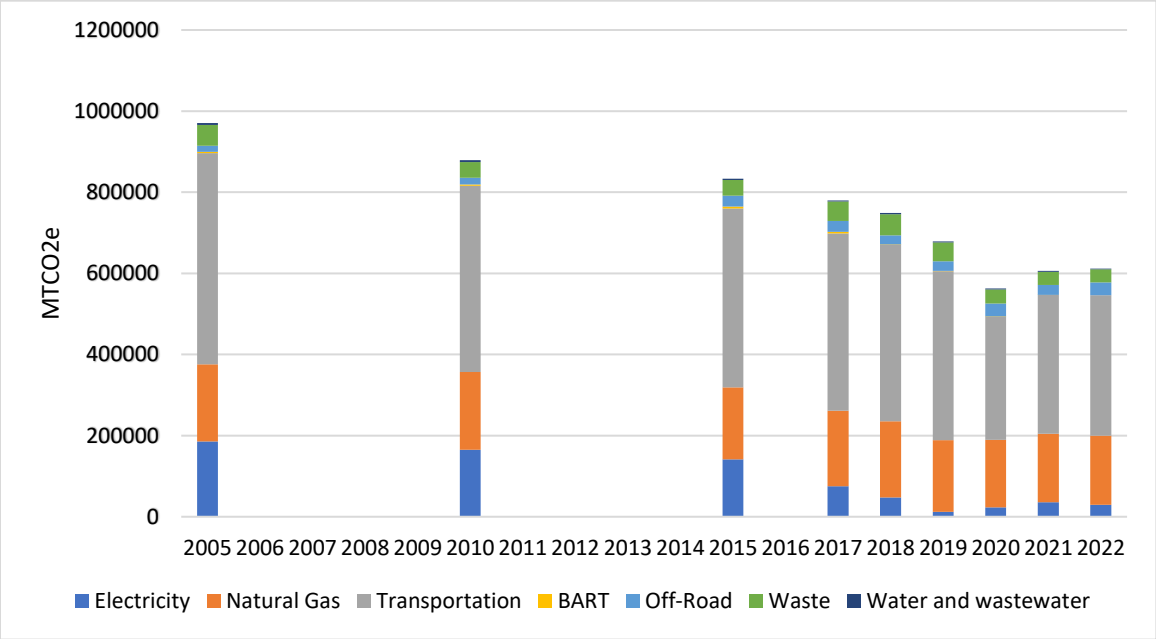
Figure 1 shows projected per capita emission levels with and without CAP measures. Following full implementation of CAP measures (yellow-dashed line), per capita emissions are estimated to reduce by 2.36 MT CO2e. While this places us on a pathway to carbon neutrality (dark orange line), CAP measures will need to be updated again in order to reach carbon neutrality by 2045.

Figure 1 – Per Capita Emissions Compared to Forecast Scenario and Target Pathway



The City's GHG inventory is comprised of eight sectors: electricity, natural gas, transportation, public buses (AC Transit), BART, off-road vehicles, solid waste, and water and wastewater. Figure 2 (below) shows the breakdown of emissions for each year by subsector and the percentage of subsector for that year. Transportation, in grey, remains the largest sector and consistently accounts for over half of the total emissions. BART, AC Transit, and water and wastewater combined account for about 1% of emissions, and solid waste comprises 4-6% of emissions, and off-road vehicles account for 1-6% of emissions. Natural gas use in buildings, shown in orange comprises a little over a quarter of all emissions at 27.9%.

Figure 2: GHG Emissions by Subsector (MT C02e)



Energy Sector (Electricity and Natural Gas)

Energy emissions, which includes electricity and natural gas, were 46.8% below 2005 levels with an 84.2% reduction in electricity emissions and 10.3% decrease in natural gas emissions from 2005 to 2022 (see Table 3). Residential electricity emissions have decreased by 61.6% and nonresidential electricity emissions have decreased by 93.5% since 2005. The main driver that has caused electricity emissions to decrease is the City's customers' transition to the energy provider Ava Community Energy (formerly known as East Bay Community Energy (EBCE)) which took place in 2018. Following this transition, the majority of Hayward customers received by default the carbon-free electricity product offered by Ava (Brilliant 100 from 2018-2021, Renewable 100 from 2022 on). While this resulted in a significant decrease in electricity emissions from 2018 (47,452 MTCO2e) to 2019 (12,467 MTCO2e), customers on Ava's cheaper alternative Bright Choice have seen an increase in emissions as this product becomes increasingly more carbon intensive.

Approximately 30% of Hayward households are enrolled in income or medical-related discount programs and receive Ava's Bright Choice energy product. Carbon-free energy sources (geothermal, solar, wind, hydroelectric, and nuclear) accounted for 86.7% of Bright Choice's energy mix in 2019; however, that declined to 55% in 2020. While the proportion of carbon-free energy did increase for Bright Choice in 2021 to 59.9% and 71.5% in 2022 (see Table 4), Bright Choice is still more carbon-intensive than PG&E's Base Plan product[3].

Due to the changes in Ava's energy mix to include more carbon-intensive sources, residential electricity emissions have increased 227% since 2019 despite a 0.3% decrease in kWh, and nonresidential electricity emissions increased 40% despite an 18% decrease in kWh. However, due to the decrease in carbon intensity in Bright Choice from 2021 to 2022, this is a considerable improvement from the 262% increase in residential electricity emissions and 110% increase in nonresidential electricity emissions from 2019 and 2021.

Residential and nonresidential natural gas emissions have decreased from 2005 to 2022 by 9.8% and 10.9%, respectively. Residential natural gas emissions have trended downwards since 2019 and may be related to increased energy efficiency and a decrease in heating degree days[4] (HDD) (see Figure 4 below).

Table 3: Energy Sector GHG Emissions

		2005	2010	2015	2019	2020	2021	2022	% Change
Residential electricity	GHG Emissions	53,939	51,166	44,807	6,326	17,547	22,930	20,704	-61.1%
	MWh	242,161	252,327	242,783	239,006	215,828	244,443	238,085	-1.7%
Nonresidential electricity	GHG Emissions	131,597	114,006	97,007	6,140	5,491	12,914	8,609	-93.5%
	MWh	590,811	562,228	525,628	511,639	381,744	410,516	418,744	-29.0%
Residential natural gas	GHG Emissions	103,502	103,027	86,736	95,291	94,811	93,713	93,396	-9.8%
	Therms (in millions)	19.489	19.400	16.332	17.943	17.853	17.646	17.587	-9.8%
Nonresidential natural gas	GHG Emissions	86,493	88,499	90,066	81,358	71,523	75,204	77,099	-10.9%
	Therms (in millions)	16.287	16.664	16.960	15.320	13.468	14.161	14.518	-10.9%

[3] Power Content Label (ca.gov)

[4] A *degree day* compares the mean (the average of the high and low) outdoor temperatures recorded for a location to a standard temperature, usually 65° Fahrenheit (F) in the United States. https://www.eia.gov/energyexplained/units-and-calculators/degree-days.php#:~:text=Heating%20degree%20days%20(HDDs)%20are,%C2%B0F%20has%2025%20HDDs

Total GHG Emissions	**375,531**	**356,699**	**318,617**	**189,116**	**189,373**	**204,761**	**199,808**	**-46.8%**

Table 4: Annual Shares of Carbon-Free Energy* in Electricity Products

	2019	2020	2021	2022
Ava's Renewable 100	100%	100%	100%	100%
Ava's Bright Choice	86.7%	55.0%	59.9%	71.5%
Pacific Gas & Electricity (PG&E) Base Plan	100%	83.5%	91.0%	95.2%

*Carbon-free energy includes nuclear and hydroelectric power in addition to renewable energy such as solar, wind, and geothermal.

Figure 3: Energy Sector GHG Emissions (MT CO2e)

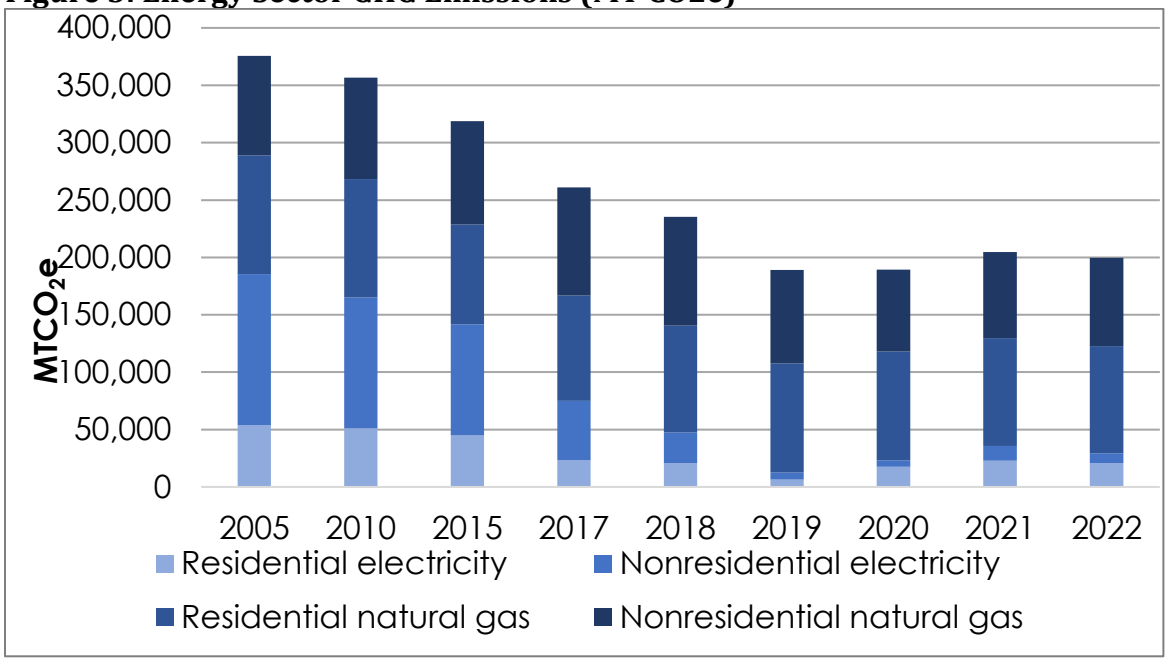
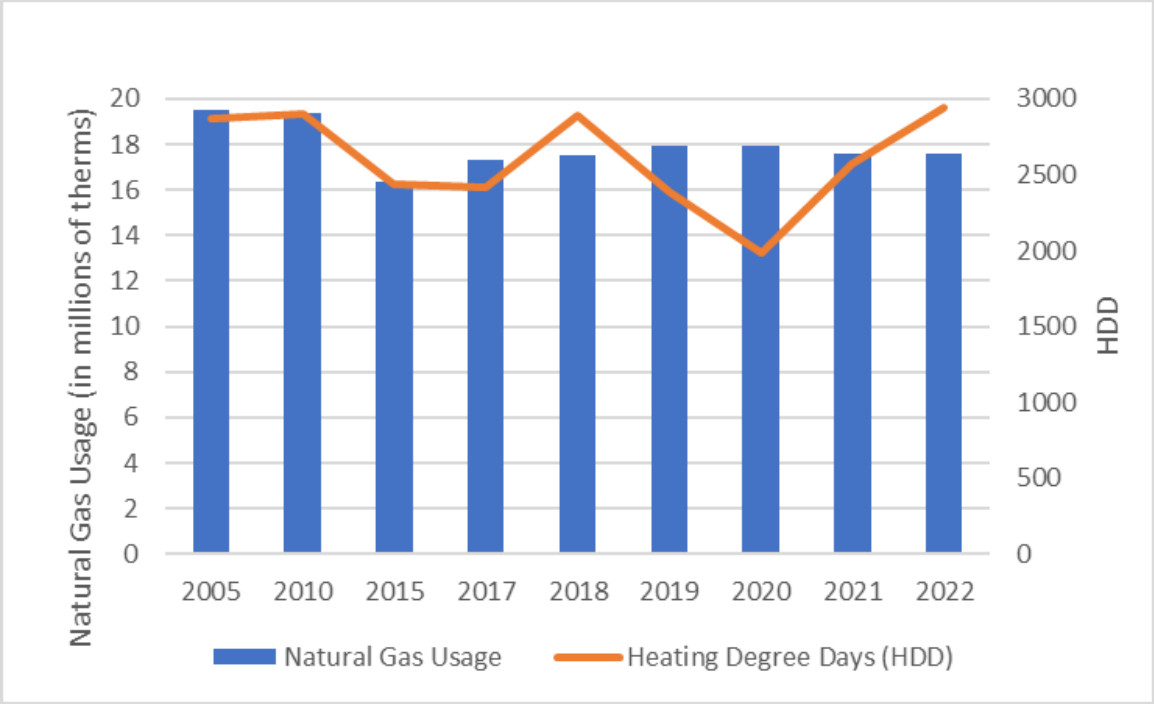


Figure 4: Residential Natural Gas Usage & Heating Degree Days in Hayward



Transportation Sector

From 2005 to 2022, transportation emissions decreased by 33.8% and vehicle miles traveled (VMT) decreased by 16.2% (see Table 5). Due to the COVID-19 pandemic, there were significant decreases in on-road transportation from 2019 to 2020, with a 31% decrease in VMT and a 41.6% decrease in total transportation emissions. From 2020 to 2021, Hayward saw a 15.5% increase in VMT and a 11.9% increase in transportation emissions as restrictions lifted and pre-pandemic activities started to resume. Staff expected this trend to continue; however, while VMT did increase from 2021 to 2022, it was only by 4.9%. This is likely due to the increased popularity of remote and hybrid work compared to before the pandemic. Though VMT increased only slightly, emissions increased by even less and are only 1.2% higher than emissions in 2021. A growing number of electric vehicles (EVs) on the road could explain why the emissions are not increasing at the same rate as VMT as we return to pre-pandemic activities.

In 2020, staff began using a new data source from Google called Environmental Insights Explorer (EIE), which captured the impact of the pandemic and created a more complete scope of transportation emissions. In inventories prior to 2020, on-road transportation activity was captured using a model from the Metropolitan Transportation Commission (MTC) which takes into account surveys of transportation patterns, land use, and population metrics to calculate VMT for passenger and commercial vehicles completing trips entirely within the city, ending or starting in the city, and those that pass through the city.

MTC data was supplemented by data from the California Air Resources Board (CARB) on motorcycles, motor homes, and buses. Google EIE's dataset accounts for all vehicle types that start or end within the city. Because it uses anonymized location history from mobile devices, it better captures residents' transportation habits than the previously used transportation model. To make accurate comparisons to the 2005 baseline, staff re-calculated transportation emissions in inventory years that were not available from Google EIE (2005-2017).

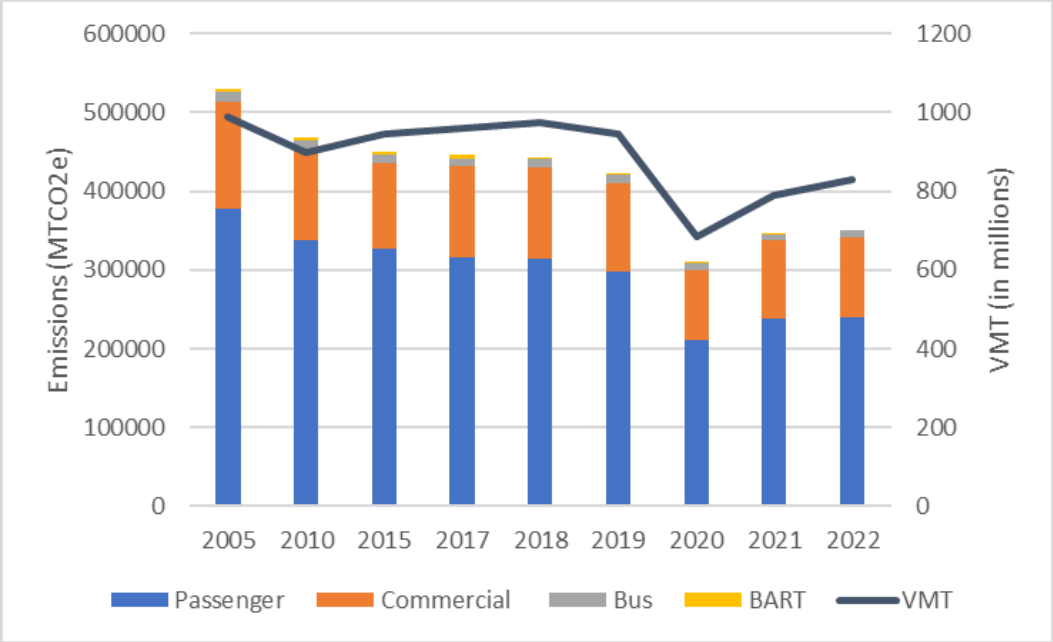
Table 5: Transportation Sector GHG Emissions

		2005	2010	2015	2019	2020	2021	2022	% Change
Passenger	GHG Emissions	377,446	338,117	326,365	298,789	211,039	238,817	239,581	-36.5%
	VMT (in millions)	892.31	816.71	865.69	861.06	617.07	717.17	737.17	-17.4%
Commercial	GHG Emissions	136,630	114,193	109,561	111,528	88,826	98,220	101,561	-25.7%
	VMT (in millions)	92.13	78.00	74.68	77.61	61.09	69.27	72.60	-21.2%
Buses*	GHG Emissions	11,801	11,990	10,722	10,131	8,757	8,833	9,154	-22.4%
	VMT (in millions)	5.58	5.48	5.43	5.64	4.83	2.51	5.19	-6.9%
BART	GHG Emissions	3,440	3,425	4,276	547	546	98	0	-100%
	Passenger Miles (in millions)	37.08	36.93	46.10	41.31	41.19 **	7.40	14.42	-61.1%
Total GHG Emissions		**529,317**	**467,725**	**450,924**	**420,995**	**309,168**	**345,967**	**350,296**	**-33.8%**
Total VMT (in millions)		**990.02**	**900.18**	**945.80**	**944.32**	**682.00**	**788.94**	**829.38**	**-16.2%**

*Buses include public (AC Transit) and private (Google EIE)

**BART passenger miles in 2020 were based off ridership from the month of February, before the COVID-19 pandemic.

Figure 5: Transportation Sector GHG Emissions (MT CO2e)



Hayward Executive Airport (HEA) Emissions

Emissions from HEA have not been accounted for in this inventory or any previous inventories. Staff is currently exploring the feasibility of incorporating HEA emissions into future annual inventories and estimating airport emissions from 2005 to establish a baseline. Based on GHG inventories from other Bay Area cities with similar-sized airports[5][6], staff expects CO2 emissions from flights to be relatively small compared to community-wide emissions. To accurately measure GHG emissions and attribute the appropriate amount to the City's emissions, staff will conduct a study with the assistance of an experienced consultant and report findings to the CSC.

Off-road Vehicles Sector

Off-road vehicles include equipment used in construction, commercial, and industrial activities. Emissions in this sector have steadily increased since 2005 by 112.8% due to increased construction and industrial change. Please note that large increases in emissions in recent years in this sector, particularly the doubling of emissions from 2021 to 2022, is due to the addition of data for some equipment categories. Notably, the addition of lawn and garden equipment to the 2022 inventory caused total off-road emissions to seemingly double from 2021 to 2022. However, comparing 2021 and 2022 emissions without the addition of lawn and garden, off-road emissions only increased by 18%. As of January 1, 2024, small gasoline-powered engines for lawn and garden equipment cannot be sold in California. It will take a few years to see reductions in this area as old equipment will continue to be used until it needs to be replaced.

[5] Palo Alto 2021 GHG inventory
[6] San Jose 2021 GHG Inventory

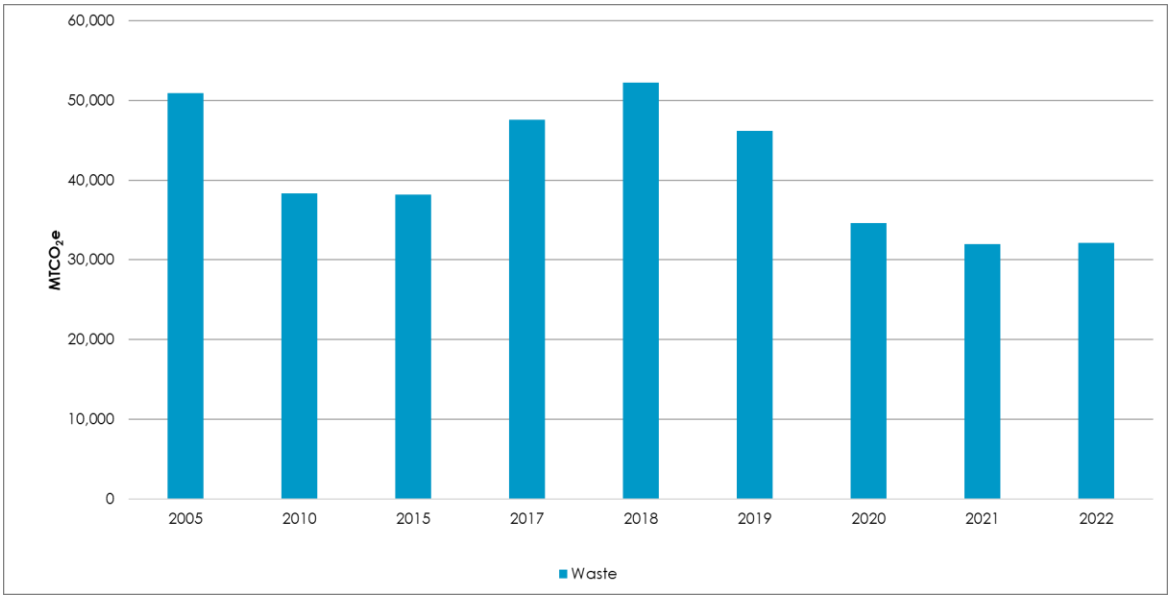
Solid Waste Sector

Solid waste emissions in 2022 were 36% below 2005 levels. After several years of increasing emissions, likely due to an increase in economic activity, emissions decreased from 2019 to 2021 and are slowly beginning to rise again (see Table 6). The decline in waste tonnage in 2020 and 2021 can be attributed to reduced economic activity during the pandemic. In early 2022, SB 1383 took effect and requires residences and businesses to sort and separately collect food scraps, yard debris, and food-soiled paper from trash and recycling, and subscribe to an organic waste collection service. It is likely too early to see the impacts of SB 1383 In this inventory, but staff expects to see reductions in the tons of waste sent to landfill and associated emissions in future inventories.

Table 6: Solid Waste Sector GHG Emissions

		2005	2015	2018	2019	2020	2021	2022	% Change
Waste Sent to Landfill	GHG Emissions	50,924	38,148	52,209	46,187	34,628	32,011	32,141	-36.9%
	Tons of waste	173,908	136,261	185,432	163,196	122,375	113,038	113,498	-34.7%

Figure 6: Solid Waste Sector GHG Emissions



Water and Wastewater Sector

Water and wastewater emissions in 2022 were 58.8% below 2005 levels. As shown in Table 7, water consumption decreased significantly from 2010 to 2015, which can be attributed to drought periods, reduced use requests from the State and the San Francisco

Public Utilities Commission, COVID-19, public awareness, and the City's water conservation programs.

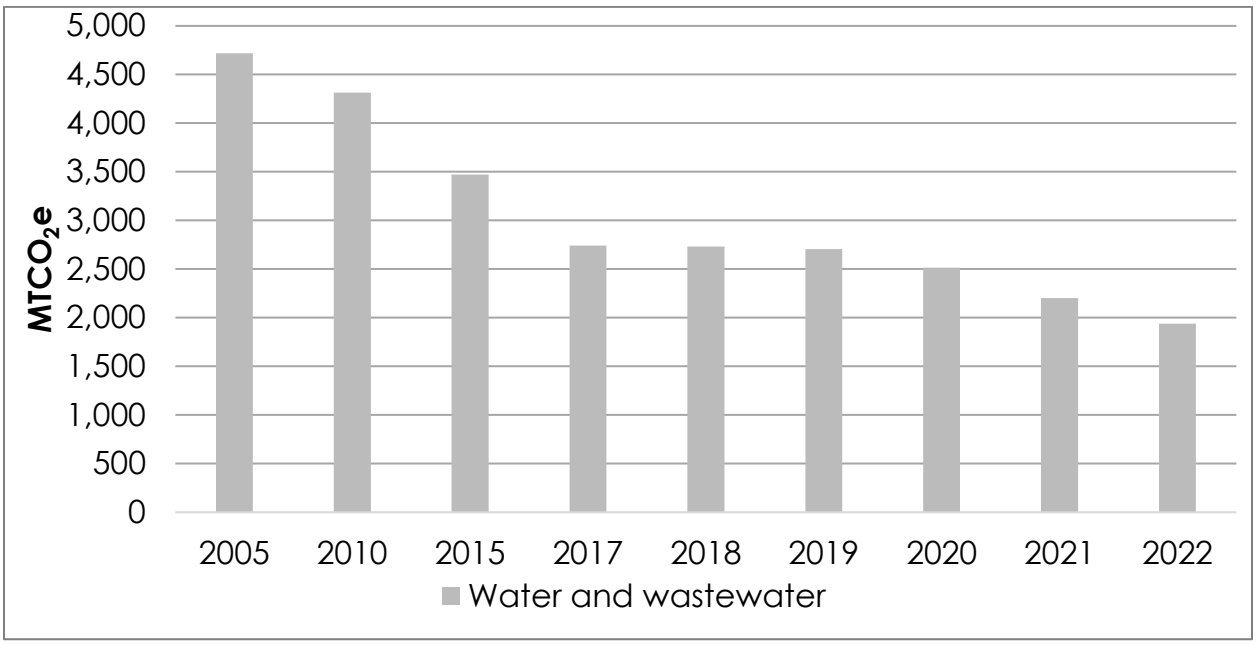
Table 7: Water and Wastewater Sector GHG Emissions

	2005	2010	2015	2019	2020	2021	2022	% Change
Water Consumption (Billions of gallons)	7.335	7.120	4.697	5.018	5.227	5.095	4.953	-32.5%
Wastewater Processed (Billions of gallons)	5.009	4.539	3.824	4.218	3.850	3.819	3.860	-23.0%
Total Emissions (MTCO2e)	**4,718**	**4,314**	**3,471**	**2,706**	**2,516**	**2,201**	**2,778.7**	**-58.9%%**
Residential Water Consumption* (Billions of gallons)	3.534	3.180	2.963	2.692	2.897	2.779	2.704[7]	-21.4%
Hayward Population	140,530	143,921	155,753	160,197	162,954	163,404	156,754	16.3%
Per Capita Residential Water Consumption (gal)/day	**69**	**61**	**52**	**46**	**48**	**47**	**47**	**-31.9%**

*2005 residential consumption water data unavailable, used 2008 data

[7] Annual Survey (bawsca.org)

Figure 7: Water and Wastewater Sector GHG Emissions



Limitations of this Inventory

The City's GHG inventory method is used by most cities worldwide and was originally designed by ICLEI and its partners in the early 2000s. The focus has always been on measuring emissions from the data sources that are most readily available, such as utility data. While this approach is practical, it comes with limitations.

Due to limited influence of the City on certain activities, inventories completed omit large sources of emissions such as upstream emissions of goods consumed in the City. For example, emission reductions from green purchasing policies would not be reflected in the current inventory. Additionally, emissions associated with the production and transport of food is one of the largest contributors of GHG emissions worldwide, but it is not reflected in Hayward's inventory.

Upstream emissions are not included because it is difficult to obtain data on consumer consumption patterns in Hayward. According to current guidance, consumption-based emissions inventory should not be a substitute for citywide inventories, but as a complement[8]. Staff will continue to monitor the newest consumption-based inventory methods and explore creating a consumption-based inventory for Hayward as data and modeling become more readily available.

The COVID-19 pandemic significantly impacted GHG emissions in 2020 and 2021. While emissions were expected to continue to rise in the years following, the 2022 inventory shows that emissions held consistent with 2021 emissions. It is likely that we are not seeing

[8] https://sustainableconsumption.usdn.org/climate/cbei-guidebook/cbei-basics

the rebound we expected due to the increased hybrid and remote work options following the pandemic.

ECONOMIC IMPACT

There is no economic impact associated with the completed inventory. However, the information acquired from the inventory provides staff with insight on what needs to be done to meet the City's GHG reduction goals. Meeting the City's ambitious GHG reduction goals will require significant investment throughout the community and has the potential to create new local jobs, however some necessary improvements are not currently cost-effective.

FISCAL IMPACT

The 2022 GHG inventory was prepared by City staff and resulted in no cost to the City beyond budgeted staff positions. In response to requests to include airport emissions in future inventories, staff will likely need to hire a consultant to accurately quantify and attribute emissions.

STRATEGIC ROADMAP

This agenda item supports the Strategic Priority of *Confront Climate Crisis & Champion Environmental Justice*. This item is not specifically related to a project identified in the Strategic Roadmap. However, this agenda item does help track progress of projects identified in the Strategic Roadmap, such as:

Project C1:	Implement Year 1 Programs from the adopted GHG Roadmap (Climate Action Plan)
Project C4:	Continue to transition City facilities from natural gas to electric, with a focus on HVAC systems
Project C5:	Work with StopWaste to promote a Circular Economy and Explore Regulation of Single Use Products
Project C7:	Reduce Carbon Emissions – transition 15% of total city fleet to EV/hybrid models
Project C10:	Plant 1,500 trees annually, directly and in partnership with community groups
Project C14:	Continue to pursue water conservation measures like increased recycled water supplies

SUSTAINABILITY FEATURES

Meeting GHG reduction goals is the primary objective of the City's Climate Action Plan. Meeting the goals will require reducing emissions in every sector and will entail improving energy efficiency in buildings, decarbonizing buildings, increasing the use of renewable

energy, and reducing vehicle-related emissions. All these actions will result in cleaner air for Hayward residents and for the region.

NEXT STEPS

Staff will continue to work with Ava, StopWaste and regional agencies to identify potential opportunities to streamline GHG inventories on a county or regional level, with the goal of maintaining annual reporting. Staff will also continue to research best practices to incorporate emissions from the Hayward Executive Airport (HEA) into future inventories.

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