DATE: September 11, 2023

TO: Council Sustainability Committee

FROM: Director of Public Works

SUBJECT 2021 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 community. This report provides the results of the calendar year 2021 inventory and compares it to the previous seven 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, in 2021, emissions were reduced by 37.4% since 2005.

Table 1: GHG Emissions by Sector (MT C02e)

	2005	2010	2015	2017	2018	2019	2020	2021	% Change from 2005
Electricity	185,536	165,172	141,814	74,919	47,452	12,467	23,038	35,844	-80.7%
Natural Gas	189,995	191,526	176,803	186,111	187,991	176,649	166,334	168,917	-11.1%
Transportation	529,317	458,988	450,925	445,769	440,914	420,995	309,168	345,905	-34.6%
Off-Road Vehicles	14,889	17,004	27,267	27,019	21,830	24,287	31,352	25,040	68.2%
Waste	50,924	38,338	38,148	47,555	52,209	46,187	34,628	32,011	-37.1%
Water and wastewater	4,718	4,314	3,471	2,742	2,730	2,706	2,516	2,201	-53.3%
Total	**975,379**	**884,079**	**838,428**	**784,115**	**753,126**	**683,291**	**567,036**	**609,918**	**-37.4%**
Hayward Population	140,530	143,921	155,753	159,623	159,603	160,197	162,954	163,404	16.3%
Total Emissions/ Capita	**6.9**	**6.1**	**5.4**	**4.9**	**4.7**	**4.3**	**3.5**	**3.8**	**-46.7%**

BACKGROUND

The last report on the City's GHG emissions, presented to the CSC on October 6, 2022,[1] showed that Hayward's emissions were reduced by 41.8% from 2005 to 2020, a temporary reduction attributed to the COVID-19 pandemic. This report presents the 2021 inventory results, which shows a 37.4% reduction. This report and previous reports are available on the City's Climate Action Plan page.[2] The City's General Plan Policy NR-2.4 sets the following GHG emissions reduction targets.

> *NR-2.4: Community GHG 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 with the 2017 inventory, the City has conducted inventories annually. All seven 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

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 surpassed its 2025 emission reduction goal of 30% below the 2005 baseline when it achieved a 41.8% emission reduction. However, the major reduction in emissions from 2019 to 2020 were attributed to the impacts of the COVID-19 pandemic on community-wide activities, and staff predicted that emissions would likely increase in 2021 as pandemic-related restrictions eased. From 2020 to 2021, community-wide emissions increased by 7%, with an overall reduction of 37.4% from the 2005 baseline. Staff predicts that emissions will continue to rise over the next few years as transportation activity increases post-pandemic.

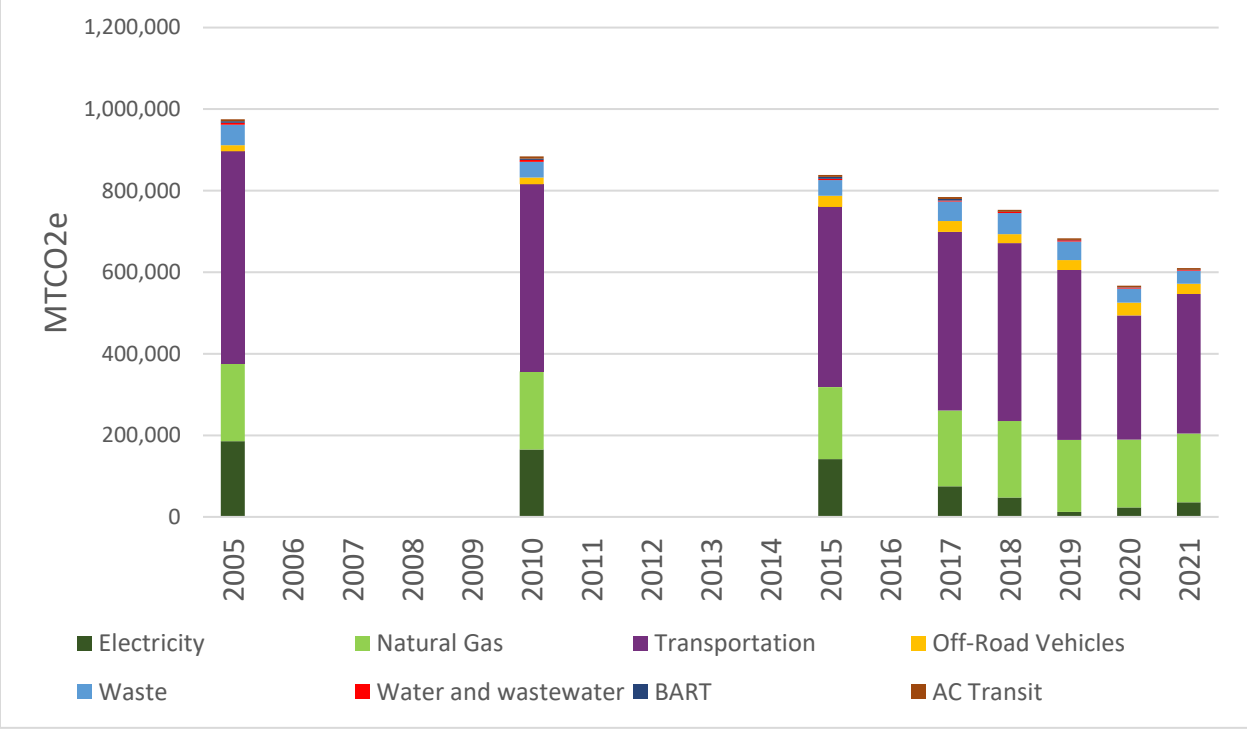
[1] https://hayward.legistar.com/MeetingDetail.aspx?ID=999218&GUID=2B77D6CD-6AFB-49FC-B7BA-7E7F414EC524&Options=info|&Search=
[2] https://www.hayward-ca.gov/services/city-services/climate-action

Table 2: GHG Emission Reduction Goals and Actual Emission Reductions

Year	Goal	Actual Reduction
2005	Baseline	
2018		21.6%
2019		25.7%
2020	20%	41.8%
2021		**37.4%**
2025	30%	
2030	55%	
2045	Carbon neutrality	

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 1 below shows the subsector breakdown for each year and the percent of each subsector for that year. Transportation, shown in purple, remains the largest sector and over the years accounts for 52-61% of the total. BART, AC Transit, and water and wastewater all account for less than 1% of all emissions, off-road vehicles account for 1-6% of emissions, and solid waste makes up 4-7% of emissions. Electricity, shown in dark green, makes up 2-19% of emissions and natural gas, shown in light green, makes up 20-30% of emissions.

Figure 1: GHG Emissions by Subsector (MT C02e[2])



Energy Sector (Electricity and Natural Gas)

Overall energy emissions in 2021 were 45.5% below 2005 levels, with an 80.7% decrease in electricity emissions and an 11.1% decrease in natural gas emissions from 2005 to 2021 (see Table 3). Residential electricity emissions have decreased by 57.5% and nonresidential electricity emissions have decreased by 90.2% since 2005. The primary reason that electricity emissions have decreased is the City's customers, starting in mid-2018, were transitioned to electricity provided by East Bay Community Energy (EBCE). As a result, electricity emissions decreased significantly from 2018 to 2019. The default product for the majority of Hayward customers has been a carbon-free electricity product (Brilliant 100 from 2018-2021, Renewable 100 from 2022 on). However, customers not on the default product have seen an increase in electricity emissions as EBCE's cheaper Bright Choice product has become increasingly dirtier. Overall, residential electricity emissions have increased 262% since 2019, despite only a 2.3% increase in kWh, and non-residential electricity emissions have increased 110%, despite a 19.7% decrease in kWh.

Residential and nonresidential natural gas emissions have decreased from 2005 to 2021, with a reduction of 9.5% and 13.1%, respectively. From 2020 to 2021, there was a 1.1% decrease in residential gas emissions. Residential natural gas emissions have continued to decrease since 2019 and may be related to the adoption of the 2019 and 2022 California Building Codes and Hayward's 2020 and 2022 reach codes, requiring some all-electric pathways in new buildings and increased energy efficiency, as well as a decrease in heating degree days (HDD) (see Figure 3 below).

Table 3: Energy Sector GHG Emissions

		2005	2010	2015	2017	2018	2019	2020	2021	% Change
Residential electricity	GHG Emissions	53,939	51,166	44,807	23,440	20,548	6,326	17,547	22,930	-57.5%
	MWh	242,161	252,327	242,783	243,910	239,735	239,006	215,828	244,416	+0.9%
Nonresidential electricity	GHG Emissions	131,597	114,006	97,007	51,479	26,904	6,140	5,491	12,914	-90.2%
	MWh	590,811	562,228	525,628	535,682	514,657	511,639	381,744	410,516	-30.5%
Residential natural gas	GHG Emissions	103,502	103,027	86,736	91,719	93,019	95,291	94,811	93,713	-9.5%
	Therms (in millons)	19.489	19.400	16.332	17.271	17.516	17.943	17.853	17.646	-9.5%
Nonresidential natural gas	GHG Emissions	86,493	88,499	90,066	94,392	94,972	81,358	71,523	75,204	-13.1%
	Therms (in millions)	16.287	16.664	16.960	17.774	17.883	15.320	13.468	14.161	-13.1%
Total GHG Emissions		**375,531**	**356,699**	**318,617**	**261,030**	**235,442**	**189,116**	**189,373**	**204,761**	**-45.5%**

Figure 2: Energy Sector GHG Emissions (MT CO2e)

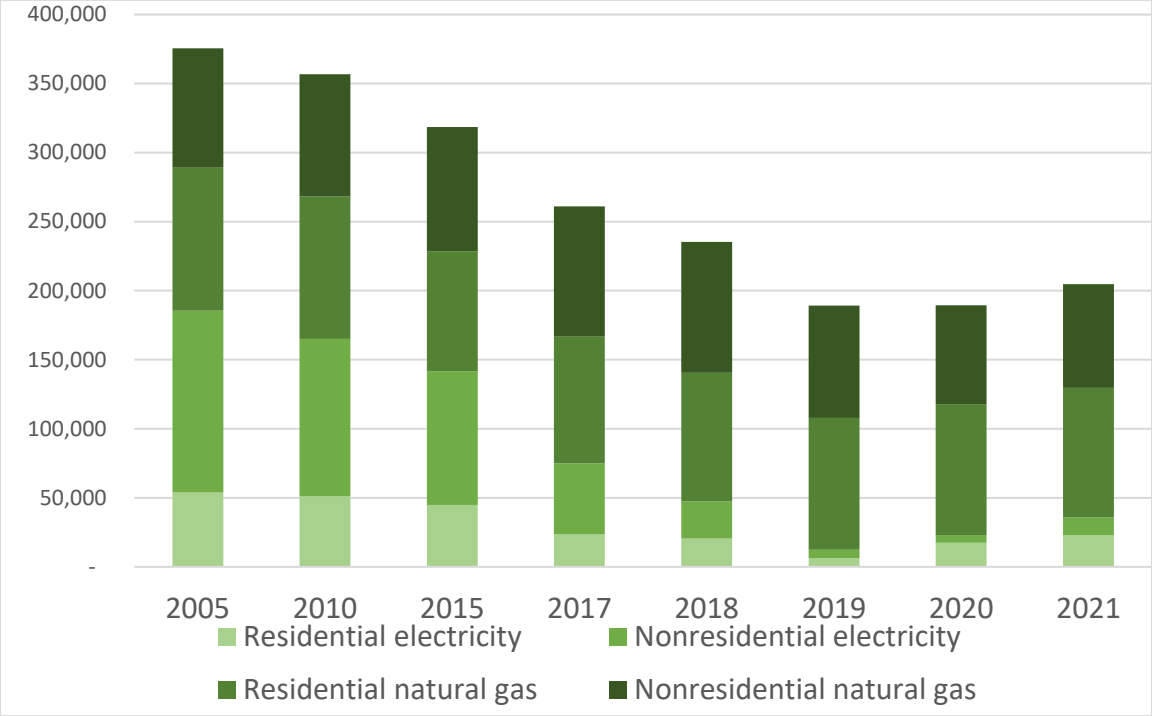
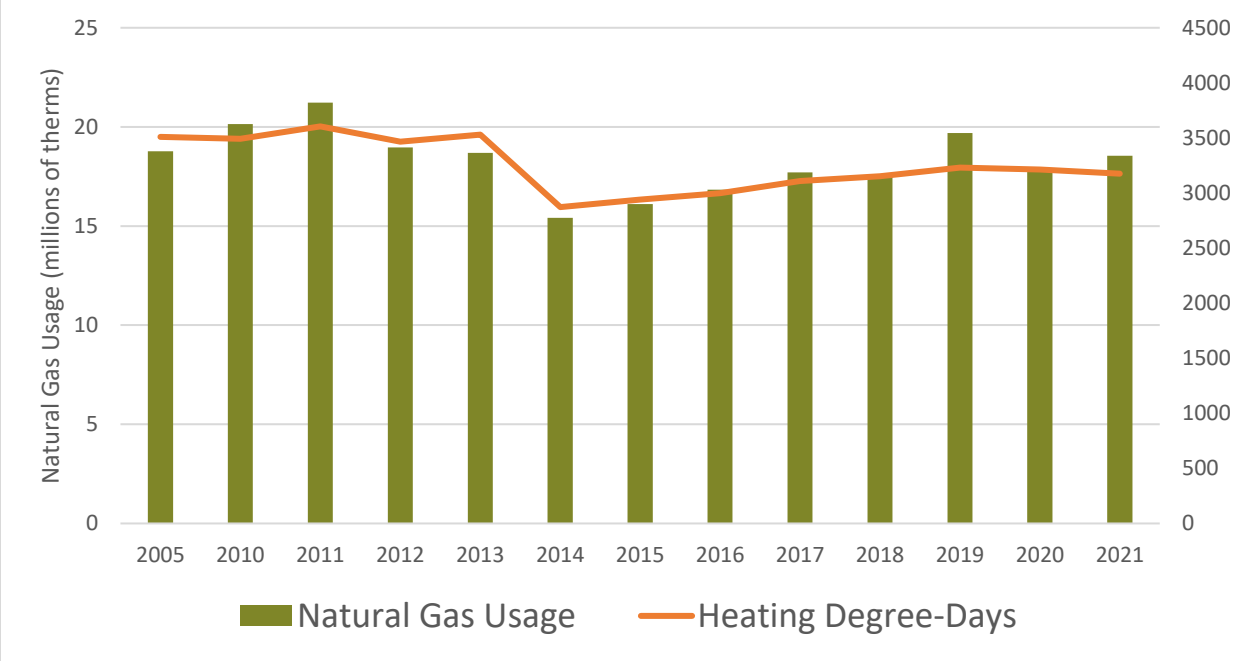


Figure 3: Residential Natural Gas Usage & Heating Degree Days in Hayward



Transportation Sector

As shown in Table 4, from 2005 to 2021 transportation emissions decreased by 34.7% and total vehicle miles traveled (VMT) decreased by 20.3%. The total VMT decreased between 2005 and 2010 and was followed by sustained increases from 2015 to 2018. This was likely related to the economic recession and recovery. From 2019 to 2020, there were significant changes in on-road transportation due to the COVID-19 pandemic, with a 31% decrease in VMT and a 41.6% decrease in total transportation emissions from 2005 levels.

As transportation patterns began to return to pre-pandemic levels in 2021, Hayward experienced an 15.5% increase in VMT and a 11.9% increase in transportation emissions from 2020 to 2021 (see Figure 4 below).

Starting in 2020, staff was able to capture the impact of the pandemic and obtain a more complete scope of transportation emissions through a new data source from Google called Environmental Insights Explorer (EIE). Previous inventories have included on-road transportation activity data from the Metropolitan Transportation Commission (MTC) which uses a model that relies on 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 within the city, and those that pass through the city.

Staff supplemented the MTC data with data from the California Air Resources Board on motorcycles, motor homes, and buses to account for the full scope of on-road transportation in Hayward. The new dataset from Google EIE accounts for all vehicle types that start or end within the city. This data is advantageous because it uses anonymized aggregated location history data from mobile devices that is a real time reflection of local changes in transportation use. Therefore, it better captures the impact of the pandemic on residents' transportation habits than the previously used transportation model. In order 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).

Overall emissions factors have decreased in all categories over the last sixteen years as vehicles have become cleaner. For example, Table 5 shows the increase in electric vehicle (EV) adoption in Hayward from 2005 to 2021, with VMT from EV's accounting for 4% of the total VMT in 2021. The decrease in emission factor value is why we have seen an overall decrease in emissions of 34.7% while seeing a smaller decrease of 20.3% in VMT. With recent legislation banning the sale of gas-powered cars beginning in 2035 and the recent push to incentivize EV purchases, it is likely this trend will continue as more people replace their cars with electric vehicles.

Table 4: Transportation Sector GHG Emissions

		2005	2010	2015	2017	2018	2019	2020	2021	% Change
Passenger	GHG Emissions	377,446	338,117	326,365	315,183	314,781	298,789	211,039	238,817	-36.7%
	VMT (in millions)	892.306	816.707	865.690	873.083	889.212	861.063	617.072	717.166	-19.6%
Commercial	GHG Emissions	136,630	114,193	109,561	115,973	114,937	111,528	88,826	98,220	-28.1%
	VMT (in millions)	92.131	78.000	74.683	80.313	79.873	77.611	61.090	69.266	-24.8%
Buses*	GHG Emissions	11,801	11,990	10,722	10,619	10,629	10,131	8,757	8,770	-25.7%
	VMT (in millions)	5.577	5.475	5.428	5.905	5.831	5.641	4.833	2.505	-55.1%
BART	GHG Emissions	3,440	3,425	4,276	3,994	566	547	546	98	-97.2%
	Passenger Miles (in millions)	37.081	36.927	46.098	43.063	42.723	41.311	41.185	7.402	-80.0%
Total GHG Emissions		**529,317**	**467,725**	**450,924**	**445,769**	**440,913**	**420,995**	**309,168**	**345,905**	**-34.7%**
Total VMT (in millions)		**990.015**	**900.184**	**945.803**	**959.302**	**974.916**	**944.316**	**682.996**	**788.938**	**-20.3%**

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*Buses include public (AC Transit) and private (Google EIE)
**Total VMT excludes BART passenger miles

Figure 4: Transportation Sector GHG Emissions (MT CO2e)

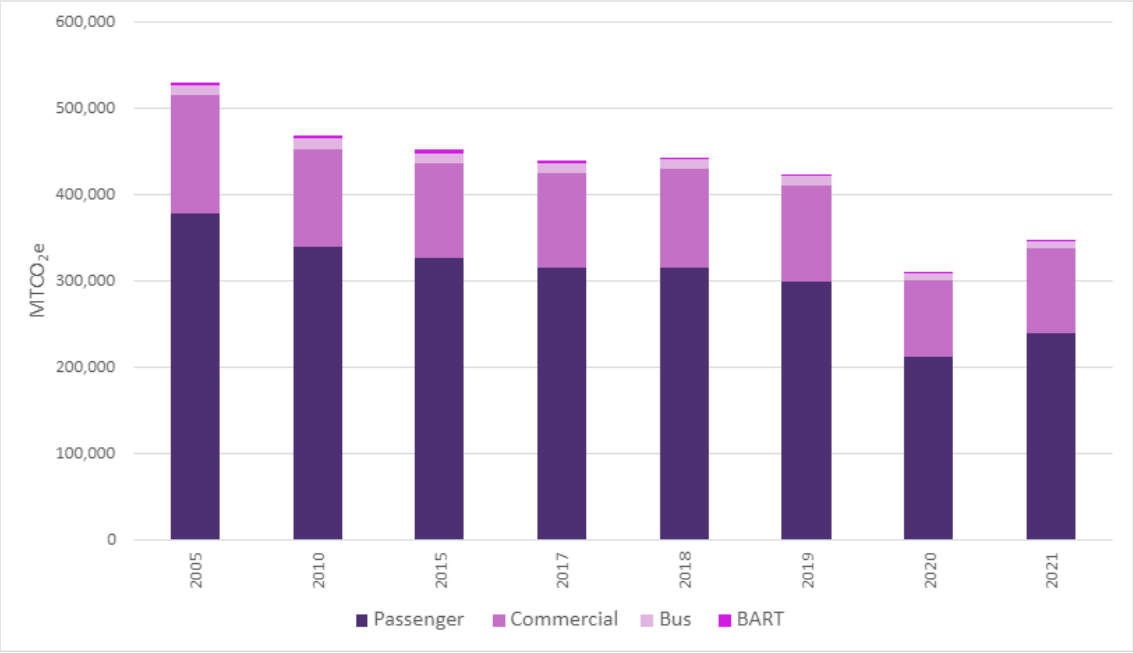


Table 5: Electric Vehicle Adoption (VMT)

	2005	2015	2018	2019	2020	2021	% Change
Electric Vehicle VMT	193,790	7,149,352	18,125,136	22,892,120	29,820,720	33,696,832	17,288%
Total VMT	990,015,264	945,803,206	974,916,441	944,316,441	682,996,441	788,938,493	-15.4%
% EV of Total	**0.02%**	**0.76%**	**1.86%**	**2.42%**	**4.37%**	**4.27%**	**21720%**

Off-road Vehicles Sector

The off-road vehicle sector includes emissions from equipment used in construction, commercial, and industrial activities. Emissions from this sector have increased by 68.2% from 2005 to 2021 as a result of increased construction and industrial activity. Note that the change in emissions is particularly large due to a lack of data for some equipment categories in 2005.

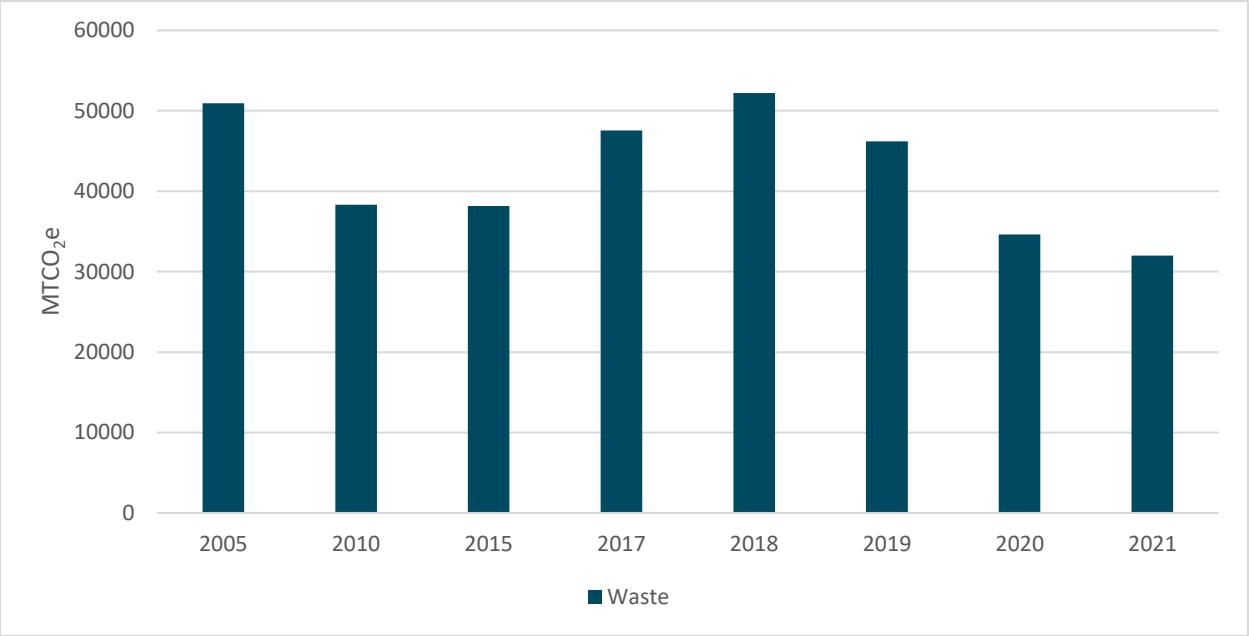
Solid Waste Sector

Solid waste emissions in 2021 were 37% below 2005 levels. As shown in Table 6, after several years of emissions increasing, which was likely due to an increase in economic activity, emissions began to decrease in 2019 and has followed the same trend through 2021. The peak in 2018 is likely due to disruptions in recycling markets caused by China's "National Sword" policies. The decline in waste tonnage starting in 2020 can be attributed to reduced economic activity during the pandemic. SB1383 went into effect early 2022, requiring 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. As a result, staff expects to see reductions in the tons of waste sent to landfill and associated emissions reductions starting with the upcoming 2022 inventory.

Table 6: Solid Waste Sector GHG Emissions

		2005	2015	2018	2019	2020	2021	% Change
Waste Sent to Landfill	GHG Emissions	50,924	38,148	52,209	46,187	34,628	32,011	-37.1%
	Tons of waste	173,908	136,261	185,432	163,196	122,375	113,038	-35.0%

Figure 5: Solid Waste Sector GHG Emissions



Water and Wastewater Sector

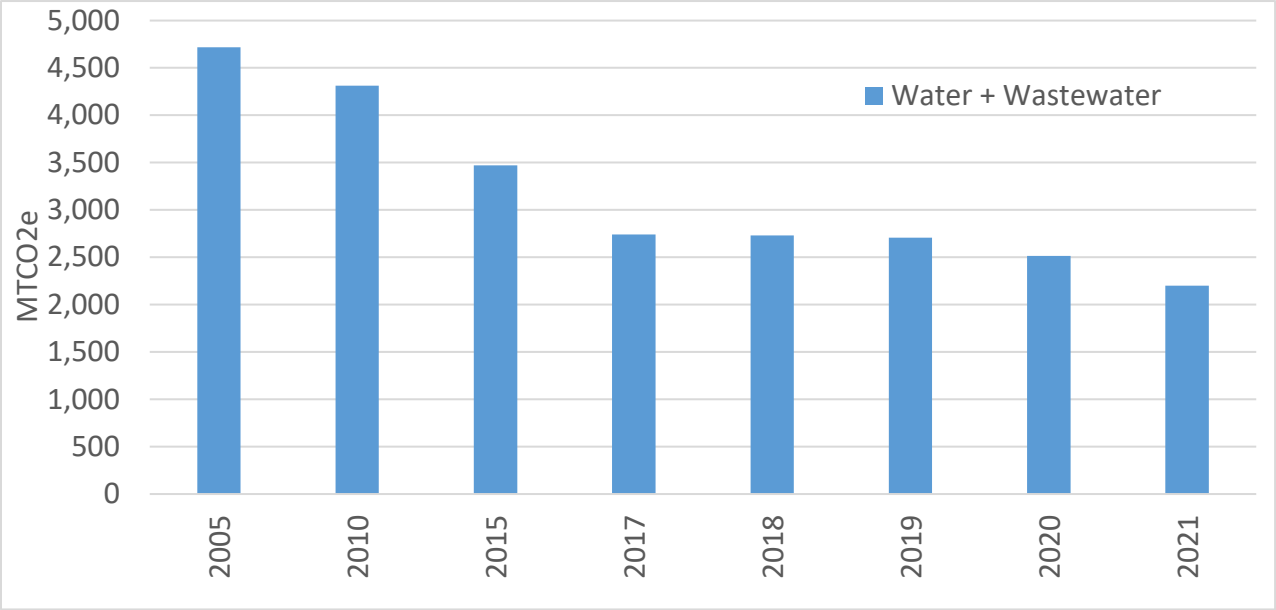
Water and wastewater emissions in 2021 were 53.3% below 2005 levels. As shown in Table 7, water consumption declined significantly from 2010 to 2015, and has hovered around 5 billion gallons per year through 2021. The total decrease in water consumption from 2005 to 2021 was 30.5%. In general, the decrease in water consumption can be attributed to drought periods, use reduction 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	2017	2018	2019	2020	2021	% Change
Water Consumption (B gal)	7.335	7.120	4.697	5.083	5.314	5.018	5.227	5.095	-30.5%
Wastewater Processed (B gal)	5.009	4.539	3.824	4.407	4.081	4.218	3.850	3.819	-23.8%
Total Emissions (MTCO2e)	**4,718**	**4,314**	**3,471**	**2,742**	**2,730**	**2,706**	**2,516**	**2,201**	**-53.3%**
Residential Water Consumption* (B gal)	3.534	3.180	2.963	2.679	2.824	2.692	2.897	2.779	-21.4%
Hayward Population	140,530	143,921	155,753	159,623	159,603	160,197	162,954	163,404	16.3%
Per Capita Residential Water Consumption (gal)/day	**69**	**61**	**52**	**46**	**48**	**46**	**48**	**47**	**-32.4%**

*2005 residential consumption water data unavailable, used 2008 data

Figure 6: Water and Wastewater Sector GHG Emissions



Limitations of this Inventory

The GHG inventory method that the City's uses, along with most cities worldwide, was originally designed by ICLEI and its partners in the early 2000s. The focus then and now is on measuring emissions from the data sources that are most readily available, such as utility data. This approach is practical, but comes with its limitations.

The inventories completed omit large sources of emissions over which the City may have some influence. Specifically, the inventory does not include the upstream emissions of the goods consumed in the City. For example, emission reductions from green purchasing policies would not be reflected in the current inventory. Additionally, one of the biggest contributors of GHG emissions worldwide, food, is not reflected in Hayward's inventory.

The reason upstream emissions are not included is that it is difficult to obtain data on consumer consumption patterns in Hayward. Current guidance states that a consumption-based emissions inventory should not be a substitute for citywide inventories, rather the two should be used together.[3] Staff will continue to monitor the latest science on consumption-based emission inventories and as data and modeling becomes more readily available, explore creating a consumption-based inventory for Hayward.

As was previously mentioned in the report, the COVID-19 pandemic had a significant impact on community-wide GHG emissions in 2020 and 2021. The emission reductions from the 2021 inventory may not be sustainable and it is possible that we continue to see a rise in emissions in the 2022 inventory as Hayward and the rest of the country return to full pre-

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

pandemic activities. With that said, the pandemic has provided insight into how impactful reducing transportation emissions can be in reaching long-term emission reduction targets.

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 2021 GHG inventory was prepared by City staff and resulted in no cost to the City beyond budgeted staff positions.

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:

Reduce Greenhouse Gases and Dependency on Fossil Fuels

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

Mitigate climate crisis impacts through resilient design and community engagement

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 EBCE, 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.

Prepared by: Nicole Grucky, Sustainability Specialist
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Recommended by: Alex Ameri, Director of Public Works

Approved by:

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Kelly McAdoo, City Manager