**DATE:** October 6, 2022

**TO:** Council Sustainability Committee

**FROM:** Director of Public Works

**SUBJECT** 2020 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 2020 inventory and compares it to the previous six inventories. Table 1 summarizes the emissions totals for the eight sectors – electricity, natural gas, transportation, public buses (AC Transit), BART, off-road vehicles, waste, and water and wastewater. Emissions are displayed in metric tons of carbon dioxide equivalent[1] (MTC02e). The table shows that, in 2020, emissions were reduced by 42.7% since 2005. In 2020, the largest reductions occurred in the transportation sector due to the stay-at-home orders and economic disruptions related to the COVID-19 pandemic.

### Table 1: GHG Emissions by Sector (MT C02e)

| | 2005 | 2010 | 2015 | 2017 | 2018 | 2019 | 2020 | % Change from 2005 |
|---|---|---|---|---|---|---|---|---|
| Electricity | 185,536 | 165,172 | 141,814 | 74,919 | 47,452 | 12,467 | 23,038 | -87.6% |
| Natural Gas | 189,995 | 191,526 | 176,803 | 186,111 | 187,991 | 176,649 | 166,334 | -12.5% |
| Transportation | 529,317 | 467,725 | 450,925 | 445,769 | 440,914 | 420,995 | 309,168 | -41.6% |
| Off-Road Vehicles | 14,889 | 17,004 | 27,267 | 27,019 | 21,830 | 24,287 | 22,924 | +54.0% |
| Waste | 50,924 | 38,338 | 38,148 | 47,555 | 52,209 | 46,187 | 34,628 | -32.0% |
| Water and wastewater | **4,715** | **4,311** | **3,466** | **2,738** | **2,726** | **2,702** | **2,516** | -46.6% |
| **Total** | **975,376** | **884,076** | **838,423** | **784,111** | **753,122** | **683,287** | **558,608** | **-42.7%** |
| Hayward Population | 140,530 | 143,921 | 155,753 | 159,623 | 159,603 | 160,197 | 162,954 | 14.1% |
| **Total Emissions/ Capita** | **7.7** | **6.9** | **6.2** | **5.7** | **5.4** | **5.1** | **4.9** | **-36.34%** |

[1] Carbon dioxide is not the only gas that contributes to climate change. Each greenhouse gas causes varying amounts of warming. For example, one ton of methane (CH4) causes the same amount of warming as 23 tons of CO2 (1 ton of CH4 = 23 tons CO2e). To simplify reporting, it is standard practice to report carbon equivalent emissions (CO2e) as opposed to the actual emissions of each gas.

## BACKGROUND

The last report on the City's GHG emissions, presented to the CSC in January 2021,[2] showed that Hayward's emissions were reduced by 25.7% from 2005 to 2019. This report presents the 2020 inventory results, which show a 42.7% reduction. This report and previous reports are available on the City's Climate Action Plan page.[3] 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 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.

## DISCUSSION

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 recalculated emissions for 2005-2019, which has included the addition of public bus emissions and a new methodology for calculating on-road transportation emissions. As a result, the emissions totals in this report do not match the numbers from previous reports. It should be noted that the impact of the COVID-19 pandemic on community-wide activities plays a significant role in the reduction in emissions from 2019 to 2020 and that an increase in emissions in 2021 is likely.

As shown below 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. As of 2020, Hayward has achieved a 42.7% reduction, surpassing the City's 2025 emission reduction goal of 30% below the 2005 baseline. ). However, it should be noted that the large reductions seen in 2020 can be primarily attributed to the stay-at-home orders and economic disruptions related to the COVID-19 pandemic. Staff has received some preliminary 2021 data and are already seeing large increases in emissions compared to 2020.

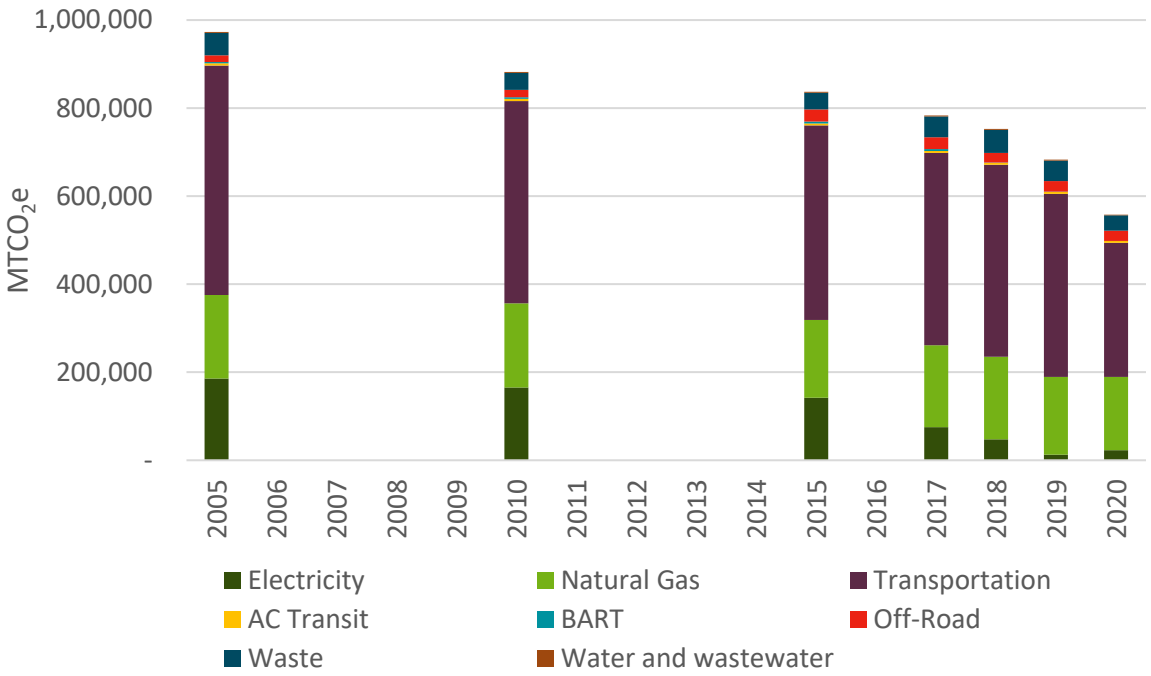
[2] https://hayward.legistar.com/LegislationDetail.aspx?ID=4747797&GUID=2B1F0C6F-B961-4AA3-9553-240ACE74B4B1&Options=&Search=
[3] https://www.hayward-ca.gov/services/city-services/climate-action

**Table 2: GHG Emission Reduction Goals and Actual Emission Reductions**

| Year | Goal | Actual Reduction |
|---|---|---|
| 2005 | Baseline | |
| 2018 | | 21.6% |
| 2019 | | 25.7% |
| 2020 | 20% | **42.7%** |
| 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 1-4% 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)[4]**




***Energy Sector (Electricity and Natural Gas)***

Overall energy emissions in 2020 were 49.6% below 2005 levels, with an 87.6% decrease in electricity emissions and a 12.5% decrease in natural gas emissions from 2005 to 2020 (see Table 3). Residential electricity emissions have decreased by 67% and nonresidential

[4] The percentages for each subsector are relative to the total emissions for each year.

electricity emissions have decreased by 96% since 2005. The primary reasons 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) and the grid having more carbon-free sources. Through the end of 2021, the default product for the majority of Hayward customers was Brilliant 100, a carbon-free product. EBCE was launched in 2018 and 2020 marked two years of Hayward customers receiving EBCE service. In January 2022, the Brilliant 100 product was discontinued, and most Hayward customers were transitioned to Renewable 100, which is 100% wind and solar power. Customers receiving income and medical-related discounts have remained on Bright Choice, EBCE's lower cost product.

From 2019 to 2020, residential electricity emissions increased while nonresidential electricity emissions decreased. The increase in residential emissions in 2020 can be attributed to a minor uptick in electricity usage (kWh) and a change in the Bright Choice product power mix. In 2019, Bright Choice was 85% carbon free (60% renewable, 25% large hydro, 13% unspecified, and 1.5% nuclear). In 2020, it was 54% carbon free (39.6% renewable, 14.5% large hydro, 44.7% unspecified, and 0.9% nuclear).

The shift in the power mix is due to a decision made by EBCE to focus on renewables rather than carbon-free content and maintain Bright Choice with a minimum of 5% more renewables than PG&E (31.7% renewable in 2019). The power mix for 2021 has not yet been released, but PG&E reported a renewable content of 36.2% for 2020, so the power content procurement floor for Bright Choice in 2021 was set to 41.2%. EBCE intends to make Bright Choice cleaner in the coming years, and in December 2020, the EBCE Board voted to establish a goal of providing 100% carbon free electricity by 2030.

Residential and nonresidential natural gas emissions have decreased from 2005 to 2020, with a reduction of 8.4% and 17.3%, respectively. From 2019 to 2020, there was a 0.5% decrease in residential natural gas. The decrease in natural gas emissions in 2020 may be related to a slight decrease in heating degree days[5] (HDD) (see Figure 3 below). With the 2019 California Building Code and Hayward's current electrification reach code in effect and the adoption of a new reach code this year, it is possible that emissions from residential natural gas will have peaked in 2019.

[5] Heating degree day is the unit which measures how many degrees, and how many days, outside air temperatures were lower than the base temperature of 65 degrees Fahrenheit.

## Table 3: Energy Sector GHG Emissions

| | | 2005 | 2010 | 2015 | 2017 | 2018 | 2019 | 2020 | % Change |
|---|---|---|---|---|---|---|---|---|---|
| Residential electricity | GHG Emissions | 53,939 | 51,166 | 44,807 | 23,440 | 20,548 | 6,326 | 17,547 | -67.5% |
| | kWh | 242,161,904 | 252,327,941 | 242,783,315 | 243,910,202 | 239,735,346 | 239,006,697 | 215,828,544 | -10.9% |
| Nonresidential electricity | GHG Emissions | 131,597 | 114,006 | 97,007 | 51,479 | 26,904 | 6,140 | 5,491 | -95.8% |
| | kWh | 590,811,842 | 562,228,183 | 525,628,036 | 535,682,182 | 514,657,102 | 511,639,672 | 381,744,082 | -35.4% |
| Residential natural gas | GHG Emissions | 103,502 | 103,027 | 86,736 | 91,719 | 93,019 | 95,291 | 94,811 | -8.4% |
| | therms | 19,489,985 | 19,400,629 | 16,332,954 | 17,271,164 | 17,516,060 | 17,943,901 | 17,853,480 | -8.4% |
| Nonresidential natural gas | GHG Emissions | 86,493 | 88,499 | 90,066 | 94,392 | 94,972 | 81,358 | 71,523 | -17.3% |
| | therms | 16,287,167 | 16,664,879 | 16,960,038 | 17,774,540 | 17,883,737 | 15,320,155 | 13,468,246 | -17.3% |
| **Total GHG Emissions** | | **375,531** | **356,699** | **318,617** | **261,030** | **235,442** | **189,116** | **189,373** | **-49.6%** |

## Figure 2: Energy Sector GHG Emissions (MT C02e)

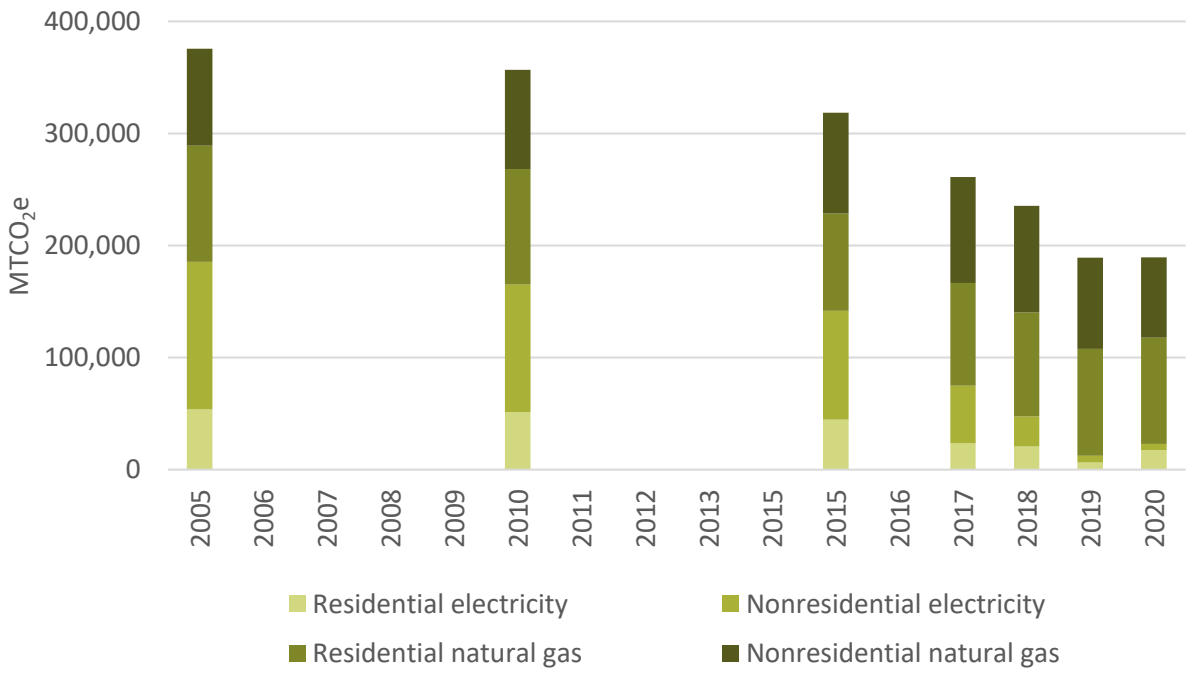
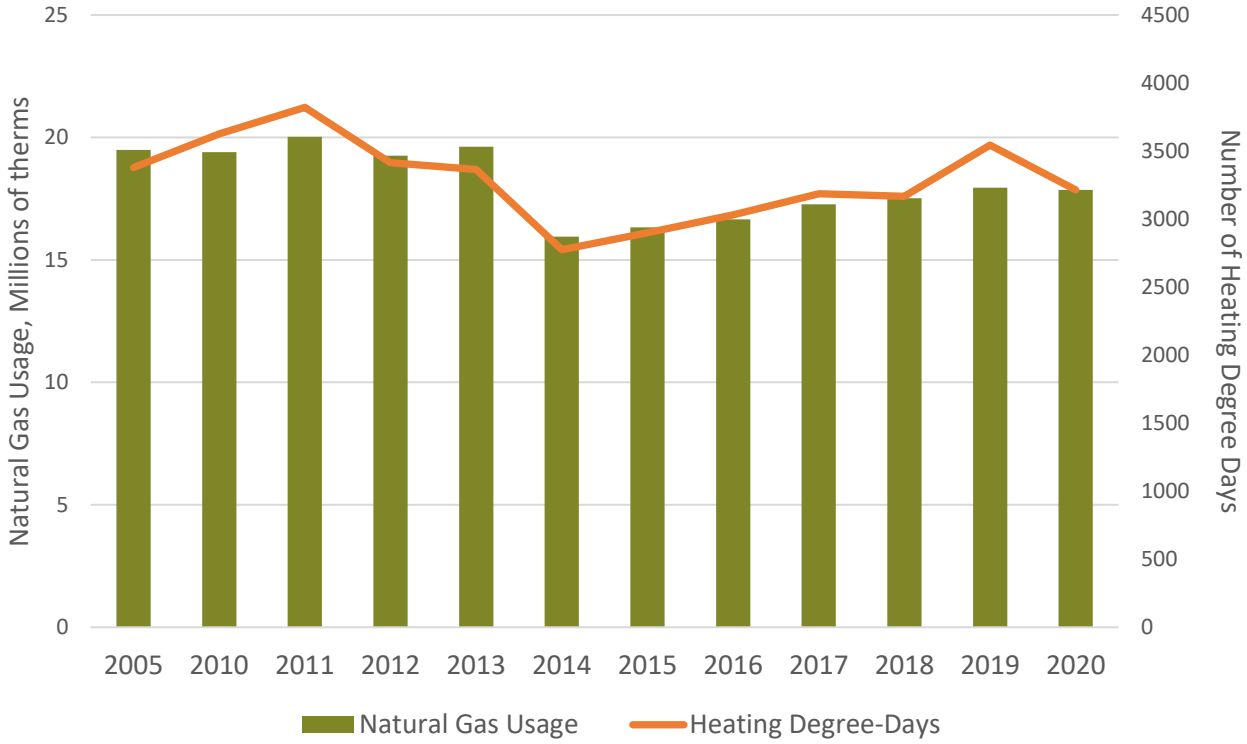


**Figure 3: Residential Natural Gas Usage & Heating Degree Days in Hayward**




***Transportation Sector***

As shown in Table 4, transportation emissions in 2020 were 41.6% below emissions in 2005. Also reflected in the table below, the total vehicle miles traveled (VMT) decreased in 2010, followed by an increase in 2015, 2017, and 2018. This is likely related to the economic recession and recovery.

From 2019 to 2020, there was a significant change in on-road transportation because of the COVID-19 pandemic. During this time, Hayward experienced a 28% decrease in VMT and a 27% decrease in emissions (see Figure 4 below). As transportation patterns begin to return to pre-pandemic levels, Hayward should experience an increase in VMT and emissions. For example, preliminary data from 2021 shows a 22% increase in emissions from 2020.

Staff was able to capture the impact of the pandemic 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 transportation 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 only pass through. 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 and aggregated location history data 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. Staff re-calculated transportation emissions in

inventory years that were not available from Google EIE (2005-2017) to make an apples-to-apples comparison to the 2005 baseline.

Overall emissions factors have decreased in all categories over the last fifteen years as vehicles have become cleaner. For example, Table 5 shows the increase in electric vehicle (EV) adoption in Hayward from 2005 to 2020, with VMT from EVs accounting for 4.4% of the total VMT in 2020. The decrease in emission factor value is why we have seen an overall decrease in emissions of 41.6%, while seeing a smaller decrease of 31% in VMT.

**Table 4: Transportation Sector GHG Emissions**

| | | 2005 | 2010 | 2015 | 2017 | 2018 | 2019 | 2020 | % Change |
|---|---|---|---|---|---|---|---|---|---|
| Passenger | GHG Emissions | 377,446 | 338,117 | 326,365 | 315,183 | 314,781 | 298,789 | 211,039 | -44.1% |
| | VMT | 892,306,860 | 816,707,906 | 865,690,372 | 873,083,596 | 889,212,170 | 861,063,825 | 617,072,288 | -30.8% |
| Commercial | GHG Emissions | 136,630 | 114,193 | 109,561 | 115,973 | 114,937 | 111,528 | 88,826 | -35.0% |
| | VMT | 92,131,008 | 78,000,821 | 74,683,974 | 80,313,371 | 79,873,038 | 77,611,421 | 61,090,968 | -33.7% |
| Buses* | GHG Emissions | 11,801 | 11,990 | 10,722 | 10,619 | 10,629 | 10,131 | 8,757 | -25.8% |
| | VMT | 5,577,396 | 5,475,994 | 5,428,860 | 5,905,211 | 5,831,233 | 5,641,195 | 4,833,186 | -13.3% |
| BART | GHG Emissions | 3,440 | 3,425 | 4,276 | 3,994 | 566 | 547 | 546 | -84.1% |
| | Passenger Miles | 37,081,195 | 36,927,142 | 46,098,239 | 43,063,231 | 42,723,729 | 41,311,182 | 41,185,416 | 11.1% |
| **Total GHG Emissions** | | **529,317** | **467,725** | **450,924** | **445,769** | **440,913** | **420,995** | **309,168** | **-41.6%** |
| **Total VMT** | | **990,015,264** | **900,184,721** | **945,803,206** | **959,302,178** | **974,916,441** | **944,316,441** | **682,996,441** | **-31.0%** |

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

**Figure 4: Transportation Sector GHG Emissions (MT CO2e)**

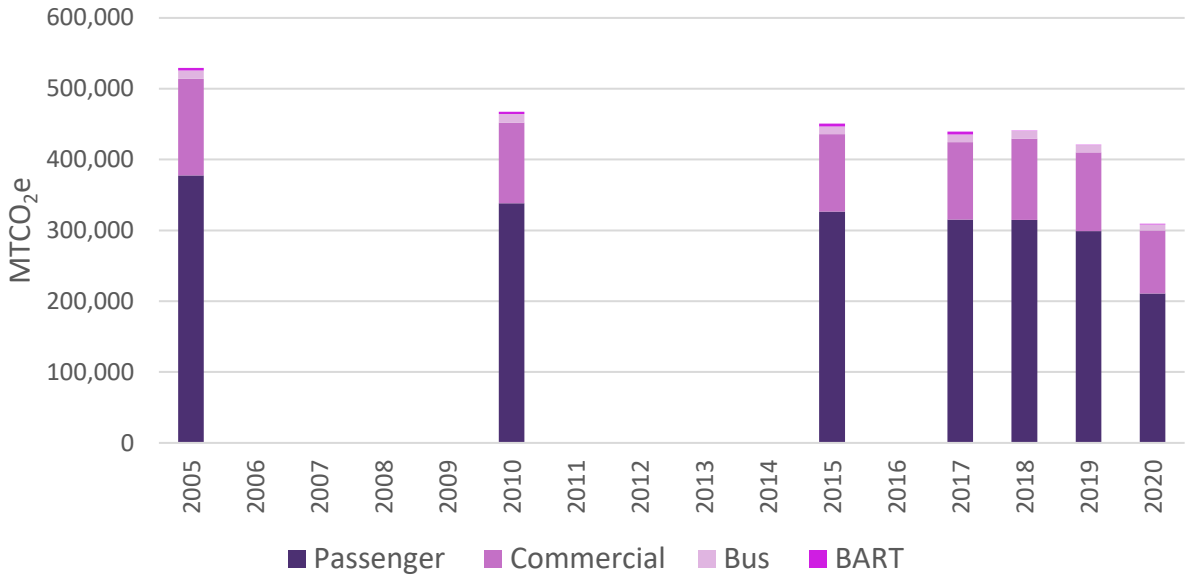



**Table 5: Electric Vehicle Adoption (VMT)**

| | 2005 | 2010 | 2015 | 2017 | 2018 | 2019 | 2020 | % Change |
|---|---|---|---|---|---|---|---|---|
| Electric Vehicle VMT | 193,790 | 294,521 | 7,149,352 | 12,840,434 | 18,125,136 | 22,892,120 | 29,820,720 | 15,288% |
| Total VMT | 990,015,264 | 900,184,721 | 945,803,206 | 959,302,178 | 974,916,441 | 944,316,441 | 682,996,441 | -31% |
| **% EV of Total** | **0.02%** | **0.03%** | **0.76%** | **1.34%** | **1.86%** | **2.42%** | **4.37%** | **22,205%** |

## ***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 54% from 2005 to 2020 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***

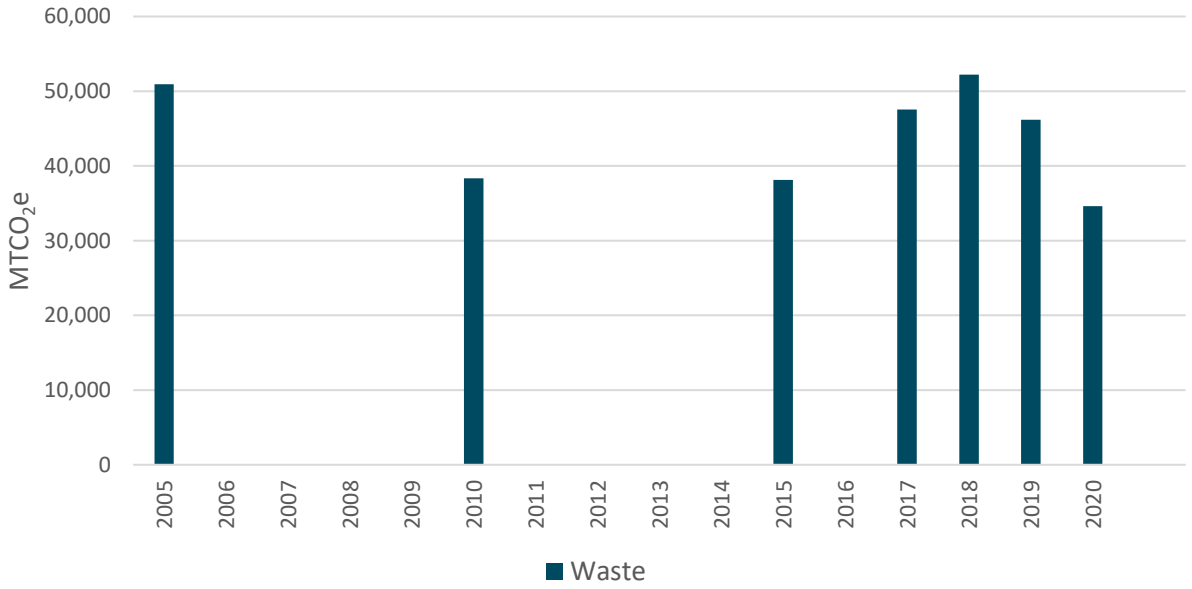
Solid waste emissions in 2020 were 32% below 2005 levels. As shown in Table 7, after several years of emissions increasing, which was likely due to an increase in economic activity, emissions decreased in 2019 and continued following the same trend in 2020. The peak in 2018 is likely due to disruptions in recycling markets caused by China's "National Sword" policies. The recent decline in waste tonnage can be attributed to reduced economic activity during the pandemic and efforts by Hayward staff to teach residents and businesses to sort waste properly and compost food scraps. As the economy recovers from the pandemic, waste tonnage is expected to increase. This year, SB1383 went into effect, 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. Staff expects that the outreach associated with SB1383 will somewhat mitigate any increases in the tons of waste sent to landfill and associated emissions.

**Table 7: Solid Waste Sector GHG Emissions**

| | | 2005 | 2010 | 2015 | 2017 | 2018 | 2019 | 2020 | % Change* |
|---|---|---|---|---|---|---|---|---|---|
| Waste Sent to Landfill | GHG Emissions | 50,924 | 38,338 | 38,148 | 47,555 | 52,209 | 46,187 | 34,628 | -32.0% |
| | Tons of waste | 173,908 | 130,806 | 136,261 | 167,434 | 185,432 | 163,196 | 122,375 | -29.6% |

**Figure 5: Solid Waste Sector GHG Emissions**




***Water and Wastewater Sector***

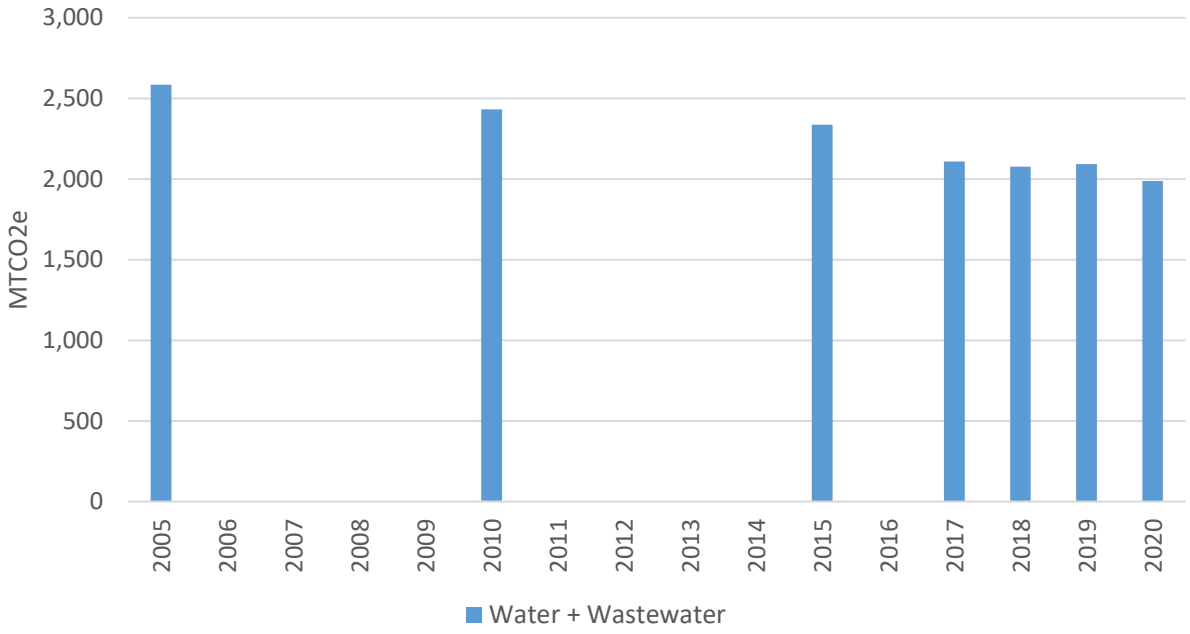
Water and wastewater emissions in 2020 were 46% below 2005 levels. As shown in Table 8, water consumption declined significantly from 2010 – 2015 and then fluctuated around 50 million gallons per year for the next 4 inventory years. The total decrease in water consumption from 2005 to 2020 was 28.7%. 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 conservation projects and programs offered by the City.

**Table 8: Water and Wastewater Sector GHG Emissions**

| | 2005 | 2010 | 2015 | 2017 | 2018 | 2019 | 2020 | % Change |
|---|---|---|---|---|---|---|---|---|
| Water Consumption (mg) | 7,335 | 7,120 | 4,697 | 5,083 | 5,314 | 5,018 | 5,227 | -28.7% |
| Wastewater Processed (mg ) | 5,010 | 4,540 | 3,825 | 4,407 | 4,081 | 4,219 | 3,851 | -23.1% |
| **Total Emissions (MTCO2e)** | **4,715** | **4,311** | **3,466** | **2,738** | **2,726** | **2,702** | **2,516** | **-46.64%** |
| Residential Water Consumption (mg) | | 3,181 | 2,964 | 2,680 | 2,825 | 2,693 | 2,898 | -8.90% |
| Hayward Population | 140,530 | 143,921 | 155,753 | 159,623 | 159,603 | 160,197 | 162,954 | 15.9% |
| **Per Capita Residential Water Consumption (gal) per day** | | **61** | **52** | **46** | **48** | **46** | **49** | **-24.28%** |

mg = million gallons

**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 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 it comes with 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. Also, one of the biggest contributors to 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 specifically for Hayward. However, some attempts are being made. In 2016, the Bay Area Air Quality Management District (BAAQMD) launched a project with UC Berkeley to create consumption-based inventories[6] for Bay Area cities.[7] Staff has concerns with the data sources used for this project, but feels that the intent is meaningful.

**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 2020 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:

Project C5: Adopt & implement 2030 GHG Goal & Roadmap along with other General Plan Elements

Project C7: Plant 1,000 trees annually

Project C8: Transition 15% of total city fleet to EV/hybrid models

Project C9: Work with EBCE to transition citywide electricity use to 100% carbon free

Project C10: Explore feasibility of banning natural gas in non-residential (commercial) buildings (for next code update)

**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

[6] http://www.baaqmd.gov/about-air-quality/research-and-data/emission-inventory/consumption-based-ghg-emissions-inventory
[7] The City's current inventory is a hybrid of consumption and production. For example, energy consumed by residents is consumption-based and energy consumed by industry is production-based. The State of California performs a true production-based inventory, measuring all emissions produced in California from all sectors, including agriculture.

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
Erik Pearson, Environmental Services Manager

Recommended by: Alex Ameri, Director of Public Works

Approved by:

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Kelly McAdoo, City Manager