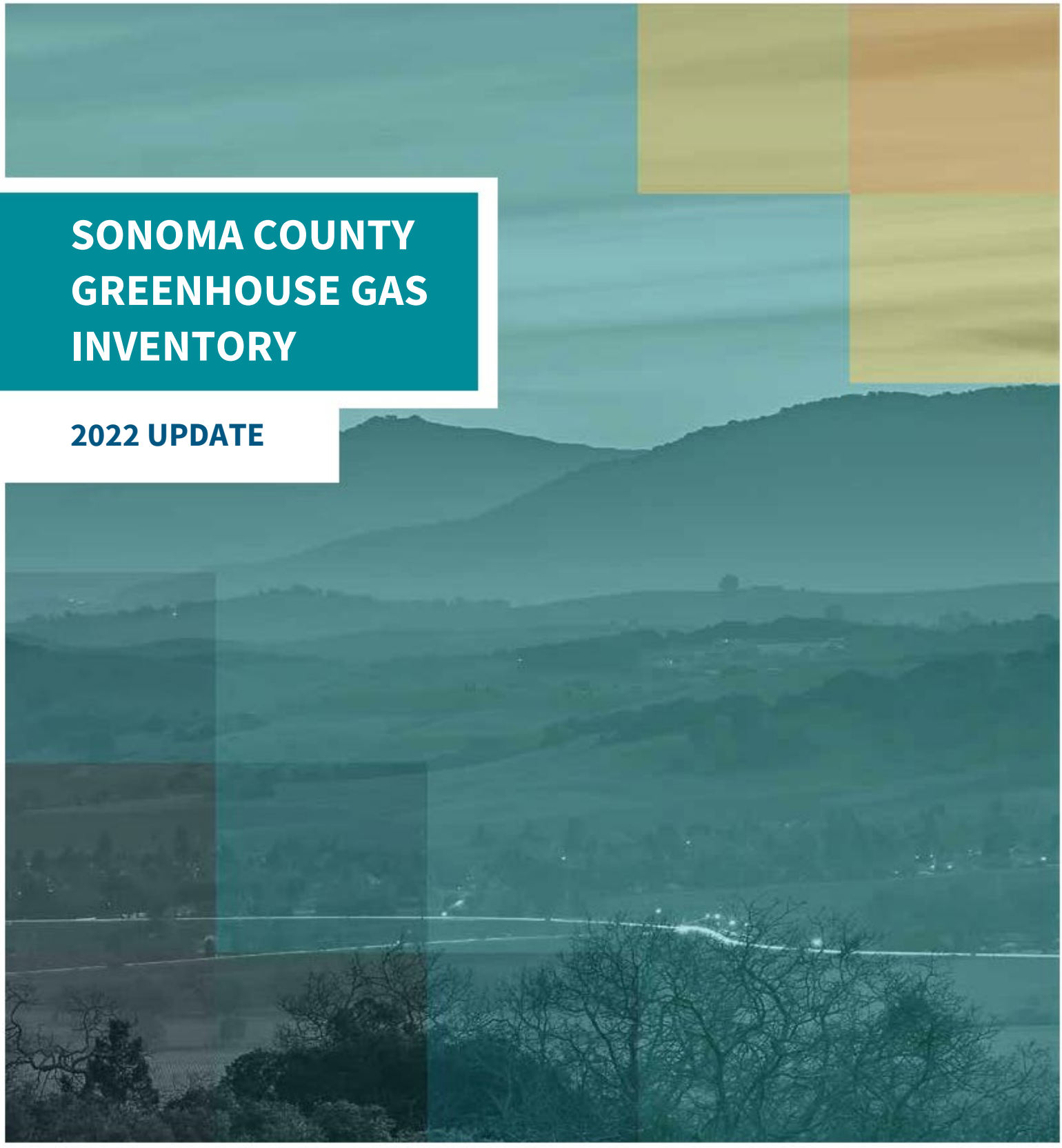
SONOMA COUNTY GREENHOUSE GAS INVENTORY

2022 UPDATE



JULY 8, 2024

rcpa
REGIONAL CLIMATE PROTECTION AUTHORITY

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CREDITS AND ACKNOWLEDGEMENTS

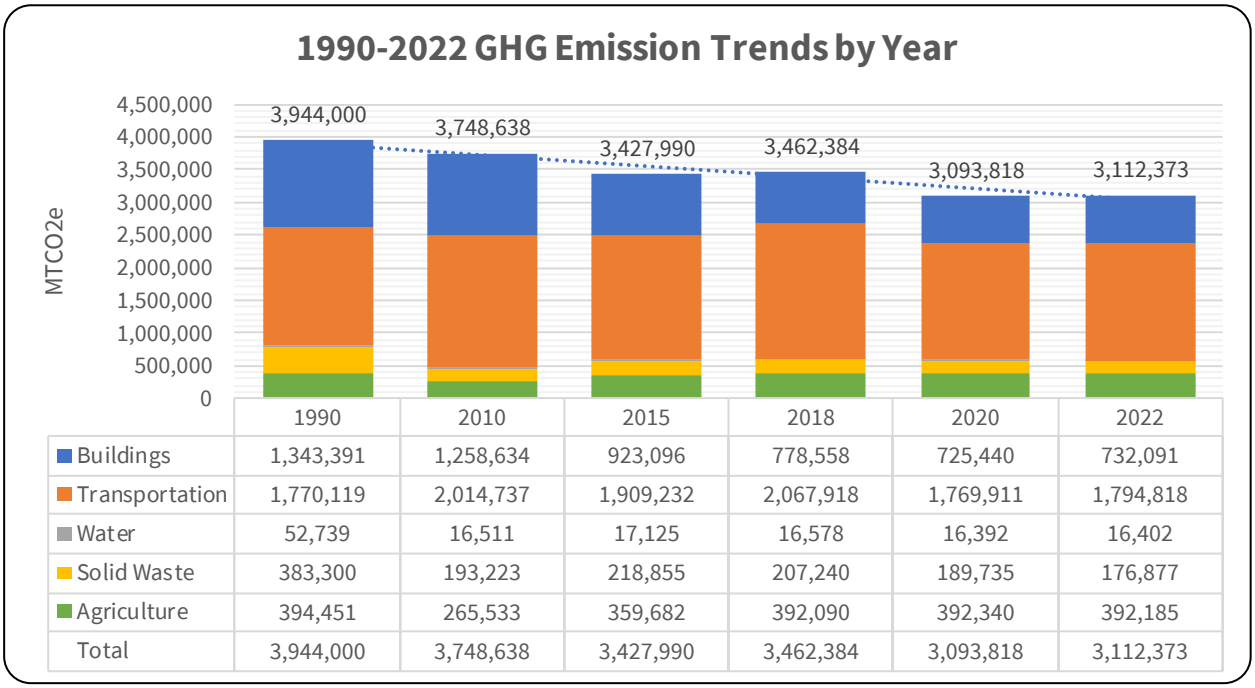
This document is prepared by the Sonoma County Regional Climate Protection Authority (RCPA).

RCPA thanks its jurisdictional member and agency partners for providing the data and information needed to develop this Countywide Greenhouse Gas Inventory Update.

ACRONYMS AND ABBREVIATIONS

- BayREN..... Bay Area Regional Energy Network
- CA2020..... Climate Action 2020 and Beyond
- CARB..... California Air Resources Board
- CH4 ..... methane
- CO2 ..... carbon dioxide
- CO2e ..... carbon dioxide equivalent
- EV..... electric vehicle
- GDP..... gross domestic product
- GHG ..... greenhouse gas
- GRP ..... Global Reporting Protocol
- ICLEI..... International Council for Local Environmental Initiatives
- IPCC ..... Intergovernmental Panel on Climate Change
- LGO..... Local Government Operations Protocol
- MMTCO2e ..... million metric tons of carbon dioxide equivalent
- MTCO2e ..... metric tons of carbon dioxide equivalent
- N2O..... nitrous oxide
- PG&E..... Pacific Gas & Electric Company
- RCPA..... Regional Climate Protection Authority
- SCP ..... Sonoma Clean Power
- SCTA ..... Sonoma County Transportation Authority
- VMT..... vehicle miles traveled
- WRI ..... World Resources Institute

EXECUTIVE SUMMARY



	1990	2010	2015	2018	2020	2022
Buildings	1,343,391	1,258,634	923,096	778,558	725,440	732,091
Transportation	1,770,119	2,014,737	1,909,232	2,067,918	1,769,911	1,794,818
Water	52,739	16,511	17,125	16,578	16,392	16,402
Solid Waste	383,300	193,223	218,855	207,240	189,735	176,877
Agriculture	394,451	265,533	359,682	392,090	392,340	392,185
Total	3,944,000	3,748,638	3,427,990	3,462,384	3,093,818	3,112,373

Sonoma County is committed to measuring, tracking, and reporting our greenhouse gas (GHG) emissions to communicate progress and focus our emission-reduction activities on reaching carbon neutrality. While our ambitious goals consider the critical role that both regional and State entities play, this inventory reflects the emissions sources that can be reduced through the actions of local governments and countywide entities.

To this end, the Sonoma County Regional Climate Protection Authority (RCPA) established a baseline community-wide inventory for 2010 and a backcast inventory for 1990 as part of the Climate Action 2020 and Beyond[1] (CA2020) development process. Since then, the inventory has been updated at approximately two-year intervals--with new data added for 2015, 2018, 2020, and 2022.

RCPA completed this 2022 inventory update to help track progress toward achieving our short and long-term emissions reduction goals. With the adoption of the Sonoma Climate Mobilization Strategy in March 2021, RCPA set a new goal for Sonoma County to achieve carbon neutrality by 2030. This is even more ambitious than the previous goal of reaching 40 percent below 1990 levels by 2030 and will take significant effort.

Sonoma County emissions in 2022 were 3.11 million metric tons of CO2e (MTCO2e), which is over a 10 percent reduction from 2018 emissions of 3.46 million MTCO2e, but a slight 0.6 percent increase from 2020 emissions of 3.09 million MTCO2e. RCPA believes this small increase is because 2020 emissions were artificially low due to the impacts of the COVID-19 pandemic and the extended economic shutdown. Therefore, 2022 emissions should be viewed not as an increase from 2020 levels, but as a continued decrease from 1990-2018 levels, with 2020 being an outlier year that produced artificially low emission levels.

[1] Climate Action 2020 and Beyond Document Library, https://rcpa.ca.gov/library/#toggle-id-13

1990-2022 Emission Totals by Sector (MTCO2e)						
Sector	**1990**	**2010**	**2015**	**2018**	**2020**	**2022**
Buildings	1,343,391	1,258,634	923,096	778,558	725,440	732,091
Transportation	1,770,119	2,014,737	1,909,232	2,067,918	1,769,911	1,794,818
Water	52,739	16,511	17,125	16,578	16,392	16,402
Solid Waste	383,300	193,223	218,855	207,240	189,735	176,877
Agriculture	394,451	265,533	359,682	392,090	392,340	392,185
Total	**3,944,000**	**3,748,638**	**3,427,990**	**3,462,384**	**3,093,818**	**3,112,373**

1990-2022 Emission Percent Share by Sector (%)						
Sector	**1990**	**2010**	**2015**	**2018**	**2020**	**2022**
Buildings	34.06%	33.58%	26.93%	22.49%	23.45%	23.52%
Transportation	44.88%	53.75%	55.70%	59.73%	57.21%	57.67%
Water	1.34%	0.44%	0.50%	0.48%	0.53%	0.53%
Solid Waste	9.72%	5.15%	6.38%	5.99%	6.13%	5.68%
Agriculture	10.00%	7.08%	10.49%	11.32%	12.68%	12.60%
Total	**100.00%**	**100.00%**	**100.00%**	**100.00%**	**100.00%**	**100.00%**

1990-2022 Emission Percent Change from 1990 by Sector (%)						
Sector	**1990**	**2010**	**2015**	**2018**	**2020**	**2022**
Buildings	0.00%	-6.31%	-31.29%	-42.05%	-46.00%	-45.50%
Transportation	0.00%	13.82%	7.86%	16.82%	-0.01%	1.40%
Water	0.00%	-68.69%	-67.53%	-68.57%	-68.92%	-68.90%
Solid Waste	0.00%	-49.59%	-42.90%	-45.93%	-50.50%	-53.85%
Agriculture	0.00%	-32.68%	-8.81%	-0.60%	-0.54%	-0.57%
Total	**0.00%**	**-4.95%**	**-13.08%**	**-12.21%**	**-21.56%**	**-21.09%**

1990-2022 Emission Percent Change from Previous Inventory Year by Sector (MTCO2e)						
Sector	**1990**	**2010**	**2015**	**2018**	**2020**	**2022**
Buildings	0.00%	-6.31%	-26.66%	-15.66%	-6.82%	0.92%
Transportation	0.00%	13.82%	-5.24%	8.31%	-14.41%	1.41%
Water	0.00%	-68.69%	3.72%	-3.19%	-1.12%	0.06%
Solid Waste	0.00%	-49.59%	13.27%	-5.31%	-8.45%	-6.78%
Agriculture	0.00%	-32.68%	35.46%	9.01%	0.06%	-0.04%
Total	**0.00%**	**-4.95%**	**-8.55%**	**1.00%**	**-10.64%**	**0.60%**

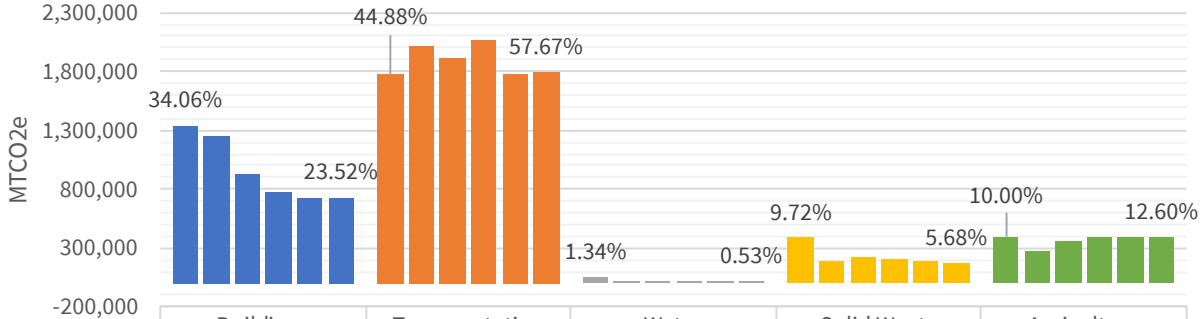
Since the last inventory update, the countywide population declined by over 1.7 percent[2], but gross domestic product (GDP) rose by 6.3 percent.[3] This increase in GDP is another indicator of the economic rebound and return to business-as-usual following the end of the pandemic that was so impactful to 2020 calculations.

This update shows that Sonoma County has made solid progress toward countywide emissions reduction goals, but we are still far from the finish line. To achieve carbon neutrality as soon as possible, local jurisdictions and countywide agencies must continue to prioritize sustainable development practices and collaborate with stakeholders at all levels to implement comprehensive strategies that reduce emissions.

[2] U.S Census Bureau American Community Survey, https://www.census.gov/programs-surveys/acs/

[3] U.S. Bureau of Economic Analysis, https://www.bea.gov/data/gdp/gdp-county-metro-and-other-areas

KEY FINDINGS



	Buildings	Transportation	Water	Solid Waste	Agriculture
1990	1,343,391	1,770,119	52,739	383,300	394,451
2010	1,258,634	2,014,737	16,511	193,223	265,533
2015	923,096	1,909,232	17,125	218,855	359,682
2018	778,558	2,067,918	16,578	207,240	392,090
2020	725,440	1,769,911	16,392	189,735	392,340
2022	732,091	1,794,818	16,402	176,877	392,185

Sonoma County greenhouse gas emissions have decreased over 20 percent from 1990. This is attributable to several key factors described throughout this report and in the findings below. Sonoma County emissions in 2022 were 3.11 million metric tons of CO2e (MTCO2e), which is over a 10 percent reduction from 2018 emissions of 3.46 million MTCO2e, but a slight 0.6 percent increase from 2020 emissions of 3.09 million MTCO2e. As stated above, the 2020 inventory was artificially low due to the impacts of the COVID-19 pandemic and the extended economic slowdown. Therefore, 2022 emissions should be viewed not as an increase from 2020 levels, but as a continued decrease from 1990-2018 levels, with 2020 being an outlier year that produced artificially low emission levels.

Emissions from energy used in buildings decreased 45.5 percent between 1990 and 2022, exceeding the short-term CA2020 goal of 27 percent by 2020. This reduction is primarily attributed to Sonoma Clean Power, created in 2014 to provide cleaner electricity to Sonoma County households and businesses. As our electricity supply has grown cleaner, emissions from natural gas have become a more significant percentage of total emissions. The next phase of our decarbonization plan is focused on phasing out natural gas for space heating, water heating, and cooking to continue reducing emissions in the building energy sector.

Transportation continues to be the largest source of emissions for the county. Nearly 58 percent of total countywide emissions were from transportation in 2022. As the COVID-19 pandemic has subsided and travel patterns have returned to more recognizable pre-pandemic levels, transportation emissions have risen slightly. However, these emissions will continue to rise at a lower rate than vehicle miles traveled (VMT) due to improvements in fuel efficiency and a shift from fossil fuel vehicles to hybrid and electric vehicles. RCPA will continue to work closely with the Sonoma County Transportation Authority (SCTA) and local jurisdictions on strategies to reduce VMT and accelerate the shift to electric vehicles.

Emissions from waste sent to landfills decreased 6.8 percent between 2020 and 2022, or 53.9 percent between 1990 and 2022. Local jurisdictional efforts to comply with new state waste reduction laws over the past few years have contributed to the decrease in emissions. Due to recent state legislation, almost all businesses in the county producing over four cubic yards of waste per week have access to a blue and green bin for recycling and composting. Between the newly adopted requirements and better local access to waste-related resources, these efforts significantly reduce overall solid waste and waste-related emissions.

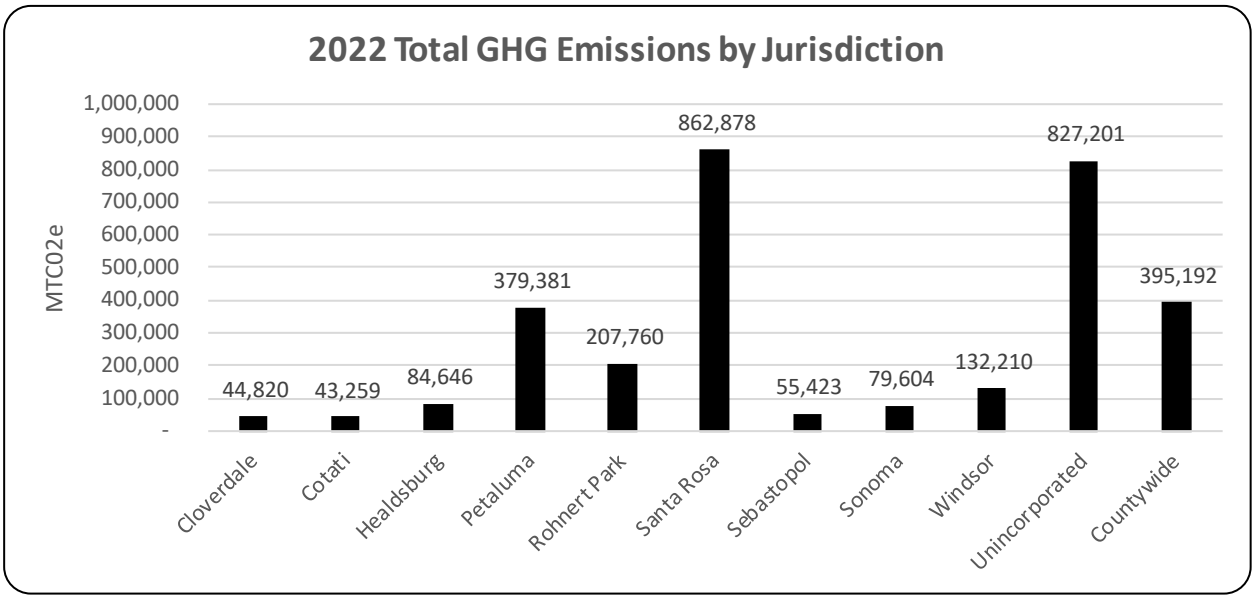
The results of the 2022 inventory update show that Sonoma County reduced emissions 21.1 percent below 1990 levels. However, more ambitious actions are needed to meet RCPA's reduction goal of carbon neutrality by 2030. Sonoma County's goal aligns with the scientific imperative to significantly reduce emissions in this decade to avoid reaching a tipping point beyond which the effects of climate change become increasingly uncontrollable. As this report shows, Sonoma County has made great progress but still has far to go to meet our climate goals.

As outlined in the original Climate Action 2020 effort, Sonoma County's regional approach to reducing GHG emissions recognizes the challenge's shared nature and that each community has a different capacity to achieve emission reductions. Additionally, statewide policies and programs to reduce GHG emissions related to building energy and transportation play a critical role.

This 2022 inventory report is an essential milestone in our work to reduce countywide emissions. RCPA will use the results from the 2022 GHG Inventory Update to inform the implementation of the Sonoma Climate Mobilization Strategy and work with its member and partner agencies to develop new climate policies and programs to achieve reductions at the speed and scale needed to respond to the climate crisis.

Sonoma County Regional Climate Protection Authority (RCPA): Formed in 2009 to coordinate countywide climate protection efforts among Sonoma County's nine incorporated jurisdictions and multiple countywide agencies, RCPA has three main areas of focus: decarbonization, carbon sequestration, and resilience. In September 2019, RCPA adopted a resolution declaring a climate emergency and began work on the Sonoma Climate Mobilization Strategy. Over the next 18 months, each jurisdiction in Sonoma County adopted a similar resolution declaring a local climate emergency, while RCPA completed the Climate Mobilization Strategy to guide countywide efforts. https://rcpa.ca.gov/

2022 SONOMA COUNTY EMISSIONS PROFILE

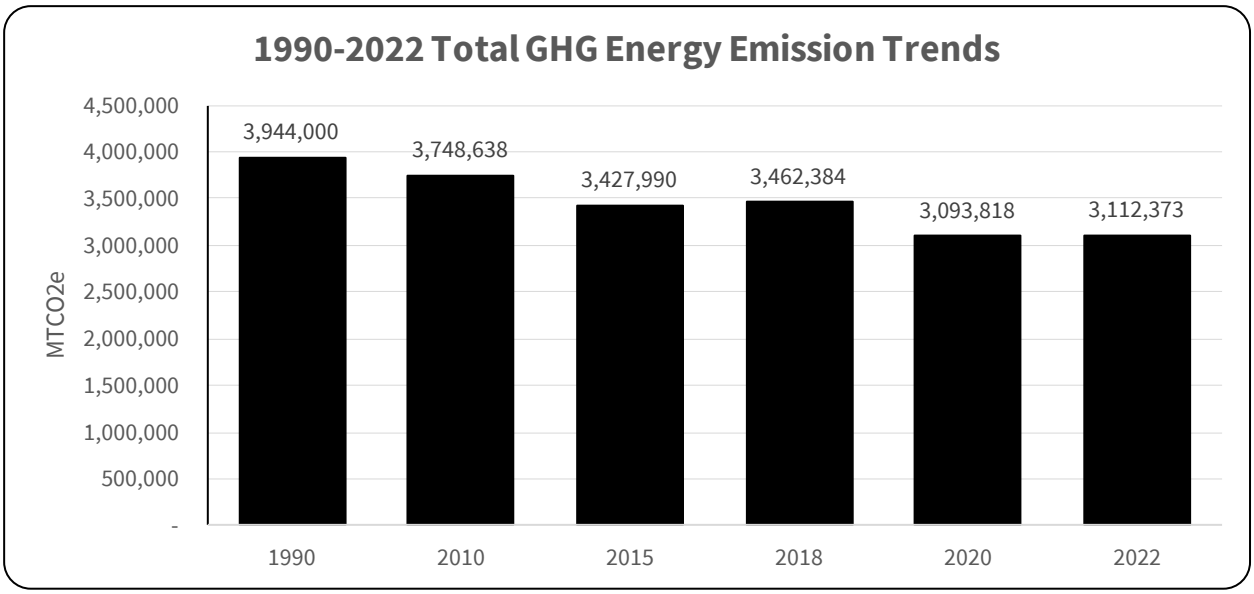


Greenhouse Gas Emission Totals by Jurisdiction (MTCO2e)						
Jurisdiction	**Total**	**Building Energy**	**Transportation**	**Water-Related**	**Solid Waste**	**Agricultural**
Cloverdale	44,820	9,408	32,022	135	3,255	-
Cotati	43,259	10,327	30,106	81	2,744	-
Healdsburg	84,646	32,672	47,759	112	4,103	-
Petaluma	379,381	104,911	252,289	553	21,628	-
Rohnert Park	207,760	46,379	145,016	304	16,061	-
Santa Rosa	862,878	271,327	524,919	2,183	64,449	-
Sebastopol	55,423	14,638	38,015	49	2,721	-
Sonoma	79,604	23,245	52,281	192	3,886	-
Windsor	132,210	37,246	85,045	391	9,528	-
Unincorporated	827,201	181,937	584,360	12,402	48,503	-
Countywide	395,192	-	3,006	-	-	392,185
Total	**3,112,373**	**732,091**	**1,794,818**	**16,402**	**176,877**	**392,185**

The countywide greenhouse gas (GHG) inventories for Sonoma County capture the primary sources of emissions that can be reduced through the actions of local governments and regional entities: energy use in our homes, businesses, and vehicles; emissions from treating and delivering water; emissions from materials that are thrown away; and fertilizer and livestock operations. This approach is known as an "activity-based" inventory. It involves measuring or modeling the primary emissions-generating activities in Sonoma County and translating them into GHG emissions based on standardized or locally specific emissions factors.[4]

The analysis of emissions includes carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O). All three gases are expressed as metric tons of carbon dioxide equivalent ($MTCO_2e$), based on the global warming potential of these gases relative to CO_2.

[4] U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions, https://icleiusa.org/us-community-protocol/

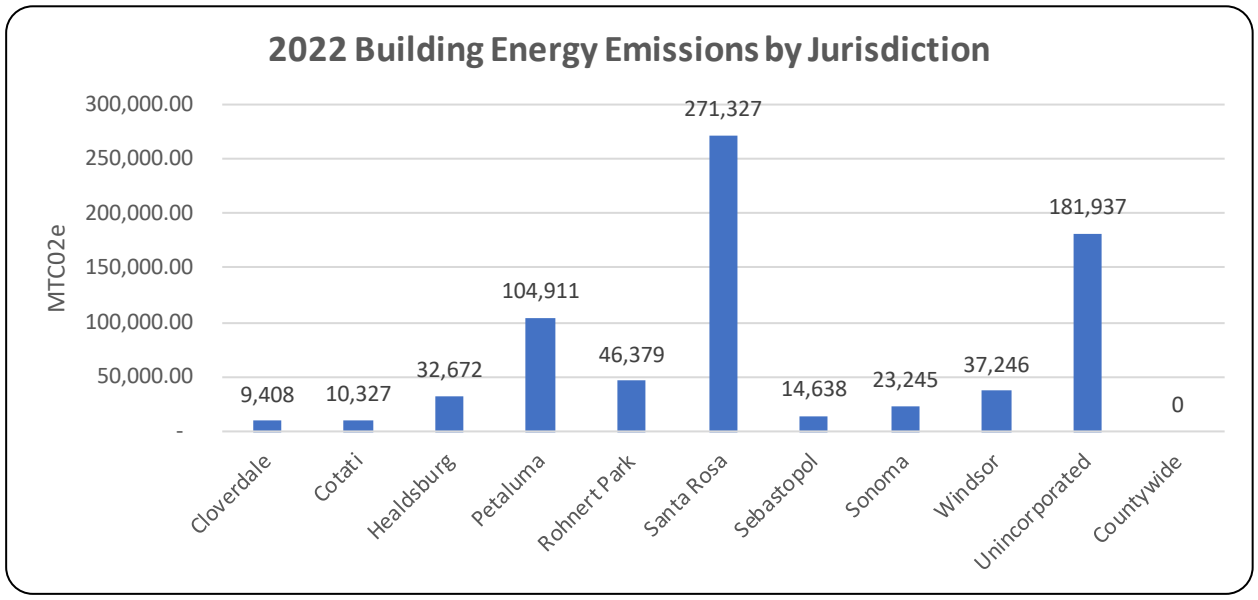


GHG Emission Trends by Jurisdiction (MTCO2e)						
Jurisdiction	**1990**	**2010**	**2015**	**2018**	**2020**	**2022**
Cloverdale	56,504	60,150	59,903	61,762	44,482	44,820
Cotati	52,501	48,622	48,852	51,871	42,300	43,259
Healdsburg	92,550	108,608	98,897	94,769	85,073	84,646
Petaluma	387,816	448,542	476,065	474,103	374,500	379,381
Rohnert Park	292,001	264,198	243,974	246,582	202,896	207,760
Santa Rosa	1,162,469	1,094,105	960,315	883,759	853,876	862,878
Sebastopol	73,350	69,276	63,610	64,115	54,464	55,423
Sonoma	97,009	100,469	100,129	95,453	76,565	79,604
Windsor	133,223	162,099	136,393	148,273	130,998	132,210
Unincorporated	1,202,125	1,127,036	880,169	947,628	835,232	827,201
Countywide	394,451	265,533	359,682	394,070	393,432	395,192
Total	**3,944,000**	**3,748,638**	**3,427,990**	**3,462,384**	**3,093,818**	**3,112,373**

While RCPA analyzes a vast amount of data for this effort, several sets of emissions are not accounted for in this activity-based inventory. These intentional omissions include the consumption of goods and services imported into Sonoma County and air travel. Based on data from a 2015 study by the Cool Climate Network[5], Sonoma County's total consumption-based emissions in 2015 were 7.2 million MT CO2e — significantly higher than the approximately 3.11 million MT CO2e activity-based emissions reported for 2022. There is some overlap in emissions accounted for in the two types of inventories. For example, the emissions from fossil fuels used to power our transportation and building sectors are included in both inventories. RCPA will share updated data on consumption-based emissions when available.

[5] Cool Climate Network, https://coolclimate.berkeley.edu/index

BUILDING ENERGY

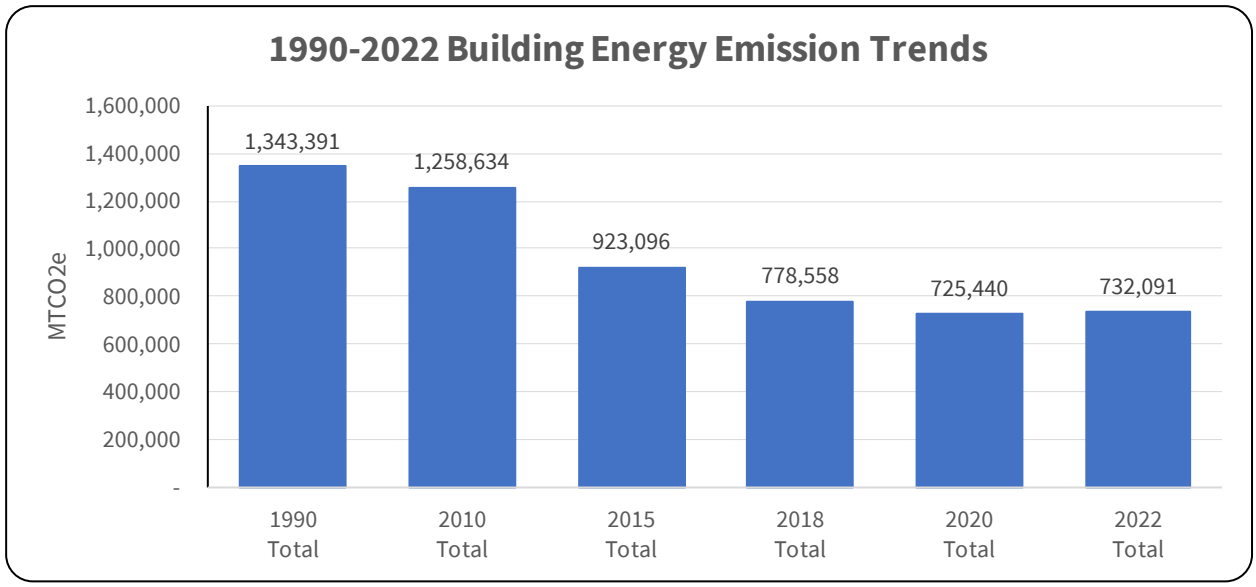


Building Energy Emission Totals by Jurisdiction (MTCO2e)

Jurisdiction	Total	Electricity	Natural Gas	Stationary Sources
Cloverdale	9,408.46	1,673.93	6,965.64	768.88
Cotati	10,327.21	1,439.09	8,187.40	700.71
Healdsburg	32,672.39	13,262.30	18,390.50	1,019.59
Petaluma	104,910.81	14,368.82	85,275.09	5,266.91
Rohnert Park	46,379.15	8,702.65	33,803.32	3,873.18
Santa Rosa	271,327.28	35,370.56	220,676.89	15,279.83
Sebastopol	14,637.59	1,685.34	12,170.23	782.02
Sonoma	23,245.45	2,622.03	19,469.08	1,154.34
Windsor	37,245.72	4,565.52	30,583.27	2,096.93
Unincorporated	181,936.61	40,240.39	129,742.86	11,953.36
Countywide	-	-	-	-
Total	**732,090.67**	**123,930.62**	**565,264.29**	**42,895.76**

Countywide emissions from energy used in buildings decreased over 45 percent from 1990 to 2022, although emissions in this sector rose just slightly from 2020. In 2022, Sonoma Clean Power provided approximately 76 percent of the total electricity used by Sonoma County residents, PG&E provide approximately 21 percent, and Healdsburg Electric--an independent utility operated by the City of Healdsburg--provided 3 percent.

As the electricity fuel mix for each of these utilities becomes cleaner over time, Sonoma County will continue to see emissions reductions in the electricity sub-sector. One opportunity to further reduce emissions is to increase the percentage of local customers choosing to voluntarily adopt 100% renewable service plans, such as Sonoma Clean Power's Evergreen rate plan, PG&E's Green Saver plan, or Healdsburg Electric's Green Rate. The extra cost of these more renewable energy products allows each utility to fund additional emission reduction strategies to further reduce emissions of their entire portfolio.



Building Energy Emission Trends by Jurisdiction (MTCO2e)						
Jurisdiction	**1990**	**2010**	**2015**	**2018**	**2020**	**2022**
Cloverdale	12,993.56	19,334.64	12,469.43	9,977.42	9,485.75	9,408.46
Cotati	14,764.55	13,636.93	11,372.86	10,683.01	9,870.18	10,327.21
Healdsburg	20,367.62	34,759.11	33,521.30	32,495.14	33,664.10	32,672.39
Petaluma	135,521.13	170,622.79	135,276.59	116,316.15	104,019.12	104,910.81
Rohnert Park	85,602.93	89,347.26	62,425.03	45,624.83	43,221.41	46,379.15
Santa Rosa	523,142.94	453,379.22	338,997.56	291,746.78	268,199.59	271,327.28
Sebastopol	21,956.92	19,468.14	17,655.07	16,279.85	14,608.78	14,637.59
Sonoma	31,871.04	36,426.23	27,660.00	23,812.11	21,862.20	23,245.45
Windsor	34,827.14	60,176.90	34,261.76	38,960.92	36,820.57	37,245.72
Unincorporated	462,343.31	361,483.00	249,456.66	192,661.52	183,688.22	181,936.61
Countywide	-	-	-	-	-	-
Total	**1,343,391.14**	**1,258,634.23**	**923,096.25**	**778,557.73**	**725,439.93**	**732,090.67**

Another critical step is transitioning from natural gas appliances for space heating, water heating, and cooking to all electric appliances. Emissions from natural gas have become the predominant source of emissions in the building energy sector as our emissions from electricity have declined due to cleaner sources. Additionally, the pipelines that deliver natural gas to our homes leak methane, a greenhouse gas 84 times more potent than CO_2 over the first 10 years of release[6]Finally, cooking with natural gas can increase indoor air pollution, which has been shown to have numerous adverse health impacts.[7]

[6] Methane: The other important greenhouse gas, https://www.edf.org/climate/methane-crucial-opportunity-climate-fight

[7] Gas Stoves: Health and Air Quality Impacts and Solutions, https://rmi.org/insight/gas-stoves-pollution-health

In pursuit of lower emissions, the Sonoma Climate Mobilization Strategy includes two strategies designed to address these opportunities and achieve the necessary emission reductions in this sector:

- All-Electric Buildings Campaign – accelerate the electrification of existing buildings and electrify all new buildings
- Carbon-Free Electricity – accelerate the transition to 100 percent carbon-free electricity

SUCCESSES AND SOLUTIONS

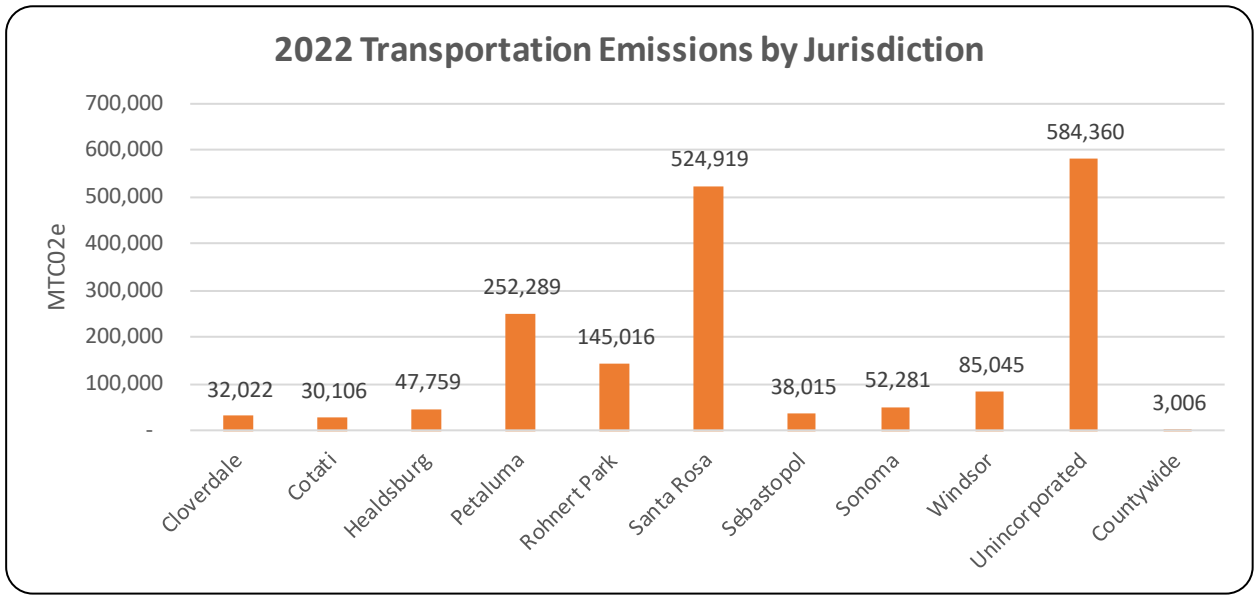
Sonoma Clean Power (SCP): The significant reduction in emissions from electricity consumption is a key result from the 2014 inception of Sonoma Clean Power – a community choice energy provider which offers Sonoma County communities the option of purchasing lower-carbon and zero-carbon electricity delivered through PG&E power lines. SCP also offers multiple programs to encourage local residents and businesses to upgrade their buildings to be more energy efficient. Many of these programs are spotlighted at SCP's Customer Center in Santa Rosa. https://sonomacleanpower.org/

Bay Area Regional Energy Network (BayREN): Led by the Association of Bay Area Governments (ABAG), BayREN is a regional collaborative that serves the Bay Area's nine counties with outreach, training, technical assistance, funding, and resources to make the Bay Area and California a greener, more resilient, more equitable and more energy efficient place to live. BayREN administers 10 programs to support local government efforts to reduce greenhouse gas emissions, including technical assistance and incentive programs for single-family residential homeowners, multifamily residential property owners, commercial businesses, and public government buildings. https://www.bayren.org/

METHODOLOGY NOTES

Power Source Disclosure (PSD) Reports: The electricity emissions for this inventory are calculated using the GHG emissions values (MTCO2e per MWh) reported to the State by the electric providers in Sonoma County in their Power Source Disclosure reports. This approach is used due to its straightforward calculation that leverages officially reported metrics. However, the Power Source Disclosure (PSD) report also has its limitations in capturing true GHG emissions required to provide electric service 24/7/365. For example, natural gas plants may have served the electric generation needed to provide electricity at a specific moment in time, but if a low- or no-carbon resource is later over-generated or over-purchased, then this omits the natural gas emissions within the PSD report. Therefore, the PSD provides an annualized accounting of emissions, but does not necessarily reflect the actual generation sources and GHG emissions associated with providing reliable electric service. https://www.energy.ca.gov/programs-and-topics/programs/power-source-disclosure-program

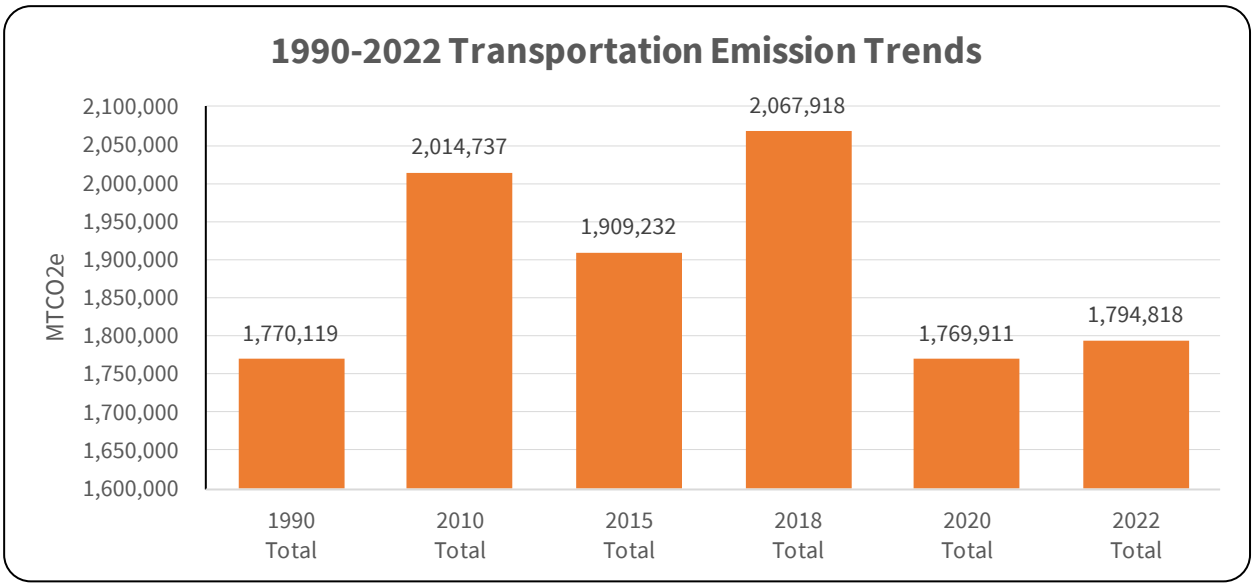
TRANSPORTATION



Transportation Emission Totals by Jurisdiction (MTCO2e)				
Jurisdiction	**Total**	**On-Road**	**Off-Road**	**Railway**
Cloverdale	32,022	30,236	1,786	-
Cotati	30,106	28,493	1,613	-
Healdsburg	47,759	45,289	2,470	-
Petaluma	252,289	240,028	12,261	-
Rohnert Park	145,016	135,637	9,379	-
Santa Rosa	524,919	488,853	36,066	-
Sebastopol	38,015	36,483	1,531	-
Sonoma	52,281	50,190	2,091	-
Windsor	85,045	79,609	5,436	-
Unincorporated	584,360	469,461	114,899	-
Countywide	3,006	-	-	3,006
Total	**1,794,818**	**1,604,280**	**187,532**	**3,006**

The transportation sector accounts for approximately 1.8 million MT CO_2e, or 57.7 percent of 2022 emissions, and is the largest source of emissions for the County. This sector includes emissions from on-road driving, off-road equipment, and diesel used for passenger rail service in Sonoma County. Countywide emissions from the transportation sector have increased 1.4 percent from 1990, showing how imperative efforts are to transition to zero-emission vehicles and reduce the total vehicle miles travelled by local residents.

On the positive side, RCPA expects that on-road transportation emissions will continue to rise at a lower rate than vehicle miles traveled due to improvements in fuel efficiency and as the shift from fossil fuel vehicles to hybrid and electric vehicles becomes even more widespread. The State of California's recently announced requirement for 100 percent zero-emission vehicle sales by 2035 is a major step in this direction.



Transportation Emission Trends by Jurisdiction (MTCO2e)						
Jurisdiction	**1990**	**2010**	**2015**	**2018**	**2020**	**2022**
Cloverdale	37,122.66	37,469.44	44,425.79	48,609.88	31,373.60	32,022.11
Cotati	30,544.35	32,274.78	34,591.32	37,365.45	29,405.59	30,106.25
Healdsburg	61,743.80	65,140.61	53,466.30	54,185.96	46,892.04	47,758.86
Petaluma	234,508.14	255,063.75	308,444.99	324,057.88	246,723.33	252,289.05
Rohnert Park	162,122.12	162,489.28	168,661.08	184,772.55	142,154.41	145,015.90
Santa Rosa	523,779.00	559,318.87	535,596.30	532,078.46	514,339.95	524,918.54
Sebastopol	42,999.16	43,505.28	40,617.19	42,004.83	36,887.23	38,014.81
Sonoma	51,975.81	53,241.94	57,674.93	59,743.98	50,342.50	52,281.20
Windsor	79,106.32	90,596.75	89,665.52	94,631.17	83,561.69	85,044.92
Unincorporated	546,217.86	715,636.74	576,088.92	688,488.11	587,138.16	584,359.75
Countywide	-	-	-	1,979.34	1,092.10	3,006.37
Total	**1,770,119.23**	**2,014,737.46**	**1,909,232.33**	**2,067,917.61**	**1,769,910.62**	**1,794,817.76**

For on-road transportation, emissions are determined by multiplying an estimate of vehicle miles traveled (VMT) by an emissions factor. The emissions factor is obtained from a California Air Resources Board (CARB) emissions model, which uses Sonoma County vehicle registration data from the Department of Motor Vehicles to estimate the number of vehicles by type and fuel. Using this data, the emission factor from the CARB model reflects improvements in fuel efficiency and the shift from fossil fuel to hybrid and electric vehicles. The Appendix contains more information on the data sources used to calculate emissions.

It is important to note that CARB has recently updated its Off-Road Emissions Factor database (EMFAC-OFFROAD) with more robust and comprehensive data. This new EMFAC data was used to recalculate off-road transportation emissions for 2010, 2015, 2018, and 2020. Our 1990 baseline remains the same as CARB did not release updated data for the years before 2000. While this recalculation shows a more complete picture of local emissions, it has also increased our past off-road totals, and those updated values are used in this report.

The Shift Sonoma County Low Carbon Transportation Plan outlines two key strategies to reduce transportation emissions – fuel shift and mode shift. The fuel shift strategy aims to reduce petroleum use in transportation by 50 percent by 2030. This goal will be achieved through overall fleet fuel efficiency gains and replacing internal combustion engine vehicles with electric vehicles (EVs). The Shift Plan sets a target of 100,000 EVs in Sonoma County by 2030. The Shift Plan also includes goals to transition to low-carbon forms of transportation, such as biking, walking, transit, and carpools. These 2040 goals are to reduce per capita vehicle miles traveled (VMT) by 10 percent, shift 4 percent of single occupant vehicle trips to biking or walking, increase transit ridership by 4 times, and reduce average household travel costs below 2010 levels. Currently, 44.3 percent of trips are single-occupant vehicles, 47.1 percent are shared-ride vehicles, 0.39 percent are transit, and 8.2 percent are walk/bike.[8]

The Sonoma Climate Mobilization includes three strategies that build on the Shift Plan and are designed to achieve the necessary emission reductions in this sector:

- Drive Less Sonoma County Campaign – make it easier to get around Sonoma County without a car
- EV Access for All Partnership – accelerate the transition to 100 percent electric vehicles for all transportation needs not otherwise met by biking or walking
- Sonoma County Vehicle Miles Traveled Mitigation Bank – develop new funding sources for transportation projects that reduce VMT

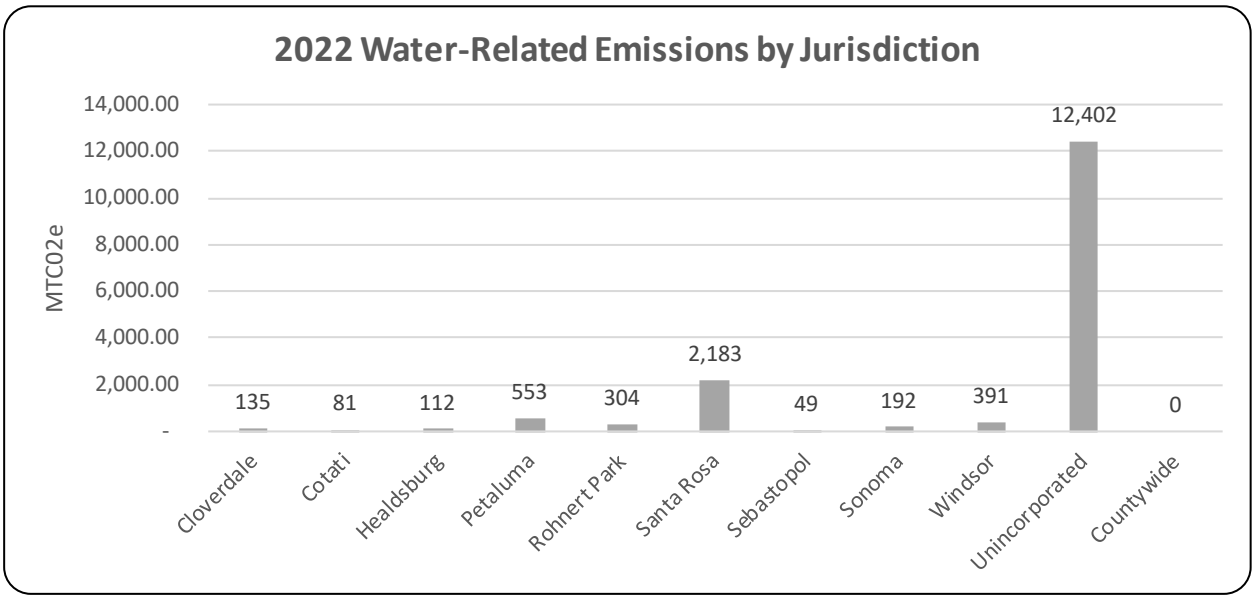
SUCCESSES AND SOLUTIONS

Sonoma-Marin Area Rail Transit (SMART): SMART has been providing passenger rail service for Sonoma and Marin residents since 2017 and has been included as part of the RCPA inventory since 2018. While SMART's locomotives do emit greenhouse gases due to diesel usage, in 2022 the service achieved a 16% reduction in greenhouse gas emissions compared to making the same trip by car These savings are directly related to increased ridership, so the emission reductions will increase as ridership continues to climb. For 2023 SMART shows a 28% reduction compared to auto emissions, and this value is expected to climb further in subsequent years. In addition, the trains are equipped with modern, efficient engines that comply with the EPA's Tier 4 emissions standards, reducing Particulate Matter (PM) emissions by 96% and nitrogen oxide (NOx) emissions by 93% compared to standard diesel engines. https://www.sonomamarintrain.org/

Countywide Active Transportation Plan (ATP): SCTA's Active Transportation Plan aims to enhance mobility and create a more responsive and efficient transportation network in Sonoma County. Local residents are encouraged to voice their transportation needs through an interactive web-mapping platform that enables city planners and government officials to improve transportation infrastructure based on community input. SCTA is currently working with several jurisdictions to update the ATP with the latest information and needs. https://scta.ca.gov/planning/countywide-active-transportation-plan/

[8] SCTA Travel Model, https://scta.ca.gov/planning/forecasting-and-travel-data/

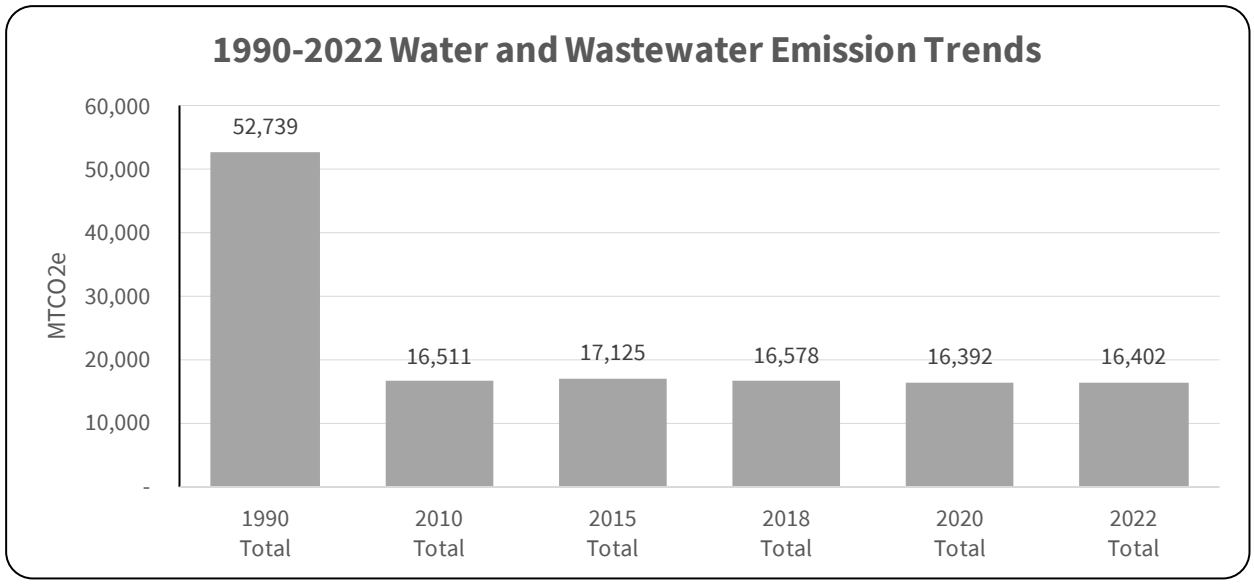
WATER AND WASTEWATER



Water-Related Emission Totals by Jurisdiction (MTCO2e)

Jurisdiction	Total	Water Conveyance	Wastewater
Cloverdale	134.55	18.82	115.73
Cotati	81.12	9.50	71.63
Healdsburg	112.08	18.96	93.12
Petaluma	552.95	78.82	474.12
Rohnert Park	303.68	76.01	227.68
Santa Rosa	2,183.24	142.73	2,040.51
Sebastopol	49.26	11.18	38.08
Sonoma	191.97	31.66	160.31
Windsor	391.36	46.10	345.26
Unincorporated	12,401.96	277.56	12,124.40
Countywide	-	-	-
Total	**16,402.18**	**711.34**	**15,690.84**

Countywide emissions from Water and Wastewater did not change significantly from 2020 to 2022 but have been reduced by nearly 69 percent from 1990 levels. Emissions in this sector result from electricity used to convey water across the county, as well as from the breakdown of organic waste during the wastewater treatment process. Most emissions in this sector result from wastewater treatment, including various processes that release methane and nitrous oxide.



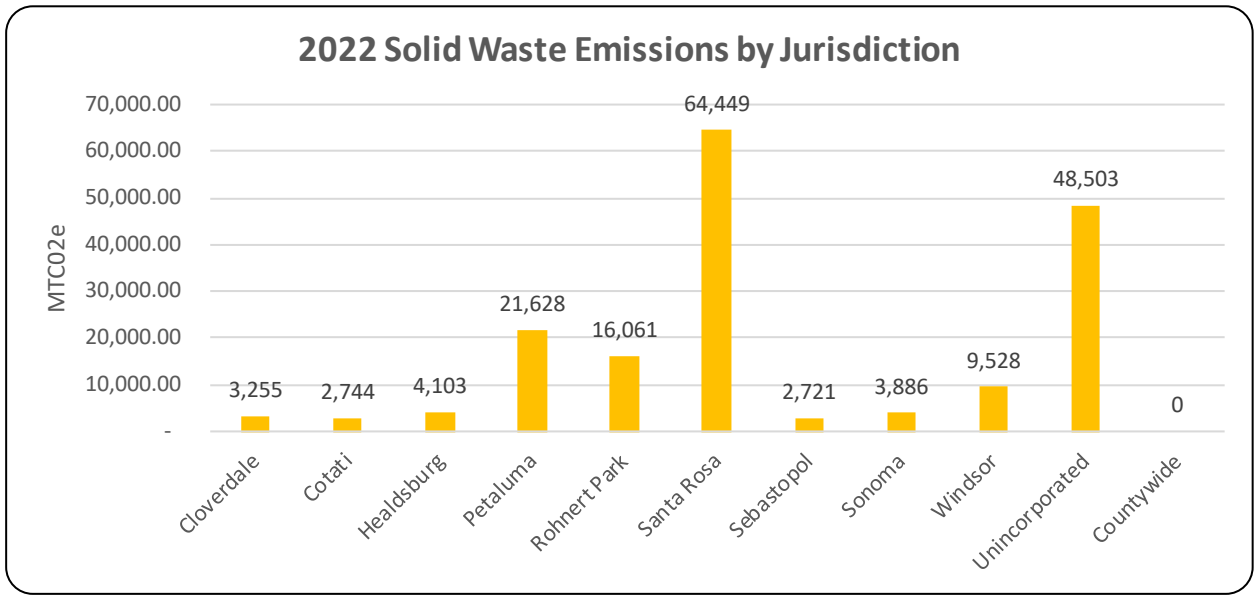
Water and Wastewater Emission Trends by Jurisdiction (MTCO2e)						
Jurisdiction	**1990**	**2010**	**2015**	**2018**	**2020**	**2022**
Cloverdale	745.00	751.10	124.77	127.56	131.26	134.55
Cotati	641.00	82.04	92.11	79.85	81.03	81.12
Healdsburg	180.00	464.24	290.38	189.26	115.34	112.08
Petaluma	5,831.00	594.05	570.61	591.69	557.48	552.95
Rohnert Park	3,443.00	322.09	373.17	287.64	291.67	303.68
Santa Rosa	13,487.00	2,225.00	2,340.07	2,203.81	2,202.97	2,183.24
Sebastopol	388.00	61.07	62.51	48.34	48.77	49.26
Sonoma	3,057.00	147.72	195.33	196.55	192.67	191.97
Windsor	2,137.00	353.06	400.80	399.87	390.74	391.36
Unincorporated	22,830.00	11,510.40	12,674.76	12,453.77	12,380.37	12,401.96
Countywide	-	-	-	-	-	-
Total	**52,739.00**	**16,510.77**	**17,124.50**	**16,578.34**	**16,392.30**	**16,402.18**

SUCCESSES AND SOLUTIONS

Water Upgrades $ave Program: RCPA is also leading the development and implementation of BayREN's Water Upgrades $ave program, an innovative new program that provides utility on-bill financing for water and energy-saving improvements in single-family and multifamily residences. The program currently operates in Sebastopol and Cloverdale and anticipates serving more Sonoma County and greater Bay Area jurisdictions soon. https://www.bayren.org/waterupgradessave

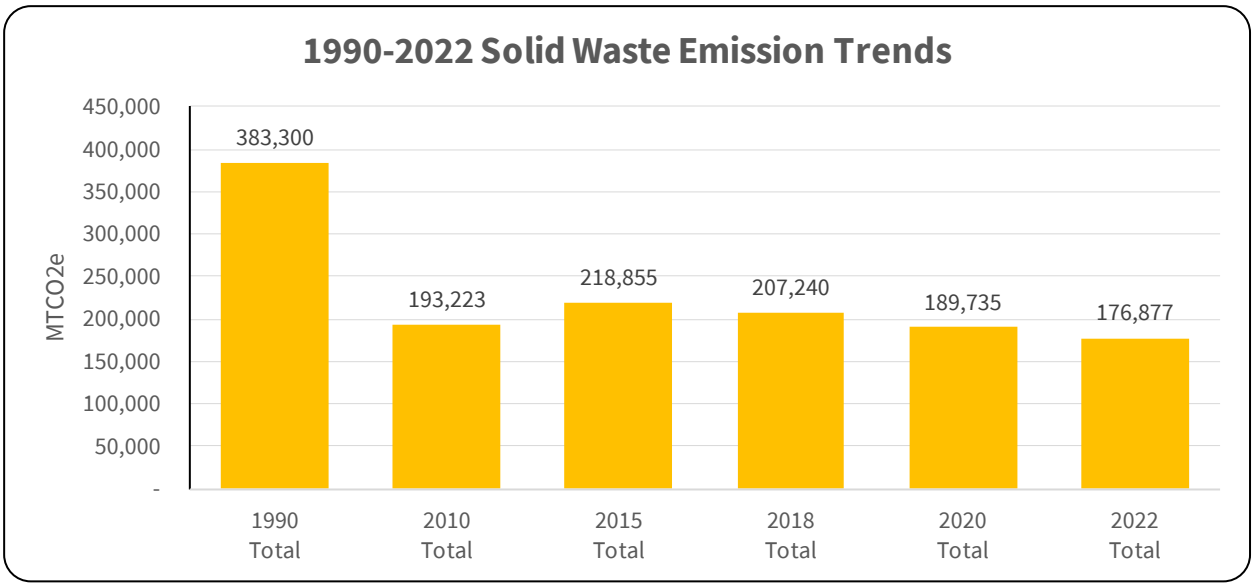
Sonoma Water: Sonoma Water manages most of the water conveyance within the county. Since 2015, Sonoma Water has had contracts to procure 100 percent of its electricity needs through renewable and carbon-free resources, thus achieving a carbon-neutral electricity supply to power Sonoma Water's water conveyance and wastewater processing systems. This initiative has been the leading cause of the dramatic reductions in water-related emissions since 1990. https://www.sonomawater.org/climate

SOLID WASTE



Solid Waste Emission Totals by Jurisdiction (MTCO2e)					
Jurisdiction	**Total**	**Residential Single Family**	**Residential Multifamily**	**Commercial**	**Self Haul**
Cloverdale	3,254.87	1,184.89	321.16	882.78	866.04
Cotati	2,743.99	998.91	270.75	744.22	730.10
Healdsburg	4,102.96	1,493.62	404.84	1,112.80	1,091.69
Petaluma	21,627.72	7,873.27	2,134.01	5,865.87	5,754.57
Rohnert Park	16,060.87	5,846.74	1,584.73	4,356.03	4,273.38
Santa Rosa	64,448.62	23,461.63	6,359.15	17,479.74	17,148.10
Sebastopol	2,721.19	990.61	268.50	738.04	724.04
Sonoma	3,885.51	1,414.47	383.38	1,053.83	1,033.83
Windsor	9,527.98	3,468.53	940.13	2,584.18	2,535.15
Unincorporated	48,503.17	17,656.91	4,785.81	13,155.02	12,905.43
Countywide	-	-	-	-	-
Total	**176,876.87**	**64,389.58**	**17,452.44**	**47,972.51**	**47,062.34**

The 2022 emissions from solid waste were a 6.7 percent decrease from 2020 and a 53.9 percent decrease from 1990. Local jurisdictional efforts to comply with new state waste reduction laws over the past few years have contributed to this decline in emissions. AB 1826 (Chesbro, 2014) requires businesses that generate a specified amount of organic waste per week to arrange for recycling services for that waste and for jurisdictions to implement a recycling program to divert organic waste from businesses subject to the law. Additionally, SB 1383 (Lara, 2016) sets requirements for jurisdictions to coordinate efforts to reduce organic waste disposal by 75 percent by 2025 and to rescue at least 20 percent of currently disposed surplus food by 2025 for people to eat instead of being throw away. Between these two efforts, almost all businesses in the county producing over four cubic yards of waste per week have access to a blue and green bin for recycling and composting. Between the newly adopted requirements at the State level and better local access to waste-related resources, these efforts significantly reduce overall solid waste and waste-related emissions.



Solid Waste Emission Emission Trends by Jurisdiction (MTCO2e)						
Jurisdiction	**1990**	**2010**	**2015**	**2018**	**2020**	**2022**
Cloverdale	5,643.09	2,594.45	2,883.46	3,047.57	3,491.49	3,254.87
Cotati	6,550.71	2,627.99	2,796.08	3,742.28	2,943.47	2,743.99
Healdsburg	10,258.09	8,244.01	11,619.39	7,898.21	4,401.23	4,102.96
Petaluma	11,955.45	22,261.56	31,773.18	33,137.12	23,199.98	21,627.72
Rohnert Park	40,833.29	12,039.71	12,514.40	15,897.10	17,228.44	16,060.87
Santa Rosa	102,060.53	79,182.23	83,381.42	57,730.03	69,133.83	64,448.62
Sebastopol	8,006.29	6,241.25	5,275.02	5,782.42	2,919.02	2,721.19
Sonoma	10,105.60	10,653.60	14,599.16	11,700.27	4,167.97	3,885.51
Windsor	17,152.58	10,971.91	12,064.70	14,280.85	10,224.51	9,527.98
Unincorporated	170,734.14	38,406.27	41,948.17	54,024.34	52,025.31	48,503.17
Countywide	-	-	-	-	-	-
Total	**383,299.79**	**193,222.97**	**218,854.98**	**207,240.20**	**189,735.24**	**176,876.87**

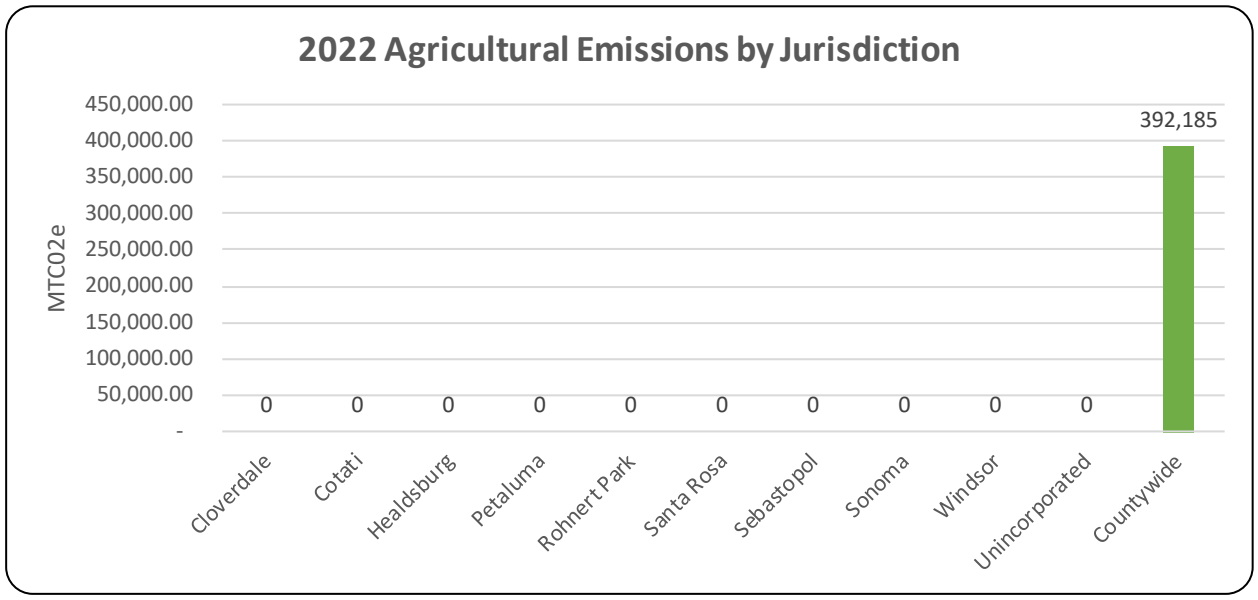
The Sonoma Climate Mobilization includes one strategy in the solid waste sector:

- Zero Waste by 2030 -- develop policies, programs, and education campaigns to eliminate waste sent to landfills

SUCCESSES AND SOLUTIONS

Zero Waste Sonoma (ZWS): In 2022, ZWS established a requirement for Tier 1 Generators, primarily consisting of local operations, to start recovering excess whole foods. ZWS also helps enforce both AB 1826: Mandatory Commercial Organics, which was eclipsed by SB 1383: Short-lived Climate Pollutants in January 2022. SB 1383 is a Senate Bill in California law that establishes statewide greenhouse gas emission reduction goals. Due to the fast-moving progress of ZWS, in 2024, Tier 2 Generators, such as larger food entities, will be required to donate excess foods. https://zerowastesonoma.gov/

AGRICULTURE

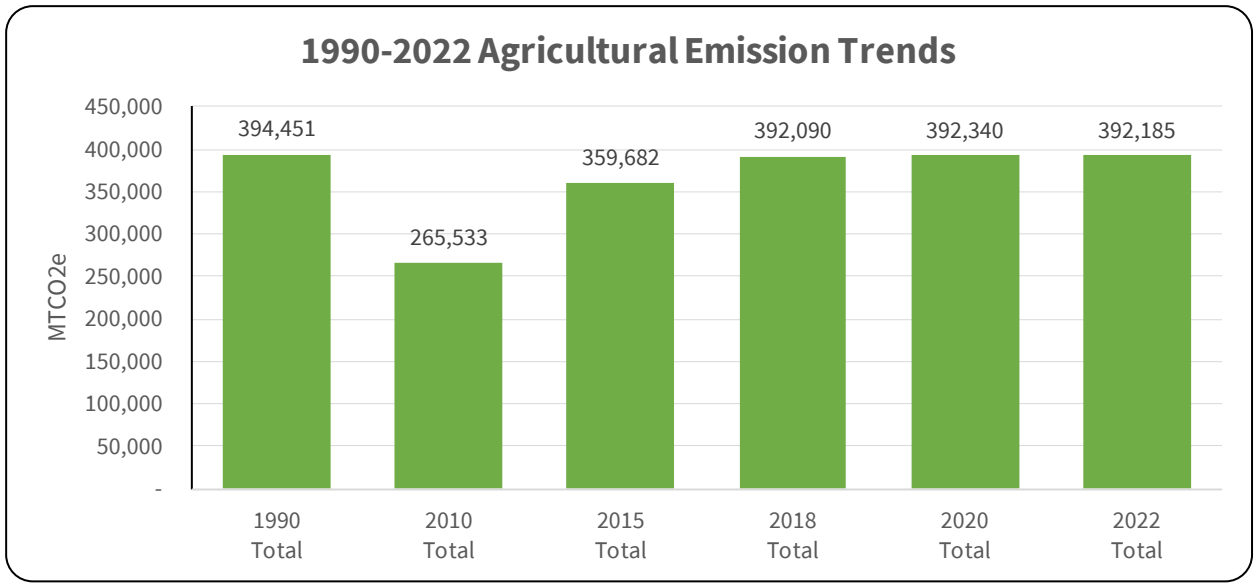


Agricultural Emission Totals by Jurisdiction (MTCO2e)			
Jurisdiction	**Total**	**Fertilizer Application**	**Manure Management**
Cloverdale	-	-	-
Cotati	-	-	-
Healdsburg	-	-	-
Petaluma	-	-	-
Rohnert Park	-	-	-
Santa Rosa	-	-	-
Sebastopol	-	-	-
Sonoma	-	-	-
Windsor	-	-	-
Unincorporated	-	-	-
Countywide	392,185.41	4,107.56	388,077.86
Total	**392,185.41**	**4,107.56**	**388,077.86**

Livestock and fertilizer emissions are the third largest source of emissions in Sonoma County. The primary emissions are generated by enteric (digestive) fermentation and manure management. Emissions from this sector were a very slight decrease from 2020, and also only a slight decrease from 1990 levels. Emissions from this sector are included in the countywide inventory but not allocated to any specific jurisdiction.

While the Sonoma Climate Mobilization does not include any strategies specific to the agricultural sector, several strategies related to carbon sequestration and climate resilience will impact this sector:

- Protect Existing Carbon Stocks -- maintain the carbon that is currently held in soil and plants
- Increase Carbon Stocks -- capture more carbon in soils and plants
- Scale Up the Infrastructure for Sequestration -- build the physical, social, and economic capacity for successful carbon sequestration



Agricultural Emission Emission Trends by Jurisdiction (MTCO2e)						
Jurisdiction	**1990**	**2010**	**2015**	**2018**	**2020**	**2022**
Cloverdale	-	-	-	-	-	-
Cotati	-	-	-	-	-	-
Healdsburg	-	-	-	-	-	-
Petaluma	-	-	-	-	-	-
Rohnert Park	-	-	-	-	-	-
Santa Rosa	-	-	-	-	-	-
Sebastopol	-	-	-	-	-	-
Sonoma	-	-	-	-	-	-
Windsor	-	-	-	-	-	-
Unincorporated	-	-	-	-	-	-
Countywide	394,450.85	265,532.58	359,681.95	392,090.43	392,340.20	392,185.41
Total	**394,450.85**	**265,532.58**	**359,681.95**	**392,090.43**	**392,340.20**	**392,185.41**

SUCCESSES AND SOLUTIONS

Sonoma-Marin Ag and County Climate Coalition (SMACCC): This effort aims to promote carbon farming and establish a regional supply chain for climate-smart agricultural products by developing a tracking system and marketing campaign for commodities produced using methods that reduce greenhouse gas emissions or sequester carbon. Over five years, the initiative will support numerous farms and ranches, significantly reducing emissions and building on existing partnerships and data systems to monitor impacts. With potential funding up to $10 million, this scalable model could support up to 100 farms and sequester hundreds of thousands of metric tons of CO2 over 20 years.
https://sonomacounty.ca.gov/administrative-support-and-fiscal-services/county-administrators-office/climate-action-and-resiliency/lands/sonoma-marin-ag-and-county-climate-coalition

FOREST LAND AND TREES

The Sonoma Climate Mobilization Strategy sets a goal of reaching carbon neutrality by 2030. To meet this end, Sonoma County must reduce its greenhouse gas emissions by at least 80 percent below 1990 levels and achieve an increase in carbon sequestration that is large enough to remove the remaining CO2 from the atmosphere. There are multiple existing efforts on rural lands to increase sequestration, and the potential exists to increase sequestration in the urban parts of the county as well. Sonoma County's forestlands and wetlands, especially the Sonoma Baylands, provide additional capacity to sequester carbon.

Sonoma County's natural resources play a pivotal role in our fight against rapid climate change. RCPA recognizes the prime importance of promoting conservation and restoration efforts to maximize the region's carbon sequestration potential. By safeguarding and enhancing these resources, we can significantly contribute to mitigating the impacts of climate change and fostering a more sustainable future. Two recent reports are being used to guide our efforts in this arena: the Sonoma County Climate Resilient Lands Strategy (August 2022) and the County Sonoma Carbon Inventory and Sequestration Potential Study (October 2023).

Forest land and trees in Sonoma County serve as significant areas for carbon sequestration, capturing and storing atmospheric carbon dioxide. Natural and working lands encompass a variety of landscapes that aid in carbon sequestration, including diverse natural ecosystems, agricultural areas, and urban green spaces. The total carbon storage across all lands regardless of ownership amounts to 101,355,691 MTCO2e, with publicly owned lands contributing 12,513,728 MTCO2e, representing approximately 12% of the naturally stored carbon in 2022. A majority of the carbon stock in Sonoma County is held within forests (48.52%), grassland (20.63%), and vineyards (7.49%).[9] The Carbon Inventory and Sequestration Potential Study offers a number of strategies to increase these carbon stocks over time. RCPA will continue to work with the County of Sonoma and other jurisdictional partners to implement projects and track progress over the upcoming years.

SUCCESSES AND SOLUTIONS

Sonoma County Climate Resilient Lands Strategy: The County of Sonoma's Climate Action and Resiliency Division and the Sonoma County Agricultural Preservation and Open Space District have collaborated to create the Sonoma County Climate Resilient Lands Strategy, a document designed to provide structure and guidance for climate-related efforts, with a focus on natural and working lands. Through this collaboration, the county aims to conserve and restore diverse landscapes, focusing on areas with high potential for carbon sequestration, climate resilience, and biodiversity enhancement. The plan aims to foster coordinated action for climate resilience and reduce fragmentation of natural lands by expanding conserved spaces and collaborating with private landowners. Additionally, this plan puts equity and measurable climate justice approaches at the forefront of the solution.
https://sonomacounty.ca.gov/administrative-support-and-fiscal-services/county-administrators-office/climate-action-and-resiliency/lands/sonoma-county-climate-resilient-lands-strategy

[9] County of Sonoma, Carbon Inventory and Sequestration Potential Study (October 2023), https://sonoma-county.legistar.com/View.ashx?M=F&ID=12410562&GUID=61659C84-5E4D-48DD-A333-40F8425F8C7A

JURISDICTIONAL EMISSION PROFILES

Sonoma County continues to work towards the cleaner, more sustainable future envisioned in the Sonoma Climate Mobilization Strategy. RCPA and all Sonoma County jurisdictions adopted Climate Emergency Resolutions that recognize the urgency of taking action to address the climate crisis. Jurisdictions continue to work on existing climate action plans, update long-term policy goals, and pursue implementing GHG reduction measures outlined in the Sonoma Climate Mobilization Strategy.

Each jurisdiction's focus on climate action demonstrates the collective recognition of the need to address climate change at the local and regional levels. To assist local staff and residents in their climate action efforts, several tables and charts are presented for each jurisdiction in the county:

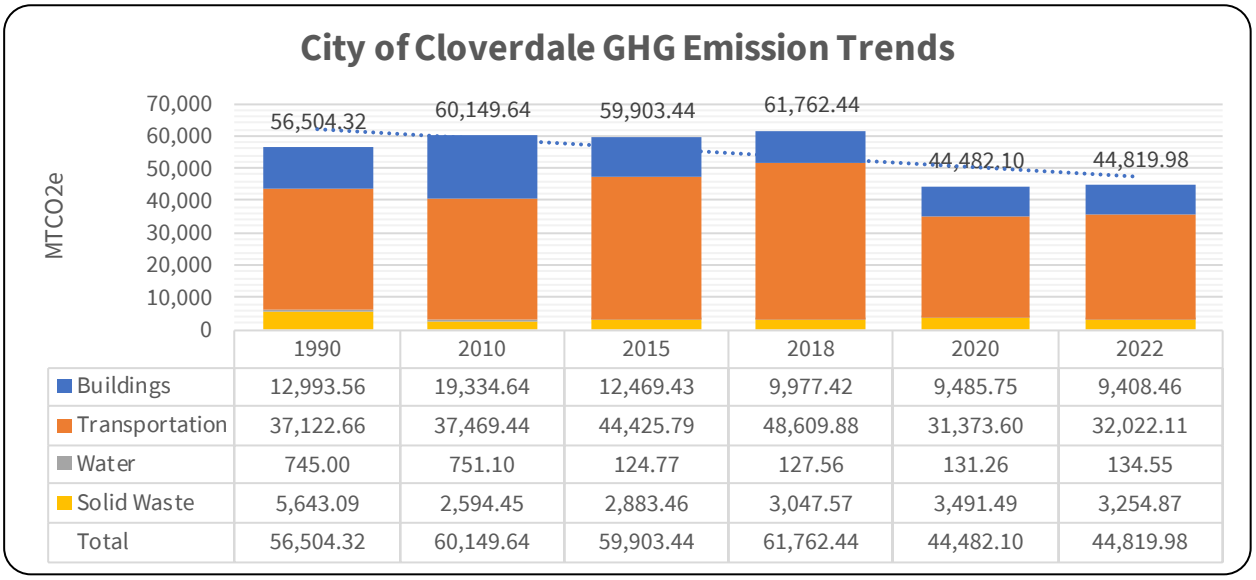
Jurisdictional Charts

- Total GHG Emission Trends
- Population-related Emission Trends
    - per Person
    - per Household
    - per Employee
- Overall Population-related Trends
    - Population Count
    - Household Count
    - Employment Count

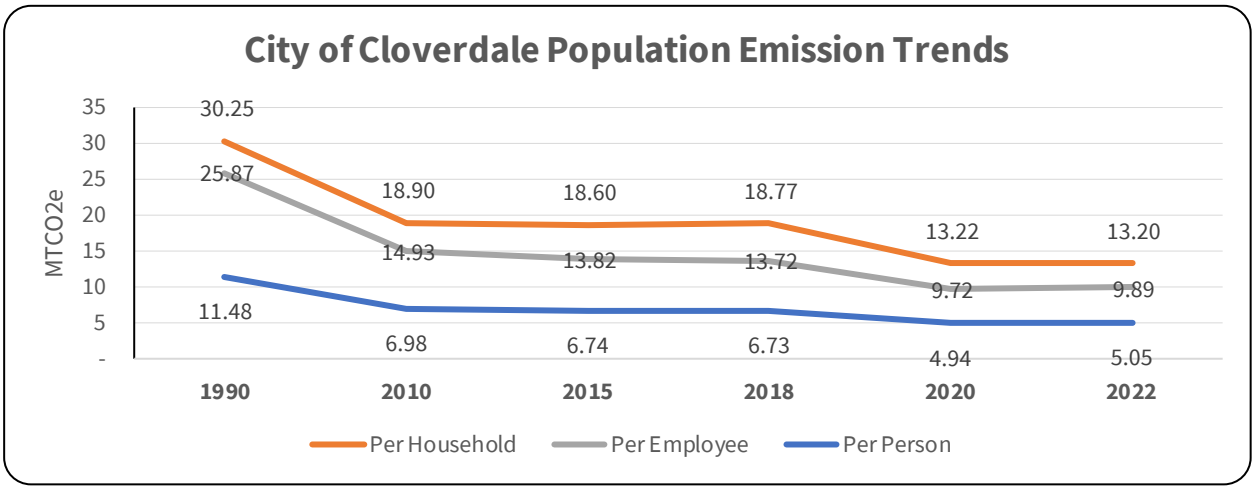
Jurisdictional Tables

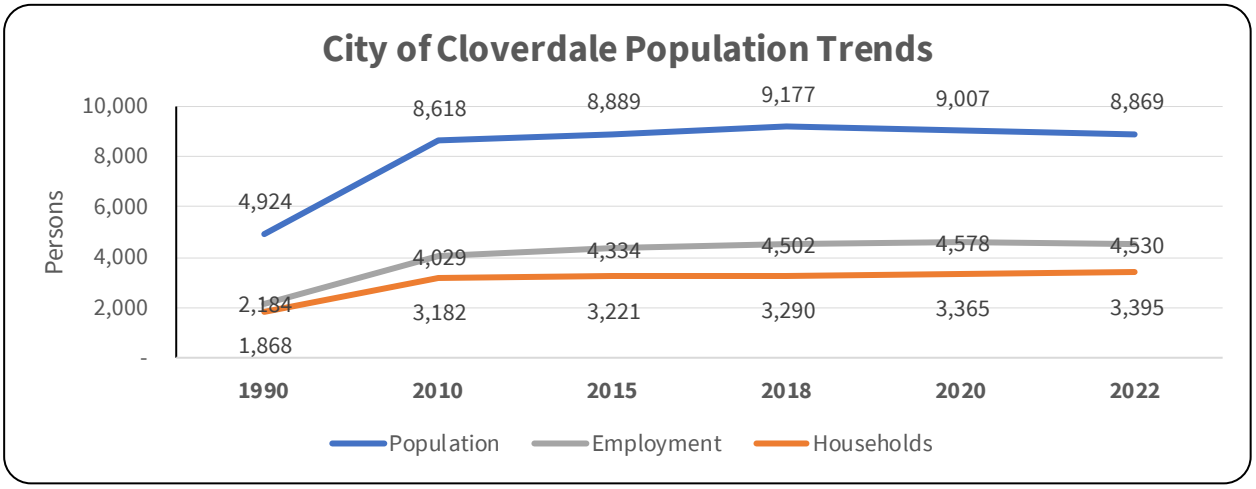
- Total GHG Emission Trends
- GHG Emission Trends per Capita/Person
- GHG Emission Trends per Household Count
- GHG Emission Trends per Employee Count
- Demographic Calculation Inputs
    - Population (#)
    - Population Share (%)
    - Households (#)
    - Household Share (%)
    - Employment Count (#)
    - Employment Share (%)

CITY OF CLOVERDALE



	1990	2010	2015	2018	2020	2022
Buildings	12,993.56	19,334.64	12,469.43	9,977.42	9,485.75	9,408.46
Transportation	37,122.66	37,469.44	44,425.79	48,609.88	31,373.60	32,022.11
Water	745.00	751.10	124.77	127.56	131.26	134.55
Solid Waste	5,643.09	2,594.45	2,883.46	3,047.57	3,491.49	3,254.87
Total	56,504.32	60,149.64	59,903.44	61,762.44	44,482.10	44,819.98





1990-2022 City of Cloverdale GHG Emission Trends by Sector (MTCO2e)							
Sector	1990-2022 Change	1990	2010	2015	2018	2020	2022
Buildings	-27.59%	12,993.56	19,334.64	12,469.43	9,977.42	9,485.75	9,408.46
Transportation	-13.74%	37,122.66	37,469.44	44,425.79	48,609.88	31,373.60	32,022.11
Water	-81.94%	745.00	751.10	124.77	127.56	131.26	134.55
Solid Waste	-42.32%	5,643.09	2,594.45	2,883.46	3,047.57	3,491.49	3,254.87
Agriculture	0.00%	-	-	-	-	-	-
Total	**-20.68%**	**56,504.32**	**60,149.64**	**59,903.44**	**61,762.44**	**44,482.10**	**44,819.98**

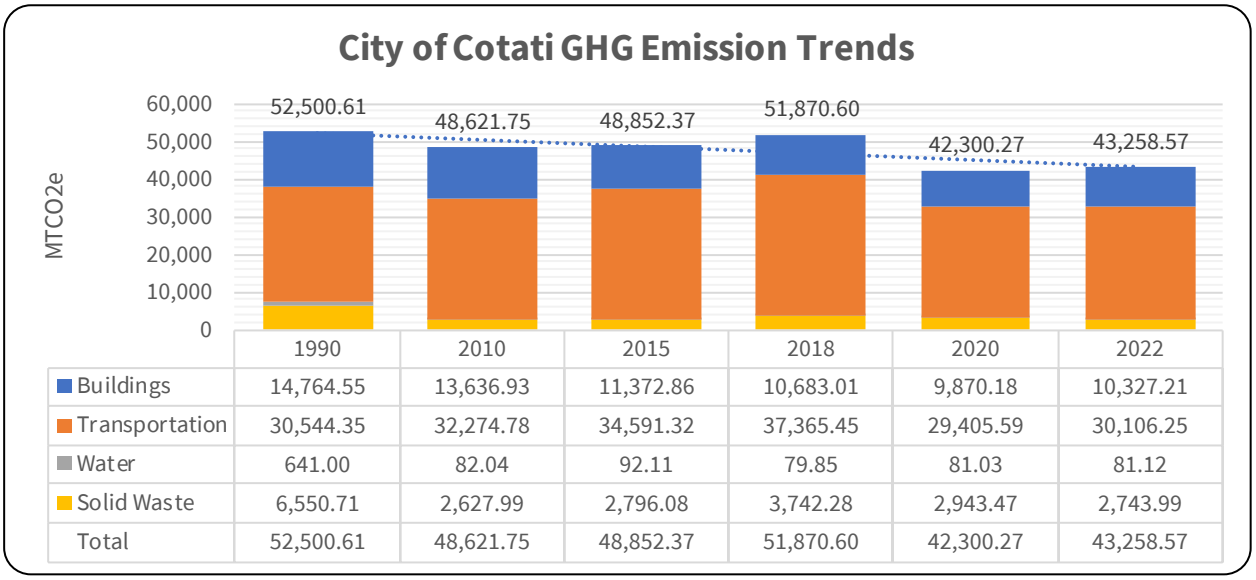
1990-2022 City of Cloverdale GHG Emission Trends per Capita (MTCO2e/person)							
Sector	1990-2022 Change	1990	2010	2015	2018	2020	2022
Buildings	-59.80%	2.64	2.24	1.40	1.09	1.05	1.06
Transportation	-52.11%	7.54	4.35	5.00	5.30	3.48	3.61
Water	-89.97%	0.15	0.09	0.01	0.01	0.01	0.02
Solid Waste	-67.98%	1.15	0.30	0.32	0.33	0.39	0.37
Agriculture	0.00%	-	-	-	-	-	-
Per Person	**-55.96%**	**11.48**	**6.98**	**6.74**	**6.73**	**4.94**	**5.05**

1990-2022 City of Cloverdale GHG Emission Trends per Household (MTCO2e/household)							
Sector	1990-2022 Change	1990	2010	2015	2018	2020	2022
Buildings	-60.16%	6.96	6.08	3.87	3.03	2.82	2.77
Transportation	-52.54%	19.87	11.78	13.79	14.78	9.32	9.43
Water	-90.06%	0.40	0.24	0.04	0.04	0.04	0.04
Solid Waste	-68.26%	3.02	0.82	0.90	0.93	1.04	0.96
Agriculture	0.00%	-	-	-	-	-	-
Per Household	**-56.36%**	**30.25**	**18.90**	**18.60**	**18.77**	**13.22**	**13.20**

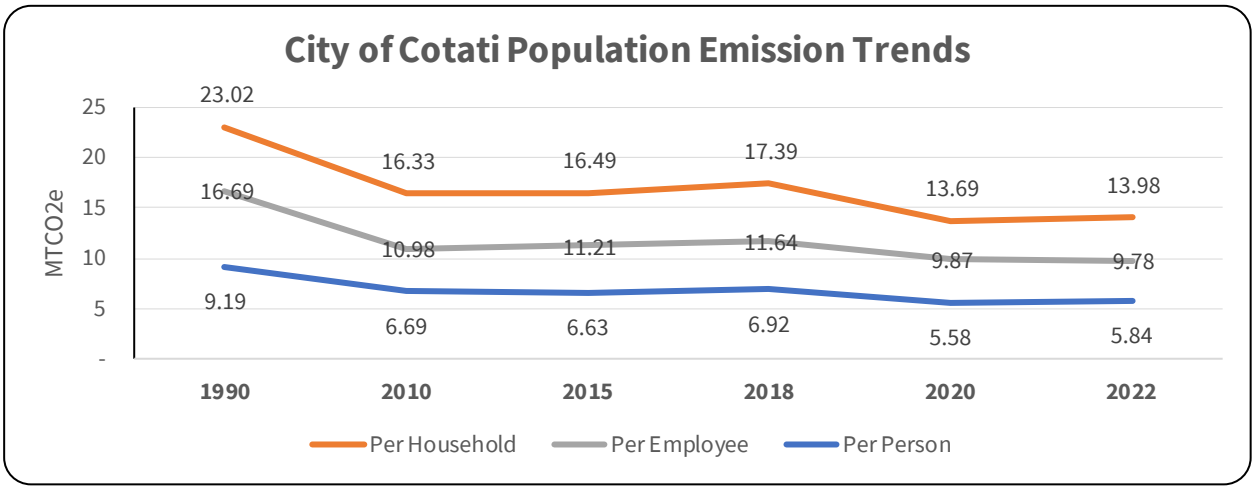
1990-2022 City of Cloverdale GHG Emission Trends per Employee (MTCO2e/Employment Count)							
Sector	1990-2022 Change	1990	2010	2015	2018	2020	2022
Buildings	-65.09%	5.95	4.80	2.88	2.22	2.07	2.08
Transportation	-58.41%	17.00	9.30	10.25	10.80	6.85	7.07
Water	-91.29%	0.34	0.19	0.03	0.03	0.03	0.03
Solid Waste	-72.19%	2.58	0.64	0.67	0.68	0.76	0.72
Agriculture	0.00%	-	-	-	-	-	-
Per Employee	**-61.76%**	**25.87**	**14.93**	**13.82**	**13.72**	**9.72**	**9.89**

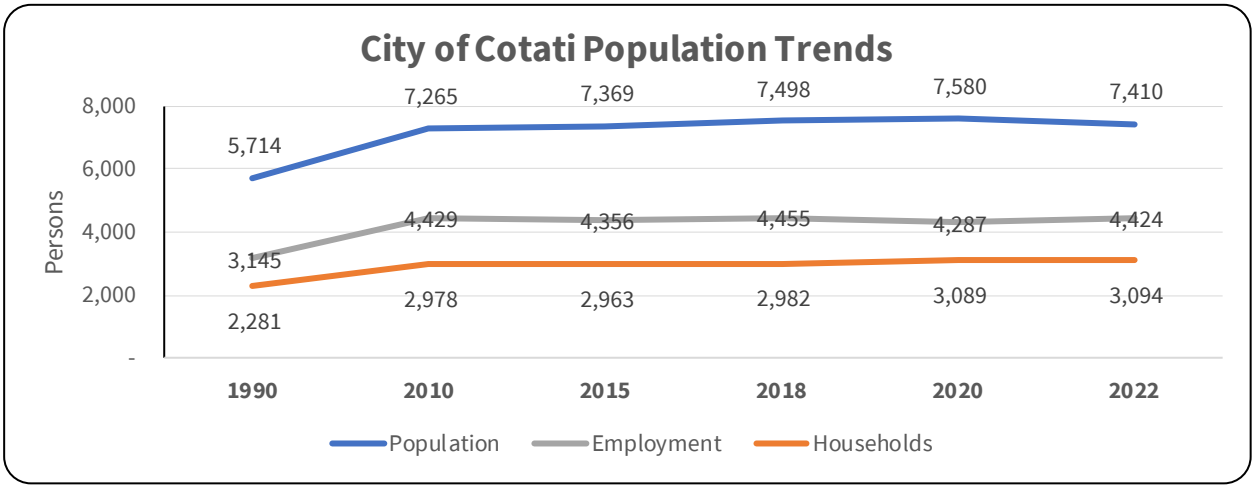
Cloverdale	1990-2022 Demographic Calculation Inputs						
Sector	1990-2022 Change	1990	2010	2015	2018	2020	2022
Population	80.12%	4,924	8,618	8,889	9,177	9,007	8,869
Pop. Share	45.49%	1.27%	1.78%	1.78%	1.83%	1.84%	1.85%
Households	81.75%	1,868	3,182	3,221	3,290	3,365	3,395
Hous. Share	42.98%	1.25%	1.71%	1.71%	1.77%	1.79%	1.79%
Employment	107.42%	2,184	4,029	4,334	4,502	4,578	4,530
Emp. Share	37.85%	1.25%	1.59%	1.65%	1.68%	1.71%	1.73%

CITY OF COTATI



	1990	2010	2015	2018	2020	2022
Buildings	14,764.55	13,636.93	11,372.86	10,683.01	9,870.18	10,327.21
Transportation	30,544.35	32,274.78	34,591.32	37,365.45	29,405.59	30,106.25
Water	641.00	82.04	92.11	79.85	81.03	81.12
Solid Waste	6,550.71	2,627.99	2,796.08	3,742.28	2,943.47	2,743.99
Total	52,500.61	48,621.75	48,852.37	51,870.60	42,300.27	43,258.57





1990-2022 City of Cotati GHG Emission Trends by Sector (MTCO2e)							
Sector	1990-2022 Change	1990	2010	2015	2018	2020	2022
Buildings	-30.05%	14,764.55	13,636.93	11,372.86	10,683.01	9,870.18	10,327.21
Transportation	-1.43%	30,544.35	32,274.78	34,591.32	37,365.45	29,405.59	30,106.25
Water	-87.34%	641.00	82.04	92.11	79.85	81.03	81.12
Solid Waste	-58.11%	6,550.71	2,627.99	2,796.08	3,742.28	2,943.47	2,743.99
Agriculture	0.00%	-	-	-	-	-	-
Total	**-17.60%**	**52,500.61**	**48,621.75**	**48,852.37**	**51,870.60**	**42,300.27**	**43,258.57**

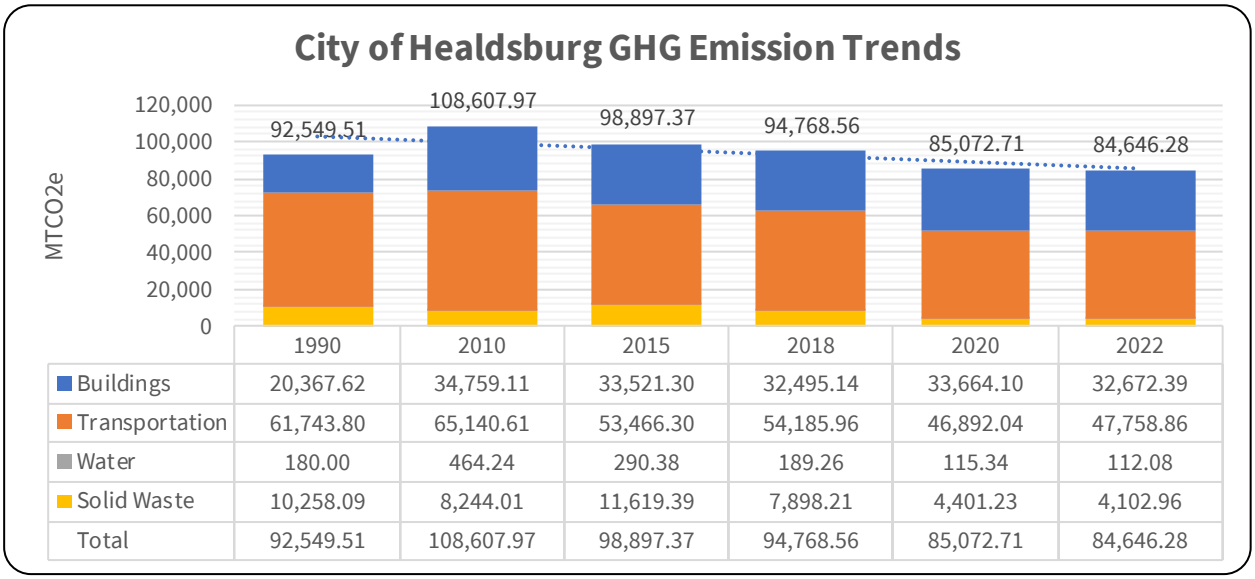
1990-2022 City of Cotati GHG Emission Trends per Capita (MTCO2e/person)							
Sector	1990-2022 Change	1990	2010	2015	2018	2020	2022
Buildings	-46.06%	2.58	1.88	1.54	1.42	1.30	1.39
Transportation	-23.99%	5.35	4.44	4.69	4.98	3.88	4.06
Water	-90.24%	0.11	0.01	0.01	0.01	0.01	0.01
Solid Waste	-67.70%	1.15	0.36	0.38	0.50	0.39	0.37
Agriculture	0.00%	-	-	-	-	-	-
Per Person	**-36.46%**	**9.19**	**6.69**	**6.63**	**6.92**	**5.58**	**5.84**

1990-2022 City of Cotati GHG Emission Trends per Household (MTCO2e/household)							
Sector	1990-2022 Change	1990	2010	2015	2018	2020	2022
Buildings	-48.43%	6.47	4.58	3.84	3.58	3.20	3.34
Transportation	-27.33%	13.39	10.84	11.67	12.53	9.52	9.73
Water	-90.67%	0.28	0.03	0.03	0.03	0.03	0.03
Solid Waste	-69.12%	2.87	0.88	0.94	1.25	0.95	0.89
Agriculture	0.00%	-	-	-	-	-	-
Per Household	**-39.25%**	**23.02**	**16.33**	**16.49**	**17.39**	**13.69**	**13.98**

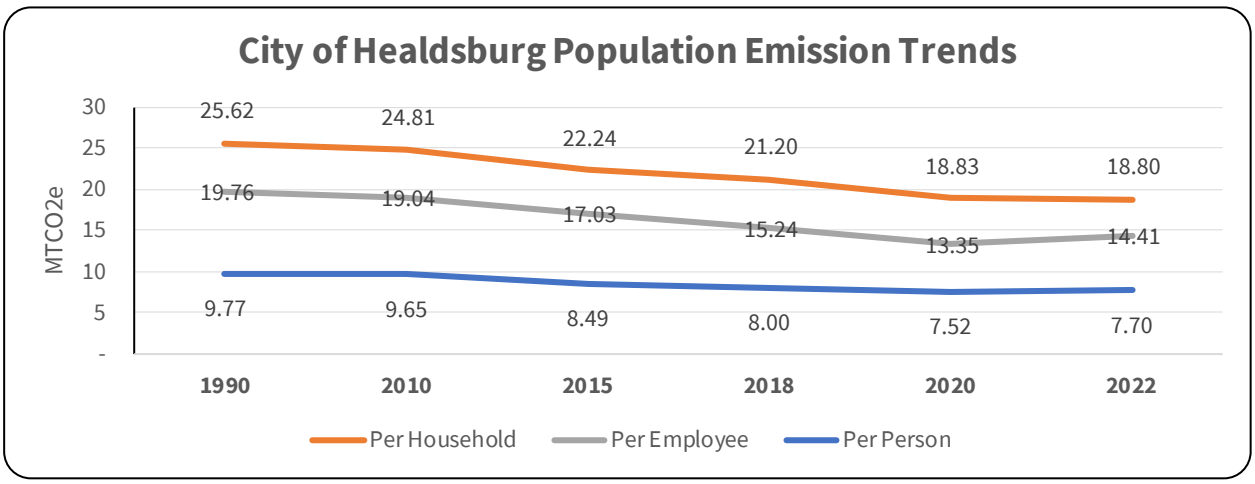
1990-2022 City of Cotati GHG Emission Trends per Employee (MTCO2e/Employment Count)							
Sector	1990-2022 Change	1990	2010	2015	2018	2020	2022
Buildings	-50.28%	4.69	3.08	2.61	2.40	2.30	2.33
Transportation	-29.93%	9.71	7.29	7.94	8.39	6.86	6.81
Water	-91.00%	0.20	0.02	0.02	0.02	0.02	0.02
Solid Waste	-70.22%	2.08	0.59	0.64	0.84	0.69	0.62
Agriculture	0.00%	-	-	-	-	-	-
Per Employee	**-41.42%**	**16.69**	**10.98**	**11.21**	**11.64**	**9.87**	**9.78**

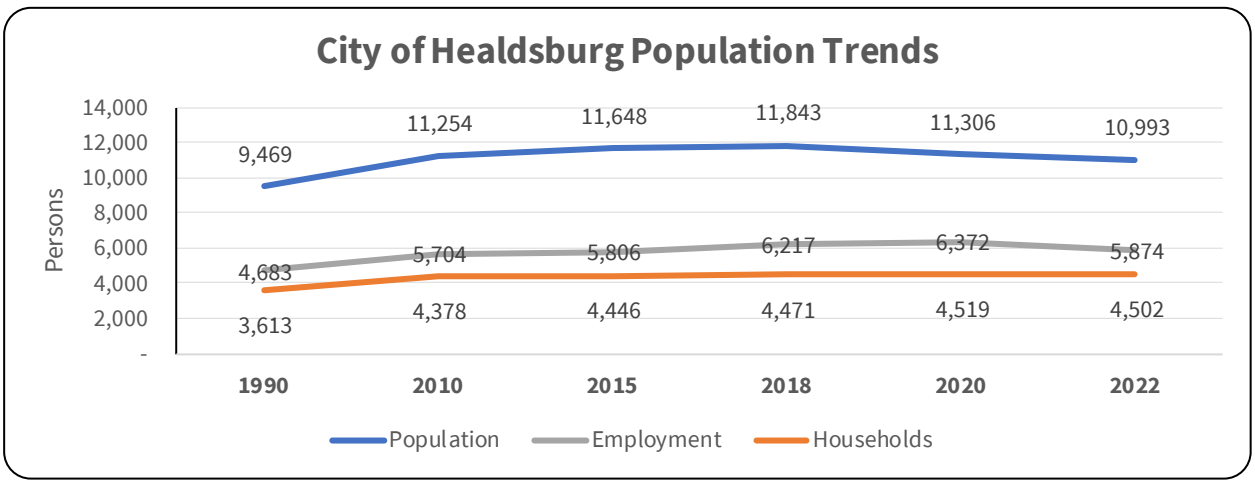
Cotati	1990-2022 Demographic Calculation Inputs						
Sector	1990-2022 Change	1990	2010	2015	2018	2020	2022
Population	29.68%	5,714	7,265	7,369	7,498	7,580	7,410
Pop. Share	4.75%	1.47%	1.50%	1.47%	1.50%	1.55%	1.54%
Households	35.64%	2,281	2,978	2,963	2,982	3,089	3,094
Hous. Share	6.71%	1.53%	1.60%	1.57%	1.60%	1.65%	1.63%
Employment	40.67%	3,145	4,429	4,356	4,455	4,287	4,424
Emp. Share	-6.51%	1.80%	1.75%	1.66%	1.66%	1.60%	1.69%

CITY OF HEALDSBURG



	1990	2010	2015	2018	2020	2022
Buildings	20,367.62	34,759.11	33,521.30	32,495.14	33,664.10	32,672.39
Transportation	61,743.80	65,140.61	53,466.30	54,185.96	46,892.04	47,758.86
Water	180.00	464.24	290.38	189.26	115.34	112.08
Solid Waste	10,258.09	8,244.01	11,619.39	7,898.21	4,401.23	4,102.96
Total	92,549.51	108,607.97	98,897.37	94,768.56	85,072.71	84,646.28





1990-2022 City of Healdsburg GHG Emission Trends by Sector (MTCO2e)							
Sector	1990-2022 Change	1990	2010	2015	2018	2020	2022
Buildings	60.41%	20,367.62	34,759.11	33,521.30	32,495.14	33,664.10	32,672.39
Transportation	-22.65%	61,743.80	65,140.61	53,466.30	54,185.96	46,892.04	47,758.86
Water	-37.73%	180.00	464.24	290.38	189.26	115.34	112.08
Solid Waste	-60.00%	10,258.09	8,244.01	11,619.39	7,898.21	4,401.23	4,102.96
Agriculture	0.00%	-	-	-	-	-	-
Total	**-8.54%**	**92,549.51**	**108,607.97**	**98,897.37**	**94,768.56**	**85,072.71**	**84,646.28**

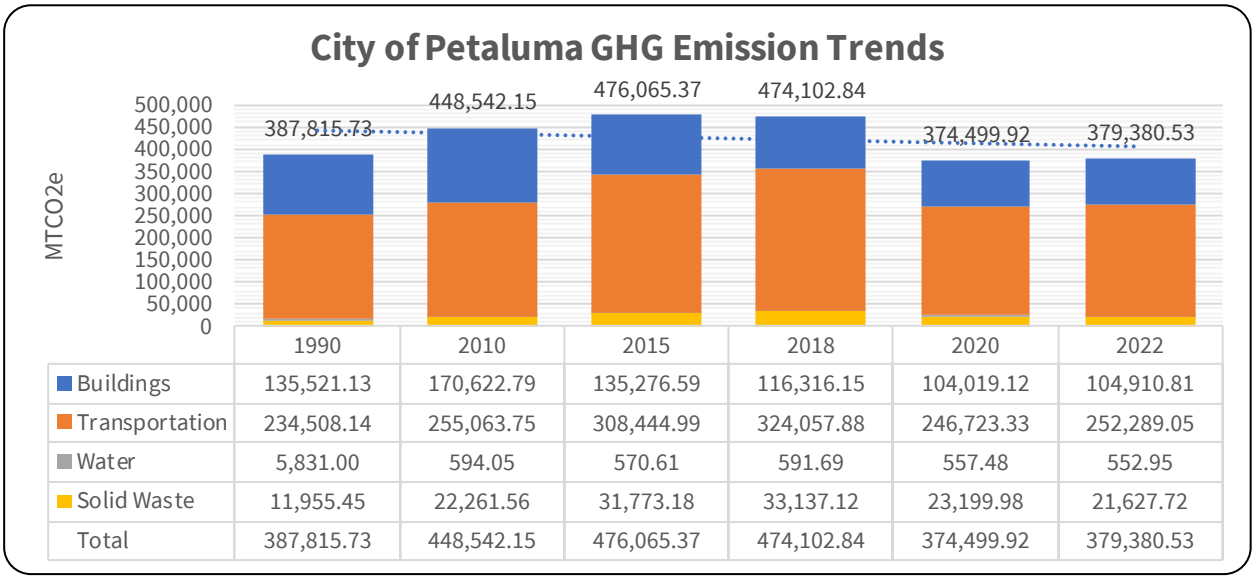
1990-2022 City of Healdsburg GHG Emission Trends per Capita (MTCO2e/person)							
Sector	1990-2022 Change	1990	2010	2015	2018	2020	2022
Buildings	38.17%	2.15	3.09	2.88	2.74	2.98	2.97
Transportation	-33.37%	6.52	5.79	4.59	4.58	4.15	4.34
Water	-46.37%	0.02	0.04	0.02	0.02	0.01	0.01
Solid Waste	-65.55%	1.08	0.73	1.00	0.67	0.39	0.37
Agriculture	0.00%	-	-	-	-	-	-
Per Person	**-21.22%**	**9.77**	**9.65**	**8.49**	**8.00**	**7.52**	**7.70**

1990-2022 City of Healdsburg GHG Emission Trends per Household (MTCO2e/household)							
Sector	1990-2022 Change	1990	2010	2015	2018	2020	2022
Buildings	28.74%	5.64	7.94	7.54	7.27	7.45	7.26
Transportation	-37.92%	17.09	14.88	12.03	12.12	10.38	10.61
Water	-50.03%	0.05	0.11	0.07	0.04	0.03	0.02
Solid Waste	-67.90%	2.84	1.88	2.61	1.77	0.97	0.91
Agriculture	0.00%	-	-	-	-	-	-
Per Household	**-26.60%**	**25.62**	**24.81**	**22.24**	**21.20**	**18.83**	**18.80**

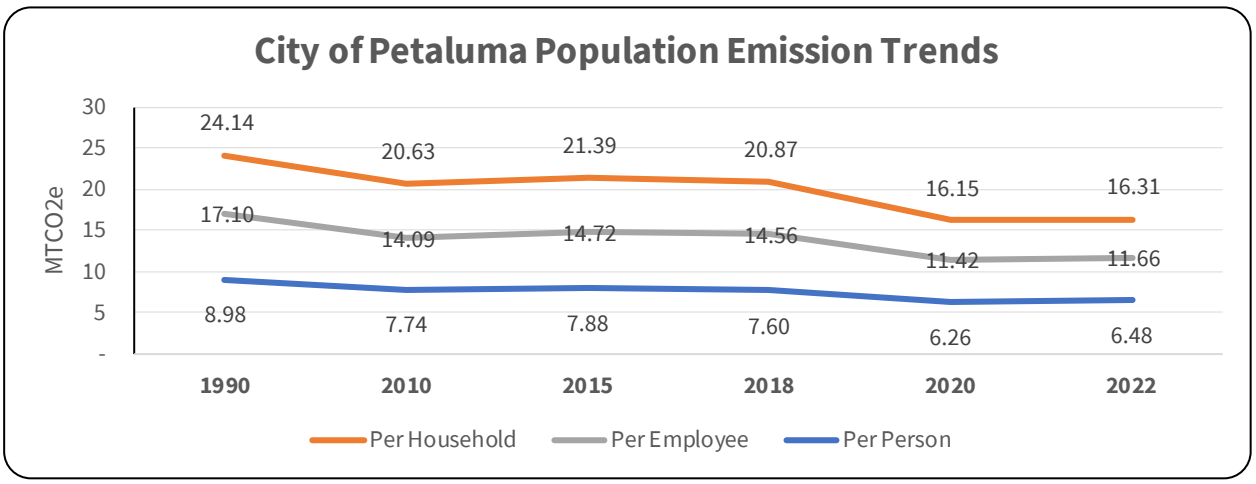
1990-2022 City of Healdsburg GHG Emission Trends per Employee (MTCO2e/Employment Count)							
Sector	1990-2022 Change	1990	2010	2015	2018	2020	2022
Buildings	27.89%	4.35	6.09	5.77	5.23	5.28	5.56
Transportation	-38.33%	13.18	11.42	9.21	8.72	7.36	8.13
Water	-50.36%	0.04	0.08	0.05	0.03	0.02	0.02
Solid Waste	-68.11%	2.19	1.45	2.00	1.27	0.69	0.70
Agriculture	0.00%	-	-	-	-	-	-
Per Employee	**-27.08%**	**19.76**	**19.04**	**17.03**	**15.24**	**13.35**	**14.41**

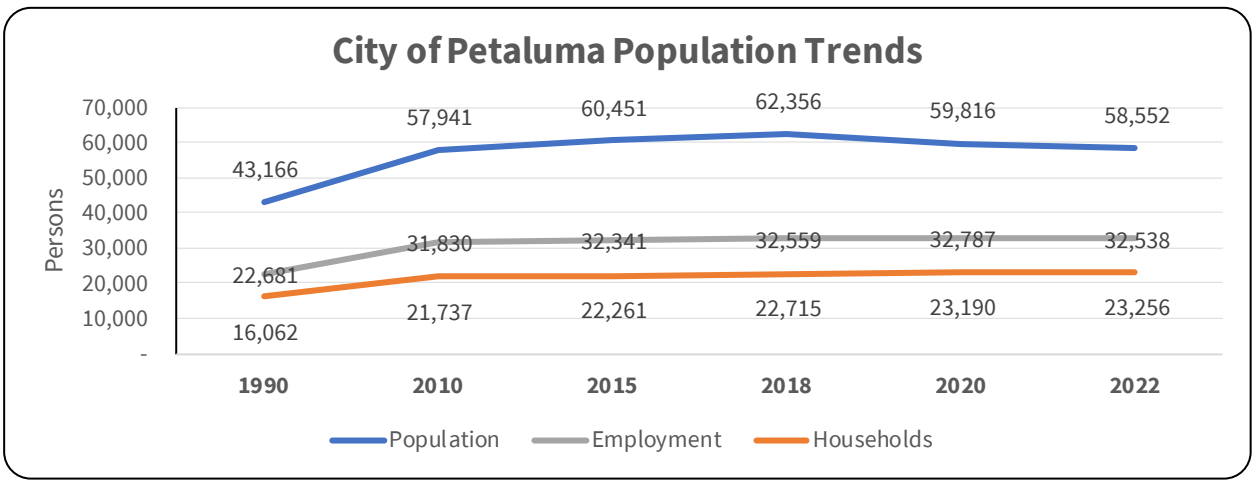
Healdsburg	1990-2022 Demographic Calculation Inputs						
Sector	1990-2022 Change	1990	2010	2015	2018	2020	2022
Population	16.09%	9,469	11,254	11,648	11,843	11,306	10,993
Pop. Share	-6.22%	2.44%	2.33%	2.33%	2.37%	2.31%	2.29%
Households	24.61%	3,613	4,378	4,446	4,471	4,519	4,502
Hous. Share	-1.97%	2.42%	2.36%	2.36%	2.40%	2.41%	2.38%
Employment	25.43%	4,683	5,704	5,806	6,217	6,372	5,874
Emp. Share	-16.64%	2.69%	2.25%	2.21%	2.32%	2.38%	2.24%

CITY OF PETALUMA



	1990	2010	2015	2018	2020	2022
Buildings	135,521.13	170,622.79	135,276.59	116,316.15	104,019.12	104,910.81
Transportation	234,508.14	255,063.75	308,444.99	324,057.88	246,723.33	252,289.05
Water	5,831.00	594.05	570.61	591.69	557.48	552.95
Solid Waste	11,955.45	22,261.56	31,773.18	33,137.12	23,199.98	21,627.72
Total	387,815.73	448,542.15	476,065.37	474,102.84	374,499.92	379,380.53





1990-2022 City of Petaluma GHG Emission Trends by Sector (MTCO2e)							
Sector	**1990-2022 Change**	**1990**	**2010**	**2015**	**2018**	**2020**	**2022**
Buildings	-22.59%	135,521.13	170,622.79	135,276.59	116,316.15	104,019.12	104,910.81
Transportation	7.58%	234,508.14	255,063.75	308,444.99	324,057.88	246,723.33	252,289.05
Water	-90.52%	5,831.00	594.05	570.61	591.69	557.48	552.95
Solid Waste	80.90%	11,955.45	22,261.56	31,773.18	33,137.12	23,199.98	21,627.72
Agriculture	0.00%	-	-	-	-	-	-
Total	**-2.18%**	**387,815.73**	**448,542.15**	**476,065.37**	**474,102.84**	**374,499.92**	**379,380.53**

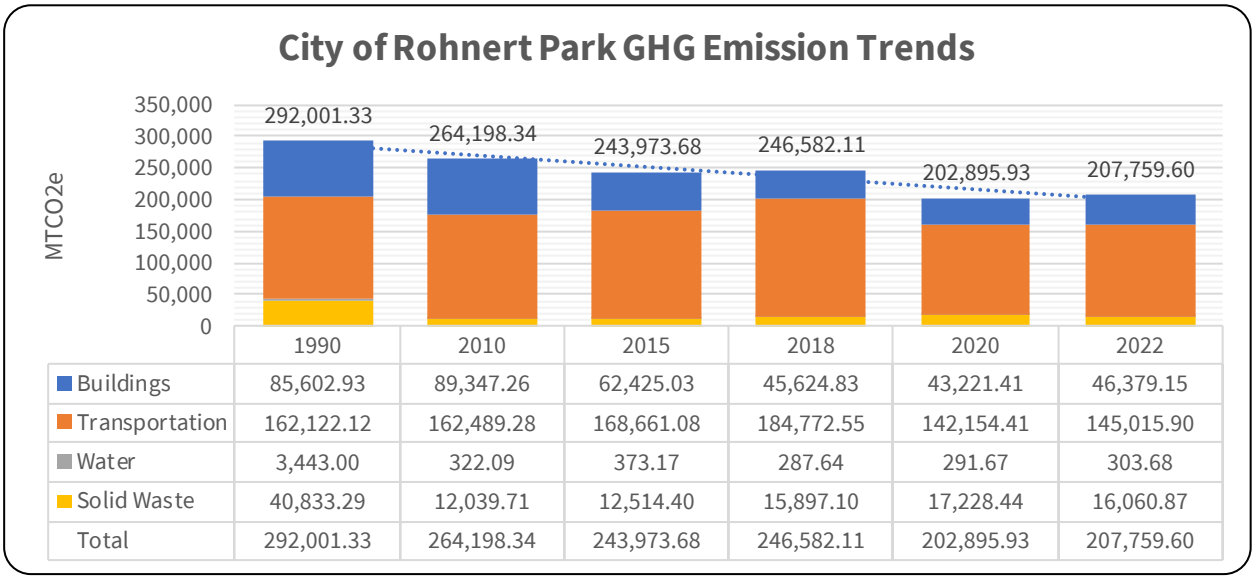
1990-2022 City of Petaluma GHG Emission Trends per Capita (MTCO2e/person)							
Sector	**1990-2022 Change**	**1990**	**2010**	**2015**	**2018**	**2020**	**2022**
Buildings	-42.93%	3.14	2.94	2.24	1.87	1.74	1.79
Transportation	-20.69%	5.43	4.40	5.10	5.20	4.12	4.31
Water	-93.01%	0.14	0.01	0.01	0.01	0.01	0.01
Solid Waste	33.37%	0.28	0.38	0.53	0.53	0.39	0.37
Agriculture	0.00%	-	-	-	-	-	-
Per Person	**-27.88%**	**8.98**	**7.74**	**7.88**	**7.60**	**6.26**	**6.48**

1990-2022 City of Petaluma GHG Emission Trends per Household (MTCO2e/household)							
Sector	**1990-2022 Change**	**1990**	**2010**	**2015**	**2018**	**2020**	**2022**
Buildings	-46.53%	8.44	7.85	6.08	5.12	4.49	4.51
Transportation	-25.70%	14.60	11.73	13.86	14.27	10.64	10.85
Water	-93.45%	0.36	0.03	0.03	0.03	0.02	0.02
Solid Waste	24.94%	0.74	1.02	1.43	1.46	1.00	0.93
Agriculture	0.00%	-	-	-	-	-	-
Per Household	**-32.44%**	**24.14**	**20.63**	**21.39**	**20.87**	**16.15**	**16.31**

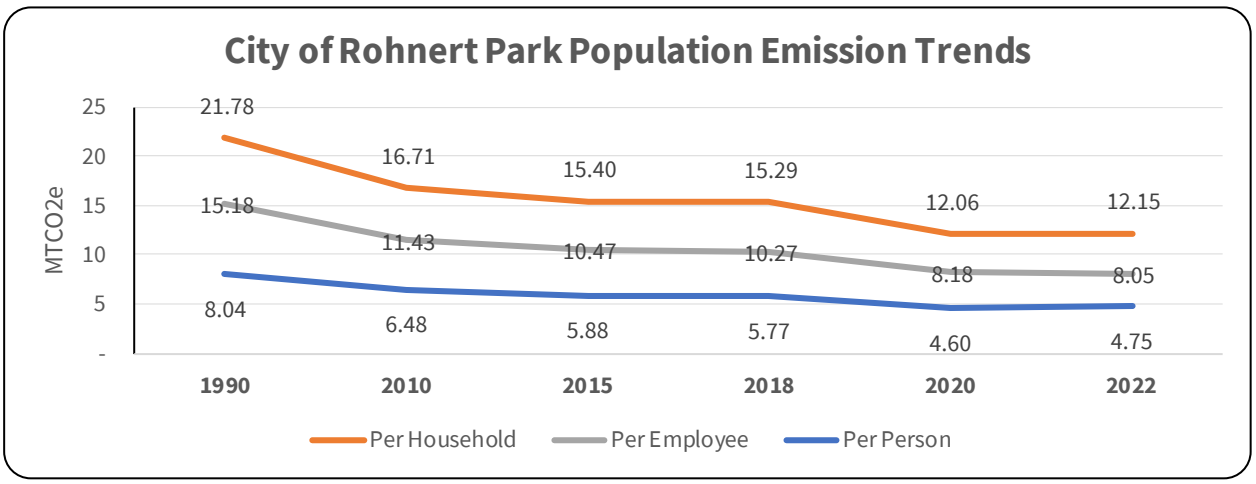
1990-2022 City of Petaluma GHG Emission Trends per Employee (MTCO2e/Employment Count)							
Sector	**1990-2022 Change**	**1990**	**2010**	**2015**	**2018**	**2020**	**2022**
Buildings	-46.04%	5.98	5.36	4.18	3.57	3.17	3.22
Transportation	-25.01%	10.34	8.01	9.54	9.95	7.53	7.75
Water	-93.39%	0.26	0.02	0.02	0.02	0.02	0.02
Solid Waste	26.10%	0.53	0.70	0.98	1.02	0.71	0.66
Agriculture	0.00%	-	-	-	-	-	-
Per Employee	**-31.81%**	**17.10**	**14.09**	**14.72**	**14.56**	**11.42**	**11.66**

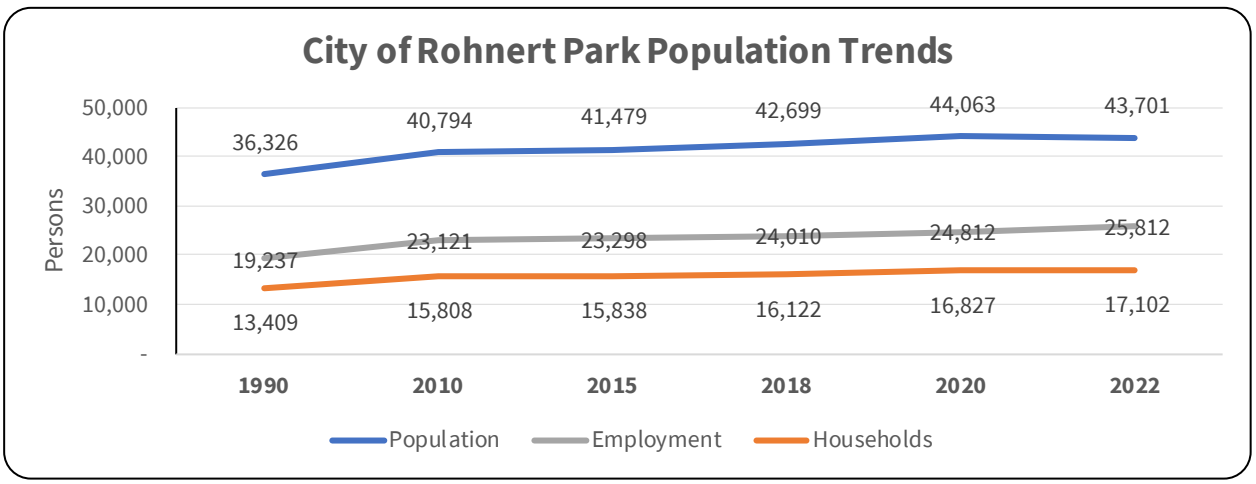
Petaluma	**1990-2022 Demographic Calculation Inputs**						
Sector	**1990-2022 Change**	**1990**	**2010**	**2015**	**2018**	**2020**	**2022**
Population	35.64%	43,166	57,941	60,451	62,356	59,816	58,552
Pop. Share	9.57%	11.12%	11.97%	12.08%	12.46%	12.24%	12.18%
Households	44.79%	16,062	21,737	22,261	22,715	23,190	23,256
Hous. Share	13.91%	10.78%	11.70%	11.81%	12.19%	12.35%	12.28%
Employment	43.46%	22,681	31,830	32,341	32,559	32,787	32,538
Emp. Share	-4.65%	13.01%	12.55%	12.34%	12.16%	12.27%	12.40%

CITY OF ROHNERT PARK



	1990	2010	2015	2018	2020	2022
Buildings	85,602.93	89,347.26	62,425.03	45,624.83	43,221.41	46,379.15
Transportation	162,122.12	162,489.28	168,661.08	184,772.55	142,154.41	145,015.90
Water	3,443.00	322.09	373.17	287.64	291.67	303.68
Solid Waste	40,833.29	12,039.71	12,514.40	15,897.10	17,228.44	16,060.87
Total	292,001.33	264,198.34	243,973.68	246,582.11	202,895.93	207,759.60





1990-2022 City of Rohnert Park GHG Emission Trends by Sector (MTCO2e)							
Sector	1990-2022 Change	1990	2010	2015	2018	2020	2022
Buildings	-45.82%	85,602.93	89,347.26	62,425.03	45,624.83	43,221.41	46,379.15
Transportation	-10.55%	162,122.12	162,489.28	168,661.08	184,772.55	142,154.41	145,015.90
Water	-91.18%	3,443.00	322.09	373.17	287.64	291.67	303.68
Solid Waste	-60.67%	40,833.29	12,039.71	12,514.40	15,897.10	17,228.44	16,060.87
Agriculture	0.00%	-	-	-	-	-	-
Total	**-28.85%**	**292,001.33**	**264,198.34**	**243,973.68**	**246,582.11**	**202,895.93**	**207,759.60**

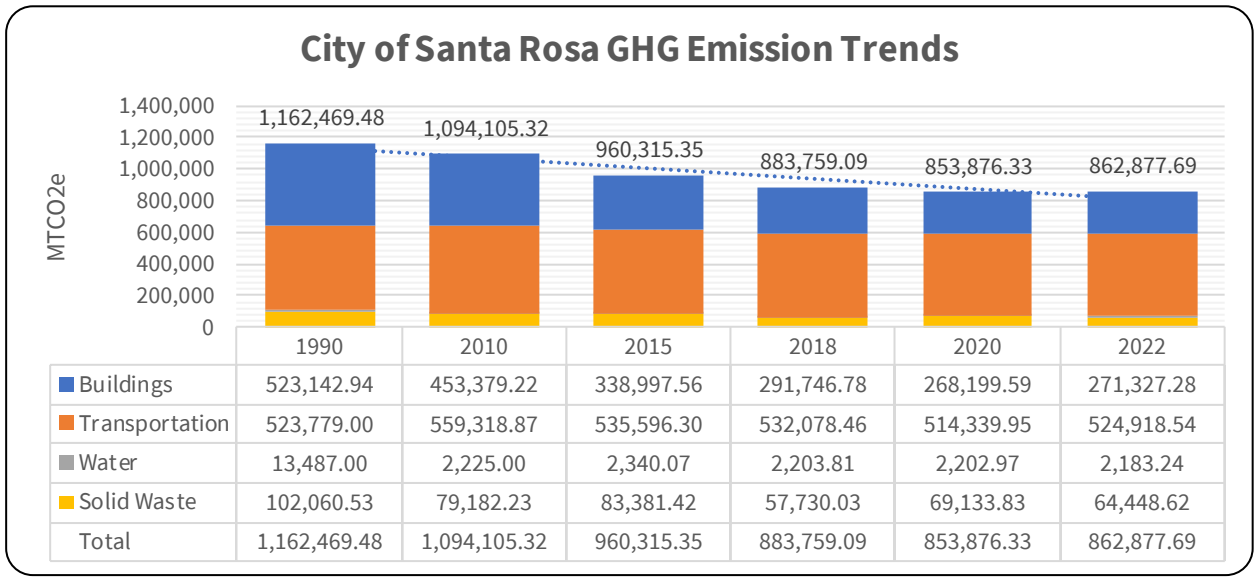
1990-2022 City of Rohnert Park GHG Emission Trends per Capita (MTCO2e/person)							
Sector	1990-2022 Change	1990	2010	2015	2018	2020	2022
Buildings	-54.96%	2.36	2.19	1.50	1.07	0.98	1.06
Transportation	-25.65%	4.46	3.98	4.07	4.33	3.23	3.32
Water	-92.67%	0.09	0.01	0.01	0.01	0.01	0.01
Solid Waste	-67.31%	1.12	0.30	0.30	0.37	0.39	0.37
Agriculture	0.00%	-	-	-	-	-	-
Per Person	**-40.86%**	**8.04**	**6.48**	**5.88**	**5.77**	**4.60**	**4.75**

1990-2022 City of Rohnert Park GHG Emission Trends per Household (MTCO2e/household)							
Sector	1990-2022 Change	1990	2010	2015	2018	2020	2022
Buildings	-57.52%	6.38	5.65	3.94	2.83	2.57	2.71
Transportation	-29.87%	12.09	10.28	10.65	11.46	8.45	8.48
Water	-93.08%	0.26	0.02	0.02	0.02	0.02	0.02
Solid Waste	-69.16%	3.05	0.76	0.79	0.99	1.02	0.94
Agriculture	0.00%	-	-	-	-	-	-
Per Household	**-44.21%**	**21.78**	**16.71**	**15.40**	**15.29**	**12.06**	**12.15**

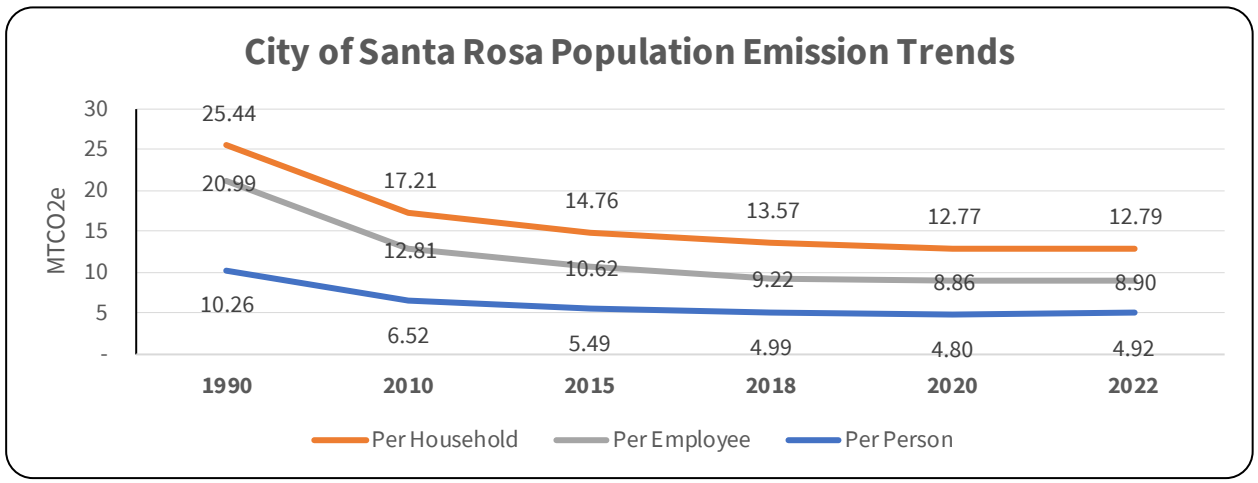
1990-2022 City of Rohnert Park GHG Emission Trends per Employee (MTCO2e/Employment Count)							
Sector	1990-2022 Change	1990	2010	2015	2018	2020	2022
Buildings	-59.62%	4.45	3.86	2.68	1.90	1.74	1.80
Transportation	-33.34%	8.43	7.03	7.24	7.70	5.73	5.62
Water	-93.43%	0.18	0.01	0.02	0.01	0.01	0.01
Solid Waste	-70.69%	2.12	0.52	0.54	0.66	0.69	0.62
Agriculture	0.00%	-	-	-	-	-	-
Per Employee	**-46.97%**	**15.18**	**11.43**	**10.47**	**10.27**	**8.18**	**8.05**

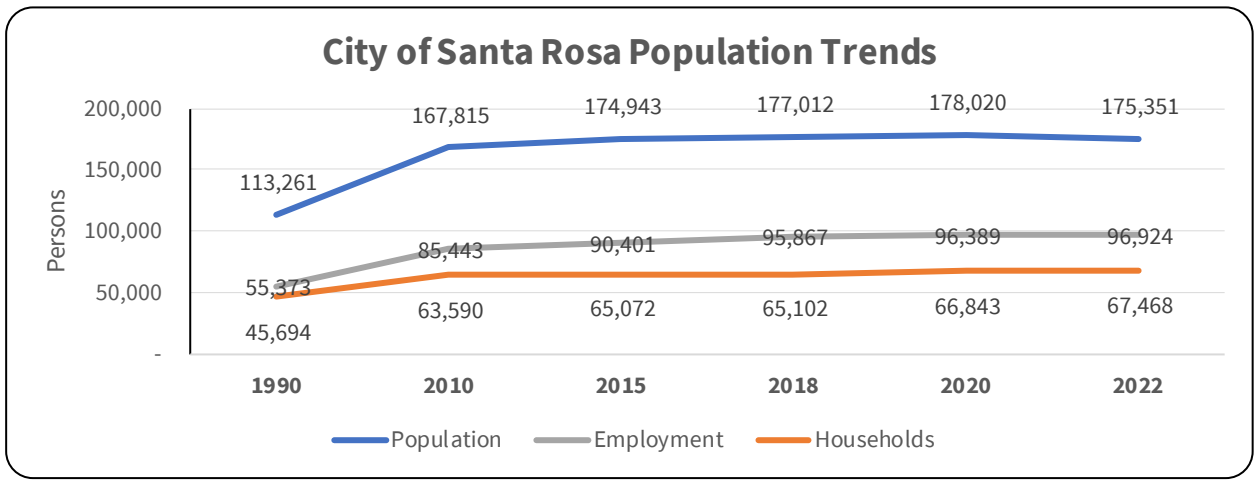
Rohnert Park 1990-2022 Demographic Calculation Inputs							
Sector	1990-2022 Change	1990	2010	2015	2018	2020	2022
Population	20.30%	36,326	40,794	41,479	42,699	44,063	43,701
Pop. Share	-2.83%	9.36%	8.43%	8.29%	8.53%	9.01%	9.09%
Households	27.54%	13,409	15,808	15,838	16,122	16,827	17,102
Hous. Share	0.34%	9.00%	8.51%	8.40%	8.65%	8.96%	9.03%
Employment	34.18%	19,237	23,121	23,298	24,010	24,812	25,812
Emp. Share	-10.82%	11.03%	9.11%	8.89%	8.96%	9.29%	9.84%

CITY OF SANTA ROSA



	1990	2010	2015	2018	2020	2022
Buildings	523,142.94	453,379.22	338,997.56	291,746.78	268,199.59	271,327.28
Transportation	523,779.00	559,318.87	535,596.30	532,078.46	514,339.95	524,918.54
Water	13,487.00	2,225.00	2,340.07	2,203.81	2,202.97	2,183.24
Solid Waste	102,060.53	79,182.23	83,381.42	57,730.03	69,133.83	64,448.62
Total	1,162,469.48	1,094,105.32	960,315.35	883,759.09	853,876.33	862,877.69





1990-2022 City of Santa Rosa GHG Emission Trends by Sector (MTCO2e)							
Sector	**1990-2022 Change**	**1990**	**2010**	**2015**	**2018**	**2020**	**2022**
Buildings	-48.14%	523,142.94	453,379.22	338,997.56	291,746.78	268,199.59	271,327.28
Transportation	0.22%	523,779.00	559,318.87	535,596.30	532,078.46	514,339.95	524,918.54
Water	-83.81%	13,487.00	2,225.00	2,340.07	2,203.81	2,202.97	2,183.24
Solid Waste	-36.85%	102,060.53	79,182.23	83,381.42	57,730.03	69,133.83	64,448.62
Agriculture	0.00%	-	-	-	-	-	-
Total	**-25.77%**	**1,162,469.48**	**1,094,105.32**	**960,315.35**	**883,759.09**	**853,876.33**	**862,877.69**

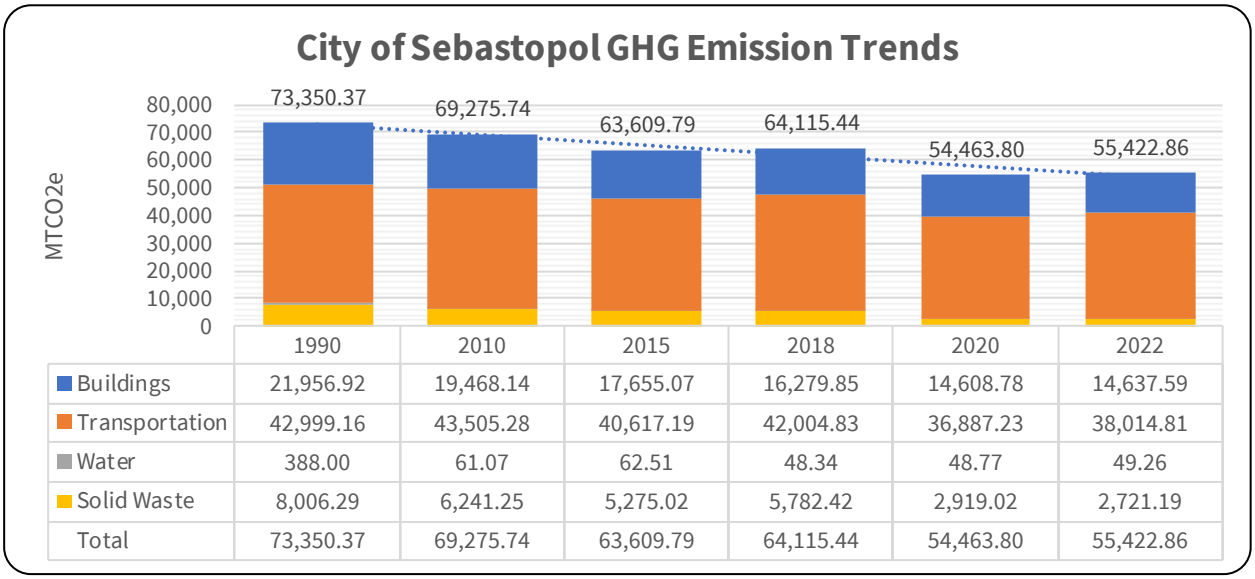
1990-2022 City of Santa Rosa GHG Emission Trends per Capita (MTCO2e/person)							
Sector	**1990-2022 Change**	**1990**	**2010**	**2015**	**2018**	**2020**	**2022**
Buildings	-66.50%	4.62	2.70	1.94	1.65	1.51	1.55
Transportation	-35.27%	4.62	3.33	3.06	3.01	2.89	2.99
Water	-89.54%	0.12	0.01	0.01	0.01	0.01	0.01
Solid Waste	-59.21%	0.90	0.47	0.48	0.33	0.39	0.37
Agriculture	0.00%	-	-	-	-	-	-
Per Person	**-52.06%**	**10.26**	**6.52**	**5.49**	**4.99**	**4.80**	**4.92**

1990-2022 City of Santa Rosa GHG Emission Trends per Household (MTCO2e/household)							
Sector	**1990-2022 Change**	**1990**	**2010**	**2015**	**2018**	**2020**	**2022**
Buildings	-64.87%	11.45	7.13	5.21	4.48	4.01	4.02
Transportation	-32.13%	11.46	8.80	8.23	8.17	7.69	7.78
Water	-89.04%	0.30	0.03	0.04	0.03	0.03	0.03
Solid Waste	-57.23%	2.23	1.25	1.28	0.89	1.03	0.96
Agriculture	0.00%	-	-	-	-	-	-
Per Household	**-49.73%**	**25.44**	**17.21**	**14.76**	**13.57**	**12.77**	**12.79**

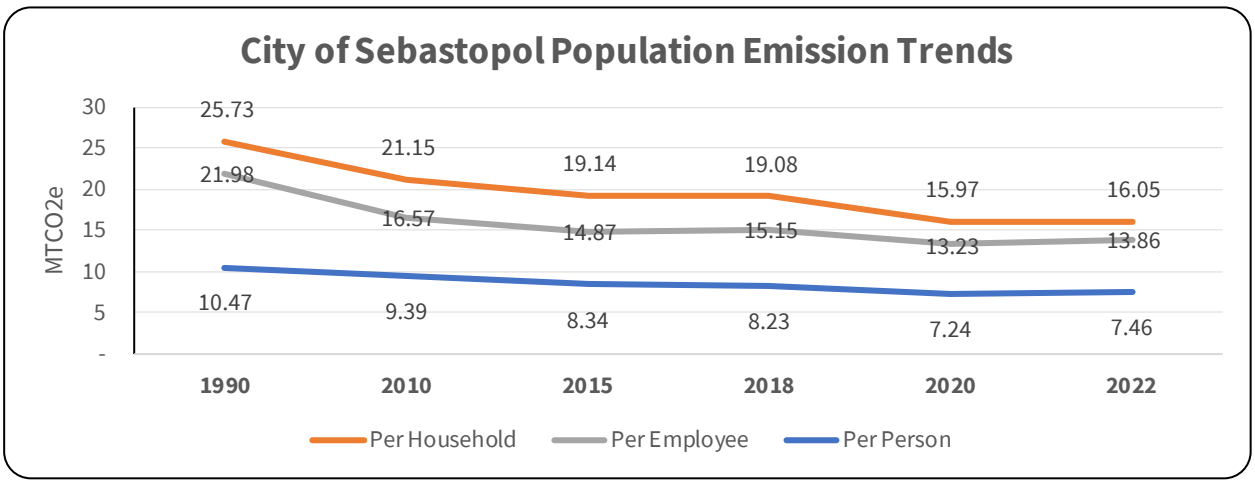
1990-2022 City of Santa Rosa GHG Emission Trends per Employee (MTCO2e/Employment Count)							
Sector	**1990-2022 Change**	**1990**	**2010**	**2015**	**2018**	**2020**	**2022**
Buildings	-70.37%	9.45	5.31	3.75	3.04	2.78	2.80
Transportation	-42.75%	9.46	6.55	5.92	5.55	5.34	5.42
Water	-90.75%	0.24	0.03	0.03	0.02	0.02	0.02
Solid Waste	-63.92%	1.84	0.93	0.92	0.60	0.72	0.66
Agriculture	0.00%	-	-	-	-	-	-
Per Employee	**-57.59%**	**20.99**	**12.81**	**10.62**	**9.22**	**8.86**	**8.90**

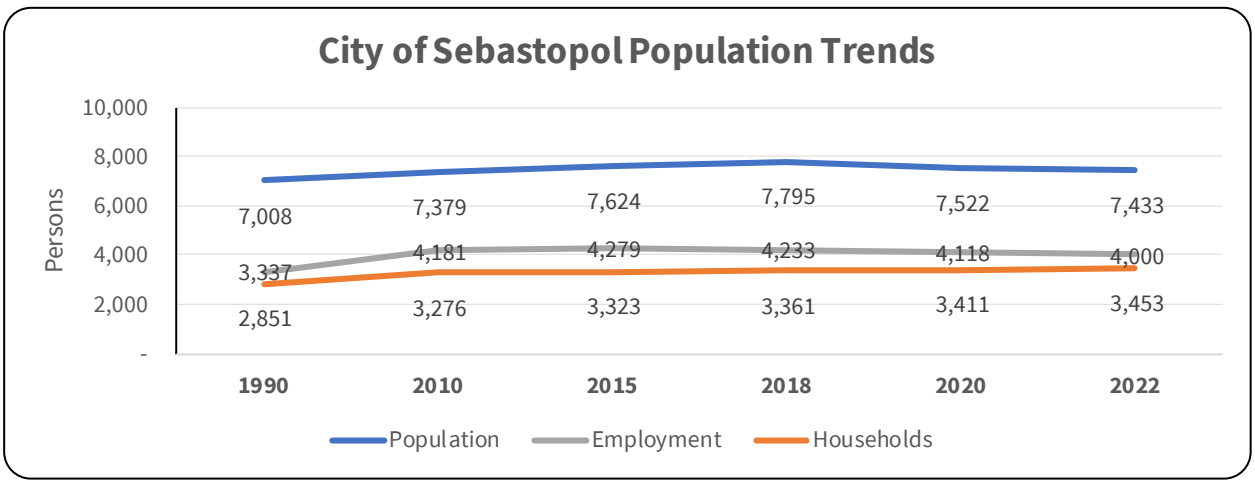
Santa Rosa	1990-2022 Demographic Calculation Inputs						
Sector	**1990-2022 Change**	**1990**	**2010**	**2015**	**2018**	**2020**	**2022**
Population	54.82%	113,261	167,815	174,943	177,012	178,020	175,351
Pop. Share	25.06%	29.17%	34.68%	34.95%	35.37%	36.42%	36.48%
Households	47.65%	45,694	63,590	65,072	65,102	66,843	67,468
Hous. Share	16.16%	30.66%	34.22%	34.52%	34.95%	35.61%	35.62%
Employment	75.04%	55,373	85,443	90,401	95,867	96,389	96,924
Emp. Share	16.33%	31.76%	33.68%	34.48%	35.79%	36.07%	36.95%

CITY OF SEBASTOPOL



	1990	2010	2015	2018	2020	2022
Buildings	21,956.92	19,468.14	17,655.07	16,279.85	14,608.78	14,637.59
Transportation	42,999.16	43,505.28	40,617.19	42,004.83	36,887.23	38,014.81
Water	388.00	61.07	62.51	48.34	48.77	49.26
Solid Waste	8,006.29	6,241.25	5,275.02	5,782.42	2,919.02	2,721.19
Total	73,350.37	69,275.74	63,609.79	64,115.44	54,463.80	55,422.86





1990-2022 City of Sebastopol GHG Emission Trends by Sector (MTCO2e)							
Sector	1990-2022 Change	1990	2010	2015	2018	2020	2022
Buildings	-33.33%	21,956.92	19,468.14	17,655.07	16,279.85	14,608.78	14,637.59
Transportation	-11.59%	42,999.16	43,505.28	40,617.19	42,004.83	36,887.23	38,014.81
Water	-87.30%	388.00	61.07	62.51	48.34	48.77	49.26
Solid Waste	-66.01%	8,006.29	6,241.25	5,275.02	5,782.42	2,919.02	2,721.19
Agriculture	0.00%	-	-	-	-	-	-
Total	**-24.44%**	**73,350.37**	**69,275.74**	**63,609.79**	**64,115.44**	**54,463.80**	**55,422.86**

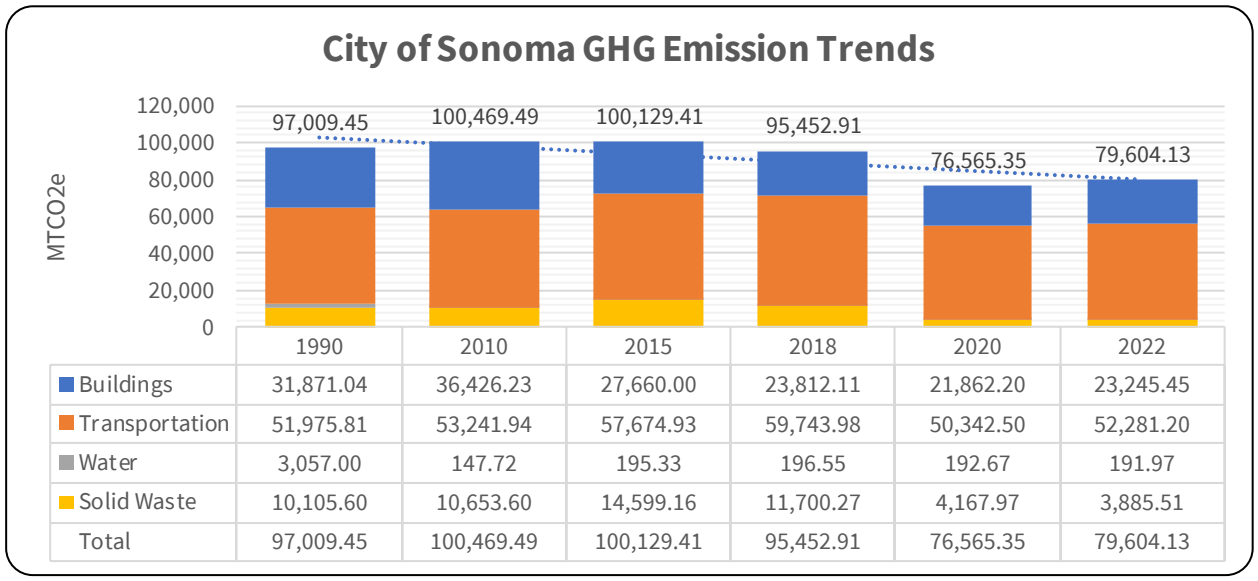
1990-2022 City of Sebastopol GHG Emission Trends per Capita (MTCO2e/person)							
Sector	1990-2022 Change	1990	2010	2015	2018	2020	2022
Buildings	-37.15%	3.13	2.64	2.32	2.09	1.94	1.97
Transportation	-16.65%	6.14	5.90	5.33	5.39	4.90	5.11
Water	-88.03%	0.06	0.01	0.01	0.01	0.01	0.01
Solid Waste	-67.96%	1.14	0.85	0.69	0.74	0.39	0.37
Agriculture	0.00%	-	-	-	-	-	-
Per Person	**-28.76%**	**10.47**	**9.39**	**8.34**	**8.23**	**7.24**	**7.46**

1990-2022 City of Sebastopol GHG Emission Trends per Household (MTCO2e/household)							
Sector	1990-2022 Change	1990	2010	2015	2018	2020	2022
Buildings	-44.96%	7.70	5.94	5.31	4.84	4.28	4.24
Transportation	-27.00%	15.08	13.28	12.22	12.50	10.81	11.01
Water	-89.52%	0.14	0.02	0.02	0.01	0.01	0.01
Solid Waste	-71.94%	2.81	1.91	1.59	1.72	0.86	0.79
Agriculture	0.00%	-	-	-	-	-	-
Per Household	**-37.61%**	**25.73**	**21.15**	**19.14**	**19.08**	**15.97**	**16.05**

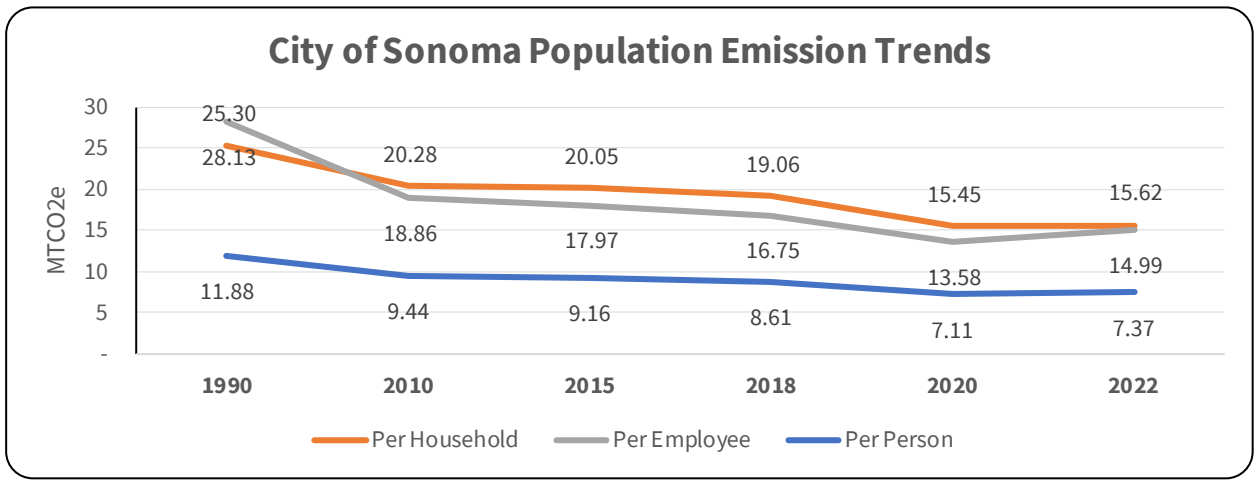
1990-2022 City of Sebastopol GHG Emission Trends per Employee (MTCO2e/Employment Count)							
Sector	1990-2022 Change	1990	2010	2015	2018	2020	2022
Buildings	-44.38%	6.58	4.66	4.13	3.85	3.55	3.66
Transportation	-26.25%	12.89	10.41	9.49	9.92	8.96	9.50
Water	-89.41%	0.12	0.01	0.01	0.01	0.01	0.01
Solid Waste	-71.65%	2.40	1.49	1.23	1.37	0.71	0.68
Agriculture	0.00%	-	-	-	-	-	-
Per Employee	**-36.96%**	**21.98**	**16.57**	**14.87**	**15.15**	**13.23**	**13.86**

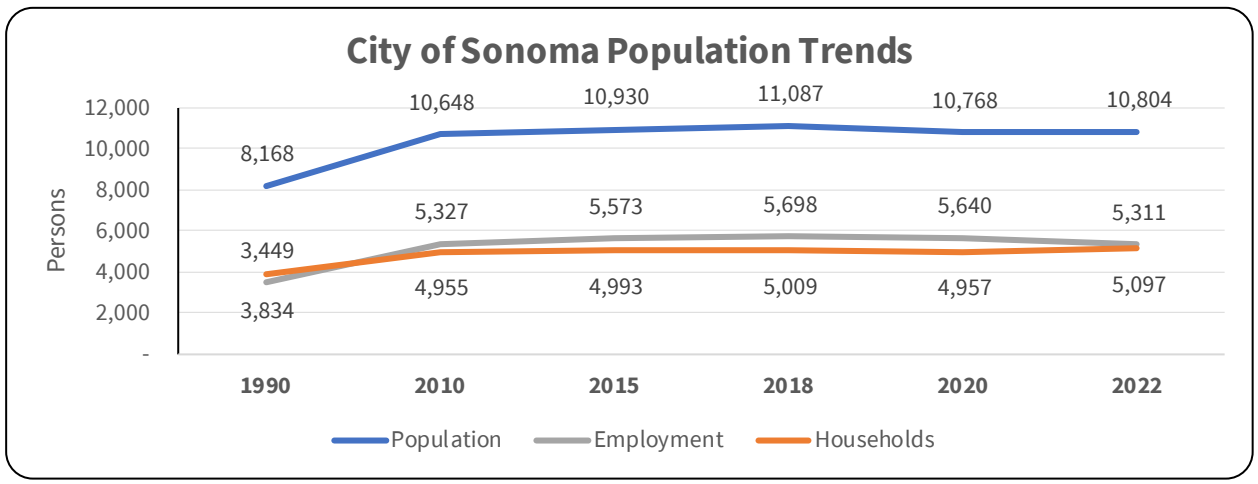
Sebastopol	1990-2022 Demographic Calculation Inputs						
Sector	1990-2022 Change	1990	2010	2015	2018	2020	2022
Population	6.06%	7,008	7,379	7,624	7,795	7,522	7,433
Pop. Share	-14.33%	1.81%	1.52%	1.52%	1.56%	1.54%	1.55%
Households	21.12%	2,851	3,276	3,323	3,361	3,411	3,453
Hous. Share	-4.72%	1.91%	1.76%	1.76%	1.80%	1.82%	1.82%
Employment	19.87%	3,337	4,181	4,279	4,233	4,118	4,000
Emp. Share	-20.33%	1.91%	1.65%	1.63%	1.58%	1.54%	1.52%

CITY OF SONOMA



	1990	2010	2015	2018	2020	2022
Buildings	31,871.04	36,426.23	27,660.00	23,812.11	21,862.20	23,245.45
Transportation	51,975.81	53,241.94	57,674.93	59,743.98	50,342.50	52,281.20
Water	3,057.00	147.72	195.33	196.55	192.67	191.97
Solid Waste	10,105.60	10,653.60	14,599.16	11,700.27	4,167.97	3,885.51
Total	97,009.45	100,469.49	100,129.41	95,452.91	76,565.35	79,604.13





1990-2022 City of Sonoma GHG Emission Trends by Sector (MTCO2e)							
Sector	1990-2022 Change	1990	2010	2015	2018	2020	2022
Buildings	-27.06%	31,871.04	36,426.23	27,660.00	23,812.11	21,862.20	23,245.45
Transportation	0.59%	51,975.81	53,241.94	57,674.93	59,743.98	50,342.50	52,281.20
Water	-93.72%	3,057.00	147.72	195.33	196.55	192.67	191.97
Solid Waste	-61.55%	10,105.60	10,653.60	14,599.16	11,700.27	4,167.97	3,885.51
Agriculture	0.00%	-	-	-	-	-	-
Total	**-17.94%**	**97,009.45**	**100,469.49**	**100,129.41**	**95,452.91**	**76,565.35**	**79,604.13**

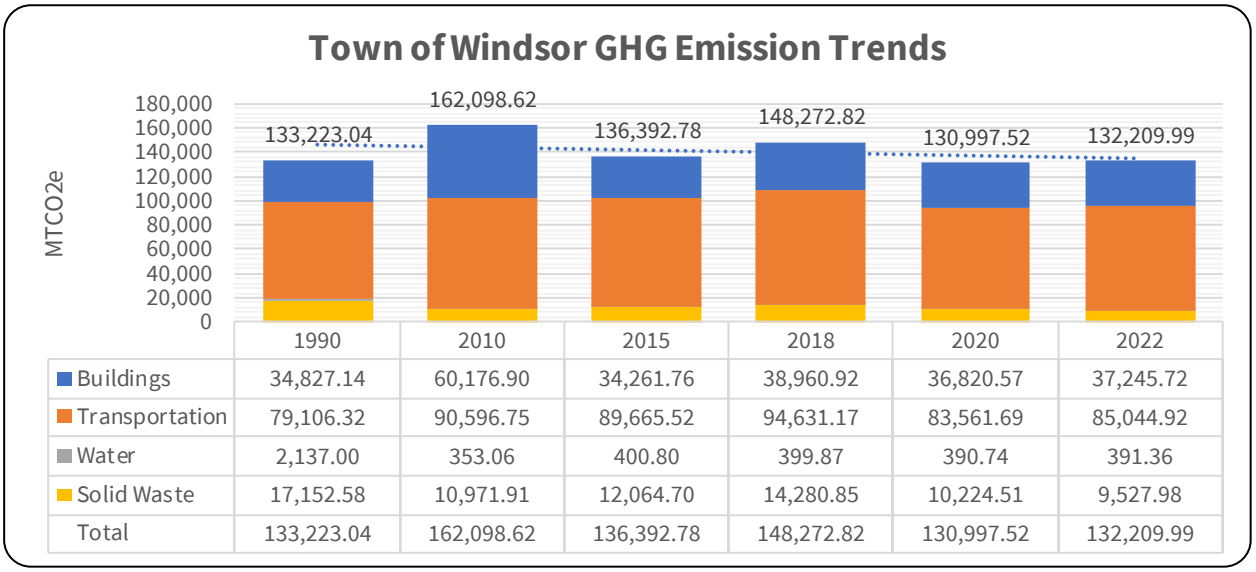
1990-2022 City of Sonoma GHG Emission Trends per Capita (MTCO2e/person)							
Sector	1990-2022 Change	1990	2010	2015	2018	2020	2022
Buildings	-44.86%	3.90	3.42	2.53	2.15	2.03	2.15
Transportation	-23.95%	6.36	5.00	5.28	5.39	4.68	4.84
Water	-95.25%	0.37	0.01	0.02	0.02	0.02	0.02
Solid Waste	-70.93%	1.24	1.00	1.34	1.06	0.39	0.36
Agriculture	0.00%	-	-	-	-	-	-
Per Person	**-37.96%**	**11.88**	**9.44**	**9.16**	**8.61**	**7.11**	**7.37**

1990-2022 City of Sonoma GHG Emission Trends per Household (MTCO2e/household)							
Sector	1990-2022 Change	1990	2010	2015	2018	2020	2022
Buildings	-45.14%	8.31	7.35	5.54	4.75	4.41	4.56
Transportation	-24.34%	13.56	10.75	11.55	11.93	10.16	10.26
Water	-95.28%	0.80	0.03	0.04	0.04	0.04	0.04
Solid Waste	-71.08%	2.64	2.15	2.92	2.34	0.84	0.76
Agriculture	0.00%	-	-	-	-	-	-
Per Household	**-38.28%**	**25.30**	**20.28**	**20.05**	**19.06**	**15.45**	**15.62**

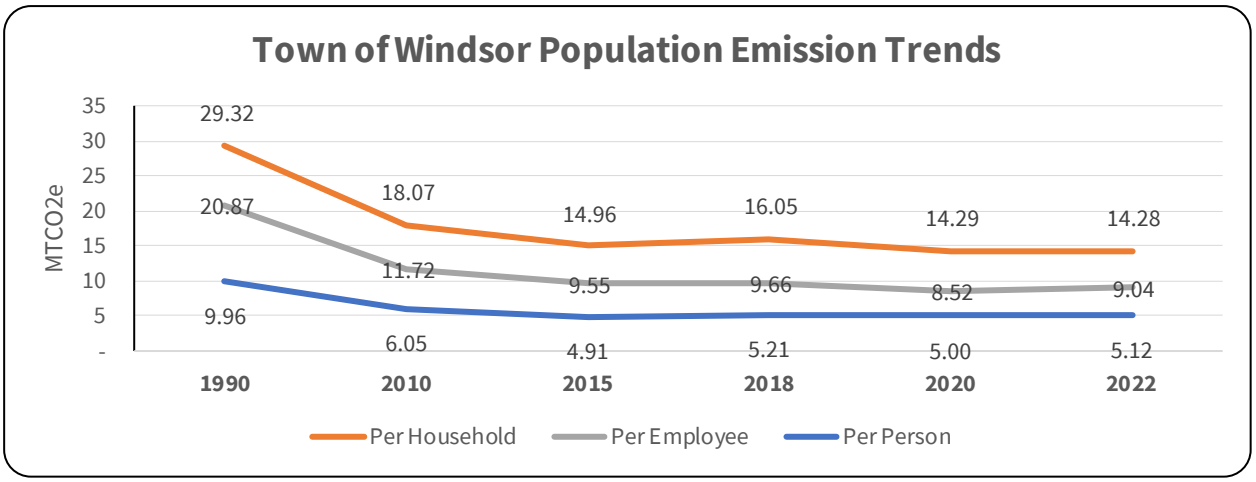
1990-2022 City of Sonoma GHG Emission Trends per Employee (MTCO2e/Employment Count)							
Sector	1990-2022 Change	1990	2010	2015	2018	2020	2022
Buildings	-52.63%	9.24	6.84	4.96	4.18	3.88	4.38
Transportation	-34.68%	15.07	9.99	10.35	10.49	8.93	9.84
Water	-95.92%	0.89	0.03	0.04	0.03	0.03	0.04
Solid Waste	-75.03%	2.93	2.00	2.62	2.05	0.74	0.73
Agriculture	0.00%	-	-	-	-	-	-
Per Employee	**-46.71%**	**28.13**	**18.86**	**17.97**	**16.75**	**13.58**	**14.99**

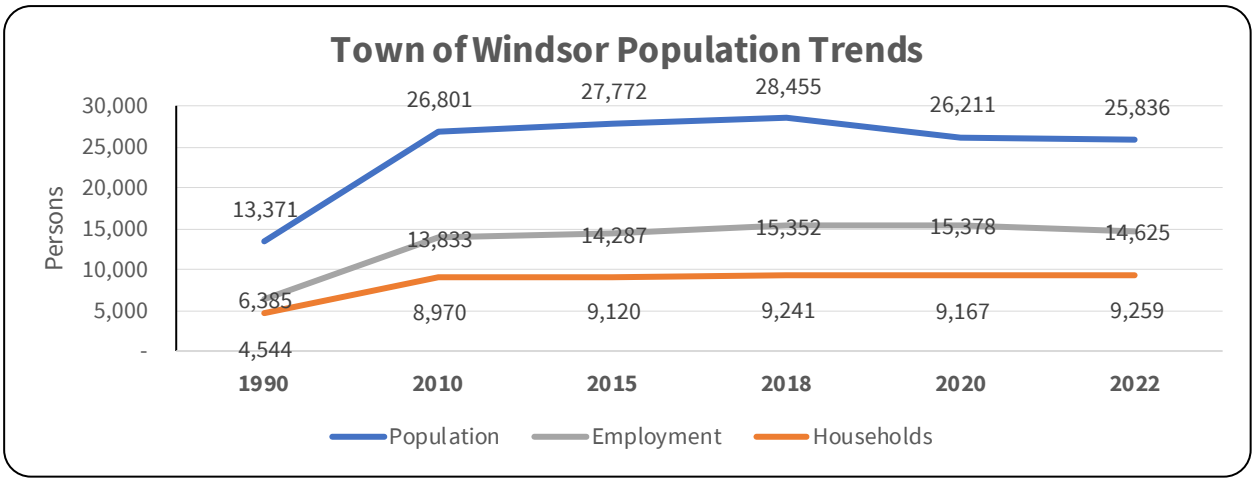
Sonoma	1990-2022 Demographic Calculation Inputs						
Sector	1990-2022 Change	1990	2010	2015	2018	2020	2022
Population	32.27%	8,168	10,648	10,930	11,087	10,768	10,804
Pop. Share	6.84%	2.10%	2.20%	2.18%	2.22%	2.20%	2.25%
Households	32.94%	3,834	4,955	4,993	5,009	4,957	5,097
Hous. Share	4.59%	2.57%	2.67%	2.65%	2.69%	2.64%	2.69%
Employment	53.99%	3,449	5,327	5,573	5,698	5,640	5,311
Emp. Share	2.34%	1.98%	2.10%	2.13%	2.13%	2.11%	2.02%

TOWN OF WINDSOR



	1990	2010	2015	2018	2020	2022
Buildings	34,827.14	60,176.90	34,261.76	38,960.92	36,820.57	37,245.72
Transportation	79,106.32	90,596.75	89,665.52	94,631.17	83,561.69	85,044.92
Water	2,137.00	353.06	400.80	399.87	390.74	391.36
Solid Waste	17,152.58	10,971.91	12,064.70	14,280.85	10,224.51	9,527.98
Total	133,223.04	162,098.62	136,392.78	148,272.82	130,997.52	132,209.99





1990-2022 Town of Windsor GHG Emission Trends by Sector (MTCO2e)							
Sector	1990-2022 Change	1990	2010	2015	2018	2020	2022
Buildings	6.94%	34,827.14	60,176.90	34,261.76	38,960.92	36,820.57	37,245.72
Transportation	7.51%	79,106.32	90,596.75	89,665.52	94,631.17	83,561.69	85,044.92
Water	-81.69%	2,137.00	353.06	400.80	399.87	390.74	391.36
Solid Waste	-44.45%	17,152.58	10,971.91	12,064.70	14,280.85	10,224.51	9,527.98
Agriculture	0.00%	-	-	-	-	-	-
Total	**-0.76%**	**133,223.04**	**162,098.62**	**136,392.78**	**148,272.82**	**130,997.52**	**132,209.99**

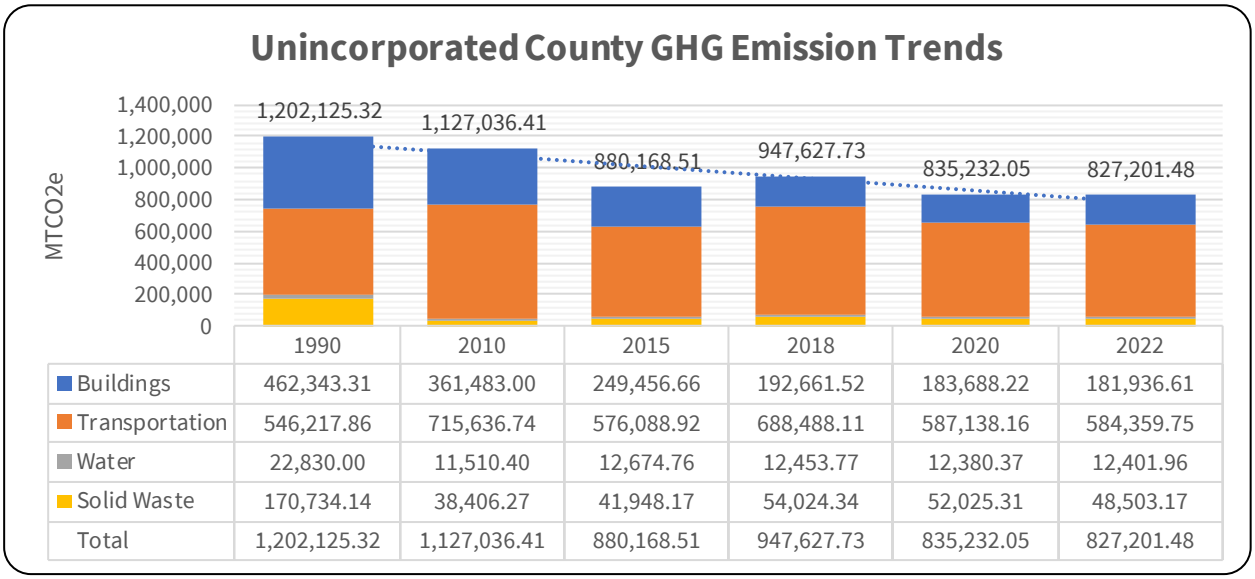
1990-2022 Town of Windsor GHG Emission Trends per Capita (MTCO2e/person)							
Sector	1990-2022 Change	1990	2010	2015	2018	2020	2022
Buildings	-44.65%	2.60	2.25	1.23	1.37	1.40	1.44
Transportation	-44.36%	5.92	3.38	3.23	3.33	3.19	3.29
Water	-90.52%	0.16	0.01	0.01	0.01	0.01	0.02
Solid Waste	-71.25%	1.28	0.41	0.43	0.50	0.39	0.37
Agriculture	0.00%	-	-	-	-	-	-
Per Person	**-48.64%**	**9.96**	**6.05**	**4.91**	**5.21**	**5.00**	**5.12**

1990-2022 Town of Windsor GHG Emission Trends per Household (MTCO2e/household)							
Sector	1990-2022 Change	1990	2010	2015	2018	2020	2022
Buildings	-47.59%	7.66	6.71	3.76	4.22	4.02	4.02
Transportation	-47.63%	17.41	10.10	9.83	10.24	9.12	9.19
Water	-90.94%	0.47	0.04	0.04	0.04	0.04	0.04
Solid Waste	-70.45%	3.77	1.22	1.32	1.55	1.12	1.03
Agriculture	0.00%	-	-	-	-	-	-
Per Household	**-51.25%**	**29.32**	**18.07**	**14.96**	**16.05**	**14.29**	**14.28**

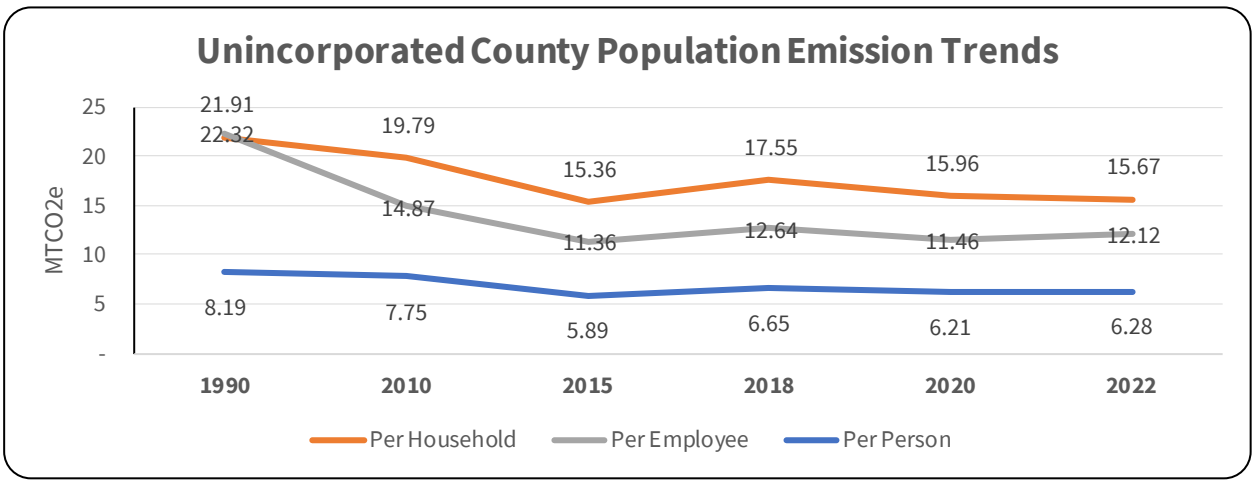
1990-2022 Town of Windsor GHG Emission Trends per Employee (MTCO2e/Employment Count)							
Sector	1990-2022 Change	1990	2010	2015	2018	2020	2022
Buildings	-56.10%	5.45	4.35	2.40	2.54	2.39	2.55
Transportation	-56.14%	12.39	6.55	6.28	6.16	5.43	5.82
Water	-92.41%	0.33	0.03	0.03	0.03	0.03	0.03
Solid Waste	-75.25%	2.69	0.79	0.84	0.93	0.66	0.65
Agriculture	0.00%	-	-	-	-	-	-
Per Employee	**-59.17%**	**20.87**	**11.72**	**9.55**	**9.66**	**8.52**	**9.04**

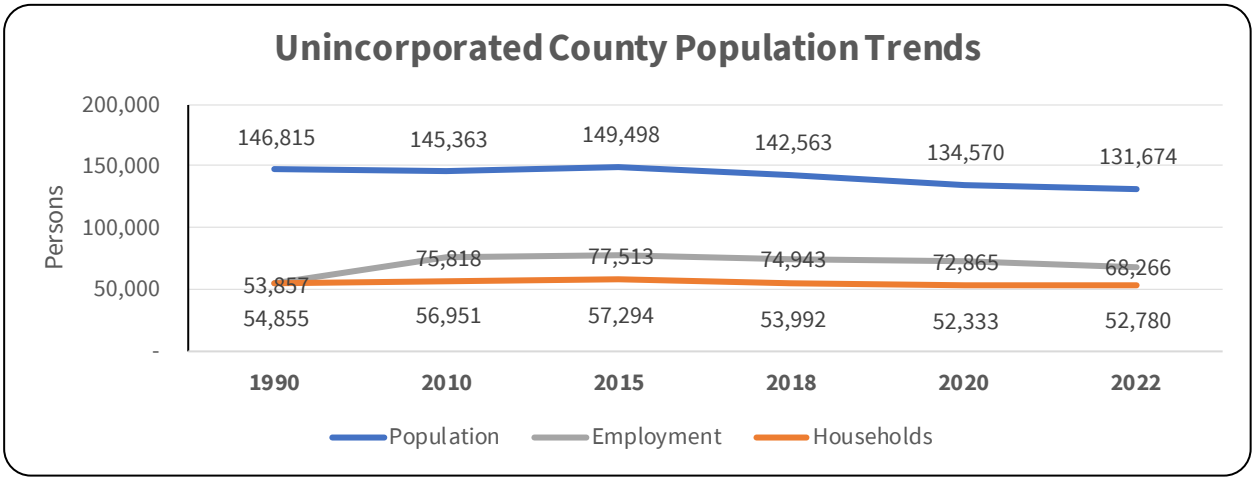
Windsor	1990-2022 Demographic Calculation Inputs						
Sector	1990-2022 Change	1990	2010	2015	2018	2020	2022
Population	93.22%	13,371	26,801	27,772	28,455	26,211	25,836
Pop. Share	56.08%	3.44%	5.54%	5.55%	5.69%	5.36%	5.38%
Households	103.74%	4,544	8,970	9,120	9,241	9,167	9,259
Hous. Share	60.29%	3.05%	4.83%	4.84%	4.96%	4.88%	4.89%
Employment	129.05%	6,385	13,833	14,287	15,352	15,378	14,625
Emp. Share	52.23%	3.66%	5.45%	5.45%	5.73%	5.75%	5.58%

UNINCORPORATED COUNTY



	1990	2010	2015	2018	2020	2022
Buildings	462,343.31	361,483.00	249,456.66	192,661.52	183,688.22	181,936.61
Transportation	546,217.86	715,636.74	576,088.92	688,488.11	587,138.16	584,359.75
Water	22,830.00	11,510.40	12,674.76	12,453.77	12,380.37	12,401.96
Solid Waste	170,734.14	38,406.27	41,948.17	54,024.34	52,025.31	48,503.17
Total	1,202,125.32	1,127,036.41	880,168.51	947,627.73	835,232.05	827,201.48





1990-2022 Unincorporated County GHG Emission Trends by Sector (MTCO2e)							
Sector	1990-2022 Change	1990	2010	2015	2018	2020	2022
Buildings	-60.65%	462,343.31	361,483.00	249,456.66	192,661.52	183,688.22	181,936.61
Transportation	6.98%	546,217.86	715,636.74	576,088.92	688,488.11	587,138.16	584,359.75
Water	-45.68%	22,830.00	11,510.40	12,674.76	12,453.77	12,380.37	12,401.96
Solid Waste	-71.59%	170,734.14	38,406.27	41,948.17	54,024.34	52,025.31	48,503.17
Agriculture	0.00%	-	-	-	-	-	-
Total	**-31.19%**	**1,202,125.32**	**1,127,036.41**	**880,168.51**	**947,627.73**	**835,232.05**	**827,201.48**

1990-2022 Unincorporated County GHG Emission Trends per Capita (MTCO2e/person)							
Sector	1990-2022 Change	1990	2010	2015	2018	2020	2022
Buildings	-56.12%	3.15	2.49	1.67	1.35	1.37	1.38
Transportation	19.28%	3.72	4.92	3.85	4.83	4.36	4.44
Water	-39.43%	0.16	0.08	0.08	0.09	0.09	0.09
Solid Waste	-68.32%	1.16	0.26	0.28	0.38	0.39	0.37
Agriculture	0.00%	-	-	-	-	-	-
Per Person	**-23.28%**	**8.19**	**7.75**	**5.89**	**6.65**	**6.21**	**6.28**

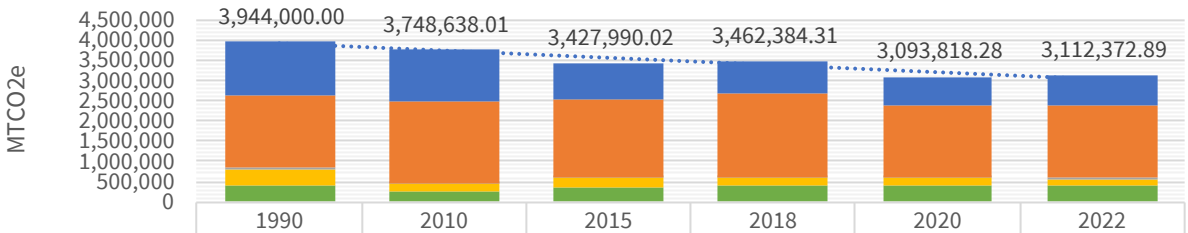
1990-2022 Unincorporated County GHG Emission Trends per Household (MTCO2e/household)							
Sector	1990-2022 Change	1990	2010	2015	2018	2020	2022
Buildings	-59.10%	8.43	6.35	4.35	3.57	3.51	3.45
Transportation	11.19%	9.96	12.57	10.05	12.75	11.22	11.07
Water	-43.54%	0.42	0.20	0.22	0.23	0.24	0.23
Solid Waste	-70.47%	3.11	0.67	0.73	1.00	0.99	0.92
Agriculture	0.00%	-	-	-	-	-	-
Per Household	**-28.48%**	**21.91**	**19.79**	**15.36**	**17.55**	**15.96**	**15.67**

1990-2022 Unincorporated County GHG Emission Trends per Employee (MTCO2e/Employment Count)							
Sector	1990-2022 Change	1990	2010	2015	2018	2020	2022
Buildings	-68.95%	8.58	4.77	3.22	2.57	2.52	2.67
Transportation	-15.60%	10.14	9.44	7.43	9.19	8.06	8.56
Water	-57.14%	0.42	0.15	0.16	0.17	0.17	0.18
Solid Waste	-77.59%	3.17	0.51	0.54	0.72	0.71	0.71
Agriculture	0.00%	-	-	-	-	-	-
Per Employee	**-45.71%**	**22.32**	**14.87**	**11.36**	**12.64**	**11.46**	**12.12**

Unincorporated 1990-2022 Demographic Calculation Inputs							
Sector	1990-2022 Change	1990	2010	2015	2018	2020	2022
Population	-10.31%	146,815	145,363	149,498	142,563	134,570	131,674
Pop. Share	-27.56%	37.82%	30.04%	29.86%	28.48%	27.53%	27.40%
Households	-3.78%	54,855	56,951	57,294	53,992	52,333	52,780
Hous. Share	-24.30%	36.81%	30.65%	30.39%	28.98%	27.88%	27.87%
Employment	26.75%	53,857	75,818	77,513	74,943	72,865	68,266
Emp. Share	-15.76%	30.89%	29.88%	29.56%	27.98%	27.27%	26.03%

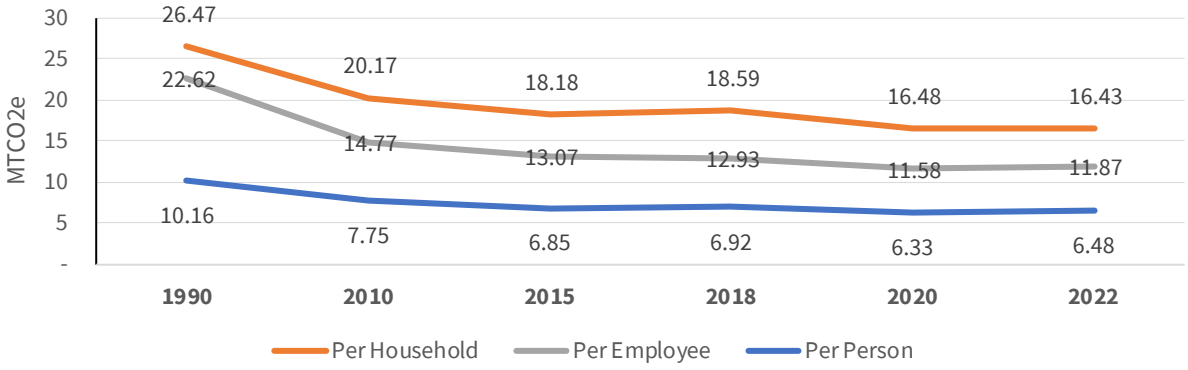
COUNTYWIDE (ALL SECTORS)

Countywide GHG Emission Trends

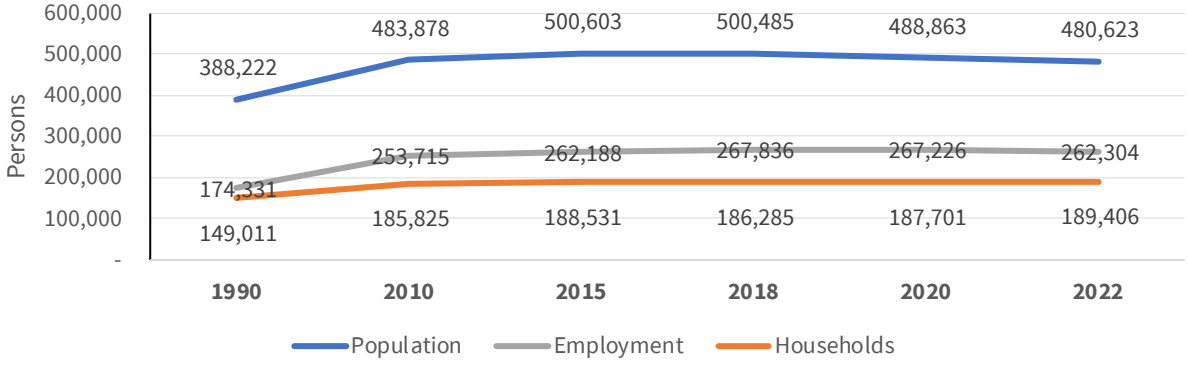


	1990	2010	2015	2018	2020	2022
Buildings	1,343,391.14	1,258,634.23	923,096.25	778,557.73	725,439.93	732,090.67
Transportation	1,770,119.23	2,014,737.46	1,909,232.33	2,067,917.61	1,769,910.62	1,794,817.76
Water	52,739.00	16,510.77	17,124.50	16,578.34	16,392.30	16,402.18
Solid Waste	383,299.79	193,222.97	218,854.98	207,240.20	189,735.24	176,876.87
Agriculture	394,450.85	265,532.58	359,681.95	392,090.43	392,340.20	392,185.41
Total	3,944,000.00	3,748,638.01	3,427,990.02	3,462,384.31	3,093,818.28	3,112,372.89

Countywide Population Emission Trends (All Sectors)



Countywide Population Trends



1990-2022 Countywide GHG Emission Trends by Sector (MTCO2e)							
Sector	**1990-2022 Change**	**1990**	**2010**	**2015**	**2018**	**2020**	**2022**
Buildings	-45.50%	1,343,391.14	1,258,634.23	923,096.25	778,557.73	725,439.93	732,090.67
Transportation	1.40%	1,770,119.23	2,014,737.46	1,909,232.33	2,067,917.61	1,769,910.62	1,794,817.76
Water	-68.90%	52,739.00	16,510.77	17,124.50	16,578.34	16,392.30	16,402.18
Solid Waste	-53.85%	383,299.79	193,222.97	218,854.98	207,240.20	189,735.24	176,876.87
Agriculture	-0.57%	394,450.85	265,532.58	359,681.95	392,090.43	392,340.20	392,185.41
Total	**-21.09%**	**3,944,000.00**	**3,748,638.01**	**3,427,990.02**	**3,462,384.31**	**3,093,818.28**	**3,112,372.89**

1990-2022 Countywide GHG Emission Trends per Capita (MTCO2e/person)							
Sector	**1990-2022 Change**	**1990**	**2010**	**2015**	**2018**	**2020**	**2022**
Buildings	-55.98%	3.46	2.60	1.84	1.56	1.48	1.52
Transportation	-18.10%	4.56	4.16	3.81	4.13	3.62	3.73
Water	-74.88%	0.14	0.03	0.03	0.03	0.03	0.03
Solid Waste	-62.73%	0.99	0.40	0.44	0.41	0.39	0.37
Agriculture	-19.69%	1.02	0.55	0.72	0.78	0.80	0.82
Per Person	**-36.26%**	**10.16**	**7.75**	**6.85**	**6.92**	**6.33**	**6.48**

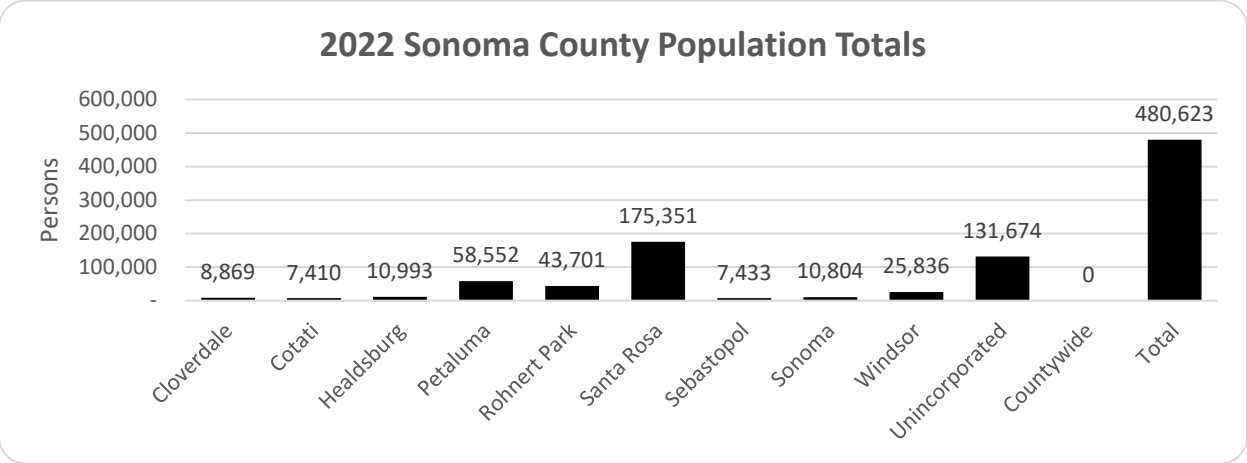
1990-2022 Countywide GHG Emission Trends per Household (MTCO2e/household)							
Sector	**1990-2022 Change**	**1990**	**2010**	**2015**	**2018**	**2020**	**2022**
Buildings	-57.13%	9.02	6.77	4.90	4.18	3.86	3.87
Transportation	-20.23%	11.88	10.84	10.13	11.10	9.43	9.48
Water	-75.53%	0.35	0.09	0.09	0.09	0.09	0.09
Solid Waste	-63.70%	2.57	1.04	1.16	1.11	1.01	0.93
Agriculture	-21.78%	2.65	1.43	1.91	2.10	2.09	2.07
Per Household	**-37.92%**	**26.47**	**20.17**	**18.18**	**18.59**	**16.48**	**16.43**

1990-2022 Countywide GHG Emission Trends per Employee (MTCO2e/Employment Count)							
Sector	**1990-2022 Change**	**1990**	**2010**	**2015**	**2018**	**2020**	**2022**
Buildings	-63.78%	7.71	4.96	3.52	2.91	2.71	2.79
Transportation	-32.61%	10.15	7.94	7.28	7.72	6.62	6.84
Water	-79.33%	0.30	0.07	0.07	0.06	0.06	0.06
Solid Waste	-69.33%	2.20	0.76	0.83	0.77	0.71	0.67
Agriculture	-33.92%	2.26	1.05	1.37	1.46	1.47	1.50
Per Employee	**-47.55%**	**22.62**	**14.77**	**13.07**	**12.93**	**11.58**	**11.87**

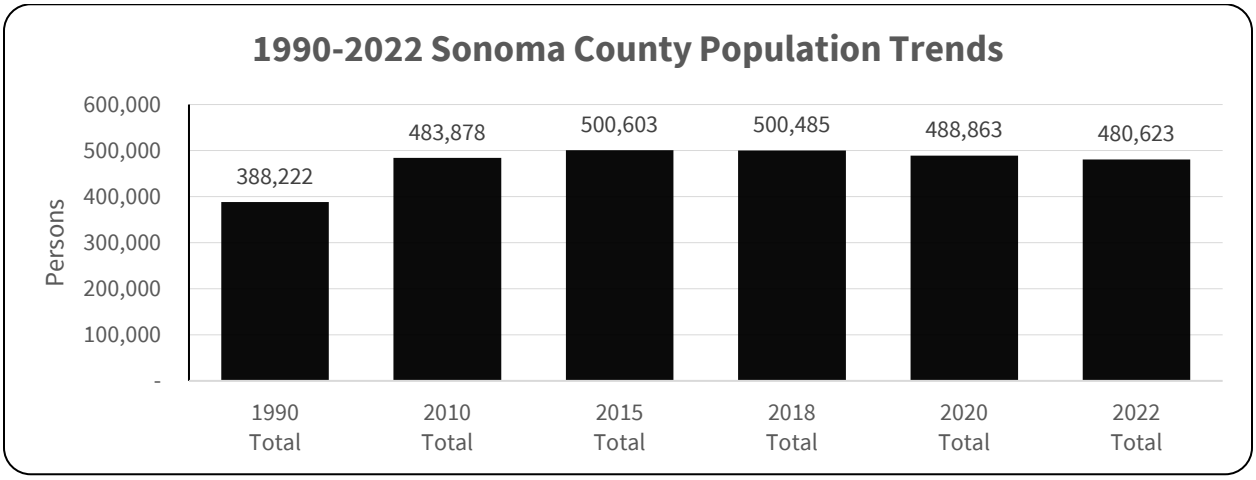
Total	**1990-2022 Demographic Calculation Inputs**						
Sector	**1990-2022 Change**	**1990**	**2010**	**2015**	**2018**	**2020**	**2022**
Population	23.80%	388,222	483,878	500,603	500,485	488,863	480,623
Pop. Share	0.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
Households	27.11%	149,011	185,825	188,531	186,285	187,701	189,406
Hous. Share	0.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
Employment	50.46%	174,331	253,715	262,188	267,836	267,226	262,304
Emp. Share	0.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

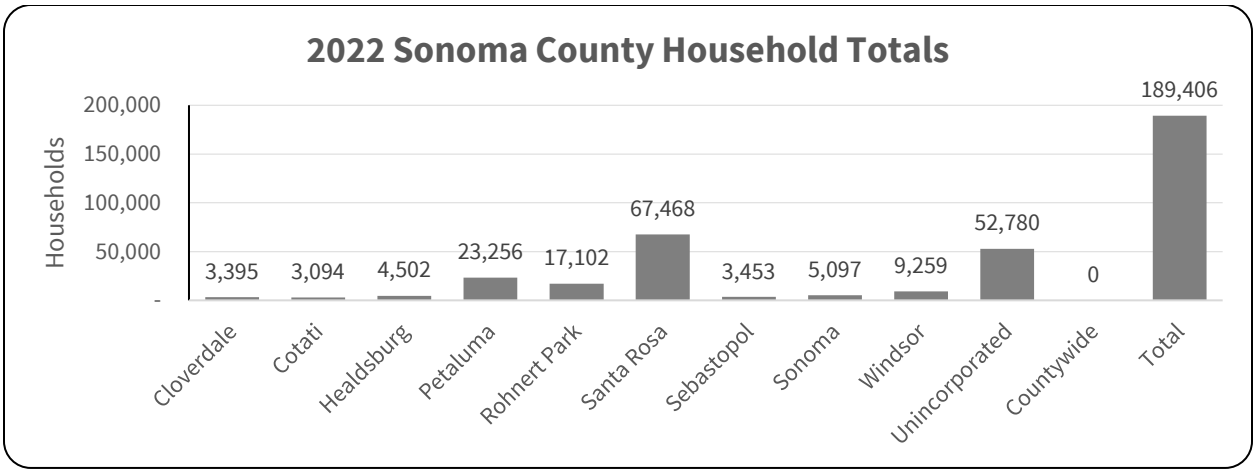
APPENDICES

SOCIO-ECONOMIC TRENDS

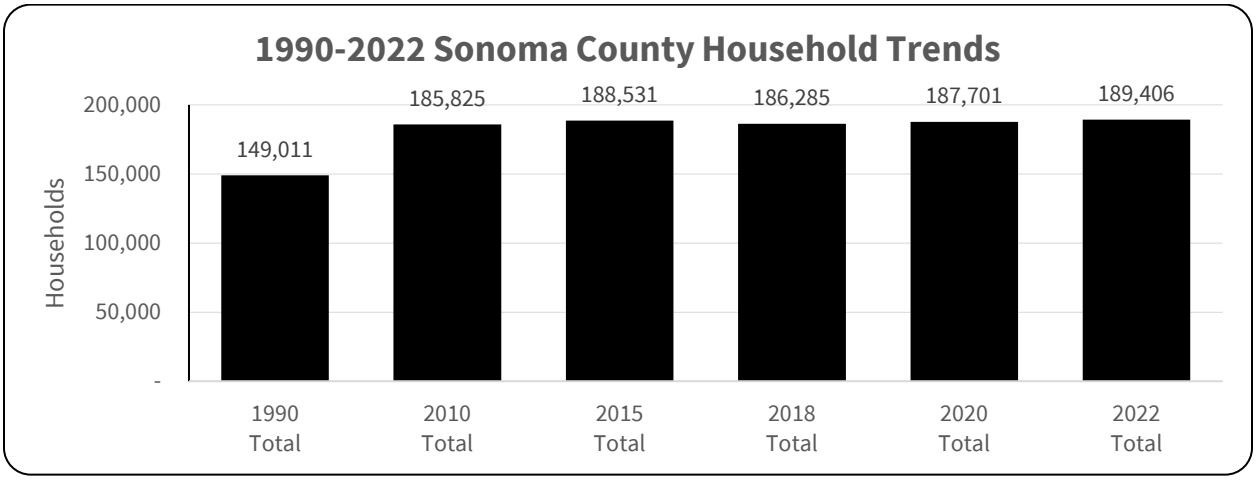


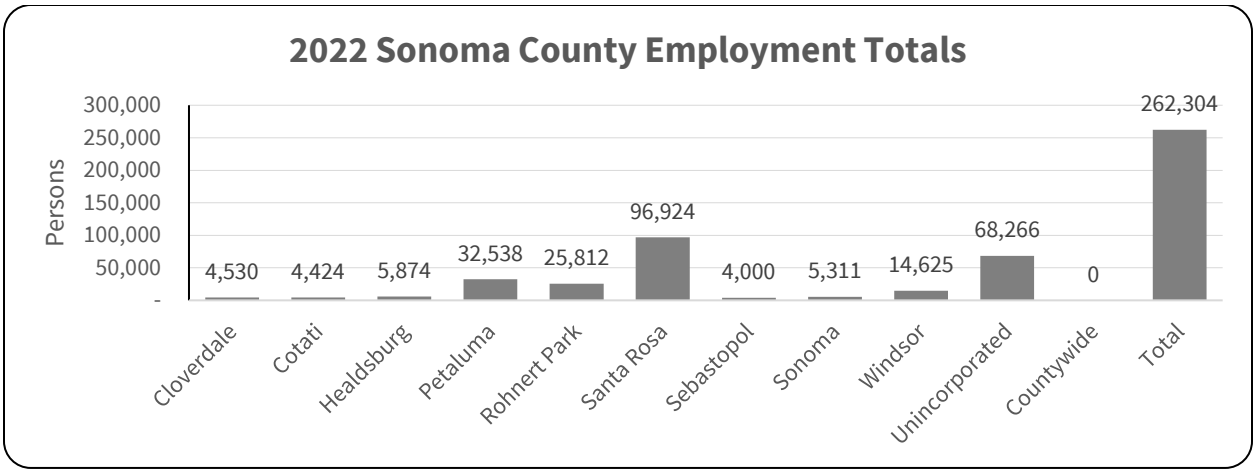
1990-2022 Sonoma County Population Trends (#)						
Jurisdiction	**1990 Total**	**2010 Total**	**2015 Total**	**2018 Total**	**2020 Total**	**2022 Total**
Cloverdale	4,924	8,618	8,889	9,177	9,007	8,869
Cotati	5,714	7,265	7,369	7,498	7,580	7,410
Healdsburg	9,469	11,254	11,648	11,843	11,306	10,993
Petaluma	43,166	57,941	60,451	62,356	59,816	58,552
Rohnert Park	36,326	40,794	41,479	42,699	44,063	43,701
Santa Rosa	113,261	167,815	174,943	177,012	178,020	175,351
Sebastopol	7,008	7,379	7,624	7,795	7,522	7,433
Sonoma	8,168	10,648	10,930	11,087	10,768	10,804
Windsor	13,371	26,801	27,772	28,455	26,211	25,836
Unincorporated	146,815	145,363	149,498	142,563	134,570	131,674
Countywide	-	-	-	-	-	-
Total	**388,222**	**483,878**	**500,603**	**500,485**	**488,863**	**480,623**



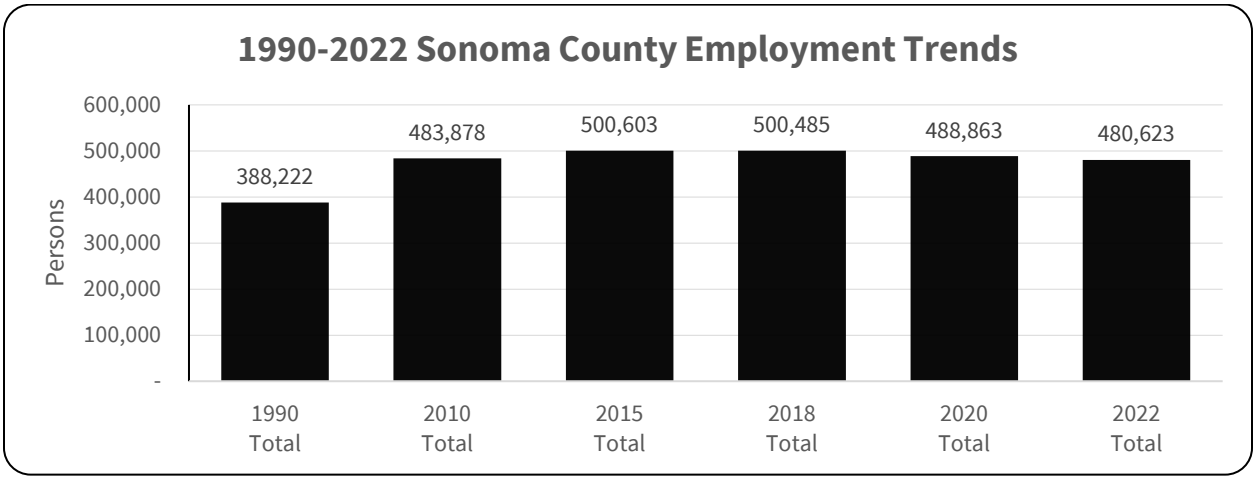


1990-2022 Sonoma County Occupied Household Trends (#)						
Jurisdiction	**1990 Total**	**2010 Total**	**2015 Total**	**2018 Total**	**2020 Total**	**2022 Total**
Cloverdale	1,868	3,182	3,221	3,290	3,365	3,395
Cotati	2,281	2,978	2,963	2,982	3,089	3,094
Healdsburg	3,613	4,378	4,446	4,471	4,519	4,502
Petaluma	16,062	21,737	22,261	22,715	23,190	23,256
Rohnert Park	13,409	15,808	15,838	16,122	16,827	17,102
Santa Rosa	45,694	63,590	65,072	65,102	66,843	67,468
Sebastopol	2,851	3,276	3,323	3,361	3,411	3,453
Sonoma	3,834	4,955	4,993	5,009	4,957	5,097
Windsor	4,544	8,970	9,120	9,241	9,167	9,259
Unincorporated	54,855	56,951	57,294	53,992	52,333	52,780
Countywide	-	-	-	-	-	-
Total	**149,011**	**185,825**	**188,531**	**186,285**	**187,701**	**189,406**





1990-2022 Sonoma County Employment Trends (#)						
Jurisdiction	**1990 Total**	**2010 Total**	**2015 Total**	**2018 Total**	**2020 Total**	**2022 Total**
Cloverdale	2,184	4,029	4,334	4,502	4,578	4,530
Cotati	3,145	4,429	4,356	4,455	4,287	4,424
Healdsburg	4,683	5,704	5,806	6,217	6,372	5,874
Petaluma	22,681	31,830	32,341	32,559	32,787	32,538
Rohnert Park	19,237	23,121	23,298	24,010	24,812	25,812
Santa Rosa	55,373	85,443	90,401	95,867	96,389	96,924
Sebastopol	3,337	4,181	4,279	4,233	4,118	4,000
Sonoma	3,449	5,327	5,573	5,698	5,640	5,311
Windsor	6,385	13,833	14,287	15,352	15,378	14,625
Unincorporated	53,857	75,818	77,513	74,943	72,865	68,266
Countywide	-	-	-	-	-	-
Total	**174,331**	**253,715**	**262,188**	**267,836**	**267,226**	**262,304**



INVENTORY METHODOLOGY

This greenhouse gas (GHG) inventory update follows the US Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions, which provides detailed methodologies tailored for local government jurisdictions and agencies working to track emissions in the United States. The U.S. Community Protocol was created by the International Council for Local Environmental Initiatives (ICLEI), an organization of local, regional, and national governments that have committed to reducing greenhouse gas emissions. This protocol is geared toward completing a GHG emissions inventory at the community scale in the United States and includes emissions from businesses, residents, and transportation. Over 600 local governments in the U.S. are ICLEI members utilizing the U.S. Community Protocol to inventory greenhouse gases.[10]

This activity-based inventory captures the primary sources of emissions within a jurisdictional boundary that can be reduced through the actions of local governments and regional entities. In contrast, a consumption-based inventory also accounts for emissions outside a jurisdictional boundary due to activities occurring within that jurisdictional boundary. In partnership with the World Resources Institute (WRI) and C40 Cities Climate Leadership Group (C40), ICLEI has also developed the Global Reporting Protocol (GRP), which is the global counterpart to the US Community Protocol and utilizes a consumption-based approach. Cities that have signed onto voluntary global networks and initiatives focused on tracking greenhouse gas reductions and comparing across countries, such as the Global Covenant of Mayors, are encouraged to use the GRP.[11]

ICLEI has developed four protocols for different emissions areas and needs. In addition to the U.S. Community Protocol and the GRP, the Local Government Operations Protocol (LGO Protocol) provides details guidance on accounting for emissions from municipal buildings, facilities, and vehicles, and the Recycling and Composting Emissions Protocol guides accounting for recycling and composting community-generated waste.

Consistent with RCPA's previous GHG inventories, this inventory does not include all human activities in Sonoma County that drive an increase or decrease in atmospheric GHG emissions. Rather than trying to account for every source of emissions, this approach focuses on monitoring progress on the most significant emissions sources that local government actions can most directly influence. The emissions categories that were excluded from this inventory update include:

- Carbon sinks through biological carbon sequestration
- Consumption of goods and services imported into Sonoma County
- Industrial and commercial stationary sources
- Air travel emissions

[10] U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions, https://icleiusa.org/us-community-protocol/

[11] ICLEI Global Reporting Protocol, https://icleiusa.org/ghg-protocols/

This inventory update uses a variety of activity data sources from local jurisdictions and state and federal sources. The inventory uses the 100-year global warming potential (GWP) values from the IPCC Fifth Assessment Report[12], consistent with current international and national GHG inventory practices.

In preparation for this inventory update, RCPA reviewed prior inventories and researched new methodologies to incorporate into the process. Where necessary to correct errors or incorporate new methodologies, RCPA recalculated emission estimates for all inventory years to maintain a consistent time series. This practice is consistent with IPCC and California Air Resources Board (CARB) inventory guidelines.

As a result of RCPA's review, changes in estimates were made to the following sectors:

- Building Energy – Electricity: Updated calculations to reference the new Power Source Disclosure (PSD) reports as reported by the California Energy Commission. This new method combines the separate emission factors for CO2, N2O, and CH4 into a single equation for calculating MTCO2e/MWH.
- Building Energy – Stationary Sources: Due to unavailability of state-specific data from the Residential Energy Consumption Survey (RECS) database, updated the stationary source calculations to reference the State Energy Data System (SEDS). Given the desire to hold 1990 values as previously reported, this backcast value was not updated to the new methodology and may stand out as anomalous in trends.
- Transportation: Updated all emission factors using the latest EMFAC2021 model. Prior inventories used earlier EMFAC2011 and EMFAC2017 versions of model. Changes were also made to the off-road inventories for all previous years (except 1990) to incorporate updated emission totals from EMFAC2021 with revised off-road models. Given that EMFAC2021 does not provide data tables for 1990, the original backcast amount from Climate Action 2020 remains unchanged.

Methodologies for calculating GHG inventories are continually evolving and changing. RCPA will continue to monitor and incorporate local government best practices for inventorying emissions to meet our ambitious emission reduction goals.

[12] IPCC Fifth Assessment Report, https://www.ipcc.ch/assessment-report/ar5/

ACTIVITY DATA BY GHG SECTOR

Sector	Primary Emissions Source	Key Activity Data	Data Sources
Building Energy: Electricity	• Production of electricity (emissions generated at power plants)	• Total electricity use (megawatt hours)	• Electricity providers: PG&E, Healdsburg Electric, Sonoma Clean Power
Building Energy: Natural Gas	• Combustion of natural gas	• Total natural gas use (therms)	• Natural gas provider: PG&E
Building Energy: Stationary Sources	• Combustion of propane, wood, and kerosene for home heating and/or cooking	• Estimated use of propane, wood, and kerosene (MMBtu)	• U.S. Energy Information Administration - State Energy Data System • American Community Survey 5-Year Estimates - DP04 Selected Housing Characteristics
Transportation: On-Road Vehicles	• Combustion of gasoline and diesel fuel in vehicles	• Vehicle miles traveled • Fuel type and fuel economy of countywide vehicle fleet • Travel patterns	• Sonoma County Transportation Authority • California Air Resources Board (CARB) EMFAC2021 Emissions Inventory

Sector	Primary Emissions Source	Key Activity Data	Data Sources
Transportation: Off-Road Vehicles and Equipment	• Combustion of fossil fuels in equipment (e.g., cranes, bulldozers, lawn mowers) Combustion of fossil fuels in off-road vehicles (e.g., tractors, boats, ATVs)	• Fuel consumption in off-road vehicles and equipment Socioeconomic data	• California Air Resources Board (CARB) EMFAC2021 Emissions Inventory
Transportation: Passenger Railway	• Combustion of diesel fuel in locomotives	• Gallons of diesel • Share of SMART passenger rail line in Sonoma County	• Sonoma-Marin Area Rail Transit (SMART)
Solid Waste	• Methane emissions from decomposition of material sent to landfills	• Tons of residential and commercial waste sent to landfills • Profile of waste material in each jurisdiction (e.g., 19 percent office paper, 36 percent food waste)	• Zero Waste Sonoma • CalRecycle
Water: Water Conveyance	• Production of electricity associated with the pumping and movement of water from source to user	• Water consumption • Water supply sources (e.g. groundwater, recycled water)	• Urban Water Management Plans and water consumption data for each jurisdiction • Sonoma Water

Sector	Primary Emissions Source	Key Activity Data	Data Sources
Water: Wastewater Treatment	• Emissions of methane and nitrous oxide that occur during wastewater treatment	• Population served by each wastewater treatment plant (WWTP) • Method of wastewater treatment at each WWTP • Amount of digester gas produced at each WWTP	• Sonoma Water • Sanitation districts and jurisdictions that operate a WWTP
Agriculture: Manure Management	• Emissions of methane and nitrous oxide from livestock and manure management	• Livestock populations in the county	• Sonoma County Annual Crop Report • U.S. Dept. of Ag National Agricultural Statistics Service
Agriculture: Fertilizer Application	• Emissions of nitrous oxide from the application of fertilizer	• Acres and types of crops grown in the county	• Sonoma County Annual Crop Report • U.S. Dept. of Ag National Agricultural Statistics Service

FREQUENTLY ASKED QUESTIONS

Inventory Protocol

What protocol does RCPA use for the Sonoma County Greenhouse Gas Inventory?

RCPA follows the U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions published by the International Council for Local Environmental Initiatives (ICLEI) for the five Basic Emission Generating Activities:

1) Use of electricity by the community,
2) Use of fuel in residential and commercial stationary combustion equipment,
3) On-road passenger and freight motor vehicle travel,
4) Use of energy in potable water and wastewater treatment and distribution, and
5) Generation of solid waste by the community.

The current version 1.2 of the protocol was released in July 2019 (https://icleiusa.org/us-community-protocol/) and includes the main protocol document as well as several appendices which RCPA uses as reference in our calculation of the five basic emission generating activities. While the protocol does contain guidance on calculating air travel emissions and on developing consumption-based inventories, RCPA's inventory has and remains focused on the five basic activity sectors. See below for additional information.

Jurisdictional Alignment

Are all jurisdictions in the county using comparable greenhouse gas inventory protocols?

RCPA conducts a "community" level inventory and currently uses the U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions v1.2. Several jurisdictions also conduct their own "municipal" inventory of emissions using the Local Government Operations (LGO) Protocol also developed and distributed by ICLEI. The LGO protocol focuses on government-operated buildings, vehicles, and other internal operations. Although the methodologies used in the two protocols are similar, results are not necessarily directly comparable due to the differing scopes of the efforts. RCPA staff is currently evaluating options to provide comprehensive reporting of both jurisdictional LGO emission inventories and the communitywide inventory that RCPA produces. Such an integrated tool would be useful for both local government staff and community members alike for future emission reduction planning.

Inventory Updates

How often is the RCPA Communitywide Greenhouse Gas Inventory updated?

RCPA's current workplan calls for updating the inventory every two years, although we can see clear value in compiling an updated inventory each year as we get closer to our 2030 carbon neutrality goals. RCPA staff will evaluate making upgrades to our inventory tracking system to allow for more easily updating inventory data on an annual basis. As part of this process, we are exploring options of completing two inventory years each time or compiling a scaled-down inventory every other year to allow for better trend analysis of key emissions data as we get closer to our 2030 carbon neutrality goals. Additional indicators that track local transportation improvements and/or housing density will also be looked at for potential integration into our existing greenhouse gas inventory methodology and reporting procedures.

Wildfire Emissions

Does the inventory include the loss of acreage due to wildfire?

- RCPA does not include greenhouse gas emissions in our community inventory directly attributable to wildfires. Given that the majority of carbon released during wildfires is "biogenic" (recently formed by biological processes), these emissions are excluded from our inventory following ICLEI protocol guidance. Within the Solid Waste sector, the total tons of solid waste disposed in Sonoma County increased significantly following the 2017 wildfires due to the large volume of fire debris. The resulting debris was largely ash, and by the time it was delivered to the landfill there were minimal gases left to escape and emissions from the debris were negligible.
- Additionally, the California Air Resources Board (CARB) estimates annual greenhouse gas emissions from wildfires. CARB also works with other State agencies to develop an ecosystem carbon inventory for natural and working lands to quantify the carbon stored in the State's forests, soils, and other natural lands. (https://ww2.arb.ca.gov/wildfire-emissions)

Consumption-Based Emissions

Are consumption-based emissions included in the RCPA Community Greenhouse Gas Inventory?

RCPA does not currently include consumption-based emissions in the Sonoma County Greenhouse Gas Inventory. Consumption-based inventories attempt to include all human activities in Sonoma County that drive an increase or decrease in atmospheric GHG emissions. Rather than trying to account for every source of emissions, RCPA's approach focuses on monitoring progress on the largest emissions sources that can most directly be influenced by local government actions. The consumption-based emissions categories that were excluded from this inventory update include the consumption of goods and services imported into Sonoma County and air travel.

As an alternative, RCPA has previously included results from a 2015 study (https://coolclimate.org/inventory) released by the Cool Climate Network, a University-Government-Business-NGO Partnership at the University of California, Berkeley. Based on this study, Sonoma County's total consumption-based emissions in 2015 were 7.2 million MT CO2e, significantly higher than the approximately 3.4 million MT CO2e activity-based emissions reported in the 2015 and 2018 inventory updates. In general, consumption-based inventory techniques complement the RCPA inventory and can help our community identify additional actions that we can all take to reduce emissions from our consumption of goods and services. RCPA will continue to include any updated results that are released by the Cool Climate Network, but does not plan to conduct a Sonoma County-specific consumption-based inventory due to budget limitations.

Energy Data

Does the inventory allow for a break-out of energy use differences between single family and multifamily housing, or for the ability to look at utility usage data broken out by income level?

The electricity and natural gas data inputs to the RCPA inventory are segregated by residential vs. non-residential and do not allow RCPA to disaggregate single family housing energy use from multifamily housing. Alternatively, there are several other sources of jurisdiction-specific building energy data that may be useful for these purposes. These include the Cost-Effectiveness Explorer developed by the California Statewide Codes & Standards Program (https://explorer.localenergycodes.com/ jurisdiction/sonoma-county/summary), as well as the Bay Area Energy Atlas developed by UCLA's California Center for Sustainable Communities, in partnership with and funded by the Bay Area Regional Energy Network (https://bayarea.energyatlas.ucla.edu/). The Bay Area Energy Atlas specifically allows a user to break out utility data by income levels for each jurisdiction.

Natural Gas Leakage

Do natural gas calculations include any direct contribution for expected leakage?

Our calculations do not build in an escalator for natural gas leakages equivalent to the transmission and distribution line loss factor that is added to electricity usage. The ICLEI protocol does not recommend this approach or provide a calculation methodology. A process for calculating these "fugitive emissions" is included in the Global Protocol for Community-Scale Greenhouse Gas Inventories (GPC), Ver. 1.1 (https://ghgprotocol.org/greenhouse-gas-protocol-accounting-reporting-standard-cities) which references the IPCC Guidelines for National Greenhouse Gas Inventories published in 2006 and updated in 2019. (https://www.ipcc-nggip.iges.or.jp/public/2019rf/vol2.html) RCPA staff will evaluate these approaches for potential inclusion in future inventory reports.

SMART Rail Emissions

Can SMART ridership be further analyzed from a per-capita basis to better compare against other transportation modes?

Our analysis of greenhouse gas emissions from the SMART rail system is based on annual systemwide diesel usage and the percentage of operating track in Sonoma County. While additional analysis of SMART ridership patterns would be helpful from a forecasting and planning perspective, it is currently not possible using the data compiled for the inventory. RCPA staff will work with our SCTA counterparts and with SMART directly to better understand what additional resources may be available for this further analysis of ridership trends.

While SMART's locomotives do emit greenhouse gases due to diesel usage, the service has still achieved a 33% reduction in greenhouse gas emissions compared to making the same trip by car. In addition, the SMART trains are equipped with modern, efficient engines that comply with the EPA's Tier 4 emissions standards, reducing Particulate Matter (PM) emissions by 96% and nitrogen oxide (NOx) emissions by 93% compared to standard diesel engines.

Air Travel Emissions

Are air travel emissions included in the RCPA Community Greenhouse Gas Inventory?

Emissions resulting from private air travel are not included in the RCPA inventory because Sonoma County communities do not have control over most aircraft sources. Although emissions directly produced by aircraft are not included in the current inventory, airport and tenant building energy use is captured in the building energy sector, and emissions from aircraft ground-support equipment (GSE) are captured in the off-road transportation sub-sector.

RCPA uses the U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions, Version 1.2 to account for community emissions. This protocol requires an initial scoping process, and certain emissions categories must be included based on the capacity of local governments to influence or control these emissions. Other emissions sources, such as air emissions, are optional because local governments do not have the same type of influence. Local governments are preempted from regulating tail-pipe emissions and do not have the direct ability to limit the number of aircraft at airports. Local governments do not, for example, have the ability to tax airport usage or flights under the federal Anti Head Tax Act, and may only tax aviation fuel if funds are used for airport improvements. Even if airports did not exist at all in the local jurisdiction, this likely would have little or no effect on the decisions of the public to fly, and in fact, abolition of airports in Sonoma County could increase emissions by increasing the distance travelled to airports (a phenomenon that is known as leakage in emissions accounting). Meanwhile, the types of factors that go into the decision to fly include the cost and speed of comparable transportation, the availability of comparable modes of travel, the state of the economy, the cost of aviation fuel, and other similar matters that are outside local government's direct control.

With the exception of emissions from local government trips and local government aircraft, it is generally accepted that private aircraft emissions are "Scope 3" for local governments. Scope 1 emissions are attributable to activities taking place within the geographic boundary of Sonoma County. Scope 2 emissions occur due to the use of grid-supplied electricity within the geographic boundary of Sonoma County. Scope 3 emissions include all upstream and downstream emissions sources associated with an organization that are not within an organization's Scope 1 and 2, or put another way, emissions that result from activities that are not from assets that are owned or controlled by the reporting entity. The Scope 3 emissions for one organization are the Scope 1 and 2 emissions of another organization, and Scope 3 emissions are generally separately reported from scope 1 and 2 emissions. Although the Community Protocol does not use the vocabulary of "scopes" in most contexts because that vocabulary was developed in the context of corporate operations (e.g., Scope 3 emissions are sometimes called "value chain" emissions), it is still the case that the Community Protocol generally focuses on Scope 1 and 2 emissions. In addition, the Community Protocol relies on the Airport Cooperative Research Program (ACRP) *Report 11 Guidebook for Preparing Airport Greenhouse Gas Inventories*, which does use the Scope 1, 2, and 3 framework.

The focus of the Community Protocol for required reporting is on emissions that are properly characterized as Scope 1 and 2 because they are related to matters that local government can control and/or influence. Scope 3 emissions are optional, as are alternative reporting frameworks such as lifecycle and consumption-based protocols. In RCPA's view, Scope 3 emissions related to airline travel could be obtained, with significant investment, but they would provide far less actionable information than Scope 1 and 2 emissions, and they would not properly be aggregated with Scope 1 and 2 emissions. At present, RCPA is considering reporting

these emissions in the future, but not in the same inventory with Scope 1 and 2 emissions. In addition, for appropriate context, RCPA would report these types of emissions in the context of other similar emissions that are not within local government's direct control. This would be a larger effort than just accounting for airline emissions.

Solid Waste Emissions

How is the transportation of solid waste into/out of Sonoma County handled in the data that is received from Zero Waste Sonoma?

The solid waste disposal values used in the inventory contain all jurisdiction waste that was disposed in California landfills, transformation facilities, engineered municipal solid waste conversion facilities, and/or exported out-of-state, except for declared disaster debris disposal and disposal in Class II facilities, as those two types of tonnage are no longer tracked by jurisdiction of origin. Zero Waste Sonoma compiled the data from waste hauler reports and transfer station self-haul tonnages based upon where the solid waste originated.

Supervisor Districts

Can the data be broken out by Supervisor Districts for electricity use, Sonoma Clean Power service level, and/or transportation mode-split percentages?

All of the data inputs used in the RCPA Greenhouse Gas Inventory are either collected at the jurisdictional level or are county-level datasets that are apportioned out to jurisdictions by population. It would prove to be very difficult--if not impossible--to translate these multiple inputs into a format that would provide reliable results through both a jurisdictional lens and through a County supervisorial district lens. Alternatively, final emission results could potentially be allocated back to individual districts by raw population counts, but this method would only mirror population levels and could also lead to discrepancies between jurisdictional and supervisorial emission level reporting.

Local Boundaries

Was the analysis completed using specific "city limits" or the larger set of Zip Codes that encompass and surround incorporated cities?

RCPA attempts to segment all data used in the inventory by jurisdictional boundaries not zip codes, but it is impossible for us to verify the exact boundaries used for each data set. As an example, the data that is provided by PG&E, Sonoma Clean Power, and Zero Waste Sonoma are pre-filtered by jurisdiction (including an "unincorporated" category) and RCPA accepts the data as labelled. Additionally, some calculations are based upon county or state averages that are apportioned to specific jurisdictions based on population or employment counts derived from the most recent census data. Again, for these RCPA is not able to verify the exact boundaries used and accepts the data as released publicly.

Housing Unit Density

Can RCPA track single-family and multifamily housing unit density per acre by jurisdiction as an indicator metric?

RCPA is planning to incorporate a series of climate indicators and resilience metrics into future Greenhouse Gas Inventory reports. These metrics will be linked to housing, transportation, land use, social equity, and environmental conditions that are related to, but may not directly link to, greenhouse gas emissions and climate change. Tracking single-family and multifamily housing unit density for each jurisdiction will be included in the scoping for this work to provide additional context for our greenhouse gas inventory trends.

Transportation Mode Shift

What is the percentage of mode shift countywide that is needed to meet our 2030 goals?

While RCPA's greenhouse gas inventory looks backward in time to determine our past emissions profile, the Comprehensive Transportation Plan (CTP) produced by our SCTA colleagues looks forward in time to determine needed actions. RCPA and SCTA staff will work together to integrate the results from the greenhouse gas inventory with guidance from the CTP to guide our future actions and report this progress each time the inventory is released.

Breakout by Water Sources

Is there an ability to break out water users by municipal water versus well users to view the per capita impact? Can the emissions intensity of water sources be investigated further for well users versus municipal water as a side study to inform groundwater sustainability agencies?

These are all important questions, but outside of the current scope of the greenhouse gas inventory. RCPA can work with Sonoma Water to compile existing information related to the countywide water sourcing and distribution system to answer some of these questions. While this information would not be directly tied to the calculations in the inventory, the results could be presented as an adjunct report for additional context and insight.

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