SACRAMENTO COUNTY 2021 GHG INVENTORY

Community-wide and Government Operations

November 2023

SACRAMENTO COUNTY

Acknowledgements

Prepared By

Alex Herrin, *CivicSpark Fellow (2022-23 Service Year)*
Sustainability Program, Office of the County Executive

Staff Team

John Lundgren, *Sustainability Manager*
Sustainability Program, Office of the County Executive

Jason Scott-Sheets, *CivicSpark Fellow (2023-24 Service Year)*
Sustainability Program, Office of the County Executive

David Villanueva, *Assistant County Executive*

Review And Assistance By

Calyn Hart, ICLEI

Sacramento County Planning and Environmental Review Division

Todd Smith, Planning Director

Planning Consultant Team Review

Ascent Environmental

Environmental Science Associates

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1 Introduction

Greenhouse gas (GHG) inventories are data-driven tools utilized to report and benchmark GHG emissions for a particular organization, facility, or jurisdiction. They can be used to measure the progress of GHG emission reduction measures when conducted periodically over time. This document presents Sacramento County's Community-wide and Government Operations emissions inventories for the calendar year 2021.

The Community-wide Inventory represents all GHG emissions generated within unincorporated Sacramento County along with emissions associated with activities occurring within unincorporated Sacramento County areas, including emissions that occur elsewhere because of those activities. The Government Operations Inventory represents emissions from only Sacramento County Government-owned-and-controlled facilities and operations. This document, hereafter referred to as the Inventory or the 2021 Inventory, builds upon the County's 2015 GHG inventory (Baseline Inventory), to examine if Sacramento County is making progress, stagnating, or regressing in GHG emissions reductions. This report also serves to assist the public and decision makers in understanding the relative emissions contributions of the various Community-wide and Government Operations sectors, and which of these may represent the best opportunities for further GHG reductions.

The 2021 Community-wide Inventory was developed using the U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions (Community Protocol) version 1.2 (July 2019) developed by Local Governments for Sustainability (ICLEI). The 2021 Government Operations Inventory was developed using the ICLEI Local Government Operations Protocol (LGO Protocol), version 1.1 (May 2010) developed by ICLEI.

Like the Baseline Inventory, the Government Operations Inventory covers all Scope 1 and 2 emissions, and Scope 3 emissions where applicable and sufficient data exists. A definition of emission scopes can be found in the Glossary section, as well as all other terminology that will be used throughout this report. Emission scopes are not classified for the Community-wide Inventory because, as noted by the Community Protocol, "the organization-related definitions of scopes do not translate to the community scale in a manner that is applicable, clear, and valuable" (ICLEI, 2019). Sacramento County is a member of ICLEI and utilized ICLEI's ClearPath GHG accounting software for conducting this Inventory.

Because this document presents unincorporated Sacramento County's Community-wide Inventory and Government Operations Inventory side by side, readers are advised that the Government Operations Inventory is not

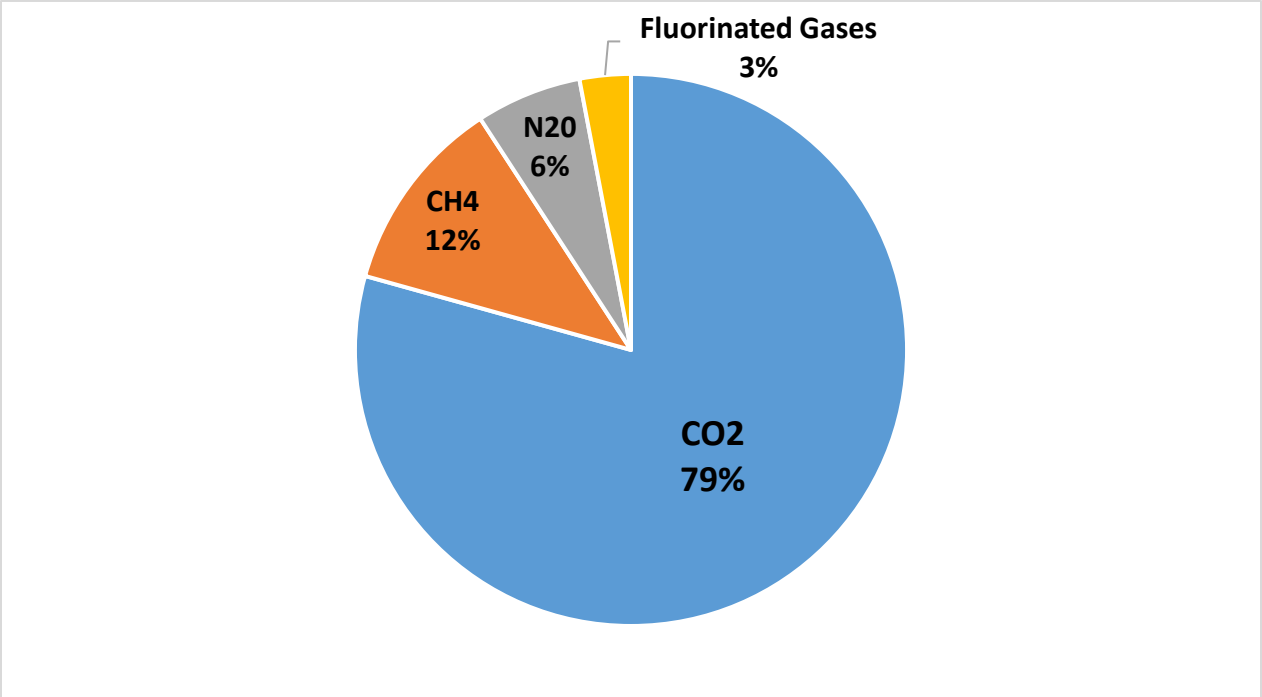
additive to the Community-wide Inventory. They are separate analyses that serve different analytical and reporting purposes. Furthermore, unlike the 2015 Inventory which was prepared by an outside consultant, the County utilized ClearPath to prepare this Inventory in-house so that it could easily repeat future inventories, with existing staff, utilizing similar methodologies and assumptions. This results in minor methodological differences between the 2015 and 2021 inventories. When making decisions regarding assumptions and methodologies, the County chose the direction that would be the most repeatable and utilize data which is the most accurate and readily available.

1.1 Global Warming Potential

GHGs contribute to climate change by trapping heat in the atmosphere. Each GHG has a respective Global Warming Potential (GWP) based on its effectiveness at trapping heat. The three most prevalent GHGs that are released from human activities are carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O). Fluorinated gases, such as chlorofluorocarbons (CFCs) and hydrochlorofluorocarbons (HCFCs), have very high GWPs but make up less than 3% of overall U.S. GHG emissions, and less than 8% of Sacramento County emissions (US EPA, 2022a).

The GWP of a gas is used to calculate its emissions value as a carbon dioxide equivalent or CO_2e (US EPA, 2022b). CO_2 is used as the benchmark because it is the most prevalent GHG, as shown by Figure 1. Every other GHG is assigned a GWP based on its ability to absorb heat and how long it remains in the atmosphere, equivalent to one unit of CO_2. The unit of measurement of CO_2e is frequently provided in metric tons (MT). GWPs can change over time as measurement accuracy increases and more data becomes available. Table 1 provides the GWPs used for this Inventory which are taken from the United Nations' Intergovernmental Panel on Climate Change (IPCC) 5th Assessment Report (AR5) 100-year Values (Myhre et al, 2013). Consistent with protocol guidance for inventories conducted at the time of this writing, 5th Assessment Report values have been utilized for this Inventory and are updated from the 4th Assessment Report (AR4) values that were utilized in the 2015 inventory.

Figure 1: Overview of U.S. GHG Emissions in 2021



Source: EPA. https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and-sinks.

Table 1: IPCC 5th Assessment 100-year GWP Values for GHGs

GHG Name	Chemical Formula	GWP
Carbon Dioxide	CO_2	1
Methane	CH_4	28
Nitrous Oxide	N_2O	265

Note: GWPs for fluorinated gases are not listed in this table, as they are only used for one section of the Inventory and are numerous. For the entire list of GWP values, see the IPCC website at https://www.ipcc.ch/.

2 Summary of Results

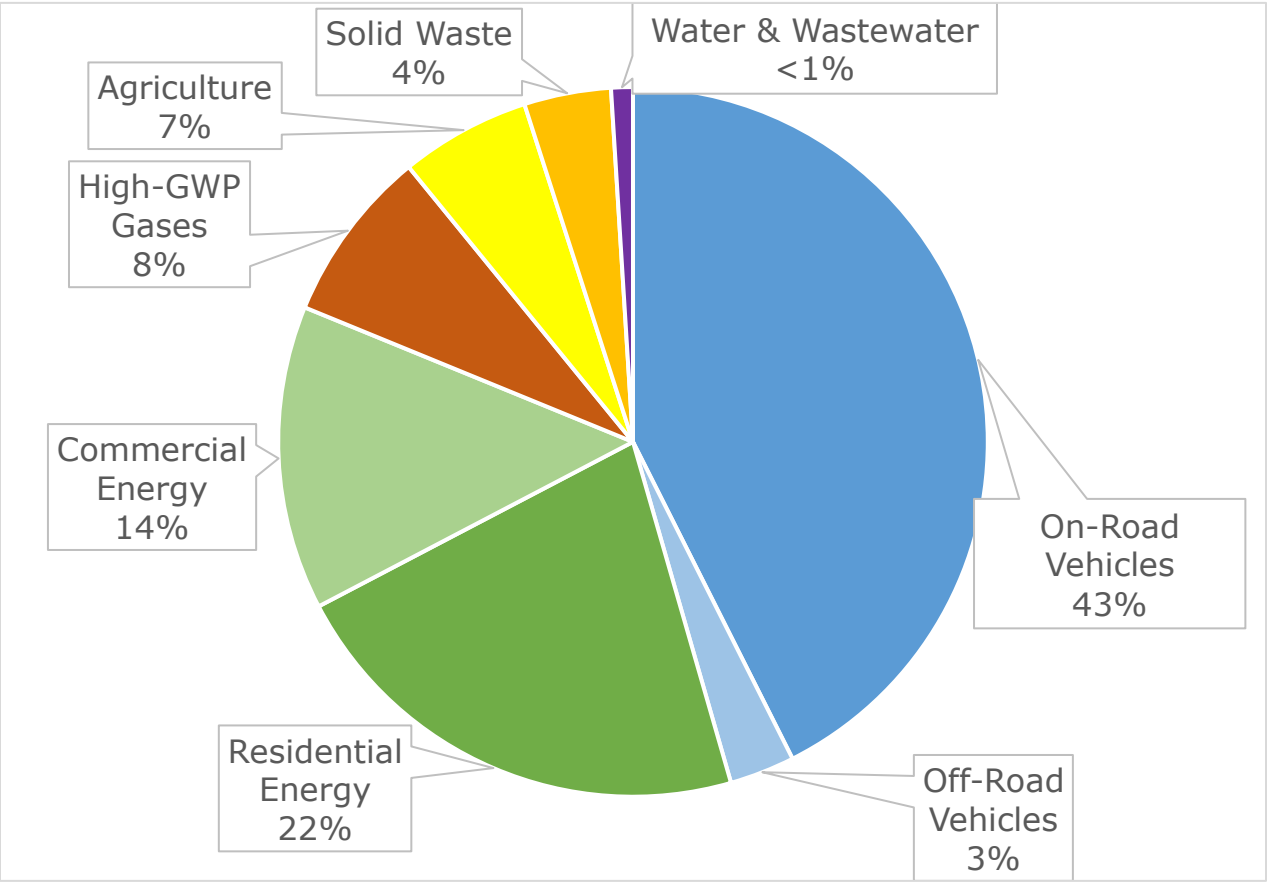
2.1 Community-wide

GHG emissions in 2021 from unincorporated Sacramento County amounted to 4,055,562 $MTCO_2e$. On-road vehicles were the largest emitter and accounted for 43% of all community-wide GHG emissions. This mirrors statewide emissions data as vehicle miles traveled (VMT) are a major contributor to GHG emissions. Building energy was the second leading emitter at 35%, also on par with statewide data as shown in the California Air Resource Board's (CARB) 2020 California GHG Inventory (CARB, 2022). High-GWP gases accounted for 8%, agriculture 7%, solid waste 4%, off-road vehicles 3%, and finally water and wastewater combined at less than 1%. Figure 2 illustrates the comparison between sectors, and Table 2 expands the data further.

Community-wide emissions decreased overall by 2.8% in comparison to the Baseline Inventory, but the rate of decrease, or in some instances increase, varied across sectors. This variance is due to different factors that may include actual emission reductions/increases or methodological differences. This will be discussed in this section and in more detail in Section 3.2.

Figure 3 and Table 3 illustrate the changes in emissions between the Baseline Inventory and this Inventory.

Figure 2: Community-Wide GHG Emissions



Note: May not total 100% due to rounding.

Table 2: 2021 Sacramento County Community GHG Inventory

Sectors	2021 (MTCO2e/year)	Percent of Total (%)
On-Road Vehicles	1,740,212	43
Off-Road Vehicles	107,174	3
Residential Building Energy	878,308	22
Commercial/Industrial Building Energy	555,596	14
High-GWP Gases	317,796	8
Agriculture	266,470	7
Solid Waste	156,744	4
Water & Wastewater	33,262	<1
Total	**44,055,562**	**100.0***

*May not total 100% due to rounding.

Figure 3: Community GHG Inventory Comparison ($MTCO_2e$)

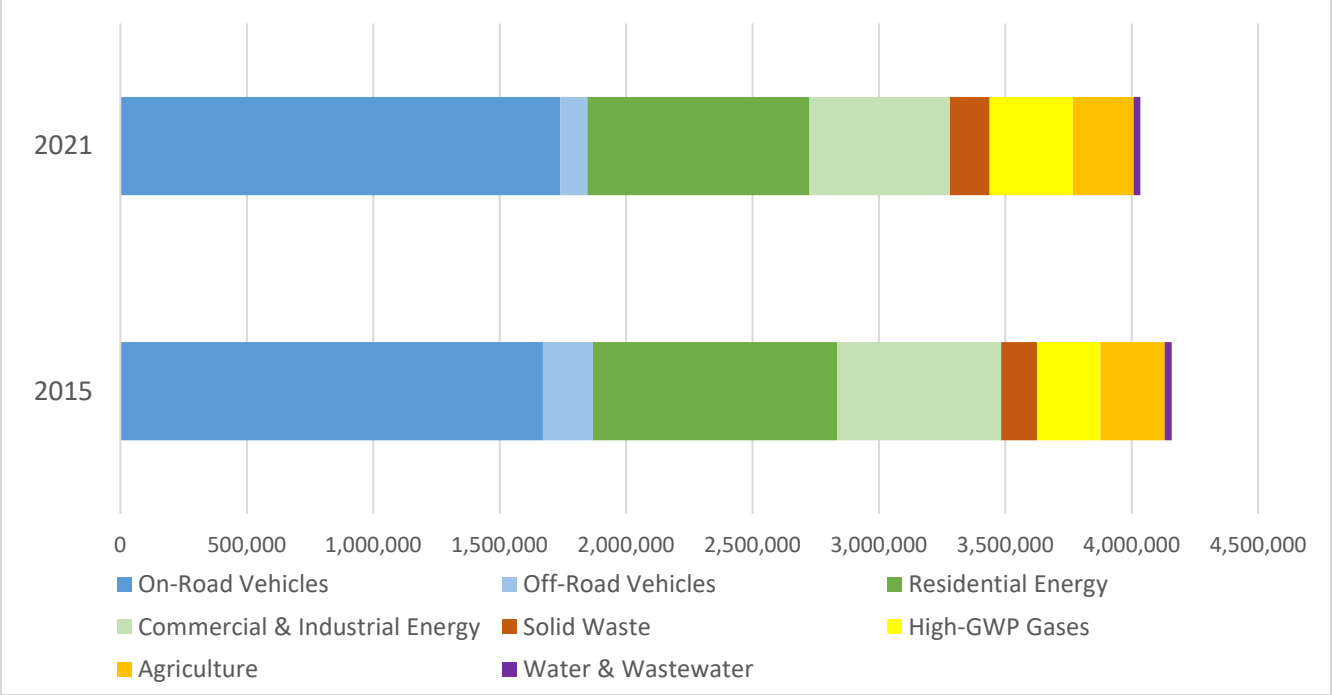


Table 3: Comparison of Sacramento County Community-wide GHG Inventories

Sectors	2015 Emissions ($MTCO_2e$)	2021 Emissions ($MTCO_2e$)	Difference 2015 to 2021 ($MTCO_2e$)	Percent (%) Change
On-Road Vehicles	1,671,596	1,740,212	68,616	4.1
Off-Road Vehicles	196,769	107,174	-89,595	-45.5
Residential Building Energy	967,253	878,308	-88,945	-9.2
Commercial/Industrial Building Energy	648,868	555,596	-93,272	-14.4
High-GWP Gases	251,085	317,796	66,711	26.6
Agriculture	254,710	266,470	-11,760	4.6
Solid Waste	140,670	156,744	16,074	11.4
Water & Wastewater	42,475	33,262	-9,213	-21.7
Total	**4,173,426**	**4,055,562**	**-117,864**	**-2.8**

Note: The 2015 Inventory utilized AR4 GWP and the 2021 utilized AR5 GWP

As shown in Table 3, changes in emissions by sector in the Community-wide Inventory included minimal reductions, large reductions, and steady increases. The building energy sector in its entirety recorded moderate reductions in emissions even though energy usage increased. This is due to the improved electricity emission factor. Emission factors and their effects on emissions will be discussed in Section 3.1.

Another sector that dropped in emissions, though more substantially, was Off-Road Vehicles. This reduction is not likely attributed to changes in GWP because the primary GHG generated by fuel consumption is CO_2, which always maintains a GWP of 1. It was most likely due to changes within the California Air Resources Board's (CARB) OFFROAD2021 model compared to the 2014 model which was used in the Baseline. Staff noted that fuel usage estimates reported by the 2014 model nearly matched the 2021 model, yet the emissions reported by the 2021 model were substantially lower.

Wastewater also recorded a measurable drop in emissions due to the owner and operator of the regional wastewater conveyance system's (Regional San's) participation in Sacramento Municipal Utility District's (SMUD's) SolarShares program and the introduction of a nutrient removal system, which is elaborated in Section 3.2.7. GWP changes may also contribute to some changes here, but to a lesser degree than improvements made by Regional San.

There were three sectors that increased in emissions: On-Road Vehicles, High-GWP Gases, and Solid Waste. On-Road Vehicles increased by 4%, which is generally consistent with the unincorporated County's population growth of 6.2% since 2015 (CA DOF, 2023). Like the off-road results, this change is not likely attributed to changes in GWP because the primary GHG generated by fuel consumption is CO_2 which always maintains a GWP of 1. It should be noted that 2021 VMT was provided by the Sacramento Area Council of Governments (SACOG) based on projected growth and not based on actual traffic counts during the pandemic downturn; the methodology is detailed further in Section 3.2.1: On-Road Vehicles. Solid Waste increased by 11%, in large part due to the increased amount of community-generated waste sent to landfill.

High-GWP Gases, which includes hydrofluorocarbons (HFCs) and other fluorocarbons, increased by 27%. This mirrors statewide data from the same period. According to CARB's 2022 Scoping Plan for Achieving Carbon Neutrality: "HFCs are the fastest-growing source of GHG emissions, primarily driven by their use to replace ozone-depleting substances and an increased demand for cooling and refrigeration. Since 2005, statewide HFC emissions have more than doubled. While the rate of increase has slowed in recent years due to the state's measures, HFC emissions are still on the rise in

California, and have grown by over 50 percent since 2010. Globally, as temperatures rise, adoption of cooling technologies (and refrigerants) is increasing rapidly. If no measures are taken, it is estimated that HFCs will account for nine to 19 percent of the total global GHG emissions by 2050. (CARB, 2022a)." Regardless of whether AR4 or AR5 GWPs are used, high-GWP gas use and associated emissions are expected to increase.

2.2 Government Operations

Total GHG emissions in 2021 for Sacramento County Government Operations were 83,502 $MTCO_2e$. Figure 4 and Table 4 provide Sacramento County Government GHG emissions by sector. Employee commute and energy usage at County buildings and facilities (including airport buildings) generated the most GHG emissions, accounting for 36.5% and 37% of total emissions respectively. The County vehicle fleet was responsible for 19% of total emissions, and the two smallest emission sectors were Water & Wastewater and Streetlights & Traffic Signals, accounting for 7% and 1.5% of total emissions respectively. Like the Community Inventory, AR5 GWP values were utilized for the Government Operations Inventory consistent with current guidance. This can result in some differences between the 2015 and 2021 inventories in sectors more heavily influenced by methane and nitrous oxide.

Government Operations emissions declined by 39,895 $MTCO_2e$, or 32%, when compared to the Baseline Inventory. Emissions declined or stayed the same across almost all sectors, with the only exception being water, which increased slightly. This is consistent with the County's efforts to reduce GHG emissions since work began on a Climate Action Plan (CAP) in 2009.

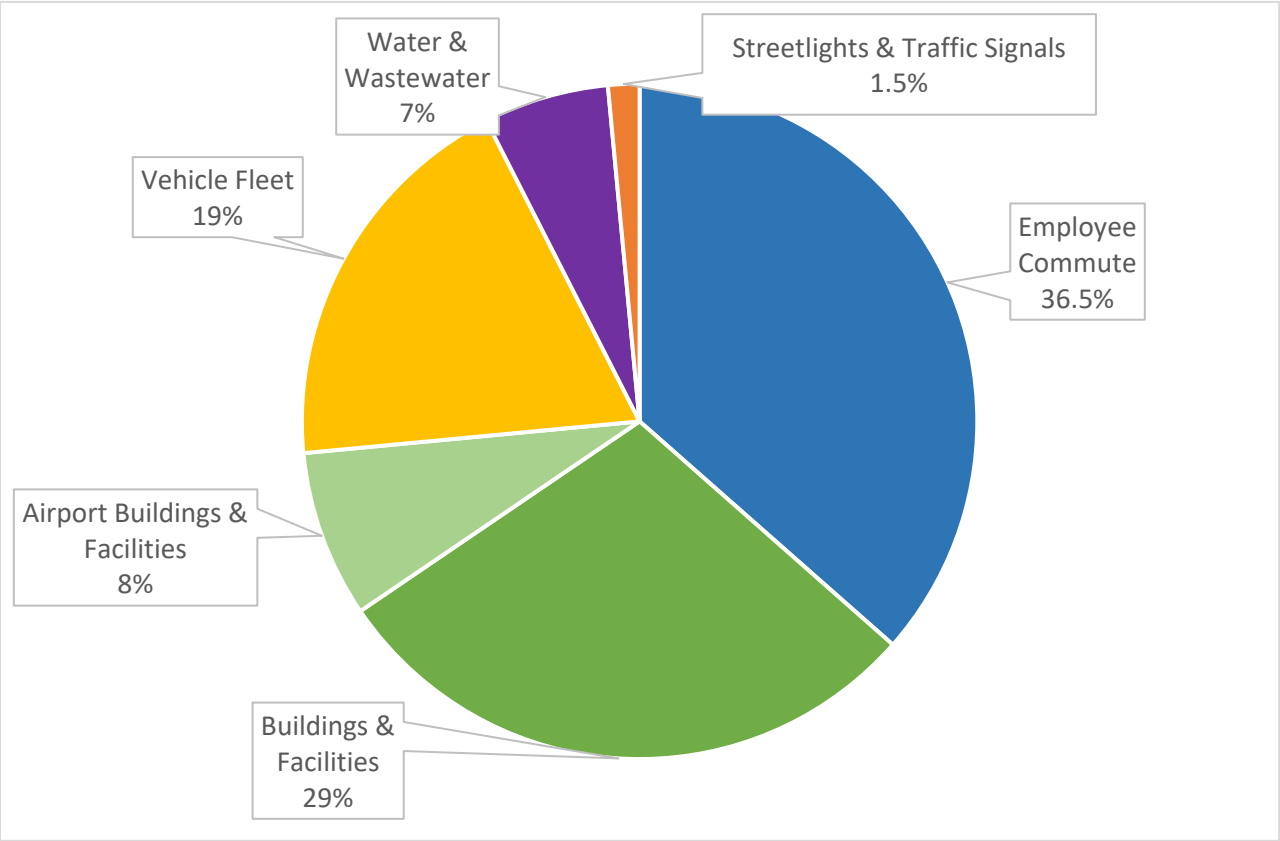
Figure 5 and Table 5 represent the $MTCO_2e$ difference from 2015 as well as the percentage change.

The largest measured emission reduction was the County fleet, which decreased by 14,035 $MTCO_2e$ or 47%. According to County fleet services, they have "put a high priority and invested heavily on reducing emissions (R. Wirth, personal communication, January 19, 2023)". County fleet emission reduction measures include: converting Department of Waste Management and Recycling (DWMR) route and long-haul operations to 100% natural gas (mostly renewable); transitioning to renewable diesel (R99); increasing number of hybrid vehicles; beginning the EV transition process; and managing/replacing vehicles on schedule to achieve the best possible fuel efficiency.

The second-largest measured emissions decrease was in the Airport Buildings & Facilities sector at 11,617 $MTCO_2e$ or 64%. This was primarily

due to a new 7.9-megawatt solar energy facility coming online in 2017 that provides power directly to the Sacramento International Airport (Sacramento County, 2017). This large decrease is without SMUD SolarShares participation, so the standard emission factor was used. SolarShares is a SMUD renewable energy program wherein a portion of the County's purchased electricity is derived directly from solar energy and therefore does not have any measurable GHG emissions (SMUD, 2023a). How this program affects emissions is discussed in more detail in Section 3.1.

Figure 4: Government Operations GHG Emissions by Sector



Note: May not total 100% due to rounding.

Table 4: 2021 Government Operations GHG Inventory

Sectors	2021 ($MTCO_2e$/year)	Percent of Total
Employee Commute	30,414	36.5
Buildings & Facilities	23,760	29
Airport Buildings & Facilities	6,693	8
Vehicle Fleet	15,556	19
Water & Wastewater	5,824	7
Streetlights & Traffic Signals	1,255	1.5
Total	**82,853**	**100***

May not total 100% due to rounding.

Figure 5: Government Operations GHG Inventory Comparison ($MTCO_2e$)

Table 5: Comparison of Government Operations GHG Inventories

Sectors	2015 Emissions ($MTCO_2e$)	2021 Emissions ($MTCO_2e$)	Difference ($MTCO_2e$)	Change as a Percentage
Employee Commute	38,290	30,414	-7,876	-21%
Buildings & Facilities	28,247	23,760	-4,487	-16%
Airport Buildings & Facilities	18,310	6,693	-11,617	-64%
Vehicle Fleet	29,591	15,556	-14,035	-47%
Wastewater	565	208	-357	-63%
Water	4,665	5,616	951	20%
Streetlights & Traffic Signals	3,729	1,255	-2,474	-66%
Total	**122,832**	**83,502**	**-39,895**	**-32.3%**

Streetlights & Traffic Signals represented the largest percentage decrease at 66% for 2,474 $MTCO_2e$. This is due to the Streetlight Improvement Plan that was enacted in 2015 by Sacramento Department of Transportation (SACDOT) to replace "7,500 old street light fixtures with newer, energy efficient models", as well as SolarShares participation by the County (Regan, 2015). Building & Facilities emissions decreased by 16%, which was mostly due to the County's participation in SMUD's SolarShares program, as total energy usage increased slightly. Total energy usage for the County in 2021 was 89,677 gigawatt hours (GWh), compared to 89,101 GWh in 2015, yet the adjusted emission factor (EF) allows the County to show a reduction in emissions due to SolarShares participation.

Employee Commute emissions declined from 38,290 $MTCO_2e$ in 2015 to 30,414 $MTCO_2e$ in 2021 and remains the largest emitter of GHGs within Government Operations. The decrease in emissions is likely related to methodological differences between the two Inventories and does not necessarily equate to a reduction in real GHG emissions. The difference in methodology will be discussed in detail in Section 3.3.1. Finally, water was the only sector that experienced increased emissions, rising by 20%. This is most likely a change in reporting methodology from the Baseline Inventory and not increased usage.

3 Methodology

3.1 Utility Emission Factors

This section outlines the utility-provided EFs that are used to calculate GHG emissions throughout the Inventory anytime purchased electricity is involved. EFs are an integral part of calculating GHG emissions by helping form the connection between raw usage data and actual GHG emissions. Most EFs will stay constant over time, though some may fluctuate based on new data becoming available from methodological changes in the way they are calculated, or by improvements in the carbon content of the energy portfolio.

EFs can be sourced directly from the IPCC Emission Factor Database (EFDB) or locally when data is available and considered reliable. Local is generally better, as it will often give a more accurate representation of emissions. This Inventory strives to use the most up-to-date and local EFs whenever possible.

Table 6 illustrates the electricity EFs used for this Inventory compared with the Baseline. Electricity EFs are expressed in pounds of a given GHG per megawatt-hour delivered and are used to calculate emissions throughout the Inventory, though they are primarily used in the buildings & facilities sectors.

Table 6: Electricity Emission Factors

2015	2021	2021 (Adjusted)	Unit
561.08	533.5	393.2	CO_2 lbs./MWh
0.03112	0.032	0.032	CH_4 lbs./MWh
0.005670	0.004	0.004	N_2O lbs./MWh

For 2015 and 2021, the CO_2 EF was provided through direct communication with SMUD. They are almost the sole provider of electricity throughout unincorporated Sacramento County, so their EF was sufficient for calculating all electricity usage emissions throughout both Inventories. The emission factor SMUD provided for 2021 decreased from 2015 in alignment with SMUD's goals to increase renewables in their energy mix. These goals are reflected in SMUD's 2030 Zero Carbon Plan, wherein SMUD has committed to reaching zero carbon emissions by 2030 (SMUD, 2021b). CH_4 and N_2O were derived from the 2020 eGRID – the EPA's Emission Factor Database (US EPA, 2023). EPA had not yet updated the eGRID to 2021 at the time of this Inventory's completion, but it is assumed that CH_4 and N_2O

would not have significant changes, as they have remained constant over the last several eGRID updates.

The Inventory used 2021 EFs for all Community-wide electricity, and 2021 (adjusted) for Government Operations. Electricity EFs consider the total energy mix of power generation from a given utility. By purchasing SolarShares, the County is allocated a carbon-free amount of electricity equal to the amount purchased. The adjusted EF accounts for the participation of the County in the SolarShares program, which in 2021 was 30,000 GWh. Of the County's total usage of 114,604 GWh, SolarShares participation accounted for 26.3% . When that percentage is applied to the SMUD-supplied emission factor, the adjusted emission factor becomes 393.2 lbs. CO_2/MWh.

Natural gas EFs remained unchanged from 2015. The EF for CO_2 was provided by PG&E for 2021, which supplies nearly all the natural gas to unincorporated Sacramento County. CH_4 and N_2O EFs were provided by ICLEI and already integrated into ClearPath for 2021.

Table 7: Natural Gas Emission Factors

2015	2021	Unit
11.7	11.7	CO_2 lbs./therm
.0011	.0011	CH_4 lbs./therm
.00002	.00002	N_2O lbs./therm

3.2 Community-wide

3.2.1 On-Road Vehicles

The most important metric for calculating GHG emissions in the transportation sector is VMT, or the "amount of travel for all vehicles in a geographic region over a given period of time" (Williams et al, 2016). VMT is a useful measure for transportation GHG emission accounting because it "provides a measure of total travel" and shows "how travel changes over time" (Williams et al). The other influential factor for determining GHG emissions is fuel type (gasoline, diesel, electric, etc.). When these factors are combined with a respective vehicle type and an EF, the emissions can be calculated.

Every four years the Sacramento Area Council of Governments (SACOG) updates a Metropolitan Transportation Plan/Sustainable Communities Strategy (MTP/SCS) for the Sacramento region. The SACOG Board adopted the 2020 MTP/SCS on November 18, 2019. The MTP/SCS used an

"activity/tour"-based travel demand model in accordance with CARB and Senate Bill (SB) 743 to calculate regional VMT. The model is "designed to estimate individual's daily travel, accounting for land use, transportation, and demographics that influence peoples' travel behaviors" (SACOG, 2021). Using that model, SACOG was able to project 2021 VMT on a linear annual rate applied to the 2016 base year based on growth. The VMT data obtained was the most up-to-date modeling available at the time this Inventory was completed. Though the VMT used for this Inventory is projected from a non-pandemic to a pandemic-affected year, SACOG is confident that VMT trends have increased back to pre-pandemic level overall. By using this methodology, Sacramento County is presenting a more meaningful inventory and not attempting to take credit for any temporary trip reductions caused by the pandemic.

SACOG provided daily VMT totaling 12,118,018 for the unincorporated County. To calculate annual VMT, the same methodology as the Baseline Inventory was applied, in that "daily VMT was multiplied by 347 days per year […] to account for lower VMT during weekends, holidays, and summer periods" (Walters et al, 2016). Since SACOG's model is based on a typical non-holiday weekday, this method is consistent with CARB methodology for GHG emission accounting. To promote continuity throughout the inventory process, it was deemed appropriate to employ the same method as was used for the Baseline Inventory. Annual VMT calculated in this way amounted to 4,204,952,246, which represents a 710 million VMT or 17% increase from 2015.

Once total VMT is found, the data must be parsed further by vehicle characterization and fuel type, as emissions will differ based on a combination of these variables. County-wide fuel and vehicle type were downloaded directly from EMFAC2021 and scaled to the unincorporated County based on the provided VMT from SACOG. The unincorporated VMT was found to be approximately 32.63% of County-wide VMT as sourced from EMFAC, so every vehicle/fuel type VMT combination was multiplied by 0.3263 to find the unincorporated VMT of each.

Vehicles are grouped into four main categories for calculating emissions: Passenger (P), Light Duty (LD) Trucks, Heavy Duty (HD) Trucks, and Motorcycles (M). For emissions purposes, the EPA designates LD as less than 8,500 lbs., and HD as over 8,500 lbs. (EPA, 2022e). These distinctions are important because each vehicle type, along with its associated fuel type, has a respective EF. The EFs used for the Inventory were derived from the EMFAC2021 model to best represent Sacramento County vehicle emissions. Table 8 provides a summary of on-road VMT by fuel and vehicle type.

Table 8: On-Road VMT by Fuel & Vehicle Type (in thousands)

VMT Category	Passenger	LD	HD	Motorcycle	Total Daily	Total Annual
Gas	5,781	4,794	367	46	10,988	3,813,904
Diesel	18	39	744	0	802	279,542
Natural Gas	0	0	28	0	28	9,545
Plug-in Hybrid	123	17	0	0	139	48,465
Electric	154	5	0	0	159	55,244
Total					**12,116**	**4,205,701**

Note: The totals calculated in this table differ by less than 1% from the SACOG provided totals due to rounding.

3.2.2 Off-Road Vehicles

Activity from off-road vehicles is not captured in SACOG's VMT and must be calculated separately. Fuel usage data based on vehicle category is obtained from CARB's OFFROAD2021 model for the entire County and scaled to the unincorporated area based on population. Sacramento County had a population of 1,580,624 in 2021, while the unincorporated population was 609,504 (Sacramento County, 2023b). The unincorporated County population represented 38.56% of the population; therefore, that ratio was applied to the countywide data provided by the OFFROAD2021 model.

Off-road vehicles include, but are not limited to, recreational vehicles (watercraft, all-terrain vehicles, etc.), airline ground support vehicles, lawnmowers, and construction equipment. There are many potential categories, but the eight most impactful and County-relevant categories are included in this Inventory and listed in Table 9: Off-Road Fuel Consumption and Emissions by Equipment & Fuel Type. Emissions from off-road agriculture vehicles are included in the agriculture section and thus omitted from this section, as was done in the Baseline. For the fuel types listed in Table 9, liquid fuels (gasoline and diesel) are shown in gallons and natural gas is in gallons gas equivalent (GGE).

Table 9: Off-Road Fuel Consumption and Emissions by Equipment & Fuel Type

Equipment Category	Gasoline (Gallons)	Diesel (Gallons)	Natural Gas (GGE)	2021 Emissions ($MTCO_2e$)	2015 Emissions ($MTCO_2e$)
Construction & Mining	119,537	3,385,448	0	35,913	96,063
Pleasure Craft	1,641,538	0	0	14,538	28,826
Transport Refrigeration Units	0	405,244	0	4,138	16,233
Lawn & Garden	1,619,716	30,430	0	14,649	12,145
Light Commercial	1,846,430	164,157	140,184	18,941	11,242
Industrial Equipment	316,611	138,881	572,243	7,990	10,627
Oil Drilling	0	151,023	0	1,555	9,781
Recreational	97,650	0	0	864	7,039
Airport Ground Support	775,304	110,126	91,272	8,586	4,633
Total	**6,416,787**	**4,385,308**	**803,698**	**107,174**	**196,589**

All categories shown in Table 9 were scaled based on population except for Airport Ground Support, because the Sacramento International Airport is located entirely in the unincorporated area of the County; therefore, the County-wide data is the same as the unincorporated. Finally, entertainment and railyard operations categories from the Baseline Inventory were omitted from this Inventory because their emissions relative to the entire off-road section were negligible and amounted to less than 200 $MTCO_2e$ combined.

3.2.3 Building Energy

GHG emissions from buildings and facilities throughout the unincorporated County are derived from purchased electricity and natural gas. While electricity does not produce emissions at the end-use location, it does create off-site emissions from where it was generated, and the level of emissions depends on the energy mix, as discussed previously. Almost all electricity in the County is served by SMUD, and almost all natural gas is delivered by PG&E. Data for this sector was provided by those respective utilities in kWh for electricity and therms for natural gas. The data in this section is broken down into residential, industrial, and commercial.

Table 10: Building Energy Use and Emissions by Source

Source	Quantity	GHG Emissions	% of Sector
Electricity	kWh/year	$MTCO_2e$/year	%
- Residential	1,982,264,551	481,450	54
- Commercial	1,392,983,289	338,326	38
- Industrial	290,216,671	70,488	8
Electricity Total	3,773,845,123	916,587	100
Natural Gas	therms/year		
- Residential	74,616,385	396,858	73
- Commercial	27,454,537	146,021	27
- Industrial	143,143	760	< 1
Natural Gas Total	102,214,065	543,639	100
Combined Totals			
Residential		878,308	61
Commercial		484,347	34
Industrial		71,248	5
Total		**1,433,903**	**100**

To parse the unincorporated consumers from the entire County, SMUD was provided a GIS shape file of the unincorporated area (PG&E has an automated data request system that parses the data automatically). Using the shape file, SMUD was able to generate a list of premises within the unincorporated area and pull the respective 2021 electricity usage data. It was observed that this data was noticeably different from the 2015 data, not only in total usage but in how it was categorized into commercial and industrial usage.

To ensure consistency with the 2015 Inventory, electricity data from 2015 was then requested from SMUD to be compiled using the same methodology as the 2021 data. When this revised 2015 data was provided by SMUD, it was noted to be more consistent with what was reported for 2021 as far as characterization of commercial and industrial usage. The total usage in the new 2015 data was lower than what was reported for the 2015 inventory. The new 2015 data was used in this Inventory to be consistent with the methodology used in generating the 2021 electricity usage data. This results in a more accurate and transparent comparison of emissions. In other words, instead of keeping the higher 2015 electricity usage and showing a larger reduction for 2021, an apples-to-apples methodology was used that shows electricity usage slightly increased over 2015.

Data was entered directly into ClearPath along with the utility EFs. The SMUD-provided, non-adjusted EF was used for electricity. Electricity usage from the Sacramento Regional Wastewater Treatment Plant (SRWWTP) and wastewater pumping was subtracted from the Industrial total, as that data is included separately in the wastewater section. Agricultural data was provided by SMUD and combined into the commercial energy category because there was no separate agriculture data from PG&E, and per communication with PG&E, agricultural gas customers are usually assigned to the commercial sector.

3.2.4 High-GWP Gases

Gases with particularly high GWP, namely hydrofluorocarbons, can be found locally in refrigerants, aerosols, foams, and fire suppressants. Refrigerants, such as those used in air conditioning systems, are the most prominent emissions source for these types of gases, especially in Sacramento County, due to the hot and dry climate. Local data wasn’t available so statewide Inventory data was scaled based on the unincorporated County population. The California Inventory was from 2020 so population data from that year was used as well, taken from the U.S Census Bureau. County population was taken directly from the County

website. Mass emissions were obtained from CARB's GHG Inventory Query Tool, and the GWPs from the 5th Assessment were applied.

2020 California population: 39,538,245

2020 Unincorporated Sacramento County population: 610,442

Ratio of unincorporated to CA: 0.01544

Using this data, the ratio was applied to each category of high-GWP gases to find their respective County emissions, as shown in Table 11.

Finally, fugitive emissions from natural gas distribution leakage were added to this Inventory based on recommendation by ICLEI. This calculation was done by inputting the total amount of natural gas used by the community in 2021 into ClearPath, which was 102,214,065 therms, and applying an ICLEI default leakage rate of 0.3%.

Table 11: High-GWP Gases Emissions Compared

Parameter	2021 Emissions ($MTCO_2e$)	2015 Emissions ($MTCO_2e$)
Refrigerants - Commercial	134,959	112,400
Refrigerants - Transportation	56,598	49,700
Refrigerants - Residential	55,597	28,900
Refrigerants - Industrial	28,251	24,900
Aerosols	9,549	14,800
Foams	11,890	18,400
Solvents & Fire Suppression	3,217	2,100
Natural Gas Distribution	17,734	N/A
Total	**317,796**	**251,200**

3.2.5 Agriculture

GHG emissions from agricultural activities in Sacramento County were found to be a result of enteric fermentation, fertilizer application, manure management, and vehicle engine combustion. Their respective calculation methods and emissions can be found in Table 12. The unincorporated

County contains virtually all the agriculture activities of the entire County, so the data that was provided for County-wide is assumed to be the same as the unincorporated County.

Table 12: Sacramento County Agriculture Emissions by Source

Emissions Category	Calculation Method	2021 Emissions ($MTCO_2e$)
Enteric Fermentation	Equation A.1	59,985
Fertilizer Application	Scaled from CA GHG Inventory	41,533
Manure Management	Scaled from CA GHG Inventory	131,369
Farm Equipment	OFFROAD2021	33,583
Total		**266,470**

According to Appendix G of the Community Protocol, "enteric fermentation is the process of microbial fermentation through which methane is produced during animal digestion," and "is one of the largest sources of methane." Digestion from ruminant animals (hoofed mammals such as cows and goats) produces the highest levels of methane so they are accounted for. The number of cattle in Sacramento County in 2021 was 24,896 and was provided in the 2021 County Crop Report (Flores, 2022). To apply the correct emission factor, it was then necessary to divide the cattle based on their type – 45% beef and 55% dairy. This information was provided by the County Agricultural Commissioner's office.

Using these percentages, it was determined that the beef cattle head count in 2021 was 11,203 and the dairy count was 13,693. The respective EFs were then applied, which were retrieved from the IPCC Emission Factor Database (EFDB), and using equation A.1 in Appendix G of the Community Protocol, the emissions were determined:

Equation A.1: Animal Population (head) x EF (kg CH_4/head/year) x (1/1000) x GWP = Emissions

In the equation above, 1/1000 represents the conversion from kg CH_4 to MT CH_4, and GWP is the CO_2e equivalent of CH_4. Using the provided data and Equation A.1, the total emissions was solved for as shown below:

Beef: 11,203 x 47 x .001 x 28 = 14,743 $MTCO_2e$

Dairy: 13,693 x 118 x .001 x 28 = 45,242 $MTCO_2e$

Total: 59,985 $MTCO_2e$

There was not sufficient local data to calculate fertilizer application & manure management, so these values were scaled down from the statewide GHG Inventory. Manure management is based on production from livestock, of which there are local and statewide head counts available from the County Crop Report and USDA State Agriculture Overview for California, respectively. The number of beef and dairy cattle in the state of California for 2021 totaled 2,400,000, and for Sacramento County it was 24,896. The ratio of Sacramento County to the state of California was then found to be 0.0104. Because cattle manure management emissions dominate all other animal categories, the scaling ratio was based on cattle to provide the best scaling estimates for Sacramento County.

This ratio was then applied to the statewide mass emissions from livestock manure management for all animals (cattle, poultry, swine, and others as obtained from the CA 2020 GHG Inventory (California, 2022)) and the GWPs from the 5th Assessment were applied. 2020 was the most recent statewide data available at the time this inventory was prepared:

12,631,625 (statewide emissions) x 0.0104 = **131,369 MTCO$_2$e**

Emissions from fertilizer are the result of micro-organisms in the soil producing "N_2O as a by-product of their metabolism" after fertilizer has been applied (Menegat, 2022). Fertilizer can either be synthetic or organic in nature, with the former resulting in far higher N_2O emissions. Since local data was not available for fertilizer application, emissions were scaled down from statewide data. To find the ratio of Sacramento County farmland to statewide farmland, crops grown in the County were compared against the same crops for harvested acreage statewide. Crop acreage totals for the County were taken from the Crop Report, and statewide data was acquired from the USDA Agriculture Review.

Table 13: Sacramento County & California Crops Harvested

Crop Type	County Acres Harvested	CA Acres Harvested
Grapes	37,888	829,000
Hay, Alfalfa	13,190	580,000
Hay, Other	4,158	330,000
Corn, Silage	8,764	345,000
Wheat	6,938	220,000
Rice	8,673	405,000
Pears	5,002	9,400
Tomatoes, Processed	4,310	228,000
Safflower	2,104	39,500
Almonds	1,752	1,320,000
Walnuts	2,163	390,000
Cherries	1,494	34,000
Total	**96,436**	**4,729,900**

Once the totals of each were calculated (1), the ratio was determined and multiplied with the state mass emissions for fertilizer (2) as pulled from the CA 2020 GHG Inventory (California, 2022), and the GWPs from the 5th Assessment were applied:

1. 96,546 / 4,729,900 = 0.0204
2. 2,035,940 $MTCO_2e$ (statewide fertilizer emissions both direct and indirect) x 0.0204 = **41,533 $MTCO_2e$**

3.2.6 Solid Waste

The GHG emissions from solid waste are primarily a result of landfill gas (LFG), which comprises mostly methane, as well as a portion of biogenic CO_2 (which is not included in GHG emissions per either Protocol) and a negligible amount of N_2O and other gasses (US EPA, 2022d). Solid waste emissions for Sacramento County comprise three categories: community waste generation, LFG flaring, and LFG combustion (for energy purposes), as outlined in Table 14.

Table 14: Solid Waste Emissions

Emissions Category	Quantity	Emissions 2021 ($MTCO_2e$)	Emissions 2015 ($MTCO_2e$)
Waste Generation	546,072 tons	156,233	140,650
LFG Flaring	78,568,023 cubic feet (cf)/year	189	N/A
LFG Combustion	2,669,779,468 cf/year	322	20
Total		**156,744**	**140,670**

Community-wide waste generation represents all solid waste that was generated by businesses and residents in the unincorporated County in 2021 and sent to landfill, which amounted to 546,072 tons. This data was sourced directly from the CalRecycle website, and the closest available year at the time of this Inventory was 2019 (CalRecycle, 2019).

The tonnage of waste was entered into ClearPath along with an LFG collection of 75% and oxidation percentage of 10%. LFG collection is the amount of LFG that is collected by the landfill before it escapes into the atmosphere, and the percentage used is consistent with the Baseline Inventory and Appendix E of the Community Protocol. Oxidation percentage is the amount of LFG that is absorbed by the soil, for which the Community Protocol standard of 10% was used. Finally, California-specific waste characterization was used. Waste characterization is the breakdown of types of waste by percentages—for example, newspaper, food, textiles, construction, etc.—and was also sourced directly from CalRecycle.

Once LFG is captured and treated by the landfill, it can be turned into energy via a combustion process or flared (burned off). Kiefer Landfill flaring & combustion data for 2021 was provided by the Sacramento County Department of Waste Management and Recycling (DWMR). They were able to provide the total amount flared for 2021 along with the percentage of methane in the LFG (45.8%) and the destruction efficiency (99%). Destruction efficiency refers to the amount of methane that is destroyed during flaring, and subsequently converted to CO_2 (Plant et al, 2022). LFG is combusted at Kiefer and turned into energy via two on-site energy plants with a 15 MW capacity. Most of that electricity is sold to SMUD, while a fraction is used on-site to run the energy plant itself and the flare compound.

Waste-in-place emissions were omitted from the 2021 Inventory due to changes in the Community Protocol and to avoid double-counting. For this reason, they are not utilized in calculating the comparison table for 2015.

Kiefer Landfill is responsible for their own mandatory GHG emission reporting, which they report to CARB and the EPA annually. By making this change, the County is focusing on current behaviors and is more in line with the Community Protocol. This creates an Inventory that is more representative of emissions from the activities of Sacramento County residents in 2021 and therefore better informs potential local actions to address these emissions.

3.2.7 Wastewater

Emissions from wastewater come from several different sources, though the most impactful is energy purchased from SMUD to operate the various treatment and pumping facilities. Regional San has a contract with SMUD for SolarShares, so its purchased electricity emissions were adjusted accordingly. Data was provided by Regional San for 2021, including the allotted amounts of SolarShares for each entry, as displayed in Table 15.

Table 15: Sacramento County Wastewater Emissions

Emission Source	Quantity	SolarShares Adjusted	Total Emissions ($MTCO_2e$)	Unincorporated Portion of Emissions ($MTCO_2e$)
Treatment Facility	102,962,388 kWh	76,991,093 kWh	18,700	7,106
Regional San - Interceptor System	10,467,789 kWh	5,491,516 kWh	1,334	507
Sac Sewer - Collection System	3,586,215 kWh	2,705,183 kWh	657	335
Effluent Discharge	5,459 kg N/day	N/A	4,148	1,576
Digester Gas Flaring	254,140 cubic feet (cf)/day	N/A	317	121
Digester & NG Gas Boilers	78576 cf/day	N/A	4	2
Process N_2O	14 MT	N/A	3,710	1410
Total			28,870	11,057

Note: kg N = kilograms Nitrogen.

These emissions represent the total energy used to power the EchoWater Resource Recovery Facility (EchoWater Facility). Per Regional San, they allocate 25,971,295 kWh of purchased SolarShares to the treatment facility, bringing their total kWh usage for emission purposes to 76,991,093 kWh. As described earlier in this report, SolarShares represent 100% renewable energy purchased from SMUD and therefore have zero emissions, so a simple subtraction was made and the unaltered SMUD EF was then applied to calculate emissions. Since Regional San also serves several incorporated cities and limited areas in Yolo County, total emissions were scaled to the unincorporated County. The scaling was based on the unincorporated County population (609,504) divided by the total Regional San reported service population (1.6 million), resulting in a ratio of 0.3809 or a 38% scaling factor. It is noted that while some of residents in the unincorporated County utilize septic systems, the total unincorporated population is being used to facilitate repeatable calculations in future inventories.

It should also be noted that instead of changing the EF to represent the SolarShares purchases, as was done in the Government Operations Inventory, here the bulk kWh is changed. This is because of the way Regional San allocates their SolarShares: it is not a blanket application like at the County, so using a singular adjusted EF did not make sense, as there would have to be several different EFs for the different allocations. The same principle is applied, and emissions are reduced by the amount of SolarShares purchased.

Data on electricity usage for wastewater pumping, collection, and conveyance was provided by Regional San for the Interceptor System (1.6 million service population) and the Sac Sewer Local Collection System (1.2 million service population). Like the EchoWater facility, SolarShares are allocated here as well. For the Interceptor System, total kWh usage was 10,467,789 minus a SolarShares allocation of 4,966,273, resulting in 5,491,516 kWh. This was then scaled by the same 38% discussed above due to the 1.6 million service population compared to the unincorporated County population. For the Sac Sewer Local Collection System, total kWh usage was 3,586,215 minus a SolarShares allocation of 881,032, resulting in 2,705,183 kWh. An adjustment for the unincorporated area based on the unincorporated population of 609,504 divided by the 1.2 million service population then resulted in a ratio of 0.5079 or a scaling factor of 51%. The results are expressed in Table 15.

In normal operations, WWTPs discharge effluent, or treated wastewater, into nearby bodies of water. According to the Community Protocol, "Conventional WWTPs are not able to remove all of the nitrogen content in wastewater," and "when this nitrogen-containing effluent reaches a natural

watershed, indirect N_2O emissions occur". The EchoWater Facility has two rates of effluent discharge for 2021, since in April they commissioned the EchoWater Nutrient Removal Project (BNR) which is a seven-stage nitrification and denitrification biological treatment process, effectively cutting their effluent ammonia releases by 99%. The average of the two rates, pro-rated based on days in operation, was used to calculate the total discharge for the year.

The wastewater also undergoes a nitrification/denitrification process, in which ammonia is oxidized to nitrite, then to nitrate, and finally released as nitrogen gas (US EPA, 2007). This releases 14MT of N_2O emissions that, according to the Community Protocol, is calculated based on the population served by the EchoWater Facility.

Anaerobic digesters take in treated wastewater solids and turn them into biogas, which is then combusted or used as a renewable fuel. Most of the biogas is sent to SMUD for electricity generation. The EchoWater Facility uses flaring and boilers to burn off the portion of biogas that is not sent to SMUD. The amount burned in the boilers and amount combusted during flaring is represented in Table 15.

3.2.8 Water Supply and Stormwater

Emissions from community water supply and stormwater collection in this Inventory are classified as a Scope 2 emission, as they are calculated from the amount of purchased energy from SMUD to operate the treatment and delivery system for potable water and the stormwater system for residents within the unincorporated County.

Potable water in Sacramento County is supplied by numerous private water purveyors and the Sacramento County Water Agency. Many of the water purveyors serve incorporated communities within Sacramento County as well as communities outside of Sacramento County. This makes isolating the emissions associated with unincorporated Sacramento County's water supply challenging to calculate. There are several estimation methods that can be utilized. The method employed for this Inventory is outlined below.

Consistent with the LGO Protocol for emissions from water delivery and pumping facilities, the Sacramento County Water Agency (SCWA) was asked to provide an Excel spreadsheet of total energy usage for 2021 within its own facilities and operations associated with Zone 41, which totaled 28,838,061 kWh. Zone 41, per the SCWA website, includes all "water production, treatment, storage, and distribution facilities, pursuant to permits issued by the California Department of Health Services." The SCWA data also included the electricity associated with stormwater pumping.

There were a handful of water-related entries on the building energy spreadsheet that were combined with the SCWA file. They amounted to only 157,113 kWh (minus duplicates totaling 47,566 kWh) and when added to the SCWA data, the final water energy total amounted to 28,995,174 kWh. SCWA also provided the number of connections they serve (59,300) and an estimation of population per connection of 3.25 based on their 2010 Water System Infrastructure Update. This results in an estimated service population of 192,725. Dividing the total kWh by service population results in an estimated 150 kWh per person for potable water supply and stormwater. Lastly, the unincorporated County population of 609,504 is multiplied by 150 kWh, resulting in an estimated 91,425,600 kWh electricity used for potable water treatment and delivery as well as stormwater in unincorporated Sacramento County. This is then entered into ClearPath with the non-adjusted SMUD emission factor to result in 22,205 $MTCO_2e$, or less than 0.5 percent of the total Community-wide Inventory.

It is acknowledged that this is an estimate and does not differentiate between unincorporated residents who use wells vs. a commercial water supply. It is also acknowledged that ICLEI guidance cautions that the electricity used for potable water can often show up in the community-wide report for commercial and/or industrial electricity usage. As such, ICLEI advises providing water supply emissions as information only. In this Inventory, the County is incorporating water emissions in the totals. By including it in the totals, it likely results in a minor overreporting of emissions. The County has made this choice so that the reader has the benefit of seeing the minor contribution to emissions water supply and stormwater creates when compared to the transportation and building energy sectors and so that these comparisons can be carried across the entire set of charts and graphs for the inventory.

3.3 Government Operations

3.3.1 Employee Commute

Like the Community-wide transportation sector, when determining employee commute emissions, the most important dataset is VMT. Though technically a Scope 3 emission, Employee Commute is included in the Inventory because of its impact on emissions. For this Inventory, VMT was calculated using an origin-destination model. Home zip codes for all County employees were compiled, as well as their respective work addresses. VMT to work locations was calculated by using either the post office as the origin, or in cases with no post office present, the centroid point of the zip code.

To account for vacation and work-from-home days, it was assumed that every other week employees either work from home or take a day off for vacation or illness, in addition to County holidays. Beginning with 365 days out of the year, then subtracting 104 for weekends, 14 for County holidays, and an additional 25 for vacation/work from home, it was determined that the average County employee commuted to work 222 days in 2021. This is consistent with what was used in the Baseline Inventory, and for all intents and purposes may be an overestimation due to the increase of employees working from home since the onset of the pandemic. However, this methodology was chosen for the sake of consistency, the ability to compare data across inventories, and to account for a gradual return to regular work schedules.

When determining mode split with alternative means of transportation such as bicycle, public transit, or carpool, several factors were considered. Based on data from the US Census Bureau, local observations, employee interviews, and the County Department of Personnel Services, it was determined that 6.5% of County employees commute to work by some other means than a personal vehicle.

Using this methodology, total annual VMT for County employees in 2021 was calculated as 81,877,233. This represents a decrease of 26 million miles from the Baseline Inventory. When computing VMT for this Inventory, there were a handful of outliers that were removed due to their reported home zip codes being hundreds or even thousands of miles away from their listed work location. Since it is not feasible for these employees to commute this distance, these entries were not included in VMT calculations for this Inventory. These entries represented only 31 of 12,209 employees, but the distances involved significantly impacted the VMT metric.

3.3.2 Building Energy

Emissions from County buildings & facilities are classified as a Scope 2 emission, meaning that they are indirect and result from purchased electricity and natural gas. Like the community, the County purchases its natural gas from PG&E and its electricity from SMUD. The difference for the County is the EF is adjusted for County-purchased SolarShares, as described previously in Section 3.1. See Table 16 for a breakdown of electricity and natural gas usage expressed in kWh and therms, respectively.

Table 16: Government Operations Building Energy Usage

Sector	Electricity (kWh)	Natural Gas (therms)	Emissions ($MTCO_2e$)
Buildings & Facilities	89,472,931	1,452,005	23,760
Airport Buildings & Facilities	24,369,743	437,124	6,693
Total	**113,842,674**	**1,889,129**	**30,453**

Buildings & Facilities includes all buildings & facilities that are owned, operated, and leased by the County. Energy usage data was provided by the County Energy Program Manager in the form of an Excel spreadsheet, which included all County energy usage and was referenced throughout the Government Operations section of the Inventory. From this spreadsheet, airport data was parsed out separately.

Airport energy usage and emissions are shown separately for two reasons. First, they have an energy program separate from the County. Second, for the purpose of continuity with the Baseline Inventory, as the airport data was broken out separately there. In addition to airport data being removed from the building energy data, there was some duplicate water-related data as well. To avoid double-counting, 206,479 kWh of stormwater pumping data was removed because it already appears in the water section of the Inventory.

3.3.3 Vehicle Fleet

This Scope 1 emission sector of the Inventory represents direct emissions from combustion and includes vehicles owned and operated by the County, both off-road and on-road. The amount of miles driven with a particular fuel, along with an EF, is used to calculate emissions associated with that fuel type. For certain fuel types used mostly by off-road vehicles, namely propane and diesel, vehicles are stationary and operate based on hours, not miles. VMT is not required for these emissions calculations and are therefore not included in the data. For the fuel types listed in Table 17, liquid fuels (unleaded, diesel, and propane) are shown in gallons and natural gas is in gallons gas equivalent (GGE).

Table 17: County Fleet (Non-Airport)

Fuel Type	Fuel Usage (gal or GGE)	VMT	GHG Emissions ($MTCO_2e$)	Biogenic CO_2 Emissions
Unleaded	1,406,894	15,575,483	12,353	N/A
Diesel	13,926	N/A	144	N/A
R99 Diesel	725,140	669,661	28	6,784
CNG	2,791	N/A	18	N/A
RNG	1,344,379	2,166,025	0	7,848
Propane	12,800	N/A	72	N/A
Total	N/A	N/A	**12,615**	**14,632**

As shown in Table 17, emissions from unleaded fuel represent by far the largest source of CO_2e. R99 Diesel and renewable natural gas (RNG), which the County sources from California's renewable natural gas procurement program, represent rather large amounts of fuel usage and VMT, but because of their renewable properties they emit biogenic CO_2, as opposed to fossil CO_2 that is extracted from underground. These renewable fuels are made from biological processes that occur upstream, re-using carbon that is already in the carbon cycle, and are therefore not counted in County GHG emissions. Biogenic CO_2 is shown in the table only for accounting purposes. This reporting methodology is consistent with the LGO Protocol.

As with building energy, the airport system manages its fleet separately from the rest of the County. Emissions from aircraft and airline-owned ground support equipment were not included in the airport emissions because these are not part of County Government Operations and therefore do not fall under any of the reportable emission Scopes. They are owned by private entities such as the airline companies themselves and should be accounted for in their inventories. The airport system uses just three types of fuels for its fleet, which are shown in Table 18.

Table 18: 2021 County Airport Fleet Usage Data

Fuel Type	Fuel Usage (gal or GGE)	VMT	Emissions ($MTCO_2e$)
Unleaded	79,858	806,536	701
Diesel	3,558	37,331	61
Natural Gas	260,662	1,091,778	1,645
Total			**2,407**

3.3.4 Wastewater

Wastewater emissions associated with County Government Operations were estimated utilizing the non-scaled 28,870 $MTCO_2e$ value from the Community-wide Inventory and scaling it to the approximate 11,500 County Employees in 2021 compared to the entire wastewater service population of 1.6 million, resulting in scaled emissions of 208 $MTCO_2e$.

3.3.5 Water Supply and Stormwater

Water Supply emissions for Sacramento County government operations were calculated by multiplying the 150 kWh per person calculation developed for the Community-wide Inventory by an approximate 11,500 County employees in 2021. The resulting 1,725,000 kWh energy usage was entered into ClearPath using the non-adjusted SMUD emission factor set, resulting in emissions of 419 $MTCO_2e$.

The emissions associated with the Sacramento County Water Agency and the Stormwater utility are also included in the Government Operations Inventory as they are solely County agencies. These emissions were calculated using the same methodology as in the Community-wide Inventory to establish the total kWh used by SCWA (28,995,174) and then entered into ClearPath with the adjusted SMUD emission factor used to account for the County's purchase of SolarShares. This calculation yielded an emissions total of 5,197 $MTCO_2e$. As described for the Community-wide Inventory as well, ICLEI advises providing water supply emissions as information only. In this Inventory, the County is incorporating water emissions in the totals. By including it in the totals, it likely results in a minor overreporting of emissions. The County has made this choice so that the reader has the benefit of seeing the minor contribution to emissions that water supply and stormwater create when compared to the transportation and building energy sectors, and so that these comparisons can be carried across the entire set of charts and graphs for the Inventory.

3.3.6 Streetlights & Traffic Signals

Streetlights & Traffic Signals represents another Scope 2 emission, as emissions originate from purchased electricity. Electricity usage for this sector was parsed out of the provided SMUD energy data using traffic signal (TS) and streetlight (SL) indicators, the same methodology as the Baseline. As mentioned earlier, there has been a large reduction in electricity usage due to the implementation of the Streetlights Improvement Plan, resulting in decreased kWh for 2021. When calculating emissions, the adjusted EF was used, further reducing emissions.

Table 19: Streetlights & Traffic Signals Emissions

Inventory	Total Usage (kWh)	Emissions ($MTCO_2e$)
2015	14,979,246	3,729
2021	7,002,921	1,255

4 Glossary

AR (4 & 5) – United Nations' Intergovernmental Panel on Climate Change 4th & 5th Assessment Reports.

ClearPath – GHG accounting software developed by ICLEI that was used to conduct this Inventory.

Community Protocol - U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions. The standard by which Community GHG Inventories are conducted in the U.S. and the inventory handbook used for this Inventory.

eGRID – Emissions & Generation Resource Integrated Database. Database of nationwide electricity emissions data.

Emission Scopes – Classification system for GHG emissions when conducting a government or other entity-driven GHG inventory. Not generally used for community inventories.

Scope 1 – Direct emissions from controlled sources such as internal combustion engines or methane from a landfill.

Scope 2 – Indirect emissions, generally from purchased electricity and natural gas.

Scope 3 – Indirect *adjacent* emissions that are not from owned and operated facilities, such as from purchased goods that were manufactured elsewhere.

GGE – Gasoline Gallon Equivalent. Measure of a particular fuel converted to gallons of gasoline for accounting and comparability purposes.

GHG – Greenhouse Gas. Gases which, when present in the atmosphere, reflect heat back to the Earth's surface. Three primary GHGs are:

CO_2 – Carbon Dioxide. Most common GHG.

CH_4 – Methane. More potent than CO_2, but less so than Nitrous Oxide.

N_2O – Nitrous Oxide. High-GWP gas.

GWP – Global Warming Potential. Unit of measure for the warming potential of a GHG.

kWh – Kilowatt-hour. Standard unit of measurement for electricity usage. Equivalent to one kilowatt of power per hour.

LGO Protocol - Shorthand for "Local Government Operations Protocol: for the quantification and reporting of greenhouse gas emissions", which is a standard by which Government GHG inventories are conducted in the United States.

MPG – Miles per Gallon. A measurement of how many miles a vehicle travels on one gallon of fuel.

Natural Gas – Fossil fuel that emits GHGs into the atmosphere when burned, primarily methane. Three types of natural gas are:

LNG – Liquefied Natural Gas.

CNG – Compressed Natural Gas.

RNG – Renewable Natural Gas.

Therms – Standard measurement for natural gas usage.

R99 Diesel – Diesel fuel containing at least 99% renewable diesel (CARB, 2023). Renewable Diesel is "a fuel made from fats and oils, such as soybean oil or canola oil, and is processed to be chemically the same as petroleum diesel (US DOE, n.d.)."

VMT – Vehicle Miles Traveled. A measure of total miles traveled by a given vehicle, or number of vehicles.

CARB – California Air Resources Board. California State agency in charge of air quality. Responsible for conducting statewide GHG Inventories.

ICLEI – Local Governments for Sustainability. "Global network of local and regional governments committed to sustainable urban development (About, 2023)." Authors of the Community and LGO Protocols and ClearPath software.

IPCC – International Panel on Climate Change. United Nations body that sets standards for GHG emission reporting.

EPA - Environmental Protection Agency. The Federal agency responsible for nationwide environmental regulation and policy.

PG&E – Pacific Gas & Electric Company. Investor-owned utility that provides natural gas services to Sacramento County.

SACOG – Sacramento Area Council of Governments. Metropolitan Planning Organization for the greater Sacramento region.

Sac Sewer – Owner and operator of the local sewer collection system.

SMUD – Sacramento Municipal Utility District. Community-owned utility that supplies electricity to Sacramento County.

DGS – Department of General Services.

SCWA – Sacramento County Water Agency.

DWMR – Department of Waste Management & Recycling.

Regional San – Owner and operator of the regional wastewater conveyance system and the EchoWater Resource Recovery Facility (EchoWater Facility) formerly known as the Sacramento Regional Wastewater Treatment Plant.

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