COMMITEE AGENDA: 03/04/21
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ITEM: (d)1.

CITY OF SAN JOSE
CAPITAL OF SILICON VALLEY

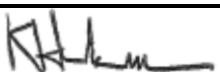
Memorandum

TO: SMART CITIES AND SERVICE IMPROVEMENTS COMMITTEE

FROM: Kerrie Romanow

SUBJECT: CLIMATE SMART SAN JOSE REPORT

DATE: February 23, 2021

Approved  Date 23 February 2021

RECOMMENDATION

Accept this report on Climate Smart San José activities.

OUTCOME

Provide a report to the Smart Cities and Service Improvements Committee on Climate Smart San José outstanding issues and project successes that have lowered greenhouse gas emissions, as indicated by various metrics on the Climate Smart San José Dashboard, with a specific focus on the decarbonization of residential and commercial buildings.

EXECUTIVE SUMMARY

The Climate Smart San José plan ("Climate Smart") was approved by City Council in February 2018 and includes goals and milestones that align with the 2016 Paris Agreement, designed to prevent global temperatures from rising more than 2^{o}C. Climate Smart is focused on achieving greenhouse gas (GHG) reductions in three primary categories: energy, water, and mobility.

Global climate change continues unabated, and 2020 brought another devastating fire season to California, even as the City's resources have been overwhelmingly occupied by the COVID-19 pandemic. Despite this difficult backdrop, City efforts to reduce greenhouse gas emissions and build a more sustainable future continue. Through work on active transportation, electric vehicles, renewable electricity, building electrification, and more, we continue to progress towards our Climate Smart goals.

This report summarizes the main areas of progress since the last Climate Smart update to City Council in Fall 2020 and includes for reference the most recently completed Greenhouse Gas Inventory, the 2018 Municipal Facilities Greenhouse Gas Inventory (Attachment A). This report

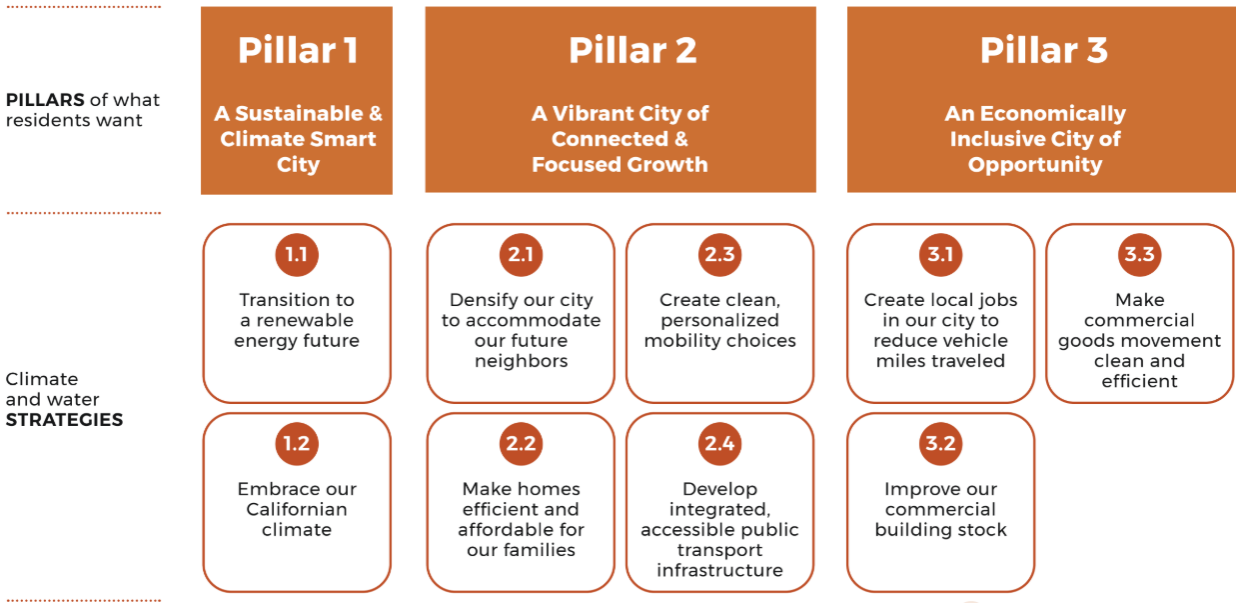
also highlights the data and software tools used to inform and guide Climate Smart implementation.

BACKGROUND

The climate challenges of this century directly affect the quality of life of all residents in San José. As in many other cities across California, the United States, and worldwide, San José has suffered disruptive flooding events, degraded air quality from massive wildfires, and record-breaking extreme heat events in the last years. Now, in addition to the response needed to address the significant, long-term threat of climate change, San José faces the urgent and immediate impacts of the COVID-19 pandemic. The two crises have many parallels, including their global nature, health impacts, and disproportionate impacts on low-income residents and residents of color. The City's climate objectives should be identified as pathways towards creating a healthier city that is more resilient in the aftermath of a crisis like the COVID-19 outbreak.

Adopted in February 2018, Climate Smart is a data-driven plan with specific goals to reduce climate change through greenhouse gas (GHG) reduction strategies organized in three pillars, as depicted in Figure 1.

Figure 1: Climate Smart San José Framework



A technical working group and executive steering committee, consisting of representatives of various City departments under the leadership of the Environmental Services Department (ESD), coordinate the City's climate action efforts. The technical working group meets monthly to

develop opportunities for departments to work together, and the steering committee meets quarterly to identify areas that require broad coordination and/or alignment on fundamental policy decisions related to the implementation of Climate Smart.

ANALYSIS

Climate Smart initiatives and projects are varied in their focus and strategies, but all align with the San José Smart City Vision through their use of data-driven decision making and emphasis on serving all City residents in a user-friendly way. In addition, many projects support the San José Smart City Vision's User Friendly City goal of using open data and visualization to inform public dialog, policy-making, and management decisions.

Climate Smart Challenge Platform

Launched through funding generously contributed through the American Cities Climate Challenge (ACCC), and now renewed for a second year, the Climate Smart Challenge is a San José-customized web platform that guides residents through over 60 potential actions they can take to lower their carbon footprint. Actions range from things as simple as choosing "Total Green" through San José Clean Energy to more capital-intensive things like purchasing an Electric Vehicle, and can be sorted by ease of implementation, energy cost savings, or pounds of CO_2e (carbon dioxide equivalent) removed from the atmosphere. The platform tracks the number of total climate actions taken and committed and dollar, carbon dioxide, kilowatt hours, natural gas therms, and gallons of water saved from those actions. The platform also displays the teams, "households", neighborhoods, and community groups that have earned the most points from actions taken, which allows for a gamified experience. It also encourages social engagement in that those actions and savings are only displayed once an individual user is part of a team, community group or household. Each team member answers a series of questions about their daily habits and the platform syncs with the individual's electrical utility account to capture data, allowing the platform to estimate a personal carbon footprint and potential savings from actions. That data is kept confidential to the individual user.

The local chapter of Mothers Out Front (MOF), a group of climate advocates that mobilize to ensure a livable climate, has also provided invaluable Climate Smart Challenge outreach. MOF organized in-person trainings and events prior to the COVID-19 restrictions, and since April 2020 have provided over 50 virtual trainings, events, and webinars to the community to promote the platform. Trainings and webinars have been presented in English, Spanish, and Vietnamese, and the Challenge site itself is also available in all three languages. The Climate Smart Challenge site is located at: https://climatesmartsjchallenge.org/.

Municipal Facilities

Voter approval of Measure T (The Disaster Preparedness, Public Safety and Infrastructure Bond) in November 2018 is allowing the Departments of Transportation (DOT) and Public

Works (PW) to implement additional conversions of the City's remaining outdoor lighting inventory to LEDs. Under an agreement with PG&E, the City's remaining streetlight inventory of 37,000 lights will be completely converted. All City park and trail lighting will be converted by 2024. LED lighting and controls upgrades will capture additional energy savings and GHG reductions.

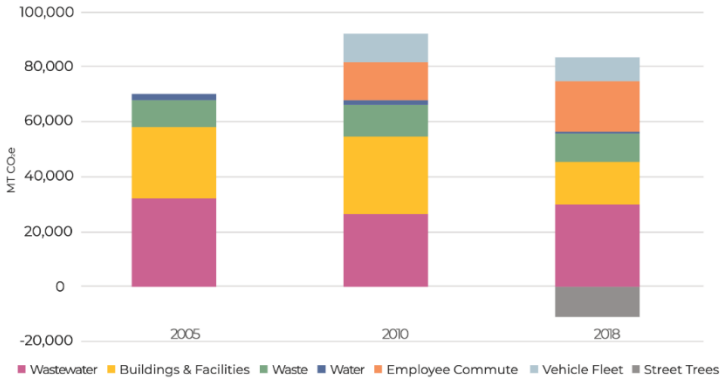
In addition, City Hall participated in a year-long emissions reduction initiative led by ESD, the Building Performance Leaders program. As part of this program, which concluded in November 2020, a lighting retrofit was performed at City Hall and a new Heating, Ventilation, and Air Conditioning (HVAC) control system was installed. The lighting retrofit is projected to save more than 5.6 million kilowatt hours per year, and the upgraded HVAC control system will provide for better control and monitoring that will allow staff to take a proactive approach to running the building.

2018 Municipal GHG Inventory

In collaboration with ICLEI – Local Governments for Sustainability (International Council for Local Environmental Initiatives), staff completed a GHG emissions inventory for municipal facilities and operations for calendar year 2018. The inventory report is publicly available on the Climate Smart dashboard website (https://www.sanjoseca.gov/your-government/departments-offices/environmental-services/climate-smart-san-jos/climate-smart-data-dashboard/ghg-emissions-city-government) and is included with this report in Attachment A.

Final results indicate that in 2018, municipal facilities and operations captured in the inventory emitted a net total of 72,090 metric tons of carbon dioxide equivalent (MT CO_2e). This is about one percent of all citywide emissions. The largest source of emissions was wastewater treatment (29,601 MT CO_2e); the next largest emissions source was employee commuting (18,376 MT CO_2e). A full breakdown is provided in Figure 2, along with breakdowns of the previous 2005 and 2010 municipal GHG emissions inventories.

Figure 2: Comparison of municipal GHG emissions in 2005, 2010, and 2018. Note: There are no orange or light blue bars for 2005 because data were not available to calculate emissions from employee commutes or the City vehicle fleet.



A possible next step is to establish emission reduction targets for city government operations, along with strategies to meet those targets. Although reducing municipal GHG emissions would have only a small direct impact on citywide GHG emissions, it would also indirectly impact citywide emissions by:

- Leading by example,
- Supporting the local green economy, and
- Building City knowledge of emission-reducing strategies.

Emission reduction strategies the City can still consider include:

- Switching to 100% carbon-neutral electricity from SJCE for all City operations,
- Re-introduction of landfill gas as a co-generation fuel at the Regional Wastewater Facility,
- Further fuel switching/electrification of both municipal buildings and vehicles,
- Further improvements to building energy efficiency (especially for poor-performing buildings identified through the Energy and Water Building Performance Ordinance), and
- Expansion of programs to encourage employees to commute by alternative modes or telecommuting on a year around basis, as opposed to more limited campaigns.

2019 Communitywide GHG Inventory

Communitywide GHG inventories are a key tool for tracking progress against our overall GHG reduction goals. The first communitywide GHG inventories for San José were for 2008 and 2014 and were prepared as part of the Envision San José 2040 General Plan update process and the first Envision San José 2040 General Plan 4-year review. The communitywide GHG inventory for 2017 marked the start of a new GHG inventory update schedule: GHG inventories will now be completed annually, alternating between communitywide and municipal operations inventories.

Staff is currently in the process of finalizing data for the next communitywide GHG inventory, for 2019. The 2019 inventory includes sectors that were not considered in previous inventories:

- Electricity transmission & distribution losses
- Other residential fuel use (wood, kerosene, propane)
- Non-local flights
- Freight rail
- Process emissions from semiconductor manufacturing
- SF_6 fugitive emissions from electricity transmission equipment
- Fugitive gases with high global warming potentials (refrigerants, solvents, etc)
- Forests & trees (carbon sequestration)

Some of these sectors (for example, non-local flights and SF_6 fugitive emissions from electricity transmission equipment) cannot easily be influenced by municipal policies or programs, and thus are often excluded from city GHG inventories. However, they have been included to fulfil

requirements of the U.S. Community Protocol and Global Covenant of Mayors Common Reporting Framework for GHG Inventories, and to give as full a picture as possible of GHG emissions in San José and resulting from the activities of San José residents.

As in other cities, data availability and quality for communitywide GHG inventories is a continuing issue. Some data, such as electricity and natural gas usage, are provided annually (in this case, by PG&E and the Community Energy Department) and are of high quality. Other data have been much more difficult to acquire. On-road Vehicle Miles Traveled (VMT) data, for instance, has been derived so far from the City Travel Forecasting model, which is based partly on historical traffic data (for 2008 and 2015) and partly on General Plan projections (for years after 2015). VMT values for years after 2015, therefore, are based on projections and not on real-world data collection. This is particularly problematic because on-road vehicles are the source of about half of San José communitywide GHG emissions. Staff is investigating other potential sources of VMT data, including Google's Environmental Insights Explorer and StreetLight Data, both of which compile transportation information from smartphone location data. In general, staff is taking a continuous improvement approach to GHG inventory data and plans to make improvements in each inventory.

Alongside completion of the 2019 inventory, the previous inventories have been fully updated to match the new methodology (see Figure 3). In addition, the 2019 and updated previous inventories have been developed using a new spreadsheet tool custom-built by staff. This new spreadsheet was designed to streamline the process of compiling inventories – it includes all data and calculations used for every inventory and thorough documentation of data sources and can be easily expanded.

When final, data will be presented to City Council and added to the Climate Smart Data Dashboard (https://www.sanjoseca.gov/your-government/departments-offices/environmental-services/climate-smart-san-jos/climate-smart-data-dashboard/ghg-emissions-community-wide-emissions). Draft data are presented below.

Figure 4 presents a detailed breakdown of 2019 communitywide GHG emissions. As in previous years, transportation emissions dominate San José's emissions profile, and on-road vehicles are by far the single largest source of GHG emissions. Transportation emissions overall are growing, but only slowly – 1% from 2017 to 2019, and only 0.2% if non-local flights are excluded.

After transportation, building energy use (electricity and natural gas) is the next largest source of emissions. Thanks to the increasingly clean electricity provided by San José Clean Energy (SJCE) and PG&E, GHG emissions from electricity decreased 4% from 2017 to 2019. Increased natural gas use, however, has led to a 6% increase in emissions from natural gas from 2017 to 2019, and an overall 2% increase in GHG emissions from building energy use overall.

Figure 3: Comparison of communitywide GHG emissions in 2008, 2014, 2017, and 2019. Forests and trees sequester carbon dioxide, resulting in negative emissions. The bars representing sequestration/negative emissions from forests and trees are difficult to see here because they are small compared to total emissions.

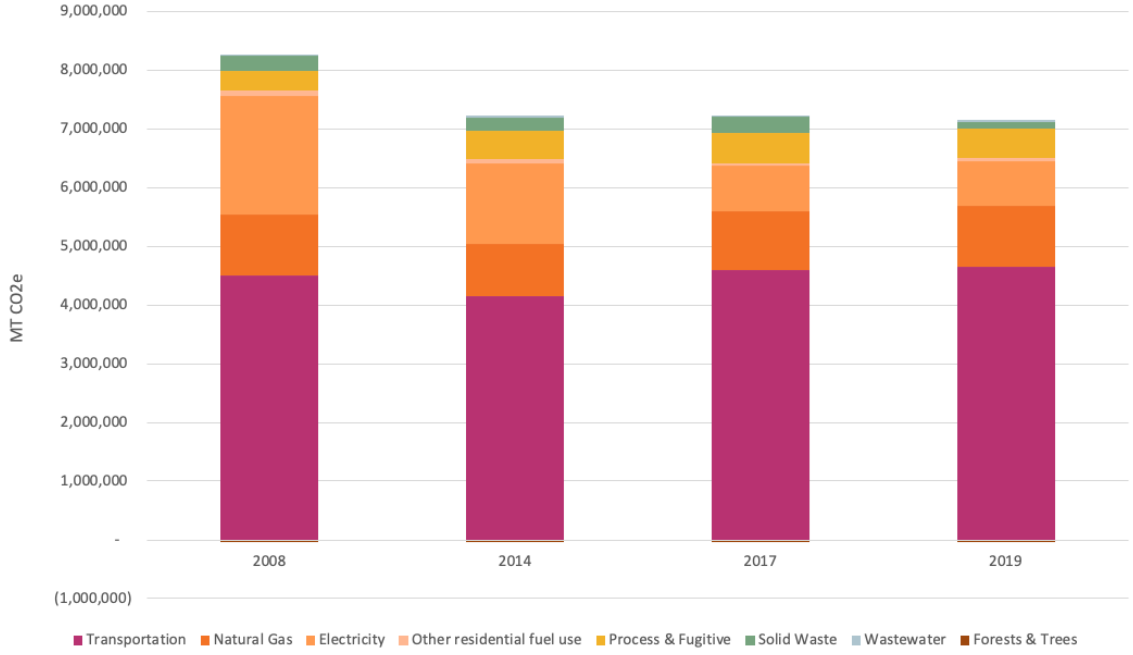
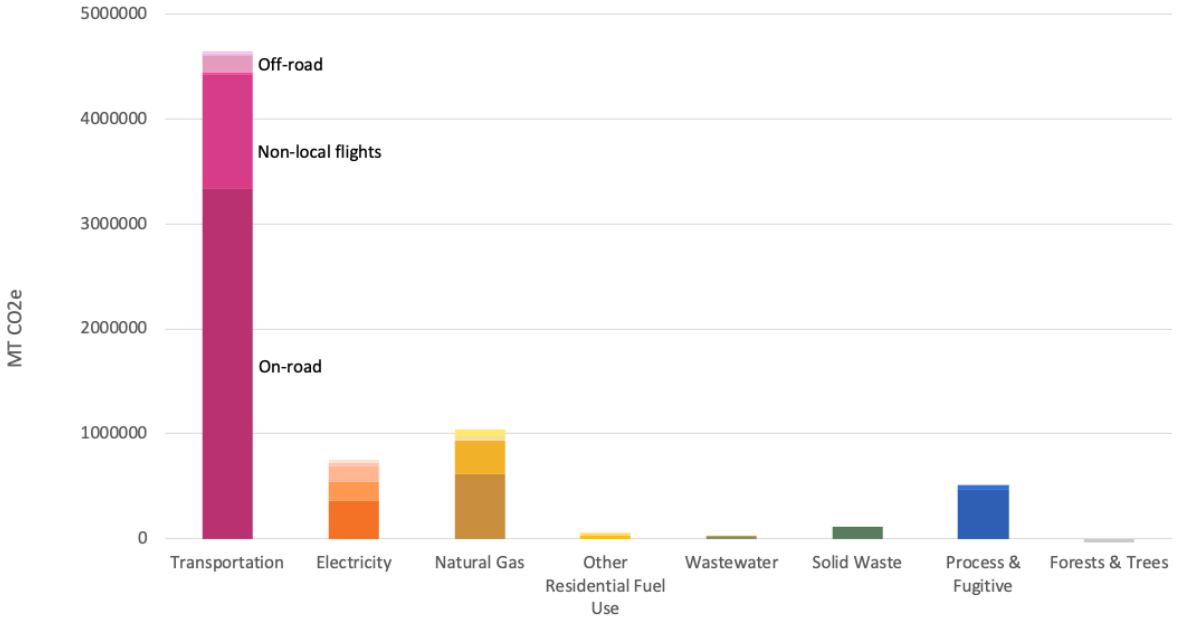
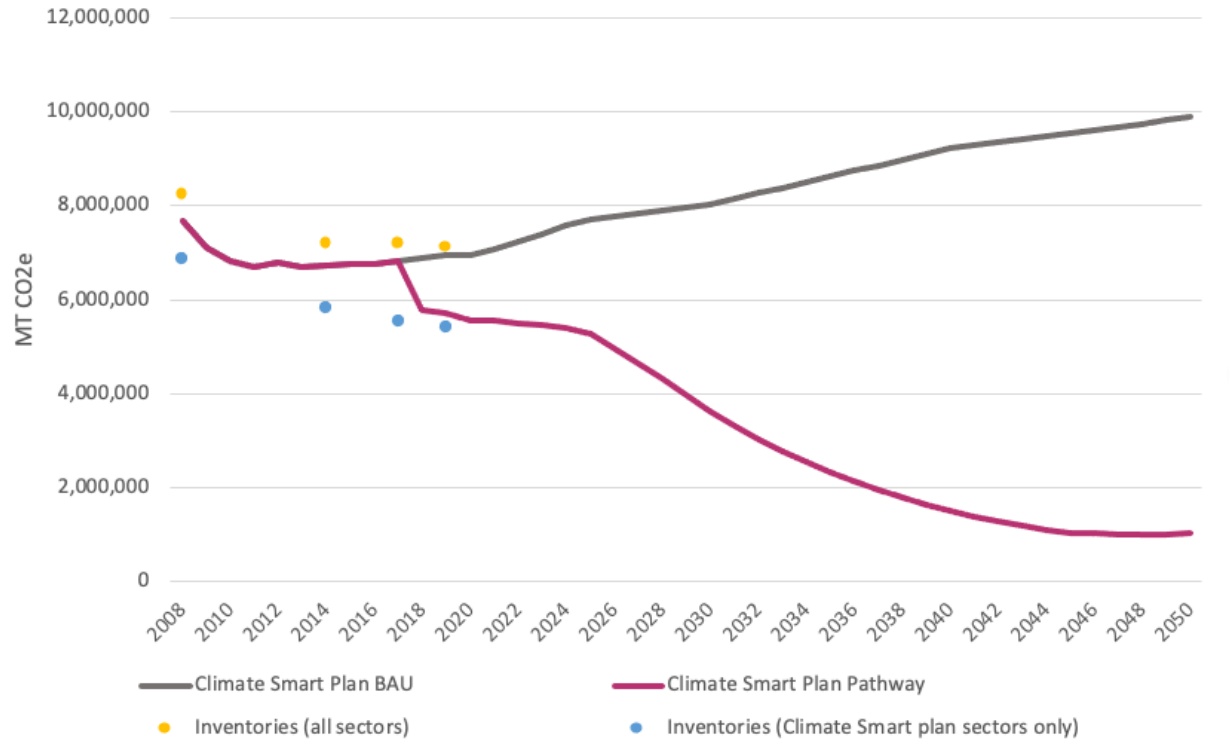


Figure 4: Sector and sub-sector breakdown of 2019 communitywide GHG emissions and sequestration.



When considering all inventory sectors included in the 2019 GHG inventory, communitywide emissions decreased 1% from 2017 to 2019. When considering only the sectors in the Climate Smart plan, communitywide emissions have decreased 3% from 2017 to 2019. This is just enough to keep San José in line with Climate Smart goals for now (Figure 5). However, the pace of emissions reductions will need to pick up in the next five years to stay in line with those goals in future.

Figure 5: San José communitywide GHG emissions compared to the business-as-usual (BAU) scenario in the Climate Smart plan and the Climate Smart plan pathway/goals. The yellow dots indicate total GHG emissions including the new sectors introduced in the 2019 inventory, and the blue dots indicate total GHG emissions including only the sectors considered in the Climate Smart plan.



Most of the decrease in GHG emissions since 2008 has come from the rapid decarbonization of electricity in California as a whole and in San José in particular. Electricity emissions are relatively easy to reduce, as changes in electricity generation and procurement by utilities affect emissions for all electricity users. As the Community Energy Department continues to make progress towards its goal of 100% carbon-free and renewable electricity, GHG emissions from electricity will continue to drop.

Emissions from natural gas use in buildings and from transportation are more difficult to reduce, as this requires the replacement of large numbers of individual vehicles and appliances with newer (ideally, electric) models, as well as behavior change by city residents and visitors. City legislative actions such as the Natural Gas Infrastructure Prohibition Ordinance and the Energy

and Water Building Performance Ordinance are large, important steps in the right direction, but much more remains to be done.

Natural Gas Infrastructure Prohibition Ordinance

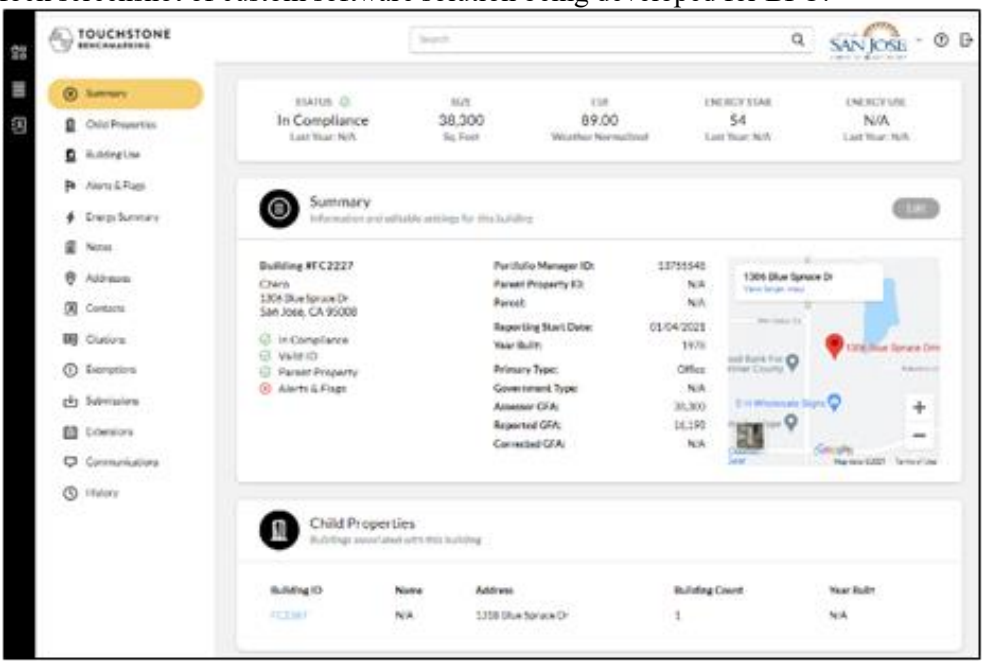
On December 1, 2020, City of San José City Council approved an ordinance prohibiting natural gas infrastructure in new construction. This was an expansion from the ordinance that was approved in October 2019, which prohibited natural gas infrastructure in residential new construction up to three stories. The expanded ordinance goes into effect on August 1, 2021, and will apply to all new construction, regardless of building height, with some time-limited exemptions.

Energy & Water Building Performance Ordinance

On December 11, 2018, City of San José City Council approved the Energy and Water Building Performance Ordinance (BPO). This ordinance requires large commercial and multifamily buildings 20,000 square feet (sq. ft.) and above to track and benchmark their energy and water use with the U.S. Environmental Protection Agency's ENERGY STAR Portfolio Manager® (ESPM) platform and report this data to the City of San José on an annual basis. The first reporting deadline was May 1, 2019, for buildings 50,000 sq. ft. and larger, and the first reporting deadline for buildings 20,000 sq. ft. and larger was July 1, 2020, (delayed due to COVID-19 pandemic). The City will make a subset of reported data publicly available. On a rolling five-year cycle, buildings will also have to complete one of two "Beyond Benchmarking Pathways," through which they will have to either 1) demonstrate high performance or performance improvement; or 2) complete an audit, building re-tuning, or targeted efficiency actions with the goal of improving their performance. It is anticipated that the original target date, 2021, will be extended to 2023. This is because building use during the COVID-19 pandemic may not reflect normal patterns, and, as a result, may not provide a reliable baseline benchmark.

On January 5, 2021, City Council approved purchase of a custom software solution for the BPO. The new Overlay system (mock screenshot below) will automate once-arduous tasks of tracking building compliance, uploading customer data, conducting data quality checks, and email communications. Starting in 2021, Covered Building Owners (CBOs) will also be able to submit online exemption and extension forms; and receive annual Scorecard compliance reports detailing their buildings' performance and compliance status.

Figure 6. Mock screenshot of custom software solution being developed for BPO.



With over 2200 buildings covered by the ordinance, this system will significantly save labor and help staff better assist CBOs to comply with BPO requirements, such as the upcoming "Beyond Benchmarking Pathways". Staff is currently working with Overlay to implement the system and expects to have it ready for use by this year's May 1st, 2021, compliance deadline.

Zero Net Carbon Demonstration Project

The Zero Net Carbon building demonstration project (ZNC demo) is a mobile, 18 feet by 8 feet trailer that features 17 ZNC and energy efficient technologies (pictured right). Since soft launching in May 2019, the ZNC demo has been to five events and has engaged with approximately 320 residents. The City partnered with VRnaculars to create augmented reality (AR) and virtual reality (VR) components for the ZNC demo in 2019. The AR component debuted at Christmas in the Park in December 2019 and helps residents to better understand the energy and carbon savings associated with upgrading to the technologies featured in the ZNC demo. The AR application allows residents to use a smartphone application that superimposes trivia questions, images, videos, and other computer-generated objects onto the technologies featured in the ZNC demo. The AR component will undergo final tests and be published on the Apple and other app stores by early Spring 2021.

For events that cannot physically accommodate the ZNC demo, a VR app was created for users to explore a virtual ZNC home with a similar user experience as the AR component. The VR application debuted at the Bay Area Home Electrification Expo in October 2019. The VR application was published in the Oculus store in November of 2020 and is accessible to anyone with an Oculus Go headset. The ZNC demo is on-hold for community events since March 2020 due to COVID-19. Staff will identify virtual opportunities to promote the VR application experience while public events continue to be on hold.

Residential Housing Decarbonization

Through support from the American Cities Climate Challenge, City staff is working with the Building Electrification Initiative (BEI) to better understand the opportunities and challenges to electrifying its building stock. To support these efforts, city staff worked with BEI to complete a Market Segmentation Analysis (MSA), a supply chain assessment, and a community engagement plan. Each of these elements provides a unique lens for evaluating building electrification opportunities and will ultimately inform our building decarbonization roadmap. The MSA provides useful information on San José's building stock (see Figures 7 and 8 below), as well as the demographics of its residents and several social and environmental vulnerability indicators used to assess differences between neighborhoods in San José. The supply chain assessment looks at the regional supply chain, the availability of heat pump technology, and the regional labor supply to better understand the state of the market. The community engagement plan involves a partnership with two community-based organizations, ICAN and Veggielution, to help lead the city in identifying and prioritizing the individual needs of the community as we seek to develop an equitable building decarbonization roadmap.

Figure 7: Data on age distribution of residential buildings in San José, from the Market Segmentation Analysis. This highlights a challenge for building electrification: the number of homes that are unlikely to have sufficient electrical panel capacity.

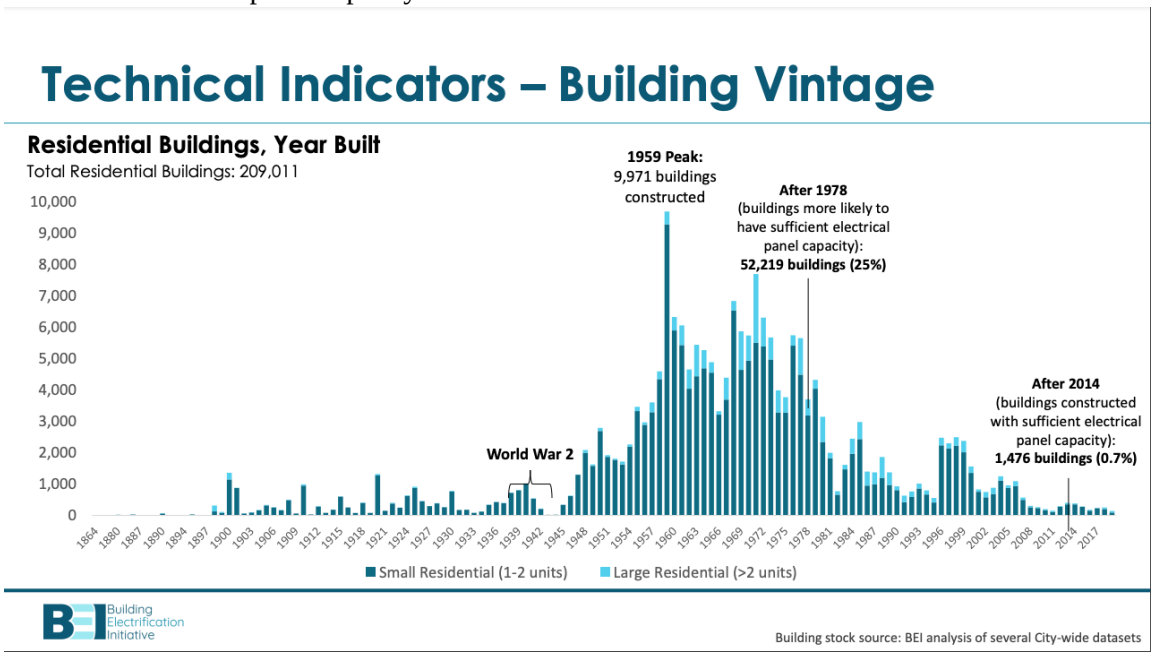
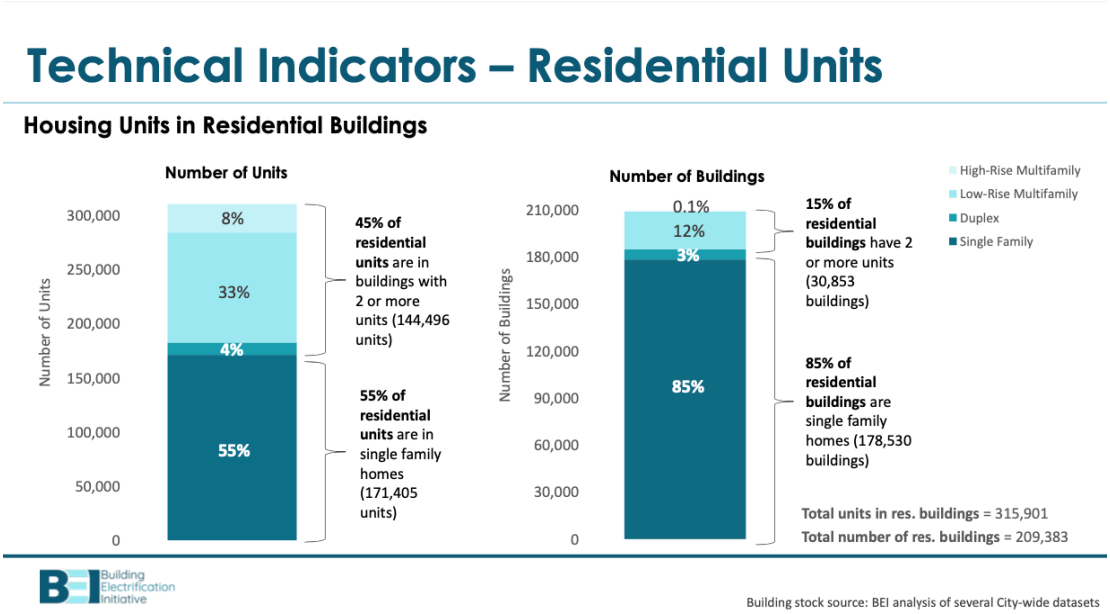


Figure 8: Residential building types in San José. While most residential buildings are single-family homes, almost half of all housing units are in duplexes or multi-family buildings.



Electrify San José

Electrify San José (www.sjenvironment.org/electrifysanjose), a residential heat pump water heater rebate program, was launched on July 1, 2019. With funding from a Bay Area Air Quality Management District (BAAQMD) Climate Protection Grant, the program provides rebates of up to $4,500 to households who upgrade from a natural gas water heater to an electric heat pump water heater. The water heaters must be EnergyStar certified and meet other energy efficiency requirements. Low-income households currently enrolled in the California Alternate Rates for Energy (CARE) or Family Electric Rate Assistance (FERA) programs are eligible for additional rebate amounts of up to $6,000. The program is currently fully subscribed, and a waitlist opened in January 2021. To date, 54 projects have been completed, with another 24 in progress. This program will phase out in April of 2021.

ZNC Educational Video

In support of Climate Smart building electrification goals and Electrify San José, City staff publicized an informational video completed in the Summer of 2019 (www.sjenvironment.org/zncbuildings) that explains ZNC building components and benefits to the community. The video is available with Spanish and Vietnamese subtitles. The video was integrated into energy efficiency, electrification, and carbon-free energy programming, including the Bay Area Home Electrification Expo, Climate Smart Youth Leaders pilot, and youth library programming. Other local jurisdictions and partner organizations such as Mothers Out Front and the City of Alameda also inserted their own logo and URL into the video and distributed the video to their communities under their own brand. Staff is currently promoting the ZNC video through the ZNC buildings webpage and through social media and other virtual promotion channels due to COVID-19 restrictions. Staff also developed a ZNC survey, accessible from the ZNC buildings webpage, to assess the impact of the ZNC video on resident understanding of and interest in ZNC technology. Residents that complete the survey will be mailed two free LED light bulbs as an incentive through the end of March 2021.

Climate Smart Dashboard

Development of the Climate Smart dashboard (online and publicly available at https://www.sanjoseca.gov/your-government/departments-offices/environmental-services/climate-smart-san-jos/climate-smart-data-dashboard) has continued since the last Climate Smart update to Council in Fall 2020, with the following major updates:

(1) Two new metrics have been added: Single-Occupancy Vehicles and Commercial & Industrial Solar.
(2) Most metrics have been updated with 2019 data.
(3) The Climate Smart dashboard was transitioned to the City website. It was previously on its own website, hosted by Prospect Silicon Valley, but this arrangement was ended by Prospect Silicon Valley.

Work continues on identifying the data needed to add the remaining Climate Smart metrics to the Climate Smart dashboard, and on developing standardized processes to obtain these data from other City departments.

External Reporting

Climate Smart staff is responsible for annual reporting to the American Council for an Energy Efficient Economy (ACEEE), the Carbon Disclosure Project (CDP), the EPA Green Power Partnership, the Global Covenant of Mayors (GCoM), and Shining Cities.

The Shining Cities 2019 report (available at https://environmentamerica.org/feature/ame/shining-cities-2019) recognizes San José as one of the country's top solar cities – third in the nation for solar capacity per capita and fifth in the nation for total installed solar capacity. The most recent EPA Green Power Partnership rankings recognize San José as ninth among U.S. local governments in green power usage (https://www.epa.gov/greenpower/green-power-partnership-top-30-local-government), and hundredth among all Green Power Partners (https://www.epa.gov/greenpower/green-power-partnership-national-top-100).

Since the last Climate Smart update to Council, San José received an "A" ranking from CDP and was ranked 9th in the nation on ACEEE's City Clean Energy Scorecard. San José is one of only 88 cities worldwide that received an "A". CDP scores are based on transparency in data disclosure and on progress in both climate change mitigation (GHG emissions reduction) and climate change adaptation (preparation for future climate impacts). The ACEEE City Clean Energy Scorecard analyzes the efforts of 100 major U.S. cities to make buildings and transportation more energy efficient and scale up the use of renewable energy. It includes metrics to assess community involvement and equity as part of cities' clean energy efforts. In addition, San José is due to receive all GCoM badges once the GCoM website is updated.

CONCLUSION

Progress on a multitude of Climate Smart objectives continues to be significant, despite the limitations imposed by the pandemic. The City has adopted nationally recognized and award-winning ordinances in the 2018 Building Performance Ordinance (existing buildings) and 2019 Reach Code and Natural Gas Prohibition (new construction). Critical attention to the City's transportation-related emissions sector, the City's largest GHG contributor, is well underway and will maximize the potential of electrification, automation, remote work, and shared mobility to achieve the City's environmental and transportation goals. The intersection of climate work and equity present a strong opportunity to help our communities most adversely affected by climate change transition to a clean energy economy and enjoy the public health benefits that come from moving away from fossil fuels and embracing "The Good Life 2.0" envisioned within Climate Smart.

EVALUATION AND FOLLOW-UP

Staff will continue to provide progress updates to T&E and City Council on Climate Smart San José activities on a semi-annual basis.

CLIMATE SMART SAN JOSE

The recommendation in this memo aligns with one or more Climate Smart San José energy, water, or mobility goals.

PUBLIC OUTREACH

This memorandum will be posted on the City's website for the March 4, 2021 Smart Cities and Service Improvements Committee Agenda.

COORDINATION

This memorandum has been coordinated with the City Attorney's Office, and the Department of Public Works.

COMMISSION RECOMMENDATION/INPUT

No commission recommendation or input is associated with this action.

FISCAL/POLICY ALIGNMENT

Climate Smart San José activities align with the Climate Smart San José strategies and the City's Envision 2040 General Plan approved by City Council.

CEQA

Staff Reports, Assessments, Annual Reports, and Informational Memos that involve no approvals of any City action. Public Project number PP17-009

/s/
KERRIE ROMANOW
Director, Environmental Services

For questions, please contact Ken Davies, Deputy Director, at (408) 975-2587.

Attachment A: 2018 City Government Operations GHG Inventory

ATTACHMENT A

CITY OF SAN JOSE

2018 Inventory of Government Operations Greenhouse Gas Emissions

Published September 2020

CLIMATE SMART
SAN JOSE
LIVING BETTER TODAY FOR TOMORROW

Credits and Acknowledgements

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Funding Source

Statewide Energy Efficiency Collaborative (SEEC) Accelerator Program

Message from Mayor Sam Liccardo

Climate change is one of the most pressing and complex challenges our community faces. Over the past decade, we've experienced the two warmest years on record, which have contributed to droughts, wildfires, and other disasters. As we prepare to release this inventory, California is experiencing one of the most intense heat waves recorded - leading to rolling blackouts and hundreds of wildfires and emphasizing the reality that climate change affects our community. We've taken this challenge as an opportunity to act in San José. Together, we are rising to the occasion and making climate action a priority for our community. In 2018, the City Council unanimously adopted Climate Smart San José, a Paris Agreement-aligned climate action plan focused on reducing carbon emissions. The Plan sets an ambitious goal of reducing emissions by 6.5 percent year-over-year through 2050. Meeting this challenge will require aligning the City's practices with our goals and leading by example.

Thankfully, San José has a history of success we will continue to expand on. Between 2010 and 2018, total municipal emissions decreased by 10 percent, with the most significant reductions seen in our City-owned buildings and water services. We are also leading by example by working to electrify our city fleet and eliminating natural gas in new municipal buildings by developing only all-electric, zero-net carbon buildings. But there's more work to be done.

To ensure we are making progress, we must rely on data to guide our decision making. This Inventory of Government Operations Greenhouse Gas Emissions is an essential step in that process. Building on this inventory, we will continue to measure our municipal and community emissions to track our progress in meeting our Climate Smart San José goals by 2050. Together, San José will create a more livable, healthier planet for future generations.

Sam Liccardo
Mayor of San José

Table of Contents

Abbreviations

Airport	Norman Y. Mineta San José International Airport
Btu	British thermal units
Cal e-GGRT	California Electronic Greenhouse Gas Reporting Tool
CEQA	California Environmental Quality Act
CH_4	Methane
CNG	Compressed natural gas
CO_2	Carbon dioxide
CO_2e	Carbon dioxide equivalent
DOT	Department of Transportation
eGRID	Emissions & Generation Resource Integrated Database
ESD	Environmental Services Department
EV	Electric vehicle
FTE	Full-time equivalent
g	Grams
GHG	Greenhouse gas
GWh	Gigawatt hours (1,000,000,000 watt hours)
GWP	Global warming potential
IPCC	Intergovernmental Panel on Climate Change
kg	Kilograms
kWh	Kilowatt hours (1,000 watt hours)
lbs	Pounds
LED	Light-emitting diode
LGO Protocol	Local Government Operations Protocol
LPG	Liquefied petroleum gas
MMBtu	Million British thermal units
MPG	Miles per gallon
MT	Metric tons
MWh	Megawatt hours (1,000,000 watt hours)
N_2O	Nitrous oxide
PG&E	Pacific Gas and Electric
PWD	Public Works Department
Wastewater Facility	San José-Santa Clara Regional Wastewater Facility
scf	Standard cubic feet
SJCE	San José Clean Energy
VMT	Vehicle miles traveled

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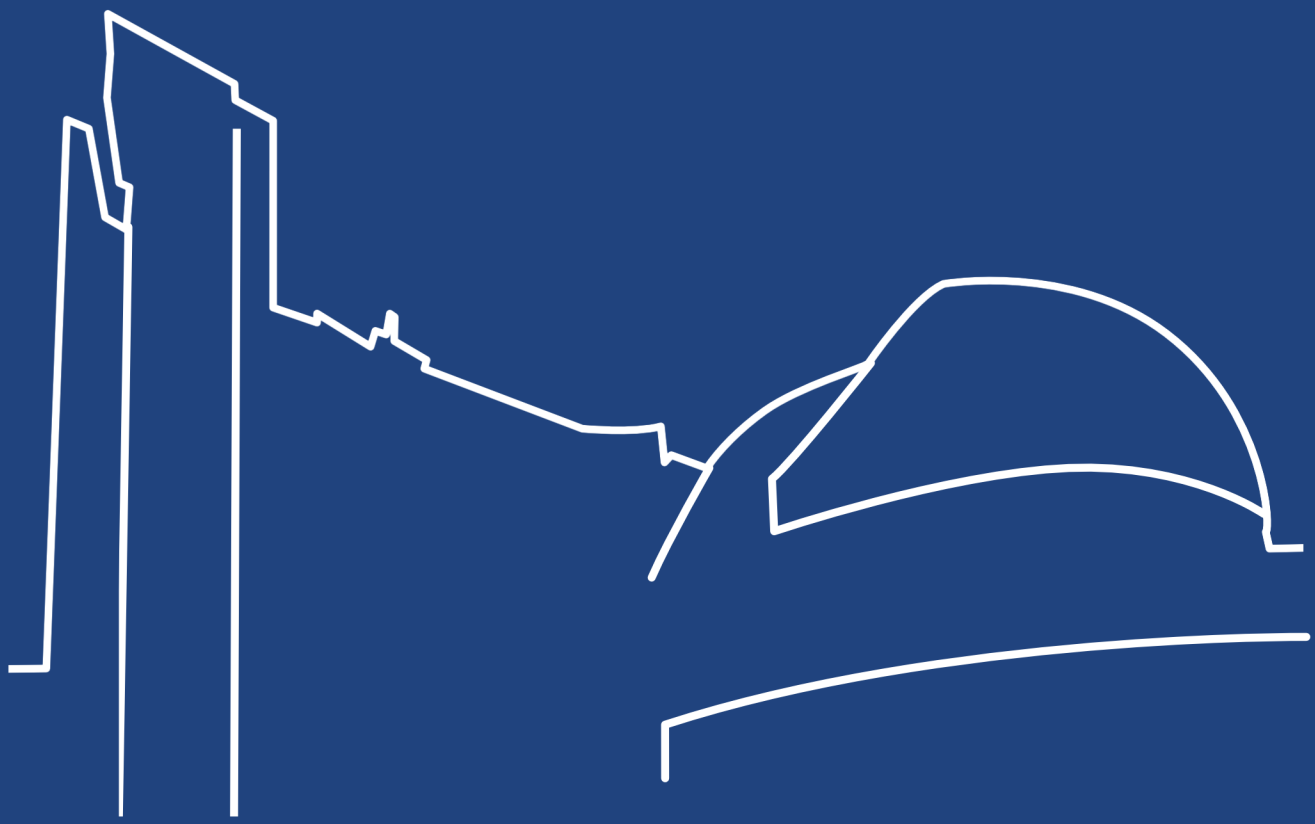
EXECUTIVE SUMMARY

The City of San José ("City") recognizes that greenhouse gas (GHG) emissions from human activity are catalyzing profound climate change, the consequences of which pose substantial risks to the future health, well-being, and prosperity of our community. Furthermore, San José has multiple opportunities to benefit by acting quickly to reduce community GHG emissions.



Actions to reduce GHG emissions can have many local benefits, such as reducing energy and transportation costs for residents and businesses, creating green jobs, improving health of residents, and making the community a more attractive place to live and locate a business. San José's goals for reducing GHG emissions are laid out in the Climate Smart San José plan, which also contains a set of strategies to guide the City in reducing community-wide GHG emissions and helping to meet the goals of the Paris Agreement.

This report provides estimates of GHG emissions resulting from the City of San José's government activities and operations in calendar year 2018 and compares them to emissions estimates for 2005 and 2010. As the Climate Smart San José plan prioritizes reductions in water consumption alongside emissions reductions, this report also provides data on water usage by City activities and operations in 2018.

Key Findings

Figure ES-1 provides a breakdown of City government operations emissions by sector in 2018. The largest contributor is the wastewater treatment sector, which comprises 35 percent of total emissions. The next largest contributor is the employee commute sector, comprising 22 percent of total emissions. Buildings and facilities, solid waste, the vehicle fleet, and water services are responsible for the remainder of City government operations emissions. The Inventory Results section of this report provides a detailed profile of emissions from San José's government operations in 2018 - key information for guiding future reduction efforts.

San José city government operations released 83,373 metric tons of CO_2 equivalent (MT CO_2e) in 2018 and sequestered 11,283 MT CO_2e, leading to net emissions of 72,090 MT CO_2e. In the most recent community-wide inventory, calculated for 2017, emissions totaled 5,711,665 MT CO_2e. This means that net emissions from City government operations made up approximately one percent of all emissions in San José in 2018.

2010 is the baseline year for measuring progress in reducing City government GHG emissions. Total City government emissions decreased by 10 percent from 2010 to 2018 (not including sequestration by City street trees, which was not estimated for 2010). Table ES-1 (page 9) shows emission reductions from 2010 to 2018 by sector.

A partial emissions inventory is also available for 2005. When considering only the sectors that were included in that inventory (buildings and facilities, solid waste, wastewater services, and water services), total City government emissions declined by 20 percent from 2005 to 2018. Figure ES-2 (page 9) provides a comparison of City government operations emissions in 2005, 2010, and 2018.

City operations and activities used 987 million gallons of water in 2018. 23 percent of the total water consumption was supplied by recycled water. 63 percent of total water consumption was used for irrigation. These data provide a baseline to track future progress in reducing City water use.

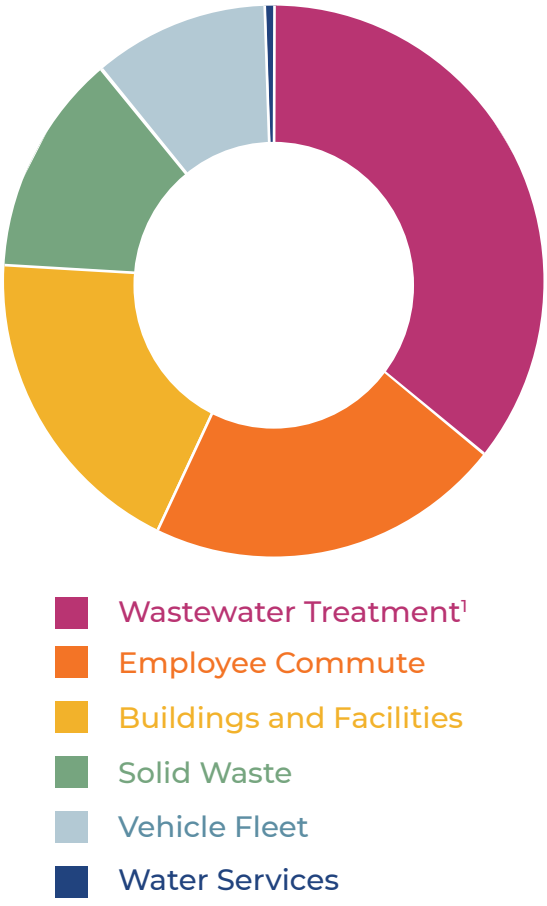


Figure ES-1 *2018 City of San José government operations emissions by sector*

[1] The City of San José provides wastewater treatment services to about three-quarters of Santa Clara County, including more than 1.4 million residents and 17,000 businesses in eight cities and four sanitation districts: Cities of San José, Santa Clara, Milpitas; Cupertino Sanitary District (Cupertino); West Valley Sanitation District (Campbell, Los Gatos, Monte Sereno, and Saratoga); County Sanitation Districts 2-3 (unincorporated); and Burbank Sanitary District (unincorporated).

Next Steps

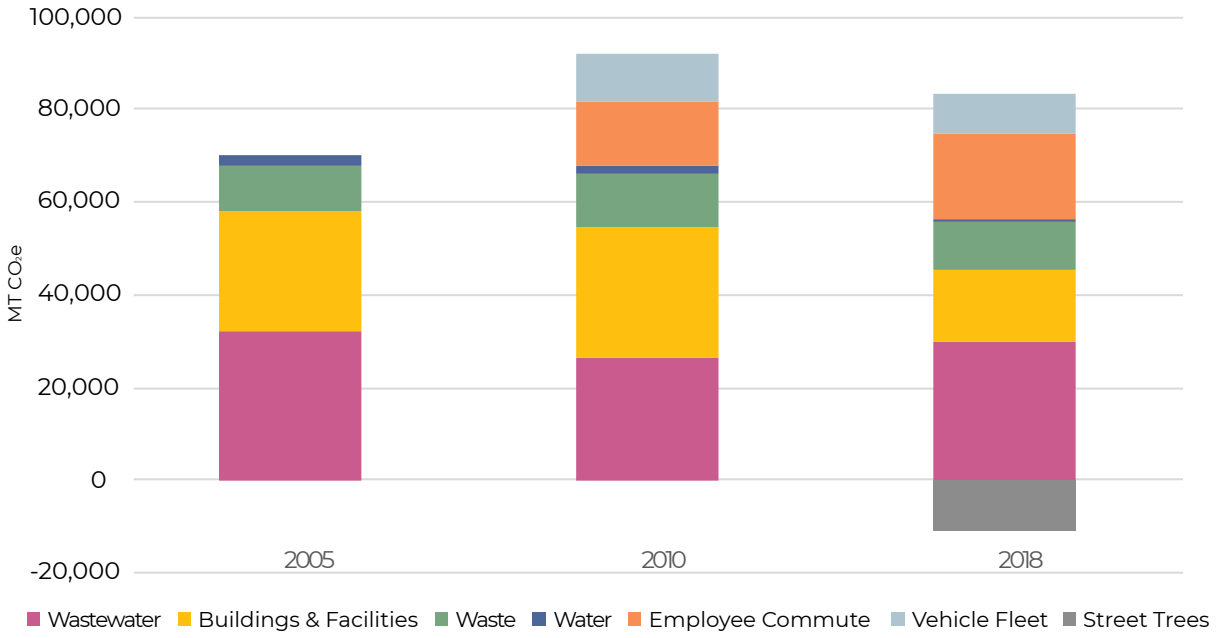
Because GHG emissions from City operations make up only a small portion of community-wide emissions, reducing City government emissions will have a limited direct impact on community-wide emissions. However, City action to reduce emissions from City operations can indirectly impact community-wide emissions by (1) setting an example, (2) supporting the local green economy, and (3) building City knowledge of emission-reducing strategies.

As a next step, the City will evaluate possible opportunities to reduce emissions from City operations. This will lay the foundation for emission-reduction strategies for City operations to be included in City priority-setting and potentially the next update of the Climate Smart plan.

Table ES-1 *2018 City of San José government operations emissions and change from baseline*

Emission sector/subsector	2018 emissions (MT CO_2e)	Percent change from 2010
Wastewater Treatment	29,601	+ 12%
Employee Commute	18,376	+ 35%
Buildings and Facilities	15,769	- 44%
Buildings & Facilities (excluding Airport)	*9,616*	*- 25%*
Airport Buildings & Facilities	*3,898*	*- 53%*
Public Lighting	*2,254*	*- 69%*
Solid Waste	10,359	- 9%
Vehicle Fleet	8,609	- 19%
Water Services	660	- 62%
Total emissions	**83,373**	**- 10%**
Street Trees	- 11,283	Newly reported
Net Emissions	**72,090**	**Not comparable**

Figure ES-2 *Comparison of 2005, 2010, and 2018 City government operations emissions*



Climate Change Background

Naturally occurring gases dispersed in the atmosphere determine the Earth's climate by trapping solar radiation. This phenomenon is known as the greenhouse effect. Overwhelming evidence shows that human activities are increasing the concentration of GHGs and thereby changing the global climate. The most significant contributor is the burning of fossil fuels for transportation, electricity generation and other purposes, which introduces large amounts of CO_2 and other GHGs into the atmosphere. Collectively, these gases intensify the natural greenhouse effect, causing global average surface and lower atmospheric temperatures to rise.

The City of San José is likely to be impacted by climate change: while historically San

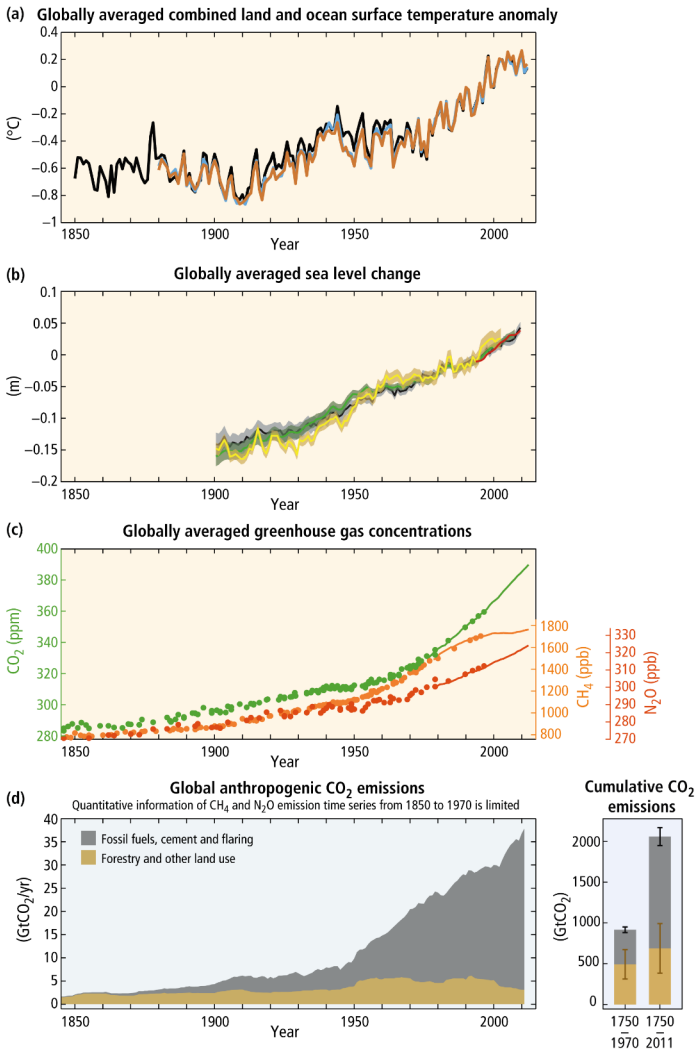


Figure 1 *Indicators of a changing global climate system*[2]

[2] IPCC, 2014: Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, R.K. Pachauri and L.A. Meyer (eds.)]. IPCC, Geneva, Switzerland, 151 pp.

José has experienced an average of two extreme heat days a year (temperature above 97 °F), that number is expected to increase to at least five days a year by 2050[3]. Like the rest of California, San José may also expect increased water shortages, wildfire risk, and the disruption of ecosystems, habitats, and agricultural activities as climate change intensifies.

Reducing fossil fuel use in the community can have many benefits in addition to reducing GHG emissions. More efficient use of energy decreases utility and transportation costs for residents and businesses. Retrofitting homes and businesses to be more efficient creates local jobs. In addition, money not spent on energy is likely to be spent at local businesses and added to the local economy. Using public transit, walking, or biking instead of driving reduces traffic; walking and biking also improve residents' health. Finally, reducing fossil fuel use improves both indoor and outdoor air quality, leading to better health for all - especially vulnerable groups like children, seniors, and people with lung or cardiovascular diseases, and disadvantaged communities, which face higher pollution burdens.

Evidence of Human-Caused Climate Change

There is overwhelming scientific consensus that the global climate is changing, and that human actions, primarily the burning of fossil fuels, are the main cause of those changes. The Intergovernmental Panel on Climate Change (IPCC) is the scientific body charged with bringing together the work of thousands of climate scientists. The IPCC's Fourth Assessment Report states that "warming of the climate system is unequivocal."[4] Furthermore, the report finds that "most of the observed increase in global average temperatures since the

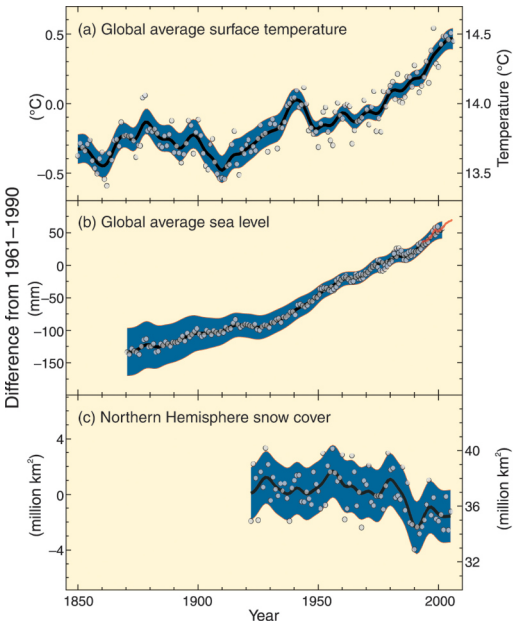


Figure 2 *Observed changes in temperature, sea level and snow cover*[5]

[3] Cal-Adapt. Data: LOCA Downscaled CMIP5 Projections (Scripps Institution of Oceanography), Gridded Observed Meteorological Data (University of Colorado, Boulder).
[4] IPCC, 2007: Climate Change 2007: Synthesis Report. Contribution of Working Groups I, II and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, Pachauri, R.K and Reisinger, A. (eds.)]. IPCC, Geneva, Switzerland, 104 pp.
[5] IPCC, 2007: Climate Change 2007: Synthesis Report.

mid-20th century is very likely due to the observed increase in anthropogenic GHG concentrations."

2012 was the hottest year on record for the continental United States, with two dozen cities breaking or tying their all-time high temperature records.[6] Globally, the past decade, 2009-2019, had the hottest years on record with 2016 being the warmest year and 2019 being the second warmest year ever.[7] The steady uptick in average temperatures is significant and expected to continue if action is not taken to greatly reduce GHG emissions.

ICLEI Climate Mitigation Program

In response to the problem of climate change, many communities in the United States are taking responsibility for addressing emissions at the local level. Since many of the major sources of GHG emissions are directly or indirectly controlled through local policies, local governments have a strong role to play in reducing GHG emissions within their boundaries. Through proactive measures around land use patterns, transportation demand management, energy efficiency, green building, waste diversion, and more, local governments can dramatically reduce emissions in their communities. In addition, local governments are primarily responsible for the provision of emergency services and the mitigation of natural disaster impacts.

Figure 3 *The ICLEI climate mitigation Milestones*

ICLEI provides a framework and methodology for local governments to identify and reduce GHG emissions, organized along Five Milestones:

[6] Burt, Chirstopher C. "2012 a Record Warm Year for Continental U.S"., January 2, 2013. http://www.wunderground.com/blog/weatherhistorian/comment.html?entrynum=112
[7] Fountain, Henry, and Nadja Popovich. "2019 Was the Second-Hottest Year Ever, Closing Out the Warmest Decade." The New York Times, The New York Times, 15 Jan. 2020, www.nytimes.com/interactive/2020/01/15/climate/hottest-year-2019.html.

1. Conduct an inventory and forecast of local GHG emissions;
2. Establish a GHG emissions reduction target;
3. Develop a climate action plan for achieving the emissions reduction target;
4. Implement the climate action plan; and,
5. Monitor and report on progress.

This report represents the completion of ICLEI's Climate Mitigation Milestone One for government operations and provides a foundation for future work to reduce GHG emissions from government operations in San José. The next step in this framework is to set a GHG reduction target for San José city government operations. This would help the City to prioritize GHG reduction actions, measure progress, and improve its ranking in external evaluations such as the American Council for an Energy-Efficient Economy's City Clean Energy Scorecard.

Inventory Methodology

Understanding a Greenhouse Gas Emissions Inventory

The first step toward achieving tangible GHG emission reductions is to measure current emissions levels and identify sources and activities generating emissions in the community. This report presents emissions from operations of the San José city government, which are a subset of community emissions, as shown in Figure 4. For example, data on commercial energy use in the community includes energy consumed by City government buildings, and community vehicle miles traveled estimates include miles driven by City fleet vehicles. San José is focusing on city government operations emissions in order to lead by example.

Local Government Operations Protocol

As local governments have continued to join the climate protection movement, a standardized approach to quantifying GHG emissions has proven essential. In 2008, ICLEI, the California Air Resources Board, and the California Climate Action Registry released the Local Government Operations Protocol (LGO Protocol).[8]

Figure 4 *Relationship of community and local government operations inventories*

[8] Local Government Operations Protocol. http://www.icleiusa.org/programs/climate/ghg-protocol/ghg-protocol

The LGO Protocol serves as the national standard for quantifying and reporting greenhouse emissions from local government operations. The purpose of the LGO Protocol is to provide the principles, approach, methodology, and procedures needed to develop a local government operations GHG emissions inventory. This inventory uses the approach and methods of LGO Protocol version 1.1.

Boundary

The LGO Protocol requires local governments to report all GHG emissions from operations over which they have control. It provides two approaches for determining whether emission sources fall within or outside a local government's organizational boundary: the operational control approach, and the financial control approach. Under the operational control approach, a local government should report emissions from all operations where it has full authority to introduce and implement operating policies. Under the financial control approach, a local government should report emissions from all operations that are fully consolidated in financial accounts.

The intention of this inventory is to use the operational control approach. For most City operations, this is straightforward, but in the case of City-owned buildings that are managed by other organizations and City-owned buildings at the Norman Y. Mineta San José International Airport ("Airport") that are occupied by tenants, it is not.

Many important San José buildings, such as the McEnery Convention Center, SAP Center, and Children's Discovery Museum, are owned by the City but managed by other organizations with City oversight. At the Airport, City and tenant operations are intertwined, with many buildings used by both City and tenant operations. In both cases, the City has some power to influence GHG emissions from these buildings. Further complicating matters, a comprehensive list of city buildings by tenant or management status was not available when this inventory was prepared, and utility data was not available for all City-owned buildings.

With the aim of maximizing transparency, given current data availability, this inventory includes electricity and natural gas usage for all buildings for which the City pays the utility bills. Table 1 lists City-owned buildings with uncertain status, noting whether they are or are not included in this inventory. Those that are included in this inventory make up four percent of total 2018

Table 1 *Buildings owned but not operated by the City, and their status in this inventory*

Included in this inventory	Not included in this inventory
• San José McEnery Convention Center • San José Museum of Art • Center for Performing Arts • History Park • Peralta Adobe – Fallon House Historic Site • Airport: Terminals A and B, Consolidated Rental Auto Center, Federal Inspection Services building, Southwest Airlines Provisioning and GSE Maintenance Hangar, Multiple Tenant Hangars, West Hangar, East Hangar, General Aviation Hangar #9, Air Freight (all occupied by tenants or by both City operations and tenants) • Reuse facilities (community and youth centers that can be used by nonprofits, associations, school districts, and providers at no cost)	• California Theatre • Children's Discovery Museum • City National Civic Auditorium • Hammer Theatre Center • Mexican Heritage Plaza • Montgomery Theater • The Tech Interactive • SAP Center • Excite Ballpark • Solar4America Ice at San José • South Hall • Parkside Hall

emissions reported. Future city government operations inventories for San José will hopefully be able to address this issue in more detail.

Emission Scopes

Emissions in local government operations inventories, as in community-wide inventories, are categorized by scope. The scope framework allows emissions from multiple jurisdictions or locations to be added up without double counting. There are three emissions scopes. In the context of a local government inventory, they encompass:

Scope 1: All direct emissions from a facility or piece of equipment operated by the local government. Examples include tailpipe emissions from local government fleet vehicles, and emissions from a furnace in a local government building.

Scope 2: Indirect emissions associated with the consumption of purchased or acquired electricity, steam, heating, or cooling.

Scope 3: All other indirect or embodied emissions not covered in Scope 2. Examples include emissions from contracted services, embodied emissions in goods purchased by the local government, emissions from employee commutes, and emissions associated with disposal of government-generated waste.

Scope 1 and Scope 2 emissions are the most essential components of a government operations GHG analysis, as they are the most easily affected by local policy making. This inventory includes all Scope 1 and Scope 2 emissions generated by City government operations, and some Scope 3 emissions.

Base Year

The inventory process requires the selection of a base year with which to compare current emissions to measure progress over time. Previous City government operations emissions inventories were completed for 2005 and 2010. This 2018 inventory utilizes 2010 as its base year, as this is the year with the most complete data available for comparison. However, to provide as much context as possible, this report also includes a comparison with 2005 City government emissions. Table 2 lists data gaps in the 2005 and 2010 inventories as compared to the 2018 inventory.

Table 2 *Data gaps in the 2005 and 2010 San José city government GHG inventories as compared to the 2018 city government GHG inventory*

Sector	2005	2010
Buildings and Facilities	No data on fuel use in generators, energy use in the San José McEnery Convention Center, or electricity use in one Airport account served by Silicon Valley Power	No data on energy use in the San José McEnery Convention Center or the Center for the Performing Arts, or electricity use in one Airport account served by Silicon Valley Power
Vehicle Fleet	No data	No data on fuel use by CNG shuttle buses at the Airport
Water Services	No data on fuel use in water pump backup generators	
Wastewater Treatment		
Solid Waste	No data on grit, grease, and screenings sent to landfill from the San José-Santa Clara Regional Wastewater Facility (Wastewater Facility)[9]	
Employee Commute	No data	
Street Trees	No data	No data

[9] The legal, official name of the facility remains San Jose/Santa Clara Water Pollution Control Plant, but beginning in early 2013, the facility was approved to use a new common name, the San José-Santa Clara Regional Wastewater Facility.

The 2005 City government operations inventory was completed by DNV-KEMA with data provided through Joint Venture Silicon Valley. The 2010 City government operations inventory was completed by DNV-KEMA and later updated by AECOM. In the process of compiling the 2018 City government operations inventory, the 2005 and 2010 inventories were updated to match the 2018 inventory methodology. The updated data, with notes on what was changed from the original inventories, are provided in Appendix Tables A-1 and A-2.

Quantification Methods

Greenhouse gas emissions can be quantified in two ways:

Measurement-based methodologies refer to the direct measurement of greenhouse gas emissions (using a monitoring system), for instance from a flue of a power plant, wastewater treatment plant, landfill, or industrial facility.[10]

Calculation-based methodologies calculate emissions using activity data and emission factors. The basic equation used to calculate emissions is:

Activity Data x Emission Factor = Emissions

Most emissions sources in this inventory are quantified using calculation-based methodologies. Activity data refers to the measurement of GHG-generating processes, such as fuel consumption by fuel type, metered electricity consumption, and vehicle miles traveled. See the Appendix for a detailed listing of the activity data used in composing this inventory.

Emission factors, often national averages, are used to convert energy usage or other activity data into associated quantities of emissions. Emission factors are expressed in terms of emissions per unit of activity data (for example, kilograms of CO_2 per megawatt hour of electricity).

To prepare this inventory, emissions of carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O) were calculated. CH_4 and N_2O emissions were converted into CO_2e using global warming potential (GWP) values from the IPCC's Fifth Assessment Report.[11] CO_2e values represent the amount of CO_2 that would lead to the same amount of warming as a given amount of CH_4 or other GHG, and are used to make GHG emissions easier to summarize and compare.

[10] San José's local government operations inventory includes emissions data provided by the Wastewater Facility that were gathered through direct measurement.
[11] IPCC, 2014: Climate Change 2014: Synthesis Report.

Calculations for this inventory were made using the ICLEI ClearPath tool. Totals presented in this report differ in some cases from summed up subsectors due to rounding.

Inventory Sectors Not Included

Due to a lack of available data, fugitive emissions from refrigerants and other GHGs leaking out of vehicles and equipment were not included. The City is investigating the possibility of developing an inventory of refrigerants in City vehicles and equipment.

Fugitive emissions from natural gas transmission and distribution (for instance, pipeline leaks) are not accounted for in this inventory because, according to LGO Protocol guidance, this is required only for local governments that own or operate natural gas transmission or distribution systems.

Data Quality and Uncertainties

The accuracy of a GHG inventory depends on the accuracy of the activity data and emission factors upon which it is based. Data errors, incomplete or missing data, inaccurate estimates, and inaccurate emission factors can all limit inventory accuracy. In this 2018 inventory, possible sources of error include:

- **Billing data used to calculate electricity and natural gas usage in City buildings and facilities.** The City oversees a large and complex set of facilities, including the Airport, the Wastewater Facility, pumping stations and reservoirs for the San José Municipal Water System and South Bay Water Recycling, the Animal Care Center, 206 neighborhood and regional parks, 35 fire stations, 25 libraries, 50 community centers, seven policing centers and police stations, 65,100 streetlights, 14 parking lots and garages, 20 sewer pump stations, and more. These facilities are covered by more than 2,000 electricity and natural gas billing accounts. Despite data cleaning, the billing data used here may be missing some City accounts, may include errors in usage, and may include errors in the assignment of accounts to inventory sectors.

- **Estimates of City solid waste totals.** The ESD Integrated Waste Management Division has precise data on the amount of waste sent to

landfill from most city facilities, but not all - the solid waste from 17 small libraries and fire stations that have residential waste service is not tracked or measured. Their waste was instead estimated by assuming that they each have one full bin each week. In addition, though we expect that very little City waste sent to landfill is organic and could generate emissions, we lack a detailed characterization of its composition, and so used a default national emission factor for this calculation. Also, the last detailed characterization of City waste was conducted in 2014, and the composition of City waste may have changed since then. Finally, only some of the amount of green waste generated by City operations is directly measured. The rest was estimated as a percentage of citywide residential green waste. All of these estimates introduce errors of unknown magnitude.

- **Estimate of emissions from biosolids sent to landfill.** Biosolids, the waste product of the wastewater treatment process, are currently sent to landfill, where they are used as alternative daily cover. Before going to landfill, they are stored in lagoons for two and a half to three years and then in drying beds for about six months. For this inventory, following guidance from ICLEI, it was assumed that they generate as much emissions in landfill as leaves. This assumption was made because, of all waste categories with existing emission factors, leaves are the category expected to behave most similarly to biosolids in landfill. However, their true emissions generation rate is unknown.

- **Estimate of emissions from nitrification and denitrification during wastewater treatment.** In the absence of detailed data, the amount of nitrogen from industrial and commercial wastewater was assumed to be one quarter of the amount of nitrogen from sewage (a default value). Actual data on industrial and commercial wastewater would likely yield a different value.

- **Estimate of emissions from employee commutes.** Employee commute emissions were estimated using data from a 2015 employee survey. This survey was not designed to support estimating commute emissions, and did not ask employees about the distance of their commute, the kind of car they drive, or what kind of public transit they use. In addition, it was answered by only 625 employees, about one-tenth of the total City workforce at the time, and commute patterns may have changed between 2015 and 2018. Multiple assumptions were made in order to estimate emissions, each of which likely introduced error to the calculation.

- **Estimate of sequestration by City street trees.** This inventory includes an estimate of negative emissions (sequestration) from City street trees. This was based on detailed data on each City street tree, but resources do not exist to survey each tree every year and data on individual trees may be up to 10 years old. In addition, no data were available on sequestration or emissions from other vegetation in City parks and street landscaping, making this estimate incomplete.

- **Emission factors.** Many of the emission factors used in this inventory are default or average emission factors that may not exactly capture local conditions. For example, the CH_4 and N_2O emission factors for electricity generation in this inventory are average values based on data for all power plants in California. In addition, the magnitude of GHG emissions often depends on factors that are not captured in emission factors. For example, GHG emissions from gasoline-burning cars depend on vehicle speed and type, but the emission factors used in this inventory are based only on total fuel use. For both of these reasons, most of the emission calculations in this inventory should be seen as estimates, which would likely differ from direct measurements of emissions.

This inventory was completed as accurately as currently possible. Our hope is for each future City government inventory to be more accurate than the last, thanks to improvements over time in City data capabilities and inventory methodologies.

San José 2018 City Government Operations Inventory Results

Emissions by Scope

As described in the Inventory Methodology section, scopes are used to categorize emissions to avoid double counting within and between entities. Table 3 lists San José government operations emissions for 2018 by scope. CO_2 sequestration by City street trees (estimated at 11,283 MT CO_2e), although reported in this inventory, is not accounted for in Table 3.

Table 3 *2018 City of San José government operations emissions by scope*

Scope	2018 emissions (MT CO_2e)	Percent of total	Emission sources included
Scope 1	42,599	51%	• Combustion of natural gas in buildings and facilities, including Airport • Combustion of natural gas, fuel oil, and biogas for wastewater treatment • Process emissions from wastewater treatment • Combustion of fuel in City vehicles, generators, and other equipment • Flaring of landfill gas at Singleton landfill
Scope 2	12,072	14%	• Electricity used in buildings and facilities, including Airport (includes electric vehicle charging) • Electricity used for wastewater treatment • Electricity used for public lighting • Electricity used for water services
Scope 3	28,702	34%	• Employee commutes • Waste sent to landfill • Composted waste
Total	**83,373**	**100%**	

Emissions by Sector

In developing emissions reduction policies, it is useful to look at emissions by sector, as each sector will require a different set of strategies. Figure 5 shows a breakdown of San José's 2018 city government operations emissions by sector. Figure 6 and Table 4 show San José's 2018 emissions broken down by sector and subsector. The remainder of this section discusses emissions from each sector in detail.

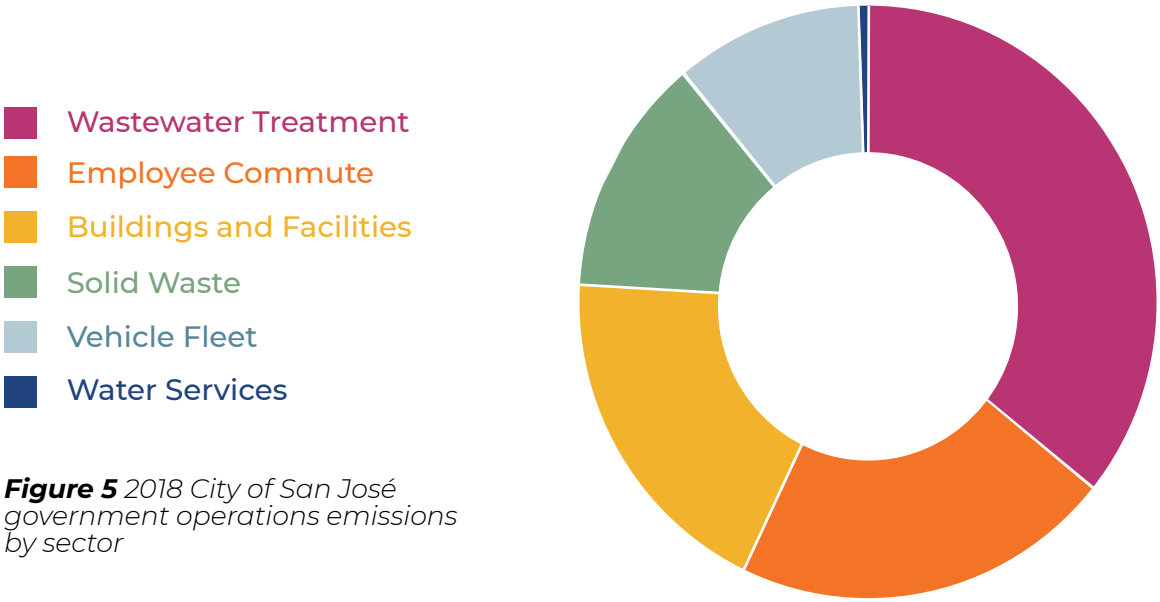


Figure 5 *2018 City of San José government operations emissions by sector*

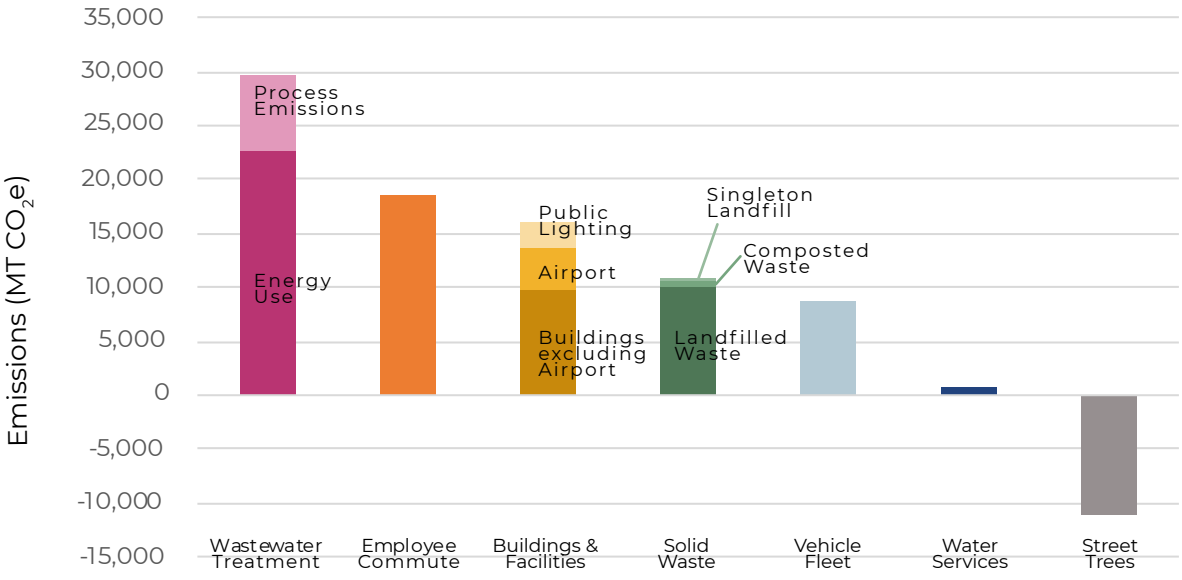


Figure 6 *2018 City of San José government operations emissions in detail*

Table 4 *2018 City of San José government operations emissions by sector and subsector*

Emission sector/subsector	Scope	2018 emissions (MT CO_2e)	Percent of total
Wastewater Treatment	1 & 2	29,601	41.1%
Energy Use	*1 & 2*	*22,538*	*31.3%*
Process Emissions	*1*	*7,063*	*9.8%*
Employee Commute	3	18,376	25.5%
Buildings and Facilities	1 & 2	15,769	21.9%
Buildings & Facilities (excluding Airport)	*1 & 2*	*9,616*	*13.3%*
Airport Buildings & Facilities	*1 & 2*	*3,898*	*5.4%*
Public Lighting	*2*	*2,254*	*3.1%*
Solid Waste	3	10,359	14.4%
Waste Sent to Landfill	*3*	*9,909*	*13.7%*
Composted Waste	*3*	*418*	*0.6%*
Combustion – Singleton Landfill	*3*	*33*	*0.1%*
Vehicle Fleet	1	8,609	11.9%
Water Services	1 & 2	660	0.9%
Street Trees	N/A	-11,283	-15.6%
Total		**72,090**	**100.0%**

Wastewater Treatment

Wastewater treatment was the largest source of San José's government operations emissions in 2018. Wastewater collection and treatment is an essential public service provided by the Wastewater Facility to about three-quarters of Santa Clara County, including more than 1.4 million residents and 17,000 businesses in eight cities and four sanitation districts. Although the cities of San José and Santa Clara co-own the Wastewater Facility, San José has full operational control of the facility and thus assumes responsibility for and reports all emissions from Wastewater Facility operations.

Wastewater treatment uses a significant amount of energy. The emissions from this energy consumption made up 76 percent of the emissions from this sector and 31 percent of total City government emissions in 2018. Table 5 shows 2018 wastewater treatment energy use emissions by fuel type.

Table 5 *2018 City of San José wastewater treatment emissions by subsector*

Subsector	Emissions (MT CO_2e)	Percent of total wastewater treatment emissions
Energy Use	22,538	76.1%
Natural gas	*19,647*	*66.4%*
Electricity	*2,647*	*8.9%*
Distillate fuel oil No. 2	*161*	*0.5%*
Digester gas	*83*	*0.3%*
Process Emissions	7,063	23.9%
Treated effluent discharge	*3,817*	*12.9%*
Nitrification/denitrification	*3,246*	*11.0%*
Total	**29,601**	**100%**

In addition, as wastewater is collected, treated, and discharged, chemical and biological processes in aerobic and anaerobic conditions lead to the creation and emission of N_2O. Table 5 shows wastewater process emissions broken down by process within the treatment plant.

The emissions from digester gas combustion were low because it is a biogas, and the CO_2 produced when biogases are burned is classified as biogenic and excluded from GHG inventories. Only the CH_4 and N_2O produced when biogases are burned are included. This is because burning biofuels, which are made from plants or animals, releases carbon that was recently pulled from the atmosphere by plants. Burning fossil fuels, on the other hand, adds ancient carbon to the atmosphere. The combustion of digester gas at the Wastewater Facility released 16,872 MT of biogenic CO_2 in 2018.

Employee Commute

City employee commute emissions were the second largest source of City government operations emissions in 2018. These emissions are not under direct operational control of San José, but the City has a variety of tools available to influence them. Emissions presented here are a rough estimate based on a 2015 Employee Commute Survey from the City DOT and 2018 data on number of employees. Full details on the assumptions used to calculate this estimate are given in Appendix Table A-3. A breakdown of employee commute modes from the 2015 survey is given in Figure 7 and a breakdown of estimated employee commute emissions by travel mode is given in Table 6.

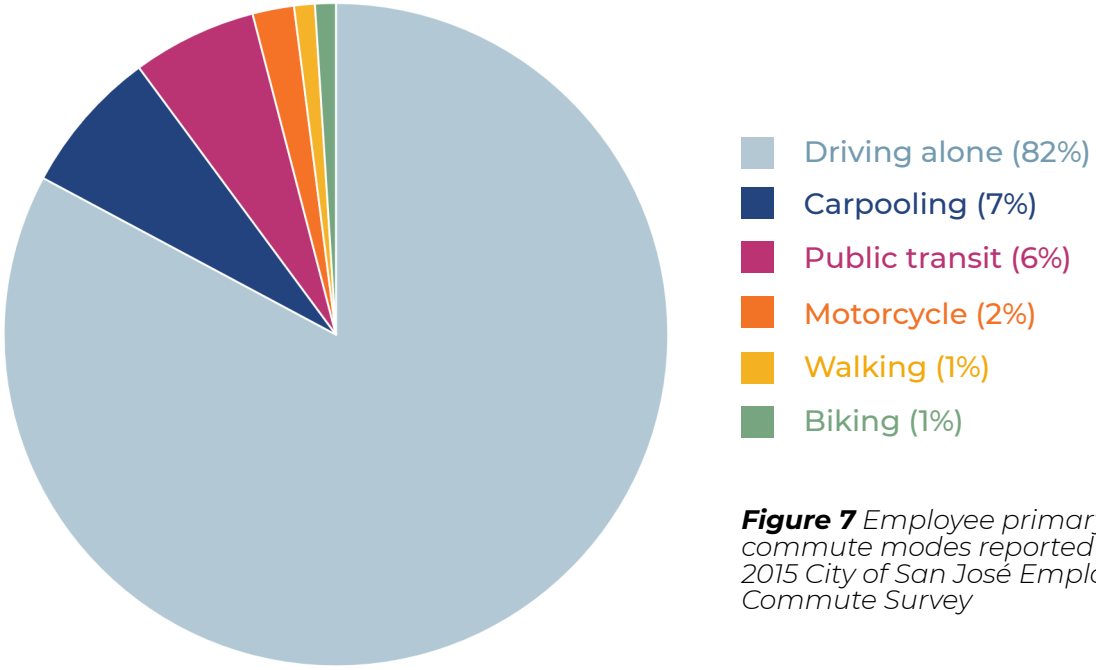


Figure 7 *Employee primary commute modes reported in the 2015 City of San José Employee Commute Survey*

Table 6 *2018 City of San José employee commute emissions by commute mode*

Commute mode	Passenger miles	Emissions (MT CO_2e)	Percent of total commute emissions	Emissions per employee (MT CO_2e)
Driving alone	47,768,413	17,463	95%	2.7
Carpooling	1,638,046	599	3.3%	1.3
Light rail	1,638,046	219	1.2%	1.0
Bus	1,638,046	95	0.5%	0.4
Total	**52,682,550**	**18,376**	**100%**	**-**

San José can influence employee commute emissions by promoting alternative commute modes such as public transit, walking, bicycling, and carpooling, and by promoting options such as compressed workweeks and telecommuting that reduce the number of commute trips employees must make.

Buildings and Facilities

The buildings and facilities sector was the third largest source of San José's government operations emissions in 2018. Table 7 shows buildings and facilities emissions by fuel type. Electricity was the largest source of buildings and facilities emissions, followed by natural gas.

Table 7 *2018 City of San José government buildings and facilities emissions by fuel type*

Fuel type	Use	Emissions (MT CO_2e)	Percent of total buildings and facilities emissions
Electricity	City buildings and facilities, public lighting	8,765	55.6%
Natural gas	City buildings and facilities	7,004	44.4%
Gasoline	Generators	0.3	0.002%
Renewable diesel	Generators	0.04	0.0002%
Total		**15,769**	**100%**

The buildings and facilities sector is divided into three subsectors:

- **City-owned buildings & facilities** (excluding those at the Airport, but including those at the Wastewater Facility)
- **City-owned buildings and facilities at the Airport**
- **Public lighting** (streetlights, traffic signals, park lights, and tree and streetscape lighting)

Table 8 provides a full breakdown of emissions by subsector.

Table 8 *2018 City of San José government buildings and facilities emissions by subsector*

Subsector	Emissions (MT CO_2e)	Percent of total buildings and facilities emissions
Buildings & Facilities (excluding Airport)	9,616	61%
Electricity	*3,861*	*24%*
Natural gas	*5,755*	*37%*
Generators	*0.3*	*0.002%*
Airport Buildings & Facilities	3,898	25%
Electricity	*2,649*	*17%*
Natural gas	*1,249*	*8%*
Generators	*0.01*	*0.0001%*
Public Lighting	2,254	14%
Total	**15,769**	**100%**

Electricity usage in City-owned buildings and facilities (including at the Airport) includes electricity used to charge City-owned electric vehicles (EVs) and equipment. Emissions from all other City vehicles are included in the vehicle fleet sector.

Airport energy use includes tenant energy use in City-owned buildings because it is difficult to separate from City operations energy use (see Inventory Methodology - Boundary section). Airport natural gas use does not include natural gas supplied to the compressed natural gas (CNG) filling station at the Airport, as this station is open to the public. CNG used in Airport shuttle buses is included in the vehicle fleet sector.

All City stationary and mobile generators are included in this sector, with the exception of backup generators for water pumps, which are included in the water services sector. Emissions from generators were low because they used little fuel, most of this was renewable diesel, a biofuel, and the CO_2 produced when biofuels are burned is classified as biogenic and excluded from GHG inventories. Only the CH_4 and N_2O produced when biofuels are burned are included. The combustion of renewable diesel by City generators released 46 MT of biogenic CO_2 in 2018.

Solid Waste

Many city government operations generate solid waste. The most prominent source of GHG emissions from solid waste is fugitive CH_4 released by the decomposition of organic waste over time in the anaerobic conditions of a landfill. The scale of these emissions depends upon the size and type of the landfill and the presence or absence of a landfill gas collection system. City waste that is not composted or recycled is sent to Newby Island landfill, which has a system for collecting and flaring landfill gas. Other emissions included in this sector are from combustion of landfill gas at the closed Singleton landfill, which is owned by the City, and from CH_4 and N_2O generated by composting green waste (for example, tree trimmings) and biowaste (organic debris sorted from City waste). Table 9 shows solid waste emissions by subsector and source. Waste and emissions totals given here include waste generated at the Airport.

Table 9 *2018 City of San José government solid waste emissions and quantity by subsector*

Subsector	Quantity (short tons)	Emissions (MT CO_2e)	Percent of total waste emissions
Waste sent to landfill	48,871	9,909	95.6%
Biosolids from Wastewater Facility	*45,315*	*8,565*	*82.7%*
Other City waste	*2,122*	*802*	*7.7%*
Grit, grease, and screenings from Wastewater Facility	*1,434*	*542*	*5.2%*
Composted waste	7,704	418	4.0%
Green waste	*3,500*	*244*	*2.3%*
Biowaste	*4,204*	*174*	*1.7%*
Combustion – Singleton landfill	N/A	33	0.3%
Total	**56,575**	**10,359**	**100%**

Vehicle Fleet

In 2018, San José operated a fleet of 2,300 vehicles and mobile equipment units (1,984 on-road and 316 off-road) to perform services such as firefighting, policing, and street maintenance. Table 10 shows vehicle emissions by fuel type.

Emissions from electric vehicle charging were counted in the buildings and facilities sector, as City EV chargers are connected to City parking garage or building electric meters. The data currently available do not allow the

Table 10 *2018 City of San José government vehicle fleet emissions and fuel use by fuel type*

Fuel type	Fuel consumption (gallons or gallons gas equivalent)	Emissions (MT CO_2e)	Percent of total vehicle fleet emissions
Gasoline	849,157	7,521	87.4%
CNG (Airport shuttle buses)	154,522	1,081	12.6%
Renewable diesel	297,886	3	0.04%
Liquefied petroleum gas (LPG)	543	3	0.04%
Total	**1,302,107**	**8,609**	**100%**

separation of electricity used for vehicle charging from electricity used elsewhere in buildings with EV chargers, so it is not currently possible to calculate the amount of electricity used for City EV charging. Mobile generators were also counted in the buildings and facilities sector.

Fuel use and emissions for City-owned Airport vehicles are included in this sector. Emissions from non-City owned vehicles used at the Airport (for instance, airline-owned ground support equipment) are not included in this inventory.

In 2018, the diesel vehicles in the City fleet used 100% renewable diesel, and no "regular" (fossil fuel) diesel. Emissions from renewable diesel appear low because the CO_2 produced when biofuels are burned is classified as biogenic, and excluded from GHG inventories. Only the CH_4 and N_2O produced when biofuels are burned are included. The combustion of renewable diesel by the City vehicle fleet released 2,815 MT of biogenic CO_2 in 2018.

Water Services

The City of San José provides multiple water services: potable water treatment and supply, stormwater and sewer pumping, and irrigation of public parks and landscaping. Table 11 shows emissions from electricity and fuel combustion used to provide these services.

City water pumps run on electricity but also have backup diesel generators. In 2018, these generators used renewable biodiesel, a biofuel. The CO_2 produced when biofuels are burned is classified as biogenic and excluded from GHG inventories. Only the CH_4 and N_2O produced when biofuels are burned are included. The combustion of renewable diesel by City water pumps released one MT of biogenic CO_2 in 2018.

Table 11 *2018 City of San José government water services emissions by fuel type*

Fuel type	Emissions (MT CO_2e)	Percent of total water services emissions
Electricity	660	99.9999%
Renewable diesel	0.0009	0.0001%
Total	**660**	**100%**

Street Trees

Land use can result in GHG emissions, but it can also lead to removal of CO_2 from the atmosphere. In the United States, land use is a net carbon sink, with removal of CO_2, mostly into forests and trees, exceeding emissions. The net effect of land use is calculated by estimating the change in carbon stocks - the stores of carbon in biomass, litter, dead wood, and soils.

Data were not available for a full accounting of GHG emissions and sequestration from City-owned land use in San José, but data on City street trees were available. The City of San José maintains approximately 248,000 street trees throughout the community. These trees pull and sequester CO_2 from the atmosphere as they grow, resulting in negative emissions in a GHG inventory. Table 12 shows an estimate of the negative emissions from San José city street trees in 2018. Note that this estimate accounts for CO_2 released when street trees are cut down, chipped, and allowed to decompose, which reduces net sequestration.

Table 12 *2018 City of San José government emissions sequestration by street trees*

Subsector	Emissions (MT CO_2e)
Sequestration by City street trees	-12,683.7
Emissions from removed City street trees	1,400.3
Total	**- 11,283.4**

City Government Water Use

The Climate Smart San José plan aims to reduce water use as well as energy use and GHG emissions. In line with this, this inventory provides data on water use from City government operations, to provide a baseline for tracking future improvements.

Data on City government water use (including water use at the Airport) were compiled by the City PWD from City water bills provided by the San José Municipal Water System, Great Oaks Water Company, and San Jose Water Company. City government water use in 2018 is presented in Table 13 and Figure 8, broken down by type (potable or recycled) and use (irrigation or

other). All water accounts with “irrigation” or “landscaping” account types were counted in the “Irrigation” categories; one City recycled water account with an “agriculture” account type was not counted as irrigation.

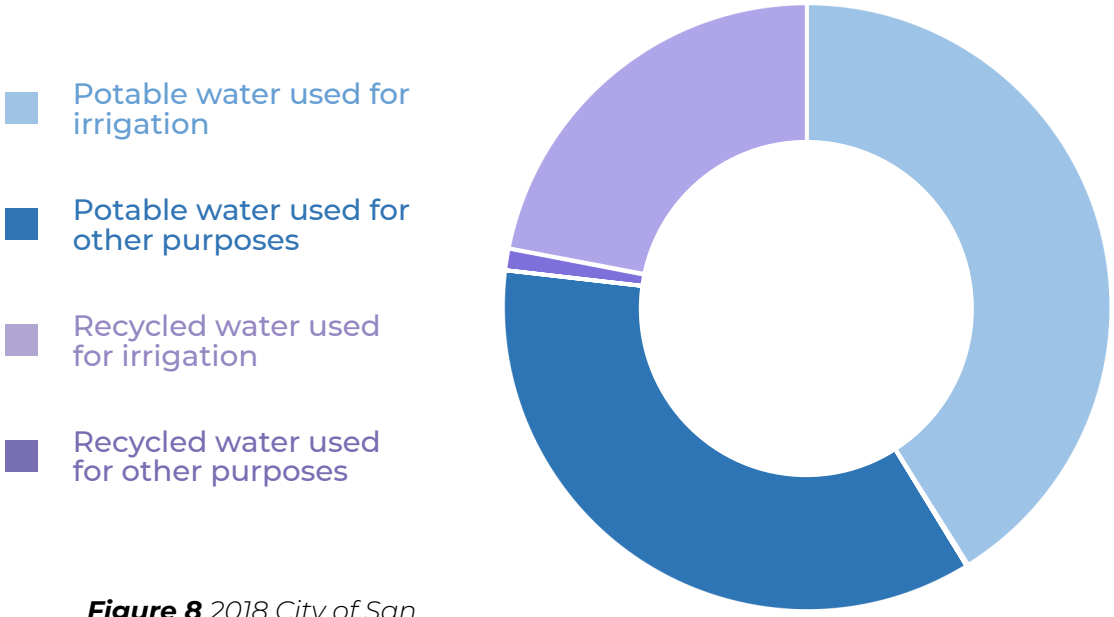


Figure 8 *2018 City of San José government water use*

Table 13 *2018 City of San José government water use*

Type	Use	Million gallons	Percent of total
Potable	Irrigation	405.3	41%
Potable	Non-irrigation	354.5	36%
Recycled	Irrigation	216.6	22%
Recycled	Non-irrigation	10.5	1%
Total		**987.0**	**100%**

Conclusion

This 2018 inventory was completed in order to measure City progress in reducing GHG emissions from government operations, using the earlier 2005 and 2010 City government operations emissions inventories as reference points. Overall emissions in 2018 were higher than in 2005 and lower than in 2010, but this is because the 2005 inventory did not account for vehicle fleet or employee commute emissions. When considering only the sectors that were included in the 2005 inventory (buildings and facilities, solid waste, wastewater services, and water services), total City government emissions declined by 20 percent from 2005 to 2018. When considering all sectors except sequestration by City street trees (which was not estimated for 2010), total City government emissions decreased by 10 percent from 2010 to 2018. Table 14 and Figure 9 provide a full breakdown of emissions in all three years.

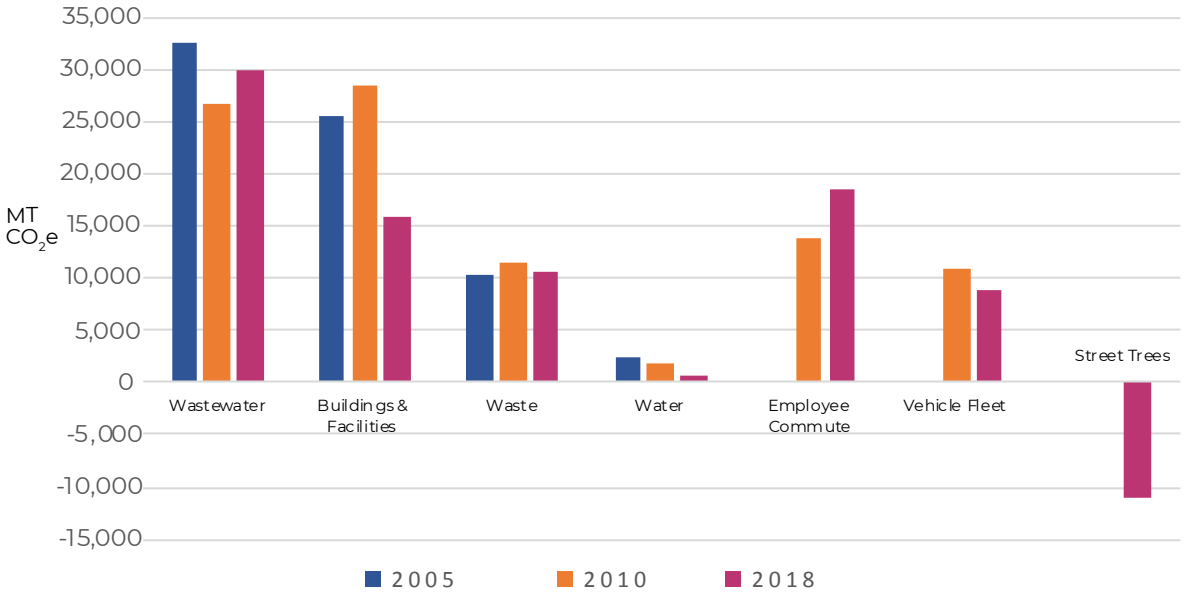
Table 14 *Comparison of 2005, 2010, and 2018 City government operations emissions* *(continued on next page)*

Emission sector/subsector	2005 emissions (MT CO_2e)	2010 emissions (MT CO_2e)	2018 emissions (MT CO_2e)
Wastewater Treatment	**32,384**	**26,488**	**29,601**
Energy Use	26,146	20,060	22,538
Natural gas	*24,130*	*14,926*	*19,647*
Electricity	*1,613*	*4,794*	*2,647*
Fuel Oil	*261*	*315*	*161*
Biogas (digester and landfill gas)	*142*	*26*	*83*
Process Emissions	6,238	6,427	7,063
Treated effluent discharge	*3,224*	*3,262*	*3,817*
Nitrification/denitrification	*3,014*	*3,165*	*3,246*
Employee Commute	**No data**	**13,586**	**18,376**

Table 14 *continued*

Emission sector/subsector	2005 Emissions (MT CO_2e)	2010 Emissions (MT CO_2e)	2018 Emissions (MT CO_2e)
Buildings and Facilities	**25,458**	**28,284**	**15,769**
Buildings & Facilities (excluding Airport)	12,990	12,779	9,616
Electricity	*9,192*	*8,432*	*3,861*
Natural gas	*3,798*	*4,260*	*5,755*
Generators	*No data*	*87*	*0.3*
Airport Buildings & Facilities	4,811	8,265	3,898
Electricity	*3,908*	*6,657*	*2,649*
Natural gas	*904*	*1,587*	*1,249*
Generators	*No data*	*21*	*0.01*
Public Lighting	7,657	7,240	2,254
Solid Waste	**10,200**	**11,366**	**10,359**
Waste Sent to Landfill	9,593	10,914	9,909
Biosolids from Wastewater Facility	*6,863*	*9,702*	*8,565*
Grit, grease, and screenings from Wastewater Facility	*No data*	*693*	*542*
Other City waste	*2,730*	*519*	*802*
Composted Waste	338	383	418
Green waste	*338*	*261*	*244*
Biowaste	*0*	*122*	*174*
Combustion – Singleton Landfill	269	69	33
Vehicle Fleet	**No data**	**10,672**	**8,609**
Airport CNG Shuttle Buses	No data	No data	1,081
Other City Vehicles and Equipment	No data	10,672	7,528
Water Services	**2,279**	**1,752**	**660**
Street Trees	**No data**	**No data**	**-11,283**
Total	**70,321**	**92,146**	**72,090**
Total - excluding Vehicle Fleet, Employee Commute, and Street Trees	**70,321**	**67,889**	**56,388**

Figure 9 *Comparison of 2005, 2010, and 2018 City government operations emissions by sector*

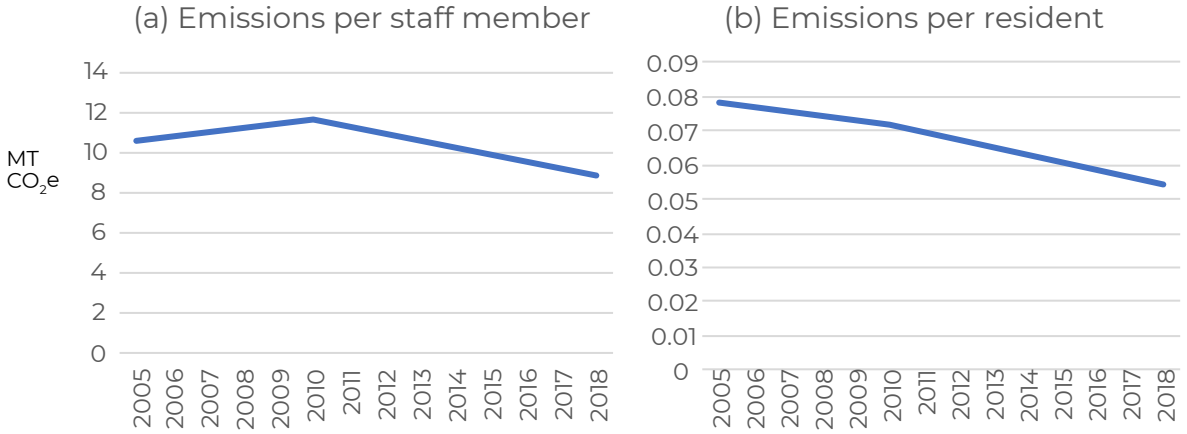


In addition, GHG emissions per City staff member and per San José resident have decreased since 2005 and 2010 (See Table 15 and Figure 10).

Table 15 *Number of City staff and total San José population in 2005, 2010, and 2018*

	2005	2010	2018
Number of City staff (full-time equivalent (FTE) from adopted City operating budgets)	6,671.8	5,839.7	6,412.6
Total San José population (From California Department of Finance Demographics Unit)	901,159	946,954	1,042,900

Figure 10 *GHG emissions per (a) City staff member and (b) San José resident from 2005 to 2018*



Emissions from the water services sector decreased both from 2005 to 2010 and from 2010 to 2018. This is a result of (1) the City being supplied with cleaner electricity by both PG&E and San José Clean Energy (SJCE; more details below in discussion of buildings and facilities emissions), (2) improvements in water pumping efficiency and (3) decreased water usage citywide as a result of drought, economic downturns, and water conservation efforts.

Emissions from the City vehicle fleet decreased by 19 percent from 2010 to 2018, even though the 2018 inventory accounts for the Airport's CNG shuttle bus fleet and the 2010 inventory does not. This is mainly the result of the increased number of electric vehicles in the City fleet, and the accompanying decrease in gasoline usage. It should be noted, however, that vehicle fleet emissions were significantly reduced in both 2010 and 2018 by the use of biodiesel/renewable diesel, which is a very low-emissions fuel.

Emissions from the buildings and facilities sector increased from 2005 to 2010 and decreased from 2010 to 2018. Emissions increased from 2005 to 2010 primarily as a result of the Terminal B expansion at the Airport. Reductions in emissions resulted from:

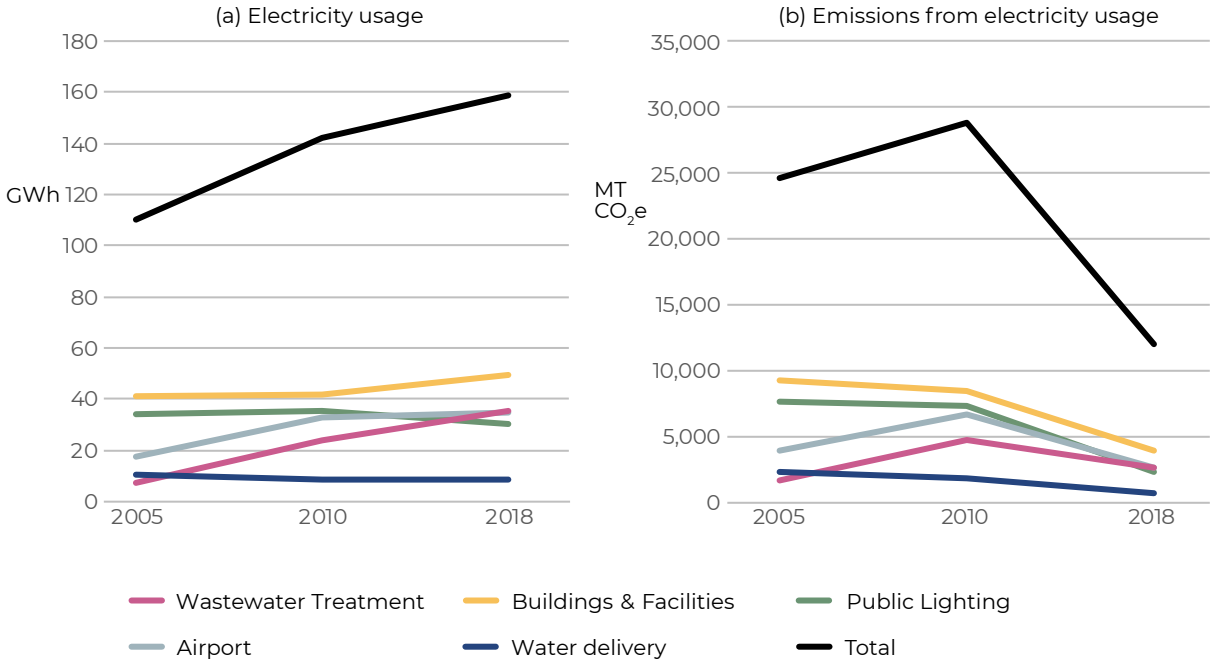
- Conversion of streetlights to LEDs - noticeable as a decrease in electricity use from public lighting from 2010 to 2018 (see Figure 11).
- SJCE supplying the City with carbon-neutral electricity in the last quarter of 2018. SJCE began operations in September 2018. Until early 2019, SJCE supplied only City facilities, allowing it to provide carbon-neutral electricity. This caused total City emissions from electricity to decrease despite increased electricity usage (see Figure 11).
- PG&E supplying more electricity from carbon-neutral sources.
- Installation of 6.5 MW of solar generating capacity on City facilities between 2009 and 2017, reducing the amount of electricity that needed to be purchased.
- A continuous improvement approach of replacing end-of-life equipment with more energy efficient equipment.

However, even as buildings and facilities emissions from electricity have declined since 2010, emissions from natural gas combustion have increased (see Figure 12). This is the result of:

- The lack of energy use data for the San José McEnery Convention Center for 2005 or 2010. In 2018, Convention Center accounts used 140,470 therms of natural gas (11 percent of buildings and facilities sector natural gas use).
- The addition of new buildings to the City's building stock.

- Problems with the heating, ventilation, and air conditioning control system at City Hall. From 2010 to 2018, natural gas use at City Hall nearly doubled, from 73,862 therms to 151,874. This problem is now being addressed and should be fixed by the end of 2020.

Figure 11 *(a) City government electricity usage and (b) emissions from City government electricity usage, 2005 to 2018*



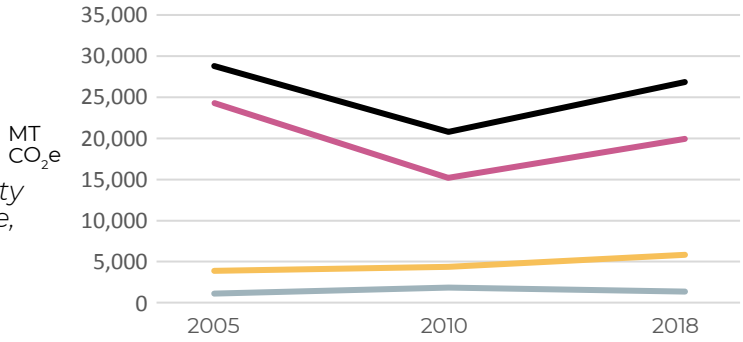


Figure 12 *Emissions from City government natural gas use, 2005 to 2018*

It should also be noted that after 2018, SJCE stopped supplying City facilities with carbon-neutral electricity (with the exception of the Environmental Innovation Center). Other City facilities now receive the same electricity mix as customers on SJCE's GreenSource plan (86 percent carbon-neutral in 2020). This electricity mix is cleaner than that provided by PG&E, but still provides an opportunity for emissions reduction. If all electricity used by the City in 2018 had been carbon-neutral electricity supplied by SJCE, this would have reduced emissions by a further 10,833 MT (15 percent of net 2018 emissions).

Emissions from solid waste also increased from 2005 to 2010 and then decreased from 2010 to 2018. Solid waste emissions increased from 2005 to 2010 for two reasons – an increase in the volume of biosolids sent from the Wastewater Facility to landfill, and a lack of 2005 data on grit, grease, and screenings sent from the Wastewater Facility to landfill. Simultaneously, emissions from the closed Singleton landfill and biowaste decreased from 2005 to 2010, because CH_4 production in Singleton landfill slowed as it aged, and because organic wastes began to be separated from the city waste stream for composting in 2008. From 2010 to 2018, emissions from solid waste decreased by approximately nine percent, largely because of a decrease in the volume of biosolids and grit, grease, and screenings sent from the Wastewater Facility to landfill. Emissions from Singleton landfill continued to decrease as well. From 2010 to 2018 there was a small increase in emissions from biowaste composting and other City government waste sent to landfill.

Emissions from energy used for wastewater treatment decreased from 2005 to 2010, and then increased from 2010 to 2018. The Wastewater Facility has mainly used four energy sources to power the wastewater treatment process: electricity, natural gas, digester gas, and landfill gas from Newby Island Landfill. Natural gas is a high-emissions energy source, digester and landfill gas are low-emissions energy sources, and electricity is intermediate. Changes in the mix of energy sources used drive changes in emissions. From 2005 to 2010, emissions decreased because natural gas use decreased and the Wastewater Facility used more digester gas and electricity instead. From 2010 to 2018, emissions increased because the Wastewater Facility stopped using landfill gas in 2012, and as a result increased its usage of natural gas and electricity. Wastewater Facility energy use emissions are expected to decrease in future as a result of two projects in the Capital Improvement Program currently underway at the Wastewater Facility. First, a new Cogeneration Facility is being built that will use digester gas more efficiently than current engines, so that the same amount of digester gas can generate more power. Second, the digester rehabilitation project should increase the amount of digester gas produced and available for consumption at the Wastewater Facility. Both these projects should reduce the Wastewater Facility's needs for natural gas and electricity. In addition, the Wastewater Facility may begin to use landfill gas from Newby Island Landfill again in coming years, which would also decrease emissions.

Wastewater process emissions (emissions generated by wastewater itself as it is being treated) is the only category in which emissions have consistently

increased over time – 17 percent since 2005 and 13 percent since 2010. These increased emissions are a result of the increase in the population served by the Wastewater Facility since 2005, from 1.3 million to 1.4 million, and the associated increase in the volume of sewage treated. Some modifications have been made to the water treatment process since 2005 that should have improved the removal of nitrogen from Wastewater Facility effluent (and thus reduced one source of emissions), likely offsetting some of the increase in emissions from population growth.

While Table 14 shows a large increase in emissions from employee commutes from 2010 to 2018, this should be interpreted with caution, as both emissions numbers are rough estimates, and they were estimated using different types of data and methods. For instance, neither of the employee commute surveys underlying these estimates collected information on vehicles used for employee commutes, and only the later survey collected detailed information on employees' home locations. An increase in commute emissions from 2010 to 2018 makes sense, however, as the number of City employees increased in that time, and the employee commute surveys used for the emissions estimates showed a decrease in employees using public transit to commute to work – from 39 percent in the 2011 survey to 12 percent (employees working downtown) or 4 percent (employees not working downtown) in the 2015 survey. Data from the two surveys on employee commute distances do not show a significant difference between 2011 and 2015, but these data are limited and it is also possible that rising housing costs have forced staff to live and commute from farther away. What these numbers definitely show is that employee commutes are a large source of GHG emissions, and that alternative commute incentive programs for City staff could be a powerful tool for reducing City government GHG emissions.

Overall, San José is making progress in decreasing emissions from city government operations and will continue to strive to do so.

A possible next step is to create a local government climate action plan including both emission reduction targets and specific, quantified strategies to meet those targets. This inventory shows that the wastewater treatment, buildings and facilities, and employee commute sectors will be particularly important areas of focus. Emission reduction strategies to consider thus include switching to 100% carbon-neutral electricity from SJCE for all City operations, increased use of landfill gas at the Wastewater Facility, further fuel switching/electrification of both buildings and vehicles, further improvements to building energy efficiency (especially for poor-performing buildings

identified through the Building Performance Ordinance), and programs to encourage employees to commute by alternative modes or telecommute. It would also be worthwhile to consider strategies that can both reduce emissions and improve resilience to future climate risks, such as installing battery storage or microgrids for critical City facilities, and adding to San José's urban tree canopy.

In addition, City staff will continue to track key energy use and emissions indicators on an on-going basis – City government emissions inventories such as this one are planned to be completed every other year.

Through these efforts and others, the City of San José can achieve both emissions reductions and additional accompanying benefits, such as saving money and improving employee safety and quality of life.

Appendix: Inventory Details

Tables A-1 through A-3 provide details on calculation methods, data sources, and emission factors for each emissions sector and subsector included in the updated 2005 and 2010 inventories and in the new 2018 inventory.

Table A-1 *Calculation methods and data source details for updated 2005 inventory*

	Activity Data		Emission Factors			Method
	Value	Unit	CO_2	CH_4	N_2O	
2005 Airport electricity use	17,477,799	kWh	489.16 lbs/MWh	30 lbs/GWh	11 lbs/GWh	LGO Protocol 1.1, Method 6.2.1

Method and data source notes: Activity data provided by PG&E; 2005 CO_2 emission factor provided by PG&E; 2005 CH_4 and N_2O emission factors are for the WECC California subregion and were retrieved from eGRID.
Change from original 2005 inventory: Categorization of electricity accounts in the raw activity data was updated to match the categories used in the 2018 inventory. CO_2e emissions calculated with updated GWP values for CH_4 and N_2O from IPCC Fifth Assessment Report.

	Activity Data		Emission Factors			Method
	Value	Unit	CO_2	CH_4	N_2O	
2005 Airport natural gas use	169,878	therms	53.02 kg/MMBtu	5 g/MMBtu	0.1 g/MMBtu	LGO Protocol 1.1, Method 6.1.1

Method and data source notes: Activity data provided by PG&E; CO_2, CH_4 and N_2O emission factors are national emission factors.
Change from original 2005 inventory: Airport natural gas use and natural gas use for wastewater treatment at the Wastewater Facility were separated from natural gas use in other City buildings. CO_2e emissions calculated with updated GWP values for CH_4 and N_2O from IPCC Fifth Assessment Report.

	Activity Data		Emission Factors			Method
	Value	Unit	CO_2	CH_4	N_2O	
2005 Buildings and facilities (excluding Airport) electricity use	41,114,430	kWh	489.16 lbs/MWh	30 lbs/GWh	11 lbs/GWh	LGO Protocol 1.1, Method 6.2.1

Method and data source notes: Activity data provided by PG&E; 2005 CO_2 emission factor provided by PG&E; 2005 CH_4 and N_2O emission factors are for the WECC California subregion and were retrieved from eGRID.
Change from original 2005 inventory: Categorization of electricity accounts in the raw activity data was updated to match the categories used in the 2018 inventory. CO_2e emissions calculated with updated GWP values for CH_4 and N_2O from IPCC Fifth Assessment Report.

	Activity Data		Emission Factors			Method
	Value	Unit	CO_2	CH_4	N_2O	
2005 Buildings and facilities (excluding Airport) natural gas use	714,019	therms	53.02 kg/MMBtu	5 g/MMBtu	0.1 g/MMBtu	LGO Protocol 1.1, Method 6.1.1

Method and data source notes: Activity data provided by PG&E; CO_2, CH_4 and N_2O emission factors are national emission factors.
Change from original 2005 inventory: Airport natural gas use and natural gas use for wastewater treatment at the Wastewater Facility were separated from natural gas use in other City buildings. Natural gas use at Airport CNG filling station (open to public) was excluded. CO_2e emissions calculated with updated GWP values for CH_4 and N_2O from IPCC Fifth Assessment Report.

	Activity Data		Emission Factors			Method
	Value	Unit	CO_2	CH_4	N_2O	
2005 Public lighting electricity use	34,246,233	kWh	489.16 lbs/MWh	30 lbs/GWh	11 lbs/GWh	LGO Protocol 1.1, Method 6.2.1

Method and data source notes: Activity data provided by PG&E; 2005 CO_2 emission factor provided by PG&E; 2005 CH_4 and N_2O emission factors are for the WECC California subregion and were retrieved from eGRID.
Change from original 2005 inventory: Categorization of electricity accounts in the raw activity data was updated to match the categories used in the 2018 inventory. CO_2e emissions calculated with updated GWP values for CH_4 and N_2O from IPCC Fifth Assessment Report.

	Activity Data		Emission Factor	Method
	Value	Unit	CH_4	
2005 Solid waste – biosolids from Wastewater Facility sent to landfill	36,312	short tons	6.75 kg/short ton	Other

Method and data source notes: Activity data provided by Wastewater Facility; CH_4 emission factor is a national emission factor. The emission factor for leaves sent to landfill was used, as biosolids behave similarly to leaves in landfill. The emission calculation assumes that the landfill gas collection system captures 75 percent of CH_4 produced and that 10 percent of the gas that is not captured is oxidized (and thus subtracted from emissions).
Change from original 2005 inventory: Not included in original 2005 inventory.

	Activity Data		Emission Factors		Method
	Value	Unit	CH_4	N_2O	
2005 Solid waste – green waste composted	4,860	short tons	0.556 kg/short ton	0.204 kg/short ton	Other

Method and data source notes: Activity data provided by Environmental Services Department, Integrated Waste Management Division; CH_4 and N_2O emission factors are national emission factors. The amount of "large civic" green waste was measured. The amount of "small civic" green waste was estimated as 2 percent of the total amount of residential green waste collected citywide.
Change from original 2005 inventory: Not included in original 2005 inventory.

	Activity Data			Emission Factor	Method
	Data Type	Value	Unit	CH_4	
2005 Solid waste – landfill gas combustion (Singleton landfill)	Average gas flow rate	304.5	scf/minute	0.059951 g/scf	LGO Protocol 1.1, Method 9.3.2
	Average fraction of CH_4 in gas	32	percent		
	Destruction efficiency	99	percent		

Method and data source notes: Activity data provided by Environmental Services Department, Sustainability and Compliance Division. This emission calculation is based on an estimate of the amount of CH_4 that escaped combustion. CH_4 emission factor is derived from the fraction of CH_4 in landfill gas and flare destruction efficiency, assuming that the density of CH_4 is 19 g/scf. Final calculation assumes that 1 year = 365.25 days.
Change from original 2005 inventory: Not included in original 2005 inventory.

	Activity Data		Emissions	Method
2005 Solid waste – waste sent to landfill	Value	Unit	CH_4	
	4220.3	short tons	97.49 MT	Other

Method and data source notes: Activity data provided by Environmental Services Department, Integrated Waste Management Division. CH_4 emissions were calculated by DNV-KEMA (consultants who conducted first 2005 inventory) by modeling year-over-year emissions for 100 years. The emission calculation assumes that the landfill gas collection system captures 75 percent of CH_4 produced and that 10 percent of the gas that is not captured is oxidized (and thus subtracted from emissions).
Change from original 2005 inventory: CO_2e emissions calculated with updated GWP value for CH_4, from IPCC Fifth Assessment Report.

	Activity Data			Emission Factors			Method
2005 Wastewater Facility biogas use for wastewater treatment – digester gas	Data Type	Value	Unit	Biogenic CO_2	CH_4	N_2O	
	Gas used	1,344,518.14	scf/ day	114.55 lbs/ MMBtu	0.00704 lbs/ MMBtu	0.001386 lbs/ MMBtu	LGO Protocol 1.1, Method 6.1.1
	Gas heat content	620	Btu/ scf				

Method and data source notes: Activity data provided by Wastewater Facility; heat content data from 2010 were used because 2005 data were not available, and this is not expected to change over time; CO_2, CH_4 and N_2O emission factors are national emission factors.
Change from original 2005 inventory: Not included in original 2005 inventory.

	Activity Data			Emission Factors			Method
2005 Wastewater Facility biogas use for wastewater treatment – landfill gas	Data Type	Value	Unit	Biogenic CO_2	CH_4	N_2O	
	Gas used	1,350,368.19	scf/ day	114.55 lbs/ MMBtu	0.00704 lbs/ MMBtu	0.001386 lbs/ MMBtu	LGO Protocol 1.1, Method 6.1.1
	Gas heat content	504	Btu/ scf				

Method and data source notes: Activity data provided by Wastewater Facility; heat content data from 2010 were used because 2005 data were not available, and this is not expected to change over time; CO_2, CH_4 and N_2O emission factors are national emission factors.
Change from original 2005 inventory: Not included in original 2005 inventory.

	Activity Data		Emission Factors			Method
	Value	Unit	CO_2	CH_4	N_2O	
2005 Wastewater Facility electricity use for wastewater treatment	7,212,486	kWh	489.16 lbs/MWh	30 lbs/GWh	11 lbs/GWh	LGO Protocol 1.1, Method 6.2.1

Method and data source notes: Activity data provided by PG&E; 2005 CO_2 emission factor provided by PG&E; 2005 CH_4 and N_2O emission factors are for the WECC California subregion and were retrieved from eGRID.
Change from original 2005 inventory: Categorization of electricity accounts in the raw activity data was updated to match the categories used in the 2018 inventory. CO_2e emissions calculated with updated GWP values for CH_4 and N_2O from IPCC Fifth Assessment Report.

	Activity Data		Emission Factors			Method
	Value	Unit	CO_2	CH_4	N_2O	
2005 Wastewater Facility fuel oil use for wastewater treatment – distillate fuel oil #2	25,413	gallons	162.712 lbs/ MMBtu	0.023914 lbs/ MMBtu	0.00159 lbs/ MMBtu	LGO Protocol 1.1, Method 6.1.1

Method and data source notes: Activity data provided by Wastewater Facility; CO_2, CH_4 and N_2O emission factors are national emission factors.
Change from original 2005 inventory: Not included in original 2005 inventory.

	Activity Data		Emission Factors			Method
	Value	Unit	CO_2	CH_4	N_2O	
2005 Wastewater Facility natural gas use for wastewater treatment	4,536,943	therms	53.02 kg/MMBtu	5 g/MMBtu	0.1 g/MMBtu	LGO Protocol 1.1, Method 6.1.1

Method and data source notes: Activity data provided by PG&E; CO_2, CH_4 and N_2O emission factors are national emission factors.
Change from original 2005 inventory: Airport natural gas use and natural gas use for wastewater treatment at the Wastewater Facility were separated from natural gas use in other City buildings. CO_2e emissions calculated with updated GWP values for CH_4 and N_2O from IPCC Fifth Assessment Report.

	Activity Data		Emission Factor	Method
2005 Wastewater process - nitrification/ denitrification	Population served	Industrial Commercial Discharge Multiplier	N_2O	
	1,300,000	1.25	7 g/person	LGO Protocol 1.1, Method 10.3.2.1

Method and data source notes: Activity data provided by Wastewater Facility; Industrial Commercial Industrial Commercial Discharge Multiplier is a standard national default value; N_2O emission factor is a national emission factor.
Change from original 2005 inventory: Not included in original 2005 inventory.

	Activity Data	Emission Factor	Method
2005 Wastewater process - effluent	Daily inorganic nitrogen load	N_2O	
	4,243 kg/day	5 g N_2O/kg nitrogen in effluent	LGO Protocol 1.1, Method 10.3.2.3

Method and data source notes: Activity data provided by Wastewater Facility; N_2O emission factor is a national emission factor. Organic nitrogen is also released in Wastewater Facility effluent, but this nitrogen is refractory – difficult to transform and not bioavailable, and so not expected to lead to significant N_2O emissions. For this reason, only the amount of inorganic nitrogen in effluent was used for this calculation.
Change from original 2005 inventory: Not included in original 2005 inventory.

	Activity Data		Emission Factors			Method
2005 Water services electricity use	Value	Unit	CO_2	CH_4	N_2O	
	10,194,492	kWh	489.16 lbs/MWh	30 lbs/GWh	11 lbs/GWh	LGO Protocol 1.1, Method 6.2.1

Method and data source notes: Activity data provided by PG&E; 2005 CO_2 emission factor provided by PG&E; 2005 CH_4 and N_2O emission factors are for the WECC California subregion and were retrieved from eGRID.
Change from original 2005 inventory: Categorization of electricity accounts in the raw activity data was updated to match the categories used in the 2018 inventory. CO_2e emissions calculated with updated GWP values for CH_4 and N_2O from IPCC Fifth Assessment Report.

Table A-2 *Calculation methods and data source details for updated 2010 inventory*

	Activity Data		Emission Factors			Method
	Value	Unit	CO_2	CH_4	N_2O	
2010 Airport electricity use	32,751,401	kWh	444.64 lbs/MWh	29 lbs/GWh	10 lbs/GWh	LGO Protocol 1.1, Method 6.2.1

Method and data source notes: Activity data provided by PG&E; 2010 CO_2 emission factor provided by PG&E; 2010 CH_4 and N_2O emission factors are for the WECC California subregion and were retrieved from eGRID.
Change from original 2010 inventory: Categorization of electricity accounts in the raw activity data was updated to match the categories used in the 2018 inventory. CO_2e emissions calculated with updated GWP values for CH_4 and N_2O from IPCC Fifth Assessment Report.

	Activity Data		Emission Factors			Method
	Value	Unit	CO_2	CH_4	N_2O	
2010 Airport generators diesel use	2,006	gallons	10.21 kg/gallon	0.58 g/gallon	0.58 g/gallon	LGO Protocol 1.1, Method 6.1.1

Method and data source notes: Activity data provided by City Fleet Manager; Emission factors are national averages taken from LGO Protocol 1.1, Tables G.11 and G.14.
Change from original 2010 inventory: Airport generators and backup generators for water delivery pumps were originally included with other generators in the "Stationary Sources" sector. CO_2e emissions calculated with updated GWP values for CH_4 and N_2O from IPCC Fifth Assessment Report.

	Activity Data		Emission Factors			Method
	Value	Unit	CO_2	CH_4	N_2O	
2010 Airport natural gas use	298,409	therms	53.02 kg/MMBtu	5 g/MMBtu	0.1 g/MMBtu	LGO Protocol 1.1, Method 6.2.1

Method and data source notes: Activity data provided by PG&E; CO_2, CH_4 and N_2O emission factors are national emission factors.
Change from original 2010 inventory: Airport natural gas use and natural gas use for wastewater treatment at the Wastewater Facility were separated from natural gas use in other City buildings. CO_2e emissions calculated with updated GWP values for CH_4 and N_2O from IPCC Fifth Assessment Report.

2010 Buildings and facilities (excluding Airport) electricity use	Activity Data		Emission Factors			Method
	Value	Unit	CO_2	CH_4	N_2O	
	41,485,115	kWh	444.64 lbs/MWh	29 lbs/GWh	10 lbs/GWh	LGO Protocol 1.1, Method 6.2.1

Method and data source notes: Activity data provided by PG&E; 2010 CO_2 emission factor provided by PG&E; 2010 CH_4 and N_2O emission factors are for the WECC California subregion and were retrieved from eGRID.
Change from original 2010 inventory: Categorization of electricity accounts in the raw activity data was updated to match the categories used in the 2018 inventory. CO_2e emissions calculated with updated GWP values for CH_4 and N_2O from IPCC Fifth Assessment Report.

2010 Buildings and facilities (excluding Airport) generators diesel use	Activity Data		Emission Factors			Method
	Value	Unit	CO_2	CH_4	N_2O	
	8,446	gallons	10.21 kg/gallon	0.58 g/gallon	0.58 g/gallon	LGO Protocol 1.1, Method 6.1.1

Method and data source notes: Activity data provided by City Fleet Manager; Emission factors are national averages taken from LGO Protocol 1.1, Tables G.11 and G.14.
Change from original 2010 inventory: Airport generators and backup generators for water delivery pumps were originally included with other generators in the "Stationary Sources" sector. CO_2e emissions calculated with updated GWP values for CH_4 and N_2O from IPCC Fifth Assessment Report.

2010 Buildings and facilities (excluding Airport) natural gas use	Activity Data		Emission Factors			Method
	Value	Unit	CO_2	CH_4	N_2O	
	800,973	therms	53.02 kg/MMBtu	5 g/MMBtu	0.1 g/MMBtu	LGO Protocol 1.1, Method 6.2.1

Method and data source notes: Activity data provided by PG&E; CO_2, CH_4 and N_2O emission factors are national emission factors.
Change from original 2010 inventory: Airport natural gas use and natural gas use for wastewater treatment at the Wastewater Facility were separated from natural gas use in other City buildings. Natural gas use at Airport CNG filling station (open to public) was excluded. CO_2e emissions calculated with updated GWP values for CH_4 and N_2O from IPCC Fifth Assessment Report.

	Activity Data			Emission Factors			Method
2010 Employee commute – bus	Transport Mode	Percent of staff	Annual passenger miles	CO_2	CH_4	N_2O	
	Bus	19.4	11,091,717	0.128 lbs/mile	0.0007 g/mile	0.0004 g/mile	Other

Method and data source notes: Activity data based on the Employee commuter/ Eco pass survey conducted by City Department of Transportation in Fall 2011; data on number of City staff from San José 2010 Operating Budget; Emission factors are national emission factors for 2010 from the US Community Protocol. Additional data used for calculations: total number of City staff (FTE) - 5,840; Average one-way commute distance – 20.7 miles. It was assumed that employees work/commute to work 237 days per year. Passenger miles and staff percentage from public transit were divided evenly between light rail and bus.
Change from original 2010 inventory: Calculation was re-done to more closely match 2018 inventory methodology.

	Activity Data			Emission Factors			Method
2010 Employee commute – light rail	Transport Mode	Percent of staff	Annual passenger miles	CO_2	CH_4	N_2O	
	Light Rail	19.4	11,091,717	0.293 lbs/mile	0.0026 g/mile	0.0174 g/mile	Other

Method and data source notes: Activity data based on the Employee commuter/ Eco pass survey conducted by City Department of Transportation in Fall 2011; data on number of City staff from San José 2010 Operating Budget; Emission factors are national emission factors for 2010 from the US Community Protocol. Additional data used for calculations: total number of City staff (FTE) - 5,840; Average one-way commute distance – 20.7 miles. It was assumed that employees work/commute to work 237 days per year. Passenger miles and staff percentage from public transit were divided evenly between light rail and bus.
Change from original 2010 inventory: Calculation was re-done to more closely match 2018 inventory methodology.

	Activity Data			Emission Factors			Method
	Transport mode	Percent of staff	Annual passenger miles	CO_2	CH_4	N_2O	
2010 Employee commute – passenger vehicles	Driving alone	50	28,586,900	0.824 lbs/mile	0.0201 g/mile	0.0174 g/mile	Other
	Carpooling/ vanpooling	5.8	1,658,040				

Method and data source notes: Activity data based on the Employee commuter/ Eco pass survey conducted by City Department of Transportation in Fall 2011; data on number of City staff from San José 2010 Operating Budget; Emission factors are national emission factors for 2010 from the US Community Protocol. Additional data used for calculations: total number of City staff (FTE) - 5,840; Average one-way commute distance – 20.7 miles. It was assumed that employees work/commute to work 237 days per year. VMT from carpooling was divided by 2 to estimate passenger miles. All vehicles were assumed to be gasoline passenger cars with fuel economy of 23.5 MPG.
Change from original 2010 inventory: Calculation was re-done to more closely match 2018 inventory methodology.

	Activity Data		Emission Factors			Method
	Value	Unit	CO_2	CH_4	N_2O	
2010 Public lighting electricity use	35,620,953	kWh	444.64 lbs/MWh	29 lbs/GWh	10 lbs/GWh	LGO Protocol 1.1, Method 6.2.1

Method and data source notes: Activity data provided by PG&E; 2010 CO_2 emission factor provided by PG&E; 2010 CH_4 and N_2O emission factors are for the WECC California subregion and were retrieved from eGRID.
Change from original 2010 inventory: Categorization of electricity accounts in the raw activity data was updated to match the categories used in the 2018 inventory. CO_2e emissions calculated with updated GWP values for CH_4 and N_2O from IPCC Fifth Assessment Report.

	Activity Data		Emission factor	Method
	Value	Unit	CH_4	
2010 Solid waste – biosolids from Wastewater Facility sent to landfill	51,335	short tons	6.75 kg/short ton	Other

Method and data source notes: Activity data provided by Wastewater Facility; CH_4 emission factor is a national emission factor. The emission factor for leaves sent to landfill was used, as biosolids behave similarly to leaves in landfill. The emission calculation assumes that the landfill gas collection system captures 75% of CH_4 produced and that 10% of the gas that is not captured is oxidized (and thus subtracted from emissions).
Change from original 2010 inventory: Not included in original 2010 inventory.

	Activity Data		Emission Factors		Method
	Value	Unit	CH_4	N_2O	
2010 Solid waste – biowaste composted	2,949.76	short tons	0.22 kg/short ton	0.133 kg/short ton	Other

Method and data source notes: Activity data provided by Environmental Services Department, Integrated Waste Management Division; CH_4 and N_2O emission factors are national emission factors. Biowaste from city buildings was estimated by multiplying the total amount of waste collected by the share of City government waste that was compostable in a previous waste characterization survey (64.4%).
Change from original 2010 inventory: Not included in original 2010 inventory.

	Activity Data		Emission Factors		Method
	Value	Unit	CH_4	N_2O	
2010 Solid waste – green waste composted	3,746	short tons	0.556 kg/short ton	0.204 kg/short ton	Other

Method and data source notes: Activity data provided by Environmental Services Department, Integrated Waste Management Division; CH_4 and N_2O emission factors are national emission factors. The amount of "large civic green waste" was measured. The amount of "small civic green waste" was estimated as 2% of the total amount of residential green waste collected citywide.
Change from original 2010 inventory: Not included in original 2010 inventory.

	Activity Data		Emission Factor	Method
	Value	Unit	CH_4	
2010 Solid waste – grit, grease, and screenings sent from Wastewater Facility to landfill	1,833.2	short tons	13.5 kg/short ton	Other

Method and data source notes: Activity data provided by Wastewater Facility; CH_4 emission factor is a national emission factor - the 2010 emission factor for 100% mixed municipal solid waste. The emission calculation assumes that the landfill gas collection system captures 75% of CH_4 produced and that 10% of the gas that is not captured is oxidized (and thus subtracted from emissions).
Change from original 2010 inventory: Not included in original 2010 inventory.

	Activity Data			Emission Factor	Method
	Data Type	Value	Unit	CH_4	
2010 Solid waste – landfill gas combustion (Singleton landfill)	Average gas flow rate	88.86	scf/minute	0.052832 g/scf	LGO Protocol 1.1, Method 9.3.2
	Average fraction of CH_4 in gas	28.2	percent		
	Destruction efficiency	99	percent		

Method and data source notes: Activity data provided by Environmental Services Department, Sustainability and Compliance Division. This emission calculation is based on an estimate of the amount of CH_4 that escaped combustion. CH_4 emission factor is derived from the fraction of CH_4 in landfill gas and flare destruction efficiency, assuming that the density of CH_4 is 19 g/scf. Final calculation assumes that 1 year = 365.25 days.
Change from original 2010 inventory: Not included in original 2010 inventory.

	Activity Data		Emissions	Method
	Value	Unit	CH_4	
2010 Solid waste – waste sent to landfill	801.57	short tons	18.52 MT	Other

Method and data source notes: Activity data provided by Environmental Services Department, Integrated Waste Management Division. CH_4 emissions were calculated by DNV-KEMA (consultants who conducted first 2010 inventory) by modeling year-over-year emissions for 100 years. The emission calculation assumes that the landfill gas collection system captures 75% of CH_4 produced and that 10% of the gas that is not captured is oxidized (and thus subtracted from emissions).
Change from original 2010 inventory: CO_2e emissions calculated with updated GWP value for CH_4, from IPCC Fifth Assessment Report.

	Activity Data		Emission Factors			Method
	Fuel Use (gallons)	Average MPG	Biogenic CO_2	CH_4	N_2O	
2010 Vehicle fleet - biodiesel use	209,400.86	24.7	9.45 kg/gallon	0.001 g/mile	0.001 g/mile	LGO Protocol 1.1, Method 7.1.1

Method and data source notes: Fuel use data provided by City Fleet Manager; Average MPG was calculated based on data in 2008 Santa Clara County Municipal Operations Inventory; Emission factors are national emission factors taken from LGO Protocol 1.1, Tables G.11 and G.13; for CH_4 and N_2O, emission factors for light duty vehicles were used.
Change from original 2010 inventory: CO_2 emissions from biodiesel vehicles, which are biogenic emissions, were included in the original 2010 inventory but excluded here. CO_2e emissions calculated with updated GWP values for CH_4 and N_2O from IPCC Fifth Assessment Report.

	Activity Data		Emission Factors			Method
	Fuel Use (gallons)	Average MPG	CO_2	CH_4	N_2O	
2010 Vehicle fleet - diesel use	6,730	24.7	10.21 kg/gallon	0.00099 g/mile	0.00149 g/mile	LGO Protocol 1.1, Method 7.1.1

Method and data source notes: Fuel use data provided by City Fleet Manager; Average MPG was calculated based on data in 2008 Santa Clara County Municipal Operations Inventory; Emission factors are national emission factors taken from LGO Protocol 1.1, Tables G.11 and G.12; for CH_4 and N_2O, emission factors for light trucks for 2006 were used.
Change from original 2010 inventory: CO_2e emissions calculated with updated GWP values for CH_4 and N_2O from IPCC Fifth Assessment Report.

	Activity Data		Emission Factors			Method
	Fuel Use (gallons)	Average MPG	CO_2	CH_4	N_2O	
2010 Vehicle fleet - gasoline use	1,166,266.65	24.7	8.78 kg/gallon	0.03146 g/mile	0.04331 g/mile	LGO Protocol 1.1, Method 7.1.1

Method and data source notes: Fuel use data provided by City Fleet Manager; Average MPG was calculated based on data in 2008 Santa Clara County Municipal Operations Inventory; Emission factors are national emission factors taken from LGO Protocol 1.1, Tables G.11 and G.12; for CH_4 and N_2O, emission factors for light trucks for 2006 were used.
Change from original 2010 inventory: CO_2e emissions calculated with updated GWP values for CH_4 and N_2O from IPCC Fifth Assessment Report.

	Activity Data		Emission Factors			Method
	Fuel Use (gallons)	Average MPG	CO_2	CH_4	N_2O	
2010 Vehicle fleet – LPG use	322.4	24.7	5.79 kg/gallon	0.037 g/mile	0.067 g/mile	LGO Protocol 1.1, Method 7.1.1

Method and data source notes: Fuel use data provided by City Fleet Manager; Average MPG was calculated based on data in 2008 Santa Clara County Municipal Operations Inventory; Emission factors are national emission factors taken from LGO Protocol 1.1, Tables G.11 and G.13; for CH_4 and N_2O, emission factors for light duty vehicles were used.
Change from original 2010 inventory: CO_2e emissions calculated with updated GWP values for CH_4 and N_2O from IPCC Fifth Assessment Report.

	Activity Data		Emission Factors			Method
	Fuel Use (gallons)	Average MPG	CO_2	CH_4	N_2O	
2010 Vehicle fleet - methanol use	518.3	24.7	4.1 kg/gallon	0.018 g/mile	0.175 g/mile	LGO Protocol 1.1, Method 7.1.1

Method and data source notes: Fuel use data provided by City Fleet Manager; Average MPG was calculated based on data in 2008 Santa Clara County Municipal Operations Inventory; Emission factors are national emission factors taken from LGO Protocol 1.1, Tables G.11 and G.13; for CH_4 and N_2O, emission factors for light duty vehicles were used.
Change from original 2010 inventory: CO_2e emissions calculated with updated GWP values for CH_4 and N_2O from IPCC Fifth Assessment Report.

	Emissions			Method
	Biogenic CO_2	CH_4	N_2O	
2010 Wastewater Facility biogas use for wastewater treatment – digester and landfill gas	52,665.92 MT	0.455 MT	0.05 MT	Other

Method and data source notes: Data retrieved from Wastewater Facility Cal e-GGRT Summary Report.
Change from original 2010 inventory: Not included in original 2010 inventory.

	Activity Data		Emission Factors			Method
	Value	Unit	CO_2	CH_4	N_2O	
2010 Wastewater Facility electricity use for wastewater treatment	23,585,124	kWh	444.64 lbs/MWh	29 lbs/GWh	10 lbs/GWh	LGO Protocol 1.1, Method 6.2.1

Method and data source notes: Activity data provided by PG&E; 2010 CO_2 emission factor provided by PG&E; 2010 CH_4 and N_2O emission factors are for the WECC California subregion and were retrieved from eGRID.
Change from original 2010 inventory: Categorization of electricity accounts in the raw activity data was updated to match the categories used in the 2018 inventory. CO_2e emissions calculated with updated GWP values for CH_4 and N_2O from IPCC Fifth Assessment Report.

2010 Wastewater Facility fuel oil use for wastewater treatment – distillate fuel oil #2	Emissions			Method
	CO_2	CH_4	N_2O	
	314 MT	0.013 MT	0.003 MT	Other

Method and data source notes: Data retrieved from Wastewater Facility Cal e-GGRT Summary Report.
Change from original 2010 inventory: Not included in original 2010 inventory.

2010 Wastewater Facility natural gas use for wastewater treatment	Emissions			Method
	CO_2	CH_4	N_2O	
	14,911 MT	0.253 MT	0.028 MT	Other

Method and data source notes: Data retrieved from Wastewater Facility Cal e-GGRT Summary Report.
Change from original 2010 inventory: Emissions from natural gas combustion for wastewater treatment were taken directly from the Wastewater Facility Cal e-GGRT report rather than from billing data provided by PG&E. CO_2e emissions calculated with updated GWP values for CH_4 and N_2O from IPCC Fifth Assessment Report.

2010 Wastewater process - effluent	Activity Data	Emission Factor	Method
	Daily inorganic nitrogen load	N_2O	
	4,293.1 kg/day	5 g N_2O/kg nitrogen in effluent	LGO Protocol 1.1, Method 10.3.2.3

Method and data source notes: Activity data provided by Wastewater Facility; N_2O emission factor is a national emission factor. Organic nitrogen is also released in Wastewater Facility effluent, but this nitrogen is refractory – difficult to transform and not bioavailable, and so not expected to lead to significant N_2O emissions. For this reason, only the amount of inorganic nitrogen in effluent was used for this calculation.
Change from original 2010 inventory: Calculation was re-done to match 2018 inventory methodology.

	Activity Data		Emission Factor	Method
2010 Wastewater process - nitrification/ denitrification	Population served	Industrial Commercial Discharge Multiplier	N_2O	
	1,365,000	1.25	7 g/person	LGO Protocol 1.1, Method 10.3.2.1

Method and data source notes: Activity data provided by Wastewater Facility; Industrial Commercial Discharge Multiplier is a standard national default value; N_2O emission factor is a national emission factor.
Change from original 2010 inventory: Calculation was re-done to match 2018 inventory methodology.

	Activity Data		Emission Factors			Method
2010 Water services backup generators diesel use	Value	Unit	CO_2	CH_4	N_2O	
	265	gallons	10.21 kg/gallon	0.58 g/gallon	0.26 g/gallon	LGO Protocol 1.1, Method 6.1.1

Method and data source notes: Activity data provided by City Fleet Manager; Emission factors are national averages taken from LGO Protocol 1.1, Tables G.11 and G.14.
Change from original 2010 inventory: Airport generators and backup generators for water delivery pumps were originally included with other generators in the "Stationary Sources" sector. CO_2e emissions calculated with updated GWP values for CH_4 and N_2O from IPCC Fifth Assessment Report.

	Activity Data		Emission Factors			Method
2010 Water services electricity use	Value	Unit	CO_2	CH_4	N_2O	
	8,604,318	kWh	444.64 lbs/MWh	29 lbs/GWh	10 lbs/GWh	LGO Protocol 1.1, Method 6.2.1

Method and data source notes: Activity data provided by PG&E; 2010 CO_2 emission factor provided by PG&E; 2010 CH_4 and N_2O emission factors are for the WECC California subregion and were retrieved from eGRID.
Change from original 2010 inventory: Categorization of electricity accounts in the raw activity data was updated to match the categories used in the 2018 inventory. CO_2e emissions calculated with updated GWP values for CH_4 and N_2O from IPCC Fifth Assessment Report.

Table A-3 *Calculation methods and data source details for 2018 inventory*

	Activity Data		Emission Factors			Method
	Value	Unit	CO_2	CH_4	N_2O	
2018 Airport electricity use (PG&E)	27,141,193	kWh	206.29 lbs/MWh	34 lbs/GWh	4 lbs/GWh	LGO Protocol 1.1, Method 6.2.1

Method and data source notes: Activity data provided by PG&E; 2018 CO_2 emission factor from the Climate Registry (https://www.theclimateregistry.org/our-members/cris-public-reports/); 2018 CH_4 and N_2O emission factors are for the WECC California subregion and were retrieved from eGRID.

	Activity Data		Emission Factors			Method
	Value	Unit	CO_2	CH_4	N_2O	
2018 Airport electricity use (Silicon Valley Power)	46,944	kWh	410.1 lbs/MWh	34 lbs/GWh	4 lbs/GWh	LGO Protocol 1.1, Method 6.2.1

Method and data source notes: Activity data provided by Airport; 2018 CO_2 emission factor from Joint Venture Silicon Valley's Silicon Valley Indicators website (https://siliconvalleyindicators.org/data/place/environment/electricity-use/emissions-intensity-for-power-providers/); 2018 CH_4 and N_2O emission factors are for the WECC California subregion and were retrieved from eGRID.

	Activity Data		Emission Factors			Method
	Value	Unit	CO_2	CH_4	N_2O	
2018 Airport electricity use (SJCE)	7,631,006	kWh	20 lbs/MWh	34 lbs/GWh	4 lbs/GWh	LGO Protocol 1.1, Method 6.2.1

Method and data source notes: Activity data provided by PG&E; 2018 CO_2 emission factor from SJCE 2018 Integrated Resource Plan; 2018 CH_4 and N_2O emission factors are for the WECC California subregion and were retrieved from eGRID.

	Activity Data		Emission Factors			Method
	Value	Unit	Biogenic CO_2	CH_4	N_2O	
2018 Airport generators renewable diesel use	1,284.8	gallons	74 kg/MMBtu	1.1 g/MMBtu	0.11 g/MMBtu	LGO Protocol 1.1, Method 6.2.1

Method and data source notes: Activity data provided by City Fleet Manager; CO_2, CH_4 and N_2O emission factors are national emission factors.

	Activity Data		Emission Factors			Method
	Value	Unit	CO_2	CH_4	N_2O	
2018 Airport natural gas use	234,825	therms	53.02 kg/MMBtu	5 g/MMBtu	0.1 g/MMBtu	LGO Protocol 1.1, Method 6.2.1

Method and data source notes: Activity data provided by PG&E; CO_2, CH_4 and N_2O emission factors are national emission factors.

	Activity Data		Emission Factors			Method
	Value	Unit	CO_2	CH_4	N_2O	
2018 Buildings and facilities (excluding Airport) electricity use (PG&E)	39,870,857	kWh	206.29 lbs/MWh	34 lbs/GWh	4 lbs/GWh	LGO Protocol 1.1, Method 6.2.1

Method and data source notes: Activity data provided by PG&E; 2018 CO_2 emission factor from the Climate Registry (https://www.theclimateregistry.org/our-members/cris-public-reports/); 2018 CH_4 and N_2O emission factors are for the WECC California subregion and were retrieved from eGRID.

	Activity Data		Emission Factors			Method
	Value	Unit	CO_2	CH_4	N_2O	
2018 Buildings and facilities (excluding Airport) electricity use (SJCE)	9,425,986	kWh	20 lbs/MWh	34 lbs/GWh	4 lbs/GWh	LGO Protocol 1.1, Method 6.2.1

Method and data source notes: Activity data provided by PG&E; 2018 CO_2 emission factor from SJCE 2018 Integrated Resource Plan; 2018 CH_4 and N_2O emission factors are for the WECC California subregion and were retrieved from eGRID.

	Activity Data		Emission Factors			Method
	Value	Unit	CO_2	CH_4	N_2O	
2018 Buildings and facilities (excluding Airport) generators - gasoline use	28.8	gallons	70 kg/MMBtu	11 g/MMBtu	0.8 g/MMBtu	LGO Protocol 1.1, Method 6.1.1

Method and data source notes: Activity data provided by City Fleet Manager; CO_2, CH_4, and N_2O emission factors are national emission factors.

	Activity Data		Emission Factors			Method
	Value	Unit	Biogenic CO_2	CH_4	N_2O	
2018 Buildings and facilities (excluding Airport) generators - renewable diesel use	3,511.7	gallons	74 kg/MMBtu	1.1 g/MMBtu	0.11 g/MMBtu	LGO Protocol 1.1, Method 6.1.1

Method and data source notes: Activity data provided by City Fleet Manager; CO_2, CH_4, and N_2O emission factors are national emission factors.

	Activity Data		Emission Factors			Method
	Value	Unit	CO_2	CH_4	N_2O	
2018 Buildings and facilities (excluding Airport) natural gas use	1,081,967	therms	53.02 kg/MMBtu	5 g/MMBtu	0.1 g/MMBtu	LGO Protocol 1.1, Method 6.2.1

Method and data source notes: Activity data provided by PG&E; CO_2, CH_4 and N_2O emission factors are national emission factors.

	Sequestration/Emissions		Method
		CO_2	
2018 Carbon sequestration by City street trees	Sequestration by existing trees	12,683.7 MT	Other
	Emissions from removed & chipped trees	1400.3 MT	

Method and data source notes: Carbon sequestration by City street trees was calculated by DOT staff using the i-Tree Eco tool (version 6; https://www.itreetools.org/). This estimate was based on the City street tree GIS layer as of May 2019. Supporting data are from the City of San José i-Tree Ecosystem Analysis report – San Jose Street Trees Urban Forest Effects and Values, which is publicly available at http://ecotrees.visualizedot.com/report.pdf. Emissions from removed trees were calculated using an estimate of street tree CO_2 stocks from the i-Tree report and information from the City Arborist on annual tree removal. Net sequestration by city trees equals sequestration minus emissions.

	Activity Data			Emission Factors			Method
	Transport Mode	Percent of staff	Annual passenger miles	CO_2	CH_4	N_2O	
2018 Employee commute – bus	Bus	6 (working downtown) 2 (elsewhere)	11,638,046	0.128 lbs/mile	0.0007 g/mile	0.0004 g/mile	Other

Method and data source notes: Activity data based on the Employee Transportation Modes Survey conducted by City Department of Transportation in Summer 2015; data on number of City staff provided by Department of Human Resources; emission factors are national emission factors for 2017. Additional data used for calculations: City staff FTE in 2018 – 6,412.6 (23.3% working downtown, 76.7 percent not working downtown). It was assumed that employees worked/traveled to work 237 days per year. Passenger miles were calculated using detailed data on employee home locations from the survey; the average one-way commute distance was 18.6 miles. Only primary commute modes were taken into account. Passenger miles from public transit were divided evenly between light rail and bus.

	Activity Data			Emission Factors			Method
	Transport Mode	Percent of staff	Annual passenger miles	CO_2	CH_4	N_2O	
2018 Employee commute – light rail	Light Rail	6 (working downtown) 2 (elsewhere)	1,638,046	0.293 lbs/mile	0.0026 g/mile	0.002 g/mile	Other

Method and data source notes: Activity data based on the Employee Transportation Modes Survey conducted by City Department of Transportation in Summer 2015; data on number of City staff provided by Department of Human Resources; emission factors are national emission factors for 2017. Additional data used for calculations: City staff FTE in 2018 – 6,412.6 (23.3% working downtown, 76.7% not working downtown). It was assumed that employees worked/traveled to work 237 days per year. Passenger miles were calculated using detailed data on employee home locations from the survey; the average one-way commute distance was 18.6 miles. Only primary commute modes were taken into account. Passenger miles from public transit were divided evenly between light rail and bus.

	Activity Data			Emission Factors			Method
	Transport Mode	Percent of staff	Annual passenger miles	CO_2	CH_4	N_2O	
2018 Employee commute – passenger vehicles	Driving Alone	69 (working downtown) 88 (elsewhere)	47,768,413	0.36 kg/mile	0.019 g/mile	0.009 g/mile	Other
	Carpooling/ vanpooling	12 (working downtown) 4 (elsewhere)	1,638,046				

Method and data source notes: Activity data based on the Employee Transportation Modes Survey conducted by City Department of Transportation in Summer 2015; data on City staff provided by Department of Human Resources and extracted from 2018-2019 Adopted City Operating Budget; emission factors are national emission factors for 2017. Additional data used for calculations: City staff FTE in 2018 – 6,412.6 (23.3% working downtown, 76.7% not working downtown). It was assumed that employees worked/traveled to work 237 days per year. VMT from carpooling was divided by 2 to estimate passenger miles, assuming that carpools consisted of 2 people. VMT was calculated using detailed data on employee home locations from the survey; the average one-way commute distance was 18.6 miles. All vehicles were assumed to be gasoline passenger cars with fuel economy of 24.2 MPG. Only primary commute modes were taken into account. Commutes by motorcycle were not included.

	Activity Data		Emission Factors			Method
	Value	Unit	CO_2	CH_4	N_2O	
2018 Public lighting electricity use (PG&E)	23,069,633.5	kWh	206.29 lbs/MWh	34 lbs/GWh	4 lbs/GWh	LGO Protocol 1.1, Method 6.2.1

Method and data source notes: Activity data provided by PG&E; 2018 CO_2 emission factor from the Climate Registry (https://www.theclimateregistry.org/our-members/cris-public-reports/); 2018 CH_4 and N_2O emission factors are for the WECC California subregion and were retrieved from eGRID.

	Activity Data		Emission Factors			Method
	Value	Unit	CO_2	CH_4	N_2O	
2018 Public lighting electricity use (SJCE)	7,476,059.5	kWh	20 lbs/MWh	34 lbs/GWh	4 lbs/GWh	LGO Protocol 1.1, Method 6.2.1

Method and data source notes: Activity data provided by PG&E; 2018 CO_2 emission factor from SJCE 2018 Integrated Resource Plan; 2018 CH_4 and N_2O emission factors are for the WECC California subregion and were retrieved from eGRID.

2018 Solid waste – biosolids from Wastewater Facility sent to landfill	Activity Data		Emission Factor	Method
	Value	Unit	CH_4	
	45,315	short tons	6.75 kg/short ton	Other

Method and data source notes: Activity data provided by Wastewater Facility; CH_4 emission factor is a national emission factor. The emission factor for leaves sent to landfill was used, as biosolids behave similarly to leaves in landfill. The emission calculation assumes that the landfill gas collection system captures 75 percent of CH_4 produced and that 10 percent of the gas that is not captured is oxidized (and thus subtracted from emissions).

2018 Solid waste – biowaste composted	Activity Data		Emission Factors		Method
	Value	Unit	CH_4	N_2O	
	4204.2	short tons	0.22 kg/short ton	0.133 kg/short ton	Other

Method and data source notes: Activity data provided by Environmental Services Department, Integrated Waste Management Division; CH_4 and N_2O emission factors are national emission factors. Biowaste tonnage from 15 small fire stations and 2 small libraries with residential service, for which waste volume is not tracked, was estimated using data from a 2014 waste characterization study on the share of City government waste that was compostable (61.3 percent) and these assumptions: total volume of waste per building per week – 1 cubic yard; density of waste – 800 lbs/cubic yard. Biowaste tonnage from the rest of City buildings was estimated by multiplying the total amount of waste collected by the share of City government waste that was compostable.

2018 Solid waste – green waste composted	Activity Data		Emission Factors		Method
	Value	Unit	CH_4	N_2O	
	3,499.9	short tons	0.556 kg/short ton	0.204 kg/short ton	Other

Method and data source notes: Activity data provided by Environmental Services Department, Integrated Waste Management Division; CH_4 and N_2O emission factors are national emission factors. The amount of "large civic" green waste (947.16 short tons) was measured. The amount of "small civic" green waste (2552.7 short tons) was estimated as 2 percent of the total amount of residential green waste collected citywide (127,636.1 short tons).

	Activity Data		Emission Factor	Method
	Value	Unit	CH_4	
2018 Solid waste – grit, grease, and screenings sent from Wastewater Facility to landfill	1,434	short tons	13.5 kg/short ton	Other

Method and data source notes: Activity data provided by Wastewater Facility; CH_4 emission factor is a national emission factor - the 2018 emission factor for 100 percent mixed municipal solid waste. The emission calculation assumes that the landfill gas collection system captures 75 percent of CH_4 produced and that 10 percent of the gas that is not captured is oxidized (and thus subtracted from emissions).

	Activity Data			Emission Factor	Method
	Data Type	Value	Unit	CH_4	
2018 Solid waste – landfill gas combustion (Singleton landfill)	Average gas flow rate	58,980	scf/minute	0.05433 g/scf	LGO Protocol 1.1, Method 9.3.2
	Average fraction of CH_4 in gas	29	percent		
	Destruction efficiency	99	percent		

Method and data source notes: Activity data provided by Environmental Services Department, Sustainability and Compliance Division. This emission calculation is based on an estimate of the amount of CH_4 that escaped combustion. CH_4 emission factor is derived from the fraction of CH_4 in landfill gas and flare destruction efficiency, assuming that the density of CH_4 is 19 g/scf. Final calculation assumes that 1 year = 365.25 days.

	Activity Data		Emission Factor	Method
	Value	Unit	CH_4	
2018 Solid waste – waste sent to landfill	2121.85	short tons	10.012 MT/short ton	Other

Method and data source notes: Activity data provided by Environmental Services Department, Integrated Waste Management Division; CH4 emission factor is a national emission factor for average mixed municipal solid waste. This is a conservative estimate – very little organic material should be left in the processing residues, but until this can be confirmed by a waste characterization study, we assume that the residues have the composition of average mixed municipal solid waste. The emission calculation assumes that the landfill gas collection system captures 75 percent of CH_4 produced and that 10 percent of the gas that is not captured is oxidized (and thus subtracted from emissions). Landfilled waste from 15 small fire stations and 2 small libraries with residential service, for which waste volume is not tracked, was estimated using 2018 data on the share of City government waste that was sent to landfill (16.7 percent) and these assumptions: total volume of waste per building per week – 1 cubic yard; density of waste – 800 lbs/cubic yard. This activity data includes only waste sent to landfill after processing at the GreenWaste Material Recovery Facility and Z-Best Composting Facility. The City also sends waste directly to landfill; this was excluded either because it is inert and does not generate emissions (construction and demolition debris; earth, dirt and soil; asphalt and concrete; debris from the fire training center) or because it is not generated by City operations (street sweepings; trash collected during creek cleanups; illegal dumping; debris from homeless encampments). This activity data also does not include waste sent to landfill that was sorted from the recyclables stream.

	Activity Data		Emission Factors			Method
	Fuel Use (gallons)	VMT	CO_2	CH_4	N_2O	
2018 Vehicle fleet - CNG use in Airport shuttle buses	154,522	652,912	53 kg/MMBtu	2 g/mile	0.18 g/mile	LGO Protocol 1.1, Method 7.1.1

Method and data source notes: Activity data derived from 2019 Mineta San José International Airport CEQA Greenhouse Gas Emissions Technical Report – Amendment to Airport Master Plan; CO_2, CH_4, and N_2O emission factors are national emission factors. Shuttle fuel use data are from 2017; VMT was estimated based on annual fuel consumption and annual fuel economy of the shuttle bus model when new.

	Activity Data			Emission Factors			Method
	Vehicle Type	Fuel Use (gallons)	VMT	CO_2	CH_4	N_2O	
2018 Vehicle fleet - gasoline use	On-road	799,967.7	8,765,533	70 kg/ MMBtu	0.031 g/mile	0.023 g/mile	LGO Protocol 1.1, Method 7.1.1.1
	On-road hybrid	44,321.1	1,320,294	70 kg/ MMBtu	0.019 g/mile	0.012 g/mile	
	Off-road large utility	263.8	74	70 kg/ MMBtu	4.6 g/ MMBtu	1.8 g/ MMBtu	
	Off-road small utility	4,311.3	33,835	70 kg/ MMBtu	4 g/ MMBtu	1.8 g/ MMBtu	
	Off-road boat	292.7	28	70 kg/ MMBtu	5.1 g/ MMBtu	1.8 g/ MMBtu	

Method and data source notes: Activity data provided by City Fleet Manager; CO_2, CH_4, and N_2O emission factors are national emission factors. On-road vehicles include bi-fuel CNG/gasoline vehicles, which only used gasoline in 2018.

	Activity Data		Emission Factors			Method
	Fuel Use (gallons)	VMT	CO_2	CH_4	N_2O	
2018 Vehicle fleet - LPG use	542.5	1,336	63 g/MMBtu	0.037 g/mile	0.067 g/mile	LGO Protocol 1.1, Method 7.1.1

Method and data source notes: Activity data provided by City Fleet Manager; CO_2, CH_4, and N_2O emission factors are national emission factors.

	Activity Data			Emission Factors			Method
	Vehicle Type	Fuel Use (gallons)	VMT	Biogenic CO_2	CH_4	N_2O	
2018 Vehicle fleet - renewable diesel use	On-road	277,986.8	2,252,647	74 kg/ MMBtu	0.005 g/mile	0.005 g/mile	LGO Protocol 1.1, Method 7.1.1.1
	On-road hybrid	315.3	1,301	74 kg/ MMBtu	0.005 g/mile	0.005 g/mile	
	Off-road large utility	8084.1	6,277	74 kg/ MMBtu	0 MT/ MMBtu	0 MT/ MMBtu	
	Off-road small utility	10,888.7	17,002	74 kg/ MMBtu	0 MT/ MMBtu	0 MT/ MMBtu	
	Off-road boat	611.1	1,809	74 kg/ MMBtu	0 MT/ MMBtu	0 MT/ MMBtu	

Method and data source notes: Activity data provided by City Fleet Manager; CO_2, CH_4, and N_2O emission factors are national emission factors.

	Emissions			Method
	Biogenic CO_2	CH_4	N_2O	
2018 Wastewater Facility biogas use for wastewater treatment – digester gas	16,871.92 MT	1.037 MT	0.20 MT	Other

Method and data source notes: Data retrieved from 2018 Wastewater Facility Cal e-GGRT Summary Report.

	Activity Data		Emission Factors			Method
	Value	Unit	CO_2	CH_4	N_2O	
2018 Wastewater Facility electricity use for wastewater treatment (PG&E)	27,135,008	kWh	206.29 lbs/MWh	34 lbs/GWh	4 lbs/GWh	LGO Protocol 1.1, Method 6.2.1

Method and data source notes: Activity data provided by PG&E; 2018 CO_2 emission factor from the Climate Registry (https://www.theclimateregistry.org/our-members/cris-public-reports/); 2018 CH_4 and N_2O emission factors are for the WECC California subregion and were retrieved from eGRID.

	Activity Data		Emission Factors			Method
	Value	Unit	CO_2	CH_4	N_2O	
2018 Wastewater Facility electricity use for wastewater treatment (SJCE)	8,347,600	kWh	20 lbs/MWh	34 lbs/GWh	4 lbs/GWh	LGO Protocol 1.1, Method 6.2.1

Method and data source notes: Activity data provided by PG&E; 2018 CO_2 emission factor from SJCE 2018 Integrated Resource Plan; CH_4 and N_2O emission factors are for the WECC California subregion and were retrieved from eGRID.

	Emissions			Method
	CO_2	CH_4	N_2O	
2018 Wastewater Facility fuel oil use for wastewater treatment – distillate fuel oil #2	160.34 MT	0.0065 MT	0.0013 MT	Other

Method and data source notes: Data retrieved from 2018 Wastewater Facility Cal e-GGRT Summary Report.

	Emissions			Method
	CO_2	CH_4	N_2O	
2018 Wastewater Facility natural gas use for wastewater treatment	19,626.45 MT	0.37 MT	0.037 MT	Other

Method and data source notes: Data retrieved from 2018 Wastewater Facility Cal e-GGRT Summary Report.

	Activity Data	Emission Factor	Method
	Daily inorganic nitrogen load	N_2O	
2018 Wastewater process - effluent	5,023 kg/day	5 g N_2O/kg nitrogen in effluent	LGO Protocol 1.1, Method 10.3.2.3

Method and data source notes: Activity data provided by Wastewater Facility; N_2O emission factor is a national emission factor. Organic nitrogen is also released in Wastewater Facility effluent, but this nitrogen is refractory – difficult to transform and not bioavailable, and so not expected to lead to significant N_2O emissions. For this reason, only the amount of inorganic nitrogen in effluent was used for this calculation.

	Activity Data		Emission Factor	Method
	Population served	Industrial Commercial Discharge Multiplier	N_2O	
2018 Wastewater process - nitrification/ denitrification	1,400,000	1.25	7 g/person	LGO Protocol 1.1, Method 10.3.2.1

Method and data source notes: Activity data provided by Wastewater Facility; Industrial Commercial Discharge Multiplier is a standard national default value; N_2O emission factor is a national emission factor.

	Activity Data		Emission Factors			Method
	Value	Unit	CO_2	CH_4	N_2O	
2018 Water services electricity use (PG&E)	6,826,594.5	kWh	206.29 lbs/MWh	34 lbs/GWh	4 lbs/GWh	LGO Protocol 1.1, Method 6.2.1

Method and data source notes: Activity data provided by PG&E; 2018 CO_2 emission factor from the Climate Registry (https://www.theclimateregistry.org/our-members/cris-public-reports/); 2018 CH_4 and N_2O emission factors are for the WECC California subregion and were retrieved from eGRID.

	Activity Data		Emission Factors			Method
	Value	Unit	CO_2	CH_4	N_2O	
2018 Water services electricity use (SJCE)	1,459,519.5	kWh	20 lbs/MWh	34 lbs/GWh	4 lbs/GWh	LGO Protocol 1.1, Method 6.2.1

Method and data source notes: Activity data provided by PG&E; 2018 CO_2 emission factor from SJCE 2018 Integrated Resource Plan; 2018 CH_4 and N_2O emission factors are for the WECC California subregion and were retrieved from eGRID.

	Activity Data	Emission Factors			Method
	Fuel Use (gallons)	Biogenic CO_2	CH_4	N_2O	
2018 Water services renewable diesel use	120.9	73.96 kg/MMBtu	10.87 g/MMBtu	0.72 g/MMBtu	LGO Protocol 1.1, Method 6.1.1

Method and data source notes: Activity data provided by City Fleet Manager; CO_2, CH_4, and N_2O emission factors are national emission factors.