City of SACRAMENTO
Community Development

Planning and Design Commission Report

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File ID: 2020-00824 August 13, 2020 **Discussion Item 03**

Title: Sacramento Climate Action Plan Update

File ID: 2020-00824

Location: Citywide

Recommendation: **Review and comment** on preliminary draft measures and associated greenhouse gas (GHG) emission reduction actions proposed for the Climate Action Plan (CAP).

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Attachments:
1-Description/Analysis
2-Background
3-Community GHG Inventory and Forecast
4-Appendix C - Draft Community GHG Emission Reductions
5-CAP Equity Considerations

Description/Analysis

Issue Detail: Recognizing the need for urgent action, the City is in the process of updating the Sacramento CAP to reduce community greenhouse gas emissions to 40% below 1990 levels by 2030 and achieve carbon neutrality by 2045.

The Sacramento CAP was first adopted on February 12, 2012 as a standalone document. Key CAP strategies were later integrated as policies into the 2035 General Plan on March 3, 2015, as summarized in Appendix B of the 2035 General Plan. The Sacramento CAP reduces community-wide GHG emissions from Sacramento community activities that primarily occur within the city boundary. Consistent with standard practice, the GHG inventory for the community CAP includes primary, local GHG emissions sources. These emissions sources are also those that local governments can influence using certain “levers” of the local government authority (or by working with partners such as SMUD and Sacramento Regional Transit), to reduce GHGs related to energy, transportation, and solid waste.

While the current CAP is incorporated within the 2035 General Plan, the new CAP will be a standalone document. Further, the CAP will integrate municipal GHG emission reduction strategies and targets that currently live separately in the 2016 CAP for Internal Operations. The new integrated CAP will be called the ***Sacramento Climate Action and Adaptation Plan (CAAP)*** to emphasize the adaptation and resiliency section that will be covered in a separate chapter within the CAAP. This report to the Commission will mainly address GHG mitigation, since the adaptation and resiliency section of the CAAP will be developed at a later stage of the project.

The CAP will meet California Environmental Quality Act (CEQA) requirements for a qualified CAP per Section 15183.5 of the CEQA Guidelines, which provide a framework for programmatic GHG emission reduction plans so that the Master Environmental Impact Report (EIR) for the 2040 General Plan can provide CEQA streamlining for development projects.

During development of the CAP through the 2040 General Plan update, staff have completed the following steps:

- Coordinated with the Mayors’ Commission on Climate Change to incorporate applicable recommendations into CAAP measures and actions
- Conducted Phase 1 and Phase 2 community outreach
- Interest-Based Focus Group on the CAP
- Identified GHG emissions resulting from sources in the community
- Prepared a GHG inventory and forecast, which quantifies existing GHG emissions for the baseline year of 2016 and projected GHG emissions associated with future growth (see Attachments 3).
- Established recommended GHG emission reduction targets which, if achieved, would render the community's greenhouse gas emissions to-be less than cumulatively considerable for purposes of CEQA

- Identified a preliminary set of measures and actions that will collectively achieve the recommended GHG emission reduction targets (see Attachment 4)
- Completed a gap analysis to identify the anticipated GHG emissions not mitigated by CAP actions, which need to be closed to meet GHG emission reduction targets for 2030 and 2045

The team has identified and substantiated the efficacy of the preliminary GHG reduction measures in a draft technical appendix for the CAAP, Appendix C (Attachment 4). The measures in this report present significant and trackable GHG reductions in the primary sectors of energy, transportation, waste, water, and carbon sequestration. Attachment 4 contains the preliminary GHG reduction measures and actions developed to date, in addition to quantification of GHG reductions and documentation of evidence to demonstrate that if implemented, measures are likely to collectively achieve GHG emission reduction targets.

Staff are requesting that the Planning and Design Commission (PDC) review and comment on the draft community GHG emissions reductions in Appendix C (Attachment 4). Attachment 2-Background includes a summary of specific emission reduction measures in which PDC input is requested.

Upcoming milestones in the development of the CAAP include the following anticipated dates as a part of the 2040 General Plan Outreach:

- Additional community outreach through virtual stakeholder meetings (ongoing)
- Conducting a citywide scientific survey (August 2020)
- Ten virtual GP Community Plan area meetings (September 2020 - October 2020)
- Staff will present to City Council the CAAP framework for approval (December 2020)
- Release of the Draft CAAP (Spring of 2021)
- Adoption of the Final CAAP (Late 2021)

Policy Considerations: The 2035 General Plan includes the following key policies related to GHG emissions reduction:

ER 6.1.5 **Community Greenhouse Gas Reductions** **.** The City shall reduce community GHG emissions by 15 percent below 2005 baseline levels by 2020 and strive to reduce community emissions by 49% percent and 83% percent by 2035 and 2050, respectively. *(RDR)*

ER 6.1.6 **Municipal Greenhouse Gas Reductions** **.** The City shall maintain and implement its Phase 1 Climate Action Plan to reduce municipal GHG emissions by 22 percent below 2005 baseline level by 2020 and strive to reduce municipal emissions by 49 percent and 83 percent by 2035 and 2050, respectively. *(SO)*

ER 6.1.7 **Greenhouse Gas Reduction in New Development** **.** The City shall reduce greenhouse gas emissions from new development by discouraging auto-dependent sprawl and dependence on the private automobile; promoting water conservation and recycling; promoting development that is compact, mixed use,

pedestrian friendly, and transit oriented; promoting energy-efficient building design and site planning; improving the jobs/housing ratio in each community; and other methods of reducing emissions. *(RDR)*

Economic Impacts: Not applicable

Environmental Considerations: Environmental Considerations: Review and comment of the Climate Action Plan for information and guidance is not subject to the California Environmental Quality Act (CEQA) as no action is being taken on the project. The Climate Action Plan is a project under CEQA and subject to review. The Climate Action Plan will be evaluated and included in the analysis contained in the 2040 General Plan Master EIR that will be provided to City Council for their consideration and certification prior to action on the project.

Sustainability: It is anticipated that the CAAP will have a net positive environmental impact due to its purpose to reduce GHG emissions caused by Sacramento's community activities and municipal operations. Other environmental co-benefits, such as improved air quality, are associated with GHG emission reductions. The CAAP will prioritize strategies that are cost-effective for the City and community (i.e., those that are financially sustainable to the extent feasible). The CAAP will also prioritize equity and actions that will result in cost savings and quality-of-life improvements for low-income households.

Commission/Committee Action: Not applicable

Rationale for Recommendation: The CAAP will provide a number of important benefits, including the following:

- Creating a roadmap for the longer-term transition to carbon-neutrality by 2045.
- Providing a uniform approach to GHG mitigation for development projects, thereby improving the predictability and certainty of the development review process.
- Helping the City prepare for pending changes to the State and Federal regulatory Environment.
- Stimulating investment and innovation in renewable energy, energy efficiency, and related technologies, thereby creating and retaining "green collar jobs" and reinvestment of energy savings in the local economy.
- Positioning the City to compete for grant funding to implement the City's sustainability policies.
- Helping low-income households save energy and money.
- Improve public health with cleaner indoor and outdoor air quality resulting from increased adoption of electric and zero-emission technologies in transportation and the built environment.
- Helping the community to begin to adapt to the likely effects of climate change in our region and achieve more resilient, equitable outcomes.

- Improve the efficiency of City operations and prioritize strategies for the City to effectively lead by example and demonstrate inclusive sustainability leadership as California's Capital.

Financial Considerations: Preliminary costs will be developed as a part of the CAAP process, and the consultant team will evaluate potential funding sources for potential CAAP actions.

Public/Neighborhood Outreach and Comments: To ensure community support for the CAAP, staff have conducted an extensive community outreach program. The majority of feedback from the community has been supportive. A focus on equity will continue to be prioritized during the implementation phase (see Attachment 5-CAP Equity Considerations, which includes responses to key concerns from the community and the EJ Working Group). To date, outreach efforts have included:

- Two meetings with the General Plan Environmental Justice Working Group (EJWG) to review 22 GHG reducing actions
- Four city-wide workshops (April/May of 2019)
- Ten community plan meetings (Summer of 2019)
- Three listening sessions (2019)
- Virtual questionnaires with 920 respondents (May-June 2020)
- Plus: Pop-up events, youth engagement at Luther Burbank High School, youth events at Dyer Kelly elementary school, youth engagement through Summer at City Hall, youth engagement with youth ambassadors from La Familia, Asian Resources, and Greentech, Lift every Voice event (2019 and 2020)

Background

The City of Sacramento has two types of climate action plans:

- A **Community CAP** that was first adopted on February 12, 2012 as a standalone document which was incorporated into the 2035 General Plan on March 3, 2015. (Appendix B of the 2035 General Plan contains a list of General Plan policies that address climate change).

  The community CAP addresses community-wide greenhouse gas emissions (GHG) from activities within the Sacramento community within the city boundary. Consistent with standard practice, the GHG inventory for the community CAP includes only categories of GHG emissions which local governments can influence (using certain levers that local governments have jurisdiction over, such as building permits), but not necessarily control. These categories include GHG emissions related to energy, transportation, and solid waste.

- The City also has a **Municipal CAP** which was first prepared in 2010 and was last updated in 2016 as the Climate Action Plan for Internal Operations (IO), or IO CAP. The IO CAP covers GHG emissions from the City's internal municipal operations, such as the City's buildings, facilities, and fleet. Within the limitations of the City's budget, the City has full control over GHG emissions in the municipal inventory.

  The municipal GHG inventory is generally a small subset of the community GHG inventory (less than 2%). The City has already exceeded its target to reduce municipal GHG emissions by 22 percent below 2005 baseline level by 2020. The municipal inventory conducted for the current CAP update process shows that the City has reduced GHGs from its municipal operations from 78,564 MT CO_2e in 2005 to 56,463 MT CO_2e in 2016, achieving a 28% reduction in GHG emissions between 2005 and 2016.

State Directives and Target Setting

California has taken an aggressive stance to mitigate climate change at the State-level through the adoption of legislation and policies. The two major State GHG-related goals are established by Assembly Bill (AB) 32 and Senate Bill (SB) 32. AB 32 required State agencies to reduce State GHG emissions to 1990 levels by 2020; SB 32 requires a 40 percent reduction below 1990 levels by 2030.

Executive Order B-55-18 was signed by the Governor in 2018. It sets a goal of achieving carbon neutral as soon as possible, but no later than 2045, and maintaining neutrality thereafter. It also calls for 100 percent renewable energy by 2045. While executive orders are binding only for state agencies, EO B-55-18 serves as a prediction for local governments regarding the likely targets for future state legislation that will be set CEQA targets for local governments.

Background

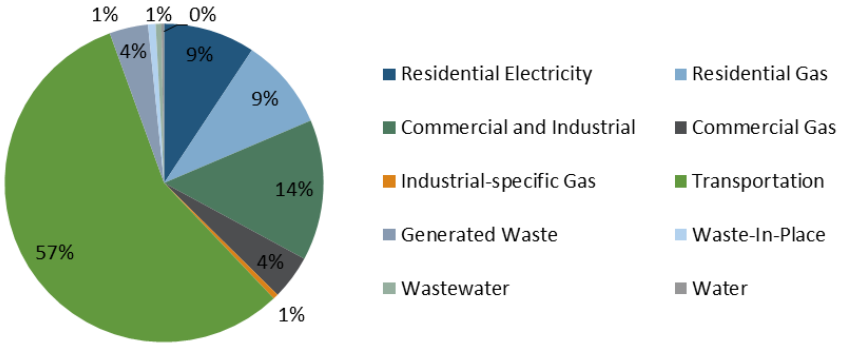
In order to have a qualified climate action plan which provides CEQA streamlining for development projects covered by the 2040 General Plan Master Environmental Impact Report, GHG targets must be consistent with state directives and should reduce emissions over the life of the plan to levels which, if achieved, would render the community's greenhouse gas emissions to be less than cumulatively considerable. The most legally defensible targets for the City of Sacramento are to set the target at 40% reduction below 1990 levels by 2030, and to develop a strategy for achieving carbon-neutral by 2045.

Greenhouse Gas Inventory

The community GHG inventory for the 2016 calendar year was completed in order to measure Sacramento's progress toward its 2020 GHG reduction goals.

Sacramento's community-wide emissions for 2016 are estimated to be 3,424,728 metric tons (MT) of carbon dioxide equivalent (CO_2e). A summary of these emissions by sector is provided in **Error! Reference source not found.** below. A detailed discussion of the results of the GHG inventory, forecast, and methodology can be found in Attachment 3.

2016 City of Sacramento Community Emissions by Sector



	2005 (MT CO_2e)	2016 (MT CO_2e)	Percent Change
Residential Electricity	365,319	318,275	-13%
Commercial/Industrial Electricity	624,811	489,945	-22%
Residential Gas	348,859	318,304	-9%
Commercia District Gas	18527	172019	-8%
Waste	455,222	160,843	-65%
Water	12,810	9,607	-25%
Wastewater	57,380	19,867	-65%
Transportation	2,184,617	1,935,870	-11%
Total Emissions	4,235,545	3,424,728	-19%

Background

Emissions Per Capita	9.57	7.04	-26%
MT CO_2e: metric tons of carbon dioxide equivalent			

The 2020 target for the Community CAP is to reduce community GHG emissions by 15 percent below 2005 baseline levels by 2020. The table above summarizes GHG emissions changes since the Sacramento's first GHG inventory was prepared in 2005. It shows that Sacramento has reduced overall emissions by 18 percent and has achieved emissions reductions in every sector in the period between 2005 and 2016.

Major reductions were seen in the waste sector and wastewater sectors although these sectors make up relatively small proportions of the City's overall emissions. Reductions in the natural gas sector were driven primarily by a reduction in gas consumption whereas emissions reductions in the electricity and transportation sectors were driven entirely by reductions in emission factors (such as SMUD shifting from fossil fuels to renewables etc.).

During the period from 2005 to 2016, Sacramento had an increase in population of 10 percent yet achieved a 26 percent reduction in per capita emissions from 2005 to 2016. This translated to a 19 percent reduction in total per capita GHG emissions from 2005 to 2016, even with population growth. This reduction exceeds the emission reduction target of 15 percent below 2005 levels by 2020 and therefore, if emissions do not increase over the next four years, the 2020 CAP target is expected to be met.

GHG Forecast, Carbon Neutral per Capita Target, and Gap Analysis

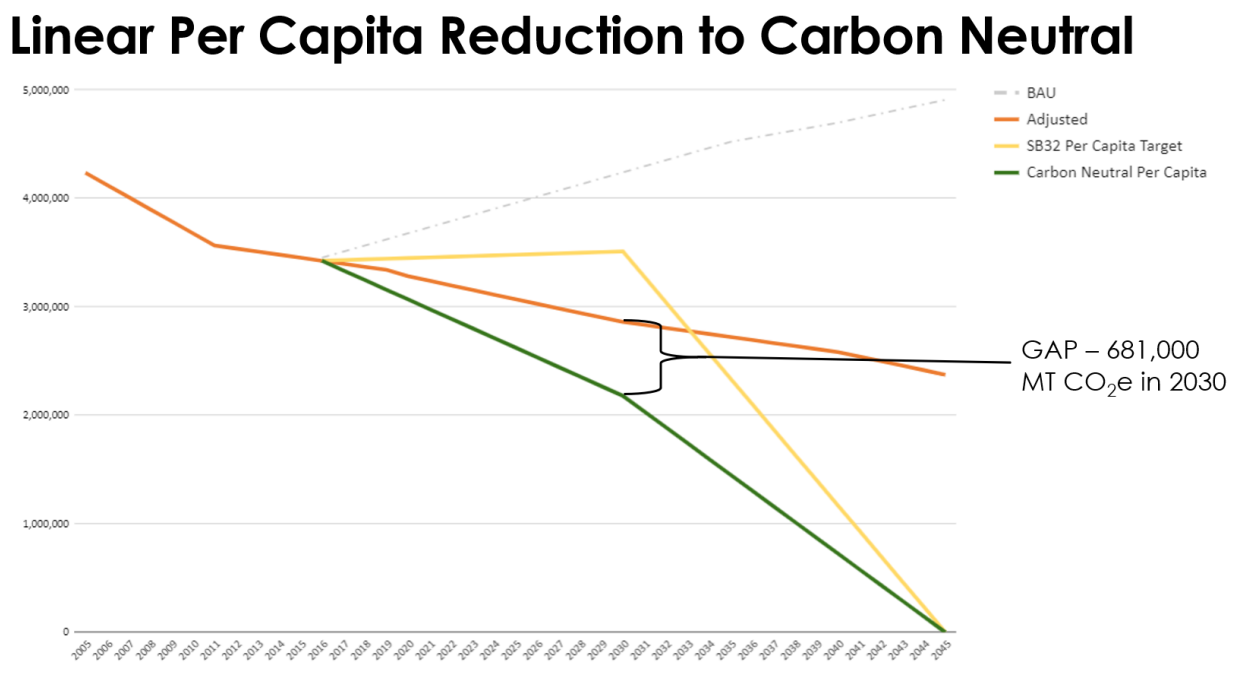
The diagram below illustrates the GHG reductions set by SB32 (yellow line), the business-as-usual (BAU) forecast (dashed line), adjusted forecast (orange line) and the linear per capita pathway to carbon neutral (green line).

Even though it is a more aggressive target than that set by SB32 for 2030, staff will be proposing that the City adopt a linear per capita reduction path to achieve carbon neutral by 2045. The logic for this recommendation is that it will be more difficult to achieve carbon neutrality in the long run if we do not take early action to significantly reduce our GHG emissions by 2030

The business-as-usual (BAU) forecast (dashed line) provides a forecast of how GHG emissions would change over time if consumption trends continue as they did in 2016 and growth were to occur as projected in the City's current General Plan, absent any regulations which would reduce local emissions.

The adjusted forecast (orange line) is an even a more informative metric for future emissions. It incorporates state and federal legislation and programs which are currently codified and are expected to continue being implemented through 2045, such as SB 100 and California Air Resources Board (CARB) tailpipe emissions standards. This forecast provides a more accurate picture of future emissions growth and the emissions reduction that the City and community will be responsible for after state regulations are implemented. Calculating the difference between orange line and the green line gives

us the gap (681,000 MT CO_2e in 2030) that needs to be closed through City CAP measures in order to meet the recommended target.



Local Government "Levers" for Climate Action

Local governments do not directly control community-wide emissions, but they do have jurisdictional authority with "levers" for either regulating activities or influencing community behaviors that generate GHG emissions. For example:

- Local governments issue building permits, which provides the opportunity to pass ordinances to reduce GHG emissions related to buildings. "Reach codes" can be passed by local governments for new construction, or even for existing structures when triggered by an applicant applying for a building permit to make changes to an existing structure.
- Revisions to the General Plan, Planning and Development Code and other plans, in combination with the review of proposals for new development enables local governments to make changes in land use patterns and standards for new development. Increasing density, intensity, mixed-use development, and reducing required parking ratios or setting maximum allowable parking for new development can incrementally reduce carbon emissions from transportation and buildings over time.
- Services: Since local governments provide services such as collecting solid waste and providing municipal water supply, they can make changes in the way services are delivered. For example, the local governments can require water meters or require separate bins for yard waste and other organics so that organics can be diverted from landfills. (This reduces GHG emissions because

anerobic decomposition of organic waste in landfills generates methane, which is a powerful greenhouse gas).

- Transportation: The City's Public Works Department is responsible for transportation infrastructure such as local streets, bikeways, and sidewalks (the City does not control the public transit system, which is operated by Sacramento Regional Transit). Within the limits of the City's budget, the City can make changes to transportation infrastructure such removing vehicle travel lanes and adding bike ways. Transportation infrastructure changes can potentially change travel behavior and result in a mode shift that reduces GHG emissions from transportation.

Electrification: A Key Strategy for the Climate Action Plan Update:

SB100 mandates that California utilities provide carbon-neutral electricity by 2045, creating an opportunity for the elimination of fossil fuels and the electrification of buildings and vehicles as a key strategy for the Climate Action Plan. SMUD is halfway to its goal of achieving carbon-neutral electricity by 2040. The City can work with SMUD to transition Sacramento to a future in which energy from fossil fuels is no longer used in buildings and transportation.

Toward this goal, the City can:

1. Eliminate natural gas in new construction by passing an ordinance that requires new construction to be all-electric. (The Climate Commission Final Report recommended that the mandate for all-electric construction be affective for new low-rise buildings by 2023 and all buildings by 2026).
2. Transition gas in existing buildings to carbon-free energy by 2045 by passing an electrification ordinance for existing buildings/construction that will be implemented through the building permit process to transition fossil fuels to electric by attrition. The existing construction ordinance would be implemented in phases as follows:

   Phase 1: No new expansions of gas appliances or gas lines at existing buildings/construction.

   Phase 2: Require HVAC system replacements and new hot water heaters, and other appliances to be all-electric or utilize other low-carbon technologies as the market evolves.

   Phase 3: Provide enforcement with a permit compliance program to be implemented at point-of-sale to ensure that existing buildings have permits for all previous work.
3. Transition motorists to zero emission vehicles by improving the availability of EV charging. This includes amending the Sacramento City Code to require 20% EV capable charging spaces and at least one installed, operational Level II EV charger in new multifamily and nonresidential development and continue to install and provide EV charger access at City-owned facilities and parking garages.

Continue to support a variety of public and public/private partnerships to provide more publicly accessible chargers throughout the City.

In addition to the key measures above, staff would be interested in hearing the Commission's input on the following supportive measures:

1. Supporting infill growth with the goal of 90% of growth in established and center/corridor communities and 90% small-lot and attached homes by 2040, consistent with the regional Sustainable Communities Strategy.
2. Reducing VMT through prioritizing active transportation over motor vehicles.
3. Increasing the urban tree canopy to sequester carbon dioxide, particularly in communities where tree canopy coverage is below average.

A detailed analysis of Draft Community CAP measures and actions can be found in Attachment 4, Appendix C – Community GHG Reductions.

Appendix A – Community Inventory and Forecast Methodology

City of Sacramento Climate Action Plan Update

prepared for

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March 2020

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1 Introduction

California considers greenhouse gas emissions (GHG) emissions and the impacts of climate change to be a serious threat to the public health, environment, economic well-being, and natural resources of the State, and has taken an aggressive stance to mitigate the impact on climate change at the State-level through the adoption of legislation and policies. Many cities have developed local climate action plans and aligned goals to correspond with State emissions reduction targets. The two major State GHG-related goals are established by Assembly Bill (AB) 32 and Senate Bill (SB) 32. AB 32 required State agencies reduce State GHG emissions to 1990 levels by 2020 whereas SB 32 requires a 40 percent reduction below 1990 levels by 2030. The goals set by AB 32 were achieved by the State in 2016[1] and many jurisdictions are completing GHG inventories to quantify progress toward their own 2020 goals as well as develop targets to align with the requirements of SB 32.

This technical appendix provides a complete analysis of the previous community-wide GHG emissions inventories completed for the City of Sacramento's 2005 and 2011[2] emissions as well as details on the methodology used for the 2016 inventory update which is also used as the baseline for the forecasting process. Emissions are forecast for the years 2020, 2025, 2030, 2040, and 2045 to align with State and City targets.

Estimating GHG emissions enables local governments to establish an emissions baseline, track emissions trends, identify the greatest sources of GHG emissions within their jurisdictions, and set targets for future reductions. This inventory is intended to inform completion of a qualified GHG reduction plan for the City of Sacramento and is compliant with the ICLEI – Local Governments for Sustainability (ICLEI) *U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions*[3] (Community Protocol) as well as California Environmental Quality Act (CEQA) Guidelines Section 15183.5(b) for the requirements of a 'qualified' GHG emissions reduction plan. Methodology for some sections has been updated slightly to conform with the industry standard for California cities as recommended in the Association for Environmental Professionals (AEP) *California Supplement to the United States Community-Wide GHG Emissions Protocol*[4] (California Supplement). Emissions inventories are an iterative process and each year must be viewed in the context of other inventories and relative trends of each sector to maintain consistency with the emissions inventory methods and factors.

Emissions contained within this inventory include activities under the jurisdictional control or significant influence of the City of Sacramento, as recommended by AEP in preparing Community Protocol and CEQA-compliant inventories.[4] The municipal operations inventory is a subset of the community-wide inventory, meaning the municipal emissions are included within the community-

[1] California Air Resources Board. California Greenhouse Gas Emissions Inventory. Accessed at: https://ww3.arb.ca.gov/cc/inventory/inventory.htm. Accessed on: July 2019

[2] Portions of the 2011 inventory were extrapolated based on growth from 2005 levels and therefore all sectors may not be comparable.

[3] ICLEI. 2013. U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions, Version 1.1

[4] Association of Environmental Professionals. 2013. The California Supplement to the United States Community-Wide Greenhouse Gas (GHG) Protocol.

wide inventory. These municipal emissions calculations and forecast are included in a separate technical appendix.

1.1 Executive Summary

The City of Sacramento has completed a GHG inventory for the 2016 calendar year to measure progress toward its 2020 GHG reduction goals as set in the first City of Sacramento Climate Action Plan[5] and assist in the development of an updated plan by developing a forecast and gap analysis to identify climate action plan policies that will be needed to achieve longer term targets. SB 32[6] established 2030 as the next major milestone of GHG reduction targets. The 2016 City of Sacramento inventory was used to develop a forecast to assist the City in setting targets which are consistent with State-level goals and the City of Sacramento General Plan which is currently being updated. Two projections were developed for the City to quantify expected emissions over time; a *business-as-usual scenario* and an *adjusted scenario*.

In 2016, the City of Sacramento's emissions are estimated to be 3,424,728 metric tons (MT) of carbon dioxide equivalent (CO_2e). A summary of these emissions by sector is provided in Table 1 with a discussion of the inventory methodology and detailed results in Section 3. A summary of the emissions forecast by year through 2045 is provided in Table 4 with further discussion in Section 4.

Table 1 2016 GHG Inventory

Sector	Activity Data	Emission Factors	Units	MT CO_2e
Residential Electricity (kWh)	1,423,419,583	0.000224	MT CO_2e/kWh	318,275
Residential Gas (therms)	59,977,656	0.00531	MT CO_2e/therm	318,304
Industrial and Commercial Electricity (kWh)	2,191,180,705	0.00022	MT CO_2e/kWh	489,945
Commercial Gas (therms)	28,980,911	0.00531	MT CO_2e/therm	153,803 [1]
District Gas (therms)	3,432,409	0.00531	MT CO_2e/therm	18,216 [1]
Transportation (VMT)	4,347,013,534	0.000445	MT CO_2e/mile	1,935,870
Generated Waste (tons)	525,968	0.255412	MT CO_2e/Ton	134,339
Waste-In-Place	N/A[2]	N/A[2]	MT CO_2e/Ton	26,504
Wastewater (kWh)	N/A[3]	N/A[3]	MT CO_2e/kWh	19,867
Water (kWh)	42,963,998	0.00022	MT CO_2e/kWh	9,607
Total Emissions				**3,424,728**

MWh: megawatt hours; kWh: kilowatt hours; CO_2e: carbon dioxide equivalent; MT: metric tons; VMT: vehicle miles traveled

[1] No natural gas usage was reported for large industrial users due to California Public Utilities Commission privacy rules. The remaining industrial usage is from Pacific Gas & Electric "district" users.

[2] Waste-in-place is a direct output of a landfill gas modeling system and does not have activity data

[3] Wastewater is a combination of stationary and process emissions, further detail is Section 3.3.

[5] City of Sacramento. 2012. City of Sacramento Climate Action Plan. *Accessed at* http://www.cityofsacramento.org/~/media/Corporate/Files/CDD/Resources/Online%20Library/CAP%20Climate%20Action%20Plan/3__Chapter_1_Intro%20CAP.pdf Accessed on: June 2019

[6] Senate Bill 32 requires the State of California to reduce its overall greenhouse gas emissions 40 percent from 1990 levels by 2030.

Figure 1 2016 City of Sacramento Community Emissions by Sector

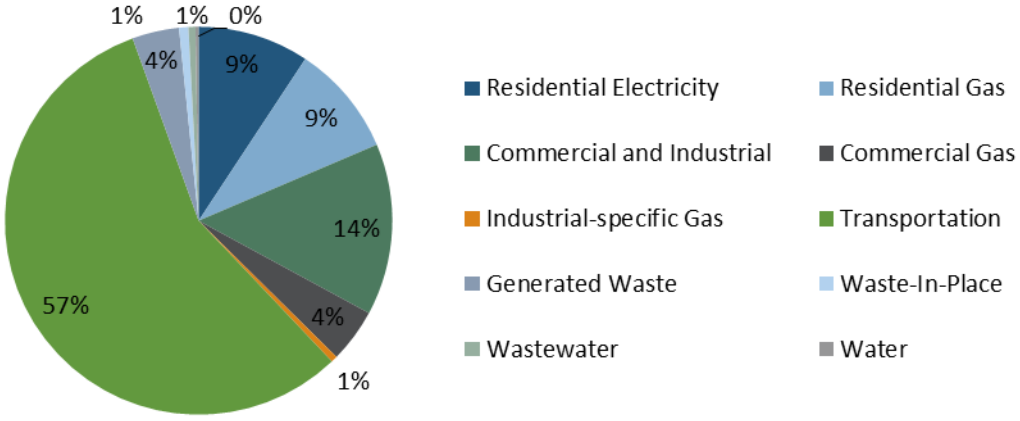


Table 2 Summary of Emissions Changes from 2005 to 2016

	2005 (MT CO_2e)	2016 (MT CO_2e)	Percent Change
Residential Electricity	365,319	318,275	-13%
Commercial/Industrial Electricity	624,811	489,945	-22%
Residential Gas	348,859	318,304	-9%
Commercial/District Gas	186,527	172,019	-8%
Waste	455,222	160,843	-65%
Water	12,810	9,607	-25%
Wastewater	57,380	19,867	-65%
Transportation	2,184,617	1,935,870	-11%
Total Emissions	4,235,545	3,424,728	-19%
Emissions Per Capita	9.57	7.04	-26%

MT CO_2e: metric tons of carbon dioxide equivalent

Since 2005 the City of Sacramento has reduced overall emissions by 18 percent and has seen emissions reductions in every sector as seen in Table 2 Summary of Emissions Changes from 2005 to 2016. Major reductions were seen in the waste sector and wastewater sectors although these sectors make up smaller proportions of the City's overall emissions. Reductions in the natural gas sector were driven primarily by a reduction in gas consumption whereas emissions reductions in the electricity and transportation sectors were driven entirely by reductions in emission factors and saw increases in activity data as shown in Table 3. During this time the City saw an increase in population of 10 percent which resulted in a 26 percent reduction in per capita emissions from 2005 to 2016. This translated to a 19 percent reduction in total GHG emissions from 2005 to 2016. This reduction exceeds the emission reduction target of 15 percent below 2005 levels by 2020 and therefore, if emissions do not increase over the next four years, the 2020 CAP target is expected to be met.

Table 3 Summary of Activity Data Changes from 2005 to 2016

Raw Activity Data	2005 Activity Data	2016 Activity Data	Percent Change
Population	442,662	486,154	10%
Residential Electricity	1,307,301,693	1,423,419,583	9%
Residential Gas Therms	65,698,581	59,977,656	-9%
Commercial Electricity kWh	2,235,898,207	2,191,180,705	-2%
District Industrial Gas Therms	5,339,537	3,432,409	-36%
Commercial Gas Adjusted	29,788,020	28,980,911	-3%
Wastewater kWh	N/A	99,541,452	N/A
Water kWh	N/A	40,101,359.00	N/A
Waste Tons	684,088	525,968	-23%
VMT	4,175,278,800	4,347,013,534	4%
VMT Emission Factor (MT CO_2e/VMT)	0.000523	0.000445	-17%
SMUD Elec Factor (MT CO2e/MWh)	0.279444984	0.223598625	-20%

MT CO_2e: metric tons of carbon dioxide equivalent

kWh: Thousand watt hours

MWh: Million watt hours

A *business-as-usual (BAU)* forecast provides a forecast of how GHG emissions would change over time if consumption trends continue as they did in 2016 and growth were to occur as projected in the City's current General Plan, absent any regulations which would reduce local emissions. The results of the (BAU) scenario are shown in Table 4. Additional discussion on the Business-as-Usual Forecast is included in Section 4.2.

A more informative metric for future emissions is the adjusted forecast. An adjusted forecast incorporates State and federal programs which are currently codified and are expected to continue being implemented through 2045, such as SB 100 and California Air Resources Board (CARB) tailpipe emissions standards. This forecast provides a more accurate picture of future emissions growth and the emissions reduction the City and community will be responsible for after State regulations are implemented. Calculating the difference between the adjusted scenario GHG emissions forecast and the reduction targets set by the City determines the gap to be closed through City Climate Action Plan policies. The results of the adjusted scenario forecast are included in Table 5 and Figure 2.

Table 4 Business-as-Usual Forecast Summary by Sector by Year

	2016 (MT CO_2e)	2020 (MT CO_2e)	2025 (MT CO_2e)	2030 (MT CO_2e)	2040 (MT CO_2e)	2045 (MT CO_2e)
Population	486,154	518,627	559,218	599,809	670,836	699,903
Jobs	217,500	253,837	299,258	344,679	408,640	426,346
Residential Electricity	318,275	339,534	366,108	392,682	439,182	458,212
Commercial/Industrial Electricity	489,945	571,798	674,115	776,431	920,511	960,396
Residential Gas	318,304	339,565	366,141	392,718	439,222	458,253
Commercial/District Gas	172,019	200,757	236,680	272,603	323,190	337,193
Waste	160,843	176,572	196,233	215,893	246,749	257,441
Water	9,607	10,546	11,720	12,895	14,738	15,376
Wastewater	19,867	21,810	24,238	26,667	30,478	31,799
Transportation	1,935,870	1,982,469	2,040,717	2,098,965	2,215,462	2,318,636
Total Emissions	**3,424,728**	**3,643,050**	**3,915,952**	**4,188,855**	**4,629,532**	**4,837,306**
Emissions Per Capita	**7.04**	**7.02**	**7.00**	**6.98**	**6.90**	**6.91**

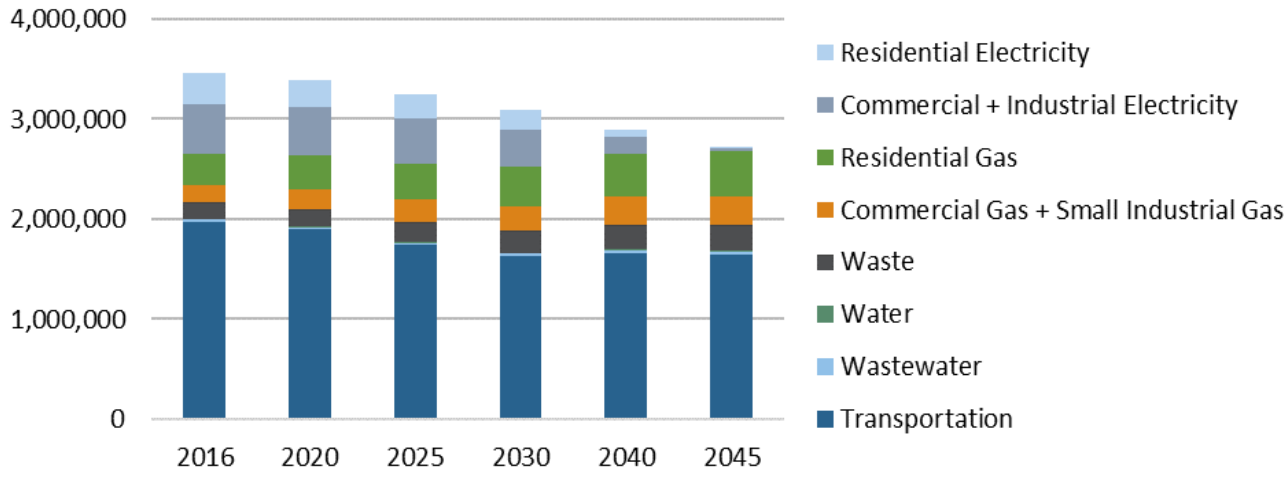
MT CO_2e: metric tons of carbon dioxide equivalent

Table 5 Adjusted Forecast Summary by Sector by Year

	2016 (MT CO_2e)	2020 (MT CO_2e)	2025 (MT CO_2e)	2030 (MT CO_2e)	2040 (MT CO_2e)	2045 (MT CO_2e)
Population	486,154	518,627	559,218	599,809	670,836	699,903
Jobs	217,500	253,837	299,258	344,679	408,640	426,346
Residential Electricity	318,275	282,001	244,445	192,905	76,710	0
Commercial/Industrial Electricity	489,945	473,740	446,096	378,081	161,952	0
Residential Gas	318,304	339,193	363,909	388,625	431,874	449,573
Commercial/District Gas	172,019	198,602	223,748	248,894	284,304	294,107
Waste	160,843	176,572	196,233	215,893	246,749	257,441
Water	9,607	8,832	8,204	6,877	2,948	0
Wastewater	19,867	21,810	24,238	26,667	30,478	31,799
Transportation	1,935,870	1,783,491	1,563,815	1,405,213	1,350,195	1,343,471
Total Emissions	**3,424,728**	**3,284,240**	**3,070,688**	**2,863,156**	**2,585,211**	**2,376,391**
Emissions Per Capita	**7.04**	**6.33**	**5.49**	**4.77**	**3.85**	**3.40**

MT CO_2e: metric tons of carbon dioxide equivalent

Figure 2 Adjusted GHG Emissions Forecast Results by Sector and Forecast Year



1.2 Background

The State of California considers GHG emissions and the impacts of global warming to be a serious threat to the public health, environment, economic well-being, and natural resources of California, and has taken an aggressive stance to mitigate the State's impact on climate change through the adoption of legislation and policies, the most relevant of which are summarized below.

- **Executive Order S-3-05,** signed by former Governor Schwarzenegger in 2005, establishes statewide GHG emissions reduction goals to achieve long-term climate stabilization as follows: by 2020, reduce GHG emissions to 1990 levels and by 2050, reduce GHG emissions to 80 percent below 1990 levels. The 2050 goal was accelerated by the 2045 carbon neutral goal established by Executive Order (EO) B-55-18, as discussed below.[7]
- **Assembly Bill 32,** known as the Global Warming Solutions Act of 2006, requires California's GHG emissions be reduced to 1990 levels by the year 2020 (approximately a 15 percent reduction from 2005 to 2008 levels). The AB 32 Climate Change Scoping Plan, first published in 2008, identifies mandatory and voluntary measures to achieve the statewide 2020 emissions limit, and encourages local governments to reduce municipal and community GHG emissions proportionate with State goals.[8]
- **Senate Bill 32,** signed by former Governor Brown in 2016, establishes a statewide mid-term GHG reduction goal of 40 percent below 1990 levels by 2030. CARB formally adopted an updated Climate Change Scoping Plan in December 2017, laying the roadmap to achieve 2030 goals and giving guidance to achieve substantial progress toward 2050 State goals.
- **Executive Order B-55-18,** signed by former Governor Brown in 2018, expanded upon EO S-3-05 by creating a statewide GHG goal of carbon neutrality by 2045. EO S-55-18 identifies CARB as

[7] Executive Orders are binding only unto State agencies. Accordingly, EO S-03-05 will guide State agencies' efforts to control and regulate GHG emissions but will have no direct binding effect on local government or private actions.

[8] Specifically, the AB 32 Climate Change Scoping Plan states CARB, "encourages local governments to adopt a reduction goal for municipal operations emissions and move toward establishing similar goals for community emissions that parallel the State commitment to reduce GHG emissions by approximately 15 percent from current levels by 2020" (p. 27). "Current" as it pertains to the AB 32 Climate Change Scoping Plan is commonly understood as between 2005 and 2008.

the lead agency to develop a framework for implementation and progress tracking toward this goal in the next Climate Change Scoping Plan Update.

The State of California, via CARB, has issued several guidance documents concerning the establishment of GHG emissions reduction targets for local climate action plans to comply with legislated GHG emissions reductions goals and CEQA Guidelines Section 15183.5(b). In the first California *Climate Change Scoping Plan,*[9] CARB encouraged local governments to adopt a reduction target for community emissions paralleling the State commitment to reduce GHG emissions. In 2016, the State adopted SB 32 mandating a reduction of GHG emissions by 40 percent from 1990 levels by 2030 and in 2017 CARB published *California's 2017 Climate Change Scoping Plan* (hereafter referred to as the Scoping Plan Update) outlining the strategies the State will employ to reach these targets.[10] With the release of the Scoping Plan Update, CARB recognized the need to balance population growth with emissions reductions and in doing so, provided a new methodology for proving consistency with State GHG reduction goals through the use of per capita efficiency targets. These targets are generated by dividing a jurisdiction's GHG emissions for each horizon year by the jurisdiction's total population for that target year and are discussed further in Section 5.

1.3 Greenhouse Gases

The 2016 City of Sacramento Community Inventory was developed using the Community Protocol[11] and California Supplement.[12] Emissions were calculated using the principles and methods from these protocols. Emissions from nitrous oxide (N_2O), methane (CH_4), and carbon dioxide (CO_2) are included in this assessment. Each GHG has a different capability of trapping heat in the atmosphere, known as its global warming potential (GWP), which is normalized relative to CO_2 and expressed as carbon dioxide equivalent, or CO_2e. The CO_2e values for these gases are derived from the Fourth Assessment Report (AR4) of the Intergovernmental Panel on Climate Change GWP values for consistency with the yearly CARB GHG inventory, as shown in Table 6.[13,14]

Table 6 Global Warming Potentials of Greenhouse Gases

Greenhouse Gas	Molecular Formula	Global Warming Potential (CO_2e)
Carbon Dioxide	CO_2	1
Methane	CH_4	25
Nitrous Oxide	N_2O	298

MT CO_2e: metric tons of carbon dioxide equivalent

[9] California Air Resources Board. 2008. Climate Change Scoping Plan. Accessed at: https://www.arb.ca.gov/cc/scopingplan/document/adopted_scoping_plan.pdf. Accessed on: June 20, 2019

[10] California Air Resources Board. California's 2017 Climate Change Scoping Plan. Accessed at: https://www.arb.ca.gov/cc/scopingplan/scoping_plan_2017.pdf. Accessed on: June 20, 2019

[11] ICLEI. 2012. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions.

[12] Association of Environmental Professionals. 2013. The California Supplement to the United States Community-Wide Greenhouse Gas (GHG) Protocol. Accessed at: https://califaep.org/docs/California_Supplement_to_the_National_Protocol.pdf. Accessed on: June 20, 2019

[13] Intergovernmental Panel on Climate Change. 2007. Fourth Assessment Report: Climate Change. Direct Global Warming Potentials.

[14] All calculations use Intergovernmental Panel on Climate Change Fourth Assessment Report GWP values with the exception of the first order of decay modeling performed for waste-in-place at the 28th Street and L&D landfills, which use a static SAR2 GWP value for methane of 21 and cannot be altered.

1.4 Excluded Emissions

The following emissions sectors have been excluded from both the 2005 and 2011 inventories and therefore were also excluded from the 2016 inventory and emissions forecast. Additional updates were also made to the 2005 and 2011 inventories in order to maintain consistency between all inventory years. These changes are summarized in Sections 2.2 and 2.3.

Consumption-based Emissions

GHG emissions from consumption of goods within the city are excluded from the inventory and forecast of City of Sacramento emissions. Currently there exists no widely accepted standard methodology for reporting consumption-based inventories.

Natural and Working Lands

GHG emissions from carbon sinks and sources in natural and working lands are not included in this inventory and forecast due to the lack of granular data and standardized methodology. CARB has included a state-level inventory of natural and working lands in the 2017 Scoping Plan Update[15] greenhouse gas inventory; however, at the time of this City of Sacramento community-wide inventory, sufficient data and tools were not available to conduct a jurisdiction-specific working lands inventory. The Nature Conservancy and California Department of Conservation[16] are exploring options for a tool which may be able to perform these inventories at a more specific geographic level.

Agricultural Emissions

Emissions from agricultural activities are not included in this inventory as the Community Protocol and California Supplement[17] both note agricultural activity is not a required component of Community Protocol inventories and should be included only if relevant to the community conducting the inventory. Regulations exist to encourage urban agriculture within the City boundaries. Many of the emissions from these activities (e.g. energy) are covered under other sectors included in this inventory and no major commercial-scale livestock activity is noted within the city boundaries.

High GWP

High GWP emissions, including chlorofluorocarbons (CFCs) and hydrofluorocarbons (HFCs) used as substitutes for ozone-depleting substances are not included in this inventory as it is not a required component of the Community Protocol and the California Supplement notes these emissions are not generally included in California inventories, including in Sacramento.

Off-Road Emissions

To maintain consistency with previous inventories (2005 and 2011) off-road emissions were not included in this analysis.

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[15] California Air Resources Board. 2017. California's Climate Change Scoping Plan.

[16] California Department of Conservation. TerraCount Scenario Planning Tool. Accessed at: https://maps.conservation.ca.gov/terracount/. Accessed on: May 15, 2019

[17] Association of Environmental Professionals. 2013. *The California Supplement to the United States Community-Wide Greenhouse Gas (GHG) Emissions Protocol.* https://califaep.org/docs/California_Supplement_to_the_National_Protocol.pdf

1.5 Forecast and Target Years Summary

Prior to 2016, the City of Sacramento completed two community-wide GHG emissions inventories, one for the year 2005 and an updated inventory for 2011. Portions of the 2011 inventory, including water, waste-in-place, and transportation, allocated emissions based solely on the overall growth of the city and therefore an accurate historical comparison between all inventories may not be feasible without further modifications to previous inventories as discussed in Section 2.

The emissions forecast is based upon the latest available data from City GHG inventories, in this case the 2016 inventory completed by Rincon. This forecast uses benchmark years of 2020, 2025, 2030, 2040 and 2045, consistent with currently codified GHG reduction targets or executive orders which are expected to be codified in future, and a target of carbon neutrality on or before 2045.

The forecast years align with the following targets:

- 2020 (AB 32)
- 2025 (progress evaluation)
- 2030 (SB 32)
- 2040 (General Plan horizon year)
- 2045 (EO B-55-18)

The 2030 and 2040 targets are required for consistency with SB 32 and the Sacramento 2040 General Plan Update respectively, while the remainder of the targets identify a clear path and milestones of progress toward the long-term State reduction goals.

2020 Progress

The first City of Sacramento Climate Action Plan was adopted in 2012. It identified how the City and broader community can reduce the City of Sacramento's GHGs and included a GHG emissions reduction target of 15 percent reduction below 2005 emissions levels by 2020 or 3,600,213 MT of CO_2e. The City of Sacramento Climate Action Plan was incorporated into the City's 2035 General Plan[18] and adopted in 2015. Based on the 2016 inventory the City of Sacramento exceeded the 2020 reduction goal by 4.8 percent and four years ahead of schedule by emitting an estimated 3,424,728 MT of CO_2e.

This 2016 inventory and forecast also considered per capita emissions reductions due to the rate at which Sacramento has grown since 2005. In 1990, GHG emissions were an estimated 9.75 MT CO_2e per person. This was calculated by back-casting the 2005 GHG inventory to 1990 (which assumes a 15 percent emission increase from 1990 to 2005) and then dividing by the 1990 population. In 2016, per capita emissions dropped to 7.04 MT CO_2e per person. This equates to an emissions reduction of 26 percent below 2005 levels and 28 percent below 1990 levels. Details and discussion of previous inventories and changes made for consistency as part of this update can be found in Section 2.

[18] City of Sacramento. 2035 General Plan. Accessed at: http://www.cityofsacramento.org/Community-Development/Resources/Online-Library/2035--General-Plan Accessed on: May 15, 2019

2 Previous Inventories

A summary of previous GHG emissions inventories can be found in Table 7. A description of the variability between methodologies used in each of the inventory years is summarized in the following sections.

Table 7 Sacramento GHG Inventories Summary

Sector	1990[1] ($MT CO_2e$)	2005[3] ($MT CO_2e$)	2011[3] ($MT CO_2e$)	2016 ($MT CO_2e$)
Residential Energy	607,052	714,178	656,472	636,578
Commercial & Industrial Energy	689,637	811,337	650,627	661,964
Transportation	1,856,925	2,184,617	2,091,154	1,935,870
Generated Waste	344,506	405,301	113,192	134,339
Waste-in-place	42,432	49,921	25,773	26,504
Wastewater	48,773	57,380	18,719	19,867
Water	10,889	12,810	9,804	9,607
Total Emissions	**3,600,213**	**4,235,545**	**3,565,741**	**3,424,728**
Emissions per capita	9.75	9.57	7.58	7.04

$MTCO_2e$: metric tons of carbon dioxide equivalent

[1] All 1990 inventory data calculated as a 15 percent reduction from 2005 inventory levels per California Air Resources Board guidelines.

[2] Methodology inconsistent, cannot be compared directly to other years

[3] Table 6 reflects the most recent numbers updated for consistency as part of the 2016 inventory and forecast

2.1 1990 Baseline

The State of California uses 1990 as a reference year to remain consistent with AB 32 and SB 32, which codified the State's 2020 and 2030 GHG emissions targets by directing CARB to reduce statewide emissions to 1990 levels by 2020 and 40 percent below 1990 levels by 2030. The City of Sacramento's initial inventory was conducted for the year 2005. The State indicated in the first Climate Change Scoping Plan in 2008 that local governments wishing to remain consistent with State targets could use a 15 percent reduction from 2005-2009 levels as a proxy for a 1990 baseline.[19] The updated 1990 proxy baseline used for target setting by the City of Sacramento is 3,600,213 MT CO_2e.

2.2 2005 Inventory Updates

In 2009, the Sacramento County Department of Environmental Review and Assessment, with guidance from ICF, Jones & Stokes prepared a GHG inventory of 2005 emissions in Sacramento

[19] Due to lack of 1990 inventory data for local governments, page 27 of the 2008 Climate Change Scoping Plan identifies 15 percent below "current" (2005-2009) levels by 2020 as consistent with the State goals of 1990 levels by 2020, allowing local governments to back-cast to develop 1990 baselines for future GHG reduction targets.

County. This inventory included unincorporated areas as well as the cities of Citrus Heights, Elk Grove, Folsom, Galt, Isleton, Rancho Cordova, and Sacramento.

Several updates to the 2005 inventory were performed as part of the current inventory and forecast efforts to align the 2005, 2011, and 2016 methodologies. These included removing large industrial natural gas users, updating the transportation emissions calculation methodologies and updating waste emissions methodology to California-specific emissions factors and AR4 GWP. Complete data for water and wastewater was not available, so the original numbers were left as found.

Natural Gas

Because of the California Public Utility Commission (CPUC) 15/15 Rule[20], although PG&E reported industrial gas use for 2005, PG&E did not report comparable data in 2016. To allow for a comparison between across all years, the 2005 inventory was updated to remove industrial gas. Large industrial emitters removed from the inventories are under the purview of the CARB Cap-and-Trade Program for emissions reductions and are, therefore, also already accounted for in the 2017 Scoping Plan Update. Attempts were made to estimate industrial natural gas emissions through CAP and Trade program data and permits, however, no complete data set could be identified. Therefore, using best available data (utility data provided by PG&E) industrial gas needed to be removed from historical inventories to allow for a consistent comparison of GHG emissions from this sector over time. Because industrial and commercial data was aggregated in the 2005 inventory, an estimate of commercial gas was made by calculating the average of the 2017 and 2016 ratios of commercial gas usage to residential gas usage (0.48207). This ratio was then used to identify the commercial portion of the commercial/industrial aggregated natural gas data. The commercial gas portion was then used to recalculate emissions for 2005 (and 2011) and the estimated industrial portion was dropped.

The ratio of residential to commercial gas use was used to correct for population growth and temperature changes which might have increased or decreased gas use in the city of Sacramento. Natural gas consumption labeled as “district” users, such as fire and school districts, were included in all years. In future years if the California Energy Commission were to change their data aggregation rules, industrial data could be reincorporated.

Waste

In 2005 and 2011, two different waste emission factors were utilized. This caused an increase in emissions from 2005 to 2011 even though the City achieved a 37 percent reduction in overall tonnage. However, neither the 2005 nor 2011 inventory documentation provided clear guidance on the methodologies used to calculate these emission factors. These values also did not make sense as an increase in methane capture occurred during these times. Therefore, to address this problem updated emission factors were derived from a waste characterization study performed by CalRecycle, previously known as the California Integrated Waste Management Board (CIWMB). Factors from the 2004 waste characterization study for the State of California were applied to the 2005 waste tonnage.

Waste-in-place was also assessed for the 2005 inventory. When the waste-in-place inventory was originally completed, it used 2002 as the baseline year for tonnage of waste in the landfills and did

[20] The 15/15 rule states no data can be provided if there are less than 15 users in any sector or if one user makes up more than 15 percent of the total usage. This applies to natural gas and electricity consumption.

not include tonnage added to the landfill from 2002 through 2005. This information was added to the CARB first order decay model and rerun to achieve a more accurate value.

Transportation

The 2005 inventory data provided in the 2012 City of Sacramento Climate Action Plan includes total transportation emissions as well as the daily vehicle miles traveled (VMT).[21] However, detailed emissions factors were not cited. Therefore, the EMFAC2017 model was used to re-calculate an emission factor, weighted average emissions per VMT, for 2005. Recalculating the emission factor and updating the 2005 inventory ensures consistency with future inventories and provides transparency for future work if needed. While not able to verify the methodology used to derive the VMT number, the VMT values appear to be consistent between inventory years and a note in the previous inventory files indicated that the data was established using the Regional Targets Advisory Committee (RTAC) origin-destination model.

Summary of Inventory Data

Table 8 and Table 9 include all of the activity data, emission factors, and total emissions available for both the original 2005 inventory (Table 8) and the updated inventory (Table 9). The only sectors for which an emission factor and activity data could not be established either through the historical inventory or through the update process were water and wastewater.

Table 8 Original 2005 GHG Inventory Data

	Original Activity Data	Original Emission Factor	Original (MT CO_2e)
Residential Electricity (kWh)	1,307,301,693	0.00028	748,792[1]
Residential Gas (therms)	65,698,581	0.00531	
Commercial and Industrial Electricity (kWh)	2,235,898,207	0.00028	
Commercial Gas (therms)	61,791,582	0.00531	979,777[1]
Industrial Gas (therms)	*included in Commercial	0.00531	
District Gas (therms)	5,339,537	0.00531	28,656
On-road Transportation (VMT)	4,175,278,800	0.000482	2,013,962
Waste (tons)	684,088	0.299459	204,856
Waste-in-Place	N/A	N/A	37,006
Wastewater	Unknown	Unknown	57,380
Water (MGY)	Unknown	Unknown	12,810
Total			**4,083,239**

kWh: kilowatt hours; mgy: million gallons per year; N/A: not applicable; MT CO_2e: metric tons of carbon dioxide equivalent; VMT: vehicle miles traveled

1: Data presented as it was provided in the original 2005 inventory.

[21] Ascent Environmental, January 13, 2012. http://ascentenvironmental.com/files/9714/0537/0505/Sacramento_CAP_Final_Draft.pdf

Table 9 Updated 2005 GHG Inventory Data

	Updated Activity Data	Updated Emission Factor	Updated (MT CO_2e)
Residential Electricity (kWh)	1,307,301,693	0.00028	365,319
Residential Gas (therms)	65,698,581	0.00531	348,859
Commercial and Industrial Electricity (kWh)	2,235,898,207	0.00028	624,811
Commercial Gas (therms)	29,787,868	0.00531	158,174
Industrial Gas (therms)	*Removed from Inventory	0.00531	–
District Gas (therms)	5,339,537	0.00531	28,353
On-road Transportation (VMT)	4,175,278,800	0.000523	2,184,617
Waste (tons)	684,088	0.59247	405,301
Waste-in-Place	N/A	N/A	49,921
Wastewater	Unknown	Unknown	57,380
Water (mgy)	Unknown	Unknown	12,810
Total			**4,235,545**

kWh: kilowatt hours; mgy: million gallons per year; N/A: not applicable; MT CO_2e: metric tons of carbon dioxide equivalent; VMT: vehicle miles traveled

2.3 2011 Inventory Updates

In 2015, the City of Sacramento, with the assistance of Ascent Environmental, conducted a GHG inventory estimate of community-wide emissions for the year 2011. After reviewing the inventory during the 2019 CAP 2.0 process, several inconsistencies were identified between the 2005 inventory, 2011 inventory, and current best practices.

Several updates to the 2011 inventory estimate were performed as part of the current effort to align the 2005, 2011, and 2016 methodologies. These included removing large industrial natural gas users (due to data availability in 2016), updating waste emissions methodology to California-specific emissions factors and AR4 GWP, and updating the transportation emissions calculation methods.

The following section outlines the changes made to the 2011 inventory for consistency with the other inventory years. Although 2011 is less important than 2005 (which derives the baseline 1990 emissions) and 2016 (which informs current progress), it still provides a useful data point for the City of Sacramento's overall emission reduction progress.

Natural Gas

Because of the CPUC 15/15 Rule[22], industrial gas was no longer reported in 2016. To allow for a comparison between across all years, the 2011 inventory was updated to remove industrial gas. Large industrial emitters removed from the inventories are under the purview of the CARB Cap-and-Trade Program for emissions reductions and are, therefore, also already accounted for in the 2017 Scoping Plan Update. Because industrial and commercial data was aggregated in the 2011 inventory, an estimate of industrial gas was made and subtracted to isolate the commercial emissions. To accomplish this, the average of the 2017 and 2016 ratios of commercial gas usage to residential gas

[22] The 15/15 rule states no data can be provided if there are less than 15 users in any sector or if one user makes up more than 15 percent of the total usage. This applies to natural gas and electricity consumption.

usage (0.48207) was applied to the 2011 inventory. This ratio was then used to identify the industrial emissions portion of the commercial/industrial aggregated natural gas data.

The ratio of residential to commercial gas use was used to correct for population growth and temperature changes which might have increased or decreased gas use in the city of Sacramento. Natural gas consumption labeled as "district" users, such as fire and school districts, was included in all years.

Waste

As noted above, in 2005 and 2011 two different waste emission factors were utilized. This caused an increase in emissions from 2005 to 2011 even though the City achieved a 37 percent reduction in overall tonnage. This was because the original 2005 calculation methodology was not able to be identified during the 2011 inventory. To address this problem, emission factors derived from the CalRecycle (formerly CIWMB) waste characterization study for the State of California for 2008 were applied to the tons of waste generated in 2011.

Waste-in-place was also updated for the 2011 inventory. When the inventory was originally completed, it simply re-used the 2005 data for 2011. However, waste-in-place is a cumulative emissions calculation. Because the landfills in Sacramento are either closed or accepting less waste, this led to an overestimate of emissions. A first order decay model using landfill waste data from 2005 to 2011 was used to update the waste-in-place number.

Transportation

The 2011 inventory data includes total transportation emissions as well as the daily VMT.[23] However, the emissions factor was calculated using older methods no longer considered standard. Therefore, the EMFAC2017 model was used to re-calculate the average emissions per VMT in 2011. While not able to verify the methodology used to derive VMT, the VMT values appear to be consistent between inventory years and a note in the previous inventory workbook suggested the data was provided using the RTAC origin-destination model.

Summary of Inventory Data

Table 10 and Table 11 include all of the activity data, emission factors, and total emissions available for both the original inventory(Table 10) and the updated inventory (Table 11). The only sectors for which an emission factor and activity data could not be established either through the historical inventory or through the update process were water and wastewater.

[23] The documents provided by Ascent in the summary of the 2005/2011 inventories stated that VMT values were derived from the RTAC Origin-Destination model and were provided by Fehr and Peers as well as SACMET.

Table 10 Original 2011 GHG Inventory Data

	Original Activity Data	Original Emission Factor	Original (MT CO_2e)
Residential Electricity (kWh)	1,343,895,669	0.00020	656,472[1]
Residential Gas (therms)	74,151,520	0.00531	
Commercial and Industrial Electricity (kWh)	2,346,768,051	0.00020	
Commercial Gas (therms)	66,911,808	0.00531	814,087[1]
Industrial Gas (therms)	*included in Commercial	0.00531	
District Gas (therms)	3,872,204	0.00531	20,561
On-road Transportation (VMT)	4,234,269,734.09	0.000475	2,009,724
Waste (tons)	427,980	0.78300	335,108
Waste-in-Place	N/A	N/A	37,006
Wastewater	Unknown	Unknown	18,719
Water (mgy)	37,149	0.263921	9,804
Total			**3,901,481**

kWh: kilowatt hours; mgy: million gallons per year; N/A: not applicable; MT CO_2e: metric tons of carbon dioxide equivalent; VMT: vehicle miles traveled

1: Numbers presented as they were in the original 2011 GHG inventory.

Table 11 Updated 2011 GHG Inventory Data

	Original Activity Data	Original Emission Factor	Original (MT CO_2e)
Residential Electricity (kWh)	1,343,895,669	0.00020	262,727
Residential Gas (therms)	74,151,520	0.00531	393,745
Commercial and Industrial Electricity (kWh)	2,346,768,051	0.00020	458,786
Commercial Gas (therms)	32,256,175	0.00531	171,280
Industrial Gas (therms)	*included in Commercial	0.00531	
District Gas (therms)	3,872,204	0.00531	20,561
On-road Transportation (VMT)	4,234,269,734	0.000494	2,091,154
Waste (tons)	427,980	0.264478517	113,192
Waste-in-Place	N/A	N/A	25,773
Wastewater	Unknown	Unknown	18,719
Water (MGY)	37,149.00	0.263921	9,804
Total			**3,565,741**

kWh: kilowatt hours; mgy: million gallons per year; N/A: not applicable; MT CO_2e: metric tons of carbon dioxide equivalent; VMT: vehicle miles traveled

3 2016 Community Inventory

The methodologies, data sources, calculations, and results associated with the 2016 GHG inventory update are included in this section. Information regarding updates to the 2005 and 2011 inventories and information relating to the emissions forecast are located in Section 2.2 and Section 2.3 of the technical appendix, respectively.

The 2016 GHG inventory is structured based on emissions sectors. The ICLEI Community Protocol recommends local governments examine their emissions in the context of the sector responsible for those emissions. Many local governments will find a sector-based analysis more directly relevant to policy making and project management, as it assists in formulating sector-specific reduction measures for climate action planning. The reporting sectors are made up of multiple subsectors to allow for easier identification of sources and targeting of reduction policies.

The 2016 inventory reports all Basic Emissions Generating Activities[24] required by the Community Protocol[25] by the following main sectors:

- Energy (electricity and natural gas)
- Transportation
- Water and Wastewater
- Solid Waste

The data used to complete this inventory and forecast came from multiple sources, as summarized in Table 12. Data for the 2016 inventory calculations were provided by the City via personal communication with Helen Selph.

[24] Required emissions generating activities include: use of electricity by the community, use of fuel in residential and commercial stationary combustion equipment, on-road passenger and freight motor vehicle travel, use of energy in potable water and wastewater treatment and distribution, and generation of solid waste by the community.

[25] ICLEI. 2012. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions. Section 2.2.

Table 12 Inventory and Forecast Data Sources

Sector	Activity Data	Unit	Source
Inventory			
Energy	Electricity Consumption	kWh	Sacramento Municipal Utilities District
	Natural Gas Consumption	Therms	Pacific Gas and Electric
Transportation	Annual Mileage	VMT	EMFAC2017 Model; Sacramento Area Council of Governments
Water	Water Pumping	AF	Sacramento DOU
	Electricity Usage	kWh	
Wastewater	Electricity Consumption, Water Treated	kWh MGD	Sacramento DOU; Sacramento Regional County Sanitation District; City of Sacramento 2011 Climate Action Plan
Solid Waste	N/A	N/A	CalRecycle; Sacramento Public Works Department United States Environmental Protection Agency Landfill Methane Outreach Program Reporting
Forecast Growth Indicators			
Population	Residents	Persons	City of Sacramento General Plan; California Department of Finance Demographic Projections
Commerce	Jobs	Number of Jobs	City of Sacramento General Plan
Transportation	Annual Mileage, Emissions	N/A	EMFAC2017 Model; Sacramento Area Council of Governments
Building Efficiency	Title 24 Efficiency Increases	Percent	California Energy Commission
Electricity Emissions	Renewable Portfolio Standard	Percent	Renewable Portfolio Standard; Senate Bill 100

kWh; kilowatt hours; VMT: vehicle miles traveled; AF: acre-foot; MGD: million gallons per day; N/A: not applicable; Sacramento DOU: Sacramento Department of Utilities

3.1 Energy

The energy sector includes GHG emissions resulting from the consumption of electricity and natural gas. Both energy sources are used in residential, commercial, and industrial buildings and for other power needs throughout the City of Sacramento. The following subsections describe the data sources, emission factors and calculation methodologies associated with electricity and natural gas.

Overall, residential and non-residential (commercial and industrial) energy emissions were approximately equal in 2016 at 49 percent and 50 percent respectively (Figure 3). It should be noted that, similar to previous years, this does not include large industrial users' gas use in the analysis. Non-residential electricity was reported in aggregate by Sacramento Municipal Utility District (SMUD) and included both industrial and commercial data. Due to data availability issues, large industrial gas data were not provided by PG&E and not been included in this inventory. Additional information on why this change was made as well as the methodologies used to estimate 2016 commercial gas data are provided in the natural gas section.

Electricity

Emissions resulting from electricity consumption were estimated by multiplying annual electricity consumption by an electricity emission factor representing the average emissions associated with generation of one megawatt hour (MWh) of electricity. Electricity is supplied to the City by SMUD. In its 2016 report to the verification body, The Climate Registry, SMUD reported an electricity carbon intensity factor of 492.95 pounds CO_2e per MWh.[26] SMUD also reported to the California Energy Commission, an average of 20 percent renewable energy in its portfolio in 2016.[27] From 2005, residential electricity use increased by 116.1 MWh while commercial electricity decreased by 44.7 MWh for a net increase of 71.4 MWh. Therefore, the 181,910 MT CO_2e reduction in GHG emissions from electricity between 2005 and 2016 was due to an approximately 20 percent reduction in the SMUD electricity emission factor.

To calculate emissions from electricity, the total electricity use reported by SMUD was multiplied by the carbon intensity factor to determine MT CO_2e. This value represents all residential, commercial, and industrial electricity use within the city. Prior to performing this calculation, the electricity use associated with in-boundary water sector activities (42,964 MWh) was removed to avoid double counting water emissions. This is discussed further in the water and wastewater section.

In 2016, a total 808,220 $MTCO_2e$ was generated within the community due to residential and commercial electricity use. Table 13 and Table 14 show the breakdown of emissions from electricity by both category (residential, commercial/industrial) and by source.

Natural Gas

In order to calculate emissions from natural gas consumption, the total therms consumed is multiplied by the PG&E reported emissions factor of 11.7 pounds CO_2/therm. Due to CPUC privacy regulations, the majority of 2016 industrial therms were not provided.[28] This resulted in a substantial decrease in emissions from industrial natural gas use from the 2005 baseline.

Any remaining reported industrial use is from PG&E "district" users, such as fire and school districts. Industrial emissions removed from the inventories are under the purview of the CARB Cap-and-Trade Program for emissions reductions and are, therefore, already accounted for in the 2017 Scoping Plan Update. The California Supplement does not recommend including these sources unless they are under the direct jurisdictional control of the reporting agency.[29] Overall natural gas usage in the commercial sector decreased from 29.8 million therms in 2005 to 29.0 million therms in 2016 while the emission factor remained constant. This means that 100 percent of the 45,063 MT CO_2e reduction was attributed to a decrease in gas use.

In 2016, the commercial, district industrial, and residential categories consumed a total of 92,390,976 therms of natural gas, which, based on the emission factor of 0.00531 MT CO_2/therm, generated 490,323 $MTCO_2e$. A complete breakdown of natural gas use by category and sector is provided in Table 14.

[26] The Climate Registry. 2016 Default Emissions Factors. Accessed at: https://www.theclimateregistry.org/wp-content/uploads/2014/11/2016-Climate-Registry-Default-Emission-Factors.pdf. Accessed on: June 17, 2019

[27] California Energy Commission. Sacramento Municipal Utility District 2016 Power Content Label. Accessed at: https://ww2.energy.ca.gov/pcl/labels/2016_labels/Sacramento_Municipal_Utility_District.pdf Accessed July 15, 2019

[28] Minor industrial emissions reported through PG&E from the 'District' customer class are included in this inventory.

[29] Association of Environmental Professionals. 2013. The California Supplement to the United States Community-Wide Greenhouse Gas (GHG) Protocol. Page 9.

Figure 3 Energy Emissions by Category for Year 2016

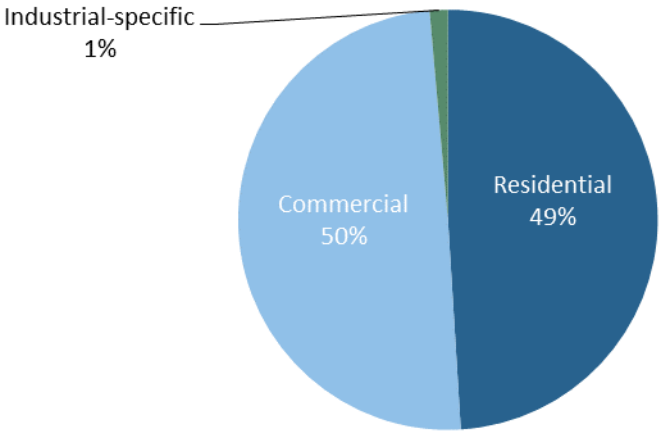


Table 13 Energy Emissions by Category for Year 2016

Source	Activity Data	Emission Factor	Total Emissions ($MTCO_2e$)
Residential			**636,578**
Natural Gas	59,977,656 therms	0.00531 MT CO_2e/therm	318,304
Electricity	1,423,420 MWh	0.2236 MT CO_2e/MWh	318,275
Commercial			**643,747**
Natural Gas	28,980,911 therms	0.00531 MT CO_2e/therm	153,803
Commercial and Industrial Electricity	2,191,181 MWh	0.2236 MT CO_2e/MWh	489,945
District Industrial			**18,216**
Natural Gas[1]	3,432,409 therms	0.00531 MT CO2e/therm	18,216
Total			**1,298,542**

MWh: megawatt hours; MT CO_2e: metric tons of carbon dioxide equivalent

[1] Large industrial natural gas has been removed due to CPUC privacy rules. See Energy Section for discussion

Table 14 Energy Emissions by Energy Source for Year 2016

Source	Activity Data	Emission Factor	Total Emissions ($MTCO_2e$)
Natural Gas	**92,390,976 therms**	**0.00531 MT CO_2e/therm**	**490,332**
Commercial	28,980,911 therms	0.00531 MT CO_2e/therm	153,803
Residential	59,977,656 therms	0.00531 MT CO_2e/therm	318,304
District Industrial[1]	3,432,409 therms	0.00531 MT CO_2e/therm	18,216
Electricity	**3,581,960 MWh**	**0.2236 MT CO_2e/MWh**	**808,220**
Commercial/Industrial	2,191,181 MWh	0.2236 MT CO_2e/MWh	489,945
Residential	1,423,420 MWh	0.2236 MT CO_2e/MWh	318,275
Total			**1,298,542**

MWh: megawatt hours; MT CO_2e: metric tons of carbon dioxide equivalent

[1] Large industrial natural gas has been removed due to CPUC privacy rules. See Energy Section for discussion

3.2 Transportation

Transportation modeling for VMT attributed to the City of Sacramento was completed by Fehr & Peers Transportation Consultants using Sacramento Area Council of Government (SACOG) activity-based model, SACSIM.[30] The emissions associated with on-road transportation were then calculated by multiplying the estimated daily VMT and the average vehicle emissions rate established by CARB EMFAC2017 modeling for vehicles within the region. In 2016 on-road transportation attributed to the City of Sacramento resulted in 1,935,870 MT CO_2e a 248,747 MT CO_2e reduction compared to 2005. During this time VMT increased by 4 percent or 172 million miles traveled. Therefore, the emissions reductions in this sector were driven by an increase in average vehicle efficiency and adoption of electric vehicles which resulted in a 10 percent decrease in average vehicles emissions per mile.

The VMT modeling results allocate VMT derived from the activity-based model to the City of Sacramento using the Origin-Destination (O-D) method. The O-D VMT method is the preferred method recommended by the U.S Community Protocol in on-road methodology TR.1 and TR.2 to estimate miles traveled based on trip start and end locations. Under these recommendations, all trips that start and end within the City are attributed to the City. Additionally, one half of the trips that start internally and end externally and vice versa are attributed to the City. A summary of the VMT results can be found in Table 15.

Table 15 Estimated Transportation Emissions for 2016

Source	Activity Data (VMT)[2]	Emission Factor	Total Emissions ($MTCO_2e$)
Internal-Internal Daily VMT	3,588,476	0.000445 MT CO_2e per VMT	1,598
½ Internal-External Daily VMT	4,463,016	0.000445 MT CO_2e per VMT	1,988
½ External-Internal Daily VMT	4,475,924	0.000445 MT CO_2e per VMT	1,993
Total Daily VMT	12,527,417	0.000445 MT CO_2e per VMT	5,579
Yearly VMT[1]	**4,347,013,534**	**0.000445 MT CO_2e per VMT**	**1,935,870**

MT CO_2e: metric tons of carbon dioxide equivalent; VMT: vehicle miles traveled

[1] Weekday to annual conversion of 347 is used per CARB guidance on VMT modeling

2 The origin-destination methodology for VMT calculation attributes 100 percent of internal to internal daily trips, 50 percent of internal-external and external-internal daily trips, and excludes all pass through trips. This sum is then multiplied by 347 to get an annual VMT number.

Transportation emissions are generated by the community of Sacramento through on-road transportation, including passenger, commercial, and heavy machinery. Emissions factors are established using the latest CARB and EPA-approved emissions modeling software, 2017 State EMissions FACtors (EMFAC) Model. Carbon dioxide, nitrous oxide, and methane emissions from engine combustion are multiplied by their GWP to determine CO_2e per VMT. Emissions for both passenger and commercial vehicles were established using the EMFAC2017 GHG module and weighted by VMT to establish an average emissions factor per VMT for the City. Emissions from electricity used by charging of electric vehicles are captured under the electricity sector. In 2016, the

30 Sacramento Area Council of Governments. SACOG Travel Demand Model. Accessed at: https://www.sacog.org/modeling Accessed on: October 4, 2019

average emissions factor for cars on the road in the County of Sacramento was 0.000445 $MTCO_2e$ per VMT as calculated using the EMFAC2017 model.[31] Technical details on the EMFAC2017 modeling tool can be found on the EMFAC Mobile Source Emissions Inventory Technical Support Documentation Portal.[32]

3.3 Water and Wastewater

Water

Water is supplied to Sacramento by the Sacramento Department of Utilities, primarily sourced from the Sacramento and American rivers. The primary water treatment plant facilities for the community are E.A. Fairbairn Water Treatment Plant and Sacramento River Water Treatment Plant, both located within the city boundaries. Water supplied to the community contributes emissions through the use of energy to extract, convey, treat, and deliver water. The amount of energy required for community water usage was calculated following Community Protocol Method WW.14, where the total emissions are equal to the energy used in each of the four phases above. The energy required for each segment of the water cycle was provided by the Sacramento Department of Utilities or based on phase-specific averages where it was unavailable. SMUD provided the annual electricity use for the water extraction, conveyance, and delivery phases (40,101 MWh),[33] while a kWh phase average of 100 kwh/million gallons was used for the treatment phase. As all energy use is in-boundary, total MWh for water transactions has been subtracted from the community energy use total calculated in Section 3.1 to avoid double counting.

SMUD is the electricity provider for the City; therefore, SMUD's energy emissions factor of 492.95 pounds CO_2e/MWh was applied to the calculated electricity used for water consumption in the city. Energy consumption related to water use in the city of Sacramento resulted in the generation of approximately 9,607 $MTCO_2e$ in 2016, or 33 percent of total water and wastewater emissions. In 2016, Sacramento water treatment plants produced 87,811 acre-feet of water. The 2005 water consumption for the City was not recorded in the previous inventory and therefore, a comparison of the methodology was not possible. However, it is likely that emission reductions have been driven in part by a reduced electricity emission factor.

Wastewater

The wastewater generated by community residents and businesses creates GHG emissions during the treatment processes, including process, stationary, and fugitive emissions. The sources and magnitude of emissions depend on the type of wastewater treatment plant and the treatment processes utilized.

Wastewater generated in the city of Sacramento is collected in local sewer lines which ultimately discharge into the Sacramento Regional Wastewater Treatment Plant managed by Regional San in Elk Grove, California. As the wastewater treatment plant treats sewage from multiple jurisdictions, methane and nitrous oxide emissions were allocated to Sacramento on a population basis per Community Protocol Methodology WW.13 shown in Figure 4. Total carbon dioxide emissions from

[31] EMFAC2017. Base year 2016, County of Sacramento model run. Accessed at: https://www.arb.ca.gov/emfac/ Accessed on: July 16, 2019

[32] California Air Resources Board. EMFAC Software and Technical Support Documentation. Accessed at: https://ww2.arb.ca.gov/our-work/programs/mobile-source-emissions-inventory/road-documentation/msei-modeling-tools-emfac Accessed on: October 4, 2019.

[33] D. Vang, personal communication, August 2018.

the Sacramento Regional Wastewater Treatment Plant were unavailable from the USEPA Greenhouse Gas Reporting Program, the ICLEI-recommended data source. Therefore, separate emissions sources (nitrous oxide, methane, electricity use) were calculated based on the population increase from 2011. In 2016, a total of 40 MT N_2O and 32 MT CH_4 were emitted from the effluent discharge and stationary sources at the treatment plant. As shown in Table 16 the total process emissions and electricity usage for Sacramento wastewater treatment and disposal resulted in emissions of 19,867 MT CO_2e per year, or 67 percent of the water and wastewater emissions.

Table 16 Water and Wastewater Emissions for Year 2016

Source	Activity Data	Emission Factor	Total Emissions (MT CO_2e)
Water Use	**42,963,998 MWh**	**0.22359 MT CO_2e/MWh**	**9,607**
Supply, Conveyance, Distribution	40,101 MWh	0.22359 MT CO_2e/MWh	8,967
Treatment	2,863 MWh	0.22359 MT CO_2e/MWh	640
Wastewater Generation	**–**	**–**	**19,867**
Process Nitrous Oxide Emissions	40 MT N_2O	1 N_2O to 298 CO_2e	11,780
Stationary Methane Emissions	32 MT CH_4	1 CH_4 to 25 CO_2e	804
Electricity Emissions	32,640 MWh	0.22359 MT CO_2e/MWh	7,298
Total			**29,474**

MWh: megawatt hours; MT: metric tons; CO_2e: carbon dioxide equivalent; CH_4: methane; N_2O: nitrous oxide

Figure 4 Wastewater Methodology

Equation WW.13$_{CH4}$ Attributed CH_4 Emissions

*Attributed CH_4 Emissions = P/P_{tot} * E*

Where:

Description		Value
Attributed CH_4 Emissions	= Annual CH_4 credited to the community ($mtCO_2e$)	Result
P	= Population of community served by the given WWTP	User input
P_{tot}	= Total population the WWTP serves	User input
E	= Total CH_4 produced by WWTP ($mtCO_2e$)	User input

Source: Developed by ICLEI Staff and Wastewater Technical Advisory Committee

3.4 Solid Waste

GHG emissions result from management and decay of organic material solid waste. The Community Protocol provides multiple accounting methods to address both emissions arising from solid waste generated by a community (regardless of where it is disposed of) as well as emissions arising from solid waste disposed of inside a community's boundaries (regardless of where it was generated). GHG emissions from the decomposition of organic material in this sector are broken down into two parts:

- Community Waste - Lifetime methane emissions from solid waste generated by the community in the year of the inventory, using Community Protocol method SW.4[34]. This methodology attributes 100 percent of lifetime GHG emissions from the tonnage reported in the inventory year.
- Waste-in-Place - Methane emissions from existing solid waste-in-place at landfills located within the community limits using Community Protocol method SW.1[35] This methodology attributes just the GHG emissions emitted in the inventory year based on the total lifetime tonnage in the landfill.

Due to the slow rate of emissions generation associated with decomposition of solid waste, this two-pronged approach also allows policy makers to target solid waste activity in a particular year, similar to other sectors (e.g., fuel combustion resulting in immediate emissions). Accounting for both of these sources may lead to some double counting in the waste sector as any waste counted in the total tonnage for the year, but also put in the City's in-boundary landfill would be counted twice. However, the City's in-boundary landfills are now closed and both methodologies convey different aspects of the solid waste emissions profile and are included for consistency with previous inventories. All emissions from vehicular transport of solid waste are included in the transportation emissions sector.

Two landfills are located within the city, therefore, solid waste emissions were estimated using both SW.1 to calculate the in-boundary landfill emissions and SW.4 to calculate the full methane commitment of solid waste generated by Sacramento in 2016. A summary of waste emissions is provided in Table 17.

Table 17 Summary of Solid Waste Emissions for Year 2016

Source	Activity Data (tons)	Emission Factor	Total Emissions (MT CO_2e)
Waste-in-Place	–	–	**26,504**
28th Street Landfill	–	–	12,027
L & D Landfill	–	–	14,478
Waste Disposal	**525,968**	**0.2554 MT CO_2e/ton**	**134,339**
Total Waste Emissions			**160,843**

MT CO_2e: metric tons of carbon dioxide equivalent

Waste-in-Place

As a primary data source for waste-in-place emissions, the Community Protocol recommends utilizing data reported from the United States Environmental Protection Agency (USEPA) in accordance with the GHG Mandatory Reporting Rule (MRR; 40 Code of Federal Regulations [CFR] §98). If the facilities are not subject to the USEPA MRR, then the alternate approach SW.1.1 should be used. Method SW.1.1 estimates emissions based on the first order decay (FOD) model and the waste-in-place in the landfill and is summarized in Figure 5. The FOD model is an exponential equation which estimates the amount of landfill gas generated in a municipal solid waste landfill based upon the amount of municipal solid waste in the landfill (or "waste-in-place") at the point of

[34] https://icleiusa.org/publications/us-community-protocol/

[35] https://icleiusa.org/publications/us-community-protocol/

time for which landfill gas generation is to be estimated, the capacity of that waste to generate methane and a methane generation rate constant which describes the rate at which municipal solid waste in the landfill is expected to decay and produce landfill gas.

Figure 5 Waste-in-Place Methodology

Equation SW.1.1 Alternate Method – Methane Emissions from Landfills

Annual fugitive CH_4 emissions =

*Comprehensive LFG Collection: ((TMMG*LFGE)*(Ox))*
Partial or No LFG Collection: ((TMMG(1-%LF)*Ox)+((TMMG*%LF*LFGE)*(Ox)))*
Where:

Term	Description	Value
Annual CH_4 emissions	= Total annual fugitive landfill CH_4 emitted ($mtCO_2e$)	Result
TMMG	= Total modeled CH_4 generated	User Input
OX*	= Account for 10% oxidation rate	(1-.10)
% LF	= Percent of landfill covered by gas collection	User Input
LFGE	= Account for 75% LFG collection efficiency	(1-.75)

Source: 40 CFR 98, Subpart HH, and 40 CFR 60, Subpart WWW

* If using the California ARB Landfill Emissions Tool oxidation has already been incorporated into landfill outputs therefor you do not have to multiply by 0.9.

The Community Protocol recommends reviewing the Landfill Methane Outreach Program (LMOP) maintained by the USEPA as the first source of emissions verification for landfills.[36] As of 2016, no emissions from the 28th Street Landfill or L&D Landfill were reported to LMOP,[37] therefore, a FOD modeling tool developed by CARB and recommended by ICLEI was utilized.[38] The FOD model outputs emissions in methane and carbon dioxide. However, only methane emissions were accounted for as the carbon dioxide is considered biogenic in origin and not recommended for inclusion per the Community Protocol. Results of the model runs for both 28th Street Landfill and L&D Landfill can be found in the attached documentation and Table 18. A collection efficiency of 75 percent was applied per the Community Protocol for landfills with methane capture. Fugitive methane emissions from existing waste at the L&D and 28th Street landfills were calculated to be 26,504 MT CO_2e in 2016. Annual waste-in-place emissions decreased by 23,416 MT CO_2e from 2005 to 2016 due to the amount of waste remaining in the now closed landfills as modeled by the FOD modeling tool.

[36] United States Environmental Protection Agency. 2016. Landfill Methane Outreach Program. Accessed at: https://www.epa.gov/lmop/project-and-landfill-data-state. Accessed on: May 15, 2019

[37] United States Environmental Protection Agency. 2016. Greenhouse Gas Reporting Program. Accessed at: https://www.epa.gov/ghgreporting. Accessed on: May 15, 2019

[38] California Air Resources Board. Local Government Operations Protocol for Greenhouse Gas Assessments. Accessed at: https://ww3.arb.ca.gov/cc/protocols/localgov/localgov.htm. Accessed on: May 20, 2019

Table 18 Waste-in-Place Summary for Year 2016

Emissions Forecast	28th Street Landfill (MT CO_2e)	L&D Landfill (MT CO_2e)
Methane generated	48,107	57,910
Methane captured (removed) at landfill	- 36,080	- 43,432
Subtotal Waste-in-Place Emissions	12,027	14,478
Total Waste-in-Place		**26,504**

MT CO_2e: metric tons of carbon dioxide equivalent

Community Generated Waste

While communities may want to understand the GHG emissions from landfills located within their boundaries (SW.1.1)[39], they are required to estimate the emissions resulting from waste disposed by the community (SW.4.1)[39], regardless of whether the receiving landfill(s) are located inside or outside of the community boundary.

Community Protocol Method SW.4.1[39] is summarized in Figure 6, utilizing mass of waste being disposed, organic content of waste, methane capture ability of the landfill, oxidation rate, and methane GWP. The 2016 emissions factor for generated waste in Sacramento was derived from the 2014 CalRecycle State Waste Characterization Study shown in Table 19.

Figure 6 Waste Generation Methodology

Equation SW.4.1 Methane Emissions

$$CH_4\ Emissions = GWP_{CH4} * (1- CE) * (1-OX) * M * \sum_i P_i * EF_i$$

Where:

Term	Description	Value
CH_4 emissions	= Community generated waste emissions from waste M ($mtCO_2e$)	Result
GWP_{CH4}	= CH_4 global warming potential	
M	= Total mass of waste entering landfill (wet short ton)	User Input
P_i	= Mass fraction of waste component i	User Input
EF_i	= Emission factor for material i ($mtCH_4$/wet short ton)	Table SW.5
CE	= Default LFG Collection Efficiency	No Collection, 0 Collection, 0.75
OX	= Oxidation rate	0.10

Source: As developed by ICLEI staff and Solid Waste Technical Advisory Committee. Emissions factors from U.S. EPA Municipal Solid Waste Publication (2008) available at http://www.epa.gov/epawaste/nonhaz/municipal/pubs/msw2008data.pdf

39 https://icleiusa.org/publications/us-community-protocol/

In 2016, Sacramento produced 525,968 tons of waste.[40] A CO_2e emissions factor for mixed-waste of 0.2554 MT CO_2e/ton was established and multiplied by the total waste disposed of from the community to calculate emissions from waste generated in 2016 of 134,339 MT CO_2e. This emission factor includes the expected lifetime emissions associated with the specified tonnage of waste sent to landfill. The emissions factor was developed using SW 4.1[39] as well as the relative waste stream percentages of different organic materials as shown in Table 19 to establish a methane emissions factor. The efficiency capture used was 75 percent, which was an update from previous inventories which relied on a regional average (42 percent) from the 2005 inventory. CalRecycle and USEPA LMOP data allow for more precise tracking of waste destination and methane capture ability and the majority of Sacramento's waste in 2016 was transported to L & D Landfill in Sacramento, Kiefer Landfill in Sloughhouse, and Forward Landfill in Manteca, all of which operate landfill gas capture programs.[41] From 2005 to 2016 GHG emissions from community waste decreased by 270,963 MT of CO_2e. This was due to a combination of factors including a reduced emission factor due to installation of methane capture programs at landfills as well as an overall reduction in waste generation of 158,120 tons.

Table 19 CalRecycle 2014 Waste Characterization Factor

Waste Type	WIPFRAC	TDOC	DANF	ANDOC	Weighted CH_4/ton	Weighted MT CO_2e/ton
Newspaper	1.44%	47.09%	15.05%	0.117%	0.000143208	0.003580198
Office Paper	0.73%	38.54%	87.03%	0.617%	0.000344557	0.00861393
Corrugated Boxes	3.13%	44.84%	44.25%	0.952%	0.000872251	0.021806282
Coated Paper	12.10%	33.03%	24.31%	0.721%	0.001366096	0.034152408
Food	18.12%	14.83%	86.52%	1.990%	0.00326912	0.081728001
Grass	1.84%	13.30%	47.36%	0.120%	0.000163279	0.004081975
Leaves	3.52%	29.13%	7.30%	0.069%	0.00010509	0.002627254
Branches	3.27%	44.24%	23.14%	0.200%	0.000470807	0.011770174
Lumber	11.91%	43.00%	23.26%	1.451%	0.00167506	0.041876495
Textiles	5.85%	24.00%	50.00%	0.656%	0.000986758	0.024668962
Diapers	4.29%	24.00%	50.00%	0.520%	0.000723544	0.018088588
Construction/Demolition	2.31%	4.00%	50.00%	0.110%	6.48827E-05	0.001622068
Medical Waste	0.11%	15.00%	50.00%	0.000%	1.19281E-05	0.000298201
Sludge/Manure	0.57%	5.00%	50.00%	0.001%	1.991E-05	0.000497751
MSW Total				7.52 %	0.010216492	0.255412288

WIPFRAC: fraction of waste in waste-in-place; TDOC: total degradable organic carbon; DANF: decomposable anaerobic fraction; ANDOC: anaerobically degradable organic carbon; CH_4: methane; MT CO_2e: metric ton of carbon dioxide equivalent

[40] Waste tonnage and destinations from https://www2.calrecycle.ca.gov/LGCentral. Accessed on: May 20, 2019

[41] Landfill gas capture program data verified from https://www.epa.gov/lmop/project-and-landfill-data-state . Accessed on: May 20, 2019

4 Forecast

A baseline inventory (i.e., the City of Sacramento's 2016 inventory) sets a reference point for a single year. However, annual emissions change over time due to external factors such as population and job growth. An emission's forecast accounts for projected growth and presents an estimate of GHG emissions in a future year. Calculating the difference between the GHG emissions forecast and the reduction targets set by the City determines the gap to be closed through City Climate Action Plan policies. This section quantifies the reduction impact State regulations will have on the City of Sacramento's forecast and presents the results in an *adjusted scenario* forecast. The *adjusted scenario* incorporates the impact of State regulations which would reduce the City of Sacramento's GHG emissions to provide a more accurate picture of future emissions growth and the responsibility of the City and community for GHG reductions once State regulations to reduce GHG emissions have been implemented.

Several indicator growth rates were developed and applied to the various emissions sectors to forecast emissions as shown in Table 22**Error! Reference source not found.**. The growth rates were applied to the most recent inventory year (2016) data to obtain projected activity data (e.g., energy use, waste production). Growth rates were developed from the 2035 Sacramento General Plan population and job forecasts, EMFAC Modeling, and Department of Finance population forecasts for Sacramento County. Applicable State and federal regulatory requirements, including Corporate Average Fuel Economy standards, Advanced Clean Car Standards, Renewable Portfolio Standard, and Title 24 efficiencies were then incorporated to accurately reflect expected reductions from State programs.

As the City of Sacramento General Plan Update is completed, population forecasts will shift. Therefore, the forecast presented in Section 4.1 may be updated over the course of the project to be consistent with the General Plan Update. To deal with these changes, a "model" has been developed which allows for these variables to be easily adjusted as changes occur.

4.1 Forecast Results Summary

Overall emissions in Sacramento are forecast to decrease 30 percent by 2045 under existing programs and regulations (Adjusted Forecast) as shown in Table 20. The adjusted forecast emissions reductions are due to SB 100 requiring 100 percent GHG-free electricity in 2045, electricity-related emissions are expected to reduce to zero. Transportation, natural gas, and waste emissions are expected to constitute the majority of emissions by 2045.

Table 20 Summary of BAU Forecast and Legislative Reductions by Year

Emissions Forecast	2020 (MT CO_2e)	2025 (MT CO_2e)	2030 (MT CO_2e)	2040 (MT CO_2e)	2045 (MT CO_2e)
Business-as-usual forecast	**3,643,050**	**3,915,952**	**4,188,855**	**4,629,532**	**4,837,306**
Reduction from State measures	358,811	845,264	1,325,699	2,044,321	2,460,915
Adjusted Forecast	**3,284,240**	**3,070,688**	**2,863,156**	**2,585,211**	**2,376,391**

MT CO_2e: metric tons of carbon dioxide equivalent

Waste emissions will likely be lower than the current forecast due to SB 1383 and the requirements for a statewide 75 percent reduction in organic materials being sent to landfill by 2025. Due to the uncertainty of how these requirements will be enacted within the city of Sacramento, the modeling of the change in emissions from SB 1383 was not included and waste-reduction measures identified in the Climate Action Plan will be credited to the City.

As shown in Table 21, State regulations will reduce community GHG emissions substantially by 2045. However, a substantial gap remains between the adjusted scenario and the targets discussed in Section 5. The required reductions to close the gap will come from existing and newly identified GHG reduction measures included in this and future iterations of the Sacramento Climate Action Plan.

Table 21 Adjusted Absolute and Per Capita Emissions Forecast

Year	Population	Absolute Emissions (MT CO_2e)	Per Capita (MT CO_2e)
2016	486,154	3,424,795	7.04
2020	518,627	3,284,240	6.33
2025	599,218	3,070,688	5.49
2030	599,809	2,863,156	4.77
2040	670,836	2,585,211	3.85
2045	699,903	2,376,391	3.40

MT CO_2e: metric tons of carbon dioxide equivalent

4.2 Business-as-Usual Forecast

The City of Sacramento business-as-usual scenario forecast provides an estimate of how GHG emissions would change in the forecast years if consumption trends continue as in 2016, absent any new regulations which would reduce local emissions. Several indicator growth rates were developed from 2016 activity levels and applied to the various emissions sectors to project future year emissions. Table 22 contains a list of growth factors used to develop the business-as-usual scenario forecast, with a summary of the results in Table 23. The BAU growth factors were then multiplied by the population or service person growth rates to develop the BAU emissions forecast.

Table 22 Business-as-Usual Growth Factors

Sector	Activity Data
Emissions per capita (MT CO2e/capita)	7.04
Residential electricity per capita (kWh/capita)	2,928
Commercial electricity use per job (kWh/employment)	10,074
Residential gas per capita (therm/capita)	123
Commercial gas use per job (therm/job)	133.2
Industrial gas per job (therm/job)	15.8
Per job industrial gas use (therm)	15.8
Waste per service person (tons/SP)	0.75
Per service pop WW GHG (MT CO2e)	0.0282
CO2e per ton waste (MT CO2e/ton)	0.306
Water electricity per service person (kWh/SP)	61.1
Water emissions per capita (MT CO2/capita)	0
Total VMT per service person (VMT/SP)	6,178

kWh: kilowatt hour; SP: service person (sum of population and employment) MT CO_2e: metric tons of carbon dioxide equivalent; VMT: vehicle miles traveled

Under the business-as-usual forecast scenario, the City of Sacramento's GHG emissions are projected to continue increasing through 2045 as shown in Table 23. This increase is led primarily by a strong commercial and residential development trend. After the current General Plan horizon year of 2035, major increases in in emissions are largely attributed to the increased population and vehicular traffic from the greater Sacramento County Area traveling into the city. By 2045, the City is expected to produce 4,837,306 MT CO_2e under business-as-usual projections, an increase of 42 percent over 2016 emissions.

Table 23 Business-as-usual Forecast by Sector

Sector	2020 (MT CO_2e)	2025 (MT CO_2e)	2030 (MT CO_2e)	2040 (MT CO_2e)	2045 (MT CO_2e)
Residential Electricity	339,534	366,108	392,682	439,182	458,212
Commercial & Industrial Electricity	571,798	674,115	776,431	920,511	960,396
Residential Gas	339,565	366,141	392,718	439,222	458,253
Commercial & Small Industrial Gas	200,757	236,680	272,603	323,190	337,193
Waste	176,572	196,233	215,893	246,749	257,441
Water	10,546	11,720	12,895	14,738	15,376
Wastewater	21,810	24,238	26,667	30,478	31,799
Transportation	1,982,469	2,040,717	2,098,965	2,215,462	2,318,636
Total Emissions	**3,643,050**	**3,915,952**	**4,188,855**	**4,629,532**	**4,837,306**
Emissions Per Capita	**7.02**	**7.00**	**6.98**	**6.90**	**6.91**

MT CO_2e: metric tons of carbon dioxide equivalent

4.3 State Legislation

The adjusted scenario estimates future City of Sacramento emissions under codified GHG reduction strategies currently being implemented at the State and federal level. The 2017 Scoping Plan Update identified several existing State programs and targets, or known commitments required by statute which can be assumed to achieve GHG reductions without City action, such as increased fuel efficiency standards of mobile vehicles. The following known commitments are factored into the adjusted scenario projection and a summary of the programs can be found in Table 24.

The largest GHG reductions realized by State programs in Sacramento will occur from the increasing decarbonization of the electricity supply due to SB 100 and the Renewable Portfolio Standard (RPS), avoiding over 1,200,000 MT CO_2e by 2045. The transportation sector will also experience over 975,000 MT CO_2e by 2045 through State and federal fuel efficiency and tailpipe emissions standards.

Table 24 Summary of Legislative Reductions

Legislation	2020 (MT CO_2e)	2025 (MT CO_2e)	2030 (MT CO_2e)	2040 (MT CO_2e)	2045 (MT CO_2e)
Senate Bill 100	148,350	299,462	505,630	966,438	1,245,550
Title 24	11,483	68,900	126,316	212,616	240,201
Transportation (Pavley, etc.)	198,977	476,902	693,752	865,267	975,164
Total	358,811	845,264	1,325,699	2,044,321	2,460,915

MT CO_2e: metric tons of carbon dioxide equivalent

Transportation Legislation

The CARB EMFAC2017 transportation modeling program incorporates legislative requirements and regulations including Advanced Clean Cars program (Low Emissions Vehicles III, Zero Emissions Vehicles program, etc.), and Phase 2 federal GHG Standards. Signed into law in 2002, AB 1493 (Pavley Standards) required vehicle manufactures to reduce GHG emissions from new passenger vehicles and light trucks from 2009 through 2016, with a target of 30 percent reductions by 2016, while simultaneously improving fuel efficiency and reducing motorists' costs.[42]

Prior to 2012, mobile emissions regulations were implemented on a case-by-case basis for GHG and criteria pollutant emissions separately. In January 2012, CARB approved a new emissions-control program (the Advanced Clean Cars program) combining the control of smog, soot causing pollutants, and GHG emissions into a single coordinated package of requirements for passenger cars and light trucks model years 2017 through 2025. The Advanced Clean Cars program coordinates the goals of the Low Emissions Vehicles, Zero Emissions Vehicles, and Clean Fuels Outlet programs. The new standards will reduce Californian GHG emissions by 34 percent in 2025.[43]

[42] California Air Resources Board. Clean Car Standards – Pavley, Assembly Bill 1493. May 2013.

[43] California Air Resources Board. Facts About the Advanced Clean Cars Program. December 2011. Accessed at: http://www.arb.ca.gov/msprog/zevprog/factsheets/advanced_clean_cars_eng.pdf. Accessed on: May 20, 2019

Reductions in GHG emissions from the above referenced standards were calculated using the CARB EMFAC2017 model for Sacramento County. The EMFAC2017 model integrates the estimated reductions into the mobile source emissions portion of the model.[44]

Title 24

Although it was not originally intended to reduce GHG emissions, California Code of Regulations Title 24, Part 6: California's Energy Efficiency Standards for Residential and Nonresidential Buildings, was adopted in 1978 in response to a legislative mandate to reduce California's energy consumption, which in turn reduces fossil fuel consumption and associated GHG emissions. The standards are updated triennially to allow consideration and possible incorporation of new energy-efficient technologies and methods. Starting in 2020, new residential developments will include on-site solar generation and near-zero net energy use. For projects implemented after January 1, 2020, the California Energy Commission estimates the 2019 standards will reduce consumption by seven percent for residential buildings and 30 percent for commercial buildings, relative to the 2016 standards. These percentage savings relate to heating, cooling, lighting, and water heating only and do not include other appliances, outdoor lighting not attached to buildings, plug loads, or other energy uses. The calculations and GHG emissions forecast assume all growth in the residential and commercial/industrial sectors is from new construction.

The 2017 Scoping Plan Update calls for the continuation of ongoing triennial updates to Title 24 which will yield regular increases in the mandatory energy and water savings for new construction. Future updates to Title 24 standards for residential and non-residential alterations past 2023 are not taken into consideration due to lack of data and certainty about the magnitude of energy savings realized with each subsequent update.

Renewables Portfolio Standard & Senate Bill 100

Established in 2002 under SB 1078, enhanced in 2015 by SB 350, and accelerated in 2018 under SB 100, California's RPS is one of the most ambitious renewable energy standards in the country. The RPS program requires investor-owned utilities, publicly-owned utilities, electric service providers, and community choice aggregators to increase procurement from eligible renewable energy resources to 50 percent of total procurement by 2026 and 60 percent of total procurement by 2030. The RPS program further requires these entities to increase procurement from GHG-free sources to 100 percent of total procurement by 2045.

SMUD provides electricity in Sacramento and is subject to the RPS requirements. SMUD forecast emissions factors include reductions based on compliance with RPS requirements through 2045. In 2016, SMUD reported an emissions factor of 492.95 pounds CO_2e per MWh.

Assembly Bill 939 & Assembly Bill 341

In 2011, AB 341 set the target of 75 percent recycling, composting, or source reduction of solid waste by 2020 calling for the California Department of Resources Recycling and Recovery (also

[44] Additional details are provided in the EMFAC2017 Technical Documentation, July 2018. Accessed at: https://www.arb.ca.gov/msei/downloads/emfac2017-volume-iii-technical-documentation.pdf. Accessed on: May 20, 2019. The Low Carbon Fuel Standard (LCFS) regulation is excluded from EMFAC2017 because most of the emissions benefits due to the LCFS come from the production cycle (upstream emissions) of the fuel rather than the combustion cycle (tailpipe). As a result, LCFS is assumed to not have a significant impact on CO_2 emissions from EMFAC's tailpipe emissions estimates.

known as CalRecycle) to take a statewide approach to decreasing California's reliance on landfills. This target was an update to the former target of 50 percent waste diversion set by AB 939.

As actions under AB 341 are not assigned to specific local jurisdictions, actions beyond the projected waste diversion target of 5.9 pounds per person per day set under AB 939 for the City of Sacramento will be quantified and credited to the City during the Climate Action Plan measure development process. As of 2016, Sacramento is meeting both the 5.9 pounds per person per day and 9.5 pounds per job per day diversion targets set by CalRecycle under AB 341.

Senate Bill 1383

SB 1383 established a methane emissions reduction target for short-lived climate pollutants in various sectors of the economy, including waste. Specifically, SB 1383 establishes targets to achieve a 50 percent reduction in the level of the statewide disposal of organic waste from the 2014 level by 2020 and a 75 percent reduction by 2025.[45] Additionally, SB 1383 requires a 20 percent reduction in "current" edible food disposal by 2025. Although SB 1383 has been signed into law, compliance at the jurisdiction-level has proven difficult. For example, Santa Clara County suggests the 75 percent reduction in organics is not likely achievable under the current structure; standardized bin colors are impractical; and the general requirement is too prescriptive.[46] As such, SB 1383 is not included as part of the adjusted forecast. Instead measures addressing compliance with SB 1383 will be addressed through newly identified GHG reduction measures included in the Climate Action Plan.

4.4 Adjusted Scenario Forecast

The adjusted scenario is based on the same information as the business-as-usual scenario but also includes the legislative actions and associated emissions reductions occurring at the State and federal levels. These actions include regulatory requirements to increase vehicle fuel efficiency or standards to reduce the carbon intensity of electricity. The difference between the emissions projected in the adjusted scenario and the GHG reduction targets established for each horizon year is the amount of GHG reductions which are the responsibility of the City. This "gap analysis" provides the City with the total GHG emissions reduction required as well as information on the emissions sectors and sources which have the most GHG reduction opportunities.

The electricity and water/wastewater sectors all experience a strong downward trend, approaching near-zero in 2045 due to extremely stringent RPS from SB 100. Natural gas emissions are expected to continue an upward trajectory until the 2035 due to strong population growth projections in the city. This trend is partially offset due to the increasingly stringent efficiency requirements for new homes in the upcoming Title 24 code cycles. Commercial growth will also lead commercial natural gas emissions on a similar trajectory. Transportation emissions are expected to decrease sharply in the next 10 to 15 years due to existing fuel efficiency requirements and fleet turnover rates. As most current regulations expire in 2025 or 2030, emissions standards will experience diminishing returns while VMT continues to increase, leading to lower rates of emissions reduction in the transportation sector.

[45] CalRecycle. April 16, 2019. Short-Lived Climate Pollutants (SLCP): Organic Waste Methane Emissions Reductions (General Information). Accessed at: https://www.calrecycle.ca.gov/climate/slcp. Accessed on: Maty 20, 2019

[46] Santa Clara County. June 20, 2018. SB 1383 Rulemaking Overview. Accessed at: https://www.sccgov.org/sites/rwr/rwrc/Documents/SB%201383%20PowerPoint.pdf. Accessed on: May 20, 2019

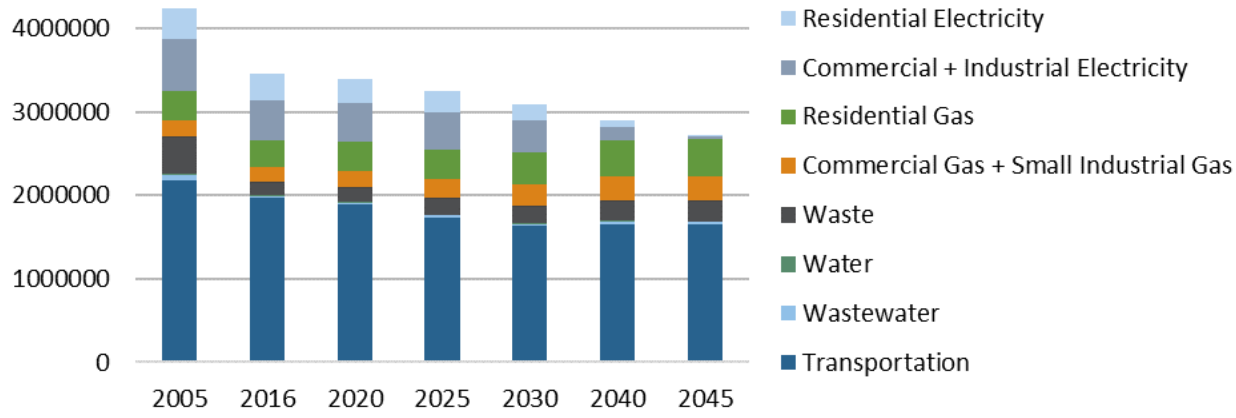
A summary of Sacramento's projected emissions by sector and year through 2045 can be found in Figure 7 and Table 25. Further details on the growth rates and emissions for each sector can be found in the corresponding discussion sections.

Table 25 Adjusted Scenario Forecast Summary by Sector by Target Year

	2016 (MT CO_2e)	2020 (MT CO_2e)	2025 (MT CO_2e)	2030 (MT CO_2e)	2040 (MT CO_2e)	2045 (MT CO_2e)
Population	486,154	518,627	559,218	599,809	670,836	699,903
Jobs	217,500	253,837	299,258	344,679	408,640	426,346
Residential Electricity	318,275	282,001	244,445	192,905	76,710	0
Commercial/ Industrial Electricity	489,945	473,740	446,096	378,081	161,952	0
Residential Gas	318,304	339,193	363,909	388,625	431,874	449,573
Commercial + District Industrial Gas	172,019	198,602	223,748	248,894	284,304	294,107
Waste	160,843	176,572	196,233	215,893	246,749	257,441
Water	9,607	8,832	8,204	6,877	2,948	0
Wastewater	19,867	21,810	24,238	26,667	30,478	31,799
Transportation	1,935,870	1,783,491	1,563,815	1,405,213	1,350,195	1,343,471
Total Emissions	**3,424,729**	**3,284,240**	**3,070,688**	**2,863,156**	**2,585,211**	**2,376,391**
Emissions Per Capita	**7.04**	**6.33**	**5.49**	**4.77**	**3.85**	**3.40**

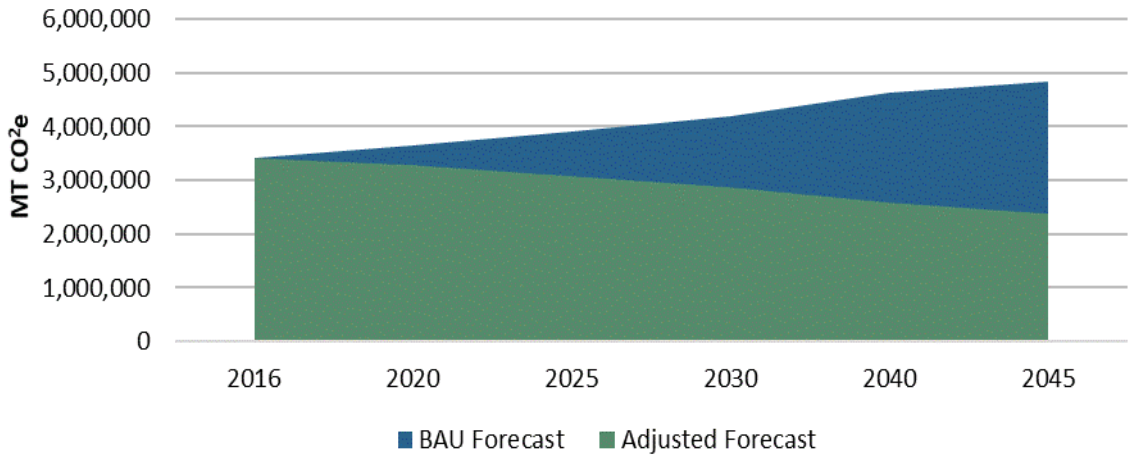
MT CO_2e: metric tons of carbon dioxide equivalent

Figure 7 Summary of Adjusted Scenario Forecast by Sector by Year



As shown in Figure 8, without legislative reductions, the City's emissions would increase proportionally with population and economic growth. In reality, several existing legislative reductions would limit the City's emissions growth, causing projected emissions to decrease. This scenario is depicted by the Adjusted Forecast. The legislative reductions for each sector and scaling methods used to project emissions are discussed in detail below.

Figure 8 BAU Scenario and Adjusted Scenario Forecast



4.5 Electricity

Between 2016 and 2045, electricity emissions for commercial, residential, and industrial buildings in the city of Sacramento, together representing the building energy electricity sector, are assumed to decrease from 808,220 MT CO_2e to 0 MT CO_2e, despite steady growth in Sacramento's population and employment levels due to the adoption of SB 100 and the renewable portfolio standard. SMUD's current plan to reach carbon neutral electricity includes the use of offsets. These offsets have not been identified fully and future work will need to ensure no double counting occurs between SMUD and Sacramento's efforts to reach carbon neutral emissions.

Emissions from future electricity use were forecasted by projecting anticipated growth in residential and commercial sectors and multiplying by expected electricity emission factors. Anticipated growth in the residential sector was projected as a function of population growth within the city while commercial sector electricity use was projected as a function of employment projections. Legislative adjustments included in the electricity sector forecast include RPS of 60 percent by 2030 and 100 percent GHG-free by 2045. Additionally, Title 24 building code efficiency increases for the 2019 code cycle were applied to all new growth within the city. The methodologies for the electricity sector which were forecasted in the adjusted scenario are summarized in Table 26 and Table 27.

Table 26 Electricity Sector Adjusted Scenario Forecast Methodology

Source Category	Forecasted Activity Data (Scaling Factor)	Emission Factor	Applied Legislative Reductions
Residential Electricity	Population growth in Sacramento	Assumes an electricity mix of 44 percent, 60 percent, and 100 percent GHG-free by 2025, 2030, and 2045, respectively, for SMUD emission factors per RPS requirements.	Title 24 standards for new construction in 2019 (53 percent residential, 30 percent commercial), RPS requirements
Commercial & Industrial Electricity	Employment growth in Sacramento		

RPS: Renewable Portfolio Standard; GHG: greenhouse gas; SMUD: Sacramento Municipal Utility District

Table 27 Electricity Adjusted Scenario Forecast Results by Target Year

Activity Data	2020	2025	2030	2040	2045
Residential Electricity					
Population	518,627	559,218	599,809	670,836	699,903
BAU per capita kWh	2,927.92	2,927.92	2,927.92	2,927.92	2,927.92
BAU total kWh	1,518,497,438	1,637,344,756	1,756,192,074	1,964,153,671	2,049,259,247
Adjusted kWh (Title 24)	1,505,899,622	1,561,757,862	1,617,616,101	1,715,358,052	1,755,357,672
Emissions factor (MT CO_2e/MWH)	0.18726	0.15652	0.11925	0.04472	0.0
MT CO_2e	**282,001**	**244,445**	**192,905**	**76,710**	**0**
Commercial Electricity					
Employment	253,837	299,258	344,679	408,640	426,346
BAU per job kWh	10,074.39	10,074.39	10,074.39	10,074.39	10,074.39
BAU total kWh	2,557,252,371	3,014,841,953	3,472,431,535	4,116,801,724	4,295,180,223
Adjusted kWh (Title 24)	2,529,796,996	2,850,109,703	3,170,422,411	3,621,481,543	3,746,346,492
Factor (MT CO_2e/MWh)	0.18726	0.15652	0.11925	0.04472	0.00000
MT CO_2e	**473,740**	**446,096**	**378,081**	**161,952**	**0**

MT CO_2e: metric ton of carbon dioxide equivalent; kWh: kilowatt hour; MWh: megawatt hour; BAU: business-as-usual

4.6 Natural Gas

Emissions from projected natural gas use were forecast using a similar methodology to the electricity sector. Anticipated natural gas use was projected for the residential and commercial sectors separately using population change and employment increase as growth indicators respectively. These results were multiplied by a natural gas emission factor of 0.00531 MT CO_2e per therm of natural gas.[47] Unlike electricity, the natural gas emission factor is based on the quality of the gas and remains relatively constant over time. This analysis did not consider any shift to renewable gas which may become more common over time and the use of which may affect future natural gas emission factors. The methodologies and data used to calculate natural gas emissions over time are summarized in Table 28 and Table 29.

Legislative adjustments applied for the natural gas sector include efficiency increases from Title 24 building code updates for new construction after the 2019 code cycle begins. Specific efficiency increases for new buildings over the previous triennial cycle are discussed in Section 4.3.

[47] The Climate Registry. 2016 Default Emissions Factors. Accessed at: https://www.theclimateregistry.org/wp-content/uploads/2014/11/2016-Climate-Registry-Default-Emission-Factors.pdf. Accessed on May 20, 2019

Table 28 Natural Gas Adjusted Scenario Forecast Methodology

Source Category	Forecasted Activity Data (Scaling Factor)	Emission Factor	Applied Legislative Reductions
Residential Natural Gas	Population growth in Sacramento	0.00531 MT CO_2e/therm	Title 24 standards for efficiency in new construction in 2019 (7 percent residential, 30 percent commercial over 2016 Title 24)
Commercial & District Natural Gas	Employment growth in Sacramento		

MT CO_2e: metric ton of carbon dioxide equivalent

Table 29 Natural Gas Adjusted Scenario Forecast Results by Target Year

Activity Data	2020	2025	2030	2040	2045
Residential Gas					
BAU therms	63,983,886	68,991,674	73,999,463	82,762,198	86,348,233
Title 24 adjusted therms	63,913,777	68,571,020	73,228,263	81,377,607	84,712,620
Factor (MT CO_2e/therm)	0.00531	0.00531	0.00531	0.00531	0.00531
MT CO_2e	**339,193**	**363,909**	**388,625**	**431,874**	**449,573**
Commercial Gas					
BAU therms	37,828,482	44,597,434	51,366,386	60,898,314	63,537,001
Title 24 adjusted therms	37,422,345	42,160,611	46,898,878	53,571,228	55,418,308
Factor (MT CO_2e/therm)	0.00531	0.00531	0.00531	0.00531	0.00531
MT CO_2e	**198,602**	**223,748**	**248,894**	**284,304**	**294,107**

MT CO_2e: metric ton of carbon dioxide equivalent; BAU: business-as-usual

4.7 Waste

The forecast used a baseline emissions rate of 0.7458 tons of waste per service population along with projected growth in Sacramento service population to establish the estimated tonnage of waste being disposed yearly through 2045. As the inventoried waste emissions include both waste-in-place and waste generation, an emissions factor of MT CO_2e per ton of waste was used to forecast emissions. An overall 2016 solid waste emissions factor, incorporating both generated waste and waste-in-place emissions, of 0.3058 MT CO_2e per ton of municipal solid waste was used to project emissions consistent with service population growth. Emissions from the waste sector will likely be less than the projected totals due to decreasing rates of organic material in the waste stream and recent legislation such as SB 1383 discussed in previous sections. At this time no mandate exists for individual cities and the waste reductions from these bills are incorporated into the Climate Action Plan through City reduction measures to avoid double counting. A summary of the methodologies and data used to model waste emission over time are provided in Table 30 and Table 31.

Table 30 Solid Waste Adjusted Scenario Forecast Methodology

Forecasted Activity Data (Scaling Factor)	Emission Factor	Applied Legislative Reductions
Service population growth	0.7458 tons per service person, 0.3058 MT CO_2e/ton of solid waste	N/A

MT CO_2e: metric ton of carbon dioxide equivalent; N/A: not applicable

Table 31 Waste Emissions Adjusted Scenario Forecast Results by Target Year

Activity Data	2020	2025	2030	2040	2045
Service Population	772,464	858,476	944,488	1,079,476	1,126,249
Ton waste per Service Population	0.7475	0.7475	0.7475	0.7475	0.7475
Total tons waste	577,402	641,694	705,987	806,888	841,850
Waste Factor (MT CO_2e/ton)	0.3058	0.3058	0.3058	0.3058	0.3058
MT CO_2e	**176,572**	**196,233**	**215,893**	**246,749**	**257,441**

MT CO_2e: metric ton of carbon dioxide equivalent

4.8 Transportation

Transportation emissions forecasts were developed consistent with the inventory methodology, through the determination of on-road annual VMT multiplied by a year-specific weighted emissions factor for emissions per mile travelled. VMT forecasts for the City of Sacramento were provided by Fehr and Peers Transportation Consultants through the use of SACOG SACSIM software. SACSIM was utilized to model VMT through 2040 with projected annual growth in County VMT as a proxy to extrapolate VMT for the years 2040 to 2045. Emissions factors were established for each year through the use of the EMFAC2017 GHG module, which established VMT and total emissions for each vehicle type in the County. These respective emissions factors were applied in each year to establish transportation emissions forecasts as shown in Table 32 and Table 33.

Table 32 Transportation Adjusted Scenario Forecast Methodology

Source Category	Forecasted Scaling Factor	Emissions Factor	Applied Legislative Reductions
On-road Transportation	SACSIM VMT Modeling[1]	EMFAC2017 model analyzing light duty (LDA, LDT1, LDT2, MDV, MCY) and heavy duty (LHD, T6, T7, PTO, MH, SBUS, UBUS, OBUS, Motor Coach, All Other Buses) vehicles.	EMFAC emission factors account for legislative reductions from Advanced Clean Cars, Pavley Clean Car Standards, Tractor-Trailer Greenhouse Gas Regulation, and adopted fuel efficiency standards for medium- and heavy-duty vehicles.

MT CO_2e: metric ton of carbon dioxide equivalent; VMT: vehicle miles traveled

[1]SACSIM incorporates data from many sources, including US Census, travel survey, and highway monitoring information. More information can be found on the SACOG SACSIM website at https://www.sacog.org/modeling

Table 33 Transportation Adjusted Scenario Forecast Results by Target Year

Activity Data	2020	2025	2030	2040	2045
Population Increase	518,627	559,218	599,809	670,836	699,903
VMT	4,451,651,325	4,582,448,563	4,713,245,802	4,974,840,279	5,206,516,958
EMFAC (MT CO_2e/VMT)	0.000401	0.000341	0.000298	0.000271	0.000258
MT CO_2e	1,783,491	1,563,815	1,405,213	1,350,195	1,343,471

MT CO_2e: metric ton of carbon dioxide equivalent; VMT: vehicle miles traveled

4.9 Water and Wastewater

Due to the increased use of the water system attributed to increases in job and population growth in Sacramento, service population was used as a scaling metric to determine water and wastewater service emissions through 2045. The Sacramento Wastewater Treatment Plant is currently undergoing renovations and upgrades through 2023 to modernize its facilities. As part of the "EchoWater Project", future wastewater emissions are expected to be lower than quantified here due to ammonia effluent reductions.

Projections for water used a baseline activity factor of 60.92 kWh per service population per year. This emissions factor was multiplied by service population growth through 2045 to find total kWh usage. The RPS for electricity generation was then applied to water emissions, as described in the Legislative Adjustment Section, to determine final MT CO_2e emissions as shown in Table 35 and Table 36.

As wastewater emissions are calculated from both methane as well as stationary and process nitrous oxide emissions, wastewater projections used an emissions factor of 0.028 MT CO_2e per service population per year and a growth indicator of service population to determine future wastewater emissions.

Table 34 Water and Wastewater Adjusted Scenario Forecast Methodology

Forecasted Activity Data (Scaling Factor)	Emissions Factor	Applied Legislative Reductions
Service population (population and employment growth)	SMUD electricity emissions factors, 60.92 kWh per service population per year	Assumes an electricity mix of 44 percent, 60 percent, and 100 percent GHG-free by 2025, 2030, and 2045 respectively for SMUD emission factors per RPS requirements.
Service population (population and employment growth)	0.0282 MT CO_2e per service person per year for wastewater	N/A

MT CO_2e: metric ton of carbon dioxide equivalent; kWh: kilowatt hour; SMUD: Sacramento Municipal Utility District; N/A: not applicable

Table 35 Water Adjusted Scenario Forecast Results by Target Year

Activity Data	2020	2025	2030	2040	2045
Service Population	772,464	858,476	944,488	1,079,476	1,126,249
kwh/Service Person	61.06	61.06	61.06	61.06	61.06
Total kWh	47,165,408	52,417,171	57,668,933	65,911,104	68,766,992
RPS Electricity Factor (MT CO_2e/kWh)	0.1872638	0.1565190	0.1192526	0.0447197	0
MT CO_2e	8,832	8,204	6,877	2,948	0

MT CO2e: metric ton of carbon dioxide equivalent; kWh: kilowatt hour; RPS: renewable portfolio standard

Table 36 Wastewater Adjusted Scenario Forecast Results by Target Year

Activity Data	2020	2025	2030	2040	2045
Service Population	772,464	858,476	944,488	1,079,476	1,126,249
MT CO_2e/Service Population	0.028	0.028	0.028	0.028	0.028
MT CO_2e	**21,810**	**24,238**	**26,667**	**30,478**	**31,799**

MT CO_2e: metric ton of carbon dioxide equivalent; kWh: kilowatt hour;

5 Provisional Target Setting

Climate action plan GHG-reduction targets can be set as either an efficiency target (MT CO_2e per capita or per service population per year) or as a community wide mass emissions target (total MT CO_2e). With CARB's publication in 2017 of the Scoping Plan Update, the State recommended using efficiency metrics for local targets to incentivize growth in a coordinated manner and not penalize cities which are growing at significant rates.[48] Throughout this section, targets are discussed in terms of per capita metrics, however, they must occasionally be translated into absolute emissions reductions to quantify reduction measures and identify the magnitude of reductions required.

Target setting is an iterative process which must be informed by the reductions that can realistically be achieved through the development of feasible GHG reduction measures. Furthermore, as mentioned previously, changes to the General Plan Update may impact the forecast results. As such, the targets identified herein should remain provisional until the General Plan Update values are finalized and the quantification and analysis of potential GHG reduction measures completed.

The City of Sacramento has achieved both efficiency and absolute emissions reductions between 2005 and 2016 despite high population growth rates. The purpose of target setting is to develop the trajectory toward achieving the State's 2030 goal and prepare for the deep decarbonization needed by 2045 in a cost-effective manner by setting an incremental path toward achieving the EO B-55-18 goals. There are several target pathways available to be consistent with State reduction goals, discussed further below.

- **SB 32 Target Pathway** is the pathway toward achieving the minimum reductions required by State law. This will require minimal reductions until 2030 and then steep reductions from 2030 to 2045.
- **Linear Carbon Neutrality Pathway** is an incremental linear pathway from current per capita emissions levels straight to carbon neutrality in 2045. This pathway is also compliant with the 2030 State goal.
- **Mass Emissions Reduction Pathway** is the pathway determined by reducing mass emissions without consideration to population growth. This pathway will require steep reductions to 2030 and then a slightly more gradual reduction to the 2045 carbon neutrality goal. This pathway is also compliant with the 2030 goal.

At this time, the State has codified a goal of reducing emissions to 40 percent below 1990 emissions levels by 2030 (SB 32) and has developed a Scoping Plan to demonstrate how the State will achieve the 2030 goal and make substantial progress toward the State's long-term GHG reduction goals. Sufficient data does not exist to perform a full 1990 inventory, however, as discussed in the Background section, the State has indicated a 15 percent reduction from 2005 GHG emissions levels can be considered equivalent to a 1990 baseline. Consistent with this methodology, a 1990 emissions level of 3,600,213 MT CO_2e, or 9.75 MT CO_2e per capita was established for Sacramento.

The State recommends utilizing a per capita efficiency metric for SB 32 targets, therefore, a target of 5.85 MT CO_2e per capita (40 percent reduction from 9.75 MT CO_2e per capita in 1990) was established as an emissions level compliant with SB 32 target levels. This is the equivalent of 3,510,283 MT CO_2e based on the 2030 forecasted population for the City.

[48] California Air Resources Board. 2017. California's Climate Change Scoping Plan, p. 99-102.

While no State plan exists to achieve carbon neutrality by 2045, EO B-55-18 directs CARB to ensure future Scoping Plan updates identify and recommend measures to achieve the carbon neutrality goal. Executive Orders are binding only unto State agencies and are not binding on local governments or the private sector. However, showing progress toward this goal is expected to be a mandatory component of CEQA analyses upon publication of the next Scoping Plan.

Based on this information, establishing provisional targets for the years 2025 (interim target), 2030 (SB 32 target year), 2040 (General Plan horizon year), and 2045 (EO B-55-18 target year) is recommended. The 2045 target is intended to be a long-term commitment demonstrating the City's commitment to achieving the long-term goal presented in EO B-55-18. The City has several potential pathways to show consistency with State targets as shown in Table 37.

To account for the expected growth in Sacramento's population and economy over the next 10 to 25 years, a per capita efficiency metric is used to normalize emissions targets. Table 37 shows the per capita emissions forecast and the different target pathway options available to achieve consistency with the SB 32 and EO B-55-18 goals.

Table 37 Per Capita Pathway Targets by Target Year

Year	Forecast	SB 32 then Carbon Neutral Pathway	Linear Carbon Neutral Pathway	Mass Reduction Pathway
	MT CO_2e per person per year			
2020	6.3	6.3	6.1	5.9
2025	5.5	6.1	4.8	4.7
2030	4.8	5.8	3.6	3.6
2040	3.9	1.9	1.2	1.1
2045	3.4	0.0	0.0	0.0

MT CO_2e: metric ton of carbon dioxide equivalent

The absolute GHG emissions gap in 2030, 2040, and 2045 between each target pathway and the forecast emissions can be found in Table 38. This gap will be bridged by local actions developed in the City of Sacramento Climate Action Plan.

Table 38 Remaining GHG Emissions Gap in 2030 and 2040 by Pathway

Pathway Emissions Gap (MT CO_2e)	SB 32 Target Pathway (minimum)	Linear Carbon Neutral Pathway	Mass Reduction Pathway
2030 Gap	-647,127	683,271	703,028
2040 Gap	1,277,478	1,773,109	1,865,168
2045 Gap	2,376,391	2,376,391	2,376,391

MT CO2e: metric ton of carbon dioxide equivalent

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City of Sacramento Climate Action Plan Update

Appendix C – Community GHG Emission Reductions

DRAFT

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Introduction

Section 15183.5(b)(1) of the CEQA guidelines establishes several criteria which must be met in order to allow for CEQA streamlining and to be considered a "qualified GHG reduction plan". This technical appendix provides the information pursuant to Subsection (D) which states, "measures or a group of measures, including performance standards, that substantial evidence demonstrates, if implemented on a project-by-project basis, would collectively achieve the specified emissions level." This technical appendix is organized around three levels which include:

- **Sectors**: Sectors define where the GHG reductions will take place and include Energy and Electrification, Mobility, Waste, and **s**equestration
    - **Measures**: Measures define core strategy that will result in substantial reductions in GHG emissions.
        - **Actions**: Each measure is driven by sets of actions that together support and generate the GHG reductions necessary to achieve the City's goal

Measures and actions can be either quantitative or supportive and are defined as follows:

Quantitative: These measures and actions have substantial evidence including case studies, calculations, or other substantial evidence that prove that the implementation of said measure/action will have a measurable GHG reduction when implemented. These measures/actions have been quantified based on this evidence and the reductions summed to show how Sacramento will meets its 2030 and 2045 goals and exceed the with the state target (SB32) of 40 percent below 1990 by 2030.

Supportive: These measures and actions may also be quantifiable and in most cases have substantial evidence to support their overall contribution to GHG reduction. However, due one of several factors including a low GHG reduction benefit, indirect GHG reduction benefit, potential for double-counting, or simply a high level of difficulty in quantifying accurate GHG reductions, they have not been quantified and do not contribute directly to the expected GHG reduction goal and consistency with the state targets. However, these measures/actions are critical to the overall success of the CAP.

Together the quantitative and supportive measures and actions listed below will help Sacramento reach their goal of reducing per capita emissions from 9.7 MT CO_2e in 1990[1] to 3.6 MT CO_2e by 2030 and net zero by 2045. This equates to a 63% reduction in per capita GHG emissions by 2030. These goals exceed the requirements of SB32 (a 40% reduction or 5.8 MT per capita in 2030) and meets the intent of Executive Order B-55-18. The total mass emissions target which corresponds to this per capita goal (based on current population projections) is 2,179,885 MT CO_2e in 2030 and carbon neutral in 2045. To reach this goal the City of Sacramento will need to reduce GHG emissions by 683,271 MT CO_2e by 2030. This technical report provides the substantial evidence that CAP measures can be expected to achieve the 2030 goal and provide substantial progress toward achieving long-term reduction toward meeting the reduction goal identified in the state's Executive Order (EO) B-55-18. Avoiding interference with, and making substantial progress toward, these long-term state targets is important as these targets have been set at levels that achieve California's fair share of international emissions reduction targets

[1] Estimated 1990 levels, equivalent to a 15% reduction below baseline 2005 GHG inventory levels, the most recent year for which a complete inventory is available and consistent with state guidance.

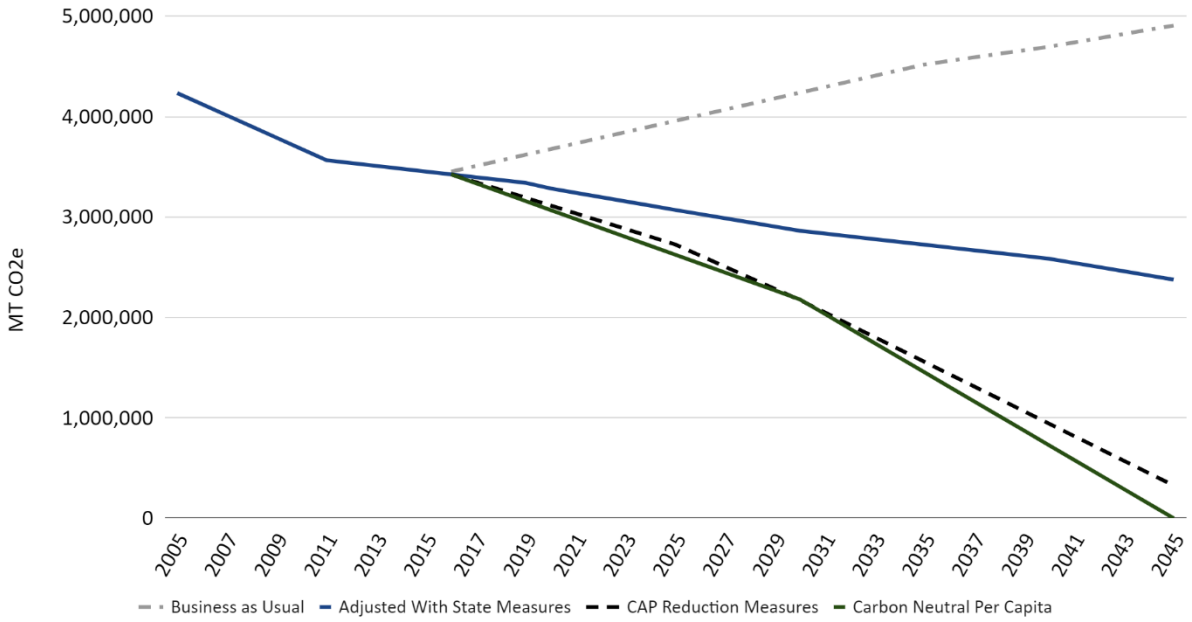
that will stabilize global climate change effects and avoid the adverse environmental consequences described under Section 3.1.3, *Potential Effects of Climate Change* (Executive Order B-55-18).

The City has also established a goal consistent with EO B-55-18 of achieving carbon neutrality by 2045. The measures identified in this CAP will lead to a significant reduction in GHG emissions and provide a foundation for achieving net carbon neutrality. However, achieving carbon neutrality will require significant changes to the technology and systems currently in place including electrification of building and transportation systems, an increased shift to shared and active mobility, carbon neutral electricity, and waste reduction and diversion. The measures and actions developed to meet the 2030 goals are the foundations and establish the trajectory for this long-term transformation. However, the 2045 GHG emissions reductions quantified in this CAP are not yet enough to meet the long term 2045 goal. As the current measures and actions are implemented the City will gain more information, new technologies will emerge, and current pilot projects and programs will scale to the size needed to reach carbon neutrality. Furthermore, the State is expected to continue providing updated regulations and support once the 2030 target is achieved. Future CAP updates will outline new measures needed to reach the ultimate goal of carbon neutrality.

GHG Reduction Summary

The City of Sacramento, in coordination with Rincon Consultants, the Mayors Climate Commission, the Sacramento Municipal Utility District (SMUD), the Sacramento Regional Transportation Agency (SACRT), and input from the community have developed a suite of measures and specific actions to reduce GHG emissions over time. Based on these measures, the total GHG emissions reduction is expected to be 736,603 MT CO_2e by 2030 and 2,088,317 MT CO_2e by 2045. This exceeds the 2030 target but falls short of the 2045 target by 288,074 MT CO_2e. This is illustrated below in Figure 1.

Figure 1: Estimated GHG Reduction and Target Pathway



A summary of the GHG emissions reduction by Measure is included in Table 1. For a complete description of each measure and the contributing actions, please refer to the appropriate sector and measure below.

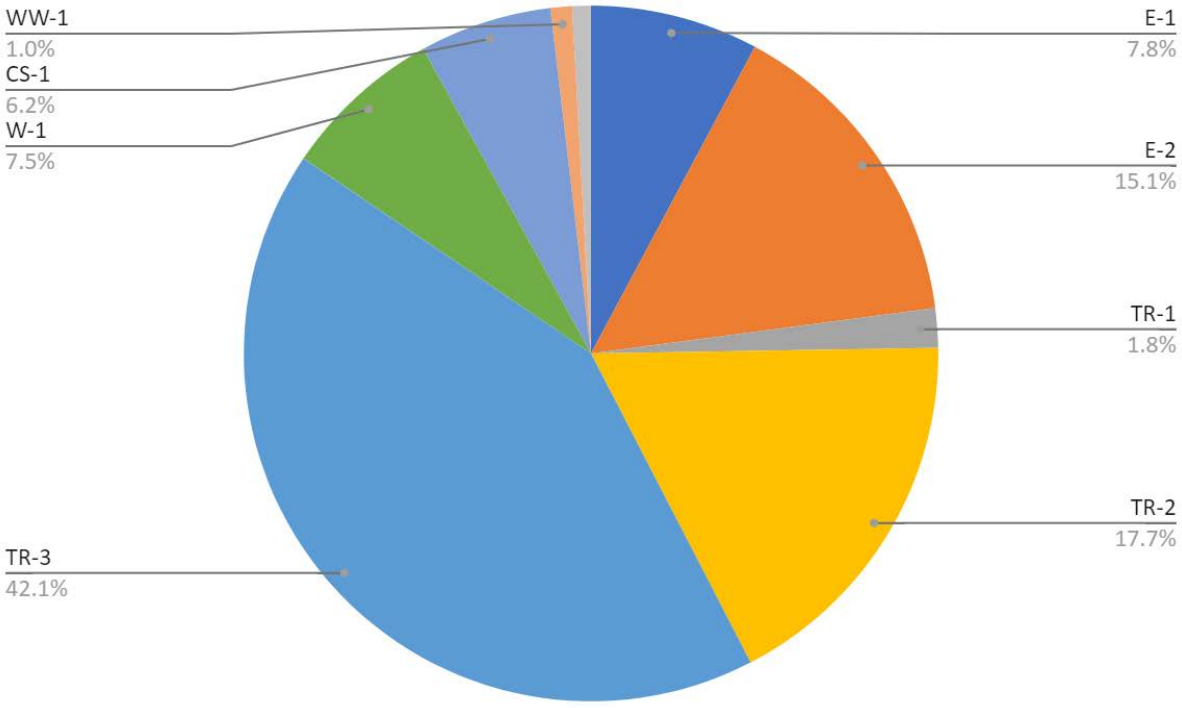
Table 1: Summary of GHG Emissions Reductions by Measure

Measure #	Measure Name	2030 Reduction MT CO_2e	2045 Reduction MT CO_2e
Built Environment (Energy and Electrification)			
E-1	Eliminate natural gas in new construction.	53,706	174,968
E-2	Transition gas in existing buildings to carbon-free energy by 2045	103,547	394,016
E-3	Increase the amount of electricity produced from local resources and work with SMUD to install 246 MWh of local storage by 2030.	Supportive	Supportive

E-4	Support infill growth to ensure that 90% of growth is in the established and center/corridor communities and 90% small-lot and attached homes by 2040, consistent with the regional Sustainable Communities Strategy. Project-level VMT should be 15% below (or 85% of) the regional average	Supportive	Supportive
Mobility			
TR-1	Reduce VMT by 3% by 2030 (129 million vehicle miles per year) and 6% (305 million vehicle miles) by 2045 compared to baseline through the prioritization of active transportation.	12,572	28,712
TR-2	Reduce VMT by 12.5% (556 million miles per year) compared to baseline through the prioritization of transit and shared mobility.	121,201	146,595
TR-3	Transfer 28% of passenger and 22% of Commercial VMT to zero emission vehicles (ZEV) by 2030 and 100% of all vehicles by 2045.	288,818	1,173,368
Waste			
W-1	Achieve the requirements of SB 1383 to reduce organic waste by 75% by 2025.	51,429	61,298
Carbon Sequestration			
CS-1	Increase urban tree canopy cover to 30% by 2030 and 35% by 2045.	42,263	61,474
Water and Wastewater			
WW-1	Reduce water utility emissions (in MT of CO_2e per MG) delivered by 100% by 2030 and maintain that through 2045.	6,877	0
WW-2	Reduce wastewater emissions by 22% by 2030 and 40% by 2045.	5,954	12,853
Reduction Summary			
Total Reduction Needed		683,271	2,376,391
Estimated Reductions Achieved		686,368	2,053,283
Gap		-3,097	323,108

As shown in Table 1, the measures adopted in this Climate Action Plan have the ability when fully implemented to reduce GHG emissions by approximately 686,368 MT CO_2e by 2030. This exceeds the goal reduction by 3,097 MT CO_2e. However, a gap of 323,108 MT of CO_2e remains in 2045. As new technologies develop, and the State consolidates around the 2045 carbon neutrality target, the City of Sacramento will adopt new strategies to achive this long term goal. Furthermore, the actions in this CAP when implemented will create the basis for long term carbon neutrality including carbon neutral buildings, electric vehicles, and improved active transportation and transit. The major sectors for GHG reductions are transportation and buildings. The percent of total reduction generated by each quantifiable measure is shown below in Figure 2.

Figure 2: GHG Reductions in 2030 by Measure



The following section provides the substantial evidence and quantification methodology which provides the reasonable assurance that the GHG reduction strategy adopted by the City of Sacramento will lead to the expected GHG reductions necessary to reach the City's ambitious GHG reduction goals.

Built Environment (Energy and Electrification)

Measure E-1: Eliminate natural gas in new construction	***2030 Target*** *53,706 MT CO_2e* ***2045 Target*** *174,968 MT CO_2e*

Performance Metric(s):

- Develop and pass an electrification ordinance which bans natural gas in new construction under four stories by 2023.
- Develop and pass an electrification ordinance which bans natural gas in all new construction by 2026.

Action #	Action	Anticipated Reduction
Quantitative Measures		
1	Develop and adopt an electrification ordinance that requires all new construction under four stories to be all-electric by 2023 and all construction to be all-electric by 2026.	53,706 MT CO_2e (2030) 174,968 MT CO_2e (2045)

Measure Quantification Background

In order for Sacramento to reach carbon neutrality, the majority of the buildings in the City will need to be carbon neutral. Electrification allows buildings to use 100% carbon neutral electricity that will be provided by SMUD by 2045. To ensure new buildings won't need to be retrofitted later, this measure will ensure all new buildings are built to utilize only electricity as an energy source. These buildings will then achieve carbon neutrality by 2045, due to SMUD's attainment of electricity from fossil-free sources as required by the state. The emissions savings for this measure were calculated as the difference between the projected therm consumption (based on the 2016 per capita therm usage and Dept. of Finance population growth) and the expected natural gas use in 2030 and 2045 under baseline conditions and Dept. of Finance population growth[2]. The forecast also included expected efficiencies due to Title 24.

Action 1: Develop and adopt an electrification ordinance that requires all new construction under four stories to be all-electric by 2023 and all construction to be all-electric by 2026.

Evidence: Continuing to allow natural gas in new buildings would result in an increase of GHG emissions through 2045, due to increases in populations and residential construction in the City projected through 2045. Conversely, GHG emissions from electricity generation will decrease to zero by 2045, due to SB

[2] See Appendix A for complete population projection numbers

100 (which requires 100% renewable electricity by 2045). The adoption of an electrification ordinance would lead to a mandatory reduction in natural gas consumption compared to baseline projections by replacing natural gas with electricity.

Since the 2023 ordinance would not completely ban natural gas in new buildings, an estimate of the number of 4+ story buildings permitted in Sacramento each year was made. This estimate was developed by looking at the total 4+ story buildings permitted in the 2018 and 2019 calendar year and developing a CalEEMod model for each construction project. The resulting calculations estimated that in both 2018 and 2019 ten projects were permitted. This equated to an estimated increase in natural gas demand by 61,078 therms per year from projects completed in 2018 and 64,598 therms per year in 2019. Assuming similar construction trends an average of 62,83 therms or 333 MT of CO_2e will be added to Sacramento's total natural gas consumption from buildings 4 stories or taller from 2023 to 2026 for a total increase in emissions of approximately 1,000 MT CO_2e. It should be noted that emissions from construction between 2020 and 2023 are already included in the calculation by using the forecasted natural gas consumption in 2023 as the basis for the calculation.

Based on the GHG emissions forecast which is predicated on Dept of Finance Population Growth and current per capita natural gas consumption, banning gas in new construction under four stories by 2023 will save an estimated 13.15 million therms of natural gas by 2030 and banning all natural gas use in buildings in 2026 will save 33.1 million therms by 2045. However, these ordinances will lead to an increase in electricity consumption because calculations assume natural gas use will be offset by electric appliances. The conversion also assumes a 300% appliance efficiency increase due to the inclusion of modern heat pump technologies[3]. By 2045 all emissions from electricity are eliminated by the use of 100% carbon free electricity. The calculation used to estimate these emissions are included below.

Quantification Results Summary

Action 1	2030	2045
Total therms saved	12,965,199	32,968,986
MT CO_2e/therm	0.00531	0.00531
Emissions reductions MT CO_2e	68,807	174,968
Emissions from electricity conversion	15,100	0
Net MT CO_2e savings	53,706	174,968

[3] https://help.leonardo-energy.org/hc/en-us/articles/203047881-How-efficient-is-a-heat-pump-

Measure E-2:

Transition gas in existing buildings to carbon-free energy by 2045

2030 Target

103,547 MT CO_2e

2045 Target

394,016 MT CO_2e

Performance Metrics:

- Develop and pass ordinance
- Reduce natural gas use by 28% by 2030
- Reduce natural gas use by 100% by 2045

Action #	Action	Anticipated Reduction
Quantitative Actions		
1	Develop an electrification ordinance for existing buildings/construction that will be implemented through the building permit process to transition fossil fuels to electric by attrition following adoption of Measure E-1). The existing construction buildings ordinance would be implemented in phases as follows: Phase 1: No new expansions of gas appliances or gas lines at existing buildings/construction. Phase 2: Require HVAC system replacements, new hot water heaters, and other appliances to be all-electric or utilize other low-carbon technologies as the market evolves. Phase 3: Provide enforcement with a permit compliance program to be implemented at point-of-insurance to ensure that existing buildings have permits for all previous work.	103,547 MT CO_2e (2030) 394,016 MT CO_2e (2045)
Supportive Actions		
2	Work with SMUD to expand existing low-income programs within the City to weatherize and retrofit/electrify existing buildings, with the goal of reducing energy consumption, decreasing utility bills, and converting to carbon-free energy use by 2040.	Supportive
3	Continue to partner with SMUD to promote and educate the community about existing programs and expand	Supportive

	electrification retrofit incentives for space and water heating to support the electrification ordinances.	
4	Continue to partner with SMUD to provide electrification retrofit incentives for space and water heating and investigate the development of programs like on-bill financing or metered energy efficiency.	Supportive
5	Continue to promote and incentivize electrification supportive energy efficiency in existing buildings including lighting, insulation, and air sealing upgrades through programs like PACE and other financing mechanisms.	Supportive
6	Work with community partners to include voluntary energy efficiency and/or GHG emissions scores at time of sale and to post results on Multiple Listing Service (MLS) or other real estate app.	Supportive

Measure Quantification Background

SMUD incentives will support the transition of existing buildings away from fossil fuels, including significant rebates on electric appliances and infrastructure. The city may need to adopt a mandatory phase out of gas appliances, depending on the success of the voluntary program. Action 1 outlines the sequence for phasing out gas appliances in existing buildings.

Action 1: Electrification ordinance for existing buildings will be implemented through the building permit process to transition gas to electric by attrition following adoption of Measure E-1. The existing buildings ordinance would be implemented in phases as follows:

Phase 1: No new expansions of gas appliances or gas lines at existing buildings.

Phase 2: Require HVAC system replacements and new hot water heaters to be all-electric.

Phase 3: provide enforcement with a permit compliance program to be implemented at point-of-sale to ensure that existing buildings have permits for all previous work.

***Evidence**:* 34% of natural gas use in buildings is from residential and commercial water heating. 40% of natural gas use in buildings is from space heating.[4] Natural gas hot water heater life expectancy is approximately 10 years.[5] Therefore, under this ordinance the City should see a 34% decrease in natural gas use from hot water heater electrification in existing buildings by 2035. Natural gas furnace lifecycles are expected to be between 15-20 years with an average of 18 years.[6] Therefore, under this program the City would expect to see an additional 40% reduction in natural gas consumption in existing buildings by 2043. Assuming a linear replacement of existing HVAC and hot water heating equipment, the City should expect to see a 28% decrease in natural gas emissions by 2030 and a

[4] https://www.synapse-energy.com/sites/default/files/Decarbonization-Heating-CA-Buildings-17-092-1.pdf
[5] https://www.lowes.com/n/how-to/when-to-replace-a-water-heater
[6] https://www.thisoldhouse.com/ideas/how-long-things-last

74% decrease by 2045 from this mandatory ordinance. This equates to approximately 26 million therms by 2030 and 68 million therms by 2045, calculated as the corresponding percent reduction from 2016 therm use.

Quantification Results Summary

Action 1	2030	2045
Total Therm Reduction from Electrification	24,997,357	74,244,055
MT per Therm	0.00531	0.00531
Gas Savings MT CO_2e	132,662	394,016
Emissions from electricity conversion (MT CO_2e)	29,114	0
Net MT CO_2e Savings	103,547	394,016

Supportive Actions

Action 2: Work with SMUD to expand existing low-income programs within the City to weatherize and retrofit/electrify existing buildings, with the goal of reducing energy consumption, decreasing utility bills, and converting to all-electric by 2040.

Evidence: According to SMUD, the low-income programs are expected to reduce GHG emissions by 33,200 MT[7] of CO_2e by 2040 by electrifying and upgrading 100% of low-income single-family homes. However, these reductions are not applied to the overall emissions reductions (to eliminate double counting issues) and are considered supportive of the overall community electrification efforts.

Electrification programs that target low-income residents are the most cost-effective and potentially successful approach for equitable decarbonization to combat climate change.[8] For example, the Low-Income Weatherization Program (LIWP) is the state's first energy efficiency program that targets low-income Californians and has reduced energy bills in participating multifamily buildings by 30 percent and overall energy usage by an average of 40 percent.[9] A case study on a major energy retrofit in a Lancaster 100-unit low income multifamily complex resulted in a one-third reduction in natural gas use (approximately 145 therms per apartment).[10] SMUD's programs, which focus on electrificaiton, could be expected to have even more pronounced GHG reduction benefits. The study also showed that such retrofits can result in increased tenant retention, improved health and comfort, and better ability to afford necessities like food, medicine, health care, and rent.

[7] Scott Blunk - SMUD
[8] http://greenlining.org/wp-content/uploads/2019/10/Greenlining_EquitableElectrification_Report_2019_WEB.pdf
[9] California Housing Partnership Corporation and Association for Energy Affordability (2018). California's Cap-and-Trade-Funded Low Income Weatherization Program Multifamily: Impact Report, 3.
[10] https://ww2.energy.ca.gov/2019publications/CEC-500-2019-021/CEC-500-2019-021.pdf

Action 3: Continue to partner with SMUD to promote and educate the community about existing programs and expand electrification retrofit incentives for space and water heating to support the electrification ordinances.

Evidence: Electrification of space and water heaters is the best and cheapest way to reduce emissions from California's existing buildings through 2045 due to SB 100.[11] The largest barrier to implementation of this is high up-front capital costs.[12] Utility-offered incentives to offset these costs for the end-user are therefore among the most promising opportunities for updating this technology.[13]

The impacts associated with promotional and educational outreach for electrification have not been well documented due to the cutting-edge nature of the strategy. Electrification has only begun to gain popularity in California mostly due to the implementation of SB 100 and the expansion of community choice aggregations. While it is not clear how the community will respond to electrification, energy efficiency outreach has been conducted since as early as the 1970's and some research has been conducted on the effects of outreach and education on energy. One study in New York showed that out of the 8,991 people who participated in informational programs, 69% implemented the recommended practices.[14] Another research meta-analysis reviewed dozens of papers covering various energy efficiency, water efficiency, and waste outreach and found that education-only campaigns could produce between 10-12% energy savings.[15]

Electrification is a new idea and not well understood by the community. The education associated with this action as well as the Climate Action Plan itself will facilitate adoption of all-electric technologies. The City will conduct a CAP update between 3 and 5 years to check progress and adopt more voluntary or potentially mandatory measures if necessary.

Action 4: Continue to partner with SMUD to provide electrification retrofit incentives for space and water heating and investigate the development of programs like on-bill financing or metered energy efficiency.

Evidence: This measure is considered supportive to the overall electrification goals. However, using on-bill financing to fund energy-saving retrofits has demonstrated energy savings results in the past. A case study from affordable multi-family residential complexes in Santa Monica showed that electricity savings from the program ranged from 1,811-17,712 kWh and natural gas savings ranged from 914-2,567 therms, with overall energy improvement ranging from 10-35%.[16]

Action 5: Continue to promote and incentivize electrification supportive energy efficiency in existing buildings including lighting, insulation, and air sealing upgrades through programs like PACE and other financing mechanisms.

[11] https://www.mdpi.com/2073-4433/10/8/435/htm
[12] California Center for Sustainable Energy. 2009. Solar Water Heating Pilot Program: Interim Evaluation Report.
[13] https://www.synapse-energy.com/sites/default/files/Decarbonization-Heating-CA-Buildings-17-092-1.pdf
[14] https://www.joe.org/joe/2009december/pdf/JOE_v47_6a6.pdf
[15] https://aceee.org/files/proceedings/2000/data/papers/SS00_Panel8_Paper10.pdf
[16] https://1p08d91kd0c03rlxhmhtydpr-wpengine.netdna-ssl.com/wp-content/uploads/2017/03/Santa-Monica-Test-Web.pdf

Evidence: While the use of carbon neutral electricity by 2045 due to SB100 ensures all-electric buildings have zero energy emissions, there is still a need to reduce energy consumption within Sacramento. Reducing energy consumption will reduce stress on the electricity grid, require less renewable energy generation to meet needs thereby saving resources, and help reduce energy bills within the community.

Action 6: Work with community partners to include voluntary energy efficiency or GHG emissions score disclosures prior to time of sale on MLS or another real-estate app.

Evidence: While this action does not itself result in any quantifiable improvements to energy efficiency in participating buildings, it would provide the initial framework to eventually require retrofits in problematic buildings at time of sale, resulting in quantifiable emissions reductions over time that would be proportional to the required retrofits. Benchmarking programs implemented in Portland, OR, Boulder, CO, and New York, NY saw average reductions in median energy use intensity (EUI) ranging from 3.5 to 6 percent over 3 to 10 years. Overall reductions may vary depending on whether or not upgrades are mandated by the program, and to what extent. In the U.S., 31 cities/counties/states have adopted some form of mandatory energy benchmarking and transparency policies. A potential co-benefit to the energy benchmarking and disclosure policy may be a decrease in vacancy rates for participating buildings. A study of Chicago office buildings showed that ENERGY STAR-label buildings experienced decreasing trends (6.7% annual decrease) in vacancy rates, indicating that "benchmarking policy can have a positive impact on improving the real estate performance of energy-efficient buildings."[17]

[17] https://www-sciencedirect-com.stanford.idm.oclc.org/science/article/pii/S0959652619343707

Measure E-3:	***2030 Target***
Increase the amount of electricity produced from local resources and work with SMUD to install 246 MWh of local storage by 2030	*Supportive*
	2045 Target
	Supportive

Performance Metrics:

- Complete a pilot local renewable energy project by 2030
- 246 MW of local (SMUD Territory) storage by 2030[18]

Action #	Action	Anticipated Reduction
1	Continue to promote and support local on-site energy generation and storage resources by working with SMUD to implement their IRP (246 MW of needed storage territory wide by 2030) as well as other community partners.	Supportive
2	Work with SMUD to develop a location and capacity-based plan to add community storage and renewable generation at locations in the City which would best support overall grid functionality while electrifying the building stock and maximizing the utilization of existing electrical infrastructure.	Supportive
3	Work alongside SMUD to promote and further incentivize battery storage and on-site solar as a means to maximize electrification benefits and improve resiliency.	Supportive
4	Develop a co-located community solar and storage project of at least 1 MW as a pilot project collaboration between SMUD and the City of Sacramento with SMUD leading project development and the City providing a location and permitting support.	Supportive

Measure Quantification Background

The actions in Measure E-3 have not been quantified but are key strategies in electrifying the City of Sacramento as well as allowing SMUD to reach their 2045 target of carbon neutral electricity. These actions will help SMUD balance the grid, generate more renewable electricity, harness the benefits of

[18] Identified need in SMUD IRP

distributed battery storage, and create more resiliency around the electricity grid in general. Without these actions, the GHG reductions associated with E-1 and E-2 are more difficult to achieve.

Supportive Actions

Action 1: Continue to promote and support local on-site energy generation and storage resources by working with SMUD to implement their IRP (246 MW of needed storage territory wide by 2030) as well as other community partners.

Evidence: While difficult to directly quantify the effects of this action on community-wide emissions, on-site energy generation and storage can help local governments and their communities achieve substantial energy, environmental, resilience, and economic benefits.[19] For example, the City of Sacramento has already installed 4.9 MW of on-site solar at City owned facilities. This results in the production of over 7,000,000 kWh of electricity per year. The City also offsets an additional 29,000,000 kWh's of electricity through SMUD's SolarShares program. In 2018, the San Francisco airport installed 72 kWh of solar photovoltaic PV, which became the world's first Zero Net Energy certified facility at an airport, helping campus-wide electricity to decline 4.7% since 2013 and supporting their goal of a Zero Net Energy campus by 2021.[20] The school district of Spirit Lake, Iowa currently operates and uses two wind turbines to power its elementary, middle, and high schools, and administrative buildings, meeting 46% of the district's needs.[21] Projects like these can also indirectly reduce community emissions by creating publicity and awareness around the issue. In 2003, Lenox, Iowa installed a 750-kW wind turbine to produce electricity for its own facilities at about the same time that the town's municipal electric utility began offering customers the option to purchase renewable energy. The opt-in response rate was 13%, almost double the typical opt-in rates seen in other jurisdictions. The success of the program was attributed to the increased public awareness generated by the new turbine.[22]

Action 2: Work with SMUD to develop a location and capacity-based plan to add community storage and renewable generation at locations in the City which would best support overall grid functionality while electrifying the building stock and maximizing the utilization of existing electrical infrastructure.

Evidence: Distributed battery storage and renewables can be used instead of traditional transmission and distribution infrastructure upgrades to help meet the increasing demand that electrification will put on the grid. While this action will not directly reduce GHG emissions, it will support the overall transition to an electrified building stock at the lowest cost and with the most resilience.

Action 3: Work alongside SMUD to promote and further incentivize battery storage and on-site solar as a means to maximize electrification benefits.

Evidence: While it's hard to know exactly how effective promotion and incentives for residential battery storage and on-site solar will be, trends across the county indicate that these options are desirable for homeowners. This effort is expected to lead to decreased emissions in the long-term and increase

[19] https://www.energy.gov/sites/prod/files/2017/02/f34/onsiterenewables508.pdf
[20] https://www.flysfo.com/environment/zero-net-energy
[21] https://siouxcityjournal.com/news/local/spirit-lake-iowa-school-district-honored-for-wind-turbines/article_055c6490-cb1f-51f8-b47e-6681825de968.html
[22] https://www.energy.gov/sites/prod/files/2017/02/f34/onsiterenewables508.pdf

community resiliency. Residential solar installations have demonstrated success in reducing emissions. A residential solar panel system as the capability of providing for the electricity needs of an entire home with about 80% lower carbon emissions than fossil fuels.[23] The largest barrier to residential solar is up-front installation costs[24], suggesting that utility-provided incentives would lead to installation increases. Battery storage can greatly maximize the benefits of renewable energy systems like solar PV. A recent 2019 study from the University of Michigan found that in California as a whole, adding 60GW of renewables could achieve 72% CO_2 reductions with close to one third curtailment.[25] Adding energy storage technologies could increase this to 90% reduction and only 9% curtailment, under one modeled scenario.[26] While industrial and commercial battery storage will drive these reductions, residential energy storage will also play an important part in the effort to increase battery storage across the state. Residential energy storage is often more flexible and resilient than larger utility-owned systems because the network is well-distributed and has buy-in from both the utility and the owners/residents. [27] Residential energy storage exceeded utility-scale storage installations in the U.S. in 2018, reflecting the high value customers are placing on having their own storage systems.[28]

Action 4: Develop a co-located community solar and storage project of at least 1 MW as a pilot project collaboration between SMUD and the City of Sacramento with SMUD leading project development and the City providing a location and permitting support.

Evidence: A one megawatt solar array would generate an estimated 1.5 MWh of electricity per year in Sacramento. The GHG emissions reduction from this array would vary depending on the GHG emissions factor of SMUD electricity it was offsetting. In 2030, 1.5 MWh is estimated to reduce GHG emissions by 188 MT CO_2e.[29] However, in 2045 when SMUD's electricity would have an emission factor of zero due to SB100, GHG reduction benefit would be zero. However, local solar projects will make SB100 a reality and provide additional co-benefits, including cost savings and resiliency, to the community.

In 2012, SMUD completed a 12-month 300kW microgrid demonstration and research project that involved the design, construction, and demonstration of a microgrid that was integrated with SMUD's central heating and cooling equipment.[30] A microgrid can operate while connected to the main utility grid and it can immediately disconnect ("island mode") if isolated from the utility, providing heightened reliability for users. SMUD's microgrid was able to successfully power AC, heating, and hot water in "island mode". According to the report, "successfully deploying microgrids could help…enable the integration of an unlimited quantity of distributed energy resources into the electricity grid. Many of these distributed resources would be renewable energy sources that would reduce the emissions of greenhouse gases."

[23] https://nature.berkeley.edu/classes/es196/projects/2013final/ArifM_2013.pdf
[24] Ibid
[25] Curtailment occurs when more power is produced than needed at a given time, leading to energy losses
[26] http://css.umich.edu/publication/role-energy-storage-deep-decarbonization-electricity-production
[27] https://www.mckinsey.com/industries/electric-power-and-natural-gas/our-insights/how-residential-energy-storage-could-help-support-the-power-grid
[28] Ibid
[29] https://pvwatts.nrel.gov/pvwatts.php
[30] https://www.smud.org/-/media/Documents/Corporate/About-Us/Energy-Research-and-Development/research-microgrid-demonstration-project.ashx

Measure E-4:

Support infill growth to ensure that 90% of growth is in the established and center/corridor communities and 90% small-lot and attached homes by 2040, consistent with the regional Sustainable Communities Strategy. Project-level VMT should be 15% below (or 85% of) the regional average.

2030 Goal

Supportive

2045 Goal

Supportive

Performance Metrics:

- 90% of infill growth occurs in established and center/corridor communities and 90% small lot and attached homes by 2040
- Project-level VMT is 15% below (or 85% of) the regional average

Action #	Action	Anticipated Reduction
Quantitative Actions		
1	Adopt General Plan policies, land use designations, and implementing actions which: • Accommodate 30% of the region's new living-wage jobs and 35% of the region's new housing units by 2040 • Focus 90% of the city's infill growth into established and center/corridor communities with the goal of achieving 90% small-lot single family and attached homes by 2040 • Prioritize construction of affordable housing through modifications of land-use designations, expansion of by-right zoning, and incentives • Prioritize public investment into areas with low VMT which are also located in disadvantaged communities, with the goal of improving public safety • Include anti-displacement policies and incentives	Supportive

Supportive Actions

2	Enable XXX (determine what is feasible during GP Update) new high density, and transit accessible residences by 2040 through the continuation of the City's expansion of by-right zoning, permit streamlining, financial incentives, and modifying single family dwelling land use designations.	Supportive
3	Enable XXX new affordable by design (120% or less of area median income) units by 2040 within 0.25 miles of transit by updating City Code to allow alternative housing types (such as dormitories and smaller units) and streamlining the permit process. Couple with anti-displacement policies and incentives.	Supportive
4	Increase the density of existing single-family neighborhoods city-wide by allowing one primary unit and 2 accessory dwelling units (ADUs) per parcel in the R-1 zone and providing streamlining and incentives for ADUs.	Supportive

Measure Quantification Background

Encouraging infill development and managing growth in the City of Sacramento will support overall VMT reduction by reducing the distance traveled to access jobs and services. Denser and more efficient development will also decrease per capita energy use by the built environment. Transit oriented development, especially when paired with transit improvements and parking maximums will further incentivize transit over single occupancy vehicles. Although all of these measures will directly contribute to GHG emissions reductions, those reductions are captured through changes in transportation mode in Measures TR-1 and TR-2.

Supportive Actions

Action 1: Adopt General Plan policies, land use designations, and implementing actions which:

1. Accommodate 30% of the region's new living-wage jobs and 35% of the region's new housing units by 2040
2. Focus 90% of the city's infill growth into established and center/corridor communities with the goal of achieving 90% small-lot single family and attached homes by 2040
3. Prioritize construction of affordable housing through modifications of land-use designations, expansion of by-right zoning, and incentives
4. Prioritize public investment into areas with low VMT which are also located in disadvantaged communities, with the goal of improving public safety
5. Include anti-displacement policies and incentives

Action 2: Enable XXX (determine what is feasible during GP Update) new high density, and transit accessible residences by 2040 through the continuation of the City's expansion of by-right zoning, permit streamlining, financial incentives, and modifying single family dwelling land use designations.

Action 3: Enable XXX new affordable by design (120% or less of area median income) units by 2040 within 0.25 miles of transit by updating City Code to allow alternative housing types (such as dormitories and smaller units) and streamlining the permit process. Couple with anti-displacement policies and incentives.

Action 4: Increase the density of existing single-family neighborhoods city-wide by allowing one primary unit and 2 accessory dwelling units (ADUs) per parcel in the R-1 zone and providing streamlining and incentives for ADUs.

Evidence for Actions 1-4: While not easily quantifiable, infill growth that increases density within areas of the community that provide multiple services and better access to jobs can help reduce per capita emissions in those areas due to reduced VMT. This is especially effective if paired with affordable housing policies and programs, as this allows a greater portion of the population to access high density areas and reduce their emissions. Affordable housing can therefore also help reduce suburban sprawl. A Berkeley study on carbon footprint planning suggests that a 10-fold increase in population density in central cities corresponds to 25% lower GHG emissions[31] due mostly to decreases in VMT. This can be substantially increased if efforts are additionally made to reduce suburban sprawl. Another study conducted by UC Davis found that a 10% increase in residential density would reduce VMT by 1.9%.[32] University of Waterloo performed a case study in Toronto to determine how quickly existing areas could be densified to meet minimum transit supportive density thresholds. The study found that 3.8 million additional residents could be residing in transit supportive environments if about 1.2 million units were added with current unit densities between 5 and 20 units per hectare. Given historic growth rates, units could be built within 34 to 95 years. Co-benefits of these action include increased stability and access to services for disadvantaged communities.

[31] https://www.cogitatiopress.com/urbanplanning/article/view/1218/1218
[32] https://www.sciencedirect.com/science/article/pii/S0191261510000536

Mobility

Measure TR-1:

Reduce VMT by 1% by 2030 (52 million miles per year) and 3% (139 million miles) by 2045 compared to baseline through the prioritization of active transportation

2030 Target

12,572 MT CO_2e

2045 Target

28,712 MT CO_2e

Performance Metrics:

- Implement the 2016 Bicycle Master Plan by constructing 40 miles of bike lanes, 48 miles of bike routes, 40 miles of buffered bike land, 18 miles of separated bikeway, and 127 miles of shared-use paths, by 2045.
- Achieve 6% bicycle mode share by 2030 and 12% by 2045
- Construct the pedestrian network in the 2006 Pedestrian Master Plan by 2045.

Action #	Action	Anticipated Reduction
Quantitative Actions		
1	Implement the 2016 Bicycle Master Plan by constructing a comprehensive, connected network of low stress bikeways, on and off street, within and across neighborhoods totaling 40 miles of bike lanes, 48 miles of bike routes, 40 miles of buffered bike lane, 18 miles of separated bikeway, and 127 miles of shared-used paths.	30,971 MT CO_2e (2030) 62,824 MT CO_2e (2045)
Supportive Actions		
2	Implement the improvements in the 2006 Pedestrian Master Plan by providing a connected, low stress pedestrian network, prioritized based on HIN (crash data), school access, equity and community needs. Low stress pedestrian network includes crossings, sidewalks, and other paths.	Supportive
3	Identify the physical barriers to active transportation by 2025 and remove them by 2030 to support local partners and community groups.	Supportive

4	Identify educational barriers and provide education and outreach to the community on active transportation options in the City including a travel training program and incentivize a spectrum of mobility options that includes public and private shared and active services.	Supportive
5	Identify ongoing funding for and implement active transportation programs (open streets, pilot projects, classes, etc.) quality and healthy opportunities for parts of the community workforce most impacted by climate change.	Supportive

Measure Quantification Background

Reducing Vehicle Miles Traveled (VMT) means reducing the number of miles and trips taken by on-road vehicles both intercity and intracity. One-way Sacramento will reduce VMT is by moving from single occupancy vehicles to active transportation like bicycles and walking. To do this the City must provide low stress and convenient infrastructure and prioritize active transportation movement. Infrastructure needs including bikeways, sidewalk improvements, and expansions of both kinds of infrastructure to all areas of the City. Once the infrastructure is available and stress/comfort is not an issue, comparison with other cities around the world suggest more people will choose active transportation. The following actions outline the infrastructure and supportive actions the City will take to increase bike/ped mode share. Each action is supported by case studies from other cities in California, other US states, and abroad.

Action 1: Implement the 2016 Bicycle Master Plan by constructing a comprehensive, connected network of low stress bikeways, on and off street, within and across neighborhoods totaling 40 miles of bike lanes, 48 miles of bike routes, 40 miles of buffered bike lane, 18 miles of separated bikeway, and 127 miles of shared-used paths.

Evidence: The Bicycle Master Plan would result in a total of 464 miles of bikeways within 100 square miles for an estimated 500,000 residents. Comparably, the City of Antwerp, in Belgium, had similar bikeway buildout, with 435 miles of bike lanes within 79 square miles serving a population size of approximately 500,000 residents in 2014. The City of Antwerp reported 29% mode share for bicycles in 2014. Assuming that bike lane mileage, density, and city population are directly correlated with bicycle mode share, Sacramento could expect to see a similar level of bicycle mode share that Antwerp saw in 2014. Furthermore, the City of Copenhagen, the gold standard for bicycle use saw a 26% increase between 2012 and 2019 from 36% mode share to 62% as a direct result of a 14-year plan to improve the quality, safety and comfort of cycling.[33] However, it should be noted that these European cities do not just build infrastructure. They also require car drivers to pay their own way with higher parking fees, gas taxes, and excise taxes on new vehicles. These cities also incentivize dense multifamily development,

[33] https://www.latimes.com/world-nation/story/2019-08-07/copenhagen-has-taken-bicycle-commuting-to-a-new-level

which Sacramento will also do through the General Plan. In the US, nearby Davis reports 15.5% of commuters get to work by bike. Santa Cruz, CA, reports 13.2% and Boulder, CO, reports 10.7% according to the Census.[34] If Sacramento achieves an increase of 4% bicycle mode share (6% total mode share in 2030) the estimated VMT reduction in passenger VMT would be approximately 52 million VMT in 2030. By 2045 a 12% mode share (10% increase over baseline) would decrease 139 million VMT.[35]

Quantification Results Summary

Action 1	2030	2045
Total Passenger VMT Decrease	52,293,482	139,482,129
MT CO2e/VMT	0.0002404	0.0002058
Emissions reductions MT CO2e	12,572	28,712

Supportive Actions

Action 2: Implement the improvements to the 2006 Pedestrian Master Plan by providing a connected, low stress pedestrian network, prioritized based on HIN (crash data), school access, equity and community needs. Low stress pedestrian network includes crossings, sidewalks, and other paths.

Evidence: Improving pedestrian networks is an important part of building Complete Streets – streets that accommodate bikes, cars, shared transit, and pedestrians in an accessible way. Nationally, 16.4% of vehicle trips were one mile or less in 2017, a distance easily travelled by foot or bicycle.[36] An improved and expanded pedestrian network is the most effective and direct approach for shifting those shorter vehicle trips to walking, and studies show that distance to destinations is one of the strongest predictors of walking as a mode choice.[37] However, not much research has been conducted to determine quantitatively how improving the pedestrian network translates to increased pedestrian mode share. This is further complicated by the fact that while improved pedestrian networks almost always have a positive correlation with increased walking, that does not always translate to decreased VMT. In other words, increased walking does not mean that walking trips are replacing driving trips. One study from 1993 looked at how improving a pedestrian network affected the number of vehicle miles travelled in Portland, OR in 1985 and found that a 1% increase in the pedestrian network was associated with a 0.14% decrease in number of vehicle trips travelled.[38]

Action 3: Identify physical barriers to active transportation by 2025 and remove them by 2030 to support local partners and community groups.

Evidence: By leveraging community groups and local partners to get firsthand feedback from the community the City will be able to better identify and eliminate the hurdles which keep people from walking and biking. The benefits of Action 3 will support overall VMT reduction.

[34] https://bikeleague.org/sites/default/files/Where_We_Ride_2017_KM_0.pdf
[35] VMT savings for increasing bicycle mode share were only taken from internal-internal (trips within the City).
[36] https://nhts.ornl.gov/vehicle-trips
[37] https://ww3.arb.ca.gov/cc/sb375/policies/ped/walking_brief.pdf
[38] https://ww3.arb.ca.gov/cc/sb375/policies/ped/walking_brief.pdf

Action 4: Identify educational barriers and provide education and outreach to the community on active transportation options in the City including a travel training program and incentivize a spectrum of mobility options that includes public and private shared and active services.

Identify ongoing funding for and implement active transportation programs (open streets, pilot projects, classes, etc.)

Evidence: Providing education on the benefits of active transportation as well as technical information such as trip planning, incentives and other programs will help generate momentum around active transportation and support overall VMT reduction.

Action 5: Identify ongoing funding for and implement active transportation programs (open streets, pilot projects, classes, etc.) quality and healthy opportunities for parts of the community workforce most impacted by climate change.

Evidence: The funding to execute TR-1 related actions have not been identified by the City and current public works budget does not allow for these projects. This measure would require the City and its partners to identify and secure funding to implement these actions. A description of funding and financing strategies can be found in Section XX.

Measure TR-2:

Reduce VMT by 12.5% (556 million miles per year) compared to baseline through the prioritization of transit and shared mobility

2030 Target

121,125 MT CO_2e

2045 Target

146,595 MT CO_2e

Performance Metrics:

- Implement new parking minimums and maximums
- Support SacRT in achieving a 10% transit mode share by 2030
- Support SacRT in maintaining a 10% transit mode share by 2045
- Continue to achieve at least 2 Million miles taken by shared mobility

Action #	Action	Anticipated Reduction
Quantitative Actions		
1	Update and implement the City's Transportation System Management Plan (TSMP) ordinance to shift travel behavior away from the single occupancy vehicle.	
2	Eliminate parking minimums City-wide, develop parking maximums and require parking management and transportation demand management plans for all areas of the City based on available transportation options, travel patterns, and land use.	
3	Work with SacRT to identify transit priority corridors to enable more frequent, reliable transit service that will support VMT reductions. Coordinate transit priority corridors with land use planning to provide transit-supportive land uses. Encourage the expansion of frequent, reliable transit services throughout the city.	120,747 MT CO_2e (2030) 146,175 MT CO_2e (2045)
4	Support SacRT in planning and implementing increased transit services with reduced headways and expanded service lines to support a 10% VMT reduction through a mode shift to transit by 2045.	
5	The City will collaborate with SacRT to identify changes to signals for transit prioritization and installation of relevant technology.	

6	Continue to provide electric car sharing options to offset at least 1 million VMT per year in the City of Sacramento through 2030.	206 MT CO_2e (2030) 206 MT CO_2e (2045)
7	Continue to support shared rideables (bikes and scooters) to enable a reduction of 1 million VMT per year	248 MT CO_2e (2030) 214 MT CO_2e (2045)

Supportive Measures

8	Support SacRT in providing improved service/communications such as interactive service maps, app payments, and real time arrival info.	Supportive
9	Continue to implement and improve curbside management strategy to better manage and price curb space, manage transportation network companies (TNC) and prepare for autonomous vehicles.	Supportive
10	Work with SacRT to remove barriers to access transit stops and stations (provide low stress connectivity) and provide enhanced, comfortable stops and stations.	Supportive
11	Implement the City's adopted plans including modal/City-wide plans and corridor/area plans (such as the Bicycle Master Plan, Broadway Complete Streets, and 65th Street Area Plan).	Supportive
12	Identify an Employee Transportation Coordinator and establish an employee commute program for City staff that includes provisions for telecommuting and encourage other public and private agencies located within the city to do the same using requirements and/or incentives.	Supportive
13	Investigate and lobby for the development of a Transportation Network Company (TNC) user tax which would put a small fee on the use of Uber, Lyft, and others and generate funds to pay for transit and mobility infrastructure and related programs	Supportive

Measure Quantification Background

Reducing Vehicle Miles Traveled (VMT) means reducing the number of miles and trips taken by on-road vehicles both intercity and intracity. One-way Sacramento will reduce VMT is by moving from single occupancy vehicles to shared mobility like trains and buses. To do this the City must work with its partners including the Sacramento Regional Transportation District (SacRT) to expand service lines and increase the convenience of transit by reducing the time it takes to reach a destination via transit as well as reducing wait times (headways) for transit. Some of the changes Sacramento will make to prioritize

transit including installing dedicated transit lanes and setting parking maximums will also make driving single occupancy vehicles less convenient to drive. By making transit more convenient and making decisions to prioritize transit over single occupancy vehicles Sacramento will begin to shift VMT towards shared transit and significantly decreasing GHG emissions. Together these strategies are expected to decrease total VMT by 9.5% by 2030 and 9.5% by 2045. Actions 1 – 6 provide quantifiable emissions reductions due to the expected shift to transit based on available information.

Action 1: Update and implement the City's Transportation System Management Plan (TSMP) ordinance to shift travel behavior away from the single occupancy vehicle. Buses

Evidence:

Action 2: Eliminate parking minimums City-wide, develop parking maximums and require parking management and transportation demand management plans for all areas of the City based on available transportation options, travel patterns, and land use.

Evidence: Fehr and Peers Model suggests this will yield a 30%-50% reduction in VMT of new development for which the ordinance covers depending on reduction in parking and whether it is a suburban or urban area (or how good the alternative options are). This equates to a 2.4%-4.1% reduction in citywide passenger vehicle emissions compared to the 2030 forecast and a 4.6%-7.7% reduction compared to the 2045 forecast. Conservatively, a citywide VMT reduction of 2.5% in 2030 and 5.4% in 2045 is expected due to the implementation of this measure which equates to 108,757,556 VMT and 225,690,495 VMT respectively.

Action 3: Work with SacRT to identify transit priority corridors to enable more frequent, reliable transit service that will support VMT reductions. Coordinate transit priority corridors with land use planning to provide transit-supportive land uses. Encourage the expansion of frequent, reliable transit services throughout the city.

Action 4: Support SacRT in planning and implementing their "ideal buildout" system to reduce headways and expand service lines to support a 10% VMT reduction through a mode shift to transit by 2030.

Action 5 City to collaborate with SacRT on high frequency transit priority corridors, dedicated bus lanes, signals for transit prioritization, and install relevant technology.

Evidence for Actions 3 through 5: The recent free student ridership program demonstrated that there is an existing strong need for public transportation in Sacramento. Through the program, SacRT student ridership doubled over the course of a few months, including during weekends and after school. SacRT also saw an overall 6% increase in system-wide ridership in 2020. These trends not only suggest that SacRT service improvements would fill a real transportation gap in Sacramento, resulting in actual VMT reductions, but also those VMT reductions would be maximized through the other incentives and programs that SacRT offers.

In general, increases and improvements to public transportation systems reduce a city's dependence on fossil fuels and reduce VMT. The best ways to improve a transit system and reduce driving is to expand its geographical reach and increase the frequency and reliability of transit service. Each new mile of transit usage replaces VMT on much more than a 1:1 basis. Approximately 1% increase in transit

frequency saves 0.5% in VMT.[39] Bus Rapid Transit can also yield a corridor-level VMT reduction of 1-2%.[40] Sacramento currently has a transit mode share of 1.5%. Oakland CA, by contrast has achieved a 21% mode share. Oakland also has a low difference in income between transit and non-transit users of 2%.[41] SacRT has a service area of 400 square miles (1.4 million people) and includes 80 bus routes. In comparison, ACTransit has a service area of 368 miles (1.5 million people) and has nearly double the bus lines with 158. Ridership on ACTransit was 53 million in 2018-2019 compared to 21 million on SACRT. An increase of SACRT service of the magnitude to match ACTransit which serves a similar size and population could reasonably result in a 21% transit mode share. However, for this CAP to be successful and allow Sacramento to reach its goals, a mode share increase of 10% above baseline by 2030 and maintaining that increase through 2045 was estimated. This increase in mode share is expected to reduce VMT by 10% or 447,406,178 VMT per year.

Quantification Results Summary

Actions 1-5	2030	2045
Percent VMT Reduction from Mode Shift to Transit due to Actions 1-5	12.5%	14.4%
Total Passenger VMT Decrease	556,163,734	710,125,438
MT CO_2e/VMT	0.0002171	0.0002058
Net MT CO_2e Savings	120,747	146,175

Action 6: Continue to provide electric car sharing options to offset at least 1 million VMT per year in the City of Sacramento through 2030.

Evidence: Research from the Transportation Sustainability Research Center at the University of California – Berkeley shows that car share programs lower vehicle ownership and overall VMT.[42] While a majority of car share members use the program to add or replace vehicle trips (leading generally to small VMT increases), a minority of members (2-5%) use car share as a replacement for vehicle ownership (leading generally to larger VMT reductions). The net effect is overall decrease in vehicle ownership, VMT, and ultimately GHG emissions. Approximately one car share vehicle replaces seven to eleven cars and VMT is reduced, on average, between 6% to 16% per car share household assuming one-way usage. In approximately one year, Sacramento's Gig electric car share program hit over 1 million miles driven providing GHG reductions as well as air quality and mobility benefits.

Action 7: Continue to support shared rideables (bikes and scooters) to enable a reduction of 1 million VMT per year while continuing to support long term public transit.

[39] https://www.smartgrowthamerica.org/app/legacy/documents/smartgrowthclimatepolicies.pdf
[40] https://www.smartgrowthamerica.org/app/legacy/documents/smartgrowthclimatepolicies.pdf
[41] https://smartasset.com/mortgage/best-cities-for-public-transportation
[42] http://innovativemobility.org/wp-content/uploads/2016/07/Impactsofcar2go_FiveCities_2016.pdf

Evidence: In 2019, a total of 1,060,405 trips were taken on shared rideables (shared bikes and scooters) in the City of Sacramento. Success of shared rideables in replacing vehicle use is not known in Sacramento, but a 2019 report from the City of Santa Monica found that 49% of shared rideable trips replaced vehicle trips based on answers to survey questions.[43] A 2014 study from Utrecht University suggests that the car substitution rate of shared rideables is dependent on what proportion of trips are already taken by car in a city. [44] In the study, Minneapolis and Melbourne had between 70% and 76% vehicle mode share in 2014 and showed high rates of car mode substitution (19% to 21%) after shared rideables were introduced. On the other hand, London and Washington DC had between 36% and 46% vehicle mode share in 2014 and showed much lower rates of car mode substitution (2% to 7%). Sacramento and Santa Monica both had high vehicle mode share (83% and 72% respectively) before shared rideables were introduced, suggesting that Sacramento would see a similar if not higher car substitution rate of shared rideables as Santa Monica. Both studies previously mentioned suggest that average trip duration of shared rideable trips is about 2 miles (this is seen consistently across the six diverse cities mentioned above) and appears to be largely independent of other city metrics. VMT reductions from introduction of shared rideables in 2019 in Sacramento were therefore estimated to be approximately 1 million miles, or 345 MT CO_2e. This assumes an average trip distance of 2 miles and a car substitution rate of 49% along with the total trips recorded in 2019.

Quantification Results Summary

Actions 1-6	2030	2045
Total VMT reduction from shared mobility	2,060,405.00	2,060,405.00
Passenger vehicle emission factor (MT CO_2e /VMT)	0.000240	0.000206
Electric car emission factor (kWh/mile)	0.29	0.29
Scooter emission factor (kWh/mile)	0.0125	0.0125
Electric car share kWh used	290,000	290,000
Scooter kWh used	12,990	12,990
SMUD emission factor (MT CO_2e /kWh)	0.0001193	0.0000
Emissions avoided (MT CO_2e)	490	420
Emissions from electricity (MT CO_2e)	36	0.0000
Emissions saved	454	420

Supportive Actions

Action 8: Support SacRT in providing improved service/communications such as interactive service maps, app payments, and real time arrival info.

Evidence: This is supportive to Actions 5-7 and the overall measure. Effective communication, especially communication that takes advantage of new and emerging technologies to accurately and easily

[43] https://www.smgov.net/uploadedFiles/Departments/PCD/Transportation/SantaMonicaSharedMobilityEvaluation_Final_110419.pdf

[44] http://mobility-workspace.eu/wp-content/uploads/Bike-shares-impact-on-car-use-3.pdf

disseminate trip planning and real-time status information, is a strong factor in helping customers decide to use transit for business or leisure trips.[45]

Action 9: Continue to implement and improve curbside management strategy to better manage and price curb space, manage transportation network companies (TNC) and prepare for autonomous vehicles.

Evidence: Curbside management strategies can help shift cities towards sustainable citywide mobility without compromising space and business needs.[46] Sacramento has already made great strides in curbside management with their innovative dynamic parking program. In San Francisco, a parking pilot program called SFPark instituted dynamic parking pricing for on-street parking and experienced a 30% drop in VMT for the area, 8% drop in traffic volume, and improved meter compliance and parking turnover.[47] In general, increasing the price to park is one of several related factors that can reduce VMT and promote mode switching.[48] This approach is more effective when combined with infill development, investments in alternative transportation, and travel demand management programs.

Action 10: Work with SacRT to remove barriers to access transit stops and stations (provide low stress connectivity) and provide enhanced, comfortable stops and stations.

Evidence: Improving transit access has the potential to shift trips from cars to transit, which may reduce vehicle trips, VMT, and greenhouse gas emissions, with time spent getting to a transit stop being the key indicator of transit access.[49] While difficult to directly quantify, improving transit stops and stations can contribute to improved transit access, and is therefore an important component of this strategy to reduce VMT.

Action 11: Implement the City's adopted plans including modal/City-wide plans and corridor/area plans (such as the Bicycle Master Plan, Broadway Complete Streets, and 65th Area Plans).

Evidence: The City has adopted plans and strategies to increase transit use through planning efforts. These actions will support the overall VMT reduction quantified under Measure TR-2.

Action 12: Identify an Employee Transportation Coordinator and establish an employee commute program for City staff that includes provisions for telecommuting and encourage other public and private agencies located within the city to do the same using requirements and/or incentives.

Evidence: In light of the recent changes made to combat the spread of COVID-19, telecommuting has proven to be an implementable and effective strategy for reducing VMT. Continuing to leverage the telecommuting and remote work lessons learned during the pandemic will allow the City of Sacramento to reduce VMT well into the future.

[45] https://transitleadership.org/docs/TLS-WP-Improving-the-Customer-Experience.pdf
[46] https://nacto.org/wp-content/uploads/2017/11/NACTO-Curb-Appeal-Curbside-Management.pdf
[47] https://www.ite.org/pub/?id=C2D66E96%2DFF01%2D0BA8%2D68C3%2D65CC9116A5AE
[48] https://dot.ca.gov/-/media/dot-media/programs/research-innovation-system-information/documents/f0016902-final-pricing-parking-management-to-reduce-vehicles-miles-travelled-pi.pdf
[49] https://ww3.arb.ca.gov/cc/sb375/policies/transitaccess/transit_access_brief120313.pdf

Action 13: Investigate and lobby for the development of a Transportation Network Company (TNC) user tax which would put a small fee on the use of Uber, Lyft, and others and generate funds to pay for transit and mobility infrastructure and related programs.

Evidence: The City of San Francisco was given a special variance by the state of California to implement a Traffic Congestion Mitigation tax on private transit service vehicles. The revenues of this tax go to offsetting the emissions from these services through the funding of transit and VMT reducing projects.[50] The City of Sacramento will pursue a similar tax in order to help offset the impacts of TNC's in Sacramento.

[50] https://sftreasurer.org/business/taxes-fees/traffic-congestion-mitigation-tax-tcm#:~:text=The%20City%20imposes%20a%20Traffic,or%20private%20transit%20services%20vehicle.

Measure TR-3:

Transfer 28% of passenger and 22% of commercial VMT to zero emission vehicles (ZEV) by 2030 and 100% of all vehicles by 2045

2030 Target

283,552 MT CO_2e

2045 Target

1,123,338 MT CO_2e

Performance Metrics:

- 11% EVs and 3,250 public EV chargers in Sacramento by 2025
- 28% EVs and 8,150 public EV chargers in Sacramento by 2030
- 100% EVs by 2045[51]

Action #	Action	Anticipated Reduction
Quantitative Actions		
1	Amend City Building Code to require 20% EV capable charging spaces and at least one installed, operational Level II EV charger in new multifamily and nonresidential development. Amend the Planning and Development Code to incentivize charging in both existing and new developments.	283,552 MT CO_2e (2030) 1,123,338 MT CO_2e (2045)
2	Continue to install and provide EV charger access at City-owned facilities and parking garages.	
3	Continue to support a variety of public and public/private partnerships to provide more publicly accessible chargers throughout the City. Examples include: public/private partnerships on private property (Electrify America), public/private partnerships on public property (EVgo), and public investment (SMUD).	
Supportive Actions		
4	Support affordable, zero emission car share expansions to serve affordable housing, such as the Sacramento Metropolitan Air District's Our Community Carshare program to more locations, contingent on funding.	Supportive

[51] The number of chargers needed to meet 100% EV's is not yet known. New technologies could significantly alter the current landscape by this time. This will be addressed in upcoming CAPs.

5	Support e-mobility hub pilot efforts, in partnership with other agencies and local groups, with special consideration for proximity to low-income/disadvantaged communities and multifamily housing.	Supportive
6	Continue to maintain a highly streamlined EV infrastructure permit process.	Supportive
7	Develop and implement a fee for use of City-owned parking facilities and EV chargers to encourage more efficient use and turnover and increase EV availability for people who really need it, including those without access to home charging.	Supportive
8	Continue to implement and improve curbside management strategy to better manage and price curb space, manage transportation network companies (TNC), and prepare for autonomous vehicles.	Supportive
9	Work and collaborate with major employers including the State of California and Sacramento County to encourage ZEV adoption, programs, and improvements to ZEV infrastructure.	Supportive
10	Continue to provide information and education about currently available incentives for expansion of Level II chargers on private property.	Supportive
11	Coordinate with community-based organizations, agencies, and non-profits to conduct EV education events with would include information on costs/benefits of owning EVs, steps on how to receive incentives for EV chargers, as well as other benefits. Events will be equitably distributed across the City, focusing on disadvantaged communities.	Supportive
12	Because zero emission technology is improving/changing at a rapid pace, continue to monitor, test, and adapt to new and emerging zero emission technologies and solutions.	Supportive

Measure Quantification Background

The state of California has a goal of putting 5 million EVs on the road by 2030. This is approximately 1/3 of the vehicles currently on the road. Forecasting to 2030 given today's rate of vehicle ownership, 5 million EVs in 2030 would be approximately 30% of the vehicle fleet. Therefore, the level of electrification proposed for this measure is in line with the State's. The City of Sacramento will support the necessary infrastructure to support a fleet with 28% EV's by 2030, with a long-term target of 100%

EVs by 2045. This is equivalent to approximately 65,000 EVs in Sacramento by 2025 and 163,000 by 2030. As of October 2018, the City had 4,849 EVs registered, with 3.3% of new vehicle sales in Sacramento being EVs.[52] While the City cannot require residents to buy and use ZEVs, the City will take actions to incentivize this behavior change and support this level of EV adoption. The City's primary target to achieve this measure is to provide one public EV charger for every 20 EVs, or 3,250 EV chargers by 2025 and 8,150 by 2030.[53] The ratio of one charger per 20 EV's is in line with the leading Cities in California (San Francisco, Los Angeles, and San Jose) when it comes to EV infrastructure and aligns with recent charging infrastructure studies through 2025. The need for charging infrastructure may change over time depending on new technologies such as smart chargers and trends in personal EV adoption. The City will continue to monitor the most recent research on EV infrastructure needs and update long term goals as necessary. The following actions are a combination of expanded public EV chargers and incentives for EV adoption.

Action 1: Amend City Building Code to require 20% EV capable charging spaces and at least one installed, operational Level II EV charger in new multifamily and nonresidential development. Amend the Planning and Development Code to incentivize charging in both existing and new developments.

Evidence: This action will account for the majority of the targeted number of EV chargers in 2025 and 2030. EV-ready building codes are one of the most effective and low-cost strategies for states and local governments to encourage consumers to buy or lease electric vehicles, and can save consumers thousands of dollars in installation costs.[54] However, new development is not projected to occur at a scale sufficient to meet the City's charging goals. EV charger installation will therefore need to occur in existing buildings as well. Sacramento is currently 5th in the nation for the number of public chargers per million population (Level II and DCFC), with a total of 682 public EV connectors, including 129 public fast chargers, as of January 2020.[55] This ordinance would be in addition to Sacramento's substantial ongoing EV programs contained in the 2017 EV Strategy and 2019 EV Blueprint.

Action 2: Continue to install and provide EV charger access at City owned facilities and parking garages.

Evidence: As of 2020, the City of Sacramento currently operates 120 chargers at City-owned facilities, 48 of which serve the City fleet and 72 of which are available for public or employee charging. Patrons of City parking facilities can currently charge their EV at no additional cost, except when using the DCFC at the Sacramento Valley Station. The City is currently completing replacements of City-owned chargers to upgrade to newer, networked electric vehicle supply equipment (EVSE) and increase charging connector availability at City facilities. This investment will nearly double the number of Level II EVSE connectors in the first phase, going from 61 to 103 at the first seven sites by spring of 2020.[56] The next phases for City-owned EVSE expansion will support planned EV purchases in the City's fleet and will likely include many public-facing community locations. A key priority for the EVSE expansion plan is to increase charging access in low income and disadvantaged communities. Providing public charging in these communities

[52] Data provided by the City of Sacramento
[53] https://theicct.org/sites/default/files/publications/US_charging_Gap_20190124.pdf
[54] https://www.swenergy.org/cracking-the-code-on-ev-ready-building-codes
[55] Data provided by the City of Sacramento
[56] Data provided by the City of Sacramento

will help to increase the viability of EV technologies, improve consumer awareness, and ensure charging options for a range of housing types.

Action 3: Continue to support a variety of public and public/private partnerships to provide more publicly accessible chargers throughout the City. Examples include: public/private partnerships on private property (Electrify America), public/private partnerships on public property (EVgo), and public investment (SMUD).

Evidence: The City of Sacramento has been a state and national leader in building electric vehicle partnerships and infrastructure since its first EV program in 1994. The City already hosts 682 public EV charging stations and connectors. Volkswagen subsidiary, Electrify America, designated Sacramento as the first Green City in its Zero-Emission Vehicle (ZEV) Investment Plan in 2017. Under this initiative, also known as "Sac-to-Zero", Electrify America invested $44 million in Sacramento between 2017 and 2020, part of which was allocated to installing new charging infrastructure. In addition, the City launched its first curbside charging pilot in May 2019 in partnership with EVgo, which offers fast charging in the right-of-way at Southside Park. The chargers are owned and operated by EVgo and available to any member of the public. Over 700 vehicles have used the chargers, resulting in an estimated 400,000 EV miles powered and more than 19,000 gallons of gasoline avoided.[57] The City is currently working with EVgo on a second curbside charging pilot with an anticipated launch date by Fall 2020.

Since 2017, the City's public/private partners have installed or will install by 2025 75 Level II, DC fast chargers, and high-power chargers through Electrify America, three EVgo curbside charging stations, and 42 new Level II connectors through the City itself, for a total of 123 new chargers. Through these existing programs and new opportunities, the City and its partners will continue to install new chargers to meet the 2025 and 2030 targets.

Quantification Results Summary

Actions 1-3	2030	2045
Passenger Vehicles		
Percent Passenger EV's	28%	100%
VMT driven by EV	1,230,848,865	4,861,008,859
MT CO2e/VMT (Adjusted to include emissions from electric car)	0.0002139	0.0002058
Passenger MT CO2e Savings	221,170	780,474
Commercial Vehicles		
Percent Commercial Vehicle EV's[58]	22%	100%
VMT driven by EV	71,025,286	345,508,099.25
MT CO2e/VMT (Adjusted to include emissions from electric car)	0.0008783	0.0009923
Commercial MT CO2e Savings	62,381.68	342,863.45
Total MT CO2 Savings	283,552	1,123,338

[57] Data provided by the City of Sacramento

[58] Commercial vehicles refers to vehicles in EMFAC classes LHD1, LHD2, T6, T7, PTO, UBUS, Motor Coach, All Other Buses, MH, T7IS, OBUS, MH

Supportive Actions

Action 4: Support affordable, zero emission car share expansions to serve affordable housing, such as the Sacramento Metropolitan Air District's Our Community Carshare program to more locations, contingent on funding.

Evidence: The City was an early partner for the Sacramento Metropolitan Air Quality Management District's Our Community CarShare program, California' first all-electric carsharing program targeted for low-income communities. Our Community CarShare offers a free membership transportation service located in low-income and affordable housing communities throughout the City of Sacramento. Residents can reserve clean zero emission vehicles to run errands, get to appointments, and take local trips. The program has successfully launched two phases, and as of January 2020 the program offers 14 vehicles at 7 sites that have delivered over 470,000 electric miles driven and more than 19,000 gallons of gasoline avoided (169 MT CO_2e). The project is currently building out its third phase for expanded service at four additional sites.

Other notable car share programs in the City of Sacramento include Envoy and GIG Car Share, both of which received funding in Sacramento from Electrify America's Sac-to-Zero initiative. Envoy is a round-trip ZEV care share service located at 40+ multifamily apartment complexes, with a majority serving low income or disadvantaged residents. GIG Care Share is the nation's largest free-floating ZEV car sharing program, with 260 all-electric vehicles in Sacramento. Recent data from GIG for the Oakland area in 2017 found that GIG cars were used 2.7 times more than privately-owned cars, based on the National Household Travel Survey's estimate that privately-owned cars are idle 94.3 percent of the time.[59]

Action 5: Support e-mobility hub pilot efforts, in partnership with other agencies and local groups, with special consideration for proximity to low-income/disadvantaged communities and multifamily housing.

Evidence: The Sacramento EV Blueprint evaluated examples of e-mobility hubs from other cities and created recommendations for an e-mobility hub in Sacramento, including a preliminary design concept and list of potential locations to consider. This action would take further advantage of the City's work to date and would lead to increased support for EVs within the City of Sacramento. Additionally, data collected from the development of a mobility hub pilot project in the City of Austin in 2018 suggested that mobility hubs can shift mode-share from single-passenger vehicles to walking or biking.[60] Efforts to evaluate and seek funding for e-mobility hubs are underway in collaboration with the Sacramento Metropolitan Air Quality Management District, the Sacramento Municipal Utility District, and other local partners.

Action 6: Continue to maintain a highly streamlined EV infrastructure permit process.

Evidence: In 2016, the City passed ordinance 15.08.190 to expedite the application process for EV charging station installation in accordance with Assembly Bill (AB) 1236. The City of Sacramento is one of only 40 cities and counties to have effectively developed and implemented a streamlined EVCS

[59] file:///C:/Users/ajared/Downloads/2018-10-30%20Item%2032%20One-Way%20Car%20Share%20%E2%80%93%20Mid-Pilot%20Program%20Report.pdf
[60] https://rmi.org/wp-content/uploads/2018/12/rmi-mobility-hub-report-2018.pdf

permitting process in accordance with AB 1236 to date. All application materials and requirements can be found on the City's website, including a simple checklist that applicants use to ensure they have all required materials included in the application. Applications can be submitted via e-mail providing additional convenience to applicants. If all required documents are submitted, applicants can expect to have their expedited EVCS building permits reviewed and approved within 24 hours for residential applications and approximately five business days for non-residential applications – both exceeding the best practices recommended by the Governor's office. Expedited implementation is supported by ongoing collaboration across the departments of Community Development and Public Works. It has further demonstrated the City's dedication to improving local air-quality, achieving community-wide climate and energy goals, and ensuring that zero-emission vehicles can be accessible and utilized by all community members.

Evidence: SMUD has a long history of supporting EV charging infrastructure in the City of Sacramento. SMUD also owns and operates 6 DCFC stations in Sacramento County.[61] SMUD's past and ongoing work to bring public EV chargers to Sacramento will be supplemented by this action to provide substantial incentives for EV owners to install their own chargers at home, where a majority of EV charging occurs. As of 2020, SMUD will offer $500 for each new electric circuit and up to $2,500 if a panel upgrade is also required, as well as a free Level II charger[62]. SMUD also offers a $1,500 incentive for each Level II charger port at businesses, with up to 20 incentives available per business.[63]

Action 7: Develop and implement a fee for use of City-owned parking facilities and EV chargers to encourage more efficient use and turnover and increase EV availability for people who really need it, including those without access to home charging.

Evidence: While not directly quantifiable, EV charging fees will increase turnover at charging stations, helping to promote equitable access to EV charging infrastructure and encourage widespread EV adoption across a greater demographic range. This will be coupled with increased parking fees for non-EV, encouraging use of both EVs and/or active transit.

Action 8: Continue to implement and improve curbside management strategy to better manage and price curb space, manage transportation network companies (TNC), and prepare for autonomous vehicles.

Evidence: Curb space is a major resource within the City serving multiple functions relating to mobility. By continuing to price curb space appropriately and preparing for a change to autonomous vehicles, the City of Sacramento can ensure the highest and best use of this limited resource.

[61] http://www.cityofsacramento.org/-/media/Corporate/Files/Public-Works/Electric-Vehicles/EVStrategy_171212_FINAL_CityOfSacramento.pdf?la=en
[62] https://www.smud.org/en/Rebates-and-Savings-Tips/Improve-Home-Efficiency/Go-Electric-Bonus-Package https://www.smud.org/en/Rebates-and-Savings-Tips/Improve-Home-Efficiency/Go-Electric-Bonus-Package
[63] https://fundingwizard.arb.ca.gov/rebates/11363

Action 9: Work and collaborate with major employers including the State of California and Sacramento County to encourage ZEV adoption, programs, and improvements to ZEV infrastructure.

Evidence: The State of California is the City's largest employer and has implemented various initiatives to increase its ZEV fleet and available ZEV charging infrastructure for employees.[64] This action would also benefit other major employers interested in providing workplace charging. Sacramento City Unified School District (SCUSD), for example, has an EV workplace charging program and offers 6 charging stations available for employees.[65]

Action 10: Continue to provide information and education about currently available incentives for expansion of Level II chargers on private property.

Evidence: The countywide CALeVIP incentive is anticipated to bring additional public DCFC and L2 workplace or fleet chargers. Rebates are reserved for at least 400 new or replacement L2 chargers, and additional community wide L2 chargers, and 76 new DCFC units.[66] SMUD incentives are detailed under Action 7. The City of Sacramento is in the top three of California cities for EV promotion activities. As the City's EV programs continue to expand, outreach surrounding incentives for installing Level II chargers on private property will support the City's targets and this overall measure.

Action 11: Coordinate with community-based organizations, agencies, and non-profits to conduct EV education events with would include information on costs/benefits of owning EVs, steps on how to receive incentives for EV chargers, as well as other benefits. Events will be equitably distributed across the City, focusing on disadvantaged communities.

Evidence: Providing information on existing and future programs, incentives, resources, and benefits of electric vehicle adoption to the community will increase adoption and contribute to the overall goal of electrified VMT in the City.

Action 12: Because zero emission technology is improving/changing at a rapid pace, continue to monitor, test, and adapt to new and emerging zero emission technologies and solutions.

Evidence: City staff are continuously evaluating emerging opportunity areas including:

- Expanded EVSE at City facilities
- Workforce development and job training for emerging ZEV industries
- E-Mobility hubs that connect multiple modes of transportation
- Community incentive programs and resources for low-income and disadvantaged communities
- Education and outreach
- Operationalizing equity & flexibility
- Public-private partnerships for acceleration of shared mobility programs and transit

While not directly quantifiable, this action will help ensure the City prioritizes the most impactful technologies and solutions as the ZEV landscape changes, maximizing on benefits from other actions and supporting the overall measure.

[64] https://www.green.ca.gov/fleet/about/initiatives/
[65] https://www.scusd.edu/ev-workplace-charging-program
[66] Data provided by City of Sacramento

Waste

Measure MM-1

Achieve the Requirements of SB 1383 to Reduce Organic Waste by 75% from 2014 levels

2030 Target

51,814 MT CO_2e

2045 Target

61,768 MT CO_2e

Performance Metrics:

- Comply with SB 1383 requirements
- Enforce composting or diversion of at least 75% of organic waste in 2025
- Increase edible food recovery by 20% by 2025

Action #	Action	Anticipated Reduction
Quantitative Measures		
1	Implement the requirements of SB 1383 to divert or compost 75% of organic waste compared to 2014 levels.	51,814 MT CO_2e (2030) 61,768 MT CO_2e (2045)
Supportive Measures		
2	Develop an implementation plan to meet the requirements of SB 1383 and AB 1826.	Supportive
3	Work with regional partners (other municipalities) and the private sector to assess the feasibility of siting long term organics processing facilities in or near Sacramento County.	Supportive
4	Continue to provide backyard compost education and reduced-cost compost bins as well as kitchen top food waste containers to participating residents.	Supportive
5	Implement a food waste diversion program for single-family residential customers by 2022.	Supportive
6	Consider a local ordinance that would give businesses access to curbside compost pickup.	Supportive
7	Partner with community-based organizations which provide local composting services and consider	Supportive

	supporting efforts to expand their programs or programs which are similar.	
8	Develop and implement an edible food recovery program which connects large food generators with local food banks, to recover at least 20% of the edible food that is currently disposed of for human consumption, consistent with SB1383.	Supportive
9	Explore the feasibility of capital improvement projects for reducing organics in the waste stream, such as organics extraction presses and anaerobic digesters.	Supportive
10	Consider an ordinance that requires composting services at businesses, including front-of-house (FOH) composting collection at most food service businesses.	Supportive

Measure Quantification Background

SB 1383 was adopted in 2016 and is a landmark waste mandate that requires the state to reduce organic waste disposal by 75% by 2025, or by about 20 million tons annually. The law also requires the state to increase edible food recovery by 20 percent by 2025. CalRecycle describes the requirements of local governments in meeting these targets as follows[67]:

- Provide organic waste collection to all residents and businesses
- Establish an edible food recovery program that recovers edible food from the waste stream
- Conduct outreach and education to affected parties, including generators, haulers, facilities, edible food recovery organizations, and city/county departments
- Capacity Planning: Evaluating your jurisdiction's readiness to implement SB 1383
- Procure recycled organic waste products like compost, mulch, and renewable natural gas (RNG)
- Inspect and enforce compliance with SB 1383
- Maintain accurate and timely records of SB 1383 compliance

Action 1: Implement the requirements of SB 1383 to divert or compost 75% of organic waste compared to 2014 levels.

The actions listed above for the climate action plan are a summary of the complete list of actions required to comply with SB 1383. More information on the requirements of SB1383 which the City would adopt in some form are included below:

1. **Expand local organics collection program.**
   Increase organics collection by offering technical assistance and outreach to commercial and residential accounts and planning for expanded processing capacity.

   Desired Result

[67] https://www.calrecycle.ca.gov/organics/slcp/education#:~:text=The%20SB%201383%20draft%20regulations,and%20other%20food%20recovery%20organizations.

- 50% reduction in landfilled organic waste by 2020.
- 75% reduction in landfilled organic waste by 2025.
- Reduce greenhouse gas emissions by 4 million metric tons statewide by 2030.

Benefits

- Compliance with SB1383 state regulation.
- Public health benefits.
- Green economy (expanded organics processing facilities and jobs).

Key Steps

- As stated in CalRecycle's proposed SB 1383 regulations[68], the City of Sacramento must engage in organic waste recycling capacity planning by supporting Sacramento County in executing the following actions:
    - Estimate Sacramento's disposal of organic waste (tons)
    - Identify and verify amount of available organic waste recycling infrastructure
    - Estimate the amount of new or expanded capacity needed to process organic waste
    - If existing and planned capacity is insufficient based on this process, the City of Sacramento shall support Sacramento County efforts to:
        - Develop and submit an implementation schedule highlighting planning effort to provide enough new or expanded organics capacity, including timelines and relevant milestones, by the end of the report period.
        - Identify proposed new or expanded facilities that could be used for additional capacity
- Expand organic waste collection for all commercial and residential generators
    - Require organics generators to subscribe to organics collection programs or alternatively report organics self-hauling and/or backhauling.
    - Work with the City of Sacramento's Recycling and Solid Waste Division and franchise waste haulers to collect organic waste and verify facility where they will transport organic waste (with exclusions of haulers transporting source-separated organic waste to a community-scale composting site and haulers transporting construction and demolition (C&D) waste in compliance with CALGreen).
    - Allow limited waivers and exemptions to generators for *de minimus* volumes and physical space constraints and maintain records for waivers/exemptions.
    - Standardize all colors and labels for carts, dumpsters, debris boxes, compactors for garbage, recycling, and organics based on SB 1383 statewide requirements.
- Develop and implement an education and outreach program that provides compliance assistance to organics generators.
        - Identify percentage of organics generators who are "limited English-Speaking households" or "linguistically isolated." If more than five percent (5%) of Sacramento's organics generators are defined as "limited English-speaking households" or linguistically isolated," provide education and

[68] Key actions are extracted from the second draft of the proposed SB 1383 regulations text.

outreach in a language or languages that will assure the information is understood by that community.

- Prior to February 2022 and annually thereafter, provide organics generators the following information:
  - Requirements to properly separate materials.
  - Organic waste prevention and on-site recycling.
  - Methane reduction benefits.
  - How to implement organic waste collection services with AVI
  - Information related to edible food donation.

- Implement inspection and compliance program with defined enforcement mechanisms and penalties by January 31, 2022 and annually thereafter.
  - Perform compliance review of all commercial garbage accounts that generate 2 cubic yards or more per week of organics and solid waste
  - Conduct annual contamination inspections and route reviews on randomly selected accounts and waste containers or conduct waste evaluations twice a year that meet the guidelines outlined in Article 3 of SB 1383
  - Enforce penalties for noncompliant entities as required by Article 16 of SB 1383.
- Maintain records, including an initial compliance report, annual report, and implementation record as required by Articles 3, 14, and 16 of SB 1383.

2. Increase edible food recovery

Develop and implement an edible food recovery program which connects large food generators with local food banks, to recover at least 20% of the edible food that is currently disposed of for human consumption, consistent with SB1383.

Desired Result

- 20% increase in recovery of currently disposed edible food from large food generators to food banks and hunger relief organizations.
- Reduction in landfilled organic waste.

Benefits

- Compliance with SB1383 state regulation.
- Reduction in food insecurity.
- New or enhanced community connections via more active and/or extensive donation networks.
- Support for businesses, which may receive tax incentives for donations.

Key Action

Recover at least 20% of the edible food that is currently disposed of for human consumption by 2025, consistent with SB1383.

- Conduct edible food recovery capacity planning by executing the following actions:
- Estimate the amount of edible food that will be disposed by organics generators in Sacramento.

- Identify the minimum capacity required to recover 20% of edible food that is estimated to be disposed.
- Work with commercial food generators to reduce excess edible food generation:
    - Connect large food generators to food banks and food recovery organizations.
    - Consider the adoption of an edible food recovery ordinance or similarly enforceable mechanism to ensure that large edible food generators connect with local food recovery programs.
    - Implement an inspection and compliance program with defined enforcement mechanisms and penalties targeted towards food generators and food recovery agencies as required by SB 1383.
- Maintain an initial compliance report, implementation record, and annual report as required SB 1383.

3. Implement organics procurement.

Increase municipal procurement of recovered organic waste products and post-consumer fiber products.

Desired Result

- Reduction in landfilled organics via bolstering the market for recycled organics products.

Benefits

- Carbon sequestration through use of purchased compost.
- Beautified landscapes through application of purchased compost.
- Public health benefits (Reduced particulate emissions from fossil fuels via increased use of clean energy sources

Key Actions

- As stated in CalRecycle's proposed SB 1383 regulations, the City of Sacramento must procure a quantity of recovered organic waste that meets or exceeds the organic waste product procurement targets for the City of Sacramento. Recovered organic waste products that a jurisdiction may procure to achieve compliance are: 1) compost, 2) renewable natural gas for transportation, electricity, heating applications, 3) pipeline ejection, or 4) electricity from biomass conversion.
- Ensure that at least 75% of City of Sacramento's annual purchase of paper products, printing paper, and writing paper is paper with a at least 30 percent post-consumer fiber paper. Require paper suppliers to certify minimum percentage of post-consumer material.
- Procure and use compost to meet California Model Water Efficient Landscape Ordinance (WELO) requirement for incorporating compost into new and renovated permitted landscapes (at least four cubic yards per 1,000 sq. ft. to a depth of six inches of compost)
- Implement an inspection and compliance program with defined enforcement mechanisms and penalties, as required by Article 16 in SB 1383.
- Maintain records, including an initial compliance report, annual report, and implementation record as required by Articles 3, 14, and 16 of SB 1383.

Evidence: The requirements and actions associated with SB 1383 have been developed to produce a 75% reduction in organics by the State of California.[69] Therefore, by taking the actions required, the City of Sacramento can expect to achieve a similar reduction level. The emissions reductions associated with a 75% reduction in organics was calculated using the 2014 waste characterization study for the County of Sacramento pursuant to the SB 1383 guidelines. A 75% reduction was applied in 2025 and continued through 2030 and the reduced amount was multiplied by CARB's emission factor for mixed organics (.31 MT/short ton).[70] Total emissions reductions are estimated to be 51,428 MT of CO_2e in 2030.

Quantification Results Summary

Action 1	2030	2045
Percentage of waste that is organics	27%	27%
Total Waste (tons)	704,696	839,935
Organic tons	188,506	224,683
Organics reduced by SB 1383 (75%)	141,380	168,512
Organics Emission Factor[1]	0.364	0.364
Emissions Saved (MT CO2e)	51,429	61,298

1. https://ww3.arb.ca.gov/cc/waste/cerffinal.pdf

Supportive Actions

Action 2: Develop an implementation plan to meet the requirements of SB 1383 and AB 1826.

Evidence: The implementation plan will ensure the complete execution of SB 1383 and AB 1826 and therefore, will support the overall GHG emissions reductions associated with these two legislations.

Action 3: Work with regional partners (other municipalities) and the private sector to site long term organics processing facilities in or near Sacramento County.

Evidence: Identifying a regional organics processing facility is a key step in diverting the required organics specified by SB 1383. Having a close facility will also reduce VMT compared trucking waste to a less local destination. Permitting is currently a hurdle for facilities in Sacramento County due local quality challenges and standards; however, other nearby regional areas may be identified.

Action 4: Continue to provide backyard compost education and reduced-cost compost bins as well as kitchen-top food containers to participating residents.[71]

Evidence: Providing compost buckets to residents will remove barriers to composting and allow for more organics to be diverted from the waste stream. Providing free buckets is also an equity benefit.

Action 5: Implement a food waste diversion program for all single-family residential customers by 2022.

[69] https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201520160SB1383
[70] https://www.epa.gov/sites/production/files/2019-06/documents/warm_v15_organics.pdf
[71] https://www.cityofsacramento.org/Public-Works/RSW/Collection-Services/Garbage/Composting

Evidence: The implementation of a food waste diversion program for all residents is a key action in achieving the SB 1383 goals. However, it is only a portion of the SB 1383 strategy and is not quantified here in order to avoid double counting.

Action 6: Consider a local composting ordinance which would require all businesses and residents to have access to curbside compost pickup.

Evidence: This measure would increase organics diversion and contribute to the overall SB 1383 reduction target.

Action 7: Partner with local community-based organizations which provide local composting services and support efforts consider supporting efforts to expand their programs or programs which are similar.

Evidence: Local composting entities are already operating in the City. These community groups can not only divert organics from the waste stream but can also provide community education and soil for community gardens and other projects. They also reduce emissions compared to large compost facilities due to their location in the City and decreased need for transportation.

Action 8: Develop and implement an edible food recovery program that complies with SB 1383. Establish an excess edible food baseline and then assist food recovery organizations with implementation.

Evidence: This action is required by SB 1383. Diverting edible food waste will both reduce GHG emissions and potentially reduce hunger and improve equity in the City.

Action 9: Explore feasible capital improvement projects for reducing organics in the waste stream, such as organics extraction presses and anaerobic digesters.

Evidence: Continuing to explore new technologies in waste diversion may allow Sacramento to better reach its long-term waste goals.

Action 10: Consider an ordinance that requires composting services at businesses, including front-of-house (FOH) composting collection at most food service businesses.

Evidence: Some cities have introduced ordinances to mandate commercial compost collection, including San Francisco, Portland, Seattle, and Boulder, among others. Boulder approved a Universal Zero Waste Ordinance in 2015, which requires that every home, business, and apartment have recycle and composting services, including front of house composting at restaurants. A waste audit study conducted by Eco-Cycle at food service establishments in Boulder found that food establishments of all types can achieve food waste capture rates (57-98%) through FOH collection with minimal contamination rates (1-22%).[72] This suggests that FOH collection can be a key source of compost material for composting facilities. The study also found that clear signage improved contamination rates for compost collection. FOH composting may also be more successful at establishments that offer compostable service ware or durable service ware.

Composting not only reduces methane emissions from decomposing food scraps in the landfill, but can also increase carbon sequestration when the compost is applied to soil.[73] Increasing compost added to

[72] https://www.ecocycle.org/files/pdfs/Reports/front-of-house-composting-study-ecocycle.pdf

[73] sciencedirect.com/science/article/pii/S0960852408010572

soil has the additional indirect benefits of decreasing the need for fertilizers (reducing GHGs produced from their production) and improving tillage and workability of soil (reducing GHG produced from working the soil). CARB estimates that approximately 0.69 MT CO_2e is avoided per ton of food waste, arising from decreased methane emissions, soil erosion, and fertilizer usage.[74] In addition, the US EPA estimates that approximately 183 kg (0.183 MT) of CO_2 is sequestered by one ton of wet compost,[75] suggesting an overall emissions reduction of 0.873 MT CO_2e per ton of composted waste.

[74] https://ww3.arb.ca.gov/cc/waste/cerffinal.pdf (see Table 10)
[75] https://www.ncurproceedings.org/ojs/index.php/NCUR2016/article/download/1698/893

Carbon Sequestration

Measure CS-1: Increase Urban Tree Canopy Cover to 35% by 2030	***2030 Target*** *42,263 MT CO_2e (Sequestered)* ***2045 Target*** *61,474 MT CO_2e (Sequestered)*
Performance Metric(s): • Achieve 35% urban tree canopy cover consistent with the Urban Forestry Master Plan	

Action #	Action	Anticipated Reduction
Quantitative Measures		
1	Implement the Urban Forestry Master Plan and achieve 30% urban canopy cover by 2030 and 35% by 2045. Prioritize tree planting in areas with the lowest average tree canopy cover and explore strategies to improve tree health and reduce barriers to tree planting in disadvantaged areas.	42,263 MT CO_2e (2030) 61,474 MT CO_2e (2045)

Measure Quantification Background

Carbon sequestration is the process by which carbon is taken out of the atmosphere and sequestered in soil, vegetation, or manmade structures. This measure deals with the carbon sequestration achieved by plants through photosynthesis whereby trees and other green plant pull CO_2 out of the atmosphere, use the carbon to grow, and release oxygen. According to the City of Sacramento's urban tree canopy report the current urban forest sequesters 73,000 MT of CO_2e per year and covers 19% of the City.[76] Expanding the urban forest to cover 35% of the City would be an expansion of 16% or 11,680 MT CO_2e.

Action 1: Implement the Urban Forestry Master Plan and achieve 30% urban canopy cover by 2030 and 35% by 2045.

Evidence: The growth of trees and other vegetation sequesters carbon.[77] According to the 2018 Urban Tree Canopy Assessment which mapped urban tree canopy using high-resolution aerial imagery and infrared technology to remotely map tree canopy and land cover in the City of Sacramento approximately 19% of the City has tree canopy cover. This vegetation sequesters approximately 73,000

[76] https://www.cityofsacramento.org/-/media/Corporate/Files/Public-Works/Maintenance-Services/Urban-Forest-Master-Plan/Copy-of-Sacramento-UTC-Assessment-20180515.pdf?la=en

[77] https://www.nrs.fs.fed.us/pubs/jrnl/2002/ne_2002_nowak_002.pdf

MT of CO_2e per year. If the City were to increase the tree canopy cover to 35% it would increase total sequestration by 84% or 63,474 MT of CO_2e per year.

Quantification Results Summary

Action 1	2030	2045
Total tree canopy coverage in 2018	19%	19%
Total tree canopy coverage goal	30%	35%
Annual sequestration in 2018	73,000	73,000
Percent increase in canopy coverage	58%	84%
Net MT CO_2e Savings	42,263	61,474

Water and Wastewater

Measure WW-1

Reduce water utility emissions (in MT of CO2e per MG) delivered by 100% by 2030 and maintain that through 2045.

2030 Target

6,877 MT CO_2e

2045 Target

0 MT CO_2e

Performance Metrics:

- Utilize carbon neutral power for 100% of water utility electricity demands by 2030

Action #	Action	Anticipated Reduction
Quantitative Measures		
1	Reduce GHG emissions associated with the water utility by procuring 100% carbon neutral electricity by 2030.	6,877 MT CO_2e (2030) 0 MT CO_2e (2045)
Supportive Measures		
2	Continue to provide greywater (laundry to landscape) incentives.	Supportive
3	Investigate the feasibility of allowing on-site wastewater treatment and distributed water resources in new development.	Supportive
4	Continue to report for the Model Water Efficient Landscape Ordinance each year.	Supportive
5	Encourage green infrastructure and low impact development strategies for new construction and development.	Supportive
6	Continue to investigate the landscaping/irrigation use of non-potable reclaimed water from regional sanitation at schools.	Supportive

Measure Quantification Background

Emissions from water are 100% attributable to electricity generation. Therefore, the primary measure for reducing GHG emissions is to reduce the emissions associated with electricity used to pump and treat water within the City of Sacramento. By 2030 the water utility will procure 100% carbon free electricity and reduce GHG emission on a per acre foot basis to zero. Additional supportive measures such as water conservation, greywater, and stormwater management will further this goal and reduce the amount of electricity needed by reducing overall water demand as the City continues to grow.

Action 1: Reduce GHG emissions associated with the water utility by procuring 100% carbon neutral electricity by 2030.

Evidence: Reducing the emission factor of electricity used to pump and treat water to zero would increase the expected reductions from SB100 by 6,877 MT of CO_2e per year. By 2045, SB100 will be fully implemented and therefore, procuring carbon neutral electricity will no longer provide a benefit above and beyond the adjusted forecast from which GHG emission reductions are calculated.

Quantification Results Summary

Action 1	2030	2045
Projected Electricity Use (kWh)	57,668,933	68,766,992
Projected Emission Factor (MT CO_2e/kWh)	0.000119	0.0
Projected Emissions (With SB100)	6877	0
Emission Factor with Action 1 (MT CO_2e/kWh)	0.0	0.0
GHG Emissions with Action 1 (MT CO_2e/kWh)	0	0
GHG Emissions Savings (MT CO_2e)	6,877	0

Supportive Actions

Action 2: Continue to provide greywater (laundry to landscape) incentives.

Evidence: The reuse of water onsite through greywater systems like laundry to landscape reduces the total amount of potable water that the utility must pump, treat, and distribute. Reducing potable water use will reduce emissions in the short term, and ultimately reduce the amount of renewable and carbon free electricity required to maintain carbon neutrality. It also saves residents money.

Action 3: Investigate the feasibility of allowing on-site wastewater treatment and distributed water resources in new development.

Evidence: As part of SB 966, the City of Sacramento is investigating the feasibility of onsite treatment and reuse of non-potable water use in multifamily residential, commercial, and mixed-use buildings. When enacted, a policy of this kind could greatly decrease the amount of potable water consumption.

Action 4: Continue to report for the Model Water Efficient Landscape Ordinance each year.

Evidence: The City will continue to report for the Model Water Efficient Landscape Ordinance on an annual basis and investigate areas for enhanced landscape water conservation.

Action 5: Encourage green infrastructure and low impact development strategies for new construction and development.

Evidence: When new projects are permitted in the City of Sacramento, the City will review and encourage applicants to use green infrastructure and low impact development strategies. These strategies can increase stormwater retention and groundwater infiltration.

Action 6: Continue to investigate the landscaping/irrigation use of non-potable reclaimed water from regional sanitation at schools.

Evidence: The City will continue to investigate the efficacy of reclaimed water application for non-potable uses at area schools. Reclaimed water use reduces the consumption of potable water both protecting a limited resource and reducing the energy needed to pump and treat potable water.

Measure WW-2 *Reduce wastewater emissions through the use of biogas and carbon free electricity by 23% by 2030 and 34% by 2045.*	***2030 Target*** ***5,954 MT CO_2e*** ***2045 Target*** ***12,853 MT CO_2e***
Performance Metrics: • Utilize carbon neutral power for 100% of water utility electricity demands by 2030	

Action #	Action	Anticipated Reduction
Quantitative Measures		
1	Biogas recovery and improvement projects.	993 MT CO_2e (2030) 1,171 MT CO_2e (2045)
2	SB100 Implementation.	4,572 MT CO_2e (2030) 11,681 MT CO_2e (2045)
3	Solar PV Generation.	389 MT CO_2e (2030) 0 MT CO_2e (2045)

Measure Quantification Background

Although GHG emissions from wastewater are generated by the Sacramento Community, operational control of the wastewater treatment facility is covered by Regional San. This means the City of Sacramento has no direct levers to reduce these emissions. However, since the GHG emissions associated with wastewater are included in the GHG emissions inventory, several of the GHG reducing activities which Regional San has undertaken are included here. The City of Sacramento and SMUD will continue to support Regional San in these and future partnerships to further reduce emissions from the wastewater sector.

Action 1: Biogas recovery and improvement projects.

Evidence: Regional San has operated a biogas recovery project which collects digester gas and utilizes it to generate electricity in a SMUD owned cogeneration facility. The combustion of the biogas reduces methane emissions which have a global warming potential of 25 and converts it to biogenic CO_2e which

does not impact global warming. This program has reduced methane emissions from the facility by 96% to 0.454 tons per year.[78] Sacramento's GHG inventory estimated methane emissions at 32 tons in 2016. To calculate the expected reduction in methane emissions from the biogas program into the future, a per service person methane value was calculated (0.000044 MT CH_4/person) and the service person forecast for each target year was applied.

Quantification Results Summary

Action 1	2030	2045
2016 estimated methane production	32	32
Estimated CH_4 emissions per service person	0.000044	0.000044
MT CH_4 in target year	42	50.0
Estimated BAU emissions	1,048	1,250
96% reduction in emissions	55	78
GHG Emissions Savings (MT CO_2e)	993	1,171

Action 2: SB100 Implementation.

Evidence: Because a majority of emissions associated with wastewater are from process emissions, specifically the generation of CH_4 and N_2O, SB100 impacts were not included in the adjusted forecast. However, a projected 43,811 MWh of electricity are expected to be used to treat Sacramento's wastewater in 2030 and 52,243 MWh of electricity in 2045. Emissions associated with this electricity are expected to go to zero by 2045.

Quantification Results Summary

Action 1	2030	2045
Projected electricity use (MWh)	43,811	52,243
BAU emission factor (MT CO_2e/MWh)	0.2236	0.2236
Projected emission factor (MT CO_2e/kWh)	0.000119	0.0
Emissions under BAU scenario	9,796	11,681
Emissions with SB100	5,225	0
GHG emissions savings (MT CO_2e)	4,572	11,681

Action 3: Solar PV Generation.

[78] https://www.regionalsan.com/biogas-recycling

Evidence: In 2018 Regional San installed a 4.2-megawatt solar array which provides an estimated 10% of its operational electricity. In 2016 it was estimated that approximately 32,645 MWh were used to treat wastewater from the City of Sacramento. Offsetting 10% of this usage would reduce GHG emission by approximately 389 MT of CO_2e. However, by 2045, due to SB100 (calculated in Action 2) reduces the GHG benefit of the solar array to zero to avoid double counting.

Quantification Results Summary

Action 1	2030	2045
Projected offset of electricity use.	10%	10%
Estimated electricity use attributable to Sacramento in 2016.	32,645	32,645
Electricity offset by solar pv	3,264.5	3,264.5
Emission Factor from SMUD (MT CO_2e/kWh)	0.000119	0.0
GHG emissions savings (MT CO_2e)	389	0

Equity Considerations and Proposed CAP Actions

The table below is a high-level summary of equity concerns from the community and EJ Working Group. Staff have prepared responses to these concerns and will continue to consider equity and incorporate it throughout the development and implementation of the CAP.

	EQUITY CONCERN	RESPONSE
1	How will electrification efforts impact low-income households?	SMUD plans to expand existing low-income programs to weatherize and retrofit/electrify existing buildings with the goal of reducing energy consumption, decreasing utility bills, and converting to all-electric. SMUD's goal is to ensure that electrification is implemented in an equitable approach, that ensures the most vulnerable households can benefit. Electrification also has a co-benefit of improving indoor air quality. Poor indoor air quality can exacerbate asthma and unhealthy living conditions. Electrification also "future-proofs" households from the costs of aging natural gas infrastructure. These costs are placed onto ratepayers through utility bills and are anticipated to escalate, with increasing impact to lower-income households that have a higher energy cost burden and are most impacted by rate escalation.
2	There is a perception that requiring new buildings to be all-electric may increase the cost of housing, trigger rent increases, or raise energy bills.	Cost effectiveness studies for initial construction costs and on-bill costs have been completed and are very favorable for low-rise residential (single family and multifamily buildings of 1, 2, and 3 stories). Reduced construction costs are likely to reduce the cost of housing for the consumer. Cost-effectiveness studies will be further evaluated and, as necessary, conducted prior to implementation for additional building types.
3	There is a perception that prohibiting the replacement of gas appliances in existing development and requiring electric appliances in their place could trigger rent increases.	This action would be phased in as the proposal is developed and more details become clear. Education and supportive programs, such as turn-key programs and pre-vetted contractors, may be required to ensure that costs are transparent and incentives are accessible. On-site solar improves the cost-effectiveness of all-electric buildings. SMUD's Greenergy program is even more cost-effective at saving carbon than on-site solar. Finally, SMUD will provide energy efficiency and electrification programs to mitigate the impact of electrification on renters and low-income households.
4	How do improvements in the public transit system benefit disadvantaged communities?	Public transit is key to reducing VMT and is essential to provide access to jobs and strengthening job opportunities for all neighborhoods. Disadvantaged communities may also have transit-dependent populations that have greater need of reliable public transit to access goods and service

Equity Considerations and Proposed CAP Actions

	EQUITY CONCERN	RESPONSE
		due to factors such as cost barriers to owning a personal vehicle, or barriers to obtaining driver's license, etc.
5	How will disadvantaged neighborhoods with low tree canopy cover be addressed?	The City will identify and prioritize street tree planting within the public right-of-way in neighborhoods with lower than average tree canopy cover. Within those priority areas, the City will identify locations where there is space to plant trees in the public right-of-way. Where street tree planters in the public right-of-way are lacking, the City will continue to support and promote community groups, businesses, and non-profit organizations who plant trees, maintain trees, and/or educate people about tree care and tree planting on private property.
6	What are the benefits of amending City Code to increase EV capable charging spaces for low-income communities?	This action helps enable the shift from vehicles with internal combustion engines to zero-emission vehicles, which have the co-benefit of reducing air pollution in disadvantaged communities that are affected by poor air quality. In addition, it will improve the availability of EV charging for renters in multi-unit buildings, giving renters the option to drive an EV.
7	Was inclusive community outreach conducted in the City's recent active transportation planning efforts, such as the planning process for the Bicycle Master Plan?	Yes, equity is a key priority in the City's transportation planning. For example, equity was used to prioritize projects in the Bicycle Master Plan and accounted for 25% of a project's overall score.
8	Will inclusive community outreach be conducted in the implementation of the City's adopted plans, including intermodal/citywide plans and corridor/area plans?	Yes, outreach to disadvantaged communities and project prioritization will be included as part of the forthcoming Transportation Master Plan and the Neighborhood Development Action Team planning efforts. The City recently completed an update of many of other transportation plans. As plans are revisited, there will be outreach at that time.
9	How will the state-mandated food waste diversion program SB 1383 impact low-income households?	The food waste diversion program is mandated by the state for all residential customers by 2022. The details of this program still need to be established. The City is evaluating proposal options to retain a vendor to implement the program. The program will be more challenging to implement in multi-family buildings and would likely require additional outreach and education to multi-family tenants.

Equity Considerations and Proposed CAP Actions