GHG Inventory, Forecast, and Targets Methodology and Calculations

Pleasanton Climate Action Plan Update

prepared for

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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 of climate change at the State-level through the adoption of legislation and policies. Many cities and counties within California have developed local climate action plans and aligned goals to correspond with State emissions reduction targets. The two major State GHG emissions-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 even earlier by the State in 2016,[1] and many California jurisdictions are completing updated GHG inventories to quantify progress toward their specific 2020 goals as well as develop targets to align with the requirements of SB 32. There is also Executive Order B-55-18, which was passed in 2018 by Governor Jerry Brown and set a goal for achieving carbon neutrality Statewide by 2045. An older Executive Order (EO), EO S-3-05 (2005), which set a goal of 80 percent reduction in GHG emissions by 2050, is also considered in this technical appendix, but is generally considered superseded by the longer-term GHG emissions reduction goal set by EO B-55-18. These Executive Orders currently are only required by law for State Agencies, but future climate legislation and goals are expected by to be passed by the California legislature in the future.

This technical appendix details the methodology and results of the greenhouse gas (GHG) emissions inventories completed for Pleasanton, the forecast of future GHG emissions, and the provisional GHG emissions reduction targets identified for the Pleasanton Climate Action Plan (CAP) Update for the years 2030 (Senate Bill [SB] 32 target year), 2045 (Executive Order [EO] B-55-018 target year), and 2050 (EO S-3-05 target year). This technical appendix also quantifies the reduction impact that State regulations will have on Pleasanton's *business-as-usual forecast*[2] and presents the results in an *adjusted forecast.*[3] Target setting is an iterative process that must be informed by reductions that can realistically be achieved through development of feasible GHG reduction measures. As such, the targets identified herein (particularly the 2030, 2045, and 2050 targets) remain provisional until quantification and analysis of potential GHG reduction measures has been completed.

The City of Pleasanton has completed GHG emissions inventories[4] for 2010, 2015, and 2017 and updated the 2005[5] GHG inventory to measure progress toward the 2020 GHG reduction goals established in the first Pleasanton Climate Action Plan (CAP).[6] These inventories use the most recent population, employment, and emission factor data allowing for consistent and comparable methodologies across all inventory years and between Bay Area jurisdictions that are also using the

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[1] California Air Resources Board. 2020. California Greenhouse Gas Emissions Inventory. Accessed: <https://ww3.arb.ca.gov/cc/inventory/inventory.htm>. Accessed: April 14, 2020

[2] Forecasts emissions based on population and job growth, with no reduction measures from federal, State, or local governments.

[3] The adjusted forecast scenario incorporates expected federal, State, and local GHG reduction measures into the emissions forecast to develop a more accurate forecast of emissions through 2045 and 2050.

[4] Note that all reference to inventories, forecasts, and targets in this memorandum are in reference to communitywide GHG emissions.

[5] The Updated 2005 GHG Emissions Inventory is an update of the previously prepared 2005 inventory that informed the first City CAP. This was done to use the most recent methodology, emission factors, and data sources available, as well as for consistency between other inventory years. The original updated 2005 inventory was created by East Bay Energy Watch, and then updated by Rincon (for more information on these updates, refer to Section 2.3 of the Technical Appendix).

[6] City of Pleasanton. 2012. City of Pleasanton Climate Action Plan. Available: <http://www.cityofpleasantonca.gov/gov/depts/os/env/cap/resources.asp>. Accessed April 14, 2020.

East Bay Energy Watch (EBEW) GHG calculation methodology. These various inventories will assist in the preparation of the Pleasanton CAP Update by tracking progress in specific GHG emission sectors and to forecast future GHG emissions and develop a respective gap analysis that will assist in identifying CAP Update policies that will achieve longer-term GHG emissions targets.

1.1 Regulatory 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 contribution to climate change through the adoption of legislation, plans, and policies, the most relevant of which are summarized below.

- **Executive Order S-3-05 (2005),** signed by former Governor Schwarzenegger in 2005, establishes Statewide GHG emissions reduction goals to achieve longer-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 (2006),** 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]
- **Climate Change Scoping Plan (2008),** the original California Climate Change Scoping Plan, includes measures to address GHG emission reduction strategies related to energy efficiency, water use, and recycling and solid waste, among other measures. Many of the GHG reduction measures included in the Scoping Plan (e.g., Low Carbon Fuel Standard, Advanced Clean Car standards, and Cap-and-Trade) have been adopted and implemented since approval of the Scoping Plan.
- **Climate Change Scoping Plan Update (2013),** the first update to the California Climate Change Scoping Plan, defines CARB climate change priorities for the next five years and set the groundwork to reach post-2020 Statewide GHG emissions reduction goals. The Scoping Plan Update highlighted California's progress toward meeting the 2020 GHG emission goals defined in the original Scoping Plan. It also evaluated how to align the State's longer-term GHG reduction strategies with other State policy priorities, including those for water, waste, natural resources, clean energy, transportation, and land use.
- **Executive Order B-30-15 (2015)** - Establishes Statewide GHG emissions reduction goals of reducing GHG emissions to 40 percent below 1990 levels by 2030.
- **Senate Bill 32 (2016),** signed by former Governor Brown in 2016, codified the 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.

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[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.

- **Executive Order B-55-18 (2018),** 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 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.

1.2 Baseline Inventory Greenhouse Gas Emissions

The 2017 Pleasanton GHG emissions inventory serves as the inventory to inform development of future GHG emissions forecasts that will assist the City in setting GHG emissions targets that are consistent with State-level goals and the Pleasanton General Plan 2005-2025. In 2017, Pleasanton GHG emissions were estimated to be 588,553 metric tons (MT) of carbon dioxide equivalent (CO_2e).[11] Data was originally gathered by EBEW and then reviewed and updated by Rincon for consistency with the latest methodology available in the Community Protocol[12] and California Supplement[13]. The updated 2005 GHG Inventory corrected a few typological errors in the water and wastewater inventory sectors and removed the Bay Area Rapid Transit (BART) emissions, because the City of Pleasanton does not have direct control over BART and is unable to reduce these emissions and because BART data was not available for the subsequent inventories. 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 Fifth Assessment Report (AR5) of the Intergovernmental Panel on Climate Change GWP values for consistency with the yearly CARB GHG inventory, as shown in Table 1.[14,15]

[9] California Air Resources Board. 2008. Climate Change Scoping Plan. Available: <https://www.arb.ca.gov/cc/scopingplan/document/adopted_scoping_plan.pdf>. Accessed: April 14, 2020

[10] California Air Resources Board. California's 2017 Climate Change Scoping Plan. Available: <https://www.arb.ca.gov/cc/scopingplan/scoping_plan_2017.pdf>. Accessed: April 14, 2020

[11] Carbon dioxide equivalent is a term for describing GHG emissions in a common unit, signifying for any GHG the amount of CO_2 that would have the equivalent global warming impact. The equivalent amount of CO_2 is calculated based on the GHG global warming potential value.

[12] ICLEI. 2012. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions. Available: <https://icleiusa.org/publications/us-community-protocol/>. Accessed: April 14, 2020.

[13] Association of Environmental Professionals. 2013. The California Supplement to the United States Communitywide GHG Protocol. Available: <https://califaep.org/docs/California_Supplement_to_the_National_Protocol.pdf>. Accessed: April 14, 2020.

[14] Intergovernmental Panel on Climate Change. 2014. Fifth Assessment Report: Climate Change. Direct Global Warming Potentials.

[15] All calculations use Intergovernmental Panel on Climate Change Fifth Assessment Report GWP values.

Table 1 Global Warming Potentials of Greenhouse Gases

Greenhouse Gas	Molecular Formula	Global Warming Potential (CO_2e)
Carbon Dioxide	CO_2	1
Methane	CH_4	28
Nitrous Oxide	N_2O	265

MT CO_2e: metric tons of carbon dioxide equivalent

Included Emissions

The 2017 community inventory for the City of Pleasanton includes estimated emissions for the following sectors:

- Energy (electricity, natural gas, direct access electricity)
- On-road Transportation (passenger, commercial)
- Off-road Transportation
- Waste (solid waste, alternative daily cover)
- Water
- Wastewater (direct, indirect)

Excluded Emissions

The following emissions sectors were excluded from Pleasanton's CAP 1.0 inventory for 2005 and are also excluded from the updated 2005, 2010, 2015, and 2017 inventories. Additional updates were also made to the 2005, 2010, and 2015 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 Pleasanton's emissions. This is due to no widely accepted standard methodology currently existing for reporting consumption-based inventories from CARB or the ICLEI U.S. Community Protocol.

Natural and Working Lands Emissions

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[16] GHG inventory; however, at the time of this City of Pleasanton 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[17] are exploring options for a tool that may be able to perform these inventories at a more specific geographic level.

[16] California Air Resources Board. 2017. California Climate Change Scoping Plan Update.

[17] California Department of Conservation. TerraCount Scenario Planning Tool. Available: <https://maps.conservation.ca.gov/terracount/>. Accessed: April 15, 2020

Agricultural Emissions

Emissions from agricultural activities are not included in this inventory as the Community Protocol and California Supplement[18] 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 Emissions

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 Pleasanton. Furthermore, many of these emissions are from industrial manufacturing sources and are already accounted for in the California Cap-and-Trade program.

1.3 Future GHG Emissions Forecasts and Targets

Prior to 2018, the City of Pleasanton completed a communitywide GHG emissions inventory for the year 2005 and was used in their 2012 CAP 1.0. This was based on an emissions inventory completed in 2008 by ICLEI. The CAP 1.0 inventory also includes forecasts of 2020 and 2025 emissions, that was based on the current population, housing, and employment growth estimates available at the time. As part of the 2020 CAP Update, new GHG inventories were developed for the years 2005, 2010, 2015 and 2017 by EBEW using the most recent population, employment and emission factor data. These changes allowed for consistent and comparable methodologies across years and between jurisdictions who are using the EBEW GHG calculation methodology. This updated methodology made several changes to the 2005 inventory which resulted in changes to the overall GHG emissions in 2005 and 1990 (which is back cast from 2005). A complete description of the differences between the CAP 1.0 GHG inventory and the updated 2005 inventory is included in Section 2.3.

Future Pleasanton GHG emissions were forecasted for six different years (2020, 2025, 2030, 2040, 2045, and 2050) in terms of both a business-as-usual scenario[19] and an adjusted forecast scenario[20] in order to quantify expected emissions through 2050. In addition, five GHG emissions reduction target pathways are presented to establish 2025, 2030, 2035, 2040, 2045, and 2050 GHG emission reduction goals that may be adopted as part of the CAP Update.

This memorandum also summarizes the State GHG emissions targets, Pleasanton 2012 CAP emissions targets, provisional Pleasanton targets, and Pleasanton target pathway options to meet those targets. The provisional targets analyzed for the Pleasanton CAP Update include:

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18 Association of Environmental Professionals. 2013. The California Supplement to the United States Community-Wide Greenhouse Gas (GHG) Emissions Protocol. Available: <https://califaep.org/docs/California_Supplement_to_the_National_Protocol.pdf>. Accessed: April 15, 2020.

19 Forecasts emissions based on population and job growth, with no reduction measures from federal, State, or local governments.

20 The adjusted forecast scenario incorporates expected federal, State, and local GHG reduction measures into the emissions forecast to develop a more accurate forecast of emissions through 2045.

- Reduce GHG emissions a minimum of 15 percent below 2005 levels by 2020, which is consistent with Assembly Bill (AB) 32;[21]
- Reduce GHG emissions 40 percent below 1990 levels by 2030, which is consistent with SB 32[22] and in line with the reduction trajectory to achieve the State 2050 reduction goal (80 percent below 1990 levels) identified in Executive Order S-3-05;[23] and
- Reduce GHG emissions 80 percent below 1990 levels by 2050, consistent with Executive Order S-3-05 or achieve carbon neutrality by 2045, which is consistent with E0 B-55-18.[24]

1.4 Progress Towards Pleasanton 2020 GHG Emissions Reduction Targets

The first Pleasanton Climate Action Plan was adopted in 2012.[25] It identified how the City and broader community can reduce Pleasanton GHGs and included a GHG emissions reduction target of 15 percent reduction below 2005 emissions levels by 2020 or a total reduction of 121,970 MT CO_2e. This target was consistent with the Statewide goal established by AB 32 in 2006 of reducing emissions to 1990 levels by 2020. This 15 percent reduction target was in line with current best practices at the time for the climate action plans developed for the County of Alameda and several Bay Area cities that also utilized 2005 baselines. According to the updated 2005 and 2017 inventories (which both use the same methodologies), Pleasanton exceeded the 2020 reduction goal three years ahead of schedule by decreasing emissions by an estimated 154,456 MT CO_2e, which equates to an overall mass emissions reduction of 28 percent below 2005 levels.

This 2017 inventory and forecast also considered per capita emissions reductions to measure Pleasanton's GHG emissions reduction progress when accounting for the rate at which Pleasanton has grown since 2005. This will be useful for the City to reference if it chooses to adopt a per capita target pathway for future GHG emissions reductions (see the Provisional GHG Emissions Targets section below for more information regarding per capita efficiency target pathways). In 2005, GHG emissions were an estimated 12.2 MT CO_2e per person. This was calculated by dividing total GHG emissions from the updated 2005 GHG inventory by the Pleasanton 2005 population. In 2017, per capita emissions dropped to 7.7 MT CO_2e per person. This equates to a per capita emissions reduction of 37 percent below 2005 levels. Details and discussion of previous inventories and changes made for consistency as part of this update can be found in Section 2.

[21] AB 32 codified the State 2020 GHG emissions target by directing the California Air Resources Board (CARB) to reduce California's Statewide emissions to 1990 levels by 2020 (approximately equivalent to a 15 percent reduction from 2005 to 2008 levels). The AB 32 Scoping Plan encourages local governments to adopt a target that parallels the State target.

[22] SB 32 codified the State's 2030 GHG emissions target by directing CARB to reduce California's Statewide emissions to 40 percent below 1990 levels by 2030. CARB is currently working on a Scoping Plan to demonstrate how the State will achieve of the 2030 target.

[23] Executive Order S-3-05 established ambitious GHG reduction targets for the State: reduce GHG emissions to 2000 levels by 2010, to 1990 levels by 2020, and to 80 percent below 1990 levels by 2050. SB 32 establishes a Statewide mid-term GHG reduction target of 40 percent below 1990 levels by 2030. To remain consistent with the trajectory of SB 32 and S-03-05, emissions would need to be reduced 40 percent below 1990 levels over the 20-year period between 2030 and 2050, which is equal to approximately 2 percent per year. Since 2035 is 5 years past 2030, emissions would need to be reduced by an additional 10 percent over the 2030 target, which is 50 percent below 1990 in 2035 (equivalent to 58 percent below 2008 levels).

[24] The Pleasanton Climate Action Plan Update will not include measures designed for implementation out to years 2045 or 2050 but rather present 2045 or 2050 forecast emissions and identify preliminary 2045 or 2050 targets to demonstrate the City commitment to achieve the City's fair share of GHG emissions of State long-term 2045 or 2050 goal presented in Executive Orders B-55-18 or S-3-05, respectively.

25 Pleasanton, City of. 2012. Pleasanton 2020 Climate Action Plan. Available: <http://www.cityofpleasantonca.gov/gov/depts/os/env/cap/resources.asp>. Accessed: April 2020.

2 Previous GHG Emissions Inventories

A summary of previous GHG emissions inventories prepared for Pleasanton can be found in Table 2. A description of the variability between methodologies used in each of the inventory years is summarized in the following sections.

Table 2 Pleasanton GHG Inventories Summary

Sector	1990[1] (MT CO_2e)	2005 CAP 1.0[2] (MT CO_2e)	2005 CAP 2.0[3] (MT CO_2e)	2010 (MT CO_2e)	2015 (MT CO_2e)
Residential Energy	96,013	113,565	112,957	110,603	91,334
Nonresidential Energy	130,864	151,860	153,958	133,401	122,438[4]
Direct Access Electricity	18,256	N/A	21,478	14,352	19,277
On-Road Transportation	328,919	401,550	386,963	367,968	340,830
Off-Road Transportation	99,506	25,410	117,067	19,205	48,262
Waste	30,172	38,826	35,497	21,912	27,063
Wastewater	1,319	N/A[5]	1,559	1,495	1,492
Water	4,361	34,426	5,130	4,090	3,820
Municipal Operations	N/A	5,370[6]	N/A	N/A	N/A
Total Emissions	**691,161**	**770,844**	**813,131**	**658,675**	**635,239**
Emissions per capita	13.7	11.5	12.2	8.44	8.38

$MTCO_2e$: metric tons of carbon dioxide equivalent

[1] All 1990 inventory data calculated as a 15 percent reduction from CAP 2.0 EBEW 2005 inventory levels per California Air Resources Board guidelines.

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

[3] EBEW inventory for 2005, using same methodology as 2010 and 2015 inventories. Used to back cast 1990 inventory numbers, and to compare emissions for 2017 inventory (CAP 2.0 baseline year).

[4] Nonresidential natural gas emissions adjusted to include estimated emissions from industrial sources, which were not reported by PG&E due to CPUC privacy rules.

[5] Wastewater emissions included with water emissions in original CAP 1.0 inventory.

[6] Municipal operations are a subset of community emissions (included in the community emissions inventory), in 2005 an inventory of municipal emissions was calculated separately for comparison purposes.

2.1 1990 Reference-Year Inventory

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 Pleasanton'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.[26] The updated 1990 proxy baseline used for target setting by Pleasanton is 691,161 MT CO_2e.[27]

2.2 CAP 1.0 2005 Inventory

In 2008, Pleasanton collaborated with ICLEI to develop a 2005 community GHG emissions inventory. The 2005 inventory quantified community emissions and forecast business-as-usual (BAU) conditions to 2020 based on expected population, employment, and growth. It included emissions from the residential energy, commercial/industrial energy, on-road transportation (using data from the Metropolitan Transportation Commission (MTC) for VMT data), and waste sectors.

In 2012, this 2005 inventory was updated to include additional sectors (referred to here as the CAP 1.0 2005 inventory) and develop forecasts of emissions for 2020 and 2025. The CAP 1.0 inventory added emissions from off-road vehicles, direct access electricity, water and wastewater systems, municipal operations, and utilized the Alameda County CMA Travel Demand Model (now known as Alameda CTC) for VMT estimates. This led to an overall 6.5% decrease in GHG emissions for the 2005 baseline inventory year compared to the original 2005 inventory completed by ICLEI.

The CAP 1.0 inventory from 2012 was updated as part of this current 2020 inventory and forecast effort for the CAP Update, using the most recent methodology, data, and emissions factors. This updated 2005 inventory for the CAP Update, along with inventories for 2010, 2015, and 2017, were originally developed by East Bay Energy Watch in 2019 and then updated by Rincon. (see section 2.3 below for more details on changes made by Rincon to these inventories).

Table 3 compares changes in emissions by sector between the previous CAP 1.0 2005 inventory and updated CAP 2.0 2005 inventory. Overall, emissions in the updated CAP 2005 inventory increased by 5 percent, mainly due to an increase in emissions from the off-road transportation sector.

[26] 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.

[27] Calculated using updated 2005 CAP 2.0 inventory created by EBEW and completed by Rincon.

Table 3 GHG Emissions Comparison Between CAP 1.0 and CAP 2.0 2005 Inventories

	2005 CAP 1.0 Emissions (MT CO_2e)[28]	Updated 2005 CAP 2.0 Emissions (MT CO_2e)	Percent Change
Residential Electricity	46,881	46,782	-0.21%
Residential Gas	66,684	66,175	-0.76%
Nonresidential Electricity	105,107	89,385	-14.96%
Nonresidential Gas	46,753	43,094	-7.83%
Direct Access Electricity	N/A[1]	21,479	-
On-road Transportation	401,550	386,963	-3.63%
Off-road Transportation	25,410	117,067	+360.71%
Solid Waste Disposal	38,826[1]	35,497	-8.57%
Water and Wastewater	34,264	6,689	-80.48%
Municipal Operations	5,370	N/A[2]	-
Total	**770,884**	**813,131**	**+5.48%**

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: Direct access electricity data included in nonresidential electricity category.

2: Municipal operations are a subset of community emissions in the updated 2005 CAP 2.0 inventory and were not calculated separately.

2.3 2005, 2010, 2015, and 2017 East Bay Energy Watch Inventories

In 2019, East Bay Energy Watch (EBEW) developed GHG inventories for jurisdictions across the Bay Area. GHG inventories for 2005, 2010, 2015, and 2017 were established for Pleasanton as a part of this effort (referred to from here as the EBEW inventories). Although the EBEW inventories use slightly different methodologies than the 2005 inventory, due to the availability of data, the consistency between years and between jurisdictions, and the use of the most recent emission factors and data sources, Pleasanton has adopted the EBEW inventories and will incorporate them into the CAP process.

The most significant differences between the EBEW inventories and CAP 1.0 2005 inventory is that the CAP 1.0 2005 inventory used the Alameda County Traffic Commission's Countywide Traffic Demand Model for VMT data modeling, while the EBEW CAP 2.0 inventories (2005, 2010, 2015, and 2017) utilize the Bay Area Metropolitan Transportation Commission (MTC) VMT data model for VMT data and projections. This led to a significant increase in on-road VMT activity data and on-road transportation emissions compared to the CAP 1.0 2005 inventory.

In addition, several updates were performed as part of the current effort to adjust the EBEW inventories specifically to Pleasanton and create a single methodology across the 2005, 2010, 2015, and 2017 inventories. These included adding natural gas emissions from the industrial sector in 2015 (due to the data being unavailable from PG&E reporting due to CPUC privacy rules) and updating the waste and water sections to better reflect the specific conditions in Pleasanton.

28 Original 2005 CAP 1.0 inventory here refers to the 2012 CAP 1.0 inventory, which had previously been updated from ICLEI's 2005 inventory (completed in 2008 for use in Pleasanton's 2012 CAP 1.0).

The following discussion outlines the changes made to the EBEW inventories for consistency with the ICLEI Community Protocol[29] and inventory years.

Direct Access Electricity

Direct access electricity[30] was not reported by PG&E for the 2005 and 2010 reporting year due to California privacy rules, specifically what is known as the 15-15 rule[31]. It was determined by examining the available PG&E data for Pleasanton (obtained via PG&E's Green Communities portal) that direct access electricity users triggered the 15-15 rule for years before 2011. This prevented PG&E from reporting 2005 and 2010 direct access electricity activity data as a part of the data request for Pleasanton's energy data, which was listed as 'ZZZZZ'. This direct access electricity data was reported in all years between 2011 and 2017.

To allow for accurate comparison of energy sector emissions between inventory years, direct access electricity usage and emissions were estimated for 2005 and 2010. This was done by using the average rate of direct access electricity usage for Alameda County in 2005, which was 13.9 percent of nonresidential electricity.[32] The rate of 13.9 percent is lower than that seen in 2017 and therefore, may underestimate the use of direct access electricity in the baseline year. Therefore, this is considered a conservative estimate which would require additional reductions to meet the 40% reduction from 1990 levels. Direct access electricity usage was estimated in this way for 2005 and 2010, so direct access electricity emissions are accounted for across all four inventory years.

Natural Gas

When examining the available PG&E natural gas data for Pleasanton (obtained via PG&E's Green Communities portal) it was determined that large industrial natural gas users triggered the 15-15 rule in 2015. This prevented PG&E from reporting 2015 industrial natural gas activity data as a part of the data request for Pleasanton's energy data, which was listed as 'Fail-Dropped'. In other years, industrial natural gas emissions were included with commercial emissions.

To allow for accurate comparison of energy sector emissions between inventory years, industrial natural gas usage and emissions were estimated for 2015. This was done by calculating the ratio of commercial natural gas usage to residential natural gas usage in other reporting years (where industrial was included with commercial), and then the average ratio was applied to 2015 to estimate industrial natural gas usage in that year. The years 2013, 2014, 2016, and 2017 were used to calculate the average commercial/residential natural gas usage ratio, as these were the closest reporting years to 2015, and there was a clear upward trend in combined commercial and industrial natural gas usage after 2013. After applying this average to 2015, the estimated activity data for combined commercial and industrial natural gas usage was used to calculate emissions from the nonresidential natural gas sector in 2015 so industrial natural gas emissions are accounted for across all four EBEW inventory years.

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

[30] Direct access electricity is retail electric service where customers purchase electricity from a competitive provider called an Electric Service Provider (ESP), instead of from a regulated electric utility. An ESP is a non-utility entity that offers electric service to customers within the service territory of an electric utility. The utility delivers electricity that the customer purchases from the ESP to the customer over its distribution system.

[31] 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.

[32] Average rate of direct access electricity in Alameda County, as cited in Appendix A of 2012 City of Pleasanton Climate Action Plan 1.0.

Water and Wastewater

The original EBEW inventories included activity data and emissions from the water and wastewater sectors, which are standard to include in accordance with the ICLEI U.S. Community Protocol. Emissions were calculated using the following ICLEI Community Protocol methods (determined based on facility information gathered by EBEW): WW.2, WW.8, and WW.12. A typological error referencing the wastewater activity data was uncovered during Rincon's review and was corrected. In addition, during a review of the EBEW inventory and Dublin San Ramone Services District (DSRSD) operations, it was determined that wastewater from the DSRSD discharges to the bay via a main pipeline. The original EBEW inventory was set as discharging into rivers and streams, which underreported electricity consumption used to pump wastewater over the pass and into the bay. Therefore, Rincon updated the calculation to reflect this additional pumping. Once these errors were resolved, emissions for water and wastewater were calculated properly with no other further issues. For more detail on water and wastewater sector calculations, see Section 3.3.

BART

The EBEW inventories originally included emissions from Bay Area Rapid Transit (BART). It was decided by City staff and Rincon to ultimately remove these emissions from the four EBEW inventory years (2005, 2010, 2015, and 2017), similar to the City of Dublin that recently made the decision to remove BART emissions from its CAP. This was due to a lack of emissions data available for years after 2013, which prevented emissions from being accurately calculated and forecasted. All four inventory years used the same emissions factor, calculated based off of 2013 data and leading to inaccurate estimation of emissions. Pleasanton ultimately does not have control over reducing these emissions, and BART already has its own GHG emissions reduction goals in place over the next decade. These emissions also represented a small percentage of Pleasanton's overall emissions (0.45 percent in 2017). For these reasons, these emissions were ultimately removed.

Summary of Previous Year Inventories Data

Table 4 and Table 5 include all of the activity data, emission factors, and total GHG emissions available for both the original previous year inventories (Table 4) and the updated previous year inventories (Table 5).

Table 4 Original EBEW 2017 GHG Inventory Data

	Original Activity Data	Original Emission Factor	Original (MT CO_2e)
Residential Electricity (kWh)	182,355,696	0.000096	17,571
Residential Gas (therms)	11,796,750	0.00531	62,647
Nonresidential Electricity (kWh)	320,791,579	0.000096	30,910
Nonresidential Gas (therms)	10,579,242	0.00531	56,181
Direct Access Electricity	52,782,630	.000203	10,700
On-road Transportation (VMT)	694,026,113	0.000852	329,615
Off-Road Transportation	N/A[1]	.0946[2]	48,634
BART (Passenger Miles)	13,634,519	.000093	1,265
Solid Waste (tons)	102,316	0.286	21,006
ADC Waste (tons)	367	0.246	2046
Wastewater	0	.000096	878
Water (mgy)	4,600	.000096	1700
Total			**590,841**

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] Off-road emissions calculated as a proportion of total emissions in Alameda County based on changes in population and does not have activity data.

[2] Effective change in service population was defined as on the sum of new population and jobs in Pleasanton divided by the total sum of new jobs and population in Alameda County for each inventory year.

Table 5 Updated EBEW 2017 GHG Inventory Data

	Updated Activity Data	Updated Emission Factor	Updated (MT CO_2e)
Residential Electricity (kWh)	182,355,696	0.000096	17,571
Residential Gas (therms)	11,796,750	0.00531	62,647
Nonresidential Electricity (kWh)	320,791,579	0.000096	30,910
Nonresidential Gas (therms)	10,579,242	0.00531	56,181
Direct Access Electricity	52,782,630	.000203	10,700
On-road Transportation (VMT)	694,026,113	0.000852	329,615
Off-Road Transportation	N/A[1]	.0806[2]	48,634
BART (Passenger Miles)	Removed	Removed	Removed
Solid Waste (tons)	102,316	0.286	29,267
ADC Waste (tons)	367	0.246	90
Wastewater (mgy)	1,878	.000096	1,188
Water (mgy)	4,600	.000096	1,750
Total			**588,553**

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] Off-road emissions calculated as a proportion of total emissions in Alameda County based on changes in population and does not have activity data.

[2] Effective change in service population was defined as on the sum of new population and jobs in Pleasanton divided by the total sum of new jobs and population in Alameda County for each inventory year.

3 2017 GHG Emissions Inventory

The methodologies, data sources, calculations, and results associated with the Pleasanton community-wide 2017 GHG emissions inventory update are included in this section. The 2017 Pleasanton GHG emissions inventory serves as the inventory to inform development of future GHG emissions forecasts that will assist the City in setting GHG emissions targets that are consistent with State-level goals and the Pleasanton General Plan 2005-2025. In 2017, Pleasanton GHG emissions were estimated to be 588,553 metric tons (MT) of carbon dioxide equivalent (CO_2e). Data was originally gathered by EBEW and then reviewed and updated by Rincon for consistency with the latest methodology available in the Community Protocol[33] and California Supplement[34]. The updated 2005 GHG Inventory corrected a few typological errors in the water and wastewater inventory sectors and removed the Bay Area Rapid Transit (BART) emissions, because the City of Pleasanton does not have direct control over BART and is unable to reduce these emissions and because BART data was not available for the subsequent inventories. Information regarding updates to the original EBEW 2005, 2010, 2015, and 2017 inventories is included in Section 2.3, and information relating to the emissions forecast are located in Section 4 of this technical appendix.

The 2017 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 2017 inventory reports all Basic Emissions Generating Activities[35] required by the Community Protocol[36] 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 6. Data for the 2017 inventory calculations were provided by the City via personal communication with Megan Campbell, Associate Planner.

[33] ICLEI. 2012. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions. Available: <https://icleiusa.org/publications/us-community-protocol/>. Accessed: April 14, 2020.

[34] Association of Environmental Professionals. 2013. The California Supplement to the United States Communitywide GHG Protocol. Available: <https://califaep.org/docs/California_Supplement_to_the_National_Protocol.pdf>. Accessed: April 14, 2020.

[35] 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.

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

Table 6 Inventory and Forecast Data Sources

Sector	Activity Data	Unit	Source
Inventory			
Energy	Electricity Consumption Natural Gas Consumption	kWh Therms	Pacific Gas and Electric
Transportation	Annual Mileage	VMT	Metropolitan Transportation Commission Vehicle Miles Traveled Data Portal; EMFAC2017 Model; OFFROAD2007
Water	Water Pumping Electricity Usage	AF kWh	Zone 7 Water; City of Pleasanton; Dublin-San Ramon Services District; Livermore Municipal Water
Wastewater	Electricity Consumption Water Treated	kWh MGD	Community Protocol Estimates, Dublin-San Ramon Services District
Solid Waste	N/A	N/A	CalRecycle; California Air Resources Board Landfill Emissions Tool Version 1.3
Forecast Growth Indicators			
Population	Residents	Persons	California Department of Finance E4 and E5 demographic datasets; Association of Bay Area Governments Plan Bay Area Projections 2040
Commerce	Jobs	Number of Jobs	California Department of Finance E4 and E5 demographic datasets; Association of Bay Area Governments Plan Bay Area Projections 2040
Transportation	Annual Mileage, Emissions	N/A	EMFAC2017 Model; Metropolitan Transportation Commission Vehicle Miles Traveled Data Portal
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;

3.1 Energy Emissions

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

Overall, residential energy emissions were about equal to non-residential (commercial and industrial) in their contribution to energy emissions in 2017, at approximately 45 percent and 49 percent respectively (Figure 3). Direct access electricity accounted for the remaining 6 percent. It should be noted that, due to data availability issues in reporting years after 2013, large industrial gas data was not provided by PG&E and was instead estimated for 2015 and 2017 to allow for more accurate comparisons between inventory. Additional information on why this change was made as well as the methodologies used to estimate 2017 commercial gas data are provided in Section 2.3.

Electricity

Emissions resulting from electricity consumption were estimated by multiplying annual electricity consumed by an emission factor representing the average emissions associated with generation of one megawatt hour (MWh) of electricity. Electricity is supplied to the City by PG&E. In its 2017 report to the verification body, The Climate Registry, PG&E reported an electricity carbon intensity factor of 210 pounds CO_2e per MWh.[37] PG&E also reported to the California Energy Commission, an average of 33 percent renewable energy in its portfolio in 2017.[38] From 2005, residential electricity use decreased by 27,275 MWh while nonresidential electricity decreased by 79,742 MWh for a total net decrease of 107,017 MWh. Therefore, the 87,686 MT CO_2e reduction in GHG emissions from electricity between 2005 and 2017 was due to a decrease in electricity usage and an approximately 57 percent reduction in the PG&E electricity emission factor.

In 2017, a total 48,481 $MTCO_2e$ was generated within the community due to residential and commercial electricity use. Figure 3 and Table 12 show the breakdown of emissions from electricity by both category (residential, nonresidential) and by source.

Direct access electricity was also calculated using the same methodology, but with a calculated emissions factor of 0.203 MT CO_2e/MWh. This is equivalent to the California State grid (CAMX) average carbon intensity of electricity (reported by the California Energy Commission), as direct access electricity is not provided by PG&E. [39] Direct access electricity accounted for 52,783 MWh of electricity use in 2017, which resulted in 10,700 MT CO_2e of emissions.

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 .00531 MT CO_2/therm, which remained constant across inventory years. Residential natural gas usage decreased from 12.5 million therms in 2005 to 11.8 million therms in 2017, and nonresidential natural gas usage increased from 8.1 million therms to 10.6 million therms. Overall, this resulted in a 9,558 MT CO_2e increase in emissions from the natural gas sector in 2005 compared to 2017.

In 2017, the residential and nonresidential sectors consumed a total of 22,375,992 therms of natural gas, which, based on the emission factor of 0.00531 MT CO_2/therms, generated 118,828 $MTCO_2e$. A complete breakdown of natural gas use by category and sector is provided in Figure 1 and Table 7.

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[37] The Climate Registry. 2019 Default Emissions Factors. Available: <https://www.theclimateregistry.org/wp-content/uploads/2019/05/The-Climate-Registry-2019-Default-Emission-Factor-Document.pdf>. Accessed: April 15, 2020

[38] California Energy Commission. Pacific Gas and Electric Company 2017 Power Content Label. Available: <https://ww2.energy.ca.gov/pcl/labels/2017_labels/PG_and_E_2017_PCL.pdf>. Accessed: April 15, 2020

[39] California Energy Commission. Total System Electric Generation. Available: <https://ww2.energy.ca.gov/almanac/electricity_data/system_power/2017_total_system_power.html>. Accessed: May 7, 2020.

Figure 1 Energy Emissions by Category for Year 2017

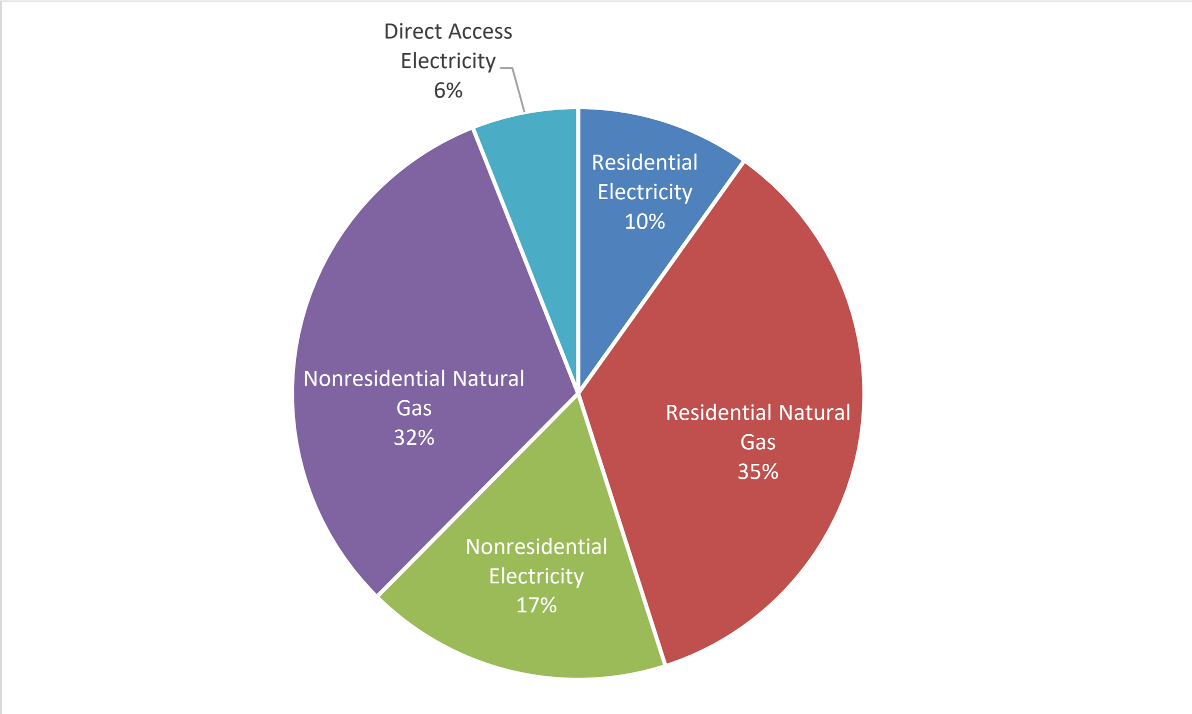

Table 7 Energy Emissions by Category for Year 2017

Source	Activity Data	Emission Factor	Total Emissions ($MTCO_2e$)
Residential			**80,218**
Natural Gas	11,796,750 therms	0.00531 MT CO_2e/therm	62,647
Electricity	182,356 MWh	0.09635 MT CO_2e/MWh	17,571
Nonresidential			**87,091**
Natural Gas	10,579,242 therms	0.00531 MT CO_2e/therm	56,181
Electricity	320,792 MWh	0.09635 MT CO_2e/MWh	30,910
Direct Access			**10,700**
Electricity	52,783 MWh	0.000203 MT CO_2e/MWh	10,700
Total			**178,009**

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

3.2 Transportation Emissions

On-Road

Transportation modeling for Passenger VMT attributed to the City of Pleasanton was obtained using the Bay Area Metropolitan Transportation Commission (MTC) VMT data model. 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. The MTC model does not directly provide VMT projections for 2017, so VMT was estimated by interpolating for years between 2015 and 2020 (for which VMT data is directly available from the MTC model). The MTC VMT modeling results allocate the total VMT derived from the activity-based model to 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, and no "pass through" trips are accounted for. Due to the MTC model not being able to provide VMT for unincorporated county areas, data was used from the Highway Performance Monitoring System,[40] which is published annually by Caltrans. This data provides VMT counts on local roads for each jurisdiction, as well as County-level VMT for all other roads (State highways, roads on land under State or federal jurisdiction such as military bases or State parks, etc.). This data includes all vehicle types and is allocated using the geographic boundary method.

Commercial VMT for heavy-duty vehicles is also provided by MTC, but separately from light-duty vehicles VMT.[41] Commercial VMT includes heavy-duty freight trucks, motor homes, public and private buses, and other commercial vehicles. Commercial VMT was assigned to individual communities by MTC using a method called "Longitudinal Employer-Household Dynamics" (LEHD). Under this method, MTC first models the county-wide VMT of heavy-duty vehicles using an approach called a geographical boundary method. In this method, all the heavy-duty VMT that occurs within a county's geographic limits is assigned to that county, regardless of where the trip begins or ends. MTC next looks at the number of jobs in specific economic sectors that generate heavy-duty vehicle trips (such as agriculture, construction, retail trade, and manufacturing) for the entire county and for each jurisdiction in the county. The US Census provides the number of jobs in these sectors through its online OnTheMap tool.[42] MTC sums the number of jobs in these sectors, and uses the percent of each community's share of jobs in these sectors, relative to the number of Alameda County jobs in the sectors, to allocate heavy-duty VMT. In 2017, Pleasanton was attributed 7.2 percent of the total commercial VMT in Alameda County, which was 3,553,565.

In 2017 on-road transportation in Pleasanton resulted in 329,615 MT CO_2e of emissions. This resulted in a 57,348 MT CO_2e reduction compared to 2005. During this time VMT increased by 2.6 percent or 17 million miles traveled and the emissions reductions in this sector were driven by an increase in average vehicle efficiency and adoption of electric vehicles. These changes drove the 17 percent decrease in average vehicles emissions per mile. A summary of the VMT results can be found in Table 8.

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[40] Caltrans. 2019. Highway Performance Monitoring System. Available: <https://dot.ca.gov/programs/research-innovation-system-information/highway-performance-monitoring-system>. Accessed: May 25, 2020

[41] East Bay Energy Watch. 2019. Regional Greenhouse Gas Inventory Methodological Summary. Available: <https://static1.squarespace.com/static/53fe4fcfe4b070b8a2eb623b/t/5c36664b21c67c309508c0ff/1547069004776/EBEW-RegionalGHGTool-Methodological-Summary.pdf>. Accessed: May 25, 2020.

[42] United States Census Bureau. 2018. OnTheMap Version 6. Available: <https://onthemap.ces.census.gov/>. Accessed: April 2020.

Table 8 Estimated On-Road Transportation Emissions for 2017

Source	Activity Data (VMT)[2]	Emission Factor	Total Emissions ($MTCO_2e$)
Internal-Internal Daily VMT	217,216	0.000445 MT CO_2e per VMT	97
½ Internal-External Daily VMT	472,942	0.000445 MT CO_2e per VMT	210
½ External-Internal Daily VMT	1,032,616	0.000445 MT CO_2e per VMT	459
Total Passenger Daily VMT	1,722,744	0.000338 MT CO_2e per VMT	522
Total Adjusted Passenger Daily VMT[3]	1,732,827	0.000338 MT CO_2e per VMT	582
Total Commercial Daily VMT	255,776	0.001366 MT CO_2e per VMT	349
Total Adjusted Commercial Daily VMT[3]	267,248	0.001366 MT CO_2e per VMT	365
Yearly Passenger VMT[1]	**601,291,074**	**0.000338 MT CO_2e per VMT**	**202,946**
Yearly Commercial VMT[1]	**92,735,039**	**0.001366 MT CO_2e per VMT**	**126,668**
Yearly VMT[1]	**694,026,113**	**.000852 MT CO_2e per VMT**	**329,615**

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.

[3] Motorcycle, motor homes, and bus VMT not included in original data, and were estimated based on average prevalence of these vehicles in Alameda County, which is approximately 1 percent.

Transportation emissions are generated by the community of Pleasanton 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 2017, the average emissions factor for cars on the road in the County of Alameda was 0.000435 $MTCO_2e$ per VMT as calculated using the EMFAC2017 model.[43] Technical details on the EMFAC2017 modeling tool can be found on the EMFAC Mobile Source Emissions Inventory Technical Support Documentation Portal.[44]

[43] California Air Resources Board. 2017. EMFAC2017. Base year 2017, County of Alameda model run. Available: <https://www.arb.ca.gov/emfac/>. Accessed: April 5, 2020

[44] California Air Resources Board. 2017. EMFAC Software and Technical Support Documentation. Available: <https://ww2.arb.ca.gov/our-work/programs/mobile-source-emissions-inventory/road-documentation/msei-modeling-tools-emfac>. Accessed: April 5, 2020.

Off-Road

Off-road emissions were calculated using the California Air Resources Board's OFFROAD2007 modeling tool.[45] At the time of this inventory, the 2017 version of the tool was still not available. OFFROAD2007 was used to obtain emissions for Alameda County, shown below in Table 9. The proportion of emissions attributed to the City of Pleasanton was based on a ratio for effective change in service population, calculated to be 0.0806, using demographic data from the Department of Finance. The effective change in service population was calculated by taking the sum of new population and jobs in Pleasanton from 2016-2017 and dividing by the total sum of new jobs and population in Alameda County for 2016-2017. No change or decreases in a jurisdiction's demographic data were counted as zero. Demographic data used is shown below in Table 10. Total emissions from off-road transportation in 2017 was 58,852 MT CO_2e, shown in Table 11.

Table 9 Estimated Off-Road Emissions for Alameda County 2017

Source	CO_2/day	CH_4/day	N_2O/day	MTCO_2e/year
Agricultural Equipment	44.49	0.004043	0.000570	14,819.72
Airport Ground Support Equipment	52.53	0.005930	0.003753	17,777.87
Construction and Mining Equipment	1,181.69	0.101368	0.007014	392,841.72
Dredging	0.00	0.000000	0.000000	0.00
Entertainment Equipment	2.61	0.000115	0.000000	865.80
Industrial Equipment	292.98	0.088145	0.016153	99,248.92
Lawn and Garden Equipment	77.83	0.115765	0.050340	31,262.29
Light Commercial Equipment	159.90	0.041037	0.025518	55,567.60
Logging Equipment	0.00	0.000000	0.000000	0.00
Military Tactical Support Equip	0.00	0.000000	0.000000	0.00
Oil Drilling	2.11	0.000153	0.000000	698.51
Other Portable Equipment	0.04	0.000003	0.000000	13.94
Pleasure Craft	63.54	0.041389	0.013664	22,621.27
Railyard Operations	0.04	0.000002	0.000000	11.67
Recreational Equipment	11.18	0.096323	0.016988	6,087.09
Transport Refrigeration Units	182.23	0.014037	0.001260	60,581.77
Total	**2,071.17**	**0.508310**	**0.135259**	**702,398**

MT CO2e: metric tons of carbon dioxide equivalent; VMT: vehicle miles traveled

45 California Air Resources Board. 2007. OFFROAD2007. Available: <https://ww2.arb.ca.gov/our-work/programs/mobile-source-emissions-inventory/msei-road-archives>. Accessed: April 1, 2020.

Table 10 Department of Finance Demographic Data for Pleasanton 2016-2017

Source	Change in Population	Change in Jobs	Change in Service Population	Effective Change in Service Population
Pleasanton	910	947	1,857	1,857
Alameda County	16,667	4,305	20,972	23,036
Effective Change in Service Population Ratio for Pleasanton[1]	–	–	–	**0.0806**

Calculated: Pleasanton Effective Change in Service Population / Alameda County Effective Change in Service Population

Table 11 Estimated Off-Road Transportation Emissions for 2017

Source	Total Emissions 2017 (MT CO_2e)
Agricultural Equipment	69
Airport Ground Support Equipment	0
Construction and Mining Equipment	31,664
Dredging	0
Entertainment Equipment	40
Industrial Equipment	5,991
Lawn and Garden Equipment	1,447
Light Commercial Equipment	4,779
Logging Equipment	0
Military Tactical Support Equip	0
Oil Drilling	0
Pleasure Craft	1,055
Recreational Equipment	284
Transport Refrigeration Units	3,305
Total	**48,634**

MT CO_2e: metric tons of carbon dioxide equivalent

3.3 Water and Wastewater Emissions

Water

Water is primarily supplied to Pleasanton by Zone 7 Water Agency and local groundwater. Zone 7 supplies the City with about 80% of its water, which is mainly treated surface water from the State Water Project in the Central Valley blended with some local groundwater. The other 20% of Pleasanton's water comes from local groundwater, pumped from wells owned and operated by the City of Pleasanton.[46] In 2017, the City began using recycled water as well, from the City of Livermore and Dublin-San Ramon Services District (DSRSD).

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 using embodied energy data emission factors based on the processes used, taken from the California Energy Commission's 2007 Refining Estimates of Water-Related Energy Use in California report. It was determined that in 2017, Zone 7 provided water at an average of 4,037 kWh per million gallons, while City groundwater provides water at an average of 3,979 kWh per million gallons. Recycled water from the City of Pleasanton and DSRSD provided water at an average rate of 2,320 kWh per million gallons. This resulted in Zone 7 using 11,810 MWh to provide the City water in 2017, along with an additional 5,883 MWh from the City of Pleasanton, 402 MWh from DSRSD, and 51 MWh from the City of Livermore.

PG&E is the electricity provider for the City; therefore, PG&E's energy emissions factor of 210 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 Pleasanton resulted in the generation of approximately 1,750 MTCO_2e in 2017, or 60 percent of total water and wastewater emissions. In 2005, the City used 5,880 million gallons of water. In 2017, Pleasanton used 4,600 million gallons of water, or about 22 percent less overall. Emissions overall decreased by 3,380 MT CO_2e, due to this decrease in water usage as well as the reduction in PG&E's 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 Pleasanton is collected in local sewer lines which ultimately discharge into the DSRSD Regional Wastewater Treatment Facility managed by DSRSD. The wastewater treatment plant treated 1,878 million gallons of sewage from Pleasanton in 2017, according to data obtained from the City. Emissions were calculated using Community Protocol Methodology WW.2, WW.8, and WW.12 based on processes used at the treatment facility, as shown in Figure 2. In 2017, a total of 3.07 MT N_2O and 2.29 MT CH_4 were emitted from the effluent discharge, process, and stationary sources at the treatment plant. The wastewater treatment plant also used 3,234,519 kWh of electricity to treat Pleasanton wastewater in 2017, which resulted in emissions of 310 MT CO2e. As shown in Table 12, the total process emissions and electricity usage for Pleasanton wastewater treatment and disposal resulted in emissions of 1,188 MT CO_2e per year, or 40 percent of the water and wastewater emissions.

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[46] Pleasanton, City of. 2018 Annual Water Quality Report. Available: <http://www.cityofpleasantonca.gov/pdf/awqr18.pdf>. Accessed: April 26, 2020.

Table 12 Water and Wastewater Emissions for Year 2017

Source	Activity Data	Kilowatts per Million Gallons[1]	Kilowatt Hours	Emission Factor ($MT\ CO_2e/MWh$)	Total Emissions ($MT\ CO_2e$)
Water Use					**1,750**
Zone 7 Water Agency	2,925.82 MG	4,036.57	11,810,278	0.09635	1,138
City of Pleasanton	1,478.55 MG	3,978.75	5,882,769	0.09635	567
Dublin-San Ramon Services District	173.48 MG	2,320.00	402,481	0.09635	39
City of Livermore	21.89 MG	2,320.00	50,778	0.09635	5
Wastewater Generation					**1,188**
Dublin-San Ramon Services District[2]	1,878 MG	1,722	3,234,519	.09635	310
Process Nitrous Oxide Emissions	0.2574 MT N_2O	–	–	1 N_2O to 265 CO_2e	68
Stationary Methane Emissions	2.29 MT CH_4	–	–	1 CH_4 to 28 CO_2e	64
Effluent Discharge	2.814 MT N_2O	–	–	1 N_2O to 265 CO_2e	746
Total					**2,938**

MWh: megawatt hours; MT: metric tons; CO_2e: carbon dioxide equivalent; CH_4: methane; N_2O: nitrous oxide; MG: millions of gallons; kWh: kilowatt hours

[1] Calculated based off of the data regarding the processes used for water and wastewater generation. Water factors included: average depth of groundwater wells (575 ft), and sources of water (surface water, groundwater, State water project, recycled water). Wastewater factors included: type of wastewater treatment technology (activated sludge and digesters), use of pumps to dispose of wastewater, wastewater discharge into the San Francisco Bay, and number of septic tanks in Pleasanton (177 in 2017)

[2] Indirect emissions from electricity use during the wastewater generation process.

Figure 2 Wastewater Methodology

Box WW.2.(alt) **Example Calculation of N_2OEmissions from Combustion when only Population Served by System is Known**

A centralized wastewater facility serves a city with a population of 100,000 people. No other data is available. Based on this scenario the N_2O emissions from the combustion of digester biogas can be calculated as follows

Description		Value
N_2O emissions	= Total N_2O emitted by combustion ($mtCO_2e$)	Result
P	= Population served by anaerobic digester	100,000
Digester gas	= Measured standard cubic feet of digester gas produced per person per day (std ft^3/person/day)	1.0
fCH_4	= Fraction of CH_4 in biogas	0.65
BTU_{CH4}	= Default BTU content of CH_4, higher heating value (BTU/ft^3)	1028
10^{-6}	= Conversion from BTU to 1 MMBTU	10^{-6}
EF_{N2O}	= N_2O emission factor (kg N_2O/MMBTU)	6.3×10^{-4} kg N_2O per MMBTU
365.25	= Conversion factor (day/year)	365.25
10^{-3}	= Conversion from kg to mt (mt/kg)	10^{-3}
GWP_{N_2O}	= Global Warming Potential; conversion from mt of N_2O into mt of CO_2 equivalents	GWP[11]

Sample Calculation:

Annual N_2O *emissions* $= (100{,}000 \times 1 \times 0.65 \times 1028 \times 10^{-6} \times (6.3 \times 10^{-4}) \times 365.25 \times 10^{-3}) \times 310$

$= 4.8\ mtCO_2e$

Equation WW.8 **N_2O Process Emissions from Wastewater Treatment Plants (or aeration basin) without nitrification or denitrification**

Annual N_2O *emissions* $= ((P \times F_{ind\text{-}com}) \times EF \times 10^{-6}) \times GWP$

Where:

Description		Value
Annual N_2O emissions	= Total annual N_2O emitted by WWTP processes ($mtCO_2e$)	Result
P	= Population served by the WWTP	User input
$F_{ind\text{-}com}$	= Factor for high nitrogen loading of industrial or commercial discharge	1.25
$F_{ind\text{-}com}$	= Factor for insignificant industrial or commercial discharge	1
$EF_{w/o\ nit/denit}$	= Emissions factor for a WWTP without nitrification or denitrification(g N_2O/ person / year)	3.2
10^{-6}	= Conversion from g to mt (mt/g)	10^{-6}
GWP_{N_2O}	= Global Warming Potential; conversion from mt of N_2O into mt of CO_2 equivalents	GWP[25]

Source: *As listed in LGO protocol Equation 10.7 from EPA Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1890-2007, Chapter 8, 8-13 (2009)*

Equation WW.12.(alt) N_2O Emission from Effluent Conversion when only Population Served by Wastewater Treatment Plant is Known

Annual N_2O emissions = $((P \times F_{ind\text{-}com}) \times (\text{Total N load} - \text{N uptake} \times \text{BOD5 load}) \times EF_{effluent} \times 44/28 \times (1 - F_{plant\ nit/denite}) \times 365.25 \times 10^{-3}) \times GWP$

Where:

Description		Value
N_2O emissions	= Total annual N_2O emitted by effluent (mtCO2e)	Result
P	= Population	User input
$F_{ind\text{-}com}$	= Factor for industrial or commercial discharge	1.25 (if applicable)
Total N-Load	= Average total nitrogen per day (kg N/person/day)	0.026[34]
N uptake	= Nitrogen uptake for cell growth in *aerobic* systems (kg N/kg BOD_5)	0.05
<u>OR</u>		
N uptake	= Nitrogen uptake for cell growth in *anaerobic or lagoon* systems(kg N/kg BOD_5)	0.005
BOD_5	= Amount of BOD_5 produced per person per day (kg BOD_5/person/day)	0.090
EF	= Emission factor (kg N_2O-N/kg sewage-N discharged)	0.005 for river or stream discharge, 0.0025 for direct ocean discharge[35]
44/28	= Molecular weight ratio of N_2O to N_2	1.57
F*plant nit/denit*	= Fraction of nitrogen removed from the WWTP with nitrification/denitrification	0.7
<u>OR</u>		
F*plant*	= Fraction of nitrogen removed from the WWTP without nitrification/denitrification	0.0
365.25	= Conversion factor (day/year)	365.25
10^{-3}	= Conversion from kg to mt (mt/kg)	10^{-3}
GWP	= Global Warming Potential; conversion from mt of N_2O into mt of CO_2 equivalents	GWP[36]

Source: *As listed in LGO protocol Equation 10.10 from EPA Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2007, Chapter 8, 8-13 (2009); except Grady, C.P. L., Jr., G. T. Daigger, and H. C. Lim, Biological Wastewater Treatment p. 108-109, 644 2nd Edition (1999)*

3.4 Solid Waste Emissions

GHG emissions result from management and decay of organic material solid waste. Community waste was calculated by determining lifetime methane emissions from solid waste generated by the community in the year of the inventory, using Community Protocol method SW.4[47]. This methodology attributes 100 percent of lifetime GHG emissions from the tonnage reported in the inventory year.

Waste from the City of Pleasanton went to 18 landfills in 2017 according to waste data obtained from CalRecycle. Data for the inventory was split between instate solid waste and alternative daily cover waste, 102,316 tons and 367 tons respectively. Waste data from one landfill site was not included in the inventory (Covanta Stanislaus, Inc.), because it only received a small quantity of 'transform waste', and there was no instate waste or alternative daily cover waste reported. Activity data for the waste sector of the GHG inventory is shown below in Table 13 by landfill destination.

Table 13 Summary of Solid Waste Activity Data by Landfill for Year 2017

Source	Solid Waste (tons)	ADC Waste (tons)
Landfills		
Altamont Landfill & Resource Recovery	2,173	143
Antelope Valley Public Landfill	1	0
Azusa Land Reclamation Co. Landfill	7	0
Corinda Los Trancos Landfill (Ox Mtn)	4	0
Fink Road Landfill	138	0
Foothill Sanitary Landfill	45	0
Forward Landfill, Inc.	1,158	0
Guadalupe Sanitary Landfill	6	0
Keller Canyon Landfill	232	135
Kirby Canyon Recycle. & Disp. Facility	5	0
Monterey Peninsula Landfill	258	0
Newby Island Sanitary Landfill	47	0
North County Landfill & Recycling Center	2	0
Potrero Hills Landfill	26	0
Recology Hay Road	713	0
Vasco Road Sanitary Landfill	97,492	79
Zanker Material Processing Facility	9	10
Total Tons of Waste Disposal	**102,316**	**367**

Communities 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 3, utilizing mass of waste being disposed, organic content of waste, methane capture ability of the landfill, oxidation rate, and methane GWP. The 2017 emissions factor for generated solid waste and ADC waste in

[47] ICLEI. 2012. US Community Protocol. Available: <https://icleiusa.org/publications/us-community-protocol/>. Accessed: May 1, 2020.

Pleasanton was derived from the California Air Resources Board California Landfill Emissions Tool Version 1.3, shown in Table 14 and Table 15 respectively.

Figure 3 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

In 2017, Pleasanton produced 102,316 tons of solid waste and 367 of ADC waste.[48] A CO_2e emissions factor for mixed-waste of 0.286 MT CO_2e/ton was established and multiplied by the total solid waste disposed of from the community to calculate emissions from waste generated in 2017 of 29,267 MT CO_2e. For ADC waste, a CO_2e emissions factor of 0.246 MT CO_2e/ton was established and multiplied by the total ADC waste disposed of from the community to calculate emissions from waste generated in 2017 of 90 MT CO_2e. These emissions factors include the expected lifetime emissions associated with the specified tonnage of waste sent to landfill. The emissions factors were developed using SW 4.1 as well as the relative waste stream percentages of different organic materials to establish a methane emissions factor. From 2005 to 2017 GHG emissions from community waste decreased by 6,139 MT of CO_2e. This was due to a combination of factors including a reduced solid waste emission factor as well as an overall reduction in waste generation of 18,370 tons. Total waste emissions for 2017 are summarized in Table 16.

48 CalRecycle. 2017. Local Government Information Center. Available: <https://www.calrecycle.ca.gov/LGCentral/MyLoGIC/>. Accessed: April 20, 2020.

Table 14 California Default Solid Waste Characterization[1]

Waste Type	WIPFRAC	TDOC	DANF	ANDOC	Weighted MT CO_2e/ton
Newspaper	1.44%	47.09%	15.05%	0.12%	0.279029616
Office Paper	0.73%	38.54%	87.03%	0.62%	1.320583313
Corrugated Boxes	3.13%	44.84%	44.25%	0.95%	0.781203158
Coated Paper	12.10%	33.03%	24.31%	0.72%	0.316139414
Food	18.12%	14.83%	86.52%	1.99%	0.505176074
Grass	1.84%	13.30%	47.36%	0.12%	0.247998153
Leaves	3.52%	29.13%	7.30%	0.07%	0.083723708
Branches	3.27%	44.24%	23.14%	0.20%	0.403054324
Lumber	11.91%	43.00%	23.26%	1.45%	0.393788725
Textiles	5.85%	24.00%	50.00%	0.66%	0.472461427
Diapers	4.29%	24.00%	50.00%	0.52%	0.472461427
Construction/Demolition	2.31%	4.00%	50.00%	0.11%	0.078743571
Medical Waste	0.11%	15.00%	50.00%	0.00%	0.295288392
Sludge/Manure	0.57%	5.00%	50.00%	0.00%	0.098429464
MSW Total				**7.52%**	**0.28604673**

[1]The static values here are from the California Landfill Emissions Tool Version 1.3

Table 15 Alternative Daily Cover Waste Characterization[1]

Waste Type	WIPFRAC	TDOC	DANF	ANDOC	Weighted MT CO_2e/ton
Newspaper	0.00%	47.09%	15.05%	0.12%	0.279029616
Office Paper	0.00%	38.54%	87.03%	0.62%	1.320583313
Corrugated Boxes	0.00%	44.84%	44.25%	0.95%	0.781203158
Coated Paper	0.00%	33.03%	24.31%	0.72%	0.316139414
Food	0.00%	14.83%	86.52%	1.99%	0.505176074
Grass	50.00%	13.30%	47.36%	0.12%	0.247998153
Leaves	25.00%	29.13%	7.30%	0.07%	0.083723708
Branches	25.00%	44.24%	23.14%	0.20%	0.403054324
Lumber	0.00%	43.00%	23.26%	1.45%	0.393788725
Textiles	0.00%	24.00%	50.00%	0.66%	0.472461427
Diapers	0.00%	24.00%	50.00%	0.52%	0.472461427
Construction/Demolition	0.00%	4.00%	50.00%	0.11%	0.078743571
Medical Waste	0.00%	15.00%	50.00%	0.00%	0.295288392
Sludge/Manure	0.00%	5.00%	50.00%	0.00%	0.098429464
MSW Total				**7.52%**	**0.245693584**

[1]The static values here are from the California Landfill Emissions Tool Version 1.3

Table 16 Summary of Solid Waste Activity Data for Year 2017

Source	Tons	Emission Factor ($MT\ CO_2e$/ton)	Total Emissions ($MT\ CO_2e$)
Solid Waste	102,316	0.286	29,267
ADC Waste	367	0.246	90
Total Waste Emissions	–	–	**29,358**

MT CO2e: metric tons of carbon dioxide equivalent

3.5 2017 GHG Emissions Inventory Results Summary

The 2017 Pleasanton GHG emissions inventory serves as the inventory to inform development of future GHG emissions forecasts that will assist the City in setting GHG emissions targets that are consistent with State-level goals and the Pleasanton General Plan 2005-2025. Overall emissions for the City of Pleasanton were estimated to be 588,553 MT CO_2e in 2017. The on-road transportation sector (passenger and commercial vehicles) was the largest emissions sector with 56 percent of total 2017 baseline inventory emissions, followed by natural gas use in the energy sector at 21 percent. Off-road transportation emissions were estimated to be 8 percent of emissions, and waste emissions accounted for 5 percent. The smallest emissions sector was water and wastewater, which combine to account for less than 1 percent of total 2017 emissions for the City of Pleasanton. Emissions are summarized in Figure 4 and Table 17 below.

Figure 4 2017 City of Pleasanton Community Emissions by Sector

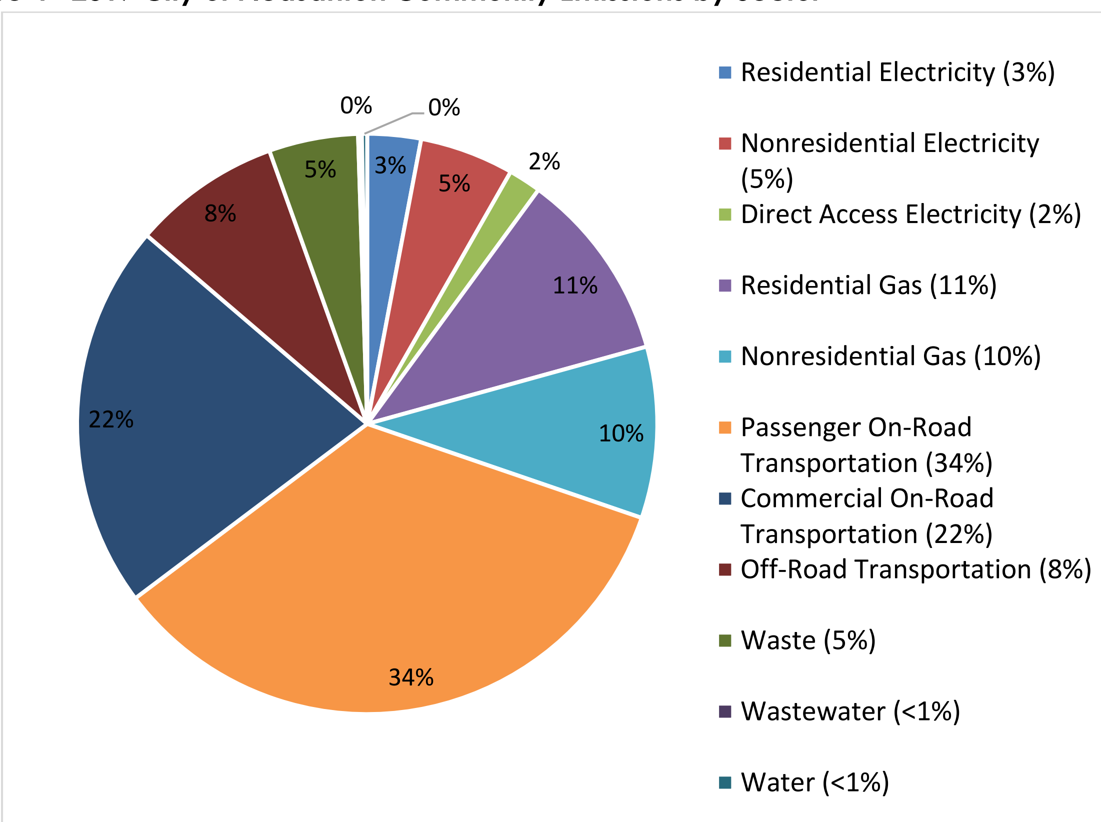

Table 17 2017 GHG Inventory

Sector	Activity Data	Emission Factors	Units	MT CO_2e
Residential Electricity (kWh)	182,355,696	0.0000963549	MT CO_2e/kWh	17,571
Nonresidential Electricity (kWh)	320,791,579	0.0000963549	MT CO_2e/kWh	30,910
Direct Access Electricity (kWh)	52,782,630	0.0002027	MT CO_2e/kWh	10,700
Residential Gas (therms)	11,796,750	0.00531	MT CO_2e/therms	62,647
Nonresidential Gas (therms)	10,579,242	0.00531	MT/CO_2e/therms	56,181
Passenger On-Road Transportation (VMT)	601,291,074	0.000338	MT CO_2e/mile	202,947
Commercial On-Road Transportation (VMT)	92,034,058	0.001366	MT CO_2e/mile	126,668
Off-Road Transportation (VMT)	N/A[1]	0.0806[2]	Effective Change in Service Population	48,634
Waste (tons)[4]	102,683	0.2860	MT CO_2e/Ton	29,357
Wastewater (kWh)	N/A[3]	N/A[3]	MT CO_2e/kWh	1,180
Water (kWh)	18,146,306	0.00009635	MT CO_2e/kWh	1,750
Total Emissions				**588,553**

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

[1] Off-road emissions calculated as proportion of total Alameda County emissions based on changes in population; doesn't have activity data.

[2] Effective change in service population was defined as on the sum of new population and jobs in Pleasanton divided by the total sum of new jobs and population in Alameda County for each inventory year.

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

[4] Includes a small quantity (367 tons) of Alternative Daily Cover Waste, for which a different emission factor was used (.246 MTCO_2e/ton). This emissions factor was calculated using data from CARB's California Landfill Emissions Tool Version 1.3.

Between 2005 and 2017, Pleasanton experienced a population increase of 15 percent but a per capita emissions reduction of 37 percent. This translates to a 28 percent reduction in total Pleasanton GHG emissions from 2005 to 2017, which exceeds the GHG emission target established in the 2012 CAP. Table 18 summarizes GHG emission changes in Pleasanton from 2005 to 2017, and Table 19 summarizes changes in activity data.[49] Between 2005 and 2017, Pleasanton reduced GHG emissions in every sector except for nonresidential gas, which may have increased due to growth in development of the commercial and industrial sectors within the City. Major GHG emissions reductions were achieved in the waste and wastewater sectors, although these sectors make up smaller proportions of overall Pleasanton emissions as shown in Figure 4. It is worth noting that large GHG emissions reductions from electricity usage were driven largely by PG&E's electricity fuel mix, which saw a significant decrease in carbon intensity[50] from 2005 to 2017. Although there was an increase in passenger vehicle miles traveled (VMT), GHG emissions associated with the passenger on-road transportation sector declined because of the increased fuel efficiency of vehicles as detailed in Tables 18 and 19.[18]

[49] Table 17, Table 18, Table 19, and Figure 4 may present data in different ways, but they are summarizing the same data. On-road transportation includes both passenger and commercial on-road transportation.

[50] Carbon intensity is the amount of carbon by weight emitted per unit of energy consumed. For example, as the percentage of renewable energy sources used to produce electricity increases, the carbon intensity of that electricity decreases.

Table 18 Summary of Pleasanton GHG Emissions Changes from 2005 to 2017

	2005 (MT CO_2e)	2017 (MT CO_2e)	Percent Change
Residential Electricity	46,782	17,571	-62%
Nonresidential Electricity	89,385	30,910	-65%
Direct Access Electricity	21,479[1]	10,700	N/A
Residential Gas	66,175	62,647	-5%
Nonresidential Gas	43,094	56,181	+30%
Waste	35,497	29,358	-17%
Water	5,130	1,750	-66%
Wastewater	1,559	1,180	-24%
On-Road Transportation	386,963	329,615	-15%
Off-Road Transportation	117,067	48,634	-58%
Total Emissions	**813,131**	**588,553**	**-28%**
Emissions Per Capita	**12.2**	**7.7**	**-37%**

MT CO_2e: metric tons of CO_2 equivalent

[1] PG&E did not report data for direct access electricity usage in Pleasanton for 2005 and 2010 due to the CPUC's 15-15 privacy rule. Direct access electricity usage was estimated for these years using the average rate of direct access electricity usage in Alameda County for 2005 (see Section 2.3 for more details on this calculation).

Table 19 summarizes GHG activity data changes in Pleasanton from 2005 to 2017.

Table 19 Summary of Pleasanton Activity Data Changes from 2005 to 2017

Raw Activity Data	2005 Activity Data	2017 Activity Data	Percent Change
Population	66,890	76,748	+15%
Residential Electricity (kWh)	209,630,848	182,355,696	-13%
Residential Gas (therms)	12,461,153	11,796,750	-5%
Direct Access Electricity (kWh)	55,674,114[1]	52,782,630	-5%
Nonresidential Electricity (kWh)	400,533,192	320,791,579	-20%
Nonresidential Gas (therms)	8,114,926	10,579,242	+30%
Wastewater (kWh)	4,546,080	3,671,304	-19%
Water (kWh)	20,975,856	15,344,462	-27%
Solid Waste (tons)	121,032	102,316	-15%
Average Daily Cover Waste (tons)	21.25	367	+1,627%
Passenger VMT	567,416,539	601,291,074	+6%
Commercial VMT	109,273,969	92,735,039	-15%
Passenger VMT Emission Factor (MT CO_2e/VMT)	0.000399	0.000338	-15%
Commercial VMT Emission Factor (MT CO_2e/VMT)	0.001470	0.001366	-7%
Off-Road Emission Factor (Effective Change in Service Population)	0.3149	0.0806	-74%
PG&E Elec Factor (MT CO_2e/MWh)	0.000223	0.000096	-57%

MT CO_2e: metric tons of CO_2 equivalent; kWh: thousand-watt hours; MWh: million-watt hours;

[1] PG&E did not report data for direct access electricity usage in Pleasanton for 2005 and 2010 due to the 15-15 privacy rule from the CPUC. Direct access electricity usage was estimated for these years using the average rate of direct access electricity usage in Alameda County for 2005 (see Section 2.3 for more details on this calculation).

4 Future GHG Emissions Forecasts

A GHG emissions inventory sets a reference point for a single year. However, annual emissions change over time due to factors such as population and job growth as well as new technologies and policies. A GHG emissions forecast accounts for projected growth and presents an estimate of GHG emissions in future years. Calculating the difference between the GHG emissions forecast and the GHG emissions reduction targets set by a jurisdiction determines the gap that needs to be closed through the jurisdiction's climate action plan policies. This section calculates an emissions forecast for the City of Pleasanton through 2050 in a *business-as-usual (BAU) forecast* scenario, and then quantifies the reduction impact that State regulations will have on the City of Pleasanton GHG emissions forecast and presents the results in an *adjusted forecast* scenario. The *adjusted scenario* incorporates the impact of State regulations which would reduce the City of Pleasanton'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 16. The growth rates were applied to the most recent inventory year (2017) data to obtain projected activity data (e.g., energy use, waste production). Growth rates were developed from the Association of Bay Area Government's Plan Bay Area Projections 2040, EMFAC Modeling, OFFROAD2007 modeling, and California Department of Finance demographic estimates for the City of Pleasanton and Alameda 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.

Plan Bay Area Projections 2040 has demographic projections starting with 2010, and was the primary source for forecast projections.[51] In comparison with demographic data from the California Department of Finance E4 and E5 datasets[52] (which are updated year-to-year based on census data and jurisdictional data on population changes), however, Plan Bay Area Projections 2040 underestimates population and job growth in Pleasanton for 2015, 2020, and subsequent forecast years. For this reason, these forecast projections were adjusted using the calculated percent difference between the Plan Bay Area Projections 2040 and the Department of Finance data for 2015 and 2020. The result is a set of adjusted population and job projections through 2045 that reflect the greater increase in growth experienced by the City of Pleasanton between 2015 and 2020.

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51 Association of Bay Area Governments and Metropolitan Transportation Commission. 2018. Plan Bay Area Projections 2040. Available: <http://projections.planbayarea.org/>. Accessed: April 10, 2020.

52 California Department of Finance. 2020. Available: <http://www.dof.ca.gov/Forecasting/Demographics/Estimates/>. Accessed: April 16, 2020.

4.1 Business-as-Usual Forecast Scenario

The City of Pleasanton business-as-usual scenario forecast provides an estimate of how GHG emissions would change in the forecast years if consumption trends continue as in 2017, absent any new regulations which would reduce local emissions. Several indicator growth rates were developed from 2017 activity levels and applied to the various emissions sectors to project future year emissions. Table 20 contains a list of growth factors used to develop the business-as-usual scenario forecast, with a summary of the results in Table 19. The BAU growth factors were then multiplied by the population or service person growth rates to develop the BAU emissions forecast.

Table 20 Business-as-Usual Forecast Scenario Growth Factors

Sector	Activity Data
Emissions per capita (MT CO2e/capita)	7.7
Residential electricity per capita (kWh/capita)	2,376.0
Commercial electricity use per job (kWh/employment)	4,909.4
Direct Access electricity per capita (kWh/capita)	687.7
Residential gas per capita (therms/capita)	153.7
Commercial gas use per job (therms/job)	161.9
Solid Waste per service person (tons/SP)	0.7
ADC Waste per service person (tons/SP)	0.0026
Wastewater Process GHG per service population (MT CO2e/SP)	0.0062
CO2e per ton solid waste (MT CO2e/ton)	0.3
CO2e per ton ADC waste (MT CO2e/ton)	0.2
Water electricity per service person (kWh/SP)	127.7
Wastewater electricity per service person (kWh/SP)	22.8
Total VMT per service person (VMT/SP)	4,884.41

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, Pleasanton GHG emissions are projected to continue increasing through 2050 as shown in Table 21. This increase is led primarily by a strong commercial and residential development trend. After the current General Plan horizon year of 2025, major increases in in emissions are largely attributed to the increased population and vehicular traffic from the greater Alameda County Area traveling into the city. By 2050, the City is expected to produce 169,689 MT CO_2e more emissions under the business-as-usual projections, an increase of 29 percent over 2017 emissions.

Table 21 Business-as-usual Forecast Scenario Summary by Sector by Target Year

	2017 (MT CO_2e)	2020 (MT CO_2e)	2025 (MT CO_2e)	2030 (MT CO_2e)	2035 (MT CO_2e)	2040 (MT CO_2e)	2045 (MT CO_2e)	2050 (MT CO_2e)
Population	76,748	79,524	80,789	83,014	87,863	92,727	97,859	103,276
Jobs	65,342	65,498	65,759	67,240	72,539	75,431	78,437	81,563
Residential Electricity	17,571	18,206	18,496	19,005	20,116	21,229	22,404	23,644
Nonresidential Electricity	30,910	30,984	31,107	31,808	34,315	35,682	37,104	38,583
Direct Access Electricity	10,700	11,087	11,263	11,574	12,250	12,928	13,643	14,399
Residential Gas	62,647	64,913	65,945	67,762	71,719	75,689	79,879	84,301
Nonresidential Gas	56,181	56,315	56,539	57,813	62,369	64,855	67,440	70,128
Waste	29,358	29,963	30,279	31,044	33,141	34,743	36,425	38,190
Water	1,748	1,785	1,803	1,849	1,974	2,069	2,169	2,275
Wastewater	1,190	1,214	1,227	1,258	1,343	1,408	1,476	1,548
On-Road Passenger Transportation	202,947	207,680	217,227	226,775	230,882	234,989	239,095	243,202
On-Road Commercial Transportation	126,668	126,797	131,035	135,273	140,210	145,147	150,084	155,021
Off-Road Transportation	48,634	51,830	57,156	62,483	68,600	74,717	80,834	86,951
Total Emissions	**588,553**	**600,774**	**622,079**	**646,644**	**676,918**	**703,457**	**730,555**	**758,242**
Emissions Per Capita	**7.67**	**7.55**	**7.70**	**7.79**	**7.70**	**7.59**	**7.47**	**7.34**

MT CO_2e: metric tons of carbon dioxide equivalent; T&D: Transmission and Distribution; Per capita based on population projections

Note: VMT data are provided by the MTC traffic demand model that are based on a variety of factors besides only projected demographic changes.

4.2 Adjusted Forecast Scenario

Adjustments Due to State Legislation

The adjusted scenario estimates future City of Pleasanton 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 22.

State programs will lead to a reduction of 233,683 MT CO_2e in GHG emissions by 2050 in Pleasanton. The increasing decarbonization of the electricity supply due to SB 100 and the Renewable Portfolio Standard (RPS) will lead to GHG emissions reductions in Pleasanton and avoid over 72,991 MT CO_2e by 2050. The transportation sector will experience the largest GHG reductions, with over 151,996 MT CO_2e reduced by 2050 through State and federal fuel efficiency and tailpipe emissions standards assuming no change to current legislation.

Table 22 Summary of Legislative Reductions Legislation

	2020 (MT CO_2e)	2025 (MT CO_2e)	2030 (MT CO_2e)	2035 (MT CO_2e)	2040 (MT CO_2e)	2045 (MT CO_2e)	2050 (MT CO_2e)
Senate Bill 100	6,596	17,692	29,208	42,522	56,198	70,720	72,991
Title 24	217	548	1,338	3,477	5,133	1,883	2,381
Transportation (Pavley, etc.)	22,973	67,430	103,931	126,264	139,416	146,985	151,996
Total	**29,786**	**85,670**	**134,477**	**172,262**	**200,746**	**224,576**	**233,683**

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.[53]

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. However, in 2019 the federal government issued a final action entitled the One National Program on Federal Preemption of State Fuel Economy Standards Rule, which finalized Part I of the Safer, Affordable, Fuel-Efficient (SAFE) Vehicles Rule and stated that federal law preempts state and local tailpipe GHG emissions standards as well as zero emission vehicle mandates. While still in flux, under the SAFE Rule discussed above, fuel economy and GHG emission standards for new vehicles may not improve beyond model year 2020. According to CARB, the federal rollback proposal of the remaining Advanced Clean Cars

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

Program standards would increase global warming emissions by 14 million metric tons per year by 2025.[54]

Reductions in GHG emissions from the above referenced standards were calculated using the CARB EMFAC2017 model for Alameda County. The EMFAC2017 model integrates the estimated reductions into the mobile source emissions portion of the model.[55]

Note: As of the time of this writing, the federal Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule Part 2 has been posted in the Federal Register but will not take effect until June 29, 2020. This new rule rolls back California fuel efficiency standards for on-road passenger vehicles, so that cars and trucks will now only achieve a 40.4 mpg industry average by 2026 compared to the 46.7 mpg projected requirement under the previous California Advanced Clean Car Program/federal Corporate Average Fuel Economy (CAFE) standards. No methodology currently exists for extracting or altering the on-road passenger vehicles fuel efficiency standard aspect of the Emissions Factors (EMFAC) model[56] used to calculate forecasted vehicle GHG emissions. In addition, the California Climate Change Scoping Plan does not yet address or provide guidance related to this pending change in fuel efficiency standards with regard to GHG emissions determination. Furthermore, California is currently challenging this new rule in the court system. Therefore, the Pleasanton adjusted forecasts have not been modified to reflect the new SAFE Rule Part 2.

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.

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54 California Air Resources Board. 2018. California moves to ensure vehicles meet existing state greenhouse gas emissions standards. Available: <https://ww2.arb.ca.gov/news/california-moves-ensure-vehicles-meet-existing-state-greenhouse-gas-emissions-standards-0>. Accessed: April 17, 2020.

55 Additional details are provided in the EMFAC2017 Technical Documentation, July 2018. Available: <https://www.arb.ca.gov/msei/downloads/emfac2017-volume-iii-technical-documentation.pdf>. Accessed: April 15, 2020. 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.

56 The EMFAC model is developed and used by CARB to assess emissions from on-road vehicles including cars, trucks, and buses in California and to support CARB regulatory and planning efforts to meet Federal Highway Administration transportation planning requirements.

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, the California 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.

PG&E provides the majority of electricity in Pleasanton and is subject to RPS requirements. PG&E forecast emissions factors include reductions based on compliance with RPS requirements through 2045. In 2017, PG&E reported an emissions factor of 210 pounds CO_2e per MWh.

Direct access electricity accounted for 9.5 percent of total electricity usage in 2017, which is provided by third party electricity providers instead of traditional energy utilities. Emissions factors for the carbon intensity of direct access electricity was assumed to be equal to the State average, calculated to equal .203 MT CO_2e/MWh in 2017. RPS requirements were used to adjust this emissions factor for forecasted emissions through 2050.

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 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 Pleasanton will be quantified and credited to the City during the Climate Action Plan measure development process. As of 2017, Pleasanton 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.[57] 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.[58] 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.

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57 CalRecycle. 2019. Short-Lived Climate Pollutants (SLCP): Organic Waste Methane Emissions Reductions (General Information). Available: <https://www.calrecycle.ca.gov/climate/slcp>. Accessed: April 16, 2020.

58 Santa Clara County. 2018. SB 1383 Rulemaking Overview. Available: <https://www.sccgov.org/sites/rwr/rwrc/Documents/SB%201383%20PowerPoint.pdf>. Accessed: April 16, 2020.

Adjusted Forecast Results

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 Pleasanton. This “gap analysis” provides Pleasanton 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 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 2050 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 significantly 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.

A summary of Pleasanton’s projected emissions by sector and year through 2050 can be found in

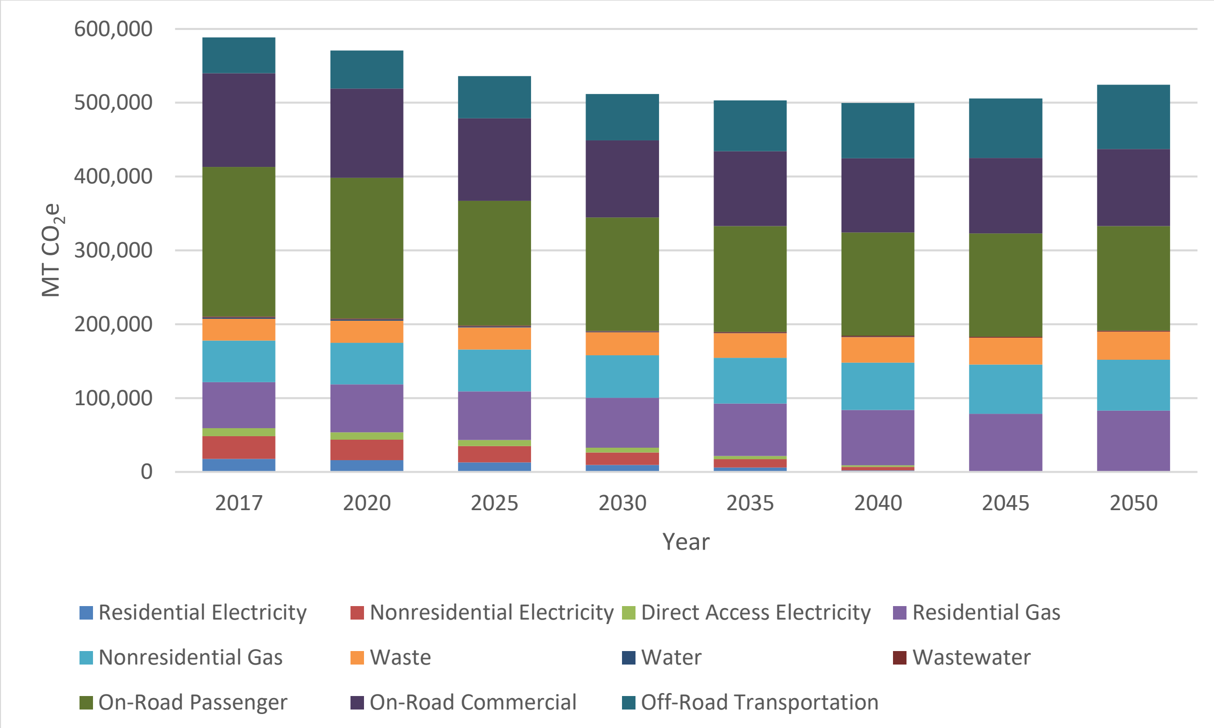
Table 23 and Figure 5. Further details on the growth rates and emissions for each sector can be found in the corresponding discussion sections.

Table 23 Adjusted Forecast Scenario Summary by Sector by Target Year

	2017 (MT CO_2e)	2020 (MT CO_2e)	2025 (MT CO_2e)	2030 (MT CO_2e)	2035 (MT CO_2e)	2040 (MT CO_2e)	2045 (MT CO_2e)	2050 (MT CO_2e)
Population	76,748	79,524	80,789	83,014	87,863	92,727	97,859	103,276
Jobs	65,342	65,498	65,759	67,240	72,539	75,431	78,437	81,563
Residential Electricity	17,571	16,154	13,021	9,894	6,782	3,485	0	0
Nonresidential Electricity	30,910	27,657	22,187	16,903	11,896	6,119	0	0
Direct Access Electricity	10,700	9,935	8,170	6,416	4,455	2,317	0	0
Residential Gas	62,647	64,859	65,820	67,509	71,190	74,882	78,778	82,890
Nonresidential Gas	56,181	56,312	56,520	57,705	61,943	64,254	66,658	69,158
Waste	29,358	29,963	30,279	31,044	33,141	34,743	36,425	38,190
Water	1,748	1,593	1,288	991	705	370	0	0
Wastewater	1,190	1,180	1,135	1,105	1,117	1,105	1,089	1,142
On-Road Passenger Transportation	202,947	190,764	168,825	153,381	143,608	140,208	140,267	141,752
On-Road Commercial Transportation	126,668	120,739	112,007	104,736	101,220	100,512	101,927	104,475
Off-Road Transportation	48,634	51,830	57,156	62,483	68,600	74,717	80,834	86,951
Total Emissions	**588,553**	**570,988**	**536,409**	**512,167**	**504,656**	**502,711**	**505,979**	**524,559**
Emissions Per Capita	**7.67**	**7.18**	**6.64**	**6.17**	**5.74**	**5.42**	**5.17**	**5.08**

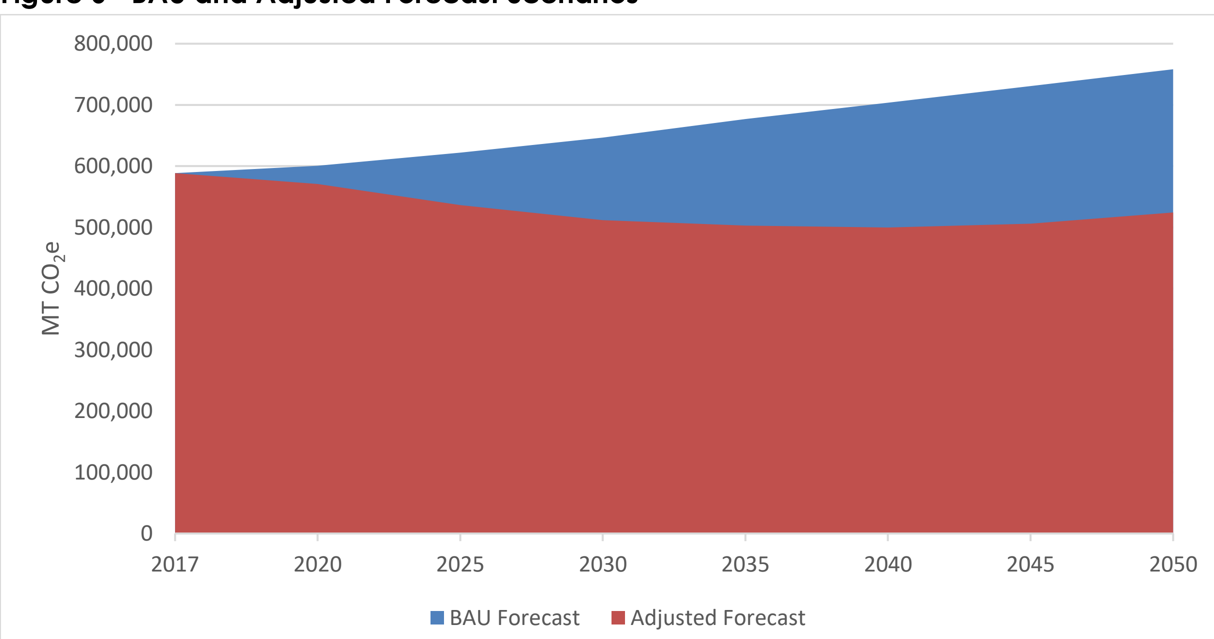
MT CO_2e: metric tons of carbon dioxide equivalent

Figure 5 Summary of Adjusted Forecast Scenario by Sector by Year



As shown in Figure 6, without legislative reductions, Pleasanton emissions would increase proportionally with population and economic growth. In reality, several existing legislative reductions would limit Pleasanton'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 6 BAU and Adjusted Forecast Scenarios



Electricity Emissions

Between 2017 and 2045, electricity emissions from residential and nonresidential buildings in Pleasanton are assumed to decrease from 59,181 MT CO2e to 0 MT CO_2e in 2045 despite steady growth in Pleasanton's population and employment levels due to the adoption of SB 100 and the renewable portfolio standard. Electricity emissions are expected to stay at 0 MT CO2e in 2050 as well. It is currently not clear if PG&E's current plan to reach carbon neutral electricity by 2045 includes the use of offsets. Future work will need to be done if so to ensure no double counting occurs between PG&E and Pleasanton'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 Pleasanton 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 24 and Table 25.

Table 24 Electricity Sector Adjusted Forecast Scenario Methodology

Source Category	Forecasted Activity Data (Scaling Factor)	Emission Factor	Applied Legislative Reductions
Residential Electricity	Population growth in Pleasanton	Assumes an electricity mix of 44 percent, 60 percent, and 100 percent GHG-free by 2025, 2030, and 2045, respectively, for PG&E 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 Pleasanton		

RPS: Renewable Portfolio Standard; GHG: greenhouse gas; PG&E: Pacific Gas and Electric

Table 25 Electricity Adjusted Forecast Scenario Results by Target Year

Activity Data	2020	2025	2030	2035	2040	2045	2050
Residential Electricity							
Population	79,524	80,789	83,014	87,863	92,727	97,859	103,276
BAU total kWh	188,952,105	191,957,699	197,244,416	208,765,114	220,321,160	232,516,883	245,387,692
BAU per capita kWh	2,376	2,376	2,376	2,376	2,376	2,376	2,376
Adjusted kWh (Title 24)	187,772,909	189,185,538	191,670,295	197,085,023	202,516,365	208,248,355	214,297,635
Adjusted per capita kWh (Title 24)	2,361	2,342	2,309	2,243	2,184	2,128	2,075
Adjusted SB 100 emissions factor (MT CO_2e/MWH)	0.08603	0.06882	0.05162	0.03441	0.01721	0	0
MT CO_2e	**16,154**	**13,021**	**9,894**	**6,782**	**3,485**	**0**	**0**
Nonresidential Electricity							
Employment	65,498	65,759	67,240	72,539	75,431	78,437	81,563
BAU total kWh	321,556,852	322,836,365	330,111,107	356,126,435	370,320,613	385,080,531	400,428,736
BAU per job kWh	4,909	4,909	4,909	4,909	4,909	4,909	4,909
Adjusted kWh (Title 24)	321,480,263	322,375,923	327,468,243	345,678,972	355,614,897	365,946,839	376,690,583
Adjusted per job kWh	4908	4902	4870	4765	4714	4665	4,618
Adjusted SB 100 emissions factor (MT CO_2e/MWh)	0.08603	0.06882	0.05162	0.03441	0.01721	0	0
MT CO_2e	**27,657**	**22,187**	**16,903**	**11,896**	**6,119**	**0**	**0**
Direct Access Electricity							
Population	79,524	80,789	83,014	87,863	92,727	97,859	103,276
BAU total kWh	54,691,953	55,561,918	57,092,151	60,426,803	63,771,686	67,301,723	71,027,163
BAU per capita kWh	687	687	687	687	687	687	687
Adjusted kWh (Title 24)	54,498,754	55,107,730	56,178,894	58,513,150	60,854,568	63,325,594	65,933,402
Adjusted per capita kWh	685	682	677	656	631	647	638
Adjusted SB 100 State Grid emissions factor (MT CO_2e/MWh)	0.1823	0.1483	0.1142	0.07614	0.03807	0	0
MT CO_2e	**9,935**	**8,170**	**6,416**	**4,455**	**2,317**	**0**	**0**

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

Natural Gas Emissions

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 therms of natural gas.[59] 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 26 and Table 27.

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 4.2.

Table 26 Natural Gas Adjusted Forecast Scenario Methodology

Source Category	Forecasted Activity Data (Scaling Factor)	Emission Factor	Applied Legislative Reductions
Residential Natural Gas	Population growth in Pleasanton	0.00531 MT CO_2e/therms	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 Pleasanton		

MT CO_2e: metric ton of carbon dioxide equivalent

Table 27 Natural Gas Adjusted Forecast Scenario Results by Target Year

Activity Data	2020	2025	2030	2035	2040	2045	2050
Residential Gas							
BAU therms	12,223,478	12,417,912	12,759,914	13,505,198	14,252,769	15,041,721	15,874,345
Title 24 adjusted therms	12,213,402	12,394,226	12,712,289	13,405,403	14,100,644	14,834,369	15,608,709
Emissions factor (MT CO_2e/therms)	0.00531	0.00531	0.00531	0.00531	0.00531	0.00531	0.00531
MT CO_2e	**64,859**	**65,820**	**67,509**	**71,190**	**74,882**	**78,778**	**82,890**
Nonresidential Gas							
BAU therms	10,604,480	10,646,676	10,886,587	11,744,534	12,212,638	12,699,399	13,205,560
Title 24 adjusted therms	10,603,890	10,643,133	10,866,250	11,664,141	12,099,477	12,552,165	13,022,895
Emissions factor (MT CO_2e/therms)	0.00531	0.00531	0.00531	0.00531	0.00531	0.00531	0.00531
MT CO_2e	**56,312**	**56,520**	**57,705**	**61,943**	**64,254**	**66,658**	**69,158**

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

[59] The Climate Registry. 2019. Default Emissions Factors. Available: <https://www.theclimateregistry.org/wp-content/uploads/2019/05/The-Climate-Registry-2019-Default-Emission-Factor-Document.pdf>. Accessed: April 15, 2020

Waste Emissions

The forecast used a baseline emissions rate of 0.7201 tons of solid waste per service population and 0.0026 tons of ADC waste per service population along with projected growth in Pleasanton service population to establish the estimated tonnage of waste being disposed yearly through 2050. A 2017 solid waste emissions factor of 0.286 MT CO_2e and a 2017 ADC waste emissions factor of 0.246 MT CO_2e 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 Pleasanton reduction measures to avoid double counting. A summary of the methodologies and data used to model waste emission over time are provided in Tables 28 and 29.

Table 28 Solid Waste Adjusted Forecast Scenario Methodology

Source Category	Forecasted Activity Data (Scaling Factor)	Emission Factor	Applied Legislative Reductions
Solid Waste	Service population growth	0.7201 tons solid waste per service person, 0.286 MT CO_2e/ton of solid waste	N/A
ADC Waste	Service population growth	0.0026 tons ADC waste per service person, 0.246 ADC MT CO_2e/ton ADC waste	N/A

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

Table 29 Waste Emissions Adjusted Forecast Scenario Results by Target Year

Activity Data	2020	2025	2030	2035	2040	2045	2050
Service Population	145,022	146,548	150,255	160,402	168,157	176,296	184,840
Ton Solid Waste per Service Population	0.72	0.72	0.72	0.72	0.72	0.72	0.72
Ton ADC Waste per Service Population	0.0026	0.0026	0.0026	0.0026	0.0026	0.0026	0.0026
Total Tons Solid Waste	104,428	105,526	108,195	115,503	121,087	126,948	133,099
Solid Waste Factor (MT CO_2e/ton)	0.286	0.286	0.286	0.286	0.286	0.286	0.286
Total Tons ADC Waste	375	379	389	415	435	456	478
ADC Waste Factor (MT CO_2e/ton)	0.246	0.246	0.246	0.246	0.246	0.246	0.246
MT CO_2e	**29,963**	**30,279**	**31,044**	**33,141**	**34,743**	**36,425**	**38,190**

MT CO_2e: metric ton of carbon dioxide equivalent

Transportation Emissions

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 Pleasanton were obtained from the MTC VMT data portal.[60] The MTC Traffic Demand Model was used to model VMT through 2050. 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 Alameda County. These emissions factors were applied in each year to establish transportation emissions forecasts as shown in Tables 30 and 31.

Table 30 Transportation Adjusted Forecast Scenario Methodology

Source Category	Forecasted Scaling Factor	Emissions Factor	Applied Legislative Reductions
On-road Transportation	MTC 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.
Off-Road Transportation	OFFROAD2007 Model[2]	OFFROAD2007 Model	N/A

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

[1] MTC VMT data portal incorporates data from the MTC's large-scale simulation model of daily travel behavior, used for its regional planning efforts and in Plan Bay Area. More information can be found on the MTC VMT Data Portal website at <http://capvmt.us-west-2.elasticbeanstalk.com/about>. Accessed: April 28, 2020.

[2] California Air Resources Board. 2007. OFFROAD2007. Available: <https://ww2.arb.ca.gov/our-work/programs/mobile-source-emissions-inventory/msei-road-archives>. Accessed: April 1, 2020.

[60] MTC. 2020. MTC VMT Model. Available: <http://capvmt.us-west-2.elasticbeanstalk.com/data>. Accessed: April 2020.

Table 31 Transportation Adjusted Forecast Scenario Results by Target Year

Activity Data	2020	2025	2030	2035	2040	2045	2050
Population	79,524	80,789	83,014	87,863	92,727	97,859	103,276
Passenger VMT	615,314,349	643,601,315	671,888,281	684,056,020	696,223,759	708,391,498	720,559,237
Commercial VMT	92,829,236	95,931,969	99,034,703	102,649,181	106,263,658	109,878,136	113,492,613
Passenger EMFAC Emission Factor (g CO_2e/mile)	310	262	228	210	201	198	197
Commercial EMFAC Emission Factor (g CO_2e/mile)	1,301	1,168	1,058	986	946	928	921
Passenger MT CO_2e	190,764	168,825	153,381	143,608	140,208	140,267	141,752
Commercial MT CO_2e	120,739	112,007	104,736	101,220	100,512	101,927	104,475
Off-Road MT CO_2e	51,830	57,156	62,483	68,600	74,717	80,834	86,951
Total MT CO_2e	**363,334**	**337,989**	**320,600**	**313,428**	**315,437**	**323,029**	**333,178**

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

Water and Wastewater Emissions

Due to the increased use of the water system attributed to increases in job and population growth in Pleasanton, service population was used as a scaling metric to determine water and wastewater service emissions through 2050. Projections for water used a baseline activity factor of 127.7 kWh per service population per year. This emissions factor was multiplied by service population growth through 2050 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 Tables 32 and 33.

Table 32 Water and Wastewater Adjusted Forecast Scenario Methodology

Forecasted Activity Data (Scaling Factor)	Emissions Factor	Applied Legislative Reductions
Water, Service population (population and employment growth)	PG&E electricity emissions factors, 127.7 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 PG&E emission factors per RPS requirements.
Wastewater, Service population (population and employment growth)	0.00618 MT CO_2e per service person per year for wastewater	N/A

MT CO_2e: metric ton of carbon dioxide equivalent; kWh: kilowatt hour; PG&E: Pacific Gas and Electric; N/A: not applicable

Table 33 Water Adjusted Forecast Scenario Results by Target Year

Activity Data	2020	2025	2030	2035	2040	2045	2050
Service Population	145,022	146,548	150,255	160,402	168,157	176,296	184,840
kwh/Service Person	127.7	127.7	127.7	127.7	127.7	127.7	127.7
Total kWh	18,520,765	18,715,598	19,188,995	20,484,966	21,475,331	22,514,795	23,605,848
RPS Electricity Factor ($MTCO_2e$/ MWh)	0.08603	0.06882	0.05162	0.03441	0.01721	0	0
MT CO_2e	**1,593**	**1,288**	**991**	**705**	**370**	**0**	**0**

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

As wastewater emissions are calculated from both methane as well as stationary and process nitrous oxide emissions, wastewater projections used an emissions factor of 0.00618 MT CO_2e per service population per year and a growth indicator of service population to determine future wastewater emissions, as shown in Table 34.

Table 34 Wastewater Adjusted Forecast Scenario Results by Target Year

Activity Data	2020	2025	2030	2035	2040	2045	2050
Service Population	145,022	146,548	150,255	160,402	168,157	176,296	184,840
Total kWh	3,301,265	3,335,993	3,420,375	3,651,377	3,827,907	4,013,188	4,207,664
MT CO_2e/ Service Population	0.00618	0.00618	0.00618	0.00618	0.00618	0.00618	0.00618
MT CO_2e	**1,180**	**1,135**	**1,105**	**1,117**	**1,105**	**1,089**	**1,142**

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

4.3 Future GHG Emissions Forecasts Results Summary

A BAU future GHG emissions forecast provides a forecast of how GHG emissions would change over time if consumption and activity trends were to continue as they did in 2017 and if growth were to occur as projected in the City 2005-2025 General Plan and Association of Bay Government future demographic forecasts. This does not include GHG emission reductions from any regulations that would reduce local emissions. BAU future GHG emissions forecast results for 2020, 2025, 2030, 2040, 2045, and 2050 are provided within Table 35.

Table 35 Summary of Pleasanton Business-as-Usual Future GHG Emissions Forecasts by Sector

	2017 (MT CO_2e)	2020 (MT CO_2e)	2025 (MT CO_2e)	2030 (MT CO_2e)	2035 (MT CO_2e)	2040 (MT CO_2e)	2045 (MT CO_2e)	2050 (MT CO_2e)
Population	76,748	79,524	80,789	83,014	87,863	92,727	97,859	103,276
Jobs	65,342	65,498	65,759	67,240	72,539	75,431	78,437	81,563
Residential Electricity	17,571	18,206	18,496	19,005	20,116	21,229	22,404	23,644
Nonresidential Electricity	30,910	30,984	31,107	31,808	34,315	35,682	37,104	38,583
Direct Access Electricity	10,700	11,087	11,263	11,574	12,250	12,928	13,643	14,399
Residential Gas	62,647	64,913	65,945	67,762	71,719	75,689	79,879	84,301
Nonresidential Gas	56,181	56,315	56,539	57,813	62,369	64,855	67,440	70,128
Waste	29,358	29,963	30,279	31,044	33,141	34,743	36,425	38,190
Water	1,748	1,785	1,803	1,849	1,974	2,069	2,169	2,275
Wastewater	1,190	1,214	1,227	1,258	1,343	1,408	1,476	1,548
On-Road Passenger Transportation	202,947	207,680	217,227	226,775	230,882	234,989	239,095	243,202
On-Road Commercial Transportation	126,668	126,797	131,035	135,273	140,210	145,147	150,084	155,021
Off-Road Transportation	48,634	51,830	57,156	62,483	68,600	74,717	80,834	86,951
Total Emissions	**588,553**	**600,774**	**622,079**	**646,644**	**676,918**	**703,457**	**730,555**	**758,242**
Emissions Per Capita	**7.67**	**7.55**	**7.70**	**7.79**	**7.70**	**7.59**	**7.47**	**7.34**

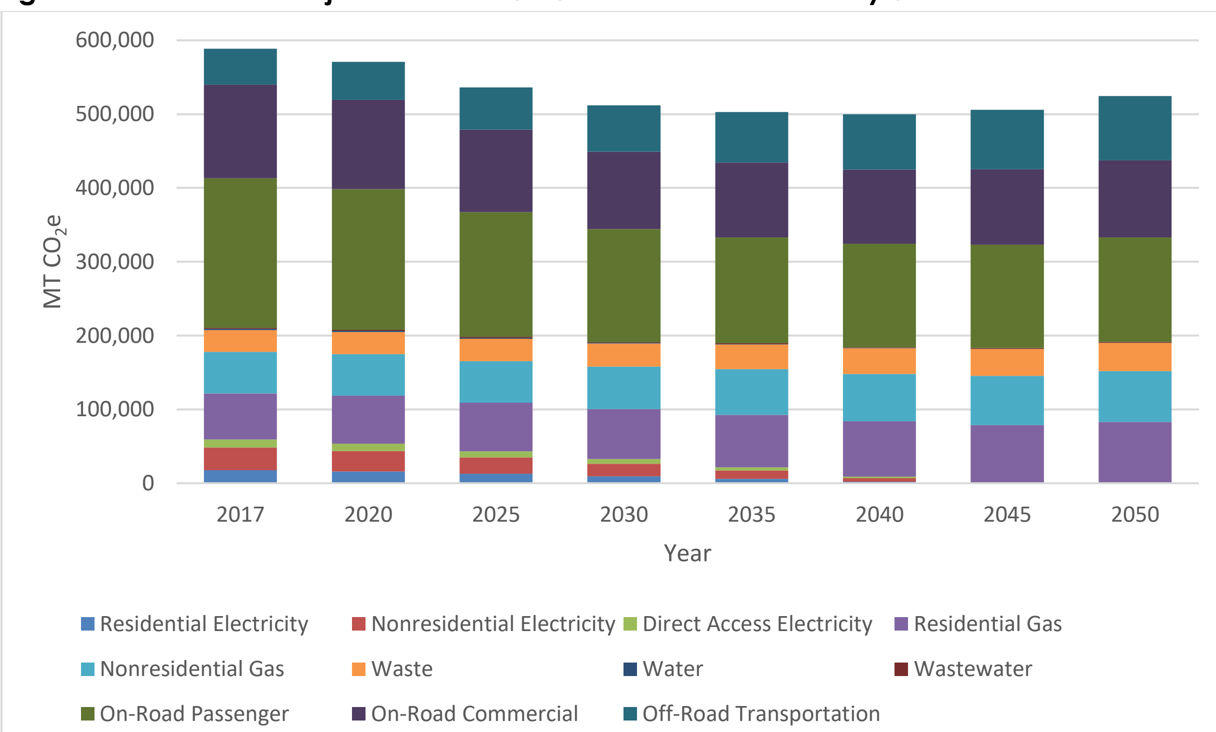
MT CO_2e: metric tons of carbon dioxide equivalent; T&D: Transmission and Distribution; Per capita based on population projections

Note: VMT data are provided by MTC traffic demand model and are based on a variety of factors besides projected demographic changes.

California has enacted multiple regulations that will reduce future local emissions. The impact of these regulations on GHG emissions have been incorporated into an *adjusted forecast*, which provides a more accurate picture of future emissions growth and the emission reduction the City and community will be responsible for after State regulations have been implemented. These State regulations include but are not limited to SB 100 (which sets a goal for reaching 100 percent electricity from renewable energy and zero-carbon sources by 2045) and California Air Resources Board (CARB) tailpipe emissions standards (Pavley Standards, Advanced Clean Cars Program).[61]

Calculating the difference between the adjusted forecast and the reduction targets set by the City determines the gap to be closed through City CAP policy implementation. Evaluating the percent change in the adjusted forecast from 2017 levels shows that Pleasanton's GHG emissions will decrease approximately 13 percent (76,386 metric tons) by 2030. Emissions will continue to decrease through 2040 but at a slower rate. Between 2030 and 2040 emissions will only decrease by an additional 2 percent, resulting in emissions being approximately 15 percent (85,842 metric tons) below 2017 levels in 2040. This is due to expected reductions from current legislation reaching the end of their effective lifetimes around 2030, particularly Title 24 and California's vehicle efficiency standards. Emissions will then begin to increase again after 2040, with expected population and job growth beginning to outpace the GHG emissions reductions resulting from the SB 100 zero-carbon electricity goal in 2045. This will lead to emissions being approximately 11 percent (63,994 metric tons) lower than 2017 levels in 2050. Future State regulation may help offset this increase, but no long-term legislation has been adopted at the time of this writing. The summary results of the adjusted future GHG emissions forecast are shown in Figure 7 and provided within Table 36.

Figure 7 Pleasanton Adjusted Future GHG Emissions Forecasts by Sector



61 Refer to Section 4.2 of this Technical Appendix for the full list of State and federal legislation that was taken into account within the forecasting model.

Table 36 Summary of Pleasanton Adjusted Future GHG Emissions Forecasts by Sector

	2017 (MT CO_2e)	2020 (MT CO_2e)	2025 (MT CO_2e)	2030 (MT CO_2e)	2035 (MT CO_2e)	2040 (MT CO_2e)	2045 (MT CO_2e)	2050 (MT CO_2e)
Population	76,748	79,524	80,789	83,014	87,863	92,727	97,859	103,276
Jobs	65,342	65,498	65,759	67,240	72,539	75,431	78,437	81,563
Residential Electricity	17,571	16,154	13,021	9,894	6,782	3,485	0	0
Nonresidential Electricity	30,910	27,657	22,187	16,903	11,896	6,119	0	0
Direct Access Electricity	10,700	9,935	8,170	6,416	4,455	2,317	0	0
Residential Gas	62,647	64,859	65,820	67,509	71,190	74,882	78,778	82,890
Nonresidential Gas	56,181	56,312	56,520	57,705	61,943	64,254	66,658	69,158
Waste	29,358	29,963	30,279	31,044	33,141	34,743	36,425	38,190
Water	1,748	1,593	1,288	991	705	370	0	0
Waste-water	1,190	1,180	1,135	1,105	1,117	1,105	1,089	1,142
On-Road Passenger Transportation	202,947	190,764	168,825	153,381	143,608	140,208	140,267	141,752
On-Road Commercial Transportation	126,668	120,739	112,007	104,736	101,220	100,512	101,927	104,475
Off-Road Transportation	48,634	51,830	57,156	62,483	68,600	74,717	80,834	86,951
Total Emissions	**588,553**	**570,988**	**536,409**	**512,167**	**504,656**	**502,711**	**505,979**	**524,559**
Emissions Per Capita	**7.67**	**7.18**	**6.64**	**6.17**	**5.74**	**5.42**	**5.17**	**5.08**

MT CO_2e: metric tons of carbon dioxide equivalent; T&D: Transmission and Distribution; Per capita based on population projections

5 GHG Emissions Reduction Targets

5.1 Provisional GHG Emissions Targets – 2030, 2045, 2050

California currently has established goals for reducing GHG emissions by 40 percent compared to 1990 levels by 2030 (SB 32), achieving carbon neutrality by 2045 (EO B-55-18), and the previous executive order (S-03-05) that called for an 80 percent reduction from 1990 levels by 2050 . It is recommended that Pleasanton establish GHG emissions targets for the years 2025 (interim target), 2030 (SB 32 target year), 2040 (interim target), and 2045 (EO B-55-18 target year) - or if desired 2050 (EO S-3-05 target year) - to show compliance with these multiple-year State goals.

The City of Pleasanton has the ability to set GHG emissions reduction targets that suit its needs. However, to be considered a "Qualified GHG Reduction Plan" that can be used for California Environmental Quality Act (CEQA) GHG emissions analyses streamlining purposes pursuant to CEQA Guidelines Section 15183.8, the City should adopt a GHG emissions target that is at least as stringent as the State targets described above. Specifically, the City should target emission reductions of at least 40 percent below 1990 levels by 2030 and adopt a longer-term target of carbon neutrality by 2045 consistent with EO B-55-18 or 80 percent below 1990 levels by 2050 consistent with S-03-05. Currently both EOs remain in place; however, it appears that EO B-55-18 will likely be codified. The carbon neutrality target has been adopted by many other California cities in their CAP updates, and some jurisdictions, such as the Sacramento Metropolitan Air Management District, have adopted carbon neutrality as a CEQA GHG emissions significance threshold.[62]

The following discussion outlines the minimum GHG reduction targets required for CEQA GHG emissions analyses streamlining. However, Pleasanton can choose to adopt other GHG emissions reduction pathways that exceed these reductions and still maintain status as a Qualified GHG Reduction Plan under CEQA. Any target pathway that reduces less emissions by 2030 would not be considered consistent with the State goals. While more aggressive targets will initially require additional effort, a more stringent short-term goal (2030) may make it easier to reach longer-term goals like carbon neutrality.

There are several different methodologies for calculating these minimum GHG emissions reductions. The City could choose to adopt mass emission, per capita, or per service person targets. The Pleasanton 2012 CAP includes only mass emissions targets. Mass emission targets describe emissions in terms of total MT CO_2e without any adjustment for population growth. The most recent State Climate Change Scoping Plan (2017) includes guidance that details the methodology and benefits of developing per capita and per service person targets. Generally, per capita targets are suggested unless circumstances such as a skewed jobs-to-residents ratio is identified. The key benefit of a per capita target is that it corrects for population growth. This means that the target does not become more difficult to reach if the City grows faster than projected. Per capita emissions targets are developed by dividing the emissions in each target year by the forecasted population. Emission targets in both mass emissions and per capita emissions are discussed below.

62 Sacramento Metropolitan Air Management District. 2020. Guide to Air Quality Assessment in Sacramento County. Available: <http://www.airquality.org/businesses/ceqa-land-use-planning/ceqa-guidance-tools>. Accessed: May 31, 2020.

Mass Emissions Pathways

The first proposed methodology for setting GHG emissions reduction target pathways is based on a total GHG emissions basis (i.e., mass emissions). This is the traditional methodology for establishing emissions targets as a part of CAP and was employed by the City for development of the 2020 target. The two pathways that meet CEQA Guidelines include:

1. **The SB 32/B-55-18 Mass Emissions Pathway.** This target pathway meets the minimum requirements for CEQA GHG emissions analyses streamlining. The pathway sets a 40 percent reduction from 1990 levels by 2030 and then carbon neutrality by 2045 consistent with EO B-55-18.
2. **The SB 32/S-03-05 Mass Emissions Pathway**. This target pathway meets the minimum requirements for SB 32. The pathway sets a 40 percent reduction from 1990 levels by 2030 but then adopts an 80 percent reduction by 2050 consistent with EO S-03-05.

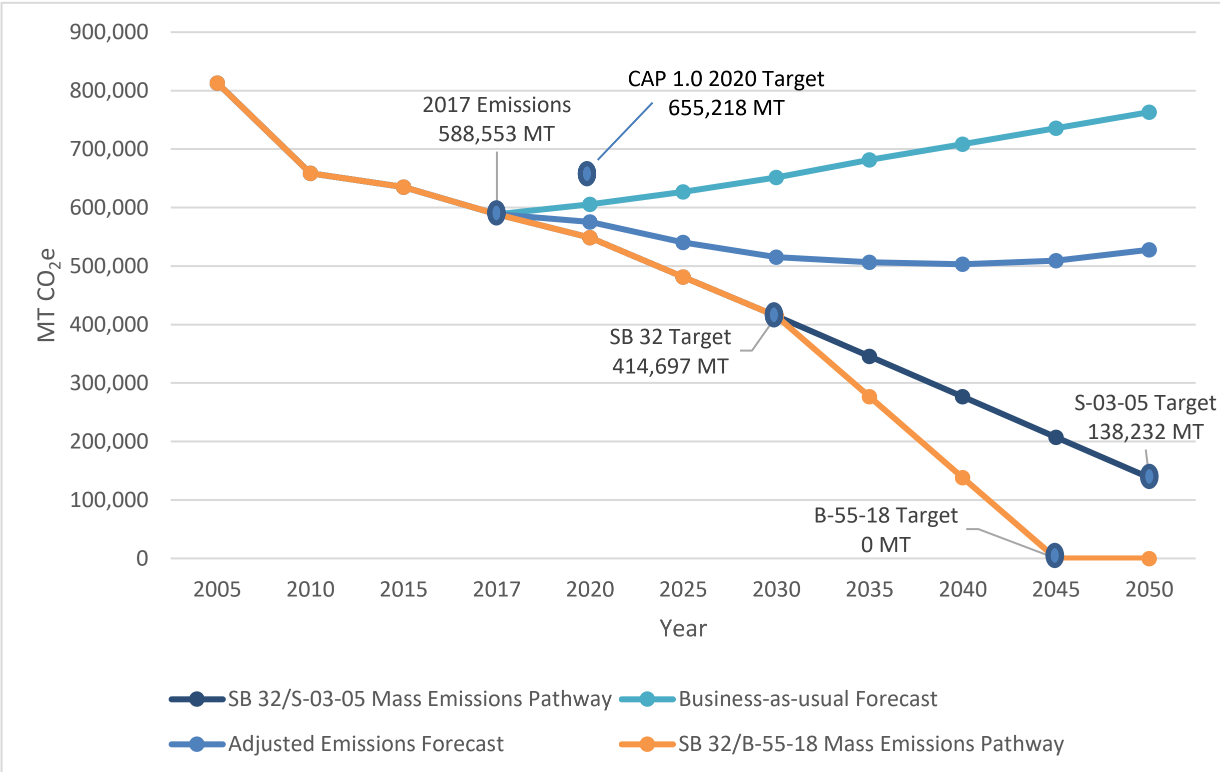
Table 37 provides GHG emissions targets for 2025, 2030, 2035, 2040, 2045, and 2050 for Pleasanton based on each of the SB 32/S-03-05 and SB 32/B-55-18 GHG mass emissions reduction target pathways. Figure 8 details the reduction necessary to achieve the mass emission targets in relation to the baseline inventory, business-as-usual forecast, and adjusted forecast. Forecasted emissions for 2020 are based off the 2017 inventory year, which already exceeds the original AB 32 target.

Table 37 Summary of Pleasanton Future GHG Emissions Forecasts by Mass Reduction Target Pathway

Emissions Forecast	2017 (MT CO2e)	2020 (MT CO2e)	2025 (MT CO2e)	2030 (MT CO2e)	2035 (MT CO2e)	2040 (MT CO2e)	2045 (MT CO2e)	2050 (MT CO2e)
Business-as-Usual Emissions Forecast	588,553	600,774	622,079	646,644	676,918	703,457	730,555	758,242
Adjusted Emissions Forecast	588,553	570,988	536,409	512,167	504,656	502,711	505,979	524,559
2045 SB 32 Mass Emissions Pathway	588,553	548,433	481,565	414,697	276,465	138,232	0	0
2050 SB 32 Mass Emissions Pathway	588,553	548,433	481,565	414,697	345,581	276,465	207,348	138,232

MT CO_2e: metric tons of carbon dioxide equivalent

Figure 8 Minimum Required Reduction Pathways for CEQA Streamlining (Mass Emissions)



Per Capita Emissions Pathways

Each of the above mass emission targets can also be expressed on a per capita basis (the second proposed methodology for setting GHG emissions reduction target pathways). Per capita targets are derived by dividing the mass emissions by the forecasted population in each target year. The benefit of per capita targets is primarily the ability to control for population growth over time. By adopting a per capita target, Pleasanton can continue to grow without sacrificing the ability to reach its GHG reduction goals.

1. **The SB 32/B-55-18 Per Capita Pathway**. This pathway translates the emissions targets referenced above under the mass emissions pathway into a per capita target by dividing each target year by the forecasted population. This pathway achieves a 40 percent reduction below 1990 levels by 2030 and then carbon neutrality by 2045.
2. **The SB 32/S-03-05 Per Capita Pathway.** This pathway translates the emissions targets referenced above under the mass emissions pathway into a per capita target by dividing each target year by the forecasted population. This pathway achieves a 40 percent reduction below 1990 levels by 2030 and then an 80 percent reduction below 1990 levels by 2050.

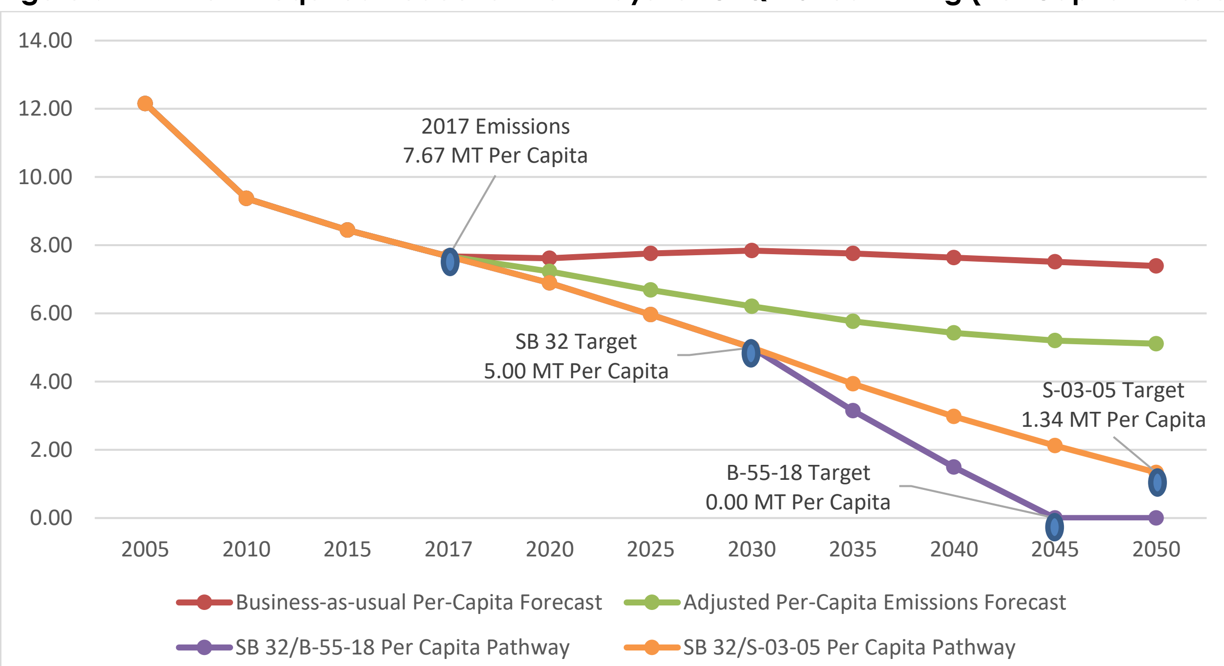
Table 38 provides per capita GHG emissions targets for 2025, 2030, 2035, 2040, 2045, and 2050 for Pleasanton based on the SB 32/S-03-05 and SB 32/B-55-18 GHG mass emissions reduction target pathways. Figure 9 details the GHG emission reduction necessary to achieve the per capita emission targets, in relation to the baseline inventory, business-as-usual forecast, and adjusted forecast.

Table 38 Summary of Pleasanton Forecasts by Per Capita Efficiency Reduction Target Pathway

Emissions Forecast	2017 (MT CO_2e)	2020 (MT CO_2e)	2025 (MT CO_2e)	2030 (MT CO_2e)	2035 (MT CO_2e)	2040 (MT CO_2e)	2045 (MT CO_2e)	2050 (MT CO_2e)
Business-as-Usual Per Capita Emissions Forecast	7.67	7.55	7.70	7.79	7.70	7.59	7.47	7.34
Adjusted Per Capita Emissions Forecast	7.67	7.18	6.64	6.17	5.74	5.42	5.17	5.08
SB 32/ B-55-18 Per Capita Pathway	7.67	6.90	5.96	5.00	3.15	1.49	0.00	0.00
SB 32/S-03-05 Per Capita Pathway	7.67	6.90	5.96	5.00	3.93	2.98	2.12	1.34

MT CO_2e: metric tons of carbon dioxide equivalent

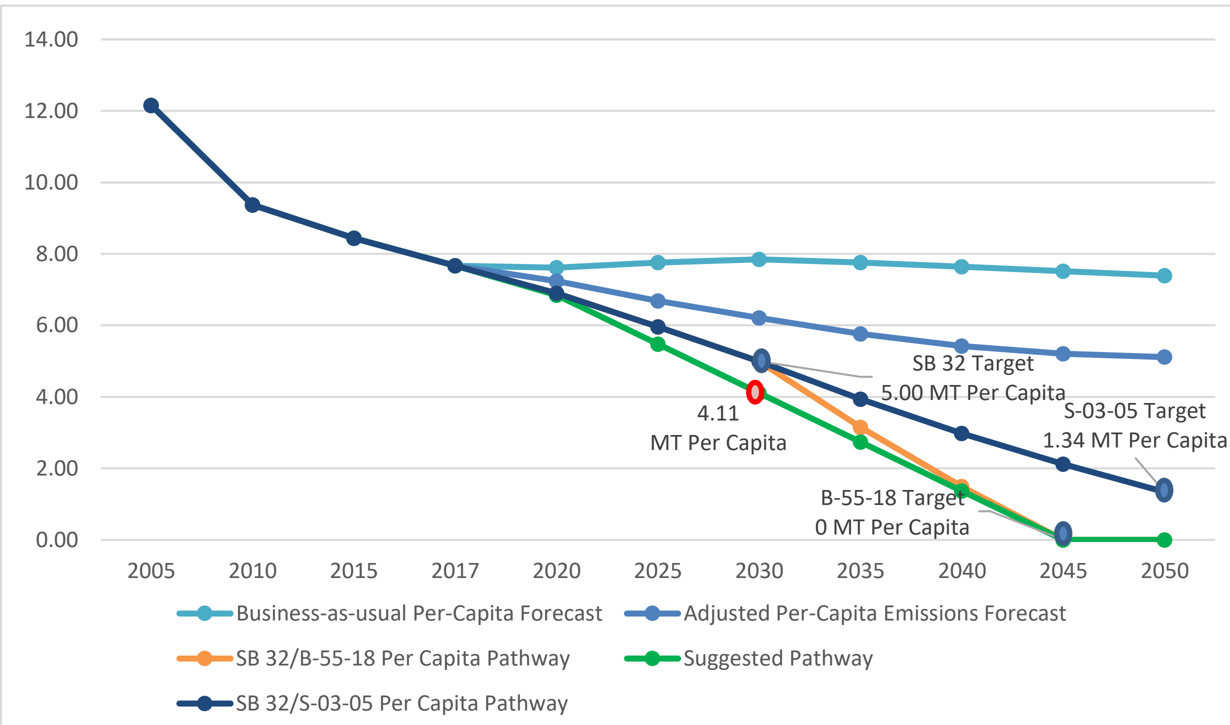
Figure 9 Minimum Required Reduction Pathways for CEQA Streamlining (Per Capita Emissions)



Suggested GHG Emissions Reduction Pathway

Pleasanton could adopt any of the GHG emissions target reduction targets discussed above for the CAP Update, as all of these pathways would comply with State emissions reduction goals and requirements for a CEQA Qualified GHG Reduction Strategy. However, the City could also choose to adopt a 2030 target on a straight-line trajectory from 2020 to 2045 that would provide a more stringent GHG reduction target than what has been established for SB32, as detailed in Figure 10. This target may be more ambitious in the short term but could spur the upfront actions required to reach the longer-term State goal of carbon neutrality. The adoption of a per capita target is also suggested, due to the increased flexibility associated with controlling for population growth. Figure 10 shows the suggested GHG emissions reduction pathways compared to pathways that are minimally compliant with CEQA.

Figure 10 Suggested GHG Emissions Reduction Pathway Compared to Minimum CEQA-compliant Pathways (Per Capita Emissions)



Although this suggested pathway is more stringent than State goals, it offers the following key benefits:

- The per capita target is more flexible and allows for population growth over time;
- More stringent short-term targets could spur the adoption of significant actions and smooth the transition to carbon neutrality in the longer term; and
- A target of carbon neutrality by 2045 will ensure CAP targets are consistent with longer-term future State targets.

5.2 Meeting the GHG Emissions Targets

The GHG emissions targets identified above will be achieved through implementation of local GHG emissions reduction measures that are to be identified within the Pleasanton CAP Update. Local measures will be identified through a comprehensive assessment of existing local and regional policies, programs, and actions and by assessing gaps and identifying additional opportunities. Additional measures will be developed from best practices worldwide and of other similar and neighboring jurisdictions, as well as those recommended by organizations and agencies, such as the California Air Pollution Control Officers Association (CAPCOA), Attorney General's office, and Air Resources Board. Measures will be vetted by City staff and the community and will be quantified to identify their overall contribution to meeting the Pleasanton GHG reduction targets. Although measures in the Pleasanton CAP Update will continue to achieve emissions reductions after 2030 and establish a trajectory for reaching longer-term goals, another phase of climate action planning and the realization of additional technological advances and State measures will be needed to meet the longer-term targets. This next phase will build on CAP Update measures, informed by monitoring and adaptive management, and take advantage of new technologies and climate protection science that will be available in the future.