

APPENDIX I

Greenhouse Gas Reduction Potential

SOAR Bakersfield Greenhouse Gas Reduction Potential for the City of Bakersfield

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LIST OF ABBREVIATIONS

AB	Assembly Bill
CARB	California Air Resources Board
City	City of Bakersfield
EV	electric vehicle
GHG	greenhouse gas
SOAR	Sustainable Opportunities Advancing Resilience

1 INTRODUCTION

Sustainable Opportunities Advancing Resilience (SOAR) Bakersfield includes measures that were designed to reduce greenhouse gas (GHG) emissions while building resilience to the hazards of climate change. These measures cover a range of projects, programs, and policies across the various GHG emissions sectors that are relevant to the City of Bakersfield's (City's) geopolitical boundaries. A comprehensive set of measures has been identified that cover the various community needs and opportunities that exist in the City to reduce GHG emissions and provide additional benefits to community members, including, but not limited to, reduction of pollution burden, improved economic opportunity, and improved mobility. While only a subset of these measures are in an appropriate stage of planning or design such that GHG emissions reductions can be confidently quantified, the full set of measures collectively contributes to long-term decarbonization of the buildings, transportation systems, and services in Bakersfield.

California has enacted legislation that sets statewide GHG reduction targets that are intended to be met through implementation of various rules, regulations, services and incentive programs, as outlined in the California Air Resources Board (CARB) Climate Change Scoping Plans. The most recent legislation, Assembly Bill (AB) 1279 sets a statewide target of reducing GHG emissions to 85 percent below 1990 emissions levels by 2045, while also achieving carbon neutrality through carbon dioxide removals by 2045. The State's strategy for reaching this target is outlined in the 2022 Scoping Plan for Achieving Carbon Neutrality (2022 Scoping Plan). The measures and goals of SOAR Bakersfield are intended to align with the statewide transitions that are outlined in the 2022 Scoping Plan.

This report analyzes the measures and goals of SOAR Bakersfield in two ways. First, it analyzes the GHG reduction potential of a subset of the measures in SOAR Bakersfield. These measures are labeled in SOAR Bakersfield as "Primary Measures", which were identified as priorities through engagement with community members, regional governmental agencies, and City departments. The majority of Primary Measures have sufficient detail that enables some confidence in the quantification of GHG emissions reductions that would occur with implementation. Second, this report analyzes the collective GHG reduction impact that the full set of measures, which is referred to as the "SOAR Bakersfield Implementation Scenario". The full set of measures in SOAR Bakersfield cannot be quantified with a bottom-up approach, so instead a top-down approach is used that scales key State target indicators to the City of Bakersfield. These target indicators are aligned with the 2022 Scoping Plan where possible, and include metrics such as number of heat pumps installed, electric vehicles sold, and acres of natural lands restored.

2 PRIMARY MEASURES QUANTIFICATION

SOAR Bakersfield defines Primary Measures as follows:

"Implementation-ready measures that emerged as high priority through extensive community and stakeholder engagement, technical analysis, and interdepartmental coordination. These measures include actionable projects and programs that can be initiated in the near term (contingent upon funding availability) and are designed to deliver direct and measurable benefits for Bakersfield residents, especially for frontline communities."

During the development process for SOAR Bakersfield, 22 Primary Measures were identified across six "Categories", which include:

- ▶ energy,
- ▶ transportation and land use,
- ▶ water and wastewater,
- ▶ solid waste,

- ▶ nature-based solutions, and
- ▶ adaptation.

Of the 22 total Primary Measures, 16 have been identified to provide quantifiable GHG emissions. The five measures that are not quantified for GHG emissions reductions either do not achieve a direct GHG emissions reduction benefit, such as the installation of EV charging infrastructure, or do not have a sufficiently defined boundary to enable quantification. Table 1 provides a summary of the annual GHG emissions reductions that would be achieved with implementation of quantified Primary Measures for the years 2030, 2040, and 2045. These years were selected as they align with the forecast years included in the GHG emissions forecast for SOAR Bakersfield. Details on calculation methods, key assumptions, and data sources can be found in Attachment A. Refer to Chapter 3 of SOAR Bakersfield for full descriptions of Primary Measures.

Table 1 Primary Measures Annual GHG Emissions Reductions for 2030, 2040, and 2045 (MTCO₂e/year)

Category	Measure ID	Measure Title	2030 ¹	2040	2045 ²
Energy	BE-P-1	Continued and Expanded Low-Income Energy Efficiency Program	0	23	23
Energy	RE-P-1	Continue and Expand Solar Installations at Residences	0	4.6	0
Transportation and Land Use	FH-P-1	California Inland Port	0	0	11,855
Transportation and Land Use	AO-P-1	Alternative-Fueled and Zero-Emission City Equipment Fleet	0	17	17
Transportation and Land Use	TDM-P-1	Vanpools	3,175	2,853	2,807
Transportation and Land Use	TI-P-1	Bus Rapid Transit on Key Corridors	125	438	457
Transportation and Land Use	TI-P-2	South Bakersfield Transit Hub	120	107	106
Transportation and Land Use	HSR-P-1	High-Speed Rail Station Area Plan "Green Loop"	0	4,481	4,404
Transportation and Land Use	WB-P-2	Active Transportation Plan Priority Trails	1,646	1,477	1,452
Water and Wastewater	WE-P-1	Turf Replacement Program	1.7	0.2	0
Water and Wastewater	WE-P-2	City of Bakersfield Water Advanced Metering Infrastructure	1,478	198	11
Water and Wastewater	WT-P-1	Renewable Energy at Treatment Plants	179	59	0
Solid Waste	OW-P-1	Expanded Curbside Organic Pickup	15,564	35,018	44,745
Nature-Based Solutions	KR-P-1	Kern River Parkway Plan Priority Projects	0	333	333
Nature-Based Solutions	UG-P-1	Central City and Citywide Tree Plan Pilot Projects	9.8	9.8	9.8
Nature-Based Solutions	UG-P-2	City Tree Program	0	3,193	3,193
Total			22,298	44,372	65,581

Notes: GHG = greenhouse gas; Measure ID = measure identifier; MTCO₂e = metric tons of carbon dioxide equivalent.

¹ Measures BE-P-1 and RE-P-1 show zero GHG emissions reductions for the year 2030, as they are not expected to be fully implemented until after the year 2030.

² Measures RE-P-1, WE-P-1, and WT-P-1 show zero GHG emissions reductions for the year 2045 because the GHG emissions reductions associated with the measures are from a reduction in the use of grid-supplied electricity. This is due to accounting for Senate Bill 1020, which requires all retail sales of electricity in California to be carbon-free by 2045, making the reduction in grid-supplied electricity have not GHG reduction impact.

The GHG emissions reductions may be utilized by the City to support future grant applications. In cases where cumulative GHG emissions reduced over time are needed for grant application, cumulative reductions can be derived by interpolating annual GHG emissions reductions between target years, and then summing annual reductions for interpolated years. In these cases, the assumptions in Attachment A should be reviewed in detail.

3 SOAR BAKERSFIELD IMPLEMENTATION SCENARIO

The SOAR Bakersfield Implementation Scenario is intended as a best-case scenario, in which all measures in SOAR Bakersfield are implemented and achieve local results that are aligned with the State's strategy for reducing GHG emissions included in the 2022 Scoping Plan. SOAR Bakersfield includes over 100 measures, many of which will require additional analyses, planning, and engagement to fully define and implement. The implementation of measures will also be driven by the availability of funding, which cannot be understood without further definition of the measures. With uncertainty in the pathway for implementation and the resulting GHG reduction impact of many measures, the quantification of the SOAR Bakersfield Implementation Scenario relies on the scaling of statewide indicators to the local level and quantifying the GHG reduction impact of these indicators.

Statewide indicators for achieving the GHG reduction targets of AB 1279 and the 2022 Scoping Plan were obtained from reports published by State agencies that support the implementation of the State's GHG reduction strategy. Statewide indicators were scaled by the ratio of California's population to the City of Bakersfield's population to estimate local targets, except for targets related to natural and working lands, which were scaled by acreage of relevant land cover types. Statewide indicators with differing target years were projected to 2045 to align with the horizon year of the SOAR Bakersfield and the 2022 Scoping Plan. GHG emissions reductions were then calculated for the local implementation of various indicators. Table 2 shows the statewide indicators that were used for calculations, their source, the local GHG emissions reduction potential associated with implementation of the indicator, and the relevant GHG emissions sectors that align with the City's GHG emissions inventory.

Table 2 California and Bakersfield Target Metrics for GHG Emissions Reductions by 2045

GHG Emissions Sector	Indicator Source	Statewide Indicator	Indicator Scaled to Bakersfield	Units of Indicator	Local Annual GHG Reduction Potential (MTCO ₂ e)
Transportation	CEC 2024	15,000,000	157,000	Passenger EVs on the road	639,876
Transportation	CEC 2024	2,110,000	21,800	Public EV charging stations	GHG reductions captured in EVs on the road
Transportation	CEC 2024	377,000	3,890	Medium/Heavy-Duty EVs on the road	481,365
Transportation	CEC 2024	264,000	2,730	Medium/Heavy-Duty charging stations	GHG reductions captured in EV's on the road
Transportation	CARB 2022	30%	30% or 1,223,291,462*	Per-capita VMT reduction	334,595
Off-road Equipment	CARB 2025	90%	89%	Fuel carbon intensity reduction	128,609
Building Energy	CARB 2022	23,000,000	237,578	Heat pumps installed	152,876
Building Energy	CARB 2022	72	0.74	GW of solar installed	GHG reductions captured in GHG emissions forecast
Building Energy	CARB 2022	37	0.38	GW battery energy storage installed	GHG reductions captured in GHG emissions forecast
Waste	CARB 2017	75% reduction or 57,000,000 tons	75% reduction or 590,600 tons	Tons of organic waste diverted	255,254
Carbon Stored in NWL	CNRA 2024	190,000	1,960	Acres of NWL restored with healthy soils	4,188
Carbon Stored in NWL	CNRA 2024	33,000	40	Acres of grasslands restored	300
Carbon Stored in NWL	CNRA 2024	55,100	70	Acres of grasslands conserved	501

GHG Emissions Sector	Indicator Source	Statewide Indicator	Indicator Scaled to Bakersfield	Units of Indicator	Local Annual GHG Reduction Potential (MTCO ₂ e)
Carbon Stored in NWL	CNRA 2024	1,300	>10	Acres of wetlands restored	41
Carbon Stored in NWL	CNRA 2024	9,200	10	Acres of wetlands conserved	293
Total					1,997,898

Notes: EV = electric vehicle; GHG = greenhouse gases; GW = Gigawatt; MTCO₂e = metric tons of carbon dioxide equivalent; NWL = natural and working lands; VMT = vehicle miles traveled.

All GHG reductions calculated are additional to those considered in the City's Legislative-Adjusted Business-as-Usual GHG emissions forecast.

The results of the SOAR Bakersfield Implementation Scenario compared to the City's GHG emissions forecast show that substantial progress would be made towards reaching a local GHG emissions target for the City that is aligned with AB 1279. Table 3 and Figure 1 illustrate the emissions reductions from the Legislative-Adjusted Business-as-Usual (BAU) scenario GHG emissions forecast that would be achieved with the SOAR Bakersfield Implementation Scenario, in comparison to a State-aligned GHG emissions target level for the years 2030, 2040, and 2045. The Legislative-Adjusted BAU scenario reflects legislation and regulations enacted by State and federal agencies, without considering any local (City) actions to reduce GHG emissions. The SOAR Bakersfield Implementation Scenario accounts for the measures Bakersfield has identified that will help the City achieve its target emissions reductions at the local level. While substantial progress would be made in reducing GHG emissions with the SOAR Bakersfield Implementation Scenario, further action may be required at both the State and local levels for the City to meet local reduction targets.

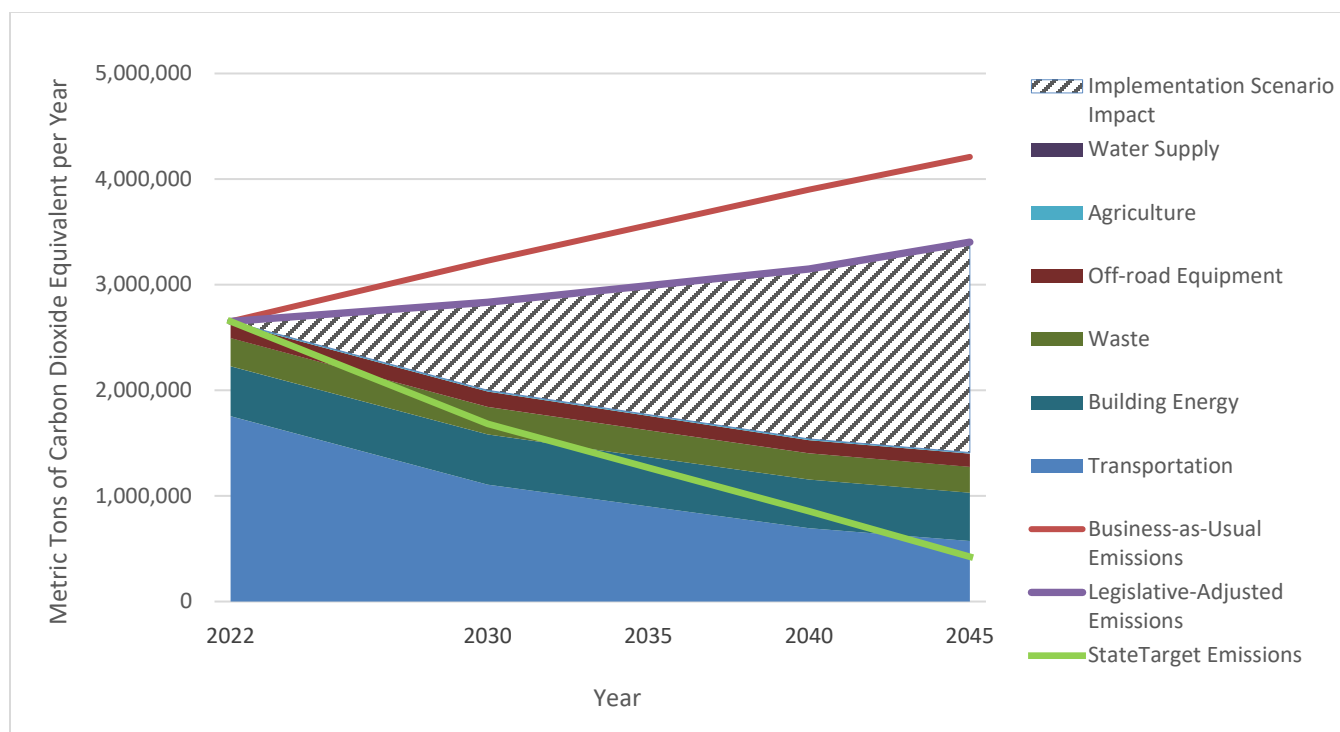
Table 3 SOAR Bakersfield Implementation Scenario GHG Emissions Reductions Compared to Legislative-Adjusted BAU Forecast and Local State-Aligned Reduction Targets

Source	2022	2030	2040	2045
City of Bakersfield BAU Forecast (MTCO ₂ e)	2,652,000	3,226,000	3,899,000	4,210,000
City of Bakersfield Legislative-Adjusted BAU Forecast (MTCO ₂ e)	2,652,000	2,834,000	3,149,000	3,403,000
City of Bakersfield State-Aligned Target Percent Reduction Below 2022 Levels	N/A	37%	68%	84%
City of Bakersfield State-Aligned Target Annual Emissions (MTCO ₂ e)	N/A	1,677,000	851,000	423,000
Reduction from 2022 Needed to Meet Target (MTCO ₂ e)	N/A	966,000	1,793,000	2,221,000
Reduction from Legislative-Adjusted BAU Forecasts Needed to Meet Target (MTCO ₂ e)	N/A	1,147,000	2,289,000	2,971,000
Implementation Scenario Emissions Reductions (MTCO ₂ e)	N/A	836,000	1,615,000	1,998,000
Remaining Emissions Reductions Needed to Meet Target	N/A	312,000	674,000	973,000

Notes: BAU = business-as-usual; GHG = greenhouse gases; MTCO₂e = metric tons of carbon dioxide equivalent; N/A = Not Applicable.

Values have been rounded and may not sum.

Figure 1 SOAR Bakersfield Implementation Scenario GHG Emissions Reductions Compared to Legislative-Adjusted BAU Forecast and Local State-Aligned Reduction Targets



4 REFERENCE

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- California Energy Commissions. 2024. *Assembly Bill 2127 Second Electric Vehicle Charging Infrastructure Assessment: Assessing Charging Needs to Support Zero-Emission Vehicles in 2030 and 2035*. Available: <https://www.energy.ca.gov/publications/2024/assembly-bill-2127-second-electric-vehicle-charging-infrastructure-assessment>. Accessed September 16, 2025.
- California Natural Resources Agency. 2024. *California's Nature-Based Solutions Climate Targets*. Available: <https://resources.ca.gov/-/media/CNRA-Website/Files/Initiatives/Expanding-Nature-Based-Solutions/Californias-NBS-Climate-Targets-2024.pdf>. Accessed September 16, 2025.
- CARB. See California Air Resources Board.
- CEC. See California Energy Commission.
- CNRA. See California Natural Resources Agency.

Attachment A

Primary Measures GHG Reduction
Quantification

TI-P-2**South Bakersfield Transit Hub**

The GHG and air pollutant reductions associated with the South Bakersfield Transit Hub would result from reduced gasoline consumption from single-occupancy commute vehicles. The increased availability of transit service and infrastructure in South Bakersfield would allow for additional travel without the use of personal vehicles. The calculations are based on the estimates for annual alightings for a Southwest Bakersfield Transit Center, as demonstrated in the 2015 Metropolitan Bakersfield Transit Center Study. Golden Empire Transit is currently transitioning their bus fleet to zero-emission hydrogen, and it is expected that bus operation will not contribute additional GHG or air pollutant emissions. Costs are not calculated due to a lack of detail on the scope of the project at this time.

GHG Emissions Context

Scope and Sector Identifier	Detail
GHG Emissions Sector:	Transportation
GHG Emissions Sub-sector:	Passenger
Start year of implementation:	2030

VMT Reduction Calculations

The calculation of vehicle travel reductions are based on the estimated alightings from the 2015 Metropolitan Bakersfield Transit Center Study, Table 2.

VMT Reduction Calculations	Units	2030	2040	2045	Notes
Annual Boardings	trips	187,970	187,970	187,970	[1]
Distance per Trip	miles	3.60	3.60	3.60	[2]
Statewide mode shift factor	percent	57.8%	57.8%	57.8%	[3]
Reduction in VMT	VMT/year	391,128	391,128	391,128	Calculated

GHG Emissions Reduction Calculations

The calculation of GHG reductions considers the reduction of vehicle miles traveled of gasoline-fueled light-duty vehicles.

Vehicle Travel GHG Reduction Calculations	Units	2030	2040	2045	Notes
Gasoline light-duty vehicle GHG emissions per mile	MTCO ₂ e/mile	0.000306	0.000275	0.000270	[4]
Annual GHG Reductions	MTCO ₂ e/year	120	107	106	Calculated
Total reduction in GHG emissions	MTCO ₂ e/year	120	107	106	Calculated

Air Pollutant Reduction Calculations

The calculation of air pollutant reductions considers the reduction of vehicle miles traveled of gasoline-fueled light-duty vehicles.

Vehicle Travel Air Pollutant Reduction Calculations	Units	2030	2040	2045	Notes
Gasoline light-duty vehicle CO emissions per mile	tons CO/mile	1.10E-06	8.76E-07	8.42E-07	[4]
Gasoline light-duty vehicle NOx emissions per mile	tons NOx/mile	7.61E-08	5.29E-08	4.86E-08	[4]
Gasoline light-duty vehicle SOx emissions per mile	tons SOx/mile	3.31E-09	2.97E-09	2.92E-09	[4]
Gasoline light-duty vehicle PM2.5 emissions per mile	tons PM2.5/mile	5.97E-09	5.52E-09	5.44E-09	[4]
Gasoline light-duty vehicle PM10 emissions per mile	tons PM10/mile	1.75E-08	1.71E-08	1.70E-08	[4]
Gasoline light-duty vehicle ROG emissions per mile	tons ROG/mile	1.29E-07	9.32E-08	8.42E-08	[4]
Reduction in VMT	VMT/year	391,128	391,128	391,128	See VMT Reduction Calculations
Annual vehicle travel CO reductions	tons CO/year	0.430	0.342	0.329	Calculated
Annual vehicle travel NOx reductions	tons NOx/year	0.0297	0.0207	0.0190	Calculated
Annual vehicle travel SOx reductions	tons SOx/year	0.00129	0.00116	0.00114	Calculated
Annual vehicle travel PM2.5 reductions	tons PM2.5/year	0.00233	0.00216	0.00213	Calculated
Annual vehicle travel PM10 reductions	tons PM10/year	0.00685	0.00669	0.00665	Calculated
Annual vehicle travel ROG reductions	tons ROG/year	0.0504	0.0365	0.0330	Calculated

References

- [1] Kern Council of Governments. 2015. Metropolitan Bakersfield Transit Center Study. Available: https://www.kerncog.org/wp-content/uploads/2009/10/Metro_Bakersfield_Transit_Center_2015.pdf.
- [2] Federal Transit Administration. 2023. National Transit Summaries and Trends 2023 Edition. Available: https://www.transit.dot.gov/sites/fta.dot.gov/files/2024-10/2023%20National%20Transit%20Summaries%20and%20Trends_1.1.pdf.
- [3] California Air Pollution Control Officers. 2021. Handbook for Analyzing Greenhouse Gas Emissions Reductions, Assessing Climate Vulnerabilities, and Advancing Health and Equity.
- [4] California Air Resources Board. EMFAC Emission Inventory (Model Version: EMFAC 2021 v1.0.2). Available: <https://arb.ca.gov/emfac/emissions-inventory/0aab195e7474e6a66cebfa6ad29a71aed1cb5494>.

Additional Notes

GHG = greenhouse gas; MTCO_{2e} = metric tons of carbon dioxide equivalent; CO = carbon monoxide; NO_x = oxides of nitrogen; SO_x = oxides of sulfur; PM_{2.5} = particulate matter with 2.5 micron diameter; PM₁₀ = particulate matter with 10 micron diameter; ROG = reactive organic gases; VMT = vehicle miles traveled.

HSR-P-1**High-Speed Rail Station Area Plan "Green Loop"**

The GHG and air pollutant reductions associated with High-Speed Rail Station "Green Loop" would result from reduced gasoline consumption from single-occupancy commute vehicles. The increased availability of active transportation infrastructure would allow residents and workers to walk and bike to destinations without the use of personal vehicles. The calculations are based on the estimated daily users from the City's Active Transportation Plan, where bike and pedestrian projects outlined in the Downtown Bakersfield High-Speed Rail Station Area Plan have been cross checked with those in the Active Transportation Plan. Only projects that could be identified in the Active Transportation Plan have been included in calculations. Costs are not calculated here as they are available in the Active Transportation Plan.

GHG Emissions Context

Scope and Sector Identifier	Detail
GHG Emissions Sector:	Transportation
GHG Emissions Sub-sector:	Passenger
Start year of implementation:	2035

VMT Reduction Calculations

The calculation of vehicle travel reductions are based on the estimated daily users from the City of Bakersfield 2025 Active Transportation Plan, pages 52-55.

15 - Q Street, Kern Island Canal & Central Branch Canal	Units	2040	2045	Notes
Daily Users	users	2,047	2,047	[1]
Length	miles	8.29	8.29	[1]
Average car occupancy	persons	1.4	1.4	[2]
Reduction in VMT	VMT/year	4,206,044	4,206,044	Calculated, assuming 347 days per year
4 – Baker Street, King Street & Lotus Lane (2 of 2)	Units	2040	2045	Notes
Daily Users	users	564	564	[1]
Length	miles	2.00	2.00	[1]
Average car occupancy	persons	1.4	1.4	[2]
Reduction in VMT	VMT/year	279,583	279,583	Calculated, assuming 347 days per year
9 – H Street	Units	2040	2045	Notes
Daily Users	users	2,641	2,641	[1]
Length	miles	9.49	9.49	[1]

Average car occupancy	persons	1.4	1.4	[2]
Reduction in VMT	VMT/year	6,212,066	6,212,066	Calculated, assuming 347 days per year
16 – Rosedale Highway & 21st Street	Units	2040	2045	Notes
Daily Users	users	1,457	1,457	[1]
Length	miles	9.02	9.02	[1]
Average car occupancy	persons	1.4	1.4	[2]
Reduction in VMT	VMT/year	3,257,373	3,257,373	Calculated, assuming 347 days per year
Total reduction in VMT	VMT/year	13,955,066	13,955,066	Calculated

GHG Emissions Reduction Calculations

The calculation of GHG reductions considers the reduction of vehicle miles traveled of gasoline-fueled light-duty vehicles.

Vehicle Travel GHG Reduction Calculations	Units	2040	2045	Notes
Gasoline light-duty vehicle GHG emissions per mile	MTCO ₂ e/mile	0.000275	0.000270	[3]
15 - Q Street, Kern Island Canal & Central Branch Canal	Units	2040	2045	Notes
Annual GHG Reductions	MTCO ₂ e/year	1,155	1,135	Calculated
4 – Baker Street, King Street & Lotus Lane	Units	2040	2045	Notes
Annual GHG Reductions	MTCO ₂ e/year	77	75	Calculated
9 – H Street	Units	2040	2045	Notes
Annual GHG Reductions	MTCO ₂ e/year	1,706	1,676	Calculated
16 – Rosedale Highway & 21st Street	Units	2040	2045	Notes
Annual GHG Reductions	MTCO ₂ e/year	895	879	Calculated
Total reduction in GHG emissions	MTCO₂e/year	3,832	3,766	Calculated

Air Pollutant Reduction Calculations

The calculation of air pollutant reductions considers the reduction of vehicle miles traveled of gasoline-fueled light-duty vehicles.

Vehicle Travel Air Pollutant Reduction Calculations	Units	2040	2045	Notes
Gasoline light-duty vehicle CO emissions per mile	tons CO/mile	8.76E-07	8.42E-07	[3]
Gasoline light-duty vehicle NO _x emissions per mile	tons NO _x /mile	5.29E-08	4.86E-08	[3]
Gasoline light-duty vehicle SO _x emissions per mile	tons SO _x /mile	2.97E-09	2.92E-09	[3]
Gasoline light-duty vehicle PM _{2.5} emissions per mile	tons PM _{2.5} /mile	5.52E-09	5.44E-09	[3]
Gasoline light-duty vehicle PM ₁₀ emissions per mile	tons PM ₁₀ /mile	1.71E-08	1.70E-08	[3]

Gasoline light-duty vehicle ROG emissions per mile	tons ROG/mile	9.32E-08	8.42E-08	[3]
15 - Q Street, Kern Island Canal & Central Branch Canal	Units	2040	2045	Notes
Vehicle trips avoided per year	VMT/year	4,206,044	0	See VMT Reduction Calculations
Annual vehicle travel CO reductions	tons CO/year	3.683	0.000	Calculated
Annual vehicle travel NOx reductions	tons NOx/year	0.2224	0.0000	Calculated
Annual vehicle travel SOx reductions	tons SOx/year	0.01249	0.00000	Calculated
Annual vehicle travel PM2.5 reductions	tons PM2.5/year	0.02324	0.00000	Calculated
Annual vehicle travel PM10 reductions	tons PM10/year	0.07195	0.00000	Calculated
Annual vehicle travel ROG reductions	tons ROG/year	0.3920	0.0000	Calculated
4 – Baker Street, King Street & Lotus Lane	Units	2040	2045	Notes
Vehicle trips avoided per year	VMT/year	279,583	0	See VMT Reduction Calculations
Annual vehicle travel CO reductions	tons CO/year	0.245	0.000	Calculated
Annual vehicle travel NOx reductions	tons NOx/year	0.0148	0.0000	Calculated
Annual vehicle travel SOx reductions	tons SOx/year	0.00083	0.00000	Calculated
Annual vehicle travel PM2.5 reductions	tons PM2.5/year	0.00154	0.00000	Calculated
Annual vehicle travel PM10 reductions	tons PM10/year	0.00478	0.00000	Calculated
Annual vehicle travel ROG reductions	tons ROG/year	0.0261	0.0000	Calculated
9 – H Street	Units	2040	2045	Notes
Vehicle trips avoided per year	VMT/year	6,212,066	0	See VMT Reduction Calculations
Annual vehicle travel CO reductions	tons CO/year	5.440	0.000	Calculated
Annual vehicle travel NOx reductions	tons NOx/year	0.3284	0.0000	Calculated
Annual vehicle travel SOx reductions	tons SOx/year	0.01845	0.00000	Calculated
Annual vehicle travel PM2.5 reductions	tons PM2.5/year	0.03432	0.00000	Calculated
Annual vehicle travel PM10 reductions	tons PM10/year	0.10627	0.00000	Calculated
Annual vehicle travel ROG reductions	tons ROG/year	0.5790	0.0000	Calculated
16 – Rosedale Highway & 21st Street	Units	2040	2045	Notes
Vehicle trips avoided per year	VMT/year	3,257,373	0	See VMT Reduction Calculations
Annual vehicle travel CO reductions	tons CO/year	2.852	0.000	Calculated
Annual vehicle travel NOx reductions	tons NOx/year	0.1722	0.0000	Calculated
Annual vehicle travel SOx reductions	tons SOx/year	0.00967	0.00000	Calculated
Annual vehicle travel PM2.5 reductions	tons PM2.5/year	0.01800	0.00000	Calculated
Annual vehicle travel PM10 reductions	tons PM10/year	0.05572	0.00000	Calculated
Annual vehicle travel ROG reductions	tons ROG/year	0.3036	0.0000	Calculated

Total Air Pollutant Reductions	Units	2040	2045	Notes
Vehicle trips avoided per year	VMT/year	13,955,066	0	See VMT Reduction Calculations
Annual vehicle travel CO reductions	tons CO/year	12.22	0.00	Calculated
Annual vehicle travel NOx reductions	tons NOx/year	0.7378	0.0000	Calculated
Annual vehicle travel SOx reductions	tons SOx/year	0.04145	0.00000	Calculated
Annual vehicle travel PM2.5 reductions	tons PM2.5/year	0.07710	0.00000	Calculated
Annual vehicle travel PM10 reductions	tons PM10/year	0.2387	0.0000	Calculated
Annual vehicle travel ROG reductions	tons ROG/year	1.301	0.000	Calculated

References

- [1] City of Bakersfield. 2025. Active Transportation Plan. Available: <https://content.civicplus.com/api/assets/2b76078a-4623-4f32-bc87-d2726851c647>
- [2] US Department of Energy. 2024. FOTW #1333, March 11, 2024: In 2022 the Average Number of Occupants Per Trip for Household Vehicles in the United States Was 1.5. Available: <https://www.energy.gov/eere/vehicles/articles/fotw-1333-march-11-2024-2022-average-number-occupants-trip-household>.
- [3] California Air Resources Board. EMFAC Emission Inventory (Model Version: EMFAC 2021 v1.0.2). Available: <https://arb.ca.gov/emfac/emissions-inventory/0aab195e7474e6a66cebfa6ad29a71aed1cb5494>.

Additional Notes

GHG = greenhouse gas; MTCO2e = metric tons of carbon dioxide equivalent; CO = carbon monoxide; NOx = oxides of nitrogen; SOx = oxides of sulfur; PM2.5 = particulate matter with 2.5 micron diameter; PM10 = particulate matter with 10 micron diameter; ROG = reactive organic gases; VMT = vehicle miles traveled.

WB-P-2**Active Transportation Plan Priority Trails**

The GHG and air pollutant reductions associated with Active Transportation Plan Priority Trails Network would result from reduced gasoline consumption from single-occupancy commute vehicles. The increased availability of active transportation infrastructure would allow residents and workers to walk and bike to destinations without the use of personal vehicles. The calculations are based on the estimated daily users from the City's Active Transportation Plan. Costs are not calculated here as they are available in the Active Transportation Plan.

GHG Emissions Context

Scope and Sector Identifier	Detail
GHG Emissions Sector:	Transportation
GHG Emissions Sub-sector:	Passenger
Start year of implementation:	2030

VMT Reduction Calculations

The calculation of vehicle travel reductions are based on the estimated daily users from the City of Bakersfield 2025 Active Transportation Plan, page 52.

12 - Mount Vernon Avenue	Units	2030	2040	2045	Notes
Daily Users	users	1,481	1,481	1,481	[1]
Length	miles	3.01	3.01	3.01	[1]
Average car occupancy	persons	1.4	1.4	1.4	[2]
Vehicle trips avoided per year	VMT/year	1,104,900	1,104,900	1,104,900	Calculated, assuming 347 days per year
11 - Ming Avenue and Belle Terrace (1 of 2)	Units	2030	2040	2045	Notes
Daily Users	users	1,051	1,051	1,051	[1]
Length	miles	3.83	3.83	3.83	[1]
Average car occupancy	persons	1.4	1.4	1.4	[2]
Vehicle trips avoided per year	VMT/year	997,707	997,707	997,707	Calculated, assuming 347 days per year
11 - Ming Avenue and Belle Terrace (2 of 2)	Units	2030	2040	2045	Notes
Daily Users	users	1,296	1,296	1,296	[1]
Length	miles	4.72	4.72	4.72	[1]
Average car occupancy	persons	1.4	1.4	1.4	[2]
Vehicle trips avoided per year	VMT/year	1,516,172	1,516,172	1,516,172	Calculated, assuming 347 days per year
2 - Akers Road and McKee Road	Units	2030	2040	2045	Notes

Daily Users	users	644	644	644	[1]
Length	miles	3.50	3.50	3.50	[1]
Average car occupancy	persons	1.4	1.4	1.4	[2]
Vehicle trips avoided per year	VMT/year	558,670	558,670	558,670	Calculated, assuming 347 days per year
4 - Baker Street, King Street, and Lotus Lane (1 of 2)	Units	2030	2040	2045	Notes
Daily Users	users	1,128	1,128	1,128	[1]
Length	miles	4.30	4.30	4.30	[1]
Average car occupancy	persons	1.4	1.4	1.4	[2]
Vehicle trips avoided per year	VMT/year	1,202,206	1,202,206	1,202,206	Calculated, assuming 347 days per year
Total reduction in VMT	VMT/year	5,379,655	5,379,655	5,379,655	Calculated

GHG Emissions Reduction Calculations

The calculation of GHG reductions considers the reduction of vehicle miles traveled of gasoline-fueled light-duty vehicles.

Vehicle Travel GHG Reduction Calculations	Units	2030	2040	2045	Notes
Gasoline light-duty vehicle GHG emissions per mile	MTCO ₂ e/mile	0.000306	0.000275	0.000270	[3]
12 - Mount Vernon Avenue	Units	2030	2040	2045	Notes
Annual GHG Reductions	MTCO ₂ e/year	338	303	298	Calculated
11 - Ming Avenue and Belle Terrace (1 of 2)	Units	2030	2040	2045	Notes
Annual GHG Reductions	MTCO ₂ e/year	305	274	269	Calculated
11 - Ming Avenue and Belle Terrace (2 of 2)	Units	2030	2040	2045	Notes
Annual GHG Reductions	MTCO ₂ e/year	464	416	409	Calculated
2 - Akers Road and McKee Road	Units	2030	2040	2045	Notes
Annual GHG Reductions	MTCO ₂ e/year	171	153	151	Calculated
4 - Baker Street, King Street, and Lotus Lane (1 of 2)	Units	2030	2040	2045	Notes
Annual GHG Reductions	MTCO ₂ e/year	368	330	324	Calculated
Total reduction in GHG emissions	MTCO₂e/year	1,646	1,477	1,452	Calculated

Air Pollutant Reduction Calculations

The calculation of air pollutant reductions considers the reduction of vehicle miles traveled of gasoline-fueled light-duty vehicles.

Vehicle Travel Air Pollutant Reduction Calculations	Units	2030	2040	2045	Notes
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Gasoline light-duty vehicle CO emissions per mile	tons CO/mile	1.10E-06	8.76E-07	8.42E-07	[3]
Gasoline light-duty vehicle NOx emissions per mile	tons NOx/mile	7.61E-08	5.29E-08	4.86E-08	[3]
Gasoline light-duty vehicle SOx emissions per mile	tons SOx/mile	3.31E-09	2.97E-09	2.92E-09	[3]
Gasoline light-duty vehicle PM2.5 emissions per mile	tons PM2.5/mile	5.97E-09	5.52E-09	5.44E-09	[3]
Gasoline light-duty vehicle PM10 emissions per mile	tons PM10/mile	1.75E-08	1.71E-08	1.70E-08	[3]
Gasoline light-duty vehicle ROG emissions per mile	tons ROG/mile	1.29E-07	9.32E-08	8.42E-08	[3]
12 - Mount Vernon Avenue	Units	2030	2040	2045	Notes
Vehicle trips avoided per year	VMT/year	1,104,900	1,104,900	1,104,900	See VMT Reduction Calculations
Annual vehicle travel CO reductions	tons CO/year	1.215	0.967	0.930	Calculated
Annual vehicle travel NOx reductions	tons NOx/year	0.0840	0.0584	0.0538	Calculated
Annual vehicle travel SOx reductions	tons SOx/year	0.00365	0.00328	0.00323	Calculated
Annual vehicle travel PM2.5 reductions	tons PM2.5/year	0.00660	0.00610	0.00601	Calculated
Annual vehicle travel PM10 reductions	tons PM10/year	0.01934	0.01890	0.01879	Calculated
Annual vehicle travel ROG reductions	tons ROG/year	0.1425	0.1030	0.0931	Calculated
11 - Ming Avenue and Belle Terrace (1 of 2)	Units	2030	2040	2045	Notes
Vehicle trips avoided per year	VMT/year	997,707	997,707	997,707	See VMT Reduction Calculations
Annual vehicle travel CO reductions	tons CO/year	1.097	0.874	0.840	Calculated
Annual vehicle travel NOx reductions	tons NOx/year	0.0759	0.0527	0.0485	Calculated
Annual vehicle travel SOx reductions	tons SOx/year	0.00330	0.00296	0.00291	Calculated
Annual vehicle travel PM2.5 reductions	tons PM2.5/year	0.00596	0.00551	0.00542	Calculated
Annual vehicle travel PM10 reductions	tons PM10/year	0.01747	0.01707	0.01697	Calculated
Annual vehicle travel ROG reductions	tons ROG/year	0.1287	0.0930	0.0841	Calculated
11 - Ming Avenue and Belle Terrace (2 of 2)	Units	2030	2040	2045	Notes
Vehicle trips avoided per year	VMT/year	1,516,172	1,516,172	1,516,172	See VMT Reduction Calculations
Annual vehicle travel CO reductions	tons CO/year	1.667	1.328	1.277	Calculated
Annual vehicle travel NOx reductions	tons NOx/year	0.1153	0.0802	0.0738	Calculated
Annual vehicle travel SOx reductions	tons SOx/year	0.00502	0.00450	0.00443	Calculated
Annual vehicle travel PM2.5 reductions	tons PM2.5/year	0.00905	0.00838	0.00824	Calculated
Annual vehicle travel PM10 reductions	tons PM10/year	0.02654	0.02594	0.02579	Calculated
Annual vehicle travel ROG reductions	tons ROG/year	0.1955	0.1413	0.1277	Calculated
2 - Akers Road and McKee Road	Units	2030	2040	2045	Notes
Vehicle trips avoided per year	VMT/year	558,670	558,670	558,670	See VMT Reduction Calculations
Annual vehicle travel CO reductions	tons CO/year	0.614	0.489	0.470	Calculated
Annual vehicle travel NOx reductions	tons NOx/year	0.0425	0.0295	0.0272	Calculated

Annual vehicle travel SOx reductions	tons SOx/year	0.00185	0.00166	0.00163	Calculated
Annual vehicle travel PM2.5 reductions	tons PM2.5/year	0.00333	0.00309	0.00304	Calculated
Annual vehicle travel PM10 reductions	tons PM10/year	0.00978	0.00956	0.00950	Calculated
Annual vehicle travel ROG reductions	tons ROG/year	0.0721	0.0521	0.0471	Calculated
4 - Baker Street, King Street, and Lotus Lane (1 of 2)	Units	2030	2040	2045	Notes
Vehicle trips avoided per year	VMT/year	1,202,206	1,202,206	1,202,206	See VMT Reduction Calculations
Annual vehicle travel CO reductions	tons CO/year	1.322	1.053	1.012	Calculated
Annual vehicle travel NOx reductions	tons NOx/year	0.0914	0.0636	0.0585	Calculated
Annual vehicle travel SOx reductions	tons SOx/year	0.00398	0.00357	0.00351	Calculated
Annual vehicle travel PM2.5 reductions	tons PM2.5/year	0.00718	0.00664	0.00654	Calculated
Annual vehicle travel PM10 reductions	tons PM10/year	0.02105	0.02057	0.02045	Calculated
Annual vehicle travel ROG reductions	tons ROG/year	0.1550	0.1120	0.1013	Calculated
Total Air Pollutant Reductions	Units	2030	2040	2045	Notes
Vehicle trips avoided per year	VMT/year	5,379,655	5,379,655	5,379,655	See VMT Reduction Calculations
Annual vehicle travel CO reductions	tons CO/year	5.914	4.711	4.530	Calculated
Annual vehicle travel NOx reductions	tons NOx/year	0.4091	0.2844	0.2617	Calculated
Annual vehicle travel SOx reductions	tons SOx/year	0.01779	0.01598	0.01570	Calculated
Annual vehicle travel PM2.5 reductions	tons PM2.5/year	0.03211	0.02972	0.02924	Calculated
Annual vehicle travel PM10 reductions	tons PM10/year	0.09417	0.09203	0.09150	Calculated
Annual vehicle travel ROG reductions	tons ROG/year	0.6938	0.5014	0.4532	Calculated

References

- [1] City of Bakersfield. 2025. Active Transportation Plan. Available: <https://content.civicplus.com/api/assets/2b76078a-4623-4f32-bc87-d2726851c647>
- [2] US Department of Energy. 2024. FOTW #1333, March 11, 2024: In 2022 the Average Number of Occupants Per Trip for Household Vehicles in the United States Was 1.5. Available: <https://www.energy.gov/eere/vehicles/articles/fotw-1333-march-11-2024-2022-average-number-occupants-trip-household>.
- [3] California Air Resources Board. EMFAC Emission Inventory (Model Version: EMFAC 2021 v1.0.2). Available: <https://arb.ca.gov/emfac/emissions-inventory/0aab195e7474e6a66cebfa6ad29a71aed1cb5494>.

Additional Notes

GHG = greenhouse gas; MTCO2e = metric tons of carbon dioxide equivalent; CO = carbon monoxide; NOx = oxides of nitrogen; SOx = oxides of sulfur; PM2.5 = particulate matter with 2.5 micron diameter; PM10 = particulate matter with 10 micron diameter; ROG = reactive organic gases; VMT = vehicle miles traveled.

TDM-P-1**Vanpools**

The GHG and air pollutant reductions associated with Vanpools would result from reduced gasoline consumption from single-occupancy commute vehicles. Increasing the number of vanpools is a key VMT reduction strategy for Kern Council of Governments, with a target of 500 vanpools in the region. The calculations assume a target number of EV vanpools would be operating, and that these would replace the need for individuals to drive gasoline-powered vehicles for work commute trips. Cost calculations include the annual operating costs and infrastructure costs.

GHG Emissions Context

Scope and Sector Identifier	Detail
GHG Emissions Sector:	Transportation
GHG Emissions Sub-sector:	Passenger
Start year of implementation:	2030

Key Assumptions and Data Inputs

The calculation of vehicle travel reductions considers the reduction in gasoline-fueled vehicle travel, and the electricity required to charge replacement EVs. The calculations are based on a target number of EV vanpools and an estimate of the average commute distance.

Vehicle Travel Reductions	Units	2030	2040	2045	Notes
Target number of Vanpools	vehicles	50	50	50	Target number for measure implementation
Worker job distance	miles	50	50	50	[1] 21.5% of workers in Bakersfield commute longer than 50 miles one way to work
Work days per year	days/year	260	260	260	
Vanpool miles per year	miles/year	1,300,000	1,300,000	1,300,000	Calculated
Average number of riders per vanpool	persons	8	8	8	Assuming vanpool capacity is 10, and not full every day
Passenger vehicle miles reduced	miles/year	10,400,000	10,400,000	10,400,000	Calculated
Increased Electricity from EV Charging	Units	2030	2040	2045	Notes
Vanpool miles per year	miles/year	1,300,000	1,300,000	1,300,000	Target number for measure implementation

Estimated energy consumption of EV Vanpool	miles/kWh	2.9	2.9	2.9	[2]
Annual electricity consumption for EV charging	MWh/year	448	448	448	Calculated

GHG Emissions Reduction Calculations

The calculation of GHG reductions considers the emissions of a gasoline-fueled light-duty vehicles that is replace with an EV.

Electricity GHG Increase Calculations	Units	2030	2040	2045	Notes
Annual electricity consumption for EV charging	MWh/year	448	448	448	See Key Assumptions and Data Inputs
Local grid-supplied electricity GHG emissions factor (PG&E)	MTCO ₂ e/MWh	0.01720	0.00570	0.00000	Obtained from ABAU Projections, which considers GHG-free electricity rates consistent with SB 100 and SB 1020 [3]
GHG emissions increase from EV charging	MTCO ₂ e/year	8	3	0	Calculated
Vehicle Travel GHG Reduction Calculations	Units	2030	2040	2045	Notes
Passenger vehicle miles reduced	miles/year	10,400,000	10,400,000	10,400,000	See Key Assumptions and Data Inputs
Gasoline light-duty vehicle GHG emissions per mile	MTCO ₂ e/mile	0.000306	0.000275	0.000270	[4]
Annual vehicle travel GHG reductions	MTCO ₂ e/year	3,183	2,856	2,807	Calculated
Total reduction in GHG emissions	MTCO₂e	3,175	2,853	2,807	Calculated

Air Pollutant Reduction Calculations

The calculation of air pollutant reductions considers the emissions of a gasoline-fueled light-duty vehicles that is replace with an EV.

Vehicle Travel Air Pollutant Reduction Calculations	Units	2030	2040	2045	Notes
Passenger vehicle miles reduced	miles/year	10,400,000	10,400,000	10,400,000	See Key Assumptions and Data Inputs
Gasoline light-duty vehicle CO emissions per mile	tons CO/mile	1.10E-06	8.76E-07	8.42E-07	[4]
Gasoline light-duty vehicle NO _x emissions per mile	tons NO _x /mile	7.61E-08	5.29E-08	4.86E-08	[4]
Gasoline light-duty vehicle SO _x emissions per mile	tons SO _x /mile	3.31E-09	2.97E-09	2.92E-09	[4]
Gasoline light-duty vehicle PM _{2.5} emissions per mile	tons PM _{2.5} /mile	5.97E-09	5.52E-09	5.44E-09	[4]
Gasoline light-duty vehicle PM ₁₀ emissions per mile	tons PM ₁₀ /mile	1.75E-08	1.71E-08	1.70E-08	[4]
Gasoline light-duty vehicle ROG emissions per mile	tons ROG/mile	1.29E-07	9.32E-08	8.42E-08	[4]
Annual vehicle travel CO reductions	tons CO/year	11.432	9.107	8.758	Calculated
Annual vehicle travel NO _x reductions	tons NO _x /year	0.7909	0.5499	0.5060	Calculated
Annual vehicle travel SO _x reductions	tons SO _x /year	0.03440	0.03089	0.03036	Calculated

Annual vehicle travel PM2.5 reductions	tons PM2.5/year	0.06208	0.05746	0.05653	Calculated
Annual vehicle travel PM10 reductions	tons PM10/year	0.18206	0.17791	0.17690	Calculated
Annual vehicle travel ROG reductions	tons ROG/year	1.3413	0.9693	0.8762	Calculated

Cost Calculations

Costs calculations are based on monthly costs of operation and estimated capital costs of charging infrastructure.

Data Description	Units	Total	Notes
Monthly cost to operate 10-passenger EV vanpool	dollars/vehicle	\$ 1,375.00	[5]
Target number of Vanpools	vehicles	50	See Key Assumptions and Data Inputs
Annual Cost		\$825,000	Calculated
Average cost per EV charging port installation	dollars/charging port	\$ 74,831.68	[6][A]
Ratio of chargers to vehicles		1	Assuming Level 2 chargers are installed
Target number of Vanpools	vehicles	50	See Key Assumptions and Data Inputs
Capital Cost		\$3,741,584	Calculated

References

- [1] City of Bakersfield. 2022. Bakersfield General Plan Existing Conditions Background Report. Available: https://bakersfield2045.com/wp-content/uploads/2022/08/20-10096_BkrsfldGnrPln_BackgroundReport_PublicDraft.pdf.
- [2] EV Powered. 2024. Ford E-Transit review: Does Ford's electric van still have Britain's back?. Available: <https://evpowered.co.uk/electric-car-reviews/ford-e-transit-review-does-fords-electric-van-still-have-britains-back/>.
- [3] City of Bakersfield. 2025. Greenhouse Gas Emissions Inventory, Forecast and Targets for the City of Bakersfield. Found in Appendix C to SOAR Bakersfield.
- [4] California Air Resources Board. EMFAC Emission Inventory (Model Version: EMFAC 2021 v1.0.2). Available: <https://arb.ca.gov/emfac/emissions-inventory/0aab195e7474e6a66cebfa6ad29a71aed1cb5494>.
- [5] California Vanpool Authority. 2025. Cost Calculators. Available: <https://calvans.gov/cost-calculators>.
- [6] Caltrans and California Energy Commission. 2024. California's Deployment Plan for the National Electric Vehicle Infrastructure (NEVI) Program Annual Update. Available: <https://dot.ca.gov/-/media/dot-media/programs/esta/documents/transportation-electrification/nevi/2024-ca-nevi-plan-update-a11y.pdf>.

Additional Notes

[A] The average cost of a charger installation was calculated from the total number of charging ports and total proposed award amount from Table 5 of the 2024 California's Deployment Plan for the National Electric Vehicle Infrastructure (NEVI) Program Annual Update.

ABAU = legislative-adjusted business-as-usual; EV = electric vehicle; GHG = greenhouse gas; Wh = watt-hour; MWH = megawatt-hour; MTCO₂e = metric tons of carbon dioxide equivalent; SB = senate bill; CO = carbon monoxide; NO_x = oxides of nitrogen; SO_x = oxides of sulfur; PM_{2.5} = particulate matter with 2.5 micron diameter; PM₁₀ = particulate matter with 10 micron diameter; ROG = reactive organic gases.

AO-P-1**Alternative-Fueled and Zero-Emission City Equipment Fleet**

The GHG and air pollutant reductions associated with the Alternative-fueled and Zero-Emission City Equipment Fleet would result from reduced gasoline consumption. The City manages an array of fleet vehicles and equipment that are essential for City operations. Data on the specific types of off-road equipment the City has and potential replacements was not available at the time of these calculations, so the measure was quantified based on estimates for replacement of gasoline-fueled light-duty vehicles in the City's fleet with EVs. Cost calculations include the purchase price of EVs and associated charging infrastructure.

GHG Emissions Context

Scope and Sector Identifier	Detail
GHG Emissions Sector:	Transportation and Off-road Equipment
Start year of implementation:	2033

Key Assumptions and Data Inputs

The calculation of vehicle travel reductions considers the reduction in gasoline-fueled vehicle travel, and the electricity required to charge replacement EVs. The calculations are based on a target number of EVs and an estimate of the average annual mileage of a municipal fleet vehicle.

Vehicle Travel Reductions	Units	2040	2045	Notes
Target number of additional EVs purchased for City fleet	vehicles	200	200	Target number for measure implementation
Average annual mileage for a municipal fleet vehicle	miles/year/vehicle	9,100	9,100	[1]
Reduction in fossil-fueled vehicle mileage with EV replacements	miles/year	1,820,000	1,820,000	Calculated
Increased Electricity from EV Charging	Units	2040	2045	Notes
Target number of EVs purchased for City fleet	vehicles	200	200	Target number for measure implementation
Average energy consumption of electric vehicles	Wh/mile	309	309	[2]
Reduction in fossil-fueled vehicle mileage with EV replacements	miles/year	61,800	61,800	From Vehicle Travel Reductions
Annual electricity consumption for EV charging	MWh/year	19	19	Calculated

GHG Emissions Reduction Calculations

The calculation of GHG reductions considers the emissions of a gasoline-fueled light-duty vehicles that are replaced with EVs.

Electricity GHG Increase Calculations	Units	2040	2045	Notes
Annual electricity consumption for EV charging	MWh/year	19	19	See Key Assumptions and Data Inputs
Local grid-supplied electricity GHG emissions factor (PG&E)	MTCO ₂ e/MWh	0.00570	0.00000	Obtained from ABAU Projections, which considers GHG-free electricity rates consistent with SB 100 and SB 1020 [3]
GHG emissions increase from EV charging	MTCO ₂ e/year	0	0	Calculated
Vehicle Travel GHG Reduction Calculations	Units	2040	2045	Notes
Reduction in fossil-fueled vehicle mileage with EV replacements	miles/year	61,800	61,800	See Key Assumptions and Data Inputs
Gasoline light-duty vehicle GHG emissions per mile	MTCO ₂ e/mile	0.000275	0.000270	[4]
Annual vehicle travel GHG reductions	MTCO ₂ e/year	17	17	Calculated
Total reduction in GHG emissions	MTCO₂e	17	17	Calculated

Air Pollutant Reduction Calculations

The calculation of air pollutant reductions considers the emissions of a gasoline-fueled light-duty vehicles that are replaced with EVs.

Vehicle Travel Air Pollutant Reduction Calculations	Units	2040	2045	Notes
Average annual mileage for a municipal fleet vehicle	miles/year	61,800	61,800	See Key Assumptions and Data Inputs
Gasoline light-duty vehicle CO emissions per mile	tons CO/mile	8.76E-07	8.42E-07	[4]
Gasoline light-duty vehicle NO _x emissions per mile	tons NO _x /mile	5.29E-08	4.86E-08	[4]
Gasoline light-duty vehicle SO _x emissions per mile	tons SO _x /mile	2.97E-09	2.92E-09	[4]
Gasoline light-duty vehicle PM _{2.5} emissions per mile	tons PM _{2.5} /mile	5.52E-09	5.44E-09	[4]
Gasoline light-duty vehicle PM ₁₀ emissions per mile	tons PM ₁₀ /mile	1.71E-08	1.70E-08	[4]
Gasoline light-duty vehicle ROG emissions per mile	tons ROG/mile	9.32E-08	8.42E-08	[4]
Annual vehicle travel CO reductions	tons CO/year	0.054	0.052	Calculated
Annual vehicle travel NO _x reductions	tons NO _x /year	0.0033	0.0030	Calculated
Annual vehicle travel SO _x reductions	tons SO _x /year	0.00018	0.00018	Calculated
Annual vehicle travel PM _{2.5} reductions	tons PM _{2.5} /year	0.00034	0.00034	Calculated
Annual vehicle travel PM ₁₀ reductions	tons PM ₁₀ /year	0.00106	0.00105	Calculated
Annual vehicle travel ROG reductions	tons ROG/year	0.0058	0.0052	Calculated

Cost Calculations

Costs calculations are based on City's 2022 grant application for 5,500 AMIs, and only consider upfront costs.

Data Description	Units	Total	Notes
Average cost per light-duty EV	dollars/vehicle	\$ 57,245.00	[5]
Average cost per EV charging port installation	dollars/charging port	\$ 74,831.68	[6][A]
Ratio of chargers to vehicles		1	Assuming Level 2 chargers are installed
Target number of additional EVs purchased for City fleet	vehicles	200	Target number for measure implementation
Total cost of vehicles	dollars	11,449,000	Calculated
Number of chargers required	chargers	200	Calculated
Total cost of chargers	dollars	14,966,336	Calculated
Total Cost		\$26,415,336	Calculated

References

[1] City of Dallas. 2018. City of Dallas Fleet Management Study. Available:

<https://dallascityhall.com/departments/budget/financialtransparency/DCH%20Documents/FMS.pdf>.

[2] Electric Vehicle Database. 2025. Energy consumption of full electric vehicles. Available: <https://ev-database.org/imp/cheatsheet/energy-consumption-electric-car>.

[3] City of Bakersfield. 2025. Greenhouse Gas Emissions Inventory, Forecast and Targets for the City of Bakersfield. Found in Appendix C to SOAR Bakersfield.

[4] California Air Resources Board. EMFAC Emission Inventory (Model Version: EMFAC 2021 v1.0.2). Available: <https://arb.ca.gov/emfac/emissions-inventory/0aab195e7474e6a66cebfa6ad29a71aed1cb5494>.

[5] Kelley Blue Book. 2025. How Much Are Electric Cars?. Available: [https://www.kbb.com/car-advice/how-much-electric-car-cost/#:~:text=Electric%20vehicles%20\(EVs\)%20generally%20cost,4.2%25%20from%20a%20year%20ago](https://www.kbb.com/car-advice/how-much-electric-car-cost/#:~:text=Electric%20vehicles%20(EVs)%20generally%20cost,4.2%25%20from%20a%20year%20ago).

[6] Caltrans and California Energy Commission. 2024. California's Deployment Plan for the National Electric Vehicle Infrastructure (NEVI) Program Annual Update. Available: <https://dot.ca.gov/-/media/dot-media/programs/esta/documents/transportation-electrification/nevi/2024-ca-nevi-plan-update-a11y.pdf>.

Additional Notes

[A] The average cost of a charger installation was calculated from the total number of charging ports and total proposed award amount from Table 5 of the 2024 California's Deployment Plan for the National Electric Vehicle Infrastructure (NEVI) Program Annual Update.

ABAU = legislative-adjusted business-as-usual; EV = electric vehicle; GHG = greenhouse gas; Wh = watt-hour; MWH = megawatt-hour; MTCO₂e = metric tons of carbon dioxide equivalent; SB = senate bill; CO = carbon monoxide; NO_x = oxides of nitrogen; SO_x = oxides of sulfur; PM_{2.5} = particulate matter with 2.5 micron diameter; PM₁₀ = particulate matter with 10 micron diameter; ROG = reactive organic gases.

FH-P-1**California Inland Port**

The reduction in GHG and air pollutant emissions associated with California Inland Port are from the shift of freight from heavy-duty trucks to trains. This project will be a multi-decadal effort, requiring coordination across many stakeholders and governmental entities. The project is currently in the phase of conducting feasibility studies, and is not fully defined. However, preliminary GHG and air pollutant reductions potentials by county are available in the 2020 California Inland Port Feasibility Analysis. The GHG and air pollutant reduction potential is for the movement of freight to and from Kern County, and is not specific to the City of Bakersfield. As such, reductions for the City of Bakersfield boundary are overestimated.

Measure Context

Scope and Sector Identifier	Detail
GHG Emissions Sector:	Transportation
GHG Emissions Sub-sector:	Heavy-duty Vehicles
Start year of implementation:	2040

GHG and Air Pollutant Emissions Reductions Calculations [1]

The calculations of GHG and air pollutant reductions for the implementation of the California Inland Port are copied from the modeling performed for the 2020 California Inland Port Feasibility Analysis. These emissions reductions are for Kern County as a whole, and there is insufficient detail on the project to enable calculation of GHG emissions reductions for the City of Bakersfield only. As such, it may not be appropriate to subtract these reductions from the City of Bakersfield GHG inventory alone, and should be considered with total Kern County GHG emissions. Emissions and reductions are shown for movement of freight along key corridors, with the direction that freight is moved.

Emissions for Freight moved by Train	Units	NOx	SOx	VOC	PM10	CO	CO2e [A]
Exports from OAK (S-58 - I-580)	tons/year	3.95	0	0.10	0.06	1.02	361
Imports thru OAK (I-580 - S-58)	tons/year	0.39	0	0.01	0.01	0.10	35
Exports from LA/LB (S-58 - US-101)	tons/year	2.42	0	0.06	0.04	0.63	221
Imports thru LA/LB (US-101 - S-58)	tons/year	2.77	0	0.07	0.04	0.72	253
Emissions for Freight moved by Truck	Units	NOx	SOx	VOC	PM10	CO	CO2e [A]
Exports from OAK (S-58 - I-580)	tons/year	24.87	0.05	0.50	0.21	1.11	5,276
Imports thru OAK (I-580 - S-58)	tons/year	2.44	0.01	0.05	0.02	0.11	518
Exports from LA/LB (S-58 - US-101)	tons/year	15.24	0.03	0.31	0.13	0.68	3,233
Imports thru LA/LB (US-101 - S-58)	tons/year	17.44	0.04	0.35	0.15	0.78	3,699
Emissions Reductions from Measure	Units	NOx	SOx	VOC	PM10	CO	CO2e [A]
Exports from OAK (S-58 - I-580)	tons/year	20.92	0.05	0.40	0.15	0.09	4,915
Imports thru OAK (I-580 - S-58)	tons/year	2.05	0.01	0.04	0.01	0.01	482

Exports from LA/LB (S-58 - US-101)	tons/year	12.82	0.03	0.25	0.09	0.05	3,012
Imports thru LA/LB (US-101 - S-58)	tons/year	14.67	0.04	0.28	0.11	0.06	3,446
Total Reductions from Measure	tons/year	50.46	0.13	0.97	0.36	0.21	11,855

References

[1] San Joaquin Valley Regional Planning Agencies. 2020. California Inland Port Feasibility Analysis. Available: <https://sjvcogs.org/wp-content/uploads/2021/07/Attachment-1-CA-Inland-Port-FS-Phase-1-Report.pdf>.

Additional Notes

[A] CO₂e values are presented in metric tons, while air pollutant values are in short tons.

ABAU = legislative-adjusted business-as-usual; GHG = greenhouse gas; CO₂e = carbon dioxide equivalent; CO = carbon monoxide; PM₁₀ = particulate matter with 10 micron diameter; NO_x = oxides of nitrogen; VOC = volatile organic compounds; SO_x = oxides of sulfur.

RE-P-1**Continue and Expand Solar Installations at Residences**

The GHG reductions associated with Continue and Expand Solar Installations at Residences would result from a reduction in the consumption of grid-supplied electricity, which would be replaced with carbon-free renewable electricity. The Southeast Strong program, which was funded through the Transformative Climate Communities Implementation Grant, is currently being implemented by the City in partnership with CAPK, Kern Community College District, and GRID Alternatives. This program will install a total 282 kW of solar at 60 homes of low-income families in Bakersfield. The Continue and Expand Solar Installations at Residences expands this program with additional installations of solar at low-income households. The calculations consider the impacts of State legislation, namely SB 100 and SB 1020, on reducing the carbon-intensity of the statewide electricity supply. As such, the GHG reductions from the program go to zero in 2045; however, real and permanent GHG reductions would be achieved over time. The GHG reductions provide an annual snapshot for key target years. Air pollutant reductions are not quantified, as there may not be local air pollutant reductions from reducing the electricity supply. Cost calculations are based on costs for solar installations from the Transformative Climate Communities Round 5 Grant budget breakdown.

Measure Context

Scope and Sector Identifier	Detail
GHG Emissions Sector:	Building Energy
GHG Emissions Sub-sector:	Residential
GHG Emissions Sub-category	Electricity
Start year of implementation:	2033

Grid-supplied Electricity Reduction Calculation

The calculation of the reduction from grid-supplied electricity is based on estimates of potential electricity generation of installed solar arrays. The calculation of the installed solar capacity is based on the average rooftop solar installations from the Southeast Strong low-income solar installations estimates. This average is then applied to the additional number of households that would be covered under an expanded program.

Reduction in Grid-supplied Electricity	Units	2029	2040	2045	Notes
TCC Round 5 grant solar installation capacity	kW	282	-	-	[1]
TCC Round 5 grant number of homes with solar installed	homes	60	-	-	[1]
TCC Round 5 grant solar capacity installed per home	kW/home	4.7	-	-	Calculated
Target number of homes for expanded program	homes	-	200	200	Target number for measure implementation
Installed solar capacity with expanded program	kW	-	940	940	Calculated
Estimated annual electricity generation for expanded program	MWh/year	-	808	808	[2]

GHG Emissions Reductions Calculations

The calculation of GHG emission reductions considers the reduction in grid-supplied electricity due to installation of solar projects.

GHG Reduction Calculations	Units	2040	2045	Notes
Reduction in grid-supplied electricity consumption from rooftop solar installations	MWh/year	808	808	From Grid-supplied Electricity Reduction Calculation
Electricity consumption GHG emissions factor	MTCO ₂ e/MWh	0.0057	0.0000	Obtained from ABAU Projections, which considers GHG-free electricity rates consistent with SB 100 and SB 1020 [3]
GHG Reductions from rooftop solar installations	MTCO ₂ e/year	5	0	Calculated
Total GHG Emissions Reductions from Implementation	MTCO₂e/year	5	0	Calculated

Cost Calculations

The estimated cost of the expanded program is based on the cost of solar installations in the TCC Round 5 grant budget breakdown.

Cost calculations	Units	2029	2030	Notes
TCC Round 5 grant cost of solar installations	dollars	\$ 2,774,720	-	[1]
TCC Round 5 grant number of homes with solar installed	homes	60	-	[1]
TCC Round 5 grant solar capacity installed per home	dollars/home	\$ 46,245	\$ 46,245	Calculated
Target number of homes for expanded program	homes	-	200	Target number for measure implementation
Total Cost	dollars	-	\$ 9,249,067	Calculated

References

- [1] City of Bakersfield. 2025. Implementation of the Transformative Climate Communities Grant Program (Southeast Strong). Appendix C Page 70. Available: <https://pub-bakersfield.escribemeetings.com/filestream.ashx?DocumentId=12659>.
- [2] National Renewable Energy Laboratory. 2025. PVWatts Calculator. Available: <https://pvwatts.nrel.gov/pvwatts.php>.
- [3] City of Bakersfield. 2025. Greenhouse Gas Emissions Inventory, Forecast and Targets for the City of Bakersfield. Found in Appendix C to SOAR Bakersfield.

Additional Notes

ABAU = legislative-adjusted business-as-usual; GHG = greenhouse gas; kW = kilowatt; kWh = kilowatt-hour; MTCO₂e = metric tons of carbon dioxide equivalent; MW = megawatts; MWh = megawatt-hour; SB =senate bill; W = watts; TCC = Transformative Climate Communities.

BE-P-1**Continued and Expanded Low-Income Energy Efficiency Program**

The GHG reductions associated with Continue and Expand Low-Income Energy Efficiency Program would result from a reduction in the consumption of grid-supplied electricity and natural gas from home energy efficiency improvements. The Southeast Strong program, which was funded through the Transformative Climate Communities Implementation Grant, is currently being implemented by the City in partnership with CAPK, Kern Community College District, and GRID Alternatives. This program will perform weatherization and minor energy efficiency upgrades at 91 homes of low-income families in Bakersfield. Continue and Expand Low-Income Energy Efficiency Program expands this program with additional upgrades at low-income households. The calculations consider the impacts of State legislation, namely SB 100 and SB 1020, on reducing the carbon-intensity of the statewide electricity supply. As such, the GHG reductions from the program are lower as the percentage of renewables in grid-supplied electricity increases. The GHG reductions provide an annual snapshot for key target years. Air pollutant reductions are quantified based on the reduction in natural gas consumption from efficiency measures. Cost calculations are based on costs for solar installations from the Transformative Climate Communities Round 5 Grant budget breakdown.

Measure Context

Scope and Sector Identifier	Detail
GHG Emissions Sector:	Building Energy
GHG Emissions Sub-sector:	Residential
GHG Emissions Sub-category	Electricity
Start year of implementation:	2033

Energy Reduction Calculations

The calculation of the reduction from grid-supplied electricity and natural gas consumption in homes is based on the energy reduction of efficiency measures. The calculation uses the Local Energy Codes Cost-effectiveness Explorer tool to understand the energy reduction potential of specific measures for different building vintages in Bakersfield. It is estimated that energy-efficiency improvements will be focused on older and less efficient homes, so the energy reductions are estimated for building vintages that are pre-1978 and between 1978 and 1991, which are then averaged. The energy efficiency measures that are considered are intended to be lower cost, and less intensive upgrades. These are based on the intended efficiency measures of the current Southeast Strong Low-income Energy Efficiency Program.

Reduction in Grid-supplied Electricity and Natural Gas	Units	2040	2045	Notes
LED Lighting electricity savings (pre-1978-1991 vintage)	kWh/home/year	2	2	[1]
Air sealing electricity savings (pre-1978 vintage)	kWh/home/year	124	124	[1]
Air sealing electricity savings (1978-1991 vintage)	kWh/home/year	89	89	[1]
Air sealing electricity savings (average)	kWh/home/year	107	107	Calculated

Air sealing natural gas savings (pre-1978 vintage)	therms/home/year	12.9	12.9	[1]
Air sealing natural gas savings (1978-1991 vintage)	therms/home/year	7.9	7.9	[1]
Air sealing natural gas savings (average)	therms/home/year	10.4	10.4	Calculated
Target number of homes for expanded program	homes	400	400	Target number for measure implementation
Estimated annual electricity generation for expanded program	MWh/year	43	43	Calculated based on number of homes and average electricity savings for different vintages
Estimated annual electricity generation for expanded program	therms/year	4,160	4,160	Calculated based on number of homes and average natural gas savings for different vintages

GHG Emissions Reductions Calculations

The calculation of GHG emission reductions considers the reduction in grid-supplied electricity and natural gas from energy efficiency measures in homes.

Electricity GHG Reduction Calculations	Units	2040	2045	Notes
Reduction in grid-supplied electricity consumption from efficiency measures	MWh/year	43	43	From Energy Reduction Calculations
Electricity consumption GHG emissions factor	MTCO ₂ e/MWh	0.0057	0.0000	Obtained from ABAU Projections, which considers GHG-free electricity rates consistent with SB 100 and SB 1020 [2]
Electricity GHG Reductions from efficiency measures	MTCO ₂ e/year	0.2	0.0	Calculated
Natural Gas GHG Reduction Calculations	Units	2040	2045	Notes
Reduction in natural gas consumption from efficiency measures	therms/year	4,160	4,160	From Energy Reduction Calculations
Natural gas GHG emissions factor	MTCO ₂ e/therms	0.00548	0.00548	[2]
Natural Gas GHG Reductions from efficiency measures	MTCO ₂ e/year	22.8	22.8	Calculated
Total GHG Emissions Reductions from Implementation	MTCO ₂ e/year	23	23	Calculated

Air Pollutant Reductions Calculations

Calculation of air pollutant reductions from implementation of the measure are on the reduced natural gas combustion and air pollutant emissions factors from EPA.

Air Pollutant Reduction Factors	Units	2040	2045	Notes
NO _x emissions factor	lbs/mmcf	104	104	[3]
PM (2.5+10) emissions factor	lbs/mmcf	7.6	7.6	[3]
VOC emissions factor	lbs/mmcf	5.5	5.5	[3]

CO emissions factor	lbs/mmscf	84	84	[3]
SO2 emissions factor	lbs/mmscf	0.6	0.6	
1,4-Dichlorobenzene emissions factor	lbs/mmscf	0.0012	0.0012	[3]
Benzene emissions factor	lbs/mmscf	0.0021	0.0021	[3]
Formaldehyde emissions factor	lbs/mmscf	0.0750	0.0750	[3]
Natural gas reduction from measure implementation	mmscf	0.42	0.42	From Energy Reduction Calculations converted from therms to mmscf (i)
CAP Reductions	Units	2040	2045	Notes
NOx reductions	tons/year	0.022	0.022	Calculated (ii)
PM (2.5+10) reductions	tons/year	0.0016	0.0016	Calculated (ii)
VOC reductions	tons/year	0.0011	0.0011	Calculated (ii)
CO reductions	tons/year	0.017	0.017	Calculated (ii)
SO2 reductions	tons/year	0.00012	0.00012	Calculated (ii)
HAP Reductions	Units	2040	2045	Notes
1,4-Dichlorobenzene reductions	tons/year	2.50E-07	2.50E-07	Calculated (ii)
Benzene emissions reductions	tons/year	4.37E-07	4.37E-07	Calculated (ii)
Formaldehyde reductions	tons/year	1.56E-05	1.56E-05	Calculated (ii)

Cost Calculations

The estimated cost of the expanded program is based on the cost of solar installations in the TCC Round 5 grant budget breakdown.

Cost calculations	Units	2029	2030	Notes
TCC Round 5 grant cost of solar installations	dollars	\$ 1,712,827	-	[4]
TCC Round 5 grant number of homes with solar installed	homes	91	-	[4]
TCC Round 5 grant solar capacity installed per home	dollars/home	\$ 18,822	\$ 18,822	Calculated
Target number of homes for expanded program	homes	-	400	Target number for measure implementation
Total Cost	dollars	-	\$ 7,528,910	Calculated

Conversion Factors and Constants

Conversion/Constant	Units	Value
(i) Natural gas therms to mmscf conversion	mmscf/therm	1.00E-04
(ii) lbs to tons conversion	tons/lb	0.00050

References

- [1] California Energy Codes and Standards. 2025. Local Energy Cost Effectiveness Explorer. Available: <https://explorer.localenergycodes.com/>.
- [2] City of Bakersfield. 2025. Greenhouse Gas Emissions Inventory, Forecast and Targets for the City of Bakersfield. Found in Appendix C to SOAR Bakersfield.
- [3] US EPA. 2018. AP 42, Fifth Edition, Volume I Chapter 1: External Combustion Sources. Available: <https://www.epa.gov/air-emissions-factors-and-quantification/ap-42-fifth-edition-volume-i-chapter-1-external-0>.
- [4] City of Bakersfield. 2025. Implementation of the Transformative Climate Communities Grant Program (Southeast Strong). Appendix C Page 70. Available: <https://pub-bakersfield.escribemeetings.com/filestream.ashx?DocumentId=12659>.

Additional Notes

ABAU = legislative-adjusted business-as-usual; GHG = greenhouse gas; kWh = kilowatt-hour; MTCO₂e = metric tons of carbon dioxide equivalent; MWh = megawatt-hour; SB =senate bill; TCC = Transformative Climate Communities; CO = carbon monoxide; PM = particulate matter; NO_x = oxides of nitrogen; VOC = volatile organic compounds; mmscf = million standard cubic feet; lbs = pounds; CAP = criteria air pollutant; HAP = hazardous air pollutant; SP₂ = sulfur dioxide.

OW-P-1**Expanded Curbside Organic Pickup**

The reduction in GHG emissions associated with providing curbside organics pickup is from a reduction in landfilled organic waste from increased organics diversion. The Expanded Curbside Organic Pickup aims to continue to provide organics pickup to new homes and businesses as the City continues to grow. The City is currently providing curbside organics pickup for existing customers and has had success in increased organics diversion. The calculation of increased organics diversion for future growth is based on the increase in diversion between 2019 and 2022. 2022 is assumed to be the first year in which SB 1383 enforcement began, and as such the change between 2019 and 2022 provides an indicator of the increased diversion that could be achieved. It is worth noting that there is potential for double counting emissions reduced from this program between the GHG emissions forecast prepared for Bakersfield, as the forecast is based on 2022 diversion rates. Air pollutant reductions are calculated based on the percent reduction in waste GHG emissions for all of Kern County GHG emissions, and applying that GHG reduction to waste-related air pollutant sources. Rough cost estimates are calculated based on an increased number of curbside carts with population growth, and may over estimate costs, and these costs may not be borne by the City of Bakersfield, but by ratepayers.

Measure Context

Scope and Sector Identifier	Detail
GHG Emissions Sector:	Waste
GHG Emissions Sub-sector:	Solid Waste Disposal
Start year of implementation:	2026

Calculation of Increased Organics Diversion

The calculation of avoided methane emissions from continuing to expand the delivery of compost bins to new customers is based on estimates of the increased organics recycling rates the City achieved from implementation of SB 1383. The City experienced a substantial increase in composting between 2019 and 2022, with 2022 being the first year that SB 1383 organics recycling was enforced. Based on the increased organics recycling during this time period, it is assumed that the availability of curbside organics collection bins will achieve an increased diversion of organics. On a per-service population basis, the 2019 organics diversion is assumed as a business-as-usual scenario, the 2022 organics diversion is assumed as the implementation of the measure. The measure assumes that this increased diversion rate would only apply to new growth beyond 2022.

Organic waste data	Units	2019	2022	2030	2040	2045	Notes
Organics diversion in 2019 (pre-SB 1383 enforcement)	tons/year	102,958	-	-	-	-	Provided by City in 2022
Organics diversion in 2022 (post-SB 1383 enforcement)	tons/year	-	196,286	-	-	-	Provided by City in 2025
Bakersfield service population (population + employment)	SP	541,087	545,833	709,965	915,130	1,017,713	[1]

Organics diversion per service population (business-as-usual)	tons/SP	0.190	0.190	0.190	0.190	0.190	Based on pre-SB 1383 enforcement organics diversion (2019)
Organics diversion per service population (with implementation of curbside collection)	tons/SP	-	0.360	0.360	0.360	0.360	Based on post-SB 1383 enforcement organics diversion (2022)
Increase in organics diversion per service population (with implementation of curbside collection and SB 1383 enforcement)	tons/SP	-	0.169	0.169	0.169	0.169	Calculated
Increase in service population above 2022	SP	-	-	164,132	369,297	471,880	Based on post-SB 1383 enforcement organics diversion (2022)
Organics diversion through implementation of curbside pickup and SB 1383 enforcement for new customers	tons/year	-	-	27,792	62,532	79,903	Calculated

GHG Emissions Reductions Calculations

Calculation of GHG reductions considers both the direct reduction in landfill emissions from the diversion of organic waste, and the lifecycle emissions reduction from the beneficial reuse of compost resulting from the diversion of organic waste. The calculation of reduction in landfill emissions provides the reductions that would be consistent with the City's GHG emissions inventory boundary. However the additional emissions reductions from beneficial reuse show a more complete picture of the benefits of increased composting. Only the reductions in landfill emissions should be compared to the City's GHG emissions inventory. Emissions accounting methods are based on the total methane commitment of waste disposed in a given year.

Avoided landfill emissions	Units	2030	2040	2045	Notes
Organics diversion through implementation of curbside pickup and SB 1383 enforcement for new customers	tons/year	27,792	62,532	79,903	From Calculation of Increased Organics Diversion
Avoided landfill emissions factor	MTCO ₂ e /ton	0.33	0.33	0.33	[2]
Avoided landfill emissions	MTCO ₂ e /year	9,171	20,636	26,368	Calculated
Total composting emissions reductions	Units	2030	2040	2045	Notes
Organics diversion through implementation of curbside pickup and SB 1383 enforcement for new customers	tons/year	27,792	62,532	79,903	From Calculation of Increased Organics Diversion
Compost emissions reduction factor	MTCO ₂ e /ton	0.56	0.56	0.56	[2]

Avoided landfill and fertilizer emissions	MTCO ₂ e /year	15,564	35,018	44,745	Calculated
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Air Pollutant Reductions Calculations

Calculation of air pollutant reductions from implementation of the measure are based on the total air pollutants generated in Kern County from sources within the relevant sector (waste), and the GHG emissions reduced by the measures compared to total countywide GHG emissions. The GHG emissions from the measure are compared to countywide emissions to get a percent reduction of emissions from the relevant sector. This percent reduction is then applied to the air pollutant emissions from sources in the same sector. Only relevant air pollutants are included in the calculation.

Countywide GHG Emissions Projections (waste)	Units	2030	2040	2045	Notes
Total waste related GHG emissions in Kern County	MTCO ₂ e /year	529,495	618,849	661,617	[3]
GHG reductions from landfilled organics reduction	MTCO ₂ e /year	9,171	20,636	26,368	From GHG Emissions Reductions Calculations
% of total Kern County waste emissions reduced	percent	2%	3%	4%	Calculated
Countywide HAP Projections (waste)	Units	2030	2040	2045	Notes
Acetaldehyde	tons/year	58	61	63	[3]
Benzene	tons/year	13	13.77	14.06	[3]
Countywide CAP Projections (waste)	Units	2030	2040	2045	Notes
Ammonia	tons/year	53	56	57	[3]
Volatile Organic Compounds	tons/year	4,729.28	4,729.28	4,729.28	[3]
HAP Reductions	Units	2030	2040	2045	Notes
Acetaldehyde	tons/year	1.01	2.05	2.50	Calculated
Benzene	tons/year	0.226	0.46	0.56	Calculated
CAP Reductions	Units	2030	2040	2045	Notes
Ammonia	tons/year	0.92	1.88	2.29	Calculated
Volatile Organic Compounds	tons/year	82	158	188	Calculated

Cost Calculations

Costs account for only residential curbside carts and do not consider collection, based on the service population and an average household size. These costs are likely to occur in service fees, and not require additional capital costs.

Data Description	Units	2022	2030	2040	2045	Notes
Projected Population	population	404,321	533,907	695,889	776,880	[1]

Population increase above 2022	population	-	129,586	291,568	372,559	Calculated
Persons per household	persons/ household	-	3.1	3.1	3.1	[4]
Number of new carts needed for service	carts	-	41,802	94,054	120,180	Calculated
Cost per cart	dollars	-	\$ 145.00	\$ 145.00	\$ 145.00	[5]
Average annual number of carts	carts/year	-	5,225	5,225	5,225	Calculated
Annual Cost			\$ 757,660	\$ 757,660	\$ 757,660	Calculated
Cumulative Cost			\$ 6,061,281	\$ 13,637,858	\$ 17,426,147	Calculated

References

- [1] City of Bakersfield. 2025. Greenhouse Gas Emissions Inventory, Forecast and Targets for the City of Bakersfield. Found in Appendix C to SOAR Bakersfield.
- [2] California Air Resources Board. 2017.METHOD FOR ESTIMATING GREENHOUSE GAS EMISSION REDUCTIONS FROM DIVERSION OF ORGANIC WASTE FROM LANDFILLS TO COMPOST FACILITIES .Available: <https://ww2.arb.ca.gov/sites/default/files/classic/cc/waste/cerffinal.pdf>.
- [3] City of Bakersfield. 2025. Air Pollution Benefits Analysis. Found in Appendix F to SOAR Bakersfield.
- [4] Census Reporter. ND. City of Bakersfield. Available: <https://censusreporter.org/profiles/16000US0603526-bakersfield-ca/>.
- [5] ULINE. ND. ULINE Trash Cans with Wheels. Available: https://www.uline.com/BL_445/Uline-Trash-Cans-with-Wheels.

Additional Notes

ABAU = legislative-adjusted business-as-usual; GHG = greenhouse gas; MTCO₂e = metric tons of carbon dioxide equivalent.

WT-P-1**Renewable Energy at Treatment Plants**

The GHG reductions associated with Renewable Energy at Treatment Plants would result from a reduction in the consumption of grid-supplied electricity, which would be replaced with carbon-free renewable electricity. The Renewable Energy at Treatment Plants proposes to install solar arrays at the City's WWTP No. 2 and the 10-million gallon water interface tank and associated boosters. The calculation of GHG reductions assumes that each project would be sized at approximately 1 MW, which was estimated based on the cost proposal for the water tank solar project. The calculations consider the impacts of State legislation, namely SB 100 and SB 1020, on reducing the carbon-intensity of the statewide electricity supply. As such, the GHG reductions from the program go to zero in 2045; however, real and permanent GHG reductions would be achieved over time. The GHG reductions provide an annual snapshot for key target years. Air pollutant reductions are not quantified, as there may not be local air pollutant reductions from reducing the electricity supply. Cost calculations are not included here, as costs estimates from the City's 2025-26 Fiscal Year Proposed Budget.

Measure Context

Scope and Sector Identifier	Detail
GHG Emissions Sector:	Building Energy
GHG Emissions Sub-sector:	Water and Wastewater
GHG Emissions Sub-category	Electricity
Start year of implementation:	2027

Grid-supplied Electricity Reduction Calculation

The calculation of the reduction from grid-supplied electricity is based on estimates of potential electricity generation of installed solar arrays. There are two proposed systems that are quantified, 1) a solar array for water systems at the City's 10 million gallon interface tank and booster stations, and 2) a solar and battery storage microgrid at the City's WWTP No. 2. Data on the sizing of these proposed systems was not readily available at the time of these calculations, and as such was estimated. The sizing of the water systems solar array was estimated based on the estimated cost of the project, \$1.5M. It was estimated that the WWTP No.2 system would be similar cost and size, and uses the same assumptions for calculation of reduction in grid-supplied electricity.

Reduction in Grid-supplied Electricity	Units	2030	Notes
Projected cost of water systems solar project	dollars	\$ 1,500,000	[1]
2023 average cost per watt for utility ground mount solar installations	dollars/W	\$ 1.20	[2]
Inflation adjustment from 2023 to 2025 dollars	dollars/dollar	1.15	[3]
2023 average cost per watt for utility ground mount solar installations (inflation adjusted)	dollars/W	\$ 1.38	Calculated

Estimated sizing of solar project based on cost (rounded)	MW	1.0	Calculated [A]
Estimated annual electricity generation for a 1 MW ground mounted solar projects in Bakersfield	MWh	5,211	[4]

GHG Emissions Reductions Calculations

The calculation of GHG emission reductions considers the reduction in grid-supplied electricity due to installation of solar projects.

GHG Reduction Calculation - Water Project	Units	2030	2040	2045	Notes
Reduction in grid-supplied electricity consumption at water interface tank and boosters from installation of solar	MWh/year	5,211	5,211	5,211	From Grid-supplied Electricity Reduction Calculation
Electricity consumption GHG emissions factor	MTCO ₂ e/MWh	0.0172	0.0057	0.0000	Obtained from ABAU Projections, which considers GHG-free electricity rates consistent with SB 100 and SB 1020 [5]
GHG Reductions from installation of solar at water interface tank and boosters	MTCO ₂ e/year	90	30	0	Calculated
GHG Reduction Calculation - WWTP No. 2	Units	2030	2040	2045	Notes
Reduction in grid-supplied electricity consumption at WWTP No. 2 with installation of solar	MWh/year	5,211	5,211	5,211	From Grid-supplied Electricity Reduction Calculation
Electricity consumption GHG emissions factor	MTCO ₂ e/MWh	0.0172	0.0057	0.0000	Obtained from ABAU Projections, which considers GHG-free electricity rates consistent with SB 100 and SB 1020 [5]
GHG Reductions from installation of solar at WWTP No. 2	MTCO ₂ e/year	90	30	0	Calculated
Total GHG Emissions Reductions from Implementation	MTCO₂e/year	179	59	0	

References

- [1] City of Bakersfield. 2025. Fiscal Year 2025-26 Proposed Budget. Page 82. Available: <https://content.civicplus.com/api/assets/2ff73909-aac8-4a3b-b0b9-b23bf507cf43>.
- [2] National Renewable Energy Laboratory. 2025. Solar Installed System Cost Analysis. Available: <https://www.nrel.gov/solar/market-research-analysis/solar-installed-system-cost>.
- [3] US bureau of Labor Statistics. CPI Inflation Calculator. Available: https://www.bls.gov/data/inflation_calculator.htm
- [4] National Renewable Energy Laboratory. 2025. PVWatts Calculator. Available: <https://pvwatts.nrel.gov/pvwatts.php>.

[5] City of Bakersfield. 2025. Greenhouse Gas Emissions Inventory, Forecast and Targets for the City of Bakersfield. Found in Appendix C to SOAR Bakersfield.

Additional Notes

[A] The sizing estimate of 1 MW for a \$1.5M solar project was verified as a realistic estimate through review of data for solar projects installed in Kern County in 2024, through the Distributed Generation Interconnection Program Data, available at https://www.californiadgstats.ca.gov/downloads/#_nem_cids.

ABAU = legislative-adjusted business-as-usual; GHG = greenhouse gas; kWh = kilowatt-hour; MTCO₂e = metric tons of carbon dioxide equivalent; MW = megawatts; MWh = megawatt-hour; SB =senate bill; W = watts; WWTP = wastewater treatment plant

WE-P-1

Turf Replacement Program

The GHG reductions associated with the Turf Replacement Program would result from a reduced need for the supply of water to irrigation end uses. The Turf Replacement Program proposes to replace existing landscaping with drought tolerant and low water use vegetation and landscaping, as well as implementing efficient drip irrigation. The program is expected to reduce water demand by 5.4 million gallons per year. The calculation of GHG reductions assumes that any water use reduction would result in a reduced demand from imported water supplies. The calculations consider the impacts of State legislation, namely SB 100 and SB 1020, on reducing the carbon-intensity of the statewide electricity supply. As such, the GHG reductions from the program go to zero in 2045; however, real and permanent GHG reductions would be achieved over time. The GHG reductions provide an annual snapshot for key target years. Air pollutant reductions are not quantified, as there may not be local air pollutant reductions from reducing the electricity supply. Cost calculations are not included here, as costs were calculated by City Recreation and Parks staff.

GHG Emissions Context

Scope and Sector Identifier	Detail
GHG Emissions Sector:	Building Energy, Water Supply
GHG Emissions Sub-sector:	Electricity
Start year of implementation:	2027

Key Assumptions and Data Inputs

The calculation of a reduction in electricity use considers the various components of the water supply and how electricity use would be reduced from the need for imported water and local treatment and distribution. Data on energy intensity of the individual components of the City's local water supply (groundwater pumping, treatment, delivery) was not available. The energy intensity of groundwater pumping was derived from estimates for average energy intensity for the Tulare Lake hydrological region, and removed from the total energy intensity of the City of Bakersfield local water supply to estimate the energy intensity of treatment and distribution. Water reductions from implementation of the measure was provided by City of Bakersfield Recreation and Parks.

Water Supply Energy Reduction Calculations	Units	2030	2040	2045	Notes
City of Bakersfield total water supply energy intensity (excluding imported water from State Water Project)	kWh/MG	1,416	1,416	1,416	[1]
Groundwater pumping energy intensity in Tulare Lake Unit	kWh/MG	1,224	1,224	1,224	[2]
Estimated City of Bakersfield energy intensity for water supply treatment and distribution	kWh/MG	191	191	191	Calculated
Imported water supply energy intensity (State Water Project)	kWh/MG	1,614	1,614	1,614	[3]

Annual water savings from implementation of turf replacement program	MG/year	5.7496	5.7496	5.7496	Provided by City Recreation and Parks
Annual local water system energy savings from implementation of turf replacement program	kWh/year	1,099	1,099	1,099	Calculated
Annual imported water energy savings from implementation of turf replacement program	kWh/year	9,281	9,281	9,281	Calculated

GHG Emissions Reductions Calculations

The calculation of GHG emission is based on the total energy reduced from the water demand reduction calculated above. The different components of the water supply have different energy sources, and as such different GHG emissions implications. Accordingly, the GHG reduction calculations are separated by utility, where local energy use is assumed to have a GHG emissions profile consistent with PG&Es grid electricity, and imported water energy has an emissions profile consistent with the regional grid average (CAMX).

Water Supply GHG Reduction Calculations	Units	2030	2040	2045	Notes
Annual local water system energy savings from implementation of turf replacement program	kWh/year	1,099	1,099	1,099	See Key Assumptions and Data Inputs
Local grid-supplied electricity GHG emissions factor (PG&E)	MTCO ₂ e/MWh	0.01720	0.00570	0.00000	Obtained from ABAU Projections, which considers GHG-free electricity rates consistent with SB 100 and SB 1020 [4]
GHG emissions reductions from local water system	MTCO ₂ e/year	0.02	0.01	0.00	Calculated
Annual imported water energy savings from implementation of turf replacement program	kWh/year	9,281	9,281	9,281	See Key Assumptions and Data Inputs
Regional grid-supplied electricity GHG emissions factor (CAMX)	MTCO ₂ e/MWh	0.18190	0.02270	0.00000	Obtained from ABAU Projections, which considers GHG-free electricity rates consistent with SB 100 and SB 1020 [4]
GHG emissions reductions from imported water system	MTCO ₂ e/year	1.7	0.2	0.0	Calculated
Total reduction in GHG emissions	MTCO₂e/year	1.7	0.2	0.0	Calculated

References

- [1] City of Bakersfield. 2021. 2020 Urban Water Management Plan. Available: <https://content.civicplus.com/api/assets/c5b0009e-ea0e-4721-a4ee-fd716aab2659?cache=1800>.
- [2] California Public Utilities Commission. 2015. Water/Energy Cost-Effectiveness Analysis. Table 7.
- [3] California Department of Water Resources. 2016. State Water Project Energy Intensity of Water Supplies data portal. Available: <https://www.arcgis.com/apps/Style/index.html?appid=c112a21431884158b58fc5564e66c439>.

[4] City of Bakersfield. 2025. Greenhouse Gas Emissions Inventory, Forecast and Targets for the City of Bakersfield. Found in Appendix C to SOAR Bakersfield.

Additional Notes

ABAU = legislative-adjusted business-as-usual; GHG = greenhouse gas; kwh = kilowatt-hour; MWH = megawatt-hour; MTCO₂e = metric tons of carbon dioxide equivalent; SB = senate bill.

WE-P-2**City of Bakersfield Water Advanced Metering Infrastructure**

The GHG reductions associated with the City of Bakersfield Advanced Metering Infrastructure (AMI) would result from reduced water demand and reduced vehicle travel from manual meter readings. The AMI proposes to replace manually read water meters with AMI, allowing for better tracking of water consumption and leak detection across the City's water distribution system. The calculation of GHG reductions assumes that any water use reduction would result in a reduced demand from imported water supplies. The calculations consider the impacts of State legislation, namely SB 100 and SB 1020, on reducing the carbon-intensity of the statewide electricity supply. As such, the GHG reductions from the water demand reductions go to zero in 2045; however, real and permanent GHG reductions would be achieved over time. The GHG reductions provide an annual snapshot for key target years. Cost calculations are based on the assumptions of the City's grant application from 2022 for 5,500 AMIs.

GHG Emissions Context

Scope and Sector Identifier	Detail
GHG Emissions Sector:	Building Energy, Water Supply
GHG Emissions Sub-sector:	Electricity
Start year of implementation:	2029

Key Assumptions and Data Inputs

The calculation of a reduction in electricity use considers the various components of the water supply and how electricity use would be reduced from the need for imported water and local treatment and distribution. Data on energy intensity of the individual components of the City's local water supply (groundwater pumping, treatment, delivery) was not available. The energy intensity of groundwater pumping was derived from estimates for average energy intensity for the Tulare Lake hydrological region, and removed from the total energy intensity of the City of Bakersfield local water supply to estimate the energy intensity of treatment and distribution. Water demand and vehicle travel reductions were estimated from the City's 2022 grant application for 5,500 AMIs.

Water Supply Energy Reduction Calculations	Units	2030	2040	2045	Notes
City of Bakersfield total water supply energy intensity (excluding imported water from State Water Project)	kWh/MG	1,416	1,416	1,416	[1]
Groundwater pumping energy intensity in Tulare Lake Unit	kWh/MG	1,224	1,224	1,224	[2]
Estimated City of Bakersfield energy intensity for water supply treatment and distribution	kWh/MG	191	191	191	Calculated
Imported water supply energy intensity (State Water Project)	kWh/MG	1,614	1,614	1,614	[3]
Annual water savings per AMIs installed	MG/year/AMII	0.123	0.123	0.123	[4][A]

Total number of AMIs installed	AMIs	40,000	40,000	40,000	
Total water savings	MG/year	4,935	4,935	4,935	Calculated
Annual local water system energy savings from implementation of turf replacement program	kWh/year	943,108	943,108	943,108	Calculated
Annual imported water energy savings from implementation of turf replacement program	kWh/year	7,965,901	7,965,901	7,965,901	Calculated
Vehicle Travel Reductions	Units	2030	2040	2045	Notes
Annual miles driven per vehicle for manual meter readings	miles/year	1,416	1,416	1,416	Grant
Vehicles used per 1,000 meters	vehicles/1,000 meters	0.73	0.73	0.73	[4][B]
Number of AMIs installed	AMIs	40,000	40,000	40,000	
Annual miles reduced for manual meter readings through use of AMIs	miles/year	41,181	41,181	41,181	Calculated

GHG Emissions Reductions Calculations

The calculation of GHG emission is based on the total energy reduced from the water demand reduction and vehicle travel reduction calculated above. The different components of the water supply have different energy sources, and as such different GHG emissions implications. Accordingly, the GHG reduction calculations are separated by utility, where local energy use is assumed to have a GHG emissions profile consistent with PG&Es grid electricity, and imported water energy has an emissions profile consistent with the regional grid average (CAMX).

Water Supply GHG Reduction Calculations	Units	2030	2040	2045	Notes
Annual local water system energy savings from implementation of turf replacement program	kWh/year	943,108	943,108	943,108	See Key Assumptions and Data Inputs
Local grid-supplied electricity GHG emissions factor (PG&E)	MTCO ₂ e/MWh	0.01720	0.00570	0.00000	Obtained from ABAU Projections, which considers GHG-free electricity rates consistent with SB 100 and SB 1020 [5]
GHG emissions reductions from local water system	MTCO ₂ e/year	16	5	0	Calculated
Annual imported water energy savings from implementation of turf replacement program	kWh/year	7,965,901	7,965,901	7,965,901	See Key Assumptions and Data Inputs
Regional grid-supplied electricity GHG emissions factor (CAMX)	MTCO ₂ e/MWh	0.18190	0.02270	0.00000	Obtained from ABAU Projections, which considers GHG-free electricity rates consistent with SB 100 and SB 1020 [5]
GHG emissions reductions from imported water system	MTCO ₂ e/year	1,449	181	0	Calculated
Total annual water supply GHG emissions reductions	MTCO ₂ e/year	1,465	186	0	Calculated

Vehicle Travel GHG Reduction Calculations	Units	2030	2040	2045	Notes
Annual miles reduced for manual meter readings through use of AMIs	miles/year	41,181	41,181	41,181	See Key Assumptions and Data Inputs
Gasoline light-duty truck GHG emissions per mile	MTCO ₂ e/mile	0.000317	0.000280	0.000272	[6]
Annual vehicle travel GHG reductions	MTCO ₂ e/year	13	12	11	Calculated
Total reduction in GHG emissions	MTCO₂e	1,478	198	11	Calculated

Air Pollutant Reduction Calculations

The calculation of air pollutant reduction is based on the reduction in vehicle travel from the elimination of manual readings.

Vehicle Travel Air Pollutant Reduction Calculations	Units	2030	2040	2045	Notes
Annual miles driven per vehicle for manual meter readings	miles/year	41,181	41,181	41,181	See Key Assumptions and Data Inputs
Gasoline light-duty truck CO emissions per mile	tons CO/mile	1.80E-06	9.28E-07	8.19E-07	[6]
Gasoline light-duty truck NO _x emissions per mile	tons NO _x /mile	1.41E-07	5.90E-08	4.83E-08	[6]
Gasoline light-duty truck SO _x emissions per mile	tons SO _x /mile	3.42E-09	3.03E-09	2.95E-09	[6]
Gasoline light-duty truck PM _{2.5} emissions per mile	tons PM _{2.5} /mile	6.70E-09	5.87E-09	5.72E-09	[6]
Gasoline light-duty truck PM ₁₀ emissions per mile	tons PM ₁₀ /mile	1.88E-08	1.79E-08	1.77E-08	[6]
Gasoline light-duty truck ROG emissions per mile	tons ROG/mile	2.60E-07	1.33E-07	1.07E-07	[6]
Annual vehicle travel CO reductions	tons CO/year	0.074	0.038	0.034	Calculated
Annual vehicle travel NO _x reductions	tons NO _x /year	0.0058	0.0024	0.0020	Calculated
Annual vehicle travel SO _x reductions	tons SO _x /year	0.00014	0.00012	0.00012	Calculated
Annual vehicle travel PM _{2.5} reductions	tons PM _{2.5} /year	0.00028	0.00024	0.00024	Calculated
Annual vehicle travel PM ₁₀ reductions	tons PM ₁₀ /year	0.00077	0.00074	0.00073	Calculated
Annual vehicle travel ROG reductions	tons ROG/year	0.0107	0.0055	0.0044	Calculated

Cost Calculations

Costs calculations are based on City's 2022 grant application for 5,500 AMIs, and only consider upfront costs.

Data Description	Units	Total	Notes
Total cost for 5,500 AMIs	dollars	\$ 1,292,435.00	[4]
Estimate cost per AMI	dollars/AMI	\$ 234.99	Calculated
Number of AMIs to be installed	AMIs	40,000	Calculated
Total Cost		\$9,399,527	Calculated

References

[1] City of Bakersfield. 2021. 2020 Urban Water Management Plan. Available: <https://content.civicplus.com/api/assets/c5b0009e-ea0e-4721-a4ee-fd716aab2659?cache=1800>.

[2] California Public Utilities Commission. 2015. Water/Energy Cost-Effectiveness Analysis. Table 7.

[3] California Department of Water Resources. 2016. State Water Project Energy Intensity of Water Supplies data portal. Available: <https://www.arcgis.com/apps/Styler/index.html?appid=c112a21431884158b58fc5564e66c439>.

[4] City of Bakersfield. 2022. Proposal for Water and Energy Efficiency Grant (WEEG) Bakersfield Advanced Metering Infrastructure (AMI) Project.

[5] City of Bakersfield. 2025. Greenhouse Gas Emissions Inventory, Forecast and Targets for the City of Bakersfield. Found in Appendix C to SOAR Bakersfield.

[6] California Air Resources Board. EMFAC Emission Inventory (Model Version: EMFAC 2021 v1.0.2). Available: <https://arb.ca.gov/emfac/emissions-inventory/0aab195e7474e6a66cebfa6ad29a71aed1cb5494>.

Additional Notes

[A] The annual water savings per AMI was calculated per information in the grant application: 221.1 AF saved for a total of 5,500 AMIs, converted from acre-feet to million gallons.

[B] The annual vehicle miles traveled reduced was calculated per information in the grant application: 5,460 miles traveled annually for 4 light-duty trucks to perform manual readings on 5,500 meters.

ABAU = legislative-adjusted business-as-usual; AMI = Advanced Metering Infrastructure; GHG = greenhouse gas; kwh = kilowatt-hour; MWH = megawatt-hour; MTCO_{2e} = metric tons of carbon dioxide equivalent; SB = senate bill; CO = carbon monoxide; NO_x = oxides of nitrogen; SO_x = oxides of sulfur; PM_{2.5} = particulate matter with 2.5 micron diameter; PM₁₀ = particulate matter with 10 micron diameter; ROG = reactive organic gases.

KR-P-1**Kern River Parkway Plan Priority Projects**

The reduction of GHG emissions associated with land restoration is due to the ability of vegetation to sequester atmospheric carbon dioxide. The restoration of riparian areas through the planting of woody plants can provide increase the carbon sequestration values of these lands, as provided in COMET-Planner. Air pollutant reductions are not quantified for this measure and are expected to be small. Cost calculations are not included here, as they are available on page 91 of the Kern River Parkway Management Plan.

Measure Context

Scope and Sector Identifier	Detail
GHG Emissions Sector:	Land Use, Agriculture and Forestry
GHG Emissions Sub-sector:	Carbon sequestration
GHG Emissions Sub-category	Not Applicable
Start year of implementation:	2035

Key Assumptions and Data Inputs

Areas identified for restoration and enhancements	Units	2035-2045	Notes
KRP-3 Truxtun Lake Park Enhancements	acres	11.9	[1]
KRP-4 San Miguel Commemorative Grove Enhancements	acres	15.6	[1]
KRP-6 Bakersfield Environmental Study Area (BESA) Improvements	acres	290.7	[1]
KRP-8: Uplands Riparian Restoration	acres	15.1	[1]
Carbon sequestered for one acre of land restored (riparian restoration)	ton CO2/acre/year	1.00	[2]

GHG Emissions Reductions Calculations

Calculations consider the identified acreage of improvements and associated carbon sequestered per acre.

GHG Reduction Calculations	Units	2040	2050	Notes
KRP-3 Truxtun Lake Park Enhancements	MT CO2e/year	12	12	Calculated
KRP-4 San Miguel Commemorative Grove Enhancements	MT CO2e/year	16	16	Calculated
KRP-6 Bakersfield Environmental Study Area (BESA) Improvements	MT CO2e/year	291	291	Calculated

KRP-8: Uplands Riparian Restoration	MT CO2e/year	15	15	Calculated
Reduction in emissions from measure implementation	MTCO2e/year	333	333	Converted from tons to MT

References

[1] City of Bakersfield. 2024. Kern River Parkway Management Plan.

[2] USDA and Colorado State University. COMET-Planner (Version 3.1.2). Available: <http://comet-planner.com/>

Additional Notes

COMET = Carbon Management & Emissions Tool; GHG = greenhouse gas; MT = metric ton; MTCO2e = metric tons of carbon dioxide equivalent

UG-P-1**Central City and Citywide Tree Plan Pilot Projects**

The reduction of GHG emissions and air pollutants associated with tree planting are due to the tree's ability to sequester atmospheric carbon dioxide, filter air, and capture air pollutants on leaves. Calculation of GHG reductions associated with this measure assume that the planted trees increase the overall carbon stock of Bakersfield. The calculations are based on the estimated tree plantings for the seven Pilot Projects included in the 2024 Central City and Citywide Tree Plan, and average reductions from the My-Tree calculator. Estimated costs are available in Appendix G of the Tree Plan, and as such are not calculated here. The outputs of the My-Tree calculator for 20 of the trees included in the City's tree palette in the 2024 Central City and Citywide Tree Plan, and a summary of the tree palette are included below.

Measure Context

Sector Identifier	Detail
GHG Emissions Sector:	Natural and Working Lands
GHG Emissions Sub-sector:	Carbon sequestration
GHG Emissions Sub-category	Not Applicable
Start year of implementation:	2026

Key Assumptions and Data Inputs

Calculation of GHG and air pollutant reductions is based on the outputs of the My-Tree tool by i-tree for 20 tree types in the tree palette provided in Appendix A of the 2024 Central City and Citywide Tree Plan. Each of the tree types were entered into the My-Tree tool to estimate the carbon sequestration and air pollution reduction values per tree. These average values are then used to calculate estimated carbon sequestration and air pollutant reductions, for both the cumulative over a 20-year period after planting and the average annual values during the 20-year period.

Project Tree Planting Estimates [1]	Units	2030-2045	Notes
P-1 Truxton Avenue	trees	100	[1]
P-2 F Street	trees	55	[1]
P-3 Green Corridor 18th Street East Segment	trees	70	[1]
P4: Green Corridor 18th Street West Segment	trees	62	[1]
P-5 Mill Creek Park / Central Park	trees	82	[1]
P-6 New Downtown Urban Park (Harrell Square)	trees	30	[1]
P-7 Partnership project with Downtown Elementary	trees	13	[1]
Total all projects	trees	412	Calculated
iTree GHG Data	Units	2030-2045	Notes
Atmospheric CO2 sequestered for 20 trees	lbs CO2	20,963	Total over a 20-year period for 20 trees included in the City's tree palette [2]

Atmospheric CO2 sequestered for 20 trees	MT CO2	9.52	(i)
Number of trees	Total trees	20	Used to calculate an average for the 20 different types of trees included in the City's tree palette
CO2 sequestered over 20 years per tree	MT CO2/tree	0.476	Calculated
Number of years	years	20	Used to calculate annual average over the 20-year period
CO2 sequestered per year per tree	MT CO2/year/tree	0.024	Calculated
iTree Air Quality Data	Units	2030-2045	Notes
Carbon Monoxide removal for 20 trees	oz. CO	47	Total over a 20-year period [2]
Ozone removal for 20 trees	oz. O3	1,384	Total over a 20-year period [2]
Nitrogen Dioxide removal for 20 trees	oz. NO2	194	Total over a 20-year period [2]
Sulfur Dioxide removal for 20 trees	oz. SO2	3	Total over a 20-year period [2]
PM2.5 removal for 20 trees	oz. PM2.5	13	Total over a 20-year period [2]
Unit conversion from oz to ton	tons/oz	0.0000313	(ii)
Number of trees	Total trees	20	Used to calculate an average for the 20 different types of trees included in the City's tree palette
Carbon Monoxide removal per tree	tons CO/tree	0.00007	Calculated
Ozone removal per tree	tons O3/tree	0.00216	Calculated
Nitrogen Dioxide removal per tree	tons NO2/tree	0.00030	Calculated
Sulfur Dioxide removal per tree	tons SO2/tree	0.00000	Calculated
PM2.5 removal for per tree	tons PM2.5/tree	0.00002	Calculated
Number of years	years	20	Used to calculate annual average over the 20-year period
Carbon Monoxide removal per tree per year	tons CO/tree/year	0.0000037	Calculated
Ozone removal per tree per year	tons O3/tree/year	0.0001081	Calculated
Nitrogen Dioxide removal per tree per year	tons NO2/tree/year	0.0000152	Calculated
Sulfur Dioxide removal per tree per year	tons SO2/tree/year	0.0000002	Calculated
PM2.5 removal for per tree per year	tons PM2.5/tree/year	0.0000010	Calculated

GHG Emissions Reductions Calculations

The calculations of total GHG emissions reductions over 20 years and average annual GHG emissions reductions from implementation of projects.

Total Carbon Sequestered by Project - 20 years	Units	2030-2045	Notes
P-1 Truxton Avenue	MTCO2	48	Calculated from project tree total

P-2 F Street	MTCO2	26	Calculated from project tree total
P-3 Green Corridor 18th Street East Segment	MTCO2	33	Calculated from project tree total
P4: Green Corridor 18th Street West Segment	MTCO2	30	Calculated from project tree total
P-5 Mill Creek Park / Central Park	MTCO2	39	Calculated from project tree total
P-6 New Downtown Urban Park (Harrell Square)	MTCO2	14	Calculated from project tree total
P-7 Partnership project with Downtown Elementary	MTCO2	6	Calculated from project tree total
Total all projects	MTCO2	196	Calculated from project tree total
Annual Carbon Sequestered by Project	Units	2030-2045	Notes
P-1 Truxton Avenue	MTCO2/year	2.4	Calculated from project tree total
P-2 F Street	MTCO2/year	1.3	Calculated from project tree total
P-3 Green Corridor 18th Street East Segment	MTCO2/year	1.7	Calculated from project tree total
P4: Green Corridor 18th Street West Segment	MTCO2/year	1.5	Calculated from project tree total
P-5 Mill Creek Park / Central Park	MTCO2/year	2.0	Calculated from project tree total
P-6 New Downtown Urban Park (Harrell Square)	MTCO2/year	0.7	Calculated from project tree total
P-7 Partnership project with Downtown Elementary	MTCO2/year	0.3	Calculated from project tree total
Total all projects	MTCO2/year	9.8	Calculated from project tree total

Air Pollutant Reductions Calculations

The calculations of total air pollutant reductions over 20 years and average annual air pollutant reductions from implementation of projects.

Total Reduced Emissions by Project - 20 years	Units	2030-2045	Notes
Carbon Monoxide			
P-1 Truxton Avenue	tons CO	0.007	Calculated from project tree total
P-2 F Street	tons CO	0.004	Calculated from project tree total
P-3 Green Corridor 18th Street East Segment	tons CO	0.005	Calculated from project tree total
P4: Green Corridor 18th Street West Segment	tons CO	0.005	Calculated from project tree total
P-5 Mill Creek Park / Central Park	tons CO	0.006	Calculated from project tree total
P-6 New Downtown Urban Park (Harrell Square)	tons CO	0.002	Calculated from project tree total
P-7 Partnership project with Downtown Elementary	tons CO	0.001	Calculated from project tree total
Total all projects	tons CO	0.030	Calculated from project tree total
Ozone			
P-1 Truxton Avenue	tons O3	0.216	Calculated from project tree total
P-2 F Street	tons O3	0.119	Calculated from project tree total
P-3 Green Corridor 18th Street East Segment	tons O3	0.151	Calculated from project tree total
P4: Green Corridor 18th Street West Segment	tons O3	0.134	Calculated from project tree total

P-5 Mill Creek Park / Central Park	tons O3	0.177	Calculated from project tree total
P-6 New Downtown Urban Park (Harrell Square)	tons O3	0.065	Calculated from project tree total
P-7 Partnership project with Downtown Elementary	tons O3	0.028	Calculated from project tree total
Total all projects	tons O3	0.891	Calculated from project tree total
<i>Nitrogen Dioxide</i>			
P-1 Truxton Avenue	tons NO2	0.030	Calculated from project tree total
P-2 F Street	tons NO2	0.017	Calculated from project tree total
P-3 Green Corridor 18th Street East Segment	tons NO2	0.021	Calculated from project tree total
P4: Green Corridor 18th Street West Segment	tons NO2	0.019	Calculated from project tree total
P-5 Mill Creek Park / Central Park	tons NO2	0.025	Calculated from project tree total
P-6 New Downtown Urban Park (Harrell Square)	tons NO2	0.009	Calculated from project tree total
P-7 Partnership project with Downtown Elementary	tons NO2	0.004	Calculated from project tree total
Total all projects	tons NO2	0.125	Calculated from project tree total
<i>Sulfur Dioxide</i>			
P-1 Truxton Avenue	tons SO2	0.0004	Calculated from project tree total
P-2 F Street	tons SO2	0.0002	Calculated from project tree total
P-3 Green Corridor 18th Street East Segment	tons SO2	0.0003	Calculated from project tree total
P4: Green Corridor 18th Street West Segment	tons SO2	0.0002	Calculated from project tree total
P-5 Mill Creek Park / Central Park	tons SO2	0.0003	Calculated from project tree total
P-6 New Downtown Urban Park (Harrell Square)	tons SO2	0.0001	Calculated from project tree total
P-7 Partnership project with Downtown Elementary	tons SO2	0.0001	Calculated from project tree total
Total all projects	tons SO2	0.0016	Calculated from project tree total
<i>PM2.5</i>			
P-1 Truxton Avenue	tons PM2.5	0.0020	Calculated from project tree total
P-2 F Street	tons PM2.5	0.0011	Calculated from project tree total
P-3 Green Corridor 18th Street East Segment	tons PM2.5	0.0014	Calculated from project tree total
P4: Green Corridor 18th Street West Segment	tons PM2.5	0.0013	Calculated from project tree total
P-5 Mill Creek Park / Central Park	tons PM2.5	0.0017	Calculated from project tree total
P-6 New Downtown Urban Park (Harrell Square)	tons PM2.5	0.0006	Calculated from project tree total
P-7 Partnership project with Downtown Elementary	tons PM2.5	0.0003	Calculated from project tree total
Total all projects	tons PM2.5	0.0084	Calculated from project tree total
Annual Air Pollutant Reductions by Project	Units	2030-2045	Notes
<i>Carbon Monoxide</i>			
P-1 Truxton Avenue	tons CO/year	0.0004	Calculated from project tree total

P-2 F Street	tons CO/year	0.0002	Calculated from project tree total
P-3 Green Corridor 18th Street East Segment	tons CO/year	0.0003	Calculated from project tree total
P4: Green Corridor 18th Street West Segment	tons CO/year	0.0002	Calculated from project tree total
P-5 Mill Creek Park / Central Park	tons CO/year	0.0003	Calculated from project tree total
P-6 New Downtown Urban Park (Harrell Square)	tons CO/year	0.0001	Calculated from project tree total
P-7 Partnership project with Downtown Elementary	tons CO/year	0.0000	Calculated from project tree total
Total all projects	tons CO/year	0.0015	Calculated from project tree total
<i>Ozone</i>			
P-1 Truxton Avenue	tons O3/year	0.011	Calculated from project tree total
P-2 F Street	tons O3/year	0.006	Calculated from project tree total
P-3 Green Corridor 18th Street East Segment	tons O3/year	0.008	Calculated from project tree total
P4: Green Corridor 18th Street West Segment	tons O3/year	0.007	Calculated from project tree total
P-5 Mill Creek Park / Central Park	tons O3/year	0.009	Calculated from project tree total
P-6 New Downtown Urban Park (Harrell Square)	tons O3/year	0.003	Calculated from project tree total
P-7 Partnership project with Downtown Elementary	tons O3/year	0.001	Calculated from project tree total
Total all projects	tons O3/year	0.045	Calculated from project tree total
<i>Nitrogen Dioxide</i>			
P-1 Truxton Avenue	tons NO2/year	0.002	Calculated from project tree total
P-2 F Street	tons NO2/year	0.001	Calculated from project tree total
P-3 Green Corridor 18th Street East Segment	tons NO2/year	0.001	Calculated from project tree total
P4: Green Corridor 18th Street West Segment	tons NO2/year	0.001	Calculated from project tree total
P-5 Mill Creek Park / Central Park	tons NO2/year	0.001	Calculated from project tree total
P-6 New Downtown Urban Park (Harrell Square)	tons NO2/year	0.000	Calculated from project tree total
P-7 Partnership project with Downtown Elementary	tons NO2/year	0.000	Calculated from project tree total
Total all projects	tons NO2/year	0.006	Calculated from project tree total
<i>Sulfur Dioxide</i>			
P-1 Truxton Avenue	tons SO2/year	0.00002	Calculated from project tree total
P-2 F Street	tons SO2/year	0.00001	Calculated from project tree total
P-3 Green Corridor 18th Street East Segment	tons SO2/year	0.00001	Calculated from project tree total
P4: Green Corridor 18th Street West Segment	tons SO2/year	0.00001	Calculated from project tree total
P-5 Mill Creek Park / Central Park	tons SO2/year	0.00002	Calculated from project tree total
P-6 New Downtown Urban Park (Harrell Square)	tons SO2/year	0.00001	Calculated from project tree total
P-7 Partnership project with Downtown Elementary	tons SO2/year	0.00000	Calculated from project tree total
Total all projects	tons SO2/year	0.00008	Calculated from project tree total

PM2.5			
P-1 Truxton Avenue	tons PM2.5/year	0.00010	Calculated from project tree total
P-2 F Street	tons PM2.5/year	0.00006	Calculated from project tree total
P-3 Green Corridor 18th Street East Segment	tons PM2.5/year	0.00007	Calculated from project tree total
P4: Green Corridor 18th Street West Segment	tons PM2.5/year	0.00006	Calculated from project tree total
P-5 Mill Creek Park / Central Park	tons PM2.5/year	0.00008	Calculated from project tree total
P-6 New Downtown Urban Park (Harrell Square)	tons PM2.5/year	0.00003	Calculated from project tree total
P-7 Partnership project with Downtown Elementary	tons PM2.5/year	0.00001	Calculated from project tree total
Total all projects	tons PM2.5/year	0.00042	Calculated from project tree total

Total Annual Reductions for Forecast Years

Total annual reductions of GHG and air pollution reductions summary.

Data Description	Units	2030	2040	2045	Notes
Carbon Sequestered	MTCO2/year	9.8	9.8	9.8	
Carbon Monoxide Reductions	tons CO/year	0.0015	0.0015	0.0015	
Ozone Reductions	tons O3/year	0.045	0.045	0.045	
Nitrogen Dioxide Reductions	tons NO2/year	0.006	0.006	0.006	
Sulfur Dioxide Reductions	tons SO2/year	0.00008	0.00008	0.00008	
PM2.5 Reductions	tons PM2.5/year	0.00042	0.00042	0.00042	

Conversion Factors and Constants

Conversion/Constant	Units	Value
(i) lbs to MT conversion	MT	0.00045
(ii) oz to ton conversion	t	3.1E-05

References

[1] City of Bakersfield. 2024. Central City and Citywide Tree Plan.

[2] i-Tree Planting tool: OurTrees Scorecard. Available: <https://mytree.itreetools.org/#/benefits/individual>. See Output below.

Additional Notes

CO2 = carbon dioxide; GHG = greenhouse gas; lbs = pounds; MT = metric tons; MTCO2 = metric tons of carbon dioxide; oz. = ounces; CO = carbon monoxide; O3 = ozone; NO2 = nitrogen dioxide; SO2 = sulfur dioxide; PM2.5 = particulate matter with 2.5 micron diameter.

Table 6: Urban Tree Palette Summary



Table 6. Urban Tree Palette Summary

#	Scientific Name	Common Name	Suitable Location	Water Needs*
1	Acer rubrum 'October Glory'	October Glory Red Maple	ALL	💧💧
2	Cinnamomum camphora	Camphor	M, PW, P	💧💧
3	Cercis reniformis 'Oklahoma'	Oklahoma Redbud	ALL	💧
4	Cedrus deodara	Deodar Cedar	M, PW, P	💧
5	Geijera Parviflora	Australian Willow	ALL	💧💧
6	Ginkgo Biloba 'Autumn Gold'	Ginkgo 'Autumn Gold'	M, PW, P	💧💧
7	Ginkgo Biloba 'Saratoga'	Ginkgo 'Saratoga'	ALL	💧💧
8	Jacaranda Mimosifolia	Jacaranda	ALL	💧💧
9	Koelrueteria Bipinnata	Goldenrain	M, PW, P	💧💧
10	Lagerstroemia Indica	Crape Myrtle	ALL	💧
11	Olea Europaea 'Swan Hill'	Fruitless Olive	ALL	💧
12	Pinus Eldarica	Mondell Pine	M, PW, P	💧
13	Pinus Taeda 'Nana'	Nana Loblolly Pine	M, PW, P	💧💧
14	Pistacia Chinensis 'Keith Davey' or 'Red Push'	Chinese Pistache	ALL	💧
15	Platanus Acerifolia 'Bloodgood'	London Plane	M, PW, P	💧💧
16	Quercus Agrifolia	Coast Live Oak	M, PW, P	💧
17	Quercus Chrysolepis	Canyon Live Oak	M, PW, P	💧
18	Quercus Ilex	Holly Oak	M, PW, P	💧
19	Quercus Lobata	Valley Oak	M, PW, P	💧
20	Quercus Suber	Cork Oak	M, PW, P	💧
21	Quercus Virginiana	Southern Live Oak	M, PW, P	💧💧
22	Umbellularia Californica	California Bay Laurel	M, PW, P	💧💧
23	Ulmus Parvifolia	Chinese Evergreen Elm 'Allee'	ALL	💧💧
24	Zelkova Serrata	Sawleaf Zelkova	ALL	💧💧

*Reflects Water Use Classification of Landscape Species (WUCOLS) designation of very low, low, and moderate water needs. No listed tree has high water needs.

Key: M (medians) PW (developed street parkways) P (developed park areas) PPS (public and private spaces in the Central City) ALL (M PW P PPS)



Now

20 Years



Benefits

Equivalents

MyTree Benefits



Tree Collection Totals, ()

Serving Size: 20 trees

Expected i-Tree benefits

over 20 years: \$4,820.76

Discover benefits of all your [community trees!](#)

Carbon Dioxide Uptake \$4,535.76

Carbon Sequestered¹ 20,963.4 lbs

CO₂ Equivalent² 76,865.8 lbs

Storm Water Mitigation \$86.34

Runoff Avoided 9,661.68 gal

Rainfall Intercepted 108,764.3 gal

Air Pollution Removal \$198.66

Carbon Monoxide 46.99 oz

Ozone 1,383.62 oz

Nitrogen Dioxide 193.59 oz

Sulfur Dioxide 2.51 oz

PM_{2.5} 13.1 oz

Benefit estimates are based on USDA Forest Service research and are meant for guidance only. Visit [www.itreetools.org](#) to learn more.

See the Project Menu for currency conversions.

► [Read the fine print](#)

UG-P-2**City Tree Program**

The reduction of GHG emissions and air pollutants associated with a City Tree Program are due to the increased ability to sequester atmospheric carbon dioxide and filter air and capture air pollutants on leaves for mature trees. Calculation of GHG reductions associated with this measure assume that a City Tree Program will increase the City's capacity to maintain the health its urban forest, thereby reducing the mortality of mature trees that provide higher levels of carbon sequestration and air pollutant removal. The calculations are based on a increased survivorship of urban tree. Estimated costs are available on page 74 of the Tree Plan, and as such are not calculated here.

Measure Context

Sector Identifier	Detail
GHG Emissions Sector:	Natural and Working Lands
GHG Emissions Sub-sector:	Carbon sequestration
GHG Emissions Sub-category	Not Applicable
Start year of implementation:	2031

GHG Emissions Reductions Calculations

The calculation of GHG reduction potential is based on a potential increase in carbon sequestration rates associated with reduced mortality in mature trees from stronger stewardship and maintenance practices. The calculation uses estimates of the City of Bakersfield urban tree canopy cover to estimate annual carbon sequestration rates. A potential increase in carbon sequestration rates is based on an improved tree survivorship rate from published values in literature reviews and case studies. A 6 year tree age is used for comparison across studies.

Carbon Sequestration Potential	Units	2031-2045	Notes
Estimated total urban tree canopy City of Bakersfield	square km	20.2	[1] [A]
Mean urban tree survivorship rate at 6 year tree age	tree survivorship	68.0	[2][B]
Mean urban tree survivorship rate at 6 year tree age with strong stewardship practices	tree survivorship	95.4	[3][C]
Increase in tree survivorship with strong stewardship practices	percent increase	40%	Calculated
Urban tree net carbon sequestration rate (mortality considered), business-as-usual	kg C/m ² /year	0.107	[4] Sequestration rate for Los Angeles, CA
Urban tree net carbon sequestration rate, with strong stewardship practices	kg C/m ² /year	0.150	Calculated
Unit conversion from kg C/m ² to MT C/km ²	MT C/km ² per kg C/m ²	1,000	(i)

Business-as-usual City of Bakersfield urban tree net carbon sequestration	MT C/year	2,161	Calculated
Strong stewardship practices City of Bakersfield urban tree net carbon sequestration	MT C/year	3,032	Calculated
Increase in net carbon sequestration with strong stewardship practices	MT C/year	871	Calculated
MT of Carbon Dioxide per MT of Carbon	MTCO ₂ /MT C	3.7	44/12 Molecular weight conversion
Increase in net carbon dioxide sequestration with strong stewardship practices	MTCO ₂ /year	3,193	Calculated

Air Pollutant Reductions Calculations

The calculation of air pollutant reductions relies on the same key assumption of the GHG reduction calculations; an reduced tree mortality will increase the number of mature trees that can provide air pollutant removals. These calculations are based on the estimated urban tree canopy of the City of Bakersfield.

Air Pollutant Removal	Units	2031-2045	Notes
Carbon Monoxide removal rate	g CO/m ² /year	14.3	[5] Removal for Fresno, CA
Ozone removal rate	g O ₃ /m ² /year	5.1	[5] Removal for Fresno, CA
Nitrogen Dioxide removal rate	g NO ₂ /m ² /year	1.6	[5] Removal for Fresno, CA
Sulfur Dioxide removal rate	g SO ₂ /m ² /year	0.6	[5] Removal for Fresno, CA
PM ₁₀ removal	g PM ₁₀ /m ² /year	6.7	[5] Removal for Fresno, CA
Unit conversion from grams to tons	tons/gram	0.0000011	(ii)
Unit conversion from m ² to km ²	km ² /m ²	0.0000010	(iii)
Increase in removal due to strong stewardship practices	percent increase	40%	See calculations in "Carbon Sequestration Potential"
Increase in Carbon Monoxide removal rate w/ strong stewardship practices	tons CO/km ² /year	6.4	Calculated
Increase in Ozone removal rate w/ strong stewardship practices	tons O ₃ /km ² /year	2.3	Calculated
Increase in Nitrogen Dioxide rate removal w/ strong stewardship practices	tons NO ₂ /km ² /year	0.7	Calculated
Increase in Sulfur Dioxide rate removal w/ strong stewardship practices	tons SO ₂ /km ² /year	0.3	Calculated
Increase in PM ₁₀ removal rate w/ strong stewardship practices	tons PM ₁₀ /km ² /year	3.0	Calculated
Estimated total urban tree canopy City of Bakersfield	square km	20.2	[1] [A]

Annual Carbon Monoxide removal w/ strong stewardship practices	tons CO/year	128	Calculated
Annual Ozone removal w/ strong stewardship practices	tons O3/year	46	Calculated
Annual Nitrogen Dioxide removal w/ strong stewardship practices	tons NO2/year	14	Calculated
Annual Sulfur Dioxide removal w/ strong stewardship practices	tons SO2/year	5.4	Calculated
Annual PM10 removal w/ strong stewardship practices	tons PM10/year	60	Calculated

Total Annual Reductions for Forecast Years

Total annual reductions of GHG and air pollution reductions summary.

Data Description	Units	2040	2045	Notes
Carbon Sequestered	MTCO2/year	3,193	3,193	
Carbon Monoxide Reductions	tons CO/year	128	128	
Ozone Reductions	tons O3/year	46	46	
Nitrogen Dioxide Reductions	tons NO2/year	14	14	
Sulfur Dioxide Reductions	tons SO2/year	5.4	5	
PM10 Reductions	tons PM10/year	60	60	

Conversion Factors and Constants

Conversion/Constant	Units	Value
(i) kg C/m2 to MT C/km2 conversion	MT C/km2	1000
(ii) g to ton conversion	t/g	1.1E-06
(iii) m2 to km2 conversion	km2/m2	1.0E-06

References

- [1] Google. 2025. Environmental Insights Explorer, Bakersfield, Tree Canopy. Available: <https://insights.sustainability.google/places/ChIJDcuUuchr6oARyHT-mAkMNIk/trees?ty=2023&hl=en-US>
- [2] Hilbert et. al.. 2019. Urban Tree Mortality: A Literature Review. Available: https://www.fs.usda.gov/nrs/pubs/jrnl/2019/nrs_2019_hilbert_001.pdf.
- [3] Roman et. al.. 2015. Stewardship matters: Case studies in establishment success of urban trees. Available: <https://canopy.org/wp-content/uploads/Roman-et-al-2015-article.pdf>.
- [4] Nowak et. al.. 2013. Carbon storage and sequestration by trees in urban and community areas of the United States. Available: https://www.fs.usda.gov/nrs/pubs/jrnl/2013/nrs_2013_nowak_001.pdf.

[5] Nowak et. al.. 2006. Air pollution removal by urban trees and shrubs in the United States. Available: https://www.itreetools.org/documents/55/UFUG_Air_Pollution_Removal.pdf.

Additional Notes

[A] Tree canopy data for the City of Bakersfield included some orchards and agricultural lands in the calculation of total tree canopy. To account for this the following Census tracts were removed from the total tree canopy area: 06029003221 and 06029003220.

[B] Estimated tree survivorship rates were provided for various conditions and tree ages in Appendix Table 4 of Hilbert et.al. 2019. For this analysis, the average of the high and low values from Middle-of-the-road survivorship for trees aged 6 years were used. The age of 6 years was used for comparability with other studies.

[C] The Roman et. al. study reported tree survivorship rates under strong stewardship condition case studies for up to 6 year age trees. The lowest value for survivorship reported in the case studies was used for calculations of increased survivorship.

CO₂ = carbon dioxide; GHG = greenhouse gas; lbs = pounds; MT = metric tons; MTCO₂ = metric tons of carbon dioxide; oz. = ounces; CO = carbon monoxide; O₃ = ozone; NO₂ = nitrogen dioxide; SO₂ = sulfur dioxide; PM₁₀ = particulate matter with 10 micron diameter; m² = square meter; km² = square kilometer.