Appendices

Appendix D: GHG Inventory and Forecast Methodology

Envision PALMDALE 2045
a **complete** community

GHG Inventory and Forecast Methodology

2017 Communitywide GHG Emissions Inventory

The Palmdale 2017 communitywide emissions inventory was developed in accordance with the ICLEI U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions.[1] It considers emissions that are contained in both the City's physical boundaries and under its jurisdictional control and focuses on the three GHGs most relevant to local government policymaking: carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O) expressed as metric tons of carbon dioxide equivalent. These gases comprise a large majority of GHG emissions at the community level. Inventory sectors include residential and nonresidential electricity and natural gas, on-road and off-road transportation, water and wastewater, and solid waste.

The inventory is an estimate based on the best available data. Table 1.1 shows the data sources for each sector.

Table 1.1 2017 Communitywide Emissions Inventory Data Sources by Sector

Sector	Subsector	Data Source
Residential Energy	Electricity	Southern California Edison
	Natural Gas	Southern California Gas Company
Nonresidential Energy	Electricity	Southern California Edison
	Natural Gas	Southern California Gas Company
On-Road Transportation		City of Palmdale origin-destination transportation model (2017)
Off-Road Transportation		California Air Resources Board OFFROAD2007 Model
Water and Wastewater		2005 and 2010 Palmdale Water District (PWD) and LA County Waterworks District 40 (LACWD 40) Urban Water Management Plans (UWMPs)
Solid Waste	Landfilled Waste	CalRecycle

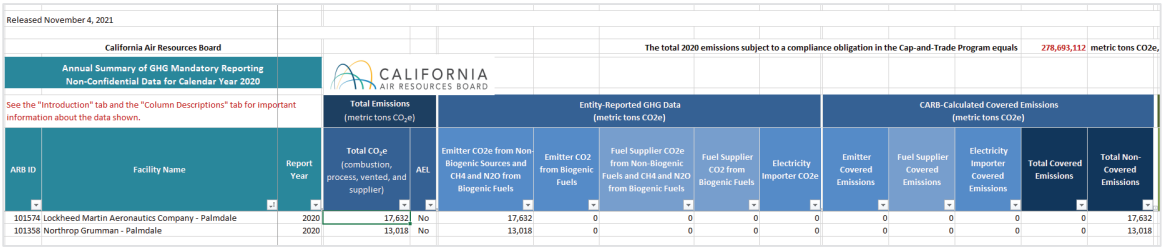
The inventory does not account for natural gas-related emissions generated by nonresidential facilities that are not under the control of the city. These facilities include but are not limited to Northrop Grumman, Lockheed Martin, and Plant 42. The inventory was not able to obtain energy use data for these facilities since the nonresidential sector in Palmdale is dominated by a few large users

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

of natural gas, the2017 data may have been “masked” due to aggregation laws. This explanation would suggest that only partial data was provided for 2017 to protect user privacy, which results in an incomplete picture of community natural gas use and associated emissions in the inventory.

However, The Northrop Grumman and Lockheed Martin facilities in Palmdale are required to report their emissions to the California Air Resources Board (CARB) per SB 32 SCR-and-trade requirements and are thus not included as part of Palmdale’s community inventory. See Figure 1.1 for more detailed CARB reporting. Similarly, Plant 42 is under Federal jurisdiction so emissions from on-site facilities have been omitted from the inventory.

Figure 1.1 2021 CARB Reporting



Released November 4, 2021

California Air Resources Board — The total 2020 emissions subject to a compliance obligation in the Cap-and-Trade Program equals 278,693,112 metric tons CO2e,

Annual Summary of GHG Mandatory Reporting
Non-Confidential Data for Calendar Year 2020

CALIFORNIA AIR RESOURCES BOARD

See the "Introduction" tab and the "Column Descriptions" tab for important information about the data shown.

			Total Emissions (metric tons CO_2e)		Entity-Reported GHG Data (metric tons CO2e)					CARB-Calculated Covered Emissions (metric tons CO2e)				
ARB ID	Facility Name	Report Year	Total CO_2e (combustion, process, vented, and supplier)	AEL	Emitter CO2e from Non-Biogenic Sources and CH4 and N2O from Biogenic Fuels	Emitter CO2 from Biogenic Fuels	Fuel Supplier CO2e from Non-Biogenic Fuels and CH4 and N2O from Biogenic Fuels	Fuel Supplier CO2 from Biogenic Fuels	Electricity Importer CO2e	Emitter Covered Emissions	Fuel Supplier Covered Emissions	Electricity Importer Covered Emissions	Total Covered Emissions	Total Non-Covered Emissions
101574	Lockheed Martin Aeronautics Company - Palmdale	2020	17,632	No	17,632	0	0	0	0	0	0	0	0	17,632
101358	Northrop Grumman - Palmdale	2020	13,018	No	13,018	0	0	0	0	0	0	0	0	13,018

Source: California Air Resources Board 2021.

Furthermore, the 2017 community inventory process updated aspects of the City’s previous inventory to be consistent with the latest 100-year global warming potential (GWP) values published in the Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report (AR5).[2] It also added water and wastewater for a more complete picture of community GHG emissions. Future inventories will follow this same methodology.

GHG Emissions Forecast

A GHG emissions forecast estimates future GHG emission changes by accounting for projected community growth as defined by Palmdale’s General Plan Update. The forecast is built off the 2017 communitywide GHG emissions forecast and thus includes the same sectors and facilities.

Calculating the difference between the GHG emissions forecast and GHG emissions reduction targets set by a jurisdiction determines the gap in GHG emissions that needs to be closed through the

[2] According to the United States Environmental Protection Agency (USEPA), the GWP was developed to allow comparisons of the global warming impacts of different gases. Specifically, it is a measure of how much energy the emissions of one ton of a gas will absorb over a given period of time, relative to the emissions of one ton of carbon dioxide (USEPA 2017; https://www.epa.gov/ghgemissions/understanding-global-warming-potentials.)

implementation of local GHG reduction policies as outlined in the CAP. Two forecast scenarios were developed for Palmdale out to horizon year 2045:

- Business-as-usual scenario- Provides a forecast of how future GHG emissions would change if consumption trends continued as they did in 2017 and growth were to occur as projected in the City's General Plan, absent any regulations that would reduce local emissions.
- Legislative adjusted scenario- Provides a forecast of how currently adopted legislation would reduce GHG emissions from the business-as-usual scenario. The legislative adjusted scenario represents the state's contribution to reducing local GHG emissions to meet state goals.

The adjusted forecast incorporates the impact of state regulations that provide GHG emission reduction potential to offer a more accurate picture of future GHG emissions growth and the responsibility of the City for GHG emissions reduction. The state legislation included in the adjusted forecast result in GHG emissions reduction related to transportation, building efficiency and renewable electricity.

GHG Reduction Target Implications

The City of Palmdale CAP includes the following GHG emissions targets:

- Reduce GHG emissions to 40% below 1990 levels by 2030 (SB 32 target year)
- Achieve carbon neutrality by 2045 (EO B-55-18 target year)

The equivalent 1990 GHG emission levels are derived by comparing the State's GHG emissions from relevant sources from given year to the statewide GHG emission in 1990, using relevant GHG emission sectors. This assumes that GHG emissions in the City of Beverly hills have generally scaled with the State's GHG emissions, as vehicle fuel economy standards, waste reduction policies, and increased renewable energy procurement would have similar effects in the City as they did statewide. For the state minimum targets presented here, the State's GHG emissions in 2005 were compared to 1990, with the agricultural GHG emission sector excluded. This showed that 2005 State GHG emissions levels were approximately 15% less than 1990 levels, and as such the City's 2005 GHG emission levels are also assumed to be 15% less than 1990 levels.

The above GHG reduction analysis presented in the CAP and in more detailed in Appendix C shows that Palmdale can reduce its fair share of emissions and achieve the SB 32 target of a 40% reduction by 2030. As a result, Palmdale's CAP can be considered a Qualified Plan under CEQA. The concept of having a "qualified" CAP means that a CAP meets the criteria specified in CEQA Guidelines Section 15183.5(b) for a plan for the reduction of greenhouse gas emissions, such that a "qualified" CAP may then be used for the specific purpose of streamlining the analysis of GHG emissions in subsequent projects. Local governments have discretion on what levels or targets are established in a "qualified" CAP, provided they address adopted policies and are based on substantial evidence.

To be sure, the CAP reduction analysis is based on the 2017 inventory and ABAU forecast, which do not include a full accounting of nonresidential natural gas use. As a result, nonresidential natural gas is not included in the reduction analysis that meets the SB 32 target. Thus, the nonresidential facilities above are not included in the CAP and will not be able to take advantage of any CEQA streamlining provided by CAP implementation.

GHG Reduction Table

The table below shows the detailed greenhouse gas reductions that the City can achieve by implementing the mitigation strategies and actions in the CAP. It also shows the participation assumptions and level of effort needed to achieve the associated reductions for each strategy based on the GHG reduction model. For example, to achieve the GHG reductions associated with the electrification strategy, 35% of existing residential and nonresidential buildings within the city have transitioned to all-electric in 2035 and 56% by 2045 and the annual number of dwelling units or buildings transitioning is 1,225 units and 65 nonresidential buildings.

Table 1.2 Projected GHG Reduction Results

Strategy	Assumptions	Cumulative Participation Rate 2035	Cumulative Participation Rate 2045	Annual Participation	*GHG Reductions MTCO2e 2030 (CEQA)*	GHG Reductions MTCO2e 2035	GHG Reductions MTCO2e 2045
Buildings + Energy							
Electrification	**Voluntary:** assume 2.5% annual participation rate	35%	56%	1,225 dwelling units 65 nonresidential buildings	*41,717*	68,094	71,420
Reach code	**Mandatory:** assume 100% participation	100%	100%		*2,368*	2,321	1,082
Energy efficiency retrofits	**Voluntary:** assume 2.5% annual participation	35%	57%	625 dwelling units 65 nonresidential buildings	*27,286*	43,157	89,023
Retro-commissioning	**Voluntary:** assume 2.5% annual participation of non-residential and	31%	20-46%	530 dwelling units 65 nonresidential buildings	*5,863*	8,224	12,815

Strategy	Assumptions	Cumulative Participation Rate 2035	Cumulative Participation Rate 2045	Annual Participation	*GHG Reductions MTCO2e 2030 (CEQA)*	GHG Reductions MTCO2e 2035	GHG Reductions MTCO2e 2045
	multifamily buildings						
EPIC (CCA)	Assume 75%-100% RE	75% carbon free	100% carbon free		*160,438*	132,020	0
Local solar installations	**Voluntary:** assume 2.5% annual participation	35%	56%	1,010 dwelling units 65 nonresidential buildings	*4,999*	3,828	0
Transportation + Land Use							
EV adoption	**Voluntary:** assume achievement of EV Blueprint Goals		3% of county population, 1% of vehicles	1,010 vehicles	*44,386*	53,049	68,719
Mode split	**Voluntary:** assume achievement of bike and ped plan goals	Carpool: 19% Transit: 7% Walk/Bike: 4%	Carpool: 20% Transit: 10% Walk/Bike: 5%		*41,356*	58,054	88,836
Materials + Consumption							
Organics diversion	**Mandatory:** SB 1383 compliance	75% reduction	75% reduction		*5,293*	5,552	5,034
Natural Systems + Water Resources							
Tree planting	**Voluntary**			40 trees	*37*	44	58
Water efficiency	**Voluntary:** assume 2.5% annual participation	25%	55%	1,225 dwelling units 65 nonresidential buildings	*1,174*	763	0
Total Reductions (MTCO2e)					*334,917*	*375,107*	*336,987*
Forecasted ABAU emissions					*813,355*	*753,932*	*706,943*
Remaining ABAU emissions					*478,438*	*378,825*	*369,956*

Strategy	Assumptions	Cumulative Participation Rate 2035	Cumulative Participation Rate 2045	Annual Participation	*GHG Reductions MTCO2e 2030 (CEQA)*	GHG Reductions MTCO2e 2035	GHG Reductions MTCO2e 2045
1990 % Reduction					***-40%***	**-52%**	**-53%**

GHG Reduction Calculator Data Sources

Emissions forecast: Raimi + Associates. 2017 Communitywide GHG Emissions Inventory. (Updated 2022).

Demographic data: Raimi + Associates. Palmdale General Plan Update Preferred Alternative. (Updated 2022).

Clean Energy

Avg. DC system size (kW): NREL PVWatts Calculator default value:
https://pvwatts.nrel.gov/pvwatts.php

Annual kWh generated by PV: NREL PVWatts Calculator default value:
https://pvwatts.nrel.gov/pvwatts.php

% homes using natural gas: California Residential Building Electrification Market Assessment
https://www.ethree.com/wp-content/uploads/2019/04/E3_Residential_Building_Electrification_in_California_April_2019.pdf

Avg. Building size: California Residential Building Electrification Market Assessment
https://www.ethree.com/wp-content/uploads/2019/04/E3_Residential_Building_Electrification_in_California_April_2019.pdf

Avg. appliance efficiencies: https://rael.berkeley.edu/wp-content/uploads/2017/07/Raghavan-Wei-Kammen-WaterHeating-_-ENergyPolicy-2017.pdf

Energy savings of retrocommissioning and solar installation: CEC Options for Energy Efficiency in Existing Buildings

Energy Savings of nonresidential retrofits: *Advanced Energy Retrofit Guides*
https://www.pnnl.gov/main/publications/external/technical_reports/PNNL-20814.pdf,
https://www.pnnl.gov/main/publications/external/technical_reports/PNNL-20761.pdf

Energy Savings of residential retrofits: CEC Large Scale Residential Retrofit Program
https://ww2.energy.ca.gov/2017publications/CEC-500-2017-009/CEC-500-2017-009.pdf.

EPIC emissions factor: Starting in 2030, assume 75% carbon neutral electricity estimated as 25% of current emissions factor for electricity

Buildings

Commercial building assumptions: A Look at the U.S. Commercial Building Stock: Results from EIA's 2012 Commercial Buildings Energy Consumption Survey (CBECS) https://www.eia.gov/consumption/commercial/reports/

SCE emissions factor: Raimi + Associates. 2017 Communitywide GHG Emissions Inventory. (Updated 2022).

SoCalGas emissions factor: Raimi + Associates. 2017 Communitywide GHG Emissions Inventory. (Updated 2022).

Transportation

EV Fuel assumptions: Hybrid and Plug-In Electric Vehicle Emissions Data Sources and Assumptions https://afdc.energy.gov/vehicles/electric_emissions.html

Number and Types of EVs in Los Angeles County: California Plug-In Electric Vehicle Infrastructure Projections: 2017-2025 https://www.nrel.gov/docs/fy18osti/70893.pdf

VMT per trip: Los Angeles County 2016 EMFAC model

Current mode split: US Census Bureau.

VMT: Provided by Parsons for General Plan Update preferred alternative

Mode split estimates: Provided by Parsons for General Plan EIR mitigation measures

Waste

Tonnage data: CalRecycle

Sequestration

Annual CO2 accumulation per Tree: CAPCOA Quantifying Greenhouse Gas Mitigation Measures