APPENDIX B
TECHNICAL APPENDIX

Appendix B – Technical Appendix

This appendix provides the details, assumptions, and methodologies used in the technical and quantitative analysis performed to complete Pasadena's CAP.

B.1 2009 GHG Emissions Inventory

Data for the 2009 baseline was taken from the City of Pasadena GHG Inventory adopted by City Council November 18, 2013. The 2009 baseline GHG emissions levels for transportation were calculated using CACP, the predecessor to the EMFAC software. Therefore, to provide a consistent methodology across past and future GHG inventories and account for GHG reductions from transportation-related state regulations in 2020 and 2035, the 2009 transportation baseline was updated using EMFAC2014[1]. In addition, updated growth rates from the General Plan (2015) were used for estimating BAU forecasts in the CAP. Because of these updates, the 2009 baseline total as well as the 2020 and 2035 forecast totals presented herein do not match the total GHGs reported in the City of Pasadena GHG Emissions Inventory (November 2013). **Table B.1** below shows the values as presented in the City of Pasadena GHG Inventory verses the CAP.

TABLE B.1: DATA UPDATED FROM GHG INVENTORY

MT CO_2e	GHG Inventory (2013)	CAP (2017)
2009 Transportation Emissions	1,062,681	1,054,901
2009 Communitywide Emissions	2,052,701	2,044,921
2020 BAU Forecast	2,186,122	1,987,226
2035 BAU Forecast	2,367,191	2,147,294

B.2 2013 GHG Emissions Inventory

Pasadena's 2013 GHG Inventory was developed as part of the City of Pasadena General Plan EIR adopted by City Council on July 14, 2015. The 2013 inventory was modified to match the methodology of the 2009 baseline inventory to allow for a comparison of Pasadena's change in emissions between 2009 and 2013. Modifications to the 2013 community-wide emissions inventory presented in the General Plan EIR included removing the wastewater and off-road sectors as these sectors were not included in the 2009 baseline inventory, removing double-counting of electricity emissions associated with water delivery, and recalculating solid waste emissions following the methodology in the 2009 inventory. In addition, the forecasting methodology used in the General Plan EIR is not consistent with the standard practice forecasting methodology used for CAPs. Therefore, the 2013 GHG emissions total as well as the 2035 forecast total presented herein do not match those reported in the City of Pasadena General Plan EIR (July 2015). **Table B.2** below shows the values as presented in the City of Pasadena General Plan EIR verses the CAP.

[1] CARB, 2015b

TABLE B.2: DATA UPDATED FROM GENERAL PLAN EIR

MT CO_2e	General Plan EIR (2013)	CAP (2017)
2013 Residential Energy Emissions	290,660	286,759
2013 Commercial Energy Emissions	497,823	495,897
2013 Municipal Energy Emissions	22,278	22,186
2013 Solid Waste Emissions	3,880	24,616
2013 Communitywide Emissions	1,854,908	1,857,280
2035 BAU Forecast	2,411,872	2,147,294

B.3 Business-as-Usual Forecast

The City of Pasadena business-as-usual forecast provides an estimate of how GHG emissions would change in the years 2020, 2035, and 2050 if consumption trends and efficiencies continue as they did in 2013, absent any new regulations that would reduce local emissions. Several indicator growth rates were developed and applied to the various sectors to project future year emissions. **Table B.3** displays the demographic data which was used to calculate growth rates and forecast GHG emissions.

TABLE B.3: DEMOGRAPHIC DATA USED FOR GHG EMISSIONS FORECASTS

Demographics	2013[1]	2020[2]	2035[3]	2050[4]
Population	135,938	143,508	161,180	147,163-167,453
Households	59,641	63,004	70,864	64,449-72,061
Employment	111,348	121,411	146,141	161,074-176,107
VMT	5,591,328	5,951,831	6,804,532	7,042,498-7,069,866

1 Data for 2013 represents build-out capacities in the City of Pasadena General Plan[2]
2 Data for 2020 was interpolated between 2013 and 2035 build-out capacities in the City of Pasadena General Plan
3 Data for 2035 represents build-out capacities in the City of Pasadena General Plan
4 Data for 2050 is presented as a range, as forecasting out to the year 2050 is inherently uncertain at this time. The ranges presented herein are based on a compilation of data including the City of Pasadena General Plan, Southern California Association of Governments[3], California Department of Finance[4], and CARB EMFAC2014.

The growth rates were applied to the 2013 emissions inventory data to obtain projected emissions in 2020, 2035, and 2050. **Table B.4** displays the growth rates (and their data sources) that were applied to each sector.

[2] City of Pasadena, 2015a
[3] SCAG, 2012; SCAG 2015
[4] California Department of Finance, 2014

TABLE B.4: GROWTH RATES BY SECTOR

Sector	Growth Rate	Source
Residential Energy	Population	U.S. Census[1], SCAG[2]
Commercial/Industrial Energy	Employment	SCAG
Transportation	Vehicle Miles Travelled	Fehr & Peers[3]
Solid Waste	Population	U.S. Census, SCAG
Water Consumption	Population	U.S. Census, SCAG

1 City of Pasadena, 2015b
2 SCAG, 2012; SCAG, 2015
3 City of Pasadena, 2015b

B.4 Adjusted Forecast

Since 2013, a number of federal and State regulations have been enacted that would reduce Pasadena's GHG emissions in 2020, 2035, and 2050. The impact of these regulations was quantified and incorporated into an adjusted forecast to provide a more accurate picture of future emissions growth and the responsibility of the City and community once State regulations to reduce GHG emissions have been implemented. **Table B.5** summarizes the local reduction that will result from and be quantified for each State regulation that will reduce local emissions in 2020, 2035 and 2050, and is followed by a brief description of each regulation and the methodology used to calculate associated reductions. As shown in the table below, these State regulations will reduce Pasadena's business-as-usual GHG emissions by approximately 315,292 MT CO_2e in 2020, 871,166 MT CO_2e in 2035 and 951,532-1,029,760 MT CO_2e in 2050.

TABLE B.5: SUMMARY OF GHG EMISSIONS REDUCTIONS FROM STATE REGULATIONS IN 2020, 2035, AND 2050

State Measure	2020 Reduction (MT CO_2e)	2035 Reduction (MT CO_2e)	2050 Reduction (MT CO_2e)
Pavley I Clean Car Standards (AB 1493) & Advanced Clean Car Standards	-75,074	-303,683	-360,632 – -365,104
Title 24	-10,867	-29,436	-37,708 – -60,434
Renewables Portfolio Standard	-221,840	-533,139	-548,710 – -599,122
Water Conservation Act of 2009 (SB X7-7)	-6,211	-3,526	-3,220 – -3,664
Construction & Demolition Waste Diversion Ordinance	-1,299	-1,382	-1,262 – -1,436
Total Reduction from State Regulations	**-315,292**	**-871,166**	**-951,532 – -1,029,760**

Note: California's 2017 Climate Change Scoping Plan was adopted in December 2017, following completion of the GHG reduction calculations from State Measures detailed above. As such, reductions associated with State regulations presented in the 2017 Climate Change Scoping Plan have not been quantified. GHG reductions from State Regulations for the year 2030 were interpolated between the calculated 2020 and 2035 values in the table above.

Pavley I Clean Car Standards (AB 1493) and Advanced Clean Cars

Signed into law in 2002, AB 1493 (Pavley I standard) requires vehicle manufactures to reduce GHG emissions from new passenger vehicles and light trucks from 2009 through 2016. Regulations were adopted by the CARB in 2004 and took effect in 2009 when the U.S. Environmental Protection Agency (EPA) issued a waiver confirming California's right to implement the bill. CARB anticipates that the Pavley I standard will reduce GHG emissions from new California passenger vehicles by about 22 percent in 2012 and about 30 percent in 2016, while simultaneously improving fuel efficiency and reducing motorists' costs.[5]

In January 2012, CARB approved the Advanced Clean Cars program which coordinates the goals of the Low Emissions Vehicles, Zero Emissions Vehicles, and Clean Fuels Outlet programs combining the control of smog, soot causing pollutants and GHG emissions into a single coordinated package of requirements for model years 2017 to 2025. The new standards will reduce GHG emissions by 34% in 2025.[6]

Reductions in GHG emissions from the above referenced standards were calculated using CARB's EMFAC2014 model for Los Angeles County. The newly updated EMFAC2014 model integrates the estimated reductions into the mobile source emissions portion of the model.[7] As shown in **Table B.5**, the combined efficiency gains resulting from California's suite of mobile efficiency measures would reduce vehicle related emissions by 75,074 MT CO_2e in 2020, 303,683 MT CO_2e in 2035, and between 360,632-365,104 MT CO_2e in 2050.

Title 24

Although it was not originally intended specifically to reduce GHG emissions, California Code of Regulations Title 24, Part 6: California's Energy Efficiency Standards for Residential and Nonresidential Buildings, was first adopted in 1978 in response to a legislative mandate to reduce California's energy consumption, which in turn reduces fossil fuel consumption and associated GHG emissions. The standards are updated periodically to allow consideration and possible incorporation of new energy-efficient technologies and methods. The updates that have occurred since the 2013 inventory year and, therefore, were not included in the business-as-usual forecast, include the 2013 and 2016 Title 24 Energy Efficiency Standards. For projects implemented after January 1, 2014, the California Energy Commission estimates that the 2013 Title 24 energy efficiency standards will reduce consumption by 25 percent for residential buildings and 30 percent for commercial buildings, relative to the 2008 standards. For projects implemented after January 1, 2017, the California Energy Commission estimates that the 2016 standards will reduce consumption by 28 percent for residential buildings and 5 percent for commercial buildings, relative to the 2013 standards. These percentage savings relate to heating, cooling, lighting, and water heating only and do not include other appliances, outdoor lighting that is not

[5] CARB, 2013

[6] CARB, 2011

[7] Additional details are provided in CARB's EMFAC2014 Technical Documentation (CARB, 2015a)Note that the Low Carbon Fuel Standard (LCFS) regulation is excluded from EMFAC2014 because most of the emissions benefits due to the LCFS come from the production cycle (upstream emissions) of the fuel rather than the combustion cycle (tailpipe). As a result, LCFS is assumed to not have a significant impact on CO_2 emissions from EMFAC's tailpipe emission estimates.

attached to buildings, plug loads, or other energy uses. Therefore, these percentage savings were applied to the percentage of energy use covered by Title 24.[8]

The calculations and GHG emissions forecast assume that all growth in the residential and commercial/industrial sectors is from new construction. As shown in **Table B.5,** the 2013 and 2016 Title 24 requirements would reduce emissions by approximately 10,867 MT CO_2e in 2020, 29,436 MT CO_2e in 2035, and between 37,708-60,434 MT CO_2e in 2050.

The AB 32 Scoping Plan calls for the continuation of ongoing triennial updates to Title 24 that will yield regular increases in the mandatory energy and water savings for new construction. Future updates to Title 24 standards for residential and non-residential alterations are not taken into consideration due to lack of data and certainty about the magnitude of energy savings that will be realized with each subsequent update.

Renewables Portfolio Standard

Established in 2002 under Senate Bill 1078, California's Renewables Portfolio Standard (RPS) was accelerated in 2006 under Senate Bill 107 by requiring that 20 percent of electricity retail sales be served by renewable energy resources by 2010. Subsequent recommendations in California energy policy reports advocated a goal of 33 percent by 2020, and on November 17, 2008, Governor Arnold Schwarzenegger signed Executive Order S-14-08 requiring that "...[a]ll retail sellers of electricity shall serve 33 percent of their load with renewable energy by 2020." Senate Bill X1-2 was signed by Governor Edmund G. Brown, Jr., in April 2011 setting the RPS target at 33% by 2020. This new RPS applied to all electricity retailers in the state including publicly owned utilities (POUs), investor-owned utilities, electricity service providers, and community choice aggregators. All of these entities had to adopt the new RPS goals of 20 percent of retails sales from renewables by the end of 2013, 25 percent by the end of 2016, and the 33 percent requirement being met by the end of 2020. Most recently, Governor Edmund G. Brown, Jr. signed into legislation Senate Bill 350 in October 2015, which requires retail sellers and publicly owned utilities to procure 50 percent of their electricity from eligible renewable energy resources by 2030.[9]

PWP is the electricity provider in Pasadena. In order to calculate future emissions that take into account the Renewables Portfolio Standard, PWP provided projected emissions factors for the years 2020 and 2035. In addition to Renewables Portfolio Standard, PWP's projected emissions factors for the years 2020 and 2035 also take into account local shifts in power sources including a large shift from coal to natural gas sources. As shown in **Table B.5**, the Renewables Portfolio Standard and PWP's commitment to reduce overall carbon intensity would reduce Pasadena's GHG emissions by approximately by 221,840 MT CO_2e in 2020, 533,139 MT CO_2e in 2035, and between 548,710-599,122 MT CO_2e in 2050.

[8] This calculation follows the methodology detailed in the Statewide Energy Efficiency Collaborative's report, Greenhouse Gas Forecasting Assistant (SEEC, 2011).

[9] California Energy Commission, 2016a

Water Conservation Act of 2009 – SB X7-7

California Senate Bill X7-7 (2009) requires all water suppliers to reduce urban per capita water consumption by 2020 – either through the "standard target", a 20 percent reduction from the average water demand between 1994 and 2004, or the "alternative minimum", a 5 percent reduction from the average water demand between 2003 and 2007. PWP is the primary water supplier for the City of Pasadena. PWP plans to reduce per-capita water use 20 percent by 2020 and maintain that per-capita water use through 2035.[10] PWP's per-capita water use target for the years 2020 and 2035 is 168 gallons per capita per day. Reductions in GHG emissions from SB X7-7 were calculated by subtracting the 2020 and 2035 per-capita water use target from the business-as-usual per-capita water usage in 2020 and 2035. As shown in **Table B.5**, SB X7-7 would reduce Pasadena' GHG emissions by approximately 6,211 MT CO_2e in 2020, 3,526 MT CO_2e in 2035, and between 3,220-3,664 MT CO_2e in 2050.

Construction and Demolition Waste Diversion Ordinance

Effective July 1, 2012, CalReycle, as directed by SB 1374, requires jurisdictions to divert a minimum of 50% of their nonhazardous construction and demolition waste from landfills.[11] Recycling construction and demolition materials reduces GHG emissions by removing material from landfills that would otherwise generate methane and may also reduce the need to harvest and transport new raw construction materials, as recycled materials can be locally repurposed and reused. According to the California Department of Resources and Recycling, Construction and Demolition debris made up 10 percent of the State's waste stream in 2014.[12] Reductions in GHG emissions from construction and demolition waste diversion were calculated by taking a 50 percent reduction in Pasadena's construction and demolition waste. As shown in **Table B.5**, the Construction and Demolition Waste Diversion Ordinance would reduce Pasadena' GHG emissions by approximately 1,299 MT CO_2e in 2020, 1,382 MT CO_2e in 2035, and between 1,262-1,436 MT CO_2e in 2050.

Sustainable Communities and Climate Protection Act – Senate Bill 375

Senate Bill (SB) 375, the Sustainable Communities and Climate Protection Action of 2008, enhances California's ability to reach its AB 32 target by aligning regional transportation planning efforts with land use and housing allocations to reduce transportation-related GHG emissions. SB 375 requires CARB to set regional GHG emissions targets for passenger vehicles and light trucks for the years 2020 and 2035 for each of California's 18 metropolitan planning organizations (MPOs). Each MPO is required to prepare a Sustainable Communities Strategy (SCS) as part of its next Regional Transportation Plan (RTP) that demonstrates how the region will meet its GHG reduction target.

SCAG's 2012 RTP/SCS is a regional growth-management strategy that targets per capita GHG reduction from passenger vehicles and light-duty trucks in the Southern California region. The 2012 RTP/SCS

[10] PWP, 2016a
[11] Chapter 8.62 of the Pasadena Municipal Code requires a minimum 75% diversion of construction and demolition waste. GHG reductions associated with Pasadena's additional 25% diversion requirement will be quantified in the Climate Action Plan.
[12] California Department of Resources Recycling and Recovery, 2015

incorporates local land-use projections and circulation networks in city and county general plans. The projected regional development pattern, including locations of land uses and residential densities included in local general plans, when integrated with the proposed regional transportation network identified in the 2012 RTP/SCS, would reduce per capita vehicular travel-related GHG emissions and achieve the GHG reduction per capita targets for the SCAG region of eight percent per capita from 2005 GHG emission levels by 2020 and 13 percent per capita from 2005 GHG emission levels by 2035.

In August 2015, the City adopted updated Land Use and Mobility Elements which are consistent with the applicable RTP/SCS goals. Projected vehicle miles travelled estimates provided by Fehr and Peers were taken from the updated Land use and Mobility Elements which account for GHG emissions reductions resulting from the RTP/SCS.

B.5 Methods for Estimating GHG Reductions from CAP Measures

The quantification of GHG reduction measures is based on full implementation of the 2020 and 2035 performance indicators identified for each measure. GHG reductions are based primarily on calculation methods detailed in the California Air Pollution Control Officers Association's (CAPCOA) report, Quantifying Greenhouse Gas Mitigation Measures (CAPCOA, 2010). There are five GHG reduction measure categories include in the CAP: Sustainable Mobility and Land Use, Energy Efficiency and Conservation, Water Conservation, Waste Reduction, and Urban Greening. The calculations utilize emissions factors and CO_2e totals from Pasadena's GHG emissions inventories and adjusted forecasts, and assumptions made about the degree of implementation in the years 2020 and 2035. A detailed list of assumptions and sources used to quantify GHG reductions for each CAP measure is provided below.

Existing Actions

Since Pasadena's most recent GHG emissions inventory for the year 2013, the City has continued to make progress toward GHG reduction. All reductions in GHGs that occurred between the 2009 baseline and 2013 refined inventory are accounted for in the Adjusted Forecast. Actions taken since 2013 have not been included in the Adjusted Forecast. To take credit for GHG reductions that occurred since 2013, the CAP quantifies GHG reductions associated with existing actions for the specific measures for which quantifiable data was available (T-1.1, E-4.1, WC-1.1, and UG-2.1). City actions that occurred since 2013 for which quantifiable data was not available were quantified for the CAP measures using the performance indicators and assumptions detailed below.

T-1.1 – Continue to expand Pasadena's bicycle & pedestrian network

Quantification:

	2020	2035
Performance Indicators	Install 3 new miles of bike lanes Acquire 400 bike share bikes Establish 1 bike share station per square mile	Install 18 new miles of bike lanes Acquire 800 bike share bikes Establish 3 bike share stations per square mile
GHG Reduction Potential	Existing: 1,079 MT CO_2e*	Existing: 1,079 MT CO_2e*

	New: 196 MT CO_2e TOTAL: 1,275 MT CO_2e	New: 523 MT CO_2e TOTAL: 1,602 MT CO_2e

Assumptions:

- *42 miles of bike lanes were installed between 2013 and 2016[13]
- 3.0% bicycle commute mode share in 2013[14]
- 4.0% transit mode share in 2035 under General Plan build out[15]
- 0.075% increase in bicycle commuting with each mile of bikeway per 100,000 residents[16]
- 0.000465 MT CO_2e/VMT in 2020, 0.000342 MT CO_2e/VMT in 2035[17]
- Ideal ratio of bikes per population is between 10 to 30 bikes per 1,000 residents; Ideal station density is between 10 and 16 stations per square kilometer[18]
- 0.5-2.5% increase in bike mode share from bike share program[19]
- Calculations conservatively assume 0.5% increase in mode share

T-1.2 – Continue to improve bicycle and pedestrian safety

This measure is considered supportive and was quantified as part of T-1.1.

T-1.3 – Continue to encourage bicycle and pedestrian travel

This measure is considered supportive and was quantified as part of T-1.1.

T-2.1 – Continue to enhance safe, reliable, and seamless transit service

Quantification:

	2020	2035
Performance Indicators	Achieve 10% transit mode share	Achieve 20% transit mode share
GHG Reduction Potential	32,414 MT CO_2e	84,828 MT CO_2e

Assumptions:

- 6.4% transit mode share in 2013[20]
- 8.4% transit mode share in 2035 under General Plan build out[21]
- 0.000465 MT CO_2e/VMT in 2020, 0.000342 MT CO_2e/VMT in 2035[22]
- 28%-84% increase in transit ridership resulting from provision of bus rapid transit system[23]
- 1.5%-2.3% increase in annual transit trips due to increased frequency of service[24]
- 4%-15% increase in annual transit trips due to increased operational speed[25]

[13] Pasadena Department of Transportation, 2016
[14] U.S. Census Bureau, 2014
[15] Fehr & Peers, 2017
[16] CAPCOA, 2010
[17] CARB, 2015b
[18] Institute for Transportation & Development Policy, 2013
[19] CAPCOA, 2010
[20] U.S. Census Bureau, 2014
[21] Fehr & Peers, 2017
[22] CARB, 2015b
[23] CAPCOA, 2010
[24] CAPCOA, 2010
[25] CAPCOA, 2010

- 0.3-20% reduction in commute VMT through implementing a subsidized or discounted transit program[26]
- Calculations conservatively assume 3.6% mode share increase by 2020 (from 6.4% to 10%) and 11.6% mode share increase by 2035 (from 8.4% to 20% resulting from a combination of providing bus rapid transit system, increasing frequency of service and increasing operational speed; equivalent to a 4% reduction in single-occupancy VMT by 2020 and 13% reduction in single-occupancy VMT by 2035

T-3.1 – Decrease annual commuter miles traveled by single occupancy vehicles

Quantification:

	2020	2035
Performance Indicators	Increase carpooling mode share to 10% by 2020	Increase carpooling mode share to 15% by 2035
GHG Reduction Potential	5,502 MT CO_2e	22,163 MT CO_2e

Assumptions:

- 8.6% carpooling mode share in 2013[27]
- 8.2% carpooling mode share in 2035 under General Plan build out[28]
- 0.000465 MT CO_2e/VMT in 2020, 0.000342 MT CO_2e/VMT in 2035[29]
- 5-15% reduction in commute VMT through ride-sharing programs[30]
- 0.07-5.5% reduction in commute VMT through encouraging telecommuting and alternative work schedules[31]
- 0.4-0.7% reduction in commute VMT through implementing a car-sharing program[32]
- 0.3-13.4% reduction in commute VMT through providing an employer-sponsored vanpool/shuttle[33]
- 0.1-19.7% reduction in commute VMT through pricing workplace parking[34]
- 0.6-77% reduction in commute VMT through implementing an employee parking "cash-out" program[35]
- Calculations conservatively assume 1.4% mode share shift from single occupancy vehicles to carpooling in 2020 (8.6% to 10%)and 6.8% mode share shift from single occupancy vehicles to carpooling in 2035 (8.2% to 15%) resulting from implementation of comprehensive trip reduction programs including providing ride-sharing programs, telecommuting, car-sharing programs, vanpool, and parking pricing/cash-out; equivalent to 0.7% reduction in single occupancy VMT in 2020 and 3.4% reduction in single occupancy VMT in 2035)

[26] CAPCOA, 2010
[27] U.S. Census Bureau, 2014
[28] Fehr & Peers, 2017
[29] CARB, 2015b
[30] CAPCOA, 2010
[31] CAPCOA, 2010
[32] CAPCOA, 2010
[33] CAPCOA, 2010
[34] CAPCOA, 2010
[35] CAPCOA, 2010

T-3.2 – Improve the existing transportation system to smooth traffic flow, reduce idling, eliminate bottlenecks, and encourage efficient driving techniques

This measure is considered supportive as the City's pilot protocol to quantify GHG emission reductions associated with Intelligent Transportation System operations indicated that Intelligent Transportation System operations do not result in significant GHG reductions.

T-4.1 – Expand the availability and use of alternative fuel vehicles and fueling infrastructure

Quantification:

	2020	2035
Performance Indicators	Achieve 5% EV mode share by 2020	Achieve 26% EV mode share by 2035
GHG Reduction Potential	27,097 MT CO_2e	134,087 MT CO_2e

Assumptions:

- 0.2% EV VMT in 2013, 1.6% EV VMT in 2020, 7.6% EV VMT in 2035[36]
- 0.000465 MT CO_2e/VMT in 2020, 0.000342 MT CO_2e/VMT in 2035[37]
- 0.4% to 20.3% reduction in GHG emissions by utilizing electric or hybrid vehicles[38]
- 0.5-12.7% VMT reduction from implementing a neighborhood electric vehicle (NEV) network[39]
- Executive Order B-16-2012 to encourage ZEVs in California and set a long-term goal of reaching 1.5 million ZEVs on California's roadways by 2025[40]
- ARB anticipates annual ZEV sales of 200,000-260,000 in the next 5-10 years, with a goal of 100% of sales are ZEV and PHEV by 2050[41]
- Light duty EV sales are expected to grow from 2.6 million in 2015 to over 6.0 million in 2024[42]
- Calculations assume 3.4% increase in EV mode share by 2020 (from 1.6% to 5%) and 17.4% increase in EV mode share by 2035 (from 7.6% to 25%) resulting from a combination of local initiatives to improve/expand the charging infrastructure as well as State initiatives to expand EV sales
- 2017 Chevy Bolt (representative example for EV vehicle): 4.1 to 4.8 miles/kWh (average of 4.45 miles/kWh was used in calculations[43]

T-5.1 – Facilitate high density, mixed-use, transit-oriented and infill development

GHG emissions reductions associated with General Plan land use were quantified within the adjusted forecast for 2020 and 2035.

[36] CARB, 2015b
[37] CARB, 2015b
[38] CAPCOA, 2010
[39] CAPCOA, 2010
[40] California Energy Commission, 2016b
[41] CARB, 2016
[42] Navigant Research, 2013
[43] Green Car Reports, 2016

T-6.1 – Reduce GHG emissions from heavy-duty construction equipment and vehicles

This measure is considered supportive as GHG emissions from construction equipment were not included in the baseline GHG emissions inventory.

T-7.1 – Reduce GHG emissions from lawn and garden equipment

This measure is considered supportive as GHG emissions from lawn and garden equipment were not included in the baseline GHG emissions inventory.

E-1.1 – Increase energy efficiency requirements of new buildings to perform better than 2016 Title 24 Standards

Quantification:

	2020	2035
Performance Indicators	Measure will be implemented after 2020	Achieve 100% of new residential units built between 2020 and 2035 are ZNE (as mandated by Title 24) and 25% of new commercial development built between 2020 and 2035 is ZNE (as mandated by Title 24).
GHG Reduction Potential	Measure will be implemented after 2020	6,784 MT CO_2e

Assumptions:

- ZNE building have zero energy use
- Percent ZNE commercial square footage is equivalent to percent employees working at ZNE commercial buildings
- Electricity emission factor: 0.362 MT CO_2e/MWh in 2020, 0.153 MT CO_2e/MWh in 2035[44]
- Natural gas emission factor is 0.005324 MT CO_2e per therm[45]
- Household growth was used to estimate GHG emissions resulting from new residential construction (59,641 households in 2013; 63,004 households in 2020; 70,864 households in 2035)[46]
- Employment growth was used to estimate GHG emissions resulting from new commercial construction (111,348 employees in 2013; 121,411 employees in 2020; 146,141 employees in 2035)[47]
- A zero energy building is an energy-efficient building where, on a source energy basis, the actual annual delivered energy is less than or equal to the on-site renewable exported energy[48]

[44] PWP, 2017
[45] CARB, at al., 2010
[46] City of Pasadena, 2015b
[47] City of Pasadena, 2015b
[48] U.S. Department of Energy, 2015a

- The California Energy Commission has indicated that the 2019 Building Energy Efficiency Standards will require all new residential construction to be ZNE or equivalent by 2020 and new commercial construction to be ZNE or equivalent by 2030[49]
- Calculations take credit for reductions resulting from implementing the 2019 Building Energy Efficiency Standards for residential construction beginning in 2020 and also includes reductions associated with 25% of new commercial development as ZNE resulting from local incentives, development review and/or requirements if voluntary initiatives are not effective

E-1.2 – Encourage the use of energy conservation devices and passive design concepts that make use of the natural climate to increase energy efficiency

This measure is considered supportive and was quantified as part of E-1.1.

E-2.1 – Facilitate energy efficient upgrades in existing homes and businesses

Quantification:

	2020	2035
Performance Indicators	Decrease energy use in existing buildings by 16% below 2013 levels by 2020	Decrease energy use in existing buildings by 40% below 2013 levels by 2035
GHG Reduction Potential	103,629 MT CO_2e	162,720 MT CO_2e

Assumptions:

- Electricity emission factor: 0.362 MT CO_2e/MWh in 2020, 0.153 MT CO_2e/MWh in 2035[50]
- Natural gas emission factor is 0.005324 MT CO_2e per therm[51]
- 1% reduction in residential energy use and 5% reduction in commercial energy from 2013 to 2015[52]GHG reductions from Title 24 were quantified in the adjusted forecast. Therefore, to avoid double counting, energy reductions associated with this measure were applied to the energy use totals presented in the Adjusted Forecast to calculate GHG reductions.
- Household growth was used to estimate GHG emissions resulting from new versus existing residential buildings (59,641 households in 2013; 63,004 households in 2020; 70,864 households in 2035)[53]
- Employment growth was used to estimate GHG emissions resulting from new versus existing commercial buildings 111,348 employees in 2013; 121,411 employees in 2020; 146,141 employees in 2035[54]
- Energy efficiency upgrades to existing buildings can achieve up to 40% energy savings cost effectively[55]

[49] California Energy Commission, 2011
[50] PWP, 2017
[51] CARB, at al., 2010
[52] PWP, 2016b
[53] City of Pasadena, 2015b
[54] City of Pasadena, 2015b
[55] California Energy Commission, 2015

- Good control systems may be able to reduce ventilation-related energy use in residences by as much as 40%[56]
- The U.S. Department of Defense examined the performance of three advanced lighting systems and was able to achieve savings above 40% using only improved sensors, lighting design, and control systems[57]
- Energy reductions of 15%–40% have been demonstrated through model-predictive control uses energy modeling, as well as real-time weather forecasts and (price) signals from the grid to tailor short-term control strategies for energy reduction, peak demand reduction, or other objectives[58]
- 5-30% reduction on energy bill by making efficient upgrades identified in energy audit[59]
- 71% of auditors report that homeowners make at least one of the recommended improvements 'fairly often' or 'always[60]'
- New front load washing machines used about 37% less energy than traditional washing machines[61]
- ENERGY STAR refrigerators, clothes washers, dishwashers, and ceiling fans use 15%, 25%, 40%, and 50% less electricity than standard appliances, respectively[62]
- Refrigerators 15 years or older use twice as much energy as an Energy Star refrigerator[63]
- Sealing and insulating ducts can improve furnace efficiency by up to 20%[64]
- The DOE reports that residents can save approximately 10% on heating and cooling bills per year by lowering the thermostat by 10-15 degrees for eight hours[65]
- Energy-saving incandescent 43 Watt (W) light bulb – 25% reduction from traditional 60 W incandescent light bulb; 15 W compact fluorescent (CFL) – 75% reduction from traditional 60 W incandescent light bulb; and 12 W LED – 75-80% reduction from traditional 60 W incandescent light bulb[66]

E-3.1 – Increase municipal energy conservation efforts

Quantification:

	2020	2035
Performance Indicators	Reduce municipal energy use by 10% from 2013 levels	Reduce municipal energy use by 50% below 2013 levels
GHG Reduction Potential	2,406 MT CO_2e	14,193 MT CO_2e

Assumptions:

- Electricity emission factor: 0.362 MT CO_2e/MWh in 2020, 0.153 MT CO_2e/MWh in 2035[67]

[56] U.S. Department of Energy, 2015b
[57] U.S. Department of Energy, 2015b
[58] U.S. Department of Energy, 2015b
[59] U.S. Department of Energy, 2017a
[60] Palmer, Karen L., et al., 2011.
[61] LifeHacker, 2012
[62] CAPCOA, 2010
[63] Energy Star, 2017
[64] Energy Star, 2009
[65] CAPCOA, 2010
[66] U.S. Department of Energy, 2017b
[67] PWP, 2017

- Natural gas emission factor is 0.005324 MT CO_2e per therm[68]
- 6% reduction in municipal energy use from 2013 to 2015[69]
- 5-30% reduction on energy bill by making efficient upgrades identified in energy audit[70]
- Energy-saving incandescent 43 W light bulb – 25% reduction from traditional 60 W incandescent light bulb; 15 W CFL – 75% reduction from traditional 60 W incandescent light bulb; and 12 W LED – 75-80% reduction from traditional 60 W incandescent light bulb[71]
- Plug loads in commercial buildings account for almost 5% of U.S. primary energy consumption (NREL 2011). On average, plug loads account for approximately 30% of electricity in offices (Moorefield, L., et al. (2008). In minimally code-compliant office buildings, plug loads may account for 25% or less of total energy consumption; in high efficiency buildings, plug loads may account for more than 50% of the total energy consumption.[72]
- Computers and monitors accounted for 66% of all [plug load] devices; office electronics (printers, faxes, multifunction devices and computer speakers) accounted for 17% of all devices; miscellaneous devices (portable lighting, telephones, and coffee makers) accounted for the remaining 17% of all plug load devices[73].

E-4.1 – Increase citywide use of carbon-neutral energy by encouraging and/or supporting carbon-neutral technologies

Quantification:

	2020	2035
Performance Indicators	Replace 950,000 kWh of electricity with carbon-neutral energy	Replace 95,000,000 kWh of electricity with carbon-neutral energy
GHG Reduction Potential	Existing:1,920 MT CO_2e* New: 344 MT CO_2e TOTAL: 2,264 MT CO_2e	Existing: 812 MT CO_2e* New: 14,535 MT CO_2e TOTAL: 15,347 MT CO_2e

Assumptions:

- Solar is currently the most common, readily available, and validated carbon-neutral technology, and as such the GHG reduction calculations for this measure demonstrate that the measure could be implemented with 100% solar technology. However, the measure also provides flexibility to utilize other types of carbon neutral technologies in the future as availability increases and data regarding associated GHG reductions is developed
- *2,792 kW of solar were installed between 2013 and 2016[74]
- Electricity emission factor: 0.362 MT CO_2e/MWh in 2020, 0.153 MT CO_2e/MWh in 2035[75]

[68] CARB, at al., 2010
[69] PWP, 2016b
[70] U.S. Department of Energy, 2017a
[71] U.S. Department of Energy, 2017b
[72] United States General Services Administration, 2016
[73] United States General Services Administration, 2016
[74] PWP, 2016b
[75] PWP, 2017

- 1 kW = 1,900 kWh per year - conversion factor[76]
- Assuming 2013 to 2016 solar installation rate (1,396 kW installed per year) continues to 2020 and 2035 would result in an installation of 9,755 kW by 2020 and 30,712 kW by 2035; equivalent to 18,534,500 kWh in 2020 and 58,352,800 kWh in 2035; solar installation rate is expected to increase above 1,396 kW/year as a result of outreach, education and incentive programs implemented as part of the CAP
- PWP is currently looking for site for community solar (500kW – 1,000 kW; equivalent to 950,000 kWh – 1,900,000 kWh)
- Solar PV installations are expected to increase from 13 gigawatts in 2017 to 18 gigawatts in 2021 with over 100 gigawatts of solar installed in the U.S. by 2021[77]

E-5.1 – Continue to expand the City's renewable and/or carbon-neutral energy portfolio

GHG emissions reductions from PWP's energy portfolio were quantified under the adjusted forecast.

PWP's Energy Portfolio[78]:

Energy Source		2009	2013	2020 Forecast	2035 Forecast
Generated	Natural Gas	16%	8%	30%	33%
Purchased	Coal	56%	47%	24%	--
	Nuclear	6%	6%	6%	6%
	Renewable	9%	24%	33%	49%
	Hydroelectric	4%	4%	4%	4%
	Bonnevile Power	1%	1%	--	--
	Market Purchases	7%	10%	3%	8%

WC-1.1 – Reduce potable water usage throughout Pasadena

Quantification:

	2020	2035
Performance Indicators	0% reduction in water consumption per capita (comply with SB X7-7)	6.4% decrease in water consumption per capita (below calendar year 2035 SB X7-7 levels)
GHG Reduction Potential	Existing: 1,867 MT CO_2e* New: 0 MT CO_2e TOTAL: 1,867 MT CO_2e	Existing: 833 MT CO_2e* New: 130 MT CO_2e TOTAL: 963 MT CO_2e

Assumptions:

- *Communitywide water consumption dropped 5% between 2013 and 2016[79]
- 11,110 kWh/million gallons water (supply, conveyance, treatment & distribution)[80]

[76] Solar-Estimate, 2017
[77] Solar Energy Industries Association, 2017
[78] PWP, 2017
[79] PWP, 2016b
[80] City of Pasadena, 2015b

- 1.31 MT CO_2e/acre-feet in 2020, 0.55 MT CO_2e/acre-feet in 2035[81]
- 24% reduction in residential water use due to water efficient appliances[82]
- 10% reduction in commercial water use due to water efficient appliances[83]
- 20-45% reduction in water use due to water efficient landscaping[84]
- Field research studies indicate that traditionally used landscape trees, shrubs, and groundcovers have considerable drought resistance and perform acceptably with about 40% to 60% of the water required to maintain the average lawn in good condition[85]
- Replacing water-consuming, high-maintenance, traditional landscapes and lawn with California native plants can reduce the average homeowner's water consumption by 60%[86]
- Drip irrigations systems use 20 to 50 percent less water than conventional pop-up sprinkler systems and can save up to 30,000 gallons per year[87]

WC-2.1 – Increase access to and use of non-potable water

Quantification:

	2020	2035
Performance Indicators	Continue to evaluate the City's NPWP	Achieve 7% of water supply sourced from recycled water
GHG Reduction Potential	0 MT CO_2e	953 MT CO_2e

Assumptions:

- 81% GHG reduction resulting from use of 100% reclaimed water in Southern California[88]
- The Pasadena Non-Potable Water Project proposed to construct a pipeline to be placed underground that would bring more than 3,000 acre feet (10% of the city's overall water use) of water annually to serve the city's non-potable water needs, such as irrigation, dust control, and commercial and industrial cooling.[89]
- Greywater systems could result in 30% reduction in total household water use[90]
- Calculation assumes full implementation of Non-Potable Water Project by 2035

WC-3.1 – Improve storm water systems to slow, sink, and treat run-off, recharge groundwater, and improve water quality

This measure is considered supportive as improvements to stormwater capture and water quality do not directly result in GHG emissions reductions.

[81] Calculated from projected water usage and electricity emissions factors
[82] California Department of Water Resources, 2013
[83] California Department of Water Resources, 2013
[84] California Department of Water Resources, 2013
[85] University of California, Center for Landscape and Urban Horticulture, 2016
[86] Save Our Water, 2017
[87] US EPA, 2017a
[88] CAPCOA, 2010
[89] City of Pasadena, 2017a
[90] HouseLogic, 2017

WR-1.1 – Continue to reduce solid waste and landfill GHG emissions

Quantification:

	2020	2035
Performance Indicators	Achieve 75% diversion rate	Achieve 87% diversion rate
GHG Reduction Potential	0 MT CO_2e	7,359 MT CO_2e

Assumptions:

- 73% diversion rate in 2010[91]
- 152,967 tons of waste disposed by Pasadena in 2013[92]
- The Zero Waste Strategic Plan outlines a path to achieve 87% diversion by 2040 through programs including:[93]
    - Expanding the Mandatory Commercial Recycling Program: 4.6% reduction in diversion
    - School Recycling Programs: 0.1% reduction in diversion
    - Enhanced Educational Outreach: 4.6% reduction in diversion
    - Technical Assistance to Businesses: 0.6% reduction in diversion
    - Commercial Food Scraps & Organics Collection Pilot program:<0.1% reduction in diversion
    - Additional waste reduction, reuse, recycling, and composting policies at City Facilities: 0.1% reduction in diversion
    - Mandatory Organics Separation and Collection at Stadiums and Large Venues/Events: 0.3% reduction in diversion
    - Expand EPR Policies: <0.1% reduction in diversion
    - Product and Disposal Bans:0.3% reduction in diversion
    - Green Business Partnership Program: 0.3% reduction in diversion
    - Recycling in Public Areas: 0.2% reduction in diversion
    - C&D Diversion Requirements: 3.0% reduction in diversion
- Calculation assumes full implementation of the Zero Waste Strategic Plan by 2035
- Chapter 8.62 of the Pasadena Municipal Code requires a minimum 75% diversion of construction and demolition waste. GHG reductions associated with 50% diversion of construction and demolition waste were calculated under the adjusted forecast consistent with the State's Green Building Standards Code. Pasadena's additional 25% diversion requirement for construction and demolition waste is quantified herein under WR1.

WR-2.1 – Establish a "Preferred Procurement Plan" for sustainable, strategic sourcing for all City departments and facilities

This measure is considered supportive and was quantified as part of WR-1.1.

[91] Pasadena Public Works Department, 2016
[92] CalRecycle, 2017
[93] City of Pasadena, 2014

WR-2.2 – Create an internal reuse program for all City departments to recirculate unwanted goods

This measure is considered supportive as it was quantified as part of WR-1.1.

WR-3.1 – Implement a citywide composting program to limit the total amount of organic material entering landfills

Quantification:

	2020	2035
Performance Indicators	Reduce organic waste disposal by 50% below 2013 levels (as mandated by SB 1383)	Reduce organic waste disposal by 75% below 2013 levels (as mandated by SB 1383)
GHG Reduction Potential	4,559 MT CO_2e	6,838 MT CO_2e

Assumptions:

- 37.4% of California's waste disposal stream is comprised of organic waste[94]
- 152,967 tons of waste disposed by Pasadena in 2013[95]
- Food scraps and yard waste currently make up 20 to 30% of residential garbage[96]
- As a nation, we have made remarkable strides towards recycling these materials, primarily through the development of effective composting technologies. Whereas in 1990 recovery via composting only diverted 2% of the total solid waste stream, we now recover 20% through composting, including 62% of all yard trimmings[97]
- Analysis of the top prevention, recovery, and recycling solutions shows that 13.2 million tons — over 20% of annual food waste — can be reduced over the next decade in cost-effective and scalable ways[98]
- In September 2016, Governor Brown signed SB 1383, establishing targets to achieve a 50% reduction in the level of the statewide disposal of organic waste from the 2014 level by 2020 and a 75% reduction by 2025. The law grants CalRecycle the regulatory authority required to achieve the organic waste disposal reduction targets and establishes an additional target that not less than 20% of currently disposed edible food is recovered for human consumption by 2025. In 2019, CalRecycle will be networking, providing technical assistance, and developing tools, model ordinances, contracts, and case studies to support efforts at the local level to meet the organic waste reduction targets and comply with the regulatory requirements. By January 2, 2024, the regulations may require local jurisdictions to impose penalties for noncompliance on generators within their jurisdiction[99]

WR-3.2 – Implement 3-bin compost systems, in addition to recycling bins and landfill bins, at public parks to compost all trimmings and waste onsite to divert organic materials from the landfill and increase locally available compost

[94] Cal Recycle, 2015
[95] CalRecycle, 2017
[96] U.S. EPA, 2017b
[97] US Composting Council, 2011
[98] ReFED, 2017
[99] CalRecycle, 2017

This measure is considered supportive as it was quantified as part of WR-3.1.

WR4.1 – Reduce the GHG impacts of the waste collection system

This measure is considered supportive as it was quantified as part of T-4.1.

UG-1.1 – Continue to preserve, enhance, and acquire additional greenspace throughout Pasadena to improve carbon sequestration, reduce the urban heat-island effect, and increase opportunities for active recreation

Quantification:

	2020	2035
Performance Indicators	Increase green space by 5 net new acres	Increase green space by 30 net new acres
GHG Reduction Potential	22 MT CO_2e	129 MT CO_2e

Assumptions:

- 4.31 MT CO_2e/year average carbon sequestration rate for grassland[100]
- Pasadena has 23 dedicated city parks totaling 635 acres of parkland[101]

UG-2.1 – Continue to protect existing and plant new trees to improve and ensure viability of Pasadena's urban forest

Quantification:

	2020	2035
Performance Indicators	Plant 500 net new trees	Plant 2,000 net new trees
GHG Reduction Potential	Existing: 144 MT CO_2e* New: 18 MT CO_2e TOTAL: 162 MT CO_2e	Existing: 144 MT CO_2e* New: 71 MT CO_2e TOTAL: 215 MT CO_2e

Assumptions:

- *4,064 trees were planted between 2013 and 2016[102]
- 0.0354 MT CO_2e/year average carbon sequestration rate for trees[103]
- In the contiguous United States alone, urban trees store over 708 million tons of carbon (approximately 12.6% of annual carbon dioxide emissions in the United States) and capture an additional 28.2 million tons of carbon (approximately 0.05% of annual emissions) per year[104]

B.6 CAP Consistency Checklist Supporting Documentation

The CAP includes 27 measures, 16 of which were selected as Sustainable Development Actions and therefore, have been included in the CAP Consistency Checklist. The table below details which of the

[100] CAPCOA, 2010
[101] City of Pasadena, 2007
[102] Pasadena Public Works Department, 2016
[103] CAPCOA, 2010
[104] Safford, H. et al., 2013

CAP measures are applicable to new development and why. CAP measures that are not applicable to new development were not included in the CAP Consistency Checklist as the checklist only applies to new development projects.

Measure Number & Name		Applicable to New Development?	Reason
T-1.1	Continue to expand Pasadena's bicycle and pedestrian network	Yes	New developments and major renovations can include end of trip facilities and bike share programs. New developments usually do not have the ability to incorporate other types of infrastructure such as bike lanes.
T-1.2	Continue to improve bicycle and pedestrian safety	Yes	New developments and major renovations can install bike racks in their facilities. Other safety measures will be based on policy changes and City projects.
T-1.3	Continue to encourage bicycle and pedestrian travel	No	These measures are policy based and will be implemented at the community scale. If new policies are put in place, they may later effect new construction and major renovations.
T-2.1	Continue to enhance safe, reliable, and seamless transit services	No	These measures are policy based and will be implemented at the community scale. If new policies are put in place, they may later effect new construction and major renovations.
T-3.1	Decrease annual commuter miles traveled by single occupancy vehicles	Yes	New construction and major renovations can include car sharing, parking de-coupling, and TDM plans to aid the reduction of VMT throughout the community.
T-3.2	Improve the existing transportation system to smooth traffic flow, reduce idling, minimize bottlenecks, and encourage efficient driving techniques	No	These measures are policy based and will be implemented at the community scale. If new policies are put in place, they may later effect new construction and major renovations.
T-4.1	Expand the availability and use of alternative fuel vehicles for fueling infrastructure	Yes	New construction and major renovations can play a major role in developing an alternative fueling system by incorporating electric car chargers.
T-5.1	Facilitate high-density, mixed-use, transit-oriented and infill development	Yes	New development can select locations near transit stops to facilitate transit-oriented development to reduce single occupancy VMT.
T-6.1	Reduce GHG emissions from heavy-duty construction equipment and vehicles	Yes	New development projects can utilize alternative fuel construction vehicles and limit idling to three minutes while performing construction activities.
T-7.1	Reduce GHG emissions from lawn and garden equipment	No	This measure relates to operations rather than construction. A City ordinance could require or incentivize the use of alternative fuel law and garden equipment.
E-1.1	Increase energy efficiency requirements of new buildings to perform better than 2016 Title 24 Standards	Yes	New buildings and major renovations can exceed Title 24 or become ZNE.
E-1.2	Encourage the use of energy conservation devices and passive design concepts that make use of the natural climate to increase energy efficiency	Yes	New buildings and major renovations can include passive design concepts.

E-2.1	Facilitate energy efficient upgrades in existing homes and businesses	No	This measure relates to existing buildings.
E-3.1	Increase municipal energy conservation efforts	No	This is a City-led initiative, pertaining to internal operations.
E-4.1	Increase citywide use of carbon-neutral energy by encouraging and or supporting carbon-neutral technologies	Yes	New construction and major renovations can include renewable energy.
E-5.1	Continue to expand the City's renewable and or carbon-neutral energy portfolio	No	This is a City-led initiative, pertaining to internal operations.
WC-1.1	Reduce potable water usage throughout Pasadena	Yes	New construction and major renovations can improve water efficiency indoor and outdoor through several strategies.
WC-2.1	Increase access to and use of non-potable water	Yes	New construction and major renovations can utilize non-potable water through greywater use and dual plumbing.
WC-3.1	Improve storm water systems to slow, sink, and treat water run-off, recharge groundwater, and improve water quality	Yes	New construction and major renovations can incorporate stormwater practices to keep stormwater on-site.
WR-1.1	Continue to reduce solid waste and landfill GHG emissions	Yes	Projects can facilitate recycling by supplying locations for trash and recycling bins and by providing handouts and/or signage to show residents how to recycle.
WR-2.1	Establish a "Preferred Procurement Plan" for sustainable, strategic sourcing for all City departments and facilities	No	This is a City-led initiative, pertaining to internal operations.
WR-2.2	Create an internal program for all City departments to recirculate unwanted goods	No	This is a City-led initiative, pertaining to internal operations.
WR-3.1	Implement a city-wide composting program to limit the amount of organic material entering landfills	Yes	New construction and major renovations can implement on-site composting.
WR-3.2	Implement 3-bin compost systems, in addition to recycling and landfill bins, at public parks to compost all trimmings and waste onsite to divert organic materials from the landfill and increase locally available compost	No	This is a City-led initiative, pertaining to internal operations.
WR-4.1	Reduce the GHG impact of the waste collection system	No	This is a City-led initiative, pertaining to internal operations.
UG-1.1	Continue to preserve, enhance, and acquire additional greenspace throughout Pasadena to improve carbon sequestration, reduce the urban heat-island effect, and increase opportunities for active reaction	Yes	New construction and major renovations can include public park space, rooftop gardens, parklets, and other strategies to increase the amount of park space in Pasadena.

UG-2.1	Continue to protect existing trees and plant new ones to improve and ensure viability of Pasadena's urban forest	Yes	New construction and major renovations can preserve existing trees and plant new ones.

B.7 CEQA GHG Thresholds Supporting Documentation

A service person efficiency threshold was chosen for this CAP because Pasadena has a higher ratio of jobs to residents then the State on average, and excluding emissions from employees would not provide a complete picture of emissions within the city. [105] Using the demographics projections developed for the CAP, Pasadena has developed four per person efficiency thresholds which are consistent with the CAP and the State targets it is designed to achieve (AB 32, SB 32, EO S-3-05). Because the 2017 Climate Change Scoping Plan (adopted December 14, 2017) was still in draft form and subject to change at the time Pasadena's local GHG thresholds were developed, a multi-threshold approach was developed to allow the City to achieve their long-term reduction goals in the absence of anticipated emission reductions from the 2017 Climate Change Scoping Plan. This is consistent with the current guidance provided by the AEP Final White Paper "Beyond 2020 and Newhall".

The following methodology was used to calculate the efficiency thresholds and to compare the values to the service person targets established by the 2017 Climate Change Scoping Plan. The City's 2030 efficiency threshold is lower than the emissions threshold suggested by the State in the 2017 Climate Change Scoping Plan, as Pasadena has set GHG reduction goals which exceed State targets. Pasadena's thresholds were calculated based on the GHG reduction goals and demographic projections included in the CAP. California data was taken from the Department of Transportation County Level Economic Forecast.[106]

California 2030 Efficiency Threshold *= 2030 GHG Emissions Goal / (2030 Residents + 2030 Employees)*

258,600,000 MT CO_2e / (44,740,000 Residents +19,091,000 Employees) = **4.05 MT CO_2e/service person**

Pasadena 2020 Efficiency Threshold *= 2020 GHG Emissions Goal / (2020 Residents + 2020 Employees)*

1,492,793MT CO_2e / (143,508 Residents +121,411 Employees) = **5.63 MT CO_2e/service person**

Pasadena 2025 Efficiency Threshold *= 2025 GHG Emissions Goal / (2025 Residents + 2025 Employees)*

1,268,560 MT CO_2e / (149,172 Residents +129,150 Employees) = **4.56 MT CO_2e/service person**

[105] A service person efficiency threshold is the amount of emissions per year for every resident and employee in a defined area. By including both residents as employees a service person threshold incorporates emissions from all sectors including transportation, commercial activities, and residential activities.
[106] California Economic Forecast, 2013

Pasadena 2030 Efficiency Threshold *= 2030 GHG Emissions Goal / (2030 Residents + 2030 Employees)*

1,042,910 MT CO_2e / (155,060 Residents +137,383 Employees) = **3.57 MT CO_2e/service person**

Pasadena 2035 Efficiency Threshold *= 2035 GHG Emissions Goal / (2035 Residents + 2035 Employees)*

838,418 MT CO_2e / (161,180 Residents +146,141 Employees) = **2.73 MT CO_2e/service person**

B.8 Zero Net Emissions Documentation

GHG Estimation

The methodology detailed in the CAP Consistency Checklist has been vetted by CARB and is used in the determination of Zero Net Carbon requirements for CEQA streamlining (under Assembly Bill 900). For an example of how to properly implement and document this methodology please see the CARB Determination for the 6220 West Yucca Street Project.[107]

GHG Reductions

Once total GHG emissions have been calculated, the project must then purchase the required offsets from Climate Action Registry's marketplace. Additional carbon credit suppliers may be added in the future as they are verified. The total emissions for the project must be offset by Climate Reserve Tonnes or CRT's through the Climate Action Reserve marketplace.

CRT's gain their GHG value through projects which are verified by Climate Action Reserve to reduce a quantity of GHG emissions through renewable energy generation, short lived climate pollution reduction, carbon sequestration, and others. For every MT of CO_2e the project sequesters or reduces from entering the atmosphere, one CRT is generated. Each CRT can be purchased to offset one MT of CO_2e generated by a project. In the above example, the proposed project would be required to purchase 90,500 CRT's through the Climate Action Reserve marketplace. Offsets cost between $12-$15 as of September 2017 but prices are subject to changes in the carbon market.

The marketplace can be found here: http://www.climateactionreserve.org/how/crt-marketplace/

Each project should reduce their overall GHG emissions through the following methodologies which have been prioritized in order of desirability.

1. Project Design Features/on-site reduction measures
2. Climate Action Reserve offsets from off-site projects within the neighborhood
3. Climate Action Reserve offsets from off-site projects within the South Coast Air Quality Management District Jurisdiction
4. Climate Action Reserve offsets from off-site projects within the State
5. Climate Action Reserve offsets from off-site projects outside the State

[107] http://opr.ca.gov/docs/FINAL_6220_Yucca_Street__CARB_Determination.pdf

This methodology has been followed and legally vetted by the Newhall Ranch Project, and was found to be consistent with all State legislation and climate action goals.[108]

Projects which show the required documentation including the full CalEEMod output (construction, existing, and 30 years of operational data) and verification of the CRT's purchased to reduce net GHG emissions to zero can be considered consistent with the Pasadena CAP.

[108] http://netzeronewhall.com/