Appendix B

Greenhouse Gas Emissions Reduction Targets and Measures

Methods for Estimating Greenhouse Gas Emissions Reductions in the Escondido Climate Action Plan

October 2020

Prepared for the City of Escondido

Prepared by the Energy Policy Initiatives Center

About EPIC

The Energy Policy Initiatives Center (EPIC) is a non-profit research center of the USD School of Law that studies energy policy issues affecting California and the San Diego region. EPIC's mission is to increase awareness and understanding of energy- and climate-related policy issues by conducting research and analysis to inform decision makers and educate law students.

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1 OVERVIEW

The City of Escondido's Climate Action Plan ("CAP") Greenhouse Gas ("GHG") Reduction Methods (document) provides a summary of the methods used to calculate GHG emissions reductions for the strategies and measures included in the City of Escondido's (referred to as "the City" or "Escondido") CAP.

Section 2 of the document details the emission reduction targets for Escondido in the years 2020, 2030, and 2035. Section 3 provides a summary of emissions reduction estimates from federal and State (California) actions, as well as nine CAP strategies, used to meet 2030 and 2035 targets. Section 4 outlines the common data sources and methods used throughout the document, while Sections 5 and 6 detail the methods used to estimate emissions reductions from each specific strategy and measure.

Unless stated otherwise, all activity data and GHG emissions reported in this document are annual values for the calendar year, and all emission factors reported in this document are annual average values for the calendar year.

1.1 Rounding of Values in Tables and Figures

Rounding is used for the final GHG values within the tables and figures throughout the document. Values are not rounded in the intermediary steps in any calculation. Because of rounding, some totals may not equal the values summed in any table or figure.

2 EMISSION REDUCTION TARGETS

California has a statewide target of reaching the 1990 GHG emissions levels, equal to an annual value of 431 million metric tons of carbon dioxide equivalent (MMT CO_2e), by 2020. At the State level, the emissions reduction target for 2020 can be calculated from any previous year for which a State inventory is available. For example, the State 2020 target is 4 percent below its 2012 inventory value, and 11 percent below its 2005 inventory value. Based on California's long-term climate goals, all state agencies with jurisdiction over sources of GHG emissions were directed to implement measures to achieve reductions of GHG emissions to meet the 2030 and 2050 targets as set forth in Executive Orders S-3-05 and B-30-15. The State target for 2030 is 40 percent below its 1990 level, or 260 MMT CO_2e.[1] This is equivalent to 42 percent below its 2012 inventory value, and 47 percent below its 2005 value. Similarly, the 2035 goal is 52 percent below its 2012 inventory value. Such equivalencies are illustrated in Figure 1.[2] It is important to note that these mid-term targets are critical to help frame the suite of planning efforts and strategies in clean technology and infrastructure (energy, transportation, agriculture, water, waste management, etc.) needed to continue driving down emissions to meet the 2050 goal of reducing emissions to 80 percent below 1990 levels. Implementing this type of methodology would put the City of track to reach the long-term sector target established by Executive Order S-3-05, to reduce emissions in year 2050 to 80 percent below 1990 levels, although no specific recommendations are made.

[1] AB 32 (Nunez) (Chapter 488, Statutes of 2006): California Global Warming Solutions Act of 2006. SB 32 (Pavley) (Chapter 249, Statutes of 2016): California Global Warming Solutions Act of 2006: emissions limit (2015–2016).
[2] California Air Resources Board (CARB): California Greenhouse Gas Inventory for 2000–2016 (June, 2018), accessed on December 13, 2018.

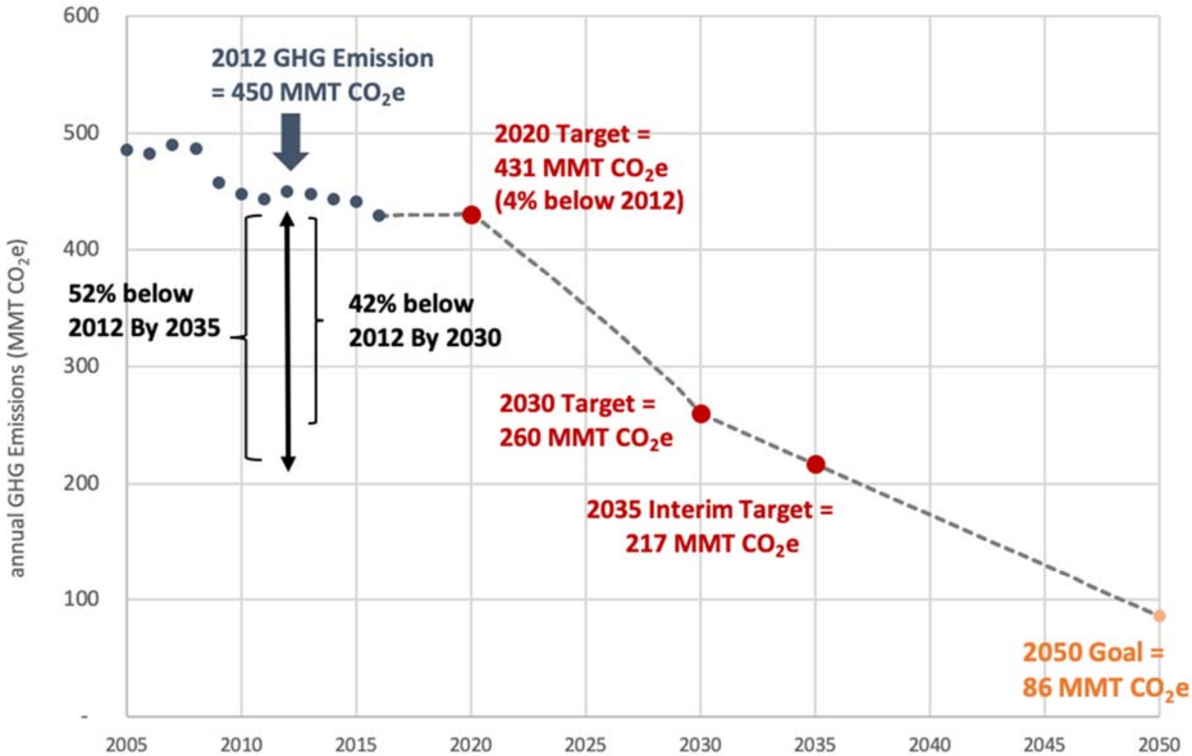

Figure adapted from California's 2017 Climate Change Scoping Plan Figure 6 that shows a linear, straight-line path to the 2030 target.
The 2050 goal is calculated based on 80% below 1990 level (80% below 431 MMT CO2e).
Source: California Air Resources Board California Greenhouse Gas Emission Inventory - 2018 Edition (June 2018).
and 2017 Climate Change Scoping Plan

Figure 1 California Statewide GHG Inventory and Emissions Reduction Targets

The Escondido CAP utilizes a baseline year of 2012 for the purposes of calculating targets. As emissions from transportation account for more than half of the City's total emissions, the inventory year should align with the best available transportation data, which is from 2012. Therefore, the target emissions levels for Escondido are set at 4 percent below the 2012 emissions level by 2020, 42 percent below the 2012 emissions level by 2030, and 52 percent below 2012 emissions level by 2035. These mass reduction targets are consistent with the emissions reduction targets at the State level, explained above.

Table 1 shows the business-as-usual (BAU) emissions projections, which represent emissions levels in the absence of any new policies and programs, targets, as well as CO_2e reductions needed in 2020, 2030, and 2035 to achieve the target levels.[3]

[3] The method to project emissions is provided in *Appendix A: City of Escondido Greenhouse Gas Emissions Inventories and Projections* (EPIC, 2018).

Table 1 Emissions Projections, Targets, and Emissions Reductions Needed

Year	Business-as-usual Projection (MT CO_2e)	Target Emissions Level (% below baseline)	Target Emissions Level (MT CO_2e)	Emissions Reduction Needed to Meet Target (MT CO_2e)
2012	943,000	-	-	-
2020	831,000	-4%	907,000	none
2030	833,000	-42%	547,000	286,000
2035	842,000	-52%	456,000	386,000

Emissions projection and reduction values are rounded.
Energy Policy Initiatives Center 2019.

No local actions are needed for Escondido to reach its 2020 target. A reduction of 286,000 MT CO_2e is needed to meet the 2030 target, and a reduction of 386,000 MT CO_2e is needed to reach the 2035 target. This document focuses on the State and local measures needed to reach the 2030 and 2035 targets. Implementing this plan would help the City achieve its 2035 target consistent with state goals.

3 SUMMARY OF EMISSIONS REDUCTION ESTIMATES

This section summarizes the GHG emissions reductions from strategies and measures included in the Escondido CAP. Table 2 below presents a summary of emissions reductions from the nine local strategies in the Escondido CAP, as well as the reductions from federal and State actions.

Table 2 Summary of 2030 and 2035 GHG Emissions Reduction by Strategy in the Escondido CAP

CAP Strategies	Emissions Reduction (MT CO_2e)	
	2030	2035
Strategy 1: Increase the Use of Zero-Emission or Alternative Fuel Vehicles (T)	4,348	7,021
Strategy 2: Reduce Fossil Fuel Use (T)	6,421	10,584
Strategy 3: Reduce Vehicle Miles Traveled (T)	19,910	36,751
Strategy 4: Increase Building Energy Efficiency (E)	935	1,260
Strategy 5: Increase Renewable and Zero-Carbon Energy (E)	44,992	33,864
Strategy 6: Increase Water Efficiency (W)	53	76
Strategy 7: Diversify Local Water Supply (W)	3,541	3,571
Strategy 8: Reduce and Recycle Solid Waste (S)	23,588	27,405
Strategy 9: Carbon Sequestration and Land Conservation (C)	734	1,049
Total Reduction from Federal and State Regulations	235,062	272,044
Total Reduction (Federal, State and CAP Measures)*	340,000	394,000

T – Transportation, E – Energy, W – Water, S – Solid Waste, and C – Carbon Sequestration
*Total emissions reduction values in 2030 and 2035 are rounded.
Energy Policy Initiatives Center 2019.

Each strategy has several measures. Table 3 presents a detailed summary of the emissions reductions from each CAP measure and from each federal and State action.

Table 3 Summary of 2030 and 2035 GHG Emissions Reductions from Measures in Escondido CAP

CAP Strategies	CAP Measures	Emissions Reduction ($MT CO_2e$)	
		2030	2035
Strategy 1: Increase the Use of Zero-Emission or Alternative Fuel Vehicles (T)	T-1.1 Transition to a clean and more fuel-efficient municipal fleet	33	33
	T-1.2 Install electric vehicle charging stations at Park and Ride Lots	463	737
	T-1.3 Adopt an ordinance to require electric vehicle charging stations at new developments	3,513	5,732
	T-1.4 Require electric vehicle charging stations at new model home developments	339	520
Strategy 2: Reduce Fossil Fuel Use (T)	T-2.1 Synchronize traffic signals	289	408
	T-2.2 Install Roundabouts	811	1,145
	T-2.3 Increase renewable or alternative fuel construction equipment	5,321	9,032
Strategy 3: Reduce Vehicle Miles Traveled (T)	T-3.1 Participate in the San Diego Association of Governments' iCommute Vanpool Program	837	787
	T-3.2 Improve pedestrian infrastructure at priority areas	44	59
	T-3.3 Continue to implement Safe Routes to School Program at Escondido Union School District	60	82
	T-3.4 Develop a citywide Transportation Demand Management Plan	533	820
	T-3.5 Update Bicycle Master Plan	231	335
	T-3.6 Increase transit commuters among new downtown residents	84	177
	T-3.7 Develop an intra-city shuttle program	4,463	6,540
	T-3.8 Increase transit ridership	7,829	16,875
	T-3.9 Develop and implement a service population-based vehicle miles traveled threshold	5,829	11,075
Strategy 4: Increase Building Energy Efficiency (E)	E-4.1 Require new residential developments to install alternatively-fuel water heaters	629	822
	E-4.2 Require new multi-family residential developments to install electric cooking appliances	143	172
	E-4.3 Reduce electricity use in streetlights	3	3
	E-4.4 Require non-residential alterations and additions to install alternatively-fuel water heaters	160	263
Strategy 5: Increase Renewable and Zero-Carbon Energy (E)	E-5.1 Increase renewable energy generated at municipal facilities	292	745
	E-5.2 Require new commercial developments to achieve zero net energy	1,618	2,668
	E-5.3 Increase grid-supply renewable and/or zero-carbon electricity	42,134	29,486
	E-5.4: Increase renewable electricity generated at school sites	947	965
Strategy 6: Increase Water Efficiency (W)	W-6.1 Reduce municipal landscape water consumption	45	64
	W-6.2 Reduce landscape water consumption at new model home developments	8	12
Strategy 7: Diversify Local Water Supply (W)	W-7.1 Develop a local water supply for agricultural water use	3,541	3,571
Strategy 8: Reduce and Recycle Solid Waste (S)	S-8.1 Increase citywide waste diversion	23,588	27,405
Strategy 9: Carbon Sequestration and Land Conservation (C)	C-9.1 Enforce landscape tree requirements at new developments	183	239
	C-9.2 Develop a citywide Urban Forestry Program	36	48
	C-9.3 Develop an Agricultural Land and Open Space Conservation Program	515	762
Federal and State Regulations	Federal and California Vehicle Efficiency Standards	87,981	103,866
	California Energy Efficiency Programs	16,778	15,836

CAP Strategies	CAP Measures	Emissions Reduction (MT CO_2e)	
		2030	2035
	Renewables Portfolio Standard	79,088	99,932
	California Solar Policy, Programs and 2019 Mandates	51,215	52,411
Total Reduction from Federal and State Regulations		235,062	272,044
Total Reduction from CAP Measures		104,521	121,582
Total Reduction (Federal, State and CAP Measures)*		340,000	394,000

T – Transportation, E – Energy, W – Water, S – Solid Waste, and C – Carbon Sequestration
*Total emissions reduction values in 2030 and 2035 are rounded.
Energy Policy Initiatives Center 2019.

Figure 2 provides a visualization of the emissions trend for the CAP horizon year through 2035.

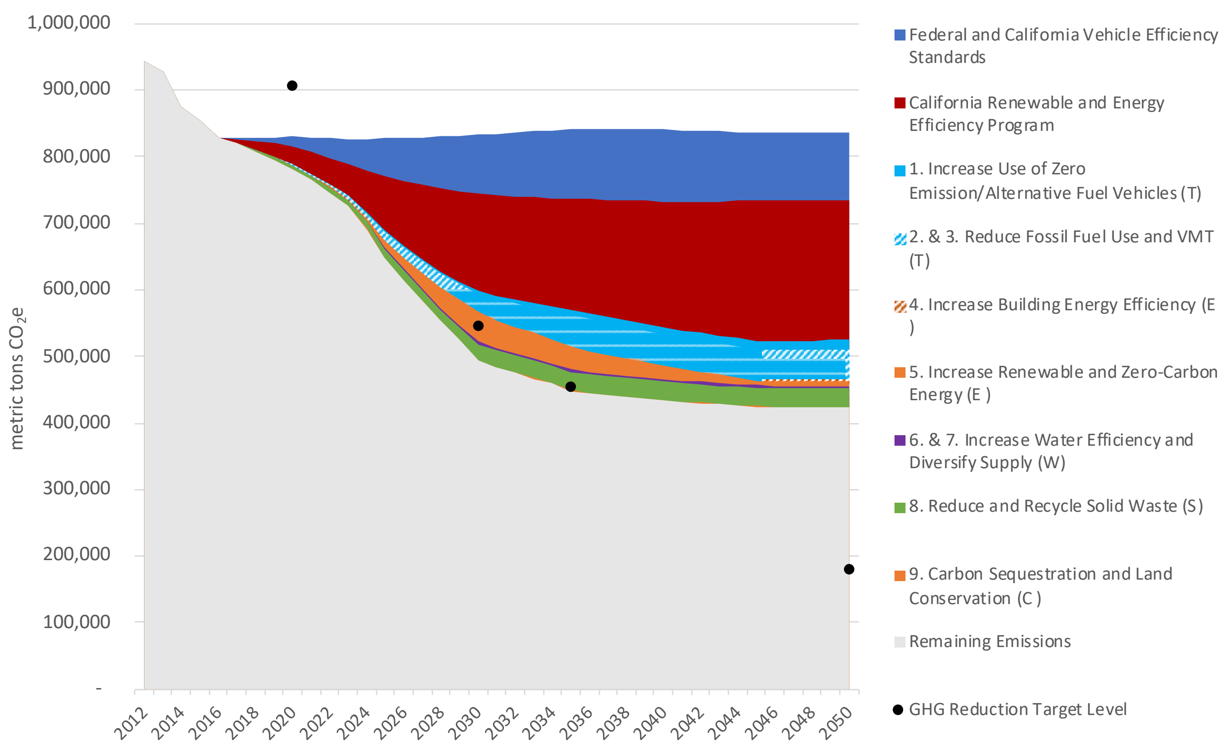

Figure 2 Escondido GHG Emissions Trend (2012–2035)

In Figure 2, the BAU emissions projection is represented along the top of the graph. The black dots represent the target emissions levels in 2020, 2030, and 2035 and the emissions goal in 2050. The colored wedges represent the reduction from each local CAP strategy and from federal and State actions. Each wedge represents the cumulative GHG reduction from each strategy from when the strategy is initiated through 2035. The grey area beneath the colored wedges represents the remaining emissions after all the actions have taken place. As shown in Figure 2, the City meets its 2020, 2030, and 2035 targets with the federal and State actions and local measures identified in the CAP.

4 BACKGROUND AND COMMON ASSUMPTIONS

A set of common assumptions and sources was used to calculate potential emissions reductions for many of the measures included in the CAP. The following section describes the assumptions that are applied to measures related to electricity, natural gas, and on-road transportation. Measures related to other categories do not have common assumptions. The detailed methods and data for each measure are provided in Sections 5 and 6.

4.1 Common Background Data

Table 4 presents a summary of common data used to estimate overall GHG emissions levels and the reduction estimates across several CAP measures.

Table 4 Common Data Used for the Escondido CAP

Year	2012	2030	2035
Population[4]	146,781	172,332	172,892
Labor Force[5]	69,300	79,608	81,903
Vehicle Miles Traveled (VMT) (annual miles)[6]	1,856,972,636	2,020,248,005	2,034,021,525
Electricity Gross Generation (GWh)[7]	762	890	909

VMT projections are based on the SANDAG Series 13 forecast. 2012 is the Series 13 Base Year.
Data in 2012 are historical data and data in 2030 and 2035 are the latest available forecasted data. The next version of SANDAG forecast will revised based on updated historical information, market trends, and new housing accommodation requirements provided by the Regional Housing Needs Assessment.
Energy Policy Initiatives Center 2019.

4.2 Common Assumptions and Methods for Calculating Electricity Emissions Reductions

The following overall assumptions and methods are used in the calculation of emissions reductions related to electricity, including both those from federal and State actions and local CAP measures. Details for the calculation of each action are provided in Sections 5 and 6.

4.2.1 GHG Emission Factor for Electricity

The GHG emission factor for electricity for a city, expressed in pounds of CO_2e per megawatt-hour (lbs CO_2e/MWh), is specific to each city and depends upon the sources of electricity supplied to the city.

[4] The 2012 population is from SANDAG's Demographic & Socio-Economic Estimates (March 9, 2017 version). The population in 2030 and 2035 are from SANDAG's Series 13 Regional Growth Forecast (Updated in October 2013). SANDAG Data Surfer, accessed on November 15, 2017. Series 13 has a base year of 2012. Projections from 2012 may differ from more recent estimates by the State, such as from the Department of Finance (DOF).

[5] The 2012 labor force is from the California Employment Development Department (EDD) Database, accessed on August 2, 2019. The 2030 and 2035 labor force are based on the SANDAG Series 13 forecast for civilian jobs estimates in 2030 and 2035, and the ratio of the 2012 labor force and 2012 SANDAG Series 13 civilian jobs estimate (2012 is the forecast base year). SANDAG's Series 13 Regional Growth Forecast (Updated in October 2013). SANDAG Data Surfer, accessed on November 15, 2017.

[6] Based on SANDAG Series 13 Origin-Destination weekday VMT, provided by SANDAG (March 23, 2017 and November 7, 2017). Weekday VMT were converted to annual VMT using the methods described in *Appendix A: City of Escondido Greenhouse Gas Emissions Inventories and Projections* (EPIC, 2018).

[7] Gross generation is the sum of the forecasted utility electricity sales, electricity generated from behind-the-meter PV systems, additional load from electric vehicles and transmission and distribution losses.

Therefore, for the purpose of estimating GHG reductions, the GHG emission factor for electricity in Escondido is the weighted average emission factor of gross generation from four sources of supply: San Diego Gas & Electric (SDG&E), other electric retail suppliers for SDG&E's Direct Access (DA) customers, a local renewables and zero-carbon program, and behind-the-meter photovoltaic (PV) systems. This citywide emission factor is needed to estimate the effects of State actions and local CAP measures that increase the grid-supply of renewable and zero-carbon electricity, as well as the impact of adding behind-the-meter PV systems and increasing building energy efficiency.

The citywide emission factor is calculated based on the percentage of renewable and zero-carbon content in, and the percentage of, gross generation from each source of supply as described below. This method is applied to 2016, the starting year for emissions projections, as well as to each year included in the CAP horizon.[8] As the percentage of renewable and zero-carbon supply in the mix increases, the weighted average emission factor of electricity supply decreases.

4.2.1.1 Supply from SDG&E

SDG&E's power mix includes electricity generated from SDG&E's own power plants and electricity procured by SDG&E (both specified and unspecified sources), known as bundled power. As of 2016, SDG&E's bundled power mix is 43 percent renewable.[9] SDG&E has already met the 2020 mandate of 33 percent renewable energy required by the Renewables Portfolio Standard (RPS) under SB 100 (de León) (Chapter 312, Statutes of 2016).[10] It is assumed that SDG&E will be at 60 percent renewable by 2030 and beyond 73percent renewable by 2035, in line with the mandates in SB 100.[11] These mandates are discussed in Section 5.1.

4.2.1.2 Supply from Electric Retail Suppliers of SDG&E Direct Access Customers

Like SDG&E, electric retail suppliers of SDG&E DA customers are required to meet RPS targets.

4.2.1.3 Supply from Renewables and Zero-Carbon Program

Under CAP Measure E-5.3, the City would present options to the City Council to increase grid-supply renewable and zero-carbon electricity. As of this writing, the City is pursuing a joint, Community Choice Energy feasibility study, with the Cities of San Marcos and Vista, which, if implemented, would accomplish this goal. It is assumed that such a program, Community Choice Energy or other commensurate program, would increase the renewable and zero-carbon electricity to 100 percent in and after 2030, or 40 percent beyond the current RPS mandates for 2030.

The renewable and zero-carbon content of the program would affect the citywide weighted average emission factor. Because the RPS requires all of California's retail electricity suppliers to meet the RPS requirement, a portion of the emissions reduction from RPS compliance is credited to State actions. The remaining portion of reductions, beyond 60 percent in 2030 and 73 percent in 2035, is attributed to the City under Measure E-5.3.

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[8] The method to project emissions is provided in the *Appendix A: City of Escondido Greenhouse Gas Emissions Inventories and Projections* (EPIC, 2018).

[9] California Energy Commission (CEC): 2016 Power Content Label San Diego Gas & Electric.

[10] SB 100 (de León) California Renewables Portfolio Standard Program: emissions of greenhouse gases (2017–2018). The interim RPS targets are 44 percent by 2024 and 52percent by 2027 from eligible renewable energy resources.

[11] 73 percent renewable by 2035 target is linearly interpolated between the 60percent renewable mandate by 2030 and the 100 percent renewable and zero-carbon mandate by 2045 under SB 100.

4.2.1.4 Supply from behind-the-meter PV Systems

Electricity generation from behind-the-meter PV systems, including residential and non-residential PV systems, is considered a part of the overall electricity supply. Electricity generation from PV is considered 100 percent zero-carbon (i.e., GHG-free). The State's solar policies and programs, the 2019 California Building Energy Efficiency Standards (Title 24, Part 6) residential PV mandates, and CAP Measure E-5.1*: Increase Renewable Energy Generated at Municipal Facilities,* Measure E-5.2*: Require New Commercial Developments to Achieve Zero Net Energy,* and Measure E-5.4*: Increase Renewable Electricity Generated at School Sites* all increase behind-the-meter PV systems in the City; they are discussed in Section 6.5.

Considering behind-the-meter PV as a source that contributes to the citywide emission factor helps to calculate the effects of energy efficiency programs that may reduce behind-the-meter electricity use, or from additional electric vehicle (EV) charging load, which may come from behind-the-meter electricity sources and not just from grid supply.

4.2.1.5 Weighted Average GHG Emission Factor for Electricity

The weighted average GHG emission factor for electricity is based on the percentage of gross generation from each previously referenced supply, as well as the percentage of renewable and zero-carbon content in each supply.

Table 5 shows the contribution from each supply to gross generation and its renewable and zero-carbon content, as well as the resulting overall citywide annual weighted average emission factors for 2016, 2030, and 2035.

Table 5 2016 and Projected 2030 and 2035 GHG Emission Factor for Electricity in Escondido

Year		2016	2030	2035
Renewables and Zero-Carbon Program	% of Gross Generation Supplied	-	57%	57%
	Zero-Carbon Content in Supply	-	100%	100%
Other Electric Retail Suppliers	% of Gross Generation Supplied	10%	8%	8%
	Renewable Content in Supply	21%	60%	73%
SDG&E	% of Gross Generation Supplied	79%	7%	7%
	Renewable Content in Supply	43%	60%	73%
Behind-the-meter PV	% of Gross Generation Supplied	11%	29%	29%
	Renewable Content in Supply	100%	100%	100%
Overall Citywide	Citywide Renewable and Zero-Carbon Supply	47%	94%	96%
	Electricity Emission Factor (lbs CO_2e/MWh)	486	53	36

2016 is the latest year with utility data available. The 2016 electricity emission factor is used for BAU emissions projections in future years, including 2030 and 2035.
2030 and 2035 data are projections based on CAP assumptions, current status, and future impact of State policies and programs.
Energy Policy Initiatives Center 2019.

In 2016, SDG&E and other electric retail suppliers supplied accounted for 89 percent of the gross generation, and behind-the-meter PV systems supplied the remainder. SDG&E's 2016 bundled emission factor was 525 lbs CO_2e/MWh, resulting in a citywide emission factor of 486 lbs CO_2e/MWh in 2016.[12]

In 2030, the projected electricity supply from behind-the-meter PV systems is estimated to be 29 percent of gross generation. To comply with the 2030 RPS target, the renewable content in the supply of both SDG&E and other electric retail suppliers will increase to 60 percent; this document assumes the renewable supply is fixed at the RPS mandate level to avoid overestimating the emissions reductions from their renewable supplies. The renewables and zero-carbon program (CAP Measure E-5.3) is assumed to have 100 percent renewable and zero-carbon sources in 2030. Based on these supply contributions, the citywide annual weighted electricity emission factor in 2030 is projected to be 253 lbs CO_2e/MWh (94 percent renewable or zero-carbon).[13] Using the same method, the projected overall citywide electricity emission factor in 2035 would be 36 lbs. CO_2e/MWh (94 percent renewable or zero-carbon).

These annual weighted citywide electricity emission factors are used to calculate the GHG reductions from CAP measures that both increase renewable and zero-carbon supply or reduce electricity use.

4.2.2 Allocation of GHG Emissions Reductions from Actions that Increase Renewables in Electricity to State Actions and Local CAP Measures

The projected citywide electricity emission factor is used to estimate the GHG emissions reductions from any measures that increase the overall renewable and zero-carbon supply. The total reduction resulting from State and local CAP measures to increase renewable and zero-carbon supply is given in Table 6. It is calculated using the projected gross generation in target years, as well as the difference in the 2030 and 2035 citywide emissions and BAU emission factors.

Table 6 Emissions Reductions from All Actions Increasing Renewable and Zero-Carbon Supply in Escondido

Year	Gross Generation (GWh)	BAU Projections		Projections with State and Local Actions in Increasing Renewable and Zero-Carbon Supply		Emissions Reduction from Increased Renewable and Zero-Carbon Supply ($MT CO_2e$)
		BAU Electricity Emission Factor (lbs CO_2e/MWh)	BAU Emissions from Electricity ($MT CO_2e$)	Projected Electricity Emission Factor (lbs CO_2e/MWh)	Projected Emissions from Electricity ($MT CO_2e$)	
2030	890	486	196,254	53	21,218	175,036
2035	909	486	200,484	36	14,693	185,791

The projections with increasing renewable and zero-carbon supply are based on CAP assumptions and State policies and programs. Energy Policy Initiatives Center 2019.

The BAU emission factor for 2016 (Table 5) is kept constant through the year 2035, as opposed to using the emission factor for the 2012 baseline year. This is because the additional renewable content in

[12] The SDG&E bundled emission factor is calculated by EPIC and the methodology is reported in the SANDAG Regional Climate Planning Framework (ReCAP) Technical Appendix I, Table 6 (2018).

[13] Starting with SDG&E's 2016 bundled emission factor of 525 lbs CO_2e/MWh (43 percent renewable), the projected 2030 SDG&E and other electric retail provider's emission factor is 368 lbs CO_2e/MWh (60 percent renewable) and the projected 2030 local program emission factor is zero (100 percent renewable or zero-carbon). The 2030 citywide emission factor is then 368 lbs CO_2e/MWh*15 percent.

SDG&E's supply and behind-the-meter PV supply in 2016 are already included in the BAU emissions projection.[14]

The total emissions reduction from increasing renewable and zero-carbon supply, as calculated above (Table 6), is attributed to each supply based on its renewable (or zero-carbon, if beyond the RPS mandate) contribution to the total citywide renewable content. This attribution and impact on GHG reductions from each supply are shown in Table 7.

Table 7 Attribution of Emissions Reductions to Supplies that Increase Renewable and Zero-Carbon Supply in Escondido

Year	Electricity Supply	Total	Renewables and Zero-Carbon Program	Other Electric Retail Suppliers	SDG&E	Behind-the-meter PV
2030	% of Gross Generation Supplied by Renewables and Zero-Carbon Sources	94%	57%	5%	4%	29%
	Emissions Reduction from Increased Renewables and Zero-Carbon Supply (MT CO_2e)	175,036	105,336	8,576	7,310	53,814
2035	% of Gross Generation Supplied by Renewables and Zero-Carbon Sources	96%	57%	6%	5%	29%
	Emissions Reduction from Increased Renewables and Zero-Carbon Supply (MT CO_2e)	185,791	109,209	10,923	9,286	56,373

2030 and 2035 data are the projections based on CAP assumptions and the future impact of State policies and programs.
Energy Policy Initiatives Center 2019.

4.3 Common Assumptions and Methods for Calculating Natural Gas Emissions Reductions

The default emission factor of 0.0054 MT CO_2e per therm is used for all years to estimate the emissions reductions for the CAP measures related to reducing natural gas use.[15]

4.4 Common Assumptions and Methods for Calculating On-Road Transportation Emissions Reductions

The following assumptions and methods are used to calculate emissions reductions for strategies related to on-road transportation, including federal and State actions and local CAP measures.

4.4.1 GHG Emission Factor for On-Road Transportation

The GHG emission factor for on-road transportation, expressed in grams of CO_2e per mile (g CO_2e/mile), is used in several ways throughout the document. It is used to estimate the effect of State actions to increase the vehicle fuel efficiency standard, the impact of reduced VMT, and the effect of State and local actions to increase the miles driven by EVs.

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[14] The method to project emissions is provided in the *Appendix A: City of Escondido Greenhouse Gas Emissions Inventories and Projections* (EPIC, 2018).

[15] Emission factor for natural gas is from CARB, Documentation of California's GHG Inventory – Index.

The default outputs of CARB's Mobile Source Emissions Inventory EMFAC2014 model are used to determine the average vehicle emission rates for the San Diego region.[16] The average vehicle emission rates for the San Diego region were used as proxies for Escondido. The EMFAC2014 model outputs include effects of all key federal and State regulations related to tailpipe GHG emissions reductions that were adopted before the model release date in 2015. The regulations embedded in the outputs are:

- For passenger cars and light-duty vehicles – Federal Corporate Average Fuel Economy (CAFE) standards and California Advanced Clean Car (ACC) Program[17]
- For heavy-duty vehicles (heavy-duty trucks, tractors, and buses) – U.S. Environmental Protection Agency's Phase-I GHG Regulation and CARB Tractor-Trailer GHG Regulation[18]

Using the EMFAC2014 default output, the average vehicle emission rates (g CO_2/mile) are calculated based on the distribution of VMT for each vehicle class and its emission rate. The results are adjusted to convert from g CO_2/mile to g CO_2e/mile to account for total GHG emissions, including CO_2, CH_4, and N_2O.[19] The average vehicle emission rates (Table 8) are used to estimate the GHG emissions reduction impact of policies that increase vehicle efficiency and increase the number of zero emission vehicles (ZEVs) on the road.[20]

Table 8 Average Vehicle Emission Rate in the San Diego Region

Year	Average Vehicle Emission Rate–with the Impact of all Adopted State and Federal Policies (g CO_2e/mile)
2016	446
2030	297
2035	279

Based on CARB EMFAC2014 model. The model includes all key federal and State regulations related to tailpipe GHG emissions reductions that were adopted before the model release date in 2015.
CARB 2015, Energy Policy Initiatives Center 2019.

The projected average vehicle emission rates in Table 8 are also used to estimate the emissions reductions from CAP measures that reduce VMT. Because vehicle efficiency improves and the population of ZEVs increase over time, the average vehicle emission rate decreases. Therefore, measures that reduce the same amounts of VMT would lead to decreasing amounts of GHG emissions throughout the CAP horizon.

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[16] CARB: Mobile Source Emissions Inventory. EMFAC2014 was the latest model available at the beginning of the CAP development process (early 2018). The latest model is EMFAC2017 released in March 2018.

[17] The ACC program includes additional standards for vehicle model years 2017–2025, and the Zero Emission Vehicle (ZEV) program requires manufacturers to produce increasing numbers of ZEVs and plug-in hybrid electric vehicles for 2017–2025 model year vehicles. CARB: EMFAC2014 Technical Documentation, Section 1.4 (v1.0.7 May 2017).

[18] EPA's Phase-I GHG regulation includes GHG emission standards for heavy-duty vehicle model years 2014–2018. CARB's Tractor-Trailer GHG Regulation includes the aerodynamic and tire improvements requirements to reduce GHG emissions from heavy-duty trucks. CARB: EMFAC2014 Technical Documentation, Section 1.4.

[19] The calculation and adjustment method are described in Section 4.1 of the *Appendix A: City of El Cajon Greenhouse Gas Emissions Inventories and Projections* (EPIC, 2018).

[20] EVs are ZEVs, however, ZEVs may include vehicles with other technologies such as fuel cell vehicles. EMFAC2014 only models the impact of EVs as ZEVs, therefore, in this document EVs and ZEVs are interchangeable.

4.4.2 GHG Emissions Reduction from Increasing Zero Emission Vehicles

CAP Measure T-1.2*: Install Electric Vehicle Charging Stations at Park and Ride Lots*, Measure T-1.3*: Adopt an Ordinance to Require Electric Vehicle Charging Stations at New Developments,* and Measure T-1.4*: Require Electric Vehicle Charging Stations at New Model Home Developments* all assist in the implementation of the State ZEV program that requires manufacturers to produce increasing numbers of ZEVs and plug-in hybrid electric vehicles (PHEVs).

The total effect of the ZEV program in future years is estimated by comparing the emissions rate in the BAU projection with no additional policy impacts after 2016 (a fixed 2016 ZEV penetration rate for the CAP horizon) and the emissions rate with the impact of the ZEV program (EMFAC2014's default ZEV penetration rate), as shown in Table 9.[21] The BAU projection is based on the year 2016, not the 2012 baseline year, to be consistent with the projection methodology in the electricity category. The additional 2016 model year vehicle fuel efficiency and ZEVs are already taken into consideration in the BAU emissions projection.

Table 9 Emissions Reduction from Increasing Miles Driven by Zero Emission Vehicles

Year	Projected VMT (annual million miles)	BAU Projection - With No Policy Impact after 2016		With Impact of Adopted ZEV Program		Total Emissions Reduction from ZEVs (MT CO_2e)
		BAU Average Vehicle Emission Rate* (g CO_2e/mile)	BAU Emissions from On-Road Transportation (MT CO_2e)	Average Vehicle Emission Rate (g CO_2e/mile)	Emissions from On-Road Transportation (MT CO_2e)	
2030	1,123	379	425,403	361	405,002	20,401
2035	1,134	377	427,295	355	402,718	24,577

*Despite the absence of additional policies and programs to increase vehicle efficiency, the BAU average vehicle emission rate decreases with natural turnover of the fleet as newer vehicles replace old vehicles.
The 2030 and 2035 VMT projection is based on the SANDAG Series 13 Growth Forecast. The projected emission rates are the projections under CAP assumptions, including future impact of State policies and programs used in the CARB EMFAC2014 model.
Energy Policy Initiatives Center 2019.

Portions of the total emissions reduction from ZEVs (20,401 MT CO_2e in 2030 and 24,577 MT CO_2e in 2035) are attributed to Measures T-1.2 through T-1.4 in proportion to each measure's contribution of electric vehicle miles (e-VMT). Table 10 provides the key assumptions and results of the attribution.

[21] The method to project emissions is provided in the *Appendix A: City of Escondido Greenhouse Gas Emissions Inventories and Projections* (EPIC, 2018).

Table 10 Allocation of GHG Emissions Reduction from Increasing Zero Emission Vehicles

Year	Projected e-VMT of Total VMT	Projected e-VMT Due to (annual million miles)				Emissions Reduction from EVs Due to ($MT CO_2e$)			
		ZEV Program	Measure T-1.2	Measure T-1.3	Measure T-1.4	ZEV Program	Measure T-1.2	Measure T-1.3	Measure T-1.4
2030	7.6%	85	1.9	14.7	1.4	20,401	463	3,513	339
2035	8.9%	101	3.0	23.5	2.1	24,577	737	5,732	520

e-VMT: electric vehicle miles
Measure T-1.2: Install Electric Vehicle Charging Stations at Park and Ride Lots, Measure T-1.3: Adopt an Ordinance to Require Electric Vehicle Charging Stations at New Developments, and Measure T-1.4: Require Electric Vehicle Charging Stations at New Model Home Developments
Projected e-VMT percent of total VMT is based on the assumptions in the CARB EMFAC2014 model for the San Diego Region.
The emissions reduction from EVs is the projection under the CAP assumptions, including future impact of State policies and programs used in the CARB EMFAC2014 model and assumptions used for local CAP actions.
Energy Policy Initiatives Center 2019.

Based on the EMFAC2014 model assumptions, in 2030, 7.6 percent of all VMT in the San Diego region will be driven by EVs, corresponding to 85 million e-VMT in Escondido. The requirement through Measure T-1.2 would result in about 1.9 million e-VMT in 2030. Therefore, 2.3 percent (the ratio of 1.9 million miles to 85 million miles) of emissions reductions from the ZEV program are attributed to Measure T-1.2. The emissions reductions from Measures T-1.3 and T-1.4 and target year 2035 are attributed using the same method.

5 FEDERAL AND STATE ACTIONS

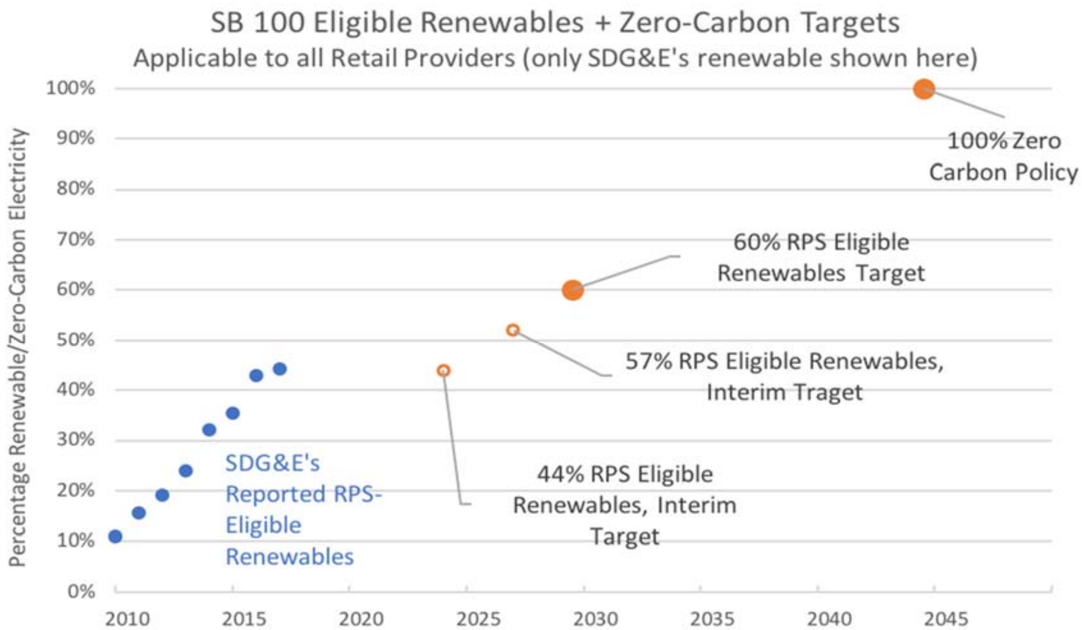
Federal and State actions are expected to reduce emissions significantly over the CAP horizon. This section provides a summary of the methods used to estimate the emissions reductions associated with the following federal and State actions to increase renewable electricity, building energy efficiency, and clean and efficient transportation:

- California RPS
- California Solar Programs, Policies and 2019 Mandates
- California Energy Efficiency Programs
- Federal and California Vehicle Efficiency Standards

5.1 California Renewables Portfolio Standard

SB 100, the 100 Percent Clean Energy Act of 2018, adopts a 60 percent RPS for all of California's retail electricity suppliers by 2030; this increases the current RPS standard from 50 percent to 60 percent. The legislation also provides goals for the intervening years before 2030 and establishes a State policy requiring that "zero-carbon" resources supply 100 percent of all retail electricity sales to end-user customers and all State agencies by December 31, 2045.[22] If interpolated linearly between 60 percent renewables in 2030 and 100 percent zero-carbon in 2045, the interim 2035 target would be 73 percent renewables. The SB 100 renewables and zero-carbon targets are shown in Figure 3 below.

[22] SB 100 (de León): California Renewables Portfolio Standard Program: emissions of greenhouse gases (2017–2018). The interim RPS targets are 44 percent by 2024 and 52 percent by 2027 from eligible renewable energy resources.



Targets apply to all retail providers include electric service providers for Direct Access, Community Choice Aggregators and Investor Owned Utilities.
Energy Policy Initiatives Center 2018.

Figure 3 SB 100 Renewables and Zero-Carbon Targets

All retail electricity suppliers are required to meet the State's RPS requirements, including SDG&E, retail electricity suppliers for SDG&E's DA customers, and any other renewables and zero-carbon programs. In this document, a conservative approach is taken which assumes all providers for current utility customers, including electricity sales to DA customers, will meet, but not surpass, the RPS requirements for 2030 and 2035. Under this assumption, all emissions reductions from SDG&E and electric retail suppliers reaching 60 percent renewables in 2030 and 73 percent renewables in 2035 are credited to the State under the RPS requirements.

For the renewables and zero-carbon program considered under Measure E-5.3, the target is to reach 100 percent renewables and zero-carbon in 2030. A portion of the emissions reductions from the program will be credited to the State under RPS compliance, and the remaining reduction will be attributed to local Measure E-5.4, as described in Section 6.5.3. Table 11 shows results from RPS mandates in target years.

Table 11 Electricity Suppliers and Projected Emissions Reduction from California Renewables Portfolio Standard

Year	(a) RPS-Related Emissions Reduction from the Utility* (MT CO_2e)	(b) RPS-Related Emissions Reduction from Renewables and Zero-Carbon Program Under Measure E-5.3 (MT CO_2e)	(a + b) All RPS-Related Emissions Reductions (MT CO_2e)
2030	15,886	63,201	79,088
2035	20,209	79,723	99,932

*Includes SDG&E and electric retail suppliers of SDG&E Direct Access customers.
2030 and 2035 data are projections under the CAP based on current status, future impact of State policies and programs, and CAP measures assumptions.
Energy Policy Initiatives Center 2019.

5.2 California Solar Programs, Policies and 2019 Mandates

5.2.1 Solar Policies and Programs

California has several policies and programs to encourage customer-owned, behind-the-meter PV systems, including the California Solar Initiatives, New Solar Home Partnership, Net Energy Metering, and electricity rate structures designed for solar customers.

The California Energy Demand 2018–2030 Revised Forecast, developed by the CEC, has projections for behind-the-meter PV generation in the SDG&E planning area through 2030. The demand forecast provides three cases: high-demand, mid-demand, and low-demand. The PV projection from 2018–2030 in the SDG&E planning area mid-demand case is used to forecast the PV generation in Escondido.[23]

The California Distributed Generation (DG) Statistics database includes capacities of behind-the-meter PV systems interconnected in a jurisdiction in a given year for each of the three Investor Owned Utility (IOU) planning areas, including SDG&E. The DG Statistics database also provides detailed information about the behind-the-meter PV systems installed in a jurisdiction from the start year of incentive programs through the current year. This provides a historical record used to determine the capacity in GHG inventory years and can also help determine trends in PV installation.

A comparison of the estimated capacity and electricity generation from PV systems in Escondido and in the SDG&E planning area are given in Table 12.[24]

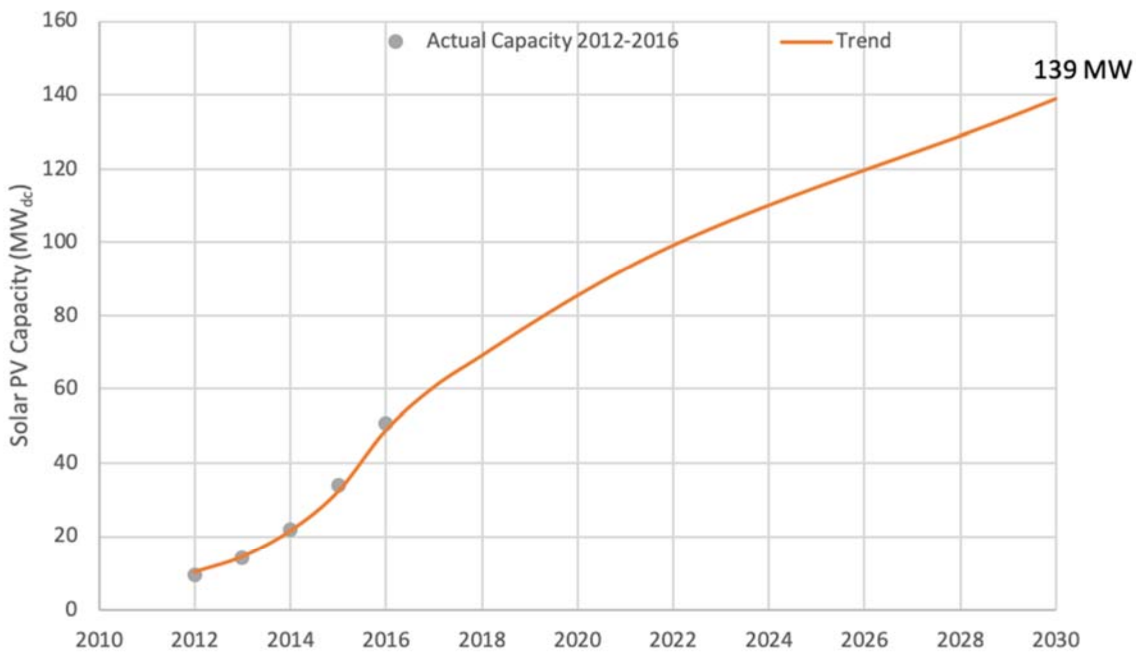
[23] Kavalec et al., 2018. Mid Case Revised Demand Forecast (February 2018). CEC, Electricity Assessments Division. Publication Number: CEC-200-2018-002-CMF, accessed July 11, 2018.
[24] The capacity of all interconnected PV systems in Escondido are from the California Distributed Generation Statistics NEM Currently Interconnected Data Set (current as of May 31, 2017), download date: September 12, 2017.

Table 12 Behind-the-meter PV Capacity and Estimated Electricity Generation

Year	Escondido*		SDG&E Planning Area**	Historical Ratio of Electricity Generation from PV (Escondido to SDG&E)
	PV Capacity (MW)	Estimated Electricity Generation (GWh)	Estimated Electricity Generation (GWh)	
2012	9	17	238	7.0%
2013	14	25	335	7.4%
2014	22	38	496	7.7%
2015	34	59	744	8.0%
2016	51	89	1,129	7.9%
			Average	7.6%

*Estimated electricity generation based on PV capacity and 20% capacity factor.
**California Energy Demand 2018–2030 Revised Forecast mid-demand case (February 2018 version).
California Distributed Generation Statistics 2017, CEC 2018, Energy Policy Initiatives Center 2019.

For future years, the electricity generation and capacity of behind-the-meter PV systems in the City are estimated based on the PV generation in CEC's mid-demand forecast for SDG&E's planning area, and the average ratio of PV generation in the City to that of SDG&E's planning area from 2012–2016 (7.6 percent). Because of California's solar programs and policies, the estimated PV capacity in 2030 in Escondido is projected to be 139 megawatts (MW). It is assumed the PV capacity from State programs will remain at 139 MW due to the lack of statewide PV projections beyond 2035. The trend of behind-the-meter PV in the City is shown in Figure 4.



Source of historical capacity: California Distributed Generation Statistics, 2017.
Source of capacity trend: California Energy Demand 2018-2030 Revised Forecast in San Diego planning area, mid-demand scenario (Feburary 2018 version).
The forecast does not include the additional PV installation due to 2019 Title 24 PV mandates or local CAP measures.
Energy Policy Initiatives Center, 2018.

Figure 4 Behind-the-meter PV Historical and Projected Trend in Escondido (2012–2030)

5.2.2 2019 Building Energy Efficiency Standards PV Mandates

The new California 2019 Building Energy Efficiency Standards, which went into effect on January 1, 2020, require all newly constructed single-family homes, low-rise multi-family homes, and detached accessory dwelling units (ADUs) to have PV systems installed, unless the building receives an exception.[25]

The San Diego Association of Governments (SANDAG) Series 13 Forecast assumes that 254 new single-family homes and 2,431 new multi-family homes will be added in Escondido from 2020 to 2035.[26] In this document, it is assumed that all new single-family and low-rise multi-family homes are subject to the mandate. For the PV system size requirement of each housing unit type, the minimum size required by the 2019 Building Energy Efficiency Standards is calculated based on the average unit size of the housing type, as shown in Table 13.[27]

[25] CEC: 2019 Building Energy Efficiency Standards – 2019 Residential Compliance Manual (December 2018). For the requirements on newly constructed single-family and low-rise multi-family homes, see Section 7.2 Prescriptive Requirements for Photovoltaic System. For the requirements on newly constructed and detached ADU, see Section 9.3.5 Accessory Dwelling Units.
[26] SANDAG Series 13 Regional Growth Forecast (October 2013). SANDAG Data Surfer, accessed November 15, 2017.
[27] Average unit size based on 2019 Building Energy Efficiency Standard Computer Compliance Program (CBECC-Res 2019.1.0) prototype homes.

Table 13 Estimated PV Requirement for New Homes after 2020 in Escondido

Housing Unit Type	Average Size of Unit (sq. ft.)*	Minimum PV Required for the Unit Size (kW_{dc})**
Single-family 1	2,700	3.1
Single-family 2	2,100	2.7
Average of Single-family		2.9
Multi-family	870	2.0

* Based on the prototype home, multi-family prototype is 8,760 sq. ft. with eight units
** Calculated based on unit size (sq. ft.) and 2019 Building Energy Efficiency Standards Residential Compliance Manual Equation 7-1 and Table 7-1. Escondido is in Climate Zone 10.
Energy Policy Initiatives Center 2019.

It is assumed that 20 percent of the new homes would be exempt for other reasons, which is consistent with the assumptions in the CEC's mid-demand case for additional achievable PV.[28] The Energy Demand 2018–2030 Revised Forecast (Revised Forecast) already assumes that a certain percentage of new single-family homes will install PV systems regardless of these mandates; therefore, the result of the PV mandate is assumed to be the additional installation not captured in the Revised Forecast and beyond the baseline assumption for single-family PV installation. The number of new homes with PV systems as a result of the PV mandate, as well as the estimated minimum system capacity, are given in Table 14. The number of new homes with PV systems and estimated system capacity are those added between 2020 and 2030, and between 2020 and 2035.

Table 14 New Homes with PV Systems after 2020 in Escondido due to PV Mandates

Year	New Single-family Homes after 2020 with PV Systems due to State Mandates		New Multi-family Homes after 2020 with PV Systems due to State Mandates		All New Homes after 2020 with PV Systems due to State Mandates	
	Number of Additional Homes with PV Systems	PV System Capacity (kW)	Number of Homes with PV Systems	PV System Capacity (kW)	PV System Capacity (MW)	Estimated Electricity Generation (MWh)
2030	83	240	1,779	3,559	3.8	6,655
2035	166	481	1,945	3,890	4.4	7,658

PV system capacities are the additional capacities in 2030 and 2035 from all systems added to new homes after 2020 as a result of PV mandates. The capacities do not include existing PV, PV installation at new single-family homes already shown in the projection in Figure 4, or PV added on other new non-residential projects.
Energy Policy Initiatives Center 2019.

5.2.3 All Solar Policies, Programs and Mandates

The California Energy Demand 2018–2030 Revised Forecast, discussed in Section 5.2.1, does not include the additional impact of the 2019 PV mandates; therefore, the PV installation trend shown in Figure 4

[28] This approach is consistent with the CEC's additional achievable PV forecast mid-case scenario for single-family homes. CEC's forecasts do not model the impact of PV mandates on low-rise multi-family homes. Personal communication with CEC staff, December 14, 2018.

does not include the additional MW PV capacity from new homes after 2020.[29] The total estimated PV capacity in Escondido resulting from California solar policies, programs, and PV mandates is projected to be 142.9 MW in 2030 and 143.3 MW in 2035.

Through CAP Measure E-5.2*: Require New Commercial Developments to Achieve Zero Net Energy*, the City plans to require PV installation at new non-residential developments. Like the residential PV mandates, this measure is not captured in the Revised Forecast and would result in additional PV installations. CAP Measure E-5.1*: Increase Renewable Energy Generated at Municipal Facilities* includes the PV installation goal for 2035; since the Revised Forecast only includes projections up to 2030, this results in additional PV capacity. However, for CAP Measure E-5.4*: Increase Renewable Electricity Generated at School Sites*, the PV installations started in 2019 and are projected to be completed by 2020; therefore, they are likely captured in the Revised Forecast. As a result, the estimated PV capacities of Measures E-5.1 E-5.2 would be 4.5 MW in 2030 and eight MW in 2035, as discussed in detail in Sections 6.5.1 and 6.5.2. This brings the projected total PV capacity in the City to 147 MW in 2030 and 151 MW in 2035.

The emissions reductions from all State and City CAP measures that increase behind-the-meter renewable supply are 53,814 MT CO_2e in 2030 and 56,373 MT CO_2e in 2035, as shown in Table 7 (Attribution of Emissions Reductions to Supplies that Increase Renewable and Zero-Carbon Supply in Escondido). The total reduction is allocated based on estimated capacity (MW) that would result from each action. As shown in Table 15, GHG emissions reductions are the projected reduction amounts in the years 2030 and 2035 only, not the sum of the annual reductions from the 2012 baseline year to 2030 or 2035.

Table 15 Key Assumptions and Results for California Solar Policies, Programs and Mandates

Year	State or City Action	Total	Measure E-5.1: Increase Renewable Energy Generated at Municipal Facilities	Measure E-5.2: Require New Commercial Developments to Achieve Zero Net Energy*	Measure E-5.4: Increase Renewable Electricity Generated at School Sites	California Solar Polices, Programs, and Mandates**
2030	Projected Behind-the-meter PV Capacity (MW)	147	0.8	3.7	2.6	**140.2**
	Projected Emissions Reduction (MT CO_2e)	53,814	292	1,360	947	**51,215**
2035	Projected Behind-the-meter PV Capacity (MW)	151	2.0	6.0	2.6	**140.8**
	Projected Emissions Reduction (MT CO_2e)	56,373	745	2,252	965	**52,411**

*Does not represent all emissions reduction from Measure E-5.2
**Solar policies, programs and mandates include the impact of the PV mandates from the 2019 Building Energy Efficiency Standard.
The projected capacity and emissions reductions based on current conditions, the future impact of State policies and programs, and CAP assumptions.
Energy Policy Initiatives Center 2019.

In 2030, 95 percent (140.2 MW out of 147 MW) of the projected citywide PV capacity will be due to State polices, programs, and mandates; therefore, 95 percent of the total emissions reduction from

[29] The 2018–2030 Revised Forecast assumes a percentage of new single-family homes will install PV systems without the mandates. The 2020–2030 percentages vary by year. However, it does not model the impact of PV mandates on low-rise multi-family homes. Personal communication with CEC staff, December 14, 2018.

increasing behind-the-meter PV (53,814 MT CO_2e) is attributed to this State action (51,215 MT CO_2e). The reductions and attribution from other measures and in target year 2035 are calculated using the same method.

5.3 California Energy Efficiency Program

In September 2017, the California Public Utilities Commission (CPUC) adopted energy efficiency goals for ratepayer-funded energy efficiency programs (Decision 17-09-025); these went into effect in 2018. The adopted energy saving goals for SDG&E's service territory are given in the Decision on an annual basis from 2018 to 2030.[30] The sources of the energy savings include, but are not limited to, rebated technologies, building retrofits, behavior-based initiatives, and codes and standards.[31]

To evaluate the impact of the energy efficiency program on Escondido, the total energy savings in SDG&E's service territory by 2030 are allocated to the City using a ratio of the City's natural gas and electricity demand to those of SDG&E's entire service territory. In the past three years, the ratios have been 4.5 percent for electricity and 4.3 percent for natural gas.[32] SDG&E's service territory electricity and natural gas savings were allocated accordingly to Escondido, as shown in Table 16.[33]

Table 16 Estimated Energy Savings from California Energy Efficiency Program

Year	Electricity Savings* (GWh)		Natural Gas Savings (Million Therms)	
	SDG&E Service Territory	Allocation of Savings to Escondido	SDG&E Service Territory	Allocation of Savings to Escondido
2030	3,564	123	60	3

*Include transmission and distribution losses.
SDG&E service territory savings are the cumulative savings after 2018 based on the 2018–2030 annual saving goals in CPUC Decision 17-09-025.
Energy Policy Initiatives Center 2019.

The utility's energy efficiency goal is not estimated by the CPUC beyond 2030; therefore, it is assumed the electricity and natural gas savings in 2035 from energy efficiency programs will be the same as in 2030. Emissions reductions from electricity savings are calculated by multiplying the electricity savings by the citywide GHG emission factor for electricity, discussed in Section 4.2.1 (GHG Emission Factor for Electricity) and shown in Table 5 (2016 and Projected 2030 and 2035 GHG Emission Factor for Electricity in Escondido). As the renewable and zero-carbon content in electricity increases, the emissions reduction from the electricity portion of the energy efficiency program decreases. Emissions reductions from natural

[30] CPUC: Decision 17-09-025, Adopting Energy Efficiency Goals for 2018–2030, accessed December 12, 2018. SDG&E's electricity service territory is larger than San Diego region.
[31] Navigant Consulting: Energy Efficiency Potential and Goals Study for 2018 and Beyond (August 2017), accessed December 12, 2018. Rebated technologies are the energy efficiency technologies from the utility's historic incentive programs, including equipment and retrofits.
[32] SDG&E's service territory demand is from California Energy Demand 2018–2030 Revised Forecast, SDG&E's planning area load 2014–2016. 2016 is the latest year with historical data in the demand forecast. Electricity and natural gas demand in Escondido were provided to EPIC by SDG&E for the GHG inventory. *Appendix A: City of Escondido Greenhouse Gas Emissions Inventory and Projection* (EPIC, 2018).
[33] CPUC: Decision 17-09-025, Adopting Energy Efficiency Goals for 2018–2030, accessed December 12, 2018. The 2018 and beyond goals are given on an annual basis for each year from 2018 to 2030, different from previous studies, in which the cumulative goals are given. The cumulative savings in 2030 from 2018 are the sum of the annual savings.

gas savings were calculated using the natural gas savings amount and natural gas emission factor. Table 17 summarizes the energy savings and GHG emissions reductions in the years 2030 and 2035.

Table 17 Emission Reductions from California Energy Efficiency Programs

Year	Electricity Savings			Natural Gas Savings			Total Emissions Reduction ($MT\ CO_2e$)
	Electricity Savings (GWh)	Emission Factor (lbs CO_2e/MWh)	GHG Reduction from Electricity Savings ($MT\ CO_2e$)	Natural Gas Savings (million therms)	Emission Factor ($MT\ CO_2e$/therm)	GHG Reduction from Natural Gas Savings ($MT\ CO_2e$)	
2030	123	53	2,925	2.5	0.0055	13,854	16,778
2035	123	36	1,983	2.5	0.0055	13,854	15,836

The emissions reductions are projected based on CAP assumptions and future impact of State policies and programs.
Energy Policy Initiatives Center 2019.

5.4 Federal and California Vehicle Efficiency Standards

As discussed in Section 4.4 (Common Assumptions and Methods for Calculating On-Road Transportation Emissions Reductions), CARB's EMFAC2014 model includes all key federal and State regulations related to tailpipe GHG emissions reductions for both light-duty and heavy-duty vehicles that were in place before the 2015 model release date.

Table 18 compares the average vehicle emission rate and emissions from on-road transportation under the BAU projection, as well as with the impact of policies that increase vehicle efficiency and ZEVs. As discussed in Section 4.4.2 (GHG Emissions Reduction from Increasing Zero Emission Vehicles), to avoid double-counting, the maximum emission reductions related to all measures in the CAP facilitating ZEV-driven miles are set at the amount expected from statewide programs and policies.

In order to attribute these reductions to the City, the effects of CAP Measure T-1.2*: Install Electric Vehicle Charging Stations at Park and Ride Lots,* Measure T-1.3*: Adopt an Ordinance to Require Electric Vehicle Charging Stations at New* Developments, and Measure T-1.4*: Require Electric Vehicle Charging Stations at New Model Home Developments* are subtracted from the maximum emissions reductions from State policies. Table 18 summarizes the key assumptions and results. The GHG emissions reductions are the projected reduction amount in the years 2030 and 2035 only, not the sum of the annual reductions from the 2012 baseline year to 2030 or 2035.

Table 18 Key Assumptions and Results for Federal and California Vehicle Efficiency Standards

Year	Projected City VMT (annual million miles)	BAU Projection – With No Policy Impact after 2016		With Impact of Adopted Statewide Policies		Emissions Reduction ($MT CO_2e$)		
		Average Vehicle Emission Rate* (g CO_2e/mile)	Emissions from On-Road Transportation (MT CO_2e)	Average Vehicle Emission Rate (g CO_2e/mile)	Emissions from On-Road Transportation (MT CO_2e)	With Impact of Adopted Statewide Policies	From CAP Measure T-1.2 through T-1.4	Remaining from Statewide Policies
2030	1,123	379	425,403	297	333,108	92,295	4,314	87,981
2035	1,134	377	427,295	279	316,441	110,853	6,988	103,866

*Despite the absence of additional policies and programs to increase vehicle efficiency, the BAU average vehicle emission rate decreases with natural fleet turnover as new vehicles replace old vehicles
Measure T-1.2: *Install Electric Vehicle Charging Stations at Park and Ride Lots*, *Measure T-1.3: Adopt an Ordinance to Require Electric Vehicle Charging Stations at New Developments*, and *Measure T-1.4: Require Electric Vehicle Charging Stations at New Model Home Developments*
The 2030 VMT projections are based on SANDAG's Series 13 Growth Forecast. The emission rates and emissions reductions are projected based on CAP assumptions and future impact of State policies and programs used in the CARB EMFAC2014 model.
Energy Policy Initiatives Center 2019.

6 CAP STRATEGIES AND MEASURES

The following section describes the methods used to estimate the GHG reductions from local CAP measures, which are organized into the following nine strategies:[34]

- Strategy 1: Increase the Use of Zero-Emission or Alternative Fuel Vehicles (T)
- Strategy 2: Reduce Fossil Fuel Use (T)
- Strategy 3: Reduce Vehicle Miles Traveled (T)
- Strategy 4: Increase Building Energy Efficiency (E)
- Strategy 5: Increase Renewable and Zero-Carbon Energy (E)
- Strategy 6: Increase Water Efficiency (W)
- Strategy 7: Diversify Local Water Supply (W)
- Strategy 8: Reduce and Recycle Solid Waste (S)
- Strategy 9: Carbon Sequestration and Land Conservation (C)

6.1 Strategy 1: Increase the Use of Zero-Emission or Alternative Fuel Vehicles (T)

The goal of this strategy is to reduce on-road transportation fossil fuel use by increasing the use of ZEVs or alternative fuel vehicles (AFVs) citywide through the following four measures.

6.1.1 Measure T-1.1: Transition to a Clean and More Fuel-Efficient Municipal Fleet

The City's Public Works Department is currently pursuing the installation of electric vehicle charging stations (EVCSs) at its Policy and Fire Headquarters. The plan is to set up approximately 30 EVCSs which will be used to support the vehicle charging needs of current EVs and PHEVs on order and allow for charging of approximately 20 additional PHEVs. As of February 2020, the City has installed 9 EVCSs at the Police and Fire Headquarters and has purchased or is going through the requisition process to have a total of 44 gasoline hybrid vehicles, one diesel hybrid trucks, 11 PHEVs, 9 all electric utility charts, and two all-electric forklifts, and 1 electric vehicle.

[34] Transportation (T), Energy (E), Water (W), Solid Waste (S) and Carbon Sequestration (C).

The average annual fuel use for a hybrid sedan in the fleet is 375 gallons of gasoline per year.[35] Assuming the 11 PHEVs will have similar use profile, the GHG emissions reductions in 2030 and 2035 are shown in Table 19.[36]

Table 19 Key Assumptions and Results for Measure T-1.1: Transition to a Clean and More Fuel-Efficient Municipal Fleet

Year	Number of New PHEVs	Gasoline Reduction *(gallons)	Gasoline Carbon Content** (lbs CO_2/gallon)	GHG Emission Reduction (MT CO_2e)
2030	11	4,125	17.8	33
2035	11	4,125	17.8	33

*Annual fuel saving per vehicle is 375 gallons **California gasoline blend has 10% ethanol.
The emissions reduction is based on the projection under the CAP assumptions.
Energy Policy Initiatives Center 2019

6.1.2 Measure T-1.2: Install Electric Vehicle Charging Stations at Park and Ride Lots

Currently, there are nine active Park and Ride parking lots within Escondido, which offer parking spaces for ride share (carpool and vanpool) and transit commuters. The Park and Ride lots are owned and operated by California Department of Transportation (CalTrans), North County Transit District (NCTD), SANDAG, or private organizations. Some Park and Ride lots are available for transit riders only, and others are available for both transit riders and ride share commuters.[37]

The City plans to add 281 EVCSs (approximately 25 percent of all nine Park and Ride lots' parking spaces) by 2035 that will be available for ride share commuters and/or transit riders. It is assumed that Level 2, or better, chargers will be installed and that the EVCSs will be available when the Park and Ride lot is available.[38] However, because not all parking spaces at the Park and Ride lots are utilized on an average workday, EVCSs are assumed to have the same utilization rate (53 percent) as an average parking space in a Park and Ride lot.[39] One EVCS will be used to support one commuter's personal vehicle, either a battery electric vehicle (BEV) or a PHEV, per workday, and the vehicle is assumed to be fully charged by the end of the workday. The vehicle charging load depends on the electric range of the EV, 210 miles for a BEV and 40 miles for a PHEV.[40] Currently, 60 percent of all EVs are BEVs, and the rest are PHEVs; assuming that ratio continues, the e-VMT charged a Park and Ride lot EVCS is 142 miles per workday.[41]

[35] Fuel use per vehicle and list of alternative fuel vehicles were provided by City (June 2019).
[36] Gasoline carbon content is based on estimates from U.S. Energy Information Administration. Frequently Asked Questions, accessed on October 24, 2018. CEC: Ethanol in California, accessed November 26, 2019.
[37] California Department of Transportation (CalTrans): San Diego Park and Ride Facilities, accessed June 26, 2019. The list of Park and Ride lots in the San Diego region and their locations, status, number of parking spaces and utilization rates were provided by SANDAG (October 2018), current as of August 2018.
[38] Some Park and Ride lots are available 9am to 6pm, while others are available all day.
[39] Average utilization rate across all Park and Ride lots in Escondido. The utilization rate varies from 16 percent to 94 percent, which were estimated based on data from 2014 to 2017. Utilization rates were provided by SANDAG (October 2018), current as of August 2018.
[40] Bedir et al., 2018. California Plug-In Electric Vehicle Infrastructure Projections: 2017–2025. CEC. Publication Number: CEC-600-2018-001. The electric range assumptions are for model year 2025 vehicles, which are higher than current EVs on the market and kept constant through CAP horizon.
[41] CEC: IEPR Lead Commissioner Workshop Preliminary Transportation Energy Demark Forecast, July 22 2019. Presentation: Light-Duty Vehicle Demand Forecast.

The GHG emissions reduction is estimated based on the ratio of projected e-VMT due to Measure T-1.2 compared with the total e-VMT from EMFAC2014 model estimates, as discussed in Section 4.4.2 (GHG Emissions Reduction from Increasing Zero Emission Vehicles) and shown in Table 10 (Allocation of GHG Emissions Reduction from Increasing Zero Emission Vehicles). It is assumed that not all e-VMT from the vehicles charging at Park and Ride lot EVCSs will result in miles driven only in Escondido. The e-VMT allocated to Escondido is based on Origin-Destination VMT allocation methods and assumes trips driven by EVs will have at least one trip-end within Escondido. The number of EVCSs, projected e-VMT, and GHG emissions reductions in 2030 and 2035 are shown in Table 20.

Table 20 Key Assumptions and Results for Measure T-1.2: Install Electric Vehicle Charging Stations at Park and Ride Lots

Year	Total Number of Park & Ride Parking Spaces*	% of Parking Spaces with EVCS	Number of Parking Spaces with EVCS	Average Number of EVCSs Utilized per workday**	e-VMT from Charging at the EVCSs (miles per workday)	e-VMT from Charging at the EVCSs (miles per year)	Escondido e-VMT from Charging at the EVCSs*** (miles per year)	Emissions Reduction (MT CO_2e)
2030	1,125	16%	181	96	142	3,492,860	1,939,717	463
2035	1,125	25%	281	150	142	5,433,338	3,017,338	737

*Spaces at all nine active Park & Ride lots within Escondido as of 2018 **Utilization rate the same as the rest of parking spaces (53%) *** The difference between the “e-VMT from Charging at the EVCSs” and the “Escondido e-VMT from Charging at the EVCSs” is due to the allocation of miles to jurisdictions in the methodology. Not all the charging will result in miles driven only in Escondido. 56% of all EV miles are allocated to Escondido based on the Origin-Destination VMT allocation methods, assuming trips driven by EVs will have at least one trip-end within Escondido.
255 Workdays per year.
The emissions reduction is projected based on CAP assumptions and future impact of State policies and programs used in the CARB EMFAC2014 model.
Energy Policy Initiatives Center 2019.

6.1.3 Measure T-1.3: Adopt an Ordinance to Require Electric Vehicle Charging Stations at New Developments

To facilitate the increasing demand of EV infrastructure at commercial developments and multi-family homes, the City will adopt an ordinance requiring new multi-family and commercial developments to install EVCSs at 10 percent of parking spaces provided. The estimated effective year of the ordinance is 2023.

Based on recent permitting data, approximately 134,750 square feet (sq. ft.) of new commercial development would have been subject to the EV requirement on average per year.[42] The Escondido Municipal Code off-street parking regulations require, on average, one parking space per 250 sq. ft. gross floor area of commercial, retail, and office use; therefore, approximately 539 parking spaces will be added every year at these new commercial developments.[43]

[42] The average annual new non-residential development sq. ft. is calculated based on new office spaces (86,000 sq. ft. in last two years) and new retail commercial spaces (183,500 in last two years) square footage, as provided by the City (June 2019). The sq. ft. is new gross floor area.
[43] Escondido Municipal Code: Off-street Parking Requirement (Section 33-765), accessed on August 1, 2019. The minimum parking requirements for commercial, office, restaurant/food, retail, etc., are different, the average is used here.

For the EVCSs to be installed at the new developments parking spaces, it is assumed that Level 2 chargers, or better, will be installed. The e-VMT resulting from the EVCSs are estimated based on the charging capacity of a Level 2 charger, EV drive efficiency, and hours in use, as shown in Table 21.[44] On average, it is assumed that 70,628 e-VMT per year are attributed to charging at an EVCS, and the EVCS would be at least a high-capacity Level 2 charger.

Table 21 Electric Vehicle Charging Efficiency by Level 2 Charger Type

Type of Charging (Level 2)	Capacity (kW)*	Hours in Use per Day	EV load (kWh/day)	Vehicle Drive Efficiency (kWh/mile) **	EV miles per Day of Charge	EV miles per Year per Commercial EVCS
Low	3.3	5	20	0.25	66	24,090
Medium	6.6	5	40	0.25	132	48,180
High	9.6	5	58	0.25	192	70,080
Highest	19.2	5	115	0.25	384	140,160
					Average	70,628

*Based on Electric Vehicle Charging Station Installation Best Practice, Center for Sustainable Energy, 2016.
**Based on CEC Plug-in Electric Vehicle Infrastructure Projections: 2017–2025 vehicle driven efficiency assumptions.
Assume chargers are used 365 days per year.
Energy Policy Initiatives Center 2019.

The estimated number of new EVCSs and e-VMT due to the requirement for new commercial developments in Measure T-1.3 are shown in Table 22.

Table 22 Assumptions for New Commercial Electric Vehicle Charging Stations under Measure T-1.3: Adopt an Ordinance to Require Electric Vehicle Charging Stations at New Developments

Year	New Annual Non-Residential Development Space Added after 2023* (sq. ft. per year)	Total Number of New Parking Spaces at Commercial Developments after 2022	% of Parking Spaces with EVCSs	Number of New EVCSs after 2023	Annual e-VMT Charged at the EVCSs (Miles per year)	Annual Escondido e-VMT due to the EVCS** (Miles per year)
2030	134,750	4,312	10%	388	24,668,208	13,699,189
2035	134,750	7,007	10%	631	40,085,838	22,261,182

*New gross floor area. Based on recent years' new development data.
** The difference between the "e-VMT from Charging at the EVCSs" and the "Escondido e-VMT from Charging at the EVCSs" is due to the allocation of miles to jurisdictions in the methodology. Not all the charging will result in miles driven only in Escondido. 56% of all EV miles are allocated to Escondido based on the Origin-Destination VMT allocation methods, assuming trips driven by EVs will have at least one trip-end within Escondido.
The number of parking spaces is based on Escondido off-street parking requirements and assumes 10% of new non-residential development would qualify for an exemption of the requirement. The projections are based on the current conditions and CAP assumptions.
Energy Policy Initiatives Center 2019.

[44] The Level 2 charger capacity range comes from the Center for Sustainable Energy: Electric Vehicle Charging Station Installation Best Practice (June 2016). The vehicle drive efficiency assumption is based on Bedir et al., 2018. California Plug-In Electric Vehicle Infrastructure Projections: 2017–2025. CEC. Publication Number: CEC-600-2018-001.

For multi-family developments in Escondido, SANDAG Series 13 projects that 1,061 new multi-family units will be added from 2023 to 2030, and an additional 207 units will be added from 2030 to 2035.[45] The Escondido Municipal Code off-street parking regulations require, on average, 1.5 parking spaces for each multi-family unit.[46] At new multi-family developments, the EVCSs will be used to charge the residents' personal EVs. Based on the EMFAC2014 model, approximately 35 miles per day are driven by an average EV in the San Diego region.[47] The estimated number of new EVCSs and e-VMT are shown in Table 23.

Table 23 Assumptions for New Multi-family Electric Vehicle Charging Stations under Measure T-1.3: Adopt an Ordinance to Require Electric Vehicle Charging Stations at New Developments

Year	Number of New Multi-Family Units after 2023*	Number of New Parking Spaces at Multi-Family Developments after 2023	% of Parking Spaces with EVCSs	Number of New EVCSs after 2023	Annual e-VMT Charged at the EVCSs (Miles per year)	Annual Escondido e-VMT due to the EVCS** (Miles per year)
2030	1,061	1,592	10%	143	1,830,517	1,016,555
2035	1,268	1,903	10%	171	2,187,514	1,214,809

*Based on SANDAG Series 13 Regional Growth Forecast.
** The difference between the "e-VMT from Charging at the EVCSs" and the "Escondido e-VMT from Charging at the EVCSs" is due to the allocation of miles to jurisdictions in the methodology. Not all the charging will result in miles driven only in Escondido. 56% of all EV miles are allocated to Escondido based on the Origin-Destination VMT allocation methods, assuming trips driven by EVs will have at least one trip-end within Escondido.
The number of parking spaces is based on Escondido off-street parking requirements and assumes 10% of new multi-family developments would qualify for exemption of the requirement. The projections are based on the current conditions and CAP assumptions.
Energy Policy Initiatives Center 2019.

The GHG emissions reduction from this measure is estimated based on the ratio of projected e-VMT due to this Measure T-1.3 to the total e-VMT from EMFAC2014 model estimates, as discussed in Section 4.4.2 (GHG Emissions Reduction from Increasing Zero Emission Vehicles) and shown in Table 10 (Allocation of GHG Emissions Reduction from Increasing Zero Emission Vehicles). The total number of parking spaces with EVCSs, projected e-VMT, and GHG emissions reductions are shown in Table 24. The GHG emissions reductions are the projected reduction amounts in 2030 and 2035 only, not the sum of the annual reductions from the 2012 baseline year to 2030 or 2035.

[45] SANDAG Series 13 Regional Growth Forecast (October 2013). SANDAG Data Surfer, accessed November 15, 2017. The annual new multi-family units added from 2023 and 2030 are estimated using linear interpolation between 2020 and 2030.
[46] Escondido Municipal Code: Off-street Parking Requirement (Section 33-765), accessed on August 1, 2019. The minimum parking requirements are different for studio and other apartments, the average is used here.
[47] CARB: Mobile Source Emissions Inventory. EMFAC2014 San Diego County 2020–2030 estimates.

Table 24 Key Assumptions and Results for Measure T-1.3: Adopt an Ordinance to Require Electric Vehicle Charging Stations at New Developments

Year	Number of EVCS added due to the Ordinance	Annual Escondido e-VMT due to the EVCSs (Miles per year)	Emissions Reduction (MT CO_2e)
2030	531	14,715,744	3,513
2035	802	23,475,992	5,732
The emissions reduction is projected based on CAP assumptions and future impact of State policies and programs used in the CARB EMFAC2014 model. Energy Policy Initiatives Center 2019.			

6.1.4 Measure T-1.4: Require Electric Vehicle Charging Stations at New Model Home Developments

The 2019 California Green Building Standards Code, Title 24, Part 11 (CALGreen 2019) requires new single-family units and townhouses with attached private garages to have “EV capable” parking spaces for each unit.[48] To further advance EV infrastructure, the City will require each single-family model home, including townhouse model homes, to be fully equipped with one EVCS. The developers would also be required to provide information about having EVCS installation as an add-on option to potential homebuyers. The estimated effective year of this requirement is 2021.

Having model homes equipped with EVCS will encourage homebuyers to choose the add-on EVCS option. To further facilitate installation, the City will allow for no-fee permitting for developers and a waiver of fees for homebuyers of that subdivision at initial occupancy. On average, it is assumed that 20 EVCSs would be installed at new single-family homes due to this requirement each year: 12 through model home construction, and eight through the homebuyer add-on option.[49]

Like the assumption for EVCS usage at multi-family homes (Measure T-1.3), the EVCSs at single-family homes will be used to charge the residents’ personal EVs. The GHG emissions reduction from this measure is estimated based on the ratio of projected e-VMT due to this (Measure T-1.4) compared to the total e-VMT from EMFAC2014 model estimates, as discussed in Section 4.4.2 (GHG Emissions Reduction from Increasing Zero Emission Vehicles) and shown in Table 10 (Allocation of GHG Emissions Reduction from Increasing Zero Emission Vehicles). The total number of parking spaces with EVCSs, projected e-VMT, and GHG emissions reductions are shown in Table 25. The GHG emissions reductions are the projected reduction amounts in the years 2030 and 2035 only, not the sum of the annual reductions from the 2012 baseline year to 2030 or 2035.

[48] 2019 California Green Building Standards Code, Title 24, Part 11: Section 4.106.4 Electric vehicle (EV) charging for new construction, accessed December 12, 2019.
[49] Assumptions were provided by the City (October 2019).

Table 25 Key Assumptions and Results for Measure T-1.4: Require Electric Vehicle Charging Stations at New Model Home Developments

Year	Annual Number of EVCSs added at New Single-Family Homes due to T-1.4*	Number of EVCS due to T-1.4 after 2021	Annual e-VMT Charged at the EVCSs (miles per year)	Annual Escondido e-VMT due to the EVCS** (miles per year)	Emissions Reduction (MT CO_2e)
2030	20	200	2,555,000	1,418,888	339
2035	20	300	3,832,500	2,128,332	520

Measure T-1.4: Require Electric Vehicle Charging Stations at New Model Home Developments
*EVCSs added through model home construction requirements and homebuyer optional add-on interest do not include homeowners or developers installing EVCSs on their own
** The difference between the "e-VMT from Charging at the EVCSs" and the "Escondido e-VMT from Charging at the EVCSs" is due to the allocation of miles to jurisdictions in the methodology. Not all the charging will result in miles driven only in Escondido. 56 percent of all EV miles are allocated to Escondido based on the Origin-Destination VMT allocation methods, assuming trips driven by EVs will have at least one trip-end within Escondido.
The projections are based on the current status and CAP assumptions.
Energy Policy Initiatives Center 2019.

6.2 Strategy 2: Reduce Fossil Fuel Use (T)

The goal of this strategy is to reduce on-road transportation fossil fuel use by improving traffic flow and to reduce off-road vehicle and equipment fuel use through increasing renewable or alternative fuel use. The strategy includes the following three measures.

6.2.1 Measure T-2.1: Synchronize Traffic Signals

The City maintains traffic signals on city corridors, while CalTrans maintains signals located at freeway ramps and along State highways within Escondido city limits. The City maintains a traffic signal priority list that identifies where new or modified traffic signals are needed.[50] The goal is to synchronize traffic signals at 35 intersections by 2035 to obtain more efficient fuel use through smoother traffic flow.[51] It is important to note that this estimate (35 intersections) is conservative; however, it is a base of analysis to estimate emission reductions.

The effect of traffic signal synchronization on fuel reduction depends on the traffic volume, number of intersections, and size of the intersections on the arterials. Based on a study of a project of similar size, the annual fuel savings per intersection is around 2,400 gallons.[52] However, as the vehicles in the region become more efficient and the number of ZEVs increases, fuel savings per synchronized intersection will decrease. Assuming the 2,400 gallons of annual fuel savings per intersection could be realized in the 2012 CAP baseline year, the increase in vehicle fuel efficiency would reduce the fuel savings per intersection to approximately 1,500 gallons in 2030 and 1,400 gallons in 2035.[53] The GHG emissions reductions in 2030

[50] Escondido: Traffic Signal Priority List, January 29, 2014, accessed June 26, 2019.
[51] Generally, the City completes traffic signal synchronization of 5–10 signals each year, assuming on average 2–4 signals at each intersection, City will complete the signal synchronization at approximately two intersections a year.
[52] Sunkari: The Benefits of Retiming Traffic Signals (2004). The Jacksonville traffic signal retiming project at a 25-intersection section resulted in estimated annual fuel savings of 65,000 gallons.
[53] The average vehicle emission rate in 2030, 297 g CO_2e/mile, is 39 percent less than that in 2012, 483 g CO_2e/mile, as discussed in Section 4.4.

and 2035 from traffic signal synchronization are shown in Table 26.[54] The GHG emissions reductions are the projected reduction amounts in the years 2030 and 2035 only, not the sum of the annual reductions from the 2012 baseline year to 2030 or 2035.

Table 26 Key Assumptions and Results for Measure T-2.1: Synchronize Traffic Signals

Year	Number of Intersections with Traffic Signal Synchronization	Increase in Vehicle Fuel Efficiency Comparing with Baseline Year 2012	Equivalent Fuel Saving per Intersection (Gallons per year)	Fuel Saving from All Intersections (Gallons per year)	GHG Emission for Fuel* (lbs CO_2e/gallon)	GHG Emissions Reduction (MT CO_2e)
2030	23	39%	1,474	34,383	18.5	289
2035	35	42%	1,386	48,508	18.5	408

*Emissions per gallon of fuel use for an average vehicle in the San Diego region, regardless of fuel type, vehicle type, or fuel economy.
Increases in vehicle fuel efficiency in 2030 and 2035 compared with 2012 are based on the decreases in the average vehicle emission rates in the San Diego region. The 2012 annual fuel saving per intersection is assumed to be about 2,400 gallons.
The emissions reduction is based on the CAP assumptions, including future impact of State policies and programs used in CARB EMFAC2014 model and CAP assumptions.
Energy Policy Initiatives Center 2019.

6.2.2 Measure T-2.2: Install Roundabouts

Through Measure T-2.2, the City plans to install 12 roundabouts by 2035. The effect of roundabouts on fuel reduction depends on the traffic volume and size of the intersections on the arterials. Based on a study of small roundabouts with similar sizes, the annual fuel savings per roundabout is around 19,000 gallons.[55] Similar to estimating the impact of traffic signal synchronization, as vehicles get more efficient and the number of ZEVs increases, the fuel savings per intersection in 2030 would be less than those in previous years. Assuming the gallons of annual fuel savings per roundabout could be realized in the 2012 CAP baseline year, the increase in vehicle fuel efficiency would reduce the fuel savings to approximately 12,000 gallons in 2030.[56]

The GHG emissions reductions in 2030 and 2035 from traffic signal synchronization are shown in Table 26.[57] The GHG emissions reductions are the projected reduction amounts in 2030 and 2035 only, not the sum of the annual reductions from the 2012 baseline year to 2030 or 2035.

[54] Emissions per gallon of fuel use for an average vehicle calculated based on 2030 CO_2 emissions from on-road transportation and total vehicle fuel use.
[55] Varhelyi: The Effects of Small Roundabouts on Emission and Fuel Consumption: A Case Study (2002). The study estimated the traffic volume of the intersection and the fuel consumption before and after the roundabout. The traffic volume is 23,500 vehicles per day and the fuel savings are approximately 144 kg per day after the roundabout installation.
[56] The average vehicle emission rate in 2030, 289 g CO_2e/mile, is 40 percent less than that in 2012, 483 g CO_2e/mile, as discussed in Section 4.4.
[57] Emissions per gallon of fuel use for an average vehicle calculated is based on 2030 CO_2 emissions from on-road transportation and total vehicle fuel use.

Table 27 Key Assumptions and Results for Measure T-2.2: Install Roundabouts

Year	Number of New Roundabouts	Increase in Vehicle Fuel Efficiency Baseline Year 2012	Equivalent Fuel Saving per Intersection (Gallons per year)	Fuel Saving for All Intersections (Gallons per year)	GHG Emission for Fuel* (lbs CO_2e/gallon)	GHG Emissions Reduction (MT CO_2e)
2030	8	39%	12,074	96,595	18.5	811
2035	12	42%	11,357	136,278	18.5	1,145

*Emissions per gallon of fuel use for an average vehicle in the San Diego region, regardless of fuel type, vehicle type, or fuel economy.
Increase in vehicle fuel efficiency in 2030 compared with 2012 is based on the decrease of the average vehicle emission rate in San Marcos. It is assumed that the annual fuel savings per intersection is about 19,000 gallons in 2012.
The emissions reduction is projected under the CAP assumptions, including future impact of State policies and programs used in CARB EMFAC2014 model, as well as CAP assumptions.
Energy Policy Initiatives Center 2019.

6.2.3 Measure T-2.3: Increase Renewable or Alternative Fuel Construction Equipment

Through the construction permitting process, the City will require a certain percentage of fuel reduction from construction equipment in new developments through the use of electric-powered or alternatively-fueled. The standard would require 30 percent fuel reduction in 2030, and 50 percent in 2035, which would yield an approximately 30 percent reduction in construction GHG emissions in 2030, and 50 percent reduction in 2035.[58] The method to project 2030 and 2035 construction emissions are based on CARB's In-Use Off-Road Equipment 2011 Inventory and the number of construction jobs in Escondido.[59] The GHG emissions reductions in 2030 and 2035 are shown in Table 28.

Table 28 Key Assumptions and Results for Measure T-2.3: Increase Renewable or Alternative Fuel Construction Equipment

Year	Projected Emissions from Construction Equipment (MT CO_2e)	Percent Reduction in Emissions	GHG Emissions Reduction (MT CO_2e)
2030	19,707	30%	5,321
2035	20,071	50%	9,032

The construction emissions are projected based on San Diego region's construction emissions and the ratio of construction jobs in Escondido to those in the region. It is assumed that 10% of new developments would qualify for an exemption of the requirement.
CARB 2011, Energy Policy Initiatives Center 2019.

6.3 Strategy 3: Reduce Vehicle Miles Traveled (T)

The goal of this strategy is to reduce the labor force commute VMT citywide by increasing alternative modes of transportation, which avoid use of single-occupancy vehicles (SOVs), and to reduce household VMT by encouraging transit-oriented development (TOD). The strategy includes the following measures.

[58] The requirement would be based on the construction equipment's horsepower.
[59] The method to project construction emissions is provided in *Appendix A: City of Escondido Greenhouse Gas Emissions Inventories and Projections* (EPIC, 2018).

6.3.1 Measure T-3.1: Participate in the SANDAG's iCommute Vanpool Program

SANDAG's iCommute Vanpool Program provides a convenient way for groups of five or more people to get to work in and around the San Diego region. The Vanpool Program provides a subsidy of up to $400 per month to offset the vehicle lease cost, and vanpool participants share the remaining vehicle lease and gas cost. Vanpools generally exceed average commute distance of approximately 25 miles round trip.[60] The number of vanpools that are in operation varies from year to year. On an annual average, from 2015 to 2018, 36 SANDAG vanpools were in operation that either started or ended within Escondido.[61] Through this measure, the City would promote the SANDAG Vanpool Program through the CAP target years to Escondido residents and business-owners to encourage ongoing participation. The specific goal is to maintain the 36 SANDAG vanpools that start or end in Escondido through 2035.

The vanpools in the program have different commute distances, trip frequencies, and number of participants. The estimated average commute distance, commute VMT avoided due to vanpools, and the GHG emissions reductions are shown in Table 29.[62]

Table 29 Projected SANDAG Vanpools in Escondido and GHG Emissions Reductions from Avoiding Single-Occupancy Vehicle Trips

Year	Number of SANDAG Vanpools	Average Number of Passengers in the Vanpool*	Average Vanpool Distance* (Miles per roundtrip per workday)	Annual VMT Avoided due to Vanpool (Miles per year)	Annual Escondido VMT Avoided due to Vanpool** (Miles per year)	Average Vehicle Emission Rate (g CO_2e/mile)	GHG Emissions Reduction (MT CO_2e)
2030	36	7	102	6,733,940	3,737,208	297	1,109
2035	36	7	102	6,733,940	3,737,208	279	1,043

*Average number of passengers and commute distance of the SANDAG vanpools in recent years. 255 workdays per year.
** The difference between the "Annual VMT Avoided due to Vanpool" and the "Annual Escondido VMT Avoided due to Vanpool" is due to the allocation of miles to jurisdictions in the methodology. Not all miles are driven only in Escondido. 56% of all miles are allocated to Escondido based on the Origin-Destination VMT allocation methods.
The emissions reduction is projected under the CAP, including future impact of State policies and programs used in CARB EMFAC2014 model, as well as CAP assumptions.
Energy Policy Initiatives Center 2019.

A portion of the emissions avoided from reducing SOV trips is offset by the emissions from operating the vanpool vehicles. As the vehicle fleet becomes more efficient, the fuel economy of a potential vanpool vehicle also improves. Assuming the average fuel economy (miles per gallon, or "MPG") of the vanpool vehicle is 20 MPG in 2019 and that it will improve to 29 MPG in 2035 due to more stringent vehicle efficiency standards, there will be reduced fuel use and reduced GHG emissions from operating the vanpool vehicles.[63] GHG emissions resulting from vanpool vehicles are shown in Table 30.

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[60] SANDAG: iCommute Vanpool.
[61] SANDAG Vanpool Program: active vanpools as of November 16, 2018. 2006 to 2018 vanpool data were provided by SANDAG to EPIC (November 2018). If the vanpool has an origin or a business city identified as Escondido, they are accounted for here. All Escondido vanpools as of November 2018 started in Escondido.
[62] SANDAG Vanpool Program: active vanpools as of November 16, 2018. 2006 to 2018 vanpool data were provided by SANDAG to EPIC (November 2018). The average number of passengers are estimated based on van capacity and the 80 percent capacity requirement. All vanpools start or end in Escondido run from Monday to Friday, therefore, the 255 workdays to year conversion is used.
[63] Based on the SANDAG Vanpool Program data the most common vanpool vehicles are Ford Traverse, Dodge Grand Caravan, and Buick Enclave. The 2019 new vehicle fuel economy of these vehicle models are approximately 20 MPG. U.S. Department of

Table 30 GHG Emissions Added from Projected SANDAG Vanpools in Escondido

Year	Number of SANDAG Vanpools	Average Fuel Economy of Vanpool Vehicle (Miles per gallon)	Average Fuel Use of Vanpool Vehicle (Gallons per year)	Carbon Content of Vanpool Gasoline Use* (lbs CO_2e/gallon)	GHG Emissions Resulting from Vanpools (MT CO_2e)
2030	36	28	936	17.8	272
2035	36	29	880	17.8	256

*California gasoline has 10% ethanol.
Vehicle fuel economy in 2030 and 2035 are based on the decreases in the average vehicle emission rates in San Diego and the 2019 vanpool vehicle fuel economy. Annual fuel use is calculated based on commute distance of the SANDAG vanpools in recent years (64 mile per roundtrip per workday) and 255 workdays per year.
The emissions reduction is projected under the CAP, including future impact of State policies and programs used in CARB EMFAC2014 model, as well as CAP assumptions.
Energy Policy Initiatives Center 2019.

The net GHG emissions reductions in 2030 and 2035, which combine the reductions from avoiding SOV trips and emissions resulting from vanpool vehicles, are shown in Table 31.

Table 31 Results for Measure T-3.1: Participate in the SANDAG's iCommute Vanpool Program

Emissions Reduction from SANDAG Vanpool Program	GHG Emissions Reduction (MT CO_2e)	
	2030	2035
Emissions Reduction from Avoiding Single Occupancy Vehicle Commute	1,109	1,043
Emissions Resulting from Operating Vanpool Vehicles	-272	-256
Net Emissions Reduction due to SANDAG Vanpool Program	837	787

The emissions reduction is projected under the CAP, including future impact of State policies and programs used in CARB EMFAC2014 model, as well as CAP assumptions.
Energy Policy Initiatives Center 2019.

6.3.2 Measure T-3.2: Improve Pedestrian Infrastructure at Priority Areas

From 2016 to 2018, the City installed an average of 2,600 linear feet (0.5 miles) of sidewalk annually.[64] Through Measure T-3.2, City plans to continue new sidewalk installation and improvements at 0.5 miles per year, and identify priority areas (e.g., at downtown employment centers, near transit stations) for the pedestrian infrastructure improvements.

Walking trips will have an impact on VMT only if they replace vehicle travel. Therefore, walking solely for recreation does not have an impact on VMT reduction. The impact of pedestrian improvement on VMT reduction depends on the street characteristics (e.g., sidewalk width, coverage), pedestrian environment quality (e.g., street crossings, topography), and neighborhood type (e.g., neighborhood density, proximity

Energy: Fuel Economy Estimates, accessed January 10, 2019. The San Diego regional average vehicle emission rate in 2030, 297 g CO_2e/mile, is 28 percent less than that in 2019, 410 g CO_2e/mile. EMFAC2014. The ratio of emission rates is used to estimate 2030 MPG, and similar method is used to calculate 2035 MPG.
[64] Sidewalk data from 2016 to 2018 were provided by the City (June 2019).

to destinations). Based on various studies, the elasticity of a 1 percent increase in sidewalk coverage is a 0.27 percent increase in walk mode choice.[65] At the time of CAP development, the specific priority areas for sidewalk improvement were not identified. It is assumed that pedestrian infrastructure will be added to Escondido's downtown employment centers, and the additional sidewalk coverage is calculated based on the ratio of the length of new sidewalks added and the length of local roads. Once the priority areas are determined, the impact may be re-evaluated based on the number of employees and percentage of employees eligible to commute by walking in the areas. The goal, 0.5 miles new sidewalk per year, translates to 0.6 percent sidewalk coverage at the Escondido's downtown employment centers.[66] For this measure, only the impact on avoiding commute VMT is quantified due to data availability. However, pedestrian infrastructure improvements also encourage non-commute trips by walking rather than by car.

The avoided VMT are estimated based on the number of additional downtown employees walking to work and miles avoided per trip. Miles avoided were converted to GHG emissions reductions using the average vehicle emission factors discussed in Section 4.4.1 (GHG Emission Factor for On-Road Transportation). The GHG emissions reductions in 2030 and 2035 are shown in Table 32.[67]

Table 32 Key Assumptions and Results for Measure T-3.2: Improve Pedestrian Infrastructure at Priority Areas

Year	Annual Average Miles of New or Improved Sidewalk (Miles per year)	Cumulative Miles of New or Improved Sidewalk (Miles)	New or Improved Sidewalk Cover in Downtown Employment Center Area (%)	Increase in Walk Commuters (%)	Number of Additional Employees Commute by Walking*	Miles Avoided (Miles per year)**	Average Vehicle Emission Rate (g CO_2e/mile)	GHG Emissions Reduction (MT CO_2e)
2030	0.5	5.8	7%	2%	301	149,064	297	44
2035	0.5	8.3	10%	3%	427	211,174	279	59

*15,130 employees as of 2019 **Average VMT avoided by commuting by walking is assumed to be 1.1 mile one-way per workday based on Escondido Centre City employment center data, with 255 workdays per year.
The emissions reduction is the projection under the CAP, including future impact of State policies and programs used in CARB EMFAC2014 model, and CAP assumptions.
Energy Policy Initiatives Center 2019.

6.3.3 Measure T-3.3: Continue to Implement Safe Routes to School Program at the Escondido Union School District

The City has an ongoing effort with the Escondido Union School District (EUSD) to implement the Safe Routes to School (SRTS) program. In the last three years, the City has completed infrastructure improvement projects near Juniper Elementary School (ES), Central ES, Farr Avenue ES, Rose ES, and Glen View ES. The infrastructure improvement projects include installation of new sidewalks, signals and high visibility crosswalk upgrades, countdown pedestrian indications at crossings, and other similar projects.[68]

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[65] CARB: Policy Brief on the Impacts of Pedestrian Strategies on Passenger Vehicle Use and Greenhouse Gas Emissions, September 30, 2014, accessed June 29, 2019. Multiple studies are reviewed in the policy brief. The elasticity from Ewing et al. (2009) is used here because of the similarity in the study area, sidewalk characteristics and Escondido data availability.
[66] The total miles of local road segment (centerline) at the Escondido downtown employment center, including major roads, arterial or collectors, local streets, and alleys, is 39.6. Assuming sidewalks are in both directions of the roads, the miles of roads (both directions) is 79.2 miles. Mileage estimated by EPIC using SANGIS "Roads_all" data, assessed July 31, 2019.
[67] SANDAG: Escondido Centre City employment center, May 2019, accessed June 26, 2019.
[68] Information on completed SRTS programs were provided by the City (June 2019).

Through Measure T-3.3, the City will continue the implementation of the SRTS program at all schools in EUSD to increase the number of students walking and riding bicycles to and from school. The SRTS program would include infrastructure improvements surrounding schools that are similar to those completed, as well as educational programs (e.g., develop pedestrian and bicycle safety education curriculum, organize safety trainings, and safety awareness campaigns) at schools.

Assuming the City completes an SRTS program at all EUSD schools by 2035, the numbers of additional students walking or riding bicycles to school are shown in Table 33.[69]

Table 33 Number of Additional Escondido School District Students Walking or Riding Bicycles to School

Year	Number of Students in Escondido School District*	Students Walking to School			Students Riding Bicycle to School		
		Baseline (%) **	With Safe Routes to School (%)	Number of Additional Students Walking to School	Baseline (%) **	With Safe Routes to School (%)	Number of Additional Students Riding Bicycle to School
2030	15,377	21%	27%	999	2.0%	2.3%	51
2035	15,377	21%	30%	1,453	2.0%	2.5%	74

* 2018–2019 Escondido Union School District enrollment statistics ** The baseline assumption is based on a San Diego Unified School District 2015–2016 student-parent survey.
Energy Policy Initiatives Center 2019.

The avoided VMT were estimated based on the number of additional students walking or riding bicycles to school and miles avoided per trip. Miles avoided per year were converted to GHG emissions reductions using the average vehicle emission factors, discussed in Section 4.4.1 (GHG Emission Factor for On-Road Transportation). The GHG emissions reductions in 2030 and 2035 are shown in Table 34.[70]

Table 34 Key Assumptions and Results for Measure T-3.3: Continue to Implement Safe Routes to School Program at the Escondido Union School District

Year	VMT Avoided from Students Walking or Riding Bicycles to School* (miles per year)	Average Vehicle Emission Rate (g CO_2e/mile)	GHG Emissions Reduction (MT CO_2e)
2030	202,659	297	60
2035	294,777	279	82

*Assumes a one-mile roundtrip distance for students walking to school and a 2.5-mile roundtrip distance for students riding bicycles to school, based on a San Diego Unified School District 2015–2016 student-parent survey, and 180 school days per year.
The emissions reduction is the projection under CAP assumptions, including future impact of State policies and programs used in CARB EMFAC2014 model.
Energy Policy Initiatives Center 2019.

[69] The current percentage of students who walk or ride bicycles to school in EUSD schools is not available. The results are based on a San Diego Unified School District 2015–2016 student-parent survey (EPIC), unpublished. The percent increase in walking and riding bicycles to school are based on Stewart, et al., 2014: Multistate Evaluation of Safe Routes to School Program, accessed August 10, 2019. Student population is from 2018–2019 school district population, accessed July 31, 2019.
[70] The current trip distance of students who walk or ride bicycles to school in EUSD is not available. The results are based on a San Diego Unified School District 2015–2016 student-parent survey (EPIC), unpublished.

6.3.4 Measure T-3.4: Develop a Citywide Transportation Demand Management (TDM) Plan

Through this measure, the City would develop a Transportation Demand Management (TDM) Plan that will include: 1) adoption of a TDM ordinance that would specify alternative modes of transportation required at new non-residential developments; and 2) working with Escondido downtown employment center businesses to develop TDM policies. The TDM plan would require new non-residential developments or existing Escondido downtown employment center businesses to include a list of TDM activities. The list of TDM activities at new non-residential development is required to lead to a 5 percent increase in alternative travel modes from employee commuting; the list of TDM activities at existing downtown employment center businesses is required to lead to a 7 percent increase in alternative travel modes.

Table 35 lists potential TDM activities that would lead to an increase in alternative modes of transportation. However, other TDM activities may be recommended or required in the ordinance.[71] The ordinance is anticipated to be effective in 2022. The TDM plan may also include a list of potential designated areas for transportation network company (TNC) vehicles (e.g., Uber, Lyft) to pick-up and drop-off. However, the impact of this policy on alternative modes cannot be estimated due to limited available information.

Table 35 Examples of TDM Activities and Effects on Increasing Alternative Transportation Modes

TDM Activity Number	Activity Details	Effect on Alternative Transportation Modes	Source
TDM-1	Provide “end-of-trip” facilities for bicycle riders including secure bicycle parking spaces or bicycle racks, showers and clothes lockers (Number of amenities will be based on occupied floor areas and/or number of employees)	2% of additional employees will bicycle to work	CAPCOA - SDT-6 and SDT-7 San Francisco TDM Ordinance Active - 2 and 3
TDM-2	Provide discounted monthly NCTD transit passes or provide at least 25% transit fare subsidies to employees (if employees are using daily or multi-day MCTD transit pass)	2% of additional employees will use mass transit to work	CAPCOA - TRT-4 San Francisco TDM Ordinance HOV - 1
TDM-3	Provide transportation marketing services and communication campaigns including carpool and vanpool ride-matching services	1% of additional employees will carpool to work	San Francisco TDM Ordinance INFO - 1
TDM-4 for downtown employees only	Develop a parking cash out policy. That is if employer offer subsidized parking, for the employees not using parking spot, the employer would provide cash payment equivalent to cost of parking spaces will be provided to the employees.	2% of employees will not drive alone to work	San Francisco TDM Ordinance PKG-3
CAPCOA – California Air Pollution Control Officers Association. CAPCOA 2010, City of San Francisco 2018.			

[71] TDM activities and their impacts are from California Air Pollution Control Officers Association’s GHG mitigation measure and San Francisco’s TDM Program Measures. CAPCOA: Quantifying Greenhouse Gas Mitigation Measures (2010). City of San Francisco: TDM Program Standards Appendix A: TDM Measures, updated June 7, 2018, access November 19, 2018.

Although TDM activities may also lead to additional VMT reductions (e.g., reduce business trip VMT), the reduction in employee commute VMT can be more readily monitored (e.g., commuter surveys). Therefore, only avoided commute VMT is quantified for this measure.

Increasing each type of alternative transportation mode leads to different reductions in VMT. For example, the commute distance by a bicycle rider and by a vanpooler are different. The estimated VMT reduction as a result of said mode are shown in Table 36.[72]

Table 36 VMT Reduction from the Examples of TDM Activities

Increase in Alternative Modes of Transportation	Goal (% Increase)	Miles Avoided per Workday*	Miles Avoided per Year**	Escondido Miles Avoided per Year***
Commute by Bicycle	2%	6	1,305	1,305
Commute by Mass Transit	2%	21	4,635	2,577
Commute by Carpool	1%	21	4,680	2,602
Alternative Modes to Avoid Drive Alone	2%	21	4,680	2,602

Not commute by drive alone is referring to commuters carpooling, vanpooling, or taking mass transit instead of driving a single-occupied vehicle.
*Based on SANDAG activity-based travel model results for Escondido Centre City employment center. **225 workdays per year. ***Miles associated with commuting by bicycling are all within Escondido and miles associated with the rest of the modes are allocated to Escondido based on Origin-Destination VMT allocation methods.
Energy Policy Initiatives Center 2019.

To calculate emissions avoided in 2030 and 2035, miles avoided per year were converted to GHG emissions reductions using the number of new commuters using alternative modes of transportation and the average vehicle emission factors, discussed in Section 4.4.1 (GHG Emission Factor for On-Road Transportation). The GHG emissions reductions in 2030 and 2035 are shown in Table 37.[73]

[72] SANDAG: Escondido Centre City employment center, May 2019, accessed June 26, 2019.
[73] Number of employees in Escondido employment center are based on SANDAG: Escondido Centre City employment center, May 2019, accessed June 26, 2019.

Table 37 Key Assumptions and Results for Measure T-3.4: Develop a Citywide Transportation Demand Management (TDM) Plan

Year	New Labor Force			Downtown Employees			Total	
	Labor Force Added after 2022	New Commuters Using Alternative Modes of Transportation	VMT Avoided from Increasing Alternative Modes (miles per year)	Number of Employees in Escondido Employment Center	New Commuters Using Alternative Modes of Transportation	VMT Avoided from Increasing Alternative Modes (miles per year)	Average Vehicle Emission Rate (g CO_2e/mile)	GHG Emissions Reduction (MT CO_2e)
2030	3,344	167	346,649	15,130	652	1,449,713	297	533
2035	5,638	282	584,471	15,130	1,059	2,355,784	279	820
The emissions reduction is the assumption under the CAP, including future impact of State policies and programs used in CARB EMFAC2014 model, and CAP assumptions. Energy Policy Initiatives Center 2019.								

6.3.5 Measure T-3.5: Update Bicycle Master Plan

Bicycle facilities are categorized as follows: 1) Class I bicycle paths, which have a completely separated right-of-way designed for the exclusive use of bicycles and pedestrians; 2) Class II separated bicycle lanes, typically designated with striping; 3) Class III bicycle routes, where bicyclists share streets with motor traffic; and 4) Class IV cycle tracks, that provide a right-of-way designated exclusively for bicycle travel which are physically protected from vehicular traffic.

Through this measure, the City plans to update the existing Bicycle Master Plan and add or improve/upgrade 15 miles of new Class II, or better, bicycle lanes by 2035 (an average of one mile per year), as well as bicycle parking standards for all residential and commercial zones. The 15 miles represents the length of roadway segments for which two-way bicycle lanes would be added. Bicycle lanes are used for both recreational and commuting purposes. For this measure, only the impact on avoiding commute VMT is quantified. The increase in percentage of bicycle commuters is assumed to be proportional to the increase in bicycle lane miles per square mile. The elasticity of adding one additional mile of Class II, or better, bicycle lane per square mile is roughly one percent for commuters.[74] In other words, one additional mile of Class II, or better, bicycle lanes per square mile would lead to roughly one additional percent of commuters riding bicycles to work. In 2035, Escondido's developed area will be approximately 27 square miles in 2035, and new bicycle lanes would lead to an additional 1.1 mile of bicycle lane per square mile, assuming the new bicycle lanes are installed in both directions.[75]

To calculate annual commute VMT avoided, the increase in the percentage of commuters by bicycle was multiplied by the average commute distance avoided per workday (5.8 miles), assuming bicycle commuters are traveling within Escondido. The avoided VMT is converted to GHG emissions reductions using the average vehicle emission factors, discussed in Section 4.4.1 (GHG Emission Factor for On-Road Transportation). The GHG emissions reductions in 2030 and 2035 are shown in Table 38.[76]

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[74] Dill and Carr (2013): Bicycle Commuting and Facilities in Major U.S. Cities: If you build them, commuters will use them – another look.
[75] Developed based on SANDAG's Series 13 Regional Growth Forecast (Updated in October 2013). SANDAG Data Surfer, accessed on November 15, 2017.
[76] SANDAG: Escondido Centre City employment center, May 2019, accessed June 26, 2019.

Table 38 Key Assumptions and Results for Measure T-3.5: Update Bicycle Master Plan

Year	Labor Force	Additional Bicycle Lanes Added (bicycle lane miles per square mile)	% of Additional Labor Force Using Bicycle to Commute	Additional Labor Force Using Bicycles to Commute	Commute VMT Avoided (miles per year)	Average Vehicle Emission Rate (g CO_2e/mile)	GHG Emissions Reduction (MT CO_2e)
2030	79,608	0.7	0.7%	597	778,878	297	231
2035	81,903	1.1	1.1%	921	1,201,986	279	335

The average VMT avoided by commuting by bicycle is assumed to be 5.8 miles per workday (roundtrip) based on Escondido Centre City employment center data, with 255 workdays per year.
The emissions reduction is projected based on CAP assumptions and future impact of State policies and programs used in the CARB EMFAC2014 model.
Energy Policy Initiatives Center 2019.

6.3.6 Measure T-3.6: Increase Transit Commuters among New Downtown Residents

The City's Downtown Specific Plan, adopted in 2013, identifies a range of residential developments (e.g., multi-family, mixed use, shopkeeper, artisan lofts) and adopts smart growth policies to take advantage of the convenient access to the nearby Escondido Transit Center and high-density urban residential developments.[77] To further encourage more transit riders in the downtown area, the City will develop a Safe Routes to Transit program that improves accessibility around transit areas and rider amenities at boarding areas. For projects in the Downtown Specific Plan area, any reduction in parking over 15 percent will be required to provide six-month transit pass purchase program at initial occupancy. The goal is to increase commuting by transit among downtown residents by five percent.

The Downtown Specific Plan area accommodates up to 5,275 residential units. As of late 2019, 2,025 units have built, with 3,250 units remaining.[78] Assuming the remaining units will be built by 2035 with an average of 1.3 commuters per household, the number of new commuters in the Downtown Specific Plan area will be 4,348.[79]

To calculate annual avoided VMT, the number of new commuters was multiplied by the percent increase in commuting by transit and miles avoided per transit trip, then converted to GHG emissions reductions using the average vehicle emission factor described in Section 4.4.1 (GHG Emission Factor for On-Road Transportation). The GHG emissions reductions in 2030 and 2035 are shown in Table 39.

[77] City of Escondido: Downtown Specific Plan, adopted August 2013, accessed December 13, 2019.
[78] The balance of units was provided by the City (October 2019).
[79] Average commuters per household is calculated using total workers 16 years and over who do not work at home (71,591) divided by the number of households in Escondido (53,516) from the American Community Survey (ACS). ACS: 2018 1-year Estimates, accessed November 13, 2019. Number of households in Escondido from other sources is available, however, to ensure consistency with the number of workers data, the number of households from ACS is used.

Table 39 Key Assumptions and Results for Measure T-3.6: Increase Transit Commuters among New Downtown Residents

Year	Number of New Units in Downtown Specific Plan Area after 2019	Number of New Commuters Live in Downtown Specific Plan*	Increase in Commuting by Transit (%)	Number New Commuters Taking Transit	Annual Total VMT Avoided** (Miles per year)	Annual Escondido VMT Avoided*** (Miles per year)	Average Vehicle Emission Rate (g CO_2e/mile)	GHG Emissions Reduction (MT CO_2e)
2030	2,167	2,898	3%	97	507,518	282,178	297	84
2035	3,250	4,348	5%	217	1,141,915	634,901	279	177

*Assumes average 1.3 commuters per household in Escondido **Assumes 10.3 mile one-way per workday based on Escondido Centre City employment center data, with 255 workdays per year. ***Miles avoided are allocated to Escondido based on Origin-Destination VMT allocation methods.
The emissions reduction is the projection under CAP assumptions, including future impact of State policies and programs used in the CARB EMFAC2014 model.
Energy Policy Initiatives Center 2019.

6.3.7 Measure T-3.7 Develop an Intra-City Shuttle Program

Through Measure T-3.7, the City plans to develop an intra-city shuttle system that operates multiple routes to reduce miles driven from internal city trips. The goal is to reduce the projected 2035 VMT within city boundaries by 10 percent, or 23 million miles, in 2035.

The potential routes and the schedule of the intra-city shuttle system have not yet been identified. The City would work with proprietors, including NCTD, residents and businesses to explore the feasibility of an intra-city shuttle program and the efficiency of routes and times selected. However, to be able to achieve the goal, the shuttle system would need to include multiple routes that connect activity centers within the city, not overlap with existing transit service area, and run on high-frequency (with at least 10 minutes headways during peak periods).

To avoid double-counting with other measures in the CAP that increase mass transit ridership, the miles avoided per passenger trip may not include the full miles avoided by commuters using the intra-shuttle to connect mass transit (SPRINTER or bus service) to or from other cities. The miles avoided per passenger trip will have to be all internal miles within city boundaries and account for the miles the passengers would otherwise have to drive to the destination. The passengers would instead take the shuttle alone or take the shuttle combined with other modes of transportation (e.g., shuttle and bicycle, shuttle and bus within the City).

The avoided VMT is converted to GHG emissions reductions using the average vehicle emission factor, discussed in Section 4.4.1 (GHG Emission Factor for On-Road Transportation). The GHG emissions reduction in 2030 is shown in Table 40.

Table 40 Key Assumptions and Results for Measure T-3.7 Develop an Intra-City Shuttle Program

Year	Miles from Escondido Internal Trips* (Miles per weekday)	% Reduction from Internal Trip Miles	VMT Avoided due to Intra-City Shuttle (Miles per weekday)	VMT Avoided due to Intra-City Shuttle** (Miles per year)	Average Vehicle Emission Rate (g CO_2e/mile)	GHG Emissions Reduction (MT CO_2e)
2030	650,422	7%	43,361	15,046,437	297	4,463
2035	675,570	10%	67,557	23,442,262	279	6,540

*SANDAG Series 13 Forecast with base year 2012 **347 weekdays per year conversion
The emissions reduction is the projection under CAP assumptions, including future impact of State policies and programs used in CARB EMFAC2014 model.
Energy Policy Initiatives Center 2019.

6.3.8 Measure T-3.8: Increase Transit Ridership

Escondido is served by both San Diego Metropolitan Transit System (MTS) and NCTD. MTS only provides bus service; MTS Route 235 from Downtown San Diego to Escondido has one of the highest ridership among buses serving Escondido. NCTD has both bus and light rail (SPRINTER) services in the City. The NCTD bus routes in Escondido with the highest ridership are Route 350 (from Del Lago Station to Escondido Transit Center) and Route 351/352 loop within the city. These mass transit services bring commuters to or from Escondido and currently make up approximately two percent of mode share. [80] Under Measure T-3.8, the City will work with MTS and NCTD to optimize ridership by coordinating land use and mobility planning for operations and more frequent services. The goal is to increase the mode share for commuters traveling to and from work or on mass transit to eight percent by 2035.

In 2017, the two SPRINTER stations in Escondido (Escondido Transit Center and Nordahl Road Station) served a total of 3,291 passengers on an average weekday, and all the bus routes in Escondido served a total of 8,228 passengers on an average weekday. Assuming 70 percent of SPRINTER passengers and 50 percent of bus passengers are commuters travelling to and from work, the baseline number of mass transit commuters is approximately 6,417 per weekday.[81] The VMT avoided are calculated based on the number of mass transit commuters, assumed to increase by three times by 2035 with Measure T-3.8, and the miles avoided per trip. The VMT avoided are then converted to GHG emissions reductions using the average vehicle emission factors discussed in Section 4.4.1 (GHG Emission Factor for On-Road Transportation). The GHG emissions reductions in 2030 and 2035 are shown in Table 39.[82]

[80] ACS: 2018 1-year Estimates, Means to Work, Escondido City. accessed November 13, 2019.
[81] FY2017 mass transit ridership by routes and stops were provided to EPIC by SANDAG (November 2018). The percentage of Sprinter passengers that are commuters are based on MTS trolley (similar light rail service) passenger boarding data by hour and assume that peak hour passengers are commuters. MTS: Community Impact and Performance Report 2016, accessed September 3, 2019.
[82] SANDAG: Escondido Centre City employment center, May 2019, accessed June 26, 2019.

Table 41 Key Assumptions and Results for Measure T-3.8: Increase Transit Ridership

Year	Target Mass Transit Mode Share* (%)	Travel to and from Work by Bus		Travel to and from Work or Colleges by Sprinter		Miles Avoided (Miles per year)	Total	
		Number of Commuters - Baseline**	Number of Additional Commuters with Target Mode Share	Number of Commuters - Baseline**	Number of Additional Commuters with Target Mode Share		Average Vehicle Emission Rate (g CO_2e/mile)	GHG Emissions Reduction (MT CO_2e)
2030	4%	4,114	6,689	2,304	3,746	26,891,635	297	7,977
2035	8%	4,114	15,245	2,304	8,537	61,287,912	279	17,099

*The current mass transit mode share is 2%. **2017 fiscal year ridership is used as the baseline, assuming 70% Sprinter riders and 50% bus riders travel to work.
The average VMT avoided by mass transit commuters is assumed to be 20.6 miles per workday based on Escondido Centre City employment center data, with 255 workdays per year. VMT is allocated to Escondido based on Origin-Destination VMT allocation methods, assuming trips will have at least one trip-end within Escondido.
The emissions reduction is the projection under the CAP assumptions, including future impact of State policies and programs used in CARB EMFAC2014 model.
Energy Policy Initiatives Center 2019.

To avoid potential double counting with Measure T-3.6: Increase Transit Commuters among New Downtown Residents, the GHG reductions in 2030 and 2035 are adjusted to 7,829 and 16,875 MT CO_2e.

6.3.9 Measure T-3.9: Develop and Implement a Service Population-Based Vehicle Miles Traveled Threshold

To close the emissions reduction gap in 2035, the City will implement additional actions to reduce projected 2035 VMT. The goal is to reduce projected 2035 VMT by 3.5 percent. The additional actions would require the City to develop and monitor a VMT threshold of significance on a jurisdiction-wide basis, and/or attempt to reach a significance conclusion on a project-by-project basis. This new way to look at new development projects will allow the City to consider how to mitigate for VMT-based impacts, and how those mitigation measures differ from traditional LOS-based measures.

After implementation, the City would be able to assess how the project increase in the total daily vehicle miles traveled per service population (population plus employment) (VMT/SP) above the baseline level for the jurisdiction. The GHG emissions reductions in 2030 and 2035 are shown in Table 42.[83]

Table 42 Key Assumptions and Results for Measure T-3.9: Develop and Implement a Service Population-Based Vehicle Miles Traveled Threshold

Year	Reduction from Projected VMT (%)	VMT Avoided (Miles per weekday)	VMT Avoided (Miles per year)	Average Vehicle Emission Rate (g CO_2e/mile)	GHG Emissions Reduction (MT CO_2e)
2030	1.8%	56,634	19,652,015	297	5,829
2035	3.5%	114,403	39,697,772	279	11,075

The emissions reduction is the projection under the CAP assumptions, including future impact of State policies and programs used in CARB EMFAC2014 model.
Energy Policy Initiatives Center 2019.

[83] SANDAG: Escondido Centre City employment center, May 2019, accessed June 26, 2019.

6.4 Strategy 4: Increase Building Energy Efficiency (E)

The goal of this strategy is to increase building energy efficiency and reduce building electricity and natural gas use through the following four measures.

6.4.1 Measure E-4.1 Require New Residential Developments to Install Alternatively-Fuel Water Heaters

To reduce reliance on natural gas end-use at residential buildings, the City will develop and implement an ordinance requiring new single-family and multi-family residential units to install non-natural gas water heaters. The anticipated effective year of the ordinance is 2023.

The energy savings from installing a non-natural gas water heater assumes replacement of a natural gas storage water heater with an electric heat pump water heater (HPWH). The energy use of these two water heaters is shown in Table 43.[84]

Table 43 Residential Water Heater Energy Use Comparison

Residential Type	Natural Gas Use from a Gas Storage Water Heater		Electricity Use from a Heat Pump Water Heater	
	(Therms/year)	(MMBtu/year)*	(kWh/year)	(MMBtu/year)*
Single-Family 1	137	14	813	2.8
Single-Family 2	146	15	925	3.2
Single-Family (Average of 1&2)	142	14	869	3.0
Multi-Family	117	12	559	1.9

*99,976 Btus per therm and 3,312 Btus per kWh.
Residential types are based on prototypes developed by the CEC for the Title 24 2019 Building Energy Efficiency Standard. The two single-family prototypes have different floor areas (square footage) and number of stories, therefore different water heating energy use.
Energy use are modeled with CEC CBECC-Res tool, March 2018 version, for Climate Zone 10 where Escondido is located.
Energy Policy Initiatives Center 2019.

While HPWH is used as an example here, other types of non-natural gas water heater may be used as a replacement water heater.[85] In Escondido, SANDAG Series 13 projects that 1,061 new multi-family units will be added from 2023 to 2030, and an additional 207 multi-family units will be added from 2030 to 2035. Similarly, for single-family developments in Escondido, 45 new multi-family units will be added from 2023 to 2030, and an additional 104 single-family units will be added from 2030 to 2035.[86] All units will be subject to this requirement beginning in 2023. Assuming 10 percent of the units will be exempt from the requirement due to certain limitations, the emissions reduced from natural gas savings and emissions added from electricity use are shown in Table 44 and Table 45.

[84] CEC: CBECC-Res , version dated March 9, 2018, model run by EPIC.
[85] Other options include, but are not limited to, instantaneous electric, tank-based electric water heater, solar water heater with HPWH back up, and solar water heater with electric tank back up.
[86] SANDAG Series 13 Regional Growth Forecast (October 2013). SANDAG Data Surfer, accessed November 15, 2017. The annual new units added from 2023 and 2030 are estimated using linear interpolation between 2020 and 2030.

Table 44 Emissions Reduction from Natural Gas Savings for Measure E-4.1 Require New Residential Developments to Install Alternatively-Fuel Water Heaters

Year	Residential Unit Type	Total New Alternative-Fuel Water Heater after 2023*	Natural Gas Savings Per Alternative-Fuel Water Heater (Therms/year)	Total Natural Gas Savings (Therms/year)	Natural Gas Emission Factor (MT CO_2e/Therm)	Emissions Reductions from Natural Gas Savings (MT CO_2e)
2030	Single-Family	40	142	5,705	0.0054	31
	Multi-Family	955	117	111,765	0.0054	612
2035	Single-Family	134	142	18,950	0.0054	104
	Multi-Family	1,142	117	133,563	0.0054	731

*Assumes 10% of water heaters will be exempt from this requirement due to limitations.
The natural gas savings and emissions reduction are the projections under the CAP assumptions, including the future impact of State policies and programs.
Energy Policy Initiatives Center 2019.

Table 45 Emissions from Electricity use for Measure E-4.1 Require New Residential Developments to Install Alternatively-Fuel Water Heaters

Year	Residential Unit Type	Total New Alternative-Fuel Water Heaters after 2023*	Electricity Added from Alternative-Fuel Water Heaters** (kWh/year)	Total Electricity Use (kWh/year)	Electricity Emission Factor (lbs CO_2e/MWh)	Emissions from Additional Electricity Use (MT CO_2e)
2030	Single-Family	40	869	35,038	53	1
2030	Multi-Family	955	559	533,990	53	13
2035	Single-Family	134	869	116,376	36	2
2035	Multi-Family	1,142	559	638,132	36	10

*Assumes 10% of water heaters will be exempt from this requirement due to limitations. **The alternatively-fueled water heater type used here is heat pump water heater.
The projected electricity use and emissions added are the projections under the CAP based on current status, future impact of State policies and programs, and CAP assumptions.
Energy Policy Initiatives Center 2019.

The net emissions reductions from Measure E-4.1 in 2030 and 2035 are shown in Table 46. The GHG emissions reductions are the projected reduction amounts in 2030 and 2035 only, not the sum of the annual reductions from the 2012 baseline year to 2030 or 2035.

Table 46 Key Assumptions and Results for Measure E-4.1 Require New Residential Developments to Install Alternatively-Fuel Water Heaters

Year	Residential Unit Type	Emissions Reductions from Natural Gas Savings (MT CO_2e)	Emissions from Additional Electricity Use (MT CO_2e)	Net Emissions Reduction* (MT CO_2e)
2030	Single-Family	31	1	30
	Multi-Family	612	13	599
			Total	629
2035	Single-Family	104	2	102
	Multi-Family	731	10	721
			Total	822

*Net emissions reductions are emissions reductions from natural gas savings minus emissions from additional electricity use. The emissions reductions are the projections under the CAP assumptions, including the future impact of State policies and programs.
Energy Policy Initiatives Center 2019.

6.4.2 Measure E-4.2: Require New Multi-Family Residential Developments to Install Electric Cooking Appliances

Another way to reduce reliance on natural gas end-use at residential buildings is to switch to electric cooking appliances. The City will develop and implement an ordinance requiring new multi-family residential units to install electric cooking appliances. The anticipated effective year of the ordinance is 2023.

As discussed in Section 6.4.1 above, SANDAG Series 13 projects that 1,061 new multi-family units will be added from 2023 to 2030, and an additional 207 units will be added from 2030 to 2035. [87] All units will be subject to the requirement beginning in 2023, and assuming 10 percent of units will be exempt from the requirement due to certain limitations, the emissions reduced from natural gas savings and emissions added from electricity use are show Table 47 and Table 48.[88]

[87] SANDAG Series 13 Regional Growth Forecast (October 2013). SANDAG Data Surfer, accessed November 15, 2017. The annual new units added from 2023 and 2030 are estimated using linear interpolation.
[88] KEMA, Inc. 2010. 2009 California Residential Appliance Saturation Study. California Energy Commission. Publication Number: CEC- 200-2010-004. Table 2-5 and Table 2-21. Statewide results are used instead of SDG&E area results, because only statewide results have the breakdown of residence type. 5+ Unit Apartment is the multi-family residence type used here.

Table 47 Emissions Reduction from Natural Gas Savings for Measure E-4.2: Require New Multi-Family Residential Developments to Install Electric Cooking Appliances

Year	Total Electric Cooking Appliances at New Multi-Family Units after 2023	Natural Gas Use per Natural Gas Cooking Appliance at Multi-Family Units* (Therms/year)	Total Natural Gas Savings (Therms/year)	Natural Gas Emission Factor (MT CO_2e/Therm)	Emissions Reductions from Natural Gas Savings (MT CO_2e)
2030	955	28	26,747	0.0054	146
2035	1,142	28	31,964	0.0054	175

*Natural gas range/oven, assume multi-family units are in 5+ unit apartment buildings
The natural gas savings and emissions reduction are projections under the CAP assumptions including the future impact of State policies and programs.
Energy Policy Initiatives Center 2019.

Table 48 Emissions from Electricity Use for Measure E-4.2: Require New Multi-Family Residential Developments to Install Electric Cooking Appliances

Year	Total Electric Cooking Appliances at New Multi-Family Units after 2023	Electricity Added Per Electric Cooking Appliance at Multi-Family Units* (kWh/year)	Total Electricity Use (kWh/year)	Electricity Emission Factor (lbs CO_2e/MWh)	Emissions from Electricity Use (MT CO_2e)
2030	955	165	157,618	53	4
2035	1,142	165	188,357	36	3

*Electric range/oven, assume multi-family units are in 5+ unit apartment buildings
The electricity use and emissions added are projections under the CAP assumptions including the future impact of State policies and programs.
Energy Policy Initiatives Center 2019.

The net emissions reductions are 143 MT CO_2e in 2030 and 172 MT CO_2e in 2035.

6.4.3 Measure E-4.3: Retrofit High Pressure Sodium Street Lights to LED Lights

The City plans to reduce electricity use from City-owned street lights by converting the current high-pressure sodium (HPS) lights to LED lights. The goal is to retrofit 450 lights by 2035 or 30 lights per year starting in 2021. It is important to note that this estimate (450 lights) is conservative, as the City already has 750 lights retrofitted; however, it is a base of analysis to estimate emission reductions.

A streetlight inventory or energy use audit was not available at the time of CAP development. Based on a street lights retrofit study, the estimated annual electricity savings from replacing a 100-Watt HPS light with an LED light of similar lumens is 372 kWh.[89] Reductions from electricity savings are calculated by multiplying the electricity savings by the GHG emission factor for electricity, discussed in Section 4.2.1 (GHG Emission Factor for Electricity) and Table 5 (2016 and Projected 2030 and 2035 GHG Emission Factor for Electricity in Escondido). As the renewable and zero-carbon content in electricity increases, the emissions reduction decreases correspondingly. The GHG emissions reductions in 2030 and 2035 are shown in Table 49.

[89] Replace a 100-W HPS light with a 50 W-LED light. Lighting retrofits data from Escondido were not available at the time of CAP development. The lighting retrofit savings were the estimated savings from a Solana Beach Municipal Retrofit Report on street lights retrofits (unpublished).

Table 49 Key Assumptions and Results for Measure E-4.3: Retrofit High Pressure Sodium Street Lights to LED Lights

Year	Annual Number of Streetlights Retrofitted to LED	Total Number of Streetlights Retrofitted to LED after 2021	Electricity Savings* (kWh per year)	Electricity Emission Factor (lbs CO_2e/MWh)	Emissions Reductions from Electricity Savings (MT CO_2e)
2030	30	300	111,600	53	3
2035	30	450	167,400	36	3

*Assumes retrofit of a 100 W HPS streetlight to LED with the same lumens and the electricity saving is 31 kWh per month
The emissions reductions are the projection under the CAP assumptions.
Energy Policy Initiatives Center 2019.

6.4.4 Measure E-4.4: Require Non-Residential Alterations and Additions to Install Alternatively-Fuel Water Heaters

To reduce reliance on natural gas end-use at non-residential buildings, the City will develop and implement an ordinance requiring all non-residential alterations or additions with permit value of $200,000 or more to install alternatively-fueled water heaters. The anticipated effective year of the ordinance is 2023. This ordinance does not include requirements for new construction, because new construction will have separate and more stringent requirements under the ordinance proposed through Measure E-5.2*: Require New Commercial Developments to Achieve Zero Net Energy*, discussed in Section 6.5.2.

Energy savings from installing a non-natural gas water heater are calculated based on using a HPWH on a per-gross floor area basis. As of November 2019, the City of Carlsbad was the only jurisdiction in the San Diego region to have a water heating ordinance related to non-residential projects. However, the ordinance only covers non-residential new construction, and Carlsbad is in a different Climate Zone (Climate Zone 7) from Escondido.[90] Therefore, the energy savings from the ordinance proposed under Measure E-4.4 are modified based on the difference in energy uses in Climate Zones 7 and 10, as well as the difference in energy uses at newly constructed versus existing buildings, as shown in Table 50.[91]

Table 50 Potential Energy Savings from Measure E-4.4: Require Non-Residential Alterations and Additions to Install Alternatively-Fuel Water Heaters

Commercial Building Type	Building Size (sq. ft.)	Electricity Added with HPWH (kWh per year)	Electricity Added with HPWH (kWh/year/ sq. ft.)	Natural Gas Savings with HPWH (Therms per year)	Natural Gas Savings with HPWH (Therms/year /sq. ft.)
New Construction Small Office with HPWH (Climate Zone 7)	5,502	1,241	0.23	249	0.05
New Construction Medium Office with HPWH (Climate Zone 7)	53,628	6,311	0.12	433	0.01
Average of New Construction Office with HPWH	-	-	0.17	-	0.03

[90] City of Carlsbad: Nonresidential Photovoltaic & Water Heating Ordinances, adopted by Carlsbad City Council on March 2019 and approved by CEC on August 2019, accessed August 12, 2019.
[91] City of Carlsbad: Energy Conservation Ordinance Cost Effectiveness Analysis, February 20, 2019, accessed November 18, 2019. The cost effectiveness analysis was done based on 2016 Energy Code, however, there is no significant difference in the water heating section of the 2016 and 2019 Energy Code.

Commercial Building Type	Building Size (sq. ft.)	Electricity Added with HPWH (kWh per year)	Electricity Added with HPWH (kWh/year/ sq. ft.)	Natural Gas Savings with HPWH (Therms per year)	Natural Gas Savings with HPWH (Therms/year /sq. ft.)
(Climate Zone 7)					
Adjustment Factor of Climate Zone Difference (%)*	-	-	95%	-	95%
Adjustment Factor of Building Age Difference (%)**	-	-	110%	-	110%
Estimates used for Measure E-4.4			0.18	-	0.03

Measure E-4.4: Require Non-Residential Alterations and Additions to Install Alternatively-Fuel Water Heater
*Ratio of water heating energy use at buildings in Climate Zone 7 (where Carlsbad is located) to Climate Zone 10 (where Escondido is located) **Ratio of water heating energy use at existing buildings to newly constructed buildings
City of Carlsbad 2019, Energy Policy Initiatives Center 2019.

HPWH is used as an example here; however, other types of non-natural gas water heaters may be used to replace existing water heaters.[92] Similarly, office buildings were used as a commercial building type example; however, other types of buildings (e.g., retail, restaurant) have different water heating energy use on a per-square footage basis and are not included here.

Based on recent permitting data, an annual average of approximately 144,000 sq. ft. of commercial additions and alterations would have been subject to this requirement. Assuming this trend continues, they will be subject to the requirement beginning in 2023.[93] Certain buildings would be exempt from this requirement due to building age or other limitations. It is assumed 10 percent of the projects would be exempt.

Emissions reductions from natural gas savings were calculated using the natural gas savings per square footage, gross floor area, and the natural gas emission factor discussed in Section 4.3. The emissions reductions from natural gas savings due to E-4.4 are summarized in Table 51.

[92] Other options include, but are not limited to, instantaneous electric, electric tank solar water heater with HPWH back up, and solar water heater with electric tank back up.
[93] Projects with permits valued at $200,000 or greater were provided by the City (November 2019). Not all permits have information on the square footage of the project, for these projects, the square footages were estimated based on a $ per sq. ft. basis from the projects with both $ and sq. ft. available.

Table 51 Natural Gas and Emissions Savings from Measure E-4.4: Require Non-Residential Alterations and Additions to Install Alternatively-Fuel Water Heaters

Year	Annual Commercial Developments Subject to the Requirement after 2023* (sq. ft. per year)	Total Non-Residential Projects with Alternative-Fuel Water Heaters after 2023** (sq. ft.)	Natural Gas Savings from Using Alternative-Fuel Water Heater*** (Therms/sq. ft./year)	Total Natural Gas Savings (Therms/year)	Natural Gas Emission Factor (MT CO_2e/Therm)	Emissions Reductions from Natural Gas Savings (MT CO_2e)
2030	150,000	1,080,000	0.03	30,094	0.0054	165
2035	150,000	1,755,000	0.03	48,903	0.0054	268

*Estimated gross floor area of non-residential major additions and alterations with permit value $200,000 or more, based on recent year's data. **Assume 10% major renovations will be exempt from this requirement due to building age or other limitations. ***Assume the alternatively-powered water theaters are HPWH
The projections are based on current status, future impact of State policies and programs, and CAP assumptions.
Energy Policy Initiatives Center 2019.

Emissions from added electricity use are calculated by multiplying the electricity use per square foot and gross floor area by the GHG emission factor for electricity, discussed in Section 4.2.1 (GHG Emission Factor for Electricity) and Table 5 (2016 and Projected 2030 and 2035 GHG Emission Factor for Electricity in Escondido). As the renewable and zero-carbon content in electricity increases, the emissions decrease correspondingly. The emissions from electricity uses due to Measure E-4.4 are summarized in Table 52.

Table 52 Electricity and Emissions from Measure E-4.4: Require Non-Residential Alterations and Additions to Install Alternatively-Fuel Water Heaters

Year	Annual Non-Residential Projects Subject to the Requirement after 2023* (sq. ft. per year)	Total Non-Residential Projects with Alternatively-Powered Water Heaters after 2023** (sq. ft.)	Electricity Added from Alternatively-Powered Water Heater*** (kWh/sq. ft./year)	Total Electricity Use (kWh/year)	Electricity Emission Factor (lbs CO_2e/MWh)	Emissions from Additional Electricity Use (MT CO_2e)
2030	150,000	1,080,000	0.18	193,688	53	5
2035	150,000	1,755,000	0.18	314,743	36	5

*Estimated gross floor area of non-residential major additions and alterations with permit value $200,000 or more, based on recent years' data. **Assume 10% major renovations will be exempt from this requirement due to building age or other limitations. ***Assume the alternatively-powered water heaters are HPWH
The projections are based on current status, future impact of State policies and programs, and CAP assumptions.
Energy Policy Initiatives Center 2019.

The net emissions reductions from Measure E-4.4 are 160 MT CO_2e in 2030 and 263 MT CO_2e in 2035.

6.5 Strategy 5: Increase Renewable and Zero-Carbon Energy (E)

The goal of this strategy is to increase both grid-supply and behind-the-meter generation of renewable and zero-carbon electricity through the following four measures.

6.5.1 Measure E-5.1: Increase Renewable Energy Generated at Municipal Facilities

Currently, there are eight Escondido municipal sites with on-site renewable electricity systems; there are PV systems at seven municipal sites and a small hydroelectric system at the City dam. The total capacity of the seven PV systems is 832 kW (0.8 MW). [94]

Through Measure E-5.1, the City plans to install additional PV systems at municipal facilities and parking lots to increase the amount of on-site renewable electricity generation. The goal is to install two MW of PV by 2035, which is equivalent to approximately 3.5 MWh a year of renewable electricity generation.[95] The City's municipal operation electricity use in 2018 was approximately 8.8 MWh (not including the utilities department). The City is not anticipating new municipal buildings during the CAP horizon. Therefore, the renewable generation from the additional two MW PV system would cover approximately 40 percent of the total municipal electricity use.

The emissions reductions from all State and CAP actions that increase behind-the-meter renewable supply are given in Table 7 (Attribution of Emissions Reductions to Supplies that Increase Renewable and Zero-Carbon Supply in Escondido). The total reduction is attributed based on estimated capacity (MW) that would result from each measure. As shown in Table 53, GHG emissions reductions from Measure E-5.1 are the projected reduction amounts in the years 2030 and 2035 only, not the sum of the annual reductions from the 2012 baseline year to 2030 or 2035.

Table 53 Key Assumptions and Results for Measure E-5.1: Increase Renewable Energy Generated at Municipal Facilities

Year	State or City Action	Total	Measure E-5.1: Increase Renewable Energy Generated at Municipal Facilities	Measure E-5.2: Require New Commercial Developments to Achieve Zero Net Energy*	Measure E-5.4: Increase Renewable Electricity Generated at School Sites	California Solar Polices, Programs, and Mandates**
2030	Projected Behind-the-meter PV Capacity (MW)	147	**0.8**	3.7	2.6	140.2
	Projected Emissions Reduction (MT CO_2e)	53,814	**292**	1,360	947	51,215
2035	Projected Behind-the-meter PV Capacity (MW)	151	**2.0**	6.0	2.6	140.8
	Projected Emissions Reduction (MT CO_2e)	56,373	**745**	2,252	965	52,411

*Does not represent all emissions reduction from E-5.2
**Solar policies, programs and mandates include the impact of the PV mandates from the 2019 Building Energy Efficiency Standard.
The projected capacity and emissions reductions based on current conditions, the future impact of State policies and programs, and CAP assumptions.
Energy Policy Initiatives Center 2019.

[94] Information provided by the City (April 2019).
[95] Information provided by the City (April 2019).

6.5.2 Measure E-5.2: Require New Commercial Developments to Achieve Zero Net Energy

A zero net energy building produces renewable energy equal to or greater than its own annual consumption. This reduces or eliminates reliance on natural gas end-use. The City will develop and implement an ordinance requiring all new commercial developments to achieve zero net energy. The anticipated effective year of the ordinance is 2023.

As of November 2019, there is no statewide modeled reach code (a local energy ordinance that exceeds the minimum standards defined by Title 24) study on achieving zero net energy at newly-constructed non-residential buildings. However, the latest *2019 Nonresidential New Construction Reach Code Cost Effectiveness Study* (Study) covers several cost-effective reach code options, including a combination of all-electric design with energy efficiency measures and PV installation that would nearly offset annual electricity use.[96] This combination is cost-effective in Climate Zone 10 and used as a proxy for the zero net energy requirement of the potential ordinance. However, other options to achieve zero net energy may be studied during the design and implementation of the ordinance.

Based on recent permitting data, an annual average of approximately 43,000 sq. ft. of new office development and 91,750 sq. ft. of new retail development would have been subject to the ordinance. Assuming this trend continues, those averages will be subject to the annual requirement beginning in 2023.[97] It is assumed that 10 percent of the projects would be exempt due to other limitations. Because office and retail building types are modeled separately in the Study, the impacts are examined separately, as well. The energy savings and PV capacity needed on a square footage basis are provided in Table 54.[98]

Table 54 Assumptions of Energy Savings and PV Capacity Needed for Measure E-5.2: Require New Commercial Developments to Achieve Zero Net Energy

Building Type	Medium Office	Medium Retail
Conditioned Floor Area (sq. ft.)	53,628	24,697
Electricity Savings from All-electric + Energy Efficiency Design (kWh)	12,344	11,737
Electricity Savings from All-electric + Energy Efficiency Design (kWh per sq. ft.)	0.23	0.48
Natural Gas Savings from All-electric + Energy Efficiency Design (Therms)	2,053	1,262
Natural Gas Savings from All-electric + Energy Efficiency Design (Therms per sq. ft.)	0.04	0.05
PV Installation (kW)	135	110
PV Installation (W per sq. ft.)	2.5	4.5

[96] TRC and EnergySoft: 2019 Nonresidential New Construction Reach Code Cost Effectiveness Study, last modified July 15, 2019, accessed August 11, 2019.
[97] New office spaces (86,000 sq. ft. in last two years) and new retail spaces (183,500 in last two years) square footage were provided by the City (June 2019). The sq. ft. is new gross floor area.
[98] TRC and EnergySoft: 2019 Nonresidential New Construction Reach Code Cost Effectiveness Study, last modified July 15, 2019, accessed August 11, 2019. The PV system measure is discussed in Section 3.2.1, and the energy savings are discussed in Figure 21 and Figure 28, Climate Zone 10, Utility SDG&E. The all-electric measure includes changing baseline gas-fueled equipment (HVAC and water heating system) to electric. The energy efficiency measures are listed in Figure 4, including building envelop, HVAC, and lighting.

Building Type	Medium Office	Medium Retail
Based on 2019 Nonresidential New Construction Reach Code Cost Effectiveness Study results of prototype medium office and medium retail spaces in Climate Zone 10, where Escondido is located. The electricity and natural gas savings are based on the energy uses of mixed-fuel designs and all-electric + energy efficiency designs. TRC and EnergySoft 2019.		

The emissions reduction from natural gas savings, emissions added from additional electricity use, and emissions reduction from added PV systems are shown in Table 55 through Table 57.

Table 55 Emissions Reduction from Natural Gas Savings due to Measure E-5.2: Require New Commercial Developments to Achieve Zero Net Energy

Year	Office Space		Retail Space		Total		
	New Floor Area Added after 2023* (sq. ft)	Natural Gas Savings due to All-Electric + EE Requirement (Therms/sq. ft./year)	New Floor Area Added after 2023* (sq. ft)	Natural Gas Savings due to All-Electric + EE Requirement (Therms/sq. ft./year)	Total Natural Gas Savings (Therms/year)	Natural Gas Emission Factor (MT CO_2e/Therm)	Emissions Reductions from Natural Gas Savings (MT CO_2e)
2030	309,600	0.04	660,600	0.05	45,608	0.0054	250
2035	503,100	0.04	1,073,475	0.05	74,114	0.0054	406

*Assumes 10 percent new development will be exempt from this requirement due to other limitations.
The projected natural gas savings and emissions reduction are the projections under the CAP, based on current status, future impact of State policies and programs, and CAP assumptions.
Energy Policy Initiatives Center 2019.

Table 56 Emissions Reduction from Electricity Savings due to Measure E-5.2: Require New Commercial Developments to Achieve Zero Net Energy

Year	Office Space		Retail Space		Total		
	New Floor Area Added after 2023* (sq. ft)	Electricity Savings due to All-Electric + EE Requirement (kWh/sq. ft./year)	New Floor Area Added after 2023* (sq. ft)	Electricity Savings due to All-Electric + EE Requirement (kWh/sq. ft./year)	Total Electricity Savings (kWh /year)	Electricity Emission Factor (lbs CO_2e/MWh)	Emissions Reductions from Electricity Savings (MT CO_2e)
2030	309,600	0.23	660,600	0.48	385,207	53	9
2035	503,100	0.23	1,073,475	0.48	625,961	36	10

*Assumes 10 percent new development will be exempt from this requirement due to other limitations.
The projected electricity savings and emissions reduction are the projections under the CAP, based on current status, future impact of State policies and programs, and CAP assumptions.
Energy Policy Initiatives Center 2019.

Table 57 Emissions Reduction from PV Systems due to Measure E-5.2: Require New Commercial Developments to Achieve Zero Net Energy

Year	Office Space		Retail Space		Total	
	New Floor Area Added after 2023* (sq. ft)	Additional PV Capacity due to PV Requirement (kW/sq. ft./year)	New Floor Area Added after 2023* (sq. ft)	Additional PV Capacity due to PV Requirement (kW/sq. ft./year)	Total PV Capacity Added (MW/year)	Emissions Reductions from Additional PV (MT CO_2e)
2030	309,600	2.5	660,600	4.5	3.7	1,360
2035	503,100	2.5	1,073,475	0.9	6.0	2,252

*Assumes 10 percent new development will be exempt from this requirement due to other limitations.
The projected PV capacity and emissions reduction are the projections under the CAP, based on current status, future impact of State policies and programs, and CAP assumptions.
Energy Policy Initiatives Center 2019.

The total emissions reductions from Measure E-5.2 are shown in Table 58. The reductions are the projected reduction amounts in the years 2030 and 2035 only and do not represent the cumulative reductions from the 2012 baseline year to 2030 or 2035.

Table 58 Results for Measure E-5.2: Require New Commercial Developments to Achieve Zero Net Energy

Emissions Reduction	GHG Emissions Reduction in 2030 (MT CO_2e)	GHG Emissions Reduction in 2035 (MT CO_2e)
Emissions Reductions from Natural Gas Savings	250	406
Emissions Reductions from Electricity Savings	9	10
Emissions Reduction from Additional PV	1,360	2,252
Total Emissions Reductions	1,618	2,668

The emission reductions projections are based on CAP assumptions including future impact of State policies and programs.
Energy Policy Initiatives Center 2019.

6.5.3 Measure E-5.3: Increase Grid-Supply Renewable and Zero-Carbon Electricity

As discussed in Section 5.1, SB 100 (100 Percent Clean Energy Act of 2018) adopts a 60 percent RPS for all of California's retail electric suppliers by 2030 and 100 percent zero-carbon electricity by 2045. Through Measure E-5.3, the City would present options to City Council to increase grid-supply to 100 percent renewable or zero-carbon electricity by 2030.

Based on the assumptions used in the most recent Community Choice Aggregation feasibility study in the San Diego region, it is assumed 95 percent of SDG&E's residential bundled customers' electric load and 85 percent of SDG&E's commercial bundled customers' electric load would be supplied by the local renewable and zero-carbon program. SDG&E DA customers, whose electric load is supplied by other retail electric suppliers, will stay with their current electric suppliers and not participate in the local renewable program.[99]

[99] The Cities of Chula Vista, La Mesa, and Santee: Community Choice Aggregation Technical Feasibility Study, Section: CCA Participation and Opt-Out Rates, Final Draft, July 16 2019, accessed August 3, 2019.

As previously explained in Section 5.1 and Table 7 Attribution of Emissions Reductions to Supplies that Increase Renewable and Zero-Carbon Supply in Escondido), because the local renewables and zero-carbon program is required to comply with the State's RPS mandates, a portion of the total emissions reduction from Measure E-5.4 is credited to the State's RPS compliance. The remaining emissions reduction beyond RPS compliance is allocated to local Measure E-5.3. The allocation of GHG emissions reduction in 2030 from this measure to the State and to the City is shown in Table 59.

Table 59 Key Assumptions and Results for Measure E-5.3: Increase Grid-Supply Renewable and Zero-Carbon Electricity

Year	State or City Action	Total for Local Renewables and Zero-Carbon Program	Local Renewables and Zero-Carbon program to Complying with RPS	Local Renewables and Zero-Carbon Program above RPS (E-5.3)
2030	Projected Renewables and Zero Carbon (%)	100%	60%	40%
	Emissions Reduction (MT CO_2e)	105,336	63,201	**42,134**
2035	Projected Renewables and Zero Carbon (%)	100%	73%	27%
	Emissions Reduction (MT CO_2e)	109,209	79,723	**29,486**

*Calculated in Table 7.
The emissions reduction is the projection under the CAP assumptions including future impact of State policies and programs.
Energy Policy Initiatives Center 2019.

6.5.4 Measure E-5.4: Increase Renewable Electricity Generated at School Sites

In November 2019, the EUSD started phase 1 of PV system construction at school playgrounds and carports. The project includes four phases and is anticipated to be completed by summer 2020. Table 60 below includes the sites and their PV system capacities.[100]

Table 60 Escondido Union School District's Sites with PV Systems

Sites	Modeled System Size (kW)
Bernardo ES	165.6
Quantum Academy	129.6
Hidden Valley MS	266.4
Rocks Spring ES	187.2
Bear Valley MS	280.8
Reidy Creek ES	208.8
Farr Avenue ES	216.8
Rinco MS	237.6
Oak Hill ES	172.8
L.R. Green ES	194.4
District Office	187.2
Orange Glen ES	158.4
Del Dios ES	187.2

[100] School sites and PV capacities were provided by the City (October 2019).

Sites	Modeled System Size (kW)
Total	**2,593**
ES – elementary school, MS – middle school Escondido Union School District 2019	

The total PV capacity from all the sites is 2.6 MW.

The emissions reductions from all State actions and CAP measures that increase the behind-the-meter renewable supply are given in Table 7 (Attribution of Emissions Reductions to Supplies that Increase Renewable and Zero-Carbon Supply in Escondido). The total reduction is allocated based on estimated capacity (MW) that would result from each action. As shown in Table 61, GHG emissions reductions from Measure E-5.4 are the projected reduction amounts in the years 2030 and 2035 only, not the sum of the annual reductions from the 2012 baseline year to 2030 or 2035.

Table 61 Key Assumptions and Results for Measure E-5.4: Increase Renewable Electricity Generated at School Sites

Year	State or City Action	Total	Measure E-5.1: Increase Renewable Energy Generated at Municipal Facilities	Measure E-5.2: Require New Commercial Developments to Achieve Zero Net Energy*	Measure E-5.4: Increase Renewable Electricity Generated at School Sites	California Solar Polices, Programs, and Mandates**
2030	Projected Behind-the-meter PV Capacity (MW)	147	0.8	3.7	**2.6**	140.2
	Projected Emissions Reduction (MT CO_2e)	53,814	292	1,360	**947**	51,215
2035	Projected Behind-the-meter PV Capacity (MW)	151	2.0	6.0	**2.6**	140.8
	Projected Emissions Reduction (MT CO_2e)	56,373	745	2,252	**965**	52,411

*Does not represent all emissions reduction from E-5.2
**Solar policies, programs and mandates include the impact of the PV mandates from the 2019 Building Energy Efficiency Standard.
The projected capacity and emissions reductions are based on current conditions and CAP assumptions including the future impact of State policies and programs.
Energy Policy Initiatives Center 2019.

6.6 Strategy 6: Increase Water Efficiency (W)

The goal of this strategy is to increase indoor and outdoor water efficiency through the following two measures.

6.6.1 Measure W-6.1: Reduce Municipal Landscape Water Consumption

The City's Landscape Maintenance District (LMD) area had 43 smart irrigation controllers and 2,698 water efficient rotator nozzles installed in early 2017 using the SoCal Water$mart rebate program. All the controllers are connected to the internet through cell, radio, or both. Smart irrigation controllers have also been installed at several City parks; going forward, if existing irrigation controllers fail, they will be replaced with smart controllers. The estimated water savings of these smart irrigation controller replacements are 40 percent. In the 2018–2019 fiscal year, the City's water use in its parks was 84,397,000 gallons. Assuming the reduction in water use is 40 percent of the current level in 2035, the water savings would be 33,758,800 gallons.[101]

The water savings are converted to GHG reductions based on the imported water GHG intensities in 2030 and 2035. The imported water GHG intensities are calculated based on projected water use and the GHG emissions from water, as assumed in the BAU emissions projection.[102] Table 62 summarizes the key assumptions and results. The GHG emissions reductions projected are the reduction amounts in the years 2030 and 2035 only, not the sum of the annual reductions from the 2012 baseline year to 2030 or 2035.

Table 62 Key Assumptions and Results for Measure W-6.1: Reduce Municipal Landscape Water Consumption

Year	Reduction in Water Use at City Parks (%)	Reduction in Water Use at City Parks (Gallons)	Reduction in Water Use at Landscape Maintenance District (Gallons)	Total Reduction in Water Use (Gallons)	Total Reduction in Water Use (Acre-feet)	Water-GHG Intensity (MT CO_2e/Acre-foot)*	Emission Reduction (MT CO_2e)
2030	27%	22,505,867	4,770,589	27,276,456	84	0.54	45
2035	40%	33,758,800	4,770,589	38,529,389	118	0.54	64

*Water-GHG intensity of imported water.
City of Escondido 2019, Energy Policy Initiatives Center 2019.

6.6.2 Measure W-6.2: Reduce Landscape Water Consumption New Model Home Developments

To reduce residential water use, the City will require each single-family model home, including townhouse model homes, to be fully equipped with greywater systems and rain barrels, or other rainwater capture systems. The requirement is similar to that in Measure T-1.4*: Require Electric Vehicle Charging Stations at New Model Home Developments*. The developers would also be required to provide information about having greywater systems and rain barrels as an add-on option to potential homebuyers. The estimated effective year of this requirement is 2021.

Having model homes equipped with such systems will encourage homebuyers to choose the add-on option. The City will allow for no-fee permitting for developers and waive fees for homebuyers of that subdivision at initial occupancy to further facilitate the implementation. On average, it is assumed that 13 new single-family homes will have such systems due to the requirement (12 through model home construction and one through a homebuyer add-on option).[103]

A California study indicates that, on average, households installing greywater systems reduce their water use by 26 percent over a year.[104] In Escondido, the water use at a single-family home is approximately 143,000 gallons a year; therefore, the water savings from a greywater system would be 37,000 gallons a

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[101] The water savings since the installation are not available. However, the cost for water has been reduced by 15 percent; therefore, the water savings were estimated based on this change. Water use and estimated savings are provided by the City (July 2019). For LMD, water savings are estimated based on cost savings and water rate of $8.13 per 1,000 gallons, User Rates for Potable Water, Effective March 1, 2019, accessed July 29, 2019.
[102] Emissions from water and projected water use are provided in *Appendix A: City of Escondido Greenhouse Gas Emissions Inventories and Projections* (EPIC, 2018).
[103] Assumptions were provided by the City (October 2019).
[104] Greywater Action: Residential Greywater Irrigation Systems in California, September 2013, accessed November 18, 2019. Water savings vary by month, this is the annual saving.

year.[105] For rain barrels, based on SoCal Water$mart rebate program data, the average savings are 420 gallons a year.[106]

The water savings are converted to GHG reductions based on the imported water GHG intensities in 2030 and 2035. The imported water GHG intensities are calculated based on projected water use and the GHG emissions from water, as assumed in the BAU emissions projection.[107] Table 63 summarizes the key assumptions and results. The projected GHG emissions reductions are the reduction amounts in the years 2030 and 2035 only, not the sum of the annual reductions from the 2012 baseline year to 2030 or 2035.

Table 63 Key Assumptions and Results for Measure W-6.2: Reduce Landscape Water Consumption New Model Home Developments

Year	Annual Number of Homes with Greywater Systems and Rain Barrels due to W-6.2	Number of Greywater Systems and Rail Barrels due to W-6.2 after 2021	Water Saving per Home with Greywater System (Gallon per year)	Water Saving per Rain Barrel (Gallon per year)	Total Water Use Reduction (gallons)	Total Water Use Reduction (Acre-Feet)	Water-GHG Intensity (MT CO_2e/Acre-Foot)*	Emission Reduction (MT CO_2e)
2030	13	130	37,221	420	4,893,396	15	0.5	8
2035	13	195	37,221	420	7,340,094	23	0.5	12
*Water-GHG intensity of imported water. Energy Policy Initiatives Center 2019.								

6.7 Strategy 7: Diversify Local Water Supply (W)

The goal of this strategy is to reduce water-related energy use by diversifying local water supply through the following measure.

6.7.1 Measure W-7.1 Develop a Local Water Supply for Agriculture Water Use

Most of the water-related energy use is from upstream energy use (e.g., importing water from outside of San Diego region). The City plans to construct and operate a new Membrane Filtration/Reverse Osmosis Facility (MFRO) to produce a high-quality water supply for local agriculture water, which will increase local water supply and reduce the reliance on imported water. Once in operation, the MFRO will produce up to six million gallons of water per day (MGD, equivalent to 6,721 acre-feet per day) for agriculture irrigation use.[108]

Assuming the local water supply reduces imported water supply, the emissions avoided is calculated based on the imported water GHG intensities in 2030 and 2035. On the other hand, there will be additional

[105] The single-family potable water use was 9,679 acre-feet in 2015 based on the Escondido 2015 Urban Water Management Plan, May 2016. Table 2-3. The number of single-family homes in Escondido in 2015 was 22,031 based on SANDAG Demographic and Socioeconomic Estimates (May 25, 2019 version). SANDAG Data Surfer, accessed on November 18, 2019.
[106] Rebate data from Escondido are not available, data from Helix Water District were used as proxy.
[107] Emissions from water and projected water use are provided in *Appendix A: City of Escondido Greenhouse Gas Emissions Inventories and Projections* (EPIC, 2018).
[108] Estimated water produced at MFRO was provided by the City (July 2019).

local electricity use to treat water at the MFRO.[109] Table 64 summarizes the key assumptions and results. The GHG emissions reductions projected are the amounts in the years 2030 and 2035 only, not the sum of the annual reductions from the 2012 baseline year to 2030 or 2035.

Table 64 Key Assumptions and Results for Measure W-7.1 Develop a Local Water Supply for Agriculture Water Use

Year	New Local Water Provided to Agricultural Customers (Acre-Feet)	Water-GHG Intensity (MT CO2e/Acre-Foot)*	Emissions Avoided due to avoided Upstream Water (MT CO_2e)	Local Electricity Use Added from Water Treatment** (kWh)	Electricity Emission Factor (lbs CO_2e/MWh)	Emissions Generated from Electricity Consumed to Treat Water (MT CO_2e)	Net Emission Reduction (MT CO_2e)
2030	6,721	0.54	3,635	3,951,868	53	94	3,541
2035	6,721	0.54	3,635	3,951,868	36	64	3,571
*Water-GHG intensity of imported water. **Based on the energy intensity (599 kWh/acre-foot) of recycled water treatment (membrane filtration/reverse osmosis) Energy Policy Initiatives Center 2019.							

6.8 Strategy 8: Reduce and Recycle Solid Waste (S)

The goal of this strategy is to reduce emissions from landfill waste through the following measure.

6.8.1 Measure S-8.1: Increase Citywide Waste Diversion

Through Measure S-8.1, the City will work with its waste hauler to achieve an 80 percent waste diversion rate by 2030, and an 85 percent waste diversion rate by 2035. The 80 percent waste diversion rate would result in 2.4 pounds per person per day (PPD) waste disposed in landfills in 2030, and the 90 percent waste diversion rate would result in 1.2 PPD waste disposed in 2035.

The citywide waste disposal amount was 5.4 PPD in the 2012 baseline year and 5.9 PPD in 2016, corresponding to approximately 54 percent and 50 percent diversion rates, respectively. From 2012 to 2016, the diversion rates fluctuated between 50 percent and 54 percent.[110] The City has not conducted a waste characterization study recently; therefore, the baseline 2012 waste composition is used and held constant through the CAP horizon.[111] Landfills in the San Diego region are in the process of upgrading gas collection systems. It is assumed the landfill gas capture rate in 2030 will be 85 percent, an increase from the default 75 percent used in the BAU emissions projection. The emissions avoided from increasing the waste diversion rate is the difference between the waste category BAU emissions and the solid waste emissions using the target diversion rates and corresponding PPD waste amounts. Table 65 summarizes the key assumptions and results.

[109] The energy intensity of treating water to recycled water levels (membrane filtration/reverse osmosis process) is used as a proxy for the treatment energy use at MFRO. *Appendix A: City of Escondido Greenhouse Gas Emissions Inventories and Projections* (EPIC, 2018). The MFRO Environmental Impact Report included estimates on the operational energy use. There, it is assumed the energy use would be like a "refrigerated warehouse", which may not be as representative as the recycled water energy intensity.
[110] Method to convert PPD to estimated diversion rate is based on Calrecycle. Per Capita Disposal and Goal Measurement. Jurisdiction PPD from 2012–2016 were downloaded from CalReycle Jurisdiction Diversion Summary.
[111] Recent State actions include organic waste recycling, which may reduce the mixed waste emission factor in future years.

Table 65 Key Assumptions and Results for Measure S-8.1: Increase Citywide Waste Diversion

Year	Waste Disposed at Landfills from Escondido			Landfill Gas Capture Rate	Emissions with Targeted Diversion Rate ($MT\ CO_2e$)	Business as Usual Emissions ($MT\ CO_2e$)	GHG Emissions Reduction ($MT\ CO_2e$)
	lbs./person/day	short tons/year	MT/year				
2030	2.4	74,223	67,334	85%	7,457	31,045	23,588
2035	1.2	37,232	33,777	85%	3,741	31,145	27,405

Emissions from waste are calculated based on the mixed waste emission factor (0.74 MT CO_2e/short ton), oxidation rate (10%), and the waste capture rates. The projected emissions reductions are based on the CAP assumptions.
Energy Policy Initiatives Center 2019.

6.9 Strategy 9: Carbon Sequestration and Land Conservation (C)

The most recent urban tree canopy assessment in the San Diego region, conducted in 2014 using high-resolution Light Detection and Ranging (LiDAR), showed an urban tree canopy covering approximately 18 percent of Escondido.[112] The goal of this strategy is to increase the urban tree cover within Escondido through the following two measures (Measure C-9.1 and Measure C-9.2). In addition, Measure C-9.3 includes development of an Agricultural Land and Open Space Conservation Program.

6.9.1 Measure C-9.1: Enforce Landscape Tree Requirement at New Developments

The City's current water efficient landscape regulation includes the following requirements for tree planting: 1) a minimum of one tree for every four opposing parking spaces at new non-residential developments; and 2) a minimum of one tree per unit at new residential developments, including single-family and multi-family developments. A minimum of 15 gallons in size and proper irrigation and maintenance are required.[113]

Based on recent permitting data, an average of approximately 134,750 sq. ft. of new commercial office and retail development and 91,750 sq. ft. of new industrial developments were added per year. [114] The Escondido Municipal Code off-street parking regulations require on average of one parking space per 250 sq. ft. gross floor area; therefore, approximately 1,019 new parking spaces will be added every year at these new non-residential developments.[115] The new parking spaces will yield 255 new trees annually. The projected total number of new trees added by 2030 and 2035 are shown in Table 66.

[112] The assessment was done in 2014 for all urban areas in the San Diego County using methods developed by University of Vermont and USDA Forest Service.
[113] Escondido Municipal Code: Sec. 33-1339. Standards for Landscaping, accessed on August 1, 2019. These requirements are in addition to street tree requirements.
[114] The average annual new non-residential development sq. ft. is calculated based on new office spaces (86,000 sq. ft. in the last two years), new retail commercial spaces (183,500 in last two years), and new industrial (240,000 sq. ft.) square footage, as provided by the City (June 2019). The sq. ft. is new gross floor area.
[115] Escondido Municipal Code: Off-street Parking Requirement (Section 33-765), accessed on August 1, 2019. The minimum parking requirements for commercial, office, restaurant/food, retail, etc., are different. The average is used here.

Table 66 Number of New Trees Added at Non-Residential Parking Spaces due to Measure C-9.1: Enforce Landscape Tree Requirement at New Developments

Year	Annual New Non-Residential Developments Added (sq. ft. per year)	Parking Spaces at New Non-Residential Developments (Spaces per year)	Parking Space Tree Requirement (Spaces per tree)	Annual Number of New Trees Added	Number of New Trees Added by Target Year
2030	254,750	1,019	4	255	2,802
2035	254,750	1,019	4	255	4,076
*Average annual commercial and industrial development areas added Energy Policy Initiatives Center 2019.					

For new residential developments, SANDAG Series 13 projects that 150 new single-family units and 2,224 multi-family units will be added from 2020 to 2030, and an additional 104 single-family units and 207 multi-family units will be added from 2030 to 2035. [116] Based on the tree planting requirements, the number of trees that will be added at new residential developments will be 2,375 by 2030 and 2,686 by 2035.

The proposed strategy is to encourage thoughtful site design practices to optimize tree planting and open space. Should this unduly constrain development at high densities, the City will allow in-lieu plantings through the payment of a fee per tree unit. This ensures that new development projects achieve their planting requirements. The carbon sequestration potential from the new trees is based on the projected total number of trees planted and the CO_2 absorption rate per tree.[117] Table 67 summarizes the key assumptions and results. The GHG emissions reductions are the projected reduction amounts in the years 2030 and 2035 only, not the sum of the annual reductions from the 2012 baseline year to 2030 or 2035.

Table 67 Key Assumptions and Results for Measure C-9.1: Enforce Landscape Tree Requirement at New Developments

Year	Number of New Trees Added by Target Year	CO2 Sequestered* (MT CO_2/tree/year)	Carbon Sequestration (MT CO_2)
2030	5,177	0.0354	183
2035	6,762	0.0354	239
*Average number of trees. An improved estimate of the carbon sequestration rate can be evaluated once the implementation parameters are decided. The projected carbon sequestration rates are based on the CAP assumptions. Energy Policy Initiatives Center 2019.			

6.9.2 Measure C-9.2: Develop a Citywide Urban Forestry Program

Through Measure C-9.2, the City will develop and implement an Urban Forestry Program to track tree planting and maintenance at City facilities, public parks, and public rights-of-way. The number of trees

[116] SANDAG Series 13 Regional Growth Forecast (October 2013). SANDAG Data Surfer, accessed November 15, 2017.

[117] On average, the CO_2 sequestration rate is 0.035 MT CO_2 per tree per year. The carbon sequestration rate depends on the tree species, climate zone, planting location, and tree age. A more accurate carbon sequestration rate will be evaluated once the parameters are decided in implementation of the measure. California Emissions Estimator Model (CALEEMOD). Appendix D Default Data Tables (October 2017).

planted by the City varies by year. From 2016 to 2018, the City planted a total of 202 new trees. Assuming the trend continues, the goal is to plant an average of 67 new trees annually.[118]

Similar to Measure C-9.1, the carbon sequestration potential is based on the projected total number of trees planted and the CO_2 absorption rate per tree.[119] Table 68 summarizes the key assumptions and results. The GHG emissions reductions are the projected reduction amounts in the years 2030 and 2035 only, not the sum of the annual reductions from the 2012 baseline year to 2030 or 2035.

Table 68 Key Assumptions and Results for Measure C-9.2: Develop a Citywide Urban Forestry Program

Year	Annual Number of New Trees Added	Number of New Trees Added by Target Year*	CO2 Sequestered** (MT CO_2/tree/year)	Carbon Sequestration (MT CO_2)
2030	67	1,010	0.0354	36
2035	67	1,347	0.0354	48

*Includes 202 trees planted by the City from 2016 to 2018.
**Average of trees. An improved estimate of the carbon sequestration rate can be evaluated once the implementation parameters are decided.
The projected carbon sequestration rates are based on the CAP assumptions.
Energy Policy Initiatives Center 2019.

6.9.3 Measure C-9.3: Develop an Agricultural Land and Open Space Conservation Program

Through Measure C-9.3, the City plans to develop an Agricultural Land and Open Space Conservation Program that will both protect agricultural land and open space from conversion to residential developments and promote smart growth infill developments elsewhere. This will include proactive Williamson Act contracting, annexation preservation goals of 75 percent, community gardening ordinance and/or incentives, and actual land purchasing. The goal is to conserve 400 acres of agricultural land and/or open space from being developed into residential units. As a result of the land conservation, it is assumed at least 400 residential units would be built as infill multi-family developments elsewhere in the city.[120]

Preserving land from development into low-density single-family units would reduce the activity (e.g., energy use, VMT) and associated GHG emissions. Most GHG emissions from households are from transportation- and energy-related activities, and only those impacts are discussed here.[121]

First, building the expected housing units in smart growth infill areas would increase density and destination accessibility around the units. This leads to household VMT reduction. Assuming the units would be built in urban areas with densities ranging from 5.5 to 45 units per acre, the new density would be an increase of at least 450 percent compared to the one unit per acre density as previously zoned at

[118] The City planted 46 trees in 2016, 114 trees in 2017, and 42 new trees in 2018. Data provided by the City (June 2019).
[119] On average, the CO_2 sequestration rate is 0.035 MT CO_2 per tree per year. The carbon sequestration rate depends on the tree species, climate zone, planting location, and tree age. A more accurate carbon sequestration rate will be evaluated once the parameters are decided in implementation of the measure. California Emissions Estimator Model (CALEEMOD). Appendix D Default Data Tables (October 2017).
[120] Annexations are not considered under BAU projections. Therefore, the impacts of annexations are not estimated here.
[121] Based on the GHG inventory results, over 90 percent of the GHG emissions are from energy and transportation related activities.

the now preserved land.[122] Based on various studies, the ratio of VMT reduction to percent increase in density is 7 percent (i.e., the elasticity of VMT with respect to density is 7 percent). For example, a 20 percent increase in density would lead to 1.4 percent VMT reduction. However, these studies also cap the VMT reduction at 30 percent to eliminate the influence of any single factor, as community design relies on multiple land use strategies.[123] The more than 450 percent increase in density of these 400 units would yield a VMT reduction beyond the capped VMT increase indicated by the studies. Therefore, the VMT reduction from the units is set at 30 percent.

Assuming the average household VMT in Escondido is similar to that throughout the San Diego region, the VMT avoided in 2030 and 2035 due to the land conservation are shown in Table 69.[124]

Table 69 Household VMT Avoided due to Measure C-9.3: Develop an Agricultural Land and Open Space Conservation Program

Year	VMT Reduction from Increased Density*	Average Household VMT** (Miles/weekday)	VMT Reduction per Household (Miles/year)	% of VMT that are Escondido VMT	Escondido VMT Reduction per Household (Miles/year)
2030	30%	76	7,950	56%	4,420
2035	30%	75	7,828	56%	4,353

*CAPCOA Quantifying GHG Mitigation Measures LUT-1 Maximum VMT reduction.
**Assumes 3.2 persons per household in Escondido and 23.5-mile average weekday VMT per capita (SANDAG Series 13 projection for San Diego region).
347 average weekdays per year. 56% of all household VMT is allocated to Escondido based on Origin-Destination VMT allocation methods, assuming trips will have at least one trip-end within Escondido.
CAPCOA 2010, Energy Policy Initiatives Center 2019.

The VMT avoided per household is then converted to GHG emissions reductions using the total number of households and the average vehicle emission factors discussed in Section 4.4.1 (GHG Emission Factor for On-Road Transportation). The GHG emissions reductions in 2030 and 2035 are shown in Table 70.[125]

[122] The density assumption of the preserved land was provided by the City (October 2019). The densities at urban residential zones are based on Escondido General Plan Land Use/Community Form Element, accessed January 4, 2020.
[123] California Air Pollution Control Officers Association: Quantifying Greenhouse Gas Mitigation Measures (2010). LUT-1 Increase Density.
[124] SANDAG: San Diego Forward: The Regional Plan Program Environmental Impact Report 4.15 Transportation (2015), accessed on November 29, 2018. 2012, 2020, and 2035 San Diego region VMT per capita is from the Regional Plan, all other years are linearly interpolated. Number of persons per households based on SANDAG Series 13 Regional Growth Forecast (October 2013). SANDAG Data Surfer, accessed November 15, 2017.
[125] SANDAG: Escondido Centre City employment center, May 2019, accessed June 26, 2019.

Table 70 Emissions Reduction from VMT Avoided for Measure C-9.3: Develop an Agricultural Land and Open Space Conservation Program

Year	Number of Residential Units*	VMT Reduction per Household (Miles/year) **	VMT Reduction from all Units (Miles/year)	Average Vehicle Emission Rate (g CO_2e/mile)	GHG Emissions Reduction (MT CO_2e)
2030	257	4,420	1,136,682	297	337
2035	400	4,353	1,741,008	279	486

* Number of single-family units not being built at the preserved land. It is assumed that they are instead built at infill land as multi-family units** This is the VMT reduction for the units projected to be built in target years, which may differ from the VMT reduction from the homes built prior to target years.
The emissions reduction is the projection under the CAP assumptions, including future impact of State policies and programs used in the CARB EMFAC2014 model.
Energy Policy Initiatives Center 2019.

In addition, a typical multi-family home uses less energy (electricity and natural gas) than a typical single-family home. With the 2019 Building Standard PV mandates, all new single-family and low-rise multi-family homes would offset the homes' electricity use with electricity generation from PV. Therefore, only the natural gas savings from a multi-family home compared with a single-family home are accounted for here. The difference in natural gas use is shown in Table 71.

Table 71 Estimated Natural Gas Use of New Homes after 2020

Residential Type	Natural Gas Use per Home (Therms per year)
Single-Family 1	223
Single-Family 2	253
Single-Family (Average of 1&2)	238
Multi-Family	112
Natural Gas Saving*	126

*Average single-family minus multi-family unit natural gas use
Residential types are based on mixed-fuel prototype types developed by CEC for 2019 Building Energy Efficiency Standard. The two single-family prototypes have different floor areas (square footage) and number of stories, therefore different energy use.
Energy use are modeled with CEC CBECC-Res 22019.1.0 tool, May 2019 version, for Climate Zone 10 where Escondido is located.
Energy Policy Initiatives Center 2019.

Emissions reductions from natural gas savings were calculated using the natural gas savings per home, total number of households, and the natural gas emission factor discussed in Section 4.3. The emissions reductions from natural gas savings are summarized in Table 72.

Table 72 Emissions Reduction from Natural Gas Savings for Measure C-9.3: Develop an Agricultural Land and Open Space Conservation Program

Year	Number of Residential Units*	Natural Gas Savings Per Household (Therms per year)	Total Natural Gas Savings (Therms per year)	Natural Gas Emission Factor (MT CO_2e/Therm)	Emissions Reductions from Natural Gas Savings (MT CO_2e)
2030	257	126	32,464	0.0054	178
2035	400	126	50,500	0.0054	276

*Number of single-family homes not being built at preserved land, and instead being built at infill land as multi-family homes
The emissions reduction is the projection under the CAP, including future impact of State policies and programs used in the CARB EMFAC2014 model and CAP assumptions.
Energy Policy Initiatives Center 2019.

The total emissions reductions from Measure C-9.3 are 515 MT CO_2e in 2030 and 762 MT CO_2e in 2035, or the sum of the target year emissions reductions from Table 70 and Table 72.