City of Escondido Greenhouse Gas Emissions Inventory and Projections

Draft

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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 educating law students.

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1 OVERVIEW

This document presents a summary of the greenhouse gas (GHG) emissions for the City of Escondido (referred to as Escondido or the City) from 2012 to 2014, and the business-as-usual (BAU) emissions projections for 2020, 2030, 2035, and 2050. This BAU projection demonstrates emissions growth in the absence of any new policies and programs and does not consider future impacts of adopted Federal and State policies. GHG reductions from these policies, are considered later in the climate action planning process and are referred to as the "legislatively-adjusted BAU".

Section 2 describes the background sources and common assumptions used for the inventory and projections. Section 3 provides the results of the GHG emissions inventory for 2012 to 2014. The methods used to prepare each category of the inventory are provided in Section 4. Section 5 provides a summary of the emissions projections for 2020, 2030, 2035, and 2050, and the methods used to prepare each category of projections.

2 BACKGROUND

2.1 Greenhouse Gases

The primary GHGs included in the emissions estimates presented here are carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O). Each GHG has a different capacity to trap heat in the atmosphere, known as its global warming potential (GWP), which is normalized relative to CO_2 and expressed in carbon dioxide equivalents (CO_2e). In general, the 100-year GWPs reported by the Intergovernmental Panel on Climate Change (IPCC) are used to estimate GHG emissions. The GWPs used in this inventory are from the IPCC Fourth Assessment Report (AR4),[1] provided in Table 1.

Table 1 Global Warming Potentials Used in Escondido GHG Emission Inventory & Projections

Greenhouse Gas	Global Warming Potential
Carbon dioxide (CO_2)	1
Methane (CH_4)	25
Nitrous oxide (N_2O)	298

2.2 Categories of Emissions

The U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions (U.S. Community Protocol) [2] requires a minimum of five basic emissions-generating activities to be included in a Protocol-compliant community-scale GHG inventory. These categories are: electricity, natural gas, on-road transportation, water and wastewater, and solid waste. GHG emissions are calculated by multiplying activity data (e.g., kilowatt-hours of electricity, tons of solid waste) by an emission factor (e.g., pounds of CO_2e per unit of electricity). For these five categories, methods used in this inventory were based on the U.S. Community Protocol standard methods and modified with regional- or City-specific data when available.

[1] IPCC Fourth Assessment Report: Climate Change 2007: Direct Global Warming Potentials (2013).
[2] ICLEI – Local Governments for Sustainability USA: U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions, Version 1.0 (2012).

Additionally, GHG emissions from off-road transportation were included in the inventory and projections, based on the methods and models used by California Air Resources Board (CARB) in the statewide GHG emission inventory.[3]

All activity data and GHG emissions reported in this document are annual values, and all emission factors reported in this document are annual average values, unless stated otherwise.

2.3 Demographics

The San Diego Association of Governments (SANDAG) estimates and forecasts population and employment for all jurisdictions in the San Diego region. The population and jobs estimate from 2012 to 2014 for Escondido are provided in Table 2.[4]

Table 2 Population and Jobs Estimates (Escondido, 2012-2014)

Year	Population	Jobs
2012	146,781	48,874
2013	148,522	49,456
2014	149,362	50,038
SANDAG, 2013 and 2017; Energy Policy Initiatives Center, 2017.		

2.4 Rounding of Values in Tables and Figures

Rounding is used only for the final GHG value within the tables and figures throughout the document. Values are rounded to the nearest integer of a higher order of magnitude. Values are not rounded in the intermediary steps in the actual calculation. Because of rounding, some totals may not equal the exact values summed in any table or figure.

3 SUMMARY OF GHG EMISSIONS INVENTORY

The total GHG emissions from Escondido in 2012 were estimated at 943,000 metric tons CO_2e (MT CO_2e), distributed into categories as shown in Figure 1.

[3] California Air Resources Board (CARB): California Greenhouse Gas Emission Inventory – 2016 Edition (June 2016).
[4] 2012–2014 Population are from SANDAG's Demographic & Socio-Economic Estimates (March 9, 2017 Version). Jobs in 2012 are from SANDAG's Series 13 Regional Growth Forecast (October 2013). Jobs in 2013 and 2014 are interpolated linearly based on 2012 and 2020 jobs estimates. The number of jobs is for civilian jobs only and does not include military jobs, SANDAG Data Surfer, accessed on November 15, 2017.

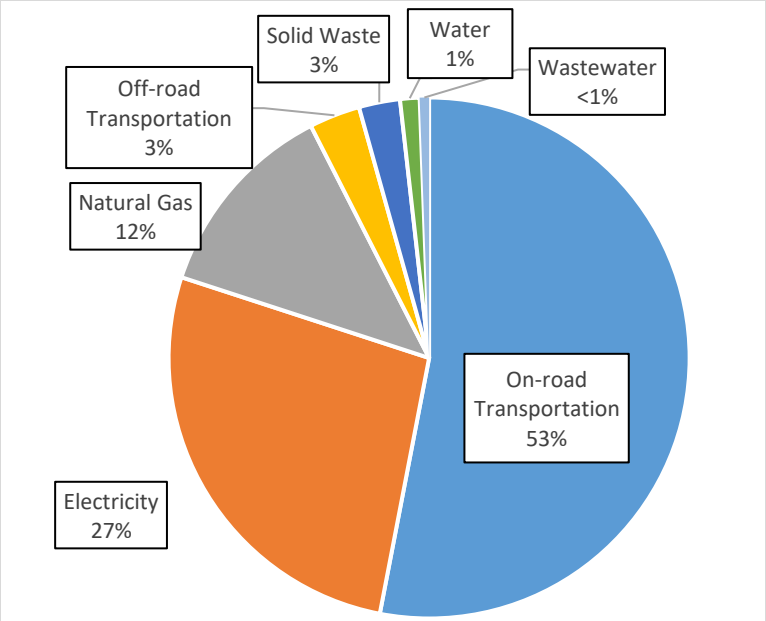


Figure 1 Breakdown of GHG Emissions in Escondido (2012)

The total GHG emissions in each year 2012, 2013, and 2014 are provided in Table 3. The 2013 estimate was 927,000 MT CO_2e and the total GHG emissions in 2014 were estimated at 874,000 MT CO_2e, 7% lower than the total emissions in 2012. Both the 2013 and 2014 GHG emissions have similar distributions among the emissions categories as the 2012 GHG emissions. The on-road transportation category contributed the most (53%) to the overall GHG emissions in 2012, while the wastewater category contributed the least (<1%). The totals and breakdown of emissions by category are presented in Table 3.

Table 3 Total and Breakdown of Estimated GHG Emissions in Escondido (2012–2014)

Emissions Category	2012 GHG Emissions (MT CO_2e)	2013 GHG Emissions (MT CO_2e)	2014 GHG Emissions (MT CO_2e)
On-Road Transportation*	498,000	490,000	479,000
Electricity	256,000	245,000	215,000
Natural Gas	118,000	121,000	108,000
Off-Road Transportation	30,000	29,000	29,000
Solid Waste	24,000	25,000	25,000
Water	11,000	12,000	13,000
Wastewater	6,000	5,000	5,000
Total	943,000	927,000	874,000

Sum may not add up to totals due to rounding.
GHG emissions for each category are rounded to the nearest thousands. Values are not rounded in the intermediary steps in the calculation.
*Based on SANDAG Series 13 vehicle miles traveled (VMT) estimates. 2012 is the Base Year.
Energy Policy Initiatives Center, 2018

4 METHODS TO CALCULATE EMISSIONS INVENTORY

4.1 On-Road Transportation

The emissions associated with on-road transportation in Escondido are calculated by multiplying the estimated vehicle miles traveled (VMT) and the average vehicle emission rate in the San Diego region in a given year. Average weekday VMT data were provided by SANDAG based on its activity-based model and the Origin-Destination (O-D) method.[5] The O-D VMT method is the preferred method proposed by the U.S Community Protocol in 'TR.1 Emissions from Passenger Vehicles' and 'TR.2 Emissions from Freight and Service Trucks' that estimates miles traveled based on where a trip originates and where it ends to better attribute on-road emissions to cities and regions of miles traveled (Figure 2).[6]

[5] SANDAG (2015). San Diego Forward: The Regional Plan. Appendix T Travel Demand Model Documentation. SANDAG (2013). Vehicle Miles Traveled Calculation Using the SANDAG Regional Travel Demand Model. Technical White Paper.
[6] ICLEI – Local Governments for Sustainability USA: U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions, Version 1.0 (2012), Appendix D: Transportation and Other Mobile Emission Activities and Sources.

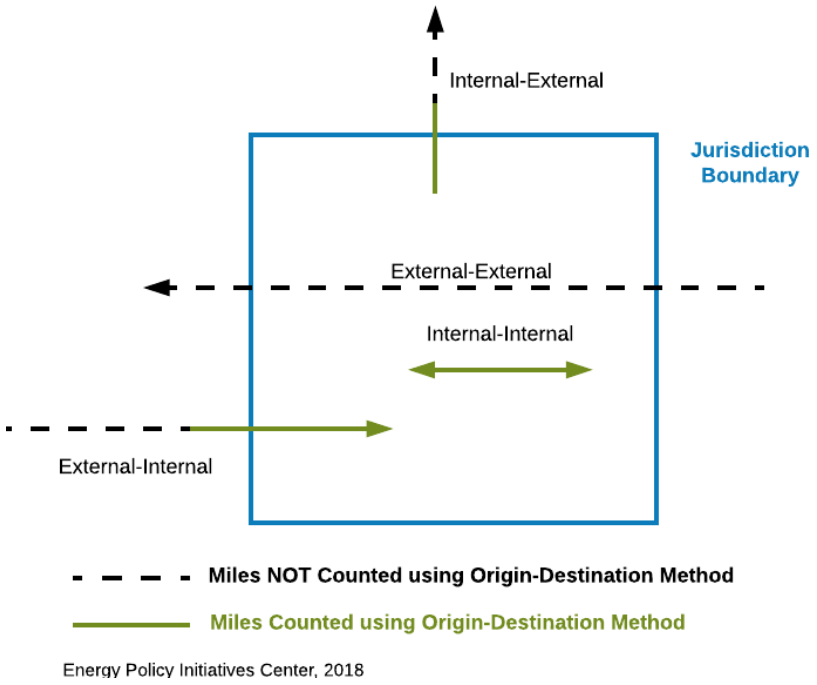


Figure 2 Components of O-D Method for VMT Calculation

O-D VMT data include all the miles traveled for trips that originate and end within a boundary (in this case, within Escondido city limits, referred to as Internal-Internal), and half of the miles traveled of the trips that either begin within the boundary and end outside the boundary (referred to as Internal-External), or vice versa (referred to as External-Internal). In accordance with the methodology, VMT from trips that begin and end outside the boundary that only pass through Escondido (referred to as External-External) are not included in the total City VMT.

The average weekday O-D VMT data for each trip type in 2012 and 2014 were provided by SANDAG, and 2013 VMT were interpolated linearly using 2012 and 2014 values (Table 4).[7]

Table 4 O-D VMT and Trip Types (Escondido, 2012-2014)

Year	Internal-Internal Trips (Miles/Weekday)	External-Internal/Internal-External Trips (Miles/Weekday)	External-External Trips* (Miles/Weekday) (Information only, excluded from City VMT)
2012	588,461	4,763,045	1,085,989
2013	582,385	4,761,943	1,156,606
2014	576,309	4,760,840	1,227,223
*Miles from External-External trips (pass-through trips) are the portion within the City boundary, not the entire trip. Based on SANDAG Series 13 VMT estimates. 2012 is the Base Year. 2013 is linearly interpolated between 2012 and 2014. SANDAG, 2018; Energy Policy Initiatives Center, 2018.			

[7] Series 13 2012 (Base Year) and 2014 average weekday VMT estimates were provided by SANDAG (March 28, 2017 and November 07, 2017). 2013 VMT were interpolated linearly between 2012 and 2014 VMT. Original data tables provided by SANDAG are in Appendix A.

In accordance with the methodology, estimated and projected Internal-External and External-Internal miles associated with Escondido are divided in half to allocate the miles between Escondido and all other outside jurisdictions (see Appendix A for source data). The total average weekday VMT is multiplied by 347 to adjust from average weekday VMT to average annual VMT, which includes weekends.[8]

The average annual vehicle emission rate expressed in grams of CO_2e per mile driven (g CO_2e/mile) were derived from the statewide mobile source emissions model EMFAC2014, developed by the California Air Resources Board (CARB).[9] EMFAC2014 was used to generate average emission rates for the San Diego region for all vehicle classes, model years, speeds, and fuel types.[10] The average emission rates (g CO_2e/mile) were calculated based on the VMT distribution of each vehicle class and its emission rate. The average vehicle emission rate was adjusted from g CO_2/mile to g CO_2e/mile, to account for total GHG emissions, including CO_2, CH_4, and N_2O.[11] This report assumes Escondido has the same distribution of vehicle types as the region.

The total VMT, average vehicle emission rates, and corresponding GHG emissions from the on-road transportation category from 2012 to 2014 are given in Table 5.

Table 5 VMT, Emission Rate and GHG Emissions from the On-Road Transportation Category (Escondido, 2012-2014)

Year	Average Vehicle Emission Rate (g CO_2e/mile)	Total VMT		GHG Emissions (MT CO_2e)
		Average Weekday Miles*	Average Annual Miles	
2012	483	2,969,984	1,030,584,328	498,000
2013	476	2,963,356	1,028,284,646	490,000
2014	467	2,956,729	1,025,984,963	479,000

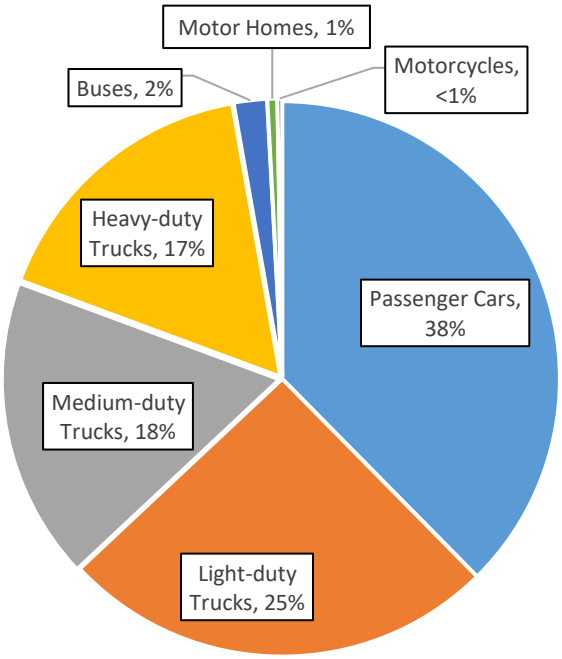
*Consistent with the methodology, this is the sum of internal-internal and half of both external-internal and internal-external VMT from Table 4. Weekday miles are converted to annual average before converting to GHG emissions.
Based on SANDAG Series 13 VMT estimates. 2012 is the Base Year. 2013 is linearly interpolated between 2012 and 2014.
GHG emissions for each category are rounded to the nearest thousands. Values are not rounded in the intermediary steps in the calculation.
CARB, 2015; SANDAG, 2018; Energy Policy Initiatives Center, 2018.

The decrease in the emission rate is likely due to the vehicle turnover rate in the San Diego region and improved vehicle emission standards of new vehicles.

Figure 3 gives the breakdown of emissions by vehicle class in 2012, based on the EMFAC vehicle class distribution in the San Diego region. This report assumes Escondido has the same distribution of vehicle

[8] The conversion of 347 weekdays to 365 days per year as used by CARB. CARB: California's 2000-2014 Greenhouse Gas Emission Inventory Technical Support Document (2016 Edition) p. 41 (September 2016).
[9] CARB: EMission FACtors model, EMFAC2014 (2015).
[10] EMFAC2014 Web Database: Emission Rates for SANDAG. Download date: January 22, 2016. The vehicle classes in EMFAC2014 are the same as the vehicle classes in the previous model EMFAC2011.
[11] The conversion factor, 1.01, was calculated based on the ratio of CO_2 emissions to total GHG emissions (CO_2, CH_4, and N_2O expressed as CO_2e) using methods from EPA GHG Equivalencies Calculations and References. Emissions were from mobile fossil fuel combustion in the transportation end-use category in 2013 (the latest available data year), on-road emissions. EPA. *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2013.* (2015). Table 3-12 to 3-14.

types as the region. Passenger cars and light duty trucks contribute the most to the City's on-road transportation emissions (63%), while motorcycles contribute the least with smaller than 1%.[12]



EMFAC2014. Energy Policy Intiatvies Center, 2017
Percentages may not add to totals due to rounding.
*EMFAC vehilce categorization is different from Enviromental Protect Agency (EPA) Emission Standards categorization.

Figure 3 On-Road Transportation Emissions by Vehicle Class in the San Diego Region

4.2 Electricity

Emissions from electricity use in Escondido were estimated using the Built Environment (BE.2) method from the U.S Community Protocol.[13] Annual metered electricity sales by the local utility, San Diego Gas & Electric (SDG&E) to Escondido customers[14] were adjusted by 1) a loss factor[15] of 1.07[16] to account for transmission and distribution losses; and 2) subtracting electricity use associated with water distribution, which is allocated to the water category emissions.

[12] In California's EMFAC2014, passenger cars are all cars and fuel types designated as Light Duty Automobiles (LDAs). Light Duty Trucks (LDTs) are divided into LDT1 and LDT2, where LDT1 includes gas, diesel, and electric fuel vehicles, while LDT2 does not include electric vehicles. Medium-duty trucks included medium duty vehicles (MDV with Gross Vehicle Weight Rating (GVWR) 5751-8,500 lbs), and heavy-duty trucks (HDTs), with GVWR larger than 8,500 lbs. Under the EPA Emission Standard category vehicles with GVWR under 8,500 lbs are considered light-duty trucks/vehicles.
[13] ICLEI – Local Governments for Sustainability USA: U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions, Version 1.0 (2012), Appendix C: Built Environment Emission Activities and Sources.
[14] 2012–2016 metered electricity sales were provided by SDG&E to EPIC (December 16, 2017).
[15] The transmission and distribution loss factor is used to scale end-use demand or retail sales to produce net energy for load. L. Wong. *A Review Of Transmission Losses In Planning Studies*, CEC Staff Paper (2011)
[16] California Energy Commission (CEC): *California Energy Demand 2016–2026 Final Forecast Mid-Case Final Baseline Demand Forecast Forms*, SDG&E Mid. The transmission and distribution loss factor is calculated based on the ratio of net energy for load (total sales + net losses) and total sales from SDG&E Form 1.2 Mid.

Emissions are calculated by multiplying the adjusted net energy for load (electricity sales + losses) by the corresponding City-specific electricity emission factor, given in Table 6, expressed in pounds of CO_2e per megawatt-hour (lbs CO_2e/MWh). For a given year, the City-specific electricity emission factor is estimated based on the specific power mix of bundled power[17] and Direct Access (DA) power,[18] and their respective emission factors. The SDG&E bundled emission factors are calculated using Federal Energy Regulatory Commission (FERC) Form 1[19] data, the California Energy Commission (CEC) Power Source Disclosure Program,[20] data on SDG&E-owned and purchased power, and U.S. EPA Emissions and Generating Resource Integrated Database (eGRID)[21] on specific power plant emissions. The DA emission factor is taken from the California Public Utilities Commission (CPUC) Decision D.14-12-037.[22]

The differences in the electricity emission factors from 2012 to 2014 reflect in part the change in the electricity power mix in the City and in SDG&E's service territory. The emission factor increased in 2012 due to the shutdown of the zero-emissions electricity supply from the San Onofre Nuclear Generation Station (SONGS) and replacement by other natural gas-fired power plant sources.[23] In the later years, more renewable resources were included in the power mix that resulted in a lower electricity emission factor. SDG&E had 32% renewable sources in the electricity supplied to its bundled customers in 2014, an increase from 19% in 2012.[24]

The net energy for Escondido's load (electricity sales + losses), electricity emission factors, and corresponding GHG emissions from the electricity category for the years 2012-2014 are given in Table 6.

Table 6 Net Energy for Load, Emission Factor and GHG Emissions from Electricity Category (Escondido, 2012–2014)

Year	Net Energy for Load (electricity sales + losses) (MWh)	Emission Factor (lbs CO_2e/MWh)	GHG Emissions (MT CO_2e)
2012	742,143	760	256,000
2013	729,519	741	245,000
2014	735,224	646	215,000
GHG emissions for each category are rounded to the nearest thousands. Values are not rounded in the intermediary steps in the calculation. SDG&E, 2018; Energy Policy Initiatives Center, 2018.			

[17] SDG&E bundled power includes the electricity from SDG&E-owned power plants and the electricity from its net procurements.
[18] The SDG&E Direct Access Program includes electricity that customers purchased from non-SDG&E electric service providers (ESPs), but SDG&E still provides transmission and distribution services.
[19] Federal Energy Regulatory Commission (FERC): Form 1- Electricity Utility Annual Report, download date: July 20, 2015
[20] California Energy Commission (CEC) Power Source Disclosure Program under Senate Bill 1305. SDG&E annual power source disclosure report (2012-2014) were provided by CEC staff to EPIC.
[21] U.S. EPA. eGRID 2012 (2015) and eGRID 2014 v2 (2017).
[22] Decision 14-12-037, December 18, 2014 in Rulemaking 11-03-012 (Filed March 24, 2011). The recommended emission factor is 0.379 MT CO_2e/MWh (836 lbs CO_2e/MWh).
[23] SONGS is partially owned by SDG&E and historically accounted for approximately 15–20% of SDG&E power generation. SONGS was permanently closed in 2013 and the energy generation was replaced by other sources, including non-renewable sources, which increased the emission factor of SDG&E-generated electricity.
[24] California Energy Commission: Utility Annual Power Content Label.

Electricity use fluctuated between 2012 and 2014, but GHG emissions from the electricity category decreased 16% from 2012 to 2014. This may be partly attributed to the increase of renewable content in the electricity supply, as reflected in the decrease in the electricity emission factor.

The net energy for load does not include self-serve renewable supply, such as customer-owned behind-the-meter photovoltaic (PV) systems, or self-serve non-renewable supply. The estimated cumulative PV capacity in Escondido at the end of 2014 was 7.7 MW, more than double the cumulative PV capacity at the end of 2012 (3 MW), corresponding to an estimated total of 37,843 MWh of behind-the-meter solar generation. The number of newly added PV systems in each year from 2012 to 2014 is also shown in Table 7.[25] Electricity generation from PV systems is assumed to have no associated GHG emissions.

Table 7 Behind-the-meter PV Systems and Electricity Generation (Escondido, 2012–2014)

Year	New PV Systems		Cumulative PV Systems since 2000		Estimated Behind-the-meter Solar Generation (MWh)
	Number of Systems	Capacity (MW_{dc})	Number of Systems	Capacity (MW_{dc})	
2012	320	3.0	1,107	9.7	16,619
2013	655	4.7	1,762	14.3	24,618
2014	1,040	7.7	2,802	22.0	37,843

The emissions from the electricity category can be broken down further into residential, commercial and industrial customer classes. In 2012, 47% of emissions were attributed to commercial electricity use, 43% were attributed to residential electricity use, and 10% from industrial use, as shown in Figure 4.

[25] NEM Interconnection Data Set (current as of May 31, 2017), download date: September 12, 2017. Based on date of NEM interconnection applications approved. Solar capacities are reported as direct current (DC). Electricity generation is converted from capacity (power) to energy using an average solar PV system capacity factor of 20% and an annual system degradation rate of 1%.

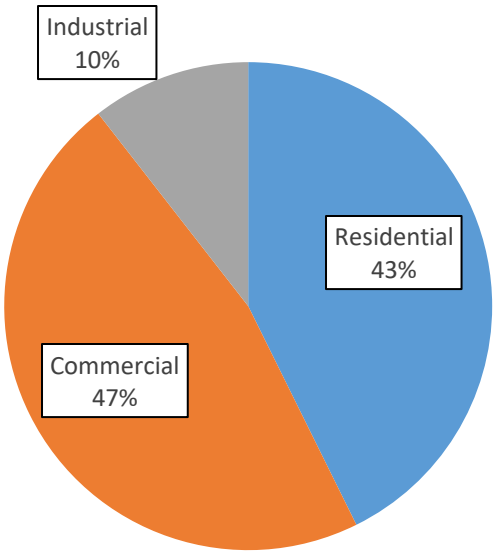


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Figure 4 Electricity Emissions by Customer Class (Escondido, 2012)

4.3 Natural Gas

Emissions from natural gas end-use in Escondido were estimated using method Built Environment (BE.1) from the U.S Community Protocol.[26] Annual metered natural gas sales were provided by SDG&E. Natural gas end-use does not include the natural gas used for utility-level electric generation (UEG) because those emissions are included in the electricity category.[27]

To estimate emissions from the combustion of natural gas, fuel use was multiplied by an emission factor for natural gas based on data from the CARB.[28] The total natural gas use and corresponding GHG emissions from the natural gas category for the years 2012-2014 are given in Table 8.

Table 8 Natural Gas Use and GHG Emissions from Natural Gas Category (Escondido, 2012–2014)

Year	Natural Gas Use (Million Therms)	GHG Emissions (MT CO_2e)
2012	21.6	118,000
2013	22.1	121,000
2014	19.7	108,000
GHG emissions for each category are rounded to the nearest thousands. Values are not rounded in the intermediary steps in the calculation. SDG&E, 2018; Energy Policy Initiatives Center, 2018.		

[26] ICLEI– Local Governments for Sustainability USA: U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions, Version 1.0 (2012), Appendix C: Built Environment Emission Activities and Sources.
[27] 2012–2016 metered natural gas sales were provided to EPIC by SDG&E (December 16, 2017 and March 13, 2018). The natural gas used for utility-level electric generation (UEG) was excluded from the data by SDG&E (March 2018). However, for the UEG facilities in Escondido, the natural gas NOT associated with electricity generation is still included in the natural gas data.
[28] Emission factor for natural gas: 0.0554 million metric tons CO_2e/Million therms. CARB: Documentation of California's GHG Inventory – Index.

Emissions from the natural gas category can be broken down further into residential, commercial, and industrial customer classes. In 2012, 64% of emissions resulted from residential natural gas use, and the remaining 30% and 6% were from commercial and industrial natural gas use respectively, as shown in Figure 5.

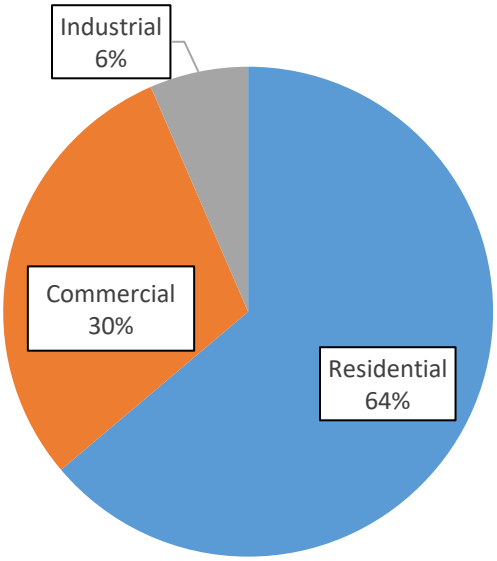

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Figure 5 Natural Gas Emissions by Customer Class (Escondido, 2012)

4.4 Off-Road Transportation

The emissions from off-road transportation in Escondido, such as gasoline and diesel fuel use for off-road vehicles and equipment, were estimated based on CARB off-road models. OFFROAD2007 is the main model for estimating off-road transportation emissions. [29] After the release of OFFROAD2007, CARB has been developing inventories and models for each sub-category based on specific regulatory requirements.[30] For example, the recreational equipment category in OFFROAD2007 was replaced by RV2013.[31] In this section, new inventories and models were used if available; otherwise, OFFROAD2007 was used.

Due to the lack of jurisdiction-specific data from CARB models, the emissions or fuel consumption from the CARB model outputs for the San Diego region were scaled to the City based on sub-category-specific scaling factors. The off-road activity sub-categories that are relevant to Escondido and the scaling factors are given in Table 9. [32]

[29] CARB: Off-Road Motor Vehicles, OFFROAD 2007.
[30] CARB: Mobile Source Emissions inventory – Off-Road Diesel Vehicles.
[31] CARB: Off-Road Gasoline-Fueled Equipment. Recreational Vehicles, RV2013 (Inventory Model Database).
[32] The sub-categories listed in this table are not the comprehensive off-road mobile sources listed in CARB, as some of the sub-categories are not relevant to Escondido, such as airport ground support, pleasure craft, commercial marine vessels, etc.

Table 9 Sub-Categories Included in the Off-Road Transportation Categories

Sub-Category	Model Source	Common Equipment Type	Scaling Factor
Recreational Vehicles	CARB RV2013	Terrain vehicles, golf carts, minibikes, off-road motorcycles	Population
Lawn and Garden Equipment	CARB OFFROAD2007	Lawn mowers, trimmers, brush cutters, chainsaws, leaf blowers/ vacuums	Population
Light Commercial Equipment	CARB OFFROAD2007	Generator set, pumps, welders	Commercial Jobs
Construction and Mining	CARB In-Use Off-Road Equipment 2011 Inventory	Excavators, off-highway tractors, loaders, paving equipment	Construction Jobs
Industrial	CARB In-Use Off-Road Equipment 2011 Inventory	Aerial lifts, forklifts, sweepers/scrubbers	Industrial Jobs
Diesel-Fueled Portable Equipment	CARB Portable Equipment 2017	Compressors, generators, pumps	Jobs

In the RV2013 model, the GHG emissions from recreational vehicles in the San Diego region were reported in tons per day and converted to annual emissions. In the Portable Equipment 2017 model and In-Use Off-Road Equipment 2011 Inventory, the fuel consumptions for the equipment in the San Diego region were reported in gallons per year and converted to annual GHG emissions. For other sub-categories, the OFFROAD2007 model outputs are annual emissions for the San Diego region. The scaling factors and the corresponding GHG emissions from the off-road transportation category in 2012 to 2014 are given in Table 10.[33]

[33] The population scaling factors were calculated based on Escondido 2012–2014 populations compared to the regional population. The regional population is from the SANDAG Demographic & Socio Economic Estimates (Updated in September 2015), download date: October 29, 2015. Regional commercial jobs in 2012 is from the SANDAG Series 13 Regional Growth Forecast (Updated in October 2013), download date: March 29, 2017, SANDAG Data Surfer. Commercial jobs include all employment types other than agriculture and mining, construction and manufacturing. The jobs estimate in 2013 is interpolated linearly based on the 2012 and 2020 jobs estimates.

Table 10 GHG Emissions from Off-Road Transportation Category (Escondido, 2012–2014)

Sub-Category	Scaling Factor	San Diego Region (Million MT CO_2e)			Escondido (MT CO_2e)		
		2012	2013	2014	2012	2013	2014
Recreational Vehicles	5%	0.004	0.004	0.004	178	170	171
Lawn and Garden Equipment	5%	0.095	0.094	0.093	4,450	4,428	4,349
Light Commercial Equipment	3%	0.103	0.102	0.102	3,459	3,428	3,397
Construction and Mining	10%	0.184	0.185	0.186	18,651	18,301	17,905
Industrial	6%	0.012	0.012	0.013	684	709	734
Diesel-Fueled Portable Equipment	4%	0.070	0.064	0.065	2,548	2,319	2,330
Total					30,000	29,000	29,000

Only total GHG emissions are rounded to the nearest thousands. Values are not rounded in the intermediary steps in the calculation.
CARB, 2007, 2011, 2013 and 2017; Energy Policy Initiatives Center, 2018.

4.5 Solid Waste

Emissions from solid waste disposed by Escondido were estimated using method Solid Waste (SW.4) from the U.S. Community Protocol.[34] To estimate emissions, the amount of waste disposed by a city in a given year is multiplied by an emission factor for mixed solid waste. Solid waste disposal data were retrieved from the California Department of Resources Recycling and Recovery (CalRecycle) Disposal Reporting System (DRS).[35]

The emission factor of mixed solid waste depends on the percentage of each waste type within the waste stream disposed in a landfill. The City of San Diego's 2012–2013 Waste Characterization Study was used as a reasonable proxy for Escondido's waste composition to determine the percentage of each waste type within the mixed solid waste and applied to 2012–2014 waste disposal for the emission calculation.[36] Only the CH_4 emissions from waste degradation are considered non-biogenic and included in this category in accordance with the methodology. The CO_2 emissions from waste degradation are considered biogenic and not included in this category.

The default capture rate of CH_4 emissions from landfills is 75% based on the U.S. Community Protocol; any CH_4 emissions above this are accounted for as emissions from the solid waste category. The total and per-capita solid waste disposal and the corresponding GHG emissions from the years 2012–2014 are given in Table 11.

[34] ICLEI – Local Governments for Sustainability USA: U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions, Version 1.0 (2012), Appendix E: Solid Waste Emission Activities and Sources.
[35] CalRecycle: Disposal Reporting System (DRS): Jurisdiction Disposal and Alternative Daily Cover (ADC) Tons by Facility. 2012–2014 solid waste disposal data from CalRecycle were confirmed by City staff. Download date: January 11, 2018.
[36] City of San Diego 2014, *Waste Characterization Study 2012–2013 Final Report*. Emission factor, 0.744 MT CO_2e/short ton calculated based on waste distribution and emission factor for each waste type in *Version 13 Waste Reduction Model (WARM)*

Table 11 Solid Waste Disposal and GHG Emissions from Solid Waste Category (Escondido, 2012–2014)

Year	Solid Waste Disposal (MT/year)	Per Capita Solid Waste Disposal (kg/person/day)	GHG Emissions (MT CO_2e)
2012	131,056	2.4	24,000
2013	133,712	2.5	25,000
2014	134,804	2.5	25,000
GHG emissions for each category are rounded to the nearest thousands. Values are not rounded in the intermediary steps in the calculation. CalRecycle, 2017; Energy Policy Initiatives Center, 2018.			

4.6 Water

The City of Escondido provides both potable and recycled water service within the City, however the water service area does not align exactly with the City's boundaries. The City is a member agency of the San Diego County Water Authority (SDCWA).[37] The City has an emergency-only treated water connection with neighbor agency Rincon Del Diablo Municipal Water District (Rincon MWD) which has not been used in the past five years.[38]

The potable water supply for Escondido comes from two sources: 1) imported untreated water from SDCWA; and 2) local surface water from the San Luis Rey River watershed. It is assumed that the percentage of water from each source supplied within the City's boundaries is the same as that of the water service area. The potable water supplied in Escondido and the percentage of water from each source are given in Table 12.[39]

Table 12 Potable Water Supplied and Supply Source (Escondido, 2012–2014)

Year	% of Potable Water from each Water Supply		Potable Water Supplied (Acre-Feet)
	SDCWA Untreated Water	Local Surface Water	
2012	85%	15%	21,837
2013	92%	8%	21,660
2014	98%	2%	21,896
Escondido, 2017.			

The energy used to produce and provide potable water from each supply of water is different due to the different source type and its location. Emissions from water use in Escondido were estimated using method Wastewater and Water (WW.14) from the U.S. Community Protocol.[40] The method considers each segment of the water system (upstream supply and conveyance, water treatment, and local water distribution) individually, as described below.

[37] Escondido 2015 Urban Water Management Plan (June 2016).
[38] Personal Communication between EPIC and City of Escondido Staff (March 02, 2017). The past five years cover all inventory years 2012–2014.
[39] Potable water supplied within the City of Escondido (2010–2015) only and the water production sources for the entire water service area (2010–2015) were provided by City staff on March 02, 2017 and March 23, 2017.
[40] ICLEI – Local Governments for Sustainability USA: U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions, Version 1.0 (2012), Appendix F: Wastewater and Water Emission Activities and Sources.

Upstream Supply and Conveyance – This is defined as supply and conveyance of water from the raw sources to the local service area. The upstream supply and conveyance energy use for SDCWA untreated water consists of conveyance of water from the State Water Project and the Colorado River through Metropolitan Water District's service area up to SDCWA's service area and onto the member agency take-over point.

Local Water Treatment – This is the energy used for water treatment plant operations. Escondido and Vista Irrigation District (VID) jointly own the Escondido-Vista Water Treatment Plant (EVWTP), and the City of Escondido operates the plant. EVWTP treats both SDCWA untreated water and local surface water to potable water standards.

Local Water Distribution – This is defined as the energy required to move treated water from water treatment plants to end-use customers. Distribution energy use includes energy use for water pump stations and/or pressure reduction stations, water tanks, etc. The City maintains five main pump stations within the boundaries.

The energy intensity per unit of water for each segment of the water-use cycle is given in Table 13.

Table 13 Energy Intensity for Each Segment of Water-Use Cycle (Escondido, 2012–2014)

Year	Upstream Supply and Conveyance - SDCWA untreated water (kWh/Acre-Foot)[41]	Local Water Treatment Energy Intensity (kWh/Acre-Foot)[42]	Local Distribution Energy Intensity (kWh/Acre-Foot)[43]
2012	1,755	56	33
2013			
2014			

For upstream supply and conveyance emissions, the amount of water from SDCWA was multiplied by the upstream energy intensity to get the total electricity use from upstream supply. The electricity use was multiplied by the average California electricity emission factor to calculate the GHG emissions.[44] Because the electricity use and GHG emissions associated with upstream supply and conveyance are outside the City boundary and would not be included in the electricity category, they are accounted for in this water category.

[41] Upstream supply and conveyance energy intensity for SDCWA untreated water includes conveyance from the State Water Project and Colorado River water to MWD's distribution system, distribution from MWD to MWD's member agencies, and SDCWA's conveyance of raw water supplies to SDCWA's member agencies.
[42] The energy intensity at the Escondido-Vista Water Treatment Plant in 2015 was used as a proxy for 2012–2014. The entire plant's operational electricity use (SDCWA untreated and local surface water) for treatment in 2015 was provided by the City staff in March 2017. The amount of water (SDCWA untreated and local surface water) treated at the EVWTP in 2015 was provided by the City of Escondido and VID (through the City of Vista). The energy intensity at the plant in 2015 was calculated by dividing electricity use (1,940,751 kWh) by volume of water treated (34,591 acre-foot).
[43] The distribution energy intensity in 2015 was used as a proxy for 2012–2014. The distribution energy intensity was calculated by dividing the electricity use at five pump stations within the City boundary (590,683 kWh) by volume of water delivered within the City (17,766 acre-foot). Both electricity use and water delivered were provided by City staff in March 2017.
[44] The Western Electricity Coordinating Council (WECC) CAMX (eGRID Subregion) emission rate from eGRID was used as a proxy for the average California electricity emission rate for upstream electricity. U.S. EPA eGRID 2012 (2015) and eGRID 2014 v2 (2017).

For water treatment emissions, the water used by Escondido was multiplied by the water treatment energy intensity and SDG&E's electricity emission factor to obtain GHG emissions associated with water treatment. Because the EVWTP is located in the City, the electricity use associated with its water treatment is included in the electricity use for Escondido. The electricity and GHG emissions have been subtracted from the electricity category, as they are accounted for in this water category.

For water distribution emissions, potable water used by Escondido was multiplied by the energy intensity for local water distribution and the SDG&E electricity emission factor. The electricity and GHG emissions associated with water distribution occur within the City boundary and have been subtracted from the electricity category, as they are accounted for in this water category.

In addition to providing potable water, the City also produces and delivers recycled water. The recycled water is treated at the City's Hale Avenue Resource Recovery Facility (HARRF). In addition to customers within Escondido, the City also provides recycled water to Rincon MWD customers and the Palomar Energy Center. The recycled water energy intensity of 588 kWh/acre-foot based on a regional analysis for the North San Diego Water Reuse Coalition (NSDWRC) is used as proxy for the City. [45] Because the HARRF is in the City, the electricity use associated with recycled water treatment is included in the electricity use for Escondido. The electricity and GHG emissions have been subtracted from the electricity category, as they are accounted for in this water category.

In 2012, 93% of the GHG emissions in the water category were from upstream supply and conveyance. The breakdown of emissions for the water category is given in Figure 6.

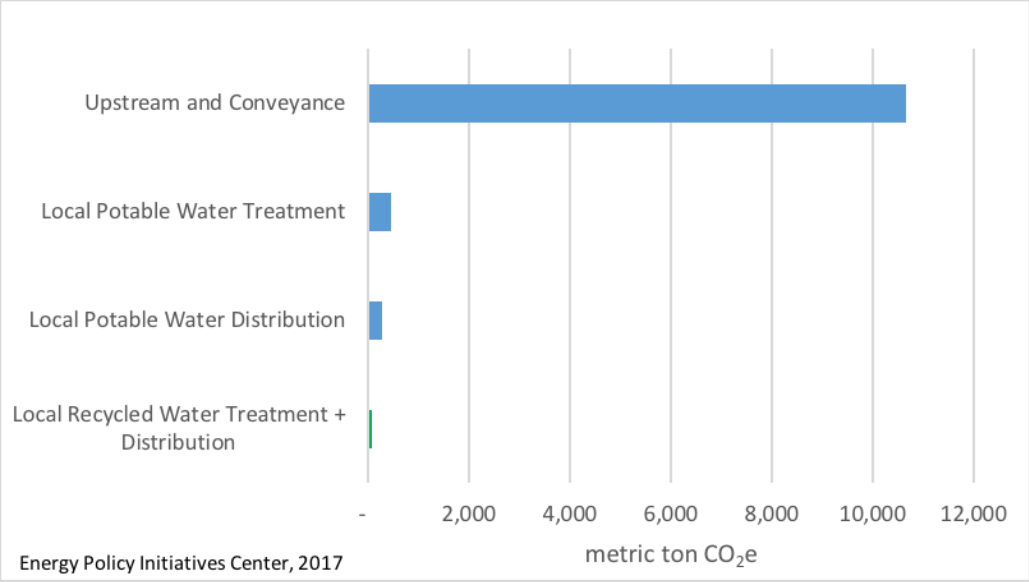


Figure 6 Emissions from the Water Category by Water System Segment (Escondido, 2012)

The total potable and recycled water supplied, as well as the corresponding GHG emissions from the water category for the years 2012–2014 are given in Table 14.

[45] City of Escondido is a member of the NSDWRC, which is a coalition of water and wastewater agencies in the Northern San Diego County. Escondido 2015 Urban Water Management Plan (June 2016), Section 5 and Section 9.3 Water Sector Energy Intensity.

Table 14 Water Supplied and GHG Emissions from the Water Category (Escondido, 2012–2014)

Year	Potable Water Supplied (Acre-Feet)	Recycled Water Supplied (Acre-Feet)	GHG Emissions (MT CO_2e)
2012	23,698	401	11,000
2013	24,266	565	12,000
2014	24,047	626	13,000
GHG emissions for each category are rounded to the nearest thousands. Values are not rounded in the intermediary steps in the calculation. Energy Policy Initiatives Center, 2018.			

Emissions associated with water end-use, such as water heating and cooling, are included in the electricity and natural gas category, and not in this water category, as data are not available to separate out those values.

4.7 Wastewater

The emissions from wastewater generated by Escondido were estimated by multiplying the total amount of wastewater generated in a given year with the emission factor of the wastewater treatment processes.

The City owns and operates its own wastewater treatment and disposal facility, HARRF. HARRF treats wastewater from the City of Escondido, as well as the City of San Diego's Rancho Bernardo community. The wastewater treatment emission factor at HARRF was not available; therefore, the emission factor at Encina Water Pollution Control Facility (Encina WPCF) was used as a proxy. The wastewater treatment GHG emissions and total wastewater flow for the Encina WPCF were provided by the Encina Wastewater Authority. In 2013, the Encina WPCF treated an average of 22.8 million gallons per day (MGD) with annual 11,359 MT CO_2e emissions. This resulted in an emission factor of 1.37 MT CO_2e/million gallons treated, which consists of emissions from: 1) stationary combustion of anaerobic digester gas; 2) process emissions from wastewater treatment with nitrification and denitrification; and 3) direct anaerobic digester gas. The wastewater emission factor derived from the Encina WPCF was applied to all wastewater flow in the City of Escondido. As similar data were not available for the other years, the emission factor was used as an estimate for all inventory years. The direct CO_2 from combustion of anaerobic digester gas is considered biogenic, while the other two components of CO_2 emissions are considered non-biogenic emissions.

The total wastewater treated at the centralized wastewater treatment plant, as well as the corresponding GHG emissions are given Table 15.[46]

Table 15 Wastewater Generated and Treated at Centralized Treatment Plant (Escondido, 2012–2014)

Year	Total Wastewater Generated (Million Gallons/year)	GHG Emissions (MT CO_2e)
2012	3,675	5,034
2013	3,587	4,914
2014	3,443	4,717

[46] 2010–2015 wastewater (million gallons) flow from the City to HARRF was provided by City staff (March 2017).

In addition to wastewater collected and treated at the centralized treatment plant, approximately 1,500 homes (4,800 persons) within the City are on septic systems,[47] the commonly used on-site wastewater treatment systems.[48] The GHG emissions were estimated based on Method WW.11 (Methane Emissions from Septic Systems) from the U.S. Community Protocol. CH_4 emissions were calculated based on the total population served by septic systems (4,800) and a septic system CH_4 emissions factor (10.7 grams CH_4/person/day).[49]

The total GHG emissions from the wastewater category are provided in Table 16.

Table 16 GHG Emissions from Wastewater Category (Escondido, 2012–2014)

Year	GHG Emissions from Centralized Wastewater Treatment (MT CO_2e)	GHG Emissions from Septic Systems (MT CO_2e)	Total GHG Emissions (MT CO_2e)
2012	5,034	469	6,000
2013	4,914	469	5,000
2014	4,717	469	5,000
GHG emissions for each category are rounded to the nearest thousands. Values are not rounded in the intermediary steps in the calculation. CARB, 2017; City of San Diego, 2017; Energy Policy Initiatives Center, 2018.			

5 BUSINESS-AS-USUAL GHG EMISSIONS PROJECTIONS

To inform the development of GHG reduction strategies within a jurisdiction's Climate Action Plan (CAP), GHG emissions are projected using the baseline year from the GHG inventory, as well as estimates for population, housing, and job growth. This is used to develop a business-as-usual (BAU) projection, which demonstrates emissions growth in the absence of any new policies and programs. The latest year with available data may be different for different inventory categories. Next, emissions from federal and State policies and programs are applied in the future, creating a legislatively-adjusted BAU. Figure 7 provides an illustrative example of the difference between a BAU and a legislatively-adjusted BAU. Only the BAU projection is discussed in this document; GHG reductions from the policies and programs included in the legislatively-adjusted BAU are considered later in the climate action planning process.

[47] The number of septic systems were estimated by City staff. From 2012 to 2014, on average the City has 3.2 persons per household based on the SANDAG Demographic & Socio-Economic Estimates (March 8, 2017 Version).
[48] U.S. Environmental Protection Agency (EPA), Septic Systems. For a septic system, wastewater is treated through physical settling and biological activities only.
[49] CARB: Documentation of California's Greenhouse Gas Inventory (8th Edition) (2015). IPCC 4D1 Domestic Wastewater Treatment and Discharge: Septic Systems.

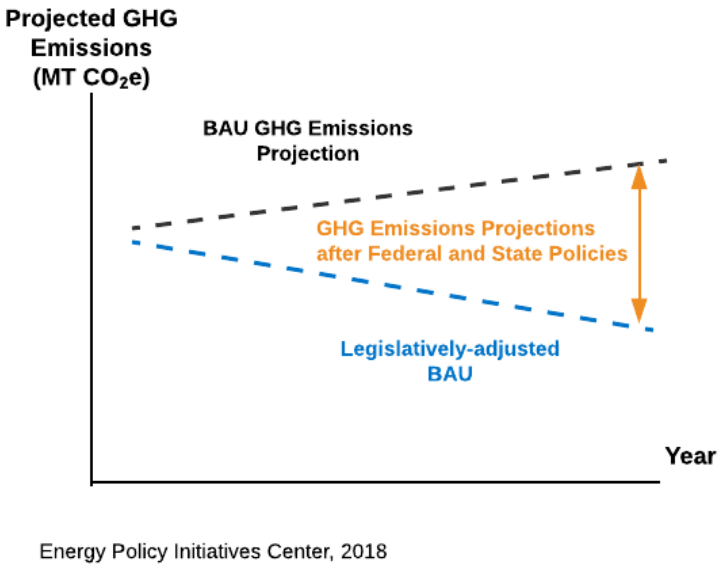
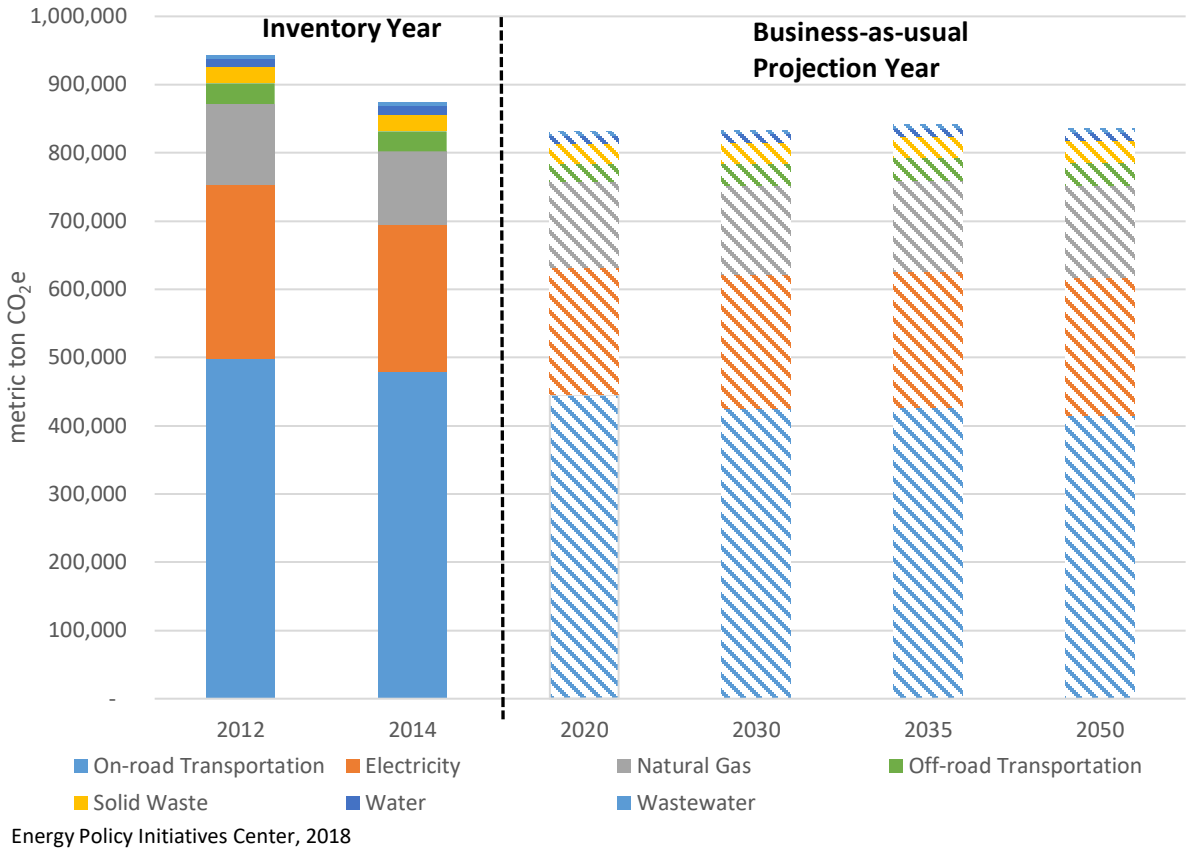


Figure 7 Illustrative Example Only: BAU and Legislatively-adjusted BAU Emissions Projections

Section 5.1 provides a summary of the BAU emissions projections for years 2020, 2030, 2035, and 2050, and Section 5.2 provides the projection methodologies used for each category.

5.1 Emissions Projections for 2020, 2030, 2035, and 2050

The total GHG emissions in 2020 are projected to be 831,000 MT CO_2e, 12% lower than the 2012 emissions level and 5% lower than the 2014 emissions level. The total GHG emissions in 2030, 2035, and 2050 are projected to be approximately 833,000 MT CO_2e, 842,000 MT CO_2e, and 836,000 MT CO_2e respectively. Figure 8 below shows a comparison of the emissions breakdown by category for the inventory years (2012 and 2014) and projection years (2020, 2030, 2035, and 2050).



Energy Policy Initiatives Center, 2018

Figure 8 BAU GHG Emissions Projections (Escondido, 2020, 2030, 2035, and 2050)

As shown in Figure 8, the on-road transportation category contributes the most to the overall emissions in each projection year. Emissions from on-road transportation are expected to decline through 2025 and then rise again but are not projected to be higher than the on-road transportation emissions in 2012 and 2014. One of the reasons for the decline of on-road transportation emissions is likely due to the decline of average vehicle emission rates as newer, more efficient vehicles replace old vehicles in the region. The total and distribution of projected emissions by category are presented in Table 17.

Table 17 Projected Total and Category-GHG Emissions in Escondido (2020, 2030, 2035, and 2050)

Year	Projected GHG Emissions (MT CO_2e)							
	On-Road Transportation	Electricity	Natural Gas	Solid Waste	Off-Road Transportation	Water	Wastewater	Total
2020	445,000	187,000	126,000	30,000	26,000	11,000	6,000	831,000
2030	425,000	196,000	131,000	31,000	32,000	12,000	6,000	833,000
2035	427,000	199,000	133,000	31,000	33,000	12,000	6,000	842,000
2050	415,000	203,000	135,000	31,000	34,000	12,000	6,000	836,000

Sum may not add up to totals due to rounding.
Projected GHG emissions for each category are rounded to the nearest thousands. Values are not rounded in the intermediary steps in the calculation.
Energy Policy Initiatives Center, 2018

5.2 Methods to Project GHG Emissions

The SANDAG Series 13 Regional Growth Forecast was used as the basis of population and job growth in Escondido, as shown in Table 18.[50] The methods used to project future emissions are provided below for each emissions category.

Table 18 SANDAG Population and Job Growth Forecast (Escondido, 2020, 2030, 2035, and 2050)

Year	Population	Commercial Jobs	Industrial Jobs
2020	165,214	44,227	9,060
2030	172,332	46,702	9,214
2035	172,892	48,224	9,314
2050	173,625	49,532	9,361

SANDAG, 2013; Energy Policy Initiatives Center, 2018.

5.2.1 On-Road Transportation

Average weekday O-D VMT forecast for each trip type in 2020, 2030, 2035, and 2050 were provided by SANDAG based on its Series 13 activity-based model, as shown in Table 19 (see Appendix A for the original data tables provided).[51]

[50] Population and jobs data are from the SANDAG Series 13 Regional Growth Forecast (Updated in October 2013). The number of jobs is for civilian jobs only and do not include military jobs. Industrial jobs include the job categories construction and manufacturing. Commercial jobs include all job categories except agriculture, construction and manufacturing. SANDAG Data Surfer, accessed on November 15, 2017.
[51] Series 13 2020, 2030, 2035, and 2050 VMT average weekday projections were provided by SANDAG (March 23, 2017 and November 7, 2017). Original data tables provided by SANDAG are in Appendix A.

Table 19 Projected O-D VMT and Trip Types (Escondido, 2020, 2030, 2035, and 2050)

Trip Type (miles/average weekday)	2020	2030	2035	2050
Internal-Internal	646,168	650,422	675,570	639,253
Internal-External/External-Internal	4,932,304	5,171,618	5,186,164	5,064,096
External-External* (Information only, excluded from VMT and GHG calculations)	1,143,650	1,258,382	1,305,508	1,403,432
*Miles from External-External trips are the portion within the City boundary, not the entire trip. SANDAG, 2018.				

To convert VMT of each type to total VMT, the method discussed in Section 4.1 was used. The VMT was multiplied by the adjusted average vehicle emission rate derived from EMFAC2014 for each projection year. Two adjustments were made to the EMFAC2014 emission rates for the projections: 1) the electric vehicle penetration rate in 2016 was kept constant for all projection years;[52] and 2) for all new vehicles entering the fleet after 2016, the emission rates are equal to the emission rates of new model year 2016 vehicles with the same vehicle class and fuel type.[53]

The projected total VMT, average vehicle emission rates, and corresponding GHG emissions from the on-road transportation category are given in Table 20.

Table 20 Projected VMT, Average Vehicle Emission Rate and GHG Emissions from On-Road Transportation Category (Escondido, 2020, 2030, 2035, and 2050)

Year	Projected Total VMT		Average Vehicle Emission Rate (g CO_2e/mile)	Projected GHG Emissions (MT CO_2e)
	Average Weekday Miles	Average Annual Miles		
2020	3,112,320	1,079,974,943	412	450,000
2030	3,236,231	1,122,972,282	379	430,000
2035	3,268,652	1,134,222,071	377	431,000
2050	3,171,301	1,100,441,424	377	419,000
Projected GHG emissions for each category are rounded to the nearest thousands. Values are not rounded in the intermediary steps in the calculation. CARB, 2015; SANDAG, 2018; Energy Policy Initiatives Center, 2018.				

As newer, more efficient vehicles replace older, less efficient vehicles in the region, the average vehicle emission rate decreases.

5.2.2 Electricity

Electricity use in the City was projected separately for the residential, commercial and industrial customer classes. For the residential customer class, the per-capita electricity use (metered electricity sales) in 2016 (1,733 kWh/person/year), the latest year with available SDG&E data, was calculated by

[52] This uses a fixed 2016 electric vehicle penetration rate of about 2% of light duty vehicles instead of using the estimated impact of the state Zero Emission Vehicle (ZEV) program on BAU emissions. The 2016 electric vehicle penetration rate is based on EMFAC2014 Technical Documentation, Section 3.2.2.4.3. The ZEV program requires auto manufacturers to make and sell ZEVs that will increase VMTs driven by ZEVs.

[53] This uses a fixed actual emission rate of the new 2016 models instead of the effect of adopted federal and state vehicle efficiency standards 2017–2025 for light-duty and heavy-duty vehicles.

dividing the total electricity sales in the residential class by the population in 2016. The per-capita electricity use is held constant and used to project BAU total electricity use for a future year by multiplying by the SANDAG Series 13 population forecast for the future year. The projected total electricity use was multiplied by the City-specific electricity emission factor in 2016 (560 lbs CO_2e/MWh), held constant, for a projected total GHG emission. The City-specific electricity emission factor in 2016 is significantly lower than that of 2012 and 2014 because SDG&E has since reached 43% renewable energy in its power mix.[54]

A similar method was used for the commercial and industrial class. The total commercial BAU electricity use was projected based on Series 13 commercial job growth and the per-commercial job electricity consumption in 2016 (7,666 kWh/commercial job/year) held constant for all future years. The total industrial BAU electricity use was projected based on Series 13 industrial job growth and the per-industrial job electricity consumption in 2016 (7,144 kWh/industrial job/year) held constant for all future years.

The total projected net energy for load (electricity sales + transmission and distribution losses) and corresponding GHG emissions from the electricity category are given in Table 21.[55]

Table 21 Projected Net Energy for Load and GHG Emissions from the Electricity Category (Escondido, 2020, 2030, 2035, and 2050)

Year	Projected Net Energy for Load (electricity sales + losses) (MWh)	Projected GHG Emissions (MT CO_2e)
2020	736,869	187,000
2030	771,497	196,000
2035	785,790	199,000
2050	798,241	203,000
Projected GHG emissions for each category are rounded to the nearest thousands. Values are not rounded in the intermediary steps in the calculation.		

5.2.3 Natural Gas

The projection method for the natural gas category is similar to that for the electricity category. The natural gas use in residential, commercial and industrial classes are calculated separately. The per-capita residential natural gas consumption (80 therms/person/year), per-commercial job natural gas consumption (170 therms/commercial job/year), and per-industrial job natural gas consumption (264 therms/industrial job/year) in 2016 were held constant with Series 13 population and job growth for the BAU projection. The natural gas emission factor used in Section 4.3 was held constant for future years. The projected total natural gas use and corresponding GHG emissions from the natural gas category are given in Table 22.

[54] 2016 renewable content in SDG&E bundled power is based on SDG&E's 2016 power source disclosure report submitted to the California Energy Commission (CEC). The 2016 report was provided by CEC staff to EPIC in July 2017.
[55] The net energy for load of each future year is adjusted using the method described in Section 4.2. The net energy for load does not include self-serve renewable supply, such as electricity generation from behind-the-meter PV systems.

Table 22 Projected Natural Gas Use and GHG Emissions from Natural Gas Category (Escondido, 2020, 2030, 2035, and 2050)

Year	Projected Total Natural Gas Use (Million Therms)	Projected GHG Emissions (MT CO_2e)
2020	23.1	126,000
2030	24.1	131,000
2035	24.5	133,000
2050	24.7	135,000

Projected GHG emissions for each category are rounded to the nearest thousands. Values are not rounded in the intermediary steps in the calculation.
Energy Policy Initiatives Center, 2018.

5.2.4 Off-Road Transportation

In the off-road transportation category, the direct output of OFFROAD2007 (lawn and garden equipment and light commercial equipment), RV2013 model (recreational equipment), and diesel-fueled portable equipment for the San Diego region were used and scaled down to Escondido based on the scaling factor as determined in Section 4.4. For the construction and industrial equipment sub-category, the In-Use Off-Road Equipment 2011 Inventory does not include emissions outputs after 2030. For the projection years 2020 and 2030, the direct output for the San Diego region from the model was used and scaled down to Escondido. For the years 2035 and 2050, the emissions were estimated based on the commercial and industrial job growth. The projected total and sub-category off-road transportation emissions are given Table 23.

Table 23 Projected GHG Emissions from Off-Road Transportation Category (Escondido, 2020, 2030, 2035, and 2050)

Year	Projected GHG Emissions (MT CO_2e)						
	Recreational Equipment	Lawn and Garden Equipment	Light Commercial Equipment	Construction and Mining	Industrial	Diesel-Fueled Portable Equipment	Total
2020	235	4,206	3,222	14,832	876	2,362	26,000
2030	277	4,720	3,400	19,707	1,030	2,845	32,000
2035	291	4,934	3,498	20,071	1,042	3,130	33,000
2050	293	5,150	3,391	20,401	1,047	3,435	34,000

Only total GHG emissions are rounded to the nearest thousands. Values are not rounded in the intermediary steps in the calculation.
CARB, 2007, 2011, 2013 and 2017; Energy Policy Initiatives Center, 2018.

5.2.5 Solid Waste

The BAU solid waste disposal by Escondido was projected using the population growth and the per-capita solid waste disposed in 2016 (2.7 kg/person/day), held constant for future years, to be consistent with other categories. The projected emissions from the disposal were calculated by multiplying the disposal amount with the emission factor for mixed solid waste, provided in Section 4.5. The projected total waste disposal and corresponding GHG emissions from the solid waste category are given in Table 24.

Table 24 Projected Solid Waste Disposal and GHG Emissions from Solid Waste Category (Escondido, 2020, 2030, 2035, and 2050)

Year	Projected Solid Waste Disposal (MT)	Projected GHG Emissions (MT CO_2e)
2020	161,248	30,000
2030	168,196	31,000
2035	168,742	31,000
2050	169,458	31,000
Projected GHG emissions for each category are rounded to the nearest thousands. Values are not rounded in the intermediary steps in the calculation. Energy Policy Initiatives Center, 2018.		

5.2.6 Water

The total water use for all BAU projection years was based on the fixed 2015 per-capita water use (as 2016 per-capita water use was not available) and Series 13 projected population growth. It is assumed that the current percentage of water from each supply source (SDCWA untreated water and local surface water) remains unchanged for the BAU projection. It is also assumed that no new recycled water sources or new potable water sources are developed under the BAU projection.

The per-capita potable water supplied in 2015 was 117 gallons/person/day, significantly lower than the amounts in 2012 and 2014 (144 gallons/person/day). The recycled water supplied in 2015, 531 acre-foot, was held constant for all projection years. The energy intensity for each segment of the water system (Table 13) and the electricity emission factor were held constant for all projection years. The projected total water supply and corresponding GHG emissions from the water category are given in Table 25.

Table 25 Projected Potable Water and GHG Emissions from the Water Category (Escondido, 2020, 2030, 2035, and 2050)

Year	Projected Potable Water Supply (Acre-Feet)	Projected Recycled Water Supply (Acre-Feet)	Projected GHG Emissions (MT CO_2e)
2020	21,739	531	11,000
2030	22,675	531	12,000
2035	22,749	531	12,000
2050	22,845	531	12,000
Projected GHG emissions for each category are rounded to the nearest thousands. Values are not rounded in the intermediary steps in the calculation. Energy Policy Initiatives Center, 2018.			

5.2.7 Wastewater

The total wastewater generation for all BAU projection years was based on the fixed 2015 per-capita wastewater generation use (62 gallons/person/day, as 2016 per-capita was not available) and Series 13 projected population growth. The emission factor derived from data based on the Encina Wastewater Authority (Section 4.7) was held constant for all projection years. It is assumed that the 1,500 homes that currently have on-site septic systems for wastewater treatment still use the systems and no new homes use septic systems in future years under the BAU projection.

The projected total wastewater treated at the centralized WWTP and the GHG emissions from the wastewater category are given Table 26.

Table 26 Projected Wastewater Generated and GHG Emissions from the Wastewater Category (Escondido, 2020, 2030, 2035, and 2050)

Year	Projected Wastewater treated at Centralized WWTP (Million Gallons)	Projected GHG Emissions from Centralized Wastewater Treatment (MT CO_2e)	Projected GHG Emissions from Septic Systems (MT CO_2e)	Projected GHG Emissions (MT CO_2e)
2020	3,726	5,104	469	6,000
2030	3,886	5,324	469	6,000
2035	3,899	5,342	469	6,000
2050	3,915	5,364	469	6,000
Projected GHG emissions for each category are rounded to the nearest thousands. Values are not rounded in the intermediary steps in the calculation.				

Appendix A. ESCONDIDO VMT BY TRIP TYPE

Average weekday VMT data tables were provided by SANDAG (from SANDAG ABM Series 13, Release 13.3.0). Revenue Constrained refers to the transportation network scenario adopted in San Diego Forward: The 2015 Regional Plan.[56] Emphasis (red squares and text) was added by EPIC.

2012 Base Year

JURISDICTION	TOTAL VMT	TOTAL City of Escondido VMT	Two Trip End City of Escondido VMT	One Trip End City of Escondido VMT	NON-City of Escondido VMT
		I-I, I-E and E-I	I-I	I-E and E-I	E - E
CARLSBAD TOTAL	3,112,152	53,042	-	53,042	3,059,110
CHULA VISTA TOTAL	3,516,790	9,915	-	9,915	3,506,875
CORONADO TOTAL	403,272	860	-	860	402,412
DEL MAR TOTAL	77,408	1,034	-	1,034	76,374
EL CAJON TOTAL	1,895,381	5,250	-	5,250	1,890,131
ENCINITAS TOTAL	1,798,580	13,755	-	13,755	1,784,825
ESCONDIDO TOTAL	2,644,325	1,558,336	588,461	969,875	1,085,989
External TOTAL	173,565	2,312	-	2,312	171,253
IMPERIAL BEACH TOTAL	92,302	63	-	63	92,239
LA MESA TOTAL	1,529,813	4,928	-	4,928	1,524,885
LEMON GROVE TOTAL	790,802	633	-	633	790,169
NATIONAL CITY TOTAL	1,545,814	7,043	-	7,043	1,538,771
OCEANSIDE TOTAL	2,675,329	89,111	-	89,111	2,586,218
POWAY TOTAL	868,020	32,427	-	32,427	835,593
SAN DIEGO TOTAL	36,928,711	1,454,531	-	1,454,531	35,474,180
SAN MARCOS TOTAL	1,838,277	573,853	-	573,853	1,264,424
SANTEE TOTAL	947,195	11,584	-	11,584	935,611
SOLANA BEACH TOTAL	603,987	2,649	-	2,649	601,338
Unincorporated TOTAL	16,372,880	1,356,289	-	1,356,289	15,016,591
VISTA TOTAL	1,610,610	173,891	-	173,891	1,436,719
REGIONWIDE TOTAL	79,425,213	5,351,506	588,461	4,763,045	74,073,707

Figure A-1 Estimated Escondido 2012 VMT by Trip Type

2014 Estimates

JURISDICTION	TOTAL VMT	TOTAL City of Escondido VMT	Two Trip End City of Escondido VMT	One Trip End City of Escondido VMT	NON-City of Escondido VMT
		I-I, I-E and E-I	I-I	I-E and E-I	E - E
CARLSBAD TOTAL	3,203,488	52,597	-	52,597	3,150,891
CHULA VISTA TOTAL	3,692,997	9,703	-	9,703	3,683,294
CORONADO TOTAL	411,739	918	-	918	410,821
DEL MAR TOTAL	78,343	1,066	-	1,066	77,277
EL CAJON TOTAL	1,995,802	5,266	-	5,266	1,990,536
ENCINITAS TOTAL	1,847,350	13,301	-	13,301	1,834,049
ESCONDIDO TOTAL	2,773,383	1,546,160	576,309	969,851	1,227,223
External TOTAL	207,246	2,724	-	2,724	204,522
IMPERIAL BEACH TOTAL	92,994	76	-	76	92,918
LA MESA TOTAL	1,574,973	4,642	-	4,642	1,570,331
LEMON GROVE TOTAL	826,374	590	-	590	825,784
NATIONAL CITY TOTAL	1,587,714	6,669	-	6,669	1,581,045
OCEANSIDE TOTAL	2,812,792	90,598	-	90,598	2,722,194
POWAY TOTAL	875,057	32,808	-	32,808	842,249
SAN DIEGO TOTAL	37,907,376	1,439,716	-	1,439,716	36,467,660
SAN MARCOS TOTAL	1,896,873	568,582	-	568,582	1,328,291
SANTEE TOTAL	973,959	11,189	-	11,189	962,770
SOLANA BEACH TOTAL	623,215	2,645	-	2,645	620,570
Unincorporated TOTAL	17,593,241	1,373,114	-	1,373,114	16,220,127
VISTA TOTAL	1,667,838	174,785	-	174,785	1,493,053
REGIONWIDE TOTAL	82,642,754	5,337,149	576,309	4,760,840	77,305,605

Figure A-2 Estimated Escondido 2014 VMT by Trip Type

[56] San Diego Forward: The 2015 Regional Plan was adopted by the SANDAG Board of Directors on October 9, 2015.

2020 Revenue Constrained					
JURISDICTION	TOTAL VMT	TOTAL City of Escondido VMT	Two Trip End City of Escondido VMT	One Trip End City of Escondido VMT	NON-City of Escondido VMT
		I-I, I-E and E-I	I-I	I-E and E-I	E-E
CARLSBAD TOTAL	3,472,327	54,956	-	54,956	3,417,371
CHULA VISTA TOTAL	4,092,102	9,869	-	9,869	4,082,233
CORONADO TOTAL	412,772	752	-	752	412,020
DEL MAR TOTAL	75,193	944	-	944	74,249
EL CAJON TOTAL	1,999,957	5,249	-	5,249	1,994,708
ENCINITAS TOTAL	1,881,627	12,894	-	12,894	1,868,733
ESCONDIDO TOTAL	2,805,409	1,661,759	646,168	1,015,591	1,143,650
External TOTAL	194,117	2,434	-	2,434	191,683
IMPERIAL BEACH TOTAL	91,844	56	-	56	91,788
LA MESA TOTAL	1,596,128	4,609	-	4,609	1,591,519
LEMON GROVE TOTAL	822,920	569	-	569	822,351
NATIONAL CITY TOTAL	1,620,907	6,851	-	6,851	1,614,056
OCEANSIDE TOTAL	2,854,499	86,703	-	86,703	2,767,796
POWAY TOTAL	925,978	34,034	-	34,034	891,944
SAN DIEGO TOTAL	39,019,437	1,470,663	-	1,470,663	37,548,774
SAN MARCOS TOTAL	1,971,319	604,019	-	604,019	1,367,300
SANTEE TOTAL	1,027,915	11,628	-	11,628	1,016,287
SOLANA BEACH TOTAL	643,319	2,947	-	2,947	640,372
Unincorporated TOTAL	17,470,061	1,433,986	-	1,433,986	16,036,075
VISTA TOTAL	1,666,374	173,550	-	173,550	1,492,824
REGIONWIDE TOTAL	84,644,205	5,578,472	646,168	4,932,304	79,065,733

0% of E-E VMT

100% of I-I VMT

50% of I-E/E-I VMT

Figure A-3 Projected Escondido 2020 VMT by Trip Type

2030 Revenue Constrained					
JURISDICTION	TOTAL VMT	TOTAL City of Escondido VMT	Two Trip End City of Escondido VMT	One Trip End City of Escondido VMT	NON-City of Escondido VMT
		I-I, I-E and E-I	I-I	I-E and E-I	E - E
CARLSBAD TOTAL	3,612,571	56,248	-	56,248	3,556,323
CHULA VISTA TOTAL	4,707,744	11,916	-	11,916	4,695,828
CORONADO TOTAL	420,504	725	-	725	419,779
DEL MAR TOTAL	76,025	1,027	-	1,027	74,998
EL CAJON TOTAL	2,161,077	5,927	-	5,927	2,155,150
ENCINITAS TOTAL	1,924,315	12,522	-	12,522	1,911,793
ESCONDIDO TOTAL	2,972,011	1,713,629	650,422	1,063,207	1,258,382
External TOTAL	222,083	2,738	-	2,738	219,345
IMPERIAL BEACH TOTAL	95,177	61	-	61	95,116
LA MESA TOTAL	1,755,104	4,872	-	4,872	1,750,232
LEMON GROVE TOTAL	867,490	491	-	491	866,999
NATIONAL CITY TOTAL	1,777,980	7,692	-	7,692	1,770,288
OCEANSIDE TOTAL	3,048,427	97,904	-	97,904	2,950,523
POWAY TOTAL	966,180	35,196	-	35,196	930,984
SAN DIEGO TOTAL	41,736,278	1,502,520	-	1,502,520	40,233,758
SAN MARCOS TOTAL	2,215,056	661,113	-	661,113	1,553,943
SANTEE TOTAL	1,097,287	11,937	-	11,937	1,085,350
SOLANA BEACH TOTAL	667,909	2,748	-	2,748	665,161
Unincorporated TOTAL	19,108,612	1,504,590	-	1,504,590	17,604,022
VISTA TOTAL	1,829,342	188,184	-	188,184	1,641,158
REGIONWIDE TOTAL	91,261,172	5,822,040	650,422	5,171,618	85,439,132

0% of E-E VMT

100% of I-I VMT

50% of I-E/E-I VMT

Figure A-4 Projected Escondido 2030 VMT by Trip Type

2035 Revenue Constrained

JURISDICTION	TOTAL VMT	TOTAL City of Escondido VMT	Two Trip End City of Escondido VMT	One Trip End City of Escondido VMT	NON-City of Escondido VMT
		I-I, I-E and E-I	I-I	I-E and E-I	E-E
CARLSBAD TOTAL	3,668,094	56,594	-	56,594	3,611,500
CHULA VISTA TOTAL	4,783,453	12,701	-	12,701	4,770,752
CORONADO TOTAL	414,244	805	-	805	413,439
DEL MAR TOTAL	74,771	900	-	900	73,871
EL CAJON TOTAL	2,198,458	5,690	-	5,690	2,192,768
ENCINITAS TOTAL	1,951,056	12,462	-	12,462	1,938,594
ESCONDIDO TOTAL	3,050,942	1,745,434	675,570	1,069,864	1,305,508
External TOTAL	234,505	2,891	-	2,891	231,614
IMPERIAL BEACH TOTAL	99,513	62	-	62	99,451
LA MESA TOTAL	1,785,371	4,717	-	4,717	1,780,654
LEMON GROVE TOTAL	864,461	574	-	574	863,887
NATIONAL CITY TOTAL	1,772,554	7,862	-	7,862	1,764,692
OCEANSIDE TOTAL	3,136,145	99,104	-	99,104	3,037,041
POWAY TOTAL	990,763	35,680	-	35,680	955,083
SAN DIEGO TOTAL	42,048,607	1,449,034	-	1,449,034	40,599,573
SAN MARCOS TOTAL	2,248,294	677,128	-	677,128	1,571,166
SANTEE TOTAL	1,108,219	11,589	-	11,589	1,096,630
SOLANA BEACH TOTAL	666,221	2,507	-	2,507	663,714
Unincorporated TOTAL	19,851,083	1,543,391	-	1,543,391	18,307,692
VISTA TOTAL	1,882,346	192,609	-	192,609	1,689,737
REGIONWIDE TOTAL	92,829,100	5,861,734	675,570	5,186,164	86,967,366

Figure A-5 Projected Escondido 2035 VMT by Trip Type

2050 Revenue Constrained

JURISDICTION	TOTAL VMT	TOTAL City of Escondido VMT	Two Trip End City of Escondido VMT	One Trip End City of Escondido VMT	NON-City of Escondido VMT
		I-I, I-E and E-I	I-I	I-E and E-I	E-E
CARLSBAD TOTAL	3,704,263	51,482	-	51,482	3,652,781
CHULA VISTA TOTAL	5,166,857	10,859	-	10,859	5,155,998
CORONADO TOTAL	373,132	579	-	579	372,553
DEL MAR TOTAL	76,244	768	-	768	75,476
EL CAJON TOTAL	2,334,183	5,333	-	5,333	2,328,850
ENCINITAS TOTAL	1,998,017	10,445	-	10,445	1,987,572
ESCONDIDO TOTAL	3,114,735	1,711,303	639,253	1,072,050	1,403,432
External TOTAL	288,176	3,051	-	3,051	285,125
IMPERIAL BEACH TOTAL	94,796	67	-	67	94,729
LA MESA TOTAL	1,917,041	4,784	-	4,784	1,912,257
LEMON GROVE TOTAL	995,434	703	-	703	994,731
NATIONAL CITY TOTAL	1,861,500	7,907	-	7,907	1,853,593
OCEANSIDE TOTAL	3,160,389	97,017	-	97,017	3,063,372
POWAY TOTAL	1,053,962	35,720	-	35,720	1,018,242
SAN DIEGO TOTAL	43,463,581	1,385,338	-	1,385,338	42,078,243
SAN MARCOS TOTAL	2,324,131	668,486	-	668,486	1,655,645
SANTEE TOTAL	1,158,599	9,922	-	9,922	1,148,677
SOLANA BEACH TOTAL	683,810	1,909	-	1,909	681,901
Unincorporated TOTAL	21,846,046	1,516,114	-	1,516,114	20,329,932
VISTA TOTAL	1,932,093	181,562	-	181,562	1,750,531
REGIONWIDE TOTAL	97,546,989	5,703,349	639,253	5,064,096	91,843,640

Figure A-6 Projected Escondido 2050 VMT by Trip Type

Appendix B. SOURCE DATA FOR THE SOLID WASTE EMISSION FACTOR

Waste Component	Waste Distribution (%)[1]	Landfill Gas Emissions	
		CH_4 without LFG Recovery (MT CO_2e/short ton)	Source[2]
Paper	16.8%	-	-
Corrugated Containers/Cardboard	*5.0%*	2.36	Exhibit 3-27, WARM v14 Containers /Packaging
Newspaper	*0.8%*	0.95	Exhibit 3-27, WARM v14 Containers /Packaging
Magazine	*0.6%*	1.08	Exhibit 3-27, WARM v14 Containers /Packaging
Mixed Paper (general)	*10.4%*	2.14	Exhibit 3-27, WARM v14 Containers /Packaging
Plastic	8.9%	-	-
Glass	1.7%	-	-
Metal	3.5%	-	-
Organics	38.9%	-	-
Food	*15%*	1.57	Exhibit 1-49, WARM V14 Organic Materials
Tree	*5.3%*	0.77	Exhibit 2-11 WARM V14 Organic Materials
Leaves and Grass	*6.8%*	0.59	Exhibit 2-11 WARM V14 Organic Materials
Trimmings	*3.5%*	0.59	Exhibit 2-11 WARM V14 Organic Materials
Mixed Organics	*8.3%*	0.53	Exhibit 2-11 WARM V14 Organic Materials
Electronics	0.6%	-	-
Construction & Demolition	24.6%	-	-
Household Hazardous Waste	0.2%	-	-
Special Waste	3.1%	-	-
Mixed Residue	1.6%	0.53	
Mixed Waste Emission Factor		**0.744**	

Source: 1) City of San Diego 2014.
2) EPA Waste Reduction Model (WARM) Version 14 (2016)