



**Climate Action Plan
2017 Annual Report
Appendix**

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Introduction

This appendix to the 2017 Annual Report of the City of San Diego's Climate Action Plan (CAP) provides additional information and data in the following four sections:

- A. Background information and calculations for the 2016 greenhouse gas (GHG) emissions inventory;
- B. Current status for the five strategies identified in the CAP;
- C. Method differences and data refinements of the GHG inventory updates;
- D. Optional GHG emissions reporting; and
- E. The analysis on jobs associated with the CAP's five strategies.

The 2016 total GHG emissions in the City of San Diego (City) were calculated to be 10.5 million metric tons of carbon dioxide equivalent (MMT CO₂e), 19% below the 2010 CAP baseline GHG emissions (12.9 MMT CO₂e) and 3% below the previous year 2015 GHG emissions (10.8 MMT CO₂e). The reduction may be attributed to higher vehicle efficiency standards, increases in renewable electricity (San Diego Gas & Electric's higher renewable content and increases in distributed solar PV systems in the City), and an increasing solid waste diversion rate.

As detailed in the CAP the City is in the first phase (January 1, 2016 - December 31, 2017) of CAP implementation, which includes short-term actions that are high-priority and return large emission reductions. Continued monitoring of the implementation process of the CAP strategies as well as tracking the impact of federal and state policies and mandates, ensures the City remains on track to achieve its emission reduction targets.

In preparation for the 2017 Annual Report, revisions and refinements were made to the 2015 City-wide GHG emissions and CAP strategies performance metrics presented in the previous 2016 CAP annual report, to reflect updated data supplied by agencies not managed by the City, and to ensure consistency with the 2016 GHG emissions estimates. The updates to 2015 City-wide emissions consist of revisions only in the electricity and natural gas measures, where revisions have been made the updated data is identified in the applicable section below. This change follows the California Air Resources Board (ARB)'s California statewide inventory method updates, based on Intergovernmental Panel on Climate Change (IPCC) recommendations to maintain a consistent time-series when developing GHG inventories. Data refinements to the 2015 GHG inventory are discussed in Section C.

The five CAP strategies are: 1) energy & water efficient buildings, 2) clean & renewable energy, 3) bicycle, walking, transit & land use 4) zero waste and 5) climate resilience. Under each strategy, the current state in 2016 is presented first followed by updates of each action. Comparisons of the current status in 2016, 2015 and baseline condition in 2010 are provided in terms of percent changes where possible. 2010 to 2016 trends are provided where multi-year data are available.

Background and Calculations

CITY OF SAN DIEGO GREENHOUSE GAS EMISSIONS INVENTORY

The emissions source categories included in 2010, 2015 and 2016 have remained consistent: electricity, natural gas, transportation, water, and wastewater & solid waste. As in past years, these reflect the five categories of emissions that are recommended in the US Communities Protocol to be routinely included in a jurisdiction’s inventory. Therefore, GHG emissions from sources such as air travel, shipping, off-road vehicles and equipment or other high global warming potential gases in use in the City were not included.

The results of the inventory calculations are shown in Table 1. Methods, data availability and sources used to calculate GHG emissions have been updated since the development of 2010 baseline emissions in the CAP. Information regarding the differences in methods and data sources are provided in Section C.

Table 1 City of San Diego Greenhouse Gas Emissions Inventories (2010, 2015 and 2016)

Emissions Category	2010 Emissions (MT CO2e)	2015 Emissions (reported in 2016 Annual Report)	2015 Emissions Revised* (MT CO2e)	2016 Emissions (MT CO2e)	Change from 2010
Transportation	7,086,297	5,771,317	5,771,317	5,677,559	-20%
Electricity	3,138,613	2,620,493	2,598,196	2,326,138	-26%
Natural Gas	2,098,983	2,062,479	2,090,718	2,097,685	
Wastewater & Solid Waste	383,172	286,573	286,573	277,237	-28%
Water	277,927	92,223	91,491	88,643	-68%
Total	12,984,993	10,833,086	10,838,295	10,467,262	-19%

*Revised values reflect updated information.
 MT CO2e = metric tons of carbon dioxide equivalent
 Sources:
 City of San Diego Climate Action Plan, 2015
 Energy Policy Initiatives Center, 2017

Total GHG emissions in the City in 2016 represent a 19% decrease from the 2010 baseline. Emissions from natural gas remained similar to 2010 levels. The decrease of emissions associated with electricity is largely due to the increasing amount of renewables in electricity generation; this includes both energy procured and delivered by San Diego Gas & Electric (SDG&E), as well as distributed solar generation (e.g. homes with rooftop solar generation). The decrease in transportation-related emissions are partially due to updated transportation models as well as continuously improving vehicle efficiency standards. The decrease in water-related emissions is likely occurring as a result of state-level water conservation mandates and updated local water system data. The decrease in waste-related emissions is due to updated waste characteristics information but not to increased waste diversion rates, which remained at roughly the same level as 2015 (see below).

The 2015 updated emissions and 2016 emissions shown in Table 1 are calculated based on the same methods and data sources, and can be compared directly.

LOW CARBON ECONOMY

The GHG intensity is the level of GHGs per unit of economic activity denominated as the Gross Domestic Product (GDP). The GDP is normally a national unit of economic activity, but can also be applied at the state, regional or city level. National GDP is measured as household expenditures on goods and services plus business investment, government expenditures and net exports. State GDP is measured by income (labor and capital minus business taxes) earned and costs of production in that state. The US Bureau of Economic Affairs has developed GDPs for regions such as San Diego County based on local personal income and industry. IMPLAN, an economic impact model, has been used to develop city-level GDPs¹.

GHG intensity is independent of total emissions and indicates how dependent economic activity is on GHG producing activities. Economic productivity is said to be more efficient, as economic growth then consumes less carbon-based fuels. If GHG emissions remained constant or decreased over time while the GDP increased, the result would be that GHG intensities would decrease. As mentioned above, the GHG emissions for the City of San Diego excludes specific emission sources, for example, emissions from air travel, shipping, off-road vehicles and equipment, or other high global warming potential gases in use in the city. Therefore, a limitation of applying this method to community-wide GHG emissions is that not all economic sectors and GHG-emitting categories are included in the inventory, and the GHG intensity is lower than it actually is. However, since the categories inventoried each year are the same, GHG intensities can be compared for the City across the years.

The City of San Diego's GHG intensity was 137 MT CO₂e/\$ million in 2010, 91 MT CO₂e /\$ million in 2015 and 84 MT CO₂e /\$ million in 2016 (Table 2). This could be an indication that the City's economy is more efficient in terms of reduced GHG producing activities while increasing the level of economic development.

Table 2 City of San Diego GHG Intensity (MT CO₂e/\$ million GDP)

	2010	2015 (reported in 2016 Annual Report)	2015 Revised *	2016
Total Emissions (MT CO ₂ e)	12,984,993	10,833,086	10,838,295	10,467,262
GDP (\$ billion)	95	119	119	124
GHG Intensity (MT CO ₂ e/\$million GDP)	137	91	91	84
*Revised values reflect updated information. GDP = gross domestic product, MT CO ₂ e = metric tons of carbon dioxide equivalent Sources: GDP estimated by Kelly Cunningham, National University System, based on Bureau of Economic Analysis, U.S. Department of commerce, 2017 Energy Policy Initiatives Center, 2017				

PER CAPITA GREENHOUSE GAS EMISSIONS

The 2010, 2015 and 2016 per capita GHG emissions in City of San Diego are given in Table 3. This is based only on the five emission categories analyzed.

¹ National University's Kelly Cunningham, Senior Economist, developed and provided the estimate based on the IMPLAN model for the City of San Diego using the city's zip code information and the current data available from the U.S. Department of Commerce's Bureau of Economic Analysis.

Table 3 City of San Diego 2010 and 2015 per capita GHG Emissions (MT CO₂e per capita)

	2010	2015 (reported in 2016 Annual Report)	2015 Revised*	2016
Total emissions from five emission categories (MT CO ₂ e)	12,984,993	10,833,086	10,838,295	10,467,262
Total Population	1,301,617	1,368,061	1,379,456	1,391,676
Per capita GHG emissions based on five sectors (MT CO ₂ e per capita)	10.0	7.9	7.9	7.5
<p>* Revised values reflect updated information from sources. MT CO₂e = metric tons of carbon dioxide equivalent</p> <p>Sources: 2010 population based on 2010 U.S. Census and SANDAG Demographic & Socio-Economic Estimates, March 9, 2017 version. Energy Policy Initiatives Center, 2017</p>				

It is important to note, as mentioned above, that GHG emissions for the City of San Diego do not include emissions from all economic sectors, and excludes emissions, for example, from air travel, shipping, off-road vehicles and equipment, or other high global warming potential gases in use in the city. Therefore, the estimated City of San Diego per capita emissions cannot be directly compared with the California statewide per capita emissions calculated using the ARB statewide inventory, which includes *all* economic sectors and additional emissions categories.

2016 Updates

STRATEGY: ENERGY & WATER EFFICIENCY BUILDINGS

Energy (fossil-fuel based electricity generation and natural gas consumption) and water consumption accounts for 43% of 2016 City-wide GHG emissions. The Energy & Water Efficiency Buildings strategy has targets to reduce citywide per capita water use, energy use in residential buildings and energy use in city operations. Water treatment and distribution to residents and businesses in the City require energy; therefore, reducing water use will also have an impact on the associated energy use.

Baseline Year and 2016 Update

The 2010, 2015 and 2016 grid supplied electricity use is provided in Table 4.

Table 4 Electricity Use (grid-supply only) in City of San Diego

	2010	2015 (reported in 2016 Annual Report)	2015 Revised*	2016	2010 - 2016 % Change	2015 Updated - 2016 % Change
Electricity Use (MWh)	8,572,155	8,450,904	8,533,909	8,290,454	-3%	-3%
Emissions from Electricity (MT CO ₂ e)	3,138,613	2,620,493	2,598,196	2,326,138	-26%	-10%
<p>* Revised values reflect updated information from sources. MWh = megawatt hour, MT CO₂e = metric tons of carbon dioxide equivalent The MWhs do not include transmission and distribution losses, or self-serve electricity generation. 2015 and 2016 electricity use excludes military, San Diego Unified Port District, and San Diego International Airport use.</p> <p>Sources: SDG&E 2017, Energy Policy Initiatives Center 2017</p>						

For electricity users with on-site electric generation only the net electricity from the grid has been included in Table 4. While electricity use decreased 3% from 2010 to 2016, GHG emissions have decreased 10% over the same time period (Figure 1). This is a result of the increase in renewable content in electricity delivered, from 11% in 2010 to 35% in 2015 and 43% in 2016.

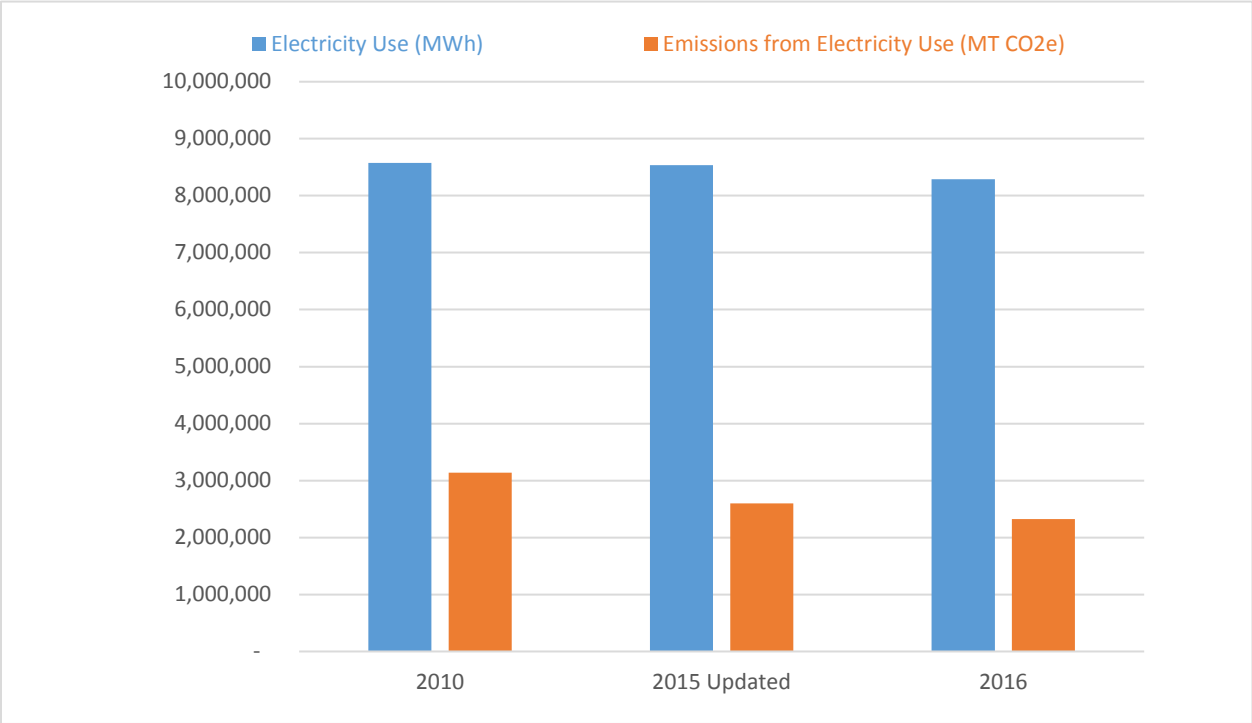


Figure 1 Comparison of Electricity Use and Emissions from Electricity Use (grid-supply only)

Table 5 provides a breakdown of electricity use by customer class in 2016.

Table 5 Electricity Use by Customer Class in 2016

Customer Class	Distribution
Residential	26%
Commercial	45%
Industrial	28%
Agricultural (includes Pumps)	1.2%
Lighting	0.5%
Total	100%

The lighting category includes street & highway lights and traffic lights. Residential outdoor lighting is included in the residential customer class and commercial outdoor lighting is included in the commercial customer class.

Source: SDG&E 2017

In 2016, 28% natural gas use was from the residential class, 22% from the commercial class and the rest from the industrial class (including electricity generation using natural gas). Table 6 provides a breakdown for natural gas end use.

Table 6 Total Natural Gas Use (SDG&E only) by Customer Class

	2010	2015 (reported in 2016 Annual Report)	2015 Revised*	2016	2010- 2016 % Change	2015 Updated - 2016 % Change
Natural Gas Use (million therms)	396	378	384	385	-2.7%	0.3%
* Revised values reflect updated information from source. 2015 and 2016 natural gas use excludes military, San Diego Unified Port District, and San Diego International Airport use, and natural gas use for utility electric generation, Source: SDG&E 2017						

Table 7 provides the electricity and natural gas end use in million British thermal units (MMBtu). MMBtu is the common unit of energy used to compare the energy content of different fuel types. In this case, MMBtu is used to convert electricity in kilowatt-hours (kWh) and natural gas in units of therms to the same unit. Natural gas constituted 57% of the total end use energy in 2016.

Table 7 City of San Diego Total Energy (Electricity + Natural Gas) Use (grid-supply only)

	2010	2015 (reported in 2016 Annual Report)	2015 Revised*	2016	2010-2016 % Change	2015 Updated - 2016 % Change
Electricity (MMBtu)	29.2	28.8	29.1	28.3	-3.3%	-3%
Natural Gas (MMBtu)	39.6	37.8	38.4	38.5	-3.7%	0%
Energy (Electricity + Natural Gas)	68.8	66.7	67.5	66.8	-3.0%	-1%
* Revised values reflect updated information from sources. MMBtu = million British Thermal Unit Conversion factors 293 kWh/MMBtu and 10 therms/MMBtu are used to convert electricity and natural gas to the same unit Sources: SDG&E 2017, Energy Policy Initiatives Center 2017						

Action & Progress: Reduce Energy Use in Residential Housing Units

Total residential electricity use includes both electricity provided by SDG&E and electricity generated from rooftop solar systems. Residential rooftop solar systems increased from 15 megawatts (MW) in 2010 to 161 MW in 2016. Combining both electricity and natural gas use, energy use per home in 2016 is 18% below the 2010 baseline (Table 8).

Table 8 City of San Diego Residential Energy (Electricity + Natural Gas) Use

	2010 Updated	2015 (reported in 2016 Annual Report)	2015 Revised*	2016	2010-2016 % Change	2015 Updated - 2016 % Change
Electricity (MWh) - SDG&E	2,498,471	2,470,781	2,293,332	2,161,017	-14%	-6%
Electricity (MW) - Solar*	15	108	114	161	973%	41%
Electricity (MWh) - Solar**	26,251	188,986	199,922	281,716	973%	41%
Total Electricity (MWh)	2,524,722	2,659,768	2,493,254	2,442,733	-3%	-2%
Total Electricity (MMBtu)	8,608,065	9,068,506	8,500,775	8,328,526	-3%	-2%
Natural Gas (million therms)	138	111	102	108	-22%	6%
Natural Gas (MMBtu)	13,781,505	11,113,826	10,222,513	10,799,970	-22%	6%
Total Energy (MMBtu)	22,389,570	20,182,332	18,723,288	19,128,495	-15%	2%
Total # of occupied units***	483,092	505,255	498,784	501,757	4%	1%
Energy use per home (MMBtu)	46.3	39.9	37.5	38.1	-18%	2%
* Revised values reflect updated information from sources. MW = megawatt, MWh = megawatt hour, MMBtu = million British Thermal Unit Sources: *Rooftop solar PV capacity calculated based on the California Solar Initiative (CSI) database, net energy metering (NEM) interconnection dataset for SDG&E - City of San Diego residential customers (May 31, 2017 version). Based on date of application approved. **Capacity to electricity converted using an average solar PV system capacity factor of 20%. ***Occupied housing units from SANDAG Demographic & Socio-Economic Estimates (March 9, 2017 version), includes single family, multi-family, mobile homes and other. Energy Policy Initiatives Center, 2017						

Total residential electricity use (including grid-supply and rooftop solar PV systems) in 2016 was 3% lower than in the baseline year 2010 and 2% lower than the previous year 2015. Total residential natural gas end use in 2016 was 22% lower than 2010, but 6% higher than 2015. Residential energy use therefore decreased 16% in 2016 compared with 2010.

In 2016, approximately 9,000 new residential solar PV systems (97% of the new systems) were approved for interconnection in the City for an additional 51 MW of new capacity.

Action & Progress: Reduce municipal (city operations) energy use

Overall, municipal operations energy use decreased by 5% in 2016 compared with 2010 (Table 9).

Table 9 Energy Use in City of San Diego Municipal Operations (SDG&E only)

	2010	2015 (reported in 2016 Annual Report)	2015 Revised *	2016	2010-2016 % Change	2015 Updated - 2016 % Change
Electricity (MWh)	205,787	169,794	182,483	184,033	-11%	1%
Electricity (MMBtu)	701,633	578,914	622,179	627,461	-11%	1%
Natural Gas (million therm)	3.4	4.2	4.1	3.6	6%	-14%
Natural Gas (MMBtu)	335,723	398,301	412,716	356,690	6%	-14%
Total energy (MMBtu)	1,037,357	977,215	1,034,895	984,151	-5%	-5%
<p>*Revised values reflect updated information from sources. MWh = megawatt hour, MMBtu = million British Thermal Unit</p> <p>Sources: 2015 and 2016 municipal energy consumption was provided by City of San Diego's Environmental Services Department in 2017, converted to MMBtu using 293 kWh/MMBtu and 10 therms/MMBtu. 2015 energy data were updated to 1) recalibrate City street light accounts based on SDG&E credits, 2) refine account information to be consistent with new data request submitted in 2017. Natural gas consumption includes gas use for space heating/cooling and electricity generation.</p>						

Year over year the City did experience an uptick in electricity consumption, which is likely attributed to the following:

- additional consumption from new City assets and added loads;
- increased consumption from City facilities that were not fully staffed and/or operational in the previous year;
- several water pumping facilities were undergoing maintenance and were non-operational in 2015 and became operational in 2016;
- water reclamation plants feed power from onsite generation; onsite generation was down for periods of time in 2016, which required additional electricity to be purchased from SDG&E; and
- many of the City's highest energy consuming facilities consume more or less electricity because of operational changes and decisions made by operators on how to best use the equipment to meet the community's needs.

Action & Progress: Reduce Daily per Capita Water Consumption

Per capita water use decreased substantially from 2010 to 2016 beyond what was projected in the CAP for 2020 (Table 10).

Table 10 City of San Diego Per capita Water Consumption

Year	Gallon per capita per day (GPCD)	The gallons per capita per day (GPCD) from 2010 to 2016 were provided by City of San Diego’s Public Utilities Department. The GPCD calculation method (volume of water entering City of San Diego’s distribution system divided by distribution system population) is consistent with the GPCD definition in SB X7-7 (the Water Conservation Act of 2009) and the City of San Diego 2015 Urban Water Management Plan (June 2016 final version). However, to be consistent with the CAP, the GPCD is reported by calendar year in the CAP Annual Report, while the GPCD in the Urban Water Management Plan and SB X7-7 are by fiscal year. Therefore, the GPCD reported here cannot be directly compared with the SB X7-7 GPCD target for 2020.
2010	128	
2011	128	
2012	130	
2013	135	
2014	134	
2015	112	
2016	111	

The amount of recycled water and water used for irrigation from 2010 to 2016 are provided in Table 11 and Table 12.

Table 11 City of San Diego per Capita Recycled Water Consumption

Year	Million Gallon Recycled Water Sales/Year
2010	1,350
2011	1,524
2012	1,867
2013	1,691
2014	2,588
2015	2,370
2016	1,637

Sources: The total metered recycled water sales (delivered) in the City from 2010 to 2016 were provided by City of San Diego Public Utilities Department.

Table 12 City of San Diego Metered Irrigation Water Use (Agricultural and Landscape)

Year	Metered Irrigation Water Use (million gallon)
2010	6,923
2011	7,193
2012	7,812
2013	7,336
2014	4,977
2015	4,378
2016	5,943

Metered irrigation water, including agricultural and landscape water use, delivered by the City of San Diego Public Utilities Department (PUD).

STRATEGY: CLEAN AND RENEWABLE ENERGY

The City of San Diego has a long-term goal of reaching 100% renewable electricity supply in 2035. Several key categories contribute to the 100% renewable goal including the renewable content in SDG&E's electricity supply, distributed renewable energy levels including rooftop solar and the renewable content in a Community Choice Aggregation or similar program (projected to start in 2020). In 2016, SDG&E achieved 43% renewable in its electricity supply, higher than the state Renewable Portfolio Standard target for 2020, and citywide, new net energy metering (NEM) rooftop solar systems increased rapidly from 2010 to a total of 225 MW system capacity in 2016.

Baseline Year and 2016 Update

SDG&E's renewable electricity supply increase from 11% in 2010 to 43% in 2016 (Table 13).

Table 13 Percentage of Renewables in SDG&E Electricity Supply

Year	Renewables in SDG&E Electricity Supply
2010	11.0%
2011	15.7%
2012	19.2%
2013	24.0%
2014	32.2%
2015	35.5%
2016	43.0%

The 2010-2015 percent renewable in SDG&E electricity supply is based on SDG&E's 2010-2015 annual power content label. The 2016 percent renewable is based on SDG&E's 2016 power source disclosure report submitted to the California Energy Commission. The percent renewable is for the electricity SDG&E supplied to its bundled customers; it does not include SDG&E's Direct Access customers.

Source: California Energy Commission

In 2016, approximately 9,000 out of 9,300 new photovoltaic (PV) permit applications were approved (51 MW out of 62 MW) in the City were from residential customers (Table 14). The cumulative NEM solar PV capacity from 1999 to the end of 2016 was 225 MW in the City. Assuming that solar PV systems have a capacity factor of 20%, the electricity generated from rooftop solar was 394,000 MWh in 2016, accounting for 5% of the total electricity consumption. The vast majority of this PV electricity was at the residential customer class level.

Table 14 Number and Capacity of Installed Solar PV Systems in City of San Diego

Year	Number of New PV Systems Approved (reported in 2016 Annual Report)	Number of New PV Systems Approved (Revised June 30, 2016)*	New PV System Capacity (kW)
2010	1,006	1,063	9,075
2011	1,077	1,161	13,264
2012	1,503	1,585	12,338
2013	3,171	3,243	22,628
2014	4,311	4,490	30,749
2015	8,124	8,436	55,420
2016		9,103**	62,996

For 2010-2015, the number of systems and system capacity in the City of San Diego are based on the approved date of interconnection as available in the CSI Net Energy Metering database. Both the number of systems and capacity in a given year are new, not cumulative. The 2014 and after system capacity is reported as direct current (DC) in kW. The 2010-2013 capacity is converted to DC from alternating current (AC), as the number of systems reported in AC and DC are inconsistent before 2014.

* Revised values reflect updated information from sources.

**The 2016 PV systems approved is from the City of San Diego Open Data Portal and is a more accurate number than from CSI because it is based on the number of permits issued, rather than on the number of approvals in any given year. In the CSI database, a system may be approved more than once, therefore the number of systems approved may be an overestimate

Sources:
California Solar Initiative (CSI) database, SDG&E Net Energy Metering (NEM) interconnection dataset, City of San Diego (June 30, 2017 version). City of San Diego <https://data.sandiego.gov/stories/solar-permits-2016/>.
Energy Policy Initiatives Center, 2017

Since 2012, a total 2.3 MW solar PV systems were installed at city facilities, including libraries, community recreation centers, water treatment facilities etc. Two of the largest solar PV systems, at Alvarado Water Treatment Plant and Otay Water Treatment Plant, produced a combined 3,300 MWh of electricity on-site in 2016.

The estimated electric vehicles (EV) sales in the City of San Diego also increased rapidly since 2010 to 8,339 EVs or 60 EVs per 10,000 capita in 2016. EV sales saw a rate increase of 20% from 2015 to 2016.

Table 15 Estimated Electric Vehicles Sales in City of San Diego

Year	Estimated Electric Vehicle Sales (reported in 2016 Annual Report)	Estimated Electric Vehicle Sales* (September 2017)
2010	3	3
2011	840	816
2012	457	462
2013	1,267	1,319
2014	1,644	1,768
2015	1,690	1,805
2016		2,166
Cumulative Total	5901	8,339

*Totals may differ from those reported previously due to data settling (eg vehicles returned, rebate processing) and zip code aggregation. Zip codes may not match jurisdictional boundaries.
 EV sales are estimates adjusted upwards from the number of EVs that received rebates (assumed 77% participation rate in rebates) from the Clean Vehicle Rebate Project (CVRP), not actual sales. The number of EV sales are the new, not cumulative, EV sales each year, including plug-in hybrids and battery electric vehicles. Excludes electric motorcycles, neighborhood EVs, and commercial EVs.

Source: Center for Sustainable Energy, 2017

Action & Progress: Increase Municipal Zero Emissions Vehicles

As of 2016, the City operations had 4,226 vehicles, of which 45 were hybrid vehicles, 90 were electric vehicles and 20 were new compressed natural gas (CNG) waste trucks purchased in 2016. The 2010 to 2015 city fleet gasoline consumption is given in Table 16.

Table 16 City Fleet Gasoline Consumption

Year	Total Gasoline (gallons)
2010	1,337,869
2011	2,155,962
2012	2,267,693
2013	2,277,559
2014	2,268,104
2015	2,262,114
2016	2,344,552

Source: City of San Diego Fleet Services Department, 2016 and 2017

Action & Progress: Convert Municipal Waste Collection Trucks to Low-Emissions Fuel

In 2016, the City put 13 CNG trucks into service and displaced the equivalent of 11,208 gallons diesel fuel, ahead of the scheduled implementation of the measure (to start the waste collection truck conversion in 2018).

STRATEGY: BICYCLING, WALKING, TRANSIT AND LAND USE

In 2016, transportation accounted for 54% of all GHG emissions within the City of San Diego. This strategy aims at reducing commuter vehicle driving by increasing the use of mass transit, bicycling and walking in the city’s Transit Priority Areas (TPA). TPAs are defined as the areas within half a mile of existing or planned major transit stops.

Baseline Year and 2016 Update

The 2016 vehicle miles travelled (VMT) and on-road transportation emissions in the City of San Diego are shown in Table 17.

Table 17 2016 Vehicle Miles Travelled (VMT) in the City of San Diego

Total VMT (miles/day)	34,842,846
Total VMT (miles/year)	12,717,638,641
Emission Rate (g CO ₂ e/mile)	446
GHG Emission (MT CO ₂ e)	5,677,559
The 2016 VMT were estimates and interpolated between the 2012 estimates and the 2020 projection from SANDAG’s Travel Demand model - Series 13 version 13.3.0	
Sources: SANDAG, ARB mobile emissions inventory EMFAC2014, Energy Policy Initiatives Center 2017	

The annual 2016 VMT were converted from the SANDAG’s estimated VMT by trip type for the City. As per the US Communities Protocol, all miles within the City are counted and miles from Internal-External/External-Internal trips (either starting or ending in the City) were divided by two to split the miles between City and outside jurisdictions.

Most of the miles in the City were driven by passenger vehicles and light trucks, which are those with a weight rating less than 8,500 lbs. (Table 18).

Table 18 2016 Vehicle Miles Travelled (VMT) by Vehicle Type

Vehicle Type	VMT Breakdown
Passenger vehicles and light trucks*	92%
Heavy duty trucks (GVWR > 8500 lbs)	6%
Buses (urban, school, and other bus)	0.5%
Motorcycles	1%
Motor Homes	0.2%
Total	100%
*Passenger vehicles and light trucks include all passenger cars and trucks with gross vehicle weight rating (GVWR) no larger than 8500 lbs.	
VMT breakdown by vehicle type is not equivalent to GHG emissions breakdown by vehicle type, as emission rates per mile are different by vehicle type.	
Sources: EMFAC 2014 for the San Diego region. Energy Policy Initiatives Center, 2017	

Action & Progress: Implement Pedestrian Improvements and Implement the Bicycle Master Plan

In 2016, the City funded and programmed 12,000 linear feet of sidewalk, approximately 20 city blocks (one city block is about 600 ft.). This is less than the 15,200 linear feet planned for 2015 as reported in the previous annual report.

The bicycle facility improvements are shown in Table 19.

Table 19 City of San Diego Bicycle Facilities Improvements and Estimated VMT Reductions since 2013

Year	2013	2014	2015	2016	Since 2013	Estimated VMT Reduced*
New Class II Bike Lane Miles Added	6.9	10.5	14.6	12.7	44.7	544,231
Existing Bike Lane Miles Improved	35.7	51.7	42.2	43.6	173.2	-
Existing Bike Lane Miles Replaced	1.3	1.6	-	-	2.9	-
Total Added or Improved Miles	43.9	63.8	56.8	56.8	221.3	-

VMT reductions could only be estimated based on pilot or research studies for Class II improvements, but not for the remaining bicycle lane improvements. Methods to monitor the impacts of all improvements are in progress.
Source: City of San Diego Transportation & Storm Water Department 2016 and 2017

Action & Progress: Roundabouts and Traffic Signal Re-timing

The city completed 2 roundabouts in CY 2016 and re-timed 60 traffic signals that led to reduced emissions from improvements to traffic flow and subsequent fuel reductions. Reductions from these measures are provided in Table 20.

Table 20 City of San Diego Roundabouts Installed and Traffic Signals Retimed in 2016 and Estimated Fuel Savings

Year	2016	Estimated Fuel Reductions (gal)
Roundabouts Installed	2	39,332
Traffic Signals Retimed	60	1,715,856

Source: City of San Diego Transportation & Storm Water Department 2017

STRATEGY: ZERO WASTE

In 2016, solid waste and wastewater emissions accounted for about 3% of the total citywide emissions. The City has a Zero Waste strategy with actions to divert waste from landfills and capture and utilize the methane from wastewater treatment.

Action & Progress: Enact Zero Waste and Divert Trash and Capture Emissions from Landfills

The waste disposed and diversion rates comparisons in the City are shown in Table 21. The waste diversion rate increased from 64% in 2015 to 66% in 2016. The amount disposed decreased from 2015 to 2016 but in 2016 was still higher than in 2010.

Table 21 City of San Diego Waste Diversion Rate and Disposed Tonnage

	2010	2015	2016
Waste Disposed in Landfills (tons)	1,296,725	1,583,833	1,521,363
Waste Diversion Rate (%)	52%	64%	66%
Tonnages were adjusted/corrected from tonnages reported in the CalRecycle database based on City information			
Source: City of San Diego Environmental Service Department 2016 and 2017			

The CAP assumed the default 75% capture rate for landfill gas in 2010 and onwards as described in the US Community Protocol 2012.² State regulation AB341(2002/2011) requires reductions of methane emissions such as to achieve less than 200 ppmv at the surface, which is close to a 100% capture rate.

Action & Progress: Capture Methane from Wastewater Treatment

The City of San Diego’s Point Loma Wastewater Treatment Plant (Point Loma WWTP) is self-sufficient with on-site renewable electricity production using biogas (captured methane from wastewater treatment) and hydropower. The excess renewable electricity generated at the Point Loma WWTP is exported back to the grid. The digester capture rate at Point Loma WWTP is now 99.9%. At North City Water Reclamation Plant (North City WRP), renewable electricity is produced from biogas delivered from Miramar Landfill and Metro Biosolids Center. The CO₂ emissions at both facilities are mostly biogenic emissions (CO₂ emission from biogas combustion), with 99% biogenic CO₂ emissions at Point Loma WWTP and 98% biogenic CO₂ emissions at North City WRP.

STRATEGY: CLIMATE RESILIENCE

Increasing urban tree canopy coverage in the city contributes to the capture and storage of carbon, as well as other benefits including stormwater management, improved air quality, increased property values, etc.

Action & Progress: Increase Urban Tree Canopy Coverage

The updated urban tree canopy coverage in 2015 was 13% in the City of San Diego, based on the Urban Tree Canopy Assessment preliminary results developed by the University of Vermont and the USDA Forest Service, funded by California Department of Forestry and the FITURE Protection (CalFire) for the City of San Diego. The City applied for two CalFire grants for tree planting program in 2016 and in 2017, the City planted 500 trees funded by a CalFire grant.

OUT OF CLIMATE ACTION PLAN SCOPE: EMISSIONS FROM IN-BOUNDARY LANDFILLS

The City of San Diego currently has two active landfills and four closed landfills within its boundary (in-boundary). In addition to including emissions from waste disposal by the city in total GHG emissions as one of the five basic emission-generating activities recommended by *U.S. Community Protocol for Accounting and Reporting of GHG Emissions*, emissions from in-boundary sources can be reported optionally. Emissions from in-boundary landfills are reported separately here.

² US Community Protocol 2012, Appendix E, page 7.

For the landfills that are required to report GHG emissions through EPA’s Greenhouse Gas Reporting Program (EPA MRR), the reported 2016 emissions are not available as of September 2017. For the landfills that are not subject to EPA MRR, emissions were calculated based on waste-in-place in the landfill and the Landfill Emissions Tool developed by ARB using the first order decay model recommended by the Intergovernmental Panel on Climate Change. Emissions from in-boundary landfills cannot be compared with or directly added to emissions from solid waste disposed in the current year. This is because emissions from solid waste disposal are calculated to include the projected future GHG emissions associated the waste generated in the current year, regardless of disposal location or method, while emissions from in-boundary landfills are emissions in the current year from waste that has already been in place at the landfills, regardless of where the waste was generated.

Table 22 City of San Diego In-Boundary Landfill Emissions

Landfill	Status	2015 Updated Landfill Emission (MT CO₂e)	2016 Landfill Emission (MT CO₂e)	Source
West Miramar Sanitary Landfill	Active	205,886	n/a	EPA Greenhouse Gas Reporting (EPA MRR)
Sycamore Landfill	Active	86,725	n/a	EPA MRR
North Miramar Sanitary Landfill	Closed in 1983	2,411	n/a	EPA MRR
South Chollas Sanitary Landfill	Closed in 1981	n/a	n/a	Discontinued reporting to EPA MRR in 2015
Arizona Street Landfill	Closed in 1974	11,285	11,062	Air Resources Board Landfill Emission Tool (ARB LET) result using waste received before closing
Mission Bay Landfill #1	Closed in 1959	6,509	6,308	ARB LET result using operation period 1952-1959 and waste-in-place at the end of 1990
Total	-----	312,816	n/a	-----

n/a = not available as of September 2017, MT CO₂e = metric tons of carbon dioxide equivalent

Source:

ARB Landfill Emission Tool (LET) v1.3 Release date November 14, 2011. LET reports CO₂e of CH₄ using 21 as CH₄ GWP, recalculated using 25 as CH₄ GWP.

Energy Policy Initiatives Center, 2017

Methodology and Data Revisions

The method differences and data refinement between 2010 and current GHG inventory calculations are given in Table 23 Method Differences and Data Refinement of GHG Inventory Updates, the differences include updated and more accurate data source, updated standards and protocols and etc.

Table 23 Method Differences and Data Refinement of GHG Inventory Updates

Category	Category Detail	2010 Inventory (CAP baseline year)	2015 Inventory (Published in 2016 Annual Report)	2015 Updated Inventory (2017 Annual Report)	2016 Inventory (2017 Annual Report)
Electricity	Activity (kWh)	Requested data from SDG&E for the city by customer class and by service provider (Bundled or Direct access)	Requested data from SDG&E for the city by customer class, service provider, and rate schedule	Included additional criteria in the SDG&E energy data request to limit to customers with City of San Diego town code as well as City of San Diego as service address city	Requested data from SDG&E by customer class, service provider, and rate schedule for customers with City of San Diego town code as well as City of San Diego as service address city
	Emission Factor (lbs CO ₂ e/MWh)	Created a weighted average emission factor based SDG&E kWh procurement from each fuel type (coal, natural gas, unspecified) and emission factor of electricity generation for each fuel type (California-wide average based on EPA eGRID2010 database)	Created a weighted average emission factor based SDG&E kWh procurement from each fuel type at each facility/power plant and emission factor of electricity generation at each facility/power plant (EPA eGRID2012 database specific plant level emission factor)	Updated the 2015 SDG&E bundled electricity emission factor using the latest EPA eGRID2014 v2 database released in 2017	Created a weighted average emission factor based SDG&E kWh procurement from each fuel type at each facility/power plant and emission factor of electricity generation at each facility/power plant (EPA eGRID2014 v2 database specific plant level emission factor)

Category	Category Detail	2010 Inventory (CAP baseline year)	2015 Inventory (Published in 2016 Annual Report)	2015 Updated Inventory (2017 Annual Report)	2016 Inventory (2017 Annual Report)
Natural Gas	Activity (therms)	Requested data from SDG&E for the city by customer class and by service provider (Bundled or transport-only)	Requested data from SDG&E for the city by customer class, service provider, and rate schedule	Included additional criteria in the SDG&E energy data request to limit to customers with City of San Diego town code as well as City of San Diego as service address city Confirmed the removal of natural gas use at grid-supply electricity generation (primary purpose) facilities in the City	Requested data from SDG&E by customer class, service provider, and rate schedule for customers with City of San Diego town code as well as City of San Diego as service address city Confirmed the removal of natural gas use at grid-supply electricity generation (primary purpose) facilities in the City
	Emission Factor (MT CO ₂ e/therm)	natural gas emission factor in California based on California Air Resources Board statewide inventory	natural gas emission factor in California based on California Air Resources Board statewide inventory	natural gas emission factor in California based on California Air Resources Board statewide inventory	natural gas emission factor in California based on California Air Resources Board statewide inventory
Transportation	Activity (VMT)	Scaled down from 2010 San Diego region-wide VMT in EMFAC2011 (SANDAG Series 12 VMT as input) using City of San Diego to regional VMT ratio provided by SANDAG	Interpolated from 2014 and 2020 total City of San Diego VMT provided by SANDAG using Series 13 Activity Based Model 13.3.0	Interpolated from 2014 and 2020 total City of San Diego VMT provided by SANDAG using Series 13 Activity Based Model 13.3.0	Interpolated from 2014 and 2020 total City of San Diego VMT provided by SANDAG using Series 13 Activity Based Model 13.3.0
	Emission Factor (g CO ₂ e/mile)	2010 San Diego region emission rate per vehicle class from EMFAC2011, convert to average vehicle emission rate using VMT distribution by vehicle class	2015 San Diego region emission rate per vehicle class from EMFAC2014, convert to average vehicle emission rate using VMT distribution by vehicle class	2015 San Diego region emission rate per vehicle class from EMFAC2014, convert to average vehicle emission rate using VMT distribution by vehicle class	2016 San Diego region emission rate per vehicle class from EMFAC2014, convert to average vehicle emission rate using VMT distribution by vehicle class

Category	Category Detail	2010 Inventory (CAP baseline year)	2015 Inventory (Published in 2016 Annual Report)	2015 Updated Inventory (2017 Annual Report)	2016 Inventory (2017 Annual Report)
Water	Activity (gallons)	Estimated based on 2010 City of San Diego population and 2010 San Diego region per capita water consumption (150 gallon per capita day)	2015 potable and recycled water supplied to City of San Diego (water production) breakdown by wholesale water (from San Diego County Water Authority) and local water (surface and groundwater)	Removed water purchases from two customers of the City that are not in the City: 1) City of Del Mar, 2) California American Water Company (for areas except San Diego South Bay)	2016 potable and recycled water supplied to City of San Diego (water production) breakdown by wholesale water (from San Diego County Water Authority) and local water (surface and groundwater) Removed water purchased by Del Mar and CalAm service area not in the City
	Emission Factor (energy intensity - kWh/gallon)	Energy intensity for water upstream supply and conveyance, treatment and distribution in southern California based on California Energy Commission/Navigant Consulting report CEC-500-2006-118	- local water conveyance, treatment and distribution energy intensity from City of San Diego 2015 Urban Water Management Plan (UWMP) - upstream supply energy intensity calculated based on Metropolitan Water District and SDCWA 2015 UWMP	- local water conveyance, treatment and distribution energy intensity from City of San Diego 2015 Urban Water Management Plan (UWMP) - upstream supply energy intensity calculated based on Metropolitan Water District and SDCWA 2015 UWMP	- local energy intensity based on 2016 water treatment plants and lake pump stations electricity consumption, all other water pump stations and facilities electricity consumption - no updates on upstream energy intensity

Category	Category Detail	2010 Inventory (CAP baseline year)	2015 Inventory (Published in 2016 Annual Report)	2015 Updated Inventory (2017 Annual Report)	2016 Inventory (2017 Annual Report)
Wastewater	Activity (gallons)	Estimated wastewater generation based on total water consumption and wastewater to water ratio provided in U.S. Community Protocol for Accounting GHG Emissions	Estimated based on 2015 total wastewater flow into Point Loma WWTP, South Bay WRP and North City WRP, and ratio of City of San Diego's share of total flow enters into Metropolitan Sewerage System	Estimated based on 2015 total wastewater flow into Point Loma WWTP, South Bay WRP and North City WRP, and ratio of City of San Diego's share of total flow enters into Metropolitan Sewerage System	Estimated based on 2016 total wastewater flow into Point Loma WWTP, South Bay WRP and North City WRP, and ratio of City of San Diego's share of total flow enters into Metropolitan Sewerage System
	Emission Factor (MT CO ₂ /gallon)	Calculated by dividing 2010 Point Loma WWTP GHG Emission reported in Air Resources Board Mandatory GHG Reporting Program (ARB MRR) by 2010 Point Loma total flow	Calculated by dividing 2015 Point Loma WWTP and North City WRP GHG Emission reported in ARB MRR by 2015 Point Loma WWTP and North City WRP total flow (ARB MRR reporting method changed in 2011)	Calculated by dividing 2015 Point Loma WWTP and North City WRP GHG Emission reported in ARB MRR by 2015 Point Loma WWTP and North City WRP total flow (ARB MRR reporting method changed in 2011)	Calculated by dividing 2016 Point Loma WWTP and North City WRP GHG Emission reported in ARB MRR by 2015 Point Loma WWTP and North City WRP total flow (ARB MRR reporting method changed in 2011)
Solid Waste	Activity	2010 waste disposed tonnage from City of San Diego reported in California Integrated Waste Management Board (CalRecycle)	2015 waste disposed tonnage provided by City of San Diego Environmental Service Department	2015 waste disposed tonnage provided by City of San Diego Environmental Service Department	2016 waste disposed tonnage provided by City of San Diego Environmental Service Department
	Emission Factor (MT CH ₄ /tons)	Mixed municipal solid waste recommended in U.S. Community Protocol for Accounting GHG Emissions	Emission factor for each waste component from EPA WARM Model 2016 version and waste components from City of San Diego waste characterization study 2012-2013	Emission factor for each waste component from EPA WARM Model 2016 version and waste components from City of San Diego waste characterization study 2012-2013	Emission factor for each waste component from EPA WARM Model 2016 version and waste components from City of San Diego waste characterization study 2012-2013

Analysis on Jobs

To objectively identify a baseline of jobs and trends associated with these five strategies, a qualitative review of industry reports associated with these sectors was conducted, as well as a quantitative analysis of job growth within associated industry sectors during 2010–15 with an update to job numbers between 2015 and 2016.

Our quantitative analysis also included additional data due to the discrepancy in the number of industries included in each sector. The number of jobs per industry in each sector was calculated for comparison (Table 2) and is included in the strategy-by-strategy analysis below.

ENERGY AND WATER EFFICIENT BUILDINGS

In San Diego, the energy and water efficiency sector is a priority for training and job growth. The City of San Diego ranked 13th for energy efficiency in the nation in 2016, which is a jump up from 27th place, according to the American Council for an Energy-Efficient Economy's City Energy Efficiency Scorecard that ranks cities based on their comprehensive energy efficiency policies and programs.³ In addition, according to the Department of Energy's 2017 National Energy and Employment Report, California is ranked first out of all 50 states for energy efficiency jobs.⁴

According to the U.S. Census Bureau, during 2010–16, Energy and Water Efficient Buildings had the second highest increase in jobs at 15.1 percent. During 2015–16 there was an increase in the number of jobs, by 0.72 percent. In 2016, Energy and Water Efficient Buildings had the most jobs per industry at 3,417. Twenty industries were identified in this CAP sector, which included 503 occupations, the highest of the five CAP sectors. In 2016, this sector continued to have the highest amount of total jobs out of the five CAP sectors.

CLEAN AND RENEWABLE ENERGY

The City of San Diego has committed to a 100% renewable electricity target in the next two decades.⁵ San Diego ranks third in the nation for cleantech leadership as of 2016, moving up one place from 2015.⁶ The ranking is based on three broad categories: technology, policy and capital. The San Diego Workforce Partnership Clean Energy Industry Overview indicates the clean energy industry in San Diego includes 9,985 businesses and 137,399 individual jobs in San Diego County.⁷ Additionally, the Cleantech Industry Economic Impact Analysis conducted by the San Diego Regional Economic Development Corporation shows that the San Diego region's cleantech job concentration is 2.59 times the national job concentration in 2016.⁸

Per U.S. Census data, during 2010–16 Clean and Renewable Energy had a decrease in the number of jobs by 1.3 percent. Nuclear Electric Power Generation industries were included within the Clean and Renewable Energy sector, which is a potential explanation for the loss of jobs due to the shutdown of the San Onofre Nuclear Generating Station in San Diego County. However, during 2015–16 Clean and Renewable Energy had the most job growth with a 2.29 percent increase. In 2016, Clean and Renewable Energy had 1,217 jobs per industry. There were 21 industries identified, which included 392 occupations, the second highest of the five CAP sectors. In 2016, this sector continued to have the second highest total number of jobs out of the five CAP sectors.

3 The City Energy Efficiency Scorecard

4 2017 US Energy and Jobs Report State Charts 2

5 City of San Diego Climate Action Plan

6 2016 U.S. Clean Tech Leadership Index

7 San Diego Workforce Partnership Clean Energy Industry Overview

8 The San Diego Regional Economic Development Corporation's Cleantech Industry Economic Impact Analysis, July 2017

CLIMATE RESILIENCY

Climate Resiliency encompasses programs that prepare the region for success as threats from climate change become a reality. From protecting the coast from the detriments of erosion to setting up tree-planting programs, climate resiliency is a critical component to help governments and companies shift the energy landscape to make the city more resilient. Jobs in climate resiliency are expected to grow as landscaping, infrastructure and city planning align with CAP goals.⁹

According to U.S. Census data, during 2010–16, jobs related to Climate Resiliency grew by 12.2 percent. However, during 2015–16 job growth decreased by 0.02 percent. In 2016, Climate Resiliency had the second highest number of jobs per industry at 2,018, but also the lowest number of industries identified at eight industries and 360 occupations. In 2016, the total number of jobs came in third out of the five CAP sectors.

TRANSPORTATION

San Diego is a leading region in advanced vehicles, electric vehicles and electric vehicle infrastructure; smart charging infrastructure and employment is a crucial part of that planning. San Diego has significant advanced transportation cluster employment and sales revenue – making it a primed market for transportation and transit-oriented job growth in sales, manufacturing, logistics and repair/maintenance.¹⁰

Per U.S. Census data, during 2010–16, Transportation job growth grew by 14 percent, coming in third behind Zero Waste and Water and Energy Efficient Buildings. During 2015–16, job growth increased by 0.4 percent. In 2016, Transportation had the lowest amount of jobs per industry of the five CAP sectors at 481. Furthermore, Transportation had 13 industries identified with the lowest amount of occupations assigned to the sector at 205 occupations. Transportation also had the lowest amount of total jobs in 2016.

ZERO WASTE

Zero waste and waste diversion are proven as an effective method to reduce and curb landfill use. The City of San Diego has a Zero Waste Plan that is in action and it requires the city to achieve 75 percent waste diversion of discarded materials from landfills by 2020 and to achieve zero waste by 2040. The Zero Waste sector has a lot of job growth opportunity due to the amount of jobs needed to divert and reduce waste in innovative ways.

According to U.S. Census data, during 2010–16, Zero Waste had the largest job growth at 15.5 percent. Even though this sector has a lot of room for job growth, during 2015–16, the sector decreased the most, by 4.14 percent. In 2016, Zero Waste had the second lowest amount of jobs per industry at 587. Furthermore, Zero Waste had the second lowest number of industries at 12 industries with 230 occupations. In 2016, it also had the second lowest amount of total jobs out of the five CAP sectors.

SUMMARY

EMSI identifies 1,001 industries within the San Diego Region. Seventy-four industries were categorized into five CAP sectors and grouped within EMSI. From those groups, EMSI output the jobs per occupations in the total of all the industries identified per CAP sector during 2010–16. These job totals were then used to identify the growth per CAP sector between 2010 and 2016. EMSI outputs <10 jobs for the occupations data, in order to process the data all <10 results were replaced with 10 jobs.

In order to identify a baseline of total jobs within the CAP strategies over the past five years, first the industries that corresponded with each CAP sector were identified (Table 1). No one industry was categorized into multiple CAP sectors. Overall, 74 industries were categorized into the five sectors; 20 industries in Energy and Water Efficient Buildings, 21 industries in Clean and Renewable Energy, eight

⁹ City of San Diego Climate Action Plan

¹⁰ City of San Diego Climate Action Plan

industries in Climate Resiliency, 13 industries in Transportation and 12 industries in Zero Waste. The occupations within the corresponding CAP sector industries were identified and then the individual jobs within these occupations were totaled for each year between 2010 and 2016.

DATA SOURCES AND METHODS

Qualitative Sources

[San Diego Workforce Partnership Clean Energy Industry Overview](#)

The San Diego Regional Economic Development Corporation's Cleantech Industry Economic Impact Analysis

[This is Advanced Energy](#)

[California's Golden Energy Efficiency Opportunity: Ramping up Success to Save Billions and Meet Climate Goals](#)

[Regional Planning Unit Summary: Southern Border](#)

[Small Businesses: Workforce Needs of Small Businesses in San Diego](#)

[Priority Sectors: Workforce Initiatives in San Diego County](#)

[City of San Diego Zero Waste Plan](#)

Quantitative Methods:

Data source: Economic Modeling Specialists International (EMSI, 2017.2) www.economicmodeling.com
(EMSI data was provided by the San Diego Regional Economic Development Corporation)

Industry Data

EMSI industry data have various sources depending on the class of worker.

(1) For QCEW employees, EMSI primarily uses the QCEW (Quarterly Census of Employment and Wages), with supplemental estimates from County Business Patterns and Current Employment Statistics.

(2) Non-QCEW employee data are based on a number of sources including QCEW, Current Employment Statistics, County Business Patterns, BEA State and Local Personal Income reports, the National Industry-Occupation Employment Matrix (NIOEM), the American Community Survey and Railroad Retirement Board statistics.

(3) Self-Employed and Extended Proprietor classes of worker data are primarily based on the American Community Survey, Non-employer Statistics and BEA State and Local Personal Income Reports.

Projections for QCEW and Non-QCEW Employees are informed by NIOEM and long-term industry projections published by individual states.

Occupation Data

EMSI occupation employment data are based on final Emsi industry data and final Emsi staffing patterns.

Table 24 Industries within Each Climate Action Plan Sector

Energy and Water Efficient Buildings	Clean and Renewable Energy	Climate Resiliency	Transportation	Zero Waste
Air-Conditioning and Warm Air Heating Equipment and Commercial and Industrial Refrigeration Equipment Manufacturing	Biomass Electric Power Generation	Environment, Conservation and Wildlife Organizations	All Other Transit and Ground Passenger Transportation	All Other Miscellaneous Waste Management Services
Architectural Services	Commercial, Industrial, and Institutional Electric Lighting Fixture Manufacturing	Forest Nurseries and Gathering of Forest Products	Bus and Other Motor Vehicle Transit Systems	Hazardous Waste Collection
Automatic Environmental Control Manufacturing for Residential, Commercial and Appliance Use	Electric Bulk Power Transmission and Control	Landscape Architectural Services	Commuter Rail Systems	Hazardous Waste Treatment and Disposal
Building Inspection Services	Electric Power Distribution	Landscaping Services	Highway, Street and Bridge Construction	Materials Recovery Facilities
Commercial and Institutional Building Construction	Electrical Contractors and Other Wiring Installation Contractors	Sewage Treatment Facilities	Interurban and Rural Bus Transportation	Other Nonhazardous Waste Treatment and Disposal
Engineering Services	Environmental Consulting Services	Soil Preparation, Planting and Cultivating	Mixed Mode Transit Systems	Other Waste Collection
Industrial and Commercial Fan and Blower and Air Purification Equipment Manufacturing	Geothermal Electric Power Generation	Water and Sewer Line and Related Structures Construction	Other Support Activities for Road Transportation	Recyclable Material Merchant Wholesalers
Industrial Building Construction	Hydroelectric Power Generation	Water Supply and Irrigation Systems	Other Urban Transit Systems	Remediation Services
Industrial Design Services	Instrument Manufacturing for Measuring and Testing Electricity and Electrical Signals		Rail transportation	Solid Waste Collection
New Housing For-Sale Builders	Mechanical Power Transmission Equipment Manufacturing		School and Employee Bus Transportation	Solid Waste Combustors and Incinerators

Energy and Water Efficient Buildings	Clean and Renewable Energy	Climate Resiliency	Transportation	Zero Waste
New Multifamily Housing Construction (except For-Sale Builders)	Natural Gas Distribution		Support Activities for Rail Transportation	Solid Waste Landfill
New Single-family Housing Construction (except For-Sale Builders)	Nuclear Electric Power Generation		Taxi Service	Used Merchandise Stores
Plumbing and Heating Equipment and Supplies (Hydronics) Merchant Wholesalers	Other Electric Power Generation		Transportation Equipment and Supplies (except Motor Vehicle) Merchant Wholesalers	
Plumbing, Heating and Air-Conditioning Contractors	Pipeline Transportation of Natural Gas			
Relay and Industrial Control Manufacturing	Power and Communication Line and Related Structures Construction			
Research and Development in the Physical, Engineering and Life Sciences (except Biotechnology)	Power, Distribution and Specialty Transformer Manufacturing			
Residential Electric Lighting Fixture Manufacturing	Semiconductor and Related Device Manufacturing			
Residential Remodelers	Solar Electric Power Generation			
Steam and Air-Conditioning Supply	Storage Battery Manufacturing			
Warm Air Heating and Air-Conditioning Equipment and Supplies Merchant Wholesalers	Turbine and Turbine Generator Set Units Manufacturing			
	Wind Electric Power Generation			

Table 25 Number of Jobs/Industry per Climate Action Plan Sector 2010 to 2016

Year	Energy and Water Efficient Buildings	Clean and Renewable Energy	Climate Resiliency	Transportation	Zero Waste
2010	2,968	1,233	1,799	422	509
2011	2,899	1,242	1,796	390	490
2012	2,956	1,224	1,848	432	497
2013	3,101	1,191	1,883	448	536
2014	3,183	1,155	1,969	468	569
2015	3,393	1,190	2,018	479	613
2016	3,417	1,217	2,018	481	587

Table 26 Number of Industries and Occupations per Climate Action Plan Sector

	Energy and Water Efficient Buildings	Clean and Renewable Energy	Climate Resiliency	Transportation	Zero Waste
Industries	20	21	8	13	12
Occupations	503	392	360	205	230

Table 27 Percent Change in Jobs from 2010 to 2016

Year	Energy and Water Efficient Buildings	Clean and Renewable Energy	Climate Resiliency	Transportation	Zero Waste
2010-11	-2.32	0.67	-0.17	-7.62	-3.57
2011-12	1.96	-1.45	2.92	10.69	1.41
2012-13	4.92	-2.70	1.90	3.71	7.73
2013-14	2.64	-2.97	4.53	4.62	6.24
2014-15	6.59	3.00	2.53	2.37	7.63
2015-16	0.72	2.29	-0.02	0.40	-4.14
2010-16	15.1	-1.3	12.2	14.0	15.5