2016 Annual Report: **Climate Action Plan**

Appendix

This appendix to the City of San Diego Climate Action Plan (CAP) 2016 Annual Report provides additional information and data for the Annual Report in the following four sections:

A. Background information and calculation for the 2015 Greenhouse Gas (GHG) emissions inventory
B. 2015 update of Climate Action Plan strategies
C. Method differences between the 2010 baseline and the 2015 GHG emissions inventories
D. Optional GHG emissions reporting for in-boundary landfills and government operations (optional inventory components not included in the 2010 inventory and will be tracked separately from 2015)
E. Impact of the Climate Action Plan on jobs
F. Impact of the Climate Action Plan on social equity

The 2015 total GHG emissions were 10.8 million metric tons of carbon dioxide equivalents (MMT CO_2e), 17% below the 2010 CAP baseline GHG emissions (12.9 MMT CO_2e). The reduction is mostly due to state policies and mandates, such as the state Renewable Portfolio Standard, vehicle efficiency standards, market changes, methodology updates, and improved data sources, etc. These fluctuations will continue to occur going forward and ongoing monitoring will be important to determine trends and ensure the City remains on track to achieve its targets. As stated in the Annual Report, the City of San Diego just adopted the CAP in 2015 and is just beginning formal implementation. For tracking purposes, reductions from federal, state, and regional actions are tracked separately from reductions resulting from City actions. However, based on the fluctuations described above, the total GHG emissions inventory for the City is the overarching metric.

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

There are 17 discrete actions in the CAP, which do not include other actions requested by city Council when the CAP was adopted or efforts that were already underway. All 17 actions are either planned or in progress during Phase 1 of implementation (2016-2017), even though six actions were identified as Phase 2 in the CAP (to be implemented in 2018-2020).

A. Background information and calculations used in the 2015 greenhouse gas (GHG) emissions inventories

2015 City of San Diego Greenhouse Gas Emissions Inventory and Comparison with 2010

The emissions source categories included in both 2010 and 2015 were the same: electricity, natural gas, transportation, water, and wastewater & solid waste. GHG emissions from other optional 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 in either inventory. The results of the inventory calculations for both years are shown in Table 1.

Methods, data availability, and sources used to calculate GHG emissions have been updated since 2010. The method differences between the 2010 and 2015 GHG emissions inventories are given in Section C.

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

Category	2010 Emissions (MT CO_2e)	2015 Emissions (MT CO_2e)
Electricity	3,138,613	2,620,493
Natural Gas	2,098,983	2,062,479
Transportation	7,086,297	5,771,317
Water	277,927	92,223
Wastewater & Solid Waste	383,172	286,573
Total	**12,984,993**	**10,833,086**

Total emissions in 2015 were 17% below that in 2010. Electricity related emissions were 25% lower, natural gas emissions were 2% lower, transportation emissions were 23% lower, water related emissions were 200% lower and waste emissions (solid waste and wastewater emissions) were 34% lower. Reductions can be attributed to several factors including efficiencies/actions, market shifts, and improvements to methodologies or data collection. While the methodological differences between 2010 and 2015 are explained in detail at Section C, briefly: the electricity emissions decrease is largely due to the increasing renewables in electricity generation; transportation emissions changes are partially due to updated transportation models; water-related emissions changes are largely due to state water conservation mandates and updated local water system data; and, waste emission changes are largely due to updated waste characteristics information.

2010 and 2015 Low Carbon Economy (GHG Emissions/GDP)

The GHG intensity is the level of GHGs per unit of economic activity, the Gross Domestic Product (GDP). The GDP is generally 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 (BEA) has developed GDP calculations also for regions such as San Diego County based on local personal income and industry. Finally, IMPLAN, an economic impact model, has been used to develop city-level GDPs. National University's Kelly Cunningham, Economist and Senior Fellow at the National University System for Policy Research, La Jolla, provided the estimates for the City of San Diego in this report based on the City's zip code information.

The metric GHG intensity is independent of total emissions and indicates how dependent economic activity is on fossil fuel use. If GHG emissions stay the same over several years while the GDP increases, the GHG intensity decreases, and the economic productivity is said to be more efficient, as economic growth then consumes less carbon-based fuels. As mentioned above, the 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. As such, the GHG intensity is lower than if all sectors were included in the inventory.

The City of San Diego's GHG intensity was 137 MT CO_2e/$ million in 2010 and 91 MT CO_2e /$ million in 2015 (Table 2). This could be an indication that the City's economy operates on reduced carbon-based fuels while producing the same or more economic development, i.e., it is now a lower carbon economy

than in 2010. This decrease has been seen in many economies for a variety of reasons including the increase in renewable energy, reduction in coal power use, and increasing efficiencies.

Table 2 City of San Diego 2010 and 2015 GHG Intensity (MT CO_2e/$ million GDP)

	2010	2015	
Total Emissions (MT CO_2e)	12,984,993	10,833,086	GDP for the City of San Diego provided by Kelly Cunningham, National University System.
GDP ($ billion)	95	119	
GHG Intensity (MT CO_2e/$million GDP)	**137**	**91**	

2010 and 2015 per capita GHG emissions

The 2010 and 2015 per capita GHG emissions in City of San Diego are given in Table 3.

Table 3 City of San Diego 2010 and 2015 per capita GHG Emissions (MT CO_2e per capita)

	2010	2015	City of San Diego 2010 population is from 2010 U.S. Census. City of San Diego 2015 population is from SANDAG Demographic & Socio-Economic Estimates, February 24, 2016 version.
Total Emission (MT CO_2e)	12,984,993	10,833,086	
Total Population	1,301,617	1,368,061	
Per Capita GHG Emission (MT CO_2e per capita)	**10.0**	**7.9**	

The 2015 per capita GHG emissions are approximately the average annual GHG emissions of 1.6 typical passenger cars, based on the EPA's estimation of a typical passenger car emitting about 4.7 MT CO_2e per year. It is less than the per capita value in 2010 of the equivalent of 2.1 passenger cars per year. As mentioned above, the 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.

B. 2015 update of Climate Action Plan strategies

Energy & Water Efficiency Buildings

Energy (electricity and natural gas) and water consumption accounts for 44% of 2015 citywide GHG emissions. The Energy & Water Efficiency Buildings strategy has targets to reduce citywide per capita water use and energy use in residential buildings and in city operations. Transporting, treating and delivering water to residents and businesses in the city requires energy. Therefore, reducing water use will also reduce the associated energy.

Baseline year and current state of energy and water use in the City of San Diego

The 2010 and 2015 electricity use from the utility is provided in Table 4.

Table 4 2010 and 2015 Electricity use (SDG&E only)

	2010	2015	% Change	2015 electricity use in the City of San Diego, excluding military, San Diego Unified Port District, and San Diego International Airport use, was provided by SDG&E. The MWh do not include transmission and distribution losses, or self-serve electricity generation.
Electricity Use (MWh)	8,572,155	8,450,904	-1%	
Emissions from Electricity (MT CO_2e)	3,138,613	2,620,493	-17%	

While electricity use decreases only marginally, GHG emissions from electricity use are significantly lower than 2010. Due to the increase in renewable content in the electricity, from 11% in 2010 to 35% in 2015, GHG emissions from electricity in 2015 are 17% lower than in 2010 (Figure 1).

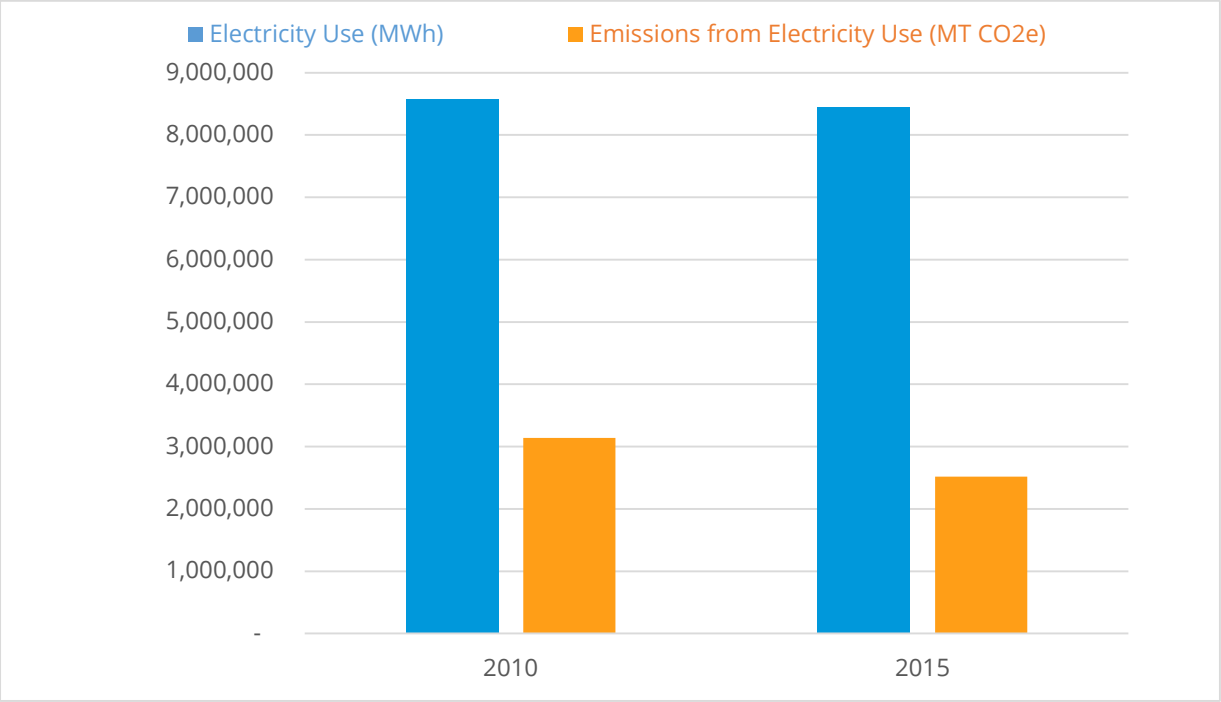

Figure 1 Comparison of Electricity Use and Emissions from Electricity Use (2010 and 2015)

Table 5 provides a breakdown of electricity use by customer class in 2015 and Table 6 provides a similar breakdown for natural gas end use.

Table 5 Breakdown of Electricity Use by Customer Class

Customer Class	Distribution	
Residential	29%	2015 electricity use provided by SDG&E was broken down by customer class. 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.
Commercial	43%	
Industrial	27%	
Agricultural	0.8%	
Lighting	0.6%	
Total	**100%**	

Table 6 2010 and 2015 Total Natural Gas Use (SDG&E only) and Breakdown by Customer Class

	2010	2015	% Change	2015 natural gas use in the City of San Diego, excluding military, San Diego Unified Port District, and San Diego International Airport use, was provided by SDG&E. 29% use was from the residential class, 25% from the commercial class and the rest from the industrial class (including electricity generation using natural gas).
Natural Gas Use (million therms)	396	378	- 4%	

Table 7 provides the electricity and natural gas end use in units of MMBTU (million British Thermal Units). MMBTU is the common unit of energy used in order to compare different energy use or fuel type. In this case, MMBTU is used to compare electricity (kWh) and natural gas (therms) in the same unit. Natural gas constituted 57% of the total end use energy in 2015.

Table 7 2010 and 2015 Total Energy (Electricity + Natural Gas) Use (SDG&E only)

	2010	2015	% Change	Conversion factors 293 kWh/mmbtu and 10 therms/mmbtu are used to covert electricity and natural gas to the same unit. In both years, 43% energy use is from electricity use.
Electricity (million mmbtu)	29.2	28.8	-1%	
Natural Gas (million mmbtu)	39.6	37.8	-4%	
Energy (million mmbtu)	68.8	66.7	-3%	

Table 8 provides the energy saved from utility energy efficiency programs in each year from 2013 to 2015.

Table 8 Energy Reduction from Utility (SDG&E) Energy Efficiency Program

Year	Electricity Saving (MWh)	Natural Gas Saving (therm)	All energy savings from measures incented and claimed through SDG&E Energy Efficiency programs only in City of San Diego, not separated by customer class. Does not include reductions from codes & standards and other programs. Energy savings were provided by SDG&E.
2013	72,418	199,767	
2014	72,713	698,353	
2015	62,674	581,712	

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 13 MW in 2010 to 108 MW in 2015 (Table 9).

Table 9 2010 and 2015 Residential Energy (Electricity + Natural Gas) Use

	2010	2015	% Change
Electricity (MWh) - SDG&E	2,498,471	2,470,781	-1%
Electricity (MW) – Solar*	13	108	701%
Electricity (MWh) – Solar**	23,597	188,986	701%
Total Electricity (MWh)	2,522,068	2,659,768	5%
Total Electricity (mmbtu)	8,599,018	9,068,506	5%
Natural Gas (million therm)	138	111	-19%
Natural Gas (mmbtu)	13,781,505	11,113,826	-19%
Total Energy (mmbtu)	22,380,523	20,182,332	-10%
Total # of occupied units***	473,092	505,255	7%
Energy use per home (mmbtu/home)	**47.3**	**39.9**	**-16%**

**Rooftop solar PV capacity calculated based on California Solar Initiative (CSI) database, net energy metering (NEM) interconnection dataset for SDG&E - City of San Diego residential customer (June 30, 2016 version). **Convert capacity to electricity using average solar PV system capacity factor 20%. ***Occupied housing units from SANDAG Demographic & Socio Economic Estimates (February 24, 2016 version), includes single family, multi-family, mobile homes and other.*

Total electricity use increased by 5% compared with 2010 in the residential category and decreased 19% for natural gas. End use residential energy use therefore decreased 16% in 2015 compared with 2010.

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

Municipal operations' energy use decreased by a total of 6% in 2015 compared with 2010 (Table 10).

Table 10 2010 and 2015 Energy Use in City Operation (SDG&E only)

	2010	2015	% Change	
Electricity (MWh)	205,787	169,794	-17%	2015 municipal energy consumption was provided by City of San Diego's Environmental Services Department. Natural gas consumption includes gas use for space heating/cooling and electricity generation.
Electricity (mmbtu)	701,633	578,914	-17%	
Natural Gas (million therm)	3.4	4.2	19%	
Natural Gas (mmbtu)	335,723	398,301	19%	
Total energy (mmbtu)	**1,037,357**	**977,215**	**-6%**	

Action & Progress: Reduce Daily per Capita Water Consumption

Per capita water use decreased substantially from 2010 to 2015 beyond what was projected in the CAP for 2020 (Table 11).

Table 11 2010-2015 Per capita Water Consumption

Year	Gallon per capita per day (GPCD)	
2010	128	The gallons per capita per day (GPCD) from 2010 to 2015 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 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 Annual Report, while GPCD in Urban Water Management Plan and SB X7-7 target are for fiscal year. Therefore, the 2015 GPCD in the progress report cannot be directly compared with SB X7-7 2015 interim urban water use target.
2011	128	
2012	130	
2013	135	
2014	134	
2015	112	

The recycled water amount also increased in the period 2010 – 2015 (Table 12) and water use for irrigation decreased 37% in the same interval (Table 13).

Table 12 2010-2015 Recycled Water per Capita

Year	Million gallon Recycled Water sales per year	City population	GPCD	
2010	1,350	1,301,617	3	The GPCD was calculated by dividing total recycled water delivered by City of San Diego population. The total metered recycled water sales (delivered) from 2010 to 2015 were provided by City of San Diego Public Utilities Department. City of San Diego population is from SANDAG Demographic & Socio Economic Estimates (February 24, 2016 version).
2011	1,524	1,309,972	3	
2012	1,867	1,315,816	4	
2013	1,691	1,333,969	3	
2014	2,588	1,347,954	5	
2015	2,370	1,368,061	5	

Table 13 Metered Irrigation Water Use (Agricultural and Landscape)

Year	Metered Irrigation Water Use (million gallon)	
2010	6,923	Metered irrigation water, including agricultural and landscape water use, delivered by City of San Diego Public Utilities Department (PUD).
2011	7,193	
2012	7,812	
2013	7,336	
2014	4,977	
2015	4,378	

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 electricity supply, distributed-level renewable energy including rooftop solar and the renewable content in a community choice aggregation or similar program (projected to start in 2030). In 2015, SDG&E achieved 35% 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 with total 157 MW system capacity in 2015.

Baseline and current state of clean and renewable energy in the City of San Diego

SDG&E's renewable electricity supply increase from 11% in 2010 to 35% in 2015, representing an increase of over 200% (Table 14).

Table 14 Percentage of Renewables in SDG&E Electricity Supply

Year	Renewable in SDG&E Electricity Supply	
2010	11.0%	2010-2014 percent renewable in SDG&E electricity supply is based on SDG&E's 2010-2014 annual power content label. The 2015 percent renewable is based on SDG&E 2015 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 Direct Access customers.
2011	15.7%	
2012	19.2%	
2013	24.0%	
2014	32.2%	
2015	35.5%	

The number of solar photovoltaic (PV) systems installed increased from 1006 in 2010 to 8124 in 2015, representing an increase of over 700%. In 2015, 8,021 out of 8,124 solar PV permit applications approved (45,722 KW out of 54,601 kW) were from residential customers (Table 15). The cumulative NEM solar PV system size from 1999 to the end of 2015 was 157 MW. Assuming that solar PV systems have a capacity factor of 20%, the total electricity generated from rooftop solar was 276,103 MWh in 2015, accounting for 3% of total electricity consumption. Total electricity consumption is the sum of electricity transmitted and distributed by SDG&E to its customers and electricity generated from rooftop solar PV systems. The vast majority of this PV electricity was in the residential sector.

Table 15 Number and Capacity of Installed Solar PV Systems, 2010-2015

Year	Number of PV System Approved	PV System Capacity (kW)	Number of systems and system capacity are based on the California Solar Initiative (CSI) database, and the SDG&E net energy metering (NEM) interconnection dataset City of San Diego (June 30, 2016 version). Both number of systems and capacity are new, not cumulative, PV systems installed each year. 2014 and 2015 system capacity are reported as direct current (DC) system capacity in kW. 2010-2013 capacity are converted to DC from alternating current (AC), as the number of systems reported in AC and DC are inconsistent before 2014.
2010	1006	9,753	
2011	1077	11,884	
2012	1503	11,807	
2013	3171	21,995	
2014	4311	28,945	
2015	8124	54,601	

Electric vehicle sales also increased from 3 electric vehicles (EVs) in the City of San Diego in 2010 to 5,901 EVs in 2015 (Table 16), an increase of more than 1900%.

Table 16 Number of Electric Vehicles in City of San Diego

Year	Number of EV Sales	Number of EV sales in the City of San Diego were provided by the Center for Sustainable Energy. The number of EV sales are not actual sales but were estimates adjusted from the number of EVs that received rebates from the Clean Vehicle Rebate Project (CVRP). The number of EV sales are the new, not cumulative, EV sales each year. The total EV sales since March 2010 to the end of 2015 was 5,901.
2010	3	
2011	840	
2012	457	
2013	1,267	
2014	1,644	
2015	1,690	
Total	**5,901**	

As of 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 (1.1 MW) and Otay Water Treatment Plant (0.8 MW), produced 2 million kWh of electricity on-site in 2015.

Action & Progress: Increase Municipal Zero Emissions Vehicles

As of December 2015, City operations had 4,213 total vehicles, in which 4,170 vehicles were conventional vehicles (1,446 in the police department, 343 in fire-rescue, 242 in environmental services), and 43 vehicles were hybrids. 2010 to 2015 city fleet gasoline consumptions are given in Table 17.

Table 17 City Fleet Gasoline Consumption

Year	Emergency Vehicles (gallon)	Non-Emergency Vehicles (gallon)	Total (gallon)	The gallons only include gasoline use, not diesel fuel use. Emergency vehicles are the vehicles used for fire-rescue, policy and environmental services. The vehicles most likely cannot be converted to electric vehicles due to overriding safety reasons. Fuel uses by fuel type and department were provided by the City of San Diego Fleet Service Department.
2010	819,080	518,788	1,337,869	
2011	1,402,053	753,910	2,155,962	
2012	1,524,034	743,659	2,267,693	
2013	1,528,761	748,798	2,277,559	
2014	1,531,477	736,626	2,268,104	
2015	1,505,800	756,314	2,262,114	

In 2015, transportation accounted for 54% of all GHG emissions within the City of San Diego. This strategy targets reducing commuter vehicle driving by increasing the use of mass transit, bicycling and walking in the city's Priority Transit Areas (TPA). TPAs are the areas within half of mile of existing or planned major transit stops.

Baseline and current state of transportation in the City of San Diego

The vehicle miles travelled (VMT) in the City of San Diego are shown in Table 18. VMT increased 3% from 2012 to 2015, although 2015 is an estimated value.

Table 18 Vehicle Miles Travelled (VMT) in the City of San Diego

Year	I-I VMT (annual miles)	I-E/E-I VMT (annual miles)	Total VMT (annual miles)	I-I VMT: Internal-internal VMT, trips begin and end in City of San Diego boundary I-E/E-I VMT: Internal-External/External-Internal VMT, trip either begins or ends within city boundary
2012	7,349,196,597	9,893,528,029	12,295,960,611	
2014	7,448,992,579	10,321,724,928	12,609,855,043	
2015	7,503,780,630	10,319,932,424	12,663,746,842	
2020	7,777,720,883	10,310,969,907	12,933,205,837	
2035	8,440,572,557	11,216,005,459	14,048,575,286	

The 2012, 2014, 2020 and 2035 VMT in miles/workday were provided by SANDAG, based on its Series 13 Activity Based Model 13.3.0. This was converted to annual VMT with an adjustment factor of 0.96. 2015 VMT was interpolated linearly between 2014 and 2020. I-E/E-I VMT were divided by two to split the miles between City of San Diego and outside jurisdictions while calculating total VMT, therefore, total VMT are all I-I VMT and half I-E/E-I VMT. This is the current best method for allocating VMT according to the *U.S. Community Protocol for Accounting and Reporting Greenhouse Gas Emissions*.

Total VMT in 2020 and 2035 are projected to be 5% and 14% higher than total VMT in 2012. Most of the miles in the city of San Diego were driven by passenger vehicles and light trucks, which are those with a weight rating less than 8,500 lbs (Table 19) and are considered to be the categories under SB375.

Table 19 Vehicle Miles Travelled (VMT) by Vehicle Type

Vehicle Type	VMT Breakdown	2015 VMT breakdown is based on EMFAC 2014 for the San Diego region, not specifically for City of San Diego and developed before SANDAG Series 13 Activity Based Model data was available. 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.
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.*

Based on the targets established under Senate Bill 375, the region is required to reduce per capita GHG emissions from passenger vehicles and light trucks 7% by 2020 and 13% by 2035 from 2005 baseline.

SANDAG's Sustainable Communities Strategy to 2050 Regional Transportation Plan lays out the strategies to achieve the reductions.

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

Planned and implemented pedestrian and bicycle improvements are shown in Table 20 and Table 21. Methods to calculate the impact of these measures are in progress.

Table 20 Pedestrian Facility Improvements Implemented or Planned

Year	New sidewalk added (linear feet)	City Blocks	Number of Locations	Sidewalk improvement was provided by City of San Diego Transportation & Storm Water Department. One city block is approximately 600 ft.
2015	9,500	19	14	
2016	15,200	30	15	
2017	14,400	29	15	

Table 21 Planned Bicycle Facilities Added 2013-2015

Year	2013	2014	2015	Bicycle facility improvement types and lane miles were provided by the City of San Diego Transportation & Storm Water Department.
New Class II Bike Lane Miles Added	6.9	10.5	14.6	
Existing Bike Lane Miles Improved	35.7	51.7	42.2	
Existing Bike Lane Miles Replaced	1.3	1.6	0	
Total Added or Improved Miles	43.9	63.8	56.8	

Zero Waste

In 2015, 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 from Landfills

The 2015 waste disposed and diversion rates are shown in Table 22. The amount of waste disposed increased from 2010 to 2015 and the diversion rate also increased.

Table 22 2010 and 2015 Waste Diversion Rate and Disposed Tonnage

	2010	2015	Disposed tonnage and diversion rate in 2015 were provided by City of San Diego Environmental Service Department. Tonnage is adjusted/corrected from tonnage reported in CalRecycle database.
Waste Disposed in Landfills (tons)	1,296,725	1,583,833	
Waste Diversion Rate (%)	52%	64%	

Action & Progress: Capture Methane from Wastewater Treatment

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 form wastewater treatment) and hydropower. The excess renewable electricity generated at Point Loma WWTP is exported back to the grid. At North City Water Reclamation Plant (North City WRP), renewable electricity is produced from biogas delivered from Miramar Landfill and Metro Biosolids Center. North City WRP is self-sufficient with on-site renewable electricity generation in 2015 and the excess electricity is sold back to the grid. At South Bay Water Reclamation Plant, half of the on-site electricity use is from on-site fuel cell with biofuel.

Climate Resilience

Increasing urban tree canopy coverage in the city contributes to the capture and storage of carbon, as well as other benefits including storm water 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 Forecast Service, funded by California Department of Forestry and FITURE Protection (CalFire) for the City of San Diego. The change from the 2010 baseline of 6.4% can in part be attributed to improved data availability and analysis in 2015. The estimated acreage of tree cover in 2010 was approximately 12,000 acres and in 2015 was approximately 24,000 acres. It is assumed that an acre of typical hardwood trees contributes 1.56 tons CO_2 reductions per acre.

C. Method differences between the 2010 baseline and 2015 greenhouse gas inventory calculations

The method differences between 2010 and 2015 Greenhouse Gas Inventory Calculations are given in Table 23, the differences include updated and more accurate data source, updated standards and protocols and etc.

Table 23 Method Differences: 2010 and 2015 Inventory

Category	Category Detail	2010 Inventory Method	2015 Inventory Method
Electricity	Activity (kWh)	Data from SDG&E based on customer class and service provider (Bundled or Direct Access)	Data from SDG&E based on customer class, service provider, and rate schedule
	Emission Factor (lbs CO2e/MWh)	Weighted average emission factor based on SDG&E kWh procurement from each fuel type (coal, natural gas, unspecified…) and emission factor of electricity generation with each fuel type (California-wide average based on EPA eGRID2010 database)	Weighted average emission factor based on 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)
Natural Gas	Activity (therms)	Data from SDG&E based on customer class and service provider (Bundled or transport-only)	Data from SDG&E based on customer class, service provider, and rate schedule
	Emission Factor (MT CO2e/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

Category	Category Detail	2010 Inventory Method	2015 Inventory Method
Transportation	Activity (VMT)	Scaled down from San Diego region-wide VMT in EMFAC2011 (SANDAG Series 12 VMT as input) using the city to regional VMT ratio from SANDAG study	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 CO2e/mile)	San Diego region emission factor per vehicle class from EMFAC2011, converted to average vehicle emission factor using VMT distribution by vehicle class	San Diego region emission factor per vehicle class from EMFAC2014, converted to average vehicle emission factor using VMT distribution by vehicle class
Water	Activity (gallons)	Estimate based on the city population and San Diego region per capita water consumption (151 gallons per capita day in 2010, from SDCWA)	2015 potable and recycled water supplied to the city (water production) broken down by wholesale water (from San Diego County Water Authority) and local water (surface and groundwater)
	Emission Factor (energy intensity - kWh/gallon)	Energy intensity for water upstream supply, 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 UWMPs
Wastewater	Activity (gallons)	Estimate of 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 total wastewater flow into Point Loma Waste Water Treatment Plant, South Bay WRP and North City WRP, and the ratio of City of San Diego's share of total flow enters into Metropolitan Sewerage System
	Emission Factor (MT CO2e/gallon)	Calculated by dividing Point Loma WWTP GHG emissions reported in Air Resources Board Mandatory GHG Reporting Program (ARB MRR) by Point Loma total flow	Calculated by dividing Point Loma WWTP and North City WRP GHG emissions reported in ARB MRR by total flow (ARB MRR reporting method changed in 2011)
Solid Waste	Activity (tons)	Waste disposed tonnage from the city reported in California Integrated Waste Management Board (CalRecycle)	Waste disposed tonnage from the city provided by City of San Diego Environmental Service Department
	Emission Factor (MT CH4/tons)	Mixed municipal solid waste emission factor 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

Optional GHG Emission Reporting

Emissions from In-boundary Landfills

The City of San Diego currently has one active landfill 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 emissions 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.

For the landfills that are required to report GHG emissions through EPA's Greenhouse Gas Reporting Program (EPA MRR), the reported emissions were used directly. 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 California Air Resources Board using the first order decay model recommended by the Intergovernmental Panel on Climate Change.

Table 24 2015 City of San Diego In-Boundary Landfill Emissions

Landfill	Status	Landfill Emission (MT CO_2e)	Source
West Miramar Sanitary Landfill	Active	205,886	2015 EPA Greenhouse Gas Reporting (EPA MRR)
North Miramar Sanitary Landfill	Closed in 1983	2,411	Closed in 2015 EPA MRR
South Chollas Sanitary Landfill	Closed in 1981	n/a	Discontinued reporting to EPA MRR in 2015
Arizona Street Landfill	Closed in 1974	10,066	Air Resources Board Landfill Emission Tool (ARB LET) result using waste received before closing
Mission Bay Landfill #1	Closed in 1959	5,805	ARB LET result using operation period 1952-1959 and waste-in-place at the end of 1990
Total	-----	**224,168**	-----

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 (2015), regardless of disposal location or method, while emissions from in-boundary landfills are emissions in the current year (2015) from waste that has already been in place at the landfills, regardless of where the waste was generated. Also, in 2015, 93% of the waste accepted at West Miramar Sanitary Landfill was from the City of San Diego (833,691 out of 888,196 tons). Some emissions would be double counted if directly adding up emissions from in-boundary landfills and waste disposal.

City of San Diego Government Operations GHG Inventory

To better support the actions to reduce emissions from city operations energy use and city fleet fuel use, GHG emissions from city operations including energy (electricity and natural gas) consumption and city fleet fuel consumption are tracked separately here.

Table 25 2015 City of San Diego Government Operations GHG Emission

Category	GHG Emissions (MT CO_2e)	Method of Calculation
City Operation Electricity Use	48,919	Electricity purchased from SDG&E, grossed up to include transmission & distribution losses multiplied by SDG&E emission factor in 2015
City Operation Natural Gas Use	21,707	Natural gas purchased from SDG&E (including used for heating/cooling and for electricity generation) multiplied by state average natural gas emission factor
City Fleet Fuel Consumption	36,236	Gasoline and diesel used for city fleet (including emergency and non-emergency vehicles) multiplied by state average fuel emission factors
Total	**106,863**	-----

All emissions from government operations, including the ones not tracked here, such as city office building water use and city staff commuting, are already integrated into the City of San Diego community-wide inventory. Therefore, emissions from government operations do not need to be added to community-wide inventory to calculate the total emissions.

D. Impact of the Climate Action Plan on jobs

Tackling climate change has created an opportunity for San Diego to do well for our environment while also boosting our economy. The CAP's five strategies could impact certain industry sectors of the San Diego job market. Each will ideally have a positive impact on the local and regional economy. Jobs in the fields related to the CAP strategies were estimated and industry reports from related fields were also consulted to estimate a baseline from which to measure future progress.

Utilizing data from the Bureau of Labor Statistics (BLS), 74 industries in San Diego County were categorized into the five CAP strategies. These results are presented in Figure 2, showing the total jobs for each strategy by year.

The BLS shows San Diego's regional job market has grown by 9.5 percent between 2010 and 2015, with job growth in industries related to the CAP strategies have grown at a slightly higher rate of 10.2 percent. This baseline analysis shows that CAP-related jobs have more potential for growth than many others in the region. Continued analysis of these trends should help understand impacts of the CAP on job growth and the economy in the future.

Concurrently, industry reports also show California experiencing job growth trends in CAP strategy related industries. Employment in California's advanced energy industry grew 18 percent in 2015, according to Advanced Energy Economy Institute. These jobs include work in electricity generation, electricity delivery and management, building efficiency, water efficiency, transportation, and fuel production and delivery. Advanced energy and clean technology industries are a large employer in the San Diego region, and especially in the city of San Diego, contributing to a majority portion of jobs associated with San Diego's CAP.

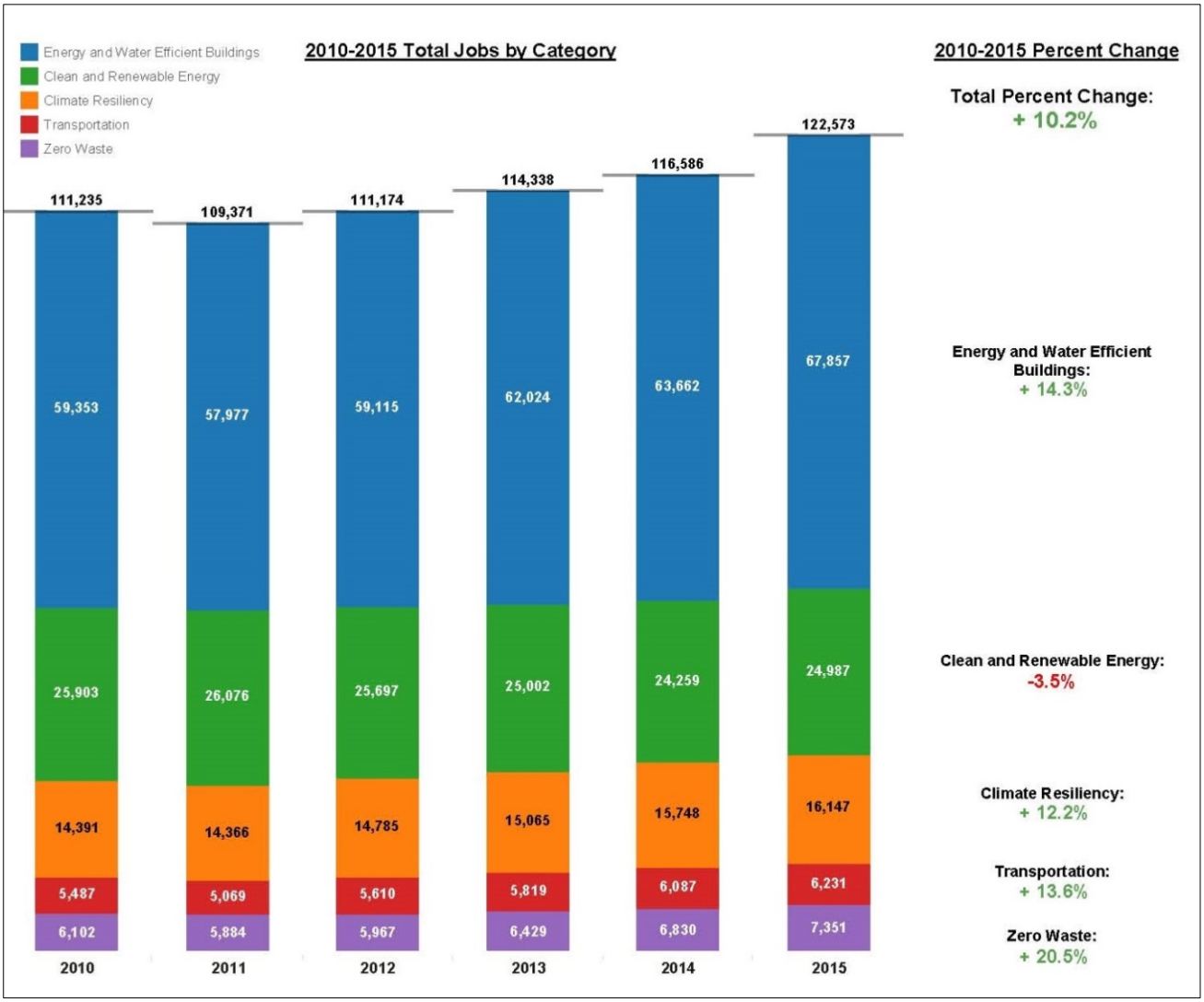

Figure 2: Total San Diego jobs by CAP strategy between 2010 and 2015

Further Analysis

In order to objectively identify a baseline of jobs and trends associated with the five CAP strategies, a qualitative review of reports associated with related industry sectors was conducted, as well as a quantitative analysis of job growth within associated related industry sectors over the past five years.

This 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 and is included in the strategy by strategy analysis below (table 27).

Energy and Water Efficient Buildings

Energy Efficiency makes up the largest share of advanced energy jobs at approximately 70 percent of the total advanced energy job market in California. In San Diego, energy and water efficient buildings are priorities for training and job growth. The City of San Diego ranks 27th for energy efficiency in the nation according to The American Council for an Energy-Efficient Economy's City Energy Efficiency Scorecard which ranks cities based on their comprehensive energy efficiency policies and programs.[1]

[1] The City Energy Efficiency Scorecard

According to the U.S. Census Bureau, in 2015, Energy and Water Efficient Buildings strategy related sectors had the most jobs per industry at about 3,400 jobs per industry. 20 industries were identified under the Energy and Water Efficient Building strategy, which included 507 occupations, which is the highest of any CAP sector. Furthermore, Energy and Water Efficient Buildings had the second highest growth rate from 2010 to 2015, at about 14.3 percent increase.

Clean and Renewable Energy

The solar energy industry grew 26 percent in San Diego in the past year only; keeping San Diego at the top as one of the prominent regions for solar jobs and installations in the nation. In 2015, the San Diego region was home to 8,300 solar jobs in 2015. Between 2014 and 2015, the San Diego region was expected to increase jobs by 11.5 percent. [2]

According to U.S. Census data, the Clean and Renewable Energy strategy related sectors have lost jobs between 2010 and 2015. Nuclear Electric Power Generation industries were included within the Clean and Renewable Energy sector, which is a potential explanation to the loss of jobs due to the shutdown of the San Onofre Nuclear Generating Station in San Diego County. Although the jobs have decreased from 2010 to 2015, the total individuals employed for Clean and Renewable Energy is the second highest of the CAP sectors.

Climate Resilience

Climate Resiliency encompasses programs that set the region up for success as threats of 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 all align to match with CAP goals.[3]

According to U.S. Census data, the Climate Resiliency strategy related sectors had the second highest number of jobs per industry in 2015.Furthermore, from 2010 to 2015, jobs related to Climate Resiliency grew by 12.2 percent, which is higher than the overall job market growth in San Diego.

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.[4]

According to U.S. Census data, between 2010 and 2015, the Transportation strategy related sectors had the lowest amount of jobs of the five CAP strategies. Although Transportation was low scoring in the amount of jobs, it had the third highest growth rate, right behind Energy and Water Efficient Buildings. Furthermore, Transportation had the lowest amount of occupations assigned to the sector.

Zero Waste

As zero waste and waste diversion become an increasingly popular 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 of achieve 75 percent waste diversion of discarded materials from landfills by 2020 and to achieve zero waste by 2040.

[2] Report: San Diego County Home to 8,300 Solar Jobs
[3] City of San Diego Climate Action Plan
[4] City of San Diego Climate Action Plan

As materials are recycled and diverted, as many as 75 new green jobs and recycling can create 10 new green jobs for every 100,000 tons of material diverted.[5]

According to U.S. Census data, between 2010 and 2015, Zero Waste strategy related sectors had the largest growth in individual jobs. As stated previously, Zero Waste has a lot of job growth opportunity due to the amount of jobs needed to divert and reduce waste in innovative ways. Furthermore, Zero Waste had the second lowest amount of industries and occupations identified to the sector.

Qualitative Sources

- 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
- Clean Energy: Labor Market Analysis Report Highlights
- Report: San Diego County Home to 8,300 Solar Jobs
- Priority Sectors: Workforce Initiatives in San Diego County
- City of San Diego Zero Waste Plan

Quantitative Methods

Data source: Economic Modeling Specialists International (Emsi) / www.economicmodeling.com. Emsi provided by the San Diego Regional Economic Development Corporation, September-October 2016.

Summary: Emsi identifies 1001 industries within the San Diego region. In order to identify a baseline of total jobs within the CAP strategies over the past five years, first the industries which corresponded with each CAP sector were identified. No one industry was categorized into multiple CAP sectors. Overall, 74, out of the 1001, industries were categorized into the five sectors; 20 industries in Energy and Water Efficient Buildings, 21 industries in Clean and Renewable Energy, 8 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 2015. These job totals were then used to identify the growth per CAP sector between 2010 and 2015. EMSI outputs <10 jobs for the occupations data, in order to process the data all <10 results were replaced with 10 jobs.

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, Nonemployer 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.

[5] City of San Diego Zero Waste Plan

Table 26 Industries within each CAP 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
New Multifamily Housing Construction (except For-Sale Builders)	Natural Gas Distribution		Support Activities for Rail Transportation	Solid Waste Landfill

Energy and Water Efficient Buildings	Clean and Renewable Energy	Climate Resiliency	Transportation	Zero Waste
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 27 Number of Jobs/Industry per CAP Sector 2010 to 2015

Jobs/Industry					
	Energy and Water Efficient Buildings	Clean and Renewable Energy	Climate Resiliency	Transportation	Zero Waste
2010	2968	1233	1799	422	509
2011	2899	1242	1796	390	490
2012	2956	1224	1848	432	497
2013	3101	1191	1883	448	536
2014	3183	1155	1969	468	569
2015	3393	1190	2018	479	613

Table 28 Number of Industries and Occupations per CAP Sector

Number of Industries/Occupations					
	Energy and Water Efficient Buildings	Clean and Renewable Energy	Climate Resiliency	Transportation	Zero Waste
Industries	20	21	8	13	12
Occupations	507	398	370	214	238

Table 29 Percent Change in jobs from 2010 to 2015

Percent Change in Jobs 2010-2015					
	Energy and Water Efficient Buildings	Clean and Renewable Energy	Climate Resiliency	Transportation	Zero Waste
2010-2011	-2.32	0.67	-0.17	-7.62	-3.57
2011-2012	1.96	-1.45	2.92	10.69	1.41
2012-2013	4.92	-2.70	1.90	3.71	7.73
2013-2014	2.64	-2.97	4.53	4.62	6.24
2014-2015	6.59	3.00	2.53	2.37	7.63
2010-2015	**14.33**	**-3.54**	**12.20**	**13.58**	**20.47**

Table 30 Total jobs in San Diego 2010 to 2015, compared to CAP related jobs

San Diego Entire Job Market			
	Total Jobs	Percent Change	Percent of CAP jobs of entire SD job market
2010	1,373,124		8.10%
2015	1,504,045		8.15%
2010-2015		9.5%	

E. Impact of Climate Action Plan on social equity

There is a natural synergy that exists between climate action and social equity. The effects of climate change can disproportionately affect underserved and low-income communities. It is therefore important to consider those communities while formulating and implementing solutions. Equity is fundamental for inclusive economic growth and development – a regional economy performs best when economic benefits are shared by all. When a San Diegan with a low or moderate income has better access to affordable transportation and lower utility bills, their resources can be redirected to other expenses, increasing economic activity throughout the region. By beginning to quantify the investments that bridge equity and sustainability the City of San Diego will identify ways to implement the Climate Action Plan in an inclusive and equitable manner, and to maintain a focus on social equity throughout the process.

With this inaugural Annual Report, the City has developed a pilot program to create a preliminary social equity lens for Climate Action Plan implementation. This first-year effort makes use of the City's Community Development Block Grant (CDBG) Program, a grant program for lower income San Diegans, to examine Climate Action Plan benefits to individuals and communities that are also most vulnerable to

climate-related hazards. Community stakeholders helped the City determine the best approach for collecting, quantifying and reporting data for this pilot assessment. This discussion also resulted in the creation of a sustainability-equity nexus area to help sort data (see map below). The areas highlighted in the map overlay both geographic areas identified by the CDBG program and the top 30% of the California Environmental Protection Agency's CalEnviroScreen[6] tool. The purpose of this nexus area was simply to provide a geographic area from which to analyze data and is not intended to be a policymaking tool.

It is important to note that CDBG funds are just a portion of the City budget. The metrics below do not represent all City actions or expenditures. The metrics below do represent actions within the geographic zone described above and represented in the map below.

Actions & Progress

- Invested over $450,000) of Community Development Block Grant (CDBG) Program funds to support the installation of photovoltaic solar systems for lower income households within the City
    - 68 photovoltaic solar systems were installed in homes owned by low to moderate-income residents
- Invested an estimated $235,000 ($236,285) of CDBG funds in improvements to increase the safety and energy efficiency for San Diego's lower homeowners.
    - Over 335 improvements were completed (e.g. smoke and carbon monoxide alarms, water efficiency improvements, water heater replacements, efficient lighting upgrades, etc.)
- Invested over $2.8 million of CDBG funds to support street improvements (e.g. new walkways/sidewalks, pedestrian countdown timers, traffic calming, curb ramps and traffic signal modifications) in the City's lower income communities.
- Over 9,500 solar permits applications received*
- Awarded contracts to replace 9.7 miles of water pipeline*
- During the first half of FY16, the City replaced 3.6 miles of cast iron water pipes*
- Replaced or rehabilitated 13.3 miles of sewer pipeline*

**Not funded by CDBG*

[6] http://oehha.ca.gov/calenviroscreen/report/calenviroscreen-30-draft

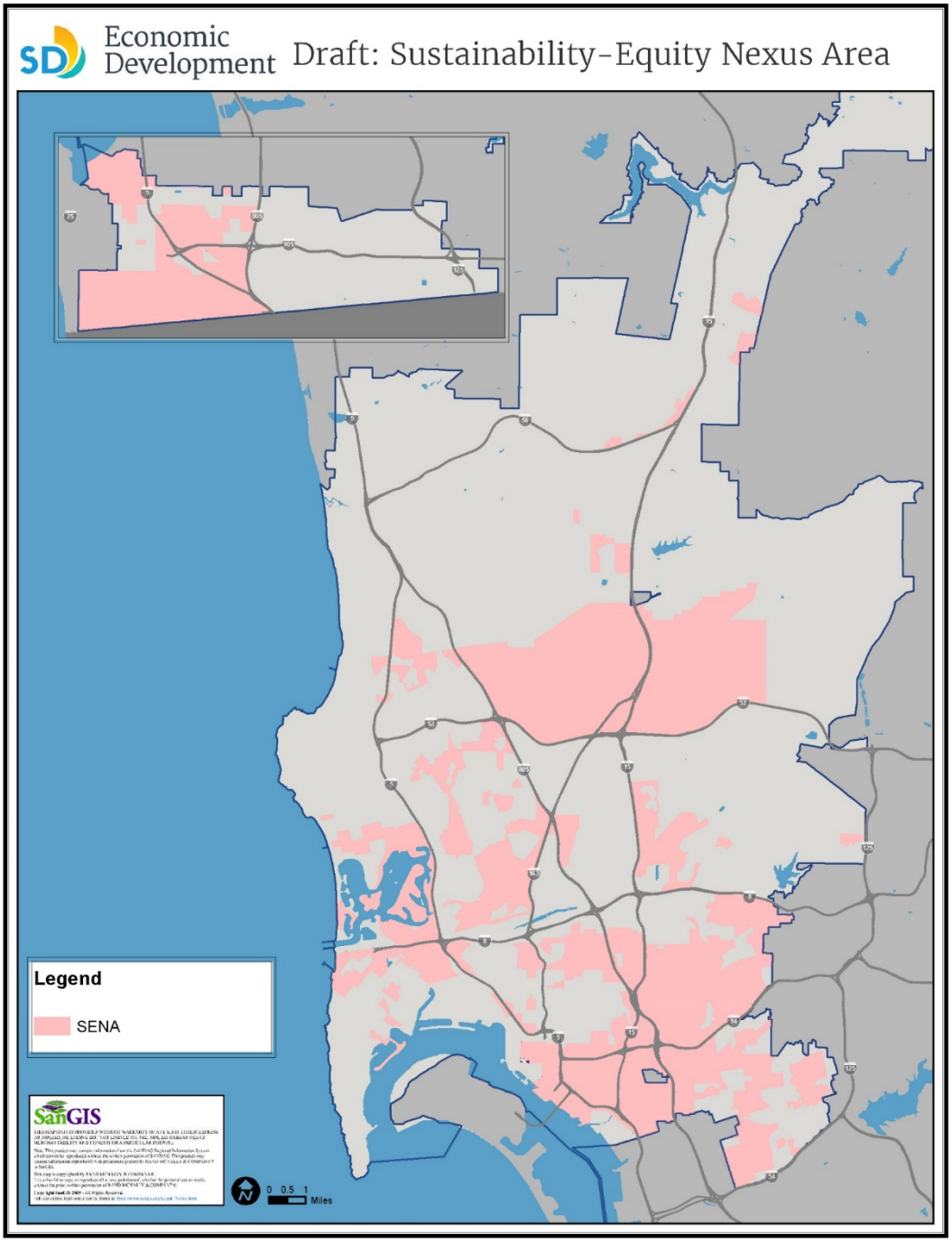

Figure 3 Geographic representation of a sustainability-equity nexus area (SENA)