Built Environment and Transportation Reduction Measure Quantification (Continued)

T-2.2					
Reduce New Non-Residential Development Vehicle Miles Traveled			**2020**	**2030**	**2050**
Passenger and LDT1 VMT *(excluding non-unincorporated County employee commute)*		1,654,960,756	1,906,820,493	2,186,461,667	2,426,351,442
New Passenger and LDT1 VMT since 2020			0	279,641,173	519,530,949
New Passenger VMT (since 2020) reduced from other measures					
	T-1.1		0	20,089,393	20,089,393
	T-1.2		0	8,109,480	8,109,480
	T-2.1		0	373,434	1,512,237
Adjusted New Passenger and LDT1 VMT (assumed to represent all new household VMT)			0	251,068,866	489,819,838
Percent of Household VMT for commuting (AASHTO 2013)		28%			
New County Commute VMT from Adjusted Passenger and LDT1 VMT since 2020			-	70,299,283	137,149,555
New Jobs in Unincorporated County since 2020				8,487	34,117
Annual VMT per employee				8,283	4,020
Target					
Target Percent Reduction in New Commute VMT starting in 2020			0%	15.0%	15%
Annual VMT reduced under T-2.2			-	10,544,892	20,572,433
Target Average Annual VMT per employee				7,041	3,417

CAPCOA Percent Commute VMT reduction from TRT-1, TRT-2, and TRT-3

CAPCOA TRT-1 Percent Shift in Vehicle Mode Share of Commute Trips for Participating Employees (Commute Trip Reduction Programs - Voluntary) - Low Density Suburb	5.2%
CAPCOA TRT-2 Percent Shift in Vehicle Mode Share of Commute Trips for Participating Employees (Commute Trip Reduction Programs with Monitoring)	21.0%
CAPCOA TRT-3 Percent Shift in Vehicle Mode Share of Commute Trips with a Ride Sharing Program - Low Density Suburb	5%

	2020	2030	2050
Percent of New Employees eligible/participating in TDM programs (Required to meet the Target Percent Reduction in Commute VMT)		100%	100%
Commute Trip Reduction Programs - Voluntary (TRT-1)	0%	33%	33%
Commute Trip Reduction Programs - Monitored (TRT-2)	0%	62%	62%
Commute Trip Reduction Programs - Ride Sharing (TRT-3)	0%	5%	5%
Total Participation Rate	0%	100%	100%
Emissions per mile for Passenger and LDT1 vehicles (MTCO2e/mi)	2.90E-04	2.07E-04	1.83E-04
GHG Reductions from T-2.2 (MTCO2e)	-	2,180	3,762

Built Environment and Transportation Reduction Measure Quantification (Continued)

T-2.3				
Reduce County Employee Vehicle Miles Traveled	**2014**	**2020**	**2030**	**2050**
County employee commute miles (scaled by change in employee forecast) (VMT)	155,043,720	156,969,260	160,178,494	166,596,960
County Employee Count Forecast	19,205	19,444	19,841	20,636
Emissions per mile for Passenger and LDT1 vehicles (MTCO2e/mi)	0.00E+00	2.90E-04	2.07E-04	1.83E-04
Forecasted emissions from County Employee Commuting (MTCO2e)	-	45,595	33,119	30,465
Percent reduction in employee commute miles **below 2014 levels**		0%	20%	20%
Annual employee commute miles after reduction (VMT)		156,969,260	124,034,976	124,034,976
Annual reduction in employee commute miles from forecasts (VMT)		-	36,143,517	42,561,984
Forecasted commute emissions after reduction (MTCO2e)		45,595	25,646	22,682
Forecasted commute emissions after reduction (MTCO2e)		45,595	22,440	19,847
GHG Reductions from T-2.3 (MTCO2e)		-	7,473	7,783

T-2.4					
Shared and Reduced Parking in New Non-Residential Development		**2014**	**2020**	**2030**	**2050**
Passenger and LDT1 VMT (excluding non-unincorporated County employee commute)		1,654,960,756	1,906,820,493	2,186,461,667	2,426,351,442
New Passenger VMT (since 2020)			0	279,641,173	519,530,949
New Passenger VMT (since 2020) reduced from other measures					
	T-1.1		0	20,089,393	20,089,393
	T-1.2		0	8,109,480	8,109,480
	T-2.1		0	373,434	1,512,237
	T-2.2		0	10,544,892	20,572,433
Adjusted New VMT			0	240,523,974	469,247,405
Percent of Household VMT for commuting (AASHTO 2013)	28%				
New Commute VMT			-	67,346,713	131,389,273
Reductions in Commute VMT from other measures not included as the percent reduction is from the forecasted commute VMT					
Target Percent VMT reduction from New Commute VMT			0%	10%	10%
Calculated Percent Reduction in Parking Spaces at new Non-residential land uses to achieve the target percent reduction (CAPCOA PDT-1)			0%	20%	20%
VMT reduction under this measure			-	6,734,671	13,138,927
Emissions per mile for Passenger and LDT1 vehicles (MTCO2e/mi)			0.00029047	0.000206765	0.000182867
GHG Reductions from T-2.4 (MTCO2e)			-	1,392	2,403

Built Environment and Transportation Reduction Measure Quantification (Continued)

T-3.1	MEASURE REMOVED			

T-3.2				
Use Alternative Fuels in County Projects	**2014**	**2020**	**2030**	**2050**
Measure assumes the level of conversion from diesel to alternative fuels is proportional to level of emissions reductions from such actions Measure also assumes that any emissions related to additional electricity use from converted equipment are negligible. Emissions from electricity use would decrease in future years due to the increasing renewable energy mix in the electricity generation.This measure only applies to construction equipment in the County fleet.				
County-Only (Municipal) Construction Equipment Emissions (MTCO2e) from CRIS database and Municipal Forecast	431	381	364	369
Percent County construction fuel offset due to conversion of equipment to renewable diesel or electric fuel sources		0%	100%	100%
Construction Equipment Emission offset by renewable and electric conversions (MTCO2e)		-	364	369
Diesel fuel emission factors (kg CO2/gal) (The Climate Registry 2016)	10.21			
Approximate diesel fuel use offset by electric conversions (gal)		-	35,653	36,143
GHG Reductions from T-3.2 (MTCO2e)		-	364	369

Built Environment and Transportation Reduction Measure Quantification (Continued)

T-3.3				
Develop a Local Vehicle Retirement Program	**2014**	**2020**	**2030**	**2050**
Measure assumes any replaced vehicles are replaced with the average light-duty vehicle in the same year, as a conservative approach. Newer vehicles would have even lower emission factors.			0.38	
			4,248.01	
Light Duty Vehicles MY1996 or older County-wide (LDA, LDT1, LDT2, and MDV)				
Vehicle Population (EMFAC2014 forecasts)			28,600	
Annual VMT			97,786,270	
Annual VMT per vehicle			3,419	
Light Duty Vehicles MY1997 or newer County-wide (LDA, LDT1, LDT2, and MDV)				
Vehicle Population (EMFAC2014 forecasts)			2,581,230	
Annual VMT			27,086,935,423	
Annual VMT per vehicle			10,494	
Average Emission Factor for Light Duty Vehicles MY1996 or older in San Diego County (g CO2/mi)			396	
Average Emission Factor for Light Duty Vehicles MY1997 or older in San Diego County (g CO2/mi)			214	
CO2 to CO2e Conversion factor used in inventory for transportation emissions			1.01	
Average Emission Factor for Light Duty Vehicles MY1996 or older in San Diego County (g CO2e/mi)			400	
Average Emission Factor for Light Duty Vehicles MY1997 or older in San Diego County (g CO2e/mi)			216	
Total Number of MY1996 vehicles removed			1,600	
Replacement Rate (based on 2013 ARB Survey Report) (https://www.arb.ca.gov/msprog/aqip/EFMP_Update_Staff_Report_November_2013.pdf) page 34			48%	
Annual VMT from retired vehicles			5,470,653	
Annual VMT from replacement vehicles			16,790,094	
Emissions from old vehicles (MTCO2e)			2,187	
Emissions from replaced vehicles (MTCO2e)			1,742	
Emissions Reductions (MTCO2e)			446	
GHG Reductions from T-3.3 (MTCO2e)			446	

T-3.4				
Reduce the County's Fleet Emissions	**2014**	**2020**	**2030**	**2050**
Forecasted BAU Emissions by Fuel from County Fleet Operations (MTCO2e)	2014	2020	2030	2050
CNG	40	41	42	43
Diesel	4,061	3,916	3,779	3,860
Gasoline	22,063	19,985	14,544	13,152
Total	26,164	23,942	18,365	17,055

Fuel Type	Scaling Factors for business-as-usual forecasted emissions
CNG	No change
Diesel	Includes additional construction emissions from capitol projects anticipated through 2020. Assumes emissions constant after 2020.
Gasoline	No change

	2020	2030	2050
Percent reduction in vehicle fleet emissions below future forecasts years	10%	20%	20%
Target fleet emissions after reduction (MTCO2e)	21,548	14,692	13,644
Annual reduction in fleet emissions from forecast (MTCO2e)	2,394	3,673	3,411
GHG Reductions from T-3.4 (MTCO2e)	2,394	3,673	3,411

T-3.5			
Install Electric Vehicle Charging Stations	**2020**	**2030**	**2050**
The reductions calculated for this measure are assumed to achieve reductions above and beyond those forecasted by the State.			
EMFAC2014 Outputs for San Diego County			
Total Vehicle Miles per day (All vehicle types)	82,315,741	89,623,697	100,696,455
VMT/year	30,045,245,368	32,712,649,577	36,754,206,224
Number of EVs	28,999	188,321	330,314
Unincorporated San Diego County Adjustments			
SANDAG unincorporated VMT/year	3,240,906,504	3,546,863,373	3,945,087,154
Unincorporated percentage of regional VMT	11%	11%	11%
Number of EVs in Unincorporated County	3,128	20,419	35,455
10% of EVs	313	2,042	3,545
10% of EVs (rounded)	310	2,040	3,550
Emissions from EV Charger Usage			
Number of Chargers installed by 2030 (no additional targets set for 2050)	-	2,040	2,040
Number of Connections per Charge	0	2	2
Average Charging hours per Connection per day	0	3	3
Number of hours of charge per year for all chargers (h/year)	-	4,169,760	4,169,760
Average Efficiency of EV LDV (kWh/100-mi) (1)	34	34	34
GHG Emissions per MWh in San Diego (MTCO2e/MWh)	0.260	0.237	0.237
Charger Power (kW) (Level 2 - High) (2)	6.6	6.6	6.6
Charged amount (kWh)	-	27,520,416	27,520,416
EV emissions (MT CO2e)	-	6,526	6,526
Source:			
(1) http://www.fueleconomy.gov/feg/download.shtml (Without EV efficiency forecasts, EV efficiency assumed to be the same for all future years)			
(2) https://www.driveclean.ca.gov/pev/Charging.php			
Emissions from Equivalent Gasoline/Diesel Vehicles			
Equivalent Annual VMT (mi)	-	81,837,791	81,837,791
Avg GHG Emissions per mi for Gasoline/Diesel Passenger and LDT1 vehicles (gCO2/mi) (EMFAC2014)	296	224	201
CO2 to CO2e Conversion factor used in inventory for transportation emissions	1.01	1.01	1.01
GHG Emissions per mi for average gasoline LDV (gCO2e/mi)	299	226	203
Equivalent Gasoline emissions (MT CO2e)	-	18,514	16,626
Emissions Reductions			
Emissions reductions (MT CO2e)	-	11,987	10,100
Emissions reductions per hour of charge (kg CO2e/h)		2.9	2.4
GHG Reductions from T-3.5 (MTCO2e)	-	11,987	10,100

T-4.1			
Establish a Direct Investment Program	**2020**	**2030**	**2050**
Calculation based on emissions reductions from the forecast needed to meet the 2030 target with all other measures applied.			
As of January 26, 2018, the revisions shown for E-1.2 resulted in a decrease in the DI reduction for 2030 by 1,842 MTCO2e.			
GHG Reductions from T-4.1 (MTCO2e)	-	140,845	-

Energy Reduction Measure Quantification

Assumptions

	2020	2030	2050
San Diego County Average Electricity Emissions Factor (MTCO2e/MWh)	0.260	0.237	0.237
SD County Average Electricity EF with E-2.1	0.000	0.000	0.000
SD County Local Government Electricity Emission Factor (MTCO2e/MWh)	0.317	0.237	0.237
Natural Gas Emissions Factor (MTCO2e/therm)		0.00685	
Propane Emissions Factor (MTCO2e/therm)		0.00627	

E-1.1 **MEASURE REMOVED**

E-1.2

Use Alternatively-powered Water Heaters in Residential Development	**2020**	**2030**	**2050**

Note: Only homes not connected to natural gas utilities are allowed to install electric water heaters (See 2016 California Energy Code, Title 24 Part 6). Measure is conservative in that it assumes no water heaters are converted to solar, which would reslut in more GHG reductions.

As of January 26, 2018, E-1.2 has been revised to reflect the impacts of this measure on new construction. Previously, water heater improvements in new construction were assumed to be accounted for in E-1.1. Without E-1.1, the credits associated with usage of more efficient water heaters in new construction have been added to the calculation of E-1.2, resulting in an increase of approximately 1,842 MTCO2e of reductions.

Percent of natural gas use in homes by end use in California (assumed to apply to propane -only homes also)	***2009***
Space Heating	25%
Water Heating	34%
Cooking	25%
Other	16%

Water heating usage by fuel type	***2009***
Natural Gas	85%
Electric	11%
Propane	4%

Source: EIA 2009. http://www.eia.gov/consumption/residential/data/2009/

Note: This is based on most recent data from the US. Energy Information Administration as of May 2017. There was a survey done in 2015, but the breakdown of fuel use by end use will not be available until 2018.

https://www.eia.gov/consumption/residential/data/2015/index.php?view=consumption

Average age of natural gas water heater at replacement (years) 13

	Percent of existing NG/Propane water heaters by age (EIA 2009)	**Assumed percent of existing NG/Propane water heaters replaced by this year by age**		
	2009	***2020***	***2030***	***2050***
Less Than 2 Years	16%	0	100%	100%
2 to 4 Years	16%	0	100%	100%
5 to 9 Years	30%	50%	100%	100%
10 to 14 Years	18%	100%	100%	100%
15 to 19 Years	7%	100%	100%	100%
20 Years or More	14%	100%	100%	100%

	2014	***2020***	***2030***	***2050***
Annual Residential Natural Gas Use in San Diego with Legislative Reductions (therms)	28,860,437	30,197,611	32,189,665	33,864,286
Annual Residential Propane Gas Use in San Diego with Legislative Reductions (therms)	1,577,792	1,650,894	1,759,799	1,851,350
Total Therms	30,438,228	31,848,505	33,949,464	35,715,636

Energy Reduction Measure Quantification (Continued)

E-1.2 (Continued)

		2020	2030	2050
Percent of replacement water heaters that are electric (only applicable to households that do not have natural gas connections per 2016 Energy Code)		0%	5%	5%
Percent of replacement water heaters that are natural gas tankless		0%	95%	95%
Natural Gas Savings from not using traditional Water Heaters in new construction				
Natural gas usage in new water heaters (No Action) (therms)			1,120,622	1,684,302
Average annual natural gas usage per water heater (therms/heater) (assuming 64 gal/year and a 0.61 energy factor) (https://energy.gov/eere/femp/energy-cost-calculator-electric-and-gas-water-heaters-0#output)	244			
Estimated equivalent number of water heaters replaced			4,593	6,903
Natural Gas Savings from avoidance of traditional water heaters in new construction (therms)			1,120,622	1,684,302
GHG Reductions from Natural Gas Savings (MTCO2e)			7,676	11,537
Natural Gas Savings from replacement of Existing Water Heaters				
Natural gas usage in existing water heaters (No Action) (therms)			9,714,461	9,714,461
Average annual natural gas usage per water heater (therms/heater) (assuming 64 gal/year and a 0.61 energy factor) (https://energy.gov/eere/femp/energy-cost-calculator-electric-and-gas-water-heaters-0#output)	244			
Estimated equivalent number of water heaters replaced			39,813	39,813
Natural Gas Savings from removal of traditional water heaters in existing homes (therms)			9,714,461	9,714,461
GHG Reductions from Natural Gas Savings (MTCO2e)			66,544	66,544
Propane Savings from replacement of Existing Water Heaters				
Propane usage in existing water heaters (No Action) (therms)			531,087	531,087
Propane usage in **existing** water heaters after replacement (therms)			-	-
Propane Savings from replacement of Existing Water Heaters (therms)			531,087	531,087
GHG Reductions from Propane Savings (MTCO2e)			3,329.91	3,329.91
Additional emissions from electricity use in new water heaters in Existing Propane-only homes				
Therms needed to heat 45 gallons of hot water (61% efficiency)	0.333333			
kWh needed to heat 45 gallons of hot water (99% efficiency)	6.6			
kwh per therm conversion for water heating	19.8000198			
Total electricity use needed to offset propane water heating (kWh)			525,776	525,776
Additional GHG emissions from Electricity Use (MTCO2e)			125	125
Additional emissions from natural gas use in new NG tankless water heaters in Existing NG Homes and New Construction				
Percent savings relative to storage tank natural gas water heaters (Average)	20%	*Source: https://energy.gov/energysaver/tankless-or-demand-type-water-heaters*		
Total natural gas use needed for new NG tankless water heaters (therms)			8,234,663	8,663,060
Additional GHG emissions from new NG Use (MTCO2e)			56,407	59,342
GHG Reductions from E-1.2 (MTCO2e)			21,018	21,945

E-1.3 **MEASURE REMOVED**

Energy Reduction Measure Quantification (Continued)

E-1.4				
Reduce Energy Use Intensity at County Facilities	**2014**	**2020**	**2030**	**2050**
Propane and diesel use is not included in these calculations because the County primarily uses these fuels for facilities in emergency generators.				
Electricity Use at County Facilities County-wide (MWh)				
Facility Type				
Airports	755	771	797	849
Buildings & Other Facilities	133,837	134,387	135,305	137,139
Public Lighting	7,594	7,879	8,354	9,305
Wastewater/Water Facilities	739	802	897	977
Total Electricity	142,925	143,840	145,353	148,270
Total Electricity in the unincorporated County (from CRIS data)	44,051	44,559	45,394	46,956
Percent of Electricity use in the unincorporated County	31%	31%	31%	32%
Natural Gas Use at County Facilities (therms)				
Airports	6,730	6,954	7,329	8,077
Buildings & Other Facilities	2,334,004	2,341,919	2,355,110	2,381,492
Total Natural Gas	2,340,734	2,348,873	2,362,438	2,389,568

Facility Type	Forecasting Methodology
Airport	County plans to construct accessory facilities at the Palomar Airport, however this project has not yet been funded through 2020. Assume no change in airport operations in future years.
Building & Other Facilities	County's 5-year plan through 2020. Assumed growth rate continues through 2050.
Lighting	County's 5-year plan through 2020. Assumed growth rate continues through 2050.
Wastewater/Water Facilities	County Population

Percent reduction in energy use **below 2014 levels**	10%	20%	20%
Target Annual Electricity Use (MWh)	128,633	114,340	114,340
Target Annual Natural Gas Use (Therms)	2,106,661	1,872,587	1,872,587
Annual Electricity Reductions (MWh)	15,207	31,013	33,930
Annual Electricity Reductions in the unincorporated County (MWh)	4,711	9,685	10,745
Annual Natural Gas Reductions (therms)	242,212	489,851	516,981
Emissions savings from reduced electricity (MTCO2e)	4,827	7,346	8,037
Emissions savings from reduced natural gas (MTCO2e)	1,659	3,355	3,541
GHG Reductions from E-1.4 (MTCO2e)	6,486	10,702	11,578

Energy Reduction Measure Quantification (Continued)

E-2.1					
Increase Renewable Electricity				**2020**	**2030**	**2050**
Background Calculations						
Forecasted County electricity from existing and new development (MWh)				2,633,427	2,788,644	3,051,096
Reductions from other measures (MWh)		*Existing or New*	*Residential or Non-residential*			
	E-1.1	*New only*		MEASURE REMOVED	0	0
	E-1.2	*New and Existing*			-526	-526
	E-1.3	*Existing Only*		MEASURE REMOVED	0	0
	E-1.4	*New and Existing (County only) Excludes municipal electricity use outside the County*			9,685	10,745
	E-2.3	*Existing Only*			1,097,768	1,097,768
	E-2.4	*New and Existing (County only) Excludes municipal electricity use outside the County*			7,142	7,242
	T-1.1	*New only*			4,595	4,595
	T-1.2	*New only*			169	1,855
	T-3.1	*New and Existing*			2,611	2,647
	W-1.3	*Excludes electricity use outside the County*			73	73
	W-2.1	*New and Existing*			10	10
	A-1.2	*New and Existing*			-1	-6
Total Reductions from Other Measures					1,121,526	1,124,403
Note: W-1.1, A-1.1, T-3.2, and T-3.3 were not included. W-1.1 savings are already included in E-1.1. A-1.1, T-3.2, and T-3.3 are not clear as to what part of the reductions are coming from electricity vs. other fuels, so it is more conservative to assume no electric replacements are being made.						
Non-Renewable Emissions from Local Utility (MTCO2e/MWh)					0.474	0.474
Estimated Renewable Energy Program (REP) Emission Factor (MTCO2e/MWh)					-	-
Average SDGE Emission Factor (MTCO2e/MWh)					0.237	0.237
REP Participation Rate					80%	90%
REP Renewable Mix					100%	100%
REP Member Participation Rate in 100% renewable option					6%	15%
City of Fairfax's current participation rate with similar subsidy program for Deep Green which is limited to 100 households			*6%*			
Overall Renewable Mix of REP (includes those choosing the 100% renewable option)					100%	100%
Adjusted County Electricity Use (MWh)					1,667,118	1,926,693
Electricity Use of Participating Customers (MWh)					1,333,694	1,734,024
Emissions related to Electricity Use from participating customers without REP program (MTCO2e)					316,269	411,202
Emissions related to Electricity Use from participating customers with REP program (MTCO2e)					-	-
Emissions Reductions (MTCO2e)					316,269	411,202
GHG Reductions from E-2.1 (MTCO2e)					316,269	411,202

E-2.2	**MEASURE REMOVED**

Energy Reduction Measure Quantification (Continued)

E-2.3

Install Solar Photovoltaic in Existing Homes

This assumes that buildings with solar would opt out of the Renewable Energy Program (REP). (See measure discounts in E-2.1). Also assumes that permitted solar panels are constructed six months after permits are approved. An assumption of 5.06 kW per home allows the calculated electricity generated by solar per existing home to match the average energy use per existing home in 2020. With additional improvements in energy efficiency from other measures, some homes may still see lower energy use compared to solar electricity generation post-2020.

Solar permits approved from July 2013 through January 2017 for **existing and new construction**	Total kW	Total Non-residential kW	Total Residential kW	Number of Residential Permits
Fiscal Year 13/14	32,680	0	32,680	4,583
Fiscal Year 14/15	57,359	8,854	48,505	6,165
Fiscal Year 15/16	70,617	7,149	63,468	8,674
Fiscal Year 16/17 (through January 2017)	27,474	2,374	25,100	3,394
Total	188,130	18,377	169,753	22,816

Annual kWh per kW in San Diego County	1,665
Average solar size per residence based on average electricity demand per existing household as of 2014 (kW)	5.06

Calculating Residential solar permits for **new construction only** with only information on number of new building permits.
Assume all new homes construct minimum solar requirement as a conservative approach.

Number of New Home Building Permits	Custom Homes	Tract Homes	Mobile Homes (Private Lot)
Fiscal Year 13/14	298	218	39
Fiscal Year 14/15	351	292	29
Fiscal Year 15/16	380	256	45
Fiscal Year 16/17 (through January 2017)	206	53	29
Total	1,235	819	142
Size per system (kW)	5.06	5.06	5.06
Annual electricity generated per system (kWh)	8,433	8,433	8,433

Assumed Solar Panel Size if all New Construction installed Solar (kW)	Total
Fiscal Year 13/14	2,810
Fiscal Year 14/15	3,403
Fiscal Year 15/16	3,448
Fiscal Year 16/17 (through January 2017)	1,458
Total	11,120

Source: County of San Diego 2017. NREL PV Watts Calculator

Energy Reduction Measure Quantification (Continued)

E-2.3 (Continued)

Calculated Size of **residential** solar permits approved from July 2013 through January 2017 for **existing buildings only**	kW	Months	Number of Existing Residential Permits
Fiscal Year 13/14	29,870	12	4,028
Fiscal Year 14/15	45,102	12	5,493
Fiscal Year 15/16	60,020	12	7,993
Fiscal Year 16/17 (through January 2017)	23,642	7	3,106
Total	158,633	43	20,620
Average annual size	44,270	N/A	N/A

	2014-2017	2018-2019	2020-2029	2040-2050
Target annual number of homes (residential permits approved) within these years	5,754	10,027	8,200	-
Target annual size of solar permits for **existing residential** buildings approved within these years (kW)	44,270	50,773	41,523	-
Size of solar permits approved within these years (kW)	177,079	101,547	415,229	
Installation rate: Percent of permitted solar panel actually constructed	95%			
		2020	2030	2050
Cumulative size of all rooftop solar systems in operation from 2014 (kW)		264,695	659,162	659,162
Average solar size per residence (kW/unit)		5.06	5.06	5.06
Target cumulative number of existing residential units with solar since 2014		52,273	130,175	130,175

		2020	2030	2050
Annual kWh generated per kW of solar PV in San Diego County	1,665			
Annual Electricity Generated by new Solar PVs from new permits in existing residences (MWh)		440,822	1,097,768	1,097,768
Feasibility Assessment				
Existing Electricity Usage in Residential land uses (MWh)		1,377,278	1,377,278	1,377,278
Electricity Reductions from Existing Residential land uses from other Measures (MWh) (excludes measures that only affect Non-residential, new construction, or any energy use not used on existing residential land uses, such as water consumption)				
E-1.2		0	-526	-526
Adjusted Electricity Usage from Existing Residential land uses (MWh)		1,377,278	1,377,803	1,377,803
Number of Existing Residential units		163,354	163,354	163,354
Electricity Usage per Existing Residence (MWh/residence)		8.43	8.43	8.43
Number of Existing Residences with Solar under this measure		52,273	130,175	130,175
Electricity use in participating residences (MWh)		440,729	1,097,954	1,097,954
Annual Electricity Generated by new Solar PVs from new permits (MWh)		440,822	1,097,768	1,097,768
Unused electricity generated (MWh)		94	(186)	(186)
Percent of electricity sent back into grid		0%	0%	0%
Percent of Electricity use in Existing Homes offset by solar (Feasibility Check)		**32%**	**80%**	**80%**
GHG Reductions from E-2.3 (MTCO2e)		114,571	260,322	260,322

E-2.4

Increase Use of On-Site Renewable Electricity Generation for County Operations	**2020**	**2030**	**2050**
County electricity use after the implementation of E-1.4 (MWh)	128,633	114,340	114,340
Percent of renewable electricity generated on-site	10%	20%	20%
Electricity offset (MWh)	12,863	22,868	22,868
GHG Reductions from E-2.4 (MTCO2e)	4,083	5,417	5,417

Solid Waste Reduction Measure Quantification

SW-1.1	
Increase Solid Waste Diversion	

See additional quantification on separate sheets.

From implementation of Zero Waste diversion program (80% diversion)

		Source
Baseline		
Total Unincorporated Waste Accepted by Landfills in 2014 (wet short tons)	449,323	Unincorporated County of San Diego 2014 Greenhouse Gas Emissions Inventory and Projections
Total Unincorporated Waste Accepted by Landfills in 2030 (Post-diversion) (tons)	545,308	Scaled with population
Organics Content in Unincorporated SD County	66%	Calculated from CalRecycle Data. Date unreported.
Total Unincorporated Waste Accepted by Landfills in 2030 (Post-diversion) - organics only (tons)	362,486	
Current Diversion Rate	62%	CalRecycle
Total Unincorporated Generated Waste (tons)	1,435,022	Calculated
Target		
Target Diversion Rate	80%	Assumed
Target Disposal Tonnage under 80% diversion rate	287,004	Calculated
Target Diverted Tonnage under 80% diversion rate	1,148,018	Calculated
Waste disposal reduction under 80% diversion rate compared to baseline (ton)	258,304	Calculated
Organics content in reduced waste	60%	Estimated from HF&H Calculations
Additional Diverted waste generation under 80% diversion rate - organics only (ton)	154,483	Calculated
Reduction in Organics		
Percent reduction in organics compared to baseline	43%	Calculated. Assume that emissions are proportional to organics content in waste

Forecasted Emissions Reductions

	2030	2050
GHG Emissions from Waste Disposal (MTCO2e)	185,492	201,915
Emissions reductions from SWP (MTCO2e)	79,052	86,052

	2020	2030	2050
GHG Reductions from SW-1.1 (MTCO2e)	-	79,052	86,052

Water and Wastewater Reduction Measure Quantification

Assumptions

	2020	2030	2050
San Diego County Average Electricity Emissions Factor (MTCO2e/MWh)	0.302	0.237	0.237
Natural Gas Emissions Factor (MTCO2e/therm)	0.00685		

W-1.1

Increase Water Efficiency in New Residential Development

Note that this measure will not be in effect until after 2020.

	Mandatory Reqmt/ Standard Equivalent	Measure Reqmt/Energy Star Rating	Requirement Metric
Kitchen Faucet Flow Rate (gal per minute)	1.8	1.5	Flow Rate
Dishwasher water use (gal/cycle)	5	3.5	Energy Star Appliance - standard size
Dishwasher energy use (kWh/year)	307	270	Energy Star Appliance - standard size
Clotheswasher water use (gal/cycle)	16.82	9.25	Energy Star Appliance - 2.5 cu-ft front loading
Clotheswasher energy use (kWh/cycle)	7.93	5.95	Energy Star Appliance

Kitchen faucet water use per day per household with dishwasher (HH) (minutes)	5	Assumption based on water usage used for dishwashing and standard flowrate: https://water.usgs.gov/edu/qa-home-percapita.html. Assumes water is also used for washing produce, cooking, and drinking.
Average dishwasher cycles per unit per year	215	https://www.energystar.gov/products/appliances/dishwashers/key_product_criteria
Average dishwasher cycles per year per HH	215	
Average American family wash loads per year	300	https://www.energystar.gov/products/appliances/clothes_washers
Average clotheswasher cycles per year per HH	300	

	2014	2020	2030	2050
Households in Unincorporated San Diego County	162,805	163,354	174,741	204,604
Number of new households since 2014		549	11,936	41,799
Activity in New Households Only				
Water use with standard equipment (MG/year)				
Kitchen Faucets			39	137
Dishwashers			13	45
Clotheswashers			60	211
Total			112	393
Water use with Tier 1 equipment (MG/year)				
Kitchen Faucets			33	114
Dishwashers			9	31
Clotheswashers			33	116
Total			75	262
Water Savings (MG/year)				
Kitchen Faucets			7	23
Dishwashers			4	13
Clotheswashers			27	95
Total			37	131
Emissions per gallon of water (MTCO2e/MG) (see calculation in measure W-2.1)			2.31	2.31
GHG Reductions from W-1.1 (MTCO2e)	**For water reductions only**	-	87	303

Note that this measure will not be in effect until after 2020.

Electricity use with standard equipment (kWh/year)				
Dishwashers			3,662,284	12,824,625
Clotheswashers			28,408,473	99,481,091
Total			32,070,757	112,305,716
Electricity use with Tier 1 equipment (kWh/year)				
Dishwashers			3,222,810	11,285,670
Clotheswashers			21,306,355	74,610,818
Total			24,529,165	85,896,488
Electricity Savings (kWh/year)				
Dishwashers			439,474	1,538,955
Clotheswashers			7,102,118	24,870,273
Total			7,541,592	26,409,228
GHG Reductions from W-1.1 (MTCO2e)	**Assumed to be included in E-1.1**	-	1,788	6,263

Water and Wastewater Reduction Measure Quantification (Continued)

W-1.2	MEASURE REMOVED			
W-1.3				
Reduce Potable Water Consumption at County Facilities	**2014**	**2020**	**2030**	**2050**
Imported Potable water consumption at all County facilities (HCF)	622,568			
Imported Potable water consumption at all County facilities (Million gallons)	466	472	481	501
Forecasting method: Employee growth				
County Employee Count Forecast	19205	19,444	19,841	20,636
Electricity Use from Potable Water Consumption (MWh)	4,988	5,049	5,153	5,359
Electricity intensity per million gallons of imported potable water (includes conveyance, treatment, and distribution) (Average for the County)				
Water Activity	*kWh/MG*			
Upstream Supply and Conveyance	*9,727*			
Local water distribution	*292*			
Conventional water treatment	*684*			
Total (kWh/MG)	*10,703*			
Total (MWh/MG)	*10.70*			
Percent reduction in potable water consumption at County facilities **below 2014 levels**		15%	20%	20%
Water use forecast with water reduction (MG)		396	373	373
Electricity Use with water reduction (MWh)		4,239	3,990	3,990
Difference in electricity use (MWh)		810	1,163	1,369
GHG Reductions from W-1.3 (MTCO2e)		244	276	325
Electricity savings from local water distribution and treatment (MWh) to calculate E-2.1		58	73	73

Water and Wastewater Reduction Measure Quantification (Continued)

W-2.1

Increase Rain Barrel Installations

Note: Rainwater catchment would only be used for landscaping uses.

Background and Assumptions	2014	2020	2030	2050
Modified Unincorporated County Population	454,599	493,604	551,712	600,560
Water Use (million gallons)	45,678	49,597	55,436	60,344
Emissions from water use (MTCO2e)	134,269	125,616	128,104	139,446
Emissions per gallon (MTCO2e/MG)		2.53	2.31	2.31

Water Demand		2020	2030	2050
Landscaping water demand		16,972	18,970	20,649
Total roof sqft in County (see below)		116,938,533	130,255,005	144,445,872
Annual landscaping water demand per roof sqft (gal/sqft)		145	146	143
Annual landscaping water demand per barrel (see below) (gal/sqft)		72,568	72,818	71,478

Rain Barrel Savings				
Annual Rainfall in San Diego, CA (inches) (height per any unit area)	10.13	*Source: Western Regional Climate Center 2016*		
Number of rain barrels installed starting in 2020		1,200	3,200	3,200
Rain barrel size (gal)	50			
Average roof collection area per barrel (e.g., half of a low-rise house roof slanted in a single direction) (sqft)	500			
Maximum annual rain collected per average roof per barrel (gal/barrel)	3,157			
Annual rain collected per roof sqft (gal/sqft)	6.31			
Annual rain collected under this measure (assuming average roof area per barrel) (gal)		3,788,883	10,103,688	10,103,688
Maximum annual barrel fillings per year (feasibility check)		3,157	3,157	3,157
Utilization/Emptying rate (Rate at which barrels are emptied everytime it is full so there is no wasted water to overflow)		100%	100%	100%
Annual water savings per year under this measure (gal)		3,788,883	10,103,688	10,103,688
Percent of landscaping demand of participating buildings		4.4%	4.3%	4.4%
Percent of landscaping demand offset by this measure		0.022%	0.053%	0.049%
Emissions reductions from water savings (MTCO2e) (million gallons X MTCO2e/MG) (see beginning of calculation)		10	23	23

Existing Countywide Rooftop Area		
Area of commercial/industrial roofspace in 2005 (sqft) (Anders and Bailek 2009)	235,047,321	
Area of residential roofspace in 2010 (sqft) (calculated below)	646,002,117	
Sum of roofspace (sqft)	881,049,438	
Source: Anders and Bailek 2009 (https://www.sandiego.edu/law/documents/centers/epic/060309_ASESPVPotentialPaperFINAL_000.pdf)		
Calculating Residential Rooftop Space in San Diego County		
Matching PV rating (kW) from NREL PV Calculator	2,772,000	*Source: Anders and Bailek 2009*
sq meter per kW	1	*PV Watts Calculator Default*
sqft per sq meter	10.76391042	*PV Watts Calculator Default*
Module efficiency	0.16	*PV Watts Calculator Default*
Size of PV area needed (sf)	186,484,748	*Calculated*
Tilt Degree	30	*Source: Anders and Bailek 2009*
Footprint of PV area needed (sqft)	161,500,529	*Calculated*
% sqft roof	50%	*Source: Anders and Bailek 2009*
% homes suitable	50%	*Source: Anders and Bailek 2009*
Footprint of Available Rooftop (sqft)	646,002,116.66	*Calculated*
Calculations based on methods used in NREL's PV Watts Calculator http://pvwatts.nrel.gov/pvwatts.php		

Estimated Unincorporated San Diego County Roofspace (Scaled from entire county) (sqft)	2014	2020	2030	2050
Commercial/Industrial	13,890,169	15,498,609	16,873,464	21,025,604
Residential	93,424,065	101,439,924	113,381,541	123,420,268
Total	107,314,235	116,938,533	130,255,005	144,445,872
All Existing Roofspace (as of 2014)	107,314,235	107,314,235	107,314,235	107,314,235
All New Roofspace (since 2014)	-	9,624,299	22,940,770	37,131,637

GHG Reductions from W-2.1 (MTCO2e)	10	23	23
Electricity savings from local water distribution and treatment (MWh) to calculate E-2.1	3.70	9.86	9.86

Agriculture Reduction Measure Quantification

Assumptions

		2020	2030	2050
San Diego County Average Electricity Emissions Factor (MTCO2e/MWh)		0.260	0.237	0.237
Cropland in SD County (acres)	97,432	96,051	95,313	94,494

A-1.1

Convert Farm Equipment to Electric		**2020**	**2030**	**2050**
Background Information		2020	2030	2050
Emissions from Agricultural Equipment Except for Irrigation Pumps. Scaled by change in cropland. (MTCO2e)	86,087	84,867	84,215	83,491
		2020	2030	2050
Percent of Equipment Converted to Electric or Alternative Fuel		0%	8%	8%
GHG Reductions from A-1.1 (MTCO2e)		-	6,737	6,679

A-1.2

Convert Stationary Irrigation Pumps to Electric		**2014**	**2020**	**2030**	**2050**
Number of Diesel Pumps in San Diego County. Scaled by change in cropland.		159	157	156	154
Total Number of Pumps Converted			4	44	44
Percent of Pump Energy Converted			3%	28%	28%
Emissions from Diesel Pumps to be Converted (MTCO2)		11,768	296	3,251	3,251
Diesel Emission Factor (kg CO2/gal)	10.21				
Calculated fuel use of converted pumps (gal)		1,152,982	28,954	318,491	318,491
Energy content of diesel (kBTU/gal) - lower heating value		128	128	128	128
Efficiency of diesel pump (%)		35%	35%	35%	35%
Energy required by pumps (kBTU)		51,851	1,302	14,323	14,323
Efficiency of electric pump (%)		75%	75%	75%	75%
Calculated electricity use in electric pumps (kBTU)		69,134	1,736	19,097	19,097
Calculated electricity use in electric pumps (kWh)		20,261	509	5,597	5,597
Emissions from electricity use (MTCO2e)			0.13	1.33	1.33
GHG Reductions from A-1.2 (MTCO2e)			295	3,249	3,249
Calculated electricity use in electric pumps for selected option (kWh)			509	5,597	5,597

Agriculture Reduction Measure Quantification (Continued)

A-2.1					
Increase Residential Tree Planting		**2014**	**2020**	**2030**	**2050**
Modified Number of Single Family Residences in Unincorporated County (detached units) (Exluding Camp Pendleton units)		134,815	146,436	164,009	178,110
Number of New SFRs starting in 2020			-	17,573	31,674
Trees planted per home			2	2	2
Total trees planted since 2020			0	35,146	63,348
Default Annual CO2 accumulation per tree for Miscellaneous Trees (MT CO2e/tree/year) (From Appendix A of CalEEMod v2016.3.1)		0.0354			
Annual Sequestration from Planted Trees (MTCO2e/year)			-	1,244	2,243
GHG Reductions from A-2.1 (MTCO2e)			-	1,244	2,243

A-2.2					
Increase County Tree Planting			**2020**	**2030**	**2050**
Annual Tree Planting Targets starting in 2017		3500			
Annual Tree Planting Targets starting in 2020		3500			
Total number of Trees Planted since 2017			14,000	49,000	119,000
Feasability Test					
Average Tree Canopy Area of mature tree (sqft)		50			
Total Acres of Planted Tree Canopy (Acres)			4.0	56.24	136.59
Total undeveloped acres in the County (Acres) (SANDAG)			346,055	306,876	219,557
Percent Coverage by new trees	**Very Low-->**		**0.001%**	**0.018%**	**0.062%**
Default Annual CO2 accumulation per tree for Miscellaneous Trees (MT CO2e/tree/year) (From Appendix A of CalEEMod v2016.3.1)		0.0354			
Annual Sequestration from Planted Trees (MTCO2e/year)			496	1,735	4,213
GHG Reductions from A-2.2 (MTCO2e)			496	1,735	4,213

Assumptions	
Category	**Value**
Conversions	
sqin/sqft	144
cubic in/gallons	231
sqft/acre	43560
acre/hectare	2.47105
g/MT	1000000
lb/MT	2204.622622
g/lb	453.592
kg/MT	1000
lb/kg	2.20462
tons/MT	1.10231
kWh/MWh	1000
MWh/GWh	1000
btu/kWh	3412.14
Btu/therm	100000
MMBtu/therm	0.1
MMBtu/MWh	3.41214148
LPG Gallons/GGE	1.344086022
LNG Gallons/GGE	1.572327044
gal/cubic foot	7.480519481
gal/Liter	3.785411784
gallon/acrefoot	325851.429
million gal/hundred cubic feet	0.000748503
million gal/acre-feet	0.325851429
GWP	
CO2	1
CH4	25
N2O	298
Source	*IPCC Fourth Assessment Report*