APPENDIX C

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Memo

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Date: May 31, 2017 (Revised August 7, 2017)

To: Planning and Development Services

From: Honey Walters, Poonam Boparai, and Brenda Hom

Subject: County of San Diego Climate Action Plan – Memorandum: Greenhouse Gas Emissions Reduction Targets, Measures, and Gap Analysis for the Unincorporated County

INTRODUCTION

This technical memorandum summarizes the results of the quantitative "gap analysis" process for the County of San Diego (County) Climate Action Plan (CAP). The purpose of the gap analysis is two-fold: 1) to ensure that all greenhouse gas (GHG)-reducing actions to be incorporated in the CAP set the County on course to meet the unincorporated County's proposed GHG reduction targets; and 2) to ensure that specific measures and associated GHG emissions reduction calculations are defensible and appropriate for the purposes of the California Environmental Quality Act (CEQA) streamlining benefits for proposed projects in the future.

The gap analysis process takes into account several steps in the climate action planning process, which are listed below and addressed in subsequent sections.

1. Summary of 2014 baseline community-wide GHG emissions inventory;

2. Summary of the community-wide GHG emissions projections for 2020, 2040, and 2050;

3. Identification and evaluation of community-wide GHG emissions reduction targets for 2020 and 2030, and a reduction goal for 2050; and

4. Quantification of GHG emissions reductions and evaluation of the calculated gap between the estimated GHG reductions and reduction targets.

GREENHOUSE GAS EMISSIONS INVENTORY

The baseline GHG emissions inventory for the year 2014 includes community-wide sources in the unincorporated County and emissions resulting from County operations occurring both within and outside the unincorporated County. Both sources are included in the unincorporated County's GHG inventory. The purpose of the baseline inventory is to gain an understanding of the sources and levels of GHG emissions within a jurisdiction, as well as to establish a level against which future GHG emissions can be compared. The 2014 GHG emissions inventory is summarized in Table 1. Total emissions from all sectors in the 2014 Inventory were 3,211,505 metric tons of carbon dioxide equivalent ($MTCO_2e$) emissions.

Further details with respect to the 2014 community-wide inventory are discussed in Appendix A and Appendix B of the County's Climate Action Plan.

Table 1 2014 Unincorporated San Diego County Greenhouse Gas Emissions Inventory

Sectors	2014[1] ($MTCO_2e$/year)
On-Road Transportation	1,456,060
Electricity	760,638
Solid Waste	338,107
Natural Gas	290,712
Agriculture	163,696
Water	134,269
Off-Road Transportation	36,927
Wastewater	21,183
Propane	9,914
Total	3,211,505

Notes: Columns may not add to totals due to rounding.

$MTCO_2e$ = metric tons of carbon dioxide equivalent
GWP = Global Warming Potential
IPCC = Intergovernmental Panel on Climate Change

[1] Uses GWP factors from IPCC's Fourth Assessment Report.

Source: Data compiled by Ascent Environmental in 2017.

Greenhouse Gas Emissions Projections

GHG emissions projections are used to estimate future levels in the absence of climate action measures. Emissions projections were prepared for both an unadjusted "business-as-usual" (BAU) and a legislative-adjusted BAU scenarios for 2020, 2030, and 2050. Projections were also developed for 2040 to provide an interim data point. To calculate the unadjusted BAU emissions, 2014 emissions were scaled based on population, housing, and employment growth anticipated in the unincorporated County as projected by the San Diego Association of Governments (SANDAG), assuming no actions would be taken to reduce emissions by federal, state, or local agencies pursuant to Assembly Bill (AB) 32, Senate Bill (SB) 32 or other legislation. No changes in emission factors were assumed because such changes would be associated with legislative actions. The County population, housing, and job projections are available in Section 2.2 of the County's *2014 Greenhouse Gas Emissions Inventory and Projections*. The unadjusted BAU projected emissions are shown in Table 2. Additional detail on scaling factors and breakdown of unadjusted BAU projected emissions can be found in Attachment 1.

The unadjusted BAU projections represent theoretical "worst-case" future conditions that scale current emissions by growth, while the legislative-adjusted BAU projections account for future emissions reductions pursuant to AB 32, SB 32, and other legislation in California from a variety of regulations and programs, including the Renewables Portfolio Standard (RPS), improving vehicle fuel economy standards due to Advanced Clean Cars, and other state and federal policies. (Note that the projected vehicle-miles traveled

[VMT] for both the unadjusted and legislative-adjusted BAU estimates include the influence of SB 375 because VMT estimates for the unincorporated County without the influence of SB 375 are not available from SANDAG.

The unadjusted BAU projections for community-wide GHG emissions are summarized in Table 2. Under the unadjusted BAU scenario, unincorporated County GHG emissions are projected to increase by approximately 6 percent by 2020, 16 percent by 2030, and 31 percent by 2050 from 2014 levels.

Table 2 Unincorporated San Diego County Emissions Unadjusted BAU Projections ($MTCO_2e$/year)

Sectors	2014	2020	2030	2050
On-Road Transportation	1,456,060	1,526,899	1,666,644	1,852,094
Electricity	760,638	829,632	910,041	1,037,458
Solid Waste	338,107	358,651	389,611	411,297
Natural Gas	290,712	310,245	352,542	492,768
Agriculture	163,696	161,376	160,136	158,760
Water	134,269	145,788	162,949	177,375
Off-Road Transportation	36,927	40,815	43,938	49,733
Wastewater	21,183	23,001	25,708	27,985
Propane	9,914	10,762	12,027	13,090
Total	**3,211,505**	**3,407,168**	**3,723,596**	**4,220,560**
Percent change from 2014 (%)	**NA**	**6**	**16**	**31**

Notes: Columns may not add to totals due to rounding.

BAU = Business as usual
NA = Not Applicable
GWP = Global Warming Potential
$MTCO_2e$ = metric tons of carbon dioxide equivalent

Source: Data compiled by Ascent Environmental in 2017.

The legislative-adjusted BAU projections for community-wide GHG emissions are summarized in Table 3. Under the legislative-adjusted BAU scenario, unincorporated County GHG emissions are projected to decrease by approximately 6 percent by 2020, 12 percent by 2030, and 7 percent by 2050 from 2014 levels.

Further details with respect to the GHG emissions projections are discussed in the County's *2014 Greenhouse Gas Emissions Inventory and Projections* document.

Table 3 Unincorporated San Diego County Emissions Inventory and Legislative-Adjusted BAU Projections ($MTCO_2e$/year)

Sectors	2014	2020	2030	2050
On-Road Transportation	1,456,060	1,306,679	1,081,223	1,116,114
Electricity	760,638	690,144	661,266	723,503
Solid Waste	338,107	358,651	389,610	411,298
Natural Gas	290,712	302,017	323,008	353,041
Agriculture	163,696	161,376	160,136	158,760
Water	134,269	125,616	128,104	139,446
Off-Road Transportation	36,927	40,815	43,938	49,733
Wastewater	21,183	23,001	25,708	27,985
Propane	9,914	10,372	11,055	11,629
Total	**3,211,505**	**3,018,671**	**2,824,049**	**2,991,507**
Percent change from 2014 (%)	**NA**	**-6**	**-12**	**-7**

Notes: Columns may not add to totals due to rounding.

BAU = Business as usual
NA = Not Applicable
GWP = Global Warming Potential
$MTCO_2e$ = metric tons of carbon dioxide equivalent

Source: Data compiled by Ascent Environmental in 2017.

GREENHOUSE GAS EMISSIONS REDUCTION TARGETS

This CAP primarily focuses on reducing emissions by 2020 and 2030, consistent with legislatively-adopted State targets. While it is important to create a long-term emissions reduction goal, it would be speculative to demonstrate achievement of a goal for 2050 with the information known today. This is primarily due to uncertainty around future technological advances and future changes in State and federal law beyond 2030. California's GHG reduction targets have been legislatively adopted for 2020 and 2030, while the 2050 goal is expressed in an executive order. In addition, California Air Resources Board's *The 2017 Climate Change Scoping Plan Update* (Scoping Plan Update) is focused on meeting the 2030 reduction target, as directed in Senate Bill (SB) 32 and Assembly Bill (AB) 32. Therefore, the County's CAP aligns with the State in setting a 2030 target. As climate change science and policy continues to evolve, the County will be able to apply new reductions toward meeting the long-term 2050 GHG emissions reduction goal in future CAP updates, as outlined in Chapter 5. As directed in AB 32, SB 32, and Executive Orders B-30-15 and S-3-05, the State aims to reduce annual statewide GHG emissions to:

- 1990 levels by 2020;
- 40 percent below 1990 levels by 2030; and
- 80 percent below 1990 levels by 2050.

The Scoping Plan Update pursuant to AB 32 indicates that reducing the State's emissions to 80 percent below 1990 levels by 2050 would be consistent with IPCC's analysis of the global emissions trajectory

needed to stabilize atmospheric concentrations at 350 ppm or less, to "reduce the likelihood of catastrophic climate change" (CARB 2014).

Some communities do not have baseline inventories dating back to 1990 and, therefore, must extrapolate from more recent inventories. To determine an overall GHG reduction target at the local level that would be consistent with the state's overall targets, CARB recommends community-wide GHG reduction goals for local climate action plans that would help the state achieve its 2030 and 2050 targets (CARB 2017). These goals, presented in the Scoping Plan Update, consist of reducing emissions to 6 $MTCO_2e$ per capita and 2 $MTCO_2e$ per capita by 2030 and 2050, respectively. Considering the overall statewide emissions in 1990 and 2014 and the projected statewide population in 2030 and 2050, these per-capita goals would be equivalent to reducing 2014 emissions by 40% by 2030 and 77% by 2050 (CARB 2016, DOF 2014). The per-capita targets were determined to be applicable to the County because a goal of the CAP is to achieve State goals and CARB's per-capita metrics provide the means to accomplish that.

The ultimate framework for setting a local GHG reduction target is based on governing legislation (AB 32 and SB 32). CARB identifies local governments as essential partners in meeting State goals and makes recommendations on setting local targets. The State is on track to meet 2020 reduction targets; therefore, specific reduction goals for 2020 are not described in the Scoping Plan Update. A target equivalent to reaching 1990 levels by 2020 can be calculated by comparing the State's GHG inventories for 1990 and 2014. Per CARB's estimate of California's GHG inventory, the state emitted approximately 431 million $MTCO_2e$ ($MMTCO_2e$) in 1990 and 441.5 $MMTCO_2e$ in 2014, a two percent increase. Applying this statewide trend at the county level, the County would also need to reduce emissions to two percent below 2014 levels to match 1990 levels. The County does not have a 1990 GHG inventory with which to develop a County GHG target for 2020 due to data constraints; therefore, the State inventories taken in 1990 and 2014 are relied upon to establish reduction targets, which are then applied to the County's 2014 inventory data. The difference between the state's 1990 and 2014 emissions are used to determine the equivalent reduction from 2014 to achieve 1990 emissions at the local level.

Setting a target with respect to a baseline year, such as 2014, is standard industry practice in climate action planning. The original 2008 Scoping Plan developed by CARB recommended a reduction below baseline levels as a valid reduction target, in recognition of the challenges in developing a 1990 inventory for a local jurisdiction. Data used for developing the 2014 inventory represent the best available data, based on improved inventory methodologies and data collection procedures. The same level of rigor cannot be applied to a 1990 inventory and any attempts to extrapolate activity data (e.g., vehicle miles traveled, energy consumption) for 1990 would introduce a large margin of error and provide an inaccurate accounting of county emissions. Therefore, reliance on State data to determine relative reduction levels that can be applied to local 2014 emissions levels is a valid methodology to determine reduction targets.

Emissions caps pursuant to AB 32, SB 32, EOs B-30-15, and S-3-05 are set at a statewide level; therefore, the relative reductions necessary from 2014 levels for the state are applied to the local inventory. It should be noted that statewide GHG emissions have been declining since the original 2008 Scoping Plan. As State regulations to achieve GHG reductions have been implemented, they also have a positive effect on local emissions, as evidenced in the legislative reductions incorporated into the projections. The original Scoping Plan identified a 15% reduction target for local governments developing CAPs. However, that relative reduction was based on then-existing levels (i.e., 2005). Because statewide emissions have declined since 2005, the relative reduction required is now lower to achieve the same absolute emissions level (i.e., 431 $MMTCO_2e$ by 2020). This does not imply that reduction targets for 2020 have been relaxed; rather, this reflects the decline in statewide emissions since 2005. In addition, 2020 is only the first milestone in the State's long-term GHG reduction strategy. Similarly, while the relative reduction target (the reduction percentage) in the CAP is different from that identified in the 2011 General Plan Update (GPU) Program

Environmental Impact Report (PEIR), it is still consistent with the reductions mandated under AB 32 for the reasons discussed above. Inventory methodologies and data collection techniques have evolved since certification of the 2011 GPU PEIR; however, the overall framework of reduction targets is inherently based on State legislation. Thus, consistent with CARB's recommended community targets and recent updates to the State's 2014 GHG emissions inventory, the following 2020 and 2030 adjusted reduction targets and 2050 goal should be achieved in the county:

- 2 percent below 2014 levels by 2020;
- 40 percent below 2014 levels by 2030; and
- 77 percent below 2014 levels by 2050.

Attaining a two percent reduction in GHG emissions would require that annual emissions be reduced to approximately 3,147,275 $MTCO_2e$ in 2020, which is approximately 64,230 $MTCO_2e$ lower than 2014 levels. To achieve long-term GHG reductions, the County would need to reduce emissions to 1,926,903 $MTCO_2e$ by 2030, or approximately 1,284,602 MTCO2e (40%) below 2014 GHG emissions levels. To achieve a 77% reduction in GHG emissions from 2014 levels by 2050, the County would need to reduce its emissions to approximately 738,646 $MTCO_2e$ in 2050, which is approximately 2,472,859 $MTCO_2e$ lower than 2014 levels. A detailed technical analysis of the County's emissions reduction targets and long-term goal can be found in Attachment 1 of this memorandum. Table 4 shows the GHG reduction targets alongside the County's emissions over time without including any measures and actions proposed in this CAP.

Legislative actions will help lower GHG emissions in the county by requiring improvements in energy efficiency in buildings and vehicles, lowering emissions associated with electricity generation, and reducing direct GHG emissions, such as from fuel combustion in off-road vehicles. The resulting legislative GHG reductions, shown in Table 4, will occur without any additional action on the part of the County. The overall decrease in emissions is primarily due to reductions from the electricity sector resulting from cleaner electricity generation, improved energy efficiency in buildings, and more fuel-efficient vehicles.

Table 4 Community-wide Unincorporated San Diego County Greenhouse Gas Emissions Reduction Targets and Goal: 2020, 2030, and 2050

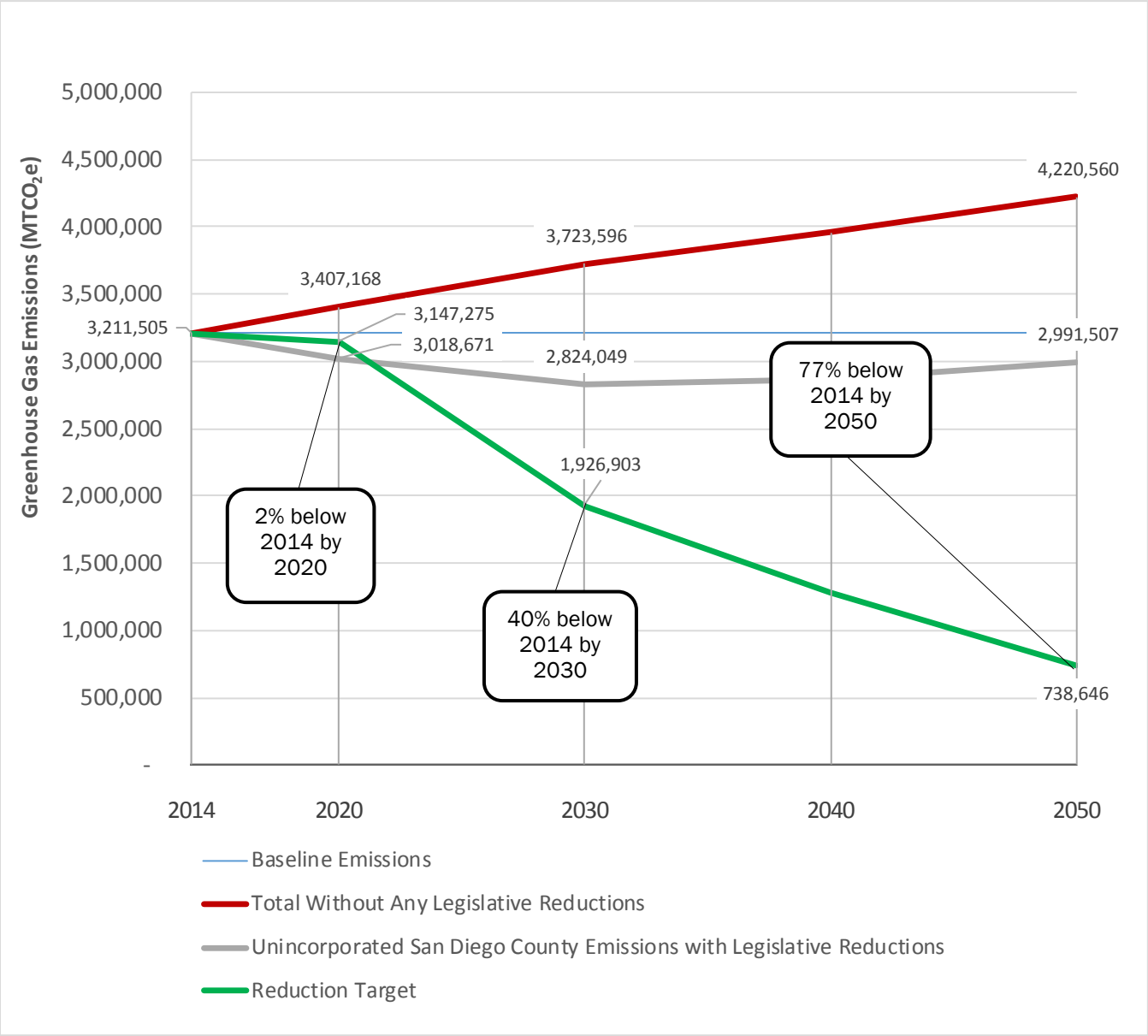
Scenario or Target	2014	2020	2030	2050
Baseline				
2014 Baseline GHG Inventory ($MTCO_2e$)	3,211,505	NA	NA	NA
Projections				
Unadjusted BAU Projections ($MTCO_2e$)	NA	3,407,168	3,723,596	4,220,560
Legislative-Adjusted BAU Projections ($MTCO_2e$)	NA	3,018,671	2,824,049	2,991,507
Legislative-Adjusted BAU Projections: Percent below 2014 levels (%)	NA	-6%	-12%	-7%
Targets				
Target Percent Reduction below 2014 levels (%)	NA	-2%	-40%	-77%
Target Emissions ($MTCO_2e$)	NA	3,147,275	1,926,903	738,646
Gap Analysis				
Reduction from Legislative-Adjusted BAU needed to meet Target ($MTCO_2e$) (Surplus)	NA	-128,605	897,145	2,252,861

Notes: Columns may not add to totals due to rounding.

BAU = Business as usual
$MTCO_2e$ = metric tons of carbon dioxide equivalent
GHG = greenhouse gas
NA = Not Applicable

Source: Data compiled by Ascent Environmental in 2017.

Figure 1, depicts the baseline, unadjusted BAU GHG emissions, and legislative-adjusted BAU GHG emissions. The green line indicates the GHG emissions reduction targets for 2020 and 2030 and the goal for 2050. The additional reductions needed to meet the 2030 target and 2050 goal to close the expected "gap" between the legislative-adjusted BAU emissions levels and the targets are also apparent in Figure 1. With respect to emissions beyond 2030, current legislation, such as the Federal Corporate Average Fuel Economy (CAFE) standards, have specific targets and policies that only address activities up to the year 2030. Though advances in new technologies and policy strategies may allow for additional significant reductions in the future, legislative reductions that may occur past 2030 are currently unknown. Thus, past 2030, emission trends assume population growth would continue while legislations no longer improve GHG reductions past 2030. Based on these known current legislations and the County's projected population growth, the County would not be able to meet the 2050 goal at this time; however, with future CAP updates the County will make progress towards the 2050 goal.



Notes: $MTCO_2e$ = metric tons of carbon dioxide equivalent; BAU = Business as usual
Source: Data compiled by Ascent Environmental in 2017.

Figure 1: Baseline Emissions Unadjusted BAU Projections Emissions, Legislative-Adjusted BAU Projections Emissions, and Emissions Reduction Targets: 2020 through 2050

Greenhouse Gas Emissions Reductions and Estimated Gap

It is projected that with legislative actions, the County will meet the 2020 target; however, additional GHG reductions are needed to achieve the GHG reduction targets for 2030 and the reduction goal for 2050. As a local government, the County can take action to adopt or update land use plans, enforce or update County ordinances, adjust County operations, encourage or influence County residents and businesses by partnering with local organizations, and work with local and regional transportation planning or other

agencies that provide services or maintain infrastructure that is not directly in the County's control. The County can effectively reduce emissions in some sectors where the County has jurisdictional control (e.g., County operations, land use change), but in some cases the County has limited ability to influence reductions (e.g., on-road transportation). A list of GHG reduction measures was developed based on the County's jurisdictional influence, public input, and other measures based on best practices. The measures have been incorporated into the County's CAP.

GHG reductions associated with these measures were calculated in a step-wise manner for the future years of 2020, 2030, and 2050. In other words, GHG reductions (in $MTCO_2e$/year) are assessed during a snapshot in time in years 2020, 2030, and 2050. This is a simplified method of characterizing GHG reductions, which would more realistically occur on a continuous basis. However, a step-wise method is appropriate for a planning-level document for setting the County's GHG reduction targets and monitoring of CAP implementation progress for these future years.

Importantly, GHG emissions reductions were quantified for measures wherever substantial evidence and reasonable assumptions were available to support calculations. The County has identified numerous programs and policies that were not quantifiable at this time due to lack of available data or quantification methods, but would still be expected to reduce GHG emissions. Such programs are characterized as supporting efforts in the CAP document and treated as supporting measures to the strategies and measures that were quantified, and could be tracked for potential quantification in the future if data and/or quantification methods become available in the future.

Summary of Results

Estimates of GHG emissions reductions, along with an estimated emissions reduction "gap", are summarized in Table 5 and illustrated in Figure 2. Detailed measure descriptions, calculations, and assumptions supporting the GHG reduction estimates are provided in Attachment 1. Measures are organized in the following categories:

- Built Environment and Transportation – Focuses on reducing emissions from on-road and off-road transportation through measures that affect land use patterns, travel demand, and low-emission vehicles and fuels.

- Energy – Focuses on reducing emissions from the electricity, natural gas, and propane use through reduced energy consumption and greater use of low-emission energy sources.

- Solid Waste – Focuses on reducing waste-related emissions through waste diversion efforts.

- Water and Wastewater – Focuses on reducing water and wastewater-related emissions through water conservation.

- Agriculture and Conservation – Focuses on reducing agriculture-related emissions through conservation, better resource management, and low-emission methods and technologies.

Table 5 Summary of Greenhouse Gas Emissions Reduction Measures Performance

Measure Number	Measure Title	GHG Reductions ($MTCO_2e$/year)		
		2020	2030	2050
Built Environment and Transportation				
T-1.1	Acquire Open Space Conservation Land	3,303	5,771	5,291
T-1.2	Acquire Agricultural Easements	323	2,330	2,136
T-1.3	Update Community Plans	0	13,949	27,913
T-2.1	Improve Roadway Segments as Multi-modal	0	604	1,292
T-2.2	Reduce New Non-residential Development Vehicle Miles Traveled	0	2,180	3,762
T-2.3	Reduce County Employee Vehicle Miles Traveled	0	7,473	7,783
T-2.4	Shared and Reduced Parking in New Non-residential Development	0	1,454	2,508
T-3.1	Use Alternative Fuels in New Residential and Non-residential Construction Projects	0	885	897
T-3.2	Use Alternative Fuels in County-initiated Projects	0	36	37
T-3.3	Develop a Local Vehicle Retirement Program	0	866	0
T-3.4	Reduce the County's Fleet Emissions	2,394	3,673	3,411
T-4.1	Establish a Direct Investment Program	0	190,262	0
Built Environment and Transportation Subtotal		6,020	229,482	55,030
Energy				
E-1.1	Improve Building Energy Efficiency in New Development	0	38,708	145,215
E-1.2	Use Alternatively-powered Water Heaters in Residential Development	0	19,176	19,176
E-1.3	Improve Building Energy Efficiency in Existing Development	0	3,694	18,470
E-1.4	Reduce Energy Use Intensity at County Facilities	6,486	8,207	9,084
E-2.1	Increase Renewable Electricity	0	230,268	252,166
E-2.2	Increase Renewable Electricity in Non-residential Development	0	13,444	13,444
E-2.3	Install Solar Photovoltaics in Existing Homes	114,571	260,322	230,322
E-2.4	Increase Use of Renewable Electricity for County Operations	4,083	5,755	5,755
Energy Subtotal		125,140	579,675	727,633
Solid Waste				
SW-1.1	Increase Solid Waste Diversion	0	57,103	62,159
Solid Waste Subtotal		0	57,103	62,159
Water and Wastewater				
W-1.1	Increase Water Efficiency in New Residential Development	0	87	303
W-1.2	Reduce Outdoor Water Use	0	17,535	19,087
W-1.3	Reduce Potable Water Consumption at County Facilities	244	276	325
W-2.1	Increase Rain Barrel Installations	10	23	23
Water and Wastewater Subtotal		254	17,920	19,738
Agriculture and Conservation				
A-1.1	Convert Farm Equipment to Electric	0	6,737	6,679
A-1.2	Convert Stationary Irrigation Pumps to Electric	295	3,249	3,249

Table 5 Summary of Greenhouse Gas Emissions Reduction Measures Performance

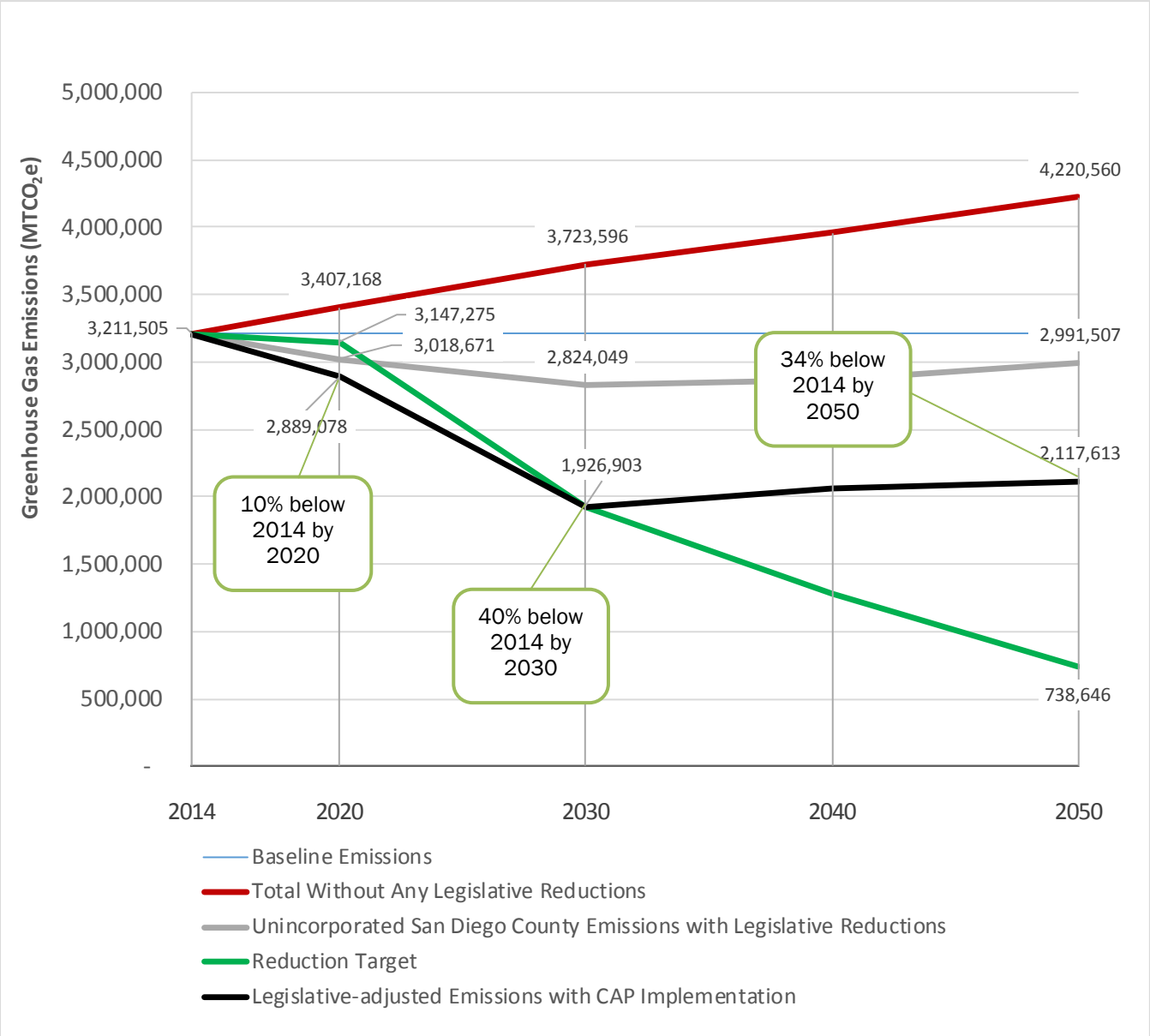
Measure Number	Measure Name[a]	GHG Reductions ($MTCO_2e$/year)		
		2020	2030	2050
A-2.1	Increase Residential Tree Planting	0	1,244	2,243
A-2.2	Increase County Tree Planting	496	1,735	4,213
Agriculture and Conservation Subtotal		791	12,965	16,384
Total Annual GHG Emissions Reductions from Measures		**132,205**	**897,145**	**880,943**
GHG Reductions Needed to Meet Target		**0**	**897,145**	**2,252,861**
Remaining GHG Emissions Reduction Gap (Surplus)		**(260,810)[a]**	**0**	**1,371,918**

Notes:

CO_2e = carbon dioxide equivalents
GHG = greenhouse gas
MT = metric tons

[a] Includes legislative reductions.

Source: Compiled by Ascent Environmental 2017



Notes: $MTCO_2e$ = metric tons of carbon dioxide equivalent
Source: Data compiled by Ascent Environmental in 2017.

Figure 2: Projections of Greenhouse Gases for the Unincorporated County with Implementation of CAP Measures and Targets: 2020 through 2050

The total estimated GHG emissions reductions from all measures quantified are approximately 132,205 $MTCO_2e$ in 2020; 897,145 $MTCO_2e$ in 2030; and 880,943 $MTCO_2e$ in 2050. The total estimated reductions in 2020 would exceed reductions required to meet the 2020 target. The measure reductions in 2030 would reduce legislative-adjusted BAU emissions to meet the 2030 target. However, the projected GHG reductions from all measures in 2050 would fall short of the long-term goal for 2050. The scale of reductions required to achieve the aggressive longer-term 2050 goal will require significant improvements in the availability

and/or cost of near-zero and zero-emissions technology, as well as potential increased reductions from ongoing state and federal legislative actions that are currently unknown.

This CAP primarily focuses on reducing emissions by 2020 and 2030, consistent with legislatively-adopted state targets. While setting a GHG reduction goal beyond 2030 is important to provide long-term objectives, it is speculative to establish targets beyond 2030 for which defensible reduction assumptions can be made. This is primarily due to uncertainty around future technological advances and future changes in state and federal law beyond 2030. California's GHG reduction targets have been legislatively adopted for 2020 and 2030, while the 2050 goal is expressed in an executive order. In addition, CARB's Scoping Plan is focused on meeting the 2030 reduction target, as directed in SB 32. Therefore, the County's CAP aligns with the state in setting a 2030 target.

In the long term, the quantifiable measures in the CAP fall short of meeting the County's 2050 reduction goal; however, over the coming decades new innovations and technologies will likely become available that will enable further GHG reductions. New methods may become available to quantify measures that are currently unquantifiable. Finally, new state and federal regulations may further reduce emissions in sectors currently addressed primarily by local County measures. As climate change science and policy continues to advance, the County will be able to apply new reductions toward meeting the long-term 2050 GHG emissions reduction goal in future CAP updates, as outlined in the CAP.

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DOF. *See* California Department of Finance.

ATTACHMENT 1

GHG Measure Reduction Summary

GHG Emission Reductions by Category

	Annual GHG Reduction (MT CO_2e)		
Category	**2020**	**2030**	**2050**
Built Environment and Transportation	6,020	229,482	55,030
Energy	125,140	579,675	727,633
Solid Waste	0	57,103	62,159
Water and Wastewater	254	17,920	19,738
Agriculture and Conservation	791	12,965	16,384
TOTAL Reductions from Proposed Measures	**132,205**	**897,145**	**880,943**
Emissions Gap: Needed reductions to meet CAP Targets after GHG Reduction Measures have been applied (MT CO_2e) (Surplus)	-260,810	0	1,371,918

Projections with Legislative Reductions

Category	Annual GHG Emissions (MT CO_2e)			
	2014	**2020**	**2030**	**2050**
Built Environment and Transportation	1,492,987	1,347,494	1,125,161	1,165,847
Energy	1,061,264	1,002,533	995,329	1,088,173
Solid Waste	338,107	358,651	389,610	411,298
Water and Wastewater	155,452	148,617	153,813	167,430
Agriculture and Conservation	163,696	161,376	160,136	158,760
TOTAL Emissions with Legislative Reductions	**3,211,505**	**3,018,671**	**2,824,049**	**2,991,507**
Projected Percent Reduction from 2014		-6%	-12%	-7%
CAP Targets (adjusted for percent reduction from 2014)		-2%	-40%	-77%
CAP Targets (MT CO_2e)		3,147,275	1,926,903	738,646
Needed reductions to meet CAP Targets from 2014 levels (MT CO_2e)		64,230	1,284,602	2,472,859
Needed reductions to meet CAP Targets from Legislative reductions (MT CO_2e) (Surplus)		-128,605	897,145	2,252,861
TOTAL BAU Emissions	**3,211,505**	**3,407,168**	**3,723,596**	**4,220,560**

Projections with Legislative Reductions and County CAP Measures

Category	Annual GHG Emissions (MT CO_2e)			
	2014	**2020**	**2030**	**2050**
Built Environment and Transportation	1,492,987	1,341,474	895,679	1,110,817
Energy	1,061,264	877,393	415,654	360,540
Solid Waste	338,107	358,651	332,508	349,139
Water and Wastewater	155,452	148,363	135,892	147,692
Agriculture and Conservation	163,696	160,585	147,171	142,376
TOTAL	**3,211,505**	**2,886,465**	**1,926,903**	**2,110,564**
Percent below 2014		-10%	-40%	-34%
Additional Reductions Needed to meet CAP Targets (MT CO_2e) (Surplus)		-260,810	0	1,371,918

GHG Measure Reduction Summary (continued)			
Percent below 2014 by Category. Legislative reductions only			
Category	**2020**	**2030**	**2050**
Built Environment and Transportation	-10%	-25%	-22%
Energy	-6%	-6%	3%
Solid Waste	6%	15%	22%
Water and Wastewater	-4%	-1%	8%
Agriculture and Conservation	-1%	-2%	-3%
Percent below 2014 by Category. Combined effect of legislative reductions and proposed actions			
Category	**2020**	**2030**	**2050**
Built Environment and Transportation	-10%	-40%	-26%
Energy	-17%	-61%	-66%
Solid Waste	6%	-2%	3%
Water and Wastewater	-5%	-13%	-5%
Agriculture and Conservation	-2%	-10%	-13%
Percent below BAU by Category. Effect of proposed actions			
Category	**2020**	**2030**	**2050**
Built Environment and Transportation	0%	-20%	-5%
Energy	-12%	-58%	-67%
Solid Waste	0%	-15%	-15%
Water and Wastewater	0%	-12%	-12%
Agriculture and Conservation	0%	-8%	-10%

Built Environment and Transportation Reduction Measure Quantification

Assumptions

	2020	2030	2050
San Diego County Average Electricity Emissions Factor (MTCO2e/MWh)	0.260	0.237	0.237
Natural Gas Emissions Factor (MTCO2e/therm)		0.00685	

T-1.1

Acquire Open Space Conservation Land	**2014**	**2020**	**2030**	**2050**
Current MSCP program (2011-2016)				
Average Annual Acres purchased	436.93			
Dwelling Units Offset	31			
Total Dwelling Units Offset between 2015 and 2020	184			
Total Dwelling Units Offset between 2021 and 2030	307			
		2020	2030	2050
Annual Dwelling Units offset due to MSCP program		184	491	491
Building Electricity Avoided (kWh)		1,723,535	4,594,533	4,594,533
Building Natural Gas Avoided (therms)		68,329	182,148	182,148
Transportation Emissions Avoided (MTCO2e)		2,189	4,154	3,674
Building Energy Emissions Avoided (MTCO2e)		916	1,090	1,090
Waste Emissions Avoided (MTCO2e)		109	291	291
Water Emissions Avoided (MTCO2e)		89	237	237

Source: Scaled from modeling results from CalEEMod 2016 for 25 single family homes in 2030.

Emissions per mile for Passenger and LDT1 vehicles (MTCO2e/mi) (used to scale emissions from 2030 values)		*2.90E-04*	*2.07E-04*	*1.83E-04*
Back-calculated annual VMT from transportation emissions		*7,536,082*	*20,089,393*	*20,089,393*
Building Energy Reductions	MTCO2e	916	1,090	1,090
Transportation Emissions Reductions	MTCO2e	2,189	4,154	3,674
Waste Emissions Reductions	MTCO2e	109	291	291
Water Emissions Reductions	MTCO2e	89	237	237
GHG Reductions from T-1.1 (MTCO2e)		3,303	5,771	5,291

T-1.2

Acquire Agricultural Easements	**2014**	**2020**	**2030**	**2050**
Annual Activity based on County estimates of $1,500,000 in annual funding starting in 2020				
Total Acres Purchased by 2020	443			
Acres per unit	24.60			
Dwelling Units Offset Annually	18			
Total Dwelling Units Offset in 2020	18			
Total Dwelling Units Offset between 2021 and 2030	180			
		2020	2030	2050
Annual Dwelling Units offset due to expanded PACE program		18	198	198
Building Electricity Avoided (kWh)		168,607	1,854,674	1,854,674
Building Natural Gas Avoided (therms)		6,684	73,528	73,528
Transportation Emissions Avoided (MTCO2e)		214	1,677	1,483
Building Energy Emissions Avoided (MTCO2e)		90	440	440
Waste Emissions Avoided (MTCO2e)		11	118	118
Water Emissions Avoided (MTCO2e)		9	95	95

Source: Scaled from modeling results from CalEEMod 2016 for 25 single family homes in 2030.

Emissions per mile for Passenger and LDT1 vehicles (MTCO2e/mi) (used to scale emissions from 2030 values)	*0.00E+00*	*2.90E-04*	*2.07E-04*	*1.83E-04*
Back-calculated annual VMT from transportation emissions		*737,225*	*8,109,480*	*8,109,480*
Building Energy Reductions	MTCO2e	90	440	440
Transportation Emissions Reductions	MTCO2e	214	1,677	1,483
Waste Emissions Reductions	MTCO2e	11	118	118
Water Emissions Reductions	MTCO2e	9	95	95
GHG Reductions from T-1.2 (MTCO2e)		323	2,330	2,136

Built Environment and Transportation Reduction Measure Quantification (Continued)

T-1.3

Update Community Plans	**2014**	**2020**	**2030**	**2050**

Measure assumes that reductions from other street-transforming measures affect areas outside of these 19 Community Plans.

Background Calculations

Number	Community Plan Area Name		2016 Population Estimate
1	Alpine		5,701
2	Bonsall		1,451
3	Central Mountain		1,854
4	County Islands		2,427
5	Desert		711
6	Fallbrook		27,508
7	Julian		55
8	Lakeside		55,251
9	Mountain Empire		1,025
10	North County Metro		28,033
11	North Mountain		123
12	Pala-Pauma		803
13	Rainbow		-
14	Ramona		9,550
15	San Dieguito		16,889
16	Spring Valley		61,401
17	Sweetwater		10,083
18	Valle De Oro		21,292
19	Valley Center		216
Population Affected by the 19 Community Plans (excluding Specific Plan Areas, Otay, and Camp Pendleton)			244,372

Source: County of San Diego 2017

	2014	2020	2030	2050
Modified Unincorporated County Population	454,599	493,604	551,712	600,560
Population affected by Community Plan updates (assumes 2016 population remains in 2020)		244,372	280,210	310,953
Percent of Population/VMT affected		50%	51%	52%
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
VMT affected by Community Plan updates		944,022,641	1,110,485,989	1,256,297,888
Percent of Plans Implemented		0%	50%	100%

CAPCOA LUT-9: Improve Design of Development (note that CAPCOA mislabels LUT-9 as LUT-8)

% VMT Reduction (Low)	3%
% VMT Reduction (High)	21%
Median Percentage	12.2%
% VMT reduction	12.2%

Emissions Reductions

Annual VMT Reduced	-	67,462,024	152,640,193
Emissions per mile for Passenger and LDT1 vehicles (MTCO2e/mi)	0.0002905	0.0002068	0.0001829
Emissions Reductions (MTCO2e)	-	13,949	27,913
GHG Reductions from T-1.3 (MTCO2e)	-	13,949	27,913

Built Environment and Transportation Reduction Measure Quantification (Continued)

T-2.1

Improve Roadway Segments as Multi-modal	**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 and LDT1 VMT since 2020 (for calculation of T-2.2)		0	279,641,173	519,530,949

CAPCOA SDT-2 (Percent reduction in VMT for rural contexts)

% of streets with improvements							
	5%	**10%**	25%	**36%**	50%	**61%**	100%
% of intersections with improvements	% VMT Reduction						
5%	0.02%	0.04%	0.12%	0.13%	0.17%	0.27%	0.42%
10%	0.04%	0.06%	0.15%	0.16%	0.20%	0.29%	0.45%
25%	0.12%	0.16%	0.25%	0.23%	0.25%	0.36%	0.50%
36%	0.15%	0.17%	0.23%	0.30%	0.38%	0.42%	0.63%
50%	0.17%	0.19%	0.25%	0.38%	0.50%	0.50%	0.75%
61%	0.27%	0.29%	0.36%	0.42%	0.50%	0.55%	0.75%
75%	0.37%	0.41%	0.50%	0.48%	0.50%	0.61%	0.75%
100%	0.42%	0.44%	0.50%	0.63%	0.75%	0.75%	1%

Note: Bolded percentage values were interpolated based on CAPCOA estimates for 25%, 50%, 75%, and 100%.

	2020	2030	2050
Number of Intersections Improved by X year	0	250	500
Streets Improved by X year (measured in centerline miles)	0	700	1200
Total Number of Intersections	5054	5054	5054
Total Streets (measured in centerline miles)	1954	1954	1954

Source: County GIS Data dated June 16, 2016

	2020	2030	2050
Percent of intersections in the Unincorporated County with improvements	0%	5%	10%
Percent of streets in the Unincorporated County with improvements	0%	36%	61%
Percent Reduction in VMT under T-2.1	0.00%	0.13%	0.29%
Annual VMT Reduced under T-2.1	-	2,919,809	7,062,562
Annual VMT Reduced under T-2.1 (from new VMT as of 2020 only)	-	373,434	1,512,237
Emissions per mile for Passenger and LDT1 vehicles (MTCO2e/mi)	2.90E-04	2.07E-04	1.83E-04
GHG Reductions from T-2.1 (MTCO2e)	-	604	1,292

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%			
County Commute VMT reduced from Adjusted Passenger and LDT1 VMT			-	70,299,283	137,149,555
Reductions in Commute VMT from other measures not included as the percent reduction is from the forecasted commute VMT					
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

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 not included because this measure takes a percent of the New commute VMT separate from T-2.4					
Adjusted New VMT			0	251,068,866	489,819,838
Percent of Household VMT for commuting (AASHTO 2013)	28%				
New Commute VMT			-	70,299,283	137,149,555
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			-	7,029,928	13,714,955
Emissions per mile for Passenger and LDT1 vehicles (MTCO2e/mi)			0.00029047	0.000206765	0.000182867
GHG Reductions from T-2.4 (MTCO2e)			-	1,454	2,508

Built Environment and Transportation Reduction Measure Quantification (Continued)

T-3.1

Use Alternative Fuels in New Residential and Non-residential Construction 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.					
County Construction Equipment Emissions (MTCO2e)		10,472	11,713	11,692	11,853
County-Only Construction Equipment Emissions (MTCO2e) from CRIS database and Municipal Forecast		431	381	364	369
Private Construction Equipment Emissions (MTCO2e) calculated		10,042	11,332	11,328	11,484
Diesel fuel emission factors (kg CO2/gal)	(The Climate Registry 2016)	10.21			
Diesel fuel use offset by electric conversions (gal)			-	55,473	56,237
Diesel energy content (lower heating value) (kBTU/gal)		128.488			
Average Diesel engine efficiency		45%			
Average Electric engine efficiency		90%			
Percent Private construction fuel offset due to conversion of equipment to renewable diesel or electric fuel sources			0%	10%	10%
Assumed percent converted to renewable diesel			50%	50%	50%
Assumed percent converted to electric			50%	50%	50%
Construction Equipment Emission offset by renewable and electric conversions (MTCO2e)			-	1,133	1,148
Diesel fuel emission factors (kg CO2/gal)	(The Climate Registry 2016)	10.21			
Diesel fuel use offset by electric conversions (gal)			-	55,472.68	56,237
Diesel energy content (lower heating value) (kBTU/gal)		128.488			
Energy from diesel fuel use (kBTU) (Work In)			-	7,127,574	7,225,789
Average Diesel engine efficiency		45%			
Average Electric engine efficiency		90%			
Engine output (kBTU) (Work Out)			-	3,207,408	3,251,605
Energy needed from electricity (kBTU) (Work In)			-	3,563,787	3,612,895
Additional electricity use from construction equipment (MWh)			-	1,044	1,059
Additional GHG emissions from electricity use (MTCO2e)			-	248	251
GHG Reductions (MTCO2e)			**-**	**885**	**897**
GHG Reductions from T-3.1 (MTCO2e)			-	885	897

T-3.2

Use Alternative Fuels in County-initiated 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.				
County-Only Construction Equipment Emissions (MTCO2e) from CRIS database and Municipal Forecast	431	381	364	369
Percent Private construction fuel offset due to conversion of equipment to renewable diesel or electric fuel sources		0%	10%	10%
Assumed percent converted to renewable diesel		100%	100%	100%
Construction Equipment Emission offset by renewable and electric conversions (MTCO2e)		-	36	37
GHG Reductions from T-3.1 (MTCO2e)		-	36	37

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 that year, as a conservative approach. Newer vehicles would have even lower emission factors.				
Light Duty Vehicles MY1996 or older County-wide (LDA, LDT1, LDT2, and MDV)				
Vehicle Population (EMFAC2014 forecasts)		75,690	28,600	-
Annual VMT		373,125,323	97,786,270	-
Annual VMT per vehicle		4,930	3,419	-
Light Duty Vehicles MY1996 or older in the Unincorporated County				
Percent of County Population that is located in the Unincorporated area		14.4%	14.9%	14.8%
Vehicle Population (Estimated)		10,874	4,248	-
Average Emission Factor for Light Duty Vehicles MY1996 or older in San Diego County (g CO2/mi)		425	423	
Average Emission Factor for Average Light Duty Vehicles in San Diego County (g CO2/mi)		310	214	186
Total Number of MY1996 vehicles removed		-	800	-
Replacement Rate		-	50%	50%
Annual VMT from participating vehicles		-	2,735,327	-
Emissions from old vehicles (MTCO2e)		-	1,158	-
Emissions from replaced vehicles (MTCO2e)		-	293	-
Emissions Reductions (MTCO2e)		-	866	-
GHG Reductions from T-3.3 (MTCO2e)		-	866	-

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

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	0.045	0.040
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

Improve Building Energy Efficiency in New Development	**2014**	**2020**	**2030**	**2050**
This calculates the reductions in energy usage solely due to the measure's energy efficiency targets and eventual zero net energy standard in 2020 for residential and 2030 for non-residential. This calculation assumes energy efficiency gains under this measure only apply to commercial/industrial and residential uses. This measure does not apply to agricultural energy uses. *Also, residential propane is not included in this calculation because a larger portion of energy use for propane is used for cooking, as opposed to space and water heating. However, there is currently no data to indentify that portion or an applicable ratio. In addition, the inventory did not include non-residential propane use.*				
Modified Unincorporated County Population	454,599	493,604	551,712	600,560
Modified Unincorporated County Jobs - Commercial and Industrial	85,742	95,671	104,157	129,788
Residential				
Forecast energy usage (w/o 2016 code, scaled by population)				
Electricity (MWh)	1,377,278	1,495,449	1,671,495	1,819,488
Natural Gas (therms)	28,860,437	31,336,685	35,025,673	38,126,823
New Energy Use Only (w/o 2016 code, difference between future and existing)				
Electricity (MWh)		118,172	294,217	442,210
Natural Gas (therms)		2,476,248	6,165,237	9,266,387
New Energy Use Only (w/ 2016 code)				
Electricity (MWh)		63,813	158,877	238,794
Natural Gas (therms)		1,337,174	3,329,228	5,003,849
Percent better than 2016 Title 24 Standards for Residential Construction		0%	100%	100%
Applicable standard for new construction		*Measure E-1.1*	*ZNE*	*ZNE*
Adjusted Energy Use from buildings built through years:	2014-2017	2018-2019	2020-2029	2040-2050
Electricity (MWh)	42,542	21,271	-	-
Natural Gas (therms)	891,449	445,725	-	-
Cumulative Energy use from New Buildings				
Electricity (MWh)		63,813	63,813	63,813
Natural Gas (therms)		1,337,174	1,337,174	1,337,174
Energy Reductions from Baseline				
Electricity (MWh)		-	95,065	174,981
Natural Gas (therms)		-	1,992,054	3,666,675
Emissions Reductions (MTCO2e)				
Electricity		**-**	**22,543**	**41,495**
Natural Gas		**-**	**13,646**	**25,117**

Energy Reduction Measure Quantification (Continued)

E-1.1 (Continued)				
Improve Building Energy Efficiency in New Development	**2014**	**2020**	**2030**	**2050**
Commercial/Industrial				
Forecast energy usage (w/o 2016 code, scaled by jobs)				
Electricity (MWh)	957,016	1,067,836	1,162,562	1,448,639
Natural Gas (therms)	22,744,894	25,378,685	27,629,983	34,429,035
New Energy Use Only (w/o 2016 code, difference between future and existing)				
Electricity (MWh)		110,820	205,545	491,623
Natural Gas (therms)		2,633,791	4,885,089	11,684,141
New Energy Use Only (w/ 2016 code)				
Electricity (MWh)		73,695	136,688	326,929
Natural Gas (therms)		1,751,471	3,248,584	7,769,954
Percent better than 2016 Title 24 Standards for Non-residential Construction		0%	10%	100%
Applicable standard for new construction		*Standard under E-1.1*	*Standard under E-1.1*	*ZNE*
Adjusted Energy Use from buildings built through years:	2014-2017	2018-2019	2020-2029	2040-2050
Electricity (MWh)	49,130	24,565	56,693	-
Natural Gas (therms)	1,167,647	583,824	1,347,402	-
		2020	2030	2050
Cumulative Energy use from New Buildings				
Electricity (MWh)		73,695	130,388	130,388
Natural Gas (therms)		1,751,471	3,098,873	3,098,873
Energy Reductions from Baseline				
Electricity (MWh)		-	6,299	196,541
Natural Gas (therms)		-	149,711	4,671,081
Emissions Reductions (MTCO2e)				
Electricity		**-**	**1,494**	**46,607**
Natural Gas		**-**	**1,026**	**31,997**
Commercial and Residential				
Emissions Reductions (MTCO2e)				
Electricity		**-**	**24,037**	**88,102**
Natural Gas		**-**	**14,671**	**57,114**

Note: ZNE aims for a net zero usage in energy, which does not necessarily translate to net zero emissions because natural gas and electricity have different emission factors. If roof-top solar is being used to offset overall energy usage, the reductions in emissions would be greater because there are more emissions reductions per unit of energy for electricity than for natural gas, based on estimated SDGE emission factors.

GHG Reductions from E-1.1 (MTCO2e)	-	38,708	145,215

Energy Reduction Measure Quantification (Continued)

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.

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)

	2014	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 replacement of Existing Water Heaters				
Natural gas usage in existing water heaters (No Action) (therms)			9,714,461	9,714,461
Natural gas usage in **existing** water heaters after replacement (therms)			-	-
Natural Gas Savings from replacement of Existing Water Heaters (therms)			9,714,461	9,714,461
Total reduction in Natural Gas Use due to Measure (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
Total reduction in Propane Use due to Measure (therms)			531,087	531,087
GHG Reductions from Propane Savings (MTCO2e)			3,330	3,330
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				
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)			7,382,990	7,382,990
Additional GHG emissions from new NG Use (MTCO2e)			50,573	50,573
GHG Reductions from E-1.2 (MTCO2e)			19,176	19,176

Energy Reduction Measure Quantification (Continued)

E-1.3

Improve Building Energy Efficiency in Existing Development	**2014**	**2020**	**2030**	**2050**
This calculation assumes participating buildings would have energy efficiency improvements equivalent to the difference between 2008 and 2016 Title 24 standards. This assumption is based on energy efficiency improvement data available from the CEC and CPUC. Energy efficiency gains under this measure only apply to commercial/industrial and residential uses. It does not apply to agricultural energy uses.				
Also, residential propane is not included in this calculation because a larger portion of energy use for propane is used for cooking, as opposed to space and water heating. However, there is currently no data to indentify that portion or an applicable ratio. In addition, the inventory did not include non-residential propane use				
Participation Rates				
Participation rate of existing buildings becoming retrofitted to meet 2016 Energy Efficiency Standards under this measure				
Residential		0%	1%	5%
Commercial		0%	1%	5%
Residential Energy Reductions				
Energy usage from existing buildings (w/o 2016 Title 24 Energy Efficiency Standards)				
Electricity (MWh)		1,377,278	1,377,278	1,377,278
Natural Gas (therms)		28,860,437	28,860,437	28,860,437
Participating Existing Energy Use Only (w/o 2016 Title 24 Energy Efficiency Standards)				
Electricity (MWh)		-	13,773	68,864
Natural Gas (therms)		-	288,604	1,443,022
Minimum percent reduction from existing electricity use by upgrading to 2016 Title 24 Energy Efficiency Standards		46%	46%	46%
Minimum percent reduction from existing natural gas use by upgrading to 2016 Title 24 Energy Efficiency Standards		46%	46%	46%
Existing Energy Use Only (w/ 2016 Title 24 Energy Efficiency Standards)				
Electricity (MWh)		-	7,437	37,186
Natural Gas (therms)		-	155,846	779,232
Energy Reductions				
Electricity (MWh)		-	6,335	31,677
Natural Gas (therms)		-	132,758	663,790
Emissions Reductions (MTCO2e)				
Electricity		**-**	**1,502**	**7,512**
Natural Gas		**-**	**909**	**4,547**
Commercial/Industrial Energy Reductions				
Energy usage from existing buildings (w/o 2016 Title 24 Energy Efficiency Standards)				
Electricity (MWh)		957,016	957,016	957,016
Natural Gas (therms)		22,744,894	22,744,894	22,744,894
Participating Existing Energy Use Only (w/o 2016 Title 24 Energy Efficiency Standards)				
Electricity (MWh)		-	9,570	47,851
Natural Gas (therms)		-	227,449	1,137,245

Energy Reduction Measure Quantification (Continued)

E-1.3 (Continued)	2014	2020	2030	2050
Minimum percent reduction from existing electricity use by upgrading to 2016 Title 24 Energy Efficiency Standards		34%	34%	34%
Minimum percent reduction from existing natural gas use by upgrading to 2016 Title 24 Energy Efficiency Standards		34%	34%	34%
New Energy Use Only (w/ 2016 Title 24 Energy Efficiency Standards)				
Electricity (MWh)		-	6,364	31,821
Natural Gas (therms)		-	151,254	756,268
Energy Reductions				
Electricity (MWh)		-	3,206	16,030
Natural Gas (therms)		-	76,195	380,977
Emissions Reductions (MTCO2e)				
Electricity		**-**	**760**	**3,801**
Natural Gas		**-**	**522**	**2,610**
Commercial/Industrial and Residential				
Energy Reductions				
Electricity (MWh)		-	9,541	47,707
Natural Gas (therms)		-	208,953	1,044,767
Emissions Reductions (MTCO2e)				
Electricity		**-**	**2,263**	**11,313**
Natural Gas		**-**	**1,431**	**7,157**
Total		**-**	**3,694**	**18,470**
GHG Reductions from E-1.3 (MTCO2e)		-	3,694	18,470

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%	15%	15%
Target Annual Electricity Use (MWh)	128,633	121,486	121,486
Target Annual Natural Gas Use (Therms)	2,106,661	1,989,624	1,989,624
Annual Electricity Reductions (MWh)	15,207	23,867	26,784
Annual Electricity Reductions in the unincorporated County (MWh)	4,711	7,454	8,482
Annual Natural Gas Reductions (therms)	242,212	372,814	399,945
Emissions savings from reduced electricity (MTCO2e)	4,827	5,653	6,344
Emissions savings from reduced natural gas (MTCO2e)	1,659	2,554	2,740
GHG Reductions from E-1.4 (MTCO2e)	6,486	8,207	9,084

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*		101,364	371,522
	E-1.2	*New and Existing*		-526	-526
	E-1.3	*Existing Only*		9,541	47,707
	E-1.4	*New and Existing (County only) Excludes municipal electricity use outside the County*		7,454	8,482
	E-2.2	*New only*		56,693	56,693
	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*		7,588	7,695
	T-1.1	*New only*		4,595	4,595
	T-1.2	*New only*		169	1,855
	T-3.1	*New and Existing*		1,044	1,059
	T-3.2	*New and Existing*		0	0
	W-1.2	*Excludes electricity use outside the County*		7,406	8,062
	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				1,293,179	1,604,989
Note: W-1.1, A-1.1, and T-3.3 were not included. W-1.1 savings are already included in E-1.1. A 1.1 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 SDG&E (MTCO2e/MWh)				0.474	0.474
Estimated Renewable Energy Program (REP) Emission Factor (MTCO2e/MWh)				0.045	0.040
Average SDGE Emission Factor (MTCO2e/MWh)				0.237	0.237
REP Participation Rate				80%	90%
REP Renewable Mix				90%	90%
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 from REP (includes those choosing the 100% renewable option)				91%	92%
Adjusted County Electricity Use (MWh)				1,495,465	1,446,108
Electricity Use of Participating Customers (MWh)				1,196,372	1,301,497
Emissions related to Electricity Use from participating customers without REP program (MTCO2e)				283,705	308,634
Emissions related to Electricity Use from participating customers with REP program (MTCO2e)				53,336	52,468
Emissions Reductions (MTCO2e)				230,368	256,166
GHG Reductions from E-2.1 (MTCO2e)				230,368	256,166

Energy Reduction Measure Quantification (Continued)

E-2.2				
Increase Renewable Electricity in Non-residential Development		**2020**	**2030**	**2050**
Measure only applies to new buildings built before ZNE standards are required.				
Non-residential				
New Non-residential grid-based Electricity Use (w/ 2016 code) (MWh)		73,695	136,688	326,929
Reductions from other measures that affect new non-residential buildings (MWh)	*E-1.1*	-	6,299	196,541
Adjusted New Non-residential grid-based Electricity Use (MWh) (Reflects new buildings built through 2029. ZNE standards applied to new buildings after 2030.)		73,695	130,388	130,388
	2014-2017	2018-2019	2020-2029	2040-2050
New Non-residential Electricity Use for buildings built through these years (MWh)	49,130	24,565	56,693	-
Percent of electricity from Non-residential buildings built through these years that install solar under this measure (Note that ZNE standards will begin requiring solar in 2030 for non-residential developments. This is already captured in E 1.1)	0%	0%	100%	0%
Electricity offset by this measure in new Non-residential buildings built through these years (MWh)	0	0	56,693	0
New Non-residential grid-based Electricity Use for buildings built through these years AFTER SOLAR installation (MWh)	49,130	24,565	-	-
		2020	2030	2050
Cumulative Adjusted New Non-residential grid-based Electricity Use for all buildings built since 2018 under this measure (MWh)		73,695	73,695	73,695
Non-residential Electricity Reduction from solar systems under this measure (MWh)	*("Adjusted New Non-residential grid-based Electricity Use" minus "Cumulative Adjusted New Non-residential grid-based Electricity Use for all buildings built since 2018")*	**-**	**56,693**	**56,693**
Total Electricity Reduction (MWh)		-	56,693	56,693
GHG Reductions from E-2.2 (MTCO2e)		-	13,444	13,444

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
E-1.3		-	6,335	31,677
Adjusted Electricity Usage from Existing Residential land uses (MWh)		1,377,278	1,371,468	1,346,126
Number of Existing Residential units		163,354	163,354	163,354
Electricity Usage per Existing Residence (MWh/residence)		8.43	8.40	8.24
Number of Existing Residences with Solar under this measure		52,273	130,175	130,175
Electricity use in participating residences (MWh)		440,729	1,092,905	1,072,711
Annual Electricity Generated by new Solar PVs from new permits (MWh)		440,822	1,097,768	1,097,768
Unused electricity generated (MWh)		94	4,863	25,058
Percent of electricity sent back into grid		0%	0%	2%
Percent of Electricity use in Existing Homes offset by solar (Feasibility Check)		**32%**	**80%**	**82%**
GHG Reductions from E-2.3 (MTCO2e)		114,571	260,322	260,322

E-2.4

Increase Use of Renewable Electricity for County Operations	**2020**	**2030**	**2050**
County electricity use after the implementation of E-1.4 (MWh)	128,633	121,486	121,486
Percent of renewable electricity generated on-site or through Power Purchase Agreements	10%	20%	20%
Electricity offset (MWh)	12,863	24,297	24,297
GHG Reductions from E-2.4 (MTCO2e)	4,083	5,755	5,755

Solid Waste Reduction Measure Quantification

SW-1.1

Increase Solid Waste Diversion

See additional quantification on separate sheets.

Sub-Measure Name	Annual GHG Reduction (MT CO_2e)		
	2020	2030	2050
Implement collection of commercial food scraps	0	17,389	18,929
Increase the minimum diversion requirements for Construction & Demolition (C&D) haulers	0	3,127	3,404
Enhance single family collection with consistent hauler requirements	0	10,142	11,040
Establish minimum recycling level requirements for commercial collection	0	8,744	9,518
Lower the project threshold for compliance with the County's C&D Recycling Program	0	1,076	1,172
Implement a social/behavior change marketing program	0	4,496	4,894
Support on-site community/commercial/farm composting	0	2,733	2,974
Expand technical assistance to multi-family, businesses, and schools	0	1,782	1,940
Collect food waste from single family premises	0	1,655	1,802
Enhance hauler performance standards, including minimum diversion goals	0	1,781	1,939
Improve diversion, tracking, and oversight of haulers	0	1,069	1,164
Promote food waste prevention	0	2,112	2,298
Establish additional hauler-provided drop-off facilities	0	410	446
Provide regular education on County and State recycling requirements	0	587	639
Total	0	57,103	62,159

	2020	2030	2050
GHG Reductions from SW-1.1 (MTCO2e)	-	57,103	62,159

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					
Reduce Outdoor Water Use		**2014**	**2020**	**2030**	**2050**
Residential and Non-residential Landscape irrigation water use per capita per day (gallons)		94	*Source: California Water Plan Update 2013 Vol. 3. Table 3-2. Based on 2009 gallons and population.*		
Modified Unincorporated County Population		454,599	493,604	551,712	600,560
Estimated annual water demand for landscaping (MG)		15,631	16,972	18,970	20,649
In existing development			15,631	15,631	15,631
In new development			1,341	3,339	5,019
Percent reduction in outdoor water use					
In existing development			0%	40%	40%
In new development			0%	40%	40%
Annual Water Reduction (MG)					
In existing development			-	6,252	6,252
In new development			-	1,336	2,007
TOTAL			-	7,588	8,260
Emissions per gallon of water (MTCO2e/MG) (see calculation in measure W-2.1)			2.53	2.31	2.31
Remaining water use for landscape irrigation (MG)					
In existing development			15,631	9,378	9,378
In new development			1,341	2,003	3,011
GHG Reductions from W-1.2 (MTCO2e)			-	17,535	19,087
Electricity savings from local water distribution and treatment (MWh) to calculate E-2.1			-	7,406	8,062

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 after W-1.2 (MG)		16,972	11,382	12,390
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	87	86
Annual landscaping water demand per barrel (see below) (gal/sqft)		72,568	43,691	42,887

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%	7.2%	7.4%
Percent of landscaping demand offset by this measure		0.022%	0.089%	0.082%
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)	9.60	23.35	23.35
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*

From HF&H 2016 study

Tonnages reduced annually from implementation of 75% waste diversion programs by 2030

	Annual Tonnage Reduced (Calculated by HF&H)						Tons of Organics in Waste Reduced						
	Recyclables	Yard trimmings	Food + Paper	C&D	HHW	Other (textiles, mattresses, carpet)	Recyclables	Yard trimmings	Food + Paper	C&D	HHW	Other (textiles, mattresses, carpet)	TOTAL
Program/Policy Description	**Median**	**Median**	**Median**	**Median**	**Median**	**Median**	**Median**	**Median**	**Median**	**Median**	**Median**	**Median**	**Median**
Enhance zoning ordinance to support organics processing	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Support organics processing facility development	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Commercial food scraps collection/mandatory organics	**0**	**10,000**	**18,000**	**0**	**0**	**0**	**0**	**10,000**	**18,000**	**0**	**0**	**0**	**28,000**
Regulate C&D haulers w/ min diversion	**0**	**0**	**0**	**23,100**	**0**	**0**	**0**	**0**	**0**	**5,036**	**0**	**0**	**5,036**
Single-family collection with consistent hauler requirements	**7,515**	**11,040**	**0**	**0**	**0**	**0**	**5,291**	**11,040**	**0**	**0**	**0**	**0**	**16,331**
Commmercial collection with minimum recycling service level requirements	**20,000**	**0**	**0**	**0**	**0**	**0**	**14,080**	**0**	**0**	**0**	**0**	**0**	**14,080**
Enhance C&D diversion through ordinance amendment to lower project threshold	**0**	**0**	**0**	**7,950**	**0**	**0**	**0**	**0**	**0**	**1,733**	**0**	**0**	**1,733**
Expand social marketing/behaviour change marketing program (including recognition programs)	**3,600**	**2,202**	**2,504**	**0**	**0**	**0**	**2,534**	**2,202**	**2,504**	**0**	**0**	**0**	**7,239**
Support on-site community/commercial/farm composting	**0**	**0**	**4,400**	**0**	**0**	**0**	**0**	**0**	**4,400**	**0**	**0**	**0**	**4,400**
Expand technical assistance program for multi-family, businesses, schools	**3,000**	**0**	**757**	**0**	**0**	**0**	**2,112**	**0**	**757**	**0**	**0**	**0**	**2,869**
Single-family food scraps collection	**0**	**0**	**2,665**	**0**	**0**	**0**	**0**	**0**	**2,665**	**0**	**0**	**0**	**2,665**
Enhance hauler performance standards	**1,340**	**1,925**	**0**	**0**	**0**	**0**	**943**	**1,925**	**0**	**0**	**0**	**0**	**2,868**
Improve diversion, tracking and oversight of haulers	**805**	**1,155**	**0**	**0**	**0**	**0**	**567**	**1,155**	**0**	**0**	**0**	**0**	**1,722**
Promote food waste prevention & donation	**0**	**0**	**3,400**	**0**	**0**	**0**	**0**	**0**	**3,400**	**0**	**0**	**0**	**3,400**
Hauler-provided drop-off facilities	**938**	**0**	**0**	**0**	**0**	**0**	**660**	**0**	**0**	**0**	**0**	**0**	**660**
Provide regular education on mandatory requirements	**435**	**387**	**252**	**0**	**0**	**0**	**306**	**387**	**252**	**0**	**0**	**0**	**945**
TOTAL	37,633	26,708	31,978	31,050	160	3,903	26,493	26,708	31,978	6,769	0	0	91,948

Total tons organics of reduced waste 91,948

Total percent organics in reduced waste 70%

Source: GHG Inputs_Mtl Types by Program_v2.xlsx from HF&H

Organic Content Calculation	Material Characterization from HF&H WARM Runs				
Percent Organic	Material	Recycling Characterization	C&D Characterization	Food and Paper Characterization	Other Characterization
0%	Aluminum Cans	1.0%			
0%	Aluminum Ingot				
0%	Steel Cans	2.9%			
0%	Copper Wire				
0%	Glass	5.6%			
0%	HDPE	2.6%			
0%	LDPE				
0%	PET	2.7%			
0%	LLDPE				
0%	PP				
0%	PS				
0%	PVC				
0%	PLA				
100%	Corrugated Containers	36.0%			
100%	Magazines/Third-class Mail	3.3%			
100%	Newspaper	6.3%			
100%	Office Paper	5.9%			
100%	Phonebooks	0.2%			
100%	Textbooks				
100%	Dimensional Lumber		21.8%		
100%	Medium-density Fiberboard				
100%	Food Waste (non-meat)				
100%	Food Waste (meat only)				
100%	Beef				
100%	Poultry				
100%	Grains				
100%	Bread				
100%	Fruits and Vegetables				
100%	Dairy Products				
100%	Yard Trimmings				
100%	Grass				
100%	Leaves				
100%	Branches				
100%	Mixed Paper (general)	18.7%		25.9%	
100%	Mixed Paper (primarily residential)				
100%	Mixed Paper (primarily from offices)				
0%	Mixed Metals				
0%	Mixed Plastics	14.7%			
0%	Mixed Recyclables				
100%	Food Waste			74.1%	
100%	Mixed Organics				
50%	Mixed MSW				
0%	Carpet		34.6%		54.3%
0%	Personal Computers				
0%	Clay Bricks				
0%	Concrete		36.7%		
0%	Fly Ash				
0%	Tires				
0%	Asphalt Concrete		3.0%		
0%	Asphalt Shingles				
0%	Drywall		3.8%		
0%	Fiberglass Insulation				
0%	Vinyl Flooring				
100%	Wood Flooring				
	Percent Organic	70%	22%	100%	0%

Waste Disposal Characterization for Unincorporated San Diego County

Row Labels	Sum of Total Residential Tons	Sum of Total Commercial Tons	TOTAL	Percent Organic Content	Tons of Organic Content
Electronics	1,342	851	2,193	0%	-
Glass	2,504	2,869	5,373	0%	-
Household Hazardous Waste (HHW)	699	184	883	0%	-
Inerts and Other	17,111	10,731	27,842	0%	-
Metal	3,504	3,623	7,127	0%	-
Mixed Residue	5,144	1,197	6,341	50%	3,170
Other Organic	55,582	46,639	102,221	100%	102,221
Paper	22,194	27,326	49,520	100%	49,520
Plastic	11,512	13,781	25,293	0%	-
Special Waste	4,257	1,992	6,249	0%	-
TOTAL	123,849	109,193	233,042	66%	154,911

Source: CalRecycle 2017 (https://www2.calrecycle.ca.gov/WasteCharacterization/ResidentialStreams?cy=37&lg=37, https://www2.calrecycle.ca.gov/WasteCharacterization/MaterialTypeStreams?cy=37&lg=37&bg=&mtf=

SWP Emission Reduction Calculations
From implementation of 75% waste diversion programs by 2030

		Source
Total Unincorporated Waste Accepted by Landfills that have LFG Capture in 2014 (wet short tons)	449,323	Unincorporated County of San Diego 2014 Greenhouse Gas Emissions Inventory and Projections
GHG Emissions from Waste Disposal in 2014 (MTCO2e)	152,841	Unincorporated County of San Diego 2014 Greenhouse Gas Emissions Inventory and Projections. Based on avg emissions factor for mixed solid waste
Organics Content in Unincorporated SD County	66%	Calculated from CalRecycle Data. Date unreported.
Estimated tonnage of organics content in landfilled waste (tons)	298,681	Calculated
Tons of organics reduced due to County's Solid Waste Plan (SWP) as calculated from HF&H study (tons)	91,948	Calculated from HF&H Estimates
Annual percent reduction in organics due to SWP	31%	Calculated
Annual percent reduction in emissions due to SWP	31%	Assumes that emissions are proportional to organics content in waste
Annual emissions reductions due to SWP if implemented in 2014 (MTCO2e)	47,051.52	Calculated

Forecasted Emissions Reductions

	2030	2050
GHG Emissions from Waste Disposal (MTCO2e)	185,492	201,915
Emissions reductions from SWP (MTCO2e)	57,103	62,159

GHG Reductions by Measure (MTCO2e)

Program/Policy Description	2030	2050
Enhance zoning ordinance to support organics processing	-	-
Support organics processing facility development	-	-
Commercial food scraps collection/mandatory organics	17,389	18,929
Regulate C&D haulers w/ min diversion	3,127	3,404
Single-family collection with consistent hauler requirements	10,142	11,040
Commmercial collection with minimum recycling service level requirements	8,744	9,518
Enhance C&D diversion through ordinance amendment to lower project threshold	1,076	1,172
Expand social marketing/behaviour change marketing program (including recognition programs)	4,496	4,894
Support on-site community/commercial/farm composting	2,733	2,974
Expand technical assistance program for multi-family, businesses, schools	1,782	1,940
Single-family food scraps collection	1,655	1,802
Enhance hauler performance standards	1,781	1,939
Improve diversion, tracking and oversight of haulers	1,069	1,164
Promote food waste prevention & donation	2,112	2,298
Hauler-provided drop-off facilities	410	446
Provide regular education on mandatory requirements	587	639
TOTAL	57,103	62,159

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